

Herpetological Review

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e-mail: theodora.pinou@yale.edu

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HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
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1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

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Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
aaron.bauer@villanova.edu

Geographic Distribution
ALAN M. RICHMOND
Biology Department, Morrill IV South
University of Massachusetts
611 North Pleasant Street
Amherst, Massachusetts 01003-9297, USA
alanr@bio.umass.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Copy Editors
HUGO ALAMILLO
ELI GREENBAUM

Current Research
OMAR TORRES-CARVAJAL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
otorres@ku.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Zoo View
JAMES B. MURPHY
Department of Herpetology
National Zoological Park
3001 Connecticut Ave., NW
Washington, D.C. 20008, USA
jbmurphy2@juno.com

Natural History Notes
JAMES H. HARDING
MSU Museum
Michigan State University
East Lansing, Michigan 48824, USA
hardingj@pilot.msu.edu

Natural History Notes
MARC P. HAYES
2636 59th Avenue NW
Olympia, Washington 98502-3449, USA
mhayesrana@aol.com

Current Research
ELI GREENBAUM
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
elig@ku.edu

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Herpetological Husbandry
RUSTON HARTDEGEN
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
ruston17@yahoo.com

Natural History Notes
GORDON W. SCHUETT
Department of Life Sciences
Arizona State University
P.O. Box 37100
Phoenix, Arizona 85069-7100, USA
gschuett@asu.edu

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

www.ukans.edu/~ssar



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2003 in the Society for the Study of Amphibians and Reptiles are as follows: **REGULAR** membership US$60 (Student $30)—includes *Journal of Herpetology* and *Herpetological Review*; **PLENARY** membership US$80 (Student $45)—includes *JH*, *HR*, and annual subscription to the *Catalogue of American Amphibians and Reptiles*; **INSTITUTIONAL SUBSCRIPTION** $115—includes *JH* and *HR*. Additional fee for airmail postage outside USA $35 for one year. Additional membership categories available on the SSAR webpage: http://www.ukans.edu/~ssar/membership.html.

All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Theodora Pinou, SSAR Treasurer, Department of Ecology & Evolutionary Biology, Osborn Memorial Labs, Yale University, 165 Prospect Street, New Haven, Connecticut 06520-8106, USA. Fax: (203) 432-5176; e-mail: theodora.pinou@yale.edu

Future Annual Meetings

2003 — Hotel Tropical, Manaus, Brazil, 26 June–2 July (with ASIH, HL)
2004 — University of Oklahoma, Norman, Oklahoma (with ASIH, HL)
2005 — University of South Florida, Tampa, Florida (with ASIH, HL)

Society for the Study of Amphibians and Reptiles
2003 Annual Meeting

together with

The Herpetologists' League

and

American Society of Ichthyologists and Herpetologists

26 June – 1 July 2003
Tropical Hotel Conference Center
(on the Rio Negro)
Manaus, Amazonas, Brazil

Richard C. Vogt and Ning Labbish Chao, Local Chairs

Keynote Address: "In Search of El Dorado: The Neotropical Herpetofauna," by William E. Duellman (University of Kansas), The Herpetologists' League Distinguished Herpetologist for 2003.

SSAR President's Travelogue: "From the Amazonian Floating Meadows to the Surumoni Canopy Crane Project: Frog Research in Amazonia," by Walter Hödl (University of Vienna).

Symposium: "Reproductive Biology and Phylogeny of Urodela (Amphibia)." *Organizer:* David M. Sever, Saint Mary's College (dsever@jade.saintmarys.edu).

Symposium: "New Frontiers in Freshwater Turtle Ecology." *Organizers:* Richard C. Vogt, Instituto Nacional de Pesquisas da Amazônia–INPA (vogt@inpa.gov.br) and Paulo Andrade, IBAMA.

Symposium: "Amazonian Frogs: Taxonomic and Ecological Diversity." Organizers: Janalee P. Caldwell, University of Oklahoma (caldwell@ou.edu); William E. Duellman, University of Kansas; Albertina Lima, INPA.

Symposium: "Sequestered Defensive Compounds in Amphibians and Reptiles." *Organizer*: Alan H. Savitzky, Old Dominion University (asavitzk@odu.edu).

Symposium: "Disease Ecology and Global Amphibian Decline." *Organizers*: Mathew J. Parris, Memphis State University (mparris@memphis.edu); Andrew Storfer, Washington State University.

Symposium: "Amphibian Metamorphosis: 30 Years of Progress." *Organizer*: Christopher K. Beachy, Clarke College (cbeachy@keller.clarke.edu).

Symposium: "Exotics and Extinction: Fates of Fishes, Amphibians, and Reptiles in the Americas." *Organizers*: Harry Grier, University of Florida (harry.grier@fwc.state.fl.us) and Maria del Carmen Uribe Aranzabal.

Symposium: "The Biology of Hypogean Fishes, Amphibians, and Reptiles." Organizer: Aldemaro Romero, Macalester College (romero@macalester.edu).

Symposium: "Amazonian Herpetofauna." *Organizers*: Ermelinda Oliveira, Universidade Federal do Amazonas (ermeoliveira@uol.com.br); Richard C. Vogt, INPA.

SSAR Student Travel Awards: Awards of US $400 each are available. An applicant must be a student and a member of SSAR. Refer to page 243 of the December 2002 issue of *HR* for details.

Student Paper Awards: Henri Seibert prizes (US $200 each) will be awarded in five categories: Systematics, Ecology, Evolution, Conservation, and Physiology/Morphology. Refer to the official Meeting Announcement for details and to *HR* 28(4):175 for recommendations to students entering the Seibert competition.

Social Activities: General Reception, Graduate Student Reception, Picnic, Joint Meeting Banquet, SSAR/HL Silent Auction.

Field Trips: Several post-meeting field trips into the Amazon are planned. Refer to the meeting website for details.

Live Animal Exhibit: A large sample of reptiles and amphibians native to the Amazon region on display and available to photographers.

Costs: Preregistration (until 28 February) US $240 regular, $80 student, $110 accompanying person. From1 March–25 June 2003, costs are $290, $130 student. After 25 June, $340 regular, $180 student. Registration information available at:
<http://www.aiha.org.br/reginfo.html>



Further Details: Refer to the official Joint Meeting website (www.aiha.org.br) for additional details, including travel requirements to Brazil.

About Our Cover: *Varanus baritji*



The family Varanidae comprises ca. 58 species (Böhme 2002. Checklist of the Living Monitor Lizards of the World [Family Varanidae]. Report prepared for CITES, 12th Meeting of the Conference of the Parties. 44 pp. PDF file available from: www.cites.org/common/cop/12/docs/ESF12i-06A.pdf), though that number varies considerably as there is disagreement regarding the taxonomic status of several forms, and new discoveries continue to be made (e.g., *Varanus juxtindicus* of the Solomon Islands; Böhme et al. 2002. Salamandra 38[1]:15–26). The most famous member of the family is the Komodo Dragon (*V. komodoensis*), the world's largest living lizard, which can attain a total length of 3 m. However, a fossil varanid from Australia is known to have reached 7 m TL and was likely contemporaneous with early Aboriginal people (King and Green 1999. Goannas: The Biology of Varanid Lizards. University of New South Wales Press, Sydney. 116 pp.).

Varanids achieve their greatest diversity in Australia—about 30 described species—most of which are endemic to that continent. The Australian varanid radiation has been especially impressive, with medium-sized (e.g., *Varanus glebopalma*, ~1 m TL) to large (e.g., *V. giganteus*, ~2 m TL) species occupying ecological positions filled elsewhere by mammalian carnivores, together with a number of smaller species, some of which are only 25–30 cm TL as adults. Maximal species diversity occurs in northern Australia, with regional associations of 8–11 species possible in northern reaches of both Western Australia and Northern Territory (Sweet 1999. Mertensiella 11, pp. 317–366).

Among the northern Australian endemic species is *Varanus baritji* (Black-spotted Ridge-tailed Monitor, among other common names), with a fairly restricted distribution from northeast Arnhem Land west to near Darwin and then south to the Katherine region, Northern Territory. The range approaches, but apparently does not overlap that of *V. acanthurus*, its sister species (Ast 2001. Cladistics 17:211–226). This species was described relatively recently (Horner and King 1987. Records of the Northern Territory Museum of Arts and Sciences 4[1]:73–79) and is named after Neville White, collector of the type specimen ("baritj" means "white" in one of the central Arnhem languages). Among regional aboriginal languages, this species is known as "Birram" in Kunwinjku, "Birrem" in Gundjeihmi (probably the same in Gagadju), and possibly "Bohlurr" in Kune (S. Sweet, pers. comm.).

V. baritji is a small species (to ca. 60 cm TL), restricted to rocky outcrops (of sandstone, shale, limestone, or basalt), typically in open woodland, where they construct shallow burrows under large, usually well-embedded rocks. They seem to be specialized predators on large therophosid spiders (Sweet 1999, *op. cit.*). Commonly, *V. baritji* co-occurs with the following species of *Varanus*: *glebopalma, scalaris, tristis, gouldii*, and *panoptes*, and occupies the same ecological role that *V. acanthurus* or *V. storri* would fill with this same complement of species elsewhere (S. Sweet, pers. comm.). Males are often more brightly colored and more distinctly marked than females, and both sexes possess bright lemon-colored chins and throats. Specimens from the western Arnhem Land region are very dark in comparison to animals from other areas. Breeding takes place during the dry season. Females produce clutches of 3–12 eggs, which in captivity have hatched in a little over 100 days. Hatchlings are very similar to those of *V. acanthurus* but lack the neck striping typical of that species (G. Husband, unpubl.).

Our cover photo was taken by **Paul Freed**, supervisor of the Herpetology Section and a 23-year veteran of the Houston Zoo. Over the last three decades, Paul has done fieldwork for Conservation International, the Carnegie Museum of Natural History, Louisiana State University, and the Raleigh State Museum, as well as his own research on herpetological parasitology. Additionally, Paul has amassed over 40,000 images of animals, plants, habitats and people during this time. Examples of his photography can be viewed at: www.freedsphotography.com.



Freed photographed the cover subject, an unsexed adult *V. baritji* ca. 30 cm TL, *in situ* ca. 75 km E of Katherine in Australia's Northern Territory. He used a Canon F-1 with a 100mm f/4.0 macro lens along with a Canon Macrolite ML-1 flash, recording the image on Fuji Velvia film.

Editor's note.—Special thanks to Sam Sweet, Grant Husband, and Steve Wilson for sharing unpublished observations of *V. baritji*.

SSAR BUSINESS

SSAR Henri Seibert Award for 2003

The Henri Seibert Award was initiated in 1992 to provide recognition for the best student papers given at the annual meeting of the SSAR. To be eligible, the presented paper must be the results of research conducted by the presenter. The research must have been done while the student was in either an undergraduate or graduate degree program. The presentations will be judged by the SSAR student prize committee. One Seibert Prize of US $200 may be given in each of the following five categories: Conservation, Ecology, Evolution, Physiology/Morphology, and Systematics. Consult *Herpetological Review* 28(4):175 for recommendations to students entering the Henri Seibert competition (also available on the SSAR web site at:

http://www.ukans.edu/~ssar/seibert.html

Students entering the competition must be members of SSAR. Students can win the Henri Seibert competition only once. Please indicate the category to which you are submitting your abstract on the abstract form in the Call for Papers.

Kennedy Student Award Committee Annual Report—2002

The Kennedy Award Committee (Robin Andrews, Diana Hews, Terry Schwaner, Lynnette Sievert, Robert Gatten, Chair) has completed its work for Volume 35 of the *Journal of Herpetology*. The Committee has selected "Effects of prolonged retention in hatcheries on green turtle (*Chelonia mydas*) hatchling swimming speed and survival" by **N. J. Pilcher** (student) and S. Enderby (Vol. 35:633–638). The Kennedy Award carries with it a cash prize of US $200 or the winner's selection of any SSAR publications valued at twice that amount.

The Committee encourages each student member of the Society to submit their work to the *Journal*, and encourages each regular member who supervises the work of students to encourage his/her students to submit their work to *JH*.

SSAR Presubmission Manuscript Reviews

The SSAR Board of Directors received a proposal at its Kansas City meeting in July 2002 from Richard Wassersug to facilitate the preparation and submission of manuscripts from colleagues whose primary language is not English. This proposal was adopted enthusiastically, and is summarized below.

English is the language of science communication and of the SSAR. Ironically, though, most of the animals that we study come from countries where English is not the first language. In order to promote the publication of research on amphibians and reptiles from those countries, the SSAR has started an editorial assistance program for herpetologists who do not have English as their first language.

Various members of the SSAR community have offered to read and edit up to three English language manuscripts per year within their specific area of herpetological expertise. This is a free service provided to herpetologists whose first language is not English, but who are striving to publish their findings in peer-reviewed English language journals. The people who are volunteering to edit manuscripts are not formally working for the SSAR and their assistance is no guarantee that your paper will be accepted in the English language press. For additional details, as well as a list of volunteering herpetologists and their areas of expertise, please consult the SSAR web site at:

<http://www.ukans.edu/~ssar/presub.html>

SSAR Student Awards Fundraiser: 2002 Results and Call for 2003 Donations

Thanks to the many generous donations from several individuals to the 2002 silent auction at Kansas City, the SSAR Student Travel Awards Committee (SSAR STAC) awarded 10 US $200 travel grants to students presenting papers or posters at the meetings. The SSAR STAC wishes to thank all who donated items to the 2002 silent auction.

The Eighth Annual Frameable Art Silent Auction at Kansas City raised over $1800.00 for future student travel awards. On behalf of the SSAR, thanks to all who helped including, Christina Loper and Gary Lechner, California State University, Chico, and Andre Ngo, University of Toronto. Special thanks for a job well done to the SSAR STAC Co-chairs, Glen Lubcke and Jack Campbell.

The SSAR STAC announces the Ninth Annual Frameable Art Silent Auction to be held at the 2003 SSAR meeting at Manaus, Brazil. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *Dawn Wilson, Biology Department, California State University, Chico, Chico, California 95929, USA; e-mail: dwilson@csuchico.edu; tel. 530-898-6303.*

SSAR Student Travel Awards Call for Applications

For the Brazil meeting, awards of US $400 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author of a paper or poster to be presented. Application package must include: 1) letter signed by his/her major advisor or department chair that states: he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. Qualified applicants are pooled and winners are drawn at random. Students from local meeting site and current members of the SSAR Travel Awards Committee are excluded from applying for a travel award. **APPLICATIONS MUST BE POSTMARKED BY 1 MAY 2003.** Award checks will be disbursed at the meeting. Direct requests for information to: *Dawn Wilson, Biology Department, California State University, Chico, Chico, California 95929, USA; e-mail: dwilson@csuchico.edu or tel. 530-898-6303.*

NEWSNOTES

CITES Nomenclature Committee To Use *Amphibian Species of the World*

Notifications to the Parties, Standard reference for amphibians:

1. Decision 11.167 regarding the nomenclature of CITES-listed species requires the Secretariat to make a print-out of the standard reference seven months before every second meeting of the Conference of the Parties, starting with the 12th meeting of the Conference of the Parties, and to submit the print-out for review and adoption by the Nomenclature Committee.

2. At its meeting of 8 April 2002 (San José, Costa Rica), the Nomenclature Committee accepted the print-out of *Amphibian Species of the World* by D. R. Frost as the standard reference for amphibians, valid as from the date of distribution of this Notification to the Parties. The pertinent pages regarding CITES-listed species of amphibians, the Amphibian Species Checklist, are provided in annex.

3. It should be noted that the layout of the website where the on-line version of *Amphibian Species of the World* can be found (http://research.amnh.org/herpetology/amphibia) looks different from the printed version adopted by the Nomenclature Committee. The content is however identical.

This notification was distributed 4 October 2002.

<http://www.cites.org/eng/notifs/2002/058.shtml>

Southwestern Research Station Positions and Grants for 2003

VOLUNTEERS—Approximately 30 volunteer positions are open in 2003 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals. The program is open to non-students as well, particularly in the spring and fall.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers

A New Facsimile Reprint from the Society for the Study of Amphibians and Reptiles

The Herpetology of Cuba

by Thomas Barbour and Charles T. Ramsden



Barbour and Ramsden's *The Herpetology of Cuba*, published in 1919, was the first complete listing of the amphibians and reptiles of Cuba to include detailed descriptions of all species. More than 80 years after its original publication, the work remains an essential reference on the systematics, natural history, and biogeography of the herpetofauna of the largest and most diverse of the islands of the West Indies. *The Herpetology of Cuba* is among the most important of Barbour's more than 200 herpetological publications and draws on the extensive field experience of both authors over many years throughout the island

Detailed accounts are provided for 70 species including 12 frogs and toads, 40 lizards, 2 amphisbaenians, 13 snakes, 1 turtle, and 2 crocodiles. Among these are five new species descriptions (2 *Sphaerodactylus* and 3 *Anolis*). Sixty-eight of these species are illustrated by 95 figures on 15 plates.



The Herpetology of Cuba, originally published in the Memoirs of the Museum of Comparative Zoology at Harvard College, has long been out of print. With the publication of the new SSAR facsimile edition this classic book is again available to herpetologists with interests in Cuba, the West Indies, or island herpetofaunas in general. A foreword by Rudolfo Ruibal of the University of California, Riverside places *The Herpetology of Cuba* in its historical context and a listing of the current names for Barbour and Ramsden's species facilitates use of the book by modern workers.

Specifications: 200 pages, 8.5 x 11 inches, 15 plates, clothbound. ISBN 0-916984-61-3. To be published March 2003.

Prices and Shipping Costs: Pre-publication to SSAR members US$45 (before 31 March 2003); Institutions, non-members $55 • *Shipping*: USA address, add $4; Canada and Mexico, add $7; all others add $9.

Send Orders To: Breck Bartholomew, P.O. Box 58517, Salt Lake City, Utah 84158-0517, USA (*telephone and fax*: area code (801) 453-0489; *e-mail*: ssar@herplit.com). Please make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks or by International Money Order. Orders may also be charged to MasterCard, Discover, American Express, and Visa (Please provide the account number and card expiration date). SSAR membership information and a complete list of all Society publications can be obtained from www.herpsoc.org or Mr. Bartholomew.



(September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA; phone/fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately US $400–$800 to graduate or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by contacting: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024-5192, USA; http://research.amnh.org/grants/index.html; e-mail: grants@amnh.org. Application due date: February 15, 2003.



SSAR Grants-in-Herpetology

Proposals are now being accepted for the 2003 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include *in situ* behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

6. INTERNATIONAL. Proposals may address needs in any of the above five categories, but applicants must be from countries where herpetological research has historically been underfunded, and where alternate sources of financial support are scarce or nonexistent.

7. BIBLIOGRAPHIC RESEARCH. This special category continues for 2003 thanks to a donation from Itzchak and Carolyn Gilboa. Proposals should address a major need to consult library or other information resources. The project must focus on a herpetological topic. Proposals from individuals only, accompanied by a letter of support from someone knowledgeable about the applicant and about the importance of the project.

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be students AND members of the SSAR with the exception of those applying for support of regional herpetological society projects, or those applying in the international category. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 2002 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. Past recipients of an SSAR GIH award in any category are not eligible for future awards. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) TITLE PAGE giving the title of the project, the name, mailing address, office and home telephone numbers and, if possible, fax number and e-mail address of the applicant. The title page should include a statement indicating that applicants "will comply with all applicable permit regulations, and adhere to all appropriate animal care guidelines in the course of conducting funded projects." (B) BACKGROUND AND OBJECTIVES of the proposed project. (C) METHODS of carrying out the project. (D) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). Include an explicit explanation of how an SSAR award of $500 would be applied toward the objectives of the project, and provide a listing of all current and pending support for the project. (E) BRIEF RESUMÉ of the applicant or project coordinator. (F) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed 1200 words, excluding title page, literature cited, resumé, and budget. Applicants must indicate word count on their application.

Applicants must designate to which of the seven categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than **28 FEBRUARY 2003** to be considered. Failure to meet these guidelines may result in elimination of a proposal from consideration. The awards will be announced on or around 1 April 2003. Successful applicants are encouraged to submit the results of their research for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Erik R. Wild, Chair, SSAR Grants-in-Herpetology, Department of Biology, University of Wisconsin - Stevens Point, Stevens Point, Wisconsin 54481-3897, USA. Tel. (715) 346-4269; Fax (715) 346-3624; e-mail: ewild@uwsp.edu.*

Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA; phone/fax: 520-558-2396; e-mail: swrs@amnh.org.*

MEETINGS

Meetings Calendar

19–23 January 2003—Sixth Latin American Congress of Herpetology (Congreso Latinoamericano de Herpetología), Museum of Natural History, Universidad Nacional Agraria, La Molina, Lima, Peru. Information: http://barrioperu.terra.com.pe/VICLAH/.

21–23 February 2003—The Desert Tortoise Council 28th Annual Meeting and Symposium, Las Vegas, Nevada, USA. Information: http://www.deserttortoise.org/symposium/2003/index2003.html.

18–22 June 2003—Second International Congress on Chelonian Conservation in Senegal. Conference to be held in English w/ French translations. Information: www.tortues.com; e-mail: soptom@soptom.com.

26 June–1 July 2003—46th Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists. Hotel Tropical, Manaus, Brazil. Details available elsewhere in this issue and from the meeting web site: http://www.aiha.org.br/.

3–6 September 2003—International Herpetological Symposium, 27th Annual Meeting, Houston, Texas, USA. Information: http://www.kingsnake.com/ihs/index.html.

OBITUARIES

Herpetological Review, 2002, 33(4), 246–249.
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James Kezer, Pioneer in Amphibian Cytogenetics and Teacher Extraordinaire 1908–2002

STANLEY K. SESSIONS
Department of Biology, Hartwick College
Oneota, New York 13820, USA
e-mail: SessionsS@Hartwick.edu

Jim Kezer, amphibian cytogeneticist and professor emeritus, University of Oregon, died at home on January 3, 2002, from causes associated with age. He was 93. Jim (or Kezer, as he was affectionately known to many) was loved and admired by friends and colleagues throughout the world, not only as a pioneer in amphibian cytogenetics, but also as a master teacher who had an almost magical influence on anyone he encountered.

Jim's interests and work bridged worlds. He was both an accomplished musician as well as biologist, researcher as well as teacher, naturalist and cytologist, comfortable in both laboratory and field. His publication record reflected this blend, ranging from life history patterns to molecular cytogenetics. He produced a solid record of accomplishments, in teaching, in research, in fighting for the preservation of wilderness, and in presenting innumerable lectures to the public in order to convey the wonders of science. His scientific contributions include: the first application of the "squashing" technique to vertebrate chromosomes, allowing the first accurate chromosome counts in numerous species of salamanders; the discovery of karyological uniqueness in proteid salamanders; pioneering work on the molecular organization of amphibian chromosomes; the discovery of multinucleated oocytes (unique among vertebrates) in the Tailed Frog (*Ascaphus truei*); the discovery of chromosomal polymorphisms in plethodontid salamanders of the genus *Aneides*; and the discovery of strongly heteromorphic X/Y sex chromosomes in tropical bolitoglossine salamanders. He and his work have had an important influence on both herpetology and cytogenetics.

L. James Kezer was born on October 17, 1908 at 716 Duck Street in Stillwater, Oklahoma, to Charles and Lulu James Kezer. He developed an interest in science early on and attended the University of Iowa as an undergraduate, earning his bachelor's degree in 1930. If it hadn't been for the Great Depression, Jim would probably have gone to work for an electric company, and the field of biology would never had experienced this legendary figure. In a fortunate twist of fate, he instead obtained a job as high school science teacher in Summit, New Jersey, teaching physics, chemistry, and biology.

During summers, when he was not teaching high school, Jim worked on his Masters degree at Cornell, and took a course on Natural History of the Vertebrates with A. H. Wright. It was in this course that Jim was first introduced to plethodontid salamanders. Jim once described to me the precise moment: During a field trip into Cascadilla Gorge near the Cornell Campus, Wright lifted a piece of bark, exposing several specimens of red-backed salamanders (*Plethodon cinereus*), and *click!* Kezer was hooked. The experience inspired Jim to incorporate field trips into his high school science classes, engaging students in surveys of vertebrate animals in the Watchung Reservation and other localities near Summit. Jim earned his Master's degree at Cornell in 1937 with Wright and W. Hamilton as his co-advisers.

Jim continued at Cornell, working on his PhD with Wright and, after Wright's retirement, E. C. Raney. A cytology course gave Jim the idea to focus his PhD research on salamander chromosomes, especially plethodontid salamanders, about which little was known. Animal cytogenetics at that time involved paraffin sections, which turned out to be a completely inadequate technique for the large chromosomes of salamanders. Jim learned about the "squash technique" in a botany course (some plants have large chromosomes too), tried it on salamanders and the results were astounding. Soon he had accurate chromosome counts for several species of plethodontids, obtained from squashes of meiotic cells from testes. (It is a remarkable fact that Jim determined accurate counts of chromosome complements in several species of salamanders years before the correct chromosome number in humans was known.)

Jim's graduate work was interrupted by World War II, and he

enlisted in the U.S. Army, rising from buck private to captain and head of bacteriology and serology at the 55th General Hospital in England and France during the years 1943-1946. It was in France, apparently, that he was introduced to what would become a lifelong love of opera. His first salamander paper was published in *Copeia* in 1944.

After the war Jim returned to Cornell to work on the chromosomes of plethodontid salamanders, winning a Stoye Award from the ASIH, and finishing his PhD in 1948. His first college teaching job was at the University of Missouri, where he taught courses in General Zoology, and in the summer worked as park naturalist at Crater Lake National Park, in Oregon. At Crater Lake, Jim began to work on western species of amphibians, including the Long-toed salamander, *Ambystoma macrodactylum*, and the Oregon Rough-skin newt, *Taricha granulosa*. It was also at Crater Lake that Jim met Ralph Huestis, who was chair of the biology department at the University of Oregon. Huestis was able to lure Jim away from the University of Missouri to take a position at the University of Oregon in 1954.

At the University of Oregon, Jim quickly built a reputation as master teacher, organizing curricula, inventing new laboratory exercises and producing laboratory manuals for General Biology in a program designed to enhance undergraduate science education and funded by a grant from the Ford Foundation. He also began to teach such courses as cell biology, histology, and cytology, and he was a highly effective and popular teacher. Once he had secured his position at the University of Oregon, Jim also began to pursue his chromosomal research in earnest, most of it funded out-of-pocket. In 1956 and again in 1960, Jim traveled to Europe in quest of *Hydromantes* from Italy and Sardinia (the only European plethodontids), and the European Cave Salamander, *Proteus anguinus,* from the caves of the former Yugoslavia. His vivid written and oral accounts of these trips are famous among his family, friends, and colleagues. At that time such expeditions were quite dangerous, and required armed soldiers to protect him from bandits. This work culminated in the first accurate chromosome count for *Proteus*, which he found to have exactly the same chromosome number as the North American Mudpuppy, *Necturus maculosus*, a chromosome number not found in any other salamanders. He and his coauthors, Takeshi Seto (Hokkaido University in Japan) and Charles Pomerat (Pasadena Foundation for Medical Research), realized that this was strong evidence that, despite their disjunct geographic distribution, *Necturus* and *Proteus* form a monophyletic lineage, rather than being an example of convergent evolution as some believed, and published the results in *The American Naturalist* in 1965.

Jim's interest in ever more detailed analyses of chromosome structure in salamanders led him to visit Joe Gall's lab in Minnesota to learn how to prepare lampbrush chromosomes from salamander ovaries. Through Gall he became acquainted with the leading lampbrush chromosome researcher in the world, Mick Callan, at St. Andrews University in Scotland. Jim soon became one of the world's experts on "lampbrushology," introducing this technology to the University of Oregon (see www.le.ac.uk/biology/lampbrush/people), and using it to study detailed chromosome structure in a wide variety of salamander species that had never before been studied in that way. Later, he began a series of collaborations with molecular biologists, including Herbert Macgregor



FIG. 1. Jim Kezer flanked by the brothers Ceron (Miguel on the left, Carlos on the right), on a trip to Mexico in 1974 with Jim Lynch and Charles Kimmel.

(University of Leicester in England) and Pedro León (now at the University of Costa Rica), producing papers on the chromosomal localization of specific kinds of DNA sequences in plethodontids as well as certain other groups of salamanders.

Most of Jim's early cytogenetic research was focused on north temperate species of plethodontids which had nearly identical karyotypes in terms of chromosome number and morphology (n = 14 pairs of all-biarmed chromosomes). He finally found an exception to this karyological uniformity when he made some squashes of Oregon *Batrachoseps*, a bolitoglossine salamander with n = 13 pairs of chromosomes. This was an astonishing discovery since the only other bolitoglossines he had examined were species of *Hydromantes* from Europe and California, which all have 14 pairs of chromosomes. At this point Jim became determined to examine more bolitoglossines, most of which are neotropical, so he organized trips to Mexico and Costa Rica that began with his sabbatical year in 1962.

His first trip, in July 1962, involved driving solo in his VW beetle all the way through Mexico and into Central America. This trip resulted in the "rediscovery" of two of the most famous amateur Mexican herpetologists ever known: the brothers Carlos and Miguel Ceron of Cuatlapán in Veracruz, who as teenagers had collected amphibians and reptiles for Hobart Smith and Edward Taylor (Fig. 1). As Jim tells the story, he was searching for salamanders beneath the leaves of red banana plants on July 15 when two local men came up to him and asked him if he knew Smith and Taylor. Carlos and Miguel Ceron subsequently became indispensable guides for many herpetologists in search of Mexican species, and the relationship between Kezer and the Cerons lasted for many years. Jim returned in 1982, his last trip to Mexico, to celebrate the 20th anniversary of the "rediscovery" of the brothers Ceron. Carlos Ceron died from cancer just last year.

In Costa Rica Jim worked with Douglas Robinson, of the University of Costa Rica, who helped him obtain specimens of *Oedipina*, among other bolitoglossines. He finally hit the jackpot, first discovering heteromorphic X/Y sex chromosomes in *Oedipina* during a visit to Callan's lab in Scotland in 1963, and soon after discovering similar sex chromosomes in the Mexican genus *Thorius*. Other discoveries included reciprocal translocations in

Thorius and *Lineatriton*, and supernumerary chromosomes in *Oedipina*, *Thorius*, *Lineatriton*, and *Chiropterotriton*. Jim made a total of sixteen visits to Latin America between 1962 and 1982.

Among the other important discoveries was the finding of chromosomal polymorphisms involving pericentric inversions in the plethodontid genus *Aneides*. This research (on which I was fortunate enough to be a collaborator) began with Oregon populations of the Clouded Salamander, *A. ferreus*, and eventually expanded to include all known species of the genus. One of the important outcomes of this research was the recognition that "*A. ferreus*" included two chromosomally distinct groups of populations. These groups have since been confirmed biochemically as two distinct species by one of David Wake's students.

Jim Kezer was one of the truly legendary characters of the University of Oregon. I do not remember when I first heard about him, but I do remember the first time I experienced one of his famous lectures. It was in Edward Novitski's evolution course. Novitski asked Jim Kezer to give a guest lecture, and Jim's lecture was on the chromosomes of plethodontid salamanders. I was spellbound as Jim took us all with him (metaphorically speaking) to Mexico and Central America to search for bolitoglossine salamanders for cytogenetic research. First an introduction to the Family Plethodontidae, and to the "masterful research by the world's leading expert on plethodontid salamanders," David B. Wake. "Plethodontid salamanders, don't you know, spread from the Appalachian region of eastern North America, on down into eastern Mexico, Central America, and on into Brazil. We've just got to look at the chromosomes of this marvelous group! Come on class, let me take you with me to Mexico and Costa Rica, where we will search for cytological treasures in *Bolitoglossa*, *Pseudoeurycea*, *Lineatriton*, *Parvimolge*, *Chiropterotriton*, *Thorius*, and, of course, *Oedipina*!" One of the truly remarkable things about the chromosomes of these salamanders is their large size, which greatly facilitates analysis of chromosome structure and behavior during meiosis. The large chromosomes of *Oedipina* in particular allowed an unobstructed view of the intimate interactions of the X and Y sex chromosomes (Fig. 2). It was a clever and effective way to introduce students to the concepts of meiosis and the evolution of sex chromosomes.

I did not meet Jim Kezer in any personal way until later, when Chuck Kimmel (U. of O. Neurobiology Institute), for whom I was working as lab technician, took me upstairs and down the hall into the old science building to meet him. As we approached his office+lab (rooms 312 and 313), I could hear the humming of opera along with the clinking of jars and bottles: we had arrived in time to find Jim cleaning and feeding his live collection of salamanders. Salamanders of all kinds were housed in gallon jars arranged on a large water table in his very small lab. An old Zeiss photoscope, complete with phase contrast and optivar lenses, was conveniently located next to a refrigerator, and next to that a Zeiss inverted microscope, and next to that a dissection stereomicroscope for making lampbrush chromosome preps. The mild fumes from fly medium (here *Drosophila* fruitflies were used only for salamander food), ivory soap (an old bar always sitting in a dish next to the sink), and photographic fixer mixed to create a signature odor, pleasantly familiar to all the students who ever worked in Kezer's lab.

A small man with short-cropped white hair, square jaw, and

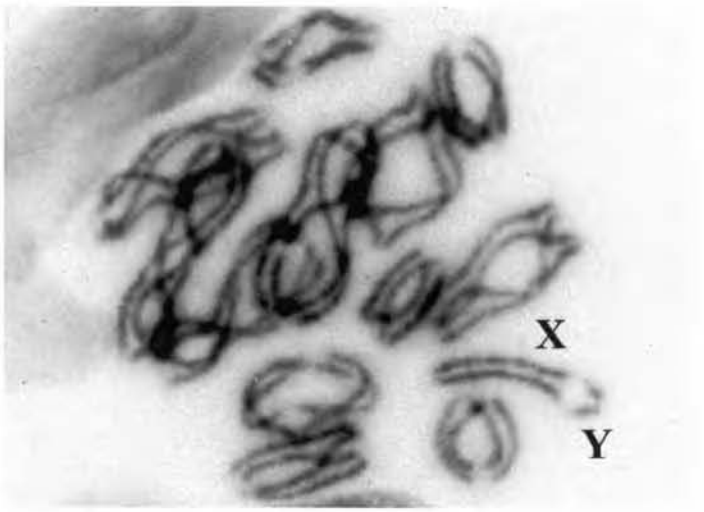


FIG. 2. The chromosomes of the Costa Rica bolitoglossine salamander, *Oedipina uniformis*, at diplotene stage of prophase of the first meiotic division. The X and Y chromosomes, still attached at their ends, are indicated.

mirthful eyes, dressed in workman's sky blue shirt (sleeves rolled up past the elbows) and dark blue Dicky's pants with polished black work shoes, Kezer did not look at all like a typical professor. In fact, Kezer resembled someone from the physical plant, an impression reinforced by his habit of emptying his own trash cans. Once he was mistaken for a janitor by a new chemistry professor who complained that his trash cans needed emptying too. In true Kezerian fashion, Jim happily and genuinely agreed to empty his trash cans right away, and then introduced himself. Needless to say, the chemistry professor was a bit embarrassed!

Kezer welcomed us into his lab. He immediately engaged us in all sorts of interesting adventures, examining the salamanders on his watertable, perusing some recent photomicrographs, leafing through some reprints sent by a colleague, and, of course, peering through the microscope at some "cytological treasure." "Come and sit down and feast your eyes on something truly marvelous. Do you see it? Do you see how the bivalents are arranged? Come on tell me: what stage is it? Why, it is a diplotene of the first meioic prophase, of course! I don't know how we do it, but we do it!" Never had I experienced so much activity and enthusiasm occurring in such a small space and with such intensity. I decided on the spot to become his student.

As I got to know him better, I realized that Jim led a "streamlined" life organized around four main things: salamanders, chromosomes, opera and, most importantly, people. Once having played the violin quite well (as a graduate student, he had been concertmaster for the Cornell University orchestra), he had given it up in favor of the art of listening. His home (2410 Emerald Street) was conveniently located only a mile from campus, and was basically a studio for listening to music, complete with a set of huge "magnaplanar" speakers and a computerized delay system to mimic the sounds of a large concert hall. He lived alone, but often entertained guests with "gala occasions" featuring opera plus plenty of ice cream and strawberries. He was a familiar sight in Eugene, commuting between home and lab via bicycle.

Jim retired from the University of Oregon in 1974, and unlike most new retirees, immediately and vigorously launched a new

phase of his professional career. It is very telling that nearly half of his publications were produced after his retirement, and most of them were based on new research findings. He also continued to be active in various organizations and especially the Eugene Natural History Society. Jim was widely admired, but he had the unique ability to turn the tables, making each person he met feel like a million bucks, as if they were the center of the universe. Thus it is impossible for anyone who has met him to forget him. Jim will always be remembered as a person who loved science and teaching and, most of all, people.

A recent gathering of Jim's closest friends and colleagues in Eugene, Oregon was hosted by Charles and Reida Kimmel (University of Oregon) and Jay and Teresa Bowerman (SunRiver Nature Center), and the participants included Pedro Leon, Takeshi Seto, David Wake, and several other scientists, including me. We took Jim's ashes to one of his favorite salamander collecting sites. Each of us took a handful of ashes and scattered them in the forest. It was a fitting tribute to such a fine biologist and teacher.

Acknowledgments.—This obituary benefitted from interactions with John Applegarth, Jim Baldwin, Jay Bowerman, and Charles Kimmel, as well as from an essay written by Will Eaton in *Nature Trials* (vol. 17, number 2, February 1983), published by the Eugene Natural History Society.

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CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres-Carvajal**; postal and e-mail addresses may be found on the inside front cover.

The current contents of various herpetological journals and other publications can be found at: http://www.herplit.com/contents.

Chemistry of Paracloacal Secretions of the American Crocodile

Paracloacal glands of crocodilians produce pheromones involved in nesting and mating behaviors. The authors used gas chromatography-mass spectrometry to study the chemistry of paracloacal gland secretions of the American crocodile (*Crocodylus acutus*). Identification of major components was supported by infrared spectra obtained with gas chromatography-Fourier transform IR spectroscopy. Secretions were obtained from individuals at three farms in Florida by manually pressing the region around the cloaca. Among the compounds found were many aliphatic acetates, butyrates, formates, free alcohols, and several hydrocarbons. This is the first time that formates are reported from reptiles. Precloacal-secretion chemistry of crocodiles has been previously studied only in the African dwarf crocodile *Osteolaemus tetraspis*. Interestingly, there are substantive chemical differences in the paracloacal gland products between *Crocodylus* and *Osteolaemus*. The authors conclude that more taxa need to be examined in order to assess the range of chemical variation within Crocodylidae.

García-Rubio, S., A. B. Attygalle, P. J. Weldon, and J. Meinwald. 2002. Reptilian chemistry: volatile compounds from paracloacal glands of the American crocodile (*Crocodylus acutus*). Journal of Chemical Ecology 28(4):769–781.

Correspondence to: Silvina García-Rubio, Department of Chemistry and Chemical Biology, Cornell University, Ithaca, New York 14853-1301, USA; e-mail: circe@cornell.edu.

Reproductive Performance of *Vipera aspis*

The reproductive performance of living organisms is affected in part by environmental factors. Species that use storage as the primary energy source for reproduction are known as capital breeders, whereas species that use energy from current food intake are known as income breeders. Infrequent reproduction has been observed among capital breeding reptiles, such as viperid snakes. The authors studied how temperature and food availability affects reproductive performance in the aspic viper, *Vipera aspis*, in west-central France. More than 400 females were marked with passive integrated transponder tags from 1992–2000. Level of fat stores was estimated by calculating initial body condition (mass relative to length), and prepartum mass change was used as an indicator of food intake during reproduction. The authors found that female *Vipera aspis* benefited from energy storage to reproduce succesfully; however, reproductive output also was limited by prey availability. Additionally, mass gain was affected by mean environmental temperature during the active season. This study demonstrates that reproductive performance of the aspic viper is determined not only by capital breeding, but also by income breeding.

Lourdais, O., X. Bonnet, R. Shine, D. Denardo, G. Naulleau, and M. Guillon. 2002. Capital-breeding and reproductive effort in a variable environment: a longitudinal study of a viviparous snake. Journal of Animal Ecology 71:470–479.

Correspondence to: Olivier Lourdais, CEBC-CNRS, 79360, Villiers en Bois, France; e-mail: lourdais@cebc.cnrs.fr.

Social Experience Affects Behavior in Leopard Geckos

Social inateractions affect the behavior and physiology in a variety of organisms. The authors investigated the effects of social experiences in adulthood on behavioral phenotype of male leopard geckos (*Eublepharis macularius*) by comparing behaviors of socially experienced and naïve geckos. All males were reared in isolation until sexual maturity (1–1.5 years). Subsequently, 11 males were placed for 1–2 years in individual, isolated cages, whereas 10 males were placed in cages containing 3–4 sexually mature females. Behavioral differences between the two groups of males were examined when males were gonadally intact, following castration, and following androgen replacement. Activity, territoriality, and courtship behaviors were observed by placing the males in test arenas (both empty and with females). Experienced males displayed more territoriality and activity than naïve males before and after castration, which suggests that territorial behavior could be androgen independent. No significant courtship behavior differences were found after castration; however, experienced males showed more courtship behavior than naïve males following androgen replacement. The results indicate that social experience in male leopard geckos influences courtship and territorial behaviors.

Sakata, J. T., A. Gupta, C. Chuang, and D. Crews. 2002. Social experience affects territorial and reproductive behaviours in male leopard geckos, *Eublepharis macularius*. Animal Behaviour 63:487–493.

Correspondence to: J. T. Sakata, Institute for Neuroscience, Patterson Hall, University of Texas at Austin, Austin, Texas 78712, USA; e-mail: jsakata@mail.utexas.edu.

Systematics of *Scinax*: How Many Species Groups?

With 84 recognized species, *Scinax* is the second largest genus within Hylinae. It ranges from southern Mexico to eastern Argentina occupying all major tropical and subtropical areas. Although five species groups have been proposed, the phylogenetic relationships among species of *Scinax* have not been ascertained yet.

In an attempt to test the monophyly of each of the five species groups and analyze the relationships among them, Faivovich made a cladistic analysis of 36 species of *Scinax* including seven outgroup taxa. Using NONA 2.0, the author performed a parsimony analysis including 86 characters of internal and external morphology of larvae and adults. A strict consensus tree was calculated from 36 most-parsimonious trees. Interestingly, Faivovich found that all of the conflict among the most-parsimonious trees was localized among species of two species groups—*Scinax rubra* Group and *S. catharinae* Group. Bremer support and parsimony jackknifing indicated that only two species groups were well supported—*Scinax catharinae* Group and *S. rostrata* Group. Based on the topology of the strict consensus tree, the author suggests to keep the *S. catharinae* Group. In addition, a *S. rubra* clade that includes *S. acuminata* and *S. rostrata* clades is proposed. Nonetheless, monophyly of the *S. rubra* clade needs to be corroborated with increased character and taxon sampling.

FAIVOVICH, J. 2002. A cladistic analysis of *Scinax* (Anura: Hylidae). Cladistics 18:367–393.

Correspondence to: Julian Faivovich, Department of Herpetology, Division of Vertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA; e-mail: julian@amnh.org.

Monkeys Also Are Frog-Spawn Predators

Most anuran families include species that breed terrestrially. Although these species avoid predation in aquatic environments, terrestrial clutches are still under predation pressure. The authors discovered a few species of monkeys that feed on foam nests and exposed frog clutches in the Taï National Park, Ivory Coast. Sooty mangabeys (*Cercocebus torquatus atys*) were found to check the vegetation intensively around ponds for exposed clutches of *Hyperolius chlorosteus* and *H. sylvaticus ivorensis* and foam nests of *Chiromanctis rufescens*. Most of the monkeys that fed on these frog clutches were adult females. Additionally, the authors also observed diana monkeys *Cercopithecus diana diana* feeding on *C. rufescens* foam nests. Rödel et al. suggest that sooty mangabeys feed on frog clutches because these monkeys face a period of food shortage during the rainy season, which is when frog terrestrial clutches are available and easy to harvest. Further research is needed in order to determine the impact of monkey predation on frog clutch survival and the energetic value of this food item for monkeys.

RÖDEL, M., F. RANGE, J. SEPPÄNEN, AND R. NOË. 2002. Caviar in the rain forest: monkeys as frog-spawn predators in Taï National Park, Ivory Coast. Journal of Tropical Ecology 18:289–294.

Correspondence to: Mark-Oliver Rödel, Theodor-Boveri-Institute (Biocenter of the University), Department of Animal Ecology and Tropical Biology (Zoology III), Am Hubland, D-97074 Würzburg, Germany.

Ecological Speciation in Scincid Lizards

Ecological speciation results from the evolution of reproductive isolation as a consequence of divergent natural selection. To determine if ecology actually plays a major role in speciation, the authors studied 54 populations of skinks of the *Eumeces skiltonianus* Group, which extends from southwestern Canada into Baja California. *Eumeces skiltonianus* and *E. lagunensis* are small, striped lizards that live in mesic and cool habitats, whereas *E. gilberti* is represented by large and uniform-colored lizards that occur in warmer and drier environments. The first step in this study was to perform a phylogenetic analysis of mtDNA using parsimony and maximum likelihood methods. Results supported monophyly of the *skiltonianus* Group and demonstrated parallel origin of three clades characterized by the *gilberti* morphotype; *E. lagunensis* was among *E. skiltonianus* populations. The second step was to evaluate evolutionary changes in body size and color pattern by mapping characters onto the reconstructed phylogeny. The authors found that *E. gilberti* lineages were clearly defined by large body size and ontogenetic color change (i.e., from striped to uniform-colored), whereas retention of stripes and smaller size characterized clades of *E. skiltonianus* and *E. lagunensis*. Parallel evolution of the *gilberti* morphotype was strongly supported by similarity in early ontogenetic trajectories and close association between differences in body size and color pattern.

RICHMOND, J. Q., AND T. W. REEDER. 2002. Evidence for parallel ecological speciation in scincid lizards of the *Eumeces skiltonianus* species group (Squamata: Scincidae). Evolution 56(7):1498–1513.

Correspondence to: Jonathan Q. Richmond, Department of Ecology and Evolutionary Biology, University of Connecticut, 75 North Eagleville Road, Storrs, Connecticut 06269-3043, USA; e-mail: jonathan.richmond@uconn.edu.

Diversification of Salamanders of the Genus *Batrachoseps*

Batrachoseps is the most diverse genus of salamanders in western North America. Like other salamanders, species of *Batrachoseps* are morphologically conservative; therefore, molecular markers (allozymes) have been used in previous phylogenetic studies. In order to study the evolutionary history of this genus in more detail, the authors analyzed sequence variation in the cytochrome *b* gene of several populations representing almost all groups within *Batrachoseps* that had been described previously. The analysis included maximum parsimony, maximum likelihood, and weighted-least-squares methods. Support for nodes was estimated with (1) bootstrapping for both the MP and LS analyses, and (2) Bayesian analysis for the ML tree. Six highly supported clades within *Batrachoseps* were concordantly identified in all analyses—subgenus *Plethopsis* and five species groups within the subgenus *Batrachoseps*. Nonetheless, significant discordance regarding population relationships was found between trees found in this study (mtDNA) and trees proposed in previous studies (allozymes). The authors suggest that these discrepancies result from fragmentation of populations, allopatric divergence, and the recontact and merging of fragments caused predominantly by male-mediated gene flow. Because of greater philopatry of females and high rate of evolution of mtDNA, differences in mtDNA between geographically separated populations accumulate rapidly as species fragment. Thus, the maternally transmitted mtDNA seems to reflect deep history, while the biparentally inherited allozymic markers seem to reflect recent and current patterns of interactions

among populations.

JOCKUSCH, E. L., AND D. B. WAKE. 2002. Falling apart and merging: diversification of slender salamanders (Plethodontidae: *Batrachoseps*) in the American West. Biological Journal of the Linnean Society 76:361–391.

Correspondence to: Elizabeth Jockusch, Department of Ecology and Evolutionary Biology, U-3043, 75 N. Eagleville Rd., University of Connecticut, Storrs, Connecticut 06269, USA; e-mail: jockusch@sp.uconn.edu.

Conservation of the Tuatara by Translocation

Translocation might be the only conservation strategy for some endangered species of terrestrial vertebrates. The only two living species of Sphenodontia are restricted to New Zealand and occupy <0.5% of their original range, and thus are among the most endangered reptilian taxa in the world. Predation by introduced mammals such as rats, dogs, cats, and mustelids is probably the major cause of decline of tuatara populations. In 1995, the authors introduced *Sphenodon guntheri* to Titi Island, a rodent-free reserve in New Zealand, and monitored the progress of this population for five years. The translocated individuals included 18 adults from the wild population on North Brother Island and 50 juveniles from eggs incubated in captivity. Monitoring consisted of six post-release visits ranging from 4–7 nights and included 3–4 people. The authors recaptured only 57% of the translocated tuatara and found that adults had gained weight following release, while juveniles showed little average weight gain. Unfortunately, no hatchlings or hatched eggs were found, but tuatara are long-lived, late-maturing species; therefore, maybe only 10% of the average generation time was monitored. In addition, cryptic appearance and elusive behavior of juveniles, and habitat inaccessibility on Titi Island are possible causes for not recapturing more individuals. Establishment of a self-sustaining population of *S. guntheri* on Titi Island might take decades to confirm.

NELSON, N. J., S. N. KEALL, D. BROWN, AND C. H. DAUGHERTY. 2002. Establishing a new wild population of tuatara (*Sphenodon guntheri*). Conservation Biology 16:887–894.

Correspondence to: Nicola J. Nelson, School of Biological Sciences, Victoria University of Wellington, P.O. Box 600, Wellington, New Zealand; e-mail: nicola.nelson@vuw.ac.nz.

Adhesion of Gecko Setae by van der Waals Forces

Two hypotheses have been proposed to explain the mechanism of dry adhesion in the millions of setae on the toes of geckos. The first hypothesis attributes adhesion to thin-film capillary forces or other mechanisms relying on hydrophilicity, whereas the second one proposes van der Waals forces as the mechanism of adhesion. The authors tested both hypotheses by measuring adhesion on two polarizable semiconductor surfaces that varied greatly in hydrophobicity. Foot and setal adhesion of live Tokay geckos (*Gekko gekko*) were analyzed with hydrophobic and hydrophilic semiconductor wafers and microelectromechanical systems. In addition, the authors fabricated synthetic setal tips to determine if adhesive force depended on material or size of the setal tips. The results supported the van der Waals hypothesis and rejected the idea of capillary adhesion, as well as the hypothesis that water contact angle of a surface predicts the attachment forces in setae. It also was found that for a given thermodynamic adhesion energy smaller spatulae result in a greater adhesive force per unit area. Finally, the authors suggested that synthetic adhesives could be enhanced by dividing their surface into small protrusions to increase surface density, and, moreover, that humans could fabricate the first dry, adhesive microstructures using gecko setae as models.

AUTUMN, K., M. SITTI, Y. A. LIANG, A. M. PEATTIE, W. R. HANSEN, S. SPONBERG, T. W. KENNY, R. FEARING, J. N. ISRAELACHVILI, AND R. J. FULL. 2002. Evidence for van der Waals adhesion in gecko setae. Proceedings of the National Academy of Sciences (www.pnas.org/cgi/doi/10.1073/pnas.192252799).

Correspondence to: Kellar Autumn, Department of Biology, Lewis & Clark College, Portland, Oregon 97219, USA; e-mail: autumn@lclark.edu.

Spermatozoa Ultrastructure in the Lizard *Ameiva ameiva*

Sperm ultrastructure has not been described in most squamate reptiles. The authors examined spermatozoa of the teiid lizards *Ameiva ameiva* in an attempt to study variation in sperm structure within Teiidae. Epididymal mature spermatozoa were obtained from an adult individual collected in Goiás State, Brazil, and examined with transmission electron and light microscopes. Some of the features described are: a depressed acrosome anteriorly, paracrystalline subacrosomal material with radial organization in transverse section, larger nuclear rostrum, and columnar mitochondria with linear cristae. The authors found that *A. ameiva* shared several character states with the teiid *Cnemidophorus sexlineatus* and the gymnophthalmid *Micrablepharus maximiliani*. Nonetheless, there are high levels of polymorphism in spermatozoa structure between the two teiids. Although no synapomorphies of Teiidae or Teiioidea (Gymnophthalmidae + Teiidae) were identified, four unique features of sperm ultrastructure in *A. ameiva* were found.

GIUGLIANO, L. G., R. D. TEIXEIRA, G. R. COLLI, AND S. N. BÃO. 2002. Ultrastructure of spermatozoa of the lizard *Ameiva ameiva*, with considerations on polymorphism within the family Teiidae (Squamata). Journal of Morphology 253:264–271.

Correspondence to: Sônia N. Báo, Departamento de Biologia Celular, Universidade de Brasília, 70919-970, Brasília, DF, Brazil; e-mail: snbao@unb.br.

How Reed Frogs (*Hyperolius nitidulus*) Detect Fire

Mechanisms of fire detection have been developed by several organisms living in fire-prone habitats, such as the West African savannah. Based on field observations in Ivory Coast, the authors hypothesized that aestivating juveniles *Hyperolius nitidulus* can hear the sound of fire and respond by fleeing into a nearby safe habitat. To test this hypothesis, the authors conducted playback experiments at Comoé National Park, Ivory Coast, in January 2001. Using amplified speakers, the sound of fire and other control sounds were played next to several specimens of *H. nitidulus*. The majority of frogs reacted strongly to the sound of fire by raising their heads, scanning their surroundings, and fleeing into nearby vegetation. Control noise stimuli were ignored. Nonetheless, frogs

did not respond to playbacks of fire in February–March, which according to the authors indicates the existence of a time-window in which frogs respond. This is the first experimental evidence that anurans use airborne sounds not just for intraspecific communication.

GRAFE, T. U., S. DÖBLER, AND K. E. LINSENMAIR. 2002. Frogs flee from the sound of fire. Proceedings of the Royal Society of London B 269:999–1003.

Correspondence to: T. Ulmar Grafe, Department of Animal Ecology and Tropical Biology, University of Würzburg, 97074 Würzburg, Germany; e-mail: grafe@biozentrum.uni-wuerzburg.de.

Frog Melanophores as Drug Detectors

Melanophores are an important class of chromatophores that contain dark brown melanin pigment granules. In response to appropriate stimuli, melanophores can appear dark if the pigment granules undergo dispersion throughout the cells, or light if the granules aggregate in the center of the cells. This response is mediated by heptahelical receptors or G-protein coupled receptors. The authors transfected melanophores of *Xenopus laevis* with the human opioid receptor 3 and tested them as biosensors for detection of two opioids—morphine and DAMGO. Absorbance readings in an aggregation assay showed that both substances caused aggregation of pigment granules in melanophores (i.e., cells become lighter). These melanophore biosensors have potential use for detection and measurements of substances in body fluids such as saliva, blood plasma, and urine.

KARLSSON, A. M., K. BJUHR, M. TESTORF, P. ÖBERG, E. LERNER, I. LUNDSTRÖM, AND S. P. S. SVENSSON. 2002. Biosensing of opioids using frog melanophores. Biosensors & Bioelectronics 17:331–335.

Correspondence to: Samuel P. S. Svensson, Department of Medicine and Care, Pharmacology, Faculty of Health Sciences, SE-581 85 Linköping, Sweden; e-mail: samuel.svensson@far.liu.se.

INSTITUTIONS

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Herpetology at the Yale Peabody Museum of Natural History

GREGORY J. WATKINS-COLWELL
Yale Peabody Museum, Department of Vertebrate Zoology
170 Whitney Avenue, P.O. Box 208118
New Haven, Connecticut 06520-8118, USA
e-mail: Gregory.Watkins-Colwell@yale.edu

Systematic collecting at Yale began in 1802 with the appointment of Benjamin Silliman, who acquired a large mineral collection for teaching purposes. This teaching collection became famous and helped attract many undergraduates to Yale, including Othniel Charles Marsh (Fig. 1), whose education was funded by his uncle, George Peabody. In 1866, near the end of Mr. Peabody's life, he donated funds to the University for the construction of a Natural History Museum (Fig. 2). In the same year, Marsh was appointed as the first Professor of Paleontology in the U.S. (second in the world). The Yale Peabody Museum opened to the public in 1876. Though the original museum had no formal herpetology collection, it did have a vertebrate paleontology collection and a collection of representative vertebrate osteology specimens for comparative use. Addison Emery Verrill (Fig. 3) was named the first Curator of Zoology in 1866. Although his primary interest was invertebrate zoology, he did collect specimens and described species in almost every major group of animals. Over time, the zoology collections grew and expanded into wet collections and study skins, in addition to osteological specimens. Ultimately the Division of Zoology was divided into the divisions of Invertebrate Zoology, Entomology and Vertebrate Zoology, with subdivisions of the latter into Ichthyology, Ornithology, Mammalogy and Herpetology.



FIG. 1. Othniel Charles Marsh (1831–1899), the founder of the Yale Peabody Museum of Natural History. Courtesy of the Peabody Museum of Natural History, Yale University.

History.—The oldest cataloged reptile in the collection is a *Phrynosoma cornutum* (YPM 00625) collected in Texas during June 1860 by "A. C." (no other data available on the collector). The oldest amphibian was collected 21 September 1861 and is a *Rana sylvatica* (YPM 03145) collected in Westville, Connecticut by Henry Shaler Williams. Williams contributed specimens to nearly every collection at the museum and was named Silliman Professor of Geology in 1894. He also was a founder of the national organization of Sigma Xi.



FIG. 2. The Peabody Museum of Natural History entrance off Whitney Avenue. Copyright © Peabody Museum of Natural History, Yale University.

The earliest specimens in the collection include those collected by Addison Emery Verrill from the island of Dominica in the late 1890's. The early part of the 20th century saw a few additions to the collection through collecting expeditions sponsored by the museum. North American collections were enhanced significantly by the work of Marshall B. Bishop and Stanley C. Ball, both of whom contributed significant collections from Florida, Connecticut, and Africa. In fact, the *Scaphiopus holbrookii* specimens collected in Connecticut by Ball during preparation of his monograph on the species represent populations that are now thought to be extirpated (Klemens 1993). In the 1950s, Willard D. Hartman collected caecilians from the Seychelles and also several important specimens from India and Papua New Guinea. However, until the 1960s herpetology held no official status in the museum.



FIG. 3. Addison Emery Verrill (1839–1926) collected many of the earlier Caribbean specimens and was the first Curator of Zoology at the museum. Courtesy of the Peabody Museum of Natural History, Yale University.

The Division of Vertebrate Zoology was officially formed in the 1950s. Thomas Uzzell Jr. was appointed the first Assistant Curator of Herpetology in 1967. His work focused on sexuality and evolutionary biology of salamanders and lizards. Under his guidance, the herpetology collection grew during the late 1960s and 1970's. It was also under his guidance that the collection was completely re-cataloged, utilizing new tag series.

After Uzzell left in 1972, herpetological leadership was largely filled by other staff within the Vertebrate Zoology division, including Curatorial Affiliates. During the mid-1970s and 1980s some specimen collection continued, though not on any large scale.

Computerization of the collection catalogues at Yale Peabody Museum of Natural History began in 1991 under the supervision of Lawrence Gall. The collections of the Vertebrate Zoology Division were among the first to be completely entered into the computer database. In 1993 the collections became searchable via the Internet, which continues today to be a valuable resource for searching the collections.

In 1995, Jacques A. Gauthier joined the museum staff as Curator of Vertebrate Paleontology and Acting Curator of Vertebrate Zoology. The collections began to grow, especially in terms of osteological specimens. Additionally, field expeditions were again organized including trips to Kenya and China led by James D. Lazell, and recently a joint venture with University of Kansas Natural History Museum and Biodiversity Research Center to El Salvador.

In June 1999, Gregory J. Watkins-Colwell joined the staff as a Curatorial Affiliate (a five-year appointment). David Skelly was named Assistant Curator in early 2000. In June 2001, Watkins-Colwell became Museum Assistant for Vertebrate Zoology with primary responsibilities being within herpetology and ichthyology. Currently the Curatorial Affiliates within Herpetology, in addition to Watkins-Colwell, are Theodora Pinou, James D. Lazell, and George D. Whitney.

Collections.—The herpetological collections at the Yale Peabody Museum of Natural History vary widely in geographic and taxonomic coverage (Table 1). In general, most of the approximately 19,000 specimens in the collection are North American in origin (46% of herpetological collection) with the majority of those being from Connecticut, Florida and Texas (15%, 14.7%, and 5% of all herpetological specimens respectively). The majority of non-United States localities are from Africa (29%). Among African sites, Egypt is the most represented with 2497 specimens collected by C. Maser, among others, in the early 1960s, including a large series numbering more than 1000 *Chalcides ocellatus*. Cameroon and Dahomey (now Benin) are also well represented by 935 (5.5% of the herpetological collection) cataloged specimens collected by Charles D. Miller in the 1970s, with roughly twice this number remaining to be cataloged. Asia accounts for 9% of the collection, with most of those specimens coming from China and Hong Kong (796 specimens collected by expeditions of J. D. Lazell, 1997–present). Caribbean specimens represent 8% of the collection, with the largest portion of them being from Haiti.

Throughout his time working with the collection, Verrill added 132 specimens; mostly from the U.S. (especially Connecticut), but also from Dominica and Venezuela. These specimens include an adult *Iguana delicatissima* collected in 1906 from Dominica. Twenty specimens in the collection were obtained by O. C. Marsh, mostly from Wyoming and Texas. Additionally, G. Baur contributed 15 specimens, mostly turtle skeletons.

The collection also includes specimens from some well-known collectors. Many of the specimens were undoubtedly received via exchange. One specimen of *Heloderma horridum* (YPM 10618; skeleton) was collected from Colima State, Mexico by J. Xantus. Raymond Ditmars collected a *Clemmys muhlenbergii* (YPM 10709; skeleton; received as a gift from Dr. R. W. Shufeldt of Washington, DC in the 1930s) from New York. A single *Alligator mississippiensis* (YPM 6528) was collected by Pope (presumably

TABLE 1. Approximate percentages of the total herpetological collection collected from each geographic region. Percentages are rounded to the next highest whole number. Total number of specimens is approximately 19,000.

Geographic Area	Approximate Percentage of Total Collection
North America	46%
Africa	29%
Asia	9%
Caribbean	8%
Europe	2%
South America	2%
Central America	2%
Australia	1%
Unknown Locality	1%

Clifford) in Miami, Florida and received by the museum in 1931. Thomas Barbour collected a *Cyclura cornuta* (YPM 10729; skeleton) which was received as a gift from him in 1934. A mounted skeleton of *Sphenodon punctatus* (YPM 723) was collected by J. Haast. Two specimens of *Chirindia rondoensis* (YPM 6916 and 6917) were collected by C. J. Ionides from Tanzania. Lorenz Müller collected some 50 specimens, mostly from Germany and Yugoslavia.

The collection includes 101 type specimens representing nine taxa. Taxa represented by type specimens are *Amphisbaena gonavensis* (YPM 3384 holotype, YPM 3386–3389 paratypes, YPM 3385 allotype), *Anolis whitemani* (YPM 3641 paratype), *Cophixalus pipilans* (YPM 5281–5283 paratypes), *Eleutherodactylus leoncei* (YPM 1167 holotype; YPM 1188–1201 paratypes), *Eleutherodactylus furcyensis* (YPM 670–679 paratypes), *Eleutherodactylus heminota* (YPM 704–760 paratypes), *Nyctimystes trachydermis* (YPM 5435–5436 paratypes), *Opipeuter xestus* (YPM 6575, 6576 paratypes), and *Typhlops gonavensis* (YPM 3003 holotype; YPM 3004 paratype, exchanged to MCZ).

Recent Improvements.—On 26 October 2001 the Environmental Science Center was dedicated on the Yale campus. This three-story 100,000 square-foot building will serve as a center for museum-based research. In addition to housing research laboratories and lecture rooms for courses in biodiversity and related fields, the multi-million dollar building also houses the museum's collections in Vertebrate Zoology, Invertebrate Zoology, Invertebrate Paleontology, Paleobotany, Botany, and Entomology. Sixty percent of the building is occupied by collections, collection staff, and associated laboratories. Specimens will be maintained in state-of-the-art, environmentally controlled rooms with multiple security measures in place and anti-pest protocols established.

With the opening of new lab and collection space, the herpetology staff is again planning research projects and collecting expeditions. The Division is also working with various state agencies on long-term projects. The specimens resulting from the Maine Amphibian and Reptile Atlas Project, and cited in Hunter et al. (1999) have recently been deposited in the collection. Additionally, all specimens resulting from the 15-year Connecticut Amphibian Monitoring Project will be deposited at the Peabody Museum. Other future projects include faunal surveys of more exotic localities, and increased sampling (including genetic) of lesser-known localities within New England.

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ZOO VIEW

Louis A. (Trooper) Walsh III retired last year from his position as Biologist/Museum Specialist in the Department of Herpetology, National Zoological Park (NZP), Smithsonian Institution, in Washington, DC. Trooper developed and guided captive management and research projects for Komodo dragons and other reptiles at NZP, and at other institutions internationally, publishing many professional and popular papers on his work. Trooper pioneered and developed behavioral research and breeding techniques for many species of boas and pythons in the early 1970s. Areas of special interest and continued research include maternal egg incubation in pythons and the energetics of reptile eggs in general during artificial incubation. He described differences between the husbandry techniques and environmental cycling employed for the successful breeding of green tree pythons, emerald tree boas, and Brazilian rainbow boas. In addition, he helped develop educational exhibits and programs for animals in the collection at NZP and elsewhere.

Trooper was involved in fundraising for the Komodo Dragon Conservation Fund, an account administered by the Zoo to support conservation projects in the field and captivity. As a pivotal member for the Komodo dragon working group under the auspices of the American Zoo and Aquarium Association (AZA) and project coordinator for the NZP Komodo dragon breeding program which resulted in the first successful reproduction outside of Indonesia, he has been directly involved in husbandry and research for these lizards. Trooper has published on the thermal biology of captive and free ranging wild dragons. He prepared the Komodo Dragon Taxon Management Account (TMA) and Egg Growth Data compilation published in the Proceedings of the December 5–7, 1995 Komodo Dragon World Conservation Union (IUCN) Workshop in Bogor, Indonesia. The next year, his TMA was published by the AZA. With other workers at the Zoo and in the academic community, he described anesthetic techniques, sonomorphological sex determination in subadults, husbandry and breeding observations, oxygen uptake by eggs as well as energetics of prolonged development in this reptile.

Beginning in 1996, Trooper and Colomba de La Panouse, Zoological Director at Parc Zoologique et Botanique de Thoiry began developing an international conference, to be hosted by Thoiry, on the advances in captive and wild management of dragons. Many varanid biologists were invited to attend the Thoiry International Komodo Dragon Conference, 4–7 November 1998. Their presentations stimulated a high level of enthusiasm and dynamic interchange which subsequently led to a book "Komodo Dragons. Biology and Conservation," based in part on the papers presented in Thoiry. Trooper and Colomba are co-editors (with Claudio Ciofi and me) of this book, recently published by Smithsonian Institution Press. One of the chapters reflects a play behavior study with a large female dragon named "Kraken" at NZP as she interacted with inanimate objects and humans. As I watched Trooper interact with Kraken during some of the trials, I was so deeply impressed by his rapport with her; it was fascinating to witness!

Trooper is one of the best animal caretakers I have ever known. Be it dragon or python, his understanding of their behavior and needs in captivity is quite exceptional. All of his first hand knowledge will not be lost to the herpetological community, however, for he has just formed a consulting company called "ZooGenesis" to advise clients about potential research projects, exhibition and captive maintenance for amphibians and reptiles.

Two of my zoo colleagues, Kevin M. Wright, Director of Living Collections at the Phoenix Zoo, and Brent R. Whitaker, Director of Animal Health at the National Aquarium in Baltimore, have published a seminal book, "Amphibian Medicine and Captive Husbandry," which is an essential reference for veterinarians and any practitioner involved in maintaining a captive colony of amphibians. This terrific compilation, with 27 chapters by top specialists, is certainly the definitive source for the diagnosis and treatment of diseases. Moreover, there is plenty of

information about husbandry including environmental parameters, diet and nutrition.

Kevin and Brent are certainly qualified to oversee a project of this magnitude. Kevin was Curator and Veterinarian of Amphibians and Reptiles from 1993 to 1999 at the Philadelphia Zoo and is an adjunct professor of Clinical Sciences at the University of Pennsylvania School of Veterinary Medicine. Brent oversees the medical management of the amphibian collection at the National Aquarium, probably the largest assemblage of Neotropical hylids and dendrobatids in any zoo or aquarium. The book is available from Krieger Publishing Company.

Over the past several decades, there has been a dramatic increase in the number of publications on various herpetological subjects in Australia. In concert with this increased activity, zoo workers have expanded their research and conservation projects as well. Chris Banks has been a leader in this resurgence which is obvious when his contribution on the history of herpetology at his zoo is read in its entirety.

—James B. Murphy, Section Editor

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A Thirty-Year History of Melbourne Zoo's Herp Department

CHRIS BANKS
Melbourne Zoo, PO Box 74
Parkville, Victoria 3052, Australia
e-mail: cbanks@zoo.org.au

Melbourne Zoo has displayed reptiles for many years—extracts from Board Reports note the death of a Boa Constrictor in 1878 and the then Reptile House being destroyed by fire in May 1882 (de Courcy 1995). In the mid-1960s, the Zoo embarked on a new Masterplan, involving the development of more naturalistic exhibits. Among the new developments was a Reptile House, although the decision was taken to implement this via conversion of a large, unused storage building.

This building had started life as a large wire aviary, which was constructed in the 1930s. It was gutted in early 1968 and construction of the exhibits and internal holding areas occurred over the following year (Fig. 1). Key features underpinning the effectiveness of the exhibits are the clear roof panels, which allow natural light through for the live plants, and the front servicing of the displays. The latter aspect allows large branches, etc. to be positioned in the exhibits and for the staff, whilst landscaping, to view the exhibit as it is by visitors.



FIG. 1. The front of the Reptile House as it appeared when the building was reopened, as the Reptile House, in October 1969.



FIG. 2. The central holding area, as it was in the early 1970s.

CAPTIVE BREEDING

The first four years were relatively quiet, with the first breeding in the new building occurring in 1970–Common Iguana (*Iguana iguana*) and Banded Basilisk (*Basiliscus vittatus*) among the four species bred in that year (Banks 1984). Notable successes since include the first Elongate Tortoise (*Indotestudo elongata*) hatches in Australia in 1974; Freshwater Crocodiles (*Crocodylus johnstoni*) in 1975 (world first captive breeding) (Dunn 1977); Thorny Devils (*Moloch horridus*) (wild-mated female) in 1976 (Dunn 1978); Saltwater Crocodiles (*Crocodylus porosus*) in 1979 (Dunn 1981); Arafuran File Snakes (*Acrochordus arafurae*) in 1983 (world first captive breeding) (Dunn et al. 1987); D'Albert's Pythons (*Liasis albertisii*) in 1985 (Banks 1985); Twist-neck Turtles (*Platemys platycephala*); Reticulated Gila Monster (*Heloderma s. suspectum*) in 1998; Fijian Banded Iguana (*Brachylophus fasciatus*) in 1996; Striped Legless Lizard (*Delma impar*) (world first captive breeding) in 1998 (Banks et al. 1999); and Rhinoceros Viper (*Bitis nasicornis*) in 1997.

Since the current House was opened in October 1969, 88 species of reptiles and amphibians have been bred—13 species of amphibians in two orders and five families, and 75 reptiles from three orders and 17 families.

UPGRADING HOLDING FACILITIES

The current House presents animals in a range of naturalistic exhibits that utilize living plants and attempt to recreate the habitats of the species displayed. However, it was not designed to house and display reptiles and amphibians, and significant problems became apparent soon after opening. Foremost amongst these was an inability to appropriately control air temperatures in the off-limit holding areas, due to lack of insulation. Apart from creating difficulties for the keepers in maintaining appropriate conditions for the animals, this system was wasteful of energy and a poor working environment for the staff. An oil-fired burner—the main heat source for the exhibits—was located in the center of the main off-limit holding area. This unit was not reliable and periodically released smoke and fumes, adding to keeper frustrations.

A second issue, which became apparent through the gradual change in working practices in zoos since the mid-1980s, was the need to upgrade the holding environments for the animals. At opening, enclosures in the service areas were arranged at one level on shelves and benches. The enclosures themselves comprised a range of wooden boxes and glass aquaria of differing sizes. Heating was delivered by suspended infra-red heat lamps (Fig. 2).

A three-pronged program to address these issues was commenced in 1987:

1. Conversion of the off-limit holding enclosures to tiered holding units (Fig. 3).
2. Conversion of the heating source from oil to natural gas and relocation of the heating units outside the building.
3. Installation of insulation in the ceiling areas and compartmentalization of the different off-limit areas.

Regional Management

The Australasian Regional Association of Zoological Parks & Aquaria, Inc. (ARAZPA) was established in 1967 (Mumaw 1992), based on the desire to maximize the value of the animal collections in its zoos, particularly their role in wildlife conservation. Like other regions, ARAZPA has a number of Taxon Advisory Groups, or TAGs, and the Reptile & Amphibian TAG was established in April 1990, with Melbourne Zoo's Curator of Herpetofauna filling the position of Reptile TAG Convenor (Banks 1999a). This involvement has continued and expanded over subsequent years and Herp Section staff fill a number of TAG positions and manage 12 taxa for the region.

The Jump into Frogs

Despite the fact that most people like frogs and these are marvelous animals for talking about concepts such as development, communication, and diversity of reproductive modes, frogs, and amphibians generally, are traditionally a sadly neglected group in zoo displays (Maruska 1986; Peterson 1996). A desire to address this failing, together with increasing awareness of global declines (Barinaga 1990), were the stimuli that finally resulted in a dedicated frog display at Melbourne Zoo in 1992. This also caused the Section to change its name from "Reptiles" to "Herpetofauna" to reflect its breadth of activities more accurately.

Designed completely in-house and with major funding support

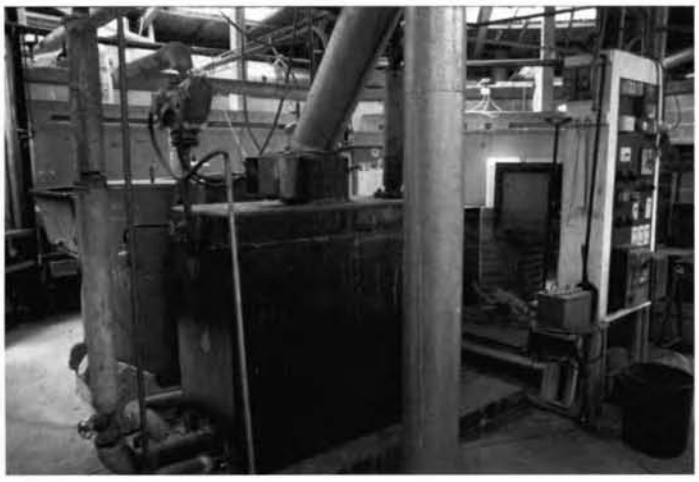


Fig. 3. The new tiered holding boxes, 1999.



Fig. 4. One of the larger exhibits in the "World of Frogs," opened in 1993.

from the Confectionary Division of Cadbury Schweppes Pty. Ltd, the Zoo's "World of Frogs" complex was officially opened on 18 August 1993 (Banks 1995). This comprised eight naturally landscaped exhibits of varying sizes, two off-limit research and breeding rooms, and an external wetland habitat (Fig. 4). Up to 12 species of amphibians are displayed at any one time and a large glass window allows viewing into the breeding rooms. Each exhibit has its own lighting, heating, misting, and biofiltration system.

Although this facility has provided the main visitor focus for the Section's amphibian endeavors, the range of involvements has been much broader, e.g.:

- An *ex situ* conservation program for Romer's Tree Frog, *Philautus romeri*, in Hong Kong (Banks 1996).
- Successful breeding of 12 species.
- Regular participation in Frog Week activities and field surveys.
- Ongoing links with the Amphibian Research Centre (ARC) and other researchers studying the chytrid fungus.
- Training of staff from other zoos in amphibian husbandry and breeding techniques, and enclosure design.

A Move into Conservation

Melbourne Zoo Herp Section's direct involvement in conservation programs, particularly *in situ*, really began in 1990 and has since focused on six main species or groups:

1. Striped Legless Lizard, *Delma impar*.

The Striped Legless Lizard, *D. impar*, is listed as Vulnerable at both national and global levels, and as Endangered in Victoria (IUCN 1996; Stanger et al. 1998). It is restricted to patches of native temperate grasslands across southern Victoria and in the ACT. Its management is coordinated by a National Recovery Team and, in Victoria, by the Victorian Striped Legless Lizard Working Group (Banks 1992). Melbourne Zoo plays a key role in the Working Group, especially through provision of the Convenor and meeting venue, but it also acts as the location for receipt of all specimens rescued through salvage operations in Victoria (Kutt et al. 1995). Zoo staff also support field work and salvage operations, and the first captive breeding occurred at the Zoo in 1998 (Banks et al. 1999).

2. Native Australian frogs.

The Action Plan for Australian Frogs lists 27 species as Vulnerable or Endangered and another 14 species that are of "potential concern" (Tyler 1996). Melbourne Zoo's Herp Section has supported Action Plan goals since 1991, including through:

- Captive management and rearing of *Geocrinia rosea* at the request of Western Australian agencies, in support of the threatened *G. alba* and *G. vitellina* (Birkett et al. 1999).
- Captive management of *Taudactylus acutirostris* at the request of the Queensland & Northern NSW Threatened Frog Recovery Team (Banks and McCracken, *in press*).
- Developing captive protocols for the Stuttering Frog, *Mixophyes balbus*, with NSW agencies.

3. Romer's Tree Frog, *Philautus romeri*.

Romer's Tree Frog, *P. romeri*, is a small rhacophorid restricted to a handful of Hong Kong islands. The development of the new international airport threatened to destroy one third of the frog's breeding sites and assistance was sought with establishing off-shore colonies and locating potential re-release sites (Banks 1996). Melbourne Zoo subsequently salvaged 30 frogs from the main island, Chek Lap Kok, and established a successful breeding program in the Reptile House. Over 800 captive-bred frogs were later returned to Hong Kong for release into new field sites identified by Hong Kong researchers. These releases, plus those of frogs and tadpoles bred at the University of Hong Kong, have all been successful and continue to be monitored by local scientists and volunteers (Dudgeon and Lau 1999).

4. Philippine Crocodile, *Crocodylus mindorensis*.

The Philippine Crocodile, *C. mindorensis*, is the most threatened species of crocodile in the world, with probably no more than 100 adults remaining in the wild (Ross 1998). Melbourne Zoo first became involved with the species in 1992, through links with Silliman University on Negros Island. A tripartite Memorandum of Agreement was signed in January 1993, between the Zoo, Silliman University, and the Philippine Department of Environment & Natural Resources (DENR). This provided the framework for directing funding and logistic support to Silliman University's breeding group, funding of a community awareness poster distributed throughout the Philippines, and for importing crocodiles into Melbourne Zoo. Over the next few years, links were established with other centers in the Philippines, particularly the Crocodile Farming Institute on Palawan Island, and interested groups in the United States and elsewhere in Australia (Banks 1996b). Since 1996 the Zoo has focused on writing the National Recovery Plan (Banks 2000) and supporting protection of a wild population in the Northern Sierra Madre region.

5. Philippine amphibians.

Like all faunal groups in the Philippines, amphibians are under great threat from habitat loss and ongoing degradation. In order to arrive at a better understanding of the status of Philippine amphibians, the Zoo's Herp Curator convened and chaired a meeting of Philippine herpetologists on Palawan in April 1999. This resulted in an additional 30 species being recommended to the IUCN and the Protected Areas & Wildlife Bureau (PAWB, Philippines) for inclusion on threatened fauna lists (Banks 1999b). The April workshop highlighted low community awareness of frogs in the Philippines, which was followed up with a schools and community-based project in the Los Banos area on Luzon Island. The Zoo helped to fund the project and is providing editorial and technical advice.

6. Southeast Asian tortoises & freshwater turtles.

Melbourne Zoo developed a support program in 1998 to help address the Asian Turtle Crisis and launched a public campaign in December 2000. The latter has since generated over A.$11,000, which has funded two staff and veterinary supplies at the Turtle Conservation & Ecology Project in Cuc Phuong National Park, Vietnam, an information brochure on Vietnamese turtles (in Vietnamese), and a CITES manual in Chinese.

The Future

Melbourne Zoo Herp Section's operations and involvements have changed dramatically over the last 30 years and there is no reason to suggest that the next 30 years will see any decrease in this, as zoos themselves continue to evolve. Zoos have demonstrated that they have a range of roles in helping to conserve the natural biodiversity of this planet, which is surely the greatest challenge facing us all.

Acknowledgments.—Apart from his landscaping and artistic skills, Roy Dunn led the Section as Curator from 1969 to 1975. Many keepers, both past and present, have contributed to the success of the Section over the past 30 years.

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ARTICLES

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Scavenging Behaviors of Cottonmouth Snakes at Island Bird Rookeries

HARVEY B. LILLYWHITE *
COLEMAN M. SHEEHY III
and
MARSHALL D. McCUE
Seahorse Key Marine Laboratory, Department of Zoology
The University of Florida, Gainesville, Florida 32611-8525, USA
e-mail [HBL]: hbl@zoo.ufl.edu

* *To whom correspondence should be addressed*

Cottonmouth snakes, *Agkistrodon piscivorus*, are well known as generalist and opportunistic feeders consuming fish, amphibians, rodents, birds, various reptiles including snakes and conspecifics, and carrion (Gloyd and Conant 1990; Savitzky 1992). The Florida cottonmouth, *A. p. conanti*, is an abundant snake throughout much of Florida, with well-established populations on some of the offshore islands. The success of this species in varied habitats is related, in part, to the wide range of prey items that provide a potential energy base for populations (see also Fritts 1988).

Insular populations of cottonmouths inhabiting the Cedar Keys of Florida have been studied by Wharton (1966, 1969) who focused his investigations on an unusually dense population of snakes inhabiting Seahorse Key. This island is approximately 64 ha in size and was estimated to support 600 cottonmouths during the period when Wharton conducted his studies. The island has no permanent fresh water, and the cottonmouths inhabit a mixed hardwood forest where they are entirely terrestrial. These snakes subsist largely or entirely on fish that are dropped or regurgitated by colonial wading birds that nest on the island in large numbers from March through September or October. At present, the colonial nesting birds are largely represented by Brown Pelicans (*Pelecanus occidentalis*), Double-crested Cormorants (*Phalacrocorax auritus*), White Ibis (*Eudocimus albus*), and several species of herons and egrets.

One of us (HL) has confirmed and extended the observations of cottonmouth behaviors recorded by Wharton. At Seahorse Key these snakes characteristically forage at night on substrate directly beneath bird rookeries where avian excreta alter the vegetation and humus layers of soil. Foraging snakes methodically investigate these environments where numerous objects become splattered with fluids that are regurgitated or excreted by birds and presumably contain fish odors. The snakes largely consume fish, although occasional young birds fallen from nests might also be ingested. It is not clear, however, whether birds are eaten for their own sake or because they bear fish odors. Dead birds that are ignored by snakes are frequently found in or near the rookeries. Both their shape and size seem to render them too difficult to swallow. Foraging snakes are generally quite placid and can be approached and observed at close distances. They readily eat fish when these are presented to, or thrown near, a foraging snake. Snakes are also observed to investigate and grasp objects such as plant materials, bones, or bird feathers that have contacted avian excreta or fish fluids. These are usually released following contact with the internal tissues of the mouth.

Recently we observed some unusual scavenging behaviors in a foraging female cottonmouth estimated to be about 110 cm in total body length. The snake was first seen at 1810 h EDST and was observed for 20 min while it foraged in an open area beneath a Brown Pelican rookery at Seahorse Key, 2 June 2001. The substrate consisted of sandy soil covered with many fallen twigs, dried leaves, and other scattered debris. Most of these objects were white or mottled because of urates that were excreted by the pelicans nesting overhead. The area was in full sun, and the ambient temperature and humidity at the time of observation were 31.4°C and 61%, respectively. The snake seemed to be in good health and was somewhat distended posteriorad, suggesting possible pregnancy.

The snake crawled very slowly and deliberately over the substrate while investigating various objects with frequent tongue flicks. We first observed the animal through binoculars from a distance of about 8 m. Eventually, we advanced closer to the snake, which continued to forage and eventually approached us within 0.5 m distance. Although the snake seemed to be aware of our presence at this point, it continued to forage as described.

Soon after we first saw the snake, it investigated the ground intensely at one location and positioned its head nearly vertically with the mouth directed downward as it grasped a dark object. When the snake lifted its head, the grasped item was seen to be soil as half of it broke away from that being held in the mouth and



FIG. 1. A female Florida cottonmouth, *Agkistrodon piscivorus conanti*, ingesting a dry mass of fish skull with adhering bones, dry leaves, sticks, and soil debris at a pelican rookery on Seahorse Key. Note the generally white appearance of the ground and numerous white spots on the leaves and other objects, including the snake. These are dried urates excreted by pelicans from the overhead tree canopy.

fell to the ground. The snake then lifted its head upward at an angle of about 30° and swallowed the soil, which was seen to be damp and loosely held together with moisture. Later inspection of the ground on which the snake foraged revealed several locations where the soil was wetted, because of excreta or regurgitated fluids from birds overhead.

Following this act, the snake continued to investigate objects that were on the ground. Next it investigated the blunt end of a wooden branch about 1 cm in diameter and bearing several stains of bird excreta. The snake grasped this branch and attempted to advance the jaws over it, but the object was soon dropped and the effort abandoned. The snake continued to crawl slowly over the substrate using rectilinear locomotion while investigating objects with searching movements of the head and tongue.

Finally, the snake stopped to investigate an object roughly 4 x 4 x 1.5 cm in overall size, composed of a partial fish skull with other bones, debris and several dry leaves adhering to it. The snake grasped this object and advanced its jaws to hold the bulk of the item firmly within its mouth (Fig. 1). Then it elevated its head further off the ground, crawled forward about 3 m and stopped with the head elevated. We believe the item would have been swallowed, but we disturbed the snake while advancing to take photographs. The snake crawled forward and disappeared within the forest edge that bordered the rookery site.

These and other observations of cottonmouth foraging behaviors at Seahorse Key suggest that numerous, diverse objects of appropriate size, shape, and odor might be ingested by foraging snakes. Thus, feces that are defecated by wild-caught snakes sometimes contain leaves that are ingested inadvertently as adhering parts of carrion. In general, *Agkistrodon* species seem to rely more on chemosensory information during foraging than do other crotalines (Chiszar et al. 1979; Cock Buning et al. 1981). It has been suggested that evolutionary reliance on an envenomation feeding system and use of a strongly proteolytic venom, coupled with predominance of chemosensory information during foraging, have likely conferred a predilection for carrion in the cottonmouth (Savitzky 1992). However, the significance of such behavior in energetic contexts has not previously been emphasized.

At Seahorse Key, fish dropped by nesting birds can be a "boom or bust" situation. In the 1970s, as many as 200,000 colonial birds occupied the Cedar Keys, and 95% of all nesting occurred on Seahorse Key (U.S. Fish & Wildlife Service, unpublished records). Such numbers produce abundant and concentrated energy resources for cottonmouths, which literally gorge themselves during periods lasting from April/May to October/November (late fall nesting attributable to pelicans; HBL, unpublished observations). In recent years, however, drought has severely impacted wetlands on which many of the nesting birds depend for feeding their chicks. Consequently, the number of nesting birds has diminished greatly. Recent counts have been as low as 10,000 or fewer nesting birds. During the severe 2000 drought in Florida (especially at Seahorse Key), avian nesting was greatly curtailed at Seahorse Key, and the snake foraging period was shortened to July–October. Moreover, cottonmouths do not forage during drought, even though dropped fish might be available at the rookeries (unpublished observations). Consequently, foraging success can vary greatly from year to year. It seems reasonable to infer that carrion degraded by age or adherence of indigestible materials might be significant resources when snakes employ foraging behaviors that maximize the intake of available energy. Snakes at Seahorse Key remain beneath or very near the rookeries, and they do not usually move extensive distances unless the locations of food resources change (Wharton 1969). Thus, the scavenging of diverse objects that yield potentially useful energy during foraging might have significant selective advantages in island environments where alternative prey items are scarce or limited. The intensive scavenging behaviors of cottonmouth snakes at Seahorse Key perhaps have become incorporated to be part of an "island syndrome" of behavioral and physiological modifications that have evolved in response to resource limitations on islands (Adler and Levins 1994; McNab 1994; Wikelski and Trillmich 1997).

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Expulsion of Intraperitoneally-Implanted Radiotransmitters by Australian Pythons

DAVID J. PEARSON
Western Australian Department of Conservation and Land Management
PO Box 51, Wanneroo, Western Australia 6065, Australia

and
RICHARD SHINE
Biological Sciences A08, University of Sydney
New South Wales 2006, Australia
e-mail: rics@bio.usyd.edu.au

The availability of miniature radiotransmitters has revolutionized the study of snake ecology (Fitch 1987; Shine and Bonnet 2000). Most workers rely upon surgical insertion of transmitters into the animal's peritoneal cavity, and methods for the surgical implantation of transmitters are now sophisticated and effective (e.g., Reinert and Cundall 1982). As more workers use these techniques, new complications will undoubtedly appear. In this paper we report a bizarre example of such a complication. Free-ranging carpet pythons (*Morelia spilota*) frequently rid themselves of surgically-implanted transmitters by incorporating the transmitter into the alimentary tract and then expelling it with the feces.

Table 1 summarizes 14 occasions when radio-telemetered pythons appear to have expelled transmitters in this way. The transmitters (Holohil models SI-2T and PD-2T) weighed 4 to 22 g, and constituted 0.7 to 3.3% of the mass of the snake into which they were implanted. The transmitters were inserted under isoflurane anesthesia, via a midventral incision approximately 10% of the snake's snout-vent length anterior to the vent. The entire unit (transmitter plus 19–30 cm antenna) was placed inside the peritoneal cavity, with the body of the transmitter positioned anterior to the antenna. The transmitter was not sutured to a rib. The incision was sutured closed, and the snake released 1–14 days after surgery.

In the course of the study, many telemetered snakes were recaptured for transmitter replacement. In all such cases except those described below, the transmitter had remained in place within the peritoneum, and was surrounded by fibrous tissue. In the cases listed in Table 1, however, attempts to relocate snakes in the field revealed only the transmitter, usually in conjunction with fecal material from the snake. Python feces are very easily distinguished from those of other large predators because the python feces are distinctive in shape, are always associated with uric acid deposits, and detailed examination reveals the presence of python teeth. Large carnivorous mammals (e.g., cats, dogs, foxes) are absent from our Garden Island study area and very rare (because of a prolonged control program) at the Dryandra site. Subsequent recapture of two of these free-ranging pythons that had lost their telemeters confirmed that the snake was in good health, and showed no scarring that would indicate loss of the transmitter through the body wall. Evidence of the route of transmitter expulsion was available for two additional snakes. First, an adult diamond python (*Morelia spilota spilota*; not listed in Table 1) was captured and kept in captivity after several months radio-tracking, prior to surgery to remove the transmitter. Before we could remove it, the snake defecated the transmitter in its cage. Second, we dissected a radio-tracked carpet python (*M. s. imbricata*; again not listed in Table 1) that died in the field after 22 months of radio-tracking. The transmitter in this snake was partially incorporated into the stomach, but the antenna remained attached in the peritoneal cavity. It seemed that fecal impaction might have led to the snake's death.

Data in Table 1 show that cloacal expulsion of transmitters was relatively frequent, although by no means universal (these snakes were 14 of 75 pythons radio-tracked during the study). The snakes that expelled transmitters covered a wide range of body sizes, included both sexes, and carried the transmitters prior to expulsion for periods of 1–24 months. At the Dryandra study site, 3 female and 7 male pythons expelled their transmitters from a total of 48 transmitters implanted. This involved 33 individual pythons, as some females were implanted twice. At the Garden Island study site, 1 female and 3 male pythons expelled their transmitters from a total of 52 transmitters implanted (consisting of 42 individual pythons).

To examine correlates of transmitter expulsion, we conducted a logistic regression on data from all radio-tracked pythons. Although some snakes were fitted with more than one transmitter in succession during our study, each animal appeared only once in the data set to avoid pseudoreplication. The dependent variable was whether or not the transmitter was expelled, and the independent variables were the snake's sex and snout-vent length. We excluded four cases where we had less reliable evidence for expulsion (no feces with transmitters: see Table 1) but inclusion or exclusion of these data did not change any of the conclusions from the analysis. The regression was based on 38 female snakes (3 of which expelled transmitters) and 36 males (7 of which expelled transmitters). Likelihood ratio tests from this regression showed that the probability of expulsion was linked both to the snake's sex ($\chi^2 = 6.75$, 1 df, $P < 0.01$) and its body length ($\chi^2 = 4.90$, 1 df, $P < 0.03$). Males expelled transmitters more frequently than did females (7 of 36, = 19% of males, vs 3 of 38, = 8% of females). The mean snout-vent lengths of snakes that expelled transmitters were larger than those of other snakes, in both sexes (males: 145 vs 119 cm; females, 188 vs 175 cm). There was no significant difference in rates of expulsion between the two study areas.

The most consistent correlate of expulsion involved feeding. Ten of the 14 expulsions were associated with fecal material (Table 1), suggesting that transmitters were expelled soon after the snake had consumed a large prey item. Although many of the other radio-tracked snakes took equally large meals and did not expel transmitters afterwards, we suspect that there is a functional link between feeding on a large meal, and transmitter expulsion. Not only

TABLE 1. Cases in which radio-telemetered carpet pythons (*Morelia spilota imbricata*) expelled intraperitoneally-implanted transmitters. SVL = snout-vent length (cm). The Table shows the characteristics of snakes, the dates at which transmitters were surgically implanted and were later found in the field (without the snake), and whether or not snake feces were present with the relocated transmitter. *For snake 22, the original transmitter was not found, but the snake was recaptured 25 Nov 1998 without its transmitter. Note that snake 80 was also recaptured 14 Nov 1995 and reimplanted after voiding its first transmitter.

Snake ID #	Location	Date implanted	Date recovered	Days before expulsion	Sex	SVL (cm)	Mass (g)	Transmitter found in fecal pellet?
2	Dryandra	9 Jan 1995	10 Feb 1995	32	F	172	1401	yes
3	Dryandra	5 April 1997	30 Dec 1997	269	F	196	1620	yes
10	Dryandra	31 March 1995	27 Feb1996	333	M	147	905	yes
17	Dryandra	8 March 1995	22 Dec 1997	196	M	130	633	no
18	Dryandra	10 Dec 1995	22 Sept 1996	287	M	145	712	yes
22	Dryandra	7 Feb 1996	?	?	M	113	248	*
25	Dryandra	5 April 1996	12 Nov 1996	221	M	146	693	yes
30	Dryandra	3 Dec 1996	22 May 1998	535	F	179	2389	no
32	Dryandra	23 Feb 1997	30 Dec 1997	310	M	160	955	yes
36	Dryandra	29 Oct 1997	30 Dec 1997	62	M	152	960	yes
80	Garden Is.	1 Dec 1995	9 Feb 1996	70	M	134	744	yes*
80	Garden Is.	14 Nov 1995	29 Jan 1997	442	M	135	759	yes
83	Garden Is.	1 Dec 1995	22 Dec 1997	752	M	129	608	no
40	Garden Is.	15 April 1995	16 Feb 1996	307	F	195	2309	yes

was transmitter loss linked to feeding events (Table 1), but the sexes and sizes of snakes that most frequently expelled transmitters (large specimens, and males rather than females) are those that tend to take very large prey (relative to snake size) in our study populations (unpubl. data).

Why should a snake consuming a large meal be likely (or indeed, able) to transfer an object in its peritoneal cavity into its alimentary tract? This ability might be linked to massive temporal shifts in size and activity of the alimentary tract in ambush predators such as pythons (Secor and Diamond 1995), including carpet pythons (Bedford 1996). The gut shrinks during non-feeding periods, but is massively up-regulated soon after a prey item is ingested. It might be able to incorporate foreign objects during this rapid increase in size. This ability might function in removal of objects such as fish spines that can penetrate the stomach wall and lodge in the peritoneum (Shine 1991).

The same ability to expel intraperitoneally-implanted transmitters through the gut has been reported in fishes (Chisholm and Hubert 1985; Marty and Summerfelt 1986), and might prove to be widespread. The only analogous phenomenon in snakes (to our knowledge) involves passive integrated transponder microchips surgically implanted in the necks of corn snakes (*Elaphe guttata*); the tags frequently (and sometimes rapidly) moved posteriorly through the body and were expelled in the feces (Roark and Dorcas 2000). If such abilities are widespread, there is an obvious caveat for interpretation of radiotelemetry studies. Researchers finding a transmitter in the field would be tempted to conclude that the animal carrying that telemeter had died and/or been consumed by a predator. Marks on a transmitter left by teeth or claws of a predator species would be interpreted as evidence for such an event, but may have been inflicted after expulsion of the unit. We advocate caution in inferring predation as a cause of death of radio-tracked snakes, unless the carcass (or part of it) is available.

Studies on fishes have attempted to determine whether changes in factors such as the size or coating of a transmitter can reduce the probability of expulsion. Smaller transmitters were less likely to be expelled (Marty and Summerfield 1986), but the transmitters used in our own study were smaller relative to snake body mass (< 4%) than is the case in most such studies. Anchoring the transmitter by suturing it to a rib during the initial surgery or by running the antenna subcutaneously (e.g., Reinert and Cundall 1982; Reinert 1992) is one obvious solution, but experimental work on fishes found that anchoring the transmitters greatly increased the rate at which they were expelled via rupturing the animal's body wall (Marty and Summerfield 1986).

Our results are interesting not only in providing a cautionary note about interpreting cases of transmitter loss, but also in revealing a hitherto-unsuspected ability of snakes to encapsulate and expel a foreign object from the peritoneum. The apparent link between expulsion and feeding (and especially to ingestion of prey that are very large relative to the predator), in a lineage of snakes known to show massive fluctuations in size and activity of the alimentary tract, strongly suggests the ability to regulate organ size in this way might have more diverse consequences than has hitherto been recognized.

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Mouthpart Pigmentation in *Rana muscosa* Tadpoles: Seasonal Changes Without Chytridiomycosis

LARA J. RACHOWICZ
Department of Integrative Biology, University of California
Berkeley, California 94720-3140, USA
e-mail: larar@socrates.berkeley.edu

Chytridiomycosis, an amphibian skin disease caused by the fungus *Batrachochytrium dendrobatidis*, has been implicated in amphibian declines in Australia, Europe, North America, and the Neotropics (Berger et al. 1998; Bosch et al. 2001; Daszak et al. 1999; Nichols et al. 2001). At least 93 amphibian species over six continents have been found to be infected with this chytridiomycete (Speare and Berger 2000). *Batrachochytrium* infections have been found in both tadpoles and adults. In postmetamorphic anurans, chytridiomycosis is associated with high mortality, but infections in tadpoles are restricted to the mouthparts and are not associated with mortality (Berger et al. 1998; Pessier et al. 1999).

Batrachychytrium grows on the keratinized epithelial cells of adult amphibians (Longcore et al. 1999) and keratinized mouthparts of some ranid and hylid tadpoles (Fellers et al. 2001; G. Fellers, pers. comm.). The superficial keratinized cells of the upper and lower jaw sheaths and tooth rows of tadpoles are typically heavily pigmented (Luckenbill 1965). Recent attention has been focused on the loss of pigmentation in mouthparts as an indicator of chytridiomycosis (Fellers et al. 2001; Vredenburg and Summers 2001). Fellers et al. (2001) found that conspicuous oral disc abnormalities including depigmented tooth rows, depigmented jaw sheaths, and swollen labial papillae (along the margins of the oral disc) are strongly associated with *Batrachochytrium* infection in the mountain yellow-legged frog, *Rana muscosa*. However, evidence presented here suggests that loss of pigmentation in tadpole mouthparts might not always be associated with chytridiomycosis and that pigmentation might vary seasonally. This paper (1) describes mouthparts and histological results for tadpoles showing abnormalities characteristic of chytridiomycosis; (2) describes seasonal changes in mouthpart pigmentation in tadpoles from several populations; and (3) describes changes in lab-maintained animals that resemble seasonal changes.

Vredenburg and Summers (2001) identified two levels of mouthpart loss in *R. muscosa* tadpoles collected at Ebbetts Pass, Alpine County, California, USA in June 2001: (1) a lack of pigmentation in the tooth rows and only a thin pigmented line on the top and bottom jaw sheaths (Fig. b in Vredenburg and Summers 2001) and (2) a complete lack of pigmentation in the tooth rows and jaw sheaths (Fig. c in Vredenburg and Summers 2001; these figures can also be viewed in color on Amphibia Web at http://elib.cs.berkeley.edu/aw/chytrid/index.html). Large-scale surveys have identified more than 100 *R. muscosa* populations throughout the Sierra Nevada in California that were characterized by a loss of pigmentation in the mouthparts (R. Knapp, L. Rachowicz, V. Vredenburg, unpubl. data). Following Fellers et al. (2001), these tadpoles would be assumed to be infected with *Batrachochytrium*.

Histological evidence suggests that the amount of pigmentation in *R. muscosa* tadpole mouthparts might vary without the presence of *Batrachochytrium*. *Rana muscosa* tadpoles experience one to two winters before metamorphosis and overwinter in ice-covered lakes (Bradford 1983). Fifteen tadpoles from Ebbetts Pass, Alpine County, California, USA were inspected early in the ice-free season (2 June 2001), and all had partially or fully depigmented jaw sheaths and tooth rows (V. Vredenburg, pers. comm.). Two of these tadpoles were collected and photographed (Figs. b and c in Vredenburg and Summers 2001). A survey late in the season (6 September 2001) found that all of the tadpoles surveyed (N = 20) from this same population had fully pigmented jaw sheaths and tooth rows. The population appeared healthy during both surveys (e.g., no die-offs, no emaciated tadpoles, no behavioral changes). The two tadpoles collected from Ebbetts Pass on 2 June 2001 (Figs. b and c in Vredenburg and Summers 2001) and six tadpoles collected from this same location on 6 September 2001 were sectioned and processed routinely for histologic examination, and no *Batrachochytrium* organisms were found.

Field surveys from the 60 Lake Basin, Fresno County, California, USA, also provide evidence for a seasonal trend in mouthpart pigmentation. During the summer of 2001, five populations of *R. muscosa* in the 60 Lake Basin were examined for loss of mouthpart pigmentation on 9 June and then again on 29 July. The June surveys took place approximately one week after winter ice melted. In each survey, 20–26 tadpoles representing two tadpole age classes at each of the five sites were captured, and their jaw sheaths were examined for pigmentation with a 10x hand lens (except at two sites where fewer tadpoles were found). The percentage of tadpoles showing thin or complete loss of pigmentation in their jaw sheaths (resembling Figs. b and c in Vredenburg and Summers 2001) at each site was high in the early season survey and very low in the later season survey (Table 1). All populations seemed healthy during surveys. These populations were not tested for chytridiomycosis.

Laboratory-maintained tadpoles showed variation in mouthpart pigmentation with temperature changes. Ten *R. muscosa* tadpoles representing three age classes were collected on 5 October 2001

TABLE 1. Percent of partially or fully depigmentated jaw sheaths at five lakes surveyed in the 60 Lake Basin, Fresno County, California, USA on 9 June 2001 and 29 July 2001 with the number of *Rana muscosa* tadpoles sampled in parentheses.

Lake	% partially or fully depigmented on 9 June (N)	on 29 July (N)
1	54 (13)	0 (22)
2	100 (21)	0 (6)
3	15 (20)	0 (25)
4	29 (21)	0 (21)
5	75 (20)	8 (26)

from a lake in the 60 Lake Basin. This lake was not in the surveys described above, and the population seemed healthy. Tadpoles were transported to the University of California, Berkeley where they were housed individually in a laboratory at 6°C and fed rabbit chow several times each week (cared for according to approved Office of Laboratory Animal Care standard operating procedures). All tadpoles had darkly pigmented tooth rows and jaw sheaths (similar to Fig. a in Vredenburg and Summers 2001) at the time of capture and on the first day in the lab (7 October 2001). On 28 November 2001, all 10 tadpoles were characterized by depigmented tooth rows and 8 of 10 had partially or completely depigmented jaw sheaths. On 4 December 2001, tadpoles were transferred to a room at 14°C, with all other variables (e.g., light, food ration) remaining the same. After two weeks at this temperature, 8 of 10 tadpoles had fully pigmented tooth rows and 7 of 10 tadpoles had fully pigmented jaw sheaths. On 20 December 2001, boiled spinach was added to the tadpole diet because of a change in standard operating procedures. On 8 January 2002, all tadpoles had fully pigmented tooth rows and 9 of 10 tadpoles had fully pigmented jaw sheaths. Subsequently, one of these tadpole was examined histologically and one examined using a wet-mount preparation of cells scraped from the oral cavity and no evidence of chytridiomycosis was found in either (J. Parker, pers. comm.).

The described observations suggest that *R. muscosa* tadpoles show variation in pigmentation of keratinized cells of the tooth rows and jaw sheaths with changes in temperature. Thus, loss of pigmentation in mouthparts does not always correlate with *Batrachochytrium* infection as confirmed by histology in eight animals from Ebbetts Pass and two lab-maintained animals. In the field, *R. muscosa* tadpoles lacked mouthpart pigmentation early in the season after spending a winter under ice and gained pigmentation as the growing season progressed. Data from lakes in the 60 Lake Basin show temperatures ranging from 2°C to 4°C during the winter and from 8°C to 28°C during the summer (V. Vredenburg, unpubl. data). In the laboratory, tadpoles lost pigmentation at 6°C water temperature and regained pigmentation at 14°C. Although the significance of light pigmentation in jaw sheaths that are typically heavily pigmented is unknown (McDiarmid and Altig 1999), it is possible that the observed changes in pigmented structures are because of the increased feeding associated with warmer temperatures. At high elevations in the Sierra Nevada, tadpoles only feed to a small extent while overwintering (Bradford 1982). At the colder temperature, the laboratory tadpoles were observed to eat approximately half as much as at the warmer temperature. Because structures with melanic pigment have been found to be stronger than those lacking pigment (McDiarmid and Altig 1999), it has been suggested that increased use of mouthparts through feeding might increase the strength of the mouthparts and thus the degree of pigmentation (R. Wassersug, pers. comm.).

Additional surveys need to be carried out, and the infectious status of tadpoles needs to be confirmed in order to understand better the association between chytridiomycosis and pigment loss. It is possible that the association found by Fellers et al. (2001) might not be valid during early summer. It is important to characterize more specifically the erosion of pigmentation in the mouthparts by chytrid infection versus other factors. For example, results obtained from a pilot study suggest there is a particular pattern of pigmentation loss associated with chytridiomycosis, characterized by discrete patches of pigment loss in the jaw sheaths (L. Rachowicz, V. Vredenburg, R. Knapp, and J. Parker, in prep.). Because chytridiomycosis has been found in populations that have undergone declines, it would be prudent for herpetologists to continue to examine tadpole mouthparts and take proper precautions to prevent spreading this disease, as suggested by Fellers et al. (2001) and Vredenburg and Summers (2001) until additional studies are completed.

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Absence of Malarial Parasites from Texas Horned Lizards, *Phrynosoma cornutum*

SCOTT E. HENKE
and
ALAN M. FEDYNICH
Caesar Kleberg Wildlife Research Institute
Texas A&M University-Kingsville
Kingsville, Texas 78363, USA
e-mail (SEH): scott.henke@tamuk.edu

The Texas horned lizard (*Phrynosoma cornutum*) population in Texas has experienced a dramatic decline over the past 40 years (Donaldson et al. 1994). Texas horned lizards are thought not to occur in Texas east of an imaginary line from Fort Worth to Corpus Christi and their abundance throughout the rest of Texas is considered to be stable or declining, depending on the region (Donaldson et al. 1994). Consequently, this species is listed as threatened by the state of Texas (Texas Parks and Wildlife Code 1987) and as a Species of Concern by the federal government.

Although there have been several hypotheses as to why Texas horned lizards have experienced such a precipitous decline, including range expansion by fire ants (*Solenopsis invicta*), urban sprawl, grazing and agricultural practices, and pesticide use (Donaldson et al. 1994; Price 1990), little scientific information exists to elucidate the root causes. The situation is complicated by the fact that even though the distribution and abundance of Texas horned lizards have declined throughout most of the state, no single, potentially causative factor occurs statewide. One often overlooked explanation is parasitic diseases. Schall (1982) and Schall et al. (1983) demonstrated that western fence lizards (*Sceloporus occidentalis*) experienced negative physiological and behavioral ramifications, including reduced fecundity, because of the common malarial parasite, *Plasmodium mexicanum*.

Malaria might be a contributing factor in the decline of Texas horned lizards in Texas. Henke (unpubl. data) recently noted that Texas horned lizards in southern Texas had clutches of <12 eggs, which was about half the number of the average clutch considered for the species (Milne and Milne 1950; Sherbrooke 1981). Although a causative link between the decline of Texas horned lizards and malaria cannot be established with circumstantial evidence, these observations do offer an interesting hypothesis about the decline of Texas horned lizards. Only one published study (Thompson and Huff 1944a) examined 58 horned lizards in Texas for malarial parasites; they reported that none were infected. However, their study was conducted in the early 1940's during a period when horned lizards were relatively abundant and not declining in Texas.

Ayala (1970) summarized the extent of the *Plasmodium mexicanum*-like complex found in herpetofauna from western North America, which included two malarial parasite species (*Plasmodium beltrani* and *Plasmodium brumpti*) found in Mexico and a species similar to *P. mexicanum* found in Arizona. Ayala (1973) experimentally infected coast horned lizards (*Phrynosoma coronatum*) and Thompson and Huff (1944b) experimentally infected Texas horned lizards with *P. mexicanum*, demonstrating that this malarial parasite could occur in these hosts as well. The objective of our study was to determine the prevalence, abundance, and intensity of malarial parasites in Texas horned lizards collected throughout Texas.

Texas horned lizards were captured by systematic and random searches, and by road cruising (see Fair and Henke 1997 for description of capture techniques) during May through September 1999 throughout five study regions (i.e., north, west, east, central, and south) of Texas as delineated by Donaldson et al. (1994). Capture locations were selected based on anecdotal evidence that Texas horned lizards were observed on site within the last two years. Horned lizards were measured for snout–vent length (SVL), marked with a passive integrated transponder to identify potential recaptures (Camper and Dixon 1988), and then were released at the site of capture. Lizards were considered adults when SVL ≥ 68 mm (Ballinger 1974). Two thin blood smears from each lizard were made from blood obtained from the caudal vein. Smears were fixed in 100% methanol and stained with Diff-Quick® (Fischer Scientific, Pittsburgh, Pennsylvania). Each blood smear was examined for 30 minutes at 1000x magnification to determine malarial prevalence. This protocol is considered sufficient to detect low intensity infections (Fedynich et al. 1993).

We captured 102 Texas horned lizards during 1999, of which 56 lizards were considered juveniles by our SVL criteria. No protozoan blood parasites, inclusive of *Plasmodium mexicanum*, were seen in any blood sample from Texas horned lizards.

The Texas population of Texas horned lizards does not seem to be affected by malarial parasites. It should be noted that lack of *P. mexicanum* in blood samples is not conclusive evidence of being free from infection. Because Texas horned lizards are a threatened species internal tissue could not be examined for exoerythrocytic schizonts. Possible causes for negative findings include (1) absence of *P. mexicanum* in Texas, (2) absence of appropriate vectors for transmitting *P. mexicanum* to Texas horned lizards, (3) insufficient vector and (or) host densities necessary to maintain infections, (4) infection rates were too low for observing *P. mexicanum* from a sample of 102 host individuals, (5) infections were highly virulent and lethal, which quickly eliminated infected hosts from the population, making detection difficult, and (6) malarial infections were highly aggregated (overdispersed) and our sampling missed these particular host individuals.

Although Texas horned lizards have declined in number throughout most of Texas, there is no evidence from samples of surviving lizards that malaria was a causative factor in the decline. It is possible that the populations of horned lizards we sampled are the survivors of past losses, and at least theoretically, malaria could have been responsible for those losses, but not be present in surviving populations. However, our data suggest that to explain the decline of Texas horned lizards other hypotheses are warranted.

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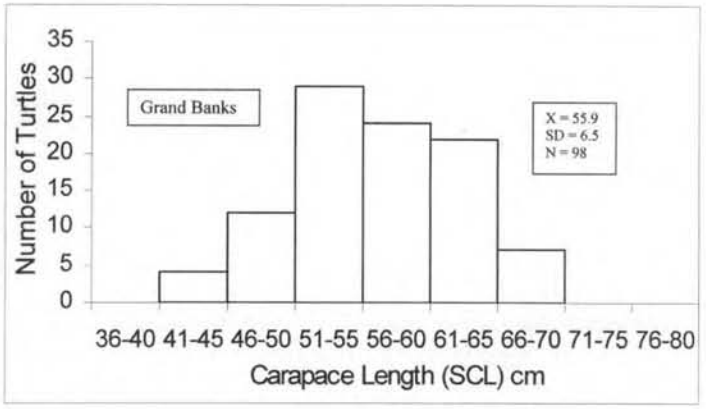
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Immature Atlantic Loggerhead Turtles (*Caretta caretta*): Suggested Changes to the Life History Model

W. N. WITZELL
National Marine Fisheries Service, Southeast Fisheries Science Center
75 Virginia Beach Drive, Miami, Florida 33149, USA
e-mail: wayne.witzell@noaa.gov

North Atlantic loggerhead turtle (*Caretta caretta*) populations have extended and complex developmental life histories. Hatchling loggerheads enter the surf and find their way into the pelagic environment where they remain for several years before returning to coastal waters (Musick and Limpus 1997). Carr (1986, 1987) hypothesized that loggerhead hatchlings from the large Florida rookeries become entrained in major current systems (e.g., Gulf Stream) and are passively transported to the eastern Atlantic, and eventually return to the western Atlantic via the North Atlantic gyre. Carr's hypothesis was supported by genetic evidence that immature eastern Atlantic (Azores Islands) loggerheads originated from western Atlantic rookeries (Bolten et al. 1998). These immature turtles are then thought to recruit from pelagic (oceanic) habitats to coastal habitats, migrating north and south along the U.S. east coast sea-



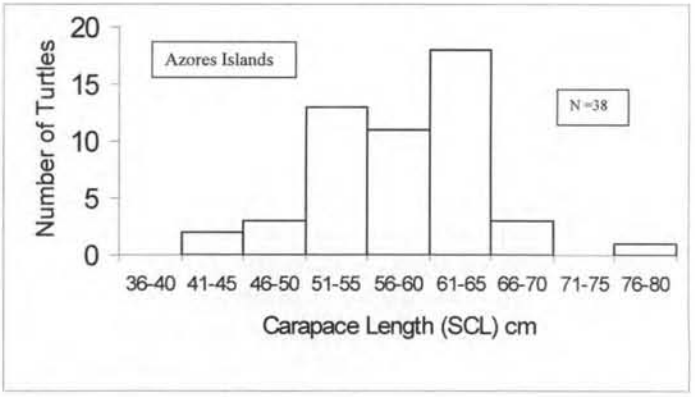


Fig. 1. Carapace lengths of Grand Banks (Witzell 1999) and Azores (Bolten et al. 1994) longline caught turtles.

sonally (Musick and Limpus 1997). The Florida turtles mature after several years in coastal habitats and nest at about 92 cm straight carapace length (SCL) (Bjorndal et al. 1983). However, there are pelagic length frequency data and flipper tag recapture data, satellite telemetry and aerial survey data, and historical evidence that suggest the popular conceptual models of loggerhead turtle life histories might be more complicated than previously thought.



FIG. 2. German submarine crew members of U-92 pose with large immature loggerhead turtle under the anti-aircraft cannon near the Azores Islands in December 1942. Photo courtesy G. Sytko.

Carapace length data from stranded turtles along the U.S. Atlantic coast have been used to estimate the size that immature turtles leave the pelagic habitat and enter coastal waters. Stranding data indicate that this settlement size ranged from 25 to 30 cm curved carapace length (CCL) (Musick and Limpus 1997) to 40–60 cm SCL (Carr 1986, 1987; Martin et al. 1989). Bjorndal et al. (2000, 2001) hypothesized from growth data that most eastern Atlantic (Azores Islands) juvenile turtles depart the eastern Atlantic pelagic habitat and recruit to the coastal U.S. habitats between 46 and 53 cm CCL. They also hypothesized that almost all eastern Atlantic loggerheads left the pelagic habitat by 64 cm CCL (presumably to the western Atlantic). Analysis of growth layers in bone sections from stranded turtles has suggested that Atlantic loggerhead turtles might settle out of the pelagic habitat to coastal habitats at 52.0 cm SCL (Snover et al. 2000). An apparent shift in growth layer patterns, termed "settlement lines," theoretically represented the shift from pelagic to coastal habitats. However, dietary analysis suggests that immature loggerhead turtles in the Mediterranean Sea did not permanently settle into coastal waters immediately, but moved back and forth from pelagic to coastal benthic habitats for an undetermined time before settling down (Laurent et al. 1998). Perhaps the extended settlement size range of North Atlantic loggerheads (25–64 cm CCL) lends support to an intermediary developmental phase as hypothesized for the Mediterranean by Laurent et al. (1998).

This flexible shift from strictly pelagic to coastal habitats might also occur in the western Atlantic loggerhead populations. Some immature turtles might stay in the pelagic habitat in the North Atlantic longer than hypothesized, and some turtles might move back and forth between pelagic and coastal foraging habitats. Witzell (1999) reported that the mean (± SD) size of loggerheads caught incidentally by swordfishermen east of the Grand Banks in the north central Atlantic was 55.9 ± 6.5 cm CCL (range = 41–70 cm). Some of these pelagic turtles (11.2%) are close to, or larger than (> 64 cm CCL), the hypothesized settlement sizes when most loggerhead juveniles are assumed to become coastal benthic foragers. The turtles captured near the Grand Banks appear similar to those turtles reported by Bolten et al. (1993) from the Azores (Fig. 1). Bolten at al. (1993, 1994) also encountered some "post-settlement size" (55–80 cm CCL) turtles near the Azores, turtles that were possibly "loafers" or coastal-pelagic "commuters." Some of these turtles are clearly larger than the size range recruiting to coastal benthic habitats, and either stayed in the pelagic habitat, or they returned from the coastal habitat. The turtles that have stayed in the pelagic habitat might be "late bloomers" and are on the verge of settling into coastal habitats. Two turtles tagged aboard swordfish vessels (61.2 cm and 60 cm CCL) on the Grand Banks were recaptured in U.S. coastal waters, and were possibly settling into the coastal habitats (Witzell 1999). One turtle was recovered in North Carolina and the other turtle from west Florida.

There is also evidence that some of these "coastal" and "pelagic" turtles might move long distances and switch between the coastal and pelagic foraging habitats. Large immature loggerheads might make trans-Atlantic movements. A 73.1 cm SCL loggerhead moved from Cape Canaveral, Florida, 5140 km east to the Azores Islands in 18 months (Eckert and Martins 1989). Another turtle (84.0 cm SCL), tagged in the Canary Islands in the eastern Atlantic, moved west 6900 km to Cuba in 5 months (Bolten et al. 1992). Four immature loggerheads (33.9–57.6 cm) satellite tagged at Madeira in the spring moved northwest against the prevailing currents (Dellinger and Freitas 2000). One of these turtles moved over 3000 km northwest to the Grand Banks (45°N, 40°W). Additionally, Morreale (1999) reported two satellite tagged loggerheads that migrated south along the U.S. east coast before moving thousands of kilometers offshore southeast of the Grand Banks. The first turtle (59.1 cm SCL) was tagged in Long Island Sound, New York, in October and moved south to Cape Hatteras before moving northeast in the Gulf Stream a distance of 1800 km. The second turtle (52.2 cm SCL) was also satellite tagged in Long Island Sound, New York, in October and moved south to Cape Lookout, North Carolina, before moving northeast a distance of 2360 km.

Furthermore, by combining aerial survey observations off the U.S. east coast (Shoop and Kenney 1992) and U.S. pelagic longline fleet captures (Witzell 1999), we know that large loggerhead turtles (mature and/or immature) routinely inhabit offshore habitats during non-winter months in the northwest North Atlantic Ocean. Some of these turtles might be associated with warm water fronts



FIG. 3. Carapace of large loggerhead sea turtle tied to the barrel of an 88 mm cannon aboard a German submarine in World War II. Photo from the U.S. National Archives and Records Administration, Washington, D.C.

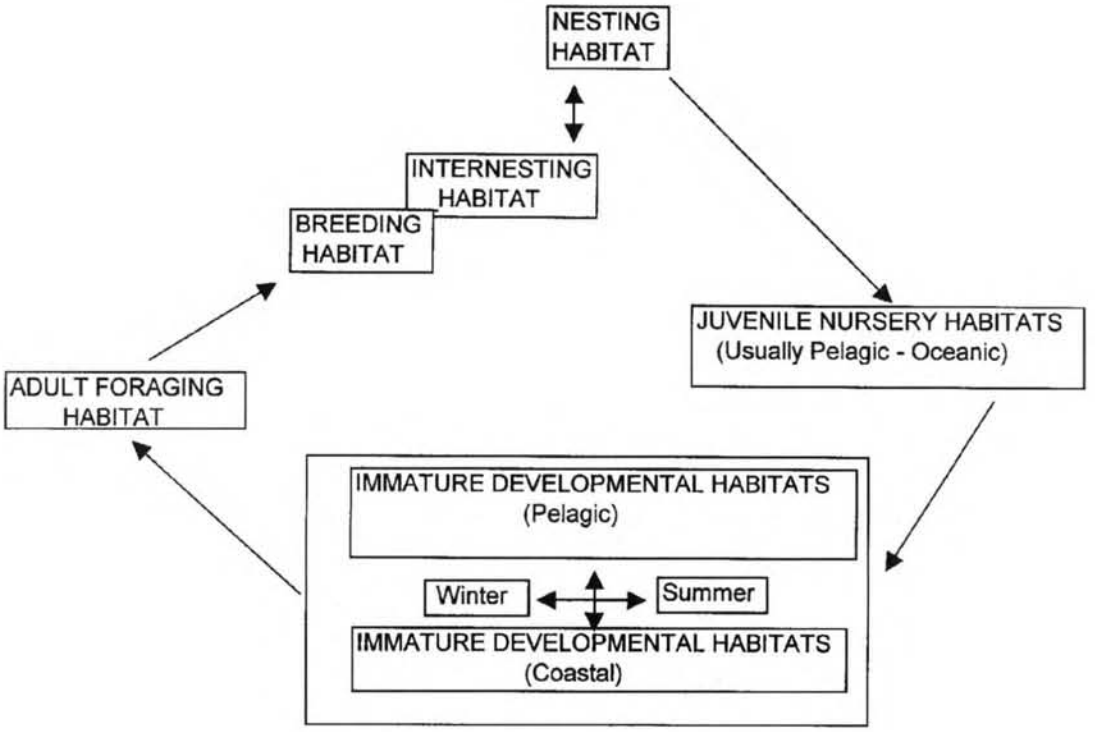


FIG. 4. Proposed conceptual model of loggerhead turtle development, showing seasonal movements between pelagic and coastal developmental habitats (modified after Musick and Limpus 1997).

and eddies associated with oceanic current systems such as the Gulf Stream and might form offshore feeding aggregations in areas of high productivity (Witzell 1999).

Historically, large immature pelagic loggerhead turtles were seemingly abundant between the Grand Banks and the Azores 50 years ago, before the declines in loggerhead turtle population of the 1970's (National Research Council 1990). German submarines reported seeing many large turtles swimming near their submarines during World War II near the Azores Islands (Wiggins 1999). While waiting for allied merchant shipping, crewmen would dive into the water after sundown, tie ropes to the turtles, and then pull them onto the U-boat deck. It is estimated from the photos that these turtles were approximately 65–75 cm (Figs. 2 and 3). The meat was used to make soups and the shells were kept as souvenirs.

Loggerhead turtles apparently have very complex life histories involving different developmental habitats. Australian loggerheads reportedly settle out of pelagic habitats at near mature sizes (79.8 cm SCL) and become residents of coastal feeding aggregations (Limpus et al. 1994). However, in the North Atlantic, the existence of later-stage immature pelagic loggerhead turtles either staying in or moving between coastal and pelagic habitats in the northwestern North Atlantic suggests the possible need for refinements to the current conceptual developmental models of Miller (1997) and Musick and Limpus (1997). The proposed new model is modified after Musick and Limpus (1997) and includes the addition of probable seasonal movements of immature turtles between pelagic and coastal developmental habitats (Fig. 4). Commonly used terms such as "coastal benthic" and "settlement lines" might be misleading and should be revised or used with caution.

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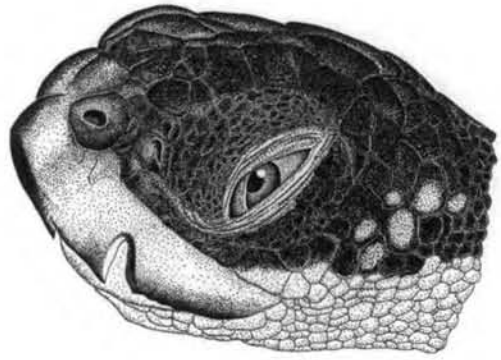
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Dermochelys coriacea (Leatherback Seaturtle) hatchling (FAU, uncat.). USA: Florida, Palm Beach Co. Illustration by Julian C. Lee.

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Reproductive Data for *Anolis quercorum*, a Little-known Anole from Zapotitlán de las Salinas, Puebla, México

AURELIO RAMÍREZ-BAUTISTA
e-mail: raurelio@servidor.unam.mx

VICENTE MATA-SILVA
e-mail: vimasil@yahoo.com

and

LUIS OLIVER-LÓPEZ
e-mail: bufohammer@yahoo.com

Facultad de Estudios Profesionales Iztacala, Unidad de Biología Tecnología y Prototipos (UBIPRO), Laboratorio de Ecología, UNAM Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla Edo. de Mex. C.P. 54090, A.P. 314 México

Lizards of the New World genus *Anolis* have been extensively studied on Caribbean islands (e.g., Creer et al. 2001; Giannasi et al. 1997; Howard et al. 1999; Losos 1996) and the North American mainland (Guyer 1988a, 1988b; Guyer and Savage 1986, 1992; Vitt et al. 1995). Numerous ecological and life history studies of *Anolis* have focused on Caribbean taxa (Andrews 1976, 1979, 1991; Losos 1996; Ruibal et al. 1972; Schoener 1968; Schoener and Gorman 1968; Schoener and Schoener 1971a, 1971b). In contrast, few ecological studies of Mexican anoles have been carried out (e.g., Ramírez-Bautista 1995; Ramírez-Bautista and Vitt 1997), as most studies of Mexican anoles have been systematic (e.g., Campbell et al. 1989a; Fitch 1978; Fitch and Henderson 1973; Guyer and Savage 1986, 1992; Nieto-Montes de Oca 1994, 1996; Smith 1968a, 1968b, 1968c; Smith and Paulson 1968). Among Mexican anoles, significant life history data are available only for *A. nebulosus* populations from the Pacific coast (Jenssen 1970; Ramírez-Bautista 1995; Ramírez-Bautista and Vitt 1997), and only spotty ecological data exist for other species (e.g., *Norops uniformis*: Campbell et al. 1989b). As few data have become available since Fitch (1982) emphasized the paucity of reproductive information on Mexican anoles, we take this opportunity to report reproductive data on the rarely observed gray anole, *Anolis quercorum*, from Zapotitlán de las Salinas in the state of Puebla, México. As human activities have substantially altered the habitats from which this species is recorded, additional opportunities to obtain data on this species might be tenuous. In particular, we provide data on egg development, size, and volume; and relative clutch mass from a sample of four adult females, and reproductive condition for two males.

Zapotitlán de las Salinas is a small town in the southeastern portion of the state of Puebla at 1420 m elevation (18°07'18"N, 97°19'24"W; Villaseñor et al. 1990). The climate is dry and temperate (mean annual air temperature 21°C; range: 17–24°C) with most precipitation occurring during summer (mean annual precipitation = 450 mm; Secretaría de Gobernación 1988). A patchwork of thorn forest, xerophyllic brushland, and deciduous tropical dry forest remnants dominate local vegetation (Rzedowski 1981) within a matrix heavily influenced by human activities.

TABLE 1. Reproductive characteristics of *Anolis quercorum* collected at Zapotitlán de las Salinas, Puebla, México in 1998.

Field Number	Date	Sex	SVL[a] (mm)	Body Weight (g)	Testis Volume (mm^3)	Oviductal Eggs Number	Mass (g) Right	Mass (g) Left	Volume (mm^3) Right	Volume (mm^3) Left	Vitellogenic Follicles Number	Vitellogenic Follicles Volume (mm^3)	NVF[b]
JLE 2551	14 May	M	41.0	1.45	13.1								
LOL-015	22 Sept	M	40.0	1.75	1.9								
LOL-014	22 Sept	F	43.0	2.25		2	0.20	0.14	255.4	147.1	1	40.0	8
JLE 3024	02 Sept	F	38.0	1.30		2	0.18	0.14	253.0	177.5	1	12.6	7
JLE 3004	12 July	F	41.0	2.00		1	—	0.15	—	169.6	—	—	16
JLE 3005	12 July	F	38.0	1.35		1	—	0.17	—	194.1	1	68.1	7

[a]Snout–vent length
[b]Non-vitellogenic follicles; number represents the sum from both ovaries

We collected six adult *A. quercorum* during the interval May–September 1998 (Table 1). Lizards were humanely killed, fixed in 10% formalin, and necropsied. We obtained linear measurements for snout–vent length (SVL) to the nearest 1.0 mm, length and width of the right testis in males, length and width of the left and right vitellogenic follicles (VF), and oviductal eggs (OE) in females, all to the nearest 0.1 mm. For females, we also recorded the number of nonvitellogenic follicles. We obtained the body weight of lizards with a 5-g Pesola™ scale to the nearest 0.05 g and the mass of each egg to nearest 0.01 g with an analytical balance. Length and width of the right testis were used to calculate its volume using the formula for an ellipsoid (Selby 1965); oviductal egg size was determined using the model of Maritz and Douglas (1994); and relative clutch mass (RCM) was determined using the method of Vitt and Price (1982). Volumetric data are reported to the nearest 0.1 mm^3. Unless otherwise noted, means are ± 1 SE. Specimens were deposited in the Laboratorio de Ecología de la Unidad de Biología, Tecnología, y Prototipos (UBIPRO), FES-I, Universidad Nacional Autónoma de México.

One male was captured on 14 May (JLE 2551) and 22 September (LOL 015). The male from 14 May had a smaller mass, but a considerably larger testicular volume, and had displayed greater reproductive activity than the male captured on 22 September (Table 1). These data suggest that reproductive activity might be greater in May.

Two adult females caught in July and September had body sizes and masses bracketing those of the two males (Table 1). The females obtained in September each carried an egg in each oviduct and one VF simultaneously (Table 1). In each case, the right OE was larger (JLE 3024: 11.6 x 6.3 mm; LOL 014: 11.0 x 6.5 mm) than the left (JLE 3024: 9.6 x 5.8 mm; LOL 014: 9.9 x 5.2 mm; see also Table 1), and a smaller VF was present (JLE 3024: 3.3 x 2.7 mm; LOL 014: 5.3 x 3.8 mm). In contrast, both females collected on 12 July carried only one OE (JLE 3004: 9.5 x 5.7 mm; JLE 3005: 10.5 x 5.8 mm), and only JLE 3005 had a smaller VF (5.9 x 4.7 mm) present. Moreover, the single OEs carried by July females were somewhat smaller in size and mass than the largest OEs of September females. This suggests that September females were pre-oviposition, whereas July females were post-oviposition. Mean OE volume was 199.5 ± 18.4 mm^3 (N = 6), mean VF volume was 40.2 ± 16.0 mm^3 (N = 3), and mean RCM was 0.122 ± 0.019 (N = 6).

Albeit limited, our data imply seasonal reproduction for *Anolis quercorum* similar to that reported for *A. nebulosus* (Jenssen 1970; Ramírez-Bautista 1995; Ramírez-Bautista and Vitt 1997). However, *A. quercorum* differs in seasonally simultaneously carrying two oviductal eggs and one vitellogenic follicle. This differs from the reproductive cycle in *A. nebulosus*, which lays an egg while an advanced vitellogenic follicle is ready to be ovulated (Ramírez-Bautista 1995). Data are too few to evaluate whether this difference reflects phylogeny or the altered habitat in which we found *A. quercorum*. Small differences in size between eggs in the right and left oviducts might indicate that the interval between ovipositions is shorter than in *A. nebulosus* (Ramírez-Bautista and Vitt 1997), but similar to that of *Norops uniformis* (Campbell et al. 1989b), *A. carolinensis* (Andrews 1985), and other island and mainland anoles (Andrews 1979). Relative clutch mass is low like other anoles (Vitt and Price 1982), but higher than in *A. nebulosus* (Ramírez-Bautista 1995). Additional data are needed to understand how this species' reproductive cycle might reflect its human-altered environment.

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TECHNIQUES

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Distance Sampling of Forest Snakes and Lizards

GORDON H. RODDA
USGS Midcontinent Ecological Science Center
Fort Collins, Colorado 80525, USA
e-mail: Gordon_Rodda@usgs.gov

and

EARL W. CAMPBELL
Ohio State University Cooperative Fish and Wildlife Research Unit
Present address: U.S. Fish and Wildlife Service, Honolulu, Hawaii 96850, USA
e-mail: 76130.312@compuserve.com

How does one test the validity of a population enumeration technique? Most validation studies perform "soft" validation; they attempt either to correlate the counts from two or more methods (Fitch 1992) or to compare the economic costs, difficulty, time requirements, or non-economic costs of carrying out selected methods (Strong et al. 1993). Soft validation does not establish the accuracy of a method. "Hard" validation, in which population estimates are checked against the true values, is obviously desirable, but it is always difficult to do and might be impossible for some systems. Hard validation studies involving reptiles or amphibians are rare and usually involve the artificial stocking of a bounded plot (Henke 1998; Rose and Armentrout 1974).

Distance sampling is a relatively new technique (Buckland et al. 1993) that has gained considerable favor for certain herpetological sampling problems (Akin 1998; Thompson et al. 1998), but has yet to be subjected to hard validation tests for reptiles or amphibians. As with strip transect searches (Duellman 1987), distance sampling involves searching for animals within a certain distance from a transect centerline, but it differs from strip transects in requiring the measurement (or estimation) of the perpendicular distance from the centerline to each detected animal. Whereas strip transect searches make the implicit assumption that detection is complete for animals within the strip, distance sampling requires only that all animals *near the centerline* be detected. The distribution of sighting distances to animals off the centerline is used to model detectability in the vicinity of the centerline, but it is only the centerline density estimate that is used and extrapolated to the habitat at large.

Because the centerline density is extrapolated to the overall habitat, it is essential that the centerline conditions be representative of the habitat. Strip transects make a similar assumption about the representativeness of the entire strip, but the corresponding distance sampling assumption is more problematic in that the centerline of many transects is a road or trail, hardly representative of adjacent habitat. In addition to having different ground cover

STORERIA DEKAYI DEKAYI (Northern Brownsnake) and ***S. OCCIPITOMACULATA OCCIPITOMACULATA*** (Northern Red-bellied Snake). **MORPHOLOGY**. Apical pits are reportedly absent in snakes of the genus *Storeria* (Boulenger 1893–1896. Catalogue of Snakes in the British Museum (Natural History). 2nd ed. 3 vols. Taylor and Francis, London. 727 pp.; Trapido 1944. Amer. Midl. Nat. 31:1–84.; Wright and Wright 1957. Handbook of Snakes of the United States and Canada. 2 vols. Comstock Publ. Co., Ithaca, New York. 640 pp.; Marx and Rabb 1972. Fieldiana Zool. 63:92–99). Herein, I report on the discovery of apical pits in two species of *Storeria*.

As part of an ongoing project dealing with the identification of shed skins, I examined 145 sheds of 21 species of North American snakes. Of the 145 sheds, six *S. d. dekayi* and eight *S. o. occipitomaculata* sheds were included for study. After being cut into sections and mounted, sheds were examined using a stereo microscope under 10x and 30x magnification. Data for various characters, including the presence or absence of apical pits were recorded. Two *S. d. dekayi* and four *S. o. occipitomaculata* sheds had apical pits on scales on the dorsal neck region (Fig.1), whereas scales beyond the nape had no observable pits.

Several factors may have been responsible for apical pits being overlooked in *Storeria* for so long. First, apical pits may be restricted and or more apparent on certain areas of the body (e.g., some specimens of *Lampropeltis triangulum*; Williams 1978. Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*. Publ. Biol. Geol. Milw. Publ. Museum 2:1–258). Second, apical pits are best seen in shed skins (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex. SSAR, Oxford, Ohio. 614 pp.). Also, it is evident that significant interspecific and intraspecific variation occurs in some groups (Ball 1996. Reptile & Amphibian Magazine. July/Aug 1996:112–116); less than half (43%) of the *Storeria* sheds in the present study had observable apical pits. The techniques used to prepare (e.g., mounting) and examine (e.g., intensity and angle of lighting) shed skins or actual specimens may affect how easily these structures are observed. If a structure is reported as absent, some may choose not to look for them. Intraspecific variation in the occurrence of apical pits warrants additional study.

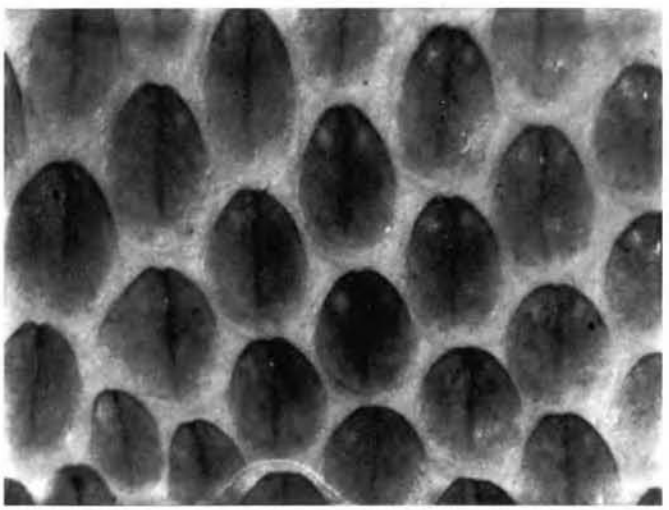


FIG. 1. Dorsal scales with apical pits on a shed skin of *Storeria dekayi dekayi* from Erie Co., Pennsylvania, USA.

I thank Brian Wettekin and Paul Curtis for providing field collected sheds, Hobart Smith for help with the literature and reviewing an earlier version of the manuscript, James Ball for confirming the presence of apical pits on the *Storeria* sheds, providing the microphotograph, and for reviewing a draft of the manuscript. I also thank James Harding whose suggestions were helpful in the final preparation of the manuscript.

Submitted by **BRIAN S. GRAY**, 1217 Clifton Drive, Erie, Pennsylvania 16505, USA.

XENOPELTIS UNICOLOR (Asian Sunbeam Snake). **DIET.** Tooth morphology of *Xenopeltis unicolor* is specialized for handling lizard prey (e.g., skinks; Greene 1997. Snakes: The Evolution of Mystery in Nature. Univ. California Press, Berkeley. 351 pp.). We report the first occurrence of oophagy by *X. unicolor*. An adult male *X. unicolor* (774 mm SVL) had two unidentified squamate eggs, measuring 23 and 29 mm in length, in its stomach. Each egg had been slit along the side one or more times and was empty. The snake was collected by Kamuran Tepedelen in central Java, Indonesia in June 1999. Both the *X. unicolor* and its stomach contents are part of the herpetological collections at the University of Michigan Museum of Zoology (UMMZ 227200 and UMMZ 227201, respectively).

Submitted by **KATHERINE A. DARIN** and **GLENN M. FOX**, Department of Ecology and Evolutionary Biology and Division of Reptiles and Amphibians, University of Michigan Museum of Zoology, Ann Arbor, Michigan 48109-1079 USA (e-mail: foxg@umich.edu).

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 33, Number 1 (March 2002). Additional note: The responsibility for checking literature for previously documented range extensions lies with authors. Do not submit range extensions unless a thorough literature review has been completed.

CAUDATA

AMBYSTOMA TIGRINUM (Tiger Salamander). USA: NORTH DAKOTA: DICKEY CO: State Hwy 11, 16.9 km E Ellendale (46°00'N, 98°19'W). 20 July 1999. Dean A. Croshaw. Sam Noble Oklahoma Museum of Natural History (OMNH 38270). Verified by Janalee P. Caldwell. Branchiate adult found on road. First county record (Hoberg and Gause 1992. North Dakota Outdoors 55:7–19).

Submitted by **DEAN A. CROSHAW**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA; e-mail: croshaw@srel.edu.

AMBYSTOMA TIGRINUM MAVORTIUM (Barred Tiger Salamander). MÉXICO: CHIHUAHUA: Reservoir at La Bamba (30°5'47.4"N, 105°24'55.0"W), 1330 m elev. 8 June and 30 July 2001. Julio A. Lemos-Espinal. Herpetological Collection of Unidad Biotecnología y Prototipos (UBIPRO 6971–7007, 7863–67); Mpio. Camargo, Reservoir El 33, Rancho Agua Zarca (29°54'34.3"N,

105°29'18.8"W), 1443 m elev. 9 June 2001. Julio A. Lemos-Espinal. UBIPRO 7008, 7026. All verified by Richard L. Holland. First records for Chihuahua (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C., 587 pp.).

Submitted by **JULIO A. LEMOS-ESPINAL**, under CONABIO Projects U003 and X004, Laboratorio de Ecología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, UNAM, Apdo. Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e–mail: lemos@servidor.unam.mx); **DAVID AUTH**, 245 NE 7th Street, Gainesville, Florida 32601, USA (e-mail: davidauth@hotmail.com); **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail: hsmith@spot.colorado.edu).

ANEIDES AENEUS (Green Salamander). USA: GEORGIA: Stephens Co: Panther Creek Cove, Chattahoochee National Forest, 8.8 km NNW of Toccoa. 27 November 2001. Matthew J. Elliott and Carlos D. Camp. Verified by M. E. McGhee. Photographic record placed in the Georgia Museum of Natural History (GMNH 46876). Rock outcrop in deciduous cove forest at 280 m elev. New county record and first record for Piedmont physiographic province in Georgia. At minimum reported elevation for eastern isolate (Corser 2001. Biol. Cons. 97:119–126). Site is unusual for Blue Ridge/Piedmont in having outcrops of limestone (Wharton 1978. The Natural Environments of Georgia, Georgia Department of Natural Resources).

Submitted by **MATTHEW J. ELLIOTT**, Georgia Gap Analysis Program, Institute of Ecology, University of Georgia, Athens, Georgia 30602, USA, and **CARLOS D. CAMP**, Department of Biology, Piedmont College, Demorest, Georgia 30535, USA.

DESMOGNATHUS AENEUS (Seepage Salamander). USA: GEORGIA: Pickens Co: Big Canoe Development, McDaniel Meadows, a conservation easement held by North American Land Trust (34.46241081N, 84.26860222W). 27 March 2002. Christopher R. Wilson. Georgia Museum of Natural History (GMNH 46878). Verified by Elizabeth McGhee. First county record (John Jensen, pers. comm.). Three individuals observed. Two were females found tending separate clutches of eggs under sphagnum moss at edge of small creek in wetland. Photographed and released. Funding for biological surveys provided by Big Canoe Company, LLC.

Submitted by **CHRISTOPHER R. WILSON**, 425 Roxanna Street, Boone, North Carolina 28607, USA; e-mail: critterfro@boone.net.

DICAMPTODON COPEI (Cope's Giant Salamander). USA: OREGON: Wasco Co: Boulder Creek, just above Forest Rd. 48. UTM's 5004876 m N, 616357 m E. 951 m elev., 9 September 2001. Charlotte Corkran. Verified by Keith B. Aubry. UWBM 2311. Specimen is a large, paedomorphic adult (96.5 SVL, 180 TL, 18.6 g). New county record and first record of this species east of the Cascade crest in Oregon. This is the southernmost and easternmost locality for this species, extending the range ca. 24 km SE of the Still Creek, Oregon, locality (Nussbaum 1976. Misc. Publ. Zool., Univ. Michigan 149:1–94). It is ca. 2 km further E than the only known eastside Washington locality, Spring Creek, Skamania Co. (Leonard et al. 1998. Herpetol. Rev. 29:244). Five other *D. copei* were captured, photographed, measured, and released during two earlier visits to Boulder Creek (unpubl. data), but no *D. tenebrosus* were observed.

We thank Robert Penson, Mt. Hood National Forest, for conducting stream surveys in the Oregon Cascades and first recognizing *D. copei* from Wasco County. We thank M. Hayes for reviewing this note.

Submitted by **LAWRENCE L. C. JONES**, USDA Forest Service, Pacific Northwest Research Station, Olympia, Washington 98512, USA (e–mail: ljones02@fs.fed.us), **CHARLOTTE CORKRAN**, Northwest Ecological Research Institute, Portland, Oregon 97229, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: ILLINOIS: Knox Co: Green Oaks, Knox College Biological Field Station: 6.5 km S of Victoria. 19 April 2001. Mathys J. Meyer and John A. Crawford. Verified by Christopher A. Phillips. Illinois Natural History Survey (INHS 17233). New county record for this state threatened species (Phillips et al. 1999. Field Guide to the Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8, Champaign, Illinois. xii + 282 pp.). Single specimen collected under a log, partially submerged in a seep originating from Lake Sharvy, in secondary oak-hickory forest. This represents the first voucher specimen for a population initially reported by Schramm and Nordgren (1978. Trans. Illinois Acad. Sci. 60:243) and discussed by Anton et al. (1998. *In* M. J. Lannoo [ed.], Status and Conservation of Midwestern Amphibians, pp. 45–48. Univ. of Iowa Press, Iowa City, Iowa). The population was believed extirpated following the drought of the late 1980s (Schramm, pers. comm). In October 1999 a specimen was discovered by Stuart Allison, however, it could not be collected due to the status of the species in Illinois. Additional specimens (N = 11) were found in various locations at Green Oaks in 2000 and 2001. This specimen was collected under a general endangered species permit (#00-20S) issued to Mathys J. Meyer and John A. Crawford by the Illinois Department of Natural Resources.

Submitted by **MATHYS J. MEYER** (e-mail: altboer@hotmail.com), Department of Biological Sciences, Illinois State University, Normal, Illinois 61790, USA; **JOHN A. CRAWFORD** (e–mail: jac7vc@mizzou.edu), Division of Biological Sciences, University of Missouri, Columbia, Missouri 65211, USA; and **STUART ALLISON** (e–mail: sallison@knox.edu), Biology Department, Knox College, Galesburg, Illinois 61401, USA.

PLETHODON GLUTINOSUS (Northern Slimy Salamander). USA: ILLINOIS: Washington Co: in rotten log on bluff above Little Muddy River, 0.98 km E of the RR crossing in Dubois (38°13'56"N, 89°12'02", 490 m elev.). 15 May 2001. Raymond Thompson. Verified by Ralph Axtell. Southern Illinois University, Edwardsville Herpetology Collection (SIUE 2831). New county record (Phillips et al. 1999. Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8, Champaign, Illinois. xii + 282 pp.).

Submitted by **AMY WISNESKI**, Department of Biological Sciences, Southern Illinois University Edwardsville, Illinois 62025, USA.

PLETHODON VENTRALIS (Southern Zigzag Salamander). USA: TENNESSEE: Fentress Co., Poplar Cove region, ca. 8 km W of Jamestown on the south side of State Hwy 52 on a private farm (36°26'30"N, 84°59'47"W). 22 March 2002. Vincent A. Cobb. Verified by A. Floyd Scott. Austin State University Museum of Zoology (APSU 3327). Two adults, one male and one female, were found under a 30–40 cm diameter limestone rock at the edge of a woodland. The male was captured and preserved as the voucher. Since approximately1986, I have observed this species several times under rocks in this woodland; always during winter or early spring when the soil is moist. New county record and extension of range into the Cumberland Mountains where status of this species is poorly known (Redmond and Scott 1996. Atlas of Amphibians in Tennessee. Austin Univ. Misc. Publ. 12:1–94).

Submitted by **VINCENT A. COBB**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

ANURA

ALSODES GARGOLA (NCN). ARGENTINA: CHUBUT: Departamento Futaleufú: Los Alerces National Park, 0.5 km N of Laguna Neira (42°39'34"S, 71°38'07"W), ca. 1120 m elev. 3 January 2002. C. Úbeda. Juvenile (SVL 26.5 mm). Museo de Ciencias Naturales de La Plata, La Plata, Argentina (MLP A 3312). Specimen was collected under a rock, at the edge of a shallow mountain stream, in a temperate deciduous forest of lenga (*Nothofagus pumilio*). Juveniles and tadpoles of the species were common. Población Neira, E shore of Rivadavia Lake (42°38'36"S, 71°40'18"W), ca. 550 m elev. 3 January 2002. C. Úbeda. Adult male (SVL 55 mm). Fundación Miguel Lillo, Tucumán, Argentina (FML 11272, color slide). Specimen was found under a log in a mountain stream in a temperate humid evergreen forest of coihue (*Nothofagus dombeyi*). Both specimens verified by N. Basso. Species is endemic to northwestern Argentinian Patagonia. It ranges from the volcanic tablelands of Lonco Luan, province of Neuquén (38°52'S, 70°34'W) (Cei 1980. Amphibians of Argentina. Monit. zool. ital. [N.S.], Monogr. 2:[I–xii] + 1–609) to La Hoya, Cordón de Esquel, province of Chubut (Úbeda 2000. Herpetol. Rev. 31:181) but its distribution is scattered. These are the first records for Los Alerces National Park and the second provincial records, and constitute a range extendion of 39–42 km NW from the first record at La Hoya (Úbeda, *op.cit.*).

Submitted by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Prov. de Río Negro, Argentina.

BATRACHYLA ANTARTANDICA (NCN). ARGENTINA: CHUBUT: Departamento Cushamen: Lago Puelo National Park, 1 km N of Lake Puelo shore, near trail to Los Hitos (42°06'S, 71°42'37"W), ca. 350 m elev. 26 January 2002. Félix Vidoz. Museo de La Plata, La Plata, Argentina (MLP A 3313). Adult male (SVL 35.6 mm). Verified by Néstor G. Basso. Specimen was calling at time of capture. Specimen was collected in a small bog with abundant ferns (*Blechnum chilense*) and some elements of Valdivian flora (*Lomatia ferruginea*, *Caldcluvia paniculata*, and *Weinmania trichosperma*) near Fuinque stream. This area was surrounded by a mixed temperate forest dominated by coihue (*Nothofagus dombeyi*), ciprés de la cordillera (*Austrocedrus chilensis*), and radal (*Lomatia hirsuta*). This site also supports populations of *Eupsophus calcaratus*, *E. emiliopugini*, *Pleurodema thaul*, *Batrachyla leptopus*, *Alsodes gargola*, and *A. monticola*. Another male specimen was found 6 km SW (42°8'48"S; 71°45'3"W), ca. 820 m, in a small *Sphagnum* bog, near Melo stream, in a humid forest with *N. dombeyi* and alerce (*Fitzroya cupressoides*).

This species is known from austral forests of Chile and Argentina, with a narrow distribution along the eastern slopes of the Andes. Few records for this species exist from Argentina: at Nahuel Huapi National Park (S of Neuquén Province and N of Río Negro Province) (Barrio 1967. Physis [Buenos Aires] 27[74]:101–109) and one record for Chubut Province at La Plata Chico Lake (Úbeda 2000. Herpetol. Rev. 31:109). This is the first record for Lago Puelo National Park and the second one for Chubut Province, and decreases the distributional gap between northern and southern localities in Argentina.

Submitted by **FÉLIX VIDOZ**, Administración de Parques Nacionales, Intendencia Parque Nacional Lago Puelo, (U9211ADA) Lago Puelo, Chubut, Argentina, **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Prov. de Río Negro, Argentina, and **JULIÁN Q. VIDOZ**, Villa del Lago, (U9211ADA) Lago Puelo, Chubut, Argentina.

BATRACHYLA NIBALDOI (Nibaldo's Wood Frog). CHILE: XI REGION DE AYSEN: Aysén Province, Las Guaitecas National Reserve: Kent Island: Beach toward the Channel Ninualac, 45°04'15"S, 74°22'21"W. 21 March 2002. Juvenile specimen collected on mosses near a beach. Museo de Zoología de la Universidad de Concepción (MZUC 26753). 45°04'13"S, 74°17'7"W. 24 March 2002. Mature female (SVL 48.6 mm) collected on mosses in a Chilean valdivian rain forest dominated by tepuales (*Tepualia stipularis*) and canelos (*Drimys winteri*) (MZUC 26754). Both verified by J. C. Ortiz. Species known in Chile from Puente Traihuanca (46°25'S, 72°04'W) (Formas 1997. Herpetologica 53:6–13) and from Laguna San Rafael National Park (Díaz-Páez and Williams 2001. Herpetol. Rev. 32:189. Extends the range of this species ca. 190 km N and W of the Puente Traihuanca record. In this area *B. nibaldoi* coexists with *Batrachyla antartandica, Eupsophus emiliopugini*, and *E. calcaratus*.

Submitted by **HELEN DÍAZ PÁEZ,** Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile, and **ESTEBAN CARREÑO,** Museo Nacional de Historia Natural, Casilla 787, Interior Quinta Normal, Santiago, Chile.

BUFO ATACAMENSIS (Atacama Toad; Sapo de Rulo). CHILE: II Region (Antofagasta): Quebrada de los Sapos also known as Los Perales (25°02'S; 70°27'W), 6 km E of the little fishing town of Paposo. 2 August 1996 (DBGUCH: 2200–2208); Las Bandurrias gorge (25°12'64"S; 70°26'25"W). 2 August 1996 (DBGUCH: 2101, 2092). III Region (Atacama): Las Chilcas in the Pan de Azúcar National Park. (26°03'S; 70°33'W). 1 April 1997 (DBGUCH: 2246–2247); La Finca of Chañaral (26°38'01"S; 69°51'38"W), 30 km NE of the mining town of Finca de Oro, 1 April 1997 (DBGUCH: 2303, 2308). IV Region (Coquimbo): Socos (30°45'S; 71°30'W), 37 km SW of Ovalle, next to Limarí River. 30 August

1996 (DBGUCH: 2079). Pajonales (29°38'S; 71°30'W), 80 km N of the city of La Serena. 19 August 1996 (DBGUCH: 2071, 2078, 2140, 2160, 2165, 2168). All specimens collected by M. Sallaberry and M. Méndez, and verified by A. Veloso, and were deposited in the herpetological collection of Departamento de Biología Celular y Genética de la Universidad de Chile (DBGUCH). This new information includes precise localities in northern part of the range and extends the southern limit of the distribution previously described by Cei (1962. Batracios de Chile, Ediciones Universidad de Chile) more than 100 km. These new localities have been recorded with the support of Grants Fondecyt 5960021–96 and 2960012–96.

Submitted by **MICHEL SALLABERRY** (e–mail: msallabe@uchile.cl) and **MARCO A. MENDEZ** (e-mail: mmendez@icaro.dic.uchile.cl) Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, PO Box 653, Santiago, Chile.

BUFO VALLICEPS (Gulf Coast Toad). USA: TEXAS: DENTON Co: Cicada Trail, Lewisville Lake Environmental Learning Area (33°03'56.1"N, 96°58'30.6"W; datum WGS 84). 23 November 2001. Joel A. Johnson. Verified by Janalee P. Caldwell. OMNH 39074–81. New county record; connects northernmost record (Grayson Co., Texas) with contiguous southern distribution (Dixon 2000. Amphibians and Reptiles of Texas. Second Edition. Texas A&M Univ. Press, College Station. 421 pp.). Specimens found along maintained trail under wooden ties in bottomland habitat adjacent to Elm Fork of the Trinity River below Lake Lewisville Dam.

Submitted by **JOEL A. JOHNSON**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA e–mail: pliscan@ou.edu.

CHIASMOCLEIS CARVALHOI (Central Humming Frog). BRAZIL: BAHIA: Una Municipality (15°18'S, 39°04'W). 28 m elev. 06 October 1999–25 February 2000. M. Dixo. Museu Nacional, Rio de Janeiro (MNRJ 28605–24). Porto Seguro Municipality: Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). 82 m elev. 20–22 June 2001. B. V. S. Pimenta. MNRJ 28957–59. 12 July 2001. B. V. S. Pimenta. MNRJ 28960–61. 13 September 2001. B. V. S. Pimenta. MNRJ 28962. Verified by José Perez Pombal, Jr. and Ulisses Caramaschi. All specimens were captured with pitfall traps. According to Cruz et al. (1997. Alytes 15[2]:49–71), *Chiasmocleis carvalhoi* is found in lowland forests in the states of Rio de Janeiro and São Paulo, in the southeast region of Brazil. This new record for the state of Bahia extends the range ca. 960 km and suggests a possible disjunct distribution for this species.

Submitted by **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net), **CARLOS ALBERTO GONÇALVES DA CRUZ** (e-mail: cagruz@uol.com.br), Departamento de Vertebrados, Museu Nacional do Rio de Janeiro, Quinta da Boa Vista, 20940-040, Rio de Janeiro, RJ, Brazil; and **MARIANNA DIXO,** Universidade de São Paulo, Instituto de Biociências, Departamento de Ecologia, C.P. 11461, CEP 05422-970, São Paulo, SP, Brazil (e-mail: maridixo@ib.usp.br.).

CHIASMOCLEIS SCHUBARTI (Schubart's Humming Frog). BRAZIL: BAHIA: Guaratinga Municipality: Fazenda Vista Bela (16°36'S, 39°55'W, 320 m elev.). 14 September 2000. B. V. S. Pimenta, R. T. Moura, A. Paglia, and R. V. Lopes. Museu Nacional, Rio de Janeiro (MNRJ 29773). Porto Seguro Municipality: Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W, 82 m elev.). 20 June 2001. B. V. S. Pimenta. MNRJ 27256. 10–11 July 2001. B. V. S. Pimenta. MNRJ 28894–97. 23 August 2001. B. V. S. Pimenta. MNRJ 28875. 27 October 2001. B. V. S. Pimenta. Museu de Ciências Naturais at Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte (MCN 2912–13). Porto Seguro Municipality: Parque Nacional Pau Brasil (16°31'S, 39°18'W, 80 m elev.). 16 September 2001. D. L. Silvano and B. V. S. Pimenta. MNRJ 28907–08. Verified by Ulisses Caramaschi and Carlos Alberto Gonçalves da Cruz. Published distribution, according to Cruz et al. (1997. Alytes 15[2]:49–71), is Atlantic Rainforest fragments in the states of Minas Gerais and Espírito Santo, in the southeast region of Brazil. This new record for the state of Bahia establishes a new northern limit of distribution for this species and extends range ca. 302 km.

Submitted by **BRUNO V. S. PIMENTA** (e–mail: brunopimenta@softhome.net) and **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net), Instituto de Estudos Sócio-Ambientais do Sul da Bahia/Universidade Federal de Minas Gerais, Laboratório de Manejo de Fauna, Depto. Zoologia/ICB, 31270-901, Belo Horizonte, MG, Brazil.

COLOSTETHUS TEPUYENSIS (NCN). VENEZUELA: ESTADO BOLÍVAR: MUNICIPIO GRAN SABANA: Forest at right margin of Cucurital River, between Wareipita River and Wareipa rapids (6°00'36"N, 62°47'27"W). 390 m elev. 14 April 1999. C. Molina. Museum of Natural History La Salle (MHNLS 14405). Purumay-vená, waterfall at Purumay River, tributary of Cucurital River (5°52'48"N, 62°45'22"W). 445 m elev. 5–9 April 2000. C. Molina, E. La Marca, and J. C. Señaris. MHNLS 14914, 14924–14926, 14940–14941. Verified by J. Ayarzagüena. First report of the species outside the type locality (La Marca 1996. Publ. Asoc. Amigos Doñana 9:1–64), extends known distribution ca. 40 km NE from the type locality near Kamarata, on the southeastern slopes of the Auyán-tepui. Specimens were collected during daytime in a small rocky stream in the forest, among the leaf litter and along the spray zone of this waterfall. With the exception of *Colostethus brunneus*, a frog apparently having a wide distribution in the Amazonian lowlands, all Venezuelan-Guayanan *Colostethus* appear to have very restricted distributions. The new localities lie within the Auyán-tepui area, one of the most biologically diverse centers in the Pantepui region (Huber 1986. Interciencia 11:301–310).

Submitted by **ENRIQUE LA MARCA**, Laboratorio de Biogeografía, Escuela de Geografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Mérida 5101, Venezuela (e-mail: lamarca1@telcel.net.ve), **J. CELSA SEÑARIS** (e–mail: celsa35@hotmail.com), and **CÉSAR MOLINA** (e-mail: washaema@hotmail.com), Museo de Historia Natural La Salle, Apartado 1930, Caracas 1010-A, Venezuela.

ELEUTHERODACTYLUS DIASTEMA (NCN) HONDURAS: GRACIAS A DIOS: Bodega de Río Tapalwás (14°56'N, 84°32'W), 190 m elev. 11 and 13 October 2001. James R. McCranie and Kirsten E. Nicholson. USNM 549350–51. Crique Yulpruan (14°54'N, 84°3''W), 140 m elev. 14 October 2001. James R. McCranie and Kirsten E. Nicholson. USNM 549352. All verified by Larry D. Wilson. First record for Honduras, extending the range ca. 90 km N of Bonanza, Atlántico Norte, Nicaragua (Köhler 2001. Anfibios y Reptiles de Nicaragua. Herpeton, Offenback, Germany, 208 pp.). McCranie and Wilson (2002. The Amphibians of Honduras. SSAR Contrib. Herpetol. 19, 625 pp.) predicted that this species likely occurred in eastern Honduras. All specimens are males and were found while they called from the tops of palm leaves 1–3 m above the ground.

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157–2933, USA (e-mail: jmccrani@bellsouth.net), **KIRSTEN E. NICHOLSON**, Department of Biology, Washington University, Campus Box 1137, St. Louis, Missouri 63130, USA, and **FRANKLIN E. CASTAÑEDA**, Departamento de Áreas Protegidas y Vida Silvestre, AFE/COHDEFOR, Apartamento Postal 1378, Tegucigalpa, Honduras.

EUPSOPHUS EMILIOPUGINI (NCN). CHILE: XI REGION DE AYSEN: Aysén Province, Las Guaitecas National Reserve: Kent Island, (45°04'S, 74°22'W). 23 March 2002. Female (SVL 47.5 mm) collected in cavities in the soil in the Chilean temperate rain forest. Helen Díaz Páez. Museo de Zoología de la Universidad de Concepción (MZUC 26845). Melchor Island (45°10'S, 74°09'W). 26 March–3 April 2002. Three mature females (SVL [in mm] 51.2, 46.9, and 55.0). Adult specimens collected under logs in Chilean temperate rain forest dominated by tepual (*Tepualia stipularis*) and canelo (*Drimys winteri*). Helen Díaz Páez. (MZUC 26843–44, 26846). Four specimens verified by Juan Carlos Ortiz. Puerto Yates, Rivero Island (45°37'S, 74°22'W). 10 March 2001. Male (SVL 40.0 mm). José Nuñez. Instituto de Zoología, Universidad Austral de Chile (IZUA 3374). Verified by J. Ramón Formas. The historical distribution of this species in Chile extended from Puyehue (40°42'S, 72°18'W) to Caleta Vidal (45°16'S, 73°27'W) (Formas 1989. Proc. Biol. Soc. Washington 102[3]:568–576). The first four records reported herein extend the known range to the Chilean coast. The Rivero Island record extends the species range ca. 84 km S and W from the Caleta Vidal record.

Submitted by **HELEN DÍAZ PÁEZ,** Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile, and **JOSE NUÑEZ** Instituto de Zoología, Universidad Austral de Chile, Casilla 567, Valdivia, Chile.

HYALINOBATRACHIUM NOURAGUENSIS (Glassfrog). BRAZIL: AMAZONAS: Presidente Figueiredo Municipality (02°09'3"S, 60°02'06.2"W), Private Reserve of Natural Patrimony (RPPN) Cachoeira da Onça. 1 September 2000. O. Pereira and A. C. Cordeiro-Duarte. Amphibian and Reptile Collection of National Institute for Amazonian Research (INPA 10.156). Verified by Ulisses Gallati. The adult male (21 mm SVL) was calling from a perch 3 m above ground in streamside vegetation 30 m downstream from a waterfall, in primary forest. This is the first record of this species from the Brazilian Amazon and extends distribution 1040 km SW of populations in French Guyana (Lescure and Marty 2000. Atlas des Amphibians de Guyane, M.N.H.N. Paris).

Submitted by **ANA C. CORDEIRO-DUARTE** and **TÃNIA M. SANAIOTTI**, Instituto Nacional de Pesquisas da Amazônia - INPA, Av. André Araújo, 2936, C.P. 478, Manaus, AM, 69.083-000, Brazil; **EMERSON L. C. DUARTE**, SEDUC, Manaus AM, 69.083-000, Brazil; and **OCÍRIO PEREIRA,** INPA/Smithsonian-PDBFF, Manaus, AM, 69.083-000, Brazil.

HYLA ALBOPUNCTATA (NCN). BRAZIL: RIO GRANDE DO SUL: Municipality of Santa Maria: Campus da Universidade Federal de Santa Maria (29°43'S, 53°43'W) and vicinities (29°44'S, 53°44'W). 26 February and 14 March 2002. K. A. Kopp and T. G. dos Santos. Herpetology Collection, Departamento de Biologia, Universidade Federal de Santa Maria, Santa Maria (ZUFSM 2813, 2822–23). Verified by Paulo Christiano de Anchietta Garcia. First record from the Depressão Central in the state of Rio Grande do Sul. This extends the range 300 km from a previous record in the northwest state of Santo Antônio das Missões Municipality (28°30'S, 55°13'W) (Garcia and Vinciprova 1998. Herpetol. Rev. 29:117–118).

Submitted by **KATIA A. KOPP, TIAGO G. DOS SANTOS, RAFAEL TREVISAN, MARCIA R. SPIES,** and **SONIA T. Z. CECHIN,** Departamento de Biologia, Universidade Federal de Santa Maria, Faixa de Camobi, Km 9, Campus, Camobi, cep: 97105-900, Santa Maria, Rio Grande do Sul, Brazil (e–mail [STZC]: cechinsz@ccne.ufsm.br).

HYLA AVIVOCA (Bird–Voiced Treefrog). USA: ARKANSAS: Clark Co: 11.3 km SW Gurdon off Hwy 67, Sec. 13 T10S R22W. 21 April 2002. Tobin Fulmer. Henderson State University collection 1056–1057. Verified by Stan Trauth. Two specimens collected from a chorus of about a dozen, which were calling from a swampy area located northeast of the Little Missouri River. First record for Clark Co., extends range northwestward in the Ouachita River Valley and into the Little Missouri River drainage (Trauth1992. Proc. Arkansas Acad. Sci. 46:80–82).

Submitted by **TOBIN FULMER** and **RENN TUMLISON**, Department of Biology, Henderson State University, Arkadelphia, Arkansas 71999, USA.

HYLA CARVALHOI (Carvalho's Treefrog). BRAZIL: RIO DE JANEIRO: Santa Maria Madalena, Parque Estadual do Desengano (21°53'S, 41°55'W). 1750 m elev. 30 June 1989. R. B. Pineschi. Museu Nacional, Rio de Janeiro (MNRJ 16983). Verified by Ulisses Caramaschi. This is the first record outside the type-locality, Parque Nacional da Serra dos Órgãos, Teresópolis, Rio de Janeiro, Brazil (22°24'S, 42°57'W), and the northernmost for the species (aerial distance between the two localities ca. 110 km), both in Serra dos Órgãos, a regional designation for the Serra do Mar range.

Submitted by **MARCELO F. NAPOLI**, Departamento de Vertebrados, Museu Nacional, Quinta da Boa Vista, Rio de Janeiro, Rio de Janeiro 20940-040, Brazil; e–mail: napoli@acd.ufrj.br.

HYLA GIESLERI (Giesler's Treefrog). BRAZIL. SÃO PAULO: Municipality of Ubatuba, Núcleo Picinguaba (23°23'S, 44°50'W). 20 February 2002. M. T. Hartmann and P. A. Hartmann. Collection

Célio Fernando Baptista Haddad, Departamento de Zoologia, Universidade Estadual Paulista, Rio Claro, São Paulo State; Brazil. (CFBH 3969, adult male). Verified by C. F. B. Haddad. Species known from the lowlands of Espírito Santo and Rio de Janeiro State (Frost 2000. Amphibian Species of the World: An Online Reference [http://research.amnh.org/herpetology/amphibia]). First state record; extends known distribution up to 180 km S from Magé Municipality (22°39'S, 43°02'W), Rio de Janeiro State (Santos et al. 1998. J. Herpetol. 32:61–66).

Submited by **MARÍLIA T. HARTMANN** (e–mail: matal@rc.unesp.br) and **PAULO A. HARTMANN** (e–mail: pahart@rc.unesp.br), Pós Graduacao em Zoologia, Instituto de Biociências, Caixa Postal 199, UNESP, 13506-900 Rio Claro, São Paulo, Brazil.

HYLA VERSICOLOR (Gray Treefrog). CANADA: ONTARIO: KENORA DISTRICT. Hwy 804, 0.3 km NE of Ontario Power Generation's Manitou Falls Generating Station (UTM Zone 15: N5603600 m, E467800 m). 8 May 1993. Wayne F. Weller and Ron Sheehan. Royal Ontario Museum (ROM 32576 [segment 3], audio cassette tape). Verified by Ross D. MacCulloch. Three or four individuals calling at 2200 h from cattail pond (fog and drizzle, air temperature 17°C). An observation of a live adult male on Hwy 804 was made 1 km E at 2355 h, but specimen was not retained. The documented northern range limit in Kenora District of northwestern Ontario is represented by specimens from (west to east) Malachi (UTM Zone 15: N5535000 m, E355000 m, ROM 9686 – August 1947), Kenora Airport (UTM Zone 15: N5515900 m, E401600 m, JPB 24697 (J. P. Bogart, University of Guelph)– July 1995), Contact Bay in Wabigoon Lake (UTM Zone 15: N5505000 m, E515000 m, ROM 10049 – June 1963), and Butler (UTM Zone 15: N5479000 m, E581500 m, NMC 24517 – June 1983). Extends range 130 km NE of Malachi, and 110 km NW of Kenora airport. This is the northernmost record in Ontario.

Submitted by **WAYNE F. WELLER**, 250 Chercover Drive, Thunder Bay, Ontario P7G 1A2, Canada.

HYLODES SAZIMAI (NCN). BRAZIL: RIO DE JANEIRO: Itatiaia: Parque Nacional do Itatiaia (22°19'S 44°45'W). 6 February 2000. Paulo A. S. Nuin, Paulo C. A. Garcia. Coleção Herpetológica do Museu de Zoologia da Universidade de São Paulo - 96264-65. Verified by Célio C. F. Haddad. First record of the species for the state of Rio de Janeiro, extending 300 km NW from the type locality (Haddad and Pombal 1995. Herpetologica 51:280) in the state of São Paulo, Brazil.

Submitted by **PAULO A. S. NUIN,** Museu de Zoologia, USP, São Paulo, Brazil, 04263-000 (e-mail: nuin@ib.usp.br), and **PAULO C. A. GARCIA**, IB, UNESP, Rio Claro, Brazil, 13506-900.

LEPTODACTYLUS PETERSII (NCN). ECUADOR: PROVINCIA DE SUCUMBIOS: Sacha Lodge (0°26'33"S, 76°27'57"W). 280 m elev. 31 January–4 February 2001. W. Chris Funk. Museo de Zoologia de la Pontificia Universidad Católica del Ecuador (QCAZ 20242–7). Verified by W. R. Heyer. First record in Ecuador. Its presence was expected because the species is widely distributed throughout the Amazon Basin (Heyer 1994. Smithson. Contr. Zool. 546).

Submitted by **SANTIAGO R. RON**, Departamento de Biología y Centro de Biodiversidad y Ambiente, Pontificia Universidad Católica del Ecuador, Apartado Postal 17-01-2184, Quito, Ecuador; e-mail: sron@puceuio.puce.edu.ec.

LEPTODACTYLUS VIRIDIS (Jim's White-lipped Frog). BRAZIL: BAHIA: Guaratinga Municipality: Fazenda Vista Bela (16°36'S, 39°55'W). 320 m elev. 17 September 2000. B. V. S. Pimenta, R. T. Moura, A. Paglia, and R. V. Lopes. Museu Nacional, Rio de Janeiro (MNRJ 29605). Verified by Ulisses Caramaschi. Previously known only from the type locality, in the Municipality of Itagibá, Bahia state (Frost 2000. Amphibian Species of the World: An Online Reference. V2.20. American Museum of Natural History). A female specimen was found in the water, in wet cow pasture, on the borders of an Atlantic Forest fragment. This habitat was very similar to that described for the type series (Jim and Cruz 1979. Rev. Bras. Biol. 39[3]:707–710). Extends the range 244 km S of type locality.

Submitted by **DÉBORA L. SILVANO** (e–mail: dsilvano@softhome.net) and **BRUNO V. S. PIMENTA** (e–mail: brunopimenta@softhome.net), Instituto de Estudos Sócio-Ambientais do Sul da Bahia/Universidade Federal de Minas Gerais, Laboratório de Manejo de Fauna, D. Zool./ICB, 31270-901, Belo Horizonte, MG, Brazil.

ODONTOPHRYNUS OCCIDENTALIS (Cururu Lesser Escuerzo). ARGENTINA: CHUBUT: Departamento Telsen: 9.5 km E of Telsen (42°25'30"S, 66°49'25"W). Ca. 430 m elev. 21 February 2002. Silvana G. Peiretti and Néstor G. Basso. Five tadpoles and three juveniles. Herpetological collection, Museo de La Plata (MLP A 3315). Verified by Jorge D. Williams; Arroyo Verde, Departamento Biedma (42°S, 65°17'W). 200 m elev. 27 February 1973. Daniel Stiebel and Claudio Stiebel. Five juveniles. Department of Herpetology, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 30346–50). Verified by Gustavo Carrizo. The southernmost population of *O. occidentalis* was known from the Somuncurá Plateau, at about 41°S in Río Negro Province (Ruiz et al. 1982. Cytogenet. Cell Genetics 33:303–311). Specimens collected at Telsen were found at a small stream in the arid Patagonian steppe, in sympatry and syntopy with the frog *Pleurodema bufoninum*. These vouchers represent the first records for the Province of Chubut, extending the known range of the species 150 km S from previously reported localities.

Submitted by **SILVANA G. PEIRETTI, NESTOR G. BASSO**, Centro Nacional Patagónico, Blvd. Brown s/n. 9120 Puerto Madryn, Chubut, Argentina, and **SERGIO D. ROSSET**, Instituto de Limnología "Dr. Raúl A. Ringuelet," cc 712, 1900 La Plata, Buenos Aires, Argentina.

PHASMAHYLA EXILIS (Mottled Leaf Frog). BRAZIL: BAHIA: Jussari Municipality: Reserva Particular do Patrimônio Natural (RPPN) Serra do Teimoso (15°08'S, 39°31'W). 17 July 2000. B. V. S. Pimenta and R. V. Lopes. Museu Nacional, Rio de Janeiro (MNRJ 28425). Verified by Carlos Alberto Gonçalves da Cruz. Known distribution was Atlantic Rainforest fragments in the state of Espírito Santo, in southeastern Brazil (Frost 2000. Amphibian Species of the World: An Online Reference. V2.20. American

Museum of Natural History). This specimen, an adult female, was collected in a forested area from a perch near a small dam. This is the first record of the genus for the northeast region of Brazil. It extends range ca. 555 km northward and establishes a new northern range limit (see Feio et al. 2000. Herpetol. Rev. 31:251).

Submitted by **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net) and **DÉBORA L. SILVANO** (e-mail: dsilvno@softhome.net), Instituto de Estudos Sócio-Ambientais do Sul da Bahia/Universidade Federal de Minas Gerais, Laboratório de Manejo de Fauna, Depto. Zoologia/ICB, 31270-901, Belo Horizonte, MG, Brazil.

PROCERATOPHRYS PHYLLOSTOMUS (Leaf-nosed Horned-frog). BRAZIL: ESPÍRITO SANTO: Santa Teresa: Valssugana Velha (ca. 19°57'22"S; 40°35'03"W). 680–800 m elev. 23 May 2000. Marcelo Passamani. Verified by C. A. Gonçalves da Cruz and E. Izecksohn. Museu de Biologia Professor Mello Leitão, Santa Teresa, Espírito Santo (MBML 1326). The species was known only from the type locality: Castelinho (ca. 20°30'40"S, 40°59'10"W), Cachoeiro do Itapemirim (now Vargem Alta), Espírito Santo, Brazil (Izecksohn et al. 1998. Revista Univ. Rural, sér. ciênc. vida. 20[1–2]:37–54). Specimen collected in a fragmented stretch of the Atlantic forest and is the third known specimen of *P. phyllostomus*. This record extends the species distribution ca. 65 km northward.

Submitted by **JOÃO LUIZ GASPARINI**, Departamento de Ecologia, Universidade Federal do Espírito Santo, Caixa Postal 5130, 29041-970 Vitória, Espírito Santo, Brazil; e-mail: gaspa.vix@terra.com.br.

PSEUDOPALUDICOLA LLANERA (Ranita Enana Llanera). VENEZUELA: ESTADO MÉRIDA: La Pedrera, Sector La Vueltosa, 5 km NW of Santa María de Caparo (07°44'N, 71°32'W). 16 August 2000. A. Chacón-Ortiz. Colección de Vertebrados, Facultad de Ciencias, Universidad de Los Andes, Mérida (CVULA 6490–91). Verified by Amelia Diaz de Pascual. With the exception of the original description (Lynch 1989. Copeia 1989:577–588), and a more recent account by Myers and Donnelly (2001. Bull. Am. Mus. Nat. Hist. 261:1–85) little is known of the distribution of this species in Venezuela. First state record and first locality north of the Orinoco River in Venezuela, ca. 400 km to the NW of nearest locality in Río Meta (Lynch, *op. cit.*).

Submitted by **CÉSAR LUIS BARRIO-AMORÓS**, Fundación AndígenA, Apartado Postal 210, 5101-A, Mérida, Venezuela (e-mail: cesarlba@yahoo.com) and **ANDRÉS CHACÓN-ORTIZ,** Fundación Bullfrog. 5101-A. Mérida, Venezuela (e-mail: aecortiz@yahoo.com).

SCINAX EURYDICE (Maracas Snouted Treefrog). BRAZIL: SÃO PAULO: Municipality of Ubatuba, Núcleo Picinguaba (23°23'S, 44°50'W). 27 July 2001. M. T. Hartmann. Collection Célio Fernando Baptista Haddad, deposited in Departamento de Zoologia, Universidade Estadual Paulista, Municipality of Rio Claro, São Paulo State; Brazil (CFBH 3936, adult male). Verified by I. Sazima and C. F. B. Haddad. Specimens were collected from perches at the margins of temporary ponds on the borders of a forest after rain. Published distribution for the species is southern Bahia to Rio de Janeiro State (Frost 2000. Amphibian Species of the World: An Online Reference [http://research.amnh.org/ herpetology/amphibia]). First state record, extends range ca. 250 km S from known distribution in Palmital, Municipality of Saquarema (22°50'S, 42°27'W), Rio de Janeiro State (Wogel et al. 2000. Bol. Mus. Nac., N.S., Zool., Rio de Janeiro 427:1–16).

Submited by **MARÍLIA T. HARTMANN** (e-mail: matal@rc.unesp.br), Pós Graduacao em Zoologia, Instituto de Biociências, Caixa Postal 199, UNESP, 13506-900 Rio Claro, São Paulo, Brazil.

SCINAX NASICA (NCN). BRAZIL: RIO GRANDE DO SUL: Municipality of Santa Maria: Camobi district: Campus da Universidade Federal de Santa Maria (29°42'S, 53°42'W) and vicinity. 23 September 2000, 2 March 2002, and 17 May 2002. S. T. Z. Cechin, T. G. dos Santos, and K. A. Kopp. Herpetology Collection, Departamento de Biologia, Universidade Federal de Santa Maria, Santa Maria (ZUFSM 2435–37, 2818, 3034). Verified by Paulo C. de Anchietta Garcia. These specimens represent the first vouchers from the Depressão Central in the state of Rio Grande do Sul and extend the range of the species ca. 500 km from the single specimen collected in Itaqui Municipality (29°20'S, 56°38'W) (Giasson 2001. Herpetol. Rev. 32:273).

Submitted by **SONIA T. Z. CECHIN, TIAGO G. DOS SANTOS, KATIA A. KOPP, MARCIA R. SPIES,** and **RAFAEL TREVISAN**, Departamento de Biologia, Universidade Federal de Santa Maria, Faixa de Camobi, Km 9, Campus, Camobi, cep: 97105-900, Santa Maria, Rio Grande do Sul, Brazil (e–mail [STZC]: cechinsz@ccne.ufsm.br).

THELODERMA HORRIDUM (NCN). WEST MALAYSIA: PAHANG: Pulau Tioman. Zoological Research Collection at The University of Singapore (ZRC) 01.9661. 19 March 2002. Jesse L. Grismer, Ricardo Escobar III, and Tim M. Youmans. Verified by L. Lee Grismer. Previously known from southern Thailand south to Singapore, Sumatra, and Borneo (Manthey and Grossmann 1997. Amphibien und Reptilien Südostasiens. Natur und Tier-Verlag, Münster. p. 139). This specimen constitutes a new island record (Grismer et al. 2002. Herpetol. Rev. 33:26–29). It was collected during the evening, from a 0.75 m diameter dipterocarp tree, ca. 3.5 m from the forest floor, in primary forest along a walking trail Kampung Tekek to Kampung Juara. When sighted, the specimen was leaning off the tree at a 45-degree angle; it then flattened against the tree in an attempt to hide.

Submitted by **JESSE L. GRISMER** (e-mail: jessgris@lasierra.edu), **RICARDO A. ESCOBAR III**, and **TIM M. YOUMANS**, Department of Biology, La Sierra University, Riverside, California 92515-8247,USA.

TESTUDINES

GRAPTEMYS PSEUDOGEOGRAPHICA (False Map Turtle). USA: ILLINOIS: Rock Island Co: Moline. (90°30.00'N, 41°25.00'W). Sec. 13 R1W T17N. 25 June 1956. Donald Richards. HDW-NIU 1801 (formerly RE 074 in the Putnam Mus. Hist. and Nat. Sci., Davenport, Iowa). Verified by Christine Chandler. New county record for Rock Island County, and extends the range 235 km N of the nearest western locality reported by Phillips et al.

(1999. Field Guide to Amphibians and Reptiles of Illinois, Illinois Nat. Hist. Surv. Manual 8. 282 pp.).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

CROCODYLIA

ALLIGATOR MISSISSIPIENSIS (American Alligator). USA: TEXAS: Morris Co: 2.2 km E US 259 and 1.1 km S FM 250 off Upper Dam Road. 26 May 2002. L. Hampton. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26995, photographic voucher). Verified by Stanley E. Trauth. New county record (Dixon 2000. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.). Specimen was estimated to measure ca. 3 m in total length. Circa 1977, another specimen was observed at a nearby site in Morris County at Lone Star Lake (Ellison Creek Reservoir). Lone Star Steel Company erected a statue to it but no voucher or photograph was ever obtained.

Submitted by **CHRIS T. McALLISTER** and **BEVERLY K. ALLEN**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA (e-mail: chris.mcallister@tamut.edu).

LACERTILIA

ANOLIS PORCATUS (Cuban Green Anole). DOMINICAN REPUBLIC: DISTRITO NACIONAL: Boca Chica, grounds of the Hotel Coral Hamaca (18°26.919'N, 69°36.323'W). 4 January 2002. Matthew E. Gifford. Verified by Robert Powell. Bobby Witcher Memorial Collection, Avila College (BWMC 06827). This female specimen represents the first record for Boca Chica and extends the known range ca. 10 km E of the nearest previously known locality at the Aeropuerto de las American (Powell 1992. Cat. Amer. Amphib. Rep. 541:1–5; Powell and Parmerlee 1991. Herpetol. Rev. 22:65). *Anolis porcatus* has apparently displaced the Hispaniolan endemic, *A. chlorocyanus*, throughout Santo Domingo and appears to be doing the same in Boca Chica. We saw only *A. porcatus* south of the main east–west highway through Boca Chica, even though *A. chlorocyanus* was common as recently as the summer of 2001. Only one *A. chlorocyanus* was seen in the city in 2002, but it was north of the highway.

Submitted by **MATTHEW E. GIFFORD** (e-mail: gif3@hotmail.com) and **BRIAN E. FONTENOT**, Department of Biology, University of Texas at Tyler, Tyler, Texas 75799, USA, and **DAVID M. NIEVES**, Reptile Education and Research, 8816 North Charlotte, Kansas City, Missouri 64155, USA.

ASACCUS ELISAE (Werner's Leaf-toed Gecko). TURKEY: SANLIURFA PROVINCE: Harran Village (36°51'N, 38°59'E). 20 April 2000. W. Bischoff, M. Franzen, and J. F. Schmidtler. Verified by W. Böhme. Three specimens (one male ZFMK 75849, one female ZFMK 75850, and one in Schmidtler's private collection) were collected from under wall carpets in the Trulli House Museum. Another individual was observed in a tree on the roof of a house at the ancient citadel. These specimens represent the second record in Turkey, extending the distribution ca. 90 km ESE from the Euphrates Valley at Birecik onto the Mesopotamian Plain (Baran and Gruber 1982. Spixiana 5:109–138; Böhme 1973. Bonn. Zool. Beitr. 24:394–398; Tok et al. 1997. Israel J. Zool. 43:71–77). Only two additional records have been reported from the Euphrates Valley in adjoining eastern Syria (Martens and Kock 1991. Senckenbergiana Biol. 71:15–21). Martens and Kock (*op. cit.*) predicted an anthropogenic range extension of this rock-dwelling species along rivers of the Mesopotamian Plain. Our finding supports this prediction because the present sampling site is located within an ancient settlement near a small river (Gülabdere or Al 'Balikh, a tributary of the Euphrates).

Submitted by **MICHAEL FRANZEN**, Zoologische Staatssammlung, Münchhausenstrasse 21, 81247 München, Germany (e-mail: michael.franzen@oekokart.de), **JOSEF FRIEDRICH SCHMIDTLER**, Oberföhringerstrasse 35, 81925 München, Germany (e-mail: josef.schmidtler@t-online.de), and **WOLFGANG BISCHOFF**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, 53113 Bonn, Germany (e-mail: W.Bischoff.ZFMK@uni-Bonn.de).

CNEMIDOPHORUS NATIVO (NCN). BRAZIL: BAHIA: Camamu Municipality: Ilha Grande (13°55'17"S; 39°00'32"W). 27 October 1999. J. A. P. Schineider and G. I. de Almeida. Museu Nacional, Rio de Janeiro (MNRJ 9487–9). Verified by M. Soares. Northernmost record for the species. Extends distribution ca. 415 km N of previous northernmost locality, in Cumuruxatiba District (17°05'S; 39°10'W), Prado municipality, also in the state of Bahia (Rocha et al. 1999. Herpetol. Rev. 30:109), and ca. 600 km N from type locality in Linhares municipality, state of Espírito Santo. With this new record, the species is now known from six localities along the coast of Espírito Santo (Linhares, Conceição da Barra, and Itaúnas municipalities) and Bahia (Nova Viçosa, Prado, and Camamu municipalities). We thank the Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq, processes 300819–4 and 461970/00–7) for funding.

Submitted by **DAVOR VRCIBRADIC**, **CARLOS FREDERICO D. ROCHA,** Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550–011, Rio de Janeiro, RJ, Brazil, and **ROGÉRIO L. TEIXEIRA**, Museu de Biologia Prof. Mello Leitão, Av. José Ruschi 4, 29650–000, Santa Teresa, ES, Brazil.

CNEMIDOPHORUS NEOMEXICANUS (= ***ASPIDOSCELIS NEOMEXICANA***) [Reeder et al. 2002. Am. Mus. Novit. 3365:1–61]. (New Mexico Whiptail). USA: NEW MEXICO: De Baca Co: Fort Sumner, northwest section of De Baca County Landfill (east to the end of Landing Road from 17th Street, N of U.S. Hwy 60-84 (34°28.827'N, 104°13.385'W), 1263 m elev. 9 June 2002. Harry L. Taylor. University of New Mexico Museum of Southwestern Biology (MSB 65617). Verified by Charles W. Painter. First record for De Baca County and the Pecos River Drainage (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque, 431 pp.). The only other population of *C. neomexicanus* reported from eastern New Mexico is located in the vicinity of Conchas Lake, San Miguel County (Leuck et al. 1981. Southwest. Nat. 26:72–74). There are two competing hypotheses to explain the striking geographic disjunction of the Conchas Lake population. The

hypothesis presented with its discovery posited that it probably originated from human introduction. This interpretation was supported by (1) the distance and sub-optimal habitats between the Conchas Lake population and the nearest neighboring populations (in the northern Rio Grande Drainage), and (2) its morphological resemblance to even more distant populations in the southern Rio Grande Drainage. A recent report of *C. neomexicanus* in Arizona (Persons and Wright 1999. Herpetol. Rev. 30:207–209) demonstrates the capacity of this species to establish a population after an apparent introduction far removed from its principal range. However, the population of *C. neomexicanus* at Fort Sumner provides greater support to the alternate hypothesis (Walker et al. 1992. Southwest. Nat. 37:82–86) that the Conchas Lake population was established after natural dispersal. The linear distance between the populations at Conchas Lake and Fort Sumner is only 100 km, and suitable habitat in the intervening area enhances the chance that other populations may occur there.

Submitted by **HARRY L. TAYLOR**, Department of Biology, Regis University, Denver, Colorado 80221, USA; e-mail: htaylor@regis.edu.

EUMECES ANTHRACINUS (Coal Skink). USA: GEORGIA: Pickens Co: Big Canoe Development, McDaniel Meadows, a conservation easement held by North American Land Trust (34.46241081N, -84.26860222W). 3 March 2002. Christopher R. Wilson. Georgia Museum of Natural History (GMNH 46877). Verified by Elizabeth McGhee. First county record (John Jensen, pers. comm.). One male individual, in breeding condition, found crawling on leaf litter in sphagnum wetland. Photographed and released. Funding for biological surveys provided by Big Canoe Company, LLC.

Submitted by **CHRISTOPHER R. WILSON**, 425 Roxanna Street, Boone, North Carolina 28607, USA; e-mail: critterfro@boone.net.

EUMECES SEPTENTRIONALIS OBTUSIROSTRIS (Southern Prairie Skink). USA: OKLAHOMA: Choctaw Co: off U.S. 70, near jct. Oklahoma 209, vic. Fort Towson. 18 April 2002. Joshua E. Kessler. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26661). Verified by Stanley E. Trauth. New county record and extends range eastward from adjacent Bryan County into a hiatus in the southeastern part of the state (Secor and Carpenter 1984. Oklahoma Herpetol. Soc. Spec. Publ. 1:1–57; Webb 1970. Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, Oklahoma, 370 pp.; Oklahoma Biological Survey's Distribution of Oklahoma Amphibians and Reptiles by Recorded Sightings, DOKARRS [http://www.biosurvey.ou.edu/dokadesc.html]). The species is also found across the Red River in extreme northern Texas in nearby Red River County (Dixon 2000. Amphibians and Reptiles of Texas. Texas A&M University Press, College Station, 421 pp.). Specimen found among railroad crossties with *Ambystoma texanum*, *Elaphe obsoleta lindheimerii*, and *Tantilla gracilis*.

Submitted by **CHRIS T. McALLISTER** and **JOSHUA E. KESSLER**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA (e-mail [CTM]: chris.mcallister@tamut.edu).

HEMIDACTYLUS MABOUIA (Amerafrican House Gecko). USA: FLORIDA: Charlotte Co: 25001 Burnt Store Road (26°47'11"N, 82°02'15"W). 4 October 2001. Florida Museum of Natural History (UF 131752); Lee Co: 2 localities: N. Ft. Myers, 14487 North Cleveland, South Trust Bank (26°40'27"N, 81°53'51"W). 29 May 2001. UF 131745–9; and Bonita Springs, 24181 Hwy 41, Truly Nolen Pest Prevention. 30 May 2001. UF 131755. Collected by Gregg S. Klowden. All verified by Kenneth L. Krysko. New county record for Charlotte County. First mainland, but not county, record for Lee County. This species was previously reported on the Gulf Coast in Monroe County (Butterfield et al. 1993. Herpetol. Rev. 24:111–112), Collier County (Bartlett and Bartlett. 1999. A Field Guide to Florida Reptiles and Amphibians. Gulf Publishing Co., Houston, Texas), and on Gasparilla Island in Lee County (Townsend et al. 2002. Herpetol. Rev. 33:75). The northern and southern Lee County records reported here, as well as additional observations, indicate that this species is well established throughout Lee County. Charlotte record represents the northernmost record on the Gulf Coast of Florida. Specimens of various size classes have also been observed slightly farther north within the center of Charlotte County indicating that this species is well established. *H. mabouia* will likely continue to move north along the Gulf Coast as it has on Florida's Atlantic coast (Butterfield et al. 2000. Herpetol. Rev. 31:53; Criscione et al. 1998. Herpetol. Rev. 29:248).

Submitted by **GREGG S. KLOWDEN**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611-0430, USA; e-mail: snakeman@ufl.edu.

HEMIDACTYLUS MABOUIA (Amerafrican House Gecko). USA: FLORIDA: Collier Co: Port of the Islands. 3 mi. S of Collier Seminole State Park on Tamiami Trail. Found on walls of the Port of the Islands Ramada Hotel. 10 October 2001. W.Boyd Blihovde and Richard D. Owen. Verified by Kenneth Krysko. Florida Museum of Natural History (FMNH) 127710–127730. County record.

Submitted by **W. BOYD BLIHOVDE**, Wekiva Basin GEOpark, 1800 Wekiwa Circle, Apopka, Florida 32712, USA (e-mail: boyd.blihovde@dep.state.fl.us), and **RICHARD D. OWEN**, Guana River State Park, 2690 South Ponte Vedra Boulevard, Ponte Vedra Beach, Florida 32082, USA (e-mail: richard.owen@dep.state.fl.us).

HEMIDACTYLUS PALAICHTHUS (House Gecko). VENEZUELA: GUARICO: carretera Universidad Rómulo Gallegos-El Castrero, sede Bomberos Universitarios, San Juan de los Morros, 500 m elev. Gilson Rivas. 19 January 2002. Museo de Historia Natural La Salle, Caracas (MHNLS 15571, adult female with two enlarged eggs). Verified by C. Molina. First state record and easternmost locality in the Venezuelan Coastal Range (Serranía del Interior). Extends the known distribution in this coastal area ca. 500 km to the southwest from the easternmost Península de Paria (Kluge 1969. Misc. Publ. Mus. Zool. Univ. Michigan 138:1–78; Powell 1990. Cat. Amer. Amph. Rept. 468.1). This taxon was previously known in Venezuela from the Venezuelan Guayana (Kluge, *op. cit.;* Rivas and Molina, in press. Herpetol. Rev.), the Venezuelan lowland region of Los Llanos (Staton and Dixon 1977. J. Herpetol. 11:17–24; Kornacker 2001. Herpetol. Rev. 32:119),

and the Andean piedmont (lowland versants of the Cordillera de Mérida) (Markezich 2002. Herpetol. Rev. in press). The presence of *H. palaichthus* in Anzoátegui (Kornacker, *op. cit.*) and Delta Amacuro (Rivas and Molina, *op. cit.*) supports the contention that these northeastern Venezuelan states, along with Sucre and Monagas, form a natural biogeographical "corridor" to the Amazonian herpetofauna.

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado Postal 1930, Caracas 1010-A, Venezuela; e–mail: anolis30@hotmail.com.

HOLBROOKIA ELEGANS (Pacific Earless Lizard). MÉXICO: CHIHUAHUA: Mpio. Casas Grandes, Km 20, Cañon de la Tinaja Hwy (30°21'59.8"N, 108°13'38.7"W), 1732 m elev. 13 June 2001. Julio A. Lemos-Espinal. Herpetological Collection of Unidad de Biología, Tecnológico y Prototipos (UBIPRO 7207). Between Pacheco and Jovales (30°04'56.7"N, 108°17'7.5"W), 2073 m elev. 14 June 2001. Julio Lemos-Espinal. UBIPRO 7309–10. All verified by Ralph W. Axtell. First record for Chihuahua and a slight range extension from the boot heel region of SW New Mexico (Axtell 1998. Interpretive Atlas of Texas Lizards [18]:1–19, privately printed).

Submitted by **JULIO A. LEMOS-ESPINAL**, under CONABIO projects U003 and X004, Laboratario de Herpetología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, UNAM, Apdo. Post. 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e-mail: lemos@servidor.unam.mx); **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail: hsmith@spot.colorado.edu).

KENTROPYX ALTAMAZONICA (Chocha Whiptail). BRAZIL: SANTARÉM (2°26'S; 54°42'W). Vila Santa Rosa, Fazenda Santa Mônica, highway Santarém-Curuá-Una. October 1998. A. Canto. Linha de Pesquisa em Herpetologia da Amazônia (LPHA), Laboratório de Pesquisas Zoológicas (LPZ), Faculdades Integradas do Tapajós, Santarém, Pará (LPHA 044). Verified by R. Nobuo Yuki. First record for the Tapajós River basin. Extends known distribution 167 km NW from the nearest record (13°8'S, 56°9'W; Avila Pires 1995. Lizards of Brazilian Amazonia [Reptilia: Squamata]. Zoologische Verhandelingen 299, 706 pp.).

Submitted by **AUGUSTO RODRIGUES MAIA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, 335, Caixa Postal 81, CEP: 68.110-200, Santarém, Pará, Brazil; e–mail: auromaia@bol.com.br.

KENTROPYX PELVICEPS (Bronzy Forest Whiptail). BRAZIL: SANTARÉM (2°26'S, 54°42'W). River Curuá-Una, Fazenda Palmares, highway Santarém-Curuá-Una. 15 July 1999. Linha de Pesquisa em Herpetologia da Amazônia, Laboratório de Pesquisas Zoológicas, Faculdades Integradas do Tapajós, Santarém, Pará State, (LPHA 815–16). BELTERRA (2°38'S, 54°57'W). Fazenda da ULBRA, highway PA 457. 4–5 September 1999. J. G. da Frota (LPHA 734 and 761–765). ITAITUBA (4°17'S; 55°59'W), Comunidade Santo Antônio, Fazenda Luiz Paulino. 27–28 July 1999. J. G. da Frota. (LPHA 823, 825–26, 830–31). All verified by R. Nobuo Yuki. First state records and first in the Tapajós River basin, extends known distribution between 441 and 636 km from the closest record (3°24'S, 60°41'W; Avila Pires 1995. Lizards of Brazilian Amazonia [Reptilia: Squamata]. Zoologische Verhandelingen, 299, 706 pp.).

Submitted by **AUGUSTO RODRIGUES MAIA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, 335, Caixa Postal 81, CEP: 68.110-200, Santarém, Pará, Brazil; e–mail: auromaia@bol.com.br.

LACERTA BILINEATA (Western Green Lizard). USA: KANSAS: SHAWNEE CO: Topeka. A species of *Lacerta* was introduced to urban SW Topeka in the late 1950s where it established a population confined to a few blocks around Gage Blvd and 21st Street, and was described as *L. viridis* (cf. Behler and King 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. A. A. Knopf, New York, 719 pp.). Based on hybridization experiments (Rykena 1991. Mitt. Zool. Mus. Berlin 67:55–68) and on genetic distance measured over 17 allozyme loci (Amann et al. 1997. Salamandra 33:255–268), *L. viridis* was later split into the green lizard (*L. viridis*) and western green lizard (*L. bilineata*). The only suitable character to distinguish these similar-looking sister species in the field is the coloration of hatchlings, which is brown dorsally and laterally, and yellowish ventrally in *L. viridis*. Young *L. bilineata* look similar but have green throats, and sometimes also green flanks (Rykena, *op. cit.*; Amann et al., *op. cit.*; Deichsel and Miller 2000. Kansas Herpetol. Soc. Newsl. 119:10–11). Deichsel and Miller (*op. cit.*) concluded that the Topeka population is *L. bilineata* based on morphological examination of 10 juveniles. Here, we confirm this conclusion using a molecular approach.

We analyzed blood drawn from the vena caudalis of three adults: two males kept by James Gubanyi (Topeka) from his garden and a female caught in another garden about 200 m away, where it was subsequently released. Total DNA was extracted from blood following standard proteinase K and phenol chloroform protocols (Sambrook et al. 1989. Molecular Cloning: A Laboratory Manual. Cold Springs Harbor Laboratory Press, Cold Springs Harbor, New York). A 1140 bp fragment of mtDNA containing the cytochrome b gene was amplified by PCR (for primer sequences and PCR conditions see Kalyabina et al. 2001. Russian J. Herpetol. 8:149–158) and sequenced using automatic capillary sequencer (ABI 3100). A part of the cyt b gene consisting of 718 bp was used for analysis. Sequences were deposited at GenBank/NCBI (Accession Nos. AY099282, AY099283, AY099284). According to the cytochrome b sequences, the three samples examined appear identical. To verify the species status of these individuals, their sequences were compared to four reference sequences, two of which were retrieved from *L. viridis* (Slovenia and northern Turkey) and two from *L. bilineata* (Boppart, Germany). Genetic distance between *L. bilineata* and the Topeka samples was 0.3% (2 substitutions). In contrast, the differences between the Topeka samples and *L. viridis* were significantly higher (7%, averaging 47 substitutions). Additionally, sequences of the Topeka samples were compared to the database HUSAR (Heidelberg Unix Sequence Analysis Resources) and a 100% match to *L. bilineata* was found, confirming that the samples represent that species.

Submitted by **SVETLANA A. KALYABINA-HAUF***, Department of Herpetology, Zoological Institute RAS, Universitetskaya emb. 1, St. Petersburg, Russia 199034; and

GUNTRAM DEICHSEL, Friedr.-Ebert-Str. 62, Biberach an der Riss, Germany D-88400. *Present address (SAK): Institute of Pharmaceutical Biology, Ruprecht-Karls-Universität, INF 364, Heidelberg, Germany D-69120 (e-mail: kalyabina@hotmail.com); (e-mail [GD]: Guntram.Deichsel@bc.boehringer-ingelheim.com).

LIOLAEMUS CHILIENSIS (NCN). CHILE: REGION IX: Victoria (38°20'S, 72°15'W), 26 December 2001 (MZUC 26645–46) and Curacautín (38°26'S, 71°53'W), 28 December 2001 (MZUC 26647–48). Region X: Lanco (39°27'S, 72°47'W), 28 December 2001 (MZUC 26649). Museo de Zoología, Universidad de Concepción. R. Moreno, M. Vidal, M. Fernández, and R. Cifuentes. Verified by P. Victoriano. This species occurs in areas ranging from Mediterranean to Temperate Southern Chilean forests and the Patagonia (Neuquén, Argentina). Hellmich (1938. Zoologischer Anzeiger 124[9–10]:237–249) established Villarrica Lake as the southernmost limit of this species. Later, Codoceo (1954. Investigaciones Zoológicas Chilenas 2[5]:69–71) stated that the area surrounding Lake Enco (Region X) was the southern range limit. Donoso-Barros (1966. Reptiles de Chile. Ediciones de la Universidad de Chile. 458 pp.) indicated that the range of this species extended to the north of Valdivia in the Lakes Region. This distribution is supported by Cei (1986. Reptiles del Centro, Centro-oeste y Sur de la Argentina. Herpetofauna de las Zonas Áridas y Semi-áridas. Museo Regionale di Scienze Naturali Torino. 527 pp.). However, Veloso and Navarro (1988. Boll. Mus. reg. Sci. nat. Torino 6[2]:481–539) suggest a more limited distribution in Chile; from Coquimbo (30°10'S; 71°15'W) to the Bío-Bío Region (37°45'S; 72°00'W). These new specimens support Donoso-Barros (1966, *op. cit.*) and Cei (1986, *op. cit*) and confirm the presence of the species in Region X, Región de los Lagos.

Submitted by **RODRIGO MORENO, MARCELA VIDAL,** and **JUAN CARLOS ORTIZ**, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile.

PHRYNOSOMA MODESTUM (Round–tailed Horned Lizard). USA: COLORADO: LAS ANIMAS CO: Wilson Ranch (UTM: 12S 668829E 4160436N). Along a small dirt road in a juniper-break woodland above a tributary of the Purgatoire River, ca. 1450 m elev. 11 June 2001. Renée Rondeau and Lee Grunau. Digital photograph deposited at University of Colorado. (RR01-06-11). Verified by Geoff Hammerson, Steve Mackessy, and Tom Mathies. This locality is the second occurrence in Colorado (Hammerson. 1999. Amphibians and Reptiles in Colorado, 2nd ed., Univ. Press of Colorado, Niwot, Colorado, 484 pp.). The other known location is ca. 105 km NW, near Fowler, Colorado in Otero County. The Otero County locality is along a roadside adjacent to a shortgrass prairie.

Submitted by **RENÉE RONDEAU,** Colorado Natural Heritage Program, Colorado State University, 254 General Services Building, Fort Collins, Colorado 80523, USA; e–mail: rjr@lamar.colostate.edu.

PODARCIS MURALIS (Common Wall Lizard). USA: KENTUCKY: KENTON CO: Park Hills. Summer 1998. Jack Wells. Cincinnati Museum of Natural History photo voucher (CMNH HP34). Verified by Jeffery G. Davis. New county record. Individuals introduced by local gardeners from nearby Cincinnati, Ohio population. Reproducing population verified by J. W. Ferner in April 2002.

Submitted by **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **JODI P. FERNER**, Honors Program, Northern Kentucky University, Highland Heights, Kentucky 41099, USA.

SERPENTES

ARIZONA ELEGANS ELEGANS (Kansas Glossy Snake). USA: COLORADO: PHILLIPS CO: Highway 385, 4.9 mi S jct County Road 12 (UTM: 130728867, 4481916). 31 May 2002. DOR. UNC-MNH 1587. Verified by David Chiszar and Hobart M. Smith. First county record (Hammerson 1999. Amphibians and Reptiles of Colorado. Second Ed. Univ. Colorado Press, Niwot. xxvii + 484 pp.).

Submitted by **LEIGHTON THOMPSON, RON MALECKI, AMBER LAWSON, LORI CRAFT**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, 501 20th Street, CB 92, Greeley, Colorado 80639-0017, USA (e–mail [SPM]: spmacke@unco.edu).

CHIRONIUS MULTIVENTRIS MULTIVENTRIS (Cobra Cipo, Sacaiboia). BOLIVIA: DEPARTAMENTO BENI: Guayaramerín: 65°22'60"W, 10°48'0"S, 119 m elev. March 1951. R. Zischka. Verified by W. Böhme. Zoologische Staatssammlung München, Germany ZSM 1215/2001. *Chironius multiventris* is a large lowland snake distributed in primary forests in northwestern Brazil, southern Venezuela, southeastern Colombia, eastern Ecuador and eastern Peru (Dixon et al. 1993. Revision of the Neotropical Snake Genus *Chironius* Fitzinger [Serpentes, Colubridae]. Monografie XIII, Museo Regionale di Scienze Naturali, Torino, 279 pp.). The specimen examined is a large male (1716 mm total length) collected in tropical rainforest area near Guayaramerín. This is the first record of this species for Bolivia.

Submitted by **DIRK EMBERT**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 150-164, 53113 Bonn, Germany; e-mail: dirkembert@hotmail.com.

CHIRONIUS QUADRICARINATUS MACULOVENTRIS (Cobra Cipo, Sacaiboia). BOLIVIA: DEPARTAMENTO TARIJA: Villa Montes: 63°30'W, 21°15'S. 440 m elev. February 1986. H. Meier. Verified by Wolfgang Böhme. Museum Alexander Koenig, Bonn, Germany (ZFMK 46356). *Chironius quadricarinatus maculoventris* is a large lowland snake known from the Chaco forests in northeastern Argentina and western Paraguay (Dixon et al. 1993. Revision of the Neotropical Snake Genus *Chironius* Fitzinger [Serpentes, Colubridae]. Monografie XIII, Museo Regionale di Scienze Naturali, Torino, 279 pp.). This specimen, from Chacoan forests of southern Bolivia, represents the first record from that country. The voucher specimen is a male with a total length of 1195 mm (tail length 392 mm) and is the largest specimen of this subspecies known.

Submitted by **DIRK EMBERT**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee

150-164, 53113 Bonn, Germany; e-mail: dirkembert@hotmail.com.

CORONELLA AUSTRIACA (Smooth Snake). SWEDEN: STOCKHOLM ARCHIPELAGO: Grinda (UTM: 362000E, 6588000N). 27 May 1999. Åsa Claesson and Christopher O'Brien. Verified by Richard Franz. Voucher material (color slide) deposited at Florida Museum of Natural History (UF 132738). The specimen was captured while outstretched on leaf litter at a rocky edge of a forest stand. This is the first record for the small island of Grinda. Of the three species of snakes in Sweden, *C. austriaca* has a spotty distribution (Ahlén et al. 1995. Sveriges Grodor, Ödlor och Ormar. Naturskyddföreningen, Stockholm). The specimen was photographed and released on site.

Submitted by **CHRISTOPHER O'BRIEN**, 2829 SW 39th Avenue, Gainesville, Florida 32608, USA; e-mail: mailcob@ufl.edu.

CROTALUS HORRIDUS (Timber Rattlesnake). USA: TEXAS: Bastrop Co: Griffith League Ranch, a 5000-acre site owned by the Capitol Area Council of the Boy Scouts of America (30°12'52"N, 97°13'58"W). 18 May 2002. Lee Ahlbrandt, Kensley Jones, Michael Forstner. University of Texas Arlington (UTA Slide No. 26921). Verified by Kathryn Vaughn. Specimen collected from a trap in a herpetofaunal array; first record from the county (Dixon 2000. Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.) This record bridges a gap in the distribution of the species between Lee County to the northeast and Caldwell County to the southwest.

Submitted by **LEE AHLBRANDT** (e–mail: ta49816@swt.edu), **KENSLEY JONES,** and **MICHAEL FORSTNER**, Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA.

ELAPHE GUTTATA GUTTATA (Cornsnake). USA: FLORIDA: Gadsden Co: Concord, Co. Rd 157, DOR 0.6 km S of intersection with Co. Rd 12 (30°38.089'N, 84°21.796'W). 7 May 2002. Matthew J. Aresco. Verified by K. L. Krysko. UF 132471. New county record.

Submitted by **MATTHEW J. ARESCO**, Department of Biological Science, Florida State University, Tallahassee, Florida 32306-1100, USA; e-mail: aresco@bio.fsu.edu.

GLOYDIUS BLOMHOFII BREVICAUDUS (Mamushi). CHINA: GUANGDONG PROVINCE: Nan Ao Island: Xia Shi Shan. Two male snakes were presented to James Lazell by Yei De Fu on 29 June 2000. Both specimens were initially deposited with Professor Li Zhenchang at South China Normal University, Guangzhou, Guangdong, Peoples Republic of China. One of them, YPM field number AA 4650 remains there but the second, cataloged as YPM 9828 (field number AA 4649), was exchanged to Yale Peabody Museum of Natural History. Identification verified by M. Shpak. This is a first record for Guangdong Province (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex: A Monographic Review. SSAR. 614 pp.) as well as a new record for the island of Nan Ao (Lazell et al. 1999. Postilla 217:1–18). This extends the known range by ca. 400 km from northwest Fukien Province (Ding and Zheng 1974. Publ. Dept. Biol. Fujian Normal Univ. [6]:1–93, 37 pls.), and is the southernmost record (Wu et al. 1985. Reptilian Fauna of Guizhou. People's Press, Guiyang, China. I–iv+436 pp.), though Gloyd and Conant (*op. cit.*) referred these populations to *Gloydius blomhofii siniticus* which is now regarded as a junior synonym of *Gloydius blomhofii brevicaudus* (e.g., David and Ineich 1999. Dumerilia. 3:1–500). This disjunct distribution pattern corresponds to that of the lizard *Gekko subpalmatus* (Lazell et al., *op. cit.*).

Submitted by **GREGORY J. WATKINS-COLWELL** (e-mail: gregory.watkins-colwell@yale.edu) and **TWAN A. A. M. LEENDERS** (e-mail: twanleenders@scinax.com), Division of Vertebrate Zoology, Yale Peabody Museum of Natural History, 170 Whitney Avenue, P.O. Box 208118, New Haven, Connecticut 06520, USA.

HYDRODYNASTES BICINCTUS SCHULTZI (Water Snake). BRAZIL: GOIÁS: Municipality of Minaçu, right bank (east) of Tocantins River (13°26'03"S, 48°08'38"W) at Cana Brava region. 18 February 2002. I. Júnior Tonial. Centro de Estudos e Pesquisas Biológicas, Goiânia – GO (CEPB/CB 12.249), collected in Cerrado vegetation. Verified by H. L. R. Silva. This species is previously known from southeastern Brazil, in the State of São Paulo, and in Central Brazil in Brasilia D.F. (Cunha and Nascimento 1978. Mus. Par. Emílio Goeldi Publ. Avulsas n° 51, Belém. 218 pp.; Hoge et al. 1974. Mem. Int. But. 38:167–178.; Jorge da Silva and Sites 1994. Cons. Biol. 9[4]:873–901.; Peters et al. 1970. The Catalogue of Neotropical Squamata, Part I (revised ed. 1986), Smithsonian Institution, 293 pp.). This is the northernmost record for *H. bicinctus schultzi*, extending its geographic distribution ca. 240 km east (Jorge da Silva and Sites, *op. cit.*).

Submitted by **NELSON JORGE DA SILVA JR.** and **IVAN FRANÇA E SOUZA**, Laboratório de Herpetologia, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Ave. Universitária, 1440, Setor Universitário, 74210-010, Goiânia, Goiás, Brazil (e-mail: njsj@ucg.br).

LEPTOPHIS AHAETULLA (Parrot Snake). BRAZIL: GOIÁS: Municipality of Minaçu, right bank (E) of Tocantins River (13°26'31"S, 48°08'45"W) at Cana Brava region. 12 February 2002. C. Amaral Souza. Centro de Estudos e Pesquisas Biológicas, Goiânia – GO (CEPB/CB 7511, SVL = 781 mm). Verified by H. L. R. Silva. Although most reports place *L. ahaetulla* in rainforest formations, in Brazil this species has been reported from outside the Amazon rainforest in Mato Grosso (Amaral 1994, Brazilian Snakes: A Color Iconography. 2nd ed. [1978], Univ. de São Paulo Ed., 246 pp.); Mato Grosso do Sul, São Paulo (Cei 1993. Mus. Reg. Sci. Nat. Torino [Monog. XIV], 949 pp.); Tocantins next to Lageado Falls (unpubl. data); and Bahía, in the Caatinga vegetational domain (Amaral, *op. cit.*; Jorge da Silva 1999. Abstr. 42nd Annual Meeting of SSAR, pp. 88–89). Here we provide a new state record for *L. ahaetulla* from a gallery forest within the Cerrado vegetational formation.

This record suggests that this species has a wider distribution in central Brazil than was previously believed (Cei, *op. cit.*; Jorge da Silva and Sites 1994. Cons. Biol. 9[4]:873–901).

Submitted by **IVAN FRANÇA E SOUZA** and **NELSON JORGE DA SILVA JR.**, Laboratório de Herpetologia, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás,

Ave. Universitária, 1440, Setor Universitário, 74210-010, Goiânia, Goiás, Brazil (e-mail: souzai@terra.com.br).

LEPTOTYPHLOPS KOPPESI (Blind Snake). BRAZIL: GOIÁS: Municipality of Minaçu, left bank (W) of Tocantins River (13°26'35"S, 48°08'42"W) at Cana Brava region. 14 February 2002. I. França e Souza. Centro de Estudos e Pesquisas Biológicas, Goiânia - GO (CEPB/CB 8873). Verified by H. L. R. Silva. This is the northernmost record for this species from the Cerrado vegetational domain and a range extension of about 670 km NE and 330 km NW of previously recorded limits (McDiarmid et al. 1999. Snake Species of the World: A Taxonomic and Geographic Reference. Vol. 1. The Herpetologists' League, Washington D.C., 511 pp.; Valdujo and Nogueira 2001. Herptol. Rev. 32:128–130; Nogueira 2001. Herptol. Rev. 32:285–287).

Submitted by **IVAN FRANÇA E SOUZA** and **NELSON JORGE DA SILVA JR.**, Laboratório de Herpetologia, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Ave. Universitária, 1440, Setor Universitário, 74210-010, Goiânia, Goiás, Brazil (e-mail: souzai@terra.com.br).

LIOPHIS FRENATUS (False Coral Water Snake). ARGENTINA: CORRIENTES: Santo Tomé Department, ca. 7.3 km N Gobernador Ingeniero Valentín Virasoro town, by National Road N° 14, (27°59'S, 56°01'W). 28 January 2002. V. Arzamendia and A. R. Giraudo. National Institute of Limnology, Santa Fe province (INALI 1048, adult female, 532 mm SVL, 100 mm TL, 37 g body mass). Verified by G. Scrocchi. First province record and third record from Argentina. Establishes the southernmost locality for the species (Dixon 1983. J. Herpetol. 17:149–165). Extends range ca.75 km S of the nearest populations in Posadas, Misiones, Argentina (Giraudo 1999. Herpetol. Rev. 30:179) and 83 km S of the Paraguayan Paraná Islands, flooded by the closing of Yacyretá Dam, Itapúa, Paraguay (Alvarez et al. 1995. Facena 11:69; Aquino et al. 1996. *In* Martinez [ed.], Colecciones de Flora y Fauna del Mus. Nac. Hist. Nat. Paraguay, Asunción, pp. 332–400).

Submitted by **VANESA ARZAMENDIA** and **ALEJANDRO R. GIRAUDO**, Instituto Nacional de Limnologia, Consejo de Investigaciones Científicas y Técnicas, José Macia 1933, 3016 Santo Tomé, Santa Fe, Argentina (e-mail [ARG]: alegiraudo@arnet.com.ar).

LIOPHIS MILIARIS MILIARIS (NCN). BRAZIL: PARÁ: Municipio de Oriximiná (55°52'W 01°45'S): Porto Trombetas. J. F. de Carvalho. 1999. Linha de Pesquisa em Herpetologia da Amazônia (LPHA), Laboratório de Pesquisas Zoológicas (LPZ), Faculdades Integradas do Tapajós, Santarém, Pará State (LPHA 1637). Verified by A. G. Guedes. Species known from northern South America in Guiana, Surinam, and French Guiana (Cayenne) (Dixon 1983. Copeia 1983:791–802). The species also occurs in Amapá State, Brazil (Cunha and Nascimento 1993. Bol. Mus. Para. Emílio Goeldi, Sér. Zool. 9[1]:1–191). First state record, enlarges the known distribution ca. 480 km from the nearest record (Serra do Navio) in Amapá State.

Submitted by **ALFREDO PEDROSO DOS SANTOS-JR** and **RUBENS NOBUO YUKI**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200 (e-mail: alphredojr@mailbr.com.br).

MICRURUS PSYCHES (Northern Coral Snake) VENEZUELA: BOLIVAR: Cerro Guaiquinima, west Aberaima River Canyon, 05°46'59"N, 63°47'07"W, 1300 m elev. 28 March 2000. J. Pérez-Emán, C. J. Sharpe, G. Picón, and I. Carreño. Verified by Gilson Rivas. Museo de Historia Natural La Salle (MHNLS 14815). This report constitutes the first specimen of this species collected at this elevation and in the Pantepui Province (Huber 1987. Pantepui [2]:2–10). The species previously has been reported only from forests in southeastern Venezuela, at elevations from 50 m to ca. 500 m (Roze 1996. Coral Snakes of the Americas: Biology, Identification, and Venoms, Krieger Publ., Malabar, Florida. 328 pp.). This specimen was collected in a *Stegolepis* meadow ca. 100 m from a small stream.

Submitted by **CÉSAR MOLINA**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010–A, Venezuela (e-mail: washaema@hotmail.com); **JORGE PÉREZ-EMÁN**, Instituto de Zoología Tropical, Universidad Central de Venezuela, Apartado Postal 47058, Caracas 1041-A, Venezuela (e–mail: jlperez@strix.ciens.ucv.ve); and **CHRISTOPHER J. SHARPE**, Apartado Postal 62826, Caracas 1060, Venezuela (e–mail: net.ve" rodsha@telcel.net.ve).

NERODIA FASCIATA (Southern Watersnake). CORRECTION OF SPECIES IDENTIFICATION: ***NERODIA SIPEDON PLEURALIS*** (Midland Watersnake). USA: FLORIDA: Liberty Co.: Sweetwater Creek (30°30'N; 84°54'W). 7 April 2001. Collected by F. Wayne King. UF 123361. Re-verified by P. E. Moler. This note serves to correct the identification of a specimen previously reported as *N. sipedon pleuralis* (Townsend and King 2001. Herpetol. Rev. 32:196) that has subsequently been identified as *N. fasciata*. This specimen does not represent a new distributional record as *N. fasciata* has previously been documented in Liberty County (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Second Ed. Windward Publ., Miami, Florida. 176 pp.).

Submitted by **JOSIAH H. TOWNSEND**, Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611, USA.

OPHEODRYS AESTIVUS (Rough Greensnake). USA: TEXAS: Marion Co: 11.3 km NW Jefferson off FM 728 on Kellyville Road 1 at Berea Community. 13 June 2002. Dawn and Miroslav Moore. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 27111). Verified by Stanley E. Trauth. First record for county and partially fills a hiatus in NE Texas (Dixon 2000. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.; Werler and Dixon 2000. Texas Snakes: Identification, Distribution, and Natural History. Univ. of Texas Press, Austin. 437 pp.). Also reported previously from nearby Caddo Lake watershed (Hardy 1995. LSU in Shreveport, Bull. Mus. Life Sci. 10:1–31) and adjacent Caddo Parish, Louisiana (Dundee and Rossman 1989. The Amphibians and Reptiles of Louisiana. LSU Press, Baton Rouge. 300 pp.).

Submitted by **CHRIS T. McALLISTER** and **DAWN I. MOORE,** Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA (e–mail: chris.mcallister@tamut.edu).

PHILODRYAS AESTIVUS (Common Green Racer): BRAZIL: BAHIA: Municipality of Rio de Contas, Brejo farm (13°26'S, 41°50'W). 1500 m elev. 1 April 2000–25 May 2001. Collector unknown. Museu de Zoologia da Universidade Estadual de Santa Cruz (MZUESC 1181); 26 May–21 November 2001. Collector unknown. MZUESC 2103–04. All specimens were found in "campo rupestre" areas. Specimens were captured by different collectors and the precise dates of capture are unknown. Thus, dates indicate periods between visits to the farms. All verified by Miguel Trefaut Rodrigues. Species is known from southwestern and southern Brazil, Amazonian Bolivia, Paraguay, Uruguay, and northern Argentina (Peters and Orejas-Miranda 1970. Bull. U.S. Nat. Mus. 297:241). In Brazil, the northern range limit is the state of Minas Gerais (Barrio et al. 1977. J. Herpetol. 11:230–231). There is a record of *P. aestivus* from Bahia (Johnson 1952. Copeia 1952:283–284), but according to Barrio et al. (*op. cit.*) that specimen was a misidentified *P. olfersii*. These first records from northeastern Brazil extend the species' range 170 km north.

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO,** Universidade Estadual de Santa Cruz - UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil (e-mail: lachesis@uesc.br), and **MARCO ANTÔNIO DE FREITAS,** Rua E quadra D lote 11, Jardim Aeroporto, CEP 42700-000, Lauro de Freitas, Bahia, Brazil (e-mail: philodryas@hotmail.com).

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New County Records of Amphibians and Reptiles from Texas

ROBERT W. BRYSON, JR.
and
JAMES M. MUELLER
Department of Biology, Sul Ross State University
Alpine, Texas 79830, USA
e-mail: jmueller@sulross.edu

A recent search of the collection databases in the James F. Scudday Vertebrate Collection at Sul Ross State University revealed eleven new county records of amphibians and reptiles for the state of Texas (Dixon 2000). All specimens were verified by James F. Scudday. Nomenclature follows Dixon (*op. cit.*).

The James F. Scudday Vertebrate Collection at Sul Ross State University contains more than 7500 amphibian and reptile specimens with the Trans-Pecos region of Texas being especially well represented. Most specimens were collected after 1960 by James F. Scudday and his students. A list of holdings is available by contacting JMM.

Caudata

Ambystoma tigrinum mavortium (Barred Tiger Salamander). PECOS CO: 17 mi W Sanderson on Mansfield Ranch. 10 May 1964. Charles Stavley. SRSU A–256. Fills a gap in the documented range of the species in the Trans-Pecos of Texas.

Siren texana (Rio Grande Lesser Siren). WILLACY CO: Farm ponds. 30 March 1970. D. Miller and P. Mooney. SRSU A–406, 407, 408. Fills a gap in the documented range of the species along the Texas coast. This species is listed as threatened by Texas Parks and Wildlife Department. Dixon (2000:51–52) described the uncertainty regarding the taxonomy of sirens in this region.

Anura

Bufo cognatus (Great Plains Toad). Loving Co: Kyle Ranch, 16 mi N of Orla; 3 mi E off Co. Rd. 652. 8 June 1995. J. Hamilton. SRSU A–1498. Extends the range of the species to the edge of the Sand Hills of the Trans-Pecos.

Syrrhophus (=Eleutherodactylus) guttilatus (Spotted Chirping Frog). JEFF DAVIS CO: 8.4 mi N of Hwy 90 on Hwy 118. 25 July 1990. John Hollister. SRSU A–1331, 1332, 1333. Extends the range of the species to include the Davis Mountains and confirms an observation of calling reported by King (Dixon 2000:64).

Testudines

Sternotherus odoratus (Stinkpot). REAL CO: East Prong of the Nueces River, Eagle Nest Ranch. 7 November 2001. James Mueller. SRSU R–6571. Fills a gap along the western edge of the documented range in Texas.

Trachemys scripta elegans (Red-eared Slider). PECOS CO: Co. Rd. 2593 between Pecos River and Imperial Reservoir; 7 mi S Grand Falls. 17 October 1989. Steve Gibson. SRSU R–5995. Same locality. 22 October 1989. Steve Gibson. SRSU R-5996.

Lacertilia

Anolis carolinensis (Green Anole). LIVE OAK CO: NE side of Lake Corpus Christi. 7 February 1987. Donna Quillian. SRSU R–5876, 5903, 5904. Fills a gap along the western edge of the species' range in south Texas. The documented range of this species in Texas is rapidly expanding, possibly due to accidental introductions (Dixon 2000:107).

Eumeces obsoletus (Great Plains Skink). LOVING CO: E side of Red Bluff Lake. 26 June 1986. Ellie Springfield. SRSU R–5689.

Sceloporus undulatus consobrinus (Southern Prairie Lizard). BORDON CO: Lake J. B. Thomas. 20 February 1966. Culligan. SRSU R–731.

Serpentes

Coluber constrictor flaviventris (Eastern Yellow-bellied Racer). WHEELER CO: E Wheeler, Britt Ranch. 8 February 1992. J. P. Karges. SRSU R–6347.

Diadophis punctatus regalis (Regal Ring-necked Snake). REEVES CO: 4.5 mi NE of Balmorhea. 13 October 1990. Scott McDonald. SRSU R–6047.

Acknowledgments.—We thank J. R. Dixon for verifying that these records are new. We also thank James F. Scudday for reviewing these records, and for his decades of work that are recorded for future generations in the James F. Scudday Vertebrate Collection.

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New Herpetological Records for High and Hog Islands of the Beaver Archipelago, Charlevoix County, Michigan

JOHN S. PLACYK JR.
Department of Ecology and Evolutionary Biology
University of Tennessee, 569 Dabney Hall, Knoxville, Tennessee 37996, USA
e-mail: jplacyk@utk.edu

MICHAEL J. SEIDER
Warnell School of Forest Resources
Athens, Georgia 30602, USA

and

JAMES C. GILLINGHAM
Department of Biology, Central Michigan University
Mt. Pleasant, Michigan 48859, USA

The Beaver Archipelago is situated in northeastern Lake Michigan in Charlevoix County, Michigan, USA. The archipelago consists of four main islands: Beaver, Garden, High, and Hog, which range in size from ca. 6.2 km^2 to 93.4 km^2. In addition there are eight smaller islands: Grape, Gull, Hat, Pismire, Shoe, Squaw, Trout, and Whiskey, each $\leq$ 0.64 km^2. Faunal surveys of the archipelago have been limited, with the last summary of such surveys being compiled in Hatt et al. (1948). Most of the early surveys described in Hatt et al. (1948) focused almost exclusively on the avian and mammalian faunas of the archipelago with little information on the amphibians and reptiles. In addition Garden, High, and Hog islands had not been surveyed at the time Hatt et al. (1948) published their book. Since 1948, an extensive survey of the land vertebrates of Garden Island has been conducted (Phillips et al. 1965); however, the land vertebrates of High and Hog islands remained unsurveyed.

While conducting field research on Common Garter Snake (*Thamnophis sirtalis*) populations between May and August 2001, six new herpetofaunal records were obtained from High Island and two from Hog Island. Specimen identifications were verified by Kenneth Bowen or Kerry Hansknecht. Voucher specimens were deposited at the University of Tennessee, Knoxville Reptile Ethology Lab collection (UTKREL).

Caudata

Ambystoma laterale (Blue-spotted Salamander). CHARLEVOIX CO: High Island. Margin of Lake Maria under a log. 17 July 2001. J. S. Placyk, Jr. and M. Seider. UTKREL 01–HI–7001.

Notophthalmus viridescens (Eastern Newt). CHARLEVOIX CO: High Island. Margin of Lake Maria under a log. 9 July 2001. J. S. Placyk, Jr. and M. Seider. UTKREL 01–HI–2001.

Plethodon cinereus (Eastern Red-backed Salamander). CHARLEVOIX CO: High Island. Margin of Lake Maria under a log. 9 July 2001. J.S. Placyk, Jr. UTKREL 01–HI–8001.

Anura

Bufo americanus (American Toad). CHARLEVOIX CO: Hog Island. Along west coast of island. 9 July 2001. J. S. Placyk, Jr. UTKREL 01–HO–0001.

Rana clamitans (Green Frog). CHARLEVOIX CO: High Island. In Lake Maria. 23 June 2001. J. S. Placyk, Jr. and J. C. Gillingham. UTKREL 01–HI–3001.

Serpentes

Nerodia sipedon (Northern Watersnake). CHARLEVOIX CO: High Island. Margin of Lake Maria under a log. 17 July 2001. J. S. Placyk, Jr. and M. Seider. UTKREL 01-HO-5002. Hog Island: West coast of island on beach. 09 July 2001. J. S. Placyk, Jr. and M. Seider. UTKREL 01–HO–5001.

Storeria occipitomaculata (Red-bellied Snake). CHARLEVOIX CO: High Island. Margin of Lake Maria within a log. 9 July 2001. J. S. Placyk, Jr. and M. Seider. UTKREL 01–HI–1001.

Acknowledgments.—All specimens were collected under the provisions of Cultural and Scientific Collectors Permit no. CO 1000 issued to JSP by the Fisheries Division of the Michigan Department of Natural Resources. We thank J. Picotte for his field assistance and R. Mehta for comments on the manuscript.

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New Records for Amphibians in the Big South Fork Region of Tennessee

TODD S. CAMPBELL
Institute for Biological Invasions
Department of Ecology and Evolutionary Biology
569 Dabney Hall, University of Tennessee
Knoxville, Tennessee 37996, USA
e-mail: lizardman@utk.edu

Established in 1974 to thwart construction of a reservoir, the Big South Fork National River and Recreation Area (BISO) encompasses ca. 125,000 acres of the Cumberland Plateau and Big South Fork River gorge in southeastern Kentucky and northeastern Tennessee. Past clear-cutting and coal mining operations dramatically altered the Plateau and its waterways, but the area has recovered such that BISO preserves significant regional biota, habitats, and geological features.

Formal herpetofaunal research in the region consists of a single unpublished study in McCreary County, Kentucky (Stephens 1985). In fact, many common Tennessee amphibians exhibit unexplainable holes in their distributions in the counties encompassing BISO (Redmond and Scott 1996). In Summer 2000 and Spring 2001, I set out to determine if these were sampling or publishing artifacts, disturbance-related gaps that filled as forests regenerated, or legitimate distributional discontinuities caused by natural conditions or landscape alterations (Campbell 2002).

I searched for amphibians and reptiles while traveling all the roads and sanctioned trails in BISO (Campbell and Campbell 2002). Here I document 18 county records for 11 species of amphibians in the counties encompassing BISO, based on Redmond and Scott (1996) and subsequent published literature. All specimens were collected and/or photographed by the author and identified using Conant and Collins (1998), Powell et al. (1998), Petranka (1998), and/or Altig (1970). Identifications were verified by A. Floyd Scott and deposited in the Austin Peay State University Museum of Zoology (APSU) in Clarksville, Tennessee.

Caudata

Ambystoma maculatum (Spotted Salamander). FENTRESS CO: Adult crossing TN154 ca. 0.64 km N of its intersection with Divide Road. 12 April 2001. APSU 06167. Fentress County record. MORGAN CO: Two adults found dead-on-road (DOR) on TN52 ca. 0.32 km W of Rugby, Tennesse. 12 April 2001. APSU 06159. Morgan County record. PICKETT CO: One larva in a road puddle in Middle Creek Road 0.48 km E of its intersection with Divide Road in BISO. 2 June 2000. APSU 06140. Adult crossing TN154 ca. 500 m SW of Pickett–Scott County line. 12 April 2001. APSU 06166. Pickett County records. SCOTT CO: Five larvae in a roadside ditch along Duncan Hollow Road ca. 1.6 km N of Bandy Creek Campground in BISO. 29 May 2000. APSU 06136. One small larva in a puddle in Terry Cemetery Road ca. 50 m E of Terry Cemetery in BISO. 2 June 2000. APSU 06138. One larva in a road puddle in Maude's Crack trail ca. 0.64 km W of Maude's Crack in BISO. 2 June 2000. APSU 06139. Two adults found DOR on TN52 ca. 1.45 km E of the Scott–Morgan County line. 12 April 2001. APSU 06158. Scott County records.

Gyrinophilus porphyriticus (Spring Salamander). SCOTT CO: Adult crossing TN154 ca. 100 m N of the Pickett–Scott County line in BISO. 12 April 2001. APSU 06165. Scott County record.

Hemidactylum scutatum (Four-toed Salamander). Scott Co: Adult crossing TN297 ca. 80 m W of the bridge over Bandy Creek in BISO. 12 April 2001. APSU 06162. Scott County record.

Plethodon dorsalis (Northern Zigzag Salamander). FENTRESS CO: Adult guarding egg mass in a narrow crack in a rock wall ca. 0.16 km N of Indian Rock House on Slave Falls Loop in BISO. 30 July 2000. APSU 06151 (specimen and color slide). Fentress County record. SCOTT CO: Adult photographed with egg mass in a crack in a rock wall in a narrow canyon between two overlook spur trails on the John Muir Trail, ca. 4.67 km north of its intersection with Grand Gap Loop in BISO. 10 July 2000. APSU 06171 (color slide). Scott County record.

Pseudotriton ruber (Red Salamander). SCOTT CO: Adult found DOR on TN297 on the east side of the Big South Fork River gorge ca. 0.96 km E of the Leatherwood Ford Bridge in BISO. 12 April 2001. APSU 06153. Scott County record.

Anura

Hyla chrysoscelis (Cope's Gray Tree Frog). SCOTT CO: Adult female found DOR on TN297 on the east side of the Big South Fork River gorge ca. 0.64 km E of the Leatherwood Ford Bridge in BISO. 17 June 2000. APSU 06148. Scott County record.

Pseudacris crucifer (Spring Peeper). MORGAN CO: Three adults crossing TN52 ca. 0.16 km W of Farrington Road near Newberry House Pond in Rugby, Tennessee. 12 April 2001. APSU 06161. Morgan County record.

Pseudacris feriarum (Upland Chorus Frog). FENTRESS CO: 15 tadpoles in a roadside ditch on the south side of Darrow Ridge Road ca. 2.6 km E of its intersection with TN154; the southwestern boundary of BISO. 27 May 2000. APSU 06132. Fentress County record.

Rana palustris (Pickerel Frog). MORGAN CO: Adult found DOR on TN52 ca. 0.16 km W of Farrington Road near Newberry House Pond in Rugby, Tennessee. 12 April 2001. APSU 06154. Morgan County record.

Rana sylvatica (Wood Frog). PICKETT CO: Seven tadpoles in a puddle in Middle Creek Road ca. 0.16 km E of Divide Road in BISO. 2 June 2000. APSU 06137. Pickett County record. SCOTT CO: Four tadpoles in a road puddle on Smith Ridge Road ca. 2.57 km E of its intersection with Duncan Hollow Road in BISO. 28 May 2000. APSU 06131. Two tadpoles in a roadside ditch along Duncan Hollow Road ca. 1.61 km N of Bandy Creek Campground in BISO. 29 May 2000. APSU 06135. Scott County records.

Scaphiopus holbrookii (Eastern Spadefoot). FENTRESS CO: Adult crossing TN52 at the entrance to Brewster Bridge Picnic Area and River Access, ca. 0.48 km W of the Brewster Bridge over Clear Fork in BISO. 12 April 2001. APSU 06160. Fentress County record. PICKETT CO: Two adults in a roadside ditch on the west side of TN154 near the entrance to Pickett State Park Superintendent's Residence ca. 1.93 km N of the Pickett State Park office. 3 June 2000. APSU 06172 (color slide). Pickett County record. SCOTT CO: Nine tadpoles in an ephemeral woodland pond on the east side of Twin Arches Road ca. 1.29 km NW of the Twin Arches Trailhead and ca. 300 m E of the Scott-Pickett County line in BISO. 2 June 2000. APSU 06133. Scott County record.

Acknowledgments.—This work was performed under National Park Service Resource Activity Permit BISO–N–00–01 and Tennessee Wildlife Resources Agency Scientific Collecting Permit 1606-00. Thanks to Reid Detring and Robert Emmott (BISO) for providing logistical support and waiving housing costs as compensation for this survey.

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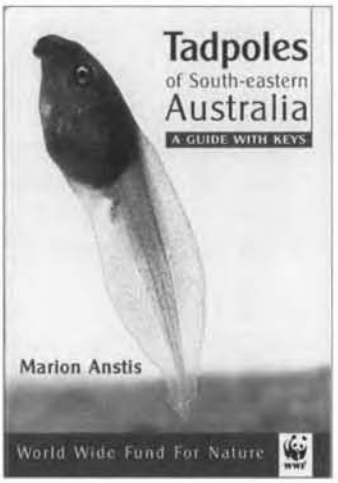
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BOOK REVIEWS

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Tadpoles of South-eastern Australia: A Guide With Keys, by Marion Anstis. 2002. New Holland Publishers (Australia) Pty Ltd, Sydney, Australia. Distributed by Krieger Publishing Company, Melbourne, Florida, USA. 281 pp. Hardcover. US $44.50. ISBN 1-876334-63-0.

RICHARD J. WASSERSUG
Department of Anatomy and Neurobiology, Dalhousie University
Halifax, Nova Scotia, B3H 4H7, Canada
e-mail: tadpole@is.dal.ca



What a lovely book!

Tadpoles of South-eastern Australia is the most comprehensive regional guidebook for tadpoles that I have ever seen. It is quaint in style, yet heroic in scope.

In this beautifully illustrated volume, Marion Anstis manages to describe the tadpoles of 84 of the 89 species of anurans found in the southeastern corner of Australia. The tadpoles for 30 of those species have never been described before. Thus this book introduces an enormous amount of new information on Australian anurans.

However, anyone interested in tadpoles from anywhere in the world should look at this book. Here is why.

In sixteen, heavily-illustrated pages at the beginning of the book, Anstis sorts tadpoles into 17 types, based on body shape, and 15 types, based on oral disc morphology. This classificatory scheme is a major refinement on the more common bipartite sorting of tadpoles into simply pond (lentic) and stream (lotic) forms. Similarly, the otherwise "common" pond tadpole oral disc, with its 2/3 denticle formula, is subdivided here into a half dozen well-defined and well-illustrated categories. With so many precisely defined morphological categories, herpetologists can begin to distinguish coexistent tadpoles of similar habitus from other regions of the world. I invite anyone describing tadpoles in the future to start with Anstis's descriptive categories, modifying them as necessary to meet their local needs.

Furthermore, only when one can see and describe morphological differences can one begin to understand the adaptive significance of those differences. Thus Anstis's partitioning of tadpoles, based on subtle variants in body shape and oral morphology, opens the way to understanding what these variations mean to the locomotor (e.g., Van Buskirk and McCollum 2000) and feeding (e.g., Wassersug and Yamashita 2001) activities of these animals.

Every species account in this book includes a photograph of the adult, a distribution map for the species, an illustration of the tadpole in lateral view, an illustration of the tadpole's oral disc, *and* photographs of the tadpole in both dorsal and lateral view. Most tadpole descriptions published elsewhere rely on either photographs or drawings, but not both. It is great to see both here, as they provide different but complimentary information.

Each species account also includes a description of the adults' breeding site, the eggs/embryos, and of course the tadpoles themselves. The accounts end with a few lines on the behavior and ecology of the tadpoles. The species with the most similar looking tadpoles are mentioned and the most effective characters for discriminating between those similar species are noted.

This book is more than illustrated with excellent pictures—it is decorated with them! All the tadpole drawings within are compiled into a mural of pretty pictures on the endpapers, inside the front and back covers. At first those plates appear to be artistic embellishments. But they are practical, allowing readers to instantly compare tadpoles of the different species, without having to flip through the whole volume.

The book is clearly aimed at the amateur non-herpetologist and does not assume much previous knowledge about the frogs or toads of Australia. All technical terms are defined. Directions are given on how to get permission to collect tadpoles, and then how to raise them and preserve them.

My criticisms are few. As an editorial oversight, in one or two places specialized taxonomic knowledge is presumed of the reader despite the book's targeted audience of neophytes. For example, *Litoria littlejohni* larvae, we are told, are "similar in type to other members of the *L. ewingii* complex" (p. 132). However that complex is never defined. Such slips are minor though. One really doesn't need to know any herpetology to make good use of this book.

I was surprised to read that *Bufo marinus* toadlets are "non-toxic" (p. 29); i.e., not "toxic to predators" (p. 274). Whereas there is good evidence that *Bufo* toxicity varies with developmental stage (see Crossland 1998 and older papers cited therein) and probably among species, given the high toxicity of *Bufo* eggs, tadpoles, and juvenile frogs from around the world, I feel that one should cautiously avoid such sweeping generalizations. Not enough *Bufo marinus* have been tested with enough predators, across the species range (despite Crossland and associates' excellent work in this area; e.g., Crossland and Alford 1998; Crossland and Azevedo-Ramos 1999), to have much confidence in Anstis's claim that their toadlets are palatable. I, for one, am surely *not* about to add *B. marinus* toadlets to my diet.

The parts of the book that are likely to be most difficult to use are the keys, of which there are two: one for eggs/embryos and one for tadpoles. One problem, which is acknowledged by the author, is that the eggs and tadpoles of a few species are not described in this volume. This means that the keys may yield erroneous IDs in some localities, but work flawlessly in others. The problematic species with unknown early life history stages, however, are few and have relatively restricted ranges, which mitigates that problem.

There are two more serious problems related to intraspecific variation, though, that keep this book from being as good as it looks. Although Anstis reports finding two different color morphs for *Litoria dentata* tadpoles at opposite sides of the same pond (p. 114) and regional variation in the color of *Litoria booroolongensis* tadpoles (p. 98), little else is said about natural variation across

species' ranges. Except in a few cases, the tadpoles selected for description and used to develop keys appear to be collected from relatively restricted areas. Thus one cannot help but wonder how well the keys will work or how accurate the descriptions are for wide-ranging species.

The whole topic of phenotypic plasticity—a major thrust of tadpole research for the last decade (see Relyea 2002 and Van Buskirk 2002 for a lead to this literature)—is not mentioned at all in this book. Predator-induced variation in tadpole morphology and behavior is now well documented for many species in North America and Europe, thanks to the work of Andy McCollum, Josh Van Buskirk, Rick Relyea, and their colleagues (discussed in Wassersug 2000). It is also known for tadpoles in Eastern Australia, including ones covered by this book (Peter Kraft and Ed Meyer, pers. comm.). Thus when we are told, for example, that *Cyclorana alboguttata* tadpole "tails are constantly damaged by numerous predators" (p. 86), one might expect those tadpoles to have slightly different shapes, behavior, and possibly color, if raised with and without predators lurking nearby.

I predict that some of the tadpoles described here as fitting one of Anstis's 17 tadpole types will eventually be found to slip into an additional type or two, based on the environment in which they are raised. In sum, phenotypic plasticity is likely to make a bit of a mess of Anstis's otherwise masterful keys. From that mess, however, should emerge a richer understanding of the causes and consequences of intraspecific variation in Australian tadpoles. Hopefully Anstis will incorporate information on that variation into future editions of her book—even if it means that some species may not be confidently diagnosed with the dichotomies provided in a key.

The ranges for many of the species that Anstis discusses are shrinking fast, as humans encroach upon their territory. This is not surprising, for the southeastern corner of Australia is the most populated part of that island continent. Anstis dedicates a whole chapter to the various forces assaulting anuran populations worldwide. In revealing the beauty and diversity of tadpoles, and focusing public attention on the need to protect their habitat, this book is a service to anurans everywhere.

Thus, although it isn't perfect, it is still a darn lovely book.

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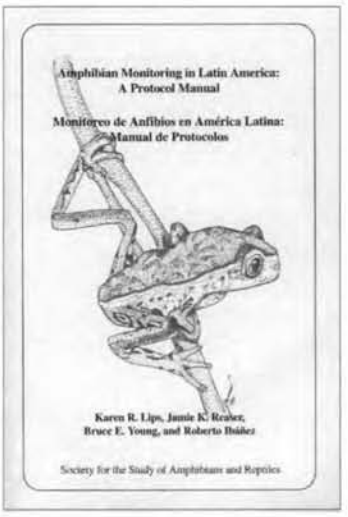
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Amphibian Monitoring in Latin America: A Protocol Manual. Monitoreo de Anfibios en América Latina: Manual de Protocolos, by Karen R. Lips, Jamie K. Reaser, Bruce E. Young, and Roberto Ibáñez, 2001. Herpetological Circular No. 30. Society for the Study of Amphibians and Reptiles. 115 pp. Paperback. $13.00. ISBN 0-916984-58-3.

MARTHA L. CRUMP

Department of Biological Sciences
Northern Arizona University, Flagstaff, Arizona 86011, USA
e-mail: peter.feinsinger@nau.edu



Most herpetologists now agree that amphibians are declining worldwide. Reports from five continents reveal that population sizes have decreased, entire populations have disappeared, and some species have gone extinct. Within the past decade, the scientific community has rallied together to document these declines and identify the causes.

The Neotropics, home to the world's richest amphibian fauna, has seen some of the most dramatic population declines and thus merits intensive investigation. In November 1999 Karen Lips, Jamie Reaser, Bruce Young, and Roberto Ibáñez held workshops in Mexico, Panama, and Ecuador with the goal of promoting efforts to inventory and monitor amphibians, and of coordinating efforts by investigators in these countries. Prior to the workshops they drafted a monitoring protocol manual and then revised it to reflect input by workshop participants. The National Science Foundation (U.S.) supported publication of the manual, which is now available to all of us.

The authors' stated purpose in writing this manual is "to make guidelines on amphibian monitoring readily available to field workers in Latin America, particularly those who might not have prior experience with amphibian monitoring." Not only have the authors successfully accomplished their goal, they have also produced a manual useful for investigators outside Latin America as well: the guidelines and field methods are appropriate just about anywhere. The authors suggest that investigators interested in initiating amphibian monitoring programs first read this manual for an introduction and guidelines, and then read the Heyer et al. book, *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians* (1994), for greater depth in field methods and data analysis.

The authors set the stage with a background on amphibian declines, pointing out that we lack the detailed surveys needed to understand patterns of decline, and that only long-term data sets can determine if populations are stable, increasing, or decreasing. Furthermore, we need to examine correlations among population status and environmental variables to identify possible causes of amphibian declines. A table of the biological and socio-economic roles of amphibians, with selected references, will be useful to investigators who need to justify the value of amphibians to the public. A second table—sites of rapid declines in amphibian populations from North America, the Caribbean, Central America, South America, and Australia, with selected references—will introduce the uninitiated to the literature. A third table, with selected references, summarizes the leading hypotheses on factors responsible for amphibian declines.

Next the authors briefly describe ecological monitoring and provide a detailed conceptual framework for establishing amphibian monitoring programs. They emphasize that not everyone will have the resources to undertake sophisticated programs but that even surveys involving a few species are worth the time and effort. This chapter is one of the most important in the book because it offers clear guidelines for developing and implementing a strategic monitoring plan. Particularly useful discussions include (1) identifying specific questions to achieve your goals, (2) how to choose your monitoring targets, (3) how to choose your site, (4) replication and timing of the fieldwork, and (5) which field method to choose.

The third section provides a concise summary of five field methods: visual encounter survey transects, audio transects and surveys at breeding sites, leaf litter plots, larval and egg surveys, and drift fences. A useful table, modified from Heyer et al. (1994), summarizes factors to consider in selecting the most appropriate field methods to obtain specific information. Investigators are urged to follow the DAPTF Fieldwork Code of Practice (provided as an appendix). Additional topics covered include duration and frequency of sampling (you need statistical power to detect changes!) and equipment needed (you don't need much.).

A short section on environmental data collection stresses that weather data are critical because activity and reproductive behavior of amphibians is so closely tied in with climatic variables. A list of standard weather variables and equipment needed to measure these variables includes air and water temperature, precipitation, wind speed and direction, relative humidity, and pH.

The next section is data analysis. Recommendations begin with constructing a species accumulation curve from lists of species present during each survey. One can calculate the number of individuals per area searched (density), the number of individuals per unit of time searched, and then compare transects or habitats. Data on reproductive phenology are valuable for determining optimal times for future monitoring efforts. The authors briefly address the question of major concern: how do we determine whether our focal populations are stable, declining, or increasing? This is a challenging question indeed, since population sizes of many amphibians naturally fluctuate widely from year to year. We may need 10 to 20 years' worth of data to determine if any real change in population size has occurred, ideally using *a priori* power analysis.

Alonso Aguirre and David Green wrote the next section: Analysis of Mortality Causes in Amphibians. What should we do if we find dead or dying amphibians in the field? Here the reader learns what field data to collect to accompany specimens and how to preserve and ship specimens for analysis. The authors warn that because some diseases can be transmitted from amphibians to humans and vice versa we need to take precautions.

A section entitled Other Considerations provides information on research and collecting permits, voucher specimens (including the minimum data that should accompany each specimen), and tape-recorded frog calls as vouchers. The authors emphasize the importance of depositing vouchers and their accompanying data in an institutional collection committed to curating the specimens and making them available for study by other researchers. Advice on personal safety is given as well as ways to avoid spreading infectious diseases among amphibians. Readers are encouraged to communicate their findings with other scientists and with the public.

The list of literature citations includes 65 references. These are certainly not comprehensive, but they should get the reader started. The first of four appendices provides valuable contact information: pathologists who will analyze dead or dying frogs, participants from the NSF-sponsored workshops willing to provide advice concerning monitoring programs, and Latin American herpetological associations. A second appendix suggests possible sources of funding for amphibian monitoring projects in Latin America. The third appendix offers practical advice on filling out field data forms (e.g., do not use ballpoint pens!) and includes sample data sheets for transect samples, leaf litter plots, and audio samples at breeding sites. These data sheets can be easily modified to fit the specific needs of a monitoring program. The fourth appendix includes information sheets: Amphibian Mortality Information Sheet, Declining Amphibian Populations, and DAPTF Fieldwork Code of Practice.

The writing is clear and the book is well organized. Written both in English and Spanish, the manual is readily accessible for Latin American investigators. Perhaps a future version could be expanded to include Portuguese—extensive monitoring is certainly needed in Brazil. The authors do not talk down to their audience, yet the information is basic and easy to understand. I found only a couple of typographical errors, one "this data," and one sentence repeated at the end of two consecutive paragraphs. There are a few inconsistencies. For example, on p. 1 the authors state "More than a dozen amphibian species are believed to have recently gone extinct." The information sheet entitled Declining Amphibian Populations states "Now conservationists fear that at least 50 species of amphibians may already be extinct." The only area I felt could have been expanded is the section on Data Analysis. Based on my experience working with Latin Americans investigating amphibian declines, this is an area of great concern: How do we analyze and present the data? How do we compare species and sites? Perhaps in a future version of this manual the authors can expand this section to include general guidelines.

This excellent contribution will help us investigate the issue of amphibian declines by encouraging monitoring efforts. The authors intend to distribute the manual throughout Latin America. I also plan to distribute this manual to participants in my workshops and to those with whom I interact in Latin America, as the manual provides easily understandable guidelines. Much more than a tech-

niques manual, it emphasizes the what, where, and when as well as the how to monitor. The advice is practical and the techniques are inexpensive. I highly recommend that this manual be used in conjunction with Heyer et al. (1994) as the standard for field monitoring in Latin America and elsewhere.

You've done amphibians and field workers a great service, Karen, Jamie, Bruce, and Roberto. ¡Felicidades y gracias!

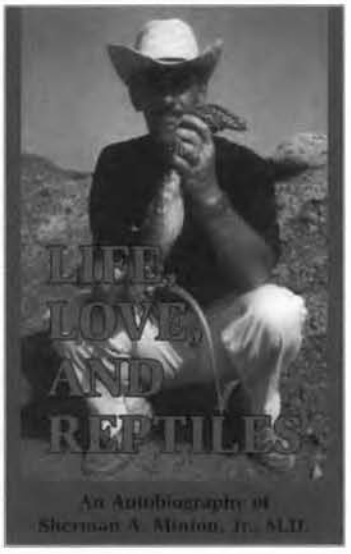
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Life, Love, and Reptiles. An Autobiography of Sherman A. Minton, Jr., M.D. 2001. Krieger Publishing Company, Malabar, Florida. xvii + 217 pp. Hardcover. US $24.50. ISBN 1-57524-172-2.

JOSEPH C. MITCHELL
Department of Biology, University of Richmond
Richmond, Virginia 23173, USA
e-mail: jmitchel@richmond.edu



Herpetology, like any other discipline or scholarly endeavor, is built upon the shoulders of those who were there before us. Being scientists, herpetologists are often more interested in writing about their discoveries than about the history behind them, and they seldom write about themselves. *Life, Love, and Reptiles* is a review of the experiences and accomplishments of a man who loved herpetology, his medical career, and his wife and family. Autobiographies like this one help us understand the context within which discoveries were made and thus allow us to better understand the value of individual contributions.

Kraig Adler, in his Foreword to this book, correctly points out that professional biologists in the 19th century who worked with herps were medical doctors. John Edwards Holbrook was the notable example from that era. Most professional herpetologists in the 20th century obtained their degrees in biology, zoology, or related fields, although a few obtained their medical degree so they could also pursue herpetology. Sherman A. Minton Jr. (1919–1999) was among the latter who made important contributions to both fields.

The manuscript for this book was written by Dr. Minton in secret. His wife of 56 years, Madge Rutherford Minton, discovered it following his death on 15 June 1999. Breck Bartholomew edited the book with the help of several of Minton's long-time friends; all of whom shared memories in the side bars scattered throughout. Kraig Adler wrote the Foreword and H. Bernard Bechtel, a close friend of the Mintons and himself a medical doctor and herpetologist, wrote the Retrospective. A list of all of Minton's publications and the taxa named after him and his wife (4 modern reptiles and 1 extinct frog) conclude the book. The 6 x 9 inch hardcover book is printed in single column format. Black and white photographs are sprinkled throughout the text and collages of photos of Minton with Madge and other herpetologists appear on the inside front and back covers and end papers. There is no index. The book is well edited with few misspellings (Marines should be capitalized, pgs. 26, 28, 30; Novotny [2002] noted 3 others) or errors. It is an easy read. I highly recommend this book to herpetologists, those interested in the history of natural history, and those curious about what drives naturalists to do what they do.

Sherman (Sherm) Minton grew up in New Albany, Indiana and learned to love all things natural, especially herps, in the southern part of the state called today the Knobstone Escarpment section of the Highland Rim Natural Region (Minton 2001). He fell in love with snakes at the age of four when a rough green snake wandered near his play area while his father played golf (Stewart 2000). He always loved Indiana and wrote the first definitive herpetology of that state in 1972 (the second expanded edition was published in 2001). The first chapter in his autobiography recounts his early years, his experiences with herps in the region, going to Indiana University, meeting the love of his life Madge Rutherford, and attending medical school where he excelled in bacteriology. One inspiring teacher at Indiana who taught evolution interviewed his students, including Minton, for a far-reaching book. This was Alfred C. Kinsey, who published the first books on human sexual behavior, including *Sexual Behavior and the Human Male*. Chapter 1 ends with the start of World War II and Chapter 2 begins with that title.

Minton joined the Naval Reserve during medical school and after graduation in late 1942 began his internship at the San Diego Naval Hospital. His narratives in this chapter and the others to follow are filled with descriptions of herp trips in the region and medical and parasitological diseases. During his stint in San Diego Madge Rutherford was recruited for the Women's Army Service Pilots (WASP). She loved to fly (see Stewart, 2000) and eventually flew nearly everything the military had at the time while moving planes around the country. Minton said he worried that some glamorous flyboy would take her away from him but they stuck it out and were married in late 1943. Shortly thereafter Minton was assigned to the USS Brooks where he saw action in the Pacific theater with the Japanese, even living through a kamikaze strike on his ship. His short dependence on drugs and alcohol following these events led to his decommission from the military and return to civilian life. He took classes at the University of Michigan where he interacted with a group of renowned herpetologists and began his life-long professional study of the herps of Indiana. In 1947 he joined the Microbiology Department at the Indiana University School of Medicine, where he taught until his retirement in 1984.

Minton's memorable long-term field trips were associated with evaluations of regional medical problems. His first sabbatical was to Big Bend to study wildlife diseases and their human interac-

tions. The visits of now famous herpetologists and the herps of the region in his six month stay are chronicled in Chapter 3. His six-week stay in Costa Rica to study intestinal parasites and malnutrition is described in Chapter 4. The Mintons went to Pakistan in 1958 so that Sherman could teach microbiology to medical students in Karachi. They stayed there over four years and dealt with cholera, malaria, smallpox, a case of anthrax, and many herps. His monograph on the herps of Pakistan published by the American Museum of Natural History in 1966 was a major contribution and now a classic. Chapter 5 is the longest one in the book and includes descriptions of living in Pakistan and the numerous field trips in pursuit of herps.

The first of many field trips to Mexico (Chapter 6) was made in 1963. The Minton's oldest daughter (Brooks) was a linguist, specializing in Spanish. She eventually lived in Mexico and Sherman and Madge would make regular visits to Querétaro to visit her and her family. There isn't much herpetology in this chapter, but Minton describes the countryside and aspects of its natural history, including how to deal with "Montezuma's Revenge." The Mintons learned to SCUBA dive in the mid 1960s. Descriptions of several diving trips to Central America and the Caribbean are in Chapter 7.

In the early 1970s, Sherman Minton, by then well recognized for his research on snake venoms, was invited to participate on an expedition to study sea snakes in the south Pacific. The ship was the research vessel *Alpha Helix*, the title of Chapter 8. Minton chronicles the places visited by the crew, many of the snakes captured, their biology, and other wildlife, including birds which he liked to watch. Chapter 9 describes the itinerary of a second expedition on the *Alpha Helix* in 1975. This time he visited the site where the *USS Brooks* had been hit by the kamikaze in January 1944. A third visit to the region, this time to Australia, is also chronicled in this chapter. Minton worked on the effects of venoms from several species of snakes to determine the relationship of venom toxicity to prey type and to determine relative resistance among prey species. Madge joined him on this excursion, and Minton's portion of the book ends with them sitting on the beach at Cairns in twilight.

Chapter 10 fills in some personal attributes and history that Minton left out, likely because of his modesty. Bechtel points out that Sherman and Madge Minton worked well as a team; they co-authored two books, raised a family, and took many trips together. They loved to dance. He describes Madge's love of flying, her career in the WASPs, the feature article on her in the June 1999 issue of *Life* magazine, and her driving—"exactly the way she handled the P-47s." Madge is easily a strong role model for women. Bechtel describes Minton's life-long participation in national and international conferences and professional societies such as The Herpetologists' League and the Society for the Study of Amphibians and Reptiles. Minton received numerous awards, including the Redi Award (named after Francesco Redi who first studied snakebite in the 17th century), the highest honor bestowed by the International Society of Toxinology. He stayed active until just a few months before his death, attending the first Conference on Venomous Snake and Treatment for Snakebite in Vietnam in late 1998. Bechtel tastefully describes his cancer diagnosis and his last wishes. Stewart (2000) is another must-read account of the Minton's personal and professional histories.

I knew the kind-hearted Mintons from our brief interactions at the herp meetings. Thus, I was immensely gratified in 2001 when I drove to the meetings in Indianapolis, Indiana to see that a bridge over the Ohio River in Louisville, Kentucky (the Sherman Minton Bridge on Interstate 65) was named after a herpetologist. I learned later that Minton's father was a U.S. Senator and an Associate Justice of the Supreme Court, and of course the bridge was named for him. Still, in my mind, the bridge to Hoosier country honors the Mintons, one of whom was a herpetologist who made major contributions to the state's natural history.

Sherman Minton's autobiography shows us that he balanced many things throughout his medical career, including love of reptiles, love of his home state, love of adventure, and especially love of his wife and family. He shows us that one does not have to have a Ph.D. in biology to make long-lasting contributions. All it takes is a true love of the animals and a desire to contribute to science. Would that other herpetologists in their later years write their own autobiographies so that we can better understand and appreciate the shoulders on which we stand.

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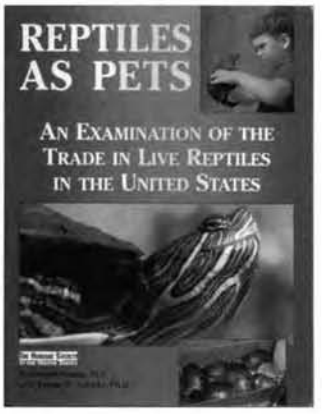
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Reptiles as Pets: An Examination of the Trade in Live Reptiles in the United States, by Joseph Franke and Teresa M. Telecky. 2001. Humane Society of the United States, Washington, D.C. xii + 146 pp. Softcover. US $10.00. ISBN 0-9658942-4-X.

JOHN J. MORIARTY
Ramsey County Parks, 2015 North Van Dyke Street
Maplewood, Minnesota 55109, USA
e-mail: john.moriarty@co.ramsey.mn.us



Reptiles as Pets is a Humane Society of the United States (HSUS) report detailing all that is wrong with pet reptiles and why they should not be kept. I started to read this report with great interest because of my concern and work for the conservation of wild populations of reptiles and also because of my experience as a reptile owner.

HSUS states that unregulated harvest of reptiles for the pet trade is a major problem. This may be true, but for most species habitat loss, the food trade, and harvest for skins are more serious. HSUS does not address these issues

and actually dismisses them as a smoke screen used by reptile importers.

HSUS suggests that reptiles pose a serious health risk to humans by the transmission of *Salmonella* and other pathogens. The data used by HSUS are highly suspect. They report 93,000 reptile-related salmonellosis cases annually leading to thousands of hospitalizations and 20 deaths. These numbers are from an unpublished report and are not supported by hard data. The numbers are based on an estimate that only one in 38 cases of salmonellosis is reported. The number of known cases was, therefore, multiplied by 38. The study's authors estimated 7% of salmonellosis cases are caused by reptiles, so they divided the first estimate by the second estimate. These numbers seem fuzzy to me. Based on data available to me, I suspect that there are many fewer cases of reptile-transmitted salmonellosis. In Minnesota, complete background checks are conducted on every reported case. Over the last five years the state averaged 25 reptile-related cases per annum with 3–5 hospitalizations and no deaths (J. Bender, DVM, University of Minnesota, pers. comm.). Based on the 2000 census, Minnesota has 1.7 % of the United States population. If Minnesota had an average incidence of reptile-related salmonellosis, the numbers nationally would be about 1500 cases per year, with 100 hospitalizations and few deaths. While this is still a concern, it is not the major health problem portrayed by HSUS.

The other chapters of the report deal with the health and care of reptiles within the wholesale and retail trade, including an entire chapter on the illegal trade in protected animals. Illegal activity can be found in any business. The vast majority of reptile keepers, breeders, and retailers would side with HSUS on the need to stop illegal activities. However, the presence of such activity is not a sufficient reason to ban the legal aspects of the business. I would argue that HSUS should be pushing for better enforcement of existing laws rather than condemning legitimate and illegitimate activities alike.

The report does make some good points about the numbers of animals imported, shipping techniques, and health concerns of the animals and owners. Unfortunately, rather than coming up with constructive solutions (e.g., education and training materials, better import regulations) to fix the problems, HSUS recommends the wholesale banning of the importation, collection, and keeping of reptiles. HSUS missed a great opportunity to promote the humane keeping and conservation of reptiles. The HSUS stand has caused many state herpetological organizations to distance themselves from that organization.

I cannot recommend this report because of its clear bias against the keeping of reptiles in captivity. Several organizations have responded to the HSUS report. One response that I recommend is from The Association of Reptilian and Amphibian Veterinarians (http://www.vaherper.com/nvrr/arav.htm).

PUBLICATIONS RECEIVED

The Herpetofauna of the Mexican State of Aguascalientes, by James R. McCranie and Larry David Wilson. 2001. Courier Forschungsinstitut Senckenberg (230):1–57. [E. Schweizerbart'sche Verlagsbuchhandlung, Johannesstr. 3 A, D-70176 Stuttgart, Germany]. Softcover. Eur 16.00 (approx. US $15.00). ISBN 3-510-61073-3.

This publication presents an overview of the amphibians and reptiles of the small central Mexican state of Aguascalientes. The herpetofauna consists of 61 species (14 amphibians and 47 reptiles). Although several short field trips to the area by the authors served as the basis of the study, all literature records and the holdings of U.S. museum collections were also incorporated into the work. The monograph opens with a review of the physiography, climate and vegetation of Aguascalientes and a short ecogeographic analysis. A key to the species precedes the species accounts, which comprise the bulk of the publication. Each account includes a synonymy (including original description, first use of current combination, and all references specifically to Auguascalientes material), a statement of range, remarks (ecological, geographic, and systematic), and lists of specimens examined, literature records, and other records (each generally citing specimens by their museum numbers). Additional sections discuss species of probable occurrence (7 taxa) and species deleted from the fauna of the state. The work closes with a gazetteer of all localities mentioned and a literature cited section of approximately 300 entries. Five color plates, each with eight photos, illustrate habitats (16 photos), frogs (3), lizards (7), and snakes (14). The publication makes a significant contribution to the herpetofauna of the region and will be of interest to the many herpetologists with an interest in Mexican amphibians and reptiles.

Comparative Vertebrate Lateralization, edited by Lesley J. Rogers and Richard J. Andrew. 2002. Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA (www.cambridge.org). ix + 660 pp. Hardcover. US $120.00. ISBN 0-521-78161-2.

This volume provides an overview of lateralization of the vertebrate brain and its consequences for such asymmetrical functions as handedness, vocal communication, cognition and memory. Although much of the work in the field has been done on chick and primate models, the book reviews the topic in a comparative context and reptile, and especially amphibian, examples are also discussed. There are contributions from 20 researchers, presented in 15 chapters grouped into four parts: Evolution of Lateralization, Development of Lateralization, Cognition and Lateralization, and Lateralization and Memory. The evolutionary section of the book contains most of the herpetological material, much of which is based on experiments conducted with species of *Bufo* and *Anolis*. Each chapter includes an extensive bibliography and is illustrated by numerous graphs and figures derived form the primary literature in the field. The book concludes with both author and subject indices. It should be of interest to herpetologists and evolutionary

or developmental biologists with an interest in neurobiology and the mechanistic basis of behavior.

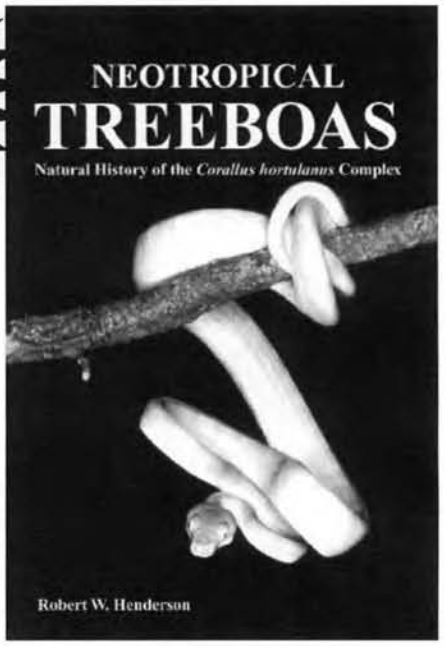
Interpretive Atlas of Texas Lizards, by Ralph W. Axtell. 1986–2001, *et. seq*. Privately published by and available from the author (Ralph W. Axtell, 2814 Rock Hill Road, East Alton, Illinois 62024, USA; e-mail: raxtell@siue.edu). Individual accounts available separately. Cost: US $0.10/page + postage and handling.

The most recent installments (numbers 24–26) in this series are *Eumeces obsoletus* (Great Plains Skink), *E. tetragrammus* (Four-lined Skink), and *Cnemidophorus uniparens* (Desert Grassland Whiptail). These new accounts comprise 21, 23, and 4 pages, respectively, in addition to detailed range maps. Axtell provides an in-depth discussion of distribution for each species in Texas, along with current taxonomy, geographic variation, conservation status, and suggestions for future work (including investigating possible hybridization between *E. tetragrammus* and *E. septentrionalis*).

Calls of New Jersey Frogs and Toads, by David M. Golden and John F. Bunnell. 2002. New Jersey Division of Fish and Wildlife, Trenton, New Jersey. CD. US $10.00. Available from: www.njfishandwildlife.com/products.htm#herpguide.

This CD contains vocalizations for the 16 species of frogs and toads native to New Jersey. Dave Golden (New Jersey Division of Fish and Wildlife, Endangered and Nongame Species Program) and John Bunnell (New Jersey Pinelands Commission) created the CD to help residents and visitors to the state accurately identify calling anurans. The majority of vocalizations were recorded by Bunnell from sites in the New Jersey Pinelands and the remaining calls were obtained from John Macgregor. The first set of tracks include vocalizations preceded by the common and scientific name of the species calling. The second group of tracks are testing tracks, to help listeners test their ability to identify the calls. Shaded distribution maps, printed on the inside of the case, indicate the occurrence of each species by county. A bar graph indicates monthly calling phenology data. This CD should prove useful to anyone interested in anuran vocalizations in New Jersey and surrounding areas.

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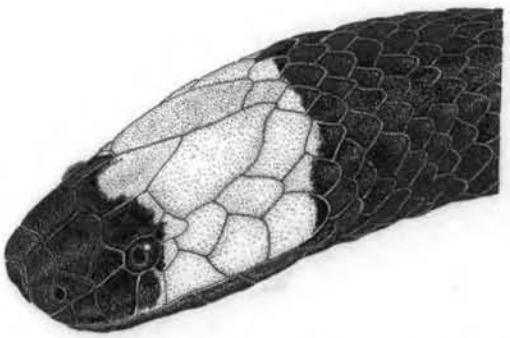


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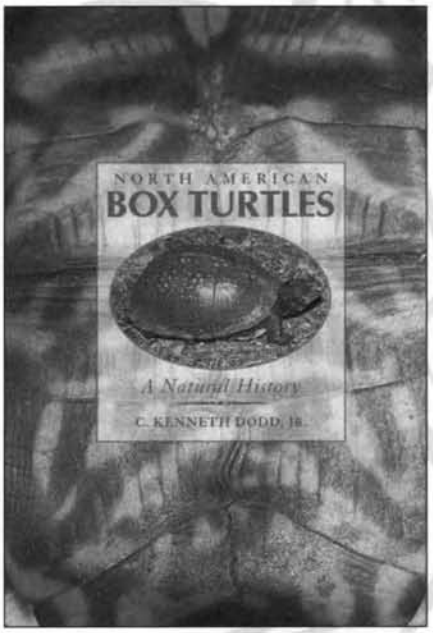
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Micrurus nigrocinctus (UMRC 89-18; 504 mm SVL). Honduras. Illustration by Julian C. Lee.

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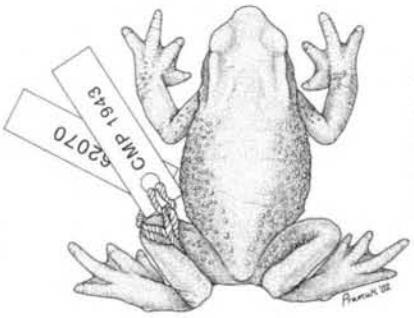
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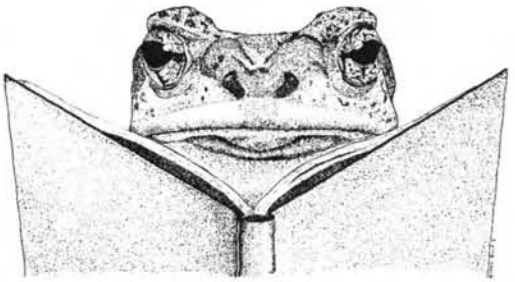
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RECENT POPULATION CHANGES

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A Historical Study of the Distribution of Blanchard's Cricket Frog (*Acris crepitans blanchardi*) in Southeastern Michigan

RICHARD M. LEHTINEN
University of Michigan Museum of Zoology
Division of Reptiles and Amphibians, 1109 Geddes Avenue
Ann Arbor, Michigan 48109-1079, USA
e-mail: rmlehtin@umich.edu

"We have seen it from New Jersey to Georgia, Louisiana, Texas and Iowa, but like most workers we have neglected this most ubiquitous tree frog. Everyone remarks their choruses." (Wright and Wright 1949)

Unfortunately, Wright and Wright's (1949) characterization of the abundance of *Acris crepitans* is no longer accurate. In recent years, there have been numerous reports of declines in populations of Blanchard's cricket frog (*Acris crepitans blanchardi*), particularly in the midwestern US and adjacent Canada (e.g., Minnesota [Oldfield and Moriarty 1994]; Wisconsin [Hay 1998; Mossman et al. 1998]; Iowa [Hemesath 1998; Lannoo et al. 1994]; northern Illinois [Mierzwa 1998]; northern Indiana [Brodman and Killmurry 1998]; Ontario [Oldham 1992]). Frost (1983) and Hammerson and Livo (1999) have also reported declines from the western edge of its range.

In Michigan, Blanchard's cricket frog was historically widely distributed in the southern half of the lower peninsula (Harding 1997; Ruthven et al. 1912). Isolated records also exist for populations in the northern portion on the lower peninsula (Lee 1998; Ruthven et al. 1912). However, there has been no recent, published report of the current distribution of these frogs in Michigan. Surveys by the Michigan Department of Natural Resources and data from the Michigan Frog and Toad Survey indicate that this species is still somewhat abundant in southwestern Michigan, but is rare in the southeastern part of the state (Lee 1998).

Long-term monitoring of distribution and abundance is critical to the ability to detect and respond to declines (Pechmann and Wilbur 1994). Museum specimens, when accompanied with appropriate locality data, provide unequivocal evidence of the occurrence of a species at a certain time and place. These, and other records, provide us with information on the historic distribution of a species and can be used in conjunction with contemporary surveys to assess its current distribution and conservation status (Shaffer et al. 1998).

To assess the historic distribution of Blanchard's cricket frog in southeastern Michigan, I compiled a database of historic localities for this species in 14 counties in southeastern Michigan, USA. This database was based on records from museums, the scientific literature, the Michigan Natural Features Inventory, the Michigan Frog and Toad Survey, and reports from local naturalists. I limited my search for historical information to the following counties in southeastern Michigan: Genesee, Hillsdale, Ingham, Jackson, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, Shiawassee, St. Clair, Washtenaw and Wayne. A total of 79 historic localities were found in the study area dating from 1878 to 1999. These historic localities included three habitat types: lakes (35%), ponds (39%) and rivers or streams (26%).

A difficulty in conducting historical studies is that the quality of information varies greatly, particularly in older records. For example, many specimens or literature records simply refer to a township or a city, (e.g., "Norvell Township" or "Ann Arbor") without any specific locality data. Also, some older records use long forgotten names (e.g., "Steere's marsh" or "Fiegel's woods"). Some of these were located after consulting old maps, but others had to be excluded from further consideration. In all, 60 localities were sufficiently informative that they could be relocated and surveyed.

Chorusing surveys were conducted at these 60 sites for Blanchard's cricket frogs during the peak breeding season. At each site, after a five minute acclimation period, I listened ten minutes for vocalizations of male cricket frogs. If cricket frogs were detected, I attempted to collect a reference specimen. Chorusing surveys were conducted between 2000 and 0100 h. The minimum air temperature to conduct a chorusing survey for cricket frogs was



FIG. 1. Location of sixty historical localities (1878–1999) for *Acris crepitans blanchardi* in fourteen counties in southeastern Michigan, USA. Open circles represent extinct populations, shaded circles represent extant populations, based on 2001 surveys.

18°C. Chorusing surveys were not conducted if it was raining heavily. Surveys began on 18 May and ended on 9 July, 2001. Each site was visited once.

Only two of the 60 sites surveyed (3%), had extant populations of cricket frogs (Fig. 1). One is located in Lenawee County in an abandoned gravel pit on a nature preserve. Previous work at this site indicates that other ponds in the preserve also have cricket frogs (R. Lehtinen, unpubl. data). The other site is a pond in a rapidly urbanizing area of Ypsilanti in Washtenaw County. Construction has already begun on a housing development on the east side of this site. Both of these sites had relatively large numbers of cricket frogs and full choruses of males and successful reproduction were detected. A reference specimen from the Lenawee County site was deposited at the Division of Reptiles and Amphibians at the University of Michigan Museum of Zoology (UMMZ 227792).

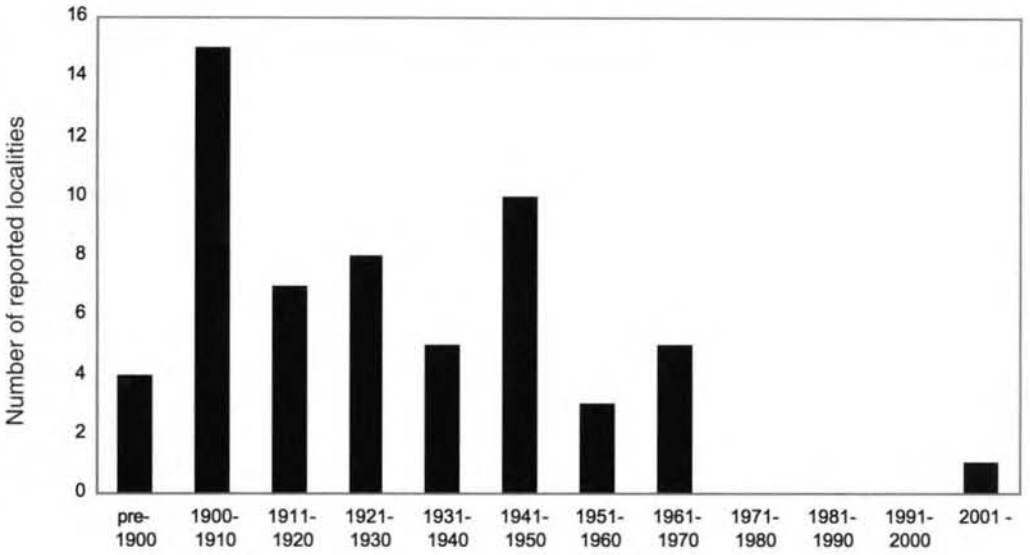


FIG. 2. Number of sites in southeastern Michigan, USA where *Acris crepitans blanchardi* specimens were collected, 1878–2001.

To estimate the timing of the decline, I tabulated the number of sites in southeastern Michigan from which cricket frogs had been collected in ten year intervals from pre-1900 to the present using all available museum specimen data (FIG. 2). While sampling effort was not uniform over this time period, this data does give a qualitative estimate of the timing of the decline. Reasonably large numbers of extant sites are present in each decade until the 1970s. As populations well into northern Ohio and Indiana (Lipps 2000; R. Brodman, pers. comm.) also seem to be declining, it seems likely that this decline began at least thirty years ago.

The decline in Blanchard's cricket frogs in southeastern Michigan is not novel, as every other state in the upper Midwest has reported similar trends (Minnesota [Oldfield and Moriarty 1994]; Wisconsin [Hay 1998; Jung 1993]; Iowa [Hemesath 1998; Lannoo et al. 1994]; Illinois [Mierzwa 1998]). In 1996–1997, Lee (1998) found six extant populations in southeastern Michigan, although some of these were based on volunteer data and might have been erroneous (see discussion below). Cricket frog populations in southwestern Michigan seem to be doing better than in the southeastern part of the state, with at least 41 sites known according to Lee (1998).

States adjacent to Michigan have also reported declines. In northwestern Ohio, Lipps (2000) conducted surveys for cricket frogs in fifteen counties from 1997 to 1999. He found extant populations at 18 out of 99 historical sites (18%, nine out of fifteen counties) and concluded that *Acris* is much less abundant in northern Ohio than in the past. Similarly, Brodman and Kilmurry (1998) found that cricket frogs had been extirpated from Jasper County in northwestern Indiana and have declined throughout much of the northern part of the state (R. Brodman, pers. comm.).

Only two of eleven sites in southeastern Michigan reported to have cricket frogs by Michigan Frog and Toad Survey volunteers (1996–1999) were found to be extant. There are three likely (and non-mutually exclusive) explanations for this discrepancy. Firstly, these populations might have very recently gone extinct. Secondly, due to sampling error, I might have failed to detect cricket frogs in my surveys at these sites. This is relatively unlikely as cricket frog vocalizations are conspicuous and surveys were carried out during the most favorable periods. Or thirdly, cricket frogs might have been erroneously reported from these areas. This is particularly likely for sites that were never confirmed by an expert.

Many causal factors have been suggested to explain the decline of Blanchard's cricket frog. These include introduced predators or competitors (Lannoo et al.1994), agricultural chemicals (Jung 1993; Oldham 1992), wetland alteration (Lannoo 1998), prolonged droughts (Lannoo 1998), acid deposition (A. Resetar, unpubl. data), and habitat change (Hay 1998). The most commonly cited reason for amphibian declines is habitat loss and degradation (Pechmann and Wilbur 1994). In this study, three sites (5%) had been destroyed since the original data was collected. Eleven other sites (18%), while still in existence, have been modified to such an extent that, in my estimation, they no longer represent useable habitat. This was most often noted at lakes where the shorelines had been completely developed. Clearly, habitat loss and degradation has been an important factor in some cases for cricket frogs in southeastern Michigan. While there is little data currently available to test rigorously any of these hypotheses, the natural history of the species might give us important clues into the causes of this decline.

Firstly, cricket frogs are early successional species (Harding 1997). On the E.S. George Reserve in Livingston County, Michigan (an area where cricket frogs once occurred—see Collins and Wilbur 1979), Skelly et al. (1999) reported that forest cover had increased from 30% in 1937 to 67% in 1999 (see also Roller 1974). In addition, Hart (1968) reported that more than 1.6 million ha of farmland were abandoned in Michigan between 1910 and 1959, most of which reverted to forest. These successional trends are typical of eastern North America (Goigel Turner and Ruscher 1990) and can have a great influence on the distribution of amphibians (Werner and Glennemeier 1999).

Secondly, cricket frogs are short-lived. Data from Kansas, Louisiana, and Texas indicate that the average life expectancy of a cricket frog is about four months, only 5% of the population survives the winter, and complete population turnover takes place every 16 months (Bayless 1966, 1969; Burkett 1984). These demographic facts, combined with a modest dispersal capacity (see Pyburn 1958), greatly predispose this species to periodic local extinction.

Lannoo (1998) has suggested that metapopulation structure interacting with environmental stochasticity (i.e., droughts) and anthropogenic changes in habitat quality might have resulted in the observed declines. In the past, when wetland habitats were more abundant and less isolated, populations might have been more buffered from extinction by immigration (the "rescue effect"—Brown and Kodric-Brown 1977) and areas experiencing local extinction might have been recolonized relatively easily. In the current landscape, isolation and dispersal barriers might result in higher extinction rates and lower recolonization rates.

Metapopulation theory suggests that when the number of suitable patches in a metapopulation is reduced, extinction of the entire metapopulation becomes increasingly probable (the "extinction debt"—Tilman et al. 1994). Therefore, over time, the loss of individual populations will reduce the viability of the entire metapopulation. The threshold number of suitable patches needed for metapopulation persistence has been termed the minimum viable metapopulation size (Hanski et al. 1996). This approach could be used to predict the vulnerability and dynamics of cricket frog metapopulations in different landscapes. Unfortunately, no empirical information is currently available on cricket frog metapopulation dynamics.

Local extinctions are a frequent occurrence in metapopulation dynamics (Marsh and Trenham 2001). Therefore, we would expect a certain proportion of historic sites to be unoccupied, even in the absence of any decline. Then, the question is, how many local extinctions indicate a decline? In this case, 58 of 60 historic populations (97%) appear to be extinct, with no other populations known in the area. I conclude that Blanchard's cricket frogs are not only declining, but are nearly extirpated from southeastern Michigan.

Metapopulation structure, habitat loss and alteration, and regional successional trends might be important factors in the decline of Blanchard's cricket frog. If these factors are the primary causes of declines in this species, habitat restoration (including wetland and grassland/oak savanna restoration) combined with repatriation of cricket frogs to suitable areas should be effective conservation measures. Alternately, if other mechanisms are primarily responsible for cricket frog declines (e.g., introduced predators or competitors), repatriated cricket frog populations will not persist.

What is required now, rather than further speculation, are empirical tests of these (and other) causal mechanisms. Comparative data on population dynamics would be particularly useful in areas where cricket frogs are declining and where they are not declining.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 33, Number 1 (March 2002). However, please take note of the updated information below.

Current section editors: **Marc P. Hayes** (amphisbaenids, crocodilians, lizards, and *Sphenodon*; mhayesrana@aol.com); **Charles W. Painter** (amphibians; cpainter@state.nm.us); **Gordon W. Schuett** (snakes; gschuett@asu.edu); and **James Harding** (turtles; hardingj@pilot.msu.edu). Electronic submission of manuscripts is required (as Microsoft Word or Rich Text format [rtf] files, as e-mail attachments). Authors without the ability to send manuscripts electronically may supply hard copy instead. Figures can be submitted electronically as JPG files, although higher resolution TIFF or BMP files will be requested for publication. If figures cannot be provided in this format, you may send them to the section editor for scanning. Additional information concerning preparation and submission of graphics files is available on the SSAR web site at: http://www.ukans.edu/~ssar/HRinfo.html.

CAUDATA

AMBYSTOMA LERMAENSE (Lake Lerma Salamander). **REPRODUCTION and DEVELOPMENT**. *Ambystoma lermaense* is an endemic and endangered species from the Estado de México, México. Here we provide the first data on reproduction and development of this species. On 3 July 1995 we collected four *Ambystoma lermaense* (two males and two females) at San Pedro Tlaltizapán Lake (19°12'34"N, 99°30'26"W) Municipio de Tianguistenco, Estado de México, México. The specimens were transported to the laboratory at Facultad de Ciencias, Universidad Autónoma del Estado de México in an 18.9-liter water container. During transportation, one female (TL 192 mm; SVL 101 mm; mass 35.1 g) began to lay eggs at 1215 h and continued until after we reached the laboratory at about 1325 h. Adults and eggs were separated and placed in aquaria with continuous aeration of water from the collecting locality; pH was 8.2–8.5.

Clutch size was 841 eggs. In a sample of 40 eggs, the average ovum diameter was 2.40 ± 0.36 mm (range 1.8–3.9) and the external capsule diameter was 7.59 ± 0.64 mm (range 6.0–8.7). Egg fertility was low (26%). Embryonic development to hatching took 240–250 hours at 16.5–21.0°C. Embryo mortality was 10%. A total of 196 embryos hatched at stage 39 or 40, and hatchling size was 9–10 mm. After several months in captivity, the female died and was deposited in the Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México (IBH 11400). These observations were part of a project supported by CONACYT of México (Proyecto1165P-N) and Universidad Autónoma del Estado de México (Clave 995/94).

Submitted by **XÓCHITL AGUILAR-MIGUEL**, Centro de Investigación en Recursos Bióticos, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario #100, Toluca, Edo. de México, México, C.P. 50000 (e-mail: xam@coatepec.uaemex.mx), **GUSTAVO CASAS-ANDREU**, Instituto de Biología, Universidad Nacional Autónoma de México, A.P. 70-153, 04510, México, D.F., México (e-mail: gcasas@servidor.unam.mx), and **EDUARDO PINEDA-ARREDONDO**, Instituto de Ecología, Xalapa, Veracruz, México.

ANURA

ADENOMERA aff. ***MARMORATA*** (NCN). **REPRODUCTION**. The first reports on reproduction in the genus *Adenomera* dealt with populations in southeastern Brazil, and indicated a highly terrestrial reproductive mode (Lutz 1931. C. R. Soc. Biol. Paris 109:755–756; Lutz 1947. Copeia 1947:242–252). Subsequent inferences derived from larval morphology supported this notion for a species in the Amazon Basin (Heyer and Silverstone 1969. Field. Zool. 51[11]:141–145), and the idea became generalized for the group. However, there was some indication from preserved larvae that perhaps reproduction was not as terrestrial in certain populations in southeastern Brazil (Heyer 1973. Contr. Sci. Nat. Hist. Mus. Los Angeles Co. 251:1–50), but this was not conclusive (De la Riva 1996. J. Herpetol. 30:556–558). Herein we report on the reproductive mode of a population in southeastern Brazil. On 30 September 2000, three *Adenomera* foam nests were found and collected beneath leaf litter, each in a small chamber in the ground. The general habitat is a cocoa plantation within an alluvial forest in the locality of Povoação (19°33'S, 39°46'W), 30 km from the town of Linhares, Espirito Santo, Brazil. The foam nests were roughly elliptical in shape and had a maximum diameter of 4 cm; ca. 3 cm were below ground level. One of the nests contained cream-colored eggs with an average diameter of 3 mm (N = 3), from which 29 tadpoles emerged; the other two nests already had 27 and 28 brown tadpoles. The foam had dried up 9 days later, and

in one of these nests the tadpoles had perished; in the other two they were still alive, and water was added. The following day the foam had been reconstituted. A few days later (23 October 2000) the earthen chambers crumbled apart and 28 tadpoles were placed in water. Before this they seemed to stall development at stages 25–27 (*sensu* Gosner 1960. Herpetologica 16:183–190) for 23 days. In the next few days these tadpoles increased dramatically in size, developed a sinistral spiracle, and were feeding on fish food and lettuce. The first metamorph emerged 77 days after the collection date. Our observations support the notion that this population exhibits a more aquatic reproductive mode than that previously described for the group in southeastern Brazil, and more similar to that reported by De la Riva (1995. Stud. Neotrop. Fauna Environ. 30:15–29).

The genus is currently undergoing significant taxonomic changes. We have termed this population as *Adenomera* aff. *marmorata* as we know it is not the same species as that reported by Kwet (1998. Herpetol. Rev. 29:48) because of distinct advertisement calls. Specimens will be deposited at the Museu de Biologia Mello Leitão – MBML, Santa Teresa, Espírito Santo.

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Submitted by **ANTONIO DE PADUA ALMEIDA** and **ARIADNE ANGULO***, UNILINHARES – Departamento de Biologia, Av. São Mateus, 1458 - Bairro Araçá, Linhares, Espirito Santo, Brazil, CEP 29.901-350; *Current address of AA: Department of Zoology, Erindale College, University of Toronto, Mississauga, Ontario, L5L 1C6, Canada; e-mail (APA): tonim@escelsa.com.br; (AA): ariadne@zoo.utoronto.ca.

ELACHISTOCLEIS OVALIS (NCN). **DEFENSIVE BEHAVIOR**. Defensive behavior is quite variable in anurans, particularly among Leptodactylidae, Hylidae, and Bufonidae (Duellman and Trueb 1994. Biology of Amphibians. Johns Hopkins Univ. Press 670 pp.). On 6 September 2000, we collected an adult male *Elachistocleis ovalis* (Museu de Biodiversidade do Cerrado [AAG-UFU] 2118) (SVL 20.3 mm) in Nova Aliança municipality (21°11'S, 49°42'W), São Paulo State, Brazil. While being manipulated for photographs during the daylight, the specimen assumed a defensive behavior: pushing the forelimbs against the ground, stretching the hind limbs out perpendicular to the body, raising the ventral region off the soil surface, and inflating the lungs. This stationary posture was held for 20 sec. A similar posture has been observed in *Xenohyla truncata* (Napoli 2001. Herpetol. Rev. 32:36–37), *Hyla geographica* (Azevedo-Ramos 1995. Rev. Brasil. Biol. 55:45–47), and *Scythrophrys sawayae* (Garcia 1999. Herpetol. Rev. 30:224). Orange stripes evident on the posterior region of the hind limbs might function as aposematic coloration.

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Submitted by **MARCELO N. DE C. KOKUBUM** and **MARCELO MENIN**, Laboratório de Ecologia e Sistemática de Anuros Neotropicais, Programa de Pós-Graduação em Ecologia e Conservação de Recursos Naturais, Universidade Federal de Uberlândia, 38400-902, Uberlândia, Minas Gerais, Brazil.

PHYSALAEMUS PUSTULOSUS (Tungara Frog). **DISPLACEMENT OF AMPLECTANT MALES.** Aggressive behavior is common during the sexual behavior of many anurans. Aggressive behavior during courtship has been occasionally observed in *Physalaemus pustulosus* (Ryan 1985. The Tungara Frog. The University of Chicago Press. 230 pp). Males were occasionally observed trying to pull off amplectant males; however, these attempts were all unsuccessful. Ryan also reported that males of *P. pustulosus* emit a "release call" when they are clasped by another male.

Here we describe the aggressive behavior of a male *P. pustulosus* that successfully displaced a larger amplectant male. On 6 October 2000 (2214 h), we observed a male *P. pustulosus* (SVL 30 mm) trying to remove an amplectant male (SVL 33 mm) from the back of a female (SVL 34 mm) in Golfito, Puntarenas Province, SE Costa Rica (8°40'N, 83°10'W). The intruder bit the thigh and foot of the amplectant male several times, pulling him forcefully while emitting a release-like call. The amplectant male kicked the aggressor several times and the couple moved away several centimeters. The intruder followed the couple and again began the release-like call, and then tried to separate the pair by pushing his head between their bodies. Then he bit the amplectant male on the waist and emitted a release-like call. The amplectant male kicked the intruder, pushing him aside, but the aggressor returned quickly and seized the amplectant male by the armpits. Approximately 26 minutes after we first saw them, the intruder pulled the amplectant male off of the female and immediately mounted her and seized her by the armpits. The displaced male tried unsuccessfully to recover the female, but the couple swam away from the displaced male.

Contrary to the observations of Ryan (1985, *op. cit.*), this male was able to remove an amplectant male. Interestingly the winning male was of smaller size. We suggest that the release-like call emitted by the intruder male could be a sensory trap (Ryan 1999. Science 283:1083a) to facilitate removal of the amplectant male.

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Submitted by **BRANKO HILJE** (e-mail: branko@biologia.ucr.ac.cr), **MARCO BARQUERO** (e-mail: marco@biologia.ucr.ac.cr), and **GUIDO SABORIO-R.** (e-mail: gsaborio@biologia.ucr.ac.cr), Escuela de Biología, Universidad de Costa Rica, 2060 San Pedro, San José, Costa Rica.

TESTUDINES

CHELODINA EXPANSA (Broad Shell River Turtle) and ***EMYDURA SIGNATA*** (Brisbane Shortneck Turtle). **REPRODUCTION**. In several species of freshwater turtle, the administration of oxytocin for egg collection (Ewert and Legler 1978. Herpetologica 38:314–318) has triggered nesting behavior in gravid females. For example, this occurs in the snapping turtle (*Chelydra serpentina*), wood turtle (*Clemmys insculpta*), and musk turtle (*Sternotherus carinatus*) (Ewert 1979. *In* M. Harless and H. Morlock [eds.], Turtles: Perspectives and Research, pp. 313–413. John Wiley and Sons Inc., Florida.). Tucker et al. (1995. Herpetol. Rev. 26:138) reported that administration of oxytocin could also induce nesting behavior in female red-eared sliders (*Trachemys*

scripta elegans) hours after they deposited eggs. This nesting behavior was attributed to the continued hormonal effects of oxytocin in turtles following induction. If the administration of oxytocin triggers nesting behavior as is suggested by the above observations, then nesting behavior is less likely to occur many days after oxytocin administration as its concentration in the body will have returned to pre-injection levels (Plumb 1999. Veterinary Drug Handbook 3rd Edition. Iowa State Univ. Press, Iowa. 750 pp.). Here I report nesting behaviors in two species of Australian freshwater turtles (*Chelodina expansa* and *Emydura signata*) many days after collection of their eggs through administration of oxytocin.

A female *C. expansa* was captured leaving the water after heavy rain to nest at the University of Queensland lakes, St Lucia, Australia on 6 May 1999. X-ray revealed 14 oviducal eggs. Initial administration of oxytocin (Syntocin, 1.5 ml/kg) yielded only two eggs over two days. A second x-ray revealed that no eggs had been broken and were preventing further oviposition. Calcium gluconate (Theracalcium, 1.0 ml/kg) was administered (McArthur 1996. Veterinary Management of Tortoises and Turtles. Blackwell Science Ltd., Oxford. 176 pp.) the night prior to a second administration of oxytocin at 1100 h the following morning. Eleven eggs were deposited within 1.5 h. The final egg was laid later that day.

This female was kept in captivity for a period of 10 days after egg harvesting and was marked by scute notching prior to release. Five days later (i.e., 15 days following the second dose of oxytocin and the deposition of all eggs) the same female (identification by scute notching) was found carrying out nesting behavior during heavy rain. She was observed to complete nesting behavior including backfilling of the nest and compacting the nest plug. Excavation of the nest indicated a proper egg chamber of typical size for a *C. expansa*; however, the nest contained no eggs.

This behavior has also been observed in *E. signata* from the same site on 27 October 1999. Several females were captured and x-rayed to reveal egg numbers. Two of the females who were induced to lay their eggs via oxytocin injection, were found attempting to nest many days after oviposition. The first female laid 21 of 21 eggs in the lab and was found attempting to nest 21 days after oviposition. A second female who laid 18 out of 18 eggs upon oxytocin induction was found attempting to nest 21 days after oviposition. All of these females left the water to attempt nesting during heavy rain, which suggests that rain may be an important nesting cue.

Clearly these findings demonstrate that oxytocin administration per se was not the cause of the nesting behavior observed in these cases. Oxytocin caused the uterine contractions directly associated with egg laying, however it is clear that other factors are the cue for nesting behavior and that there are probably many behavioral and hormonal steps involved in completing a nesting bout. If a female on her way to nest is captured and her eggs gathered artificially by oxytocin administration, an important instinctual behavior associated with oviposition, i.e., nest construction is not completed and it appears that the female perceives she is still carrying eggs. This perception may be attributed to the failure of a normal nesting-related hormonal sequence to occur during artificially induced oviposition.

For example, Guillette et.al. 1991 (Gen. Comp. Endocrinol. 82:121–130) found that in loggerhead turtles (*Caretta caretta*) a hormonal sequence takes place from the onset of body pitting (or the start of the nesting process). They found that the onset of body pitting induced the release of Arginine Vasotocin (AVT), which in turn induced the synthesis and release of Prostoglandin F (PGF). Prostoglandin E_2 (PGE_2) is released at the same time as PGF however the stimulus for the synthesis and release of this hormone is unknown. All three hormones (AVT, PGF, PGE_2) then act to promote uterine contractions and therefore egg laying. Therefore, behavior associated with nest site choice and beginning to dig a suitable nest may be important to the endocrinology of oviposition in that it might initiate the hormonal sequence necessary to complete the laying bout. If this type of hormonal sequencing occurs in all turtles, females in which oviposition is artificially induced might still perceive they are gravid until they have had the chance to go through a complete nesting procedure and thus undergo the successive hormonal sequence associated with nest construction.

The discovery of non-gravid *C. expansa* and *E. signata* females attempting to nest many days after oxytocin injection and egg harvesting, suggests that these species might exhibit a sequence of hormone release similar to that of *Caretta caretta* where behaviors associated with nesting (e.g., body pitting or beginning to dig the nest) trigger the beginning of the hormone sequence and the nesting bout (Guillette et al., *op. cit.*). Endocrine studies on the different stages of hormone release in these species would need to be undertaken however, before this can be confirmed.

Submitted by **JULIA McCOSKER**, Department of Zoology and Entomology, School of Life Sciences, University of Queensland, St. Lucia 4072, Australia.

CHELONIA MYDAS (Green Sea Turtle). **ADULT MALE SIZE.** Only a handful of studies have reported on adult male sea turtles (Booth and Peters 1972. Anim. Behav. 20:808–812; Limpus 1993. Wildl. Res. 20:513–523; Limpus 1994. Mem. Queensland Mus. 35:139–154). A major logistical difficulty is finding and observing adults in the marine environment. Serendipitously, we have been able to observe and capture adult male *Chelonia mydas* in Atol das Rocas, Brazil (3°52'S, 33°49'W) while they are available in the central lagoon of this ring-shaped atoll at high tide. On several separate occasions, from 1990 through 1997, males were captured by hand during free dives. While still in the water, they were tagged with monel or inconel tags, and were measured for curved carapace length and width (CCL and CCW). A total of 48 *Chelonia mydas* males were captured a total of 56 times. The males were on average smaller than nesting females from Atol das Rocas (t = 12.5, $p < 0.0001$, Welch t-test,, see Table 1), which is not unlike the green turtle populations in Australia (Limpus 1993, 1994, *op cit.*).

Few females were captured in the central lagoon, despite the fact that many females nest in Atol das Rocas during the nesting season (Bellini and Sanches 1996. Marine Turtle Newsl. 72:1–2). It is likely that most females remain in the waters outside the ring-shaped atoll, although dangerous diving conditions kept us from investigating these areas in detail. On a few occasions, we came across pairs of copulating turtles, usually accompanied by several extra males, but no captures were made. On three separate occasions, copulating pairs of *Chelonia mydas* were observed up on the beach; on one of these occasions in 1991, the female successfully nested with a male (100.0 cm CCL) securely attached to her carapace.

TABLE 1. Carapace size (mean ± SEM) of *Chelonia mydas* males in the waters of Atol das Rocas, Brazil. Data for nesting females are from Bellini and Sanches (1998. Anais Semana Nacional de Oceanografia, 11, Rio Grande, RS, pp. 335–337).

	Males	Nesting Females
CCL (cm)	105.4 ± 0.84	115.9 ± 0.001
N	45	1702
range	85.0–118.0	100.0–134.0
CCW (cm)	97.1 ± 1.15	107.6 ± 0.001
N	43	1147
range	69.0–110.0	94.0–123.0

We are grateful to Augusto C. C. D. da Silva and Jaqueline C. de Castilhos and everyone else who helped with the captures. Thanks to N. Mrosovsky for stimulating us to publish these data, to M. H. Godfrey for helping with the translation, and to the Reserva Biologica do Atol das Rocas - IBAMA for logistical support. Projeto TAMAR-IBAMA is co-managed by the Fundação Pró-TAMAR and is officially sponsored by Petrobras.

Submitted by **TAISI M. SANCHES**, Fundação Pró-TAMAR, Caixa Postal 50, Fernando de Noronha - PE, 53990-000 Brazil, and **CLAUDIO BELLINI**, Projeto TAMAR-IBAMA, Caixa Postal 50, Fernando de Noronha - PE, 53990-000 Brazil (e-mail: cbellini@tamar.org.br).

DERMOCHELYS CORIACEA (Leatherback Sea Turtle). **SIZE.** Carapace length and mass are nearly exclusively used as indicators of body size in sea turtles. Of the two, carapace length is more often measured, because of the logistic challenges associated with weighing animals that might exceed several hundred kilograms. Carapace length can be converted to body mass using previously published formulae (e.g., Boulon et al. 1996. Chel. Conserv. Biol. 2:141–147; Leslie et al. 1996. Chel. Conserv. Biol. 2:159–168). The carapace of *D. coriacea* lacks the thickened bony plates typically associated with hard-shelled turtles, and is composed of a mosaic of small irregular ossicles that can be less than 5 mm thick. The carapace of *D. coriacea* terminates at the caudal end in a thin peduncle (Fig. 1a), which comprises one end of the midline used in standard carapace measurement as described by Bolten (1999. *In* Eckert et al. [eds.], Research and Management Techniques for the Conservation of Sea Turtles, pp. 110–114. IUCN/SSC Marine Turtle Specialist Group Publication No. 4). This unique anatomy increases susceptiblity to abrasion and damage; indeed, up to 20% of nesting *D. coriacea* might have visible wounds, either fresh or healed, on the carapace, with many having damaged or missing (Fig. 1A) peduncles (Fretey 1981. Rev. fr. Aquariol. 8:199–128; Rueda-A. et al. 1992. *In* Rodriguez-Mahecha and Sanchez-Paez [eds.], Contribucion al Conocimiento de las Tortugas Marinas de Colombia, Libro 4, pp. 1–131. Serie de Publicaciones Especiales del INDERENA, Santafe de Bogota, Colombia). These injuries can be caused by predators such as sharks, killer whales, or billfish (Eckert et al. 1994. Herpetol. Rev. 25:63–64; Frazier et al. 1994. Envir. Biol. Fishes 39:85–96), and from debris on nesting beaches (Fretey, *op. cit.*; B. Godley, pers. comm.). These injuries complicate accurate measurement and lead to inconsistency in data collection.

As a potential solution to this problem, we investigated the correlation between curved carapace length (CCL) and length of the second pair of keels parallel to the midline keel of the carapace in *D. coriacea* with undamaged peduncles, to see if this measurement would have utility as an estimator of CCL in individuals with peduncle damage. We measured the carapaces of nesting female *D. coriacea* on Awala-Yalimapo Beach in French Guiana, from 23 May–2 June 2000 and 14–21 July 2001. We limited the measurements to a span of 10 days or less to avoid remeasuring the same female, as the within-season renesting interval for *D. coriacea* in French Guiana is about 10 days (Girondot and Fretey 1996. Chel. Conserv. Biol. 2:204–208). For nesting females without any carapace deformities, CCL was measured as described in Bolten (*op. cit.*): using a flexible metal measuring tape laid on the lateral side of the midline keel from the nuchal notch to the end of the caudal peduncle (Fig. 2). Side keel length was measured on both sides of the midline, from the anterior edge of the carapace to the posterior edge, alongside the keel ridge (Fig. 2). We chose the second parallel keel, rather than the first, because the latter terminates towards the end of the caudal peduncle, and thus injuries that affect midline CCL measurement would also likely affect the measurement of the first parallel keel. In all cases, the tape was laid flat, to the right of and as close as possible to the midline of the keel. Measurements were recorded to the nearest 0.5 cm. Simple correlation coefficients were determined and significance analyzed by an *F*-test (Zar 1999. Biostatistical Analysis. Prentice Hall, Upper Saddle River, New Jersey. 663 pp).

Mean ± SD CCL from 91 adult female *D. coriacea* was 158.2 ± 7.7 cm (range = 139–180 cm), while left side keel length (SKL) was 113.5 ± 6.2 cm and right SKL was 113.3 ± 6.1 cm (absolute mean length difference between left and right SKL = 1.6 ± 1.9 cm, range = 0–13 cm). The correlation coefficient (r) between CCL and left SKL was 0.80 (Fig. 3). The correlation coefficient (r) between CCL and right SKL was also 0.80, and both of these correlation coefficients were significantly different from zero ($p < 0.0001$). The correlation between left and right keels was also highly significant ($r = 0.92$, $p < 0.0001$), as was the correlation between CCL and the mean value of the two side keels ($r = 0.82$,

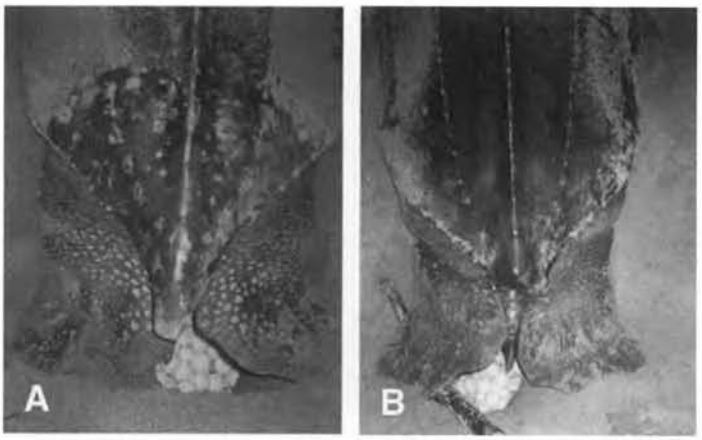


FIG. 1. A) Posterior half of carapace of a nesting *D. coriacea*, with an intact terminating peduncle. B) Posterior end of carapace of a nesting *D. coriacea* turtle with damaged terminating peduncle.

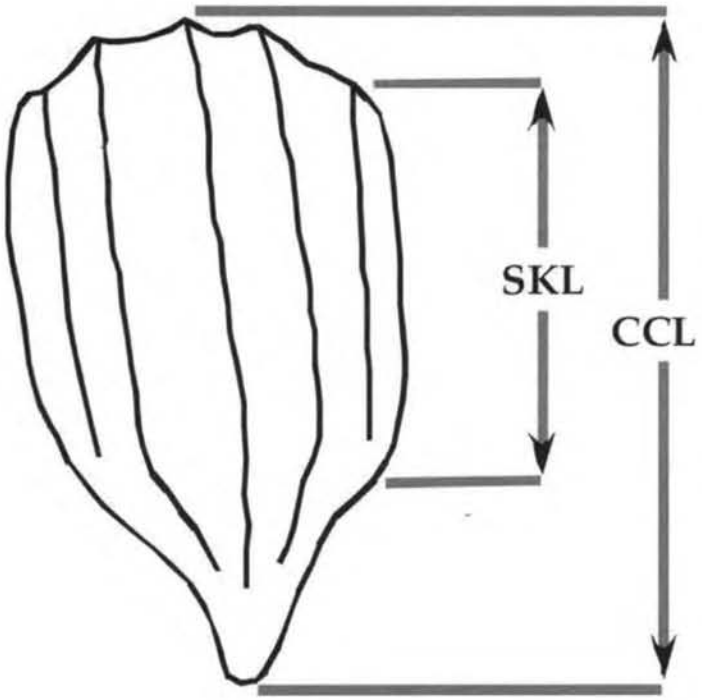


FIG. 2. Schematic representation of measurements collected from nesting *D. coriacea* females in French Guiana.

$p < 0.0001$). The equation for the linear relationship between left SKL and CCL is $Y = 0.995X + 45.26$, where X is the left SKL and Y is CCL. The equation for the right side keel is $Y = 1.008X + 44.06$. These equations can be used to estimate CCL from SKL for *D. coriacea* with damaged carapaces.

Based on our observations, it is possible to use SKL to estimate CCL. We found a significant correlation between SKL and CCL in non-injured *D. coriacea*. However, the correlation was not strong. It might be the case that the relationship between these two measures changes according to body size, perhaps with a different relationship for juveniles or subadults, and a likely difference between males and females. We also suspect that the relationship between these two measures might be population specific; hence we recommend that prior to using SKL as an index of CCL in other populations, a similar correlation analysis be performed. The variation in the relationship between side and center keel length in *D. coriacea* is also likely to be affected by the degree of curvature of the carapace. On high density nesting beaches in French Guiana and Suriname, we have observed a wide range of variation in curvature of the carapace of *D. coriacea*, ranging from oblique to sharp, and occasionally we have seen kyphotic individuals. This variation in curvature is not limited to *D. coriacea*, but is seen in other species of turtles, and is likely because of developmental defects (Tucker 1997. Bull. Maryland Herpetol. Soc. 33:171–177). One way to minimize the influence in variation in curvature is to collect straight-line measurements (Bjorndal and Bolten 1989. Bull. Mar. Sci. 45:189–192; Frazier, *op. cit.*). However, the calipers required to take straight-line measures are large and awkward, reducing their practicality in difficult and isolated field conditions. In many situations, including ours, CCL is the only feasible option for measurement of *D. coriacea*. In some cases, the carapace damage of nesting females affects an area large enough to impede measurement of the side keel length. If both sides of the carapace are damaged, we recommend excluding data from that individual from a dataset on standard lengths. However, we suggest that this method of estimating CCL will enable researchers to include more individuals in their studies, and will help standardize the measurement of CCL in *D. coriacea*.

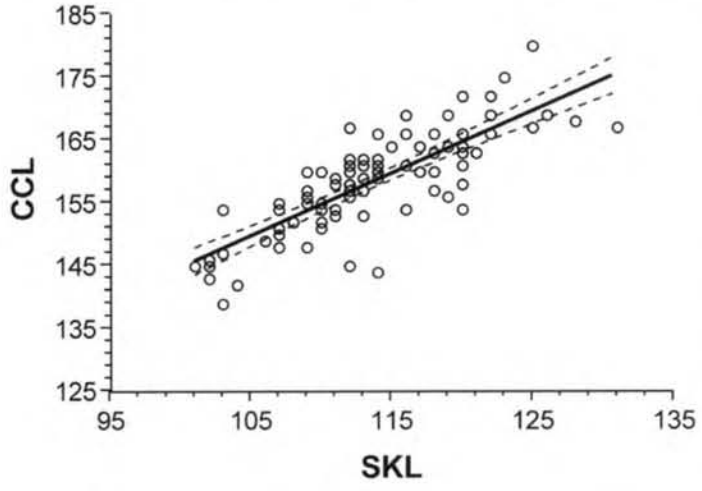


FIG. 3. Relationship between curved carapace length (CCL) and left side keel length (SKL) of 91 individual female *D. coriacea* in French Guiana. Simple linear regression analysis is shown by the solid line ($Y = 0.995X + 45.26$; $r = 0.80$), and the two dashed lines bind the 95% confidence interval.

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Submitted by **MATTHEW H. GODFREY**, Laboratoire d'Ecologie, Systematique et Evolution, University Paris XI, Bâtiment 362, 91405 Orsay, France & Réserver Naturelle de l'Amana, 270 avenue Paul Henri, 97319 Awala-Yalimapo, French Guiana (e-mail: matthew.godfrey@ese.u-psud.fr), and **OUISSEM DRIF**, 6, rue Koenig, 94700 Maisons-Alfort, France.

GRAPTEMYS GIBBONSI (Pascagoula Map Turtle). **PREDATION**. On 26 September 1999, a ca. 600 g spotted bass (*Micropterus punctulatus*) was caught in Pushepatapa Creek, NW of Hwy 21, in Washington Parish, Louisiana, USA. While cleaning the fish, a small specimen of *Graptemys gibbonsi* (NLU 70484) was dissected from the stomach. The turtle measured 35.6 mm in carapace length and 31.5 mm plastron length. It was a recently emerged hatchling as judged by the presence of an acute ventral flexure of the bridge along the longitudinal seam between pectoral-abdominal and marginal scutes, plus a plastral fontanelle indicating the presence of a fresh umbilical scar at the time of death. Damage to the specimen was limited to the margin of the posterior carapace where peripheral bones and/or marginal scutes were missing from ca. marginals 6–9 on the left and 4–12 on the right. Costal scutes 3 and 4 on the right were also missing.

There are no previous reports of specific predators for any life stage of this species (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, DC. 578

pp.). Predatory fish such as bass have only infrequently been reported to eat hatchling turtles (Semlitsch and Gibbons 1989. Copeia 1989:1030–1031; Britson and Gutzke 1993. Copeia 435–440); however, it is not possible to state whether the specimen reported here was ingested alive or dead. Both studies reported that *Micropterus salmoides* (largemouth bass) eat dead hatchling turtles, but not live ones. The presence of the hatchling in a fish at this location indicates that there is nesting along Pushepatapa Creek by *G. gibbonsi*, and that nest emergence occurs in late summer-early fall.

We thank Randy Lanctot for saving the specimen and depositing it in the Museum of Natural History.

Submitted by **JOHN L. CARR**, Department of Biology, The University of Louisiana at Monroe, Monroe, Louisiana 71209-0520, USA, and **MARTHA ANN MESSINGER**, 2022 Gemini Drive, Bastrop, Louisiana 71220-3467, USA.

CROCODYLIA

CAIMAN LATIROSTRIS (Broad-snouted Caiman). **COMMUNAL NESTING**. Communal nesting is described for many squamates (e.g., Capula and Luiselli 1995. Herpetol. Rev. 26:38; Rand 1968. Copeia 1968:552–561; Shanbhag 1999. Herpetol. Rev. 30:166; Swain and Smith 1978. Herpetologica 34:175–177), but little is known about this behavior among crocodilians. Yanosky (1990. Revue Fr. Aquariol. 17:19–31) mentioned communal nesting in *Caiman latirostris*, but did not detail his evidence. Here, I describe evidence for communal nesting in *C. latirostris* from Estancia El Lucero in the northern part of Departamento San Cristobal, Provincia de Santa Fe, Argentina.

During harvest of caiman eggs for Proyecto Yacare in the unusually dry season of January 2000, I discovered a small (ca. 1 ha) lagoon within a dense bulrush (*Scirpus*) and cattail (*Typha*)-dominated marsh 8 km N Estancia El Lucero (29°54'43"S, 60°50'36"W). This lagoon was the only body of water within 20 km. During my survey of the lagoon, I found 23 *C. latirostris* nests scattered in its floating vegetation that contained a total of 879 eggs. Three of these nests exhibited evidence of oviposition by more than one female: egg numbers were higher than clutch sizes reported for *C. latirostris*, clusters of eggs of at least two different sizes were present, and nests were at least partly divided into two or more chambers. Two of the three nests had 59–67 eggs, two different sizes of eggs, and partial division of the nest into two chambers. The remaining nest had 129 eggs, was divided into four chambers, but had a central chamber with eggs of different sizes, some of which were broken. These data suggest that 2 or 4 females created these nests. Clutch size range reported for *C. latirostris* (23–44, mean = 37.1; Larriera 1991. Rev. Asoc. Cienc. Nat. Litoral 22:19–23) is similar to the number of eggs in the other 20 nests I found in the lagoon (19–41; mean = 31.2), which supports the idea that one female made each one. Nests with evidence of communal oviposition did not differ substantially in size and shape from remaining *C. latirostris* nests.

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Submitted by **ALEJANDRO LARRIERA**, Proyecto Yacare (CONVENIO MAGIC/MUPCN), Pasaje Privado 4455 (Centeno 950), Santa Fe 3000, Argentina; e-mail: yacare@arnet.com.ar.

CROCODYLUS ACUTUS (American Crocodile). **HATCHLING DIET**. Few field studies of hatchling crocodilian diets exist, and the feeding ecology of hatchling *C. acutus* is unstudied. We provide the first report on the diet of hatchling *C. acutus* based on data from Turneffe Atoll, Belize, a ca. 50-km island chain located 35 km E of the mainland.

On 9 July 1997, we captured 26 hatchlings from a black mangrove (*Avicennia germinans*) lagoon (<1 ha) next to a known *C. acutus* nesting beach (Platt and Thorbjarnarson 2000. Copeia 2000:869–873) on Northern Cay (17°29'N, 87°47'W). Despite recent heavy rainfall, salinity (measured with an Atago S-10E® optical refractometer) in the lagoon matched that of seawater (34 ppt). Hatchlings were captured by hand from 2000 to 2230 h with the aid of a headlamp. Two adult crocodiles also present in the lagoon did not respond to distress calls of hatchlings during the latter's capture. Hatchlings were measured (total length [TL]; snout-vent length [SVL]; and head length [HL]: measured dorsally from the tip of snout to median posterior edge of the cranial roof), permanently marked by notching a unique series of caudal scutes, and then released at the capture site the next night. Mean (± SD) hatchling morphometrics were: TL = 28.8 ± 1.0 cm (range = 26.2–34.0 cm); SVL = 13.7 ± 1.0 cm (range = 12.4–16.3 cm); HL = 4.3 ± 3.1 cm (range = 3.9–5.0 cm); HL/SVL ratio = 0.31 ± 0.004 (range = 0.30–0.32). Based on presence of an egg tooth and open umbilical scar, 20 of the hatchlings were probably < 7 days old; the remainder were estimated at 7–21 days old.

Stomach contents were flushed using a modification of the technique Taylor et al. (1978. J. Herpetol. 12:415–417) described. A flexible plastic tube (30 cm long; 5.5 mm exterior diameter) lubricated with vegetable oil was eased down the esophagus and into the stomach. Water (ca. 4 cc) was slowly poured into the tube until the abdomen distended visibly. Gently palpating the abdomen caused a mixture of water and stomach contents to surge into the tube. The hatchling was then inverted and the mixture directed across a fine mesh screen. The process was repeated (usually 3–4 times) until only water free of stomach contents was observed.

We recovered prey items from 18 (69%) hatchlings; six of 20 (30%) hatchlings < 7 days old and two of six (33%) older hatchlings had empty stomachs, indicating that neonates initiate feeding within a week of hatching. Similarly, Platt (1996. The Ecology and Status of Morelet's Crocodile in Belize. Dissertation, Clemson University, Clemson, South Carolina) found hatchling *C. moreletii* began feeding 4–7 days post-hatching, and prey items have been recovered from 1–2-day-old *Caiman crocodilus* (JBT and T. Escalona, unpubl. data). Hatchling *C. acutus* with empty stomachs were not included in our dietary analysis. Stomach flushing suggests that hatchling *C. acutus* feed mostly on invertebrates. Insect remains were recovered from 12 (67%) hatchlings and consisted primarily of highly macerated bits of chitin and fleshy material unidentifiable to taxon, although one contained parts of a beetle (Coleoptera). The stomach contents of five (27%) hatchlings contained crustaceans, probably fiddler crabs (*Uca* sp.), which were abundant along the shoreline. Thorbjarnarson (1988. Bull. Florida State Mus., Biol. Sci. 33:1–86) found fiddler crabs to be the most important prey of juvenile (TL < 0.5 m) *C. acutus* in Haiti. A partially digested fish (length = 13.5 mm) recovered from one (5%) hatchling was the only vertebrate found among the stomach contents we examined. We expected higher levels of fish

consumption as this might be an important way for hatchling *C. acutus* to behaviorally osmoregulate in saline environments (Thorbjarnarson 1989. *In* P. M. Hall [ed.], Crocodiles: Their Ecology, Management, and Conservation, pp. 228–258. IUCN, Gland, Switzerland).

Fischer et al. (1991. J. Herpetol. 25:253–256) contend that hatchling *Alligator mississippiensis* cannot effectively capture small prey owing to a long snout in relation to body size (Mean HL/SVL ratio = 0.31; S.E. = ± 0.001; N = 288), and instead rely on metabolizing residual yolk as an energy source. However, no significant difference exists between the HL/SVL ratio of *C. acutus* and *A. mississippiensis* hatchlings (ANOVA; $F_{1,312} = 0.002$; $P > 0.05$), and the prevalence of prey remains among stomach contents indicates *C. acutus* neonates are adept predators, which begin feeding within 7 days of hatching. Therefore, failure of *A. mississippiensis* hatchlings to capture small prey might not be because of morphological constraints.

Submitted by **STEVEN G. PLATT**, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460-1099, USA (e-mail: splatt225@aol.com), **THOMAS R. RAINWATER**, The Institute of Environmental and Human Health, Department of Environmental Toxicology, Texas Tech University Box 41163, Lubbock, Texas 79409-1163, USA (e-mail: thomas.rainwater@tiehh.ttu.edu), and **JOHN B. THORBJARNARSON**, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460-1099, USA (Jthorbjarnarson@wcs.org).

CROCODYLUS INTERMEDIUS (Orinoco Crocodile). **AGE AT FIRST REPRODUCTION.** Hunting pressure has extirpated or nearly extirpated many crocodilian populations. As a consequence, conservation efforts in many countries have focused on both protecting land and head-starting wild-caught or farmed neonates which are then reintroduced to protected areas. Orinoco crocodiles, *Crocodylus intermedius*, were nearly extirpated in the Venezuelan llanos prior to a ban on their commercial harvest during the 1970s (Muñoz and Thorbjarnarson 2000. J. Herpetol. 34:397–403; Thorbjarnarson 1992. Crocodiles: An Action Plan for their Conservation, IUCN/SSC. 136 pp.). Since 1990, conservation efforts have resulted in the release of > 1300 juveniles in protected private and public lands (C. Chávez, pers. comm.). To date, only modest efforts have been devoted to assessing success of reintroduced individuals. Available data show that animals survive and remain in protected areas (Muñoz and Thorbjarnarson, *op. cit.*), but whether re-introduced individuals were reproducing was uncertain. Here, we document the successful nesting of reintroduced crocodiles in two large cattle ranches located in Distrito Muñoz, State of Apure, Venezuela (7°30'N, 69°18'W).

Both ranches, Hatos El Frío (80,000 ha) and El Cedral (54,000 ha), are located in the flooded savannas of the Venezuelan llanos that previously harbored *C. intermedius*, where hunting pressure had locally extirpated the species (Arteaga and Hernandez 1996. Proceedings of the 13th Working Meeting of the Crocodile Specialist Group, pp. 207–222, IUCN). In 1990, an initial group of 31 juveniles 1–4 years of age was released in Hato el Frío. In 1994, five juveniles were released in Hato El Cedral; four of these were born in 1993 (sizes ranging roughly from 60 to 80 cm in total length) and the remaining juvenile was between 3 and 5 years old. These reintroduced juveniles were regularly observed, but lack of appropriate nesting habitat in the near vicinity limited opportunities for reproduction. As a result, from 1996 to 2001 management built artificial nesting sites. These artificial sites consisted of ~1 m^3 holes excavated in the edges of the water bodies that were filled with river sand from beaches where *C. intermedius* had nested historically.

In March 1998, we found the first two nests (52 and 56 eggs) with fertile eggs. The females that laid these clutches were not captured, so their age is uncertain; however, this site had animals up to 12 years old. In March 2001, at least two of the females released in El Cedral laid eggs. Clutch fertility (30+ eggs in one case; predators destroyed the other nest) could not be assessed because ranch workers mistakenly removed the eggs and they were not incubated for any length of time.

Females that laid the eggs at El Cedral were not caught, but the only *C. intermedius* present were from the 1994 release. Thus, minimum reproductive age for females is no greater than 8 years because only one older *C. intermedius* was known to be present and two clutches were laid. Two of the released females caught in January 2001 were 322 and 342 cm total length, and weighed 145 and 175+ kg, respectively.

Some release sites selected for *C. intermedius* have been on public lands protected only on paper (Arteaga and Hernandez, *op. cit.*; Muñoz and Thorbjarnarson, *op. cit.*). Fishing and poaching have resulted, at best, in limited success for such public land re-introductions. Our data show that re-introductions on private lands where systematic protection is enforced can be successful, at least over a few years. Continued investigation of this promising pattern is needed to determine whether it will continue.

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Submitted by **JESÚS A. RIVAS,** National Geographic Television, 1145 17th Street NW, Washington, D.C. 20036, USA (e-mail: anaconda@prodigy.net), and **RENEE Y. OWENS,** 1152 Sloan Canyon Road, Jamul, California 91935, USA.

LACERTILIA

ANOLIS QUERCORUM (Gray Anole). **GENERAL ECOLOGY.** An unfortunate consequence of the huge diversity in the genus *Anolis* (> 300 spp.; Guyer and Savage 1986. Syst. Zool. 35:509–631) is that ecology of many species is unknown. Sparse knowledge for anoles is marked in México, where few taxa have been studied (e.g., Ramírez-Bautista and Vitt 1997. Herpetologica 53:423–431). Here, we address this gap through provision of a few data on the infrequently observed anole *Anolis quercorum*, a species for which no data have become available since its description from Nochixtlán, Oaxaca, México (Fitch 1978. Contrib. Biol. Geol., Milwaukee Pub. Mus. 20:1–15).

Over 4 days (14 May, 12 July, and 2 and 22 September 1998), we collected six *A. quercorum* (four females [field numbers: JLE 3004-5, 3024; and LOL 014] and two males [JLE 2551 and LOL

015]) in the town Zapotitlán de las Salinas, Puebla, México (19°07'19"N, 97°19'24"W) at 1420 m elevation. Vegetation consists of patchwork remnants of thorn forest, xerophilic brushland, and deciduous tropical forest (Rzedowski 1978. Vegetación de México. Editorial Limusa, México) heavily altered by human activities. All anoles were reproductively active adults caught on sunny days between 1300 and 1830 h. They were captured on or under rocks, a dead cactus (*Neobuxbaumia tetetzo*), or a dry "mesquite" tree (*Prosopis laevigata*). Shortly after a heavy rain at dusk on 22 September, we observed male LOL 015 attempt to court female LOL 014 from 1730 to 1830 h. Both anoles were perched in a mesquite tree. The male was facing downward ca. 2 m above the ground, and flashing his dewlap at the female located 1.25 m away and 0.75 m below the male. The female ignored the male despite his continued advances, and ultimately fled to a remote part of the tree. After 35 min of courting attempts by the male, the female jumped to a nearby rock heap, and concealed herself. The male then positioned himself in front of the rock heap for ~15 min, but then returned to the tree, where he again began flashing his dewlap.

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Submitted by **AURELIO RAMIREZ-BAUTISTA, LUIS OLIVER-LOPEZ,** and **VICENTE MATA-SILVA,** Facultad de Estudios Profesionales Iztacala, Unidad de Biología, Tecnología y Prototipos (UBIPRO), Laboratorio de Ecología, Universidad Nacional Autónoma de México, Avenida de los Barrios s/n, los Reyes Iztacala, Tlalnepantla, Edo. de Mex. C.P. 54090, A.P. 314; e-mail (ARB): raurelio@servidor.unam.mx; (LOL): bufohammer@yahoo.com; and (VMS): vimasil@yahoo.com.

ANOLIS SMALLWOODI (Chipojo). **FOOD HABITS**. Schwartz and Henderson (1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions and Natural History. Univ. Florida Press, Gainesville. 720 pp.) note that in captivity *Anolis smallwoodi* consumes plant matter, meat, other anolines, and house mice. However, no reports on the diet of *A. smallwoodi* under natural conditions exist. Here, we provide the first field report of *A. smallwoodi* diet.

On 12 September 1999, we witnessed an adult *A. smallwoodi* (ca. 150 mm SVL) eating a juvenile (ca. 45 mm) Cuban treefrog, *Osteopilus septentrionalis* (Hylidae), in the Botanical Gardens of Santiago de Cuba. The lizard sat on the shaded branch of a Salvadera tree (*Hura crepitans*) 8 m above the ground. When first observed at 1000 h, the anole had grasped the hindquarters of the frog, and the latter was emitting squeaks similar to those when it is being swallowed by a Cuban racer, *Alsophis cantherigerus* (see Buide 1985. Reptiles de Cuba, Gente Nueva, La Habana, 90 pp.). For ca. 1 h, the anole tried to swallow the frog, shaking it vigorously and striking it against the branch until the frog stopped moving or vocalizing. For another hour, the lizard kept repositioning the frog in attempts to swallow it. Finally around 1200 h, the *A. smallwoodi* swallowed the frog. During the 2 h of prey handling, the anole changed position several times, switched branches, went up and down ca. 40 cm in the tree, but always remained in the shade.

This is the first record of *A. smallwoodi* consuming an anuran. Some giant anoles are known to prey on vertebrates (Losos et al. 1991. Caribb. J. Sci. 27:173–179), such as amphibians, anoline lizards, and birds. Nevertheless, among Cuban giant anoles, only *A. equestris* has been reported to feed on *Osteopilus* (Schwartz and Henderson, *op. cit.*). The lengthy prey handling interval may indicate that *O. septentrionalis* is infrequent prey for *A. smallwoodi*.

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Submitted by **ANSEL FONG G.**, Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), Museo de Historia Natural "T. Romay," Enramadas #601, Santiago de Cuba 90100, Cuba (e-mail: ansel@bioeco.ciges.inf.cu), and **JOSEFINA BLANCO OJEDA**, Departamento de Biología, Universidad de Oriente, Santiago de Cuba, Cuba.

ANOLIS SMALLWOODI SMALLWOODI (Chipojo). **MAXIMUM SIZE.** The reported maximum size (as SVL) for *A. smallwoodi smallwoodi* is 158 mm for females and 172 mm for males, both from Sierra Maestra in eastern Cuba (Schwartz 1964. Bull. Mus. Comp. Zool. 131:403–428, Schwartz and Garrido 1972. Stud. Fauna Curacao Caribbean Isl. 134:1–86). Here, I report on a larger individual also collected in eastern Cuba.

At 1430 h on 8 December 1996, Leopoldo Viña collected a female *A. smallwoodi* from the branch of shrub 2.5 m above the ground in a garden in the village of El Modelo, El Caney, Santiago de Cuba Province (20°02'46"N, 74°46'40"E). This female *A. smallwoodi smallwoodi* was 177 mm SVL (tail = 325 mm, mass = 155 g), which exceeds the previous record for the species by 5 mm, and for females by 19 mm. The specimen (BSC.H 828) was deposited in the herpetological collection of the Centro Oriental de Ecosistemas y Biodiversidad (BIOECO) in the Museum of Natural History "T. Romay".

I thank Leopoldo Viña for donating the specimen, John E. Cadle for providing key literature, Iliana Boza for helping with the English translation, and Renata Platenberg for her review.

Submitted by **ANSEL FONG G.**, Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), Museo de Historia Natural "T. Romay," Enramadas # 601, Santiago de Cuba 90100, Cuba; e-mail: ansel@bioeco.ciges.inf.cu.

EGERNIA STOKESII (Gidgee Skink). **OPPORTUNISTIC DISPERSAL.** In the Flinders Ranges of South Australia, *Egernia stokesii* occupy crevices in isolated rocky outcrops (Gardner et al. 2001. Mol. Ecol. 10:175–183). In these outcrops, we have recorded *E. stokesii* family groups of up to 17 lizards forming stable aggregations that can persist for over five years. Multiple groups can be found in an outcrop, group members share small home ranges, and dispersal is relatively rare (Gardner et al., *op. cit.*). Some lizards that occupy crevices on the edges of family group territories, termed floaters, may have greater opportunity for dispersal. Here we report on the car-mediated opportunistic dispersal of a male floater, recorded during our six-year (1992–98) study of 17 family groups occupying a single 1.5-ha outcrop,

Camel Hill, near Hawker (31°53'26"S, 138°25'24"E), South Australia.

We first recorded and individually marked a male *E. stokesii* (182 mm SVL) on the Camel Hill outcrop during the 1995–96 field season, when it occupied marginal crevices in the abutting territories of two stable family groups. Undetected during the 1996–97 field season, we recaptured this male in May 1997 (two months after completion of fieldwork) in the engine of GAD's car in Adelaide, 500 km S of the study area. The car had been regularly parked at a location 350 m from the outcrop. We inferred from deposited scats and scratch marks in the oil that the lizard had occupied the engine for some time. The front grill of the car had accumulated numerous grasshoppers over the previous summer. Scat deposits contained grasshopper remains. Crevice-like aspects of the engine structure and/or presence of grasshoppers on the grill may have induced this male *E. stokesii* to take up residence in the car's engine.

After being kept over winter in Adelaide, we released the male *E. stokesii* the following spring (September 1997) in a crevice it previously had occupied on the Camel Hill outcrop. We recaptured it on the outcrop in October 1997, but it moved to a rock pile 300 m north of Camel Hill in the same month, and was not subsequently seen.

Our observation indicates that opportunistic transport can result in the movement of *E. stokesii*, and that this form of dispersal, albeit rare, may provide opportunities for range expansion. We thank the Australian Research Council for supporting this research.

Submitted by **GLEN A. DUFFIELD** and **C. MICHAEL BULL**, School of Biological Sciences, Flinders University, GPO Box 2100, Adelaide, South Australia 5001, Australia; e-mail (CMB): michael.bull@flinders.edu.au.

HELODERMA SUSPECTUM (Gila Monster). **EGG PREDATION BY JUVENILES**. Highly specialized, wide-ranging foraging for patchily distributed vertebrate nests (e.g., newborn mammals in their burrows, ground-nesting bird eggs and nestlings, and tortoise eggs) is a well-documented aspect of the life history of adult *Heloderma suspectum* (Beck 1990. J. Herpetol. 24:56–68; Jones 1983. Herpetologica 39:247–253; Porzer 1981. Movement, Behavior, and Body Temperature of the Gila Monster, *Heloderma suspectum* Cope, in Queen Creek, Pinal County, Arizona, Masters Thesis, Arizona State Univ., Tempe. 100 pp.). However, no published studies to date have addressed the diet of juvenile Gila monsters, which are rarely observed in the wild. Lowe et al. (1986. The Venomous Reptiles of Arizona, Ariz. Game and Fish Dept., 115 pp.) and Brown and Carmony (1991. Gila Monster: Facts and Folklore of America's Aztec Lizard, High-Lonesome Books, New Mexico, 127 pp.) refer to the ability of "young" Gila monsters to consume 50% of their body weight, but the age, size, diet, and status (captive or wild) of the *H. suspectum* supporting their statements was not reported. Accordingly, I provide here the first report of juvenile Gila monster diet in the wild.

I removed the stomach contents of two juvenile *H. suspectum* salvaged as road-kills in Arizona. Both of these specimens, along with four of six reptile eggshells in their stomachs, are deposited in the California Academy of Sciences (CAS). I salvaged the first (CAS 212926: 130 mm SVL, 66 mm TL) as a fresh kill on 3 August 1996 at 0714 h on U.S. Hwy I-10 frontage road 0.6 mi E State Hwy 83 (~20 mi SE Tucson), Cochise Co. The small size of this specimen is notable as it falls within the range of captive-hatched neonates (Peterson 1982. Herpetol. Rev. 13:122–124; unpubl. SVL data for 43 neonates: mean = 127 mm; range = 108–143 mm). Three reptile eggs and a small amount of mammal hair were retrieved from its digestive tract. Measurements of the eggshells inflated with water prior to preservation were 17.0 x 11.5 mm, 17.0 x 11.5 mm, and 18.3 x 11.5 mm. The second juvenile (CAS 212927:175 mm SVL, 88 mm TL) was salvaged as a fresh kill by Brendan McGraw on 17 August 1990 at 2056 h on State Hwy 96 at MM 6 between the towns of Hillside and Bagdad, Yavapai Co. I also removed three reptile eggs from this specimen. Shells of two of the eggs measured 18.0 x 12.5 mm and 20.0 x 12.5 mm (the third egg was not precisely measured but was the same size as the other two). In each specimen, all eggs were in the same initial state of digestion, suggesting that they were consumed as a group. If the two sets of three eggs represent an entire clutch, their size, shape, and number indicate that they are likely to be lizard eggs, perhaps those of *Cnemidophorus tigris* (Fitch 1970. Univ. Kansas Mus. Nat. Hist. Publ. 52:1–247; Fitch 1985. Univ. Kansas Mus. Nat. Hist. Publ. 76:1–76; BMM, unpubl. data).

Reptile eggs, typically deposited in well-concealed, often subterranean locations, are presumably widely distributed in the wild. The difficulty in locating such prey testifies to the well-developed sensory capability of Gila monsters at an early age, a capability previously only documented in adult *H. suspectum*. These stomach contents also show that the widely foraging strategy of adults to prey on nests also extends to juvenile Gila monsters.

Specimens were collected under authority of Arizona Game and Fish Department Scientific Collecting Licenses SP655335 (CAS 212926) and SP780427 (CAS 212927).

Submitted by **BRIAN M. McGURTY**, 24419 Top Court, Diamond Bar, California 91765-1870, USA; e-mail: mcgurty@adelphia.net.

LEIOCEPHALUS MACROPUS (Bayoya). **SAUROPHAGY**. *Leiocephalus macropus* is a moderate-sized (75–95 mm SVL) terrestrial lizard (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions and Natural History. Univ. Florida Press, Gainesville. 720 pp.) that feeds primarily on invertebrates (insects, spiders, centipedes, and mollusks), but also consumes plant material, mainly flowers (Sampedro et al. 1979. Cien. Biol. 3:129–139). Saurophagy and cannibalism had been reported for other generally larger Cuban species of *Leiocephalus*—*L. carinatus* (Martínez and Rodríguez 1987. Misc. Zool. 29:1–2), *L. stictigaster* (Martínez et al. 1990. Poeyana 403:1–18), and *L. cubensis* (Martínez and Fernández 1994. Cien. Biol. 26:21-29; Milera 1984. Misc. Zool. 22:2)—but never for *L. macropus*. Here, we provide the first report of saurophagy in *L. macropus*.

During a recent study of the trophic ecology of lizards of Eastern Cuba, two adult (67 and 68 mm SVL) male *L. macropus* were collected at Siboney, Santiago de Cuba on 10 March 1998. Both individuals were collected as they were climbing on rocks in xeric coastal shrub (Capote and Berazaín 1984. Rev. Jardín Bot. 5:1–49). Examination of the gastrointestinal tract of the larger male

revealed an adult *Anolis jubar* (40 mm SVL, 1.66 g mass) and several insects, principally ants and beetles. *Anolis jubar* is an abundant lizard in Siboney, commonly found on the ground and at the base of tree trunks (Castillo 1998. Partición del Nicho Ecológico en la Comunidad de Saurios de la Reserva Natural Siboney, Santiago de Cuba. Tesis de Licenciatura, Santiago de Cuba). These characteristics and the fact that *L. macropus* forages on the ground would potentially make *A. jubar* relatively accessible prey for *L. macropus*.

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Submitted by **ANSEL FONG G.**, Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), Museo de Historia Natural "T. Romay," Enramadas # 601, Santiago de Cuba 90100, Cuba (e-mail: ansel@bioeco.ciges.inf.cu), and **E. B. DEL CASTILLO**, Departamento de Biología, Universidad de Oriente, Santiago de Cuba, Cuba.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard). **NOCTURNAL NESTING, EGGS, NEST PREDATION, HATCHLINGS.** In reporting nocturnal nesting of *Phrynosoma modestum* (Sherbrooke 2000. Herpetol. Rev. 31:242–243), I reviewed nesting reports of *P. cornutum,* which included diurnal and nocturnal observations. Between 29 May and 1 June 2000 three female Texas horned lizards (that later nested) were road collected in the Playas Valley, Hidalgo Co., New Mexico, USA (Sherbrooke 2002. Herpetol. Rev. 33:21–24). Snout–vent length (SVL) and mass were as follows (in sequence of lizards presented below): 88 mm, 40.7 g; 103 mm, 66.3 g; 104 mm, 68.5 g. They were maintained with other *P. cornutum* in captivity at the Southwestern Research Station, Portal, Arizona, in an outdoor screened cage, 7.0 x 3.8 x 2.4 m. Animals were fed seed-harvester ants (*Pogonomyrmex* spp.; Sherbrooke 1995. Herpetol. Rev. 26:25–26) and crickets (*Acheta domesticus*) daily, and provided with water by hose sprinkler and natural rainfall for "rain-harvesting" (Sherbrooke 1990. J. Herpetol. 24:302–308). While held in captivity all three females gained weight from time-of-capture mass. Nest sites, nesting activities, and hatchling emergence were photographed.

On 25 July (0730 h MST) a group of 24 *P. cornutum* was moved from the holding cage, where the soil was compact clay, to an identical unit in an animal behavior observatory that had looser and sandier soil, and an alternately-arranged pattern of artificial "shrubs" of *Ephedra trifurca* branches (70 cm high) and groups of four rocks (5 cm diam), spaced at 1 x 0.75 m. Lizards were numbered (18 point type) dorsally with glued-on white paper tags. Two females proved to be gravid; 25 July mass of each was 53.3 g and 71.0 g. Previous rainfall in July was 2.7 cm, with 1.4 cm falling 16 July, and early-evening trace amounts falling on 23, 25, and 26 July. On 29 July 0.4 cm of rain fell. Daily 24-hour high and low temperatures (between 1700 h) were as follows: 24–25 July 32.7/13.3°C; 25–26 July 32.7/15.0°C; 26–27 July 32.9/18.3°C.

At 2045 h on 25 July one female was discovered digging a nest in the moist soil midway between a shrub and rock site. She was completely underground in the slanted tunnel (in further than 5 cm). Freshly-dug soil was scattered at the surface. The following morning (26 July; 0730 h) the filled-in tunnel was covered to the surface where the female was resting. The soil covering the entrance was distinct from the surrounding soil. A coin was placed on the entrance site. By 1030 h the surface had been covered with scattered pebbles, matching the texture of surrounding areas, and the penny was buried from view. The lizard, sitting under a shrub when I entered the cage, moved toward the nest, a behavior repeated when I again entered at 1300 h. On 28 July this female weighed 32.3 g, having lost 21.0 g (39.4% of pre-laying body weight).

At 2100 h on 26 July a second female in the same group and cage was found digging a nest in moist soil midway between a shrub and rock site. At 2200 h she was actively working underground, but with her tail and hindquarters visible. By six hours later (0400 h; 27 July) she had laid her clutch of eggs and refilled most of the soil in the tunnel to within 5 cm of the opening. She was still working at this task. Facing away from the tunnel, she raked soil behind her, with front and hind legs, into the remaining entrance of the tunnel and then turned 180° to face into the depression. Then she repeatedly head butted the soil so as to compactly fill the cavity. By 0515 h the underground/covered tunnel was filled in, but the female was still below the surface level in the indentation leading to the tunnel. At 0715 h she was in final stages of covering the depression with surface sand and gravel when a light rain started. At 0930 h scratch marks were noted in areas adjacent to the former entry indicating where surface materials had been removed to disguise the nest. On 28 July this female weighed 40.1 g, having lost 30.9 g (43.5% of pre-laying body weight).

The morning of 31 July both nest sites were excavated for examination of nest tunnel form, and egg recovery. The former tunnel entrance of the first nesting was oriented toward the north-northwest. The delicate eggs were 16 cm down the soil-filled tunnel, with the uppermost layer of eggs at 12 cm deep. Eggs were tightly packed with damp sandy soil in a terminal oval chamber which measured 2.5 cm deep and 5 cm across. Twenty eggs were recovered, four of which were broken; several more leaked tiny amounts of fluid. The orientation of the opening of the second nesting had also been toward the north-northwest. The former-tunnel channel sloped downward for about 10 cm before reaching the top of a spherical terminal chamber, 4 cm deep and 5.5 cm across. The uppermost eggs, tightly packed in moist soil, were 12 cm below the soil surface. The 40 eggs were arranged in three to five layers, all in very close proximity to each other. Three eggs were damaged and not weighed.

Of the first clutch, 16 eggs were weighed: mean = 1.16 ± 0.05 SD g/egg. Using the mean-egg-weight for the four unweighed eggs, the estimated mass of the 20-egg clutch was 23.14 g. This was 2.14 g more than the laying-associated weight loss (21.0 g) of the female, indicating a clutch weight gain of 9.2% (apparently due to water uptake and soil adhesion).

Thirty-seven of the second-clutch eggs were weighed: mean = 0.87 ± 0.05 SD g/egg. Using the mean-egg-weight for the three unweighed eggs, the estimated mass of the 40-egg clutch was 34.89 g. This was 3.99 g more that the laying-associated weight loss (30.9 g) of the female, indicating a clutch weight gain of 11.4% (seemingly because of water uptake and soil adhesion).

A third female was fitted with a Holohil PD-2 radiotransmitter (3.4 g; 148 kHz, pulse 0.6 sec; whip antenna 16 cm; glued to the

central back with clear silicone and sprinkled with soil for background camouflaging) and released 12 July 2000 (1130 h; lizard mass 75.6 g) in Chihuahuan Desert habitat 5 km E of Portal, Arizona, in the San Simon Valley. During the subsequent five days the lizard was relocated 2–3 times/day (13 times).

When located at 2135 h (air temperature, AT 27°C) on 14 July the lizard was in the process of excavating a cavity in moist soil into which its head and body had entered, but into which it did not disappear from view. The lizard removed soil with its hind feet while digging with its forefeet. Later, when revisited at 2330 h there was only minimal progress on enlarging the cavity. The next morning (15 July) at 0930 h (AT 31°C) the lizard was found in the shade of an *Acacia constricta* one meter from the cavity entrance. The east-facing opening was 3–4 cm high, 7 cm wide, and 12 cm deep, with a notch in the roof apparently worn by the radiotransmitter package. At 1320 h (AT 35°C) the lizard was 2 m from the cavity at the base of an acacia shrub, and the cavity, with a pile of soil at the entry, appeared undisturbed since morning. That night, at 2140 h (AT 24°C), the female was back digging in the nest, at times entirely underground. The following morning (0900 h; AT 28°C; 16 July) the lizard was encountered standing high on stretched legs while facing the sun from on top of the former-cavity entry, now completely filled and covered with soil. By 1330 h (AT 31°C) the nest-cavity site had been raked over with small pebbles, as had two or three places up to 0.75 m away; the lizard was 2 m away in the shade of a shrub. Heavy rain fell at 1400 h. At 2125 h (AT 24°C) the female was sleeping 4 m from the nest under an acacia shrub, and the following day (17 July) by 1330 h she was 100 m away. Later (2205 h), she was recaptured, still distant from the nest site. This lizard's mass on 18 July (0700 h) was 42.2 g, with a weight loss of 33.4 g (44.2% of pre-laying body weight). Nesting was accomplished over a two-night period, with intervening cessation of digging activities during the heat of day.

On 29 July (0710 h) this desert nesting site was revisited and found to have been disturbed (and predated). When excavated, the tunnel cavity was found to be 22 cm long. Seven eggs (five of which were damaged during removal) were located 10 cm below the surface; weights of two intact eggs were both 1.09 g. Based on female loss of body mass (in laying eggs) and increased weights of eggs hydrated in nests (see two captive females above), I estimate that eggs gained 10% in mass after laying (10% above female body-weight loss). Thus, this radiotelemetered female, having lost 33.4 g in laying, must have had a nest clutch weighing 33.4 + 3.3 (10% gain) = 36.7 g. With an egg weight of 1.09 g for recovered nest eggs, the unpredated clutch size is estimated to have been 33.7 (probably 34) eggs. The disturbance characteristics of the nest site (a narrow hole) by the predator and its extraction of eggs from the long tunnel cavity suggests that an ophidian predator consumed 27 eggs, 79.4% of the clutch.

Considering the SVLs of the three gravid females (88, 103, and 104 mm), the smallest lizard laid the lowest percentage of its body weight as percent body-mass lost (39.4%, 43.5%, and 44.2%), and the smallest female laid the smallest clutch of eggs (20 vs. 40 and 34-estimated).

Eggs of the three females were placed on dampened vermiculite (50% distilled water by weight) in glass bowls inside clear plastic bags (Zweifel 1961. Copeia 1961:112–113) and incubated at 23.3–33.3°C. Two eggs (of the remaining four) of the field-predated nest hatched 21 September 2000, after 68 days; the remaining two eggs had molded. Hatchling masses were 0.81 and 0.83 g; dry shell masses were 0.05 and 0.07 g. The same day four eggs (N = 16 incubated, of 20), from the first cage-nesting female, hatched 59 days after laying. Five more eggs of this clutch hatched the following day, and the final seven eggs hatched on the next day, 23 September. Included in these successfully incubated eggs were several that had leaked some egg fluid when removed from the nest site. Hatchling mass was mean = 0.87 ± 0.07 SD g, and shell mass was mean = 0.04 ± 0.02 SD g.

On 23 September the eggs (N = 36 incubated, of 40) of the second cage-nesting female were moved, in anticipation of hatching, from the incubation chamber into the bottom of a glass aquarium (15.5 x 51 x 31 cm high) where they were arranged in a single-layer, six-eggs x six-eggs square pattern, 6 cm across. More than half of the eggs leaked fluid as a result of handling. Eggs were covered with 8 cm of moist, sandy soil. The tank was usually placed in the sun during the day, and indoors at night. On 25 September at 0600 h several eggs had started hatching, 62 days after being laid. They were seen through the glass bottom of the tank. On the 26th and 27th of September additional hatching movements were noted. A hardened evaporation-soil-crust had formed by the early morning of the 28th and this was broken up and removed, thus reducing the soil-cover depth to 6.5 cm. One emerging hatchling was uncovered in the process. Hatchlings continued appearing at the surface throughout the afternoon and evening (1200–2200 h), and by 0630 h on 29 September 32 hatchlings had emerged via seven exit holes (4.57 hatchlings/hole). Up to four hatchlings simultaneously occupied an expanded exit-hole opening before fully emerging onto the soil surface. The exit holes covered an area 6 x 10 cm. Twenty-one of the surfaced hatchlings (N = 32) had egg teeth; in 11 hatchlings egg teeth were missing. Of those egg teeth in place, some were loosely attached, and some were still tightly attached. At 1400 h (30 September) the remaining unemerged eggs were excavated. They were located at the bottom of the soil, on the aquarium glass. All four hatchlings had partially emerged, one its head only, and three with head and front legs emerged. Three were dead (and partially deteriorated), and one was breathing. By 1700 h the live lizard had extricated itself from its shell; its weight (0730 h, 1 October) was 0.61 g, low for its clutch. What its fate would have been if it had remained undisturbed is unknown. But, another hatchling of identical mass (the lowest) had emerged earlier to the surface.

The emerged hatchlings were weighed (mean = 0.73 ± 0.05 SD g). Thus the mean mass of each hatchling was 83.9% of the initial (nest) egg mass (mean = 0.87 g). This compares to the 1-day earlier nesting by the smaller female where the mean mass of each hatchling (0.87 g) was 75.0% of mean initial (nest) egg mass (1.16 g). Of the two, the smaller female laid larger eggs which produced larger hatchlings.

Burrow (2000. MS. Thesis, Oklahoma State University, Stillwater. 144 pp.), working with radiotelemetered *P. cornutum* in southern Texas, found seven nests all dug in the morning and concealed by evening or the following morning (no night observations). Nests were located under shrub clumps, where herbaceous vegetation was absent. Nests were usually dug straight down and later turned 90 degrees. The three Arizona nestings of *P.*

cornutum reported here, also another nesting of *P. cornutum* reported earlier and one for *P. modestum* (Sherbrooke 2000, *op. cit.*), contrast with the southern Texas observations of *P. cornutum* by Arizona nests (1) being located away from shrubs, (2) being dug, oviposited, and covered at night, and (3) being sloped into the soil. Regional climatic conditions or genetic differences might play a role in nesting behavior of *P. cornutum*.

Submitted by **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA; e-mail:wcs@amnh.org.

PHRYNOSOMA HERNANDESI (Short-horned Lizard). **SUCCESSFUL OPEN-MOUTHED THREAT DEFENSE.** On 11 April 1988 at 1600 h MST a group of three individually color-banded Mexican jays (*Aphelocoma ultramarina*), part of a resident flock of 18 individuals under study at the Southwestern Research Station in the Chiricahua Mountains of southeastern Arizona, were seen by one of us (ERB) to be mobbing an adult *Phrynosoma hernandesi*. One bird picked up the lizard in its beak and flew to a branch of an alligator juniper (*Juniperus deppeana* Steud.), about 1.5 m off the ground, where all three birds congregated. Shortly the lizard freed itself from the bird and dropped to the ground. The dominant bird (the dominance hierarchy of this flock has been studied) continued pursuit, keeping the other two birds from approaching the lizard. The lizard raised itself up on all four legs, faced the bird and opened its mouth widely (showing red inside; observed with binoculars). Hissing, often exhibited with open-mouthed defensive displays in various species of horned lizards (Sherbrooke 1991. Am. Midl. Nat. 126:187–195; Sherbrooke and Middendorf 2001. Copeia 2001:1114–1122), was not heard, but might have been executed. The defense was successful as the jay, known to eat some lizards (Brown 1994. *In* A. Poole and F. Gills [eds.], The Birds of North America, No. 118:1–16), flew away leaving the lizard (5–10 min after originally seen) apparently unharmed and defensively motionless on the ground. No defensive blood-squirting (Middendorf and Sherbrooke 1992. Copeia 1992:519–527) was observed. On 9 April 1999 a two-year-old juvenile Mexican jay from a neighboring resident flock (a second bird was seen departing) was observed (by Adrienne Smith for 12 min beginning at 1645 h MST) pecking a small-adult short-horned lizard (approximate snout–vent length 70 mm) on a branch while sitting in an alligator juniper. The lizard was held by the bird in its feet and was pecked at vigorously, and later was held in its beak before the bird departed with the dead lizard. One of these observations documents a successful use of a postulated antipredator display, open-mouth threat, against a predatory species. The second observation shows that the Mexican jay can be a lethal horned lizard predator.

Submitted by **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA (e-mail:wcs@amnh.org), **ESTHER R. BROWN** and **JERRAM L. BROWN**, Department of Biological Sciences, State University of New York at Albany, Albany, New York, 12222, USA (e-mail:JLB81@albany.edu).

PHRYNOSOMA HERNANDESI (Short-horned Lizard). **DEFENSIVE HISS.** On 24 July 1993 a gravid adult female (SVL 78 mm; mass 39.2 g) was collected 5.3 miles S jct. NM Hwy 130 on NM Hwy 6563 south of Cloudcroft, Lincoln National Forest, Sacramento Mountains, 2727 m elev., Otero Co., New Mexico (USA), and brought to Portal, Arizona. When handled this lizard exhibited open-mouth threats and hissed, and on 26–27 July 1993 recordings were made of four hiss sounds at room temperature. Oscillograms and frequency spectrograms were prepared of the four similar hisses; one was selected for illustration (Fig. 1). Open-mouthed threats and hissing have been reported in several species of *Phrynosoma* (Carpenter and Ferguson 1977. *In* Gans and Tinkle [eds.], Biology of the Reptilia Vol. 7, Ecology and Behaviour A. pp. 335–554. Academic Press, London; Sherbrooke 1991. Am. Midl. Nat. 126:187–195), but their audio characteristics have not previously been analyzed.

The recordings were made with a Marantz PMD 430 stereo-cassette tape recorder (flat response to 19 kHz) fitted with a Schoeps CMC-4-UK cardioid response microphone (flat response to 22 kHz; a Sennheiser MZW 201 windscreen protected the microphone) and a customized microphone preamplifier. The tape recording was transferred to a computer via an analogue:digital converter (8bits; 60,000 samples/sec), and the digital signal was filtered (high-pass, set at 200 Hz) and analyzed by appropriate software which also provided the printout.

The hisses ranged from 220 to 228 ms in duration (Fig. 1a), and had frequencies extending from < 0.5 kHz to > 5 kHz (Fig. 1b). This broad frequency range is comparable to that found in the warning sounds (rattling) of rattlesnakes (Young and Brown 1993. Amph.-Rept. 14:373–380; Cook et al. 1994. Herpetologica 50:358–368), which can vary with temperature (Martin and Bagby 1972. Copeia 1972:482–485), and whose characteristics can be assessed by some potential prey of rattlesnakes (Swaisgood et al. 1999. Anim. Behav. 57:1301–1310) and possibly their potential predators.

Hisses and other sounds produced by animals during defensive displays may startle potential predators (Edmunds 1974. Defense in Animals: A Survey of Anti-predator Defenses. Longman Group Limited, Essex. 357 pp.; Young et al. 1999. J. Herpetol. 33:557–566) by engaging an additional sensory modality—an auditory one—in an abrupt fashion so as to trigger reflexive defensive responses. The widespread ability of vertebrate hissing, resulting from exhalation of respiratory air (Gans and Maderson 1973. Amer. Zool. 13:1195–1203), to elicite startle responses suggests its defensive utility. The behavioral context of hissing by horned lizards fits this pattern. One adaptive value of broad-band hisses may be that they are likely to be heard by diverse receivers having different auditory ranges. We suggest that hissing behavior by horned lizards might be one component of a multiple array of displays exhibited in response to approach by particular predators. Moreover, the broad-band frequency characteristics of the hiss (hostile in bird and mammal communications; Morton 1977. Am. Nat. 111:855–869) are similar enough to snake hisses, rattlesnake rattling, and hostile homeotherm acoustic communications as to cause some predators to innately hesitate, thus disrupting subjugation-attack sequences. Functioning thus, hissing might be an antipredatory form of acoustic Batesian mimicry (Rowe et al. 1986. Ethology 72:53–71).

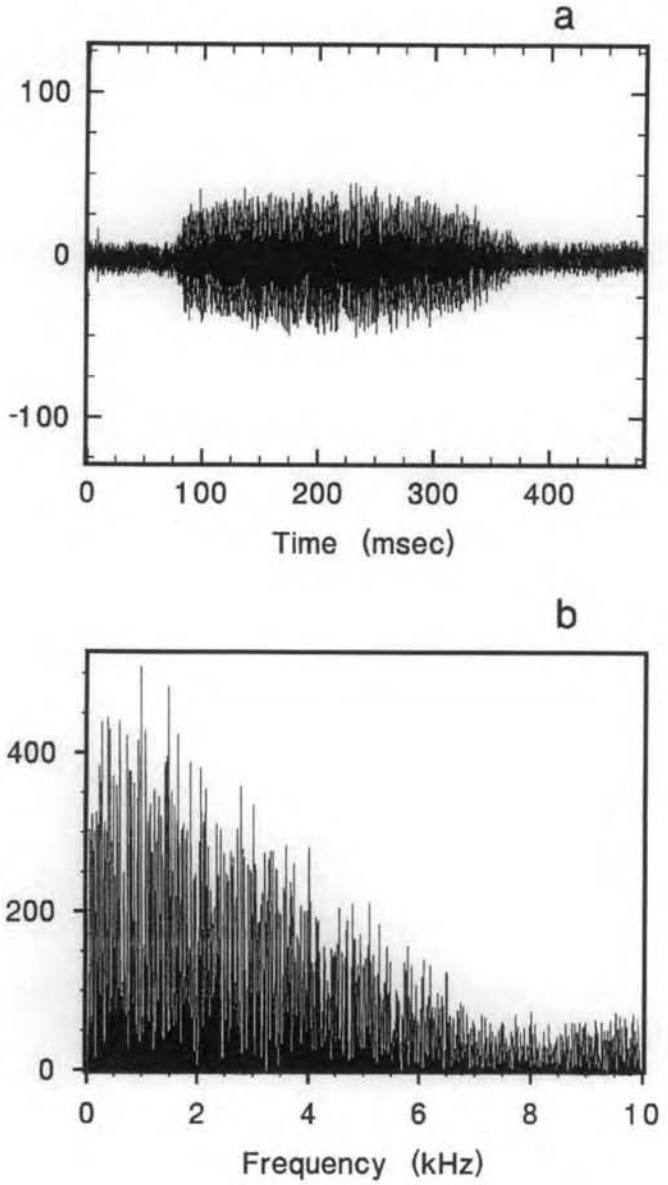


FIG. 1 (a). Oscillogram illustrating energy versus time of *Phrynsoma hernandesi* hiss induced by human handling. (b). Frequency spectrogram of *Phrynosoma hernandesi* hiss induced by human handing. In both (a) and (b) the y-axis is scaled in arbitrary, linear units.

Submitted by **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA (e-mail: wcs@amnh.org), and **MICHAEL D. GREENFIELD**, Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, Kansas 66045-2106, USA (e-mail: greenfie@ukans.edu).

TUPINAMBIS TEGUIXIN (Teiú, Tegu). **DIET**. *Tupinambis teguixin* is reported to have a generalized diet. Foods range from seeds and fallen fruits to a suite of vertebrates (fishes, amphibians, lizards, snakes, birds, and small mammals) and invertebrates (arachnids, gastropods, and insects) (Cei 1986. Monog. IV, Mus. Reg. Sci. Nat. Torino, 527 pp.; Cei 1993. Monog. XIV, Mus. Reg. Sci. Nat. Torino, 949 pp.; Dessem 1985. Copeia 1995:245–247; Duellman 1978. The Biology of an Equatorial Herpetofauna in Amazonian Ecuador. Misc. Publ. 65, Kansas Univ. Press, 352 pp.; Gallardo 1979. *In* W. E. Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution, and Dispersal, pp. 299–307, Univ. Kansas Press; Gudynas 1982. Bull. Chicago Herpetol. Soc. 16:29–39; Martuscelli and Olmos 1996. Herpetol. Rev. 27:21; Norman and Naylor 1994. Amphibians and Reptiles of The Paraguaian Chaco, Vol. I. Privately published, 281 pp.; Rivas et al. 2001. Herpetol. Rev. 32:108; Vanzolini et al. 1980. Répteis das Caatingas. Acad. Bras. de Ciências Ed., 161 pp.). However, with scattered exceptions the specific identity of vertebrate prey has been rarely provided. Specific-level identity of prey is essential to characterize precisely a species' life history. Here, we provide the first record of amphibian prey for *T. teguixin* identified to species.

On 16 November 2001, we collected a large juvenile (SVL = 329 mm) *T. teguixin* next to the Tocantins River, municipality of Minaçu in the Cana Brava region, Brazil (13°34'11"S, 48°06'49"W). Examination of the stomach contents revealed most of the posterior limbs and pelvic region of an adult *Leptodactylus mystaceus* (femur 24.4 mm; tibia 27.1 mm; tarsus 14.6 mm). *Leptodactylus mystaceus* is a terrestrial frog common in the Brazilian Cerrado, the adults of which frequent vicinity of water in primary or secondary forest (Duellman, *op. cit.*; Rodriguez and Duellman 1994. Guide to the Frogs of the Iquitos Region, Univ. Kansas Press, 80 pp.). Thus, *T. teguixin* has opportunity to encounter this species during its terrestrial foraging.

The *T. teguixin* specimen (CEPB/IFS 227-01) and its anuran prey were deposited in the herpetological collection of the Centro de Estudos e Pesquisas Biológicas at the Universidade Católica de Goiás in Goiânia, Brazil.

Submitted by **IVAN FRANÇA E SOUZA, HÉLDER LÚCIO RODRIGUES SILVA,** and **NELSON JORGE DA SILVA JR.**, Laboratório de Herpetologia, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Ave. Universitária, 1440, Setor Universitário, 74.210-010, Goiânia, Goiás, Brazil; e-mail: souzai@terra.com.br.

SERPENTES

AGKISTRODON CONTORTRIX PHAEOGASTER (Osage Copperhead). **BREEDING**. Records of *in situ* copulations by *Agkistrodon contortrix phaeogaster* have rarely been reported. Fitch (1960. Univ. Kansas Publ. Mus. Nat. Hist. 13:85–288) suggests that copperheads are primarily late spring breeders although there is no set breeding season. The Osage copperhead barely enters Nebraska and is restricted to the extreme southeastern part of the state. Nothing is known about the reproductive season and cycle of *A. c. phaeogaster*.

On 27 August 1998, at 0820 h in Gage County, Nebraska, USA, a pair of Osage copperheads was found copulating. The habitat, located on the west bank of the Big Blue River west of the town of Barneston (T1N, R7E, Sec. 13, SE1/4), can be characterized generally as riparian woodland dominated by cottonwood (*Populus deltoides*) and American elm (*Ulmus americana*). The copulating snakes were located on top of leaf litter in a patch of stinging nettles (*Urtica dioica*). They were observed and photographed for ca. 5 min. before they separated, at which time they were captured and examined. The snout–vent length (SVL) for the female was 53.1 cm and she weighed 157 g. The male measured 73.2 cm SVL and weighed 398 g. The male copperhead was a recapture from

the previous spring and was located 350 m from his emergence den. The ambient temperature was 25.7°C. This is the first report of the reproductive season for Osage copperheads in Nebraska.

Submitted by **DANIEL D. FOGELL**, Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska 68182-0040, USA, **TED J. LEONARD**, 14067 Monroe Circle, Omaha, Nebraska 68137, USA, and **JAMES D. FAWCETT**, Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska 68182-0040, USA.

COLUBER CONSTRICTOR CONSTRICTOR (Northern Black Racer). **INGESTION OF PLANT MATERIAL**. Incidental ingestion and subsequent passage of plant material by snakes is rarely reported, but might not be an uncommon occurrence in some species (e.g., species that feed in leaf litter, or on prey that have a moist exterior to which debris is likely to adhere). Plant material adhering to ingested prey may generally be of little consequence, but might occasionally pose a threat because of mechanical blockage of the intestine.

On 1 October 2000, we discovered a female black racer (1030 mm SVL, 325 mm TL, 372.6 g mass) beneath a cover board at Shield's Cove at the juncture of Grainger, Union, and Knox counties, Tennessee, USA (36°11'N, 83°42'30"W). We captured the snake by hand and noticed a pine needle (*Pinus taeda*) protruding from the cloaca. The needle was slowly pulled from the cloaca, revealing two additional needles. The first needle broke, was dropped and lost. The two needles left intact each measured 16.1 cm in length and came out tips first, followed by the bundle to which all three needles were attached. As the needles were removed, the snake excreted uric acid as well as an unidentified liquid.

The snake was returned to the Reptile Ethology Laboratory at the University of Tennessee, Knoxville where it was measured, sexed, and weighed, implanted with a PIT tag, and subsequently released to the site of capture.

Submitted by **MATTHEW T. BEALOR**, Department of Environmental, Population and Organismic Biology, University of Colorado at Boulder, Boulder, Colorado 80309, USA (e-mail: matthew.bealor@coloradol.edu), and **GORDON M. BURGHARDT**, Department of Psychology, University of Tennessee, Knoxville, Knoxville, Tennessee 37996, USA.

COLUBER HIPPOCREPIS (Horseshoe Whip Snake). **CAUDAL AUTOTOMY**. The ability to shed or to readily lose the tail as a method of escape from enemies is developed to varying degrees in certain salamanders, in tuataras, in many lizards, in some amphisbaenids, in a few snakes, and in certain rodents. Snakes have the most elaborate antipredator mechanisms yet described among reptiles (Greene 1988. *In* Gans and Huey [eds.], Biology of the Reptilia, 16, Ecology: Defense and Life History, pp. 1–152. Alan R. Liss Inc., New York). However, tail autotomy in snakes is a very rare condition. Intervertebral autotomy has been reported in the colubrids *Pliocercus* sp., *Rhadinea decorata, Scaphiodontophis venustissimus,* and *Sibynophis,* all characterized by very long tails (Arnold 1988. *In* Gans and Huey [eds.], Biology of the Reptilia, 16, Ecology: Defense and Life History, pp. 235–273. Alan R. Liss Inc., New York). Herein I report curling behavior and caudal autotomy of *Coluber hippocrepis* under natural conditions.

On 28 October 2000, at Grazalema Natural Park (Cadiz, Spain), I captured a *C. hippocrepis* of ca. 800 mm total length. When I grasped the snake by the tail, the snake quickly and actively curled the body as a screw, transmitting strong pressure to the curled tail at the point where my hand grasped it. After a few seconds, the snake broke off the end of its tail next to my hand and fled. The shed tail (50 mm) moved vigorously for few minutes as happens with autotomized lizard tails.

This species is a medium size snake with a relatively long tail. It is diurnal and when threatened it tries to escape or displays aggressive behavior. A posterior morphological study of 66 *C. hippocrepis* from the collection of the Doñana Biological Station (Sevilla, Spain) showed that tail loss was common in adults of this species and tail autotomy could have contributed to the high rate of tail loss. None of 19 young snakes (< 50 mm SVL) showed any evidence of tail loss. However, 22 of 47 (46.8%) adult snakes (> 50 mm SVL) exhibited some degree of tail loss. These individuals had blunt tails that were usually black. There was no evidence of tail regeneration. Tail curling and tail autotomy have not been previously described for this species. This antipredator response could be very useful when its main predators, diurnal raptors or carnivorous mammals, capture this snake.

Submitted by **ADOLFO MARCO**, Estación Biológica de Doñana, Apartado 1056, 41080, Sevilla, Spain (e-mail: amarco@cica.es).

CROTALUS CERBERUS (Arizona Black Rattlesnake). **DIET and PREY SIZE**. Herein we report for the first time, to the best of our knowledge, prey of neonatal *Crotalus cerberus* (Coues) (see taxonomic revision in Douglas et al. in press. *In* Schuett, Höggren, Douglas, and Greene [eds.], Biology of the Vipers, Eagle Mountain Publishing, L.C., Eagle Mountain, Utah) and information on prey size. On 30 September 2000, as we inspected dens (hibernacula) and observed denning behavior of *C. cerberus* at several nearby sites ca. 23 km S of Flagstaff, Arizona, USA (Coconino County; 2172 m elev.), we located a neonate at 1545 h, in shade, lying on needles of Ponderosa pine (*Pinus ponderosa*) and partly covered by a cone of the same species. This animal was ca. 50 m W of a den (den entrance was west-facing) used by adult, juvenile, and neonatal conspecifics. Ground temperature was 25°C, air temperature (1 m above ground) was 25.4°C, and relative humidity was ca. 25%.

The noteworthy observation concerning this animal was that it appeared to have recently consumed an unusually large prey item, thus rendering it incapable of rapid movement because of prey size rather than low temperatures. This conclusion was supported by the observation that another neonate (with no conspicuous meal) found 45 min earlier (30 cm off the substrate on a rock ledge ca. 10 m below the den entrance), in shade and exposed to slightly higher substrate (28°C) and air (27°C) temperatures quickly retreated from one of us (GWS) when approached. Palping the neonate revealed that it had consumed a lizard, but attempts to induce regurgitation failed and hence specific identification was not possible. The neonate was collected and retained for further observa-



FIG. 1. Autopsy of a neonatal *Crotalus cerberus* (Coues) found alive on 30 September 2000, and an adult male *Sceloporus undulatus* that it had recently consumed.

tions but died within several hours likely as a result of handling. Prior to dissection, we determined body mass of the neonate (with the prey intact) to be 17 g, SVL was 218 mm, and tail length (to the base of the button) was 17 mm, with only a button present. Sex was female. Upon dissection it was revealed that an adult male *Sceloporus undulatus* had been consumed. Body mass of the prey was 9.05 g, SVL was 68 mm (the snout was partially digested), and length of the tail (fully intact) was 92 mm (Fig. 1). The prey's partially digested snout was positioned at the caudalmost region of the neonate's stomach, its fully intact limbs were adpressed against its body, and its tail was extended cranially (without curvature) in the esophagus. Harry W. Greene verified identification of both species, and they (and Kodachrome slides) are deposited at Cornell University Museum.

Recently, Cundall and Greene (2000. *In* Schwenk [ed.], Feeding: Form, Function, and Evolution in Tetrapod Vertebrates, pp. 293–333, Academic Press, San Diego, California) provided an overview and synthesis of the feeding mechanisms and ecology of snakes, emphasizing in several lineages (e.g., Boidae and Viperidae) the capacity to subjugate and consume bulky prey of extreme relative body mass (Type III prey; prey/predator mass ratios can exceed unity). In our case, the prey/predator mass ratio was 1.138. Importantly, our observation documents that in neonatal *C. cerberus* (a) highly agile prey, such as adult male sceloporine lizards, can be subjugated (presuming the prey was alive) and consumed, (b) first prey in life can be extremely large, exceeding their own body mass, and (c) the capacity to retreat quickly with large, ingested prey is compromised. Consumption of large prey by neonates likely increases vulnerability to predators (or enemies) and critical environmental factors such as low temperatures and inclement weather (for a similar conclusion, see Pauly and Benard 2002. Herpetol. Rev. 33:56–57). Two weeks following the observations of the present neonates the den site was revisited, and at that time (15 October 2000) mid-day air temperature was 14.5°C, and snow showers occurred the following day.

Submitted by **GORDON W. SCHUETT**, Department of Life Sciences, Arizona State University, P.O. Box 37100, Phoenix, Arizona 85069-7100, USA (e-mail: gschuett@asu.edu), **ERIKA M. NOWAK**, USGS Forest and Rangeland and Ecosystem Science Center, Colorado Plateau Field Station, Northern Arizona University, P.O. Box 5614, Flagstaff, Arizona 86011, USA (e-mail: erika.nowak@nau.edu), and **ROGER A. REPP**, National Optical Astronomy Observatory, 950 North Cherry Avenue, Tucson, Arizona 85719, USA (e-mail: repp@noao.edu).

CROTALUS HORRIDUS HORRIDUS (Timber Rattlesnake). **HABITAT**. Records of *Crotalus horridus horridus* using agricultural fields as summer habitat are anecdotal at best (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley. 1533 pp.). We report here the use of row crop fields by five *C. horridus* in southern Gage County, Nebraska, USA, during a single-season radiotelemetry study in 1999 (N = 8).

On 1 July 1999, a gravid female *C. horridus* (84.8 cm SVL, 700 g mass) was radiotracked to an alfalfa field. She traveled through the field and eventually took refuge in a pile of discarded wood and metal adjacent to an active hog shed. Although woodland corridors existed, they were ignored as the snake opted for a more direct route through the alfalfa field. On 29 August 1999, this same snake left her refuge and traveled back to her previous location by way of a grazing pasture and a sorghum field, once again ignoring woodland corridors.

Another instance of a *C. horridus* traveling through a row crop field occurred on 21 August 1999. A non-gravid female (87.0 cm SVL, 574 g mass) crossed a milo field and took refuge in a woodpile in a roadside ditch as she traveled between two woodland patches. She traveled across this field again on 21 September 1999 as she returned to her previous location. In this case a woodland corridor was not available.

The remaining three snakes were not found traveling through agricultural fields but had instead taken refuge in them on various occasions. On 8 August 1999 a small female *C. horridus* (68.2 cm SVL, 250 g mass) was radiotracked to a cornfield adjacent to the wooded area she had previously been occupying. She remained in the cornfield for 13 days during which time she shed her skin and successfully fed. On 14 September 1999, an adult male *C. horridus* (88.7 cm SVL, 547 g mass) was found in a soybean field exhibiting a classic ambush posture. He remained in the soybean field for 14 days but did not successfully feed and was subsequently found foraging in a woodland strip adjacent to the soybean field on the 15th day. Neither of these individuals used row crop fields on more than one occasion. However, a female (73.0 cm SVL, 320 g mass) used a soybean field on two separate occasions for a total of 34 days, which constituted 31.5% of her total summer activity time. She initially entered the soybean field on 19 July 1999 and remained there for 20 days, at which time she entered a strip of tall grass and shrubs separating the soybean field from a small creek. She shed and fed while in this grassy area and re-entered the soybean field to digest her food on 6 September 1999, remaining there for 14 days until she began migrating back to her den. This snake did not appear to be foraging in the soybean field and in fact left the beans to feed in the buffer strip. We suspect that the microclimate beneath the soybean canopy was favorable, which may explain an apparent preference by this snake for such an unusual habitat.

The high incidence of agricultural field use by *C. horridus* in Nebraska may be explained by their biogeography. This population of *C. horridus* is at the extreme periphery of their range, thus preferred habitat is scarce and available habitat is sub-optimal. These kinds of pressures often create situations where such aberrant behaviors are more prevalent than they are in the center of a range.

We thank the University of Nebraska at Omaha (UNO) Committee on Research, the UNO Department of Biology, The

Chicago Herpetological Society, and the Nebraska Herpetological Society for financial assistance with this study.

Submitted by **DANIEL D. FOGELL**, Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska 68182-0040, USA (e-mail: dfogell@unomaha.edu), **TED J. LEONARD**, 14067 Monroe Circle, Omaha, Nebraska 68137, USA, and **JAMES D. FAWCETT**, Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska 68182-0040, USA.

CROTALUS HORRIDUS HORRIDUS (Timber Rattlesnake). **CLIMBING**. During a radiotelemetry study in Gage County, Nebraska, USA, climbing behavior by *Crotalus h. horridus* was observed on four separate occasions. On 18 May 1999, a subadult female *C. h. horridus* (68.2 cm SVL, 250 g mass) was radiotracked to a riverbank where she was located ca.1.5 m high in a recently felled tree. The snake was wedged between the outer bark and the inner wood. She remained in this position for two days. Her previous location was < 1 m above the water line of the Big Blue River, thus it is possible that rising water levels in the river because of recent heavy precipitation may have forced an upward retreat.

On 19 May 1999, an adult male timber rattlesnake (89.0 cm SVL, 545 g mass) was found coiled and basking on a primary branch of an ash tree (*Fraxinus* sp.) at a height of ca. 3 m. This snake was captured for inclusion in the radiotelemetry study and was released on 22 May 1999 on the same branch. After being released, the snake retreated into a hole in the branch and remained there for one day. The tree was located in a clearing on the upper slope of riparian woodland and was commonly used as a basking site for adult black rat snakes (*Elaphe obsoleta obsoleta*).

Another radiotracked female (73.0 cm SVL, 320 g mass) was observed on 12 June 1999 leaving the lower branches of a small cottonwood tree (*Populus deltoides*) ca. 2 m above the ground. Her shed skin was found interwoven among the branches. The site was located on the bank of a dry stream. Apparently, this snake was using the tree branches to assist in sloughing off her skin.

A gravid female (84.8 cm SVL, 700 g mass) was radiotracked on 7 July 1999 at 0900 h to a large pile of discarded corrugated metal at the base of a red mulberry tree (*Morus rubra*). A dead branch was lying across the metal pile at a height of 2 m above the ground and 1 m above the metal. The gravid female timber rattlesnake was stretched along the dead branch in such a position that her abdominal region was draped over the branch and above the metal so that the developing follicles were receiving reflective heat from the warm metal surface. The air temperature on the branch above the metal was 30.5°C whereas the temperature 2 m away from the metal was 27.4°C.

Although climbing behavior has been previously reported in *C. horridus* (Saenz et al. 1996. Herpetol. Rev. 27:145), it is uncommon and is often explained as either foraging behavior or an attempt to escape rising flood waters. Of the four accounts described above, only one (19 May 1999) could possibly be described as foraging behavior, however none of the telemetered snakes in this study fed before 20 June 1999. The 18 May 1999 account is probably explained by rising water. The remaining two, however, clearly were neither foraging nor escaping rising water. Additionally, there have been no other reports of gravid timber rattlesnakes exhibiting climbing behavior.

We thank the University of Nebraska at Omaha (UNO) Committee on Research, the UNO Department of Biology, The Chicago Herpetological Society, and the Nebraska Herpetological Society for financial assistance with this study.

Submitted by **DANIEL D. FOGELL**, Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska 68182-0040, USA (e-mail: dfogell@unomaha.edu), **TED J. LEONARD**, 14067 Monroe Circle, Omaha, Nebraska 68137, USA, and **JAMES D. FAWCETT**, Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska 68182-0040, USA.

ELAPHE OBSOLETA OBSOLETA (Black Rat Snake). **MALE COMBAT.** A proximate goal of male combat in *Elaphe obsoleta obsoleta* is to achieve physical superiority over an opponent and establish dominance (Gillingham 1987. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 184–209. McGraw-Hill Publishing Co., New York). Presumably, the ultimate goal of such combat is to provide the victor with priority access to an estrous female. However, the functional significance of combat in the reproductive biology of the species has not been clearly demonstrated.

There are few published observations of male combat in free-ranging black rat snakes. Stickel et al. (1980. Amer. Midl. Nat. 103:1–14) recorded three instances of combat in a 35-year Maryland study and one observation each was reported by Rigley (1971. J. Herpetol. 5:65–66) and Mitchell (1981. Catesbeiana 1:7–9). All of these observations have taken place during the spring to early summer breeding season; however, the presence of a female was noted in only one report (Mitchell, *op. cit.*) with no male-female interactions recorded.

Whatever role combat may play in reproduction, these records suggest that the physical presence of a female is not essential to initiate male combat. It is possible that females have been present but hidden during observations of combat in free-ranging males; however, in laboratory trials of male combat conducted with captive male black rat snakes, initiation of combat sequences did not involve females (Gillingham 1980. Herpetologica 36:120–127).

On 9 June 1996, we observed male combat in a pair of free-ranging *E. o. obsoleta* and did not find any females present. We were able to recognize behaviors analogous to those defined by Gillingham (*op. cit.*) from combat sequences with captives. These observations occurred in Hanging Rock State Park in Stokes County, North Carolina, USA, and are summarized below.

The snakes were initially discovered 2.5 m from a residence and adjacent to an area where one or more unidentified *E. o. obsoleta* had been observed regularly over several days. When first observed at 1305 h, the snakes were fully entwined along their body lengths except for their anterior 20–25 cm. This intertwining was maintained during the entire combat episode, although it was not a static position. At times the smaller snake appeared to be held in a "corkscrew" of the larger snake's coils (Fig. 1). The snakes would occasionally entwine almost to their heads. The larger of the two snakes (122 cm) appeared to be attempting to press down upon the smaller (107 cm) snake's head. During periods of these head pressing jousts, both snakes formed short, lateral, and U-shaped curves of the neck immediately posterior to the head (Fig. 2) and used these to press downwards



FIG. 1. Smaller snake held in "corkscrew" of dominant male's coils during combat between male *Elaphe obsoleta* in Stokes County, North Carolina, USA.



FIG. 2. Head pressing posture in the form of lateral, U-shaped curves of the neck during combat between male *Elaphe obsoleta* in Stokes County, North Carolina, USA.

on the opponent. Intermittently, the larger snake would poise this body arrangement over the head of the smaller snake (Fig. 2) and would then attempt additional downward presses. When both snakes formed this U-shaped posture in opposite directions they would seem to face each other, forming a "caduceus." At times, both snakes' fore bodies would lift off the ground to nearly vertical, and then the larger snake would press down upon the area immediately posterior to or directly on the head of the smaller snake bringing him back horizontal to the ground. At no time during active engagement did the snakes seem concerned about human observers ≤ 2 m away.

At 1350 h the smaller snake broke away and was pursued by the larger snake into shrubbery adjacent to the house. The smaller snake fled the shrubbery, moving back into the open yard, and was no longer pursued by the larger snake. Remaining in the shrubbery, the larger snake appeared to be moving towards an opening in the house's siding 2 m away. With the combat apparently terminated, both snakes were captured for sexing and measurement and were then immediately released at their points of capture. After release the smaller snake left the area and the larger snake fled 15 m from the release site and entered root tunnels beneath dense vegetation. At 1530 h the larger snake (identified by old scars along his dorsum) had returned to the point of combat. Due to rapid tongue flicking and a sweeping motion of the head he appeared to be searching. No other snakes were found.

Black rat snakes are mobile, exhibit overlapping home ranges (Fitch 1963. Copeia 1963:649–658), and frequent certain large, isolated trees that serve as focal points common to the range of many individuals in the population. These focal trees are visited repeatedly by both sexes and are used for basking, shedding, courtship, and mating (Stickel et al., *op. cit.*; J. Flora, pers. comm.). Perhaps the stimulus to establish male intrasexual dominance in the absence of females is based on the expectation of future encounters in the presence of estrous females.

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Submitted by **JOHN B. SEALY**, Department of Biology, Appalachian State University, Boone, North Carolina 28608, USA (e-mail: jsealy@boone.net), and **JAYE C. DOW**, 1040 Residence Road, Westfield, North Carolina 27053, USA (e-mail: jbird1959@webtv.net).

ELAPHE OBSOLETA OBSOLETA (Black Rat Snake). **PREDATION.** Birds are among the many vertebrate predators of snakes. In particular, raptors and herons have frequently been observed preying on snakes (Fitch 1963. Copeia 1963:649–658; Godley 1980. Ecol. Monogr. 50:411–436; Toland 1985. J. Field Ornithol. 56:419–422; Jennings 1997. Herpetol. Rev. 28:205–206; Vandermast 1999. Herpetol. Rev. 30:169). Predation on snakes by birds other than raptors or herons is less common and these species generally prefer small individuals. American robins (*Turdus migratorius*), loggerhead shrikes (*Lanius ludovicianus*), and bluejays (*Cyanocitta cristata*) are some of the species that prey on small snakes (Plummer 1990. J. Herpetol. 24:327–328; Mahrdt and Banta 1996. Herpetol. Rev. 27:81; Hedeen 1998. Herpetol. Rev. 29:103). Herein, we report a predation attempt by an American crow (*Corvus brachyrhynchos*) on an adult of a large species, the black rat snake, *Elaphe obsoleta obsoleta*.

On 31 May 2000 at ca. 1600 h we observed a live adult *E. o. obsoleta* (920 mm SVL, 980 mm TL) on the pavement on the south side of Little River Road, Great Smoky Mountains National Park, Tennessee, USA ca. 0.5 mi E of Metcalf Bottoms Campground (Wear Cove Quadrangle, 35°40'19"N, 83°38'23"W, ca. 561 m elevation). An adult *C. brachyrhynchos* was pecking the snake. The snake had ca. 10 wounds on its head and body, with the greatest number of wounds (4) concentrated cranially. The right eye had been enucleated, the right mandible and the crown of the skull lacerated, and the snake could not tongue-flick and had great difficulty moving and orienting. After we collected and euthanized the snake, it was palpated and no additional injuries (spinal fractures or other major traumas) were observed, ruling out the possibility that the snake was first hit by a car and then attacked by the crow. All wounds appeared to be consistent with injuries sustained during the observed predation attempt.

American crows are predators of small snakes and will mob potential predators, including snakes (Kale and Maehr 1990. Florida's Birds. Pineapple Press, Sarasota, Florida. 288 pp.). The event described here does not appear to have begun as a mobbing

incident, however, as no other crows were present at the time of the observations and Fitch (*op. cit.*) observed that actual attacks on *E. o. obsoleta* during mobbing are very unusual. Predatory attacks by passerine birds on adults of large snake species are also unusual, and this is the first documentation of a predatory attack by *C. brachyrhynchos* on an adult *E. o. obsoleta*.

These observations were made in conjunction with the USGS Southeastern Amphibian Research and Monitoring Initiative under permits from Great Smoky Mountains National Park (GRSM 00-025) and the Tennessee Wildlife Resources Agency (No. 1103). The specimen will be deposited in the National Museum of Natural History. We thank Lora L. Smith and C. Kenneth Dodd, Jr. for comments on the manuscript.

Submitted by **KEVIN G. SMITH, JAYME L. WALDRON,** and **WILLIAM J. BARICHIVICH**, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA.

ERYX JAYAKARI (Arabian Sand Boa). **REPRODUCTION**. No published accounts of reproduction for *Eryx jayakari* could be found, yet this species is generally assumed to be viviparous as has been recorded for several other *Eryx* species. We report here the first recorded successful captive breeding, egg laying, and hatching for this species. Both oviparity and viviparity are represented in other genera of snakes (e.g., *Elaphe*, *Vipera, Natrix, Trimeresurus*) (Tinkle 1977. Misc. Pub. Mus. Zool. Univ. Michigan, No. 154), however, this is the first record for both reproductive modes within the genus *Eryx*.

One female (64 g) and two male (23 and 51 g) *Eryx jayakari* (imported from Saudi Arabia in 1999) were introduced after a mild brumation. The female later showed obvious signs of pregnancy and laid one infertile and six fertile eggs on 12 August 2001. The eggs were incubated in slightly moistened vermiculite at 31–33°C. The hatchlings pipped the eggs on 17 October 2001 after incubating for 66 days. Just prior to hatching (01 October), egg masses were 9.9, 10.2, 10.6, 11.5, and 12.7 g. The masses of the hatchlings were 4.5, 4.8, 4.9, 5.3, and 5.5 g. The sixth fertile egg began to decompose part way through the incubation, and contained a partially developed embryo.



FIG. 1. Two *Eryx jayakari* emerging from eggs. The tight fit of the egg shell around the hatchling's neck upon emergence is especially visible in the animal on the left.

The hatchlings did not appear to possess an egg tooth. Instead they ruptured the thin shell of the egg with their head by force. This action created rough tears in the shell rather than smooth cuts as has been observed for other species including *Calabaria reinhardtii* (pers. obs.).

We have recently become aware of a second instance of oviparity in sand boas. A captive female *Eryx muelleri* laid four thin-shelled eggs and a single hatchling emerged after a very short incubation period (14 days). The hatchling, as in *E. jayakari*, also lacked an egg tooth (Bruce Miller, pers. comm.).

Submitted by **RICHARD E. STAUB**, Department of Nutritional Sciences and Toxicology, University of California, Berkeley, California 94720, USA (e-mail: rstaub@nature.berkeley.edu), and **JOHN EMBERTON,** East Bay Vivarium, 1827 Fifth Street, Berkeley, California 94720, USA.

LAMPROPELTIS PYROMELANA (Sonoran Mountain Kingsnake). **DIET.** Here I provide the first evidence for chiropterophagy by the genus *Lampropeltis* (see Schätti 1984. Bonn. Zool. Beitr. 35:335–342, for a review of chiropterophagy by snakes). An adult female *L. pyromelana* (705 mm SVL) was collected DOR on Hwy 80, 37 km S of Interstate 10, Hidalgo Co., New Mexico, USA by Sandilee Burgess, August 1996. A long-legged myotis bat (*Myotis volans*) was found partially digested in the stomach of the snake. The snake and bat were deposited into the collections of the University of Michigan Museum of Zoology (UMMZ 225039, 172544 respectively).

Subitted by **GLENN M. FOX**, Department of Ecology and Evolutionary Biology and Division of Reptiles and Amphibians, University of Michigan Museum of Zoology, Ann Arbor, Michigan 48109-1079, USA; e-mail: foxg@umich.edu.

MASTICOPHIS FLAGELLUM (Coachwhip). **OPHIOPHAGY**. *Masticophis flagellum* is known to take a variety of prey items including snakes: *Arizona elegans* (Small et al. 1994. Herpetol. Rev. 25:28); *Diadophis punctatus* and *Heterodon platirhinos* (Hamilton and Pollack 1956. Ecology 37:519–526); *Opheodrys aestivus* (Reams et al. 2000. Herpetol. Rev. 31:247); *Thamnophis butleri* and *T. sirtalis* (in captivity); *Crotalus atrox* (Ortenburger 1928. Mem. Univ. Michigan Mus.1:1–247); and *Crotalus viridis* (Tabor and Germano 1997. Herpetol. Rev. 28:90). Smith (1956. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 9:1–357) also described *M. flagellum* as preying on other snakes. Here we report a snake as a prey item not previously documented for *M. flagellum*.

On 4 May 1980 a *M. flagellum* was observed ingesting a live gopher snake (*Pituophis catenifer*) between Black Canyon Petroglyphs and Harper Dry Lake (north of Barstow), San Bernardino County, California, USA. The *M. flagellum* had hold of the *P. catenifer* by the tail and was proceeding to swallow it. The two snakes struggled for almost one hour before the *M. flagellum* had completely ingested the *P. catenifer*. The snakes were photographed and a color slide was deposited in the Natural History Museum of Los Angeles County (LACM PC 1339).

Submitted by **KENT R. BEAMAN**, Section of Herpetology, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, USA (e-mail:

kbeaman@nhm.org), and **JACK M. HARRIS**, 4104 Jefferson Street, Riverside, California 92504, USA.

MICRURUS CORALINUS (Coral Snake). **ENDOPARASITES.** Travassos (1917. Mem. Inst. Osw. Cruz 9:5–62) first reported *Oligacanthorhynchus spira* cystacanths in snakes. Travassos (*op. cit.*) found larvae attached to the peritoneum of many snakes including *Boa, Clelia, Erythrolamprus, Liophis, Lystrophis, Mastigodryas, Philodryas, Waglerophis, Bothrops,* and a snake possibly misidentified as *Dipsadomorphus dendrophilus.* Adults were also found in the intestines of birds including *Cathartes, Coragyps, Sarcoramphus,* and *Buteogallus*. This note reports the first occurrence of cystacanths of *O. spira* in *Micrurus corallinus* (Elapidae).

Snakes (N = 89) were collected in São Paulo state, southeastern Brazil, fixed in 10% formalin and preserved in the collection of Instituto Butantan (São Paulo, SP). They were dissected, and the cystacanths were extracted and dehydrated in ethyl alcohol and gradient cleared in methyl salicylate, a procedure modified from Torres and Puga (1996. Mem. Inst. Osw. Cruz 91:717–719). All larvae of *O. spira* were found in the peritoneum of the snakes. The prevalence of cystacanths was 28.08% and the mean intensity of infection was 24.92 larvae/snake (±1.01 SD), ranging from 1 to 144 larvae/snake.

Micrurus corallinus feed mainly on amphisbaenians, a few elongate lizards, caecilians, and other snakes (Marques and Sazima 1997. Herpetol. Nat. Hist. 5:88–93), whereas cystacanths often occur in invertebrates (Schmidt and Roberts 1996. Foundations of Parasitology. 5th ed.W. C. Brown Publ., Dubuque. 659 pp.). We suspect that *M. corallinus* become infected with cystacanths by consuming insectivorous prey.

We thank Otavio Marques and Francisco Luís Franco for help in current snake taxonomy and permission to examine specimens. We also thank Marlene T. Ueta for general suggestions. Finally, we thank André Victor Lucci de Freitas, Arício X. Linhares, Ivan Sazima, and José Roberto Trigo for critically reviewing this note.

Submited by **LÍGIA PIZZATTO,** Undergraduate Course of Biology, Instituto de Biologia, Depto. Zoologia, Universidade Estadual de Campinas, CP 6109, 13083-970, Campinas, São Paulo, Brazil (e-mail: ligia_oceanica@yahoo.com), and **RUBENS R. MADI,** Depto. de Parasitologia, Instituto de Biologia, Universidade Estadual de Campinas, CP 6109, 13083-970, Campinas, São Paulo, Brazil (e-mail: rmadi@unicamp.br).

MICRURUS FRONTALIS PYRRHOCRYPTUS (Coral Snake)**. PREDATION**. Observations of predation on *Micrurus* by birds are scarce (Pough 1988. *In* Gans and Huey [eds.], Biology of the Reptilia Vol. 16, pp. 153–234. Alan R. Liss, Inc., New York; Roze 1996. Coral Snakes of the Americas: Biology, Identification and Venoms. Krieger Publ., Malabar, Florida. 328 pp). Here I report predation by *Cariama cristata* (red-legged chuña or seriema, Aves: Cariamidae) on *Micrurus f. pyrrhocryptus*. The event occurred on 10 April 2000 at 1500 h in the Graciela Ranch (29°40.945'S, 64°02.443'W), Departamento Sobremonte in the northwest of the Province of Cordoba, Argentina. The adult snake (ca. total length 30 cm) was first seen by the semi-tame, but wild, bird from a distance of ca. 6 m. The bird ran rapidly toward the snake and captured it by the head. I followed and observed the encounter from a distance of a meter or less. First, the bird crushed the head with repeated closures of its beak, then still holding it by the head, it lifted the coral snake into the air and rapidly swung it downwards onto the ground. The action was similar to that used by roadrunners ("centrifugal-slam" technique; Sherbrooke 1990. Wilson Bull. 102:171–174). Possibly this was to ensure that the snake was dead. Then it dropped the snake onto the ground and waited 15–30 sec. before picking it up again in its beak, near the head. The bird then proceeded to reposition its thin-bodied prey in its beak several times before beginning to ingest it, a section posterior to the head entering first and leaving two portions extending from its mouth. Ingestion (encompassing at least 2 min.) proceeded until first the head end was completely engulfed and then the tail end. Snakes are uncommon prey items of *Cariama cristata* (Sick 1993. Birds in Brazil: A Natural History, pp. 217–219. Princeton University Press, New Jersey). This observation suggests that the red-legged chuña or seriema does not have an innate fear response to coral-snake colors and pattern, as has been reported in other birds (Smith 1975. Science 187:757–760; Smith 1977. Nature 265:535–536), and that coral snakes, despite being venomous, may not have an effective defense against the bird's attack.

I thank Wade C. Sherbrooke, Mike Westphal, and M. Gabriela Perotti for assistance.

Submitted by **MARIANA PUETA**, Cátedra de Diversidad Animal II, F.C.E.F y N, Universidad Nacional de Córdoba, Av. Velez Sarsfield 299, CP 5000, Córdoba, Argentina; e-mail: maripueta@hotmail.com.

RHADINAEA FORBESI (Forbes's Graceful Brown Snake). **REPRODUCTION**. Reproductive data for this species are unknown owing to its rarity in collections—a consequence of fossorial habits and geographic restriction to the high mountainous region of central Veracruz, Mexico (Myers 1974. Bull. Amer. Mus. Nat. Hist. 153:1–262). Miguel Angel de la Torre Loranca collected a gravid female at Petlacala, Municipio de San Andres Tenejapan, Veracruz, Mexico (18°47'N, 97°06'W, 2100 m elev.) on 11 March 2000 in a pine-oak forest (see Lopez-Luna et al. 1999. Herpetologica 55:382–389, for a complete description of the habitat and location). The snake deposited four eggs measuring 10 mm x 23.2 mm and weighing 1.4 g (mean) on 12 April 2000. The female weighed 17.6 g on 11 April the day before oviposition, and 12.1 g on 12 April after oviposition. The eggs were incubated in a 1:1 ratio by weight of vermiculite and water at a constant temperature of 28°C. Four hatchlings emerged after 51 days of incubation. Hatchlings measured 15.97 cm total length and weighed 1.69 g (mean). The female and hatchlings were deposited in the herpetological collection of Estación de Biología Tropical Los Tuxtlas. This is the first known register of reproduction for this species.

Submitted by **MIGUEL A. DE LA TORRE-LORANCA** and **MARCO LOPEZ-LUNA**, Centro de Investigaciones Herpetologicas de Veracruz A.C. Apt. Post. 473, Cordoba Veracruz Mexico C.P. 94500 (e-mail: delatorreloranca@hotmail.com), and **RICHARD C. VOGT**, Estación de Biología Tropical Los Tuxtlas, Apt. Post. 91, C.P.95700 San Andres Tuxtla, Veracruz, Mexico (e-mail: dickturtle@aol.com).

STORERIA DEKAYI DEKAYI (Northern Brownsnake) and ***S. OCCIPITOMACULATA OCCIPITOMACULATA*** (Northern Red-bellied Snake). **MORPHOLOGY**. Apical pits are reportedly absent in snakes of the genus *Storeria* (Boulenger 1893–1896. Catalogue of Snakes in the British Museum (Natural History). 2nd ed. 3 vols. Taylor and Francis, London. 727 pp.; Trapido 1944. Amer. Midl. Nat. 31:1–84.; Wright and Wright 1957. Handbook of Snakes of the United States and Canada. 2 vols. Comstock Publ. Co., Ithaca, New York. 640 pp.; Marx and Rabb 1972. Fieldiana Zool. 63:92–99). Herein, I report on the discovery of apical pits in two species of *Storeria*.

As part of an ongoing project dealing with the identification of shed skins, I examined 145 sheds of 21 species of North American snakes. Of the 145 sheds, six *S. d. dekayi* and eight *S. o. occipitomaculata* sheds were included for study. After being cut into sections and mounted, sheds were examined using a stereo microscope under 10x and 30x magnification. Data for various characters, including the presence or absence of apical pits were recorded. Two *S. d. dekayi* and four *S. o. occipitomaculata* sheds had apical pits on scales on the dorsal neck region (Fig.1), whereas scales beyond the nape had no observable pits.

Several factors may have been responsible for apical pits being overlooked in *Storeria* for so long. First, apical pits may be restricted and or more apparent on certain areas of the body (e.g., some specimens of *Lampropeltis triangulum*; Williams 1978. Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*. Publ. Biol. Geol. Milw. Publ. Museum 2:1–258). Second, apical pits are best seen in shed skins (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex. SSAR, Oxford, Ohio. 614 pp.). Also, it is evident that significant interspecific and intraspecific variation occurs in some groups (Ball 1996. Reptile & Amphibian Magazine. July/Aug 1996:112–116); less than half (43%) of the *Storeria* sheds in the present study had observable apical pits. The techniques used to prepare (e.g., mounting) and examine (e.g., intensity and angle of lighting) shed skins or actual specimens may affect how easily these structures are observed. If a structure is reported as absent, some may choose not to look for them. Intraspecific variation in the occurrence of apical pits warrants additional study.

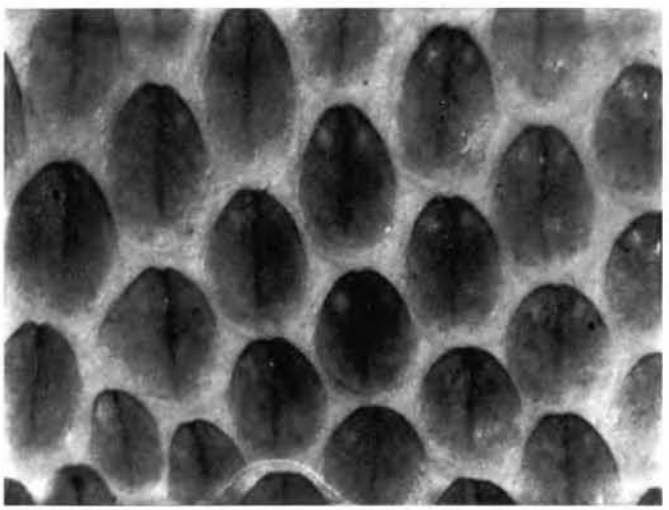


FIG. 1. Dorsal scales with apical pits on a shed skin of *Storeria dekayi dekayi* from Erie Co., Pennsylvania, USA.

I thank Brian Wettekin and Paul Curtis for providing field collected sheds, Hobart Smith for help with the literature and reviewing an earlier version of the manuscript, James Ball for confirming the presence of apical pits on the *Storeria* sheds, providing the microphotograph, and for reviewing a draft of the manuscript. I also thank James Harding whose suggestions were helpful in the final preparation of the manuscript.

Submitted by **BRIAN S. GRAY**, 1217 Clifton Drive, Erie, Pennsylvania 16505, USA.

XENOPELTIS UNICOLOR (Asian Sunbeam Snake). **DIET.** Tooth morphology of *Xenopeltis unicolor* is specialized for handling lizard prey (e.g., skinks; Greene 1997. Snakes: The Evolution of Mystery in Nature. Univ. California Press, Berkeley. 351 pp.). We report the first occurrence of oophagy by *X. unicolor*. An adult male *X. unicolor* (774 mm SVL) had two unidentified squamate eggs, measuring 23 and 29 mm in length, in its stomach. Each egg had been slit along the side one or more times and was empty. The snake was collected by Kamuran Tepedelen in central Java, Indonesia in June 1999. Both the *X. unicolor* and its stomach contents are part of the herpetological collections at the University of Michigan Museum of Zoology (UMMZ 227200 and UMMZ 227201, respectively).

Submitted by **KATHERINE A. DARIN** and **GLENN M. FOX**, Department of Ecology and Evolutionary Biology and Division of Reptiles and Amphibians, University of Michigan Museum of Zoology, Ann Arbor, Michigan 48109-1079 USA (e-mail: foxg@umich.edu).

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CAUDATA

AMBYSTOMA TIGRINUM (Tiger Salamander). USA: NORTH DAKOTA: DICKEY CO: State Hwy 11, 16.9 km E Ellendale (46°00'N, 98°19'W). 20 July 1999. Dean A. Croshaw. Sam Noble Oklahoma Museum of Natural History (OMNH 38270). Verified by Janalee P. Caldwell. Branchiate adult found on road. First county record (Hoberg and Gause 1992. North Dakota Outdoors 55:7–19).

Submitted by **DEAN A. CROSHAW**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA; e-mail: croshaw@srel.edu.

AMBYSTOMA TIGRINUM MAVORTIUM (Barred Tiger Salamander). MÉXICO: CHIHUAHUA: Reservoir at La Bamba (30°5'47.4"N, 105°24'55.0"W), 1330 m elev. 8 June and 30 July 2001. Julio A. Lemos-Espinal. Herpetological Collection of Unidad Biotecnología y Prototipos (UBIPRO 6971–7007, 7863–67); Mpio. Camargo, Reservoir El 33, Rancho Agua Zarca (29°54'34.3"N,

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Geographic Distribution
JERRY D. JOHNSON
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The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Herpetological Husbandry
RUSTON HARTDEGEN
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
ruston17@yahoo.com

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Department of Life Sciences
Arizona State University
P.O. Box 37100
Phoenix, Arizona 85069-7100, USA
gschuett@asu.edu

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2002 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Theodora Pinou, SSAR Treasurer, Department of Ecology & Evolutionary Biology, Osborn Memorial Labs, Yale University, 165 Prospect Street, New Haven, Connecticut 06520-8106, USA. Fax: (203) 432-5176; e-mail: theodora.pinou@yale.edu

Future Annual Meetings

2003 — Hotel Tropical, Manaus, Brazil, 26 June–2 July (with ASIH, HL)
2004 — University of Oklahoma, Norman, Oklahoma (with ASIH, HL)
2005 — University of South Florida, Tampa, Florida (with ASIH, HL)

About Our Cover: *Hemiphractus helioi*



A half-dozen hylid frog species comprise one of the most distinctive, if not the weirdest, groups in the family (Mendelson et al. 2000. Zool. J. Linnean Soc. 128:1–24). Called casque-heads owing to their large, box-like skulls, frogs in the genus *Hemiphractus* look like props from a Star Wars movie set. Bony processes ornament the head and fleshy protuberances adorn the eyelids and snout, and the over-sized mouth contains sharp, fang-like maxillary and premaxillary teeth. Bulging eyes with horizontal pupils give these hylids a decidedly extraterrestrial appearance.

Casque-heads are known only from lower Central America, and South America in the Chocó, the Andes Mountains, and the western Amazon Basin. The genus is considered to show an Amazonian distribution (*Hemiphractus bubalus*, *H. helioi*, *H. proboscideus*, and *H. scutatus*), with *Hemiphractus fasciatus* and *H. johnsoni* being Chocoan vicariants (Duellman 1999. *In* W. E. Duellman [ed.], Patterns of Distribution of Amphibians, pp. 255–328. Johns Hopkins University Press, Baltimore; Trueb 1974. Occasional Papers of the Museum of Natural History, University of Kansas 29:1–60). *Hemiphractus* is known to occur in Panama, Colombia, Ecuador, Peru, and Bolivia.

These frogs live in dense, tropical rainforest and cloud forest up to about 2000 m above sea-level. They look for all the world like the leaf litter in which they hide during daytime. By night casque-heads can be found perched on low twigs and leaves or sitting in ambush (*H. scutatus*) on the forest floor. The diet consists of arthropods and small vertebrates, especially frogs. Prey is seized rapidly and subdued by a powerful bite. Vocalization is only spottily documented, and calling behavior is unknown for several species. The breeding biology of casque-heads also is an enigma, although females of some species have been found brooding eggs on their backs.

After a hiatus of nearly three decades (Trueb 1974, *op cit.*), relationships among hemiphractines recently have been the subject of much investigation (Mendelson et al. 2000, *op cit.*; Sheil and Mendelson 2001. Herpetologica 57:189–202; Sheil et al. 2001. Herpetologica 57:203–214). The discovery of a previously undescribed species, *Hemiphractus helioi*, that had been ascribed erroneously to *H. johnsoni* for nearly a century, has altered our concept of *Hemiphractus*. Two lineages are recognized currently, with *H. johnsoni* being the sister taxon to *H. bubalus* + *H. proboscideus*, and *H. helioi* being the sister taxon to *H. fasciatus* + *H. scutatus* (Sheil et al. 2001, *op cit.*).

The cover photograph depicts a *Hemiphractus helioi* (Helio's Casque-head) feeding on an *Eleutherodactylus carvalhoi*, which it ingested over a period of several minutes. The photo was taken by **William W. Lamar**, who found and photographed the frogs *in situ* at night in leaf litter of low primary rainforest near a swamp in eastern Peru, adjacent to the Brazilian frontier. Lamar used a Pentax LX camera, Vivitar Series 1 f/2.5 90mm macro lens, extension tubes, Vivitar Series 1 flash, and Fuji Velvia film.



PHOTO BY PEKKA SONNI

Lamar comments that he has observed *H. helioi* in adjacent western Brazil, and that the species is widespread across northeastern Peru in the Departamento de Loreto, where he has found it in sympatry with *H. proboscideus* and *H. scutatus*, always in primary rainforest, and always at night.

Bill has spent half of his life in the Neotropics, and much of that time he has been carefully documenting the remarkably diverse herpetofauna of the western Amazon Basin in Colombia, Ecuador, and Peru for a book he is writing. Lamar believes the best way to become environmentally aware is by celebrating nature, and towards that end he leads specialists as well as the general public on tropical expeditions for GreenTracks, Inc. Jonathan A. Campbell of the University of Texas at Arlington and Bill have just completed a new book, "**The Venomous Reptiles of the Western Hemisphere**," to be published next year by Cornell University Press.

SSAR BUSINESS

North American Common Names Publication Now Available Online

As a service to the herpetological community, SSAR has made the official list of names of amphibians and reptiles of North America free for download as a PDF file (ca. 1.6 MB). "*Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding*" by the Committee on Standard English and Scientific Names (Brian I. Crother, Chair) is now available at:

http://www.herplit.com/SSAR/circulars/HC29/Crother.html

A printed version of the book may be ordered from the SSAR Publications Secretary at:

http://www.herplit.com/SSAR/index.html

This names list has been adopted by all three North American herpetological societies (ASIH, HL, SSAR) as the official list of accepted common names, and also serves as an important resource for current taxonomic arrangements for North American taxa.

SSAR Grants-in-Herpetology Committee Annual Report (2002)

An award in the amount of US $500 was made to each of the following individuals:

Field Research.—**Jerry Husak**, Oklahoma State University. Project title: "Environmental constraints on the evolution of collared lizard (genus *Crotaphytus*) display behavior and coloration."

International.—**Christopher Kelly**, Oxford University. Project title: "Afromontane snakes: species boundaries, phylogenetics and phylogeography."

Conservation.—**Michael J. Rubbo**, Pennsylvania State University. Project title: "Urbanization, ecosystems, and amphibians: Do changes in ecosystem functioning prescribe the composition of amphibian communities?

Laboratory Research.—**Carol L. Spencer**, University of Texas at Arlington. Project title: "Phylogeography and comparative analysis of a widespread pitviper, *Crotalus atrox*.

Travel.—**Julie E. González**, Iowa State University. Project title: "Inheritance of nest-site choice in the field in a turtle with temperature-dependent sex determination."

2002 Grants-in-Herpetology Committee.—Chair: Erik R. Wild. Reviewers: Jeffrey Parmelee, Karen Lips, Kirsten Nicholson, Rafael de Sá, and Chris Parkinson.

SSAR congratulates the 2002 GIH recipients and thanks the committee members for their efforts.

Seibert Award Winners for 2002 Announced

The eleventh annual Seibert Awards were presented at the 45th Annual Meeting of the SSAR in Kansas City, 3–8 July 2002. These

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES
2003 ANNUAL MEETING

together with

THE HERPETOLOGISTS' LEAGUE

and

AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

26 June – 1 July 2003
Tropical Hotel Conference Center
(on the Rio Negro)
Manaus, Amazonas, Brazil

Richard C. Vogt and Ning Labbish Chao, Local Chairs

First Announcement

A more detailed meeting announcement will appear in the December 2002 issue of *HR*.

The Meeting Announcement/Call for Papers will be mailed to all members of the sponsoring societies 1 November 2002. It is also available as a PDF file at <http:www.fua.br/jmih2003.html>.

Travel: Varig Travel Vacations is offering a package airfare and hotel round trip from Miami to Manaus with 6 nights in Hotel Tropical with breakfast and buffet lunch US$ 1300 per person double occupancy. Add on prices from other cities can be arranged. <www.varigtravelvacations.ws> or 1-877-687-1000. Attendees may also download the Varig Travel Package reservation form (PDF file) from the SSAR web site: <http://www.ku.edu/~ssar/Manaus_Regform.pdf>

awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). In recognition of outstanding student presentations at the annual meeting, a single award was given in each of the following categories: Systematics (4 eligible presentations), Physiology/Morphology (8 eligible presentations), Ecology/Evolution (19 eligible presentations), and Conservation (10 eligible presentations). All four awardees received a check for US $200 and a book from Academic Press. The winners:

Systematics: **Gregory Pauly**, Section of Integrative Biology, University of Texas at Austin, "Phylogenetic Relationships of North American Bufonids."

Physiology/Morphology: **Gabriel Rivera**, Department of Biological Sciences, Old Dominion University, "Regional Variation in Mechanical Properties of the Integument of *Thamnophis sirtalis* (Serpentes)."

Ecology/Evolution: **Jason Kolbe**, Department of Biology, Washington University, "A Comparative Study of Interspecific Interactions among Three Antiguan Lizards."

Conservation: **John Roe**, Department of Biology, Indiana-Purdue University, "Wetland Use Patterns and Spatial Ecology in Two Sympatric Water Snakes, *Nerodia sipedon* and the imperiled *Nerodia erythogaster neglecta*."

The judges also acknowledged additional outstanding presentations as Honorable Mention recipients:

Systematics: **Ted Townsend**, Department of Biology, Washington University, "Phylogeography and Species Status of Dwarf Chameleons of the *Bradypodion transvaalense* Complex of South Africa."

Physiology/Morphology: **Charles Smith**, Department of Ecology and Evolutionary Biology, University of Connecticut, "Sexual Dimorphism in the Forked Tongue of the Northern Copperhead Snake."

Ecology/Evolution: **Erin Casey**, Department of Biological Sciences, Eastern Illinois University, "Genetic Diversity, Phylogeography, and Conservation of the Seal Salamander, *Desmognathus monticola*." **Patrick Owen**, Department of Ecology and Evolutionary Biology, University of Connecticut, "Graded Aggressive Response in the Green Frog *Rana clamitans*." **Jessica Stapley**, School of Botany and Zoology, Australian National University, "The Behavioral Responses of Lizards to Multiple Predators."

Conservation: **Tracy Green**, Division of Biological Sciences, University of Missouri, "Salamanders Alter Emigration Behavior at a

Forest-Grassland Edge: Variation among Metamorphs, Adults, and Translocated Adults." **Deni Porej**, Department of Evolutionary, Ecology and Organismal Biology, The Ohio State University, "Amphibian Aspect of Mitigation for Wetland Losses."

The judges were Robin Andrews (Virginia Polytechnic and State University), Chris Austin (University of North Dakota), David Bickford (University of Miami), Steve Johnson (U.S. Geological Survey), Peter Nelson (Emory University), Kirsten Nicholson (Washington University), Chuck Peterson (Oklahoma State University), Marion Preest (Chair, The Claremont Colleges), and Lora Smith (Joseph W. Jones Ecological Research Center).

Proposed Amendment to SSAR Bylaws

Members of the Society for the Study of Amphibians and Reptiles are hereby notified of a proposal approved by the SSAR Board of Directors to amend the following articles of the SSAR Bylaws to alter the terms of office for several officers to either two- or four-year terms (dependent upon position) and increase the number of Directors from six to eight. The purpose of the amendments is to increase the number of board members and enable the SSAR to benefit more fully from their expertise and acquired knowledge of the society. These changes will furthermore allow elections for officers be held only every other year, rather than annually, as also approved by the Board.

Article II, Section 1a, currently reads: "The elected officers shall be President, President-elect, Secretary, Treasurer, six Directors and the immediate past President."

If amended, it will read: "The elected officers shall be President, President-elect, Secretary, Treasurer, eight Directors and immediate Past-President."

Article II, Section 3, currently reads: "The terms of office for the President, President-elect and immediate Past-President shall be for two years; those for Secretary, Treasurer, Publications Secretary and Directors shall be for three years (with election to provide staggered terms so that no more than two Directors shall be elected in any one year)."

If amended, it will read: "The terms of office for the President, President-elect, Secretary, Treasurer, Publications Secretary, and immediate Past-President shall be for two years; those for Directors shall be for four years (with election to provide staggered terms so that no more than four Directors shall be elected in any one year)."

Article III, Section 1, currently reads: "The Board of Directors shall consist of the President, President-elect, Secretary, Treasurer, six Directors, Publications Secretary and immediate Past-President.

If amended, it will read: "The Board of Directors shall consist of the President, President-elect, Secretary, Treasurer, eight Directors, Publications Secretary and immediate Past-President."

These proposed amendments will be on the agenda for discussion at the 2003 annual business meeting in Manaus, Brazil (precise date and time to be determined). A ballot on the amendments will be submitted to the SSAR membership after the annual meeting in Manaus. The new terms of office would take effect in 2005 for those persons elected by mail ballot in 2004.

NEWSNOTES

International Society for the History and Bibliography of Herpetology

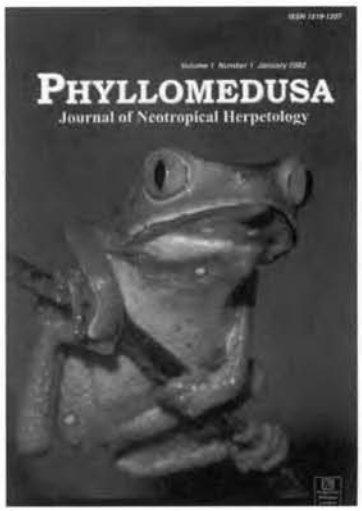


The ISHBH is a not-for-profit organization established to bring together individuals for whom the history and bibliography of herpetology is appealing and to promote the knowledge of related topics among members and the general public. Membership is open to anyone who shares the aims of the society. Members receive the biannual ISHBH Newsletter and Bulletin. The society also organizes seminars, visits to libraries, museums, research stations, etc., in connection with international herpetological meetings. Web address:

<www. teorekol.lu.se/~rana/ISHBH>

Formal application for membership (US $30/regular and $10/student) should be directed to: *Richard Wahlgren, Chairperson, ISHBH, Box 2123, SE-220 02, Lund, Sweden; e-mail: Richard.Wahlgren@skanska.se.*

Phyllomedusa, Journal of Neotropical Herpetology



Phyllomedusa—Journal of Neotropical Herpetology, is a biannual journal dedicated to the study of all aspects of the biology of Neotropical amphibians and reptiles, and is published by Melopsittacus Publiçacões Científicas. Volume 1, Number 1 made its appearance in 2002. Although English is the primary language of the journal, manuscripts will be accepted in Portuguese or Spanish, with English abstracts. The Editor is Jaime Bertoluci (e-mail: bertoluc@icb.ufmg.br). Subscriptions within Brazil: R $20.00; outside Brazil: US $20.00. Correspondence to: *Caixa Postal 1474, Belo Horizonte - Minas Gerais, CEP 30.123-970, Brazil.*

Additional note: Attendees at the 2002 Kansas City meetings

who paid for subscriptions to *Phyllomedusa* need to send their e-mail addresses to Dick Vogt (e-mail: vogt@inpa.gov.br).

Herpetological Collection Moved

The research collection of amphibians and reptiles of the Department of Biology, George Mason University, Fairfax, Virginia (GMU) has been deposited in the Division of Amphibians and Reptiles, National Museum of Natural History, Smithsonian Institution, PO Box 37012, NHB W203, mrc 162, Washington, DC 20013-7012, USA. Please contact Ronald Crombie (e-mail: crombie.ron@nmnh.si.edu) for information concerning specimens.

MEETINGS

Meetings Calendar

25–28 November 2002—VII National Meeting, Sociedad Herpetológica Mexicana (SHM) (Mexican Herpetological Society), Universidad de Guanajuato, México. Information: www.iztacala.unam.mx/shm/.

18–22 June 2003—Second International Congress on Chelonian Conservation in Senegal. Conference to be held in English w/ French translations. Further info: www.tortues.com; e-mail: soptom@soptom.com.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres-Carvajal**; postal and e-mail addresses may be found on the inside front cover.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Cryptic Patterns in Horned Lizards

Horned lizards of the genus *Phrynosoma* are relatively slow moving animals that utilize crypsis as their primary means of escaping detection. Sherbrooke discusses the vertebral line patterns of two species, which are black in *P. mcalli* and white in *P. cornutum*. The author argues that these lines mimic plant stem shadows and plant stems, respectively. Both species spend large amounts of their daily surface activity underneath clumps of grass, shrubs, and other vegetation. The blotched-spotted patterns of these lizards are consistent with an antipredatory strategy of cryptic defense. Future studies can test this hypothesis in the context of experimental manipulation of vertebral-line patterns, behavioral selection of backgrounds, and geographic variation of these taxa.

SHERBROOKE, W. C. 2002. Do vertebral-line patterns in two horned lizards (*Phrynosoma* spp.) mimic plant-stem shadows and stem litter? Journal of Arid Environments 50:109–120.

Correspondence to: Wade C. Sherbrooke, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA; e-mail: wcs@amnh.org.

Swimming Performance in the Frog *Xenopus laevis*

Numerous studies have failed to demonstrate a trade-off between speed and endurance in locomotor performance of vertebrates. The authors propose two competing hypotheses to explain this phenomenon: 1) the performance trade-off may not pertain to all vertebrates; or 2) trade-off effects of whole muscle may be difficult to observe at the whole-organismal level. These hypotheses were addressed by examining the burst swimming performance and endurance of 55 post-metamorphic *Xenopus laevis*; eighteen of these individuals also were tested for isolated muscle performance with the work-loop technique. Statistical analyses were performed with Pearson's product moment correlation, the Bonferroni method, and student's *t*-test. Results of whole-animal performance experiments indicated no trade-off between measurements of speed and endurance. Isolated whole-muscle performance experiments did not demonstrate any significant correlation between measures of whole-animal performance and *in vitro* muscle performance. However, peak instantaneous power output at six Hz was negatively correlated with the fatigue-resistance of force production at two Hz. It is possible that *in vitro* measures of muscle performance do not accurately reflect *in vivo* locomotor states.

WILSON, R. S., R. S. JAMES, AND R. VAN DAMME. 2002. Trade-offs between speed and endurance in the frog *Xenopus laevis*: a multi-level approach. The Journal of Experimental Biology 205:1145–1152.

Correspondence to: Robbie S. Wilson, Laboratory of Functional Morphology, Department of Biology, University of Antwerp, Universiteitsplein 1, Wilrjk B-2610, Belgium; e-mail: rwilson@uia.ua.ac.be.

Organophosphate and pH Levels of Frozen *Rana sylvatica*

Thawing frogs may experience disruption of vital functions as a consequence of low ATP and creatine phosphate (CP) levels and/or abnormal pH of the blood. The authors used NMR spectroscopy to examine these factors (and inorganic phosphate, P_i) in wood frogs (*Rana sylvatica*) that were exposed to either slow or rapid freezing at -1.5°C for seven days. Statistical tests included repeated measures analysis of variance, Tukey tests, and unpaired *t*-tests. Most of the test subjects survived the slow-freeze treatment (3 of 4), but no frogs survived the rapid-freeze treatment. Levels of P_i increased in both slow and fast-freeze treatments, whereas CP levels declined in both treatments. Levels of ß-ATP were stable in the slow-freeze treatment, but declined in the fast-freeze treatment. Intracellular pH was stable in the slow-freeze treatment, but declined in the rapid-freeze treatment. It is likely that the slow-freeze treatment allowed frogs to maintain sufficient pools of ATP and CP because effective glucose distribution per-

mitted adequate energy metabolism. The likely cause of death in the rapid-freeze test subjects was acidosis.

LAYNE, JR., J. R., AND S. D. KENNEDY. 2002. Cellular energetics of frozen wood frogs (*Rana sylvatica*) revealed via NMR spectroscopy. Journal of Thermal Biology 27:167–173.

Correspondence to: Jack R. Layne Jr., Department of Biology, Slippery Rock University, Slippery Rock, Pennsylvania 16057, USA; e-mail: jrl@sruvm.sru.edu.

Tongue Evolution in the Family Plethodontidae

Many species of plethodontid salamanders have evolved extremely rapid and extendable tongues for the purpose of prey capture. The authors hypothesize that plethodontids with a larval stage of development have experienced a constraint on the evolution of their tongue protraction because of conflicting functions of the hyobranchial apparatus in their biphasic life history. The authors tested the behavioral prediction of this hypothesis—that adult plethodontids will possess poor suction-feeding abilities. This behavior was observed in seven taxa of the subfamily Desmognathinae; all examined species have a life history with an aquatic larva that reorganizes the hyobranchial apparatus during metamorphosis. A total of 275 prey-capture attempts was recorded with a high-speed video camera against a background grid of 5 mm or 1 cm squares. High-quality, videotaped feedings were digitized to facilitate kinematic analyses. Larvae of all examined taxa used suction feeding via hyobranchial depression to capture prey; no animals fed during metamorphosis. Terrestrial-feeding adults used tongue protraction in 32 of 34 feeding attempts, and jaw prehension for the remaining attempts. Aquatic-feeding adults captured prey by lunging forward and grasping prey with the jaws or by tongue protraction—prey were manipulated less effectively in larvae. These results support the authors' contention that the loss of suction feeding in adult plethodontids is a consequence of the evolution of tongue protraction. The evolution of tongue protraction in plethodontids suggests a terrestrial or semi-terrestrial habit was present in ancestral members of this group.

DEBAN, S. M., AND S. B. MARKS. 2002. Metamorphosis and evolution of feeding behaviour in salamanders of the family Plethodontidae. Zoological Journal of the Linnean Society 134:375–400.

Correspondence to: Stephen M. Deban, Department of Biology, 201 South Biology, University of Utah, Salt Lake City, Utah 84112, USA; e-mail: sdeban@usa.net.

Introduced Species of Snakes in Brazil

São Paulo is one of the major commercial centers of southeastern Brazil. The illegal trafficking of exotic and native species of snakes is concentrated in this area. The authors used Sander's Rarefaction Method and data from snakes sent to Instituto Butantan to assess the pattern of new species arrivals in this area. Each species was qualitatively classified for 24 biological categories (e.g., foraging mode) into a niche; niche similarities were estimated using multivariate methods. Twenty-six species of native snakes and 76 species of exotic snakes were included in the investigation. Three main groups (0.2 similarity level) were identified from a cluster analysis of interspecific similarities of biological attributes. The authors point out that some of these species present a potentially lethal threat to humans, and the exotic trade prohibition in Brazil should continue.

ETEROVIC, A., AND M. R. DUARTE. 2002. Exotic snakes in São Paulo City, southeastern Brazil: why xenophobia? Biodiversity and Conservation 11:327–339.

Correspondence to: Marcelo Ribeiro Duarte, Laboratório de Ecologia Evolutiva, Departamento de Ecologia Geral, Instituto de Biociências, Universidade de São Paulo, Rua do Matão 321, Brazil; e-mail: mrduarte@attglobal.net.

FOR SALE
ORIGINAL WATERCOLORS BY DAVID M. DENNIS

SSAR is pleased to announce the availability of the original watercolor paintings from which the color plates were reproduced in William Duellman's classic book "Hylid Frogs of Middle America." These are one-of-a-kind drawings, two to three times the size of the published versions, and each individually signed by the artist. Prices range from US$100 to $800.



Mr. Dennis is widely recognized as one of the foremost illustrators of amphibians and reptiles. His award-winning natural history paintings have been displayed in major galleries and exhibits and are reproduced in numerous books.



A complete pricelist of the paintings is available on request from the SSAR Publications Secretary, Breck Bartholomew, address: SSAR Publications, P.O. Box 58517, Salt Lake City, UT 84158–0517; e-mail: ssar@herplit.com. Copies of the book in two clothbound volumes ($125) and printed sets of the 46 color plates ($45) are also available from Mr. Bartholomew.

Behavioral Dominance in the Lizard *Cnemidophorus laredoensis*

The *Cnemidophorus laredoensis* complex consists of two sympatric, diploid, all-female parthenogenetic species (LAR-A and LAR-B). Behavioral observations in the field suggest that in aggressive interactions, LAR-B is behaviorally dominant to LAR-A, and that both species defend their burrows from intruders. The author tested these hypotheses in a laboratory setting by placing one individual of each species (approximately the same size) in a 91 x 45 x 54 cm glass aquarium with a cardboard partition that divided the terrarium into two equal sides. The lizards were given 48 hours to adjust to their setting (and dig burrows), and were then filmed two minutes after the partition was removed for 60-min trials. Specific types of behavior dictated whether an interaction resulted in a "winning encounter" for an individual lizard—if an individual "won" more than 50% of the encounters, it was classified as the dominant individual for that trial. Statistical analyses were conducted with Binomial tests, Chi-square tests, Wilcoxon sign rank tests, and conventional *t*-tests. Individuals of the LAR-B species won 13 of 16 trials with clear, overall winners; reproductive state of the lizards did not have an effect on trial outcomes. Individuals of both species did not attempt to defend their burrows from intruders. The discrepancy in burrow-defense behavior in field observations and this study may be an artifact of the experimental design.

PAULISSEN, M. A. Interspecific dominance and burrow use in the two species of the parthenogenetic lizard complex *Cnemidophorus laredoensis* (Teiidae). Southwestern Naturalist 47:21–29.

Correspondence to: Mark A. Paulissen, Department of Biological and Environmental Sciences, McNeese State University, Lake Charles, Louisiana 70609, USA; e-mail: mpauliss@mail.mcneese.edu.

Habitat Selection of the Wood Turtle *Clemmys insculpta*

Previous models of habitat selection in mobile species assume that an animal's entire home range is available to it between successive observations. However, this assumption does not seem valid for wood turtles (*Clemmys insculpta*) because this species has low mobility and large home ranges. The authors present a model of habitat selection that utilizes samples from one or more random locations paired with each animal location, and a paired logistic regression to analyze the habitat selection. Thirty-seven turtles from western Maine were captured and radio tagged (Lotek MBFT-6 transmitters); these turtles were located by radiotelemetry one to three times per week for several months in the summers of 1997 and 1998, and these data were entered into a geographic information system. Several types of habitat measurements and variables were recorded from activity areas of the turtles. Most of the turtle locations occurred in forest, scrub-forest, bog-fen, or "emergent cover" habitats; males were found in water twice as often as females. Coefficients of the best model from activity-area scales suggest that turtles selected nonforested, low canopy-cover areas that are close to water; overall the models did not demonstrate strong predictive power. A watershed-scale model suggested that turtles select activity areas near streams and rivers with moderate (10–50%) amounts of forest cover—this model had an overall correct classification rate of 84%. The incongruence of models for the different scales is a likely reflection of a trade-off between feeding and thermoregulation.

COMPTON, B. W., J. M. RHYMER, AND J. MCCOLLOUGH. 2002. Habitat selection by wood turtles (*Clemmys insculpta*): an application of paired logistic regression. Ecology 83:833–843.

Correspondence to: Bradley W. Compton, Department of Natural Resources Conservation, University of Massachusetts, Amherst, Massachusetts 01003, USA; e-mail: bcompton@forwild.umass.edu.

Fang Formation in Elapid and Viperid Snakes

Previous workers have proposed two conflicting hypotheses to describe snake fang formation. The infolding hypothesis states that embryonic fangs develop an anterior groove that deepens and comes together to form a closed canal. Proponents of the "brick chimney" hypothesis contend that mineralization of hollow fangs proceeds basally without any folding around the canal. Jackson examined a developmental series of fangs from *Naja kaouthia* and *Bitis arietans* with scanning electron microscopy; additional cleared-and-stained specimens of *Crotalus horridus* were examined with light microscopy. Replacement fangs of adult specimens were examined from *Naja melanoleuca, Bothrops lansbergii,* and *Bitis arietans*. Results supported the "brick chimney" hypothesis—shortening of the discharge orifice in viperids may have confused proponents of the infolding hypothesis. Formation and morphology of the first fang in embryonic snakes differed from that of adults and may represent a plesiomorphic condition retained from an opisthoglyphous ancestor.

JACKSON, K. 2002. How tubular venom-conducting fangs are formed. Journal of Morphology 252:291–297.

Correspondence to: Kate Jackson, Museum of Comparative Zoology, Harvard University, 26 Oxford Street, Cambridge, Massachusetts 02138, USA; e-mail: kjackson@oeb.harvard.edu.

Effects of Temperature on Eggs of the Scincid *Bassiana duperreyi*

Suboptimal incubation conditions serve as a stimulus for hatching in some species of squamate reptiles. Shine hypothesized that cool temperatures in the montane scincid *Bassiana duperreyi* might stimulate early hatching and produce different phenotypic traits. Eggs were collected from wild nests and transferred to incubators that simulated normal, relatively warm incubation conditions. At various times in the latter half of normal development (7–11 weeks), some eggs were transferred to incubators with either gradual or sudden declines in incubation temperatures—both treatments mimic conditions that have been recorded from wild nests. Locomotor speed of hatchlings was assessed on a one-meter raceway. Hatching success was 73% and 80% for eggs shifted to the "sudden decline" treatment at seven and eight weeks, respectively. All other treatments had a hatching success rate of 93%. Incubation duration was longer for eggs transferred to cooler temperatures at seven weeks, but later transfers had a smaller effect. Longer

incubation periods produced relatively heavy-bodied lizards; locomotor performance was affected by time of egg transfer and the magnitude of temperature decline. Growth was affected in numerous ways by the treatments. Data from other taxa are needed to assess whether these results represent adaptations to local conditions.

SHINE, R. 2002. Eggs in autumn: responses to declining incubation temperatures by the eggs of montane lizards. Biological Journal of the Linnean Society 76:71–77.

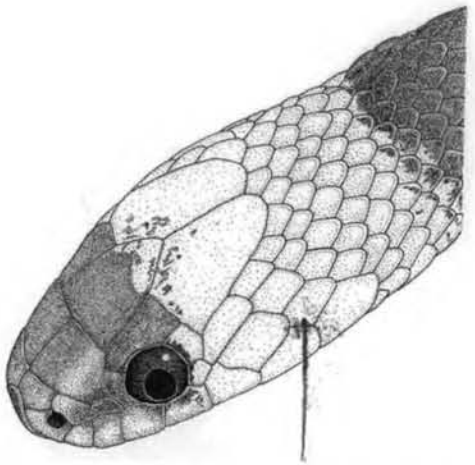
Correspondence to: Rick Shine, Biological Sciences A08, University of Sydney, NSW 2006, Australia; e-mail: rics@bio.usyd.edu.au.

Variation of a Peruvian Herpetofauna

Neotropical rain forests are not homogeneous throughout their distribution, and local and regional effects on the herpetofauna in these areas are poorly understood. To understand the effects of microgeographic variation on the herpetofauna of Tambopata Region in Peru, the authors intensively surveyed five localities for 23 months in 1997 and 1998. Each site had four quadrat parcels (80 x 70 m; 56 quadrats each) and two visual encounter survey parcels (1 ha; 24 transects each). During each 18-day visit, 84 quadrats were visited during the night and 24 during the day; each of the visual encounter transects was visited once during the day and once at night. Diversity and similarity between sites was examined with the Shannon-Wiener diversity index and the coefficient of biogeographic resemblance. Revised checklists resulting from this study have distinguished this region of Peru as the most diverse herpetofauna known in the world. Results indicated that many factors are responsible for the herpetofaunal composition in various types of forest, including local hydrography, topography, and soil types.

DOAN, T. M., AND W. A. ARRIAGA. 2002. Microgeographic variation in species composition of the herpetofaunal communities of Tambopata Region, Peru. Biotropica 34:101–117.

Correspondence to: Tiffany M. Doan, Department of Biology, University of Texas at Arlington, Box 19498, Arlington, Texas 76019, USA; e-mail: tiffperu@yahoo.com.



Clelia scytalina (juvenile, 480 mm SVL) (Mussurana). Costa Rica. Illustration by Julian C. Lee.

ZOO VIEW

Approximately fifty years ago, my tolerant parents took me for the first time to the Lincoln Park Zoo in Chicago. There I met Edward J. Maruska, then a keeper in the feline building. Gifted zoo people—brilliant, eccentric, dedicated, often aggressive and controversial, and productive—have always fascinated me and Ed clearly fit this category. Even at this tender age, I recognized his encyclopedic knowledge of the animal kingdom. He was able to field every question I posed with ease and he spent many hours instructing me about animal diversity, captive animal management, and the vagaries of the zoo profession.

Later, soon after I was miraculously accepted as an undergraduate student at Xavier University in Cincinnati, Ed was offered the position of Assistant Director at the Cincinnati Zoo and Botanical Garden. When his boss left to become director at another zoo, Maruska was elevated to the top post. Ed embraced this challenge but was faced with a zoo in a deplorable state: outmoded and inadequate exhibits, many poorly trained keepers, organizational instability, substandard animal collection, political pressure, low visitation, and public indifference. One example of shoddy keeper training will illustrate the lack of professional standards. Shortly after Ed arrived at the Zoo, he watched in amazement and horror as a keeper washed the concrete floor of a cage containing a huge adult male baboon. The primate grabbed the hose, pulled the keeper across the enclosure, bared his enormous canines and screamed in his face, then held the keeper's shoulders firmly and shook him violently for many minutes. During the whole episode, Ed yelled at the keeper to vacate the cage immediately. Shaken and concerned, Maruska asked the keeper upon exiting if he had been traumatized or injured. The employee responded that he was just fine and Ed need not worry; this ritual had been a daily occurrence for years! Because Ed is an energetic fellow, he plowed his considerable talents into improving the Zoo. Today, this institution is considered to be one of the world's finest.

When the annual SSAR meeting was held in nearby Miami, Ohio many years ago, a tour of the Zoo was scheduled for the attendees. Prominent amphibian biologists from the museum and academic community had heard that Maruska had amassed a salamander collection but they were not prepared for the width and breadth of this caudate assemblage. Salamanders were housed in every nook and cranny throughout the Zoo. As they viewed olms, giant salamanders, rare cave salamanders, and other exotic forms infrequently seen alive, their collective impression was one of awe. Because Ed is a talented photographer, he had created dioramas using living ferns, mosses, lichens, mushrooms, and other plants to be used as a backdrop for photographing his specimens. In addition, there was an extensive preserved collection as Ed was fastidious about maximizing the use of this collection by recording locality data. Many colleagues told me that this was without doubt the most overwhelming living salamander collection ever assembled!

Maruska published a number of papers outlining his procedures for setting up and maintaining his salamander colony (see Maruska 1994. *In* J. B. Murphy, K. Adler, and J. T. Collins [eds.], Captive Management and Conservation of Amphibians and Reptiles, pp. 229–242. SSAR. Contributions to Herpetology, volume 11 for an example.). Because the salamander collection is so diverse and comprehensive, an impressive number of longevity records have been compiled and many husbandry and medical protocols developed. In the second edition of "Longevity of Reptiles and Amphibians in North American Collections" (SSAR Herpetol. Circ. No. 21), 66 taxon-records derive from the Cincinnati Zoo collection. Salamanders of 32 species lived over 10 years and of these, five passed 20 years. This is a remarkable accomplishment. According to "International Zoo Yearbook" (1998:Volume 28), composition of the collection was 97 taxa of reptiles with 365 specimens and 66 taxa of amphibians numbering over 560 specimens.

Because Ed is a collector par excellance, a visit to his zoo office was always an adventure. Piles of books, photographs, posters, zoo memora-

bilia, artifacts from his world travels such as weapons, statues, carvings, and a myriad of other objects, littered this room; in fact, he had to clear part of the accumulation off a chair so I could sit during my last visit. When I mentioned that his collecting impulse was beyond control, he said that his home was stuffed to the breaking point with many more of his treasures.

I have a special warm feeling for him as he was my mentor, advisor, confidant, and friend throughout my career; although now retired, his influence in our profession was and is still likely to be profound.

During the Third World Congress of Herpetology in Prague, Czech Republic in 1997, I first met Hans-Werner and Patricia A. Herrmann. Patricia, whose maiden name was Mahaney at that time, worked at the Arizona-Sonora Desert Museum. They discovered each other there as well and founded their relationship in this professional setting.

Although we had not interacted earlier, Hans-Werner's reputation was widespread for he had established an enviable research and conservation program at the Cologne Zoo where he was curator. I had been impressed with his publications on viperid phylogeny and knew of his herpetofaunal surveys in Cameroon and Vietnam so the chance to ask him in person about his herpetological activities was welcome.

Last year, they traveled to Washington, D.C. and came to my abode for a few glasses of wine and dinner. Hans-Werner pulled a sizeable pile of photographs from his briefcase and asked if I would like to see them. I assumed that these would be wedding or honeymoon photos but, alas, it should have been apparent that herpetologists more often have photos of amphibians and reptiles. In this case, the images were of his newly described Vietnamese horned pitviper *Triceratolepidophis sieversorum*, as well as the rare *Trimeresurus cornutus*, photographed from every conceivable angle.

To pursue his love of field research, Hans-Werner left the Cologne Zoo earlier this year to embark on an exciting new adventure. He and Patricia will continue to study the biology of the endangered goliath frog in Cameroon, sponsored by the Center for the Reproduction of Endangered Species at the San Diego Zoo. I asked if they would share highlights of their earlier time in Cologne and their account follows.

—James B. Murphy, Section Editor.

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Herpetological Conservation at the Cologne Zoo

HANS-WERNER HERRMANN
and
PATRICIA A. HERRMANN
Center for Reproduction of Endangered Species (CRES)
Zoological Society of San Diego, P.O. Box 120551
San Diego, California 92112-0551, USA
e-mail: hwherrmann@t-online.de

The Cologne Zoo was founded in 1860; it is the third oldest zoo in Germany. The aquarium building was added over a century later in 1971. This building follows in the German zoo fashion of building so-called "exotariums" or "vivariums" in which amphibians and reptiles, but also fishes and invertebrates, are housed. Cologne's zoo, together with the aquarium, was voted the "Number 1" zoo in Germany by the prominent Stern news magazine in 2000. There are about 100 species of herpetofauna. Breeding is an integral part of the collection's husbandry policy. Examples of noteworthy breedings are *Palaeosuchus palpebrosus*, *Cyclura cornuta*, *Chamaeleo* spp., *Chelodina oblonga*, *Holaspis leavis*, and several dendrobatid species.

In 1998 an important new direction was founded in the Cologne aquarium. In situ biodiversity conservation activities were commenced in Cameroon with corporate sponsorship by the German branch of the American Linen Supply Company (ALSCO), and the Zoo Cologne Nature Conservation project was started in Vietnam. The latter project presently is run as an in situ activity affiliated with the new rainforest house at the zoo. Nevertheless, the initiation of this project and a large portion of the actual in situ work has been carried out by aquarium staff.

The ALSCO Biodiversity Conservation Initiative in Cameroon was started in 1998 at Mt. Nlonako, a mountain rainforest area in the vicinity of Nkongsamba, Southwest Cameroon (Herrmann et al. 1999). First herpetological surveys (see also Herrmann et al. 2000; Kolter et al. 2001) have produced a total of more than one hundred species including such enigmatic representatives as the Goliath frog (*Conraua goliath*), the hairy frog (*Trichobatrachus robustus*), and the rare Pfeffer's chameleon (*Chamaeleo pfefferi*), known from the female type specimen only for about one hundred years.

As a result of the teaching commitments of Cologne Aquarium staff at the Department of Biology, Philipps-University Marburg, graduate students are currently conducting amphibian ecology research within the framework of the conservation activities. One goal of this work is to obtain baseline data on amphibian species ecology in tropical Africa to be used to analyze the African situation within the global perspective of declining amphibian populations. In the future the study of the ecology and conservation biology of selected anuran species as well as their possible value as biological indicators will be additional focal points of the project.



Conraua goliath as bushmeat offer.



Triceratolepidophis sieversorum portrait showing supraocular horns.

The ALSCO biodiversity conservation activities are also focused on the Tchabal Mbabo area, a particularly isolated mountain rainforest relict in the Adamaoua plateau region of Western Cameroon adjacent to the border of Nigeria. This area is one of the northernmost rainforests in Africa and shows a fair degree of endemism including the recently described caecilian *Crotaphatrema tchabalmbaboensis* (Lawson 2000). Due to the remoteness and inaccessibility of this region, only initial surveys have been conducted thus far.

In 1999 Cologne Zoo began its involvement with the conservation of the Phong Nha Nature Reserve in Quang Binh province in Central Vietnam (Herrmann and Pagel 2000). This karst mountain area is situated in the Annamite mountain range, which runs along the Vietnam-Laos border and is remarkable for a number of newly discovered and endemic large mammal species (i.e. *Pseudoryx nghetinhensis*, *Megamuntiacus vuquangensis*, *Nesolagus timminsi*). The area has revealed 96 different amphibian and reptile species (Ziegler and Herrmann 2000). Recent investigations have uncovered additional species which increases the total number to well over one hundred species. The most spectacular finding was a hitherto unknown genus and species of large crotalid, which was subsequently described as *Triceratolepidophis sieversorum* (Ziegler et al. 2000). Recently the Phong Nha area together with the adjacent Ke Bang area were elevated to the Phong Nha-Ke Bang National Park by the Vietnamese government.

All the above-mentioned areas and their biodiversity are threatened by habitat loss and fragmentation due to encroachment and logging. Poaching for the bushmeat market and traditional medicine practices plays an important role in population declines. In these projects we are sensitive to the close relationship between sociological aspects and conservation; involvement of local communities in all levels of fieldwork and education is vital. Close associations with the conservation authorities and local universities and researchers are maintained.

Acknowledgments.—We thank Jim Murphy for his invitation to contribute to this column. We are grateful to those staff members at the Cologne Aquarium, without whose enthusiasm and help neither the husbandry nor breeding of amphibians and reptiles would have been possible. Special thanks goes to ALSCO Germany, namely Mr. Horst Nobis, who almost exclusively financed the Zoo Cologne Cameroon conservation activities. The Cameroonian Ministries of Scientific and Technical Research (MINREST) and Environment and Forestry (MINEF) issued permits and supported our activities at Mt. Nlonako and Tchabal Mbabo. In Vietnam we received support from the Hanoi Center for Natural Resources Management and Environmental Studies (CRES), the Forest Planning Department (FPD) and the Peoples Committee of Quang Binh. Last but not least, we wish to thank all our enthusiastic and capable students and colleagues in Cameroon, Vietnam, and elsewhere for their companionship and assistance.

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Project Golden Frog Clarification

In the March 2002 issue of *HR*, the inaugural edition of the Zoo View column featured the Detroit Zoo's National Amphibian Conservation Center and its most high-profile program, *Project Golden Frog*. In attributing authorship of the project summary to NACC staff, the section editor inadvertently gave the impression that PGF is a Detroit Zoo initiative. On the contrary, PGF began in 1997 as a collaboration between the Columbus Zoo and then-Ohio State University doctoral candidate Erik Lindquist. Since that time, Dr. Lindquist has relocated to Lee University, and staff/research associates at the Smithsonian Tropical Research Institute, Círculo Herpetológico de Panamá, Baltimore Zoo, and Detroit Zoo have also taken on leadership roles and have greatly contributed to all aspects of the Project. Project Golden Frog is truly a multi-institutional initiative whose success is entirely dependent on the diverse experience and insight of its co-PIs. We apologize for the inadvertent oversight in recognition.

ARTICLES

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The Relationship Between Mass and Snout–Vent Length in the New Zealand Tor-Inhabiting Skink *Oligosoma grande*

ALLEN E. GREER
Herpetology Section, Australian Museum
6 College Street, Sydney, NSW 2010, Australia
e-mail: alleng@austmus.gov.au

and
TONY WHITAKER
R.D. 1, Motueka 7161, New Zealand
e-mail: whitaker@ts.co.nz

Considering the significance of mass as a covariate of other morphological and ecological variables, it is remarkable how little information and analysis there is for this fundamental parameter in many species of squamates. For example, there are analyses that address the issue of the allometric relationship for mass on snout-vent length in only two of the some 1252 species of skinks: *Eumeces laticeps* (Vitt and Cooper 1985) and *Mabuya heathi* (Vitt 1995).

During the course of field work on the New Zealand tor-inhabiting skink *Oligosoma grande* in the Macraes Flat area of the South Island in the period January 1994 to April 1995, one of us (TW) gathered data on mass (to nearest 0.5 g with Pesola™ spring balance), snout–vent length (to nearest 1 mm by hanging the relaxed live skink against a metric ruler), and sex (where feasible by eversion of tail base). No specimens were taken due to the fact that the species is one of New Zealand's most severely threatened species. The data were presented graphically in the resulting technical report (Whitaker 1996:Fig. 2), but no further analysis was undertaken. Here we analyze these data further, especially with regard to the relationship between mass and snout–vent length. Statistical anaylsis was carried out with Systat 9 software.

There is a strong sexual dimorphism in this species, with females attaining much larger snout–vent lengths and greater masses, although part of the greater mass in females might be because of the virtual certainty of some being gravid. Snout–vent length in sexable males ranged from 66 to 101 mm (mean = 88.3 mm, SD = 8.84, N = 40) and in sexable females from 81 to 109 mm (mean = 98.1 mm, SD = 5.19, N = 41)(Mann-Whitney = 1383, $P < 0.001$). Mass in males ranged from 5.8 to 22 g (mean = 14.9 g, SD = 4.37, N = 40) and in females from 9.5 to 29.0 g (mean = 19.4 g, SD = 3.90, N = 41)(Mann-Whitney = 1239, $P < 0.001$).

The relationship between mass and snout–vent length in each sex was examined by regression analysis of the log transformed data (in order to make the relationship more nearly linear). The regression line for log mass on log snout–vent length for the sexable males has the equation: log mass = –4.76 + 3.04 log snout–vent length ($P < 0.0001$, $r^2 = 0.93$, N = 40). The regression line for the sexable females has the equation: log mass = –5.16 + 3.23 log snout-vent length ($P < 0.001$, $r^2 = 0.73$, N = 41)(logs base 10)(Fig. 1). The 95 percent confidence intervals for the slopes for the two regressions are ± 0.28 and ± 0.62, respectively, both intervals confidently include the slope indicative of isometry: 3.00. The reason that more of the variance in mass is explained by snout–vent length in males (0.93) than in females (0.73) and the confidence interval for the slope is smaller in males (± 0.28) than in females (± 0.62) is again, in part, because of the likelihood of some females being gravid. The regression for log mass on log snout–vent length for all specimens combined (sexed and unsexed) has the equation: log mass = –4.89 + 3.10 log snout-vent length ($P < 0.0001$, $r^2 = 0.99$, N = 184). The 95 percent confidence interval for the slope is ± 0.05 suggesting a relationship of mild positive allometry. That this positive allometry is not just because of the probable inclusion of gravid females is indicated by the positive allometry for all individuals exclusive of sexable females. The equation is: log mass = –4.96 + 3.14 log snout–vent length ($P < 0.0001$, $r^2 = 0.99$, N = 0.99, N = 143). The 95 percent confidence interval for the slope is ± 0.06 suggesting, again, a relationship of mild positive allometry. Therefore, we take the regression for log mass on log snout-vent length for all specimens as indicative for the species (Fig. 2).

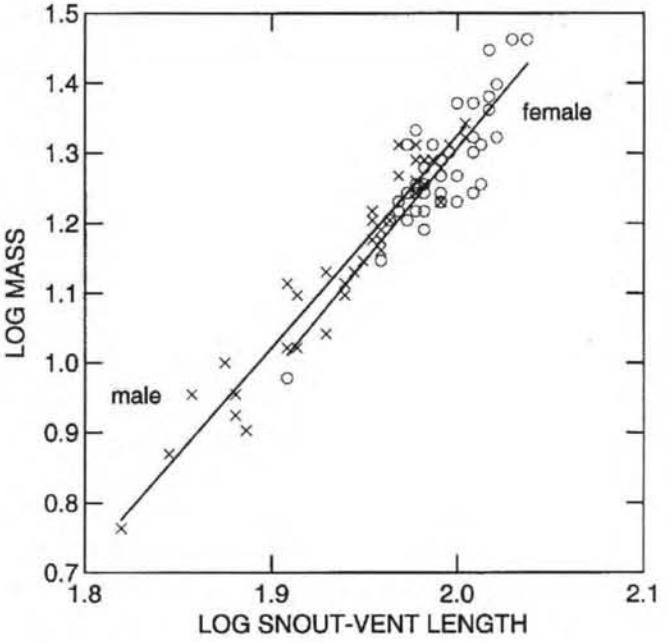


FIG. 1. Regression for log mass on log snout–vent length for the sexable specimens of male (X) and female (O) *Oligosoma grande*. Regression equation for males: log mass = –4.76 + 3.04 log snout–vent length ($P < 0.0001$, $r^2 = 0.93$, N = 40) and for females: log mass = –5.16 + 3.23 log snout–vent length ($P < 0.001$, $r^2 = 0.73$, N = 41).

The regression lines for the log mass on log snout–vent length for each sex were compared by analysis of covariance (ANCOVA) to find differences in the slopes of the two lines and if not, then for a difference in the intercepts (elevations) of the two lines. This analysis showed there was no significant difference between the sexes in the slopes ($F = 0.34$, df = 77, $P = 0.56$) and a barely nonsignificant difference in the intercepts ($F = 3.69$, df = 78, $P = 0.058$)(Fig. 1). This comparison of the two lines was permitted because the residual variances around the regressions were not significantly different ($F = 1.40$, df = 39,38, $P > 0.05$). If the difference in intercepts were to be taken as significant, males could be interpreted as being heavier for their length than females.

In most skinks, females are larger than males in snout–vent length

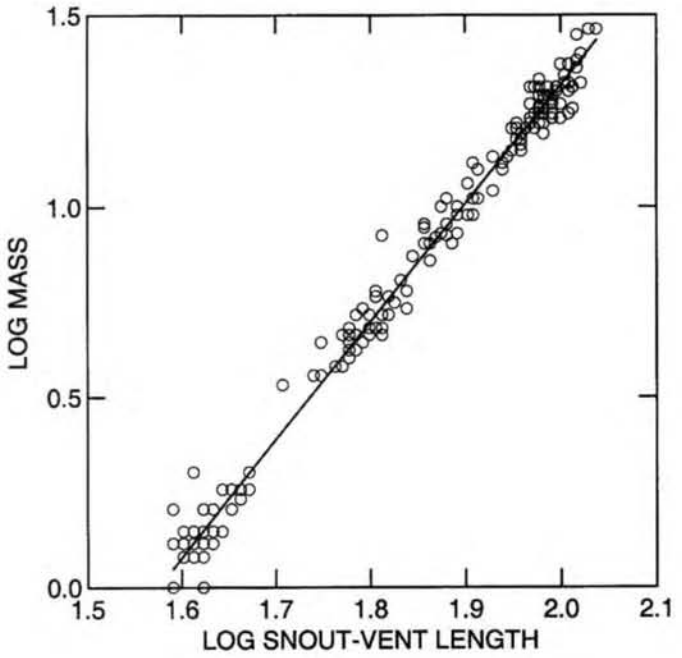


FIG. 2. Regression for log mass on log snout–vent for both sexed and unsexed specimens of *Oligosoma grande*. Regression equation: log mass = –4.89 + 3.10 log snout–vent length ($P < 0.0001$, $r^2 = 0.99$, $N = 184$).

(Fitch 1981; AG, pers. obs.), although in some species males are larger than females, e.g., *Eumeces laticeps* (Vitt and Cooper 1985). With females larger than males, *Oligosoma grande* is typical of most skinks.

The relationship between mass and snout–vent length shows negative allometry in male *Eumeces laticeps* (Vitt and Cooper 1985:Table 1 where the slope is 2.34 and the 95 percent confidence interval is ± 0.46) and isometry in female *E. laticeps* (Vitt and Cooper 1985:Table 1 where the slope is 2.72 [not the misprinted 0.72, L. Vitt, pers. comm.] and the 95 percent confidence interval is ± 0.52) and in both sexes combined in *Mabuya heathi* (Vitt 1995:Appendix I where the slope for mass$^{1/3}$ is 1.004 and the 95 percent confidence interval is ± 0.03). Our finding of positive allometry for both sexes combined in *Oligosoma grande* thus adds another form of allometry for the mass on length relationship in skinks. Why this species should "bulk up" disproportionately (albeit slightly) as it increases in size is unclear. Male combat might not be the answer because male *Eumeces laticeps* are one of the most combative groups of skinks (Vitt and Cooper 1985), and yet they become relatively less bulky with size (above). Clearly more data on mass and length relationships are needed before any phylogenetic or ecological trends emerge.

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Status of Larval Identities Among the Peninsular Malaysian Anura

TZI MING LEONG
Department of Biological Sciences, National University of Singapore
Singapore 119260, Singapore
e-mail: scip0132@nus.edu.sg

As a result of the rapid increase in tadpole research, the basic need for the proper identification/characterization of anuran larvae could never be greater (Altig and McDiarmid 1999). For Peninsular Malaysia, the most concerted research effort with particular emphasis on tadpoles was by Berry (1972), who described eight species in careful detail. Despite demonstrating her competency in accurate tadpole descriptions, she did not incorporate larval characteristics in her reference book published later (Berry 1975). Moreover, a number of earlier larval descriptions had already been published for various Malaysian species. However, because of its proximity (past connections across the Sunda Shelf) with neighboring land masses (e.g., Sumatra, Java, Borneo), Peninsular Malaysia shares many anuran species with these regions, and has a relatively low incidence of endemic species (Inger 1999). Thus, a compilation of larval descriptions (not strictly from the peninsula) of anuran species of Peninsular Malaysia would provide a clearer overall picture as to the status of their true identities, and also point out the direction in which heightened research efforts should be channeled.

After a comprehensive literature search, an updated species checklist of the Peninsular Malaysian anurans was produced (Table 1). Each species was numerically scored according to the certainty/thoroughness of its larval assignment/description. The scores range from 0 to 2.0, where 0 – unknown; 0.5 – known, with uncertainty; 1.0 – basic, minimal description/illustration; 1.5 – more detailed descriptions/illustrations; 2.0 – detailed descriptions/illustrations plus internal oral morphology; 0* – in the process of being described; DD – Direct Development. Where applicable, respective references are included and arranged in chronological order. Since Berry (1975), new species have been described and name changes have occurred at the familial, generic, and species levels. The present nomenclature of the species in Table 1 is in accordance with Appendix 8:1 of Inger (1999). A total of 88 species are listed. The five families represented are Bufonidae (14 species), Megophryidae [previously Pelobatidae] (8 species), Microhylidae (18 species), Ranidae (30 species), and Rhacophoridae (18 species). In his checklist, Kiew (1984c) published the names of four species (*Rana cryptica*, *Rana paludicola*, *Kalophrynus leucovitellus*, and *Kalophrynus silus*) seemingly occurring in Peninsular Malaysia. As there was virtually no detailed description of the species named, all four should be effectively regarded as *nomena nuda*, and considered invalid (R. Inger, pers. comm.).

Among the 88 species listed, 71% of the bufonids, 88% of the megophryids, 83% of the microhylids, 77% of the ranids, and 56% of the rhacophorids have their larval identities known with certainty (scores of 1.0, 1.5, or 2.0). Hence, by focusing on the species with scores of 0 and 0.5, progressive efforts might be made to eventually elucidate their hidden identities.

TABLE 1. Peninsular Malaysia Tadpole Status Checklist (0 – Unknown; 0.5 – Known, with uncertainty; 1.0 – Basic, minimal description/illustration; 1.5 – More detailed descriptions/illustrations; 2.0 – Detailed descriptions/illustrations plus internal oral morphology; 0* - In the process of being described; DD – Direct Development).

No.	Species	Status	References
	F. BUFONIDAE		
1.	*Ansonia leptopus*	1.5	Inger, 1992
2.	*Ansonia malayana*	0	
3.	*Ansonia penangensis*	1.5	Flower, 1899
4.	*Ansonia tiomanica*	0	
5.	*Bufo asper*	2.0	Smith, 1930; Berry, 1972; Inger, 1985; Iskandar, 1998
6.	*Bufo divergens*	2.0	Inger, 1966, 1985
7.	*Bufo macrotis*	0	
8.	*Bufo melanostictus*	2.0	Flower, 1896; Inger, 1966; Chou & Lin, 1997; Leong & Chou, 1999
9.	*Bufo parvus*	1.5	Smith, 1916a; Annandale,1917
10.	*Bufo quadriporcatus*	1.5	Leong & Chou, 1999
11.	*Leptophryne borbonica*	2.0	Berry, 1972; Inger, 1985; Iskandar, 1998
12.	*Pedostibes hosii*	2.0	Inger, 1966, 1985
13.	*Pelophryne brevipes*	2.0	Inger, 1960, 1966, 1985
14.	*Pseudobufo subasper*	0	
	F. MEGOPHRYIDAE		
15.	*Leptobrachium hendricksoni*	2.0	Inger, 1966, 1983, 1985
16.	*Leptobrachium nigrops*	2.0	Berry, 1972; Inger, 1983, 1985; Leong & Chou, 1999
17.	*Leptolalax gracilis*	2.0	Inger, 1966, 1983, 1985; Grandison, 1972
18.	*Leptolalax heteropus*	0	
19.	*Leptolalax pelodytoides*	1.5	Smith, 1917; Pope, 1931; Inger, 1983
20.	*Megophrys aceras*	1.0	Annandale, 1917; Smith, 1926
21.	*Megophrys longipes*	1.5	Leong & Chou, 1998
22.	*Megophrys nasuta*	2.0	Inger, 1966, 1985; Leong & Chou, 1999
	F. MICROHYLIDAE		
23.	*Calluella guttulata*	1.5	Smith, 1917
24.	*Chaperina fusca*	2.0	Bourret, 1941; Inger, 1956, 1966, 1985; Manthey & Grossmann, 1997
25.	*Kalophrynus palmatissimus*	1.5	Kiew, 1984a
26.	*Kalophrynus pleurostigma*	2.0	Berry, 1972; Inger, 1956, 1985, Leong & Chou, 1999
27.	*Kalophrynus robinsoni*	0	
28.	*Kaloula baleata*	1.0	Parker, 1934; Iskandar, 1998
29.	*Kaloula pulchra*	1.5	Smith, 1916a; Leong & Chou, 1999
30.	*Metaphrynella pollicaris*	1.0	Manthey & Grossmann, 1997
31.	*Microhyla annectens*	0*	
32.	*Microhyla berdmorei*	1.0	Smith, 1924
33.	*Microhyla borneensis*	1.5	Inger, 1985; Leong & Chou, 1997
34.	*Microhyla butleri*	2.0	Flower, 1899; Chou & Lin, 1997; Leong & Chou, 1999
35.	*Microhyla heymonsi*	2.0	Smith, 1916a; Chou & Lin, 1997; Leong & Chou, 1999
36.	*Microhyla ornata*	2.0	Flower, 1899; Heyer, 1971; Chou & Lin, 1997
37.	*Microhyla palmipes*	1.0	Iskandar, 1998
38.	*Microhyla superciliaris*	0	
39.	*Micryletta inornata*	1.5	Heyer, 1971
40.	*Phrynella pulchra*	1.5	Berry, 1972
	F. RANIDAE		
41.	*Amolops larutensis*	1.5	Laidlaw, 1900
42.	*Hoplobatrachus tigerinus*	1.5	Flower, 1899; Pope, 1931
43.	*Ingerana tenasserimensis*	0	
44.	*Limnonectes blythii*	2.0	Inger, 1966, 1985; Leong & Chou, 1999
45.	*Limnonectes cancrivorus*	1.5	Inger, 1966; Leong & Chou, 1999
46.	*Limnonectes doriae*	0	
47.	*Limnonectes hascheanus*	1.0	Taylor, 1962
48.	*Limnonectes kuhlii*	2.0	Smith, 1917; Inger, 1966, 1985; Dring, 1979; Chou & Lin, 1997; Iskandar, 1998
49.	*Limnonectes laticeps*	0.5	Inger, 1985
50.	*Limnonectes limnocharis*	2.0	Chou & Lin, 1997; Leong & Chou, 1999
51.	*Limnonectes malesianus*	1.5	Kiew, 1984b; Leong & Chou, 1999
52.	*Limnonectes nitidus*	0	
53.	*Limnonectes paramacrodon*	0	

TABLE 1. Continued

54.	*Limnonectes plicatellus*	1.5	Leong & Chou, 1999
55.	*Limnonectes tweediei*	0*	
56.	*Occidozyga lima*	1.5	Smith, 1916b; Pope, 1931; Iskandar, 1998
57.	*Phrynoglossus laevis*	2.0	Smith, 1916b; Inger, 1985; Leong & Chou, 1999
58.	*Phrynoglossus martensii*	1.0	Nutphund, 2001
59.	*Rana alticola*	1.5	Boulenger, 1882; Annandale, 1912; Smith, 1924; Taylor, 1962
60.	*Rana baramica*	0	
61.	*Rana chalconota*	2.0	Flower, 1896; Inger, 1966, 1985; Leong & Chou, 1999
62.	*Rana erythraea*	1.5	Bourret, 1941; Leong & Chou, 1999
63.	*Rana glandulosa*	1.5	Berry, 1972
64.	*Rana hosii*	1.5	Inger, 1966; Manthey & Grossmann, 1997; Iskandar, 1998
65.	*Rana luctuosa*	2.0	Flower, 1896; Inger, 1966, 1985; Grandison, 1972; Dring, 1979
66.	*Rana macrodactyla*	1.5	Smith 1917
67.	*Rana miopus*	0	
68.	*Rana nicobariensis*	1.5	Van Kampen, 1923; Inger, 1956, 1966; Iskandar, 1998
69.	*Rana nigrovittata*	1.5	Smith, 1916a; Manthey & Grossmann, 1997
70.	*Rana signata*	2.0	Inger, 1966, 1985
	F. RHACOPHORIDAE		
71.	*Nyctixalus pictus*	2.0	Inger, 1966, 1985; Leong & Chou, 1999
72.	*Philautus petersi*	DD, 1.5	Yong et al., 1988
73.	*Philautus vermiculatus*	DD, 0	
74.	*Polypedates colletti*	0.5	Inger, 1966, 1985
75.	*Polypedates leucomystax*	1.5	Inger, 1966; Leong & Chou, 1999
76.	*Polypedates macrotis*	2.0	Inger, 1966, 1985
77.	*Rhacophorus appendiculatus*	0.5	Inger, 1966, 1985
78.	*Rhacophorus bimaculatus*	0	
79.	*Rhacophorus bipunctatus*	1.5	Bourret, 1941; Dring, 1979; Manthey & Grossmann, 1997; Inger et al. 1999
80.	*Rhacophorus nigropalmatus*	2.0	Berry, 1972; Inger, 1966, 1985
81.	*Rhacophorus pardalis*	2.0	Inger, 1956, 1966, 1985
82.	*Rhacophorus prominanus*	1.5	Berry, 1972; Grandison, 1972
83.	*Rhacophorus reinwardti*	1.0	Siedlecki, 1909; Iskandar, 1998
84.	*Rhacophorus robinsoni*	0	
85.	*Rhacophorus tunkui*	0	
86.	*Theloderma asper*	0	
87.	*Theloderma horridum*	1.5	Boulenger, 1903
88.	*Theloderma leprosa*	0	

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Microhabitat Selection in *Porthidium nasutum* (Serpentes: Viperidae) in Costa Rica, with Comments on Ontogenetic Variation

TODD A. CASTOE*
Department of Biology, The University of Texas at Arlington
Arlington, Texas 76019-0498, USA

**Present address:*
Department of Biology, University of Central Florida
4000 Central Florida Boulevard, Orlando, Florida 32816-2368, USA
e-mail: tcastoe@mail.ucf.edu

The rainforest hognosed pitviper, *Porthidium nasutum*, is an inhabitant of the humid tropical lowlands of Middle America and northwestern South America, belonging to the Eastern Mesoamerican Complex of Savage (1966) and the Humid Tropical Assemblage of Duellman (1966). The range of *P. nasutum* includes most of the lowland rainforests of Middle America as well as Colombia and Ecuador (see Campbell and Lamar 1989, for detail). Throughout its range, this species occurs from near sea level to about 900 m in elevation, but is generally found below 600 m (Porras et al. 1981).

Despite its relatively high abundance in Costa Rica (pers. obs.), little has been reported on the behavior and ecology of this species. According to Porras et al. (1981), *Porthidium nasutum* is terrestrial and nocturnal, although specimens can be found basking by day. Based on a review of previous work on the species, Porras et al. (1981) report specimens having been found inside cavities in the trunks of trees, underneath roots of trees or rocks, under logs, among loose rocks of archaeological ruins, or lying on the forest floor. Campbell (1998) stated that while this species is considered nocturnal, it is most often found in the early mornings crossing jungle paths or roads, or lying coiled in leaf litter in small patches of sunlight. He stated that encounters are most frequent in primary forest or in small patches of secondary forest surrounded by primary forest. In this study, microhabitat preferences and activity patterns of *P. nasutum* were investigated by examining environmental features and behavior of this species in a wet tropical forest in northeastern Costa Rica.

Methods.—Snakes were located through visual encounters along trails in the three major forest tracts of Estación Biológica La Suerte (Limon Province, northeastern versant of Costa Rica) in July of 1999. These tracts are a mosaic of primary and secondary tropical wet forest. The age class of each snake was recorded as adult (> 30 cm) or sub-adult (< 30 cm) based on overall body length. Individuals (N = 6; 3 adults, 3 sub-adults) were uniquely identified based on color pattern. Observations were conducted during daylight hours as well as at night (using a low luminosity red lamp).

The area immediately surrounding each individual snake was

surveyed for characteristics possibly influencing microhabitat selection. The distance from the snake to the trunk of the nearest buttressed tree (> 0.5 m in diameter) was recorded to the nearest 0.5 m. The area within a 0.5 m radius of the snake was surveyed for placement of woody structure of debris (> 5 cm in height). Leaf litter depth was recorded in close proximity to each individual by measuring 5 randomly selected points within 0.5 m of each snake. The location of each snake was plotted on maps of the forest and used to identify the closest stream to each occurrence. The estimated snake-to-stream distance was later ground-truthed to the nearest meter in the field. The data collected for leaf litter depth, snake-to-stream distance, and snake-to-buttressed tree distance were analyzed using a Mann-Whitney U test to determine significant differences between age classes. The presence or absence of woody structure within a 0.5 meter radius was analyzed using a sign test. Results of the microhabitat measurements were summarized as means with standard errors and are presented in Table 1.

TABLE 1. Summary of quantitative habitat/microhabitat selection data for *Porthidium nasutum*. Microhabitat measurements for sub-adults, adults, and overall are reported as means ± standard error. (* Indicates statistically significant differences between adults and sub-adults).

	Adult	Sub-adult	All	Sub-adult vs. Adult P-value
Distance from nearest butressed tree (m)	1.8 ± 0.88	7.3 ± 1.76	4.3	0.513
Leaf litter + humus depth (cm)	1.7 ± 0.53	1.3 ± 0.33	1.5	0.421
Percentage of snakes with woody structure present within 0.5 m radius	33.3%	100.0%	66.6	0.480
Distance from nearest stream (m)	43.3 ± 3.33	22.7 ± 2.33	33	0.043*

Results and Discussion.—The results of this study demonstrate the first quantitative microhabitat data reported for this species (Table 1), which includes previously unreported ontogenetic variation in microhabitat selection. While the first three tests were not significant, the data show a significant ontogenetic difference relative to distancing from streams (Table 1). On average, sub-adult snakes were found 15.6 m closer to streams than were adults. Similar ontogenetic shifts in snake to stream distance have been reported in *Bothrops atrox* in Venezuela and are thought to be linked to the micro-geographic structuring of prey communities at varying distances from these streams (Reinert 1993, Sexton 1957).

Several ontogenetic differences associated with the morphology of this species give reason to suspect ontogenetic differences in microhabitat choice. Porras et al. (1981) reported that specimens show ontogenetic shifts in color pattern, with juveniles being more distinct and brightly colored than adults, especially with regard to the mid-dorsal stripe which fades or disappears in adults (Porras et al. 1981). Increasing size also leads to the fragmentation of blotches that often gradually divide into two portions, laterally displaced from the mid-dorsal line (Porras et al. 1981). Such apparent morphological differences might represent adaptive features which facilitate ontogenetic microhabitat shifts reported in this study.

To date, information on the diet of this species is available only as anecdotal accounts. Campbell (1998) stated that adults of this species in Guatemala feed mostly on frogs and lizards as well as small rodents, while juveniles are known to feed on invertebrate prey. Porras et al. (1981) reported the diet to include lizards and mice, in addition to juveniles eating earthworms in captivity. Greene (1997) reported that juveniles of this species commonly feed on frogs and lizards while adults consume mostly mammals and the occasional bird. Additionally, *Porthidium yucatanicum* and *Cerrophidion godmani* (members of the "*Porthidium* group" sensu Burger 1971), show a similar ontogenetic shift as juvenile diets focus on invertebrates, frogs and lizards, while adults of both species shift to mammalian prey (Campbell and Solórzano 1992; McCoy and Censky 1992). The preliminary data on microhabitat partitioning in *Porthidium nasutum* presented here might be associated with such ontogenetic shifts in diet.

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Notes on the Effects of *Trimorphodon biscutatus* Venom on a Human

DANIEL H. FOLEY III
Department of Biology, Utah State University
Logan, Utah 84322-5305, USA
e-mail: wildlife@biology.usu.edu

Approximately 2500 species of snakes have been described, the majority (~ 70%) of which belong to the family Colubridae, of which the systematics is largely unresolved (Pough et al. 2001). There is considerable variation in maxillary dentition among colubrids. Moreover, the variation in tooth size and extent of groove is nearly continuous among colubrids. Nevertheless, general distinctions are made among colubrids with or without grooved rear teeth. Many species of colubrids possess solid teeth, without grooves (aglyphous) or connections to venom glands. Other species possess grooved rear teeth (opisthoglyphous) situated below a supralabial Duvernoy's gland, specialized to produce venom (Rodríguez-Robles 1994). Colubrids are generally considered nonvenomous; however, possibly half are capable of producing toxic secretions from their Duvernoy's gland (Gans 1978). Moreover, 40 species have been recorded as capable of producing toxic effects in humans or other animals (Brown 1939; Gans 1978; McKinstry 1978), four of which have caused human fatalities. Opisthoglyphous snakes inject venom by masticating prey, allowing the venom to be channeled down the grooves of the enlarged rear teeth.

Trimorphodon biscutatus possess an opisthoglyphous dentition with associated Duvernoy's glands. Hill and Mackessy (1997, 2000) tested the venom yields from 12 species of opisthoglyphous colubrids. Among those tested, *Trimorphodon biscutatus* possessed the fourth largest average venom yield (130 ml) with an average of 6.34 mg of dry venom yield per strike. Among the seven North American species tested, *T. biscutatus* produced the largest venom yield. Understanding the effects of this species' venom on humans is therefore important. Scant information is available documenting envenomation effects. However, here I report the effects of an induced bite from a *T. biscutatus* on a human.

On 28 April 2000, an adult male *Trimorphodon biscutatus* (SVL ~ 550 mm) was collected from the Black Mountains in Mohave County, Arizona, USA, 7.2 km east of the Oatman Rd./US Route 66 junction. The following evening the snake was induced to bite and the observations below recorded. The specimen was eventually preserved and deposited with the University of Texas at Arlington collection of vertebrates (UTAR 50702).

29 April 2000, 1849 h: the snake was induced to bite the second joint of the left outer finger. Once the snake grasped the finger it immediately began making chewing motions and copious amounts of a saliva-like substance were visibly oozing from its mouth. The snake was allowed to continue its chewing motion for approximately 30–45 seconds, after which the snake was forcefully removed from the finger. A thick layer of a saliva-like substance completely covered the bite site, and a small amount of blood flowed from two distinct punctures (Fig. 1). 2 min: a stinging sensation was noticeable within the bitten finger. 5 min: a whitish ring formed around the distal most fang puncture, and minor swelling of the finger was apparent. 7 min: the entire finger had the sensation of being hot and began to itch. 8 min: swelling continued to progress within the entire finger. 11 min: the proximal fang puncture site showed noticeable swelling and was raised slightly above the surrounding tissue. 17 min: swelling of the bitten finger continued so that the finger felt tight and normal flexion was reduced. 22 min: swelling not spreading into hand; pain continues within finger with distinct throbbing sensation. However, the injury is not extremely painful. The sensation is similar to that experienced by a wasp or scorpion sting. 47 min: throbbing sensation ceased and pain subsided; finger still very swollen, tight and inflexible. 1 h 10 min: swelling subsided, enough to allow finger to be fully flexed. 2 h 07 min: swelling reoccurred so that finger can now only be flexed about half of normal. 2 h 39 min: no change in amount of swelling; still only capable of bending finger about half of normal. 4 h 19 min: finger still with sensation of being tight and still noticeably swollen; can only be bent approximately 3/4 of normal. 30 April 2000, 12 h 40 min: finger slightly swollen at base; can now be bent fully. However, this action causes a very slight pain.

Although experiments have shown that the venom of *Trimorphodon biscutatus* is capable of killing small lizards (Cowles and Bogert 1935), the effect on humans seems to be rather minimal with regard to this case report. Localized pain and swelling can result from bites in which the snake is able to chew for an extended period of time, although this seems improbable during normal field encounters. It must be stressed that all protein-based

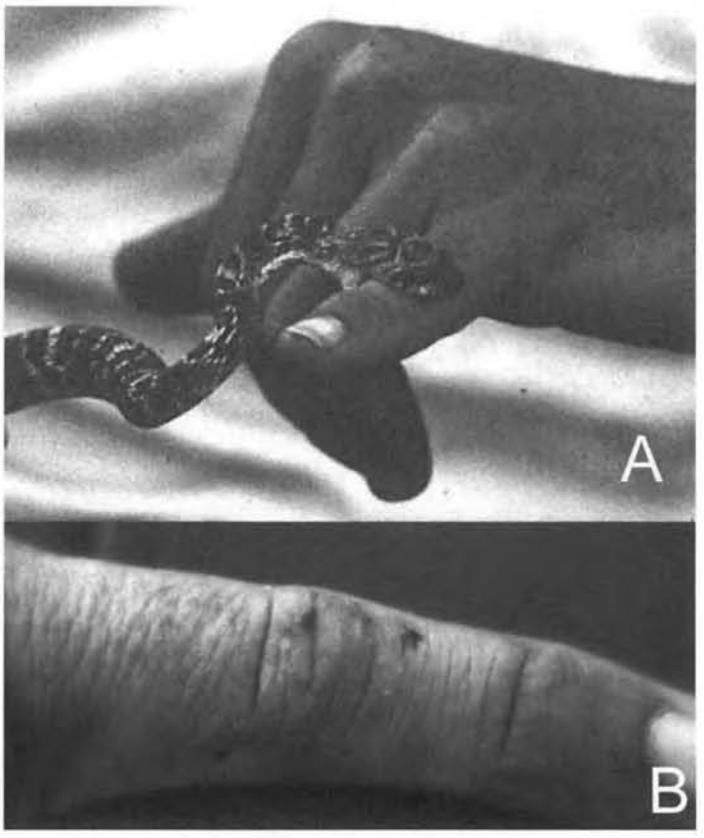


FIG 1. Photographs showing (A) the envenomation and (B) the resulting puncture wounds.

venoms might carry the risk of anaphylaxis and other severe allergic reactions. Therefore, it is best to use caution when handling any species of rear-fanged snake.

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Some Observations of the Natural History of the Prehensile-tailed Skink, *Corucia zebrata*, in the Solomon Islands

LUKE J. HARMON*
Sir Dudley Tuti College, Kamaosi, Bugotu District
Santa Isabel, Solomon Islands

**Current address: Department of Biology, Campus Box 1137*
Washington University, St. Louis, Missouri 63130-4899, USA
e-mail: harmon@biology.wustl.edu

The prehensile-tailed skink, *Corucia zebrata*, is endemic to the Solomons archipelago in the southwestern Pacific, occurring on the Solomon Islands as well as on adjacent islands in the North Solomons province of Papua New Guinea (McCoy 2000; Parker 1983). *Corucia zebrata* is a large, unique arboreal species of skink with an unusual caudal anatomy (Zippel et al. 1999). It is the only truly herbivorous member of the Scincidae (Iverson 1982). Much previous work on *C. zebrata* comes from captive animals, with limited information available from wild populations (Hediger 1937; Honegger 1975; McCoy 1980; Parker 1983). The species might exhibit communal torpidity (Kinghorn 1928), as observed in the related genus *Egernia* in Australia, but this behavior has yet to be confirmed in the field. Skinks from different islands in the Solomons archipelago differ significantly in coloration, morphology, and diet (Köhler 1997; McCoy 2000; Schmidt 1991), and a new subspecies (*C. z. alfredschmidti*) was recently described from populations on Bougainville (Köhler 1997). I studied the natural history of wild *Corucia zebrata* from a little-known population in the Bugotu district of Santa Isabel, Solomon Islands. In this report, I present additional data and anecdotal information on the morphological characteristics, life history, and reproduction of *C. zebrata* from this natural population that corroborate captive observations. Furthermore, I present data on communal living habits of these skinks in the wild, along with evidence of previously unreported sexual dichromatism in the Isabel skinks. This study adds to the limited knowledge of the natural history of wild *C. zebrata*, information that might be useful in conservation efforts for this potentially threatened species.

The study area was primary rainforest bordering the Sir Dudley Tuti College school compound, located about 2 km inland from Kasera Bay in southeastern Santa Isabel (159°48'E, 8°28'S). Along with student field assistants, I located lizards by searching primary rainforest areas and identifying potentially suitable habitat—large trees with extensive epiphytic growth (Parker 1983). Additionally, the distinctive smell of the feces of *Corucia zebrata* (Honegger 1985) was used to locate trees in which individual animals resided; this is the first documented use of olfactory cues to locate skinks in the wild. If a *C. zebrata* was present in the vicinity, the smell of its feces was apparent, even at ground level, to an experienced observer. Several local students skilled in locating these animals by smell assisted me. Once a promising location was found, nearby trees were climbed and actively searched by student field assistants.

Data collected on all captured skinks included mass, snout–vent length (SVL), total length, coloration, and characteristics of the capture site, including height of the hole above ground, type of tree, and presence or absence of surrounding vines. Sex was determined by eversion of hemipenes. Captured skinks were marked with unique combinations of toe clips and released at the original site of capture. Sizes of each sex were compared using a t-test with separate variance, conducted using SYSTAT 7.0 for Windows (SPSS 1997). Additionally, two females were dissected to determine reproductive status and examine stomach contents.

Twelve skinks were examined: five adult males, three adult females, two juveniles, and two adult lizards whose sex was uncertain. No skinks were recaptured. Measurements of the adult skinks were similar to those reported in previous studies (N = 10; means ± SD: mass = 716 ± 53 g, SVL = 29.3 ± 2.7 cm, total length = 64.9 ± 3.9 cm). The juvenile captured in late August 1999 (150 g, 17.9 cm SVL, 37.3 cm total length) was slightly larger than the reported sizes for newborn *Corucia zebrata* (Honegger 1975; Parker 1983; Schmidt 1991), while the second, caught in early October 1999, was larger (290 g, 23.8 cm SVL, 49.0 cm total length). The sex of these two juvenile skinks could not be determined. Adult females were significantly larger than males in mass ($p = 0.006$), nearly significantly larger in SVL ($p = 0.053$), and not significantly different in total length (Table 1). This difference in mass is likely because of the fact that at least two of the three adult females were gravid when caught.

TABLE 1. Sexual size dimorphism in *Corucia zebrata* on Santa Isabel, Solomon Islands. P-value from t-test with separate variance.

	Male Mean ± SD	Male Range	Female Mean ± SD	Female Range	p-value
Mass (g)	680 ± 39	640–730	775 ± 25	750–800	0.006
SVL (cm)	29.4 ± 1.6	27.1–31.4	31.4 ± 0.8	30.5–31.8	0.053
Total Length (cm)	64.9 ± 3.4	59.5–68.5	67.9 ± 1.3	66.5–69.1	0.125

Habitat use and diet was similar to that reported for wild skinks from other islands in the archipelago (Honegger 1975; McCoy 2000; Parker 1983). The skinks were found in large rainforest trees, with strangler figs (*Ficus* sp.) a preferred species (McCoy 2000). The trees always had extensive surrounding vines, especially *Scinadapsus* sp. and *Piper* sp. (Honegger 1975; Parker 1983). All skinks except one were found during the day inside holes in large trees in primary rainforest. The exception was a male found foraging in a tree among *Scinadapsus* vines on an overcast day. No individuals were found on the ground at any time, and lizards were frequently found high in the trees (4–9 m above ground). Stomach contents of a dissected female included a large amount of partially digested leaf matter, along with the red fruit of the *Scinadapsus* vine, previously identified as a preferred food of *C. zebrata* (Parker 1983). The stomach also contained large numbers of small parasitic nematodes, as reported previously (Iverson 1982). No insect matter or skin fragments were seen in the digestive tract of either dissected lizard.

Skinks observed for this study showed a range of coloration similar to that described previously (Köhler 1997; McCoy 2000; Schmidt 1991), but also possessed a unique sexual dichromatism. Three individuals had scattered entirely or partly black scales along the body, although the number of these markings varied greatly between individuals. Adults range in color from olive green to dark green, some with very distinct lighter stripes along the sides of the body and others with no apparent stripes. Both juveniles were olive green in color with distinct stripes. The skinks also showed variation in eye color, with the iris varying from yellow-green to dark brown. The darkest eye color was observed in the three adult females. All five of the adult male skinks had a distinctive yellow patch on the underside of their throat, a feature lacking in adult females. Balsai (1995) stated that males can often be distinguished by wider jowls and large, broad heads. Sexual dichromatism, however, has not been described for other populations of *Corucia zebrata*, and may be unique to this population. Previous authors have reported other examples of inter-island variation in *C. zebrata*, with several studies showing differences in coloration between skinks from Malaita and Bougainville (McCoy 1980; Schmidt 1991). McCoy (1980) stated that skinks from Malaita are darker than those from elsewhere in the Solomons. Schmidt (1991) reported that animals from Malaita tend to have yellow coloring at the front of the head, which was sometimes present along with the throat patch in male skinks captured on Isabel. Also, Schmidt (1991) suggests that there is more variation in the prominence of stripes among skinks from Bougainville, and this variation also seems to be true for skinks from Isabel. Kohler (1997) identifies differences in iris color and head color as distinguishing characters between the Bougainville species (*C. zebrata alfredschmidti*) and the Solomons subspecies (*C. zebrata zebrata*). However, my examination of Isabel specimens in the field shows wide variation in both of these color patterns, with individuals from the same population exhibiting a range of body and eye colors representative of both subspecies. Further characterization of geographic variation in *C. zebrata* will require more data collected from individuals throughout the archipelago. In particular, previous work has focused on skinks from Bougainville and Malaita, but including material from Isabel, located between these two islands, could give a more complete picture of geographic variation in the species.

I also verified previous reports (Honegger 1975; Kinghorn 1928; Parker 1983) of skinks using communal holes as resting places during the day. Of the twelve lizards caught, 8 (67%) were found sharing tree holes with conspecifics. These groups included three pairs, two of which were adult male-female pairs. One pair member, a gravid female, was eaten by a local family before data could be collected, while the second female, caught in October 1999, was dissected (see below) and found to be gravid with a well-developed embryo. A third pair consisted of an adult female with a juvenile. A group of three was also found, consisting of an adult male, an adult female, and a juvenile (the larger of the two juveniles found). This group was found in a tree hole that contained standing water. The bottom two lizards were completely submerged, with the male's head raised just above the water. The female in this group, caught and dissected in late May 2000, had a number of small, yolkless eggs in her abdomen, but no obvious developing embryos. Previous studies have reported groups of skinks in a single hole, with the skinks resting in the bottom of holes being much thinner, and surviving off the feces of those above (Kinghorn 1928). No evidence was found for this, and such stories seem to be absent from local folklore on Isabel. Observations of skinks sharing holes suggest that they might have stable social aggregations, as seen in *Egernia stokesii* (Gardner et al. 2001), likely a close relative of *C. zebrata* (Honda et al. 1999). Further research using paternity analysis could be used to test the hypothesis of stable aggregations and family structure in these skinks.

I made observations of reproduction of *Corucia zebrata* in the wild that corroborate observations from captive animals. In captivity, the skinks usually give birth to a single large offspring (Honegger 1975, 1985), although twins have been reported (Hediger 1937; Honegger 1985; Schmidt 1991). I found a single large, membrane-covered yolk mass (~9 x 7 x 5 cm) and embryo (~5 cm SVL) in one female that was dissected. The total mass of yolk and embryo was 140 g, representing a relative clutch mass of 0.19, which is within the range of values found for other skinks (Vitt and Price 1982).

This dissection also provided an opportunity to investigate autotomy in prenatal *Corucia zebrata*. I used forceps to apply a slight tug to the tail of the embryo, and it immediately broke in the center leaving a jagged edge. The force required to break the tail was

extremely small, and seemed to be much less than the force needed to tear through normal embryonic tissue of that thickness. Adult *C. zebrata* do not exhibit autotomy, perhaps as a consequence of their unique tail morphology (Zippel et al. 1999). Furthermore, newborn *C. zebrata* also are unable to lose their tail. Other species in the *Mabuya* group, which includes *Corucia* (Greer 1989), lose the ability to autotomize during ontogeny (Cogger 1975). The embryo's brittle tail suggests that *C. zebrata* might also show this ontogenetic shift, a possibility suggested by Arnold (1984).

Although the status of this species in the wild is unknown, these skinks are likely threatened by both the international pet trade and by local consumption (Balsai 1995; Honegger 1975). *Corucia zebrata* remains a sought-after food item in the Solomons (Hediger 1937), especially in rural areas on Isabel and other islands. Solomon Islanders frequently seek out this species during nighttime hunts, and their pungent smell makes them easy targets for experienced hunters. Such hunters can find multiple individuals in a single night, and report success rates of more than 10 per night in some locations. The Solomon Islands has the fastest rate of population growth in the Pacific (Population Reference Bureau 2000), and this species is under constant and increasing threat from human hunters. Furthermore, they have suffered from over-collection for the international pet trade. Records show increasing trade in *C. zebrata*, both in the US and internationally, during the early 1990s (Hoover 1998). Over 12,000 *C. zebrata* were imported into the US alone in the period 1992-1995 (Hoover 1998). They remain a popular species in the pet trade. Because of lack of field studies of these lizards in their natural habitat, their present status is uncertain, and the effects of consumption and the pet trade on their populations are unknown. More studies are needed to understand and protect these unique lizards.

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TECHNIQUES

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Rearing Larval Anurans in the Field: Maintenance of Equal Volumes and Ease of Multiple Sampling Using a Two-Component Enclosure

STEPHEN C. RICHTER
Department of Zoology and Sam Noble Oklahoma Museum of Natural History University of Oklahoma, 2401 Chautauqua, Norman, Oklahoma 73072, USA
e-mail: richter@ou.edu

and

LYNDA A. RICHTER
Sam Noble Oklahoma Museum of Natural History, University of Oklahoma 2401 Chautauqua, Norman, Oklahoma 73072, USA
e-mail: Lrichter@ou.edu

Understanding larval biology is of interest because of continuing concerns about declining amphibian populations (Alford and Richards 1999). Various studies have documented the effects of anthropogenic stressors to larval anurans using field enclosures (e.g., Semlitsch et al. 2000), though most authors do not describe enclosure design (see Harris and Bogart 1997). To address the effects of chemicals associated with landfill leachate on development of gray treefrog (*Hyla versicolor*) tadpoles in the field, we constructed enclosures for rearing larvae to monitor survival and

body condition through metamorphosis (S. Richter, unpubl. data).

The enclosures allowed a large number of larvae to be reared at moderate and equal density (one larva per liter; up to 60 larvae per enclosure) by monitoring the number of larvae per enclosure and adjusting depth (thus volume) of the enclosure accordingly. They were designed to remain in the water column and stationary with respect to location in the pond and could be moved vertically as water levels changed between and within study ponds. The top was securely attached but could easily be removed to allow multiple sampling. Our design is an alternative to larger field pens (e.g., Wilbur 1976), which must be placed on the pond bottom and moved horizontally if water levels change. Both methods are valid; the appropriate enclosure should be chosen based on goals and logistics of the study.

Each enclosure was cylindrical and housed in an outer cage, which allowed the inner enclosure to be removed when necessary (Fig. 1). The cylinder of the inner enclosure was constructed of 1.6-mm aluminum screening (92 cm high and 30.5 cm diameter), and the top and bottom panels were made from 1.6-mm fiberglass screening and attached to the cylinder using 30.5-cm cross-stitch hoops, which are readily available at craft stores. To ensure proper size, we wrapped the aluminum screen around the inner hoop of the 30.5-cm wooden cross-stitch hoop (made of two hoops, the outer with a screw for tightening material between them), stitched the seam closed using 20-gauge galvanized wire, and then sealed the seam using nontoxic silicon. We attached the top and bottom panels with the cross-stitch hoops. The inner hoop was stitched to the inside of the cylinder with 20-gauge galvanized wire. A 35.5-cm^2 piece of fiberglass screening was placed over the hoop and cylinder; then the outer hoop was positioned over the screen and tightened with the screw. Thus, the cylinder and end screen were tightened between the inner and outer hoops. We strengthened the bottom by applying nontoxic silicon around the edges of the outer and inner hoop and cutting away excess fiberglass screening. No silicon was applied to the top of the enclosure so that it could be removed to sample larvae and metamorphs.

The outer cage was a cylinder with an open top made of 1.3-cm, 19-gauge hardware cloth and was slightly larger (2.5 cm) in diameter and 2/3 the height of the inner enclosure. We stitched the bottom panel (33 cm diameter) to the cylinder (61 cm high) using 20-gauge galvanized wire. We attached the outer cage to a stake in the study pond using two wood screws and plastic cable ties, which allowed depth to be adjusted by cutting the cable ties, placing the cage at the new level on the wood screws, and replacing the cable ties. The outer cage protected the inner cage from floating debris and ensured that it maintained an upright position. It was adjusted as water levels changed within and between sites to maintain an equal water volume in the inner enclosure. When installed with the top 10 cm above the water surface, the volume of water in the inner enclosure was 60 L (total volume = 67 L).

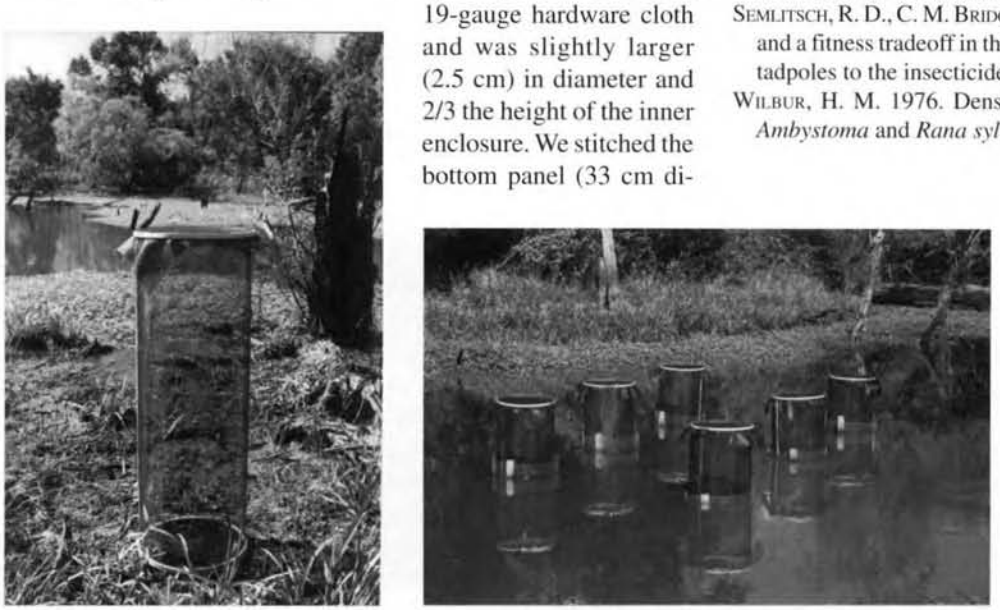


FIG. 1. Field enclosure showing (left) inner component and (right) inner components installed in outer components in the field.

Because of the small size of most early-stage anurans compared to the mesh of the inner enclosure, eggs and embryos might need to be housed in the laboratory in water from the study ponds until the larvae reach a large enough size to preclude escape. If the experiment needs to begin in ponds, our enclosure could be modified by replacing the fiberglass and aluminum screening with Nitex nylon (500-µm mesh; Tetko, Inc., New York), as used by Harris and Bogart (1997).

Our method can be used in various studies of larval amphibians. The two-component design (outer cage and inner enclosure) is unique and allows multiple sampling through metamorphosis while maintaining equal water volume between sites with ease. The large size allows high initial density of larvae so that multiple sampling is possible with adequate sample sizes. The enclosure is particularly useful in studies designed to assess the effects of different pond environments on various stages of anuran development or in studies that manipulate density as a treatment.

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An Apparatus to Measure the Locomotor Activity of Freshwater Turtles Held in Captivity

W. BEN CASH
Department of Biology, Maryville College
Maryville, Tennessee 37804, USA
e-mail: wbcash@maryvillecollege.edu

and
REBECCA L. HOLBERTON
Department of Biological Sciences, University of Maine
Orono, Maine 04469, USA

Activity and movement patterns of animals are fundamental issues in many areas of biology, particularly ecology and conservation biology. Locomotor activity patterns in squamate reptiles under controlled laboratory situations concurrent with some physiological measure (e.g., aerobic capacities) is well studied compared to other reptilian groups, particularly freshwater turtles (reviewed by Garland and Losos 1994). For lizards, the standard device for measuring locomotor performance has long been the treadmill or a variant thereof (Beck et al. 1995; Carpenter and Ferguson 1977). This simple device has endless functional (e.g., sprint speed) or ecophysiological (e.g., effects of temperature on locomotion) application. One reason for the lack of similar studies involving freshwater turtles is the lack of an apparatus for measuring basic aspects of locomotor activity. While there are many studies that measure the movement and activity of freshwater turtles in the wild (e.g., Bodie and Semlitsch 2000; Brown and Brooks 1993; Morreale et al. 1984; Rowe and Moll 1991), we are aware of only three studies that investigate proximate questions of locomotion and activity under controlled laboratory conditions in freshwater turtles (Brett 1971; Cash and Holberton 1999; Finkler 1998). Here we describe an apparatus that we designed for quantifying locomotor activity in freshwater turtles. We also provide suggestions that expand the applicability of our device.

Activity chambers were constructed from 75 L opaque plastic tubs (heavy-duty, solid walled laundry basket: 50 cm diameter top, 42 cm diameter bottom, 41.5 cm depth; Fig. 1). At the bottom of each tub, a plastic tray platform (40 cm diameter, 4 cm depth) was placed atop a stationary point; a golf ball (~ 4 cm diameter) adhered to the bottom-center of the tub with Dap waterproof silicone, which allowed the platform to pivot. A small hole (1.5 cm diameter) was drilled in the center of the platform (the point at which the platform rested on the pivot ball) to help stabilize the platter on the ball. Four to six non-slip bathtub adhesive strips (approx. 1.5 cm diameter) were attached to the platform to provide traction for the turtle. The platform was suspended with strands of 20-gauge wire, distributed equally around its perimeter, from the lever of each of the four micro-switches (Omron Industries model # B2-2RW80-82) distributed equally around the top of the tub. The micro-switches on each tub were mounted to the inside of the tub using two small metal bolts (standard #6 x 2 in.). Each of the four micro-switches was wired to the power supply and to a common ground in sequence such that when a lever was depressed on any switch an electrical circuit was completed and registered (see Fig. 2) on the single Sodeco digital counter (2.5W, 12V DC)



FIG. 1. Illustration showing a side cut-away of the locomotor activity apparatus with golf ball, platform, turtle and one micro-switch shown (50 cm diameter top, 42 cm diameter bottom, 41.5 cm depth).

mounted on each tub. In this way, any movement by the turtle on any part of the platter, regardless of its direction, would result in a count on the counter. Each activity apparatus was then connected to a single Epsco DC variable power supply (0–16V, 0–10 Amp). The amount of volts provided could be adjusted for the number of turtles to be monitored. Power could be supplied continuously or be turned on and off automatically by a plug-in timer. Turtles were placed in their respective activity apparatus chamber and the water level was adjusted based on the size of the turtle (to the top of the turtle's carapace). Regardless of the turtle's direction of movement, the platform would be displaced, thus depressing one or more switch levers. A variety of measurements can be made from these data (e.g., counts per hour, counts over a 24 h period), depending on the scope of the investigation.

Other considerations warranted attention. In studies involving the slider turtle, *Trachemys scripta* (Cash and Holberton 1999; Cash, unpubl. data), turtles were found to elicit what could be described as "escape behavior" within the first 24 h after being placed in the activity chambers. Activity levels are often significantly higher than any mean activity level after the initial 24 h. Therefore, it might be important to include an acclimation period, which might be species specific, before activity recording begins. The water level was checked daily in order to insure that the recording dynamics of each apparatus remains constant over the duration of the activity trials. It was also important to insure that each chamber received equal light intensity, which ideally, should be homogeneous within the chamber. Finally, there might be variation in turtle body mass and size, as well as sensitivity in platform movement to turtle activity, that could potentially obfuscate differences in treatments of interest (for instance, the mass range for turtles used in the study by Cash and Holberton (1999) was 404.1 to 1280.0 g). We recommend that, for comparisons across treatment groups, variation in turtle mass or size be equally distributed

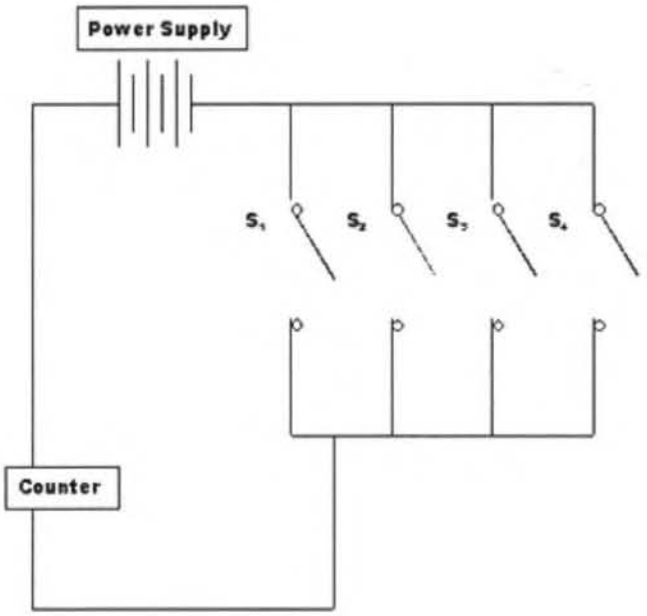


FIG. 2. A schematic of the basic locomotor activity circuit. S1 – S4 represent each micro-switch.

across the groups of interest. When looking for changes in activity within individuals, we recommend that the same turtle be maintained in its original chamber throughout the study (cf. Cash and Holberton 1999).

There are additional applications that the activity chambers provide, with modification. The simple addition of voltage specific resistors in the line to all micro-switches would enable each of these points to have unique voltage. By using a logging digital multi-meter with a serial interface or similar device (analog/digital board; computer interface; Vernier Serial Logger Pro), the capabilities of the activity chambers greatly expands. This modification first allows temporal recording of activity data that would enhance the experimental design options and hence the number and different types of questions that the investigator could ask. Questions related to circadian biology could be explored. Because each micro-switch can have a unique voltage requirement (with resistors in-line), these points could be assigned and oriented to directional coordinates (i.e., N, S, E, W) for use in studies regarding orientation, water finding, and homing ability in freshwater turtles.

We believe that the locomotor activity apparatus provides a simple way of quantifying locomotor activity in freshwater turtles. The devices lend themselves to comparative studies where investigators are interested in basic locomotor activity and the effects of specific independent variables (e.g., hormone application, Cash and Holberton 1999) on this activity. The devices are not, however, intended to measure other aspects of locomotor performance, like endurance or sprint speed. Except for the DC variable power supply, which costs ca. US $270 but can be used to power multiple chambers, each chamber can be constructed for ca. US $35 from material that can be purchased at a local hardware store. We believe that the activity apparatus provides an inexpensive, easy-to-construct way to enhance our understanding of the behavioral ecology and physiological ecology of a poorly understood group of animals, under controlled laboratory conditions.

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Efficacy of Three Funnel Traps for Capturing Amphibian Larvae in Seasonal Forest Ponds

RICHARD R. BUECH
and
LEANNE M. EGELAND
USDA Forest Service, North Central Research Station
Forestry Sciences Lab, 1831 Highway 169 East
Grand Rapids, Minnesota 55744, USA
e-mail: rbuech@fs.fed.us

Among the many techniques that have been used to study amphibians, funnel traps are commonly recommended to determine species presence, breeding success, and relative abundance of amphibian larvae in aquatic habitats. Several authors have discussed the advantages and disadvantages of funnel traps for sampling amphibian larvae (Adams et al. 1997; Fronzuto and Verrell 2000; Shaffer et al. 1994). However, recent reviews of methods for studying amphibians (Heyer et al. 1994; Olson et al. 1997) make it clear that more research is needed on the species-specific

effectiveness of methods that have been proposed.

A variety of funnel traps have been tried and tested including commercially available cylindrical traps constructed of 6 mm mesh galvanized wire, box funnel traps made of 3 mm mesh galvanized wire (Mushet et al. 1997), traps made from plastic beverage bottles (Calef 1973; Griffiths 1985; Richter 1995), collapsible nylon mesh traps (Adams et al. 1997), and traps constructed with acrylic plastic sheet (Smith and Rettig 1996). Some authors have compared the effectiveness of funnel traps of different styles and materials. Smith and Rettig (1996) compared the efficacy of three homemade funnel traps constructed of PVC pipe, acrylic plastic sheet, and plastic beverage bottles. Mushet et al. (1997) compared the effectiveness of cylindrical 6 mm mesh galvanized wire traps to their 3 mm mesh galvanized wire box traps. Fronzuto and Verrell (2000) compared the efficacy of cylindrical 6 mm mesh galvanized wire and cylindrical 2–4 mm mesh plastic funnel traps. Our objectives were to: 1) determine the efficacy of commercially available funnel traps for catching aquatic amphibian larvae living in small seasonal forest ponds, and 2) determine if net leads would enhance the efficacy of funnel traps.

We conducted the study on a selection of seasonal forest ponds in northern Minnesota on the Sucker Lakes Watershed in Cass County and on the Rice River Watershed in Itasca County. In 1997, we compared capture rates of commercially available plastic versus metal funnel traps and investigated the effect of adding net leads. The plastic funnel trap [Nylon Net Company, Memphis, Tennessee; MT1 at US $6.90 each in orders of six or more] consisted of two halves fastened in the middle of the trap; one half was colored blue and the other white. Dimensions of this near cylindrical trap were 43.2 cm long, 22.9 cm maximum diameter, and a 2.4 cm entrance centered in an 11.4 cm deep funnel positioned on each end of the trap. Mesh size of the plastic trap ranged from 4 x 6 mm where the trap halves join, to 3 x 4 mm at the trap ends. The metal funnel trap [Cuba Specialty Manufacturing Co., Fillmore, New York; G-40 at US $7.80 each] also consisted of two halves clipped together in the middle of the trap. Its dimensions were very similar to the plastic trap, only its length was slightly shorter (41.9 cm) and the dimension of its entrance was variable (2.2–2.4 cm). Metal traps were constructed of galvanized hardware cloth, which had larger openings (four holes per 2.5 cm, or 6 x 6 mm mesh size) than those of the plastic traps.

In 1997, we trapped amphibians in 29 ponds for three consecutive days each, from 18 June through 7 August. Metal and plastic traps were paired side-by-side in shallow water perpendicular to shore in water deep enough to submerge the trap entrance, yet still provide air for amphibians to breathe. Three trap pairs were spaced roughly 3–6 m apart along the shore in each pond, regardless of pond size. A net lead was positioned between the plastic and metal traps of the central pair. The net lead consisted of a 3.0 m long minnow seine staked from a position located between the traps out into deeper water. Traps were not baited and were set out during the day on Mondays, checked daily the following three days, and removed on the last day. Captured amphibians were identified to species, counted, and released.

In 1998, we trapped amphibians in 45 ponds for three consecutive days each, from 3 through 25 June, to compare capture rates of metal funnel traps of two different mesh sizes; 4 openings per 2.5 cm (6 x 6 mm mesh) and eight openings per 2.5 cm (3 x 3 mm mesh). Traps with 3 mm mesh were substantially more expensive than traps with 6 mm mesh [Cuba Specialty Manufacturing Co., Fillmore, New York; US $19.53 (G-48M) versus US $7.80 (G-40).] Traps were not paired as in 1997 but instead, were evenly spaced around the pond, alternating mesh sizes from a random start. We set 2 to 6 traps (1 to 3 traps of each mesh size) in ponds; the number of traps chosen so as to approximate an equivalent effort per unit of pond surface area. As in 1997, unbaited traps were set out Monday, checked the following three days, and removed. Captures were handled as in 1997.

Data were first converted from counts of larvae in each trap over the three trap night period to a daily capture rate for each trap and species (total number of individuals captured for a species divided by three trap nights). Repeated measures ANOVA was used to determine if 1997 daily capture rates of three species differed between trap types (plastic versus metal) and between trap pairs with net leads versus those on either side that lacked net leads. These analyses were conducted using square root transfor-

TABLE 1. Descriptive statistics for analysis of the efficacy of two funnel trap types (plastic versus 6 mm mesh, metal hardware cloth) and efficacy of net leads for capturing amphibian larvae of three species. Number of traps, median capture rate (CR) [number of individuals captured per night in each trap, averaged over three trap nights], and interquartile ranges are reported. N = number of ponds where species was trapped out of 29 possible ponds.

Species	Statistic	All Plastic	All Metal	Plastic Net	Plastic Without Net	Metal Net	Metal Without Net
Rana sylvatica	Number of traps	66	66	22	44	22	44
N = 21	Median CR	0.67	0.83	0.33	0.67	1.17	0.67
	Interquartile range	0.00, 1.33	0.33, 2.67	0.00, 1.33	0.00, 1.50	0.33, 2.67	0.33, 3.67
Ambystoma laterale	Number of traps	42	42	14	28	14	28
N = 14	Median CR	0.33	0.00	0.17	0.33	0.00	0.00
	Interquartile range	0.00, 1.00	0.00, 0.33	0.00, 1.00	0.00, 0.83	0.00, 0.33	0.00, 0.33
Pseudacris crucifer	Number of traps	12	12	4	8	4	8
N = 4	Median CR	0.00	0.00	0.00	0.00	0.00	0.00
	Interquartile range	0.00, 1.17	0.00, 0.00	0.00, 0.17	0.00, 2.00	0.00, 0.33	0.00, 0.00

mations to normalize the data. Data for 1998 were summarized as a daily capture rate for each trap type (6 mm versus 3 mm mesh) in a pond. Wilcoxon signed ranks tests were used to determine if 1998 daily capture rates differed between the two trap mesh sizes for three species (the simplified 1998 experimental design allowed use of this test and avoided assumptions about normality of data). All analyses were conducted using SYSTAT 8.0.

TABLE 2. Analysis of the efficacy of funnel traps constructed with hardware cloth of two different mesh sizes (6 mm versus 3 mm openings) for capturing amphibian larvae. For each species, a capture rate per night was calculated for each trap type in each pond by averaging the total number of larvae captured for each trap type in each pond (N = 1 to 3 traps per pond) over a 3-day period. Tests of significance were derived from a Wilcoxon signed ranks test.

Species	Statistics	6 mm Mesh	3 mm Mesh	Z	P
Rana sylvatica [Present in 35 ponds]	No. ponds where captured	33	35	-1.028	0.304
	Median pond capture rate	4.1	3.8		
	Interquartile range	0.9–24.2	0.9–16.4		
Ambystoma laterale [Present in 15 ponds]	No. ponds where captured	2	15	3.308	0.001
	Median pond capture rate	0.0	0.3		
	Interquartile range	0.0–0.0	0.2–0.9		
Pseudacris crucifer [Present in 15 ponds]	No. ponds where captured	5	14	3.023	0.003
	Median pond capture rate	0.0	0.3		
	Interquartile range	0.0–0.2	0.2–1.1		

In 1997, wood frog (*Rana sylvatica*) larvae were captured in the most ponds, followed by blue-spotted salamanders (*Ambystoma laterale*), and spring peepers (*Pseudacris crucifer*) (Table 1). The median daily capture rate of wood frog larvae in metal traps was 0.83 per trap compared to 0.67 in plastic traps, whereas median daily capture rates of blue-spotted salamander and spring peeper larvae were lower than those of wood frog larvae in either type of trap (Table 1). Trap type was a significant variable in explaining daily capture rates of wood frog ($F_{1,20} = 13.92$, $P < 0.001$), but not blue-spotted salamander or spring peeper larvae ($P > 0.20$ for both species). Neither net leads ($P > 0.55$ for all species) nor an interaction of net leads and trap type ($P > 0.30$ for all species) affected daily capture rates of any species.

In 1998, wood frog larvae were again captured in the most ponds (35 ponds), whereas blue-spotted salamander and spring peeper larvae were found in 15 ponds each (Table 2). Traps with 3 mm mesh correctly recorded species occurrences in all but one instance (3 mm mesh traps failed to record spring peepers in one pond). In contrast, 6 mm mesh traps did a poor job in recording the presence of species with small larvae (i.e., blue-spotted salamander and spring peeper). Median daily capture rates of wood frog larvae were slightly higher in 6 mm than in 3 mm mesh traps, but not significantly so ($P = 0.30$). In contrast, daily capture rates of spring peeper and blue-spotted salamander larvae were greater ($P < 0.005$) in traps constructed with 3 mm versus 6 mm mesh hardware cloth.

Funnel traps of many styles and materials have been used by investigators to sample amphibians in aquatic settings. It is clear from their collective experiences that several factors impinge on the efficacy of funnel traps in capturing amphibians. For example, effectiveness is known to vary by species, trap characteristics, size of larvae, and habitat conditions (Adams et al. 1997; Fronzuto and Verrell 2000; Shaffer et al. 1994). Our results support these findings with regard to species, trap characteristics, and size of larvae.

Trap characteristics had a significant effect on capture rates of amphibian species found in our small, seasonal forest ponds. Our 1997 results demonstrated that 6 mm mesh metal traps were more effective than plastic traps in capturing wood frog tadpoles. We did not determine why this was so; e.g., we do not know if the plastic trap's blue and white color or physical appearance lowered wood frog capture rates. In contrast, plastic traps had slightly higher capture rates of blue-spotted salamanders than metal traps. Although this difference was not statistically significant, it makes sense that the smaller mesh size of plastic traps would reduce the likelihood of the smaller salamander larvae escaping from these traps. These observations were consistent with Fronzuto and Verrell (2000) who reported that some long-toed salamanders (*Ambystoma macrodactylum columbianum*) escaped from metal funnel traps with 6 mm mesh size, but not from plastic funnel traps that had a smaller mesh size.

In 1998, we confirmed the importance of mesh size. Metal traps with 3 mm mesh were better at capturing species with small larvae (i.e., blue-spotted salamander and spring peeper) than traps with 6 mm mesh openings. At the same time, captures of larger wood frog larvae in 3 mm versus 6 mm mesh traps were similar. These results suggest that 6 mm mesh hardware cloth might not adequately sample small larvae. We conclude 3 mm mesh funnel traps would provide a more unbiased assessment of the relative abundance of amphibian larvae living in our seasonal forest ponds.

Net leads, drift fences, and drive nets have been used to enhance capture of a variety of fish (Hubert 1983) and wildlife (Day et al. 1980) species, including herps in terrestrial settings (Heyer et al. 1994). These devices intercept the movement of animals and direct their travel towards traps. Because net leads are very effective in fisheries surveys, we thought they might also enhance the efficacy of unbaited funnel traps in catching amphibian larvae. Our result that they were not effective in directing amphibians into traps was surprising and is worthy of further study. The larvae of some amphibians school or diurnally migrate in response to light, temperature, and oxygen concentrations (Duellman and Trueb 1986). Perhaps amphibian species that live in small forest ponds are more sedentary than these amphibians or fishes, and thus their capture is less likely to be affected by net leads.

In summary, of the funnel traps we tested, we recommend using metal traps constructed of 3 mm mesh hardware cloth for sampling amphibian species whose larvae or adults are small, or when assessing the relative abundance of species in communities that include species with such characteristics. If one is sampling only species with large larvae or adults, 6 mm mesh might be adequate

or possibly preferable. Net leads did not enhance capture rates of larvae of the amphibian species we encountered in small forest ponds, perhaps because their larvae are relatively sedentary. The same might not be true for larvae of other amphibians, especially those that live in larger aquatic habitat types. This possibility has implications for amphibian methodology, sampling design, and understanding of larval behavior. We suggest that these be explored further to understand the mechanisms underlying our results using net leads.

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A Simple Method of Sterilizing Male Snakes: A Potential Aid in Preventing the Spread of Brown Treesnakes (*Boiga irregularis*) from Guam

FIONA J. QUALLS
and
CARL P. QUALLS
US Geological Survey/Ohio State University - Brown Treesnake Project
P.O. Box 8255, MOU-3, Dededo, Guam 96912, USA

Current address: Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, Mississippi 39406-5018, USA
e-mail (FJQ): fqualls@cnr.colostate.edu, (CPQ) carl.qualls@usm.edu

The brown treesnake, *Boiga irregularis*, was inadvertently introduced from Australasia to Guam around the end of World War II (Savidge 1987). By the mid 1980s brown treesnakes were abundant and distributed island-wide (Rodda et al. 1992; Savidge 1987). The snake irruption is believed responsible for the extirpation of nine of the island's 13 native forest bird species (Savidge 1987), loss of two lizard species (Fritts 1988), and for a drastic decline in numbers of the Mariana fruit bat, *Pteropus m. mariannus* (Wiles 1987). Additionally, brown treesnakes caused more than 1650 electrical outages on Guam between 1978 and 1997 (Fritts and Chiszar 1999; T. H. Fritts, unpubl. data).

Currently, brown treesnake control efforts are divided into two areas: reducing snake abundance in localized areas of Guam, and preventing dispersal of snakes from Guam. One dispersal-prevention tool used on Guam, Oahu (Hawaii) and Saipan (Northern Mariana Islands, NMI) is the detector dog program (Engeman et al 1998a; Engeman et al. 1998b; Vice and Engeman 2000). Detector dogs are trained to recognize the scent of brown treesnakes that have stowed away in cargo, and to signal the presence of the snakes to their handlers. Initial training of the dogs and ongoing refresher training requires frequent exposure of the dogs to live brown treesnakes. This poses no problem on Guam where snakes are plentiful. However, importation of brown treesnakes to Hawaii and the NMI for dog training is problematic. Recently, the export to Hawaii of a limited number of sterilized male brown treesnakes for dog training has been approved (importation of live females and reproductively intact males is not permitted). Unfortunately, there is no established protocol for sterilizing male snakes. Thus, we identified a need for a simple and immediately effective method of sterilizing male brown treesnakes for export to snake-free areas for training snake detector dogs.

Thirty male *Boiga irregularis* were collected from the wild on Guam. Each snake's snout–vent length (SVL), total length (TL), and mass were recorded prior to it being individually housed in a plastic box (34 x 24 x 13 cm) with numerous ventilation holes. Each box contained a lining of white paper, a water dish, and a piece of PVC pipe in which the snake could shelter. The room in which the snakes were housed was ventilated by air from outside the building. All snakes were offered one dead adult mouse weekly from the time of capture until the termination of the experiment. Of the 30 candidate snakes, 29 settled into captivity and fed at every weekly feeding session. These 29 snakes were retained for

use in the experiment. At the conclusion of the experiment 25 of the snakes were euthanized. The "working life" of a sterilized brown treesnake is likely to be on the order of a few months. Therefore, we retained four snakes in captivity for observation to determine if there were any longer-term effects of the experimental procedure on the snakes.

Each snake was assigned to one of three experimental treatments: both hemipenes removed by ligation; one hemipenis removed by ligation (either left or right); or no hemipenes ligated (control treatment). The initial size of snakes did not differ among experimental treatments (1 factor ANOVA, initial mass: $F_{2,26}$ = 0.54, P = 0.591, initial SVL: $F_{2,26}$ = 1.09, P = 0.351). All snakes increased in mass over the course of the study (mean increase in mass = 28%, range = 14–48%). There was no difference among treatments in the daily rate of mass increase (1 factor ANOVA, $F_{2,26}$ = 1.16, P = 0.331).

Two people were required to carry out each ligation procedure. One person restrained the snake and everted the target hemipenis by applying thumb pressure to the base of the snake's tail. A second person swabbed the hemipenis and cloacal area with Brite-Life® 2% iodine tincture (Bergen Brunswig Drug Company, California) and sprayed the area with Lanacaine® anaesthetic spray (benzocaine 20%, benzethonium chloride 0.2%; COMBE, Inc., White Plains, New York). The second person then placed a hemostat clamp transversely across the everted hemipenis midway down its length to prevent its withdrawal back into the snake. At this point, pressure on the tail base was released. A modified transfixation technique using a C-23 cutting needle with a non-absorbable suture attached (Bralon®, 3-0 braided nylon; USSC sutures) was used to ligate the hemipenis. The needle and suture were passed through the base of hemipenis, then looped around the hemipenis and secured in place with a square knot. The suture was tightly wrapped around the hemipenis a second time and secured with another square knot. An option at this stage of the procedure would be to sever the hemipenis distal to the ligation site to ensure that the structure is successfully removed. However, we did not do this. Consequently we have no data on infection rates, recovery times, or mortality of snakes that have had their hemipenes severed. After completion of the ligation procedure, the hemostat was removed and the snake was returned to its holding box. Between 10 and 15 minutes were required to complete each bilateral ligation. This included the time required to capture the snake from its holding cage, complete the procedure, and return the snake to its holding cage.

Between four and six weeks post-procedure we conducted a blind assessment of the success of the ligations. A combination of techniques (attempted eversion of hemipenes and internal probing of hemipenes) was used to determine whether each hemipenis was intact or the tissue fused at the point of ligation. Skilled application of pressure to the base of a brown treesnake's tail will generally evert an intact hemipenis. However, if this method fails to induce eversion, a blunt-ended probe can be inserted gently into the hemipenis lumen. In an adult male brown treesnake with intact hemipenes, the probe will pass 25–30 mm into the lumen before reaching the end of the inverted hemipenis. In a snake that has undergone the ligation procedure there are three possible outcomes:

1) If the procedure has been successful, and the wound has healed over, the probe will not enter beyond the point of ligation (typically 2–4 mm deep).

2) If the procedure has been successful but the ligation site has not healed over and sealed completely, the probe will pass through the unhealed wound to a depth considerably greater than the usual 25–30 mm.

3) If the procedure failed, the probe will enter to a depth of around 25–35 mm.

For each snake the evaluator used both eversion and probing techniques to score the presence or absence of hemipenes.

The blind evaluation procedure correctly assigned every snake to its experimental treatment. That is, correct assessment (as ligated or not ligated) of all 58 hemipenes was achieved. Of the 33 ligations (bilateral in 12 snakes and unilateral in nine snakes), 32 were completely successful: the portion of the hemipenis distal to the suture was gone, and the base of the hemipenis was fully healed over. One ligated hemipenis remained partially intact (ca. 10 mm of hemipenis remained). It is very unlikely that this hemipenis was functional as the wound at the distal end of the hemipenis was completely healed over, thus preventing the passing of fluids (including semen).

To compare the ability for ligated versus intact hemipenes to pass ejaculatory fluid we attempted to collect fluids from each snake. Fluid collection was achieved by massaging the base of each snake's tail at the time of the evaluation. Successful collection of any fluid implies that the posterior section of the sperm duct contains the fluid and that there is no blockage preventing passage of the fluid from the sperm duct. An unsuccessful collection attempt means that either fluid is not present in the posterior section of the sperm duct, or that it is present but it is prevented from moving because of a blockage in the sperm duct, or that the method used to collect the fluid has failed. Thus, collection of any fluid is conclusive evidence that the sperm transfer mechanism is potentially still intact, but unsuccessful collection attempts are inconclusive.

Fluid was successfully collected from 16 (64%) of the 25 intact hemipenes, whereas none (0%) of the 33 ligated hemipenes could be induced to pass any fluid. The probability that failure to collect fluid from all 33 of the ligated hemipenes was because of chance is extremely low ($P < 0.0001$, $\chi^2 = 29.2$, 1 d.f.). Thus, the ligation treatment successfully prevents fluids (including ejaculate) from leaving the snakes.

Five months after ligation of both of their hemipenes, the four snakes that were held for observation remained healthy and were feeding well. There were no signs of hemipenis regeneration and no fluid could be forced from any of the eight ligated hemipenes.

We have termed this sterilization technique the "bilateral hemipenis ligation" method. Each sperm duct is ligated at its most posterior point. Thus, there is no reservoir of viable sperm left posterior to the ligation site. Additionally, the intromittent organs are removed, thereby curtailing the ability to copulate. There are some species with internal fertilization that mate without benefit of a male intromittent organ (e.g., most birds, tuatara), however these species have evolved to convey sperm without the aid of such structures. Female brown treesnakes have not so evolved, so sperm transfer by hemipenis-ligated males should be very appreciably hindered.

Our method of sterilizing male brown treesnakes is effective

(successful in at least 32 of 33 attempts), quick (the procedure requires less than fifteen minutes per snake) and inexpensive (less than US $1.00 per snake for materials). The technique has a 0% mortality rate in laboratory tests, and it requires only a moderate skill level. Failed attempts are very easy to identify; if a hemipenis is still present, it can be detected via manual eversion or probing. Thus, there is very little risk of exporting a non-sterile snake from Guam. We recommend that bilateral hemipenis ligation of male snakes is adopted by agencies that need an increased supply of sterile snakes for training detector dogs in areas at risk of brown treesnake infestation.

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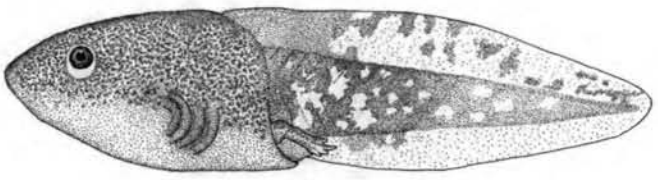
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Hypopachus variolosus (KU 104203; 25 mm TL). Mexico: Chiapas: 24 km S Las Cruces. Illustration by Julian C. Lee.

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Snout-to-Hind-Leg as a Measure of the Body Size of Eastern Red-backed Salamanders

KANDYD J. SZUBA*
Nipissing University, 100 College Drive
North Bay, Ontario, Canada P1B 8L7

BRIAN J. NAYLOR
Ontario Ministry of Natural Resources
Southcentral Science & Information Section
3301 Trout Lake Road, North Bay, Ontario, Canada P1A 4L7

DAVID F. HACKETT
Nipissing University, 100 College Drive
North Bay, Ontario, Canada P1B 8L7

and
MERILYN P. TWISS
Ontario Ministry of Natural Resources, Robinson Place, 300 Water Street
P.O. Box 7000, Peterborough, Ontario, Canada K9J 8M5

**Present address: Domtar Inc., 79 Tudhope Street*
Espanola, Ontario, Canada P5E 1S6
e-mail: kandyd.szuba@domtar.com

Snout-to-vent length (SVL) is a standard measure of the body size of salamanders, but the vent of an eastern red-backed salamander (*Plethodon cinereus*) can be difficult to see under adverse conditions and on small individuals. The legs, however, are obvious. Regression analysis showed that SVL can be predicted from snout-to-hind-leg length (SLL) with a high degree of accuracy. The regression model was validated with an independent *P. cinereus* data set which suggested that, within the species, it has wider applicability than the data set from which it was derived. Compared with SVL, SLL is relatively easy to measure resulting in more rapid processing of salamanders, less stress to the animals, and has potential for use even by inexperienced observers in a large monitoring program.

The eastern red-backed salamander (*Plethodon cinereus)* may be common in the woodlands of southeastern Canada and northeastern portions of the United States. Wyman and Hawksley-Lescault (1987) noted sensitivity of these salamanders to changes in soil pH, and Frisbie and Wyman (1995) concluded that the species is a potentially useful sentinel of change within forest ecosystems. *Plethodon cinereus* has been selected as an indicator of the sustainability of forest management practices in Ontario (McLaren et al. 1998). Measures of body length could provide valuable information for a variety of questions related to environmental impact and habitat use (see above), as well as behavioral interactions and interspecific competition (e.g., Jaeger 1972).

Petranka (1998) described standard measures of body size for salamanders as total length and snout-to-vent length. Total length (TL) is measured from the tip of the snout to the tip of the tail on a straightened body. Snout-to-vent length (SVL) is usually measured from the tip of the snout to the posterior margin of the vent (though sometimes the anterior margin of the vent has been used). Compared with TL, SVL is a more reliable measure of body length for *Plethodon cinereus* because these salamanders regularly autotomize their tails if threatened. Also, tails are frequently bitten

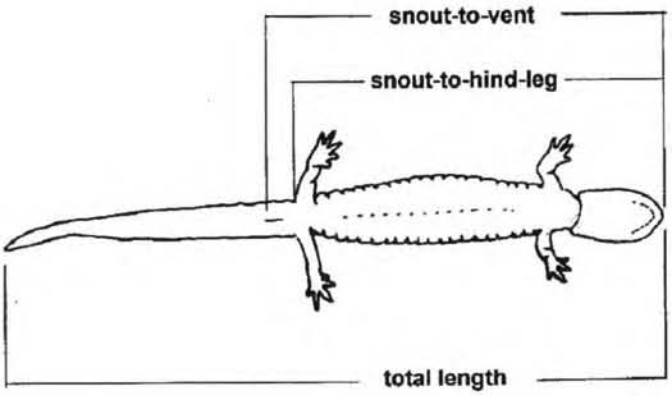


FIG. 1. Ventral view of a *Plethodon cinereus* illustrating how total length (TL), snout-to-vent length (SVL), and snout-to-hind-leg length (SLL) were measured on live specimens. SLL is measured on a straightened animal from the tip of the snout to the posterior surface of a hind leg where it joins the body.

during agonistic interactions (Jaeger et al. 1982), and this might result in breakage (Petranka 1998). However, *P. cinereus* are small, with adults typically ranging from 65 to 125 mm in total length, and hatchlings from 19 to 25 mm (Petranka 1998). Vents can be difficult to see, particularly on juveniles, and on all ages at night when these salamanders are most readily observed and captured.

In this paper we use regression analysis to relate standard SVL to snout-to-hind-leg length (SLL), a new measure of body length which is more easily assessed on small animals under sub-optimal conditions. Like SVL, SLL is affected less than TL by agonistic interactions and predation.

The study was conducted in central Ontario, within a radius of approximately 40 km to the east and south of the city of North Bay (approx. 46°13'N, 79°22'W). It was part of a larger project designed to compare sampling techniques (see Hackett et al. 1999; Szuba 1999). Two sets of data were used in the analysis: the main data set to derive a regression equation, and an independent data set to test it. Data used for derivation were collected from two sites: a mature sugar maple (*Acer saccharum*) stand and a mature white pine *(Pinus strobus)* stand. Test data were obtained from 36 different sites that were spread out over the larger study area. The 36 test sites were mature forest stands representing three main vegetation types: a) mixed poplar (*Populus* spp.), white birch (*Betula papyrifera*), and balsam fir (*Abies balsamea*), b) mixed sugar maple, white birch, poplar, and white pine, and c) sugar maple mixed with yellow birch (*B. alleghaniensis*).

A variety of techniques was used to locate salamanders, including cover boards (76 x 20 x 2.5 cm in size) that were checked during the day or night, diurnal searches in 1 m^2 litter plots, diurnal searches under or inside natural cover objects in 25 m^2 quadrats, and above-ground searches along prescribed transects at night.

Plethodon cinereus were captured periodically on all study sites from late April to mid-October 1998. Each salamander was placed in a thin plastic bag and held in such a way that the animal was immobilized in a relaxed position. SVL, SLL, and TL were measured on the ventral surface of the straightened body (Fig. 1) to the nearest millimeter with the aid of a ruler. If the precise location of the distal end of the vent was indeterminable in the field, we did not measure SVL and data for that animal were excluded from the SVL analysis. Thus, the analysis includes measures only for those animals whose vents were clearly visible, presumably reflecting an accurate assessment of SVL. We also noted condition of the tail (intact, or with obvious signs of breakage or regrowth). We did not differentiate between the sexes or among ages.

Linear regression analysis was used to determine the relationships among body measurements (Analytical Software 2000). Data from the two main sites were used as input (N = 363) to build the model relating SVL and SLL. A Durbin-Watson test was performed on the residuals from this analysis to check for autocorrelation (independence of residuals; Analytical Software 2000). Residual plots were also examined visually to determine if the residuals were normally distributed and homoscedastisic. The regression model was validated using two approaches. First, the test data (N = 214) were run through the regression model to determine the number of cases that fell outside the 95% prediction interval. A prediction interval is expected to contain observed values of the dependent variable 95% of the time (Analytical Software 2000). Second, a new regression analysis was performed in which actual measurements from the test batch were used as the dependent variable, and the predicted values for the same salamanders were used as the independent variable. If the test data fit the equation well, there should have been a non-significant intercept, and the slope of the regression line should not have differed significantly from 1.0 (Montgomery and Peck 1982). A high R-square would also indicate a good fit.

Linear regression of SLL and SVL resulted in a highly significant model (F = 5010.9, df = 362, P = 0.000) that fit the data well (R^2 = 0.933; Fig. 2). There was no significant autocorrelation among residuals (Durbin-Watson statistic = 1.9809, P of positive correlation = 0.4244, P of negative correlation = 0.5756, N = 363). Residual plots also suggested that the residuals were normally distributed and homoscedastisic. The regression of SLL and TL also was significant (F = 1077.84, df = 362, P = 0.031). However, TL was not predicted as well from SLL (R^2 = 0.748; Fig. 3). This was expected, and probably reflects a combination of phenotypic variation in tail lengths, and the results of injury or autotomization (and

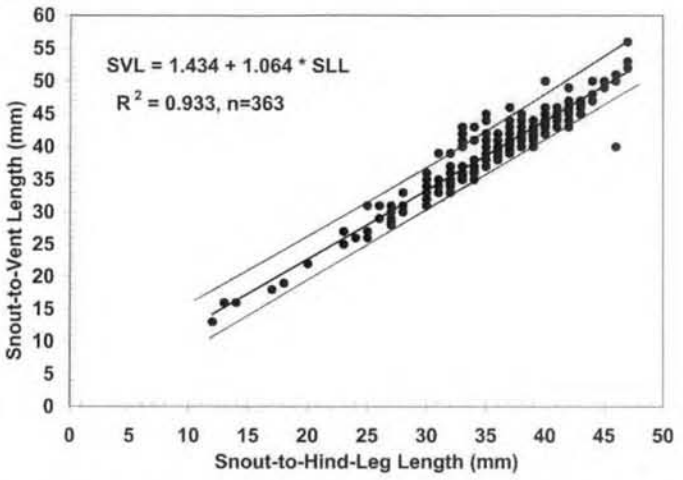


FIG. 2. Linear regression model relating snout-to-hind-leg length (SLL) and snout-to-vent length (SVL) of *Plethodon cinereus* captured near North Bay, Ontario. The solid lines show the 95% prediction interval (PI) for SVL. True (or observed) values of SVL are expected to fall within the PI 95% of the time.

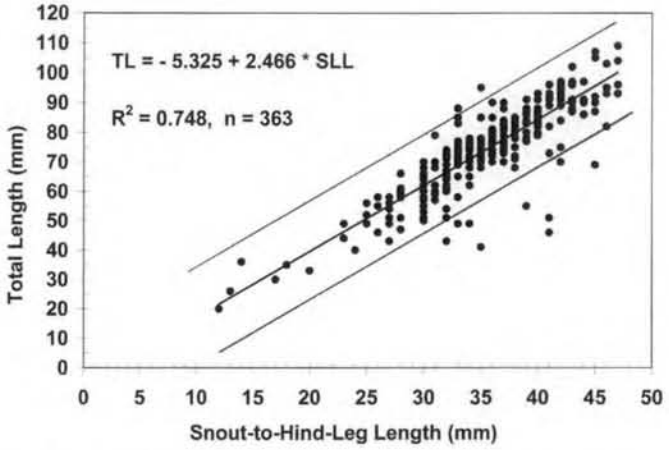


FIG. 3. Linear regression model relating snout-to-hind-leg length (SLL) and total body length (TL) of *P. cinereus* captured near North Bay, Ontario. The solid lines show the 95% prediction interval for TL. True (or observed) values of TL are expected to fall within the PI 95% of the time.

subsequent regrowth) that were not caused by the sampling methods. Seventy-nine (21.8%) of the *P. cinereus* used to derive the regression equation showed obvious evidence of past tail damage or regrowth (e.g., discontinuity of the tail profile manifested as an extremely blunted tip, an extremely pointed tip beyond an old injury, or, in a few cases, most of the tail missing).

Validation of the SLL/SVL model with the test data suggested that the model has wider applicability for *Plethodon cinereus* than the data base from which it was derived. When the test data from the larger area were run through the regression model, only 5 of the 214 values (2.3%) fell outside the 95% prediction interval. Moreover, performing a new regression of actual SVLs from the test data and predicted SVLs from the model resulted in a highly significant regression ($F = 4872.82$, $df = 213$, $P = 0.000$) with a non-significant intercept ($P = 0.9777$), a slope not significantly different from one ($t = 0.708$, $df = 212$, $P = 0.478$), and a high R-square value ($R^2 = 0.958$). Thus, both of these tests failed to invalidate the SLL/SVL model.

In the field, SLL was relatively easy to measure under a variety of conditions. The ease of measurement resulted in more rapid processing of individuals and therefore less handling and associated stress to the study animals. Legs were much more obvious on the smaller individuals than vents. This gives SLL the potential to be measured easily and accurately by unskilled volunteers participating in salamander monitoring programs.

Future research could involve testing or calibrating this equation in other parts of the geographic range of *Plethodon cinereus*. Alternately, SVL could be predicted for other populations using a two-phase sampling scheme. This would involve measuring SLL on all salamanders, and SVL on a subset to develop a regression estimator for the local area. A regression of SLL and SVL might also prove to be useful for other species of small salamanders.

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Field Use of a Local Anesthetic, Lidocaine Hydrochloride, for Radiotransmitter Implantation in *Boa constrictor imperator*

DAVID A. HOLTZMAN*
and
CHRISTINA D. STOSIC
Department of Brain and Cognitive Sciences
University of Rochester, Rochester, New York 14627, USA

and
JEFFREY WYATT
Seneca Park Zoo, Rochester, New York 14621, USA

**Corresponding author. Present address:*
Department of Psychology, SUNY Brockport, Brockport, New York 14420, USA
e-mail: dholtzma@brockport.edu

The use of general anesthetics is the standard procedure for the implantation of radiotransmitters in snakes (Anderson et al. 2000; Reinert 1992; Reinert and Cundall 1982; Weatherhead and Anderka 1984; and see excellent reviews by Hardy and Greene 1999, 2000). However, the use of general anesthesia presents several limitations, which are compounded in the field. If an injectable general anesthetic is used, investigators must become proficient in finding veins (usually the tail vein) or in heart puncture (Anderson et

al. 2000). If an inhalant general anesthetic is used, the investigator must be able to regulate the amount of anesthetic given, and experience is needed to reduce overdosage and the use of artificial ventilation for resuscitation (Hardy and Greene 2000). The use of any general anesthestic necessitates the determination of safe dosages for a given species and the possibility of death because of overdosage. This report shows that a local anesthestic can be used safely and effectively in the field for the implantation of radiotransmitters. The use of local anesthesia virtually eliminates the possibility of death because of overdosage and simplifies the surgical procedure without compromising the health of subjects. In addition, recovery times are significantly shortened, and snakes can be released safely within 4 h post-surgery.

We have begun studies on the spatial ecology of *Boa constrictor imperator* on Ometepe Island, Nicaragua, in order to examine similarities and differences with temperate snakes for orientation. Ometepe is an island of 276 km^2 in Lake Nicaragua. By studying the spatial ecology of boa constrictors on Ometepe, we hope to identify preferred habitat and movement patterns and understand the thermal ecology of these snakes. Four *Boa constrictor imperator* were purchased from local residents, and the exact location and time of capture were noted. All snakes were captured in the municipalities of San Ramon and La Tijeretas on the south to southeast sides of the volcano Maderas. All snakes inhabitated secondary growth, dry tropical forest interspersed with agricultural fields.

Radiotransmitters were surgically implanted between 11 and 17 July 2000. Before surgery, all snakes were weighed, measured, sexed, and all external ticks were removed. We used two males and two females (N = 4), ranging from 153 to 171 cm snout–vent length and 1.9–3.4 kg. Snakes were implanted with temperature-sensitive radiotransmitters (151–152 MHz, G3-Temp B [CS1 and CS2] or SM1-H-Temp B [CS3 and CS4], AVM Instrument Co., Livermore, California, USA), which were less than 2% of body weight. Transmitters and instruments were soaked in 100% ethanol for 10 min and then rinsed in 0.9% sterile saline prior to implantation. All surgeries were performed using aspetic technique.

Snake heads were covered with cotton socks to reduce visual stimuli to the snake as well as to prevent bites to investigators (Rivas et al. 1995). The sock was secured with a rubber band around the neck. The upper third of each snake was placed in PVC tubing (tubing technique of Murphy 1971), and the remainder of the snake was restrained by 2–3 people. The operating table was first wiped with Betadine (10% povidone-iodine solution) and then covered with a sterile cloth. The snake's ventral scales were exposed, wiped with Betadine, and a total of 1.5 ml of 2% lidocaine hydrochloride without epinephrine (Astra Pharmaceuticals, Westborough, Massachusetts, USA) was injected subcutaneously and intramuscularly as a local anesthetic underneath three, consecutive ventral scales approximately 40 cm anterior to the cloaca. For any snake, this would be equivalent to a total dosage of 0.5 ml of lidocaine/kg of snake given approximately one quarter of the snake's length anterior from the cloaca. Injections were made using a sterile 1 ml tuberculin syringe with a 3/8 inch, 26 gauge needle. Investigators holding snake near incision site and making incision wore sterile gloves. After 10 min without physical restraint, the snake was restrained again; the injected region was poked with a 26 gauge needle to ensure the absence of a withdrawal reflex; and a transverse incision (approx. 4 cm) was made with a sterile scalpel underneath the middle of the three ventral scales injected previously with lidocaine. A radiotransmitter was inserted into the peritoneal cavity and advanced posteriorly with a sterile cotton applicator, leaving the end of the whip antenna underneath the incision site (Fig. 1). No reflexive or excessive movements were noted during intraperitoneal implantation. The incision was then closed with 3-0 Dexon II absorbable suture (Davis-Geck Inc., Manati, Puerto Rico, USA) in a subcuticular, simple interrupted, horizontal pattern so that skin edges and dermal layers are everted and closely opposed for strong healing (Hardy and Greene 1999). The sutured incision is then covered with liquid bandage (New Skin, Medtech Laboratories, Inc., Jackson, Wyoming, USA) in order to provide additional strength. The entire procedure from the injection of lidocaine to placement of the last suture ranged from 20 to 30 min (recall that 10 of those minutes are waiting for the lidocaine to take effect). Snakes were allowed to recover for 3 to 10 h. The tops of their heads were painted with green latex paint (Wash 'n Wear, Glidden Co., Cleveland, Ohio, USA), and they were released at their capture points.

Snakes were tracked once or twice daily over 22–30 days and localized 14–25 times, using a TRX-1000S receiver and 3 element folding Yagi antenna (Wildlife Materials, Inc., Carbondale, Illinois, USA). At the end of this period, three of the four snakes

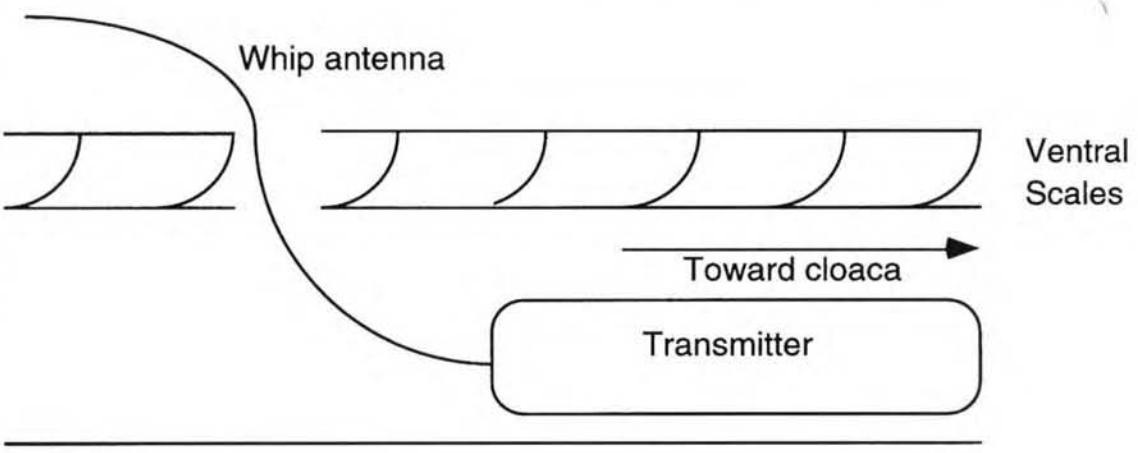


FIG. 1. Placement of radiotransmitter in body cavity. Snakes were injected with a total dosage of 0.5 ml of lidocaine/kg of snake (distributed under three consecutive ventral scales), given approximately one quarter of the snake's length anterior from the cloaca. A transverse incision was made with a sterile scalpel underneath the middle of the three ventral scales injected 10 min previously with lidocaine. After the transmitter is pushed caudally, the antenna lies completely within the body cavity. All surgeries were performed using aspetic technique (see text for details).

were recaptured, and transmitters were removed using the same procedures described above. After injection of lidocaine, transmitters were removed by an incision at the same incision site made for implantation, followed by closure as described above. In all cases, no movement of the transmitter had occurred, and all transmitters were removed by gently palpating the transmitter anteriorly. No adverse effects were seen on snakes released within 3 h of surgery, and no signs of infection or necrosis were observed at the time of transmitter removal. Indeed, one snake had no signs of surgery except for a faint line between the reattached ventral scales.

Although we have only attempted this technique on four animals in the field to date (and two corn snakes, *Elaphe g. guttata*, at the Seneca Park Zoo prior to field work), the surgery technique described has several advantages over those described previously. First, there is virtually no chance of mortality because of anesthesia. This is critical when working with species that are rare or hard to obtain, working with gravid females, or when working under primitive conditions. Although this method necessitates physical restraint, we feel that the slight discomfort and stress experienced by the subject for less than 20 min is minimal compared to the risk of mortality using general anesthesia. In addition, the injection of lidocaine affords adequate analgesia at the surgical site, does not necessitate any special training, and can be performed safely using sterile syringes and needles. The implantation of radiotransmitters and antennas into the body cavity did not harm the snake in any way and did not affect the transmission of signals. We were able to localize snakes in thick, secondary forest up to 150 m (the greatest distance traveled by an individual between localizations). Although this method could potentially be used with any species, it might be advisable to use general anesthesia when working with venomous species to minimize the chance of envenomation.

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External and Implanted Methods of Radiotransmitter Attachment to a Terrestrial Anuran (*Eleutherodactylus augusti*)

CAREN S. GOLDBERG
Wildlife and Fisheries Science, School of Renewable Natural Resources
125 Biosciences East, University of Arizona, Tucson, Arizona 85721, USA
e-mail: cgoldber@ag.arizona.edu

MATTHEW J. GOODE
Wildlife and Fisheries Science, School of Renewable Natural Resources
125 Biosciences East, University of Arizona, Tucson, Arizona 85721, USA
e-mail: mgoode@ag.arizona.edu

CECIL R. SCHWALBE
USGS Western Ecological Research Center, Sonoran Desert Field Station
University of Arizona, Tucson, Arizona 85721, USA

and

JAMES L. JARCHOW
Sonora Animal Hospital
410 West Simmons Street, Tucson, Arizona 85705, USA

While recent refinement of miniaturized radiotransmitters has made it possible to study small organisms using radiotelemetry (White and Garrott 1990), determining how to attach transmitters to small animals is still problematic. Anurans might be particularly difficult to attach transmitters to because of the sensitivity of their skin. Transmitters attached externally might get caught on objects in the environment and cause abrasions. Implanting transmitters requires the researcher to conduct surgery, a longer process that leaves an incision which might become infected. In this paper, we compare the effectiveness of internal and external radiotelemetry attachment methods for a terrestrial anuran, the barking frog (*Eleutherodactylus augusti*), and provide details on implantation of transmitters.

Many materials have been used to attach external transmitters to anurans: beaded metal chain (Rathbun and Murphey 1996; Matthews and Pope 1999), latex (Van Nuland and Claus 1981), rubber (Fukuyama et al. 1988; Werner 1991), satin ribbon (Bull 2000), webbing (Schwarzkopf and Alford 1996), gauze bandages (Hodgkison and Hero 2001), and silicone (Holenweg and Reyer 2000), polyethylene (Bartelt and Peterson 2000), and teflon tubing (Waye 2001). Many of these attachments have resulted in sores and limited mobility of frogs, perhaps leading to decreased survivorship (Bartelt and Peterson 2000; Bull 2000; Rathbun and Murphey 1996; Waye 2001; Werner 1991; P. Griffen, pers. comm.). Common frogs (*Rana temporaria*) and common toads (*Bufo bufo*) force-fed transmitters regurgitated them in 2–38 days (Fiorito et al. 1996; Oldham and Swan 1992).

For longer studies, some researchers (Richards et al. 1994; Werner 1991) have suggested that implanting the transmitter into the coelomic cavity might be less dangerous to the frog than attaching it externally. Most published field studies using implantation in anurans do not discuss any effects of transmitter implantation (Bradford 1984; Carey 1978; Denton and Beebee 1993; McClanahan and Shoemaker 1987; Seitz et al. 1992; Smits 1984; Stinner et al. 1994), but some report no infection or direct mortal-

ity (Eggert et al. 1999; Lamoureux and Madison 1999; Olders et al. 1985; Sinsch 1988; Speiler and Linsenmair 1998). One study noted infection in one of six individuals implanted, apparently because of improper suturing (Werner 1991). Implanted transmitters did not negatively affect survival, feeding, or weight change in salamanders (*Ambystoma maculatum*) in field and laboratory experiments (Madison 1997).

We used three methods to attach radiotransmitters (models BD-2T [external, 1.55 g], BD-2HT [internal, 1.4–1.45 g], BD-2G [external, 1.2–1.4 g], BD-2GH [internal, 1.25–1.55 g]; Holohil Systems Ltd., Carp, Ontario, Canada) to barking frogs in the Huachuca Mountains of southern Arizona during the summers of 1996, 1999, and 2000. Transmitters were built to last 9 weeks. In 1996 we used aluminum beaded chain belts (Rathbun and Murphey 1996) on four frogs and in 1999 we surgically implanted transmitters in six frogs. In 2000 we surgically implanted transmitters in five frogs and used a silicon tubing belt (P. Griffen, pers. comm.) on one additional frog. This belt was made of a silicon tube (2.1 mm outside diameter; Cole-Parmer Instrument Co., Vernon Hills, Illinois, USA) which had 10-pound test fishing braid (SpiderWire, Pure Fishing, Spirit Lake, Iowa, USA) at the core and tied in a knot. We pushed the knot back into the tube and glued the ends together with a drop of silicon glue, fitting the belt as described in Bartelt and Peterson (2000). This external belt was on a gravid female; we avoided operating on gravid females because of possible complications with the egg mass. Implanted transmitters had helical antennae; external transmitters had whip antennae. Mass of transmitters did not exceed 5% of the mass of the frog. Transmitters were 15 or 16 mm in length; frogs had snout–vent lengths between 67 and 81 mm and masses between 25 and 45 g.

To anesthetize frogs for implantation surgery, we used an aqueous solution of 0.03–0.05% tricaine methanesulfonate (MS-222, Finquel, Argent Chemical Laboratories, Inc., Redmond, Washington, USA) buffered with sodium bicarbonate to pH 7 as recommended by Fellers et al. (1994). The depth of the solution was shallow enough to enable the frog to sit on the bottom of the container and have its mouth above water. We conducted surgeries on large, autoclaved sponges to soak up any solution that ran off the frog when anesthetic was administered during the surgery by pipette or soaked gauze. We avoided getting solution in the incision.

Transmitters were coated by the manufacturer with a non-reactive coating of butyl rubber and we had them gas sterilized prior to surgery. We autoclaved all surgical instruments and used sterile gloves for each surgery. We made a 12–15 mm incision laterally with a #11 scalpel blade and used Polysorb 6/0 suture with a tapered, half-circle needle (United States Surgical Corporation [USSC], Norwalk, Connecticut, USA) to close the peritoneal tissue. This tissue was very thin, and we used two or three simple, interrupted sutures to close this layer. We used Monosof 5/0 (USSC) suture with a 3/8 circle reverse cutting needle and closed the skin with seven or eight horizontal mattress sutures. Using a mattress stitch ensured that inner epidermal layers were opposed, creating an area of rapid healing that reduced the chance of infection.

We attempted to dose the frogs with the appropriate amount of anesthetic so that they started to recover during skin closure, indicating that we had not over-anesthetized them. After surgery, we placed frogs in very shallow water and changed it regularly until they were alert. We then replaced the water with a damp paper towel. We usually conducted surgeries in the morning and released frogs that same night.

In 1996, one frog lost its beaded chain belt after five days. Sores were not seen on the other three frogs two weeks after attachment but the frogs developed bleeding ulcerations on their sides by 21 days in the field. In 2000, the frog with the silicon belt did not have sores after 11 days in the field. She remained almost completely underground for the next 34 days, when we observed that she had deep ulcerations on both sides and immediately removed the belt. Signals from transmitters attached externally were audible from greater than 200 m.

We conducted 11 implantation and 7 transmitter removal surgeries. One removal procedure was not successful because the frog came out of anesthesia before we retrieved the transmitter and did not respond to additional anesthetic; we closed the incision and released the frog with the transmitter still implanted. One transmitter that we successfully removed had moved out of the coelomic cavity to a subcutaneous position, probably because of an inadequate number of sutures in the peritoneal tissue. No irritation or wearing of the skin was apparent from the transmitter being in this position, and the peritoneal tissue had healed completely. We did not attempt to retrieve transmitters from the remaining four frogs: two frogs entered their overwintering sites with transmitters still implanted, one frog stopped moving in the second week of radiotelemetry and presumably died of unknown causes, and one frog prolapsed its bladder after surgery. We drained the bladder of this frog and moved it back inside the body cavity as we released the frog. This frog moved in a similar pattern to other frogs throughout the season, but we decided that recapturing it for transmitter removal would be more stressful to the frog than leaving the transmitter implanted.

Frogs usually took between 10 and 20 minutes to reach a surgical level of anesthesia, but this was highly variable (range 6–45 min). When a frog did not right itself when placed on its back, we determined that it had reached the appropriate level of anesthesia and removed it from the solution. We found that waiting for the toe pinch reflex to disappear (Fowler 1993; Van Gelder and Bugter 1987) resulted in a dangerously deep level of anesthesia. One frog that was allowed to reach this level was unconscious for more than two hours and eventually had to be revived by tracheal intubation and ventilation with oxygen. Barking frogs often did not breathe for several minutes at a time during surgery, but their heartbeats were visible. Occasional pharyngeal breathing indicated an appropriate level of anesthesia. We often had to continue to administer anesthetic solution to frogs during the surgery.

Immediately after coming out of anesthesia, many frogs resumed a defensive posture by filling their lungs with air to increase their size and some males started calling immediately upon release. The skin of all frogs that we observed had healed completely within two weeks of the surgery. We observed a slight thickening of the lung tissue in one frog that had a transmitter inside it for over a year, but no inflammation was apparent. All other removal surgeries were conducted 5–9 weeks after implantation. We saw no evidence of infection or mortality due to implantation of transmitters; we recaptured 7 of the 10 frogs one year after surgery and saw no external evidence of the surgery aside from a barely visible scar. Signals from implanted transmitters were audible from a maximum distance of between 6 and 40 m.

Both methods of external attachment of transmitters to barking frogs caused potentially dangerous ulcerations. Even though our sample size is small, we feel that the consistency of our results is important to note. Terrestrial species such as barking frogs might be especially prone to developing sores from dirt trapped under belts and harnesses because of the lack of water to wash away abrasives. In addition, it is often impossible to inspect visually the effects of belts and harnesses on frogs that occupy underground areas.

Achieving the appropriate level of anesthesia was the most problematic part of surgery. Similar concentrations of MS-222 have been used in studies of *Rana arvalis* (0.05%; Van Gelder and Bugter 1987), *Rana temporaria* (0.02–0.03%; Seitz et al. 1992), *Bufo calamita* (0.05%; Sinsch 1988), and *Bufo bufo* (0.02%; Olders et al. 1985). Other studies have successfully used much higher concentrations for *Rana muscosa* (0.4%; Bradford 1984) and *Rana clamitans* (0.5%; Lamoureux and Madison 1999), and lower concentrations for *Bufo americanus* (0.01%; Werner 1991). The higher concentrations would almost certainly have caused mortality in barking frogs, while the lower concentration would likely have resulted in too shallow a depth of anesthesia.

With careful use of anesthesia and sterile protocols, we believe that implantation of transmitters is the safest and most reliable method of transmitter attachment for terrestrial anurans if the length of the study is sufficient to allow for healing. Aquatic frogs might be less prone to injury from belts and more easily accessed for examination, and external attachment might be a more appropriate method for them. The short distance at which the transmitter signal is audible might also limit the use of this method with more mobile species.

While we hope that the information provided in this paper will enable field biologists to safely implant transmitters in frogs, we emphasize that surgery is a difficult and risky undertaking for any species. Researchers should only operate on sensitive species after they have practiced techniques on other frogs (we used bullfrogs [*Rana catesbeiana*] from an extirpation program), preferably under the supervision of an experienced surgeon.

Acknowledgments.—Funding for this project was provided by the Arizona Game and Fish Heritage Program, National Park Service, and Southern Parks and Monuments Association. Barbara Alberti of the National Park Service initiated this study and contributed with field, administrative, and editorial work. We would like to thank Brenda Carbajal and Cecily Westphal for administrative assistance, Erika Duross, Cori Dolan, Mary Gilbert, and all our volunteers for fieldwork, and Don Swann, Dale Turner, and two reviewers for their helpful comments. Surgeries for this project were conducted under IACUC #99-038.

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RECENT POPULATION CHANGES

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A Historical Study of the Distribution of Blanchard's Cricket Frog (*Acris crepitans blanchardi*) in Southeastern Michigan

RICHARD M. LEHTINEN
University of Michigan Museum of Zoology
Division of Reptiles and Amphibians, 1109 Geddes Avenue
Ann Arbor, Michigan 48109-1079, USA
e-mail: rmlehtin@umich.edu

"We have seen it from New Jersey to Georgia, Louisiana, Texas and Iowa, but like most workers we have neglected this most ubiquitous tree frog. Everyone remarks their choruses." (Wright and Wright 1949)

Unfortunately, Wright and Wright's (1949) characterization of the abundance of *Acris crepitans* is no longer accurate. In recent years, there have been numerous reports of declines in populations of Blanchard's cricket frog (*Acris crepitans blanchardi*), particularly in the midwestern US and adjacent Canada (e.g., Minnesota [Oldfield and Moriarty 1994]; Wisconsin [Hay 1998; Mossman et al. 1998]; Iowa [Hemesath 1998; Lannoo et al. 1994]; northern Illinois [Mierzwa 1998]; northern Indiana [Brodman and Killmurry 1998]; Ontario [Oldham 1992]). Frost (1983) and Hammerson and Livo (1999) have also reported declines from the western edge of its range.

In Michigan, Blanchard's cricket frog was historically widely distributed in the southern half of the lower peninsula (Harding 1997; Ruthven et al. 1912). Isolated records also exist for populations in the northern portion on the lower peninsula (Lee 1998; Ruthven et al. 1912). However, there has been no recent, published report of the current distribution of these frogs in Michigan. Surveys by the Michigan Department of Natural Resources and data from the Michigan Frog and Toad Survey indicate that this species is still somewhat abundant in southwestern Michigan, but is rare in the southeastern part of the state (Lee 1998).

Long-term monitoring of distribution and abundance is critical to the ability to detect and respond to declines (Pechmann and Wilbur 1994). Museum specimens, when accompanied with appropriate locality data, provide unequivocal evidence of the occurrence of a species at a certain time and place. These, and other records, provide us with information on the historic distribution of a species and can be used in conjunction with contemporary surveys to assess its current distribution and conservation status (Shaffer et al. 1998).

To assess the historic distribution of Blanchard's cricket frog in southeastern Michigan, I compiled a database of historic localities for this species in 14 counties in southeastern Michigan, USA. This database was based on records from museums, the scientific literature, the Michigan Natural Features Inventory, the Michigan Frog and Toad Survey, and reports from local naturalists. I limited my search for historical information to the following counties in southeastern Michigan: Genesee, Hillsdale, Ingham, Jackson, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, Shiawassee, St. Clair, Washtenaw and Wayne. A total of 79 historic localities were found in the study area dating from 1878 to 1999. These historic localities included three habitat types: lakes (35%), ponds (39%) and rivers or streams (26%).

A difficulty in conducting historical studies is that the quality of information varies greatly, particularly in older records. For example, many specimens or literature records simply refer to a township or a city, (e.g., "Norvell Township" or "Ann Arbor") without any specific locality data. Also, some older records use long forgotten names (e.g., "Steere's marsh" or "Fiegel's woods"). Some of these were located after consulting old maps, but others had to be excluded from further consideration. In all, 60 localities were sufficiently informative that they could be relocated and surveyed.

Chorusing surveys were conducted at these 60 sites for Blanchard's cricket frogs during the peak breeding season. At each site, after a five minute acclimation period, I listened ten minutes for vocalizations of male cricket frogs. If cricket frogs were detected, I attempted to collect a reference specimen. Chorusing surveys were conducted between 2000 and 0100 h. The minimum air temperature to conduct a chorusing survey for cricket frogs was



FIG. 1. Location of sixty historical localities (1878–1999) for *Acris crepitans blanchardi* in fourteen counties in southeastern Michigan, USA. Open circles represent extinct populations, shaded circles represent extant populations, based on 2001 surveys.

effectively at the site following disturbance. In order to document revegetation of the site, we also measured changes in the biomass of plant material over time. Although the rate of increase slowed in 1999 (1.05 m^3/month) compared to 1998 (1.52 m^3/month), the total biomass of vegetation at the site continued to grow throughout the study period.

Public education is key to the success of any conservation program. Thanks to a supplemental award from the National Science Foundation's Informal Education Program, we have been able to incorporate a public education component into our work on the base. Although Cuban iguanas comprise a conspicuous component of the local fauna and have been adopted as an informal mascot by many base residents, their biology and conservation status are not widely understood or appreciated. A major focus of our educational efforts has been to provide opportunities for the general public to participate actively in our field research effort. On three separate trips in 1997, we offered interested volunteers on the base the opportunity to participate in standardized iguana censusing and help collect data on antipredator and thermoregulatory behavior. Feedback from over 40 participants in the form of surveys was overwhelmingly positive, with 93% of respondents finding the research experience extremely worthwhile, 83% of respondents experiencing a positive shift in attitude regarding scientific research following their field experience, and 90% of respondents indicating that they would recommend the research experience to other base residents.

In collaboration with HVS Productions, we also produced a video that describes the basic biology of iguanas, their conservation status and requirements, and the goals, study methods, and results of our research program. Copies of the videotape have been distributed to the environmental office, library, and schools on the base. On each of our trips to the base, we have offered public lectures at which we provide information on iguanas, their conservation status, and how to appreciate and enjoy them without harming them. We have given numerous presentations to both elementary and secondary students on the base, prepared an endangered species pamphlet for incoming base personnel, and designed an Iguana Crossing sign for sites on the base where road casualties were known to have occurred.

Our work at Guantanamo Bay is but one example of the many contributions zoos are making to the conservation of West Indian iguanas. Over 20 American Zoo and Aquarium Association (AZA) member institutions have provided direct funding and other resources to West Indian iguana conservation projects, primarily in Jamaica, but also in Dominica, the Cayman Islands, the Dominican Republic, the Bahamas, the Turks and Caicos Islands, and the British Virgin Islands. With the help of zoos and other dedicated conservation partners, some of the rarest and most impressive lizards in the world are starting to make a comeback.

Further Reading

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 33, Number 1 (March 2002).

GYMNOPHIONA

OSCAECILIA ZWEIFELI (Zweifel's Caecilian). **PREDATION**. Virtually nothing is known about the ecology of *Oscaecilia zweifeli* (Lescure and Marty 2000. Atlas des Amphibiens de Guyane. Patrimoines Naturels, 45). At the field station of Nouragues (4°5'N, 52°41'W 110 m elev.), 8 km N of Saut Pararé, Arataye River, French Guiana, during the rainy season on 25 May 1999, one of us (RB) found, under a rotted trunk on the ground, an *O. zweifeli* (Museúm National d'Histoire Naturelle, Paris [MNHN] 1997.6482) whose head was maintained by the chelicera of an adult giant tarantula, *Theraphosa leblondi* (Theraphosidae) (Fig. 1). The tarantula had produced a silk cocoon around the head of the dead caecilian; the head was already partly digested. When disturbed, the tarantula raised its forelegs and threw urticating setae. This specimen of *O. zweifeli* is the second one known from French Guiana, the species having been recorded in that country only from a single specimen from Cayenne (Lescure and Marty, *op. cit.*).

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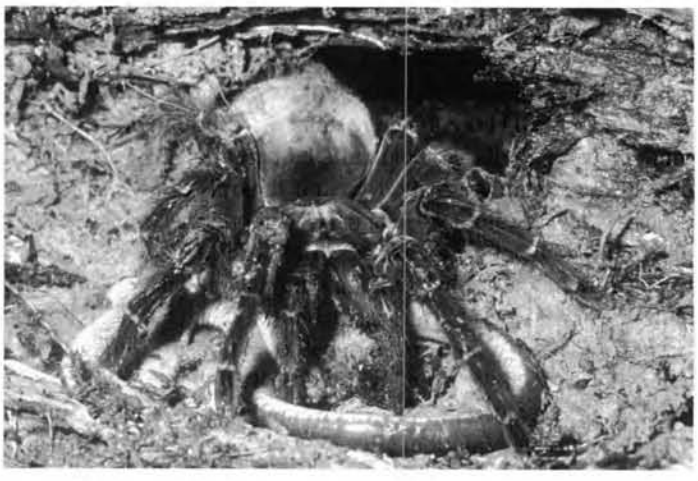


Fig. 1. Giant tarantula, *Therophosa leblondi* (Theraphosidae) preying on a Zweifel's caecilian, *Oscaecilia zweifeli*, at Nouragues Field Station, French Guiana, May 1999.

Submitted by **RENAUD BOISTEL**, Laboratoire de Biogéographie et Ecologie des Vertébrés, E.P.H.E., Univ. de

Montpellier II, case courrier 094, Place Eugène Bataillon, F-34095 Montpellier, France and Université Paris Sud, Centre Scientifique d'Orsay, Laboratoire des Mécanismes de Communication animale, N.A.M., C.N.R.S., U.R.A. 1491, Bât. 446, 91405 Orsay, France, and **OLIVIER S.G. PAUWELS**, Department of Recent Vertebrates, Institut Royal des Sciences naturelles de Belgique, Rue Vautier 29, 1000 Brussels, Belgium (e-mail: osgpauwels@hotmail.com).

CAUDATA

AMBYSTOMA LATERALE (Blue-Spotted Salamander). **HABITAT.** On 6 April 2001, a gravid female *Ambystoma laterale* was collected at George Wyth Memorial State Park, Cedar Falls, Black Hawk County, Iowa, USA. On 7 April 2001, a male (evidenced by a swollen cloaca) was collected at the same locality. *Ambystoma laterale* are listed State Endangered by the Iowa Department of Natural Resources and are only found at two sites within the State, Behrens Ponds, Linn County, and George Wyth Memorial State Park, Black Hawk County.

Before this study, only one individual of *A. laterale* had been reported (by a park visitor) at the George Wyth Memorial State Park site (1996) since the completion of the Hwy 218 expansion project in 1989, which runs adjacent to the park. It was feared *Ambystoma laterale* had been extirpated from the George Wyth site because of the altered hydrology caused by the highway expansion. Both specimens were returned to the exact locations where they were found. Future research will concentrate on gaining an accurate estimate of the size and genetic diversity of this geographically disjunct population.

We thank Gary Dusenberry (Director of George Wyth Memorial State Park) and the students of Field Zoology at UNI for their assistance. We also thank James W. Demastes for confirming the species identification and the opportunity to search for the salamanders under Iowa DNR permit number SC-5530101.

Submitted by **DAVID WOJNOWSKI**, NCDENR/Division of Water Resources, 1611 Mail Service Center, Raleigh, North Carolina, 27699-1611, USA; **CRAIG A. MALLICOAT** and **RYAN L. WELCH**, Department of Biology, 2438 McCollum Science Hall, University of Northern Iowa, Cedar Falls, Iowa, 50614, USA.

AMBYSTOMA MACRODACTYLUM KRAUSEI (Northern Long-toed Salamander). **VOCALIZATION**. Vocalization has been documented in many terrestrial salamanders, often in association with defensive or aggressive behavior (Licth 1973. Can. J. Zool. 51:1055–1056; Brodie 1978. Copeia 1978:127–129). On 24 April 2001 at a wetland near Lost Horse Creek in the Bitterroot Mountains, Montana, USA (46°05'91"N, 114°15'82"W), a male *Ambystoma macrodactylum krausei* in breeding condition twice made a squeaking noise and three times produced a series of rapid clicks while being manipulated for photographs. The squeaks were produced with the mouth closed and might have been caused by expelling air through the nostrils. The clicks were produced by the salamander inflating its body and rapidly snapping its jaws 2–3 times. Both types of sound were audible from 0.5 m. Biological significance of the noises is uncertain because no defensive postures or aggressive movements were observed.

Submitted by **BLAKE R. HOSSACK**, Division of Biological Sciences, University of Montana, Missoula, Montana 59812, USA and Aldo Leopold Wilderness Research Institute, 790 East Beckwith Avenue, Missoula, Montana 59807, USA; e-mail: blake_hossack@usgs.gov.

DESMOGNATHUS CAROLINENSIS (Carolina Mountain Dusky Salamander) and ***PLETHODON WELLERI*** (Weller's Salamander); ***DESMOGNATHUS MONTICOLA*** (Seal Salamander) and ***DESMOGNATHUS WRIGHTI*** (Pygmy Salamander). ***GYRINOPHILUS PORPHYRITICUS*** (Spring Salamander) and ***DESMOGNATHUS OCOEE*** (Ocoee Salamander). **INTRAGUILD PREDATION**. Plethodontid salamanders are generalist predators as well as competitors, and thus fit the definition of intraguild predators (Polis et al. 1989. Annu. Rev. Ecol. Syst. 20:97–330). Hairston (1986. Amer. Nat. 127:266–291) experimentally demonstrated that both predation and competition structure salamander ensembles of *Desmognathus*. However, there is a paucity of records of interspecific predation by salamanders (perhaps because habitat partitioning effectively reduces opportunities for size-mediated predation) and the idea that predation is a significant ecological factor in structuring salamander ensembles has been questioned (Camp 1997. J. Herpetol. 31:613–616). Here I document three different predator-prey interactions based on disgorged stomach contents of wild caught salamanders. On 9 September 1995, a large (SVL 58.6 mm) gravid *Desmognathus carolinensis* was collected along Grandfather Trail on Grandfather Mt., Avery Co, North Carolina (USA) that disgorged a partially digested *Plethodon welleri* (TL 58 mm). On 20 June 1995, an adult *Desmognathus monticola* collected at Glade Gap, Nantahala Mountains, Macon Co., North Carolina disgorged a partially digested *Desmognathus wrighti*, not previously reported from this area. In September 1987 I flushed the stomach of an adult *Gyrinophilus porphyriticus* captured at Whiteside Mountain, Jackson Co., North Carolina; it disgorged a large male *Desmognathus ocoee* (SVL >50 mm).

These observations document three different predator-prey interactions involving six different species. In each case, not surprisingly, the larger individual ate the smaller individual, suggesting that body size evolution in plethodontids that coexist with other species of salamanders can drastically alter a species' role as predator or prey. For example, the large body size attained by *Desmognathus carolinensis* at high elevations throughout its range may be an example of ecological release. At these high elevation sites, it occupies a territory largely devoid of the large aquatic species (e.g., *D. monticola*, *D. quadramaculatus*, and *Gyrinophilus porphyriticus*) that normally prey upon the smaller species. Such ecological release may drive evolution of body size in high elevation populations of *D. ocoee* and *D. carolinensis* allowing these species to take on the role of dominant predator to prey upon smaller species.

Submitted by **JOSEPH BERNARDO**, Department of Biology, Frostburg State University, 101 Braddock Road, Frostburg, Maryland 21532, USA; e-mail: jbernardo@frostburg.edu.

GYRINOPHILUS PORPHYRITICUS (Spring Salamander). **MALE COMBAT**. Behavioral interactions among plethodontid

salamanders in the field are scarce, particularly in less common species, and sexual behavior of many species has never been observed in the field (Arnold 1977. *In* Taylor and Guttman [eds.], Reproductive Biology of Amphibians, pp. 141–183, Plenum Press, New York). There is little published information about sexual behavior in spring salamanders. Bishop (1941. Salamanders of New York. Bull. New York State Mus. No. 324, Albany, New York) provided a detailed description (pp. 243–244) of an interaction between two specimens in the field, that he presumed to be a courting pair. This observation was also reported by Petranka (1998. Salamanders of the United States and Canada. Smithsonian. Inst. Press, Washington, D.C.). Bishop's description of *Gyrinophilus* courtship differs significantly from the elaborate courtship including tail-straddle walk that typifies courtship in the Plethodontidae (Arnold 1977, *op. cit.*) and that reported for closely related *Pseudotriton* (Organ and Organ 1968. Copeia 1968:217–223). It also differs from the description provided by Beachy (1997. Herpetologica 53:289–296) based on extensive observations from staged laboratory encounters.

On 21 September 1995 at Whiteside Mountain, Jackson County, North Carolina (USA), we encountered two large (SVL 86.7 mm and 90.6 mm) *G. porphyriticus* engaged in behavior remarkably similar to that described by Bishop. The two salamanders were in a shallow pool (~10 cm) in a small stream at the base of a rock face. The animals wrestled and writhed while biting each other aggressively. The behavior we observed resembled the aggressive interactions reported for many species of plethodontids (reviewed by Arnold 1977, *op. cit.*). After watching the salamanders engage in this behavior for about 10 minutes, they were collected and sacrificed the next day. Dissection revealed that both individuals were males, meaning that these behavioral interactions and probably those reported by Bishop (1941, *op. cit.*) are male-male agonistic behavior (sexual interference: Arnold 1976. Z. Tierpsychol. 42:247–300) rather than courtship behavior. The two specimens have been deposited in the North Carolina State Museum of Natural Sciences (NCSM 62159–62160).

Submitted by **JOSEPH BERNARDO**, Department of Biology, Frostburg State University, 101 Braddock Road, Frostburg, Maryland 21532, USA (e-mail: jbernardo@frostburg.edu) and **STEVAN J. ARNOLD**, Department of Zoology, Oregon State University, Corvalis, Oregon 97331, USA.

NECTURUS MACULOSUS (Mudpuppy). **PREDATION**. Predation on mudpuppies is not well documented. Herein I report predation on mudpuppies by mink (*Mustela vison*). During July 2001, Steven and Maureen Maslak of Rome, Maine, observed an adult mink carrying a mudpuppy in its mouth on the shore of Long Pond. The Maslaks often observe mink at this site, and often capture mudpuppies in their minnow traps. To my knowledge this is the first report of such predation.

Submitted by **MICHAEL J. LITTLE**, 82A Summer Street, Waterville, Maine 04901, USA; e-mail: brca@gwi.net.

NOTOPHTHALMUS VIRIDESCENS (Eastern Red-Spotted Newt). **PREDATION**. No significant predation on adult eastern red-spotted newts, *Notophthalmus viridescens*, has been documented in the wild. Natural predation on the toxic adult newts might help explain their cryptic dorsal coloration.

During late September 1998, two female newts were placed in a minnow trap overnight in Binghamton University's Nature Preserve pond (Broome County, New York, USA), and one experienced limb and tail predation that provided the impetus for further investigation of newt predation. At 1700 h on 25 September and 2 and 9 October 2000 at the same site, three newts were placed in each of nine minnow traps set ca. 7 m apart, 45 cm deep, and 1.0 m from shore. Trap checks at 1000 h the following mornings revealed no newt captures. On 26 September, two of the 27 newts had disappeared and 11 had serious or fatal injuries: all lost limbs (Fig. 1), four had partial or total tail loss, and one had only the spine, head, and dorsal skin remaining (Fig. 2). On 3 October, one of the 27 newts was missing and one had lost a limb. No newts were injured or missing on 10 October. The first frost of the year occurred between the first and second trapping sessions, and two frosts occurred between the second and third. Injuries seemed to have been inflicted from outside the traps because many newts were found with their bodies partially pulled through the trap mesh. The predation seems to be crepuscular or nocturnal, as we have over 1500 newt captures in 3000 h of diurnal trapping (1000–1700 h) at the same population from March until June of 1999 and 2000 without an incident of predation (unpublished).



FIG. 1. Examples of limb predation on adult *Notophthalmus viridescens*.

These are the first observations of natural and significant preda-



FIG. 2. Example of tail and ventral surface predation on adult *Notophthalmus viridescens*.

tion on adult eastern red-spotted newts. Many predator species can be ruled out either because they are not found at our site (crayfish), were concurrently captured in traps with newts during the day without predation (fish, dragonfly larvae), repeatedly reject newts as food (fish, water snakes, garter snakes: Hurlbert 1970. J. Herpetol. 4:47–55), are diurnal foragers (painted turtles: Johnson 1997. The Amphibians and Reptiles of Missouri. Missouri Dept. Conserv., Jefferson City, Missouri. 163 pp.), or are incapable of removing newt limbs (water beetles and bugs have piercing mouthparts: Peckarsky et al. 1990. Freshwater Macroinvertebrates of Northeastern North America. Cornell University Press, Ithaca, New York. 138 pp.). However, snapping turtles (*Chelydra serpentina*) have consumed adult newts and newt limbs in the laboratory (Hurlbert, *op. cit.*), and use a combination of sucking and rapid head movements to bite off sections of prey (Lagler 1943. Am. Midl. Nat. 29:257–312), which would be necessary to draw newt limbs through the trap mesh for seizing. Additionally, at a similar latitude (ca. 45°N, Ontario, Canada), snapping turtles are crepuscular and entered winter dormancy as temperatures dropped during October, matching the timing of our predation declines (Obbard and Brooks 1981. Copeia 1981:630–637). Future studies will confirm whether snapping turtles consume newts in the wild.

Submitted by **JASON R. ROHR** and **DALE M. MADISON**, Department of Biological Sciences, Binghamton University, Binghamton, New York 13902, USA; e-mail (JRR): jrohr@uky.edu.

SPELEOMANTES AMBROSII (Ambrosi's Cave Salamander). **ALBINISM**. The European plethodontid salamander *Speleomantes ambrosii* is endemic to a small area between Tuscany and Liguria in NW Italy (Lanza et al. 1995. Mus. Reg. Sci. Nat., Monografie, Torion, 16:368 pp.). While conducting research in a karstic area near the town of La Spezis (Liguria), an albino adult female *S. ambrosii* (SVL 65 mm; mass 3.8 g) was observed on 5 and 12 August 2001 in an artificial tunnel with several other normally-pigmented individuals. The specimen had reddish eyes with blood vessels visible through the skin (Fig 1.). Only light yellow pigmentation was visible on the back, and thus this salamander can be considered a partial albino with xanthophores (Drykacz 1981. SSAR Herpetol. Circ. 11:131 pp.). This is the first report of albinism in the European plethodontid salamander genus *Speleomantes*.



FIG. 1. The albino female *Speleomantes ambrosii* from La Spezia, Liguria NW.

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Submitted by **STEFANO CORSINI** and **MIRKO FERRETTI**, Gruppo Speleologico Lunense, La Spezia, Italy; **MAURO VALERIO PASTORINO** and **ALLESSANDRO PRATI**, Gruppo Speleologico Ligure Arturo Issel, Busalla, Genova, Italy; **GABRIELE ALARIO** and **SEBASTIANO SALVIDIO**, Dipartimento per lo Studio del Territorio e delle sue Risorse (DIP.TE.RIS), Corso Europa 26, I-16132 Italy.

ANURA

ASCAPHUS TRUEI (Tailed Frog). **ALBINISM**. On 8 July 1996, we captured an albino *Ascaphus truei* larva in the South Fork of Quartz Creek, Clatsop County in the northern Coast Range of Oregon, USA. The larva was of similar developmental stage (rear limb buds) and size as other non-albino larvae captured during that sample (mean ± SD: SVL 13.1 ± 2.0 mm, TL 40.3 ± 2.7 mm; N = 73). The larva was almost completely lacking pigmentation on dorsal and ventral surfaces, but possessed a slight pink/orange hue, which was more concentrated in the eyes. Its coloration contrasted markedly with other larvae from the site, which were predominately the more typical dark brown or black. The animal thus fits the description of an albino (Dyrkacz 1981. SSAR Circular No. 11. 31 pp.). To our knowledge, there are no instances of albinism or leucisticism reported for *Ascaphus truei*, a primitive anuran endemic to the Pacific Northwestern U.S. and southwestern Canada. The frequency of albinism in *Ascaphus truei* remains unknown, but our surveys over the last 4+ years have revealed no other examples in Oregon.

Submitted by **CHRISTOPHER A. PEARL,** U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, Oregon 97331, USA (e-mail: christopher_pearl@usgs.gov), **DONALD J. MAJOR**, Department of Fisheries and Wildlife, Utah State University, 5210 Old Main Hill, Logan, Utah 84321, USA, and **R. BRUCE BURY**, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, Oregon 97331, USA.

BUFO CALIFORNICUS (California Arroyo Toad). **HABITAT and POPULATION STATUS.** In the coastal and foothill drainages of southern California and northwestern Baja California, Mexico, populations of the endangered *Bufo californicus* are often associated with open to partially open stream terraces, shallow permanent or intermittent streams and pools, and sand and gravel stream bottoms free of vegetation from periodic flooding (McLaughlin and Stephenson 2001. Fed. Register 66[26]:9414–9474). Although several authors have studied the species' ecology in coastal drainages and, to a lesser extent, in upland habitats of southern California, reports on the natural history, distribution, and status of *B. californicus* in Baja California are lacking (U.S.

Fish and Wildlife Service 1999. Arroyo southwestern toad (*Bufo microscaphus californicus*) Recovery Plan. USFWS, Portland, Oregon. 119 pp.). Currently, *B. californicus* is distributed disjunctly in northwestern Baja California from the coastal plains (e.g., Río San Vicente, Río San Telmo, Río Santo Domingo), inland foothills (e.g., Cañon Agua Caliente, Ojos Negros, Río Valladores, Rancho San Antonio, Arroyo San Rafael), peninsular range of the Sierra San Pedro Mártir (e.g., Misión San Pedro Mártir, La Grulla at 2157 m, Santo Tomás), and south to Arroyo Simón, ca. 16 km southeast of San Quintín (Gergus et al. 1997. Herpetol. Rev. 28:47).

We report on the habitat, recruitment, and present status of a new population of *Bufo californicus* in the coastal drainage of the Río Guadalupe, La Misión (La Misión de San Miguel), Baja California, México. The Río Guadalupe and its tributaries, herein recognizied as a third order stream (see Sweet 1992. Initial Report on the Ecology and Status of the Arroyo Toad [*Bufo microscaphus californicus*] on the Los Padres National Forest of southern California, with management recommendations. Report USDA Forest Service, Los Padres National Forest, Goleta, California), meanders nearly 90 km west of its headwaters in the western foothills of the Sierra Juarez (elev. 1700 m) and drains ca. 1960 km^2 of watershed before reaching the Pacific Ocean.

We conducted surveys at three sites, Puente La Misión (32°5.838'N, 116° 51.344'W, elev. 9 m), Cañada Los Alisos (32°6.103'N, 116°48.495'W, elev. 19 m), and Rancho Viejo (32° 5.913'N, 116° 47.425'W, elev. 23 m) during April–July 2001. These sites are within the coastal Río Guadalupe drainage (stream length 7 km, stream gradient 2 m/km) in close proximity to where *B. californicus* were previously observed (C. Mahrdt, 1995 unpubl. field notes). The westernmost Puente La Misión site is located 2.4 km east of the Pacific Ocean and 0.8 km east of any tidal influence. Since 1973, the habitat of the lower drainage has been severely altered by grazing, agriculture, dredging, and sand mining activities and within the last four years these activities have extended nearly 3 km upstream (Mahrdt, pers. obs.). Numerous man-made cattail (*Typha* sp.) ponds and channels < 2.5m in depth in association with stockpiles of alluvial sand and rock currently are scattered throughout much of the drainage. The extensive streambed alteration has resulted in a series of barren to sparsely vegetated stream terraces dominated by non-native vegetation (e.g, *Tamarisk* sp., *Bromus* sp.) along with relictual and recruiting native vegetation (e.g., *Baccharis* sp., *Iva* sp.). Further upstream, several ponds < 0.5 m in depth fed by subsurface aquifers have been created because of the heavy mining and export of alluvial soils. These ponds were largely unvegetated, although some of the presumably older basins supported large, floating mats of *Ceratophyllum* sp. and isolated patches of cattail. In addition, these ponds occurred on and were surrounded by barren unconsolidated alluvium with a sparse scatter of herbs (*Sonchus* sp.) and seedling shrubs (*Nicotiana* sp., *Salix* sp.).

On 14 April, two of us (CRM and SJZ) conducted a nocturnal survey along a 200 m portion of stream at the Puente La Misión site. At 2205 h, 12 males were calling and a pair was observed in amplexus in a shallow (< 10 cm), slow moving stream covered with a dense layer of algae and watercress (*Rorippa* sp.). Larvae were observed in large numbers (ca. 200) in small pools made by the hoof prints of horse and cattle. The air temperature was 10.8°C and the relative humidity 81% at 2200 h. The streambed lacked a gravel or pebble substrate and was composed of fine sandy-clay soil covered by a dense and heavily grazed mat of non-native grasses, (e.g., *Paspalum* sp.) intermixed to a lesser extent with a variety of herbaceous annuals, (e.g., *Ranunculus* sp., *Cotula* sp., *Anemopsis californica*, *Anagallis* sp., *Plantago major*), seedling shrubs (e.g., *N. glauca*, *Salix* sp.), and halophytes (e.g. *Heliotropium* sp., *Distichlis* sp.).

During the evening (ca. 2100–2330 h) of 8 June and morning (ca. 0630–0830 h) of 9 June, two of us (CRM and REL) conducted surveys at all three sites. At Puente La Misión, only one subadult *B. californicus* (SVL 52 mm; mass 16 g) was seen active on the stream terrace at 2150 h. Adult toads, metamorphs, and tadpoles were not observed although predators such as crayfish (*Procambarus* sp.) and bullfrog (*Rana catesbeiana*) were present in the stream. Further upstream at the Cañada Los Alisos site, six adult male toads (SVL 68–72 mm; mass 32–41 g) were seen at night (2230–2330 h) in shallow water at the edge of a recently constructed 0.5 ha pond. Approximately 100 metamorphs (SVL < 2 cm) were found on the steep banks of the pond and associated artificial terraces. During the cool overcast conditions that morning, metamophs (ca. 300) were present on quarry roads and terraces within 100 m of six artificial ponds (0.25–0.75 ha) along 2 km of riverbottom at the Rancho Viejo site. Metamorphs occurred along with low numbers of juvenile *Hyla regilla* and *Bufo boreas* and were highly conspicuous against the sparse vegetation and open sand terraces at recently quarried sites. Several juvenile *B. californicus* were found crushed presumably by sand and gravel truck traffic in this area.

A daytime inspection (0945–1245 h) of the sites by CRM and SJZ on 22 July failed to locate *B. californicus* of any life stage. The stream at the Puente La Misión site and smaller ponds at the Rancho Viejo site had dried up since our 8 June visit.

Our observations suggest that artifical ponds and man-made stream terraces may play a role in the breeding biology of *B. californicus*. Price and Sullivan (1988. Cat. Amer. Amphib. Rept. 415.1–415.3) commented on the increased utilization of artificial habitat sites of *B. californicus*. Although anthropogenic habitat modification (e.g., grading, off-road vehicle use, overgrazing, mining, and dredging) has clearly contributed to the decline of *B. californicus* populations (Sweet, *op. cit.*), some aspects of these disturbances might contribute to an increase in potential breeding sites and recuritment, at least in the short term. Sand mining of the Río Guadalupe has eliminated most of the vegetative cover and has created large areas of exposed, friable alluvium proximal to shallow pools. In this case, such a disturbance might be beneficial in that it mimics the effects of natural disruptive forces (e.g., seasonal floods) which ordinarily create open terraces and shallow oxbow pools in high-energy, dynamic river systems such as the Río Guadalupe. Stream alteration and the construction of wells and pumping stations are used to supply water to the nearby agricultural areas. It is not clear what effect the region's hydrology might have on the long-term viability of *B. californicus*; however, any substantial drop in water table depth would be expected to attenuate the river's capacity to flood and subsequently scour adjacent creek terraces. Future surveys in the Río Guadalupe drainage as well as other major drainages and their tributaries in northwest Baja California will help provide a more thorough understanding of the distribution, habitat characteristics, and popula-

tion trends of *B. californicus* in this region.

We thank B. D. Hollingsworth and K. R. Beaman for comments and criticisms on the manuscript and providing museum locality records. We extend our gratitude to C. Brown for his efforts in photographing various aspects of the coastal Río Guadalupe drainage. Voucher slides were deposited at the Los Angeles County Museum of Natural History (LACM-PC 1365a–e).

Submitted by **CLARK R. MAHRDT**, Herpetology Department, San Diego Natural History Museum, P.O. Box 1390, San Diego, California 92112, USA, **ROBERT E. LOVICH,** AC/S Environmental Security, Box 555008, Marine Corps Base, Camp Pendleton, California 92055-5008, USA, and **SALVATORE J. ZIMMITTI**, P&D Environmental, 401 West "A" Street, San Diego, California 92101, USA.

BUFO FOWLERI (Fowler's Toad). **PREDATION.** *Bufo fowleri* reaches its northern limit in Ontario, Canada on the Lake Erie shoreline (Green 1989. Can. Field Nat. 103:486–496). In Canada it is listed as a threatened species (Committee on the Status of Endangered Wildlife in Canada) largely because of disjunct populations and fluctuating abundance (Green 1997. Herpetol. Conserv. 1:45–56). Although threatened, there is little information regarding *B. fowleri* predators in Canada. Herein we report observations made of predation on a male *B. fowleri* by a male bullfrog (*Rana catesbeiana*).

On 11 May 2001, a male *R. catesbeiana* was spotted at a known *Bufo fowleri* breeding pond. Upon hand capture, the bullfrog 'screamed' and it was possible to see *B. fowleri* hind limbs inside the bullfrog's throat. The toad was immobile and covered in mucus after removal from the bullfrog (Fig. 1). The toad was kept in a plastic bag, until movement returned (two hours), and then released at the same location the next day. These observations were made in a dune pond near Long Point Ontario, Canada (N42.575686, W080.472468). The area is locally dominated by *Typha* sp., *Populus* sp., and in the spring of 2001 was ca. 60 m from the Lake Erie shoreline.



FIG. 1. Male *Bufo fowleri* being extracted from a male *Rana catesbeiana*. Photo by Dan Brouilette.

Submitted by **M. ALEX SMITH** (e-mail: alex.smith@mcgill.ca) and **DAVID M. GREEN** Redpath Museum, McGill University, 859 Sherbrooke Street West, Montréal, PQ, H3A 2K6, Canada.

ELEUTHERODACTYLUS FITZINGERI (Common Rain Frog). **CLUTCH SIZE and PARENTAL CARE.** On 29 March 2001 we found a brooding adult female (SVL 51 mm) *Eleutherodactylus fitzingeri*. The specimen was under a pile of sticks and coffee leaf litter, 4.38 km SE San Vito, Los Angeles (08°47'22.4"N, 82°56'40.1"W, 1006 m elev.), Coto Brus District, Puntarenas Province, Costa Rica. The original vegetation (pre-montane rain forest; Holdridge et al. 1971. Forest Environments in Tropical Life Zones: A Pilot Study. Pergamon Press) had been transformed into coffee plantations and pasture lands. The nest was in a small cavity on the ground and contained a clutch of 85 eggs (each ca. 2 mm diameter) The clutch of round and yellowish eggs was bunch-shaped and without jelly or foam to join or to protect the eggs. When we removed the sticks and leaves the female remained over the nest in a protective attitude. However, when the female was picked up she voided urine, perhaps as a defensive behavior. When the female was returned to the nest site, she again covered the nest with her body. Color slides of the specimen were taken and deposited at the Museo de Zoología, Facultad de Ciencias, UNAM slide collection.

Submitted by **FERNANDO MENDOZA QUIJANO**, Instituto Tecnológico Agropecuario de Hidalgo, Apdo. Postal 094, Huejutla de Reyes, C.P. 43000, Hidalgo, México, **GEORGINA SANTOS-BARRERA**, Museo de Zoología, Fac. Ciencias, UNAM. A.P. 70-399, C.P. 04510, México, and **JESÚS PACHECO-RODRÍGUEZ**, Instituto de Ecología, UNAM. A.P. 70-275, C.P. 04510, México, DF.

EPIPEDOBATES FEMORALIS (NCN). **DIET.** The dendrobatid frog *Epipedobates femoralis* occurs in the lowland forests of Guyana, Surinam, and French Guiana, and in the Amazon drainage of Colombia, Ecuador, Peru, and Brazil (Frost 2000. Amphibian Species of the World: An Online Reference V2.20 [September 2000]). On 18 February 2001 we captured a female *E. femoralis* (33 mm TL) at Reserva Florestal Adolfo Ducke, Amazonas, Brazil (03°08'S, 60°04'W). Upon capture the frog immediately regurgitated a live juvenile *Anolis fuscoauratus* (40 mm SVL). The lizard remained immobile for 20 minutes, and then walked off. Due to the lack of collecting permits, the lizard and frog were released.

Ants and termites are the main diet of *E. femoralis* (Toft 1980. Oecologia [Berlin] 45:131–141; Caldwell 1996. J. Zool. London 240:75–101). To our knowledge, this is the first report of predation on lizards by frogs in the family Dendrobatidae.

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Submitted by **GRAZIELA M. BIAVATI**, **ALBERTINA P. LIMA**, and **CAROLINA TOSI**, Coordenação de Pesquisas em Ecologia, Instituto Nacional Pesquisas da Amazônia, CP 478, 69011-970, Manaus, Amazonas, Brazil.

HYLA PUNCTATA (NCN). **DIET.** *Hyla punctata* is widely distributed in the Neotropical region, from Colombia to French Guiana and south through Brazil, Bolivia, and Paraguay. Within Argentina, it occurs in the provinces of Formosa and Chaco (Cei 1980. Amphibians of Argentina. Monit. Zool. Ital. [NS] Monog. 2:609).

TABLE 1. Prey consumed by *Hyla punctata* (N = 19) from Santa Fe Province, Argentina. No. = number of prey items; % Total = percentage taxa in the total number of prey; % Vol = percentage of each prey volume (mm^3); Freq. = number specimens containing prey; % Occ. = percentage occurrence.

Taxa	No.	% Total	% Vol (mm^3)	Freq.	% Occ.
INSECTA					
Hymenoptera	16	20.2	15.6	6	31.6
Diptera	45	57	31.2	11	57.9
Coleoptera	13	16.4	31.2	9	47.4
ARACHNIDA					
Aranae	5	6.3	6.2	4	21.1
Unidentified arthropod parts	—	—	15.6	10	52.6
TOTAL	79	100%	100%	—	—

Although many aspects of ecology of *Hyla punctata* were discussed by Gallardo (1987. Anfibios Argentinos. Guía para su Identificación. Biblioteca Mosaico, 98 pp.) the diet of this hylid frog has not been described.

Between 15 December 1999 and 2 February 2001 we collected 19 specimens (8 males, mean SVL = 20.23 mm ± 8.81 mm and 11 females, mean SVL = 19.35 mm ± 3.06 mm). The samples were taken in two semi-permanent ponds of Santa Fe Province, Argentina (31°35'S, 60°41'W). Frogs were captured by hand between 2000 and 2300 h and preserved in 10% formalin. Analysis of the stomach contents suggests that *H. punctata* has a carnivorous diet, composed mainly of arthropods. The most frequently taken prey items were dipterans (N = 45; 57%) and hymenopterans (N = 16; 20%). These results suggest that *H. punctata* has a sit and wait foraging behavior for capturing prey. Table 1 summarizes these results.

Submitted by **JAVIER A. LOPEZ** (e-mail: inali@ceride.gov.ar), **PAOLA M. PELTZER** (e-mail: paolapeltzer@hotmail.com, and **RAFAEL C. LAJMANOVICH,** National Institute of Limnology, José Maciá 1933, 3016 Santo Tomé, Santa Fe, Argentina.

LIMNONECTES LIMNOCHARIS (Paddy Frog): **PREDATION.** Herein we report predation of *Limnonectes limnocharis* by four species of colubrid snakes collected during July 1989 at a single locality in west-central Thailand, precisely 25 km NW of Lan-Sak, 65 km NW of Uthai-Thani, ca. 220 km NW Bangkok, 110 m elevation, in Uthai Thani Province. Juvenile *L. limnocharis* were found in the stomachs of the following snakes: one in a *Dendrelaphis pictus* (Institut Royal des Sciences naturelles de Belgique IRSNB 15587; SVL 497 mm), two in a *Enhydris plumbea* (IRSNB 15589; SVL 215 mm), one in a *Ptyas korros* (IRSNB 15590; SVL 826 mm), three in a *Xenochrophis flavipunctatus* (IRSNB 155927; SVL 340 mm), and one in another *X. flavipunctatus* (IRSNB 15593; SVL 297 mm). No other prey items were detected in the stomach of these snakes. Although the list of ophidian predators on *L. limnocharis* at Lan-Sak is undoubtedly longer, this report is indicative of the high predation pressure on *L. limnocharis* at some localities and hence its importance in the local trophic chain.

We thank G. Lenglet, G. Coulon (IRSNB) and R. Peuchot (Universite Libre de Bruxelles, Brussels).

Submitted by **OLIVIER S. G. PAUWELS**, Department of Recent Vertebrates, Institut Royal des Sciences naturelles de Belgique, Rue Vautier 29, 1000 Brussels, Belgium; e-mail: osgpauwels@hotmail.com.

PHYLLOMEDUSA HYPOCHONDRIALIS AZUREA (Orange-legged Leaf Frog). **METAMORPH BEHAVIOR.** Wiping of skin secretions in metamorphic *Phyllomedusa hypochondrialis azurea* is reported. The specimen (SVL 2.08 cm) was collected on 8 Dec 2000, near the town of Tavaí, Reserva San Rafael (26°18'27"S; 55°40'29"W), Department of Cazaapá, Paraguay during a survey conducted by the Natural History Museum and Biodiversity Research Center (KUNHM BRC) of the University of Kansas and the Museo Nacional de Historia Natural del Paraguay (MNHNP). The specimen was collected at night in 0.5 m high grass, at the edge of a cattle pond utilized by several species of anurans; humidity was high and the temperature was ca. 26°C. On the following day, we observed the wiping behavior at mid-day (1100 h) while the metamorph was perched on a branch. Mid-day temperatures during this behavior were ca. 37.7°C. The specimen is deposited at KUNHM BRC (KU 290892).

The behavior was consistent with the description by Blayloch (1976. Copeia 1976:283–295) and began with the frog rubbing its dorsum and pelvic region with the hind limbs. Secretions appeared to be concentrated on the dorsum of the pelvic region, where lipid glands presumably are present in metamorphs as well as adults (Fig. 1). The right foot was raised and pronated to grasp and wipe the right flank and left leg; subsequently the dorsum was wiped posteriorly-anteriorly. Once the parotoid gland was reached, the metamorph proceeded to wipe its shoulder, elbow, and forearm. While the forearm was being wiped, the dorsal surface of the femur was also reached and covered with secretions. This motion was repeated on the left side with the left foot. A more intricate, scissors-like pattern of wiping the femurs was employed, with both feet wiping simultaneously, the right foot wiping the left and visa versa. After wiping the back, the juvenile used its hands to smear the head and chest with secretions (Fig. 2). Wiping the head began by pronating the hand and grasping the parotoid region, with Digit I (i.e., thumb) directed ventrally and Digits II-IV directed dorsomedially over the parotoid gland. Wiping of the body with



FIG. 1. Regularly arranged dorsal glands of *Phyllomedusa hypochondrialis azurea*.

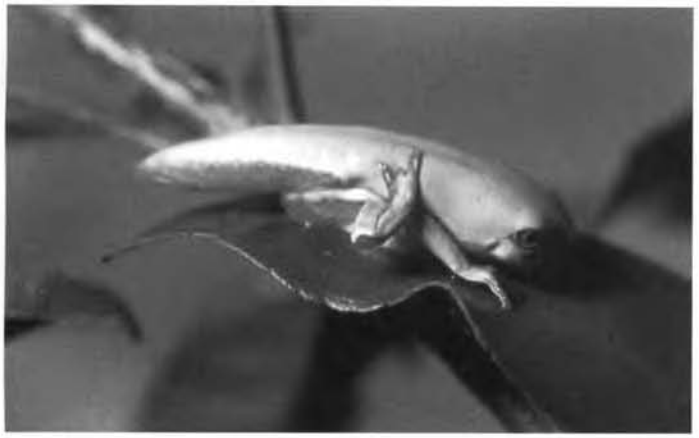


FIG. 2. *Phyllomedusa hypochondrialis azurea* metamorph wiping secretions on its body with pronating hind limb.

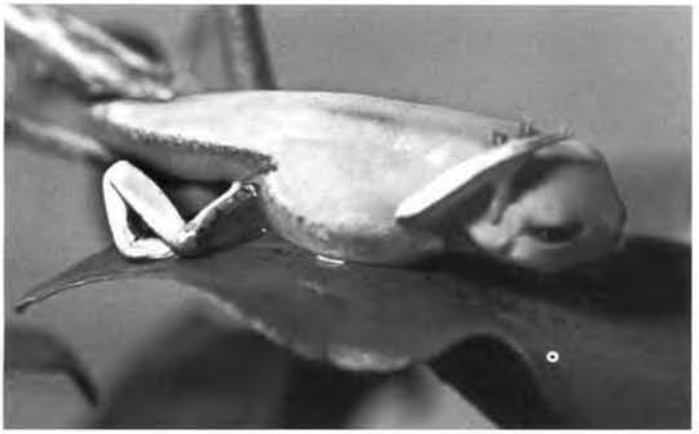


FIG. 3. Metamorph wiping secretions on its head with pronating forelimb.

the forelimb began at the parotoid, then progressed towards the face and snout, and postventrally over the belly. Once a wiping motion was initiated, the individual would continue it to a certain point and would restart from the original point of initiation; rubbing was not observed. When the entire body had been wiped, the juvenile entered a torpid state. To our knowledge, this is the first report of wiping behavior in a phyllomedusine metamorph, and may be the first for any anuran metamorph.

We thank J. Simmons and Nancy Lopez de Kolchalka for directing the KUNHM BRC and the MNHNP participation in a herpetofaunal survey of the Reserva de San Rafael. We also thank C. A. Sheil, O. Torres, and L. Trueb for suggesting revisions to improve this manuscript.

Submitted by **HUGO ALAMILLO** and **JENNIFER B. PRAMUK** Division of Herpetology, KU Natural History Museum and Biodiversity Research Center, 1345 Jayhawk Boulevard, Lawrence, Kansas 66045-7561, USA; e-mail (HA): atelopus@ku.edu; (JBP): pramuk@ku.edu.

PLETHODONTOHYLA TUBERATA (NCN). **DEFENSIVE BEHAVIOR**. During a herpetological survey in January 1993 at Forestry Station of Manjakatompo (Ankaratra Massif, Antananarivo Province, Madagascar; 19°21'S, 47°18'E; ca. 1700 m), we observed a peculiar defensive behavior of the cophyline microhylid *Plethodontohyla tuberata*. The individual (a male) was captured and handled to be photographed. Disturbed, it lowered the head, closed the eyes, and inflated the body. More or less simultaneously the frog extended the hindlimbs and, hanging on the inner side of the feet, he elevated the posterior part of the body, showing light spots, which are usually hidden in the inner surface of the thighs. The dorsal dermal glands exuded copious quantities of a thick, whitish, and sticky secretion. This secretion was visible on the back for several minutes, later losing its density and color. Such a defensive behavior is not associated with an overall aposematic coloration, although the inguinal spots in this and in related species (e.g., *P. laevipes*) have an evident aposematic significance. Such a defensive behavior has not been documented previously in the genus *Plethodontohyla*. However, a comparable behavior was reported for *Balebreviceps hillmani* from Ethiopia, (Largen and Drewes 1989. Trop. Zool. 2:13–30). Among the Malagasy microhylids, a similar antipredator strategy is known in the tomato frog, *Dyscophus antongili* (Pintak 1987. Salamandra 23[2/3]:106–121). However, in *D. antongili* inflation of the body and the production of a toxic secretion is accompanied by a clear aposematic (orange-red) coloration.

Submitted by **RICCARDO NINCHERI**, Via Empolese, 85/B, San Vincenzo a Torri, I-50020 Scandicci (Fi), Italy, and **FRANCO ANDREONE,** Sezione di Zoologia, Museo Regionale di Scienze Naturali, Via Giolitti, 36, I-10123 Torino, Italy; e-mail: frand@tin.it.

PSEUDACRIS TRISERIATA TRISERIATA (Western Chorus Frog). **REPRODUCTION.** Western chorus frogs (*Pseudacris triseriata triseriata*) are small, spring-breeding amphibians common to south-central Ontario (Weller and Oldham 1988. The Ontario Herpetofaunal Summary. Ontario Field Herpetologists, Cambridge, Ontario). There has been little information reported regarding their reproduction (Hecnar and Hecnar 1999. Herpetol. Rev. 30:38) despite their common occurrence. Herein I report observations of apparently communal chorus frog egg deposition.

In late April and early May 1997, 1998, and 1999, I observed chorus frog males calling from the periphery of what I propose was a site of communal egg deposition. The site was ca. 80 cm in diameter and contained 70 egg masses with eggs ranging from Gosner Stage 11–22 (Gosner 1960. Herpetologica 16:183–190). Egg masses were ca. 4–5 cm long and contained 20–50 eggs. These observations were made on the campus of Trent University (44°21'N, 78°17'W) in the Kawartha Region of south-central Ontario. The area is locally dominated by willow (*Salix* sp.) and contained numerous temporary vernal pools. No other calling congregations were observed at nearby pools and no egg masses were discovered in adjacent pools. This is the first report of potentially communal egg deposition for this species.

I thank the Natural Sciences and Engineering Research Council (NSERD, Canada) for supporting my field research during this observation.

Submitted by **M. ALEX SMITH**, Watershed Ecosystems Graduate Program, Trent University, Peterborough Ontario, K9J 7B8. Current address: Redpath Museum, McGill University, 859 Sherbrooke Street W., Montréal, PQ, H3A 2K6, Canada.

PSEUDOPALUDICOLA FALCIPES (NCN). **DIET.** *Pseudopaludicola falcipes* is a very small (to 1.4 cm SUL), common leptodactylid frog. It is found in Argentina, southern Brazil, Paraguay, and Uruguay. The diet of 20 *P. falcipes* (8 males; 12 females) captured 15 km NE Corrientes City (27°28'S, 58°50'W), Corrientes Province, Argentina during March–May 1997 consisted of ten prey categories, dominated numerically by acari (N = 137; 52.3%) and volumetrically by coleopterans (6.10 cm^3 x 10^3; 30.9%). Collembolans were encountered most frequently (15). The values of prey diversity calculated by Shannon's index (H') and niche amplitude by Levins's index, were 1.24 and 2.56, respectively. *Pseudopaludicola falcipes* is a widely foraging predator with a generalized arthropod diet. Table 1 summarizes data collected during this study.

I thank Arturo I. Kehr for suggestions regarding this manuscript.

TABLE 1. Prey consumed by *Pseudopaludicola falcipes* (N = 20) from Corrientes, Argentina.

Items	N	% Total	Vol (cm^3) x 10^3	% Vol.	Freq.
ARACHNIDA					
Araneae	2	0.8	0.01	0.05	2
Acarina	137	52.3	2.7	13.7	10
INSECTA					
Coleoptera	6	2.3	6.1	30.9	3
Hemiptera	10	3.8	0.8	4.1	6
Hymenoptera (ants)	3	1.1	0.9	4.6	2
Hymenoptera (no ants)	2	0.8	0.2	1.0	2
Diptera	6	2.3	3.7	18.7	5
Trichoptera	1	0.4	0.04	0.2	1
Homoptera	7	2.7	1.9	9.6	4
Collembola	88	33.6	3.4	17.2	15
TOTAL	262	100%	19.75	100%	

Submitted by **MARTA I. DURE**, Centro de Ecología Aplicada del Litoral (CECOAL-CONICET), C.C: 140, (3400) Corrientes, Argentina. mdure@compunort.com.ar.

RANA AURORA AURORA (Northern Red-legged Frog). **DIET.** Diet data for northern red-legged frogs (*Rana aurora aurora*) indicate that they consume mostly insects and slugs (Fitch 1936. Amer. Midl. Nat. 17:634–652; Licht 1986. Can. Field Nat. 100:22–31). No vertebrate prey has been reported for this species. The closely related, larger California red-legged frog (*Rana aurora draytonii*) is known to take vertebrate prey with some frequency (Hayes and Tennant 1986. Southwest. Nat. 30:601–605), but with a reported maximum size of ca. 100 mm SVL (Storm 1960. Herpetologica 16:251–259; Hayes and Miyamoto 1984. Copeia 1984:1018–1022), the ability of *R. a. aurora* to take vertebrate prey is likely restricted to smaller taxa. Herein, we provide the first report of a *R. a. aurora* predation attempt on a vertebrate.

On 26 September 2000 between 1015 and 1115 h, we surveyed a small (ca. 6 m^2), isolated seepage in the Stillman Basin, Lewis County, southwestern Washington, USA. This seep, located in a 55-year-old, managed Douglas-fir stand, had a mud substrate, little (< 1 m^2) standing water, two large (≥ 50 cm diam) decayed logs, a few skunk cabbage (*Lysichiton americanum*), and one large black cottonwood (*Populus balsamifera*). Searching beneath woody debris next to the logs revealed an adult (45 mm SVL, 2.2 g) male Columbia torrent salamander (*Rhyacotriton kezeri*). Less than one minute following its release, we detected an adult (80 mm SVL, 70.5 g) female *R. a. aurora* nearby. When we examined the frog a few minutes later, it opened its mouth slowly, and a living male *R. kezeri* emerged headfirst. The salamander seemed unharmed, and based on its size and mass, was believed to be the same animal previously captured.

We do not know if the *R. aurora* would have eaten the *R. kezeri* had the frog not been disturbed. We also do not know if the frog released the salamander because of handling or because the salamander was unpalatable. Shrews reject *Rhyacotriton* (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest), and their reduced palatability has been demonstrated for Pacific giant salamanders (*Dicamptodon tenebrosus*: Rundio and Olson. 2001. J. Herpetol. 35:133–136).

These observations were made as part of a headwater stream study funded by Washington State Department of Natural Resources and conducted by the Washington Department of Fish and Wildlife through the Landscape and Wildlife Advisory Group and the Amphibian Research Consortium.

Submitted by **JORDAN H. RABINOWE**, 4325 Dayton Avenue North, Seattle, Washington 98103, USA (e-mail: jrabinowe@hotmail.com), **J. TUESDAY SERRA**, 603 North Fir Street, Olympia, Washington 98506, USA (e-mail: serratls@hotmail.com), **MARC P. HAYES**, Washington Department of Fish and Wildlife, Habitat Program, 600 Capitol Way North, Olympia, Washington 98501, USA (e-mail: hayesmph@dfw.wa.gov), and **TIMOTHY QUINN**, Washington Department of Fish and Wildlife, Habitat Program, 600 Capitol Way North, Olympia, Washington 98501, USA (e-mail: quinntq@dfw.wa.gov).

RANA CAPITO CAPITO (Carolina Gopher Frog). **REFUGIA.** Except during its breeding season when it visits temporary ponds, the gopher frog (*Rana capito* ssp.) is terrestrial and inhabits animal burrows, stump holes, and other ground cavities. In this note we report the unique appearance of burrows used by *Rana capito capito* in the Atlantic Coastal Plain of southeastern Georgia, USA.

On 7 October 1999 at 1430 h, we observed an adult gopher frog near a small burrow in dry longleaf pine (*Pinus palustris*)–wiregrass (*Aristida beyrichiana*) flatwoods habitat on the Fort Stewart Military Installation, Long County, Georgia. The frog quickly moved into the burrow as we approached. The entrance was well-worn and smooth-sided with a "platform" of bare ground-ca. 13 x 9 cm-along one edge of the burrow (Fig. 1). When we returned to this site on 11 January 2000 the burrow appeared the same. We excavated the burrow and found an adult gopher frog (83 mm SVL) at the bottom of the burrow. The burrow measured 3.4 cm wide at the entrance, and sloped at ca. 45° angle for ca. 51 cm (to a depth of 36 cm). The burrow was clean of debris along its entire length.

A second nearby burrow, assumed to contain a gopher frog because of its similar size and appearance, was also excavated. This



FIG. 1. Burrow inhabited by adult *Rana capito capito* (Long County, Georgia).

burrow possessed a smooth-sided entrance (4.2 cm wide at entrance) and a "platform" (11.6 x 9.8 cm) from April 1999 (when first discovered) until 13 January 2000 (when excavated). For a short distance this burrow descended into the soil at a 45° angle, but it then paralleled the ground surface for ca. 135 cm before connecting (at a depth of 41 cm) to the shaft of an abandoned gopher tortoise (*Gopherus polyphemus*) burrow. Just before this burrow connected to the abandoned tortoise burrow, we found an adult gopher frog (69 mm SVL).

The gopher frog's habit of sheltering in gopher tortoise burrows and other animal burrows, including those of the oldfield mouse (*Peromyscus polionotus*), has long been recognized (Carr 1940. Univ. Florida Publ., Biol. Sci. Ser. 3:1–118). Gopher tortoise and oldfield mice are common at the site mentioned above where we excavated gopher frogs from small burrows. Based on its length and angle of descent, we believe that the first burrow described above might have been an abandoned *P. polionotus* burrow (see Lee 1968. Herpetologica 24:83–84 for a description of *P. polionotus* burrows). Gentry and Smith (1968. J. Mammal. 49:562–565) excavated "numerous" gopher frogs from *P. polionotus* burrows, but only from burrows that were no longer occupied by mice.

Although we have yet to test this prediction, an ability to identify small burrows occupied by gopher frogs based on the rather unique appearance of the burrows at their entrances (i.e., smooth-sided entrances and bare "platform") might have some merit for locating frogs or new frog populations, especially at pine flatwoods sites where herbaceous plants, debris, and litter have been removed or trimmed back by recent fire events.

Submitted by **DIRK J. STEVENSON** and **KAREN J. DYER**, Fort Stewart Fish and Wildlife Branch, Directorate of Public Works, 1113 Frank Cochran Drive, Fort Stewart, Georgia USA, 31314-4940 (e-mail:stevensond@emh5.stewart.army.mil).

RANA CATESBEIANA (American Bullfrog). **DIET**. Data were obtained opportunistically from 28 adult (14 M; 14 F) bullfrogs collected during April 2001 from Meadow Valley Wash located between the cities of Carp and Elgin, Lincoln County, Nevada, USA (37°17'N, 114°30'W). Although there are two summary reports that provide publication lists of bullfrog food/diet literature (Bury and Whelan 1984. Ecology and Management of the Bullfrog. USDI, FWS Resource Publ. 155. 23 pp.; Casper and Hendricks, *in press*. *In* M. J. Lannoo [ed.], Status and Conservation of U.S. Amphibians. Univ. California Press, Berkeley), there are, to our knowledge, no published bullfrog diets from this region.

Bullfrogs were collected by gigging. After collection, bullfrogs were weighed to the nearest gram and measured from the tip of the snout to the vent (to the nearest millimeter). After the hindlegs were removed by the sportsmen, the frogs were placed on ice in plastic bags and transported to the laboratory. Stomachs were dissected and preserved in 10% formalin.

Several weeks after collection, stomach contents were rinsed with 70% ethanol, and separated into the following categories: food items, unidentifiable boluses, plant material, and rocks. A wet mass was obtained prior to identification (Table 1). Food items were identified minimally to order, and to family and/or genus in most instances (Table 2).

Nearly all stomachs examined contained food items or digested food boluses (86% M; 100% F). No statistical differences were detectable between males and females when comparing the means from various measurements (Table 1; independent t-tests all resulted in $P > 0.05$). Further, no relationship was found between total wet mass of ingested items and frog length and mass for either sex (linear regression, $P > 0.05$ in all cases). Interestingly, there were significant inverse relationships between female length and mass and the diversity of food items in the stomach, wherein smaller females had a higher diversity of food items (linear regression: diversity vs. length, $P = 0.028$; diversity vs. mass, $P = 0.038$); this relationship was not true for males. The variety of ingested items, including the large number of stomachs containing plant material and rocks, supports the notion that bullfrogs have voracious appetites and will swallow anything taken into their mouths.

TABLE 1. Means (sample sizes; standard errors) for selected measurements from 28 adult *Rana catesbeiana* collected in Meadow Valley Wash between Carp and Elgin, Lincoln County, Nevada in April 2001. Female sample size for Simpson's Diversity Index is not 14 as one female contained an unidentifiable food bolus, and diversity could not be calculated. Frog length was measured snout-to-vent.

Gender	Frog length (mm)	Frog mass (g)	Food items (g)	Plant matter (g)	Rocks (g)	Total gut wet mass (g)	Simpson's Diversity Index
Female	127.00 (14; 5.21)	210.15 (14; 23.45)	1.60 (13; 0.36)	2.30 (11; 0.81)	3.78 (4; 2.81)	4.48 (14; 1.06)	3.04 (13; 0.36)
Male	140.21 (14; 4.43)	275.64 (14; 25.47)	2.13 (12; 0.66)	1.56 (8; 0.63)	1.7 (3; 0.95)	3.08 (14; 0.98)	2.74 (14; 0.48)

TABLE 2. Stomach contents from 28 adult *Rana catesbeiana* collected in Meadow Valley Wash between Carp and Elgin, Lincoln County, Nevada in April 2001. The total number of items (N) collected and the total number of frogs containing individual food items (No. Frogs) are shown. All items are adults unless indicated otherwise (L = larvae).

Ingested Items	Males (N = 14)		Females (N = 14)	
	N	No. Frogs	N	No. Frogs
Arachnida				
Lycosidae (*Lycosa*)	1	1	0	0
Lycosidae (*Pardosa*)	2	2	1	1
Phalangiidae	2	1	1	1
Tetragnathidae (*Tetragnathus*)	0	0	1	1
Coleoptera				
Gyrinidae	2	1	0	0
Scarabidae	1	1	1	1
Silphidae	2	2	2	2
Unidentified (Tenebrionidae? & Carabidae?)	0	0	2	2
Crustacea				
Armadillidae (*Armadillidium*)	1	1	0	0
Isopoda	1	1	1	1
Diplopoda				
Spirostreptida (*Orthoporus*)	0	0	5	4
Diptera				
Muscidae	3	1	3 (L = 1)	1
Syrphidae	3	1	0	0
Tabanidae (*Tabanus*)	5 (L = 2)	4	3	2
Tipulidae	3	2	3 (L = 2)	1
Unidentified	3 (L = 1)	2	1	1
Hemiptera				
Belostomidae (*Belostoma*)	1	1	1	1
Largidae	0	0	1	1
Homoptera				
Cicadellidae	0	0	1	1
Hymenoptera				
Unidentified	1 (L = 1)	1	0	0
Lepidoptera				
Pyralidae	5 (L = 5)	1	0	0
Mollusca				
Gastropoda	2	2	3	3
Odonata				
Lestidae (*Archilestes*)	1	1	4	4
Libellulidae	1	1	0	0
Unidentified (parts)	9	3	8	7
Pisces				
Cyprinidae (parts)	3	2	3	2
Other Items				
Plant material	8	8	11	11
Rocks	3	3	4	4
Unidentifiable digested mass	0	0	3	3

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Submitted by **CHAD L. CROSS**, U.S. EPA, Landscape Ecology Branch, 944 East Harmon Avenue, Las Vegas, Nevada 89119, USA (e-mail: cross.chad@epa.gov), and **SHAWN L. GERSTENBERGER**, Department of Environmental Studies, University of Nevada, Las Vegas, 4505 Maryland Parkway, Box 454030, Las Vegas, Nevada, 89154, USA (e-mail: sgersten@ccmail.nevada.edu).

RANA CATESBEIANA (Bullfrog). **DIET.** As part of a study of *Thamnophis gigas* at Colusa National Wildlife Refuge, Colusa County, California, we investigated to what extent non-native *Rana catesbeiana* preyed on these endemic aquatic snakes, which are federally and state listed as Threatened. Predation on young water snakes is thought to be a significant source of mortality for snake populations (Mushinsky and Miller 1993. Copeia 1993:660–665) and bullfrogs have been shown (Willis et al. 1982. Copeia 1982:98–10) to be a significant source of predation on Mexican garter snakes (*T. eques*). Identifying sources of mortality for *T. gigas* would be useful in managing the recovery for this listed species.

We sampled 15 bullfrogs each month in late July and early August 2000, when radio-tracked giant garter snakes were seen giving birth. Nearly all frogs contained remains of one or more crawfish (*Procambarus clarkii*). Various crustaceans, insects, and other invertebrates (Isopoda, Oligochaeta, Arachnida, Anisoptera, Zygoptera, Chilopoda, Hymenoptera, Hemiptera, Corixidae, Dytiscidae, Hydrophilidae, and Notonectidae) were also recorded. We found the remains of three recently born *T. gigas* in the stomachs of two frogs; one in the July sample and two in the August sample. These frogs were among the smallest individuals sampled (270–300 g), suggesting that a wide size range of *R. catesbeiana* are capable of eating young of the year *T. gigas*. To our knowledge our results provide the first confirmation of such predation.

Submitted by **NIEL M. CARPENTER**, U.S. Fish and Wildlife Service, 752 County Road 99W, Willows, California 95966, USA (e-mail: mike_carpenter@r1fws.gov), **MICHAEL L. CASAZZA**, U.S. Geological Survey, 6924 Tremont Road, Dixon, California 95620, USA (e-mail: mike_casazza@usgs.gov), and **GLENN D. WYLIE**, 6924 Tremont Road, Dixon, California 95620, USA (e-mail: glenn_wylie@usgs.gov).

RANA CATESBEIANA (Bullfrog). **DIET**. Bullfrog food items have been extensively documented in the literature (Bury and Whelan 1984. U.S. Fish Wildl. Serv. Resource Publ. 155. 23 pp.; Schwalbe and Rosen 1999. Sonorensis 19:8–10; Korschgen and Baskett 1963. Herpetologica 19:89–99). A recent summary of the bullfrog's life history that included a literature review of prey items documented eight species of snakes taken as prey (Casper and Hendricks, *in press*. *In* M. J. Lannoo [ed.], Status and Conservation of U.S. Amphibians. Univ. California Press, Berkeley); however, this is the first observation of the Sonoran gopher snake *(Pituophis catenifer affinis)* as a bullfrog prey item.

During the early evening of 21 August 2001, 13 adult bullfrogs were collected by gigging at Watson Lake, Yavapai County, Arizona, USA. The frogs were placed in individual plastic bags and chilled on ice. The specimens were later transferred to a commercial freezer and euthanized. The following day the specimens were dissected and the gastrointestinal tracts removed for examination. Stomach contents consisted primarily of crayfish (*Procambarus clarkii*) and small bullfrogs. The stomach of one female bullfrog (mass 441 g; SVL 159 mm) contained an almost intact Sonoran

gopher snake. The snake was weighed and measured (mass 13.9 g; TL 365 mm). Both the frog and snake were catalogued into the herpetological collection at Arizona State University (ASU 33175 and 33178).

Submitted by **K. A. KING**, **J. C. RORABAUGH**, and **J. A. HUMPHREY**, U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office, 2321 West Royal Palm Road, Phoenix, Arizona 85021-4951, USA; e-mail (KAK): kirke_king@fws.gov.

RANA CATESBEIANA (Bullfrog). **EFFECTS ON NATIVE ANURAN COMMUNITY**. During December 1997, I compiled a list of 14 species of anurans that used an area of Cerrado (savanna-like vegetation), on a farm (Fazenda Estrels) in Alexânia County, Goiás State, central Brazil. The area was ca. 20 ha and was composed of a mosaic of artificial and natural ponds, some dry and wet savannas (locally called "veredas"), and gallery forests. The most abundant species were the hylids *Hyla minuta* and *Scinax fuscovarius*, and the leptodactylids *Leptodactylus ocellatus* and *L. labirinthycus* that are frequently caught for food by the local inhabitants. Despite the high hunting pressures, the same community persisted in the area in 1998 and 1999.

During early 2000, a farmer introduced six female and two male bullfrogs into the area. These bullfrogs quickly proliferated, occupying all of the ponds on the farm. I observed several bullfrog egg masses at the edge of the ponds just a few weeks after their introduction, and tadpoles could be found in almost all ponds. The bullfrogs preferentially occupied recent and large artificial ponds without peripheral vegetation. Some partitioning of space was noticed, with the hylid frogs using mainly the ponds with peripheral vegetation. By December 2000, the bullfrogs had produced significant changes in the local anuran community, as the previously abundant leptodactylids, *L. ocellatus* and *L. labirinthycus* had disappeared. Food was not likely a limiting resource for these frogs as they are generalists and food resources were locally abundant.

The farming of bullfrogs is a growing activity in Brazil, but regulations and studies upon the potential effects of this activity on the native anuran communities are lacking. This note confirms the strong colonizing skills of *R. catesbeiana* and that the introduction of this exotic species can disturb local anuran communities.

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Submitted by **CRISTIANE G. BATISTA**, Departamento de Zoologia, Universidade de Brasília, Campus Universitário "Darcy Ribeiro," 70910-900, Brasília-DF, Brazil; e-mail; cbatista@unb.br.

RANA LUTEIVENTRIS (Columbia Spotted Frog). **BURROW USE**. Amphibians use burrows to conserve water and for shelter from thermal extremes, and burrowing is a common behavior in arid-dwelling amphibians (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill Book Co. New York. 670 pp.). *Rana luteiventris* in the Great Basin Desert of the western United States overwinter primarily in undercut stream banks and spring heads (K. Hatch, pers. com.), and have been observed under rocks during the active season (Ross et al. 1999. Herpetol. Rev. 30:163; pers. obs.). Although to our knowledge, the use of burrows has not been documented in *R. luteiventris* herein we report an observation of these frogs using a small mammal burrow.

On 26 July 1999, we visited a site along Toiyabe National Forest Road 018 (Nye County, Nevada; UTM 456360E, 4298150N; 2195 m elev.) between 0810–1124 h. This site included a 300 m section of Indian Creek, and was part of a mark-recapture study of *R. luteiventris*. During the visit, we searched for frogs visually and physically (i.e., moving vegetation and other cover objects and probing possible cover areas). At 0828 h, shortly after the sun had risen enough over Black Mountain to reach the west bank of the creek, we observed three frogs (male SVL 68 mm; female SVL 45 mm; unidentified) emerge from a small mammal burrow ca. 30 cm from the edge of the water. This burrow was ca. 4 cm in diameter and appeared to be the burrow of a long-tailed vole (*Microtus longicaudus*), which is common in riparian areas of the Toiyabe Range (pers. obs.). The burrow was in the west bank of the stream, which was ca. 5 cm in height, and was in a mixed gravel and sand substrate. The riparian vegetation along this part of the creek consisted of willows (*Salix* spp.) and sedges (*Carex* spp.). Air temperature 1 cm above the entrance to the burrow was 15.6°C and the temperature of the nearest water was 8.7°C.

This study was supported by a grant from the United States Fish and Wildlife Service. All frogs were handled under a scientific collection permit from the Nevada Division of Wildlife.

Submitted by **SEAN M. BLOMQUIST*** and **JOHN C. TULL**, Biological Resources Research Center, Department of Biology / 314, University of Nevada Reno, Reno, Nevada 89557-0015, USA. *Current address: Nongame Branch, Arizona Game and Fish Department, 2221 West Greenway Road, Phoenix, Arizona 85023-4312, USA; e-mail: sblomquist@gf.state.az.us.

RANA TEMPORARIA (European Common Frog). **ALBINO LARVAE**. Throughout the last decades numerous reports of albino amphibians or their larvae have appeared in the literature. In the Netherlands, several recent observations have been made although the phenomenon has not been reported in Flanders, Belgium, which abuts Netherlands to the south.

In 1997, 1998, 2000, and 2001 between 9 and 100 albino larvae of *Rana temporaria* were found in a small artificial pond at Hofstade, Belgium (50°59'35"N, 04°31'37"E). In 1999 no albino larvae were found; however, because of flooding at least 10–20% of the larvae were lost at an early age. All the eggs from clutches deposited in those years showed the typical black color but some larvae became gradually pale after some weeks. It is unknown if all the albino larvae originated from one or from different clutches, nor what percentage of the larvae were albino. Each year only small numbers of albino larvae were found, thus we expect they are subject to high predation rates. Albino larvae raised in aquaria with typically-colored larvae did not exhibit higher mortality or slower growth rates than normal-colored larvae. After metamorphosis froglets had pink eyes and a golden, cream-colored skin.

Submitted by **JEF NIJS**, Laboratorium voor Ecologie and Systematiek, Vrije Universiteit Brussel, Pleinlaan 2 B-1050, Brussel, Belgium (e-mail: jnijs@vub.ac.be) and **HEINZ KELLER**, Veldonkstraat 308 B-3120 Tremelo, Belgium.

XENOPUS LAEVIS (African Clawed Frog). **BEHAVIOR**. *Xenopus laevis* is frequently regarded as being totally aquatic at all stages of its life history. In both natural and introduced populations, this species has been observed to rapidly colonize isolated ponds (McCoid and Fritts 1980. Southwest. Nat. 25:272–275). Observations of adult mass migrations have been made during torrential rain (Tinsley et al. 1996. *In* Tinsley and Kobel [eds.], The Biology of *Xenopus*, pp. 35–59), and mark-recapture studies have documented movement of individual animals (Measey and Tinsley 1998. Herpetol. J. 8:23–27), but conditions under which these individual movements are made remain unknown.

On the evening of 26 September 2001, we sampled rodents in agricultural fields around Santiago, Chile (La Platina 33°34'04.2"S, 70°37'13.9"W) using Sherman traps. One trap was placed in a dry irrigation canal, and the following morning it contained a juvenile (SVL 36.4 mm) *X. laevis* (Museo Nacional de Historia Natural de Chile MNHNC-3368). A thorough inspection of the area revealed a dam, with a known population of *X. laevis* 1500 m from the capture site. From the dam, a number of irrigation canals run throughout the area. Flow is regulated by a system of gates, and the nearest ditch with standing water was 170 m from the capture site.

The use of *X. laevis* in a laboratory context has provided misleading conclusions about its natural history, especially with regard to terrestrial behavior. This finding corroborates observations of Measey and Tinsley (*op. cit.*) that individual *X. laevis* move overland. Further, we are able to add that movements are nocturnal and that animals may not be inhibited by dry conditions. This observation is important in studies of population dynamics and gene flow in this species. It is particularly important in relation to the management of invasive populations, currently known from UK, Chile, and USA.

Submitted by **GABRIEL LOBOS**, Departamento de Ecología, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, Casilla 114 D, Santiago de Chile, and **CARLOS GARÍN** Departamento de Ciencias Biológicas, Facultad de Ciencias Veterinarias, Universidad de Chile, Casilla 2 correo 15, Santiago de Chile.

TESTUDINES

CHRYSEMYS PICTA PICTA (Eastern Painted Turtle). **PREDATION**. On 1 August 2000 at 0900 h, I observed a northern harrier (*Circus cyaneus*) attacking a juvenile *Chrysemys picta picta* at Blandy Experimental Farm, Clarke County, Virginia, USA. The turtle was on land in a mowed clearing ca. 60 m from a drying pond. The harrier was accidentally flushed, thereby aborting the attack, by my approaching vehicle. I do not know whether the harrier would have been successful. Aside from superficial scratches on the carapace, the turtle appeared unharmed. Body mass and plastron length were 102 g and 81.2 mm, respectively. The turtle was released at point of capture. Several raptors have been reported to occasionally prey upon *C. picta* (Ernst et al. 1994. Turtles of the United States and Canada, Smithsonian Institution Press, Washington D.C. 578 pp). To my knowledge, predation by the northern harrier on *C. picta* has not been previously documented (Sherrod 1978. Raptor Res. 12:49–121).

I thank Joseph C. Mitchell for commenting on this note.

Submitted by **DAVID R. BOWNE,** Department of Environmental Sciences, University of Virginia, Charlottesville, Virginia 22904, USA; e-mail: drb9d@virginia.edu.

CROCODYLIA

CAIMAN LATIROSTRIS (Broad-snouted Caiman) **COURTSHIP BEHAVIOR.** The reproductive biology of the broad-snouted caiman has been studied in association with its ranching (Larriera 1988. Rev. Arg. Prod. Anim. 8:429–432) and farming (Verdade 1995. *In* Larriera and Verdade [eds.], Conservación y Manejo de los Crocodylia de America Latina. Vol. 1. Santo Tomé, Santa Fe, Argentina: Fundación Banco Bicaprograms) programs. However, little is known about its reproductive behavior.

Courtship behavior of crocodilians might be as intricate and complex as that exhibited by some birds, although not as many studies have been conducted with this group. Eight distinct behavioral components have been described for the American alligator (*Alligator mississippiensis*) (Vliet 1989. Amer. Zool. 29:1019–1031): A) elevated posture; B) head oblique tail arched posture; C) subaudible vibrations; D) headslap; E) jawclap; F) growl; G) inflated posture; and, H) tail wag. Among them, subaudible vibration has been described only for males, generally preceding headslap. Some vocalization (e.g., jawclap and growl) might also be associated with these displays. While the reproductive behavioral components are well known for the American alligator, they have never been described for the broad-snouted caiman. Although some differences are clear, some of the social displays listed above might also apply for the broad-snouted caiman, as our observations suggest.

On 23 October 2000, at 1030 h we observed the following behavior in one of the breeding groups (one male: four females) of the captive colony of *Caiman latirostris* at the University of São Paulo (22°42.557'S, 47°38.246'W) in Piracicaba, State of São Paulo, Brazil. The male (109 cm SVL), swimming slowly, approached the group of females basking at the edge of the pool. Still in the water, the male exhibited a head oblique tail arched posture (similar to B, above). He then assumed an elevated posture (similar to A, above) remaining this way for ca. 1 min. He then turned to the head oblique tail arched posture (B) and contracted his trunk slightly, shaking his head and producing a subaudible vibration (similar to C, above) that lasted for ca. 2 min. Although not a "water dance" (as described by Vliet 1989, *op. cit.*), the water sprinkling caused by vibration was visible, the 1.2 m high brick wall 2 m from him vibrated simultaneously as an effect of the caiman's subaudible vibration. The male did not produce any sound like headslap, jawclap, or growl either during or after vibrating, but the females did growl (similar to F, above) in response to him. After that, the male assumed an inflated posture (similar to G, above), but did not show any tail movement like tail wag (H). After 23 October, the head oblique tail arched posture (B) was observed in association with copulation attempts, but with neither subaudible vibration nor the other behavioral act components described by Vliet (1989, *op. cit.*).

Vocalizations in crocodilians seem to be associated with habitat (Lang 1987. *In*: Webb, Manolis, and Whitehead [eds.], Wildlife Management: Crocodiles and Alligators. Surrey Beatty, Chipping Norton, Australia). Species that inhabit vegetated areas tend to be

more vocal than species that live in open rivers. The broad-snouted caiman is essentially a palustrine and not a riverine species (Verdade and Sarkis-Gonçalves. *In press*. *In* Larriera and Verdade [eds.], Conservación y Manejo de los Crocodylia de America Latina. Vol. 2. FEALQ, Piracicaba, São Paulo, Brazil), whereas the American alligator lives in both open river and swamps. Notwithstanding, the behavior described above suggests that *Caiman latirostris* presents a less elaborate courtship and less vocal behavior than the American alligator.

Submitted by **TARSIS RODRIGO O. PIFFER** and **LUCIANO M. VERDADE***, Laboratório de Ecologia Animal / ESALQ, Universidade de São Paulo, C.P. 09 Piracicaba, SP 13418-900, Brazil. *Corresponding author.

CAIMAN LATIROSTRIS (Broad-snouted Caiman). **THERMOREGULATION.** It has been demonstrated that increasing body temperature (fever) is a common response to infection among crocodilians (Lang 1987. *In* G. J. W. Weeb, C. Manolis and P. J. Whitehead [eds.], Wildlife Management: Crocodiles and Alligators, Surrey Beatty and Sons, Chipping Norton, New South Wales. 552 pp.). Deakins (1980. *In* J. B. Murphy and J. T. Collins [eds.], Reproductive Biology and Diseases of Captive Reptiles, SSAR, Lawrence, Kansas. 277 pp.) reported that parasitic infections in snakes can be treated by increasing environmental temperature. On the other hand, decreasing temperatures often exacerbates viral and bacterial infections, making reptiles more susceptible to disease (Marcus 1980. *In* Murphy and Collins, *op cit.*). This is the first report of fever behavior in *Caiman latirostris*.

Observations were made at the breeding facility of "Granja la Esmeralda," Santa Fe, Argentina, a naturalistic facility comprised of large ponds enclosed by fence. The facility is operated for educational and research purposes (not production), so animal densities are kept low. At the beginning of the breeding season for broad-snouted caimans in Santa Fe (31°42'S, 60°44'W; December through March), females and males struggle for a suitable place in the breeding pool. In December 1997, a young female (ca. 1.5 m) sustained an injury to her back and legs while fighting with a larger female. After the fight, the young female behaved normally, but two days later colleagues and I observed that the caiman's wounds were inflamed and showed signs of infection and, later, necrosis. At this point, she increased the time spent basking. At noon and early evening, when the other animals in the enclosure were in shaded water, she was observed basking; this behavior is consistent with fever behavior as reported by Lang (1987, *op. cit.*). She basked continuously, including the hottest part of the day (ca. 1600 h). Body temperature was not measured, but temperature of water and shade in the pool was recorded during the breeding season with two calibrated Hobo Temp Data Loggers (Onset Computer Corp., Pocasset, Massachusetts, USA). Average temperatures were: 25.8°C (water) and 24.8°C (air). Temperature differences between shade and sun averaged 10°C during the day. Lang (1987, *op. cit.*) reported that the mean difference in body temperature between infected animals and controls (mean of 30.1°C) was 4.9°C with a maximum difference of 7.4°C. The young female of this report continued her heat-seeking behavior for 10 days and then reassumed typical behavior, acting similar to the rest of the animals of the enclosure.

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Submitted by **CARLOS I. PIÑA**, Proyecto Yacaré, CIC y TTP-CONICET, Dr. Matteri y España, CP 3105, Diamante, Entre Ríos, Argentina; e-mail: cidcarlos@infoshopdte.com.ar.

LACERTILIA

CYCLURA NUBILA NUBILA (Cuban Iguana). **CARRION FEEDING**. West Indian iguanas of the genus *Cyclura* feed almost exclusively on vegetation (Alberts [ed.] 2000. West Indian Iguanas: Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland. 111 pp.; Auffenberg 1982. *In* Rand and Burghardt [eds.], Iguanas of the World: Their Behavior, Ecology, and Conservation. Noyes Publications, Park Ridge, New Jersey. 472 pp.; Wiewandt 1977. Ecology, Behavior, and Management of the Mona Island Ground Iguana, *Cyclura stejnegeri*. Unpublished Doctoral Dissertation, Cornell University. 338 pp.). Animal matter typically constitutes less than 5% of the diet of *Cyclura*, consisting primarily of slow moving arthropods, such as lepidopteran larvae, and other prey that are easily captured (e.g., Wiewandt 1977, *op. cit.*). Predation of vertebrates is not known in *Cyclura*, but feeding on vertebrate carrion (fish and birds) has been described for *C. carinata carinata* in the Turks and Caicos Islands (Iverson 1979. Bull. Florida State Mus., Biol. Sci. 24:175–358). Here, we report observations of vertebrate carrion feeding for *C. nubila nubila* at the United States Naval Base at Guantanamo Bay, Cuba.

At 1030 h on 23 July 2000, three of us (GPG, TDG, and ACA) observed an adult female *C. n. nubila* (ca. 35 cm SVL) crossing the Ridgeline Trail Road carrying a dead bird in its jaws (Fig. 1). The iguana was followed and observed for fifteen minutes. During this time, the iguana stopped several times to feed on the carcass. Each time, the iguana grasped the bird in the edge of its jaws and shook its head to tear loose some feathers and presumably flesh, which were swallowed. After the fourth such feeding bout, the iguana was chased away before it could pick up the bird again so that the carcass could be examined and identified. The bird was identified by one of us (MAH) as a nestling mourning dove, *Zenaida macroura*. Due to the condition and odor of the carcass, it was clear that the bird had been dead for at least a day. Iverson



FIG. 1. Adult female *Cyclura nubila nubila* with a dead *Zenaida macroura* in its jaws.

(1979, *op. cit.*) describes *C. c. carinata* being attracted to carrion by odor, and this might be the case for *C. n. nubila* as well.

On another occasion, while monitoring active bird nests at the Naval Base, one of us (MAH) observed an iguana scavenging on the decaying remains of a nestling white-winged dove, *Z. asiatica*, which had fallen out of its nest and died several days prior. In addition, researchers using mist nets to capture birds for a banding study at the Naval Base reported observations to us suggesting that iguanas might occasionally take small birds, such as Cuban grassquits (*Tiaris canora*), captured in nets.

These observations of *C. n. nubila*, combined with reports by Iverson (1979, *op. cit.*) for *C. c. carinata*, suggest that probably all *Cyclura* are opportunistic scavengers of vertebrate remains. In contrast, there is no evidence that *Cyclura* prey on living vertebrates under natural conditions. In fact, some *Cyclura* populations co-occur with dense concentrations of breeding seabirds: e.g., *C. c. carinata* with bridled terns (*Sterna anaethetus*) and brown noddys (*Anous stolidus*) on small cays in the Turks and Caicos Islands, and *C. n. caymanensis* with red-footed boobys (*Sula sula*) and magnificent frigatebirds (*Fregata magnificens*) on Little Cayman Island. There is no indication that iguanas actively prey on the eggs or nestlings of these birds (GPG, pers. obs.).

Submitted by **GLENN P. GERBER**, **TANDORA D. GRANT**, and **ALLISON C. ALBERTS**, Division of Ecology and Applied Conservation, Center for Reproduction of Endangered Species, P.O. Box 120551, Zoological Society of San Diego, San Diego, California 92112-0551, USA, and **MAGGIE A. HOSTETTER**, The Institute for Bird Populations, PSC 1005, BX 37-39, FPO AE 09593 (e-mail: ggerber@sandiegozoo.org).

EUMECES BREVIROSTRIS (Short-nosed Skink). **REPRODUCTION.** *Eumeces brevirostris* is a montane skink that is widely distributed in Mexico (Flores-Villela 1993. Herpetofauna Mexicana. Annotated List of the Species of Amphibians and Reptiles of Mexico, Recent Taxonomic Changes, and New Species. Special Publication No. 17, Carnegie Museum of Natural History. 73 pp.). Reports that *E. brevirostris* is viviparous are summarized in Blackburn (1993. Herpetologica 49:118–132). The purpose of this note is to provide information on the reproductive cycle from a histological examination of reproductive tissue from museum specimens.

Thirty-six *E. brevirostris* were examined: six from the Natural History Museum of Los Angeles County (LACM), 20 from the University of Arizona (UAZ), and 10 from the Field Museum of Natural History (FMNH). The sample consisted of 18 males, mean SVL = 55 mm ± 6 SD, range = 46–64 mm; 16 females, mean SVL = 56 mm ± 5 SD, range = 49–66 mm, and two neonates. Lizards were collected 1938–1979. Specimens were from the Mexican states of Durango, Guerrero, Nuevo Leon, and Puebla. The posterior portion of the body cavity was opened and the left gonad was removed for histological examination except for enlarged, yolked follicles (> 5 mm diameter) or oviductal eggs, which were measured with calipers. Tissues were embedded in paraffin and sections were cut at 5 µm. Slides were stained with Harris hematoxylin followed by eosin counterstain.

Male Cycle: June (N = 6), three males in spermiogenesis, three in late recrudescence with metamorphosing spermatids but no sperm; July (N = 2), late recrudescence with metamorphosing spermatids but no sperm; August (N = 9) all in spermiogenesis; September (N = 1) spermiogenesis. Minimum size for reproductive activity (spermiogenesis) was 46 mm SVL.

Female Cycle: March (N = 1) two enlarged follicles 5 mm length; April (N = 2) one with five oviductal eggs from 9 April; one with three oviductal eggs from 9 April; June (N = 4) one with two well developed embryos from 5 June; three with no yolk deposition which may have already given birth; July (N = 1) no yolk deposition; August (N = 8) six with no yolk deposition, two with early yolk deposition. Minimum size for reproductive activity (eggs 5 mm length) was 49 mm SVL. Two neonates were collected in June: 19 June SVL = 23 mm; 27 June SVL = 21 mm.

The reproductive cycle of *E. brevirostris* seems similar to that of another high-elevation, viviparous Mexican skink, *E. copei*, which was studied by Guillette (1983. J. Herpetol. 17:144–148) and Ramirez-Bautista et al. (1996. Southwest. Nat. 41:103–110). In *E. copei*, males have maximum testicular volumes in spring and summer; females begin vitellogenesis in August, ovulate in late autumn, and births occur between May and July (Ramirez-Bautista et al., *op. cit.*). The timing of events in the *E. brevirostris* reproductive cycle appear similar.

I thank David A. Kizirian (Natural History Museum of Los Angeles County), Charles H. Lowe (University of Arizona), and Alan Resetar (Field Museum of Natural History) for permission to examine *E. brevirostris*.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA; e-mail: SGoldberg@whittier.edu.

EUMECES LATICEPS (Broad-headed Skink) **DIET.** On 11 September 1997 in Morehouse Parish, Louisiana, USA (32°47'N, 91°52'W) we observed a female *Eumeces laticeps* eating from a peeled banana. Vitt and Cooper (1986. J. Hepertol. 20:408–415) reported finding no plant material in 84 stomachs of *E. laticeps*, but they had observed *E. laticeps* eating muscadine grapes and blackberries, both in the field (Cooper, pers. comm. to GP in 1998). In 1998 we observed a male *E. laticeps* eating a mixture of food, prepared for box turtles, the primary ingredients of which were ground carrots and lean ground beef, oat bran, and Knox® gelatin.

We thank William E. Cooper, Jr. for his help.

Submitted by **GEORGE M. PATTON** and **MARTHA ANN MESSINGER,** 2022 Gemini Drive, Bastrop, Louisiana 71220-3467, USA; e-mail: gpatton@bayou.com.

FURCIFER OUSTALETI (Oustalet's Chameleon). **DIET.** *Furcifer oustaleti* is one of the largest chameleons of Madagascar; adult males can reach 68.5 cm TL (Brygoo 1971. Faune de Madagascar 33:1–318). Chameleons generally catch their prey using their long, protusible tongue. Because of this mechanism, prey mostly consists of invertebrates (Davison 1997. Chameleons: Their Care and Breeding. Hancock House Publishers, Blaine, Washington. 118 pp.). Mammals (mice) and small birds have also been noted as potential prey (Necas 1999. Chamäleons - Bunte Juwelen der Natur. Chimaira, Frankfurt. 249 pp.), but to our knowledge there have been no reports of Malagasy chameleons preying on



FIG. 1. Adult male *Furcifer oustaleti* carrying a bird in its jaws at Ampijoroa Forest Station.

birds. On 23 May 2000 at ca. 1600 h, one of us (GG) observed an adult male *F. oustaleti* at Ampijoroa Forest Station (16°20'S, 46°47'E, elev. ca. 70 m) on a shrub branch at ca. 2 m height. The lizard was carrying a dead bird in his mouth (possibly a young *Foudia madagascariensis*) (Fig. 1). During the observations (ca. 30 min), the chameleon moved along the branch without leaving its prey, and finally swallowed it completely. The bird was not a hatchling (as recognizable by its well-developed feathers), and therefore almost certainly was not captured in a nest.

Submitted by **GERARDO GARCÍA**, Durrell Institute of Conservation and Ecology, University of Kent, Canterbury, Kent CT2 7NS, U.K. (e-mail: gerardo.garcia@wanadoo.fr), and **MIGUEL VENCES**, Laboratoire des Reptiles et Amphibiens, Muséum National d'Histoire Naturelle, 25 rue Cuvier, 75005 Paris, France (e-mail: m.vences@t-online.de).

GECKOLEPIS MACULATA (Spotted Fishscale Gecko). **PREDATION**. Few cases of scorpions preying on lizards have been reported: *Centruroides exilicauda* preying on *Phyllodactylus* sp., *Hadrurus arizonensis* on *Cnemidophorus* sp., *Parabuthus villosus* on *Palmatogecko rangei*, and *Opistophthalmus carinatus* on *Pachydactylus capensis* and *Mabuya striata* (McCormick and Polis 1990. *In* Polis [ed.], The Biology of Scorpions. Stanford Univ. Press, Stanford, California. 587 pp.). The first two examples concern species from North America and the other two from South Africa. No data concerning scorpions preying on Malagasy lizards are available. On 14 March 2000 we observed a scorpion eating a subadult specimen of *Geckolepis* at Montagne des Français, northern Madagascar (12°19'34"S, 49°20'09"E, 335 m elev.). The specimens were found during the day under a stone in degraded dry forest. The *Geckolepis* (SVL ca. 33 mm) had already been partly consumed (tail, left hindleg, and part of digestive tract); it was preserved and deposited in the Zoologische Staatssammlung München (ZSM 527/2000). *Geckolepis* systematics are in need of revision; according to the meristic characters used for species diagnosis in the genus (Angel 1942, Les lezards de Madagascar, Mem. Acad. Malgache 36. 139 pp.), the specimen was determined as *G. maculata*. The scorpion was an adult male *Grosphus flavopiceus* with a total length of 85 mm, including the telson; it was deposited at the Muséum national d'Histoire naturelle (MNHN-RS-8539). *Grosphus flavopiceus* is known from Montagne des Français (Lourenço 1996, Scorpions [Chelicerata, Scorpiones], Faune de Madagascar 87. 102 pp.); it lives almost exclusively in dry areas (Lourenço and Cloudsley-Thompson 1998, Biogeographica 74:183–187) and is an active predator of prey with rapid movements, similar to most scorpion species from deserts or dry areas.

Submitted by **FRANK GLAW**, Zoologische Staatssammlung, Münchhausenstr. 21, 81247 München, Germany (e-mail: Frank.Glaw@zsm.mwn.de), **MIGUEL VENCES**, Muséum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles et Amphibiens), 25 rue Cuvier, 75005 Paris, France, and **WILSON R. LOURENÇO**, Muséum national d'Histoire naturelle, Laboratoire de Zoologie (Arthropodes), 61 rue Buffon, 75005 Paris, France.

HELODERMA SUSPECTUM (Gila Monster). **MORTALITY/PREDATION**? Little is known about potential predators of the venomous Gila monster, but they are suspected to be few (Bogert and Del Campo, 1956. Bull. Amer. Mus. Nat. Hist. 109:1–238). As part of a study of the activity of Gila monsters in the Sonoran Desert near Phoenix, we observed the apparent outcome of a predation event involving a male Gila monster and a mammalian carnivore.

An adult male Gila monster, 250 mm SVL (294 g), was initially captured in northern Phoenix, Arizona, on 12 April 2000, surgically implanted with a small radio-transmitter (12 g), and released (1600 m from its capture site) in typical Upland Sonoran Desert dominated by creosote bush, bursage, palo verde, and saguaro cacti. It was relocated once or twice a week over the next fifteen months, during which time it grew 19 mm in length and 26 g in mass. On 27 June 2001 we radio-tracked the male Gila monster, and located the exposed tag and the head and neck of the lizard. The tag was exceptionally clean and exhibited small indentations consistent with the bite marks of a canid or similar-sized carnivore. The tag was imbedded in dry grasses over which an animal had apparently rolled repeatedly. Approximately 10 m from the tag the head and neck of the Gila monster were found with evidence that tissue had been "stripped" from the ribs and vertebral column. The lizard had been radio-tracked on 23 June 2001; at that time it was in a pack rat nest approximately 125 m from the subsequent location of the tag and head.

Although we have no direct evidence, we think that a coyote is the most likely candidate as the predator responsible for killing and consuming the Gila monster. Firstly, other carnivores (e.g., feral dogs, kit or grey foxes, skunks, badgers) have not been observed at the site, which is entirely surrounded by urbanization, over the past two years; coyotes are commonly observed at the site. Secondly, the radio tag was exceptionally clean (as if mouthed repeatedly) and apparently "rolled on," behaviors commonly exhibited by canid predators. Lastly, given the short time that had elapsed since its previous location in a traditional refuge, it seems unlikely that the Gila monster died of some other cause and subsequently was fed upon (as carrion) by a coyote.

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Submitted by **BRIAN K. SULLIVAN**, Department of Life Sciences, Arizona State University West, PO Box 37100, Phoenix,

Arizona 85069, USA, **GORDON W. SCHUETT**, Grand Canyon University, Department of Biology, Phoenix, Arizona 85061, USA, and **MATTHEW A. KWIATKOWSKI**, Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523-1474, USA.

TROPIDURUS MONTANUS (NCN). **CANNIBALISM.** Cannibalism is a common occurrence among reptiles (Polis and Myers 1985. J. Herpetol. 19:99–107) and has been recorded in several lizard species (e.g., Polis and Myers, *op. cit.*; Rocha 1992. Herpetol. Rev. 23:60; Vrcibradic and Rocha 1997. Herpetol. Rev. 27:201–203; Zamprogno and Teixeira 1998. Herpetol. Rev. 29:41–42). Here we report a case of cannibalism in the Brazilian endemic, sit-and-wait tropidurid *Tropidurus montanus* from the Serra do Cipó (19°20'S, 43°44'W), Minas Gerais, in the Espinhaço Range in southeastern Brazil.

Stomach contents of 133 adult lizards collected during the dry (June–August) and wet (December–February) seasons of 1996/1997 were analyzed. One adult male (76.6 mm SVL, 14.5 g), collected in August, had a partly digested juvenile conspecific in its stomach. The juvenile lacked a head and middle of the body, and its tail was broken. Morphological comparison with other specimens of the same population indicates the juvenile was ca. 40 mm SVL. Several ants, wasps, and a grasshopper, all food items common in the diet of *T. montanus* (Kiefer 1998. Unpubl. Master's Thesis, Universidade Estadual Paulista, Rio Claro, São Paulo, Brazil. 92 pp.), were also found in the examined stomach. The relatively low incidence of cannibalism (0.7%) recorded for the studied population of *T. montanus*, and its occurrence in the dry season when there is a great number of juveniles in the population and the availability of arthropods is lower, may suggest that cannibalism is a consequence of opportunistic foraging. Thus, conspecific juveniles would be treated as another prey available for adults (Polis and Myers, *op. cit.*). Opportunistic predation on lizards other than conspecifics has been reported for *T. montamus* (Kiefer 1998. Herpetol Rev. 29:41). The two specimens (predator and prey) were deposited in the herpetological collection of the Museu de História Natural da Universidade Estadual de Campinas (ZUEC 02283 and 02284, respectively).

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Submitted by **MARA CÍNTA KIEFER***, Curso De Pós-graduação em Zoologia, Dept. Zoologia, Universidade Estadual Paulista, Av. 24A, 1515, 13506-900 Rio Claro, São Paulo, Brazil, and **IVAN SAZIMA**, Museu de História Natural and Dept. Zoologia, Caixa Postal 6109, Universidade Estadual de Campinas, 13083-970 Campinas, São Paulo, Brazil. *Present address: Curso de Pós-graduação em Ecologia, Dept Zoologia, Caixa Postal 6109, Universidade Estadual de Campinas, 13083-970 Campinas, São Paulo, Brazil (e-mail [MCK]: kiefer@unicamp.br).

SERPENTES

AGKISTRODON PISCIVORUS (Cottonmouth). **PREDATION.** *Agkistrodon piscivorus* is a generalist forager that consumes live prey and carrion (Gloyd and Conant 1990. Snakes of The *Agkistrodon* Complex: A Monographic Review. SSAR, Oxford, Ohio. 614 pp.; Greene 1997. Snakes: The Evolution of Mystery in Nature. University of California Press, Berkeley, California. 351 pp.). Dietary plasticity in *A. piscivorus* might be a consequence of the snake's use of various aquatic and semi-aquatic environments (Ernst 1992. Venomous Reptiles of North America. Smithsonian Inst. Press, Washington D.C. 236 pp.). Although several species of terrestrial and aquatic birds have been reported eaten by *A. piscivorus*, consumption of wood duck (*Aix sponsa*, Anseriformes) ducklings by this snake is unknown (Gloyd and Conant, *op. cit.*). This seems unusual because ranges of *A. sponsa* and *A. piscivorus* greatly overlap in southern United States (Bellrose 1980. Ducks, Geese, and Swans of North America. Stackpole Books, Mechanicsburg, Pennsylvania. 540 pp.).

I studied survival, habitat use, and causes of mortality of radiomarked *A. sponsa* ducklings in three unique wetland environments at Noxubee National Wildlife Refuge (NNWR) in east-central Mississippi, USA (1996–1999) and in a riverine system of the Tennessee-Tombigbee River Waterway (TTRW) in western Alabama, USA (1998–1999). At NNWR, I studied in Loakfoma Lake (243 ha); the lake contained willow (*Salix nigra*), buttonbush (*Cephalanthus occidentalis*), and a variety of herbaceous species. Mosaics of vegetation were often dense and interspersed along Loakfoma's shoreline and islands. My second study site at NNWR was a reservoir (Bluff Lake, 405 ha), a needle-leaved deciduous forested wetland dominated by bald cypress (*Taxodium distichum*) and interspersed emergent herbaceous vegetation. The third site at NNWR was bottomland hardwood forest adjacent to Loakfoma and Bluff Lakes. At TTRW, I studied at Aliceville Lake (3320 ha) near Pickensville, Alabama, USA. The lake consisted of a navigation channel and numerous backwater coves remaining from the Tombigbee River. Coves at TTRW contained various aquatic macrophytes and were generally bordered by patches of dense emergent herbaceous vegetation adjacent to forest or oldfield upland habitats.

I captured *A. sponsa* ducklings and the brooding female in nest boxes and fitted birds with radio transmitters. Three ducklings per brood were usually marked. I attempted to radiomark equal numbers of ducklings through time at both study areas in 1998 and 1999 to control for temporal variation in duckling survival. I tracked radiomarked ducklings daily. Snakes suspected of ingesting radiomarked ducklings were captured with tongs to verify species, and to note their size and appearance. I released snakes alive at the capture site and recorded their location at time of capture.

I used program MICROMORT (Heisey 1985. MICROMORT version 1.2. Minn. Dept. of Natur. Resour., Minneapolis, Minnesota, USA) to calculate cause-specific mortality rates of ducklings, and to estimate the importance of predation of ducklings by *A. piscivorus* relative to other predators. *A. piscivorus* consumed a total of 21 radiomarked *A. sponsa* ducklings at both sites during 1996–1999. Intraseasonally (1999), one snake ingested 2 and another snake ingested 3 radiomarked ducklings. The other snakes each consumed 1 radiomarked duckling; I based this on size, color

characteristics, and location of the snakes captured. No radiomarked brood-rearing hens (N = 135) were killed by snakes. *A. piscivorus*-specific predation rates of ducklings relative to other agents of duckling mortality across years and study areas ranged from 0 to 15.9% (0.076 ± SE). *A. piscivorus*-related duckling mortality annually ranked from zero to 3rd in importance among other mortality agents. Most (16 of 21) radiomarked ducklings were eaten by *A. piscivorus* in Loakfoma Lake; 2 and 3 ducklings were consumed by snakes in Bluff Lake and TTRW, respectively. No ducklings were consumed by *A. piscivorus* in bottomland hardwood forest. Ducklings averaged 7.2 d of age (range 1–18 d) when consumed by snakes. Water levels at duckling predation sites (n = 14) averaged 29 cm (range 7.0-48.3 cm) among wetlands. No other species of snake consumed radiomarked wood duck ducklings in this study although four species of *Nerodia* were present on the study areas (Lohoefener and Altig 1981. Miss. Herpetol. Miss. State Univ. Res. Bull. 1).

Agkistrodon piscivorus ingested *Axis sponsa* ducklings in 3 of 4 wetland environments at the two study areas. However, snakes ate the greatest proportion of ducklings in Loakfoma Lake, usually among dense patches (i.e., nearly complete coverage of water) of interspersed *C. occidentalis* and herbaceous emergent vegetation that were flooded ≤ 29 cm deep. Although several factors may have influenced the observed pattern of consumption of ducklings by *A. piscivorus* in Loakfoma Lake, scrub-shrub habitats (e.g., *C. occidentalis*) are favorable habitats for *A. sponsa* (Bellrose and Holm 1994. Ecology and Management of The Wood Duck. Wildlife Management Institute. Stackpole Books, Mechanicsburg, Pennsylvania. 588 pp.) and seem to be favorable resting and foraging areas for *A. piscivorus*. *A. piscivorus* may be important predators of *A. sponsa* ducklings during simultaneous spatio-temporal use of some wetland environments in southern United States.

Submitted by **J. BRIAN DAVIS**, Department of Wildlife and Fisheries, Box 9690, Mississippi State University, Mississippi State, Mississippi 39762, USA. *Present address: Ducks Unlimited, Inc., 4511 East 43rd Street, North Little Rock, Arkansas 72117, USA; e-mail: bdavis2@ducks.org.

ATRACTUS PANTOSTICTUS (Fura-terra). **CLUTCH SIZE.** Colubrid snakes of the genus *Atractus* are oviparous, produce clutches of about 3 eggs and are fossorial (Amaral 1978. Serpentes do Brasil: Iconografia Colorida. 2ª ed. São Paulo, Edusp. 248 pp.; Fernandes and Puorto 1993. Mem. Inst. Butantan 55:7–14; Martins. 1994. História Natural e Ecologia de uma Taxocenose de Serpentes de Mata na Região de Manaus, Amazônia Central, Brasil. Ph.D. dissertation. Univ. Estadual de Campinas, São Paulo, Brazil. 98 pp.). Their fossorial habits make data gathering difficult. There are no data on oviposition by *A. pantostictus* except for one laboratory record of a female that deposited four eggs (mean length = 36.7 mm, mean weight = 1.88 g) (Fernandes and Puorto, *op. cit.*). Herein we report the clutch size of one female of *A. pantostictus* found in Belo Horizonte, Minas Gerais, Brazil.

A female collected on 4 March 1999 near Belo Horizonte (19°55'S, 43°56'W) laid in captivity three ellipsoid eggs (mean length = 32.0 mm, mean width = 7.5 mm, mean weight = 1.05 g) on 5 March 1999. Oviposition behavior was not observed. Measurements of the female following oviposition were: 9.5 g., 290.0 mm SVL, and 35.4 mm tail length. The clutch mass/female mass ratio was 0.33. The eggs did not hatch.

The adult female and eggs were deposited in the herpetological collection of the Universidade Federal de Minas Gerais (UFMG - 322).

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Submitted by **JOSÉ CASSIMIRO, JAIME BERTOLUCI**, and **WALDNEY PEREIRA MARTINS**, Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil (e-mail [JC]: j_cassimiro@hotmail.com).

BITIS CAUDALIS (Horned Adder). **PREY SIZE.** On 27 May 2000 we collected a small horned adder (*Bitis caudalis*) (CAS 214559) at the base of a small shrub in coastal gravel plains east of Henties Bay, Swakopmund District, northern Namibia (22°06'15"S, 14°17'27"E). The specimen contained a large Carp's barking gecko (*Ptenopus carpi*) in its stomach (Fig. 1). Measurements for the snake were: 130.42 mm SVL, 10.01 mm tail length, 7.12 mm head width, 10.22 mm head length, 10.06 mm maximum body width; weight (preserved, drained and patted dry) 2.02 g. The prey, an adult female gecko, had been ingested headfirst and was intact except for slight digestion of the skin anterior to the eyes. The gecko measured 51.55 mm SVL, 33.56 mm tail length, and weighed 3.17 g (preserved, patted dry). The relative prey mass (RPM; prey mass/snake mass) was 1.57. The intact state of the prey item suggests that it had been ingested the previous evening when conditions were cold (11–13°C) and foggy and large numbers of *P. carpi* were active on the surface at nearby localities.

Shine et al. (1998. Copeia 1998:391–401) noted that most horned adder prey items are relatively small, and that the relative prey mass is greatest in small snakes. The largest RPM they recorded for the species, 0.73, involved a juvenile snake (<170 mm SVL). Horned adders are generally born in the southern summer (December–February) at total lengths of 130–140 mm (Broadley 1990. FitzSimons' Snakes of Southern Africa. Jonathan Ball and Ad. Donker Publ., Parklands, South Africa. 387 pp.) and it is certain that the small adder involved in this case was in its first postnatal season. This record substantiates Haacke's (1975. Ann. Transvaal Mus. 29:197–243, pls. 10–11) listing of *Bitis caudalis* as a potential predator of *Ptenopus carpi*.



FIG. 1. Juvenile *Bitis caudalis* (CAS 214559) weighing 2.02 g and its prey, a *Ptenopus carpi* weighing 3.17 g. Total length of snake = 140.43 mm. The skin of the snake's body is distended because the specimen was fixed prior to removal of the prey item. Photo by Dong Lin, California Academy of Sciences.

Viperids in general often take exceptionally large prey, but data are lacking for most viperines (Greene 1983. Amer. Zool. 23:431–441). Among the greatest relative prey masses recorded from crotaline vipers are 1.29 for a hognosed pitviper (*Porthidium nasutum*) feeding on a spiny pocket mouse (*Heteromys desmarestianus*)(Greene 1997. Snakes. The Evolution of Mystery in Nature. University of California Press, Berkeley, California. 351 pp.), 1.30 for juvenile jararacas (*Bothrops jararaca*; prey item not stated)(Sazima 1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 199–216. Selva, Tyler, Texas), and 1.56 for a *Bothrops atrox* that had ingested a *Cnemidophorus gramivagus* (Greene 1983, *op. cit.*, 1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 107–117. Selva, Tyler, Texas). The last record is comparable to our own and, like ours, is subject to some error because weights were taken from preserved material (H. W. Greene, pers. comm..).

This new relative prey size record far surpasses any other known for the horned adder or for any other viperine; it also appears to represent the relatively largest meal ever recorded for any snake species.

Submitted by **WILLIAM R. BRANCH**, Department of Herpetology, Port Elizabeth Museum, P.O. Box 13147, Humewood 6013, South Africa (e-mail: pemwrb@zoo.upe.ac.za), **AARON M. BAUER**, Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA (e-mail: aaron.bauer@villanova.edu), and **TRIP LAMB**, Department of Biology, East Carolina University, Greenville, North Carolina 27858, USA (e-mail: lamba@mail.ecu.edu).

COLUBER RHODORACHIS (Wadi/Cliff Racer). **DIET**. *Coluber rhodorachis* is one of the commonest snakes encountered in the Hajar Mountains, especially in wadis, in the eastern United Arab Emirates and northeastern Sultanate of Oman. Although *C. rhodorachis* feeds mainly on lizards (Leviton et al. 1992. Handbook to Middle East Amphibians and Reptiles. Society for the Study of Amphibians and Reptiles. 252 pp.), records of fish (fresh and saltwater), toads, rodents, other reptiles and even bats are also included in the diet (Gallagher 1993. Snakes of the Arabian Gulf and Oman, Mazoon Printing Press, Oman. 16 pp.; Jongbloed 2000. Wild about Reptiles, Barkers Trident Communications, London. 116 pp.). During December 2000, I witnesses an adult *C. rhodorachis* preying on *Bufo arabicus* tadpoles in an ephemeral pool in Wadi Shawayah, in the Hatta (UAE/Sultanate of Oman) border area. Although *Bufo dhufarensis* toads also occur in the area, identification of the tadpoles in the pool confirmed *B. arabicus* as the prey species. It is expected that *C. rhodorachis* also prey upon *B. dhofarensis* although not witnessed here, or documented previously. I have also seen the freshwater fish, *Garra barreimiae* (a cyprinid endemic to the Hajar Mountains) and *Aphanius dispar* (Arabian killifish, a euryhaline cyprinodont) preyed on by *C.rhodorachis* in similar habitats. Although it could be expected that tadpoles fall prey to *C. rhodorachis* I believe this is the first record of *B. arabicus* tadpoles in the diet of *C.rhodorachis*.

Submitted by **PETER LOW CUNNINGHAM**, P.O. Box 17258, Al Ain, United Arab Emirates; e-mail: plc@emirates.net.ae.

CROTALUS CERASTES (Sidewinder). **ENDOPARASITES.** *Crotalus cerastes* has previously been reported to harbor two species of nematodes, *Thubunaea cnemidophorus* and *Hexametra boddaertii* (Babero and Emmerson 1974. J. Parasitol. 60:595; Bursey et al. 1995. J. Helminthol. Soc. Washington 62:78–80). The purpose of this note is to report an additional endoparasite, larvae of spiny-headed worms (Acanthocephala). Eight *C. cerastes* collected in Pima County, Arizona, USA, and accessioned in the herpetology collection of the Natural History Museum of Los Angeles County (LACM) were examined. A mid-ventral incision was made in the body wall, and organ surfaces and mesenteries in the posterior portion of the body cavity were visually checked for endoparasites. Oblong whitish bodies, ca. 1 x 3 mm were seen in LACM 76338 and 115995. These bodies proved, upon microscopic examination, to be oligacanthorhynchid acanthocephalan cystacanths. Prevalence of infection (infected snakes/sample examined x 100) was 25%. Parasite voucher specimens were deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland as USNPC 91080.

Oligacanthorhynchid cystacanths have been reported from other North American viperids: *Crotalus atrox, C. lepidus, C. mitchellii, C. scutulatus, C. tigris, C. viridis,* and *C. willardi* (Bolette 1997a. J. Parasitol. 83:751-752; Bolette 1997b. Southwest. Nat. 42:232–236; Bolette 1998. J. Helminthol. Soc. Washington 65:105–107; Goldberg and Bursey 1999. Herpetol. Rev. 30:44-45; Goldberg and Bursey 2000. Herpetol. Rev. 31:104). Rattlesnakes serve as paratenic (transport) hosts for oligacanthorhynchid cystacanths (Bolette 1997b, *op. cit.*). Development to the adult form occurs when the snake is eaten by a carnivore (definitive host) (Matthews 1998. An Introduction to Parasitology. Cambridge University Press, UK. 192 pp).

We thank David A. Kizirian (Natural History Museum of Los Angeles County) for permission to examine *C. cerastes*.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA and **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 161646, USA.

CROTALUS DURISSUS (Neotropical Rattlesnake). **PREDATION.** Several studies on ocelot (*Leopardus pardalis*) feeding habits show that this cat feeds primarily on small to medium-sized terrestrial mammals, however reptiles can also be important components of their diet (Konecny 1989. *In* Redford and Eisenberg [eds.], Advances in Neotropical Mammalogy, pp. 243–264. Sandhill Crane Press, Gainesville, Florida). Snakes most often eaten by ocelots are colubrids (e.g., Ludlow and Sunquist 1987. Nat. Geogr. Res. 3:447–461).

On 5 May 2000, I collected an ocelot scat sample at Parque Estadual Morro do Diabo (22°30'S, 52°20'W), São Paulo state, southeastern Brazil, containing the remains (four distal rattle segments, and ventral and dorsal scales) of *Crotalus durissus*. The size of the scales indicates that the snake was an adult. *Crotalus durissus* is an extremely venomous and common species, found throughout the ocelot's geographic range, but has not been reported in the diet of ocelots. It is not possible to determine if the rattlesnake was consumed as prey or taken as carrion, but there is little

evidence that the ocelot is a scavenger. On the other hand, it is likely that the ocelot preyed on the rattlesnake, as other carnivorous species, such as the crab-eating fox (*Cerdocyon thous*), are known to consume venomous species (Sunquist et al. 1989. *In* Redford and Eisenberg [eds.], Advances in Neotropical Mammalogy, pp. 197-232. Sandhill Crane Press, Gainesville, Florida).

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Submitted by **ELLEN WANG**, Museu de Historia Natural, IB/Unicamp, CP 6109, 13083-970, Campinas, SP, Brazil; e-mail: ellenwan@unicamp.br.

CROTALUS HORRIDUS (Timber Rattlesnake). **CAVE USE.** During the summer of 1999, we surveyed 90 small caves in the Ozark National Forest in Crawford County, Arkansas, USA (35°43'N, 94°28'W). During these surveys, we found *Crotalus horridus* occupying locations within or beyond the twilight zone at four sites. Individual snakes were located an average of 11.5 ± 1.50 m into the caves (range 7.5 –16. 2 m, Table 1). In two of these sites, the snakes were present for at least one week, and were found at greater distances in the cave on the second visit (Table 1).

All of these snakes were found in caves between 30 July and 28 August, although some might have been present previously because the caves had not been surveyed since May. July and August are generally the hottest and driest months of the year in the Ozarks. During August 1999, temperatures ranged from 12.9° to 39.2°C, and mean temperature during the month of August was 26.9°C (Anonymous 1999. NOAA Natl. Clim. Data, Arkansas, 15 pp.). Air temperatures near the snakes in the caves ranged from 17.6° to 20.7°C, with a mean of 19.2°C ± 0.62 (Table 1). In addition, this period was very dry; significant precipitation had not fallen since 11 July. All of the snakes were found inside the caves at locations where the cave floor was still moist. On the night of 26 August, 2.0 cm of rain fell in the area, and on a subsequent visit only one snake remained in the cave in which it had been found.

We suggest that these snakes were probably occupying the caves in order to thermoregulate and maintain water balance. All of these snakes were small (< 0.7 m) and exhibited low body mass compared to others seen outside the caves during the same period. Smaller snakes change body temperature more rapidly and lose water more quickly because of larger surface area per unit volume than do larger snakes (Bentley 1976. *In* Gans and Pough [ed.], Biology of the Reptilia, Vol. 5, pp. 365–412. Academic Press, New York). Therefore, these smaller sized *C. horridus* may have been using the caves to reduce water loss because of the hot, dry condition outside the caves. Increased exposure to hot, dry environmental conditions can be stressful for reptiles (Huey 1982. *In* Gans and Pough [ed.], Biology of the Reptilia, Vol. 12, pp. 25–91. Academic Press, New York), therefore, cooler and wetter conditions in caves might provide temporary relief until favorable conditions exist for feeding and breeding.

TABLE 1. Distances at which *Crotalus horridus* were located from cave entrances during summer of 1999.

Cave Number*	Date	Distance from entrance (m)	Cave Air Temp. (°C)
CW2363	30 Jul	16.2	17.6
CW2336	04 Aug	10.5	19.9
CW2337	16 Aug	7.5	20.7
CW2337	22 Aug	15.0	19.8
CW2360	22 Aug	7.5	17.8
CW2360	28 Aug	12.0	—

* denotes U.S. Forest Service number.

All but one *C. horridus* encountered in the caves were found in coiled position and were alert to our presence. The one exception, a snake in cave CW2363, appeared to be stalking a small woodrat (*Neotoma floridana*) that was apparently dying after being bitten. Woodrats and other small rodents were commonly seen during our surveys in these caves. Other studies have determined that small rodents comprise the majority of prey items for *C. horridus* (Savage 1967. Copeia 1967:226–227; Reinert et al. 1984. Copeia 1984:976–981), so it is possible that these snakes were occupying caves to search for prey as well as to escape the heat.

To our knowledge, there has been only one report of this species using caves outside of hibernation, a single adult found near the entrance of a cave in Oklahoma (Black 1973. Proc. Oklahoma Acad. Sci. 53:33–37). In general, pitvipers are considered accidental visitors to areas inside caves in the Ozarks (Drda 1968. J. Herpetol. 1:64–70; Black, *op. cit.*; McDaniel and Gardner 1977. Proc. Arkansas Acad. Sci. 31:68–71). Summer surveys, especially at smaller and less frequently visited sites, may produce more records of *C. horridus* in underground locations.

Submitted by **JEFFREY T. BRIGGLER*** and **JOHN W. PRATHER****, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

*Present address for JTB: Missouri Department of Conservation, P.O. Box 180, Jefferson City, Missouri 65102, USA.

**Present address for JWP: Department of EPO Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA.

CROTALUS LEPIDUS MACULOSUS (Durangan Rock Rattlesnake). **DIET**. Little published data exist on the natural history of *Crotalus lepidus maculosus* and no prey items have been recorded for this subspecies. Armstrong and Murphy (1979. The Natural History of Mexican Rattlesnakes. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 5:1–88) stated that lizards of the genus *Sceloporus* appear to be the main food item of *C. l. maculosus*, presumably based on the association of these lizards with *C. l. maculosus* habitat.

From 28 June 2000 to 1 July 2000 we obtained dietary records for three *C. l. maculosus* collected in Durango, México, off Highway 40 near the Durango/Sinaloa border. A neonate (ca. 160 mm TL) collected on 28 June had a noticeable mid-body bulge. Gentle palpation of the abdomen revealed the bulge to be a juvenile lizard based on size and body proportions. Later analysis of the fecal remains confirmed the prey's identity as *Anolis nebulosus*. This species is common in the area, and because of their slender shape and ground-dwelling habits might account for a large portion of juvenile *C. l. maculosus* diet. At 1105 h on 1 July an adult female *C. l. maculosus* (540 mm TL, 74.6 g) was collected under a prickly pear (*Opuntia* spp.) ca. 25 cm away from a large adult male *Sceloporus jarrovii jarrovii* (200 mm TL). By 1128 h the lizard

had died. Examination of the lizard revealed two fang puncture marks on its hind leg. Analysis of fecal remains from a third *C. l. maculosus* (adult male) revealed the dorsal guard hairs of an unidentified small mammal.

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Submitted by **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA, **JAVIER BANDA** and **DAVID LAZCANO**, Laboratorio de Herpetología, Universidad Autónoma de Nuevo León, Apartado Postal - 513, San Nicolas de los Garza, Nuevo León, C.P. 66450, México.

CROTALUS PRICEI PRICEI (Twin-Spotted Rattlesnake). **HABITAT SELECTION**. *Crotalus pricei pricei* typically inhabit high elevation temperate pine-oak forest (>1900 m) and are most commonly associated with rocky habitats (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley, California. 1533 pp.; Armstrong and Murphy 1979. The Natural History of Mexican Rattlesnakes. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 5:1–88; Campbell and Lamar 1989. The Venomous Reptiles of Latin America. Comstock Publ. Assoc., Ithaca, New York. 425 pp.). Armstrong and Murphy (*op. cit.*) found *C. p. pricei* often utilized rocks for basking and cover. They also stated that this species may be found in grassy mountain valleys where there is an abundance of prey. Here we report on the collection of three *C. p. pricei*, all found using woody cover.

We collected three specimens of *C. p. pricei* in the Sierra del Nido mountains in Chihuahua, México, on 22 July and 24 July 2000. All specimens were collected in a high elevation pine-oak forest at elevations ranging from 2732 to 2748 m. One specimen (adult female 385 TL, 43.5 g) was collected in a grassy meadow at the base of a tree stump, a second (adult male 380 TL, 33.4 g) among the branches of a fallen dead tree, and the third (adult male 425 TL, 41.4 g) in the hollow of a dead stump. Heavy logging had occurred in the past in this area and there were numerous dead pine (*Pinus* spp.) stumps, logs, and fallen branches and trees in the area. All three specimens encountered were using the cover provided by the dead stumps and branches. *Barisia levicollis* and *Sceloporus grammicus* appeared to be most abundant in or near the dead stumps, logs, and branches as well and are both probable prey items of *C. p. pricei*. These observations suggest that *C. p. pricei* might use woody cover when available and suggest that woody cover might be an important habitat component of some populations.

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Submitted by **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA, **JAVIER BANDA** and **DAVID LAZCANO**, Laboratorio de Herpetología, Universidad Autónoma de Nuevo León, Apartado Postal - 513, San Nicolas de los Garza, Nuevo León, C.P. 66450, México.

CROTALUS VIRIDIS CONCOLOR (Midget Faded Rattlesnake). **MAXIMUM LENGTH.** On 30 June 2000, a male *Crotalus viridis concolor* was found basking on a dirt road within our study site near Green River, Sweetwater County, Wyoming, USA. Measurements were taken prior to radio transmitter implant surgery while the snake was under halothane inhalation anesthesia. The snout–vent length (SVL) was 70.6 cm, total body length (TBL) (excluding rattle) was 75.6 cm, and body mass was 205 g. Klauber (1972. Rattlesnakes. University of California Press, Berkley and Los Angeles, California. 1533 pp.), Baxter and Stone (1992. Amphibians and Reptiles of Wyoming, 2nd ed. Wyoming Game and Fish Department, Cheyenne, Wyoming. 137 pp.) and Hammerson (1982. Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver, Colorado. 131 pp.) all suggest that *C. v. concolor* usually obtain lengths less than 65 cm, whereas Cox and Tanner (1995. Snakes of Utah. Brigham Young University, Provo, Utah. 92 pp.) suggest that they do not reach lengths exceeding 92 cm. This is only the second specimen reported to exceed 65 cm in length. The first account was a specimen that measured 74 cm SVL and 77.5 cm TBL (T. Patton, pers. comm.). The body mass was not measured and the length measurements may have been slightly off because it had been run over by a vehicle and the rattles had been removed.

Submitted by **JOSHUA M. PARKER** and **STANLEY H. ANDERSON**, Department of Zoology and Physiology, University of Wyoming, P.O. Box 3166, Laramie, Wyoming, 82071, USA; e-mail (JMP): jmparker@uwyo.edu.

ERYTHROLAMPRUS AESCULAPII (Coral-patterned Snake). **DIET**. In a study of the stomach contents of *E. aesculapii* deposited in the herpetological collection of the Museo de Historia Natural La Salle, Caracas (MHNLS), we found a specimen (665 mm SVL; MHNLS 11711), collected from the right margin of the Ariza River in Bolívar State, Venezuela, 290 m elevation, having in its gut a snail-eating snake, *Dipsas catesbyi* (465 mm SVL; MHNLS 14971). The *D. catesbyi* was partially digested from the anal plate to the tail. This supports previous reports that *E. aesculapii* swallows other snakes tail first (Marques e Puorto 1994. Rev. Brasil. Biol. 54:253–259). This is the first report of an identified prey item from *E. aesculapii* in Venezuela and the second report of *Dipsas* in the diet of *E. aesculapii* in South America. Marques and Puorto (*op. cit.*) found that the prey of adult *E. aesculapii* consisted of only terrestrial colubrids, with the exception of a single specimen of *Dipsas incerta*. *Dipsas catesbyi* is a colubrid with arboreal habits that may be vulnerable to predation from *E. aesculapii* only when it descends to the ground to feed on snails.

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado postal 1930, Caracas 1010-A. Venezuela; e-mail: gilsonrivas@mixmail.com.

LIOCHLOROPHIS* (= *OPHEODRYS*) *VERNALIS (Smooth Green Snake). **REPRODUCTION.** Reproductive characteristics of *Liochlorophis vernalis* in the Rocky Mountains and southwestern United States are relatively poorly known (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico

Press, Albuquerque. 431 pp.; Hammerson 1999. Amphibians and Reptiles in Colorado, 2nd ed. Univ. Press of Colorado and Colorado Div. Wildlife, Niwot, Colorado. 484 pp.). In this note, I provide information on eggs and neonates from northeastern New Mexico.

On 28 July 2000, I found 13 *L. vernalis* eggs under a ca. 5 cm thick, rock slab near State Highway 518, 5.5 km by road W of La Cueva, Mora Co., New Mexico, USA (2188 m elev.). The nest was on a south facing, 30–40° slope between the highway and the Mora River floodplain, and the smooth-shelled, whitish eggs were loosely clustered in an indistinct depression in the soil beneath the slab. Twelve eggs were collected (a 13th was damaged); 10 of the eggs were adhered to each other in groups of two, two, and six, which prevented individual measuring and weighing of some. Total mass of the 12 eggs was 31 g, with an average mass per egg of 2.6 g. Egg length and width (in mm, N = 9) averaged 26.4 (24–29) and 12.0 (11–15).

Eggs were incubated at 22–32°C on moist paper towels. The adhered group of six eggs hatched 9–11 August, and five other eggs hatched 13–14 August (one failed to hatch). Neonates numbered six males and five females, and dorsal coloration was a dull gray-green rather than the typical bright green of adults. Neonate SVL and total length (in mm) averaged 104.8 (93–114) and 146.9 (134–154), respectively, and neonate mass averaged 1.2 g (1.0–1.3). Female SVL/total length ratios (0.73 ± 0.01 SE) were significantly greater than those of males (0.70 ± 0.01 SE; $t = 2.78$, $P < 0.03$).

Degenhardt et al. (1996, *op. cit.*) noted that *L. vernalis* clutches might number 2–18 eggs, with 6–7 more typical. It is possible that two clutches were present in the cluster of 13 eggs as there was > 1 day separation between hatching dates of the adhered group of six and the remaining eggs. Communal oviposition has been reported in northern and eastern populations (e.g., Gregory 1975. Copeia 1975:185–186; Lawson 1983. Herpetol. Rev. 14:20) and probably also occurs in the southwestern part of the range.

Neonates and egg remains are deposited in the University of New Mexico Museum of Southwestern Biology (MSB 61990-62000). I thank C. W. Painter for comments.

Submitted by **JAMES N. STUART**, New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico 87504-5112, USA; e-mail: JStuart@state.nm.us.

MORELIA BOELENI (Boelen's Python). **ENDOPARASITISM**. On 18 November 2000 a wild collected *Moreila boeleni* was acquired by the Dallas Zoo. Upon arrival this specimen was determined to be a female weighing 7.3 kg with a snout–vent length of 230 cm and a tail length of 29 cm. During routine cage maintenance several specimens of the nematode *Ophidascaris papuanus* were found. A previous report details the treatment of *O. papuanus* in a long-term captive specimen of *M. boeleni* (Hartdegen et al. 1998. ARAV 8,1: 8).

Submitted by **RUSTON W. HARTDEGEN**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA, and **KATHRYN C. GAMBLE**, Department of Veterinary Medicine, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA.

OHPIOPHAGUS HANNAH (King Cobra). **DIET**. *Ophiophagus hannah* primarily feeds on rat snakes (*Ptyas mucosus*) but also preys on other snakes, lizards (Whitaker 1978. Common Indian Snakes: A Field Guide. Macmillan and Co., New Delhi. 154 pp.), and the porcupine *Hystrix indica* (pers. obs.). Here I discuss two observations of *O. hannah* preying on the Indian rock python (*Python molurus*) on the western slopes of the Western Ghats of Karnataka, India. The area is a matrix of protected forests and cultivated regions. Most of the cultivated regions contain paddy crops, arecanut gardens, and a few rubber and cashew plantations. The forest is characterized by semi-evergreen vegetation and receives >5000 mm of precipitation annually.

The first observation occurred on 12 October 1997 at 1025 h in Kudremukh National Park, Dakshina Kannada, India. People from a nearby village discovered an *O. hannah* (4.88 m total length) entwined with a *P. molurus* (3.66 m total length). The snakes remained entwined for more than 2 h in a paddy field. The people that had gathered disturbed the snakes and the *O. hannah* released the *P. molurus*. The partially paralyzed *P. molurus* crawled into a crevice in the laterite rock near the field and the *O. hannah* fled into a nearby thicket. After the crowd of people left, the *O. hannah* returned at 1545 h and searched for, found, and ate the *P. molurus*.

The second observation occurred on 12 November 1998 at 1330 h in Subramanya, Dakshina Kannada, India. Subramanya is a small township on the edge of the Pushpagiri Wildlife Sanctuary. A forest guard reported that an *O. hannah* (ca. 4.26 m total length) was feeding on a *P. molurus* (ca. 1.8 m total length). The *O. hannah* held the *P. molurus* at the mid-section. After ca. 30 min. the *P. molurus* bit the *O. hannah* but could not escape. With in 1 h, the *P. molurus* was paralyzed. It took the *O. hannah* ca. 15 min. to position the *P. molurus*. The *O. hannah* produced much saliva as it began to swallow the *P. molurus*. Swallowing by the *O. hannah* began slowly but accelerated when over half of the *P. molurus* was ingested. The *O. hannah* raised its hood to ca. 60 cm above the ground before the last 30 cm of the *P. molurus* was swallowed. It took 2 h for the *O. hannah* to completely swallow the *P. molurus*.

Submitted by **SHARATH B. KRISHNA**, Department of Biosciences, University of Mysore, Hemagangothri, Hassan 573220, India; e-mail: sharathbk@vsnl.com or bsharath@sancharnet.in.

PHILLODRYAS BARONI BARONI (Baron's Racer). **ENDOPARASITISM**. On 14 November 2000 three (1.2) adult wild collected *Phillodryas baroni baroni* were acquired by the Dallas Zoo. The one male weighed 190 g with a snout–vent length (SVL) of 91 cm and a tail length (TL) of 31.2 cm. Female mean measurements were as follows: 285 g with an SVL of 101.8 cm and a TL of 32.5 cm. During routine cage maintenance, several specimens of *Hexametra boddaertii* were voided with feces.

Submitted by **RUSTON W. HARTDEGEN**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA, and **KATHRYN C. GAMBLE**, Department of Veterinary Medicine, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA.

PHILOTHAMNUS CARINATUS (NCN). **REPRODUCTION and GROWTH.** Nothing is known on the reproduction and growth of *P. carinatus*, a species of green bush snake (Colubridae) widespread in the Guinea-Congo forest (Chippaux.1999. Les Serpents d'Afrique Occidentale et Centrale. IRD Editions, Paris. 278 pp.). Here we provide data on specimens captured in southeastern Nigeria. The study area (Odukpani, Cross River State, 04°49'N, 08°21'E), a secondary thick forest surrounded by a mosaic of suburbs, farms, and plantations, is tropical with a pronounced wet season occurring from May to September.

Three gravid females were captured at Odukpani during 1999. The first (SVL = 53.4 cm) laid three large eggs on 3 January, the second (SVL = 51.7 cm) laid four large eggs on 9 December, and the third (SVL = 66.2 cm) laid three large eggs on 18 December. No gravid females were captured during any other period of the year.

Two newly-hatched *P. carinatus* (with fully evident umbilical scars) were captured and scale-clipped at the study area. One (unsexed, SVL = 16.7 cm, tail = 5.9 cm) was captured on 22 April 2000, and another (SVL = 17.1 cm, tail = 6.8 cm) on 15 April 1999. The latter (a male) was recaptured on 2 February 2000 (SVL = 25.2 cm, tail = 9.7 cm) 36 m linear distance from the first site of capture. The growth of this specimen was 8.1 cm SVL and 11.0 cm total length in < 300 days. Therefore, we calculated a growth rate for this individual of 0.027 cm x d^{-1} SVL, or 0.037 cm x d^{-1} total length. A voucher at the Zoological Museum of Copenhagen (ZMUC 601598), captured at Osomba (Cross River State) on 16 February 1959, was nearly identical in size (SVL = 25.0 cm, tail = 9.8 cm) to our marked male at the recapture time. This voucher also probably hatched in April, assuming a similar growth rate as that recorded in our marked specimen.

Our data, although preliminary, demonstrate that in this species eggs are laid during the dry season, and hatch during the interphase between end of dry season and the onset of wet season, exactly as seen in *P. h. heterodermus* from southeastern Nigeria (Akani et al. 2001. Herpetol. Rev. 32:50–51). Whether *P. carinatus* may have multiple periods of egg laying (and thus also of hatching) is not known. Moreover, the fact that our scale-clipped juvenile was recaptured very close to the site of first capture after almost 300 days suggests that young *P. carinatus* may be very sedentary throughout their first year of life (daily movement rate = 0.12 m x d^{-1}).

This study also extends the known range of *P. carinatus* in Nigeria. Before, it was known only from southwestern Nigeria close to the political border with Benin Republic (i.e., Lagos State, cf. map in Chippaux 1999, *op. cit.*), but our records (both field data from Odukpani and two vouchers from Osomba: ZMUC 601597 and ZMUC 601598) came from Cross River State (capital: Calabar) in the extreme southeastern part of the country, near the political border with Cameroon.

We thank E.N.I.-Agip Environmental Department, Aquater S.p.A., T.S.K.J. Nigeria Ltd., Ecosystem s.r.l., F.I.Z.V., and Chelonian Research Foundation (Linnaeus Fund) for financially supporting parts of our long-term research in Nigeria. Claudia Corti is gratefully thanked for measuring vouchers at the Zoological Museum of Copenhagen, Jens Rasmussen (ZMUC) for allowing measurements of specimens, Francesco M. Angelici, Zena Tooze, Edoardo Politano, and Dario Capizzi for providing fieldwork and/or data input.

Submitted by **GODFREY C. AKANI**, Department of Biological Sciences, The Rivers State University of Science and Technology, P.M.B. 5080, Nkpolu, Port Harcourt, Rivers State, Nigeria (e-mail: g.c.akani@usa.net), and **LUCA LUISELLI**, Institute of Environmental Studies "Demetra", via dei Cochi 48/B, I-00133 Rome, Italy, and F.I.Z.V., via Olona 7, I-00198 Rome, Italy (e-mail: lucamlu@tin.it).

THAMNOPHIS COUCHII (Sierra Garter Snake). **MAXIMUM SIZE and RECORD LITTER SIZE.** Rossman et al. (1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman. 332 pp.) reported that *Thamnophis couchii* attains a maximum size of 957 mm SVL (based on LSUMZ 55661, an adult female from Tulare Co., California, USA, with an incomplete tail). This same snake also gave birth to 38 neonates, the largest litter recorded for this species (Rossman et al., *op. cit.*).

An adult female *T. couchii* collected by Ted Thompson in May 2001 from Pine Flat Reservoir, Fresno Co., California gave birth to 39 young on 6 August 2001. Following parturition, she measured 1000 mm SVL. Her tail was incomplete. Using the tail length/total length ratios for adult females given by Rossman et al. (*op. cit.*), her estimated total length was 1259–1341 mm. The adult female and all neonates were released at the original collection site.

Submitted by **ROBERT W. HANSEN**, 16333 Deer Path Lane, Clovis, California 93611-9735, USA; e-mail: rwh13@csufresno.edu.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). **DIET.** The diet of *Thamnophis sirtalis* includes invertebrates, fish, amphibians, mammals, and birds (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. University of Oklahoma Press, Norman, Oklahoma. 332 pp.; Wright and Wright. 1957. The Handbook of Snakes of the United States and Canada. Comstock, Ithaca, New York. 1105 pp.), as well as carrion. Carrion feeding usually involves the ingesting of a previously killed amphibian (Palmer and Braswell. 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, North Carolina. 412 pp.; Ruthven. 1908. Bull. U.S. Natl. Mus. 61:1–201). However, literature reports of *T. sirtalis* consuming dead birds are scarce. Ruthven (*op. cit.*) reported an incident where a *T. sirtalis* was observed swallowing a yellow warbler (*Dendroica petechia*) that had been seen dead the previous day. A more recent observation by Sajdak and Sajdak (1999. Herpetol. Rev. 30:229) of a DOR *T. s. sirtalis* killed while in the act of swallowing a DOR passerine bird provides an additional record of this behavior. Here I report a third incident of carrion consumption by *T. s. sirtalis*.

On 28 July 1998, I discovered an adult female *T. s. sirtalis* (ca. 500 mm TL) under a wooden panel, 1.1 km ENE of the Erie International Airport, Erie Co., Pennsylvania, USA. The snake had a considerable swelling near mid-body suggesting a recent meal, but otherwise appeared thin and under weight, similar to that of a postpartum female. Upon handling, the snake disgorged the partially digested feet and tarsi of a bird. The structure of the feet and tarsi were characteristic of the thrush family (Turdidae). Based on the size of the bird limbs and the appearance that the limbs were gnawed, it is apparent that the snake consumed the limbs as car-

rion and not an entire bird.

I thank Arthur Hulse for reviewing this manuscript and offering helpful comments and suggestions.

Submitted by **BRIAN GRAY**, 1217 Clifton Drive, Erie, Pennsylvania 16505, USA.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). **WINTER PREDATION.** Predation by red-tailed hawks on snakes has been well documented (Knight and Erickson 1976. Raptor Res. 10:108–111; Fitch and Bare 1978. Trans. Kansas Acad. Sci. 81:1–13; see Preston and Beane 1993. *In* Poole and Gill [eds.], The Birds of North America, No. 52, pp. 1–20. Acad. Nat. Sci., Washington, D.C. The American Ornithologists' Union). In particular, red-tailed hawks are known to prey on members of the genus *Thamnophis* (Knight and Erickson, *op. cit*; Fitch and Bare, *op. cit.*; Ernst and Barbour 1989. Snakes of Eastern North America. George Mason Univ. Press, Fairfax, Virginia. 282 pp.). On 31 January 2001, one of us (JK) salvaged a red-tailed hawk (*Buteo jamaicensis* "*kriderii*") along U.S. Hwy 49, ca. 2.4 km S Weiner, Poinsett County, Arkansas, USA (T11N, R2E, Sec 18; 35°35'57"N, 90°54'90"W). Habitats on either side of the highway are mainly temporary, vegetated, aquatic ditches normally filled with overflow water from rice fields. Upon closer examination of the hawk, the tails of two eastern garter snakes (*Thamnophis s. sirtalis*) were found protruding from a neck wound. Complete dissection of the hawk revealed that only the tails along with small portions of the posterior abdominal region of both snakes (an adult male and female) remained in the gullet of the bird. This observation suggests that by exiting overwintering retreats to presumably bask in brief periods of warm weather (as was the case here), *T. s. sirtalis* becomes highly susceptible to avian predators which primarily hunt for small mammals in habitats associated with fallow agricultural fields during the winter. The snakes were deposited in the Arkansas State University herpetological collection (ASUMZ 25498–25499). We thank Jim Bednarz for verifying the "kriderii" morph of the red-tailed hawk.

Submitted by **STANLEY E. TRAUTH** and **JENNIFER KLOTZ**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467-0500, USA.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 33, Number 1 (March 2002). Additional note: The responsibility for checking literature for previously documented range extensions lies with authors. Do not submit range extensions unless a thorough literature review has been completed.

CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). USA: OHIO: Erie Co: Kelly's Island. On 20 September 2000, a sub-adult *Ambystoma opacum* was found under a board at N 41°37.116'N, 82°42.419'W on Kelley's Island. The animal was approximately 56 mm total length. Identity verified by Ronald A. Nussbaum. Photographic specimen No. 7240 UMMZ. In addition, on 6 August 2001 one of the authors (KMS) found a dead adult at N41°35.604'N, 82°41.387'W. This animal was 105 mm total length and is deposited at the Cleveland Museum of Natural History (8911). Identity verified by Timothy O. Matson. Although Lowcock and Bogert (1992. Can. Field Nat. 106:2) previously recorded this species on Kelley's Island, only larvae were present. We believe that the specimens reported herein are the first of post-metamorphic individuals on the island.

Submitted by **WILLIAM P. FLANAGAN III**, The National Amphibian Conservation Center, Detroit Zoological Institute, 8450 West Ten Mile, Royal Oak, Michigan 48068, USA (e-mail: Bflanagan@detroitzoo.org; Bflanagan@detroitzoo.org), **KRISTIN M. STANFORD**, Northern Illinois University, Department of Biological Sciences, Dekalb, Illinois 60115, USA (e-mail: kristins@niu.edu), **KENT A. BEKKER**, The Toledo Zoo, Department of Herpetology, 2700 Broadway, Toledo, Ohio 43609, USA (e-mail: herpers@toledozoo.org).

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: FLORIDA: Gulf Co.: 0.4 km W of Two Pen Ridge Road, 0.9 km N of Stone Mill Creek (NE 1/4 Sec 31, T3S, R10W). 17 January 2002. John G. Palis. SIUC H–6547. Verified by J. G. Steward. Adult male found under a log within an isolated *Taxodum ascendens* pond. First record for county (Ashton and Ashton. 1988. Handbook of Reptiles and Amphibians of Florida, Part Three: The Amphibians. Windward Publ., Miami, Florida. 191 pp.).

Submitted by **JOHN G. PALIS**, P.O. Box 387, Jonesboro, Illinois 62952, USA.

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: TEXAS: Houston Co: Davy Crockett National Forest, compartment number 56, approximately 800 m southeast of the intersection of Forest Service roads 503 and 503B. 30 January 2002. Daniel Saenz. TCWC 84718. Verified by James R. Dixon. New county record (Dixon 2000. Amphibians and Reptiles of Texas, Second edition, Texas A&M Press, College Station, 421 pp.). The adult salamander (56 mm SVL and 94 mm TL, tip of tail missing) was caught in a funnel trap in a manmade wildlife mitigation pond (Davy Crockett National Forest wildlife pond 56–2). This may be the westernmost record for *Ambystoma talpoideum* and the first record for the Neches River drainage.

Submitted by **DANIEL SAENZ**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA, **CORY K. ADAMS** and **JAMES B. JOHNSON**, Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA.

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: ARKANSAS: Clark Co: 6.5 km W Arkadelphia, Sec. 10 T7S R20W. 19 February 2002. Martin Campbell. Henderson State University collection 898. Clark Co: 8 km NW Gurdon, SW 1/4 Sec. 27 T9S R21W. 23 February 2002. Renn Tumlison. Henderson State University collection 899, 903–906. Verified by Stan Trauth. Gurdon record includes one adult and several larger specimens of larvae from a permanent woodland pond without fish. First records for Clark Co., helps verify northward range extension in the West Gulf Coastal Plain toward the Ouachita Mountains, and fills gap between records in adjacent Dallas Co. and nearby Garland Co. (Trauth et al. 1993. Proc. Arkansas Acad. Sci. 47:154–156).

Submitted by **RENN TUMLISON** and **MARTIN CAMPBELL**, Departments of Biology and Chemistry, Henderson State University, Arkadelphia, Arkansas 71999, USA.

AMBYSTOMA TIGRINUM (Eastern Tiger Salamander). USA: INDIANA: Perry Co.: Highway 66. 1.4 km S of Highway 70 (Sec 4, T5S, R1W). 15 December 1995. John G. Palis. SIUC H–6548. Verified by J. G. Stewart. Fresh DOR gravid female collected during a light rain at 2008 h. First record for county (Minton 2001. Amphibians and Reptiles of Indiana. Second Ed. Indiana Academy of Science, Indianapolis, Indiana. 404 pp.)

Submitted by **JOHN G. PALIS**, P.O. Box 387, Jonesboro, Illinois 62952, USA.

NECTURUS MACULOSUS MACULOSUS (Common Mudpuppy). USA: WISCONSIN: Ashland Co: Iron River just above confluence with Bad River, at Forest Road 184 (T44N, R3W, Sec 26). 24 May 1999. John Lyons and Philip A. Cochran. Milwaukee Public Museum (MPM) 31830. Verified by Gary Casper. Juvenile collected by electrofishing confirms presence of mudpuppies above a barrier waterfall on a tributary to Lake Superior's south shore, in this case Copper Falls on the Bad River (Cochran 1999. Bull. Maryland Herpetol. Soc. 35:4–13). Cestodes in the intestine of this specimen were probably *Proteocephalus loennbergii*, which has been reported from *N. maculosus* in southeast Wisconsin (Coggins and Sajdak 1982. Proc. Helminthol. Soc. Washington 49:99–102), but identification to species was precluded by the use of ethanol to preserve the mudpuppy. Their presence permits the inference that, in addition to *N. maculosus*, the parasite and the crustacean host for its procercoid larvae were also able to colonize the upper Bad River system prior to the establishment of Copper Falls.

Submitted by **PHILIP A. COCHRAN**, Biology Department, Saint Mary's University, Winona, Minnesota 55987, USA; **JOHN LYONS**, Wisconsin Department of Natural Resources, 1350 Femrite Drive, Monona, Wisconsin 53716, USA; and **MATTHEW G. BOLEK**, School of Biological Sciences, University of Nebraska–Lincoln, Lincoln, Nebraska 68588.

PLETHODON IDAHOENSIS (Coeur d 'Alene Salamander). USA: MONTANA: Ravalli Co: Lake Como Falls (UTM Zone 11, E709158, N5102643, 1305 m elev). 10 October 2001. Bryce A. Maxell. Idaho State Museum of Natural History (IMNH) 1919: 47.5 mm SVL, 93 mm TL; and IMNH 1920: 41 mm SVL, 80 mm TL). Verified by Charles R. Peterson. This record extends the known range ca. 45 km south and 60 km east of the nearest known localities in Montana and Idaho, respectively (Wilson et al. 1997. Great Basin Nat. 57[4]:359–362). Both individuals were found at 1720 h at 5°C under moss-covered cobble in a waterfall spray zone. The locality is within the geographic area predicted to have suitable climatic and geologic attributes and indicates that even more southerly localities in the Bitterroot River drainage are possible (Wilson and Larson 1998. Northwest Sci. 72[2]:111–115).

Submitted by **BRYCE A. MAXELL**, Wildlife Biology Program, University of Montana, Missoula, Montana 59812, USA; e-mail: nathist@selway.umt.edu.

PLETHODON SERRATUS (Southern Red-backed Salamander). USA: ARKANSAS: Hot Spring Co: 3.5 km S Oak Bower at DeGray Lake Resort State Park, Towering Pines Trail. 1 February 2002. C. T. McAllister. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26396–26402). Verified by Stanley E. Trauth. New county record (Trauth et al., in prep., The Amphibians and Reptiles of Arkansas). Specimens collected from shortleaf pine-oak habitat off north-central shore of DeGray Lake, a 1972 Corps of Engineer impoundment of the Caddo River in the Athens Piedmont Plateau subdivision of the Ouachita Mountains natural division.

Submitted by **CHRIS T. McALLISTER**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA; e-mail: chris.mcallister@tamut.edu.

ANURA

DERMATONOTUS MUELLERI (Mueller's Narrow-mouthed Frog) BRAZIL: GOIÁS: Municipality of Goiânia, Santa Rita Ranch (16°40'47"S, 49°20'04"W). 26 June 1999. D. Alves Lôbo. Centro de Estudos e Pesquisas Biológicas, Goiânia, Goiás: CEPB 373, adult female (SVL 77.1 mm); Municipality of Minaçu, Cana Brava (13°34'12"S, 48°06'52"W). 22 April 2000. I. França e Souza. CEPB/IFS 439–00, adult female (SVL 62.7 mm), and an adult male, CEPB/IFS 568–00 (SVL 55.8 mm). Verified by M. Trefaut Rodrigues. New state records (Cei 1980. Mon. Zool. Ital. [N.S.] Monogr. 2. 607 pp; Frost 1985. Amphibian Species of the World, Allen Press, Lawrence, Kansas, 732 pp; Norman and Naylor 1994. Amphibians and Reptiles of the Paraguaian Chaco, Vol. 1. 281 pp.).

Submitted by **HELDER LÚCIO RODRIGUES DA SILVA** (e-mail: hsilva@ucg.br), **NELSON JORGE DA SILVA JR.**, and **IVAN FRANÇA E SOUZA**, Laboratório de Herpetologia, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Ave. Universitária 1440, Setor Universitário, 74.605-010 - Goiânia, Goiás, Brazil.

ELEUTHERODACTYLUS BILINEATUS. (Two-lined Robber Frog). BRAZIL: BAHIA: Wenceslau Guimarães Municipality: Estação Ecológica Estadual de Nova Esperança (13°35'S, 39°43'W). 15 March 2000. B. V. S. Pimenta, P. H. C. Cordeiro, M. A. S. Silva, and E. V. Santos. Museu Nacional, Rio de Janeiro (MNRJ 26487–88). Jussari Municipality: Reserva Particular do Patrimônio Natural (RPPN) Serra do Teimoso (15°08'S, 39°31'W). 30 April 2000. B. V. S. Pimenta and P. H. C. Cordeiro. MNRJ 26489. Nilo Peçanha Municipality: Fazenda São João (13°42'S, 39°14'W). 6 September 2000. B. V. S. Pimenta and R. V. Lopes. MNRJ 26490–91. All verified by U. Caramaschi. All specimens were found in the leaf litter at night. Published distribution of this species was its type locality, at Itabuna Municipality, Bahia (Frost 2000. Amphibian Species of the World: An Online Reference. V2.20. American Museum of Natural History). These new records extend range ca. 102 km northward and ca. 24 km southward.

Submitted by **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net) and **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net), Instituto de Estudos Sócio-Ambientais do Sul da Bahia/Universidade Federal de Minas Gerais, Laboratório de Manejo de Fauna, D. Zool./ICB, 31270-901, Belo Horizonte, MG, Brazil.

HYLA ATLANTICA (NCN). BRAZIL: BAHIA: Nilo Peçanha Municipality: Fazenda São João (13°42'S, 39°14'W). 8 September 2000. B. V. S. Pimenta and R. V. Lopes. Museu de Ciências Naturais at Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte (MCN 2265). Camamu Municipality: Projeto de Assentamento Zumbi dos Palmares (14°01'S, 39°09'W). 11 December 2000. B. V. S. Pimenta and P. H. C. Cordeiro. MCN 2277. All verified by U. Caramaschi. This species was previously known only from its type locality, at Itabuna Municipality, Bahia (Frost 2000. Amphibian Species of the World: An Online Reference. V2.20. American Museum of Natural History). These records extend range ca. 102 km northward. Specimens were collected while calling on the margins of ponds at the borders of Atlantic Forest fragments.

Submitted by **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net) and **BRUNO V. S. PIMENTA** (brunopimenta@softhome.net), Instituto de Estudos Sócio-Ambientais do Sul da Bahia/Universidade Federal de Minas Gerais, Laboratório de Manejo de Fauna, D. Zool./ICB, 31270-901, Belo Horizonte, MG, Brazil.

HYLA CINEREA (Green Treefrog). USA: ARKANSAS: Perry Co.: (N34.98921° W092.76386°); NE1/4, SW1/4, Sec. 13, R17W, T4N; on Arkansas Hwy 300, 2 mi ENE jct of Arkansas Hwy 300 and Hwy 9, Harris Brake Wildlife Management Area. 22 October 2001. K. J. Irwin and L. K. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26451). Verified by Stan Trauth. AOR adult. First record for county (Trauth et al., in prep., The Amphibians and Reptiles of Arkansas).

Submitted by **LISA K. IRWIN**, U.S. Fish and Wildlife Service, 1500 Museum Road, Suite 105, Conway, Arkansas 72032, USA (e-mail: Lisa_Irwin@fws.gov), and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

HYLA FEMORALIS (Pine Woods Treefrog). USA: FLORIDA: Franklin Co: Dog Island, (N29.80651°, W084.58833°), ca. 150 m W of northern end of airfield. 31 December 2001. L. K. Irwin and K. J. Irwin. Sternberg Museum of Natural History, Ft. Hays State University, Hays, Kansas (MHP 6930). Verified by Travis Taggart. Adult found under log in slash pine-scrub forest. First record for Dog Island (Blaney 1971. Herpetologica 27:406–430).

Submitted by **LISA K. IRWIN**, U.S. Fish and Wildlife Service, 1500 Museum Road, Suite 105, Conway, Arkansas 72032, USA (e-mail: Lisa_Irwin@fws.gov) and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

HYLA PUNCTATA (Polkadot Treefrog): VENEZUELA: TACHIRA: Municipio Uribante: Campamento Siberia. Doradas River, 28 km S of Pregonero (7°46'N, 72°00'W), 950 m. 27 May 2001. Colección de Vertebrados, Facultad de Ciencias, Universidad de Los Andes, Mérida (CVULA–IV 6301). Verified by C. Barrio. First state record and highest elevation recorded for the species in the Venezuelan Andes. Previously known from four localities in Venezuela, two from the delta region of Amacuro, another from Bolívar (Hoogmoed 1979. Zool. Verh. 172:1–46; Barrio 1998. Acta Biol. Venezuelica 18[2]:1–93), and another from Barinas (Barrio et al. 2000. Herpetol. Rev. 31:50), all of which were within savannah lowlands below 600 m elevation.

Submitted by **ANDRES CHACÓN-ORTIZ, AMELIA DIAZ DE PASCUAL,** Facultad de Ciencias, Universidad de Los Andes, Venezuela (e-mail: aecortiz@yahoo.com, adiaz@ciens.ula.ve) and **FRANCISCO GODOY**, Desarrollo Uribante Caparo, filial de CADAFE, Táchira, Venezuela (e-mail: cuencaparo@telcel.net.ve).

HYLA VERSICOLOR (Gray Treefrog). CANADA: ONTARIO: Kenora District. Hwy 804, 0.3 km NE of Ontario Power Generation's Manitou Falls Generating Station (UTM Zone 15: N5603600m, E467800m). 8 May 1993. Wayne F. Weller and Ron Sheehan. Royal Ontario Museum (ROM 32576 [segment 3], audio cassette tape). Verified by Ross D. MacCulloch. Three or four individuals calling at 2200 h from cattail pond (fog and drizzle, air temperature 17°C). An observation of a live adult male on Hwy 804 was made 1 km E at 2355 h, but specimen was not retained. The documented northern range limit in Kenora District of northwestern Ontario is represented by specimens from (west to east) Malachi (UTM Zone 15: N5535000 m, E355000 m, ROM 9686 – August 1947), Kenora airport (UTM Zone 15: N5515900 m, E401600 m, JPB 24697 [J.P. Bogart, University of Guelph]– July 1995), Contact Bay in Wabigoon Lake (UTM Zone 15: N5505000 m, E515000 m, ROM 10049 – June 1963), and Butler (UTM Zone 15: N5479000 m, E581500 m, NMC 24517 – June 1983). Extends range 130 km NE of Malachi, and 110 km NW of Kenora airport. This record represents the northernmost record in Ontario.

Submitted by **WAYNE F. WELLER**, 250 Chercover Drive, Thunder Bay, Ontario P7G 1A2, Canada.

LEPTOLALAX TUBEROSUS. VIETNAM: QUANG NAM PROVINCE: Tra My District: Ngoc Linh Mountain Range (940 m, 15°11'41"N, 108°02'25"E). Nguyen Quang Truong. Verified by Robert F. Inger. AMNH A–163665. First provincial record for Quang Nam (Inger et al. 1999. Fieldiana Zool. 92:5–7, Fig. 2).

Submitted by **RAOUL BAIN**, Center for Biodiveristy and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA, and **NGUYEN QUANG TRUONG**, Department of Zoology, Institute of Ecology and Biological Resources Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

LITHODYTES LINEATUS (Sapito Listado). VENEZUELA: BOLÍVAR: Municipio Gran Sabana: Río Ourowapá, right bank of a tributary of the Río Cucurital (5°54'39"N, 62°44'23"W) and in forest on the right bank of the Río Cucurital, 500 m downstream from its confluence with the Río Purumay, 420 m elev. 1–6 April 2000. J. C. Señaris, C. Lasso, and R. Rivero. Museo de Historia Natural La Salle (MHNLS 14884, 14934). Verified by G. Rivas. In Venezuela, this species has been reported from some localities in the state of Amazonas, and Andean piedmont of the states of Trujillo, Táchira and Zulia (Ginés 1959. Mem. Soc. Cienc. Nat La Salle 19:85–146; Rivero 1961. Bull. Mus. Comp. Zool., 126:1–207; Lynch 1979, *In* W. E. Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution and Dispersal, pp. 189–215. Mus. Nat. Hist. Univ. Kansas Monogr. 7; McDiarmid and Paolillo 1988. *In* Brewer Carias [ed.], Cerro Neblina. Resultados de la

Expedición 1983–1987, pp. 667–670, Fudeci, Caracas; Barrio 1999. Herpetol. Rev. 30:50; Barros and Barrio 2001. Herpetol. Rev. 32:114–115). These new specimens, found among roots and leaf litter of *Phenakospernum* sp. (Musaceae), constitute the first documented record for the state of Bolívar, although a previous unvouchered report exists for La Hoyada, near El Paují, 100 km SSE of El Manteco (Barrio 1998. Act. Biol. Venez. 18[2]:1–93). The new locality is of interest because it fills a distributional gap within Venezuela for a frog also known to occur in Colombia, Guianas, Ecuador, Brazil, Peru, and Bolivia (La Marca 1992. Catálogo Taxonómico, Biogeográfico and Bibliográfico de las Ranas de Venezuela. Cuadernos Geográficos 9, Univ. Los Andes, Mérida, Venezuela).

Submitted by **J. CELSA SEÑARIS** Museo de Historia Natural La Salle, Apartado 1930, Caracas 1010-A, Venezuela (e-mail: celsa35@hotmail.com), **ENRIQUE LA MARCA** Laboratorio de Biogeografía, Escuela de Geografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Mérida, Venezuela 5101 (e-mail: lamarca1@telcel.net.ve), and **CÉSAR MOLINA** (Museo de Historia Natural La Salle (e-mail: washaema@hotmail.com).

RANA CATESBEIANA (Bullfrog). MÉXICO: MÉXICO: Municipio de Villa Guerrero: 5 km S Villa Guerrero (18°55'18"N, 99°38'00"W), 1990 m elev. 22 July 1999. X. Aguilar, R. Cruz, and G. Casas. Colección Nacional de Anfibios y Reptiles del Instituto de Biología, Universidad Nacional Autónoma (IBH 13292–294). Verified by Fausto R. Méndez de la Cruz. First record for the state (Camarillo-R and Smith 1992. *In* Strimple and Strimple [Eds], Contributions in Herpetology, pp. 39–41. Greater Cincinnati Herpetological Society; Casas et al. 1997. Anfibios y Reptiles, Lista Taxonómica de los Vertebrados Terrestres de Estado de México. Univ. Autón. Edo. México, Cienc. Tec. No. 32:9–53).

Submitted by **GUSTAVO CASAS-ANDREU**, Instituto de Biología, UNAM, Apdo. Post. 70–153, 04510 México, D.F., México (e-mail: gcasas@servidor.unam.mx); **RICARDO CRUZ-AVIÑA** and **XOCHITL AGUILAR MIGUEL**, Facultad de Ciencias Universidad Autónoma del Estado de México, Instituto Literario #100, 50000 Toluca, Estado de México, México.

RANA LUTEIVENTRIS (Columbia Spotted Frog). CANADA: YUKON TERRITORY: Bennett Lake, beaver pond on Partridge River tributary stream (60°01'27"N, 135°11'49"W). 18 July 2001. Bennett Lake, pond on south shore of West Arm (60°03'30"N, 134°58'18"W. 18 July 2001. Bennett Lake, Birch Pond on north shore of West Arm (60°04'47"N, 135°00'37"W). 17 July 2001. Collected by Brian G. Slough. Verified by David M. Green. Redpath Museum, McGill University, Montréal (3379, 3381–82). First specimens for the Yukon Territory, although reported from the first two locations (Mennell 1997. Herpetol. Conserv. 1:107–109).

BRITISH COLUMBIA: Pond near Deep Lake, Lindeman Creek drainage (59°46'00"N, 135°07'04"W). 26 June 2001. Photographs (collections limited in Chilkoot Trail National Historic Site by Parks Canada). Pond near Log Cabin, Tutshi River drainage (59°46'20"N, 134°56'00"W). 17 June 2001. Dan Johnson Lake, Lindeman Creek drainage (59°47'37"N, 135°02'31"W). 26 June 2001. Hoboe Creek wetland, Willison Bay, Atlin Lake (59°15'08"N, 134°06'03"W). 12 July 2001. Pond near Lang Lake (59°12'43"N, 129°44' 31" W). 22 July 2001. Collected by Brian G. Slough. Verified by David M. Green. Redpath Museum, McGill University, Montréal (3788, 3376, 3378, 3377, 3380). Royal British Columbia Museum specimens 1394 and 1395 were reportedly collected at the Tutshi River (59°46'N, 135°55'W) (Ovaska 1999. Status Report on the Columbia Spotted Frog, *Rana luteiventris* in Canada, Committee on the Status of Endangered Wildlife in Canada. 38 pp.), however the Tutshi River is at longitude 134°55'W. The Lang Lake location is 5 km north of the Simmons Lake reported by Ovaska (*ibid.*) (National Museum of Canada specimen 19475) (58°53'N, 129°46'W), however Simmons Lake is at latitude 59°11'N.

Submitted by **BRIAN G. SLOUGH**, Yukon Coordinator, Canadian Amphibian Reptile and Conservation Network, 35 Cronkhite Road, Whitehorse, Yukon Territory, Y1A 5S9, Canada; e-mail: bslough@yknet.yk.ca.

RHACOPHORUS ORLOVI (Orlov's Tree Frog). VIETNAM: QUANG BINH: Phong Nha - Ke Bang (17°01–34'N, 106°15–18'E). 27 August to 1 September 2001. Thomas Ziegler, Hans-Werner Herrmann, and Vu Ngoc Thanh. Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK 75798–75803). VIETNAM: NINH BINH: Cuc Phuong. April 1998. Roland Männel. Staatliche Naturhistorische Sammlungen Dresden, Museum für Tierkunde (MTKD 40764). All verified by Wolfgang Böhme. *Rhacophorus orlovi* was recently described from the South of Ha Tinh Province (18°00–06'N, 105°58'–106°06'E) in Vietnam (Ziegler and Köhler 2001. Sauria 23:37–46). The new findings from Phong Nha - Ke Bang near the Laotian border in Quang Binh Province, which borders Ha Tinh Province in the north, represent the first provincial record and the southernmost record of the species (Ziegler and Herrmann 2000. Biogeographica 76:49–62). The specimen from Cuc Phuong represents the first record for Ninh Binh Province, being separated from the type locality in Ha Tinh Province by the northern Provinces of Nghe Anh and Thanh Hoa, thus also being the northernmost record of the species. The *R. orlovi* specimen from Cuc Phuong is a juvenile (SVL 24 mm), the specimens from Phong Nha - Ke Bang are subadults and adults. The latter include the largest known female (ZFMK 75800, SVL 52.5 mm) and male (ZFMK 75802, SVL 39.2 mm) of the species.

Submitted by **THOMAS ZIEGLER**, Staatliche Naturhistorische Sammlungen Dresden, Museum für Tierkunde, A. B. Meyer Bau, Königsbrücker Landstraße 159, D-01109 Dresden, Germany; present address: Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany (e-mail: dr.th.ziegler@t-online.de), **HANS-WERNER HERRMANN**, Zoologischer Garten Köln, Riehler Straße 173, D-50735 Köln, Germany, and **JÖRN KÖHLER**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

GYMNOPHIONA

SIPHONOPS PAULENSIS. BRAZIL: GOIÁS: Municipality of Minaçu. 12 November 1996. M. Cândido da Costa. Centro de Estudos e Pesquisas Biológicas, Goiânia, Goiás: CEPB 4881 (SVL 139.5 mm; body weight 26.0 g). Collected at a cerradão habitat in

a Cerrado Vegetational Domain, on the left bank (W) of Tocantins River (14°00'30"S, 48°24'53"W). Verified by M. Wilkinson. *Siphonops paulensis* Boetger 1892, was reported to be present at eastern, southeastern, and southern portions of the Atlantic Forest, (Lynch 1979. *In* W. E. Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution, and Dispersal, pp. 189–215. Univ. Kansas Mus. Nat. Hist. Monogr. 7; Frost 1985. Amphibian Species of the World, Allen Press, Lawrence, Kansas. 732 pp.; Duellman 1999. *In* W. E. Duellman [ed.], Patterns of Distribution of Amphibians: A Global Perspective, pp. 255–328. Johns Hopkins Univ. Press, Baltimore, Maryland) and southern Brazil (Cei 1980. Mon. Zool. Ital. [N. S.], Monogr. 2, 607 pp). In recent studies this taxon was mentioned as being present beyond the Atlantic Forest domain (Kokubum and Menin 2001. Herpetol. Rev. 32:53) at the Municipality of Brasília - DF, Brazil, but the authors did not offer any additional data about the specimen. This is the first record of *S. paulensis* in the state of Goiás, extending its geographic distribution up to 580 km (E) from previously known range (Kokubum and Menin, *op. cit.*).

Submitted by **IVAN FRANÇA E SOUZA** (e-mail: souzai@terra.com.br), **HÉLDER LÚCIO RODRIGUES SILVA** and **NELSON JORGE DA SILVA JR.**, Laboratório de Herpetologia, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Ave. Universitária, 1440, Setor Universitário, 74.210-010, Goiânia, Goiás, Brazil.

TESTUDINES

CLEMMYS MARMORATA (Pacific Pond Turtle) USA: CALIFORNIA: Plumas Co: Greenhorn Creek east of Quincy. A sub-adult was observed on 12 August 2001 basking on a log along Greenhorn Creek (678029 N, 4426072 E, 1021 m) (CAS PC 48.150, photo voucher). Verified by Jens Vindum. This is the first known occurrence of *C. marmorata* in Plumas County (Jennings and Hayes 1994. Amphibian and Reptile Species of Special Concern in California. California Department of Fish and Game. Sacramento, California; Koo and Vindum 1999. Amphibians and Reptiles of the Plumas National Forest: Historical Collections and California Academy of Sciences 1998 and 1999. Unpubl. report on file, Department of Herpetology, California Academy of Sciences. San Francisco, California).

Submitted by **PIERRE FIDENCI**, 735 Balboa Street #4, San Francisco, California 94118, USA; e-mail: pfidenci@garciaandassociates.com.

EMYS ORBICULARIS (European Pond Turtle). TURKEY: ICEL: In the moat of Mamure Kalesi (a castle; 36°04'54.42"N, 32°53'42.84"E), Anamur. Discovered at sunset on 10 June 2000 by the authors. MVZ 233303 (photographic voucher). Verified by Jim Buskirk and Ted Papenfuss. First record for Icel Province, Turkey. The nearest reported locality of *E. orbicularis* is Finike, Antalya Province and Seydisehir, Konya Province (both ~200 km away). The distribution of *E. orbicularis* in Turkey is given by Basoglu and Baran (1977. Ege Univ. Fen Fak. Kit. Ser. 76:1–272) and Fritz (1989. Salamandra 25:143–168). This record, along with Finike and Hatay Province, is only the third locality for *Emys* on the Mediterranean coast of Turkey. This record lies in the middle of a gap in the range of *E. orbicularis*. We saw two individuals, but only photographed one. We also observed several dozen *Mauremys caspica rivulata*. *M. caspica* is reported for Icel province, but not from the Anamur region (reported from Silfke and Mersin, >100 km E; Basoglu and Baran, *op. cit.*). The presence of a single, non-endemic turtle (*Trachemys scripta elegans*) in the moat raises the possibility that the *Emys* were introduced, however a natural presence in the Anamur region is very plausible.

Submitted by **JAMES FORD PARHAM**, Department of Integrative Biology, University of California, Berkeley, California 94720-3140, USA (e-mail: Parham@socrates.berkeley.edu), and **TONYA VAN LEUVAN**, Institute of Human Origins, Arizona State University, PO Box 874101, Tempe, Arizona 85287-4101, USA.

HYDROMEDUSA MAXIMILIANI (NCN). BRAZIL: BAHIA: Municipality of Elisio Medrado, Jequitibá Reserve (12°52'S, 39°28'W, 700 m). 8 August 1999. M. A. Freitas, C. Moura, and E. Moraes. Museu de Zoologia da Universidade Estadual de Santa Cruz, Ilhéus, Bahia (MZUESC 107). Municipality of Jussari, São José farm (15°11'S, 39°24'W, 500 m). 10 May–26 June 2001. Collector unknown (MZUESC 1235). Municipality of Boa Nova, Boa Esperança farm (14°19'S, 40°05'W, 730 m). 1 July–12 September 2001. Collector unknown. (MZUESC 1774). Municipality of Barra do Choça, Recanto da Adriana farm (14°57'S, 40°33'W, 850 m). 1–30 September 2001. J. O. Ruas. (MZUESC 2019). Municipality of Pau Brasil, Pratinha farm (15°23'S, 39°35'W, 530 m). 15 November 2001. Collector unknown. (MZUESC 2107). All specimens verified by Miguel Trefaut Rodrigues. The range of this species was previously considered restricted to the states of Espírito Santo, Rio de Janeiro, and São Paulo, Brazil (Ernst and Barbour 1989. Turtles of the World. Smithsonian Inst. Press, Washington, D.C., and London. xii + 313 pp.). These records extend the known distribution of this species at least 600 km north.

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz–UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil (e-mail: lachesis@uesc.br), and **MARCO ANTÔNIO DE FREITAS**, Rua E quadra D lote 11, Jardim Aeroporto, CEP 42700-000, Lauro de Freitas, Bahia, Brazil (e-mail: philodryas@hotmail.com).

KINOSTERNON HERRERAI (Herrera's Mud Turtle). MÉXICO: MÉXICO: Municipality of Temascaltepec, El Tule, on the bank of Temascaltepec River (19°00'N, 100°05'W), 1520 m elev. 17 May 1999. Vicente Mata-Silva and Martín Paredes-Flores. Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos, FES-Iztacala, Universidad Nacional Autónoma de México (VMS 235). Verified by Edmundo Pérez-Ramos. First record for the state of México (Camarillo-R and Smith 1992, *In* Strimple and Strimple [eds.], Contributions in Herpetology, pp. 39–41. Greater Cincinnati Herpetol. Soc., Cincinnati, Ohio. viii + 111 pp.). Closest record for this species is from the Gulf lowlands in the state of Hidalgo (Iverson 1992. A Revised Checklist with Distribution Maps of the Turtles of the World. Privately printed, Richmond, Indiana. viii + 363 pp.).

Submitted by **VICINTE MATA-SILVA, AURELIO RAMIREZ-BAUTISTA** (e-mail: raurelio@servidor.unam.mx), **MARTIN PAREDES-FLORES**, and **MANUEL ESPINO-OCAMPO**, Laboratorio de Ecología, UBIPRO, Facultad de

Estudios Superiores-Iztacala, UNAM, Apdo. Post. 314, Avenida de Los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México.

LACERTILIA

ANOLIS DISTICHUS (Bark Anole). USA: FLORIDA: MONROE COUNTY: Florida Keys: Long Key: Keys Marine Laboratory (KML) in Layton, US1 mile marker 68.5. 20 September 2001. Todd Campbell. Verified by Kenneth Krysko. UF 129704. One male collected (55 mm SVL; 3.6 g); another male and two females seen in mangroves near the KML boat ramp. Long Key record. This introduced species was first recorded from Monroe County in Key West in 1977 (Lazell 1989. Wildlife of the Florida Keys. Island Press, Washington D.C. 254 pp.). Also recorded from US1 mile marker 110 on Cross Key in 1983 (UF 121939), and in Marathon, Vaca Key in 1994 (Watkins-Colwell and Watkins-Colwell 1995. Herpetol, Rev. 26:44).

Submitted by **TODD S. CAMPBELL**, Institute for Biological Invasions, Department of Ecology and Evolutionary Biology, 569 Dabney Hall, University of Tennessee, Knoxville, Tennessee 37996, USA, and **KYM ROUSE CAMPBELL**, The Cadmus Group, Inc., 78A Mitchell Road, Oak Ridge, Tennessee 37830, USA.

AMPHISBAENA FULIGINOSA FULIGINOSA. BRAZIL: AMAZONAS: TEFÉ (02°42'04.8" S, 64°37'05.9" W), Boa Vista, Amanã Sustainable Development Reserve, Municipality of Tefé. 01 February 2001. Miguel de La Torre Loranca. Instituto Nacional de Pesquisas da Amazônia - INPA, Coleção de Anfíbios e Répteis (INPA 9531). Verified by Tânia Sanaiotti. Adult captured in pitfall trap in secondary forest. This specimen represents the first record for this subspecies in Amazonas State, in northern Brazil. The record enlarges the know distribution to more than 1400 km from Paramaribo, Suriname (Vanzolini 1951. Bull. Mus. Comp. Zool. 106:1–65).

Submitted by **HIPÓCRATES DE MENEZES CHALKIDIS** (e-mail: chalkidis@bol.com.br), **ANA CRISTINA CORDEIRO-DUARTE** (e-mail: cristina@inpa.gov.br.), and **RICHARD C. VOGT** (e-mail: vogt@inpa.gov.br), Instituto Nacional de Pesquisas da Amazônia - INPA, Coleção de Anfíbios e Répteis, Av. André Araujo, No. 2936, C.P. 478, Manaus, Amazonas, Brazil, CEP: 69.083-000.

HEMIDACTYLUS LEIGHTONI (House Gecko). VENEZUELA: ZULIA: Sinamaica, 11°05'N, 71°57'W. 15–16 July 2000. A. Mijares-Urrutia, J. Manzanilla, and R. Rivero. Museo de Historia Natural La Salle, Caracas (MHNLS 15574) and Museo de la Estación Biológica de Rancho Grande, Maracay (EBRG 3786). Verified by C. Molina. First record for Venezuela and easternmost locality for this species (Powell and Maxey 1990. Cat. Amer. Amph. Rept. 493:1–3, as *Hemidactylus brookii leightoni*). Boulenger (1911. Ann. Mag. Nat. Hist. London, sér. 8, 7[3]:19) described *H. leightoni* from Colombia. Kluge (1969. Misc. Publ. Mus. Zool. Univ. Michigan 138:1–78) treated this taxon as a subspecies of *H. brookii*, restricted it to a region extending from the northwestern coast to the central highlands of Colombia, and mentioned that it could be present in western Venezuela. Powell and Maxey (*op. cit.*) listed six subspecies for *H. brookii*, of which two, *H. b. leightoni* and *H. b. haitianus*, occur in America and the Caribbean. Subsequently, Powell et al. (1996. *In* Powell and Henderson [eds.], Contributions to West Indian Herpetology: A Tribute to Albert Schwartz, pp. 51–93. Contr. Herpetol. 12) elevated *H. haitianus* to a full species (see also Powell 1993. Herpetol. Rev 24: 35–137; Powell and Parmerlee. 1993. Dactylus 2:54–55). Likewise, R. Powell (*in litt.*) suggested that *H. leightoni* is distinct from *H. brookii* and *H. haitianus* and recommended that it be considered a full species; consequently restricting *H. brookii* to the Eastern Hemisphere (Rivas et al. 2002. Herpetofauna 23[134]:5–8).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado Postal 1930, Caracas 1010-A, Venezuela; e-mail: anolis30@hotmail.com.

HEMIDACTYLUS MABOUIA (Amerafrican House Gecko). BRITISH WEST INDIES: Grand Cayman Island: Bodden Town District, Newlands (exterior walls of a house). 12 November 2001. A. C. Echternacht. Verified by R. Powell and S. B. Hedges. Bobby Witcher Memorial Collection (BWMC), Avila College, 06821–22 (gravid adult females). First observed at the site on 24 August 2001 (a minimum of 10 individuals representing both sexes, neonates to adults). This is the first record of the genus and species in the Cayman Islands (Powell et al. 1998. Cat. Amer. Amphib. Rept. 674:1–11).

Submitted by **A. C. ECHTERNACHT**, Department of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, Tennessee 37996-1610, USA (e-mail: echterna@utk.edu), and **F. J. BURTON**, P.O. Box 10308 APO, Grand Cayman, Cayman Islands, British West Indies.

LEIOCEPHALUS CARINATUS ARMOURI (Little Bahama Curly-tailed Lizard). USA: FLORIDA:BREVARD CO: Cocoa Beach, at NE corner of Orlando Ave (Hwy A1A southbound) and S 7th Street. 15 January 2002. K. L. Krysko, F. Wayne King, and Terry Taylor. Verified by Max A. Nickerson. Florida Museum of Natural History, University of Florida (UF 129550). New county record and extends the species range north ca. 158 km of the previous most northern locality along the eastern coast of Florida (Hauge and Butterfield 2000. Herpetol. Rev. 31:53). Additionally, there are four unreported specimens that were collected from the same vicinity: MCZ R–176773–74 collected on 11 January 1991 and AMNH R–3 collected on 1 October 1991. Our specimen provides evidence that this species has been established on Cocoa Beach for more than a decade.

Submitted by **KENNETH L. KRYSKO** (e-mail: kenneyk@flmnh.ufl.edu) and **F. WAYNE KING** (e-mail: kaiman@flmnh.ufl.edu), Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA.

SCINCELLA LATERALIS (Little Brown Skink). USA: FLORIDA: FRANKLIN CO: Dog Island, (N29.80573°, W084.58541°), Dog Island airfield. 31 December 2001. L. K. Irwin and K. J. Irwin. Sternberg Museum of Natural History, Ft. Hays State University, Hays, Kansas (MHP 6942). Verified by Travis Taggart. Adult found under debris along margin of sod runway. First record for Dog Island (Blaney 1971. Herpetologica 27:406–430).

Submitted by **LISA K. IRWIN**, U.S. Fish and Wildlife Service, 1500 Museum Road, Suite 105, Conway, Arkansas 72032, USA (e-mail: Lisa_Irwin@fws.gov) and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

SPHENOMORPHUS TERSUS. MALAYSIA: PENINSULAR MALAYSIA: Selangor; Kepong, Forest Research Institute Malaysia, Sungei Kroh waterfalls; among boulders adjacent to main stream (3°14'N, 101°38'E), ca. 100 m elev. 27 February 2001. Tzi Ming Leong. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.2.4915, adult female, SVL 70.5 mm, total length 197.7 mm). Verified by Kelvin K. P. Lim. New country record and southerly range extension. Previously known from south Thailand (Khao Wang Hip in Nakhon Sri Thamarat, and Pak Chan estuary at Tasan - Isthmus of Kra) (Smith 1930. Bull. Raffles Mus. 3:1–149). This represents the twelfth species of the genus *Sphenomorphus* known to occur in Peninsular Malaysia (Denzer and Manthey 1991. Raffles Bull. Zool. 39[2]:309–322).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg), **NORSHAM SUHAINA YAAKOB**, Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia, and **INDRANEIL DAS**, Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.

TROPIDURUS TORQUATUS (Calango). BRAZIL: RIO GRANDE DO SUL: Municipality of Machadinho. 17 September 2001. A. Tomas França. Left bank (S) of Uruguai River (27°34'04"S, 51°35'15"W). Centro de Estudos e Pesquisas Biológicas, Goiânia - GO (CEPB/NAT 977; SVL 240.6 mm). Verified by M. Trefaut Rodrigues. *Tropidurus torquatus* (Wied, 1820) is a widespread species in central, southeastern (Hoogmoed 1979. *In* Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution, and Dispersal, pp. 241–279; Giaretta 1996. Herpetol. Rev. 27:80–81) and southern Brazil (Rodrigues 1987. Arq. Zool. S. Paulo 31[3]:105–203). A single record (two specimens) was obtained from the extreme southern portion of the State of Rio Grande do Sul (Lema and Fabián-Buermann 1977. Iheringia, Sér. Zool. Porto Alegre [50]:61–92). Our specimen confirms the presence of *T. torquatus* in southern Brazil, and extends its range 500 km northward.

We thank the staff of NATURAE - Projetos e Consultoria Ambiental Ltda. at the Cotiara Faunal Rescue Operation for help during fieldwork.

Submitted by **IVAN FRANÇA E SOUZA** (e-mail: souzai@terra.com.br), **WILIAN VAZ SILVA** and **NELSON JORGE DA SILVA JR.** Laboratório de Herpetologia, Centro de Estudos e Peaquisas Biológicas, Universidade Católica de Goiás, Ave. Universitária 1440, Setor Universitário, 74.210-010, Goiânia, Goiás, Brazil.

SERPENTES

AGKISTRODON CONTORTRIX (Copperhead). USA: ARKANSAS: Phillips Co.: (N34.61422°, W090.61646°); SW 1/4, SE 1/4, Sec 7, T1S, R5E; ca. 100 m S of intersection of Phillips Co. roads 211 and 239; St. Francis National Forest. 19 October 2001. K. J. Irwin and L. K. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26447). Verified by Stan Trauth. DOR adult female in bottomland hardwood/cypress-tupelo gum forest. First record for county (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us), and **LISA K. IRWIN**, U.S. Fish and Wildlife Service, 1500 Museum Road, Suite 105, Conway, Arkansas 72032, USA (e-mail: Lisa_Irwin@fws.gov).

CROTALUS TIGRIS (Tiger Rattlesnake). USA: ARIZONA: Santa Cruz Co: Atascosa Mts.: Atascosa Canyon, SW 1/4 of SW 1/4 Sec 18, T23S, R12E, Coronado National Forest. 16 July 1999. J. M. Howland. UAZ 53662–PSV. Pajarito Mts.: 6.7 mi (by Ruby Road) WSW Interstate Hwy 19 (31°22.75'N, 111°03.64'W). 25 July 2001. E. F. Enderson, R. L. Bezy. UAZ 53674. Tumacacori Mts., Tubac, 49 Guadalupe Road, W of Interstate Hwy 19. 9 August 1998. Shirley Titcomb. UAZ 51528. Pima Co: Altar Valley, Buenos Aires National Wildlife Refuge, 10.9 mi E of Hwy 286 on Arivaca Road. 23 July 2001. B. H. Sigafus, M. L. Sigafus. UAZ 53554. Verified by G. L. Bradley. Records fill a gap in the range in southern Arizona (as mapped by Lowe et al. 1986. The Venomous Reptiles of Arizona. Arizona Game and Fish Department, Phoenix. ix+115 pp.) between the Santa Rita, Sierrita, and Baboquivari Mts. (Klauber 1956. Rattlesnakes. Volume 1. Univ. California Press, Berkeley. xxix +708 pp.) and tend to substantiate an undocumented record for "Bear Canyon, 4 mi. N. of Mexican Border, Santa Cruz Co." [? = Bear Valley, Atascosa Mts] (Fowlie 1965. The Snakes of Arizona. Azul Quinta Press, Fallbrook, California. lv+164 pp.).

Submitted by **JEFFREY M. HOWLAND**, U.S. Fish and Wildlife Service, Santa Ana National Wildlife Refuge, Route 2 Box 202A, Alamo, Texas 78516, USA, **ERIK F. ENDERSON**, 3234 East Patricia, Tucson, Arizona 85716, USA, **ROBERT L. BEZY**, Section of Herpetology, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA, **BRENT H. SIGAFUS**, School of Renewable Resources, University of Arizona, Tucson, Arizona 85721, USA, and **ALLISON TITCOMB**, 1811 North Hitching Post Road, Tucson, Arizona 85745, USA.

HETERODON NASICUS (Western Hog-nosed Snake). USA: TEXAS: Crane Co: 34.6 km E of Iraan on US Highway 190. July 1997. Mike Price. Verified by James M. Mueller. SRSU R–6541. New county record (Dixon 2000. Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ROBERT H. HIBBITTS** and **ROBERT W. BRYSON, JR.** Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA.

LAMPROPELTIS GETULA SPLENDIDA (Desert Kingsnake). USA: TEXAS: Crane Co: Crane County Golf Course. May 1991. Mike Price. Verified by James M. Mueller. SRSU R–6543, R–6555. New county record (Dixon 2000. Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ROBERT H. HIBBITTS** and **ROBERT W.**

BRYSON, JR., Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA.

LYSTROPHIS NATTERERI (NCN): BRAZIL: BAHIA: Municipality of Rio de Contas, Vaccaro farm (13°32'S, 41°52'W, 1200 m). 1 April 2000–25 May 2001. Collector unknown. Museu de Zoologia da Universidade Estadual de Santa Cruz, Ilhéus, Bahia (MZUESC 1172). Vicinity of the city of Rio de Contas (13°34'S, 41°48'W, 1050 m) 15–20 May 2001. Collector unknown. MZUESC 1188. Specimens were captured by different collectors and the precise dates of capture are unknown. Dates indicate periods between visits to the farms. Both verified by Miguel Trefaut Rodrigues. Species is known from states of Piauí, Goiás, Mato Grosso do Sul, São Paulo, and Paraná, Brazil, between 45° and 55° W (Hoge et al. 1975. Mem. Inst. Butantan 39:37–50). These records extend the range of *L. nattereri* nearly 280 km in relation to 45°W and represent the new easternmost limit of this taxon.

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz - UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil; e-mail: lachesis@uesc.br.

NERODIA FASCIATA CONFLUENS (Broad-banded Watersnake). USA: ARKANSAS: Perry Co.: NE1/4, Sec 7, T4N, R16W; 2.4 road miles NNE of intersection of Arkansas Hwy 300 and Hwy 216 on Hwy 216. 24 May 2001. K. J. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26439). Verified by Stan Trauth. DOR adult male. First record for county and fills hiatus between Saline County to the south and the most northwesterly record in the state in Conway County (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **KELLY J. IRWIN**, Arkansas Game & Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA; e-mail: kirwin@agfc.state.ar.us.

NERODIA FASCIATA FASCIATA (Banded Watersnake). USA: CALIFORNIA: Sacramento Co: 100 m SE of intersection of Riley Street and Blue Ravine Road (38°39'35"N, 121°09'30"W). June 2000. Peter S. Balfour and Eric W. Stitt. California Academy of Sciences (CAS 215207–215214). Verified by Robin Lawson (CAS) and Rhonda Lucas (CAS). This introduced population was originally discovered by the senior author (PSB) in 1992. The accessioned specimens were collected from a constructed pond and adjacent watershed. Twenty-seven additional captured individuals (many provided by the California Department of Fish and Game) have ranged in length between 63.5 and 130 cm. Seventeen females were dissected and found to contain between 12 and 55 developing ova (mean = 24). Several additional individuals, of all size classes, have been observed prior to and since this collection. This subspecies is native to southern Alabama, northeast through North Carolina (Conant and Collins 1991. Reptiles and Amphibians of Eastern/Central North America. Houghton Mifflin Co., Boston, Massachusetts, 450 pp.).

Submitted by **PETER S. BALFOUR**, ECORP Consulting, Inc., 2260 Douglas Blvd., Suite 160, Roseville, California, 95661, USA (e-mail: pbalfour@ecorpconsulting.com), and **ERIC W. STITT**, University of Arizona, School of Renewable Natural Resources, 125 Biological Sciences East, Tucson, Arizona, 85721, USA (e-mail: estitt@u.arizona.edu).

NERODIA RHOMBIFER (Diamond-backed Watersnake). USA: ARKANSAS: Perry Co.: SE1/4, SW1/4, Sec 22, T4N, R17W; on Arkansas Hwy 9. 22 October 2001. K. J. Irwin and L. K. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26450). Verified by Stan Trauth. DOR adult female. First record for county (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **KELLY J. IRWIN**, Arkansas Game & Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us), and **LISA K. IRWIN**, U.S. Fish & Wildlife Service, 1500 Museum Road, Suite 105, Conway, Arkansas 72032, USA (e-mail: Lisa_Irwin@fws.gov).

OXYRHOPUS DOLIATUS (False Coralsnake). VENEZUELA: CARABOBO: Bahía de Patanemo, 10 m. 15 July 1974 Daniel Loureiro. Museo de Historia Natural La Salle, Caracas (MHNLS 6190). First state record (Lancini and Kornacker 1989. Die Schlangen von Venezuela. Verlag Armitano, Caracas, 381 pp.; Manzanilla et al. 1996. Acta Científica Venezolana 47:191–204; Roze 1966. La Taxonomía y Zoogeografía de los Ofidios en Venezuela. Univ. Central de Venezuela. Edic. Biblioteca, Caracas, 362 pp.). VARGAS: Suapo, Hacienda El Limón, 180 m. 20 December 1968. José M. Peláez (MHNLS 4338). First state record (Roze, *op. cit.*; Lancini and Kornacker, *op. cit.*; Manzanilla et al., *op. cit.*). YARACUY: Quebrada El Charal, ca. 12 km NNW de Aroa, 500 m. 12 April 1994. Ramón Rivero. Ministerio del Ambiente y de los Recursos Naturales, Museo de la Estación Biológica de Rancho Grande, El Limón (EBRG 2941, male). First state record and south-westernmost records for the species in the Venezuelan coastal range (Roze, *op. cit.*; Lancini and Kornacker, *op. cit.*; Manzanilla et al., *op. cit.*). Specimens verified by C. R. Molina. Until recently, the species was known as *O. venezuelanus*, now recognized as a synonym of *O. doliatus* (Zaher and Caramaschi 2000. Dumerilia 4[2]:113–122).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado Postal 1930, Caracas 1010-A, Venezuela; e-mail: anolis30@hotmail.com.

RACHIDELUS BRAZILI. Brazil: Goiás: Município de São João da Aliança: Jatobazinho (11°26'S 46°38'W). March–April 1956. Collected during the Machris expedition of the Los Angeles County Museum and Museu Nacional, Rio de Janeiro, Brazil (MNRJ 3235, adult male SVL 673 mm, TL 153 mm). Verified by R. Fernandes. First state record, extends the known distribution 1350 km north from the city of São Paulo (Peters and Orejas-Miranda 1970. Catalogue of the Neotropical Squamata: Part I. Snakes. U.S. Natl. Mus. Bull. 297:1–346).

Submitted by **DANIEL S. FERNANDES** (e-mail: danfer@acd.ufrj.br) and **PAULO PASSOS** (e-mail ppassos@mn.ufrj.br), Departamento de Vertebrados, Museu Nacional. Universidade Federal do Rio de Janeiro, Quinta da Boa Vista s/n, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

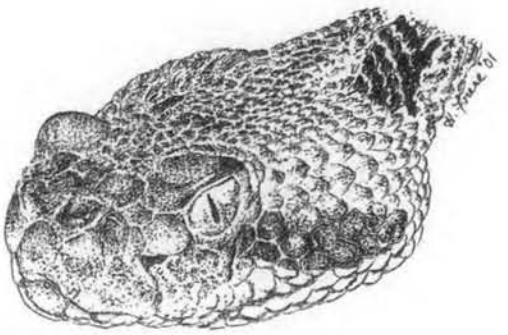
RAMPHOTYPHLOPS BRAMINUS (Brahminy Blindsnake). USA: VIRGINIA: Newport News, apartment complex at 21st Street and Jefferson Avenue. Eight individuals were seen in the kitchens and back porches of two adjoining apartments; five specimens (USNM 546147–546151) were collected from one apartment.

USNM 546147 (5.5 cm TL) collected alive in kitchen by William Lopez on 27 Sept. 2000. USNM 546148 (6.4 cm TL) collected under a rubber doormat on the back porch on 29 Sept. 2000 by Barbara A. Savitzky and Robert T. Belcher. USNM 546149 (7.5 cm. TL) and 546150 (6.9 cm TL) collected under wood and cardboard debris on the porch together with a dead, desiccated specimen (USNM 546151) on the porch pavement, all by Irene Brumley on 9 November 2000. Verified by Van Wallach (Museum of Comparative Zoology, Harvard University). Wallach noted that all specimens are subadults and difficult to sex; snout scalation is slightly aberrant, but head and body scalation are consistent with *R. braminus*. First record for the state of Virginia and mid-Atlantic coast; third record for mainland USA outside of Florida. First Florida record was in coastal Dade Co. in 1983 (Wilson and Porras 1983. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9:1–89), although several Florida populations are now known (Ernst and Brown 2000. Herpetol. Rev. 31:256). Outside of Florida, the other two mainland US localities, New Orleans, Louisiana (Thomas 1994. Herpetol. Rev. 25:34 and Boston, Massachusetts (Wallach et al. 1991. Herpetol. Rev. 22:68 and Jones et al. 1995. Herpetol. Rev. 26:210–211) are coastal ports, as is Newport News. The site is <0.25 km from an international shipping terminal.

Submitted by **BARBARA A. SAVITZKY,** Department of Biology, Chemistry, and Environmental Science, Christopher Newport University, Newport News, Virginia 23606, USA (e-mail: bsavitz@cnu.edu); **ALAN H. SAVITZKY**, Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529, USA (e-mail: asavitzk@odu.edu); **ROBERT T. BELCHER**, Department of BCES, Christopher Newport University, Newport News, Virginia 23606, USA, and **SCOTT EWERS** Cooperative Extension Service of Virginia Polytechnic Institute and State University, Newport News, Virginia 23606, USA (e-mail: jsewers@vt.edu).

REGINA ALLENI (Striped Crayfish Snake). USA: GEORGIA: LOWNDES CO: Moody Air Force Base. Burma Road at south end of runway. 5 July 2001. John G. Palis. SIUC R–3758. Verified by J. G. Stewart. DOR adult. First record for county and westernmost for Georgia (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN G. PALIS**, P.O. Box 387, Jonesboro, Illinois 62952, USA.



Crotalus horridus (Timber Rattlesnake). Illustration by Heather Frese.

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New Amphibian and Reptile County Records from Logan County, Illinois, USA

MARIO D. GIAZZON
Department of Biological Sciences, Illinois State University
Campus Box 4120, Normal, Illinois 61790-4120, USA
e-mail: mdgiazz@ilstu.edu

Our early understanding of the geographic distribution of Illinois herpetofauna was largely due to the exhaustive work of Smith (1961). In the last decade, increased field work and examination of museum collections have led to the modification of Smith's work. Several contributions have filled distributional gaps of Illinois amphibians and reptiles at both regional (Markezich and Beckett 2001; Tucker 1994; Wilson 1999) and statewide (Petzing et al. 1998, 2000; Redmer and Ballard 1995) levels. Historically, some counties in Illinois seem to have harbored little herpetological interest and therefore have received very limited organized field work. As a consequence, many species in these counties have not been documented. Logan County is an example of such a county, most likely because 93% of its land is comprised of privately owned cropland and grassland (Illinois Department of Natural Resources 1996). I conducted a survey of the amphibians and reptiles in Logan County from March to August 2001, which resulted in four updated county records and eight new county records.

Previous collection efforts in Logan County have documented six species of amphibians and eight species of reptiles (Phillips et al. 1999). Most of these records are vouchered by only a few specimens, many of which are over 30 years old. One of the goals of this survey was to determine if these species were still present (updated county records) and if some were yet unrecorded (new county records). Updated county records are worth noting because not only do they determine if a species is still present in an area, but they also allow for investigation of possible range extensions within a county. For the purposes of this paper, an updated county record will be defined as a species that has not been documented in Logan County for at least a period of twenty years, a standard adopted by Phillips et al. (1999). Updated county records were determined by accessing museum collection records from the Field Museum of Natural History (FMNH), Chicago, Illinois; the Illinois Natural History Survey (INHS), Champaign, Illinois; the University of Illinois Museum of Natural History (UIMNH), Champaign, Illinois; and the University of Michigan Museum of Zoology (UMMZ), Ann Arbor, Michigan. The specimen catalog number and the year of the most recent voucher specimen have been included for updated county records. New county records were verified by checking the Illinois Herpetological Vouchered Database, which contains data from thirty U.S. collections. A web page developed from this database can be accessed at <http://www.inhs.uiuc.edu/cbd/collections/AmphReptColln/herps.html>. Voucher specimens of new county records were verified by Christopher A. Phillips and deposited at the Illinois Natural History Survey (INHS) in Champaign, Illinois.

Ambystoma texanum. E of Middletown near Polecat Hill; 1.4 km W of int. Co. Rd. 350E and Co. Rd. 1300N (NW 1/4 NE 1/4 Sec. 16, T19N, R4W). 25 March 2001. M. D. Giazzon. INHS 17072.

New county record. Former stream bed of Salt Creek containing temporary pools, bordered to the east by deciduous forest. Four specimens were observed under a large rotten log approximately 8 m from the water's edge.

Pseudacris triseriata. E of Middletown near Polecat Hill; 1.4 km W of int. Co. Rd. 350E and Co. Rd. 1300N (NW 1/4 NE 1/4 Sec. 16, T19N, R4W). 25 March 2001. M. D. Giazzon. INHS 17075. New county record. Former stream bed of Salt Creek containing temporary pools, bordered to the east by deciduous forest. The specimen was found under a flat piece of rotten wood approximately 1 m from the water's edge.

Pseudacris crucifer. E of Middletown near Polecat Hill; 1.4 km W of int. Co. Rd. 350E and Co. Rd. 1300N (NW 1/4 NE 1/4 Sec. 16, T19N, R4W). 25 March 2001. M. D. Giazzon. INHS 17074. New county record. Former stream bed of Salt Creek containing temporary pools, bordered to the east by deciduous forest. The specimen was found under a rotten log approximately 1 m from the water's edge. Only a few males were heard calling at this site upon subsequent visits.

Hyla chrysoscelis/ *Hyla versicolor*. SE of Union; 0.7 km W of int. Co. Rd. 1450E and Co. Rd. 2400N (NW 1/4 NW 1/4 Sec. 21, T21N, R2W). 22 April 2001. M. D. Giazzon. INHS 17152. New county record. Small woodland pond west of Sugar Creek.

Rana catesbeiana. 1.2 km SE of Union; (SE 1/4 NW 1/4 SW 1/4 Sec. 8, T21N, R2W). 25 March 2001. M. D. Giazzon. INHS 17076. Updated county record. Juvenile found dead in pond, possibly killed from recent freeze. Last known voucher specimen was collected in 1953 (INHS 7174).

Nerodia sipedon. NW of Mount Joy; 0.16 km N of int. Co. Rd. 1600E and Co. Rd. 2575N (NE 1/4 NE 1/4 Sec. 10, T21N, R2W). 22 April 2001. M. D. Giazzon. INHS 17151. Updated county record. Found near a small stream that flows under the road. Last known voucher specimen was collected in 1967 (FMNH 208229).

Storeria dekayi. NNW of Lawndale; 0.5 km S of int. Co. Rd. 1600E and Co. Rd. 2250N (SE 1/4 SE 1/4 Sec. 27, T21N, R2W). 22 April 2001. M. D. Giazzon. INHS 17153. New county record. Specimen was DOR.

Thamnophis sirtalis. SW of Chestnut; 0.32 km W of int. Co. Rd. 2000E and Co. Rd. 850N (NE 1/4 SE 1/4 Sec. 5, T18N, R1W). 13 October 2000. M. D. Giazzon. INHS 17353. Updated county record. Last known voucher specimen was collected in 1957 (INHS 8748). Specimen was DOR.

Thamnophis radix. NNW of Rocky Ford Bridge; 0.48 km N of int. Co. Rd. 675E and Co. Rd. 1400N (NE 1/4 SE 1/4 Sec. 6, T19N, R3W). 17 June 2001. M. D. Giazzon and T. C. Giazzon. INHS 17352. Updated county record. Last known voucher specimen collected in 1976 (UMMZ 142860). Specimen was DOR.

Chelydra serpentina. SE of Union; 0.7 km W of int. Co. Rd. 1450E and Co. Rd. 2400N (NW 1/4 NW 1/4 Sec. 21, T21N, R2W). 22 April 2001. M. D. Giazzon. INHS Herpetological Slide 2001.01. New county record. Small woodland pond west of Sugar Creek. The turtle was trapped and subsequently released. A photographic voucher was taken since the specimen was a sexually mature adult.

Chrysemys picta. NNW of Mount Joy; 0.7 km W of int. Co. Rd. 1700E and Co. Rd. 2600N (SW 1/4 SE 1/4 Sec. 2, T21N, R2W). 22 April 2001. M. D. Giazzon. INHS 17150. New county record. Pond next to agricultural fields with a small forested buffer zone.

Trachemys scripta. S of Rocky Ford Bridge; 0.4 km SE of int. Co. Rd. 675E and Co. Rd. 1400N (NE 1/4 NE 1/4 Sec. 7, T19N, R3W). 24 June 2001. M. D. Giazzon and T. C. Giazzon. INHS 17351. New county record. Trapped in first large pond south of bridge and east of Salt Creek.

Acknowledgments.—I thank the landowners of Logan County, who so kindly allowed me to survey their property, Tricia Giazzon for occasional field assistance, and John E. Petzing and Christopher A. Phillips for critically reviewing the manuscript. This project was funded by the Illinois Department of Natural Resources, Natural Heritage Division from contributions to the Illinois Wildlife Preservation Fund (Grant 01-048W). All specimens were collected under Illinois Department of Natural Resources permit number A01.0455.

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Nerodia erythrogaster neglecta in Iowa with Comments on Ontogenesis of Color and Pattern

JAMES L. CHRISTIANSEN
Department of Biology, Drake University
Des Moines, Iowa 50311, USA
e-mail: james.christiansen@drake.edu

and

JEFFREY B. LECLERE
878 Galtier Street, St. Paul, Minnesota 55117, USA

Nerodia erythrogaster was known in Iowa from a single specimen collected from the "vicinity of Mount Pleasant" in the 1920s (exact date Chicago Acad. Sci. 7427 uncertain). The lack of heavy ventral pigment or color notes referring to a red belly support

the identification of this specimen as a Yellow-bellied Water Snake, *N. e. flavigaster*. The closest population in Illinois was clearly *N. e. flavigaster* (Blanford and Brandon 1996; Conant and Collins 1998). In 1973 and 1976, two adult specimens with bright red-orange bellies were taken in Muscatine and Louisa Counties and were ascribed to *N. e. flavigaster* by Christiansen and Bailey (1991) on the basis of geographic proximity to that subspecies. Recent collection of additional juvenile and adult specimens allow more thorough analysis, suggesting that the Muscatine-Louisa counties population is probably a relict population of *N. e. neglecta*, the Copper-bellied Water Snake. In this note, we report changes in color and pattern during the first feeding year of life that support the identification of these snakes as a relict population of the *N. e. neglecta*.



FIG. 1. *Nerodia erythrogaster neglecta* color and pattern change from neonate to adult. A and B, adult; C and D, neonate captured in June 2000; E and F, the same juvenile prior to release one year later. All specimens were captured from the Iowa side of the Mississippi River between Muscatine and the union of the Mississippi and Iowa Rivers. The dense ventral black pigment, occasional union of dorsal bands, and red-orange belly are characteristic of this subspecies and provide the first evidence of *N. e. neglecta* in Iowa.

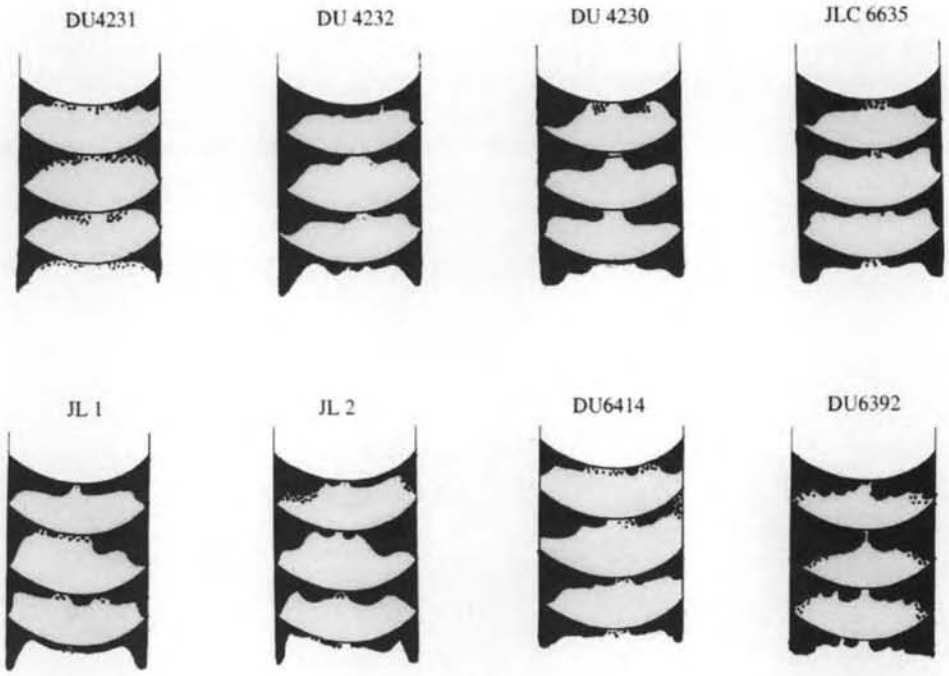


FIG. 2. Drawings of ventral pigment of *Nerodia erythrogaster neglecta* from Iowa. DU 4231 and 4232 were collected south of Muscatine, Iowa in 1973 and 1976 respectively, and are less pigmented than later specimens. All other specimens were taken in eastern Iowa from 1996 through 2000. The two specimens lacking DU numbers were captured as neonates, raised one year, and released in the area where they had been captured. The ventral scutes drawn were in the posterior 1/2 of the body, usually beginning with scute 75.

One adult and five juveniles were acquired from the Muscatine and Louisa counties populations during 1996–2000. Two of the specimens were found DOR and four were taken alive. We describe the pattern and color changes from three neonates captured in May and June 2000 and maintained in captivity seven to eight months on a diet of fish, frogs, and pink mice. The juvenile snakes were photographed when collected in May and June and again February of the following year. Surviving captives were released within the Odessa Wildlife Area near where they were taken.

The ventral coloration of all three adult snakes taken from the Louisa and Muscatine counties populations was bright red-orange and the dorsum was uniform dark brown with only the faintest hint of the underlying juvenile pattern (Fig. 1 A and B). Ventral black pigment was extensive in two of the three adults. The smaller amount of black ventral pigment on the first adult taken contributed to our initial hesitancy in calling this specimen *N. e. neglecta*.

Additional support for the *N. e. neglecta* designation was provided by a DOR juvenile, a DOR neonate, and three neonates taken alive. Both of the DOR specimens had undergone substantial decay and the ventrals were yellow with only traces of orange. All had substantial black ventral pigment (Fig. 2). Many of the anterior dorsal bands of the three living specimens were connected and the ventrals were yellowish anteriorly, light orange at mid body, and red on the tail (Fig. 1C, 1D). Eight months later, the light dorsal bands had darkened considerably and the entire ventral surface had become distinctly red-orange (Fig. 1E, 1F). Fig. 1 (C–F) shows the same snake and is typical of all of the juvenile snakes we maintained in captivity.

The original description of the four subspecies of *N. erythrogaster* by Conant (1949) distinguished *N. e. neglecta* by its bright red-orange ventral color and heavy ventral black pigmentation. Blanford and Brandon (1996) concluded that *N. e. flavigaster* sometimes has orange ventrals but lack the dark black ventral pigment. They also noted that juveniles of *N. e neglecta* tend to have fused dorsal blotches while those of *N. e. flavigaster* lack such fusions. All of our juvenile specimens had at least some fusion of dorsal blotches (Fig. 1C, 1E). Conant and Collins (1998) distinguish *N. e. neglecta* by its red-orange belly, ventral black pigmentation, and irregular, sometimes connecting dorsal blotches of juveniles.

We conclude that the isolated northern population of *Nerodia erythrogaster* in Iowa should be regarded as *N. e. neglecta.* While the ancestral population may have intergraded with *N. e. flavigaster,* the survivors all appear to be exclusively *N. e. neglecta* in appearance. This suggests that *N. e. neglecta* spread westward across northern Illinois while *N. e. flavigaster* was differentiating farther south. The Iowa population of *N e. flavigaster* near Mount Pleasant may be extirpated but the remaining populations of *N. e. neglecta* are afforded endangered species protection in Iowa.

Acknowledgments.—We thank the U.S. Fish and Wildlife Service for funding the search for *Nerodia erythrogaster* in Iowa.

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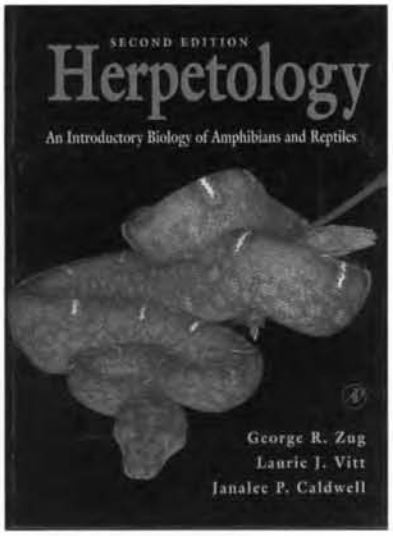
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BOOK REVIEWS

Herpetological Review, 2002, 33(2), 155–157.
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Herpetology: An Introductory Biology of Amphibians and Reptiles, 2nd edition, by George R. Zug, Laurie J. Vitt, and Janalee P. Caldwell. 2001. Academic Press, San Diego, California. xiv + 630 pp., hardcover. US $69.95. ISBN 0-12-782622-X.

JULIAN C. LEE
Department of Biology, University of Miami
Coral Gables, Florida 33124, USA
e-mail: jlee@miami.edu



Ten years ago, persons seeking an introductory textbook on herpetology could choose from the early editions of Goin and Goin (1962, 1971), Porter (1972) and Goin et al. (1978). Each of those books had strengths, but many of us teaching herpetology opted to forego a textbook in favor of handouts and reading assignments from the primary literature. In 1993 *Herpetology An Introductory Biology of Amphibians and Reptiles* by George R. Zug appeared in its first edition and became the text of choice for many people teaching introductory courses in herpetology. The appearance in 1998 of *Herpetology*, edited by Harvey Pough, marked a turning point in the development of textbooks in herpetology. Coauthored by six herpetologists—all specialists in their fields—the book presented an authoritative treatment of unprecedented scope and depth. Although in its 1st edition Pough et al. (1998) did have some deficiencies (Bauer 1998), it nonetheless set a new standard for herpetology textbooks. The 2nd edition (Pough et al., 2001) improved on what was already the textbook of choice for many (Zamudio and Chan 2001). Now comes the second edition of *Herpetology An Introductory Biology of Amphibians and Reptiles*, a fully revised and expanded version of the original, the latest entry in the field of textbooks in herpetology.

Textbook publishers are often accused of producing revised editions that differ only in minor detail from preceding editions, simply to defeat the used textbook market. In this case that criticism cannot be leveled at Academic Press, for this second edition bears so little resemblance to its predecessor that to call it a revised edition is something of a misnomer. To assist with this dramatic make-over, Academic Press enlisted the services of Laurie J. Vitt, an evolutionary ecologist who works principally with reptiles, and Janalee P. Caldwell, an expert on amphibian biology. The addition of Vitt and Caldwell provides additional herpetological expertise and a somewhat different perspective; their inclusion nicely complements Zug's broad herpetological expertise. The influence of the new authors is easily seen by examining the number of papers cited on which they are first authors: Vitt 33, up from 5 in the 1st edition; Caldwell 16, up from 2 in the 1st edition. In the bibliography Vitt is cited as first author more than any other person. Thus, the new authors appear to have taken seriously the admonition to "write what you know," for they draw heavily upon their own extensive research experience. In terms of illustrative material, the impact of the new authors is also immediately apparent: of 141 black and white photos, 64 (45.4%) are credited to Vitt and/or Caldwell; of 184 color photos, 57 (31%) are credited to one or both of them.

In a brief preface, the authors set forth their goals in producing this revised edition: "... to update the text to include new concepts and interpretations ... and to provide the evolutionary and classificatory perspective of living amphibians and reptiles circa mid-1999." A second goal is to "... improve the didactic scope of the text ...." The authors serve notice that their classifications are evolution-based, mostly. Thus, they tend to eschew the named categories and fixed levels of the Linnaean hierarchy, except where they find it convenient to use them "... within a textual discussion." Classifications are presented as indented lists of names with those of uncertain monophyly enclosed in quotation marks and with alternative names in parentheses. The biosystematic approach is cladistic, and the authors generally insist on the monophyly of taxa (Anthracosauria is excluded from Amphibia, for example), but as a practical matter they implicitly accept a paraphyletic Reptilia, excluding from treatment the approximately 9000 extant species of feathered dinosaurs.

Comparison of the two editions is presented in Table 1. The second edition is larger in size, has more pages, and thus weighs more. There are more than twice the number of bibliographic entries in the second edition, and nearly twice the number of black and white photos. The second edition includes a glossary, a welcome addition (but see below). Production values of the second edition far exceed those of the original. Larger page size and double column format allows greater flexibility in layout, which is generally efficient and attractive. Especially notable is the inclusion of many color photographs illustrating the diversity of amphibians and reptiles. These are placed conveniently throughout the taxonomic section, rather than being bound in one or a few adjacent signatures.

Many of the errors in the first edition have been corrected. For example, *Hydromantes* replaces *Hydromantoides* (Fig. 1.1 of original), the misstatement that in amphibians rods are the color receptors in the retina (p. 28) has been corrected, Eublepharide (Fig. 17.2) is corrected to Eublepharidae, Trogonophidae (p. 438) is corrected to Rhineuridae, and the misspelling of Mascrene (p. 451) has been eliminated by reference to Mauritius.

The main portion of the book consists of six parts: Evolutionary History, Reproduction and Life Histories, Physiological Ecology, Behavioral Ecology, Population and Community Ecology, and Classification and Diversity, each with two to six chapters. Each chapter begins with an abbreviated table of contents that makes it easy to find particular topics of interest and, with the exception of the chapters in Part VI (Classification and Diversity), each concludes with a short section on additional reading and with a list of references bearing on the main topics covered in the chapter. Ex-

cept for the taxonomic sections, the treatment integrates information on amphibians and reptiles on a conceptual basis, rather than treating the two groups separately, consistent with the current emphasis in organismal biology on multidisciplinary, concept-oriented approaches that integrate rather than divide fields (Pianka et al. 1998).

Part I provides an overview of the evolutionary history of amphibians and reptiles, placing them in the larger context of vertebrate relationships, with emphasis on tetrapod origins and the diversification of amniotes. Chapter 1 is essentially a primer on the theory and practice of systematics. Methods of analysis, kinds of characters, and the rules of nomenclature are briefly treated. Chapter 2 treats the anatomy of amphibians and reptiles, including consideration of embryogenesis, morphogenesis, and heterochrony. I cannot agree with the caption of Figure 2.7, that "When growth is determinant or asymptotic, a sigmoid pattern during juvenile stages is followed by slower growth after sexual maturity and finally curtailment of growth." Normally the term asymptotic growth applies to species that have indeterminant growth in which, subsequent to maturation, the animal grows at an ever-slower rate, thus approaching asymptotic size. Chapter 3 provides a brief introduction to the evolution and diversification of tetrapods and traces the evolution of amphibian and reptilian clades, with special emphasis on those leading to modern forms.

Part II deals with reproduction and life histories. In chapter 4 gamete formation, courtship and fertilization are reviewed, reproductive modes are described, and sexual reproduction is contrasted with non-sexual reproduction. The chapter ends with a consideration of forms of parental care and their evolution. Chapter 5 is concerned with reproductive ecology and life histories. Included here is consideration of temperature-dependent sex determination, the evolution of viviparity, and the evolution of life histories.

Part III is devoted to physiological ecology and contains two chapters, one dealing with water balance and gas exchange (chapter 6), the other with thermoregulation, performance, and energetics (chapter 7).

Part IV, behavioral ecology, consists of four chapters. Chapter 8 treats spacing, movements, and orientation. Included here is consideration of home ranges, territoriality and its evolution, dispersal, homing and orientation. Chapter 9 provides a review of communication in the major groups of amphibians and reptiles, describes various kinds of mating systems, and treats sexual selection and sexual dimorphism. Chapter 10 deals with foraging ecology and diets, including consideration of foraging modes, sensory modalities involved in prey detection, biomechanics of prey capture and handling, and the evolution of diets. Chapter 11 deals with defense and escape. Predator avoidance, mimicry, chemical defense, caudal autotomy, and defenses against the effects of parasitism are discussed.

In Part V chapter 12 is devoted to population ecology, including consideration of population densities, age distributions, life tables, survivorship curves, population growth models, and metapopulation dynamics. The ecology of communities is treated in chapter 13, together with geographical ecology and historical biogeography. Chapter 14, concerned with conservation, discusses the impact of humans on herpetofaunal assemblages, including consideration of the affects of habitat fragmentation, pesticides, acid rain, estrogen-mimicking compounds, and disease. Oddly, amphibian die-offs are treated separately from the issue of declining amphibian populations. Consideration is given to the issues of preservation and management, as well as to captive breeding programs. The authors conclude that augmentation of natural populations, repatriations, and translocations are of questionable value as management tools. This chapter begins with the quote of a 1970 Neil Young lyric " ... *look at mother nature on the run in the 1970's.*" Given the accelerating pace of environmental degradation over the past thirty years, Young's update of that lyric " ... *we've got mother nature on the run in the twenty-first century*" would seem more timely.

Part VI, by far the most extensive section of the book, is concerned with classification and diversity. Chapters 15 through 21 treat caecilians, salamanders, frogs, turtles, crocodilians, lizards and tuatara, and snakes, respectively. A summary overview is provided for each of these major groups, and cladograms of hypothesized familial relationships are presented. Each family (occasionally subfamily) account places the group in a cladistic framework, indicates its probable sister taxon, and includes a list of included taxa. A brief statement concerning distribution is followed by a paragraph characterizing the group, largely on the basis of morphological features. This is followed by a paragraph summarizing salient aspects of the group's biology. Accounts conclude with a list of pertinent references. Distribution maps are provided for each family, with geographical extent depicted in red or blue. As high-level generalizations of distribution the maps are useful, but there are errors in the plotted distributions and there are inconsistencies between the maps and text. For example, although not so indicated on the maps, caeciliids are known from the Pacific slope of Ecuador (Fig. 15.3), and plethodontids extend far north into the Yucatán Peninsula (Fig. 16.7) as do xantusiids (Fig. 20.15). According to Fig. 20.18) gymnophthalmids do not occur north of Honduras, when in fact *Gymnophthalmus speciosus* is known from Belize on the basis of a specimen collected by Laurie Vitt! Helodermatids are shown as not occurring east of the Isthmus of Tehauntepec; in reality *Heloderma horridum* is known from interior valleys of Chiapas, Mexico, and Guatemala (this distribution is more accurately depicted in Fig. 17.13 of the first edition). Leptotyphlopidae (Fig. 21.4) is indicated as not occurring in the base of the Yucatán Peninsula, yet there is a published record for

TABLE 1. Comparison of three text books in herpetology.

	Zug 1993	Zug et al. 2001	Pough et al. 2001
Dimensions (cm)	23.5 x 16.0	28.5 x 22.0	26.0 x 21.0
Mass (kg)	0.86	1.75	1.40
Page Format	Single Column	Double Column	Double Column
No. Pages	542	630	612
No. Biblio. Entries	891	2,015	1,927
No. Color Photos	0	184	17
No. B/W Photos	75	141	220
Glossary	No	Yes	No
Citations in Text	No	Yes	Yes

Leptotyphlops goudotii from Petén, Guatemala. Accompanying the accounts are color photographs of representative species. These are generally organized in groups of four and are conveniently placed near the appropriate account. The great majority of the images are of high quality, but a few appear out of focus in my review copy (e.g., *Uperoleia mjobergii*, Fig. 17.22; *Scaphiopus holbrookii*, Fig. 17.5). Contrary to the informal convention in biological illustration, the color photographs are oriented with anterior to the right, with the curious exception of *Tylotriton verrucosus*, Fig. 16.9.

The book includes a brief glossary of herpetological terms, introduced with the disclaimer that it "... does not attempt completeness." The glossary is indeed minimalist. Under "K," for example, where one might expect to find such terms as "keel," or "keratin," the sole entry is "karyotype" and the reader is directed to "see chromosome." The book concludes with an extensive bibliography of 2105 entries, a taxonomic index, an author index, and a subject index. The latter is brief, and excludes many terms and concepts that one might expect to find in a comprehensive subject index. There is, for example, no entry for "tadpole," none for "parthenogenesis," and none for "competition." An expanded glossary and a more detailed subject index would make the material of this information-rich volume more easily accessible, especially to readers new to the study of herpetology.

Any book that covers so broad a topic—the biology of amphibians and reptiles—must necessarily be selective, and every reader is likely to find some favorite detail or subject omitted. I was disappointed, for example, that there is no explicit treatment of the historical development of herpetological knowledge, no photographs of the great 19th century herpetologists (e.g., Boulenger, Wiegmann, Cope), and no consideration of the role played by the great museums and universities of the world in the accumulation of herpetological knowledge. Many courses in herpetology begin by placing the accumulation of herpetological knowledge in an historical context; formal treatment of that topic would have been welcome.

Ultimately this book must be evaluated relative to Pough et al. (2001), the sole competing textbook in herpetology. Table 1 provides some basis for this comparison. The two books are roughly comparable in their dimensions, they have similar numbers of pages and numbers of bibliographic entries. They cover much of the same material, using many of the same examples and illustrations. There are differences in emphasis, however, with Pough et al. providing greater depth of coverage on topics such as the biomechanics of feeding and locomotion, and physiology, whereas Zug et al. is particularly strong in their treatment of population and community ecology and life history evolution. Superior production values are apparent in Zug et al. for there is uniformity of type fonts on graphs and diagrams; in Pough et al. a diversity of type fonts and line weights are evident (compare, for example, Figs. 5-23 and 6-13 in Pough et al.). Zug et al. has a glossary, whereas Pough et al. does not. The two differ most conspicuously in the lavish and effective use of color in Zug et al. Where Pough et al. has but 17 color photos, plus one color graphic bound together in a single signature, Zug et al. has 184 color photos placed conveniently throughout the taxonomic sections. Although cosmetic, these differences in production values are important. For a readership that has grown up playing video games and whose attention span (I was once reminded by a University of Miami undergraduate) may not exceed the length of one MTV video, visuals do matter.

Taken as a whole, Zug et al. (2001) is an impressive volume, at once visually pleasing for its attractive layout and high production values, and at the same time intellectually satisfying in its scope and detail. It is well-suited as a textbook for senior undergraduates and graduate students, and it will be a standard herpetological reference for years to come. With publication of the second edition of *Herpetology An Introductory Biology of Amphibians and Reptiles*, Zug, Vitt, Caldwell, and Academic Press have upped the ante in the competition for the herpetological readership, and they pose a severe challenge to Pough et al. for supremacy in the herpetological textbook field.

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PUBLICATIONS RECEIVED

Dangerous Wildlife in the Southeast, by F. Lynne Bachleda. 2001. Menasha Ridge Press, Birmingham, Alabama (www.menasharidge.com). xiii + 321 pp. Softcover. US $22.95. ISBN 0-89732-335-1.

This book presents basic information about potentially dangerous animals and plants of the southeastern United States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee). Amphibians and reptiles are treated in 62 pages. Six venomous snakes, three crocodilians, five turtles, four frogs and three salamanders have species accounts. Each account begins with a statement of the danger posed by the species (from allergic reactions to potentially lethal envenomation), followed by short summaries of abundance and range, size, description, similar species, diet, habitat and traits (ecological and behavioral features). All of the amphibians and reptiles discussed are illustrated by one or more color photos and in some instances, case histories of attacks or envenomations are provided. Aside from herps the book treats insects and arachnids,

sharks, rays, cnidarians and other marine invertebrates, mammals and a variety of plants. The book is intended for a general audience and stresses prevention and avoidance of dangerous wildlife encounters, but does provide information about first aid and regional contacts for poison control centers and agencies dealing with "problem animals." It should prove to be a useful general guide for hikers, homeowners and naturalists in the region covered.

In Quest of Great Lakes Ice Age Vertebrates, by J. Alan Holman. 2001. Michigan State University Press, East Lansing, Michigan (www.msupress.msu.edu). ix + 230 pp. Hardcover. US $59.95. ISBN 0-87013-591-0.

J. Alan Holman provides a brief introduction to the study of geology, paleontology, and vertebrate evolution as an introduction to this book on the Pleistocene vertebrates of Michigan, Wisconsin, Illinois, Indiana, Ohio, and Ontario. Amphibians and reptiles occupy 22 pages of text. Most of the species treated are still extant in the Great Lakes region today (two salamanders, seven frogs, nine turtles, one lizard and nine snakes). Only the giant tortoise *Hesperotestudo crassiscutata* has become extinct. Accounts of each taxon include information about the appearance, biology, and distribution of the species today (if applicable) as well as a listing of Pleistocene localities and brief comments about the probable paleoecology of the animal. Black-and-white illustrations of the living animal and/or fossil elements are provided for most species. Fishes, birds, and especially mammals make up the remainder of the species accounts. The book is rounded out by chapters dealing with fossil collection and dating, important fossil sites, community structure, Pleistocene extinctions, and an extensive bibliography. It complements the author's earlier books on Pleistocene amphibians and reptiles and should be of special relevance to those interested in the affect of the Ice Age on the fauna of the Upper Midwest.



Lampropeltis triangulum triangulum (Eastern Milk Snake). Illustration by Heather Frese.

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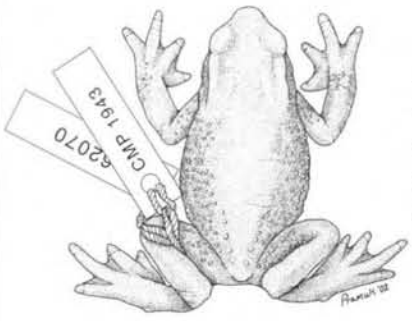
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L. LEE GRISMER

FOREWORD BY HARRY W. GREENE

The Baja California peninsula is home to many forms of life found nowhere else on earth. Grismer has produced the most comprehensive work on the herpetofauna of the peninsula and its islands ever published. With its stunning color images, detailed accounts of many little-known species, and descriptions of the region's diverse environment, this is the definitive guide to the amphibians and reptiles of a fascinating and remote region.



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–Robert Hansen, Editor, *Herpetological Review*

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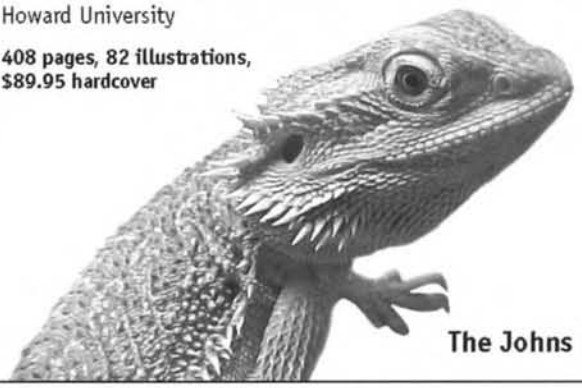
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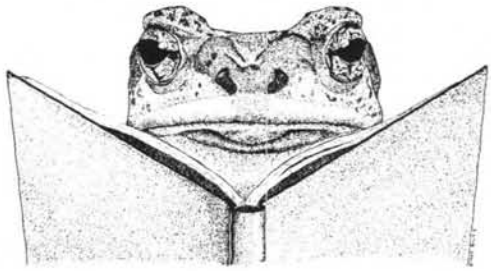
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A Novel Method for the Extraction and Amplification of DNA from Amphibians

ADAM DAVIS
LESLIE B. SLUSHER*
and
JOHN T. BENESKI
Department of Biology, West Chester University of Pennsylvania
West Chester, Pennsylvania 19383-2130, USA

** Author to whom all correspondence should be addressed:*
e-mail: lslusher@wcupa.edu

Here we describe a simple method for extraction and amplification of DNA from salamanders that neither affects the mortality of live specimens nor jeopardizes rare and endangered populations. We tested the FTA Gene Guard System® (Gibco BRL; Rockville, Maryland) and compared its efficacy for DNA extraction and amplification to that of a more conventional method that relies on fresh tissue. FTA cards (Gibco BRL; Rockville, Maryland) make use of filter paper impregnated with a proprietary formulation for long-term DNA storage and protection. Currently published techniques using FTA cards include extracting DNA from humans (Burgoyne et al. 1997), plants (Lin et. al. 2000), field mice (Higgins et al. 2000), and bacteria (Hansen and Blakesley 1998; Rogers and Burgoyne 1997).

Material and Methods.—Eight salamanders from the family Plethodontidae were sampled using the FTA method of DNA extraction and amplification: *Desmognathus conanti* (Cullman Co., Alabama), *D. fuscus* (Chester Co., Pennsylvania), *D. welteri* (Harlan Co., North Carolina), *Eurycea bislineata* (Chester Co., Pennsylvania and Monroe Co., Pennsylvania), *E. wilderae* (Watauga Co., North Carolina), *Gyrinophilus porphyriticus* (Macon Co., North Carolina), and *Pseudotriton ruber* (Jackson Co., North Carolina). The conventional method of DNA extraction and amplification used tail tissue that was excised from the *D. fuscus* and both the northern and southern Pennsylvania forms of *E. bislineata*. A partial sequence of the mitochondrial 12S rRNA gene was amplified, subcloned, and sequenced from all individuals. The primers used for PCR amplification and DNA sequencing (5'-CAA ACT GGG ATT AGA TAC CCC ACT AT-3'; 5'-TTC CGG TAG ACT TAC CAT GTT ACG-3') and the internal primers used for DNA sequencing (5'-AAG AAA TGG GCT ACA TTT TT-3'; 5'-AAA AAT GTA GCC CAT TTC TT-3') were developed from the previously published sequences of Titus and Larson (1996).

In the conventional method approximately 0.03 g of tail tissue was removed from each specimen, finely minced with a sterile razor blade and added to a 1.5 ml centrifuge tube with 700 µl of DNA extraction buffer (Hedges et al., 1991). All DNA samples were digested with 35 µl of 10 mg/ml Proteinase K at 37°C for 6–10 h, extracted using a standard phenol-chloroform extraction protocol followed by ethanol precipitation, and diluted to 100 ng/µl for PCR. In the FTA method epithelial cells were scraped from the dorsal side of each salamander with a sterile toothpick and transferred to an FTA card. The FTA card was left to dry from 24 h up to several months in a zip-locked plastic bag. A 4 mm disc containing the DNA sample was punched out of the card and deposited into a sterile 0.5 ml microcentrifuge tube. DNA purification was performed according to the manufacturer's protocol using FTA purification reagent (Gibco BRL; Rockville, Maryland) and TE buffer, pH 7.5.

DNA obtained by conventional extraction was amplified in a 100 µl reaction mixture containing 0.5 µM of each primer, 1X PCR reaction buffer, 200 µM dNTPs, 2.5 U Taq Polymerase, 1 ng/µl DNA template, and ddH_2O. The same PCR reaction mixture, minus the 1 ng/µl DNA template, was used to amplify the purified FTA sample. Reactions excluding DNA template were prepared as negative controls. DNA amplification was performed in 30 cycles of denaturation at 94°C for 30 s, annealing at 55°C for 35 s, and extension at 72°C for 150 s, with 4 s added to the extension time per cycle (Titus and Larson 1996). A final cycle was added which had a 7 min extension period at 72°C.

Results and Discussion.—Although DNA yields from the conventional method were higher than those from the FTA method, the PCR products from all preparations were sufficient to successfully clone and subsequently sequence the DNA (Fig. 1). A total of 444 base pairs (bp) were recovered by both the conventional and FTA methods for *Desmognathus fuscus*, 439 bp from the northern Pennsylvania form of *Eurycea bislineata*, and 440 bp from the southern Pennsylvania form of *E. bislineata*. The DNA sequences that were derived using both methods were 100% identical for all three salamanders tested. As for the five additional DNA sequences that were extracted solely by the FTA method,

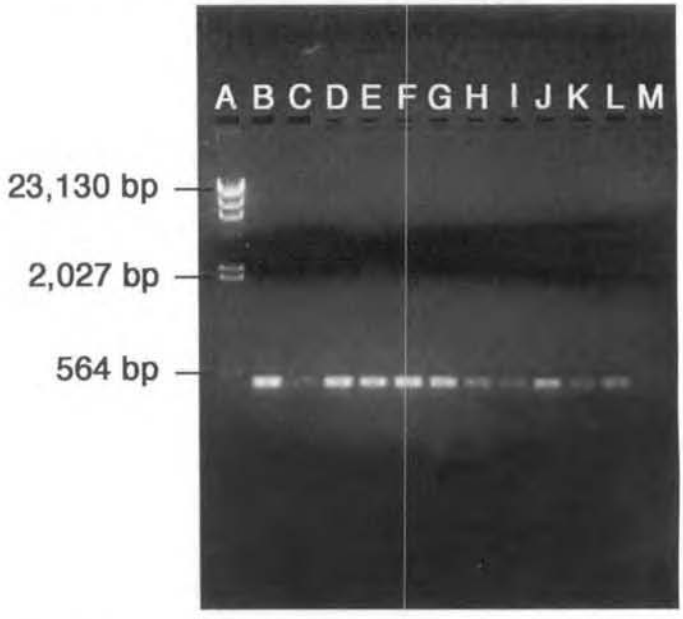


FIG. 1: Comparison of PCR products obtained from conventional (Lanes B, D, and F) versus FTA extraction methods (Lanes C, E, G, H, I, J, and K). One percent agarose gel with 0.02 µg/ml ethidium bromide containing l DNA cut with Hind III (A), salamander PCR products (B–L), and a negative control (M). Numbers on the left side of the agarose gel correspond to fragment sizes in base pairs (bp) of the l DNA ladder. Species sampled include *Desmognathus fuscus* (B and C), the northern Pennsylvania form of *Eurycea bislineata* (D and E), the southern Pennsylvania form of *E. bislineata* (F and G), *D. conanti* (H), *D. welteri* (I), *E. wilderae* (J), *Gyrinophilus porphyriticus* (K), and *Pseudotriton ruber* (L).

441 bp were recovered from *D. conanti*, 443 bp from *D. welteri*, 437 bp from *E. wilderae*, 440 bp from *Gyrinophilus porphyriticus*, and 440 bp from *Pseudotriton ruber*. Sequences recovered from all eight individuals are listed in the Genbank database (www.ncbi.nlm.nih.gov) under accession numbers AF290183–90.

The fact that we obtained identical sequences for the 3 salamanders tested by both methods and that we were able to obtain sequences for the 5 additional specimens using the FTA method demonstrates the effectiveness of FTA cards as a reliable, non-injurious alternative to conventional methods of DNA extraction and amplification from live individuals. Its relatively unintrusive means of collecting DNA templates from amphibians by scraping epithelial cells renders it conducive to large-scale field sampling of rare and endangered species. By carrying a zip-locked plastic bag containing an FTA card, a pair of sterile lab gloves, a sterile toothpick, and a sterile petri dish, researchers can easily collect and store DNA at any opportunity. In addition, the use of FTA cards does not conflict with simultaneous morphological or behavioral analyses by removing tissue, nor does it reduce the value of individuals as potential voucher specimens (Summers et al. 1999). Finally, FTA cards can be shared easily throughout the research community since DNA samples can be transported between laboratories on whole FTA cards or as punched-out 4 mm discs. Given these advantages, the FTA method of DNA extraction and amplification could be a highly beneficial technique for reliably obtaining molecular information without risking the conservation of amphibian species.

Acknowledgments.—We gratefully acknowledge Paul A. Verrell of Washington State University for allowing us to collect epithelial cell samples from his specimens of *Desmognathus conanti*, *D. welteri*, *Eurycea wilderae*, *Gyrinophilus porphyriticus*, and *Pseudotriton ruber*.

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The Doubly-Labeled Water Technique is Impractical for Measurement of Field Metabolic Rate in Freshwater Turtles

DAVID T. BOOTH
Department of Zoology and Entomology, The University of Queensland Queensland 4072, Australia
e-mail: DBooth@zen.uq.edu.au

Doubly-labeled water is a powerful method for measuring field metabolic rate in wild animals and has been used numerous times on a diversity of reptiles (Beaupre 1996; Benabib and Congdon 1992; Christian and Green 1994; Christian et al. 1996; Nagy and Shoemaker 1975, 1984; Nagy et al. 1984, 1991; Peterson 1996a; Peterson et al. 1998; Plummer and Congdon 1996; van Marken et al. 1993). The technique uses the difference in rates of loss of isotopically labeled oxygen (usually ^{18}O) and hydrogen (^{2}H or ^{3}H) atoms from body water to estimate carbon dioxide production, providing an indirect measure of metabolic rate (Lifson and McClintock 1966; Nagy 1975, 1980, 1989). The labeled oxygen is lost by two routes: 1) through body water turnover and 2) carbon dioxide lost via respiratory gas exchange, while the labeled hydrogen is only lost via water turnover (see Nagy 1980 and 1989 for a detailed account of theory and experimental errors associated with this technique).

To use this technique, animals need to be caught twice and blood samples taken on both occasions. On the first occasion, total body water is determined by isotope dilution, and the starting blood isotope concentrations established. On the second occasion end isotope concentrations are determined.

There is a trade-off between water and carbon dioxide turnover rates and time between recapture. Ideally the amount of isotope given should be minimal while the period between recapture as long as possible to allow any "abnormal" behavior associated with capture to be "swamped" by normal activity. If turnover rates are so high that the time between release and recapture needs to be less than a day, this technique is not very useful because of the possibility of "abnormal" behavior associated with capture and handling of animals completely obscuring "normal" behavior.

High water turnover rate might also cause isotopically labeled oxygen and hydrogen atoms to reach background levels before a difference in rates of isotope loss can be detected (Congdon et al. 1982; Peterson et al. 1998). Aquatic gill breathing animals such as fish fall into this category because the rate of water turnover is extremely high (Nagy and Peterson 1988). However, aquatic reptiles are air breathers and have an integument that is relatively impermeable to water, so the doubly-labeled water technique should be suitable for these animals. For example this method has been successfully utilized in field studies on marine iguanas (Nagy and Shoemaker 1984), a semi-aquatic lizard (Christian et al. 1996) and a semi-aquatic snake (Peterson et al. 1998). Here I report the feasibility of using the doubly-labeled water method to measure field metabolic rate in two species of freshwater turtle by measuring water turnover rate of these animals in captivity.

Two adult female Brisbane river turtles (*Emydura signata*) and a single adult female broad-shelled river turtle (*Chelodina expansa*)

were captured and held in a 20,000-liter tank exposed to prevailing weather conditions during the Austral summer (December 1998). Turtles were not fed for 5 d prior to and during the measurement periods. Turtles were removed from the water, weighed and injected intra-muscularly into a hind limb with 100 $\mu Ci \cdot ml^{-1}$ tritiated water (HTO), 1.0 ml in *E. signata* and 2.0 ml in *C. expansa*. After a 2 h equilibration period where turtles were held in containers out of water, a 1.0 ml blood sample was taken from the occipital sinus to determine body water volume via isotope dilution (Nagy and Costa 1980) and to determine isotope concentration at the beginning of the measurement period. Two trials were run. In the first (4–7 Dec), turtles were released back into water immediately after the initial blood sample, and a second blood sample taken after 3 d in water. In the second trial (17–20 Dec) turtles were held out of water for 2 d after the initial blood sample was taken. A second blood sample was taken and then the turtles were released into water for 1 d before a third blood sample was taken. Turtles were weighed every time a blood sample was taken. Water was micro-distilled from blood samples (Wood et al. 1975) and the HTO activity of the distillate determined in triplicate by liquid scintillation counting with appropriate blanks and standards. Any mass change between successive blood sampling times (maximum mass change was 70 g) was treated as if it occurred linearly and because of the loss/gain of water, so average water efflux and influx during the experiment were calculated using equations (4) and (6) respectively of Nagy and Costa (1980).

TABLE 1. Body mass, total body water and rate of water influx and efflux of turtles during trial 1. The trial lasted three days and animals were in water continuously during this time. Predicted water flux from allometric equation for reptiles in Nagy and Petersen (1988).

Turtle	Mass (g)	Total Body Water (ml)	Water Content (%)	Water Influx (ml/day)	Water Efflux (ml/day)	Predicted Water Flux (ml/day)
E. signata #1	1703	1014	60	4387	4360	45.3
E. signata #2	1852	1160	63	3308	3317	48.2
C. expansa	3046	1923	63	3268	3296	69.1

TABLE 2. Body mass, total body water, rate of water influx and efflux of turtles during trial 2. The trial lasted three days, the first two days on land, the last day in water. Predicted water flux from allometric equation for reptiles in Nagy and Petersen (1988).

Turtle	Mass (g)	Total Body Water (ml)	Water Content (%)	Water Influx (ml/day)		Water Efflux (ml/day)	Predicted Water Flux (ml/day)
E. signata #1	1822	1141	62	Land	2.2	56.7	47.6
				Water	4930	4890	
E. signata #2	1900	1212	64	Land	3.2	14.6	49.0
				Water	2759	2706	
C. expansa	3090	1973	64	Land	17.0	49.5	69.8
				Water	3223	3220	

Mean water temperature during the trial was 26°C, but water temperature fluctuated daily between 24°C and 28°C. Turtle mass, total body water volume, and water flux rates for trials 1 and 2 are presented in tables 1 and 2, respectively. Water efflux was approximately two orders of magnitude lower when turtles were held out of water compared to when they were in water (Table 2).

Comparison with other species of turtle is complicated by the allometric effect of body size. The most appropriate comparison can be made using an allometric equation for water turnover in reptiles (Nagy and Peterson 1988). Water turnover rates were similar to predicted when turtles were held out of water (Table 2), but two orders of magnitude above predicted when turtles were in water (Tables 1 and 2). Thus turtles turned over their entire body water pool 1.6 to 4.3 times per day when in water. *C. expansa* and *E. signata* do not actively ventilate their cloaca (Priest 1997; personal observation), so it is unlikely that large amounts of water are exchanged with the environment via the cloaca. Assuming that the integument is relatively impermeable to water, turtles must have been drinking and urinating large volumes of water because they did not feed during the measurement period. The reason why these turtles drank so much remains unknown. Except for a study on hatchling diamondback terrapins (*Malaclemys terrapin*; Dunson 1985), water turnover rates of turtles in freshwater have not been reported in the literature. In Dunson's (1985) study the hatchling also had much higher than predicted (4.6 $ml \cdot d^{-1}$ measured verses 0.84 $ml \cdot d^{-1}$ predicted) water turnover rates so very high water turnover rates appear to be typical of freshwater turtles. As such, these extremely high water turnover rates make the doubly-labeled water method impracticable for measuring field metabolic rate in freshwater turtles, a finding foreshadowed by Congdon and coworkers (Congdon et al. 1982).

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The "Frog Box:" A New Bulk Holding Device for Anurans

MALCOLM L. McCALLUM
P.O. Box 847, Environmental Sciences Ph.D. Program
Arkansas State University, State University, Arkansas 72467, USA
e-mail: mmccallu@mail.astate.edu

BENJAMIN A. WHEELER
P.O. Box 847, Environmental Sciences Ph.D. Program
Arkansas State University, State University, Arkansas 72467, USA
e-mail: bwheeler@astate.edu

and

STANLEY E. TRAUTH
P.O. Box 599, Department of Biological Sciences
Arkansas State University, State University, Arkansas 72467, USA
e-mail: strauth@mail.astate.edu

Collecting frogs in the field can be a very arduous task. Their leaping ability allows them to escape quickly from whatever container in which they are placed. Plastic ziploc bags have been utilized, but they sometimes become awkward to seal, especially if mud gets into the ziploc mechanism. Bags can become expensive as they are not typically reusable. These bags also have the disadvantage in that they easily open, releasing the frogs, and that they are easily squashed because of their flimsy nature. The device described herein allows bulk collection of frogs as well as other amphibians and reptiles, without the time-consuming task of preventing the contained frogs from escaping as new captures are added. A detailed version of the device is described below (Fig. 1).

Construction of this holding chamber requires two plastic or styrofoam cups, a styrofoam ice chest or a styrofoam box (commonly used for shipping tropical fish), and either a pair of tooth-

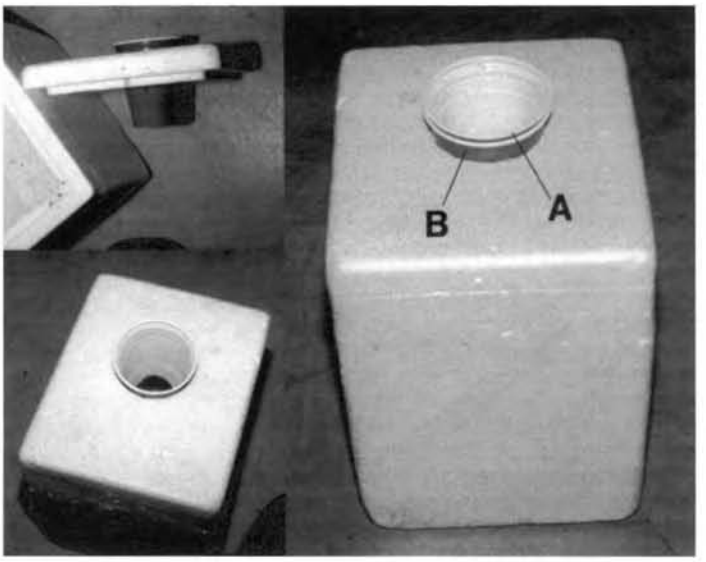


Fig. 1. Design of device for bulk field collection of anurans and other herps. The upper left box shows the position of the cup in the lid. The right hand box shows how the two cups are seated inside each other to prevent the escape of frogs. The lower left box shows the view into the box through which specimens are deposited during collection.

picks or duct tape. First, cut a round hole in the lid of the ice chest so that a plastic cup (Cup B) can be forced into it to about 2/3 of its length. Cut the bottom off the plastic cup and lodge it into the hole. The second intact cup (Cup A) is inserted inside the first cup to close the hole. Toothpicks can be used to hold the lid in place by sticking them through the lid and into the bottom of the box (preferably at a 45° angle to the top). Duct tape can be used instead of toothpicks.

The simplicity of this container is affirmed in its utility as a reservoir for holding large numbers of anurans. Place 2–3 cm of water in the bottom of the box. As each frog is captured, lift Cup A out of Cup B so the frog can be placed into the box. Return Cup A to its original position in Cup B to confine the frog. Cup B will function as a funnel does in a funnel trap (i.e., it keeps the frogs in). Cup A is placed in Cup B to prevent frogs from leaping out, a special problem if treefrogs are being collected.

This device has worked quite well in the field. It is light weight, inexpensive, and can temporarily house a large number of frogs. This "frog box" allows quick collection and secure containment of large numbers of anurans from a single location. The styrofoam insulates specimens from heat, especially if water and/or a small bag of ice is/are placed inside. There are some disadvantages that can be overcome with a little creativity. The device can be bulky if a large-sized version is used. Duct tape tears the styrofoam making it difficult to reuse the frog box. It is not capable of supporting heavy objects stacked on it because of its styrofoam construction. It can also be difficult to retrieve frogs from the device. The difficulty with removing frogs might be alleviated by placing a small plastic garbage bag in the box with the mouth of the bag extending out of the entry hole. A bottomless cup can be inserted in the bag's mouth to hold it open. The addition of the internal bag works, but can cause other problems detracting from the simplicity of this container. We have found that this container alleviates the hassle of opening and closing plastic containers or ziploc bags during inclement weather. Overall, it provides a useful method for temporarily housing frogs as well as other herps in the field.

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A Comparison of Two Methods for Estimating the Abundance of Amphibians in Aquatic Habitats

JOSEPH J. WILSON*
and
TIMOTHY J. MARET
Department of Biology, Shippensburg University
Shippensburg, Pennsylvania 17257, USA
e-mail (TJM): tjmare@ship.edu

**Present address: Gannett Fleming, Inc., 101 Innovation Boulevard, Suite 213*
State College, Pennsylvania 16803, USA
e-mail: jwilson@gfnet.com

Accumulating evidence for the global scope of declines among amphibian populations (Blaustein and Wake 1990; Houlahan et al. 2000) has generated increased interest in their monitoring. Determining whether a particular population is declining or experiencing natural fluctuations requires long-term population studies (Blaustein et al. 1994; Pechmann et al. 1991). Aquatic amphibian populations have been surveyed using a number of methods, including seining, dip netting, trapping, and enclosure sampling (Olson et al. 1997; Shaffer et al. 1994). There are, however, serious limitations to aquatic surveys (Fellers and Freel 1995). For example, sampling methods to determine species presence are often ineffective for estimating abundance or density. Most methods of estimating abundance actually provide an index of number of individuals per unit time or distance (Fellers and Freel 1995; Olson et al. 1997). Furthermore, methods that actually estimate density, such as enclosure sampling (Shaffer et al. 1994), are frequently too cumbersome or impractical for broad application. If a large number of habitats is to be sampled regularly, a method that estimates aquatic amphibian abundance quickly and accurately is clearly needed.

We tested the effectiveness of timed dip net collections for estimating aquatic amphibian abundance by comparing timed collections results to density estimates obtained from "drop box" enclosure sampling. Timed collections require little effort and can be performed in minutes, making them ideal for long-term monitoring of pond-dwelling amphibians. Drop box sampling, on the other hand, is cumbersome and often takes well over an hour per sampling event (Maret, pers. obs.).

We sampled nine temporary ponds in the Michaux State Forest (Franklin County, Pennsylvania) twice during June 1999 using both drop box sampling and timed dip net collection (Sampling event 1: timed dip net collection on June 1, drop box sampling on June 2–4; Sampling event 2: drop box sampling on 16 June, time dip net collection on 21 June). On each of the two occasions, sampling with each method took place within five days of each other and was performed by the same individuals. Four of the ponds dried between the two sampling dates so only five ponds were sampled during the second interval. Six species were sampled during the study: larval *Ambystoma maculatum* (spotted salamanders); *A. jeffersonianum* (Jefferson salamanders); *A. opacum* (marbled salamanders); *Rana sylvatica* (wood frogs); and *Pseudacris crucifer* (spring peepers), and adult *Notophthalmus viridescens* (red-spotted newts). The pond habitats sampled varied considerably, from heavily shaded ponds with leaf litter and woody debris to open ponds with herbaceous and some woody vegetation.

The drop box sampler was constructed of 1/8 inch plexiglass, enclosed a surface area of 0.49 m^2 (0.7 m x 0.7 m), and was 0.75 m high. Marks on the side of the box were used to gauge water depth. We attempted to drop the box at evenly spaced sample locations along 2 or more (depending on pond size and shape) straight transects across each pond, but scattered woody debris occasionally caused us to deviate from this alignment. The number of drops ranged from 2 in a pond that had dried to a small puddle to 10–12 in the larger ponds (the largest pond surveyed covered an area of approximately 1096 m^2). Once the box was dropped at a location, the bottom edges were quickly pressed into the sediment to prevent animals from escaping. The inside of the box was thoroughly swept with a dip net (1/8 inch mesh) to collect amphibians trapped within the box. Dip net sweeps continued until no animals were collected in three successive sweeps. Amphibians were identified and released back into the ponds. Water depth was determined in order to calculate water volume within the box so that amphibian density (per m^3) could be calculated. Drop box sampling was con-

TABLE 1. Density (DENS) and catch/person/minute (CPM) estimates of amphibians from aquatic habitats in south-central Pennsylvania sampled by two methods. Density was determined using the drop box method and is reported as number/m^3. Four ponds dried before the second sampling event.

		A. opacum		*A. jeffersonianum*		*A. maculatum*		*N. viridescens*		*R. sylvatica*		*P. crucifer*	
Sampling Event	Pond	DENS	CPM	DENS	CPM	DENS	CPM	DENS	CPM	DENS	CPM	DENS	CPM
1	1	14.05	0.32	0.00	0.00	0.00	0.00	0.59	0.06	36.89	0.92	0.00	0.00
	2	9.59	0.46	4.11	0.00	15.07	2.13	0.00	0.00	332.06	6.24	0.00	0.00
	3	4.11	0.04	0.00	0.00	3.29	0.04	0.00	0.00	9.05	0.00	0.00	0.22
	4	20.61	0.13	0.00	0.00	17.87	0.00	21.99	0.06	2.75	0.05	1.37	0.06
	5	0.00	0.03	9.66	0.08	3.22	0.00	0.00	0.01	190.80	1.38	0.00	0.00
	6	10.65	0.35	0.00	0.01	7.10	0.01	0.00	0.01	5.32	0.50	0.00	0.01
	7	8.78	1.93	0.00	2.48	0.00	0.28	0.00	0.00	1518.54	27.57	21.94	0.28
	8	68.50	2.52	8.56	0.19	77.06	3.81	0.00	0.00	2.85	0.00	0.00	0.00
	9	9.49	0.69	18.98	0.34	664.45	2.06	0.00	0.00	1196.01	34.29	465.12	1.37
2	1	5.49	0.00	5.49	0.07	3.66	0.16	12.81	0.04	30.20	0.03	0.00	0.00
	2	5.41	0.00	24.32	1.83	5.41	1.80	2.70	0.00	502.77	9.59	0.00	0.00
	3	0.00	0.00	3.43	0.04	0.00	0.00	1.14	0.00	35.44	0.11	0.00	0.00
	4	0.00	0.00	0.00	0.00	61.22	0.23	108.84	0.16	13.60	0.00	54.42	0.31
	5	0.00	0.00	23.04	0.07	3.29	0.03	0.00	0.00	268.82	1.38	0.00	0.00

ducted by the same person on both sampling occasions (once the box was in place, two other people helped with the dip net sweeps)

Long-handled dip nets (16 inches wide x 12 inches high x 12 inches deep, 1/8 inch mesh) were used for the timed dip net collections. Three people sampled each pond by dividing the pond roughly into thirds, wading into the water, and dip netting all microhabitats. Sampling lasted from three to five minutes depending on the size of the pond. Generally, ponds less than 300 m^2 were sampled for three minutes while ponds greater than 300 m^2 were sampled for five minutes. Sampling ceased after five minutes at which time specimens were sorted by species and counted. Results were converted to catch/person/minute. If more than one hundred individuals were caught of a species (which only occurred with *R. sylvatica*), counting stopped at one hundred individuals. Timed collections were performed by the same three people on both sampling occasions.

We used a standard statistics package (SPSS Inc. 1999) to compare catch per unit effort measures from dip net sampling with density estimates from drop box sampling. Spearman's rank correlation coefficients (two-tailed) were determined for each sampling occasion and for both sampling occasions combined, using abundance estimates of each species from each pond as observations.

Six amphibian species were collected (Table 1). Red-spotted newts (*Notophthalmus viridescens*) were captured as adults while other species were represented as larvae. High scores from timed dip net collections generally corresponded with high density estimates from drop box samples. In 10 of 84 samples, a species was detected during drop box sampling but not during timed dip net collection. Species tended to be absent from timed collections and present in drop box samples when ponds contained diverse microhabitats, including areas of dense vegetation and woody debris (the absence of *A. opacum* from timed collections at ponds 1 and 2 during the second sampling event is most likely because of larvae metamorphosing and leaving the ponds prior to the timed dip net collection). For this reason, we attribute much of this discrepancy between sampling methods to habitat heterogeneity, and recommend that ponds with complex habitats be sampled more intensively, especially when performing timed collections. Pond heterogeneity also might interfere with drop box sampling and therefore may affect density estimates. Woody debris and dense vegetation are difficult to sample and species might be underrepresented in samples from complex habitats. In 8 of the 84 samples, a species was detected during the timed dip net collection but not during drop box sampling. In all of these samples, catch/person/minute was very low, indicating that the density of the species was most likely also low. This suggests that collection by dip net might be more likely to detect rare species than drop box sampling.

Measures of abundance from dip net sampling were closely correlated with density estimates (Sampling event 1: N = 54 samples [9 ponds x 6 species], Spearman's rho = 0.724, $p < 0.01$; Sampling event 2: N = 30 [4 ponds dried and were not sampled], Spearman's rho = 0.804, $p < 0.01$; Combined events 1 and 2: N = 84, Spearman's rho = 0.729, $p < 0.01$). Timed dip net collections seem to provide relatively reliable estimates of aquatic amphibian abundances. In addition, timed collections were performed in less than one tenth the time needed to perform the drop box surveys. During the first sampling event it took three days to sample nine ponds using the drop box method and less than one day to sample by timed collections. Ponds had dried considerably by the second event; drop box sampling of five ponds took approximately eight hours while the timed collections were concluded in less than one hour (another disadvantage of drop box sampling is that it involves carrying the large and heavy box between sampling locations, which might be difficult if sampling remote locations).

A rapid yet accurate means to quantify aquatic amphibian abundance is needed for effective long-term monitoring of this taxon. Timed collections seem to be an appropriate method for long-term monitoring programs because they are rapid, yield reasonably accurate representations of species abundances, and can be performed easily with minimal equipment. Combining timed collections with a method of estimating density, as we have done with our drop box sampling, allows conversion of catch per unit effort values into estimates of density. Both methods might yield inaccurate results in complex habitats because of difficulty in sampling all habitats. Adopting the timed collection sampling method into amphibian monitoring programs should allow researchers to monitor a larger number of habitats while maintaining a relatively high certainty that abundance estimates are reasonably accurate.

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Rana areolata (Crawfish Frog). Illustration by Heather Frese.

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Modifications for the Successful Use of Thermocouples in Studies of Thermoregulation

DEBORAH I. LUTTERSCHMIDT*
Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA

and

WILLIAM I. LUTTERSCHMIDT
Department of Biological Sciences, Sam Houston State University Huntsville, Texas 77341, USA
e-mail: bio_wil@shsu.edu

**Present Address: Department of Zoology, Oregon State University Corvallis, Oregon 97331, USA*
e-mail: luttersd@bcc.orst.edu

The measure of body temperature in ectothermic species is essential to studies investigating behavioral and physiological thermoregulation. Cloacal thermocouples have been used successfully to measure body temperatures (T_b) in a wide variety of species, including frogs, salamanders, turtles, lizards, and snakes (e.g., Cothran and Hutchison 1979; Erskine and Hutchison 1981; Hutchison et al. 1979; Lutterschmidt et al. 1997; Sievert and Poore 1995; Tu and Hutchison 1994). In addition, the combination of thermocouples and data acquisition systems (e.g., Omega OM-550 data logger, Omega Engineering, Stamford, Connecticut) has allowed for the measurement of T_b over extended periods of time without disturbing the animal's activity.

Continuous measures of T_b are typically obtained by inserting and taping a variable- gauge copper-constantan nylon-coated thermocouple 3–4 cm into the cloaca of an animal. A thermocouple-equipped animal may then be placed in a laboratory thermal gradient (e.g., Lutterschmidt 1991) for study of behavioral thermoregulation. Thermocouples must be long enough to reach each end of a linear thermal gradient from a centrally-located fixed point where the thermocouple is connected to a data logger. This length ensures that an animal may have full access to all areas along the length of the gradient. Unfortunately, excess thermocouple wire commonly becomes tangled as the animal moves back and forth along the gradient. We found this to be especially problematic when studying snake species, as they are capable of very unique body movements as compared to other amphibians and reptiles. Once large knots have been placed in the thermocouple, the thermocouple's length is reduced, thus restricting the movement of the animal within the gradient and preventing the animal from thermoregulating. Unlike the problems associated with small snakes, whose movements are restricted by the tangled and shortened thermocouple, larger and stronger snakes often pull their thermocouples from their cloaca. In addition to these problems, thermocouples that are tangled repeatedly are much more likely to break, preventing the collection of T_b by the data acquisition system. Breaks in wires covered by the thermocouple's insulation often go undetected until the downloading of a data file.

We have described common problems associated with the use and tangling of thermocouples and offer a few inexpensive suggestions and modifications to help 1) reduce the occurrence of

thermocouple tangling and 2) prevent animals from easily removing thermocouples from their cloaca. Details on the basic function and making of copper-constantan thermocouples have been described and may be found elsewhere (e.g., Omega Engineering, Inc. 1998).

Thermocouple Coiling.—One method used to aid in reducing thermocouple tangling was described by Tu and Hutchison (1994). They also observed that straight thermocouple wires tangled easily and were often broken by snakes. Thus, thermocouples were reshaped into a long spiral or spring-like coil by tightly coiling it around a glass rod or pipette and taping it in place. The coil was then placed in a boiling water bath for approximately 30 min and then quickly immersed in an ice bath. The heating, softening, and then sudden cooling of the thermocouple's nylon insulation reshaped the straight thermocouple into a spring-like coil. Although we found this method useful in our studies (Lutterschmidt et al. 1997; Lutterschmidt et al. 1998), it is not without difficulties. Firstly, the coiling of thermocouples works well for small-gauge thermocouple wire. Larger-gauged (i.e., thinner) thermocouple wire easily stretches and does not retain its spiral or spring-like coiling because of its thinner insulation. Secondly, the coiling of smaller-gauged (i.e., thicker) thermocouple wire is suited best for larger snakes (≥ 200 g), as smaller-bodied snakes are not strong enough to stretch the coil to gain access to the ends of the thermal gradient. Thirdly, although coiled thermocouples seem to work well with the more passive thermoregulatory movements of water snakes (*Nerodia rhombifer*), they were disastrous when used with bullsnakes (*Pituophis melanoleucus*). The greater activity and climbing-like movements of *P. melanoleucus* created very restrictive tangles in the thermocouple wire, which were nearly impossible to untangle (as one with experience in attempting to untangle a Slinky® would concur).

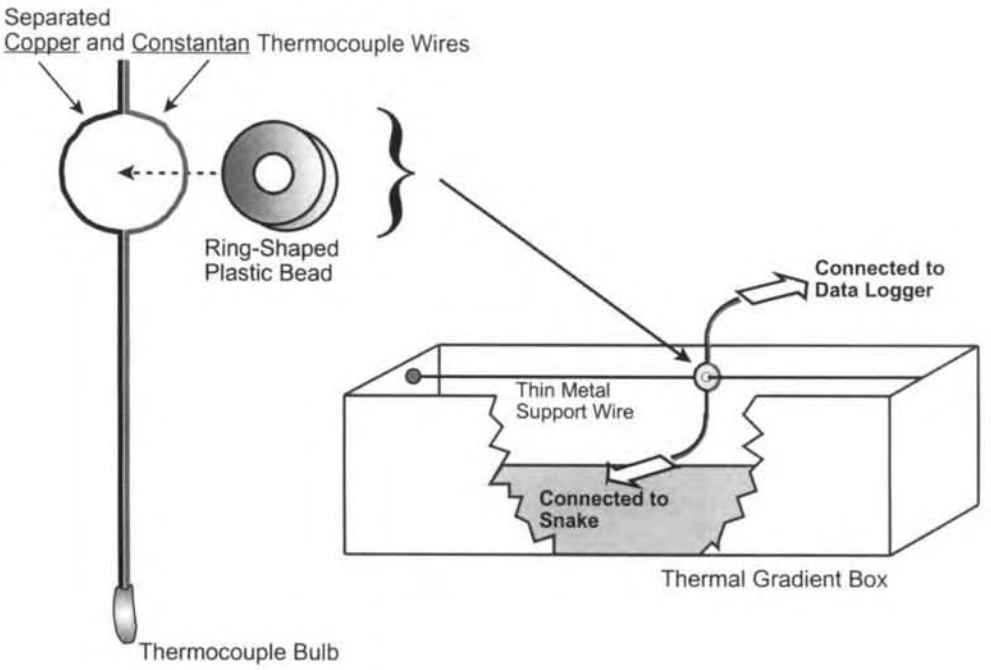


FIG. 1. Illustration of the thermocouple hanging-support system showing the placement of the ring-shaped bead in the thermocouple and the hanging-support wire in the linear thermal gradient box.

Thermocouple Hanging-Support System.—This alternate method reduces the occurrence of thermocouple tangling by keeping the thermocouple from resting entirely on the floor of the thermal gradient. We first separated the copper and constantan wires approximately 50 cm from the thermocouple's bulb-end using a scalpel, being careful not to damage the insulation covering the copper and constantan wires. This 50 cm length was used because it was slightly longer than the diagonal distance from the support wire to the edge of the gradient floor, ensuring complete access to all areas of the gradient's substrate. Once the copper and constantan wires were separated, we used epoxy to secure each wire to either side of a small ring-shaped plastic bead. Once the epoxy had set, we threaded the ring-shaped bead onto a thin metal wire, which was tightly strung across the length of the gradient (ca. 35 cm above the gradient floor) by two tension screws (Fig. 1). Possible friction and drag between the bead and wire was reduced by applying lubricant to the wire.

We tested and used this system in studying the thermoregulation of the Woodhouse's Toad (*Bufo woodhousii*) and the African House Snake (*Lamprophis fuliginosus*). This thermocouple hanging-support system worked extremely well in keeping excess thermocouple wire from dragging on the gradient floor. A few individuals of *L. fuliginosus* had a tendency to climb onto the hanging-support wire. One might want to further consider this possible problem when testing more arboreal snake species. Although we have limited data on skinks (*Eumeces*), we expect this system to work well with most non-arboreal species.

Thermocouple Duct-Tape Patches.—The problems associated with individuals pulling out their thermocouples result primarily from the methods used to secure a thermocouple to an animal. Thermocouple wires have a small surface area, and therefore only a very small proportion of the thermocouple wire actually contacts the tape's adhesive. Thus, within a few hours, the secured thermocouple loosens from the tape used to attach it to the study animal. Normal tension placed on the thermocouple from an animal's movement in the gradient can then cause the thermocouple to be pulled from the cloaca, even though the tape used to secure the thermocouple is often still attached securely to the animal. This problem might be solved by using a strong-adhesive tape rather than a medical tape (e.g., 3M-brand Nexcare® waterproof adhesive tape) to ensure attachment of the thermocouple. However, a strong-adhesive tape would be difficult to remove and could damage the scales and skin of the animal.

These problems were solved by placing a small patch of strong-adhesive duct tape around the thermocouple. This patch was placed ca. 5–6 cm from the bulb-end of the thermocouple. This patch increased the surface area of the thermocouple to be taped and

secured to the animal with the 3M-brand Nexcare® tape. The duct-tape patch was made from a piece of duct tape measuring approximately 7 cm in length and 5 cm in width (i.e., width of the duct tape) for use with snakes having a snout-vent length of approximately 60 cm and a body mass of 100 g. The thermocouple wire was placed perpendicular to the tape's length and attached to the piece of duct tape with the adhesive side facing upward. The sides of the duct tape were then folded over the thermocouple in a tri-fold fashion so that the duct tape's strong adhesive was not exposed (Fig. 2a). This patch now measured 5 cm (tape's original width) along the length of the thermocouple and was approximately 2–3 cm wide after tri-folding over the ends. The patch of duct tape would now securely hold the thermocouple because 1) the duct-tape adhesive in contact with the thermocouple is much stronger than the 3M-brand Nexcare® waterproof adhesive tape used to attach the thermocouple to the snake, 2) the strong adhesive of the duct tape covers both sides of a 5 cm length of the thermocouple, and 3) this duct-tape patch creates a larger surface area to be attached to the animal with the Nexcare® tape. The finished duct-tape patch should be wide enough to cover the ventral scales of the snake just anterior to the vent, leaving many of the dorsal scales exposed for contact with the Nexcare® tape's adhesive.

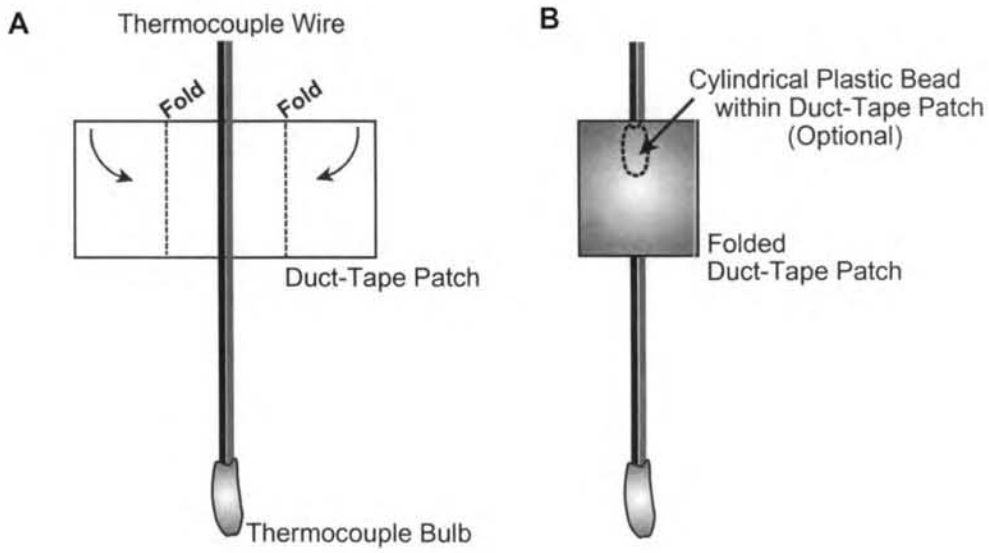


FIG. 2. Illustration of the (a) attachment of a duct-tape patch to a thermocouple and (b) the placement of the cylindrical plastic bead within the duct-tape patch.

An additional modification can be used to help prevent the occasional thermocouple from sliding within the duct-tape patch. We threaded a small and thin cylindrical plastic bead (ca. 1 cm in length) onto the thermocouple wire. We suggest a bead that slides snugly over the thermocouple for a secure fit. The bead must be threaded onto the thermocouple prior to making the temperature-sensing bulb-end of the thermocouple. The bead was further secured to the thermocouple with epoxy 5–6 cm above the bulb-end of the thermocouple; the duct-tape patch was placed over the bead (Fig. 2b). This bead may further prevent a thermocouple from being pulled through the duct-tape patch.

The combination of the plastic bead and the surface area of the duct-tape patch provided a secure attachment of the thermocouple to the animal which remained in place for at least 36 h while monitoring the thermoregulatory behavior of *P. melanoleucus*. We have tested similar versions of these modified thermocouples with skinks (*Eumeces*), juvenile *Alligator mississippiensis*, and sunbeam snakes (*Xenopeltis*). We do not recommend the use of these methods for securing thermocouples to amphibians; methods for attaching thermocouples to toads have been described by Sievert and Poore (1995). We hope that these described modifications to the basic thermocouple will prove quite useful to experimenters studying the thermoregulatory behavior of ectotherms in the laboratory.

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Continuously Recording Body Temperature in Terrestrial Chelonians

KENNETH E. NUSSEAR
Ecology, Evolution, and Conservation Biology & Biological Resources Research Center/MS 314
University of Nevada, Reno, Nevada 89557, USA
e-mail: spiney@unr.edu

TODD C. ESQUE
Ecology, Evolution, and Conservation Biology & Biological Resources Research Center/MS 314
University of Nevada, Reno, Nevada 89557, USA
and
U.S. Geological Survey, Western Ecological Research Center
6770 South Paradise Road, Las Vegas, Nevada 89119, USA

and

C. RICHARD TRACY
Ecology, Evolution, and Conservation Biology & Biological Resources Research Center/MS 314
University of Nevada, Reno, Nevada 89557, USA

Body temperatures of turtles and tortoises have been measured using mercury-in-glass thermometers (e.g., Hillard 1996; Woodbury and Hardy 1948), temperature-reporting transmitters attached to the surface of the animal (Zimmerman et al. 1994), and implanted (or swallowed) devices to measure internal-body temperatures (e.g., Marlow 1979; Sajwaj 1998; Zimmerman et al. 1994). Samples of body temperatures have been used to describe the range of body temperatures available to individuals under a variety of environmental conditions (e.g., Christian and Tracy 1985; Hillard 1996; Zimmerman et al. 1994). Profiles of body temperatures require repeated measurements on each animal, but those measurements can be time consuming and might cause disturbance to the animal measured (Sajwaj and Lang 2000).

Here, we describe the use of an externally mounted thermistor and datalogger to obtain data on temperatures of terrestrial chelonians at many temporal scales. We describe a location on the body to measure a body temperature closely approximating cloacal temperature. Use of this instrument does not require frequent handling or disturbance to the animal, and does not interfere with natural behavior including mating and egg deposition (Nussear et al., unpubl. data).

We used StowAway™ TidbiT™ temperature dataloggers (Onset Computer Corporation, Pocasset, Massachusetts), customized by Onset from their standard design (TBICU108, –20°C to +70°C). Our datalogger had a weather-resistant thermistor on a 150 mm wire mounted external to the instrument, and no protective coating on the datalogger. The dataloggers were 25 mm in diameter, 14 mm thick and weighed approximately 11 g. Data from the dataloggers were retrieved via an infrared (IR) interface (Optic Base Station-DSA, Onset Computer Corporation, Pocasset, Massachusetts).

Each instrument was calibrated in a water bath against a high-resolution mercury-in-glass thermometer. A thin layer of silicone sealant was applied to the entire exterior surface of the datalogger, which was then coated with dental acrylic (Coralite Duz-All™ acrylic, Bosworth Co., Skokie, Illinois). The coated datalogger weighed 16 g. After coating, we re-calibrated each datalogger and covered it with a circular polyvinyl chloride (PVC) cap (Fig. 1A) before attaching it to the animal. The PVC cap was 32 mm in diameter and 15 mm high (Part # 9745, Shepherd Hardware Products, INC., Three Oaks, Michigan), with holes cut for the IR interface and the thermistor wire (Fig. 1B and C). The IR interface hole was covered with transparent acetate, which allowed for programming and downloading the datalogger without removing the PVC cap or the acetate. Additionally the PVC cap ensured that the optical interface was protected from the environment (Fig. 1D). Silicone sealant and epoxy secured the datalogger to the carapace, and quick-setting glue (Super Glue, Via-Chem INC., St. Laurent, Quebec Canada) followed by a layer of silicone secured the thermistor to the animal.

Our first experiment was to determine an external location for the thermistor probe that best approximated cloacal temperature. While cloacal temperature can differ from temperatures at other locations on the body, this measurement of temperature is reported frequently in the literature (Hailey and Loveridge 1998; Hillard 1996; Woodbury and Hardy 1948) and was suitable for addressing other research questions on body temperature and ecology of this animal. We attached the thermistors (Fig. 1F) of five dataloggers to a single desert tortoise (*Gopherus agassizii*) at the following locations: (1) above the tail (glued to the skin and the shell at the junction of the tail and caudal scute Fig. 1G), (2) left axillary region, (3) junction of the neck and clavicle region, (4) right inguinal region, and (5) in the cloaca (2–3 cm deep). The tortoise was placed in an aquarium (30 x 60 x 40 cm) in an indoor laboratory under a 150 W flood lamp and was heated for one hour. The dataloggers recorded temperatures at one-minute intervals.

In this experiment the temperatures measured above the tail were the least different from cloacal temperature relative to the four external locations measured (Fig. 2). Additionally, the location above the tail was the only location at which the thermistor re-

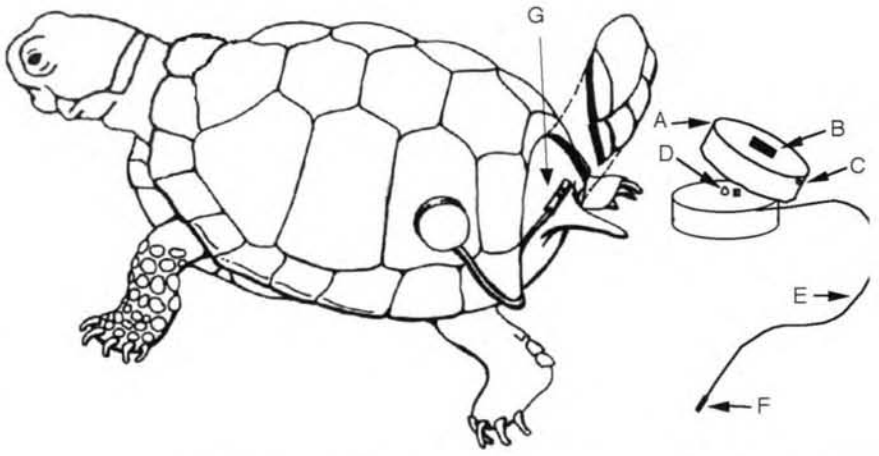


FIG. 1. A schematic of a tortoise showing the datalogger with, (A) PVC protective cap with holes (B, C) cut for the (D) IR interface and (E) thermistor wire, (F) thermistor, and (G) site for thermistor attachment above tail.

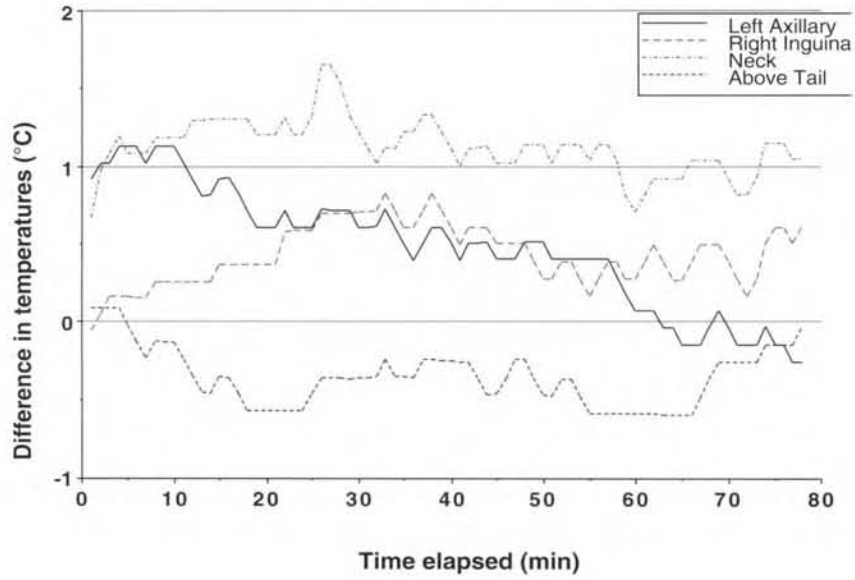


FIG. 2. Temperature differences for four locations on the body of one tortoise as compared to the cloaca during heating for a one hour time period.

mained attached to the tortoise for more than a few days. This is probably because the thermistors at the three other sites were on skin that is moveable (and therefore flexible), and that is regularly shed. We found that areas such as the neck and shoulders provided very short-term attachment sites, which was undesirable for a field study. In contrast, the thermistor above the tail was still attached after four weeks on this animal. Thus, the above-tail attachment point was chosen for subsequent data collection.

Our second experiment was conducted to replicate the correspondence of externally measured temperature to cloacal temperature found in the first experiment, among different animals. We measured body temperatures on six individuals subjected to a broad range of environmental temperatures. The tortoises ranged in length from 99 to 236 mm carapace length (CL), (mean = 169), and in mass from 273 to 2428 g (mean = 1148). A single datalogger was attached to each animal with the thermistor attached above the tail as described above. Tortoises were moved from room temperature (ca. 22°C) into a constant temperature cabinet at 12°C. After cooling, the tortoises were moved to a galvanized metal trough (1.8 x 0.6 x 0.3 m) with eight 150 W flood lamps mounted 40 cm overhead. The floor of the trough was covered with 2 cm of silica sand. This influx of radiant energy created sand surface temperatures of ca. 65°C. Cloacal and esophageal temperature were measured (at 3 and 5cm deep, respectively) after 25 min, and approximately every 10 minutes thereafter using a hand held thermocouple reader (Omega 871A digital thermometer, OMEGA Engineering INC., Stamford, Connecticut). The dataloggers recorded above-tail temperatures once each minute.

In this second experiment the difference between the above-tail temperature and cloacal temperature was greatest (as high as 6°C; mean = 4.4°C) when the animals were warming (Fig. 3). This difference was as low as 2.4°C as the animals approached a body temperature of 35°C. A similar pattern occurred in the difference between esophageal and cloacal temperature (Fig. 3). The time to reach the greatest temperature difference between the cloaca and the esophagus was longer in this case (36 min) with maximum a difference of 3.75°C (mean = 1.96) that later narrowed to 0.68°C.

The datalogger described facilitates automated collection of body temperatures, which can provide more information with less work than other methods (Vitt and Sartorius 1999). For example, using this instrument, researchers can record the body temperatures of many tortoises simultaneously and at a myriad of temporal scales: from fractions of seconds or minute-to-minute measures that can enhance our understanding of physiology and microhabitat selection, to long-term data that can yield information such as the timing of the onset of hibernation and the recurrence of activity in the spring. Temperatures measured above the tail corresponded well with cloacal temperatures (Fig. 2). The thermistors located at other possible attachment sites on the animal did not stay affixed to the animal. Thus, the alternate attachment sites other than above the tail would probably not work well in the field.

The correspondence between external temperature and cloacal temperature can be obscured by differential dynamics in temperatures of body parts during rapid heating or cooling of the animal (Sturbaum and Riedesel 1977; Zimmerman et al. 1992). Under extreme heating conditions, both tail and esophageal temperatures differed from cloacal temperature (Fig. 3). Nonetheless, temperatures above the tail yielded estimates of cloacal temperature with accuracy comparable to that presented by Zimmerman et al. (1992) for temperatures taken from the skin in the scapular region of tortoises. We interpret the discrepancy between cloacal temperature and temperatures measured at different locations on the body as evidence of thermal heterogeneity within

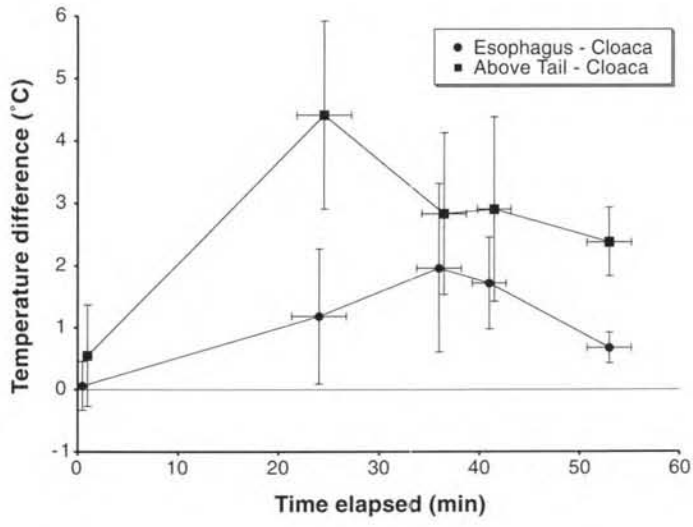


FIG. 3. Temperature differences between above-tail and esophageal temperatures on six tortoises as compared to the cloaca during heating for a one hour time period. Error bars represent the standard deviation of each mean. Horizontal error bars represent the standard deviation of the average measurement time.

the body in this large ectothermic vertebrate, rather than a technological limitation. This in turn raises new questions "is there a single meaningful body temperature in these organisms, and if so, is that meaningful temperature that of the cloaca?" and "to what temperature do tortoises respond when they are in a thermal transient and there are large gradients of temperature within the body?"

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Using Masks to Monitor Oxygen Consumption and Breathing Rates of Snakes

CHARLES R. BLEM
and
LAURENCE G. MENDOZA
Department of Biology, Virginia Commonwealth University
P.O. Box 842012, Richmond, Virginia 23284-2012, USA
e-mail (CRB): cblem@saturn.vcu.edu

The measurement of respiration has been an important facet of the study of vertebrate energetics for several decades (Lillywhite 1987). Traditionally, oxygen consumption has been measured using animals tested in respiratory chambers such as a 3.7-L paint can or other enclosure. Such chambers are useful because they are simple to make and because they provide the ability to exclude environmental factors other than ambient temperature (e.g., light, noise). However, such chambers also prevent study of the effects of these same factors, are not conducive to study of costs of locomotion, and often are not extremely sensitive to short-term changes in metabolic rates. Some researchers have used light-weight, clear plastic masks to overcome these difficulties (e.g., see Gessaman 1987). These allow inhalation of fresh air and collect the gases that are exhaled. Measurement of respiration of snakes by means of masks has been done (Walton et al. 1990), but appears to be rare. Herein we present a critique of two problems potentially associated with measurement of respiration in masked snakes (i.e., effects of stress and failure to include measurement of cutaneous gas exchange) and illustrate some advantages of such techniques.

Materials and Methods.—Brown water snakes (*Nerodia taxispilota*) used in these studies were collected by hand near the confluence of the Appomattox and James rivers, near Hopewell, Virginia, during September 1996, April 1998, and September 1998. The area includes large areas of tidal swamp and marshland. For details about the habitat, see Blem (1981) and Blem and Blem (1990a, 1995). Snakes were kept in groups of 3–4 in glass aquaria 120 x 60 x 60 cm deep in the laboratory for at least three weeks of thermal acclimation at a photoperiod of 12L:12D before the initiation of measurements. They were provided whole small fish (*Fundulus* sp.) and water *ad libitum*. Snakes were not fed for two weeks before each measurement in order to assure that all determinations were being made under post-absorptive conditions.

Oxygen consumption was measured by open-flow respirometry at 12, 17, 22, 27, and 32°C using snakes acclimated for more than two weeks to each of these temperatures (see Blem and Blem 1990b; Blem and Killeen 1993, for details). Oxygen consumption of each snake was measured twice: once in a respirometry chamber and once with a mask. The order of test procedures was determined at random, and the interval between the paired tests was never more than two days. Measurements were made for 15 min after levels of oxygen consumption remained stable for at least 10 min. In chamber tests, air was pulled through a 3.7-L respirometer at 200–500 ml/min, depending upon temperature and mass of individual snakes. An Applied Electrochemistry SR 3-A/I oxygen analyzer interfaced to a personal computer with Sable Systems software was used to make measurements of oxygen consump-

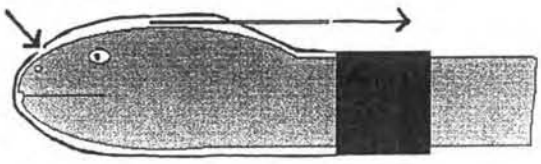


FIG. 1. Mask used in respiration measurements. Arrows indicate direction of air flow.

tion throughout all experiments. Carbon dioxide production was monitored by means of a Beckman 864 infrared CO_2 analyzer. An arrangement of respirometer, flow meter, and pump was used that provided measurements that were independent of the respiratory quotient (Withers 1977; also see Blem and Blem 1990b).

In mask tests, snakes were fitted with 50-ml masks (Fig. 1) generally resembling those used in avian studies (see Gessaman 1987; Walton et al. 1990; Withers 1977). These were constructed of light plastic vials with incurrent ports near the snake's nares. The masks were fastened over the snake's head either with tape or with a small rubber spacer. This did not visibly disturb snakes for more than a few minutes. Outside air was drawn through the mask at a constant rate of 100–300 ml/min by means of thin plastic tubing attached to the posterior end of the mask (Fig. 1). Incurrent openings were slightly larger than the tubing to avoid creating a negative pressure in the mask. In a separate set of tests, rates of inspiration/expiration in masks were determined by using the open-flow system described above, except that flow rates were adjusted in some instances so that individual breaths could be recorded.

All computations of metabolism were done according to Withers' equation 4a (1977). All data sets were tested for normality by means of the Shapiro-Wilk statistic, (SAS 1992; PROC UNIVARIATE), and variances were tested for homogeneity by means of Bartlett's test (Zar 1999). All comparisons of test groups were made by means of paired t-tests.

Results and Discussion.—There are two primary problems potentially associated with use of masks in respiration measurements of snakes. First, one must be sure that masks do not stress test animals so as to cause abnormally high levels of respiration. Brown water snakes became accustomed to masks with repeated tests, but one should be sure to handle the snake carefully and gently while putting the mask in place. Second, because chambers enclose the entire snake and masks do not enclose the body, cutaneous respiration is not being measured and determinations made with masks might therefore be lower than true values. With regard to both problems, none of the mask measurements differed significantly from chamber measurements (Table 1), but chamber values generally were 1–3.9% higher than those recorded with masks. The magnitude of the difference between mask and chamber levels seemed to be a function, at least in part, of test temperature. This probably is because mask measurements do not include respiration through the skin, which can amount to about 8% of total respiration of terrestrial reptiles (Walton et al. 1990) and might be greater when metabolic rates are increased at higher ambient temperatures. The relatively low magnitude of the differences indicates that mask measurements are reasonable approximations of metabolic levels of whole animals. However, respiration through the skin may vary taxonomically, particularly among snakes with different habitats (e.g., aquatic vs terrestrial or desert). This could lead to varying differences between mask and chamber results.

Use of masks can provide a means for measuring energetic costs of ophidian activity (Bennet 1982; Walton et al. 1990). Furthermore, costs of relatively minor factors such as visual or tactile disturbance can be evaluated using clear masks. At rest, mask measurements provide very rapid response times because of the relatively small volume of the mask relative to a respirometry chamber. In fact, one should choose materials in such a way as to minimize both mask weight and volume. There are numerous plastic containers (e.g., centrifuge tubes, vials, or other containers) suitable for this purpose. Only simple modification needs to be done. A hole should be drilled near the tip of the nose to provide an opening for incurrent gas and small-diameter (2–3 mm inside diameter) plastic tubing should be attached near the rear of the mask to carry away the sample gas (Fig. 1). The mask need not be airtight, so long as the oxygen content of surrounding air is known and air is continuously drawn through the mask (see Gessaman 1987).

Under optimal conditions, individual respiration cycles can be recorded (Figs. 2A, 2B). The precision of these is dependent upon: (1) flow rate, which can easily be adjusted to produce results such as those illustrated here, and (2) the rate at which measurements are recorded on the computer. Software can be adjusted to record at very small time intervals (e.g., < 0.01 s) and large files can be accumulated. Care must be taken to adjust flow rates to avoid abnormal (triphasic) respiration typical of excited animals (Clark et al. 1978; Gans and Clark 1978). The actual rate must be determined experimentally and will depend upon the species and size of the snake. Segments of these can be selected, analyzed, adjusted, or deleted. Measurements can also be extended over many hours, although desiccation of the test animal is a concern. This provides opportunity for study of a variety of responses, including respiration rates during locomotion (Walton et al. 1990) or during various behaviors (Blem and Killeen 1993). For example, individual brown water snakes appear to hold their breaths when disturbed (Fig. 2C). This response was observed in all ten snakes tested. The duration of breath holding seems to be independent of body size

TABLE 1. Body mass (g) and respiration rates (ml O_2/h) of brown water snakes measured with a face mask and in a respirometry chamber. N is number of individual snakes. P values are for paired-t tests comparing measurements made using masks with those made in chambers.

Temperature (°C)	N	Mass	Mask	Chamber	P
12	21	265.7 ± 13.7	4.3 ± 0.3	4.4 ± 0.3	0.58
17	17	248.3 ± 13.6	6.4 ± 0.7	6.4 ± 0.8	0.89
22	16	254.3 ± 14.2	10.4 ± 1.3	10.5 ± 1.2	0.49
27	15	259.1 ± 15.6	14.1 ± 1.9	14.3 ± 1.8	0.59
32	15	258.9 ± 15.8	18.1 ± 2.2	18.8 ± 2.1	0.06

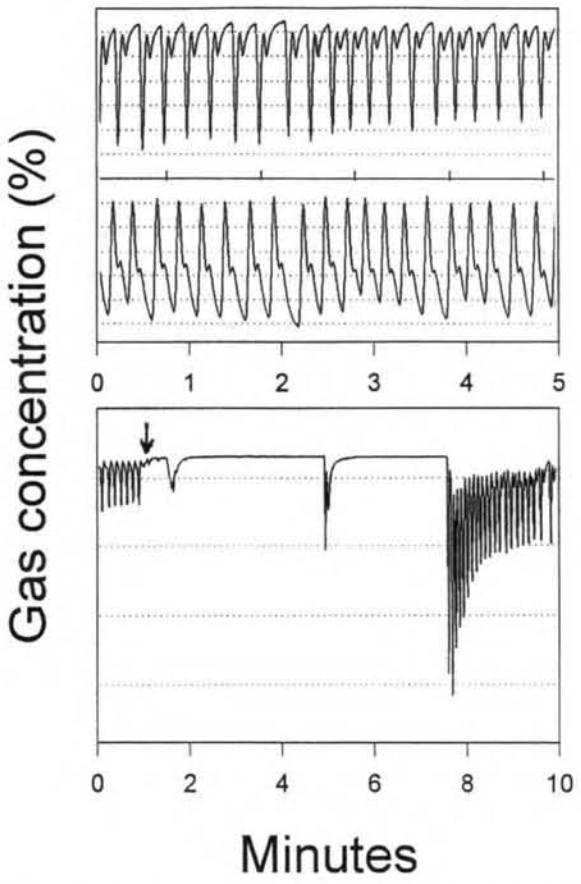


FIG. 2. Measurements of gas concentrations during respiratory cycles in brown water snakes. A. Oxygen. B. Carbon dioxide. C. Oxygen; the snake was prodded at the time indicated by the arrow. Downward extremes of oxygen represent inspiration; upward peaks of carbon dioxide indicate expiration.

and therefore may represent some sort of death-feigning, but this needs more study. Such behavior cannot be tested in closed chambers.

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HERPETOLOGICAL HUSBANDRY

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A Cage System for Maintaining Small Treefrogs

CRAIG S. IVANYI
and
STÉPHANE POULIN
Herpetology Department, Arizona-Sonora Desert Museum
2021 North Kinney Road, Tucson, Arizona 85743, USA

Captive amphibians can be housed in a variety of ways. Often they are maintained in small glass aquaria that are set up as aquatic or semi-aquatic terraria (depending upon the species' habits). There are pros and cons of using such aquaria. On the up side are their low cost and the commercial availability of a variety of sizes. However, the downside is ease of breakage, lack of drains, and the need for modifications to use them for different types of amphibians. For over 4 decades, this type of enclosure was used to house almost all species of amphibians (about 30 species of toads, spadefoots, true frogs, treefrogs and salamanders) maintained at the Arizona-Sonora Desert Museum. After the construction of a new herpetological holding facility, we devised a new type of cage system for small treefrogs.

The system consists of four 40 cm square, polyethylene frame boxes constructed of 20 mm square framing sticks screened with 4 mm high-density, polyethylene mesh (Fig. 1). The mesh is secured by a thin strip of polyethylene that is stapled into a 6 mm deep rabbetted channel in the frame. If the species to be kept requires higher humidity or visual separation, transparent or opaque solid plastic panels (0.125 mm thick) can be used instead of the mesh, which might require that a dado slot is cut into the framing



FIG. 1. Front view of cage system including plumbing.

sticks that allows them to be inserted into the slots. The front panels are attached to the other panels with a plastic piano hinge and secured with stainless steel suitcase latches (Fig. 2), while the rest of the panels are fastened with #6 stainless steel woodscrews. These boxes form the upper story of the animals' enclosures. Located below each box is a 35.5 cm x 22.8 cm x 22.8 cm plastic Rubbermaid® container holding a pool of water 5 cm deep. A large plastic sink drain with a 4 mm mesh plastic filter is installed in each container and allows wastewater to be conducted to a floor drain through PVC pipe. An in-line shut-off valve is installed below each sink drain. Below this a PVC tailpiece nests inside the drainage pipe, but isn't directly connected, which allows removal or replacement of the Rubbermaid® containers when necessary.

The screen boxes are secured with #6 stainless steel woodscrews to a 1.86 m x 48 cm x 20 mm thick polyethylene shelf. The Rubbermaid® containers are inserted through four large rectangular openings in the shelf and are supported by the containers' flanges (flared top lips). The support shelf is attached to a wall at the rear, while the front is supported by a 1.82 m long x 5 cm x 5 cm strip of angle aluminum (4 mm thick) and three 30.5 cm x 40 cm x 20 mm thick vertical polyethylene supports.

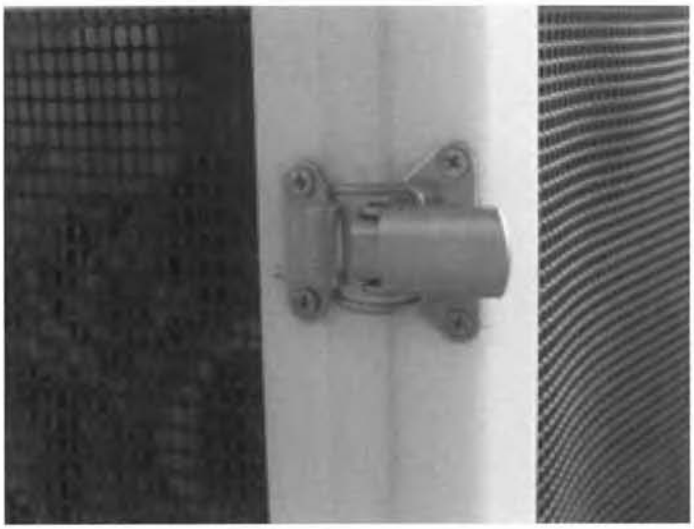


FIG. 2. Stainless steel door latch.

This system can be built for a cost of US $350.00–400.00, if one uses in-house labor. The most expensive component is the polyethylene frame material, which is purchased as a large sheet (1.2 m x 2.46 m) for approximately $150.00–200.00. However, one sheet can be used to build several sets of cages, which can be mounted in rows one above the other, and this significantly lowers the unit cost of each set of cages. Less expensive materials can be substituted for the polyethylene. The benefits of using polyethylene are that it is non-toxic and impervious to water and most chemicals; it maintains stable dimensions (despite fluctuating relative humidity); it is shatterproof and can be cut, drilled and joined under pressure without splintering; and it should give many years of reliable service.

This type of caging system might be suitable for a wide variety of small arboreal or semi-arboreal amphibians. We have used these cages to house adult Canyon Treefrogs (*Hyla arenicolor*), Arizona Treefrogs (*H. eximia*), and Mexican Treefrogs (*Smilisca baudini*). Additionally, we reared recently-metamorphosed frogs of both these *Hyla* species, and the *H. arenicolor* bred in one of the small boxes. The tadpoles were removed and reared through metamorphosis in other cages and returned to these units afterwards.

ZOO VIEW

The first reptile collection at the San Diego Zoo was assembled in 1922 and the first reptile house was the modified International Harvester building, built for the Panama-California Exposition during 1915–16. In 1931, C. B. "Si" Perkins was in charge and lobbied for a better facility; his new building, designed specifically for reptiles, opened on 4 July 1936. This large structure is still home for the collection. Many reptiles are kept outdoors in large enclosures: crocodilians, giant tortoises, and large varanids and iguanids. A series of small buildings named in honor of the late Laurence Klauber, known for his studies on rattlesnakes, house a number of smaller amphibians and reptiles. Klauber was the first curator of reptiles in the 1920s, consulting curator beginning in 1931, and served on the Board of Trustees from 1943 to 1968.

Charles Shaw followed Perkins and developed successful reproductive programs for Galápagos tortoises and other reptiles. When Shaw died, Jerry Staedeli was installed in his post. Later, James Bacon became curator until he died in 1986. Jim was concerned about conservation issues, especially those related to the potential loss of island populations. His assistant, Earl (Tom) Schultz was elevated to his post until he retired several years ago. The present curator, Donal Boyer, was formerly the supervisor at the Dallas Zoo where we were colleagues for over a decade.

Herpetological research at the San Diego Zoo has been ongoing over many years, especially from the Center for Research of Endangered Species (CRES), which began in 1975. Developed to improve captive breeding and health of wild and captive animals, CRES has been in the forefront of zoo conservation initiatives. One of the major thrusts has been the West Indian iguana effort, involving an *in situ* and *ex situ* component. In fact, Allison Alberts, Valentine Lance, John (Andy) Phillips, and retired CRES Director Kurt Benirschke have published many papers on herpetological subjects.

Allison heads the CRES Applied Conservation Division. She has used statistical models based on radiographic measurements to predict oviposition date and clutch size in Cuban iguanas (*Cyclura nubila*) and also studied the effects of incubation temperature and water potential on growth and thermoregulatory behavior. She has predicted gender of lizards

using two dimensional ultrasound imaging and plasma testosterone concentration. Her investigations include seasonal reproductive cycles of the desert tortoise, pheromonal self-recognition in desert iguanas, dominance hierarchies in male lizards, pre-release health screening in animal translocations, chemical and behavioral studies of femoral gland secretions in iguanid lizards, and many other studies on chemical recognition and behavioral aspects of lizards and chelonians. Recently, four Anegada Island iguanas, a species found in the British Virgin Islands, hatched at the CRES off-exhibit reptile research facility. Fewer than 300 individuals remain in the wild and there has been an 80% decline since the 1960s. The Zoo supports a head-starting program on the island and the staff is currently surveying the wild population and investigating nesting ecology. In addition to her work in the Caribbean, Allison has a long-standing interest in the reptiles of southern California, with division staff currently conducting radiotelemetry studies to better understand the behavioral ecology of coast horned lizards, rosy boas, and red diamond rattlesnakes.

When I read her seminal publication "West Indian Iguanas: Status Survey and Conservation Action Plan," which included conservation strategies, taxonomic accounts, action plans, and beautiful color photographs compiled by specialists, it seemed appropriate to ask her to share her accomplishments with our community. Because Allison is so committed to the continued survival of West Indian iguanas, her description of the Cuban iguana program below nicely incorporates her vision of a successful zoo conservation effort using combined expertise and resources for the overall recovery of a species.—*James B. Murphy, Section Editor.*

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Ten Years of Conservation Research on Cuban Rock Iguanas

ALLISON C. ALBERTS
Center for Reproduction of Engandered Species
Zoological Society of San Diego, P.O. Box 120551
San Diego, California 92112, USA
e-mail: aalberts@sandiegozoo.org

With funding from the National Science Foundation Conservation and Restoration Biology Program, I and fellow researchers in the CRES Applied Conservation Division began studies of Cuban iguanas on the U.S. Naval Base at Guantanamo Bay, Cuba, in 1992. Our intentions were to gain an understanding of the basic biology of these iguanas, as well as to develop practical conservation strategies for population recovery. For three years, we collected baseline data on population density, social behavior, reproductive hormone cycles, home range size, and daily and seasonal activity patterns. We found a negative relationship between female size and reproductive success, with larger females producing a higher percentage of non-viable eggs. That larger, presumably older, females tend to show greater infertility and egg mortality suggests that reproductive senescence might occur in this long-lived species. We also found that hatchlings from eggs incubated at higher temperatures grow more quickly than those incubated at lower temperatures. Finally, field experiments revealed that temporary alteration of local social structure through translocation of dominant males might represent a valuable management tool for small iguana populations by ensuring that a greater percentage of males have an opportunity to contribute to the gene pool.



As elsewhere in the Caribbean, one of the main threats to iguanas at Guantanamo Bay is a sizeable population of feral cats, which consume large numbers of juveniles each year. In 1995, we released 45 juvenile Cuban iguanas, collected as eggs on the base and reared at the San Diego Zoo, at two locations on the base. These animals were part of a long-term head-starting experiment designed to test whether juveniles that have been raised in captivity until they reach a less vulnerable body size have improved chances for survival against introduced predators in the wild.

Prior to the release, several studies were undertaken with the captive juveniles at the Zoo. Monthly measurements of the distance individual iguanas would allow an observer to approach before fleeing indicated that captivity did not result in a decrease in fear of humans. Food preference tests showed that juveniles were willing to sample unfamiliar native plants after several months on an artificial diet, suggesting that they are unlikely to experience difficulty in adapting to natural food sources. A thorough veterinary screening showed that all of the juvenile iguanas were in good health and could be released safely. A CNN film crew accompanied us to Guantanamo to cover the release, and the story, which aired on both Headline News and Science and Technology Week, generated international attention. Follow-up studies indicated that the released juveniles adapted well to life in the wild. Their growth, thermoregulation, and behavior, particularly with regard to predator avoidance, closely parallel their wild counterparts.

In late 1994 and early 1995, approximately 60,000 Cuban and Haitian migrants arrived unexpectedly on the base. Extensive areas of natural habitat were graded along the coastline to construct temporary housing, resulting in disturbance to natural ecosystems. At the height of the migrant crisis, the dry tropical forest surrounding our study site was reduced to less than 5% of its former extent, and we could only locate a single adult male in the area. With funding from the Zoo, we studied how rapidly and to what degree the iguana population was able to achieve its former dimensions, and how the natural process of recolonization of the area by iguanas correlated with recovery of vegetation at the site. This research provided an ideal opportunity to document the extent to which Caribbean dry tropical forest ecosystems are resilient enough to recover from disturbance, and to study the ecological role that iguanas play in the recovery process.

By 1999, we had documented a relatively stable group of 25 individuals at the site, with approximately 15% turnover in group composition per year. For both males and females, the relationship between body mass and body length was comparable to that of healthy wild iguanas, indicating that iguanas were able to forage

effectively at the site following disturbance. In order to document revegetation of the site, we also measured changes in the biomass of plant material over time. Although the rate of increase slowed in 1999 (1.05 m^3/month) compared to 1998 (1.52 m^3/month), the total biomass of vegetation at the site continued to grow throughout the study period.

Public education is key to the success of any conservation program. Thanks to a supplemental award from the National Science Foundation's Informal Education Program, we have been able to incorporate a public education component into our work on the base. Although Cuban iguanas comprise a conspicuous component of the local fauna and have been adopted as an informal mascot by many base residents, their biology and conservation status are not widely understood or appreciated. A major focus of our educational efforts has been to provide opportunities for the general public to participate actively in our field research effort. On three separate trips in 1997, we offered interested volunteers on the base the opportunity to participate in standardized iguana censusing and help collect data on antipredator and thermoregulatory behavior. Feedback from over 40 participants in the form of surveys was overwhelmingly positive, with 93% of respondents finding the research experience extremely worthwhile, 83% of respondents experiencing a positive shift in attitude regarding scientific research following their field experience, and 90% of respondents indicating that they would recommend the research experience to other base residents.

In collaboration with HVS Productions, we also produced a video that describes the basic biology of iguanas, their conservation status and requirements, and the goals, study methods, and results of our research program. Copies of the videotape have been distributed to the environmental office, library, and schools on the base. On each of our trips to the base, we have offered public lectures at which we provide information on iguanas, their conservation status, and how to appreciate and enjoy them without harming them. We have given numerous presentations to both elementary and secondary students on the base, prepared an endangered species pamphlet for incoming base personnel, and designed an Iguana Crossing sign for sites on the base where road casualties were known to have occurred.

Our work at Guantanamo Bay is but one example of the many contributions zoos are making to the conservation of West Indian iguanas. Over 20 American Zoo and Aquarium Association (AZA) member institutions have provided direct funding and other resources to West Indian iguana conservation projects, primarily in Jamaica, but also in Dominica, the Cayman Islands, the Dominican Republic, the Bahamas, the Turks and Caicos Islands, and the British Virgin Islands. With the help of zoos and other dedicated conservation partners, some of the rarest and most impressive lizards in the world are starting to make a comeback.

Further Reading

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 33, Number 1 (March 2002).

GYMNOPHIONA

OSCAECILIA ZWEIFELI (Zweifel's Caecilian). **PREDATION**. Virtually nothing is known about the ecology of *Oscaecilia zweifeli* (Lescure and Marty 2000. Atlas des Amphibiens de Guyane. Patrimoines Naturels, 45). At the field station of Nouragues (4°5'N, 52°41'W 110 m elev.), 8 km N of Saut Pararé, Arataye River, French Guiana, during the rainy season on 25 May 1999, one of us (RB) found, under a rotted trunk on the ground, an *O. zweifeli* (Museúm National d'Histoire Naturelle, Paris [MNHN] 1997.6482) whose head was maintained by the chelicera of an adult giant tarantula, *Theraphosa leblondi* (Theraphosidae) (Fig. 1). The tarantula had produced a silk cocoon around the head of the dead caecilian; the head was already partly digested. When disturbed, the tarantula raised its forelegs and threw urticating setae. This specimen of *O. zweifeli* is the second one known from French Guiana, the species having been recorded in that country only from a single specimen from Cayenne (Lescure and Marty, *op. cit.*).

We thank J.-C. Baloup F. Catzeflis, P Charles-Dominique, M. Dewynter, P. Gaucher, G. Lenglet, and S Lochon for working facilities.

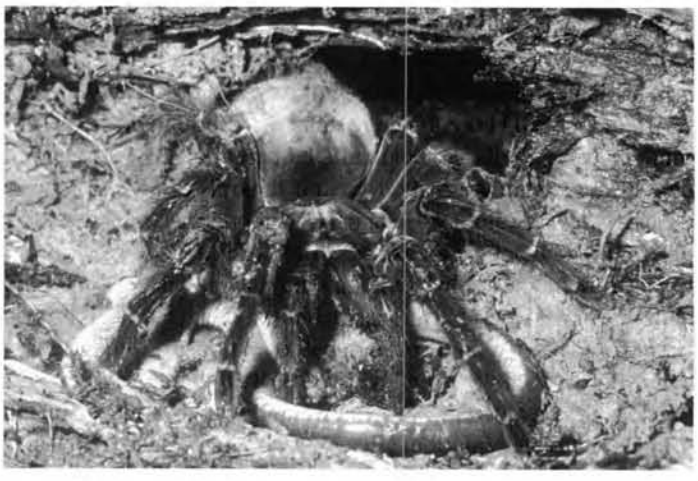


Fig. 1. Giant tarantula, *Therophosa leblondi* (Theraphosidae) preying on a Zweifel's caecilian, *Oscaecilia zweifeli*, at Nouragues Field Station, French Guiana, May 1999.

Submitted by **RENAUD BOISTEL**, Laboratoire de Biogéographie et Ecologie des Vertébrés, E.P.H.E., Univ. de



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HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
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bowen@gnv.ifas.ufl.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

DARYL R. KARNS
Hanover College
karns@hanover.edu

MICHAEL E. DORCAS
Davidson College
midorcas@davidson.edu

SHARYN B. MARKS
Humboldt State University
sbm1@axe.humboldt.edu

PAUL A. STONE
University of Central Oklahoma
pstone@ucok.edu

ROBERT E. ESPINOZA
California State University, Northridge
robert.e.espinoza@csun.edu

GUNTHER KÖHLER
Forschungsinstitut und
Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

DEANNA H. OLSON
USDA Forestry Science Lab
dede.olson@orst.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
aaron.bauer@villanova.edu

Current Research
OMAR TORRES-CARVAJAL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
otorres@ku.edu

Current Research
ELI GREENBAUM
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
elig@ku.edu

Geographic Distribution
ALAN M. RICHMOND
Biology Department, Morrill IV South
University of Massachusetts
611 North Pleasant Street
Amherst, Massachusetts 01003-9297, USA
alanr@bio.umass.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Zoo View
JAMES B. MURPHY
Department of Herpetology
National Zoological Park
3001 Connecticut Ave., NW
Washington, D.C. 20008, USA
jbmurphy2@juno.com

Herpetological Husbandry
RUSTON HARTDEGEN
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
ruston17@yahoo.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
MARC P. HAYES
2636 59th Avenue NW
Olympia, Washington 98502-3449, USA
e-mail: mhayesrana@aol.com

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

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2002 — Crown Center Hotel, Kansas City, Missouri, USA. 3–8 July (with ASIH, HL)
2003 — Hotel Tropical, Manaus, Brazil (with ASIH, HL)
2004 — University of Oklahoma, Norman, Oklahoma (with ASIH, HL)

About Our Cover: *Brookesia perarmata*



Brookesia is a genus of pygmy chameleons endemic to the island-continent of Madagascar. It is currently comprised of approximately 24 species (Klaver and Boehme 1997. Das Tierreich 109:1–306). At best, this number should be considered tentative as new species are being discovered and others synonymized with known forms.

The largest known species of the genus is the bizarre armored leaf chameleon, *Brookesia perarmata* Angel 1933, reaching a total length of 11 cm (Glaw and Vences 1994. A Fieldguide to the Amphibians and Reptiles of Madagascar, 2nd ed., rev., Verlag GbR, Cologne. 480 pp.). It possesses the largest dorso-lateral spines, arranged in paired longitudinal rows of rosettes, and its body is wider and more heavily built than its congeners. An essentially two-toned coloration, featuring a golden tan head and prominent ear-like ocular cones extending to the rear, contrast sharply with its dark brown body. Lack of a pelvic shield is a further identification point.

The karst limestone ('tsingy') massif of the Bemaraha Plateau, located in west-central Madagascar, is the only known habitat of this species. *B. perarmata* lives on the ground and in low bushes between steep tsingy canyons where it presumably feeds upon a variety of invertebrates.

Virtually nothing can be said of this species' biology in the wild as no field studies have been undertaken in its remote and largely inaccessible habitat. Captive females lay paired eggs which hatch into miniature near-replicas of the adults, but with lighter bodies overall. Captive animals apparently require high humidity levels to thrive, but must not be kept upon wet or even damp substrates.



The cover image of an adult female *Brookesia perarmata* was photographed by **Bill Love / Blue Chameleon Ventures**. He recorded this captive specimen on Fujichrome Velvia (ASA 50) film, using a Nikon F90X camera and SB-21 "ring" flash. Separation and imaging of Love's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

NEWSNOTES

Ermi Zhao Elected to Chinese Academy

Professor Ermi Zhao, senior scientist at the Chengdu Institute of Biology, China's leading center for herpetological research, has been elected to membership in the Chinese Academy of Science. Academician is the highest honor accorded to a scientist in the PRC. Zhao is only the second herpetologist ever elected to the academy, the other being his former teacher, Cheng-chao Liu, author of the classic book, Amphibians of Western China (Chicago, 1950).

Zhao is the author of numerous studies on amphibians and reptiles from all parts of China and has conducted field research throughout the country. He has written eight books, among them two published by SSAR (Studies on Chinese Salamanders, 1988; Herpetology of China, 1993). He has been an active promoter of Chinese herpetological research and conservation and their links to the international community. He served on the Executive Committee of the First World Congress of Herpetology and is active in several international conservation organizations. Ermi Zhao is a longtime member of SSAR and the Society congratulates him on this great honor.

New Herpetological Journal

The Ukrainian Academy of Medical and Biological Sciences has established a new journal, *Gerpetologicheskii Vestnik*. The Editor-in-Chief is Dr. Igor R. Gul of Lvov, Ukraine. This is the first herpetological periodical in Ukraine. It publishes papers on amphibians and reptiles in their natural environment and on keeping and breeding them in captivity, as well as book reviews. Papers are published in Russian, chosen to make the journal more available for a majority of researchers from the ex-Soviet republics. English abstracts are provided, thereby making summaries available to non-Russian speakers. Further information available from: *Dr. Igor R. Gul, P.O. Box 10485, P.O. 49, Lvov 290049 Ukraine.*

Salamandra Now Publishes Articles in English

The quarterly published German herpetological journal *Salamandra* (founded 1965; ISSN 0036-3375), previously a German language only publication, now publishes articles in English. *Salamandra* is one of several journals distributed by the Deutsche Gesellschaft fuer Herpetologie und Terrarienkunde (DGHT). The other DGHT journals such as *amphibia, elaphe, Die Eidechse, Iguana*, and *Radiata* contain German language articles on various aspects of herpetoculture. *elaphe* also publishes articles on ecology and conservation of amphibians and reptiles. *Die Eidechse* involves all aspects of the biology of the family Lacertidae. The turtle and tortoise-centered journal *Radiata* is also published as an English edition. In addition, DGHT publishes the mongraphic se-

ries *Mertensiella*. To this point, 13 volumes on various herpetological subjects have been published completely or partly in English.

Authors are invited to submit English or German language manuscripts with herpetological or herpetocultural content for publication in *Salamandra*. Contributors should follow the instructions for manuscript preparation at:

www.dght.de/salamandra/instructions.htm

For 60 EURO per year one can subscribe to *Salamandra* plus *elaphe* and one of the other DGHT publications of your choice (excluding *Mertensiella*) by surface mail. For details please contact the DGHT office via e-mail: gs@dght.de.

New Bibliography and Index of Herpetological Names, AMNH Novitates

Ernest A. Liner has compiled a bibliography and index to scientific names of amphibians and reptiles, fossil and Recent, published in American Museum Novitates. The Novitates included are all issues from number one through number 3285, published from the years 1921 through 1999.

The bibliography is also set up as a searchable database, thanks to Mark Breedlove. Searches can be made on the basis of author, taxon, title, volume, or year of publication. Both the complete bibliography/index and the searchable database are available on the web at the following address, then click on "Publications":

http://research.amnh.org/herpetology

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one-page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 2002, with notification by 1 December 2002. Grantees are expected to complete their Academy visit by 15 September 2003. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

The CAS holdings are included in the Department of Herpetology database:

http://research.calacademy.org/herpetology/catalog/

Brett Stearns Award for Chelonian Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round-trip transportation and limited per diem expenses—to researchers who wish to visit our collections to support their work in chelonian biology. Preference will be given to graduate students.

Proposals should include a short, one-page description of the research project and a budget. In the case of graduate students, a letter of support from the student's faculty advisor is required.

Proposals are due on 15 October 2002; notification will be made by 1 December 2002. Awardees are expected to complete their Academy visit by 15 September 2003. Please call (415) 750-7039 for further information.

Proposals should be sent to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

The CAS chelonian holdings are included in the Department of Herpetology database:

http://research.calacademy.org/herpetology/catalog/

New AMNH Website

The Center for Biodiversity and Conservation at the American Museum of Natural History is pleased to announce the launch of its new website: http://research.amnh.org/biodiversity/. Of particular interest to herpetologists is the site's ongoing report of recent herpetofaunal surveys of Vietnam (listed under Biotic Surveys):

http://research.amnh.org/biodiversity/vietnamresearch/

For comments or inquiries regarding the website or the CBC's herpetological program in general, contact Raoul Bain (e-mail: bain@amnh.org).

An Invitation from the Editor of *BioScience*

BioScience, ranked 5/51 journals in the Biology category of ISI's Journal Citation Report, is the preeminent journal for overviews of research in the biological sciences, with strong suits in organismal and environmental biology and ecology. In addition to research overviews we also publish essays in a variety of areas pertinent to Biology and its practice. With a paid circulation of about 8,500 copies per month, we reach an extremely broad readership, ranging from advanced high school students and teachers to professional biologists and policymakers.

The member organizations of the American Institute of Biological Sciences represent a largely untapped source of authors, who may not always be aware of *BioScience*'s broad reach and unique audience. Instructions for manuscript preparation may be found at our website:

http://www.aibs.org/bioscienceguide/resources/contributors.html

Additional information may be obtained from the Editor, Matthew H. Greenstone, Ph.D., Science Editor, *BioScience*, 2404 Northwood Lane, Edmond, Oklahoma 73013, USA; e-mail: mgreenstone@aibs.org.

Journal of Kansas Herpetology

The Kansas Herpetological Society is pleased to announce the premier issue of the *Journal of Kansas Herpetology*. Initiated with issue Number 1 in March 2002, the *Journal of Kansas Herpetology* replaces the former publication of the Society, the *Kansas Herpetological Society Newsletter*. The content of this new scientific periodical will consist of more scholarly works, which will undergo a professional peer review process. The new journal will continue to publish all Society business items, as well as the annual KHS Amphibian, Turtle, and Reptile Counts. Additional information available from: Travis W. Taggart, KHS Editor (e-mail: ttaggart@fhsu.edu).

New Website: *Early Classics in Biogeography, Distribution, and Diversity Studies: To 1950*

This service consists of a bibliography "enhanced" in several ways, including the addition of links to Web-based biographical information on the authors involved, and the full-text (as collected in several ways) of many of the entries. It is meant to serve advanced students and faculty involved in related studies and course work.

The goal of this project is to identify and make electronically available, as possible, those primary sources (especially periodical articles) that have most affected the evolution of our thoughts on the geographical and ecological distribution and diversity of life. The target field is biogeography; not only does this study have a long and distinguished history extending back to before the advent of the theory of natural selection, but it is also highly interdisciplinary, incorporating elements of many other sciences—including ecology, paleobiology, geology, conservation studies, physical geography, evolutionary biology, bioclimatology, and systematics—into its own emphasis on "what lives where, and why." This site may be accessed at:

<http://www.wku.edu/~smithch/biogeog/>

MEETINGS

Meetings Calendar

18–21 July 2002—26th Annual Meeting of the International Herpetological Symposium, Sheraton Westport Hotel Plaza, St. Louis, Missouri, USA. Information: www.kingsnake.com/ihs/26meeting.html.

25–28 November 2002—VII National Meeting, Sociedad Herpetológica Mexicana (SHM) (Mexican Herpetological Society), Universidad de Guanajuato, México. Information: www.iztacala.unam.mx/shm/.

OBITUARIES

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Dean E. Metter 1932–2001

ROBERT POWELL
Department of Biology, Avila College
Kansas City, Missouri 64145-1698, USA
e-mail: powellr@mail.avila.edu



Dean E. Metter died on 23 June 2001 at the age of 68. His life and professional work focused on Missouri, where he was a member of the Zoology faculty at the University of Missouri-Columbia for 30 years. "Doc," as he was universally known to his students until his retirement in 1994 (after which he began signing his frequent correspondence "ex-Doc"), began life in Champaign, Illinois, married Sylvia Michlig in 1954 in Sheffield, Illinois, earned a bachelor's degree from Eastern Illinois University, a master's degree from Washington State University, and a doctorate from the University of Idaho in 1963. He began his zoological career interested primarily in fishes, and, to his dying day, ranked the lowly bluegill as nature's greatest wonder (although in later years, I suspect it was almost exclusively due to its outstanding gustatory qualities). While in the Pacific Northwest, he became enamored with amphibians, and they subsequently became his life-long passion. He joined the faculty at Missouri in 1964, and began a long tenure of introducing students to his favorite animals, the habitats in which they lived, and the natural processes to which they were subjected.

An excellent, albeit demanding teacher, Doc was feared by several generations of pre-medical students, some of whom actually survived his comparative anatomy course (many of those later came to appreciate his efforts when they found gross anatomy manageable). However, Doc's greatest impact as an instructor was on the students who passed through his zoology, herpetology, and evolution courses. Many of us were not only challenged to do better than we thought possible, we became sufficiently excited about the subject matter that we pursued higher degrees and, in several instances, became educators in our own right. Doc was a living example of the precept that any educator's best tool is his own enthusiasm for the subject.

That enthusiasm was not immediately evident to the student who merely showed up to class and was subjected to a non-stop 50 minutes of information delivered clearly and logically, but very,

very rapidly. However, the student who made the effort to stop by before or, more usually, after class (Doc was a morning person and generally scheduled his courses during the earliest time slot permitted by the University), was rewarded with Doc's undivided attention and a willingness to address concerns, provide additional information, or sometimes just chat — assuming, of course, that the student's motive wasn't limited to queries regarding what would be covered on the next exam. Doc had a notable lack of patience with "learners" who learned only to pass an exam.

In contrast, Doc provided many opportunities for the student who became motivated to pursue the learning process beyond the classroom. Unlike many of my herpetological colleagues, I didn't hunt snakes at a tender age, instead my interest in herps was triggered by Doc's herpetology class, in which I had enrolled only to fulfill a requirement. Once in, however, I became enthralled, especially with the lizards. Because I was having some difficulty with the characters that distinguish the skinks, I asked if I could come in outside of class time and look them over. Doc not only let me into the lab, but stayed close to make sure that I would benefit from my uncharacteristic burst of diligence.

Doc was a big believer in putting classroom learning to the test in the field. He regularly scheduled trips on which all of the current students were invited. Initially amazed that so many former students and graduate students participated, we soon learned why. Doc expected the same effort in the field that he did in the classroom (and that extended to chores around camp as well as collecting animals). He had learned (maybe the hard way?) that hungry students didn't perform very well. Consequently, the meals were noted for both quality and quantity; I can remember many a feast during which I ate pounds of salad, several potatoes, and two thick steaks. Additional motivation to consume heartily was provided by the fact that any left-overs inevitably appeared in the next morning's eggs. Costs were kept reasonable because we did all of our own cooking, camped only where it was free, and, although he never admitted it in so many words, Doc covered any budget overrun out of his own pocket.

Doc mentored numerous master's students and three Ph.D. students. The total would have been higher, but Doc saw too many graduates having to settle for jobs well below their abilities or outside their specialties to feel good about contributing to the glut of applicants for all-too-few jobs. As a result, he took doctoral students only when they had positions in hand and, even then, only after a harrowing interview during which he spelled out in excruciating detail the realities of work in academia. Although I was subjected to the standard protocol, Doc had, years before, taken the sting from his presentation. On an exceptionally hot day in the Ozarks, when the critters were showing more sense than we were by not being out and about, we finally gave up. Sitting chest-deep in Table Rock Lake waiting for cooler evening hours, Doc noted that "it's a good life when you're paid to do what you like doing."

Doc was a naturalist of the old school, interested in everything, and he never stopped learning or being a teacher. When he took anyone on long drives through central Missouri, during which he'd repeatedly visit a number of favorite places, he'd never cease pointing out the vast diversity of the flora, even to those who had tagged along on many a previous occasion. In Stewart Hall, where Doc resided for most of his years at MU, he established and maintained an extensive collection of live animals. Although all of his students, to varying degrees, learned about and often helped care for the current set of residents (and frequently made the trek to the animal lab to collect mice and rats for what became regularly scheduled and well-attended events), it was when casual passers-by or groups of school children came through, that another side of Doc came to light. Never talking down to anyone, he conveyed many of the fundamental ideas that define biology to kids for whom a visit to the "snake room" was the highlight of the school year.

Doc read widely and never confined his own ongoing education to biological topics. He was amazingly well-informed (and quite opinionated) about almost everything. Wandering through the state, he had acquired quite a collection of arrowheads. During a brief visit to drop off some information related to my dissertation, he noticed that my daughter, then 11 years old, seemed fascinated by his display of artifacts. Ignoring me, he spent nearly an hour explaining how the Indians had made the various pieces, the uses for which they were designed, and the sources of the rocks they had used. She was spellbound. Although she had never before shown any interest in history or anthropology, she spoke of that day for many years.

Doc did excellent research, but published fewer than 35 papers. However, his dissertation work on *Ascaphus truei*, the tailed frog of the Pacific Northwest, is still considered a definitive work on the species. He attended few meetings (although he encouraged his students to do so). Doc's contention was that the good papers would show up in journals within a few months, and the others weren't worth the bother. What he did do was encourage his students to tackle tough problems and to use methods that would not only help find the answers, but would translate into marketable skills. He was always available to his students, whether sitting in on a study session before comps or helping in the field. I'll never forget the late February day we were seining for spotted salamanders (*Ambystoma maculatum*) in an upland Ozark pond. Never one to dump on students any chore he wasn't willing to take on himself, Doc found himself on the far end of the seine in water suddenly deeper than his waders were high. Moving faster than any human had a right to move, he ploughed through the water and up the bank, flopped on his belly facing down the hill, and gave a huge sigh of relief as the 33° water flowed back into the pond. Few professors would risk such an experience for a mere grad student. Along the same lines, Doc saved me many a trip to Columbia by walking over to the graduate school to enroll me for another semester. When I finally completed my dissertation, the entire grad school staff commented on how fortunate I was to associate with the only prof who would make the effort to save a student some time and a little money.

Doc obviously had a kind heart, but he didn't often let it show. The phrase I heard more than once at his memorial service was "compassionate ass-chewing" — and many of us had been on the receiving end of one, often more than once. We never resented these occasions. For one thing, they were always one-on-one, never public, and, secondly, we invariably deserved it. Interestingly enough, being chewed out by Doc was considered a tribute of sorts. He never bothered with folks he felt were incapable of improvement, so his attention served as an affirmation of sorts. Doc rarely complimented anyone face-to-face, but frequently bragged about them behind their backs. He felt free to criticize

any of us, but would not abide us or anyone else bad-mouthing his students and friends behind their backs (however, if the target was present and able to defend itself, it was open season).

Though not adverse to picking up a phone, Doc relied on long, informative letters, handwritten on yellow legal pads, to maintain long-distance relationships. His letters were beautifully written and filled with insights and humor. Doc also taught many of us how to write effectively. More than once, he returned papers to me on which he had bled profusely, often making pointed comments on my incomparable ability to string thoughts together in such a way that convoluted sentences became entire paragraphs. When I was named an editor of a professional publication, he bemoaned the desperate state of herpetology (but was secretly pleased, I think, that I had learned at least a little of what he had tried to teach me).

Doc was a co-founder of the Bobby Witcher Society, the bi-annual meetings of which were an excuse to see old friends and eat mounds of bluegill filets (summer) or various unusual repasts that relied heavily on the warped imaginations of members and their ability to provide strange fare for the table (winter). The real legacy of the Society, however, was the scholarship fund that grew well beyond the founders' fondest hopes, largely due to Doc's diligent oversight. The interest from the fund served as a means of rewarding outstanding herpetology students who intended to continue their education and make a career in some aspect of vertebrate biology. The Society recently agreed to fund an SSAR Grant-in-Herpetology to support field-based student research. The formal announcement of the aptly named Dean E. Metter Memorial Award will occur in 2002.

Doc touched many people, his family, his friends, his colleagues, his students (many of whom became life-long friends), the recipients of Witcher Awards, and even the visitors to the snake room in Stewart Hall — and every one of us was better for it.

Acknowledgments.—I thank Richard Daniel, Kathleen Metter, and the members of the Bobby Witcher Society for sharing recollections and comments.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres-Carvajal**; postal and e-mail addresses may be found on the inside front cover.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Systematics of Microteiid Lizards

The neotropical family Gymnophthalmidae is composed of 178 species included in 36 genera, which occur from southern Mexico to Argentina, in the Caribbean, and on some islands of the continental shelves of South and Central America. The authors used a total of 2379 bp of mitochondrial and nuclear sequences of 50 species to perform phylogenetic analyses under the optimality criteria of maximum parsimony and maximum likelihood. Confidence in resulting nodes was assessed by bootstrap and partitioned Bremer support analyses. Three species of macroteiid lizards, *Cnemidophorus ocellifer*, *Kentropyx calcarata*, and *Tupinambis quadrilineatus*, were used as outgroups. Based on the topology recovered by maximum parsimony, the authors proposed several taxonomic changes. The family Gymnophthalmidae was divided into four subfamilies, two of which are new, and a new tribe within Gymnophthalminae also was proposed. Additionally, the authors commented on the evolution of fossoriality and ecological implications of the phylogenetic relationships of microteiid lizards.

Pellegrino, K. C., M. T. Rodrigues, Y. Yonenaga-Yassuda, and J. W. Sites. 2001. A molecular perspective on the evolution of microteiid lizards (Squamata: Gymnophthalmidae), and a new classification for the family. Biological Journal of the Linnean Society 74:315–338.

Correspondence to: Jack W. Sites, Department of Zoology, Brigham Young University, Provo, Utah 84602, USA; e-mail: jack_sites@byu.edu.

Reproductive Biology of an African Colubrid

The brown house snake (*Lamprophis fuliginosus*) is a widespread African colubrid that readily breeds in captivity. Previous work on the reproductive biology of this species has used information from single females, or females from various localities—both approaches failed to account for geographic variation in clutch size and offspring size. The author reports data for 13 animals collected in Arusha, Tanzania. Snakes were fed approximately 10% of their body mass in mice per week, and maintained in individual cages under a 14:10 light/dark cycle at 28°C. Females were paired with a male at least once a week. Clutch size (5–8) and clutch mass were weakly correlated with female SVL. There was about 20% variation among females in egg mass, but little variation in individual clutches. Egg mass was not correlated to clutch size. Because clutch size can be influenced by food intake, clutch size of captive snakes may not accurately represent what occurs in the wild. However, egg masses in snakes from specific localities may be affected local selection pressures.

Ford, N. B. 2001. Reproduction in the brown house snake, *Lamprophis fuliginosus*, from Tanzania. African Journal of Herpetology 50:31–34.

Correspondence to: Neil B. Ford, Department of Biology, University of Texas at Tyler, Tyler, Texas 75799, USA; e-mail: Nford@mail.uttyl.edu.

Snake Behavior and Phylogenetic Correlation

Male-male fighting (MMF) in snakes is restricted to males during the breeding season, and the presence or absence of this behavior has taxonomic trends. The authors had two main goals for this study: 1) to assess the origin, sequence, and frequency of MMF in higher-level snake taxa; and 2) to address the apparent correlation between MMF with mode of prey subjugation. The latter notion was tested with concentrated-changes tests and the subtree decomposition method. Currently, MMF is not documented for 9 of 26 higher-level snake lineages, which led the authors to use the

heuristic method for scoring MMF. Snake phylogenies were slightly modified from studies, and MacClade was used to reconstruct the character evolution of MMF. Several most-parsimonious reconstructions of MMF were obtained, and all trees indicated that MMF ahs been indepentdently gained and lost a minimum of 4–8 times during the evolution of snakes. Results indicate there is some evidence for a significant correlation between MMF and constriction and/or envenomization as the primary mode of prey subjugation. The authors explain this correlation as independent responses to ecological limitations imposed by diet.

SCHUETT, G. W., E. W. GERGUS, AND F. KRAUS. 2001. Phylogenetic correlation between male-male fighting and mode of prey subjugation in snakes. Acta Ethologica 4:31–49.

Correspondence to: Gordon W. Schuett, Department of Biology, Grand Canyon University, 3300 West Camelback Road, Phoenix, Arizona 85017, USA; e-mail: gschuett@asu.edu.

Snake-Induced Fear in Human Behavior

Humans can detect threatening events regardless of focused and conscious attention. According to the primary author's fear model, threats are evaluated and then receive preferential access to arousal systems for further processing. The authors tested whether fear-relevant stimuli (e.g., images of snakes and spiders) could be processed at an automatic level, including the efficient selection of the stimuli from complex visual displays. Mean reaction time of participants was shorter for fear-relevant than fear-irrelevant images. Participants who were fearful of snakes or spiders had faster reaction times than participants who were not fearful. These results suggest that humans have a predisposition to preferentially detect attention toward threatening stimuli such as snakes and spiders.

ÖHMAN, A., A. FLYKT, AND F. ESTEVES. 2001. Emotion drives attention: detecting the snake in the grass. Journal of Experimental Psychology: General 130:466–478.

Correspondence to: Arne Öhman, Section of Psychology, Department of Clinical Neuroscience, Karolinska Institute and Hospital, Z6, S-171 76 Stockholm, Sweden; e-mail: arne.ohman@cns.ki.se.

Female Mimicry in Male Garter Snakes

Males of several unrelated animal species might mimic females in order to steal inseminations from rivals or avoid aggression. The authors report on some male garter snakes (*Thamnophis sirtalis parietalis*) that can secrete female-like phermones and attract other males. It is suggested that these "she-males" benefit by reduced predation and temperature increases from the resulting balls of amorous males. The phenomenon is restricted to the first two days of emergence from hibernation. Empirical data confirmed that emerging females warmed up faster if they were covered by courting males. Further experiments indicated that she-males tended to attract males if they had a cooler temperature—warmer she-males did not secrete as many pheromones as colder she-males.

SHINE, R., B. PHILLIPS, H. WAYE, M. LEMASTER, AND R. T. MASON. 2001. Benefits of female mimicry in snakes. Nature 414:267.

Correspondence to: Rick Shine, Department of Biological Sciences, University of Sydney, New South Wales 2006, Australia; e-mail: rics@bio.usyd.edu.au.

Diving Behavior of Marine Green Turtles

Marine turtles are excellent model organisms for studying long-distance animal migration. Several species move thousands of kilometers between feeding areas and breeding grounds. The authors studied diving behavior of several female *Chelonia mydas* that nest on Ascension Island and migrate to feeding grounds along the Brazilian coast. Satellite transmitters were attached to 12 individuals at the end of the nesting season on Ascension Island. In addition, time/depth recorders were attached to five turtles that had been displaced 60 and 270 km away from the island. In general, there was a tendency for the submergence duration to be short and significantly longer at night than during the day. However, periods of longer submergences were registered during migration. Short dives (2–4 min) were associated with turtles diving near the surface (<5 m), whereas long dives (20–30 min) were associated with turtles diving deeper (5–20 m). Apparently, the key factor driving swimming depth in green turtles is minimization of their cost of transport. Swimming below the surface where drag is reduced could be the optimum strategy. In addition, by diving below the surface, green turtles reduce the extent to which they are silhouetted against the surface, thereby becoming less susceptible to predators, such as sharks.

HAYS, G. C., S. ÅKESSON, A. C. BRODERICK, F. GLEN, B. J. GODLEY, P. LUSCHI, C. MARTIN, J. D. METCALFE, AND F. PAPI. 2001. The diving behaviour of green turtles undertaking oceanic migration to and from Ascension Island: dive durations, dive profiles and depth distribution. The Journal of Experimental Biology 204:4093–4098.

Correspondence to: G. C. Hays, School of Biological Sciences, University of Wales Swansea, Singleton Park, Swansea SA2 8PP, UK; e-mail: g.hays@swan.ac.uk.

Immune Function and Fitness of Side-Blotched Lizards *Uta stansburiana*

Density-dependent competition affects species fitness. Immunosuppression has been suggested as one of the mechanisms having a deleterious effect on fitness at high population densities. The authors used a Californian population of *Uta stansburiana* to analyze the effects of female morphotype and number of neighbors on immune function and survival during two reproductive seasons. This dense population is characterized by females exhibiting two heritable throat-color morphs—orange and yellow. Mark-recapture methods were used to investigate survival of females and hatchlings. Immune function was assessed by measuring immune response of individual lizards to tetanus toxoid. Standard ELISA with a modified laboratory protocol was used. Breeding females of both throat-color morphs that were surrounded by many neighbors had suppressed immune function, with stronger effects in orange females. Evidence for genetic correlation between female morphotype and immune responsiveness was found by comparing the immune responsiveness between daughters of orange and yellow females. These results indicate that fitness of side-

blotched lizards is jointly influenced by female morphotype and density-dependent immune function. The authors are interested in investigating more correlations between throat color of *Uta stansburiana* and other fitness-related factors, such as clutch size and egg mass.

SVENSSON, E., B. SINERVO, AND T. COMENDANT. 2001. Density-dependent competition and selection on immune function in genetic lizard morphs. Proceedings of the National Academy of Sciences 98(22):12561–12565.

Correspondence to: Erik Svensson, Department of Animal Ecology, Lund University, S-223 62 Lund, Sweden; e-mail: erik.svensson@zooekol.lu.se.

Vocalization and Parental Care of *Tribolonotus gracilis*

Most species of lizards that are known to vocalize belong to the families Gekkonidae or Pygopodidae. In these taxa, vocalizations generally fall into two categories—advertisement or distress. The authors studied vocalization of the crocodile skink, *Tribolonotus gracilis*, and its implications in parental care. One pair of adult crocodile skinks was used to record defensive vocalizations, whereas three pairs were used in parental care observations. Male calls had a longer duration and faster pulse rate than female calls. Calls of both sexes contained harmonics and shared a similar overall frequency range. Parental care was exhibited mainly by females, which were always found curled around their eggs. Females exhibited defensive open-mouth lunges whenever eggs were handled by the observer. This defensive display included vocalizations in about half of the trials. In addition, neonates were observed to stay close to their mothers for two weeks after hatching. The authors propose that vocalization of crocodile skinks plays a defensive role, which may be associated with parental care. Also, they suggest that the acoustic sexual differences might be caused by sexual dimorphism within the larynx or trachea.

HARTDEGEN, R. W., M. J. RUSSELL, B. YOUNG, AND R. D. REAMS. 2001. Vocalization of the crocodile skink, *Tribolonotus gracilis* (de Rooy, 1909), and evidence of parental care. Contemporary Herpetology 2.

Correspondence to: Ruston W. Hartdegen, Dallas Zoo, Department of Herpetology, 650 South R. L. Thornton Freeway, Dallas, Texas 75203, USA; e-mail: ruston17@yahoo.com.

Chameleon Speciation: Oceanic Dispersal or Continental Break-up?

Chameleons are thought to have biogeographic patterns that are congruent with the Gondwanan break-up of Africa and Madagascar 165 myr ago. The authors tested the Gondwanan vicariance hypothesis by constructing area cladograms based on phylogenetic analyses of 52 species of chameleons. Molecular, morphological, and behavioral data were included in the parsimony-based analysis. The results supported the monophyly of Chamaeleoninae. The most basal clades were represented by *Brookesia*, which is endemic to Madagascar. Thus, the resulting area cladogram showed that the most basal clades occur in Madagascar, whereas more derived lineages are distributed in Madagascar, Africa, the Seychelles, and India. This area cladogram is inconsistent with proposed Gondwanan break-up vicariance models. Instead, it supports a post-Gondwanan origin of chameleons in Madagascar, with subsequent oceanic dispersal to Africa, India, and the Seychelles. Other evidence consistent with this post-Gondwanan origin model includes presence of chameleons in isolated volcanic islands, fossil record of the group, and molecular clock mtDNA divergences. The species radiation of chameleons is similar to species radiations of other animals that have been demonstrated to have post-Gondwanan origins in Africa or Asia with subsequent transmarine migrations.

RAXWORTHY, C. J., M. R. J. FORSTNER, AND R. A. NUSSBAUM. 2002. Chameleon radiation by oceanic dispersal. Nature 415:784–787.

Correspondence to: C. J. Raxworthy, American Museum of Natural History, Central Park West at 79th street, New York, New York 10024-5192, USA; e-mail: rax@amnh.edu.

Factors Affecting Foraging Behavior of the Red-Backed Salamander, *Plethodon cinereus*

Terrestrial salamanders of the genus *Plethodon* are among the animals that show defensive responses to a variety of chemical cues, such as damaged tissues of conspecifics or chemicals released by predators. In *Plethodon*, the responses include avoidance of substrates, change of activity levels, or delay of emergence from refugia. The authors investigated costs of responses of red-backed salamanders *Plethodon cinereus* to chemical cues of eastern garter snakes *Thamnophis sirtalis*. One snake and 48 salamanders were collected in New York. Foraging activity of salamanders exposed to snake-soiled water and salamanders exposed to unsoiled water was measured. This was achieved by measuring the number of actions oriented toward a prey (cricket) per minute. Salamanders exposed to snake-soiled water had lower foraging activity than those exposed to unsoiled water. In addition, the authors found that foraging activity of individuals in both odor treatments showed a bimodal periodicity consistent with natural activity patterns that are controlled by internal biorhythms. Food deprivation or sex did not appear to affect salamander foraging activity and responsiveness to chemical cues. Consideration of behavioral biorhythms in this kind of study is suggested by the authors.

MAERZ, J. C., N. L. PANEBIANCO, AND D. M. MADISON. 2001. Effects of predator chemical cues and behavioral biorhythms on foraging activity of terrestrial salamanders. Journal of Chemical Ecology 27(7):1333–1344.

Correspondence to: John C. Maerz, Department of Natural Resources, Fernow Hall, Cornell University, Ithaca, New York 14853, USA; e-mail: jcm63@cornell.edu.

Foot Muscles of Myobatrachids

There are many hypotheses and no agreement regarding the taxonomy and phylogenetic relationships among members of Myobatrachidae. Subfamilies Myobatrachinae and Limnodynastinae are widely supported. In an attempt to find informative phylogenetic characters, the author described the foot musculature of *Limnodynastes tasmaniensis* and used that description as a basis of comparison for other myobatrachid frogs. Given

that many myobatrachids are burrowing frogs, the author also studied the relationship between foot musculature and burrowing. All 21 genera of Myobatrachidae and several representatives of Hylidae, Pelobatidae, and Pelodytidae were examined. Variation within Myobatrachidae was found in 25 muscles. In some cases, there was considerable intraspecific and intrageneric variation (e.g., M.m. transversi metacarporum I-IV). The extent of the insertion of the m. abductor brevis plantae digiti V was the only character that consistently separated Myobatrachinae from Limnodynastinae. Other clades were supported by several apparent synapomorphies. A new muscle, m. adductor praehallucis, apparently associated with the fossorial habit, was described. Additionally, differences in the musculature associated with the metatarsal tubercles were found among several clades. According to the author, these differences indicate that burrowing evolved several times in Myobatrachidae.

BURTON, T. C. 2001. Variation in the foot muscles of frogs of the family Myobatrachidae. Australian Journal of Zoology 49:539–559.

Correspondence to: Thomas C. Burton, Department of Pharmacy, La Trobe University-Bendigo, PO Box 199, Bendigo, Vic. 3552, Australia; e-mail: t.burton@bendigo.latrobe.edu.au.

Environmental Contaminant Accumulation and Effects on Snakes

Reptiles are crucial to the proper functioning of many ecological processes and should therefore be included in any ecological risk assessment. World Conservation Union's 1996 Red List of Threatened Animals includes 67 species of snakes, of which 15 are listed as critical. Because snakes reside in middle and higher trophic levels, they are susceptible to the bioaccumulation of environmental contaminants. The authors summarized the available information on bioaccumulation and effects of organic and inorganic contaminants and radionuclides/radiation on snakes. They found information on organic contaminants (e.g., DDT, aldrin, endrin, mirex, oxychlordane) for Colubridae, Boidae, Viperidae, and Elapidae. Data on inorganic contaminants (e.g., cobalt, copper, zinc, boron) was available for the same families, as well as for Typhlopidae, Leptotyphlopidae, Aniliidae, Xenopeltidae, and Acrochordidae. In contrast, information on radionuclides/radiation was found for Viperidae and Colubridae only. Given that this information is poor (no data for six families), the authors conclude that more ecotoxicological studies on snakes are badly needed. Some studies presented in this article indicate that snakes are ideal bioindicators. Finally, Campbell and Campbell suggest that representative species of reptiles should be included in the U.S. Environmental Protection Agency or any other regulatory agency's list of species used in pesticide testing.

CAMPBELL, K. R., AND T. S. CAMPBELL. 2001. The accumulation and effects of environmental contaminants on snakes: a review. Environmental Monitoring and Assessment 70:253–301.

Correspondence to: Kym Rouse Campbell, The Cadmus Group, Inc., Oak Ridge, Tennessee, USA; e-mail: kcampbell@cadmusgroup.com.

From Lizards to Snakes

Radical transformations in body plan of animals are often associated with the origin of higher taxa. The authors studied the evolution of body form of anguid lizards to analyze the transition from lizardlike to snakelike body form. Morphological, ecological, and molecular data of 23 species were analyzed with statistical phylogenetic methods. Regarding the evolutionary changes in body form, the authors found that the evolution of limb-reduced and elongate body form occurred independently in three different clades—anniellines, *Ophiodes*, and anguines. The data suggested that there is not necessarily a sequence of evolutionary change from body elongation to limb reduction to digit reduction. Hypothesized relationships between limb reduction and digit reduction, and limb reduction and body elongation were supported by multivariate and bivariate analyses. No consistent relationship was found between miniaturization and the evolution of elongate body form, limb reduction, or digit loss. The hypothesized relationship between limb loss and burrowing was not supported by Maddison's concentrated-changes test. Similarly, the presence of a pectoral girdle in some elongate, limbless forms does not support the idea that elongation and loss of the forelimbs are simply the result of anterior expansion of more posterior domains of Hox gene expression. Finally, given that the data suggested a slow transition from lizard to snakelike body form, the authors support the idea that the origin of higher taxa may proceed gradually through the same processes that occur within groups and among closely related species.

WIENS, J. J., AND J. L. SLINGLUFF. 2001. How lizards turn into snakes: a phylogenetic analysis of body-form evolution in anguid lizards. Evolution 55(11):2303–2318.

Correspondence to: John J. Wiens, Section of Amphibians and Reptiles, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213-4080, USA; e-mail: wiensj@carnegiemuseums.org.

Systematics and Conservation of Chinese Turtles

Demand of Chinese markets is one of the primary causes for the decimation of Asian turtle populations. Over the past 16 years, 13 new geoemydid turtles have been described from China. Unfortunately, most of these recent descriptions are based on type specimens purchased through the Hong Kong animal trade, which has caused problems, such as simultaneous description of the same species by separate authors. Furthermore, failure to collect more specimens at the alleged type localities has led several authors to suggest either falsification of some localities or that these new species represent intergeneric hybrids. The authors investigated the phylogenetic affinities and provenance of two recently described species—*Mauremys iversoni* and *Cuora serrata*— using 22 specimens representing 10 species acquired from animal trade and museum collections. Allozyme variation was studied as the first test of phylogenetic affinity. In addition, phylogenetic analyses were performed to infer the evolutionary relationships of mtDNA lineages using maximum parsimony and maximum likelihood. Both allozyme and mtDNA data provided evidence that all the specimens of *M. iversoni* and *C. serrata* included in the analyses resulted from multiple, recent hybridization events. Given

that there is no evidence that *M. iversoni* and *C. serrata* are valid species, and given the propensity of distantly related turtles to hybridize, the authors propose to reconsider the systematic status of the specimens examined. They conclude that investigating the origin and validity of new species of turtles described from pet trade specimens is critical for conservation efforts.

PARHAM, J. F., W. B. SIMISON, K. H. KOZAK, C. R. FELDMAN, AND H. SHI. 2001. New Chinese turtles: endangered or invalid? A reassessment of two species using mitochondrial DNA, allozyme electrophoresis and known-locality specimens. Animal Conservation 4:357–367.

Correspondence to: James Parham, Department of Integrative Biology, University of California, Berkely, California 94720-3140, USA; e-mail: parham@socrates.berkeley.edu.

ARTICLES

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Observations on Hibernacula and Overwintering Ecology of Eastern Hog-nosed Snakes (*Heterodon platirhinos*)

MICHAEL V. PLUMMER
Department of Biology, Box 12251, Harding University, Searcy, Arkansas 72149, USA
e-mail: plummer@harding.edu

Hibernacula and overwintering ecology of the hognose snake *Heterodon platirhinos* are known only from anecdotal observations and may differ in some respects from that of many snakes (Anderson 1965; Platt 1969). In addition, because overwintering ecology of reptiles may vary geographically (Gregory 1982; Sexton et al. 1992), it is important to study it in various parts of a species' range. In the course of monitoring *H. platirhinos* by radiotelemetry for a study of spatial ecology and survivorship during the activity season (Plummer and Mills 2000), I made observations on individual snakes over the winter months in the south central part of the species' range. These observations contribute to our understanding of the hibernacula and overwintering ecology of this species.

Temperature-sensitive transmitters (Telonics CHP-2P; <5% of snake mass) were implanted into adult *H. platirhinos* following the procedures of Reinert (1992). One male was monitored over winter in 1992, and two females and four males were monitored over winter in 1993. A minimum-maximum thermometer recorded shaded air temperatures 1 m above ground. The study area (N35°16', W91°43') is located in the easternmost part of the Arkansas River Valley subdivision of the Ouachita Mountain region of Arkansas, USA (Foti 1974). Topography is rolling to hilly and varies from approximately 60 m to 120 m above sea level. The sandy soils are thin and often rocky. The occasionally stunted vegetation of the xeric higher areas is upland deciduous woodland whereas that of the more mesic lower areas is upland deciduous forest (Foti et al. 1994). Common trees included oaks, *Quercus stellata* and *Q. marilandica*, hickory, *Carya texana*, and juniper, *Juniperus virginiana*. Natural grassy openings were common, especially in the higher areas. Other grassy openings included roads, trails, abandoned fencerows, pipeline and powerline right-of-ways, pastures, and mowed fields. Burrows of the mole, *Scalopus aquaticus*, were common throughout most of the study area.

The normal activity season for *H. platirhinos* at this locality is mid-April to mid-October during which inactive snakes seek refuge under the cover of grass or surface litter. Snakes typically do not use mole burrows during the activity season (Plummer and Mills 2000). During short periods of cold weather just before and after hibernation (i.e., November and March), *Heterodon* also took refuge under the cover of grass or surface litter. Snakes temporary retreated into mole burrows only occasionally occurred during this time. At this locality, winters are mild and continuous hibernation usually occurred from about December through February. By tracking telemetered snakes, I located individual *H. platirhinos* in 13 different hibernacula from December through February. Snakes were located at irregular intervals (1–4 times per week) in the mid to late afternoon. Transmitters functioned well and without problems at the lower than activity season temperatures.

All *Heterodon* hibernated singly in one or more mole burrows. The hibernacula were distributed throughout the approximate 250 ha study area in open woodlands (N = 8), a fencerow at the edge of a grassy field (N = 3), and a grassy pipeline right-of-way (N = 2). Two snakes changed hibernacula in December–February. One female moved 14 m on 29 December to a new hibernaculum and 24 m on 2 February and 22 m on 6 February to new hibernacula. One male moved 56 m on 7 February to a new hibernaculum. Each hibernaculum shift was preceeded by a period of one or more sunny days when maximum air temperatures ranged from 14 to 21°C.

One male abruptly moved in each of two years from a distant portion of its home range to hibernacula on a power line right-of-way. This snake traversed the same path each year, moving a minimum of 800 m in 3 d (1993) and 700 m in 2 d (1994). Dates of arrival at the hibernacula were 6 October 1993 and 7 October 1994. The two hibernacula were located within 150 m of each other. There were no obvious habitat differences between the location left and the hibernacula sites (both were open woodland habitat with distinct habitat edges). Although movement to and from hibernacula and hibernating singly at this latitude have been reported in other snake species (Gregory 1982; Sexton et al. 1992), migration and fidelity to a distant hibernaculum in snakes most often is associated with communal hibernacula at high latitudes (Gregory 1984).

I excavated one hibernaculum on 22 January 1994 and found the snake in a small chamber located approximately 75 cm from the mouth of the burrow at a depth of 25 cm. The soil temperature of the chamber was 4.5°C (measured with a thermocouple probe) and the body temperature of the snake was 4.7°C (measured with the temperature-sensitive transmitter). In December–February, body temperatures of snakes in their hibernacula averaged 10.1 ± 2.4°C (SD) (range 4.7–13.6°C, N = 16) in 1992 and 11.4 ± 1.3°C (9.8–14.6°C, N = 23) in 1993. These relatively high temperatures were within the normal range of body temperatures for hibernating reptiles (1–15°C; Gregory 1982) and support the notion that hibernating snakes often seek the warmer parts of their hibernaculum (Sexton et al. 1992). During this same period, snakes occasionally basked when maximum air temperatures exceeded ap-

proximately 18°C for several consecutive days. Body temperatures of basking snakes in December–February averaged 23.7 ± 3.7°C (21.1–26.3°C, N = 2) in 1992 and 23.1 ± 6.1°C (16.6–32.6°C, N = 6) in 1993.

One male was found dead on 5 December 1993 near the mouth of its hibernaculum where it had been monitored since 17 November. The snake was last observed basking in the same position and location on 28 November. Freezing was the likely cause of death as minimum air temperatures had dropped to at least –6°C during that time and there was no gross physical damage to the body or evidence of disease.

Percent change in the body mass of hibernating snakes determined from measurements taken at highly variable times before and after the December–February hibernation averaged 0.3 ± 9.3% (–11.3% to 11.4%, N = 5). Based on the intensity of monitoring and the times of body mass measurement, body mass change due to overwintering probably was best represented by one female who weighed 244 g on 15 October and 238 g on 2 February. The 2.5% loss in mass during this time was associated with a mean body temperature of 11.4 ± 1.3°C (N = 23), two hibernacula shifts, and at least four bouts of basking in December–February. It is unknown whether the mass loss represented lean mass, lipid, or water loss.

My observations differ from various anecdotal reports on hibernation in *H. platirhinos* because they report histories of individual snakes monitored over extended times. The mole burrow hibernacula described herein as well as various other kinds of hibernacula have been reported previously for *H. platirhinos* (Anderson 1965; Arndt 1980; Neill 1948; Platt 1969). In contrast to opportunistic encounters which limit the discovery of hibernacula to only where one searches (e.g., Neill 1948), telemetric observations should better represent unbiased overwintering "preferences" because, assuming no transmitter effect, they demonstrate choices of hibernacula made by individual snakes (Weatherhead and Charland 1985). Consistent with these results are reports that *Heterodon* usually are absent in hibernacula harboring other snake species (Platt 1969). For example, in Missouri, *Heterodon* are absent in the limestone edge hibernacula used by most other snakes, choosing instead to hibernate in mammal burrows in nearby open fields (Anderson 1965). It is known that *Heterodon* may dig their own hibernacula (Arndt 1980; Platt 1969). The loose, sandy soils on my study area appeared to be suitable for burrowing and I have observed *Heterodon* to dig when foraging (unpubl.). The lack of burrowing for hibernacula at this locality may have resulted from the high availability of natural mole burrows.

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Update on the List of Reptiles Known from Honduras

LARRY DAVID WILSON
Department of Biology, Miami-Dade Community College
Kendall Campus, Miami, Florida 33176-3393, USA
e-mail: lwilson@mdcc.edu

and

JAMES R. McCRANIE
10770 Southwest 164th Street
Miami, Florida 33157-2933, USA

The years that have transpired since we last updated the Honduran herpetofauna (Wilson and McCranie 1994a) have been productive ones, resulting in major additions to our knowledge. Unlike two previous lists (Wilson 1983; Wilson and McCranie 1994a), we treat here only the reptile component of the herpetofauna, inasmuch as the amphibians will be dealt with in McCranie and Wilson (2002). That book treats 116 species of amphibians, including two caecilians, 25 salamanders, and 89 anurans. These figures compare with a total of 89 species, including 3 caecilians (see McCranie and Wilson 2002, for an explanation of the decrease of one species), 17 salamanders, and 69 anurans in the 1994 list.

As with the 1983 and 1994 lists, additions to the reptile fauna have occurred through range extensions or taxa being described as new to science. In addition, a few taxa have been resurrected or added to the reptile fauna as a result of the clarification of the status of some Honduran populations. Currently, the total number of species of Honduran reptiles is 217, up from 188 on the 1994 list, a 15.4% increase. The increase of 29 taxa involved numerous modifications, as detailed below. No changes occurred in the list of crocodilians. Fourteen species of turtles are currently recog-

nized on the Honduran mainland and in Honduran waters. This figure is two fewer than that in the 1994 list, inasmuch as *Dermatemys mawii* has been deleted from the list, as no material from Honduras has made its way into collections (McCranie and Wilson, in prep.), and *Chelonia agassizi* is no longer recognized as a species distinct from *C. mydas* (Kamezaki and Matsui 1995; Karl and Bowen 1999; Parham and Zug 1996). The lizard fauna increased from 69 to 88 species, due to descriptions of 11 new species (as well as one taxon listed in 1994 as *Celestus* sp. and two species of *Ctenosaura* named as new based on separating Honduran populations from those in the remainder of two taxa indicated in the 1994 list) and eight range extensions. The snake fauna now comprises 113 species, up from 101 in the 1994 list. The change in number results from the description of five new species (as well as one taxon listed in 1994 as *Ninia* sp.), six range extensions, and one resurrection. Since the 1994 list, then, 16 descriptions of new species have appeared in print or are in press. In addition, the range of 14 species has been extended into Honduras.

As with the previous paper (Wilson and McCranie 1994a), the reptilian species are listed alphabetically under each order. In addition, each name is followed by a parenthetically-enclosed number referring to a numbered reference in the Literature Cited section in which that species was reported as occurring in Honduras.

TESTUDINES (14 species)

Caretta caretta (11)
Chelonia mydas (11)
Chelydra serpentina (45)
Dermochelys coriacea (11)
Eretmochelys imbricata (11)
Kinosternon leucostomum (45)
Kinosternon scorpioides (45)
Lepidochelys olivacea (11)
Rhinoclemmys annulata (45)
Rhinoclemmys areolata (6; also see reference 48)
Rhinoclemmys funerea (45)
Rhinoclemmys pulcherrima (45)
Staurotypus triporcatus (45)
Trachemys scripta (45, as *Chrysemys ornata*)

CROCODILIA (2 species)

Caiman crocodilus (45)
Crocodylus acutus (45)

SAURIA (88 species)

Abronia montecristoi (37)
Abronia salvadorensis (59, as *Abronia montecristoi*; see reference 3)
Ameiva ameiva (50)
Ameiva festiva (45)
Ameiva undulata (45)
Anolis allisoni (45)
Aristelliger georgeensis (1)
Aristelliger praesignis (50)
Basiliscus plumifrons (45)
Basiliscus vittatus (45)
Celestus bivittatus (59)
Celestus montanus (45)
Celestus scansorius (35)
Cnemidophorus deppii (45)
Cnemidophorus lemniscatus (45)
Cnemidophorus motaguae (45)
Coleonyx mitratus (45)
Corytophanes cristatus (45)
Corytophanes hernandesii (26)
Corytophanes percarinatus (36)
Ctenosaura bakeri (45, as *Enyaliosaurus bakeri* [in part]; see reference 5)
Ctenosaura flavidorsalis (17)
Ctenosaura melanosterna (2)
Ctenosaura oedirhina (5)
Ctenosaura similis (45)
Eumeces managuae (4)
Eumeces sumichrasti (45)
Gonatodes albogularis (45)
Gymnophthalmus speciosus (45)
Hemidactylus brookii (16)
Hemidactylus frenatus (7)
Hemidactylus mabouia (38)
Iguana iguana (45)
Laemanctus longipes (45, [in part])
Laemanctus serratus (23)
Leiocephalus carinatus (50)
Lepidophyma flavimaculatum (45)
Mabuya unimarginata (45, as *Mabuya mabouya*)
Mesaspis moreletii (45, as *Barisia moreleti*)
Norops amplisquamosus (43)
Norops bicaorum (15)
Norops biporcatus (45, as *Anolis biporcatus*)
Norops capito (45, as *Anolis capito*)
Norops crassulus (45, as *Anolis crassulus*)
Norops cupreus (45, as *Anolis cupreus*)
Norops cusuco (30)
Norops heteropholidotus (18)
Norops humilis (45, as *Anolis humilis*)
Norops johnmeyeri (54, as *Anolis johnmeyeri*)
Norops kreutzi (30)
Norops laeviventris (45, as *Anolis laeviventris*)
Norops lemurinus (45, as *Anolis lemurinus* [in part])
Norops limifrons (45, as *Anolis limifrons* [in part]; see reference 56)
Norops lionotus (24, as *Norops oxylophus*)
Norops loveridgei (45, as *Anolis loveridgei*)
Norops muralla (20)
Norops ocelloscapularis (21)
Norops pentaprion (45, as *Anolis pentaprion*)
Norops petersii (32)
Norops pijolensis (44, as *Norops pijolense*)
Norops purpurgularis (25)
Norops roatanensis (19)
Norops rodriguezii (56)
Norops rubribarbaris (20)
Norops sagrai (45, as *Anolis sagrei*)
Norops sericeus (45, as *Anolis sericeus*)
Norops sminthus (45, as *Anolis sminthus* [in part])
Norops tropidonotus (45, as *Anolis tropidonotus*)

Norops uniformis (56)
Norops utilensis (14)
Norops wampuensis (29)
Norops yoroensis (31)
Norops zeus (19)
Phyllodactylus palmeus (45)
Phyllodactylus tuberculosus (45)
Polychrus gutturosus (45)
Sceloporus malachiticus (45)
Sceloporus squamosus (45)
Sceloporus variabilis (45)
Sphaerodactylus dunni (45)
Sphaerodactylus glaucus (8)
Sphaerodactylus millepunctatus (45, as *Sphaerodactylus continentalis*)
Sphaerodactylus notatus (50)
Sphaerodactylus rosaurae (45)
Sphenomorphus assatus (28)
Sphenomorphus cherriei (45, as *Scincella cherriei* (in part])
Sphenomorphus incertus (56)
Thecadactylus rapicauda (45)

SERPENTES (113 species)

Adelphicos quadrivirgatus (60)
Agkistrodon bilineatus (60)
Alsophis cantherigerus (50)
Amastridium veliferum (60)
Atropoides nummifer (60, as *Bothrops nummifera*)
Boa constrictor (60)
Bothriechis bicolor (60, as *Bothrops bicolor*)
Bothriechis marchi (60, as *Bothrops marchi*)
Bothriechis schlegelii (60, as *Bothrops schlegeli*)
Bothrops asper (60, as *Bothrops atrox*)
Cerrophidion godmani (60, as *Bothrops godmani*)
Chironius grandisquamis (60)
Clelia clelia (60)
Coniophanes bipunctatus (60)
Coniophanes fissidens (60)
Coniophanes imperialis (60)
Coniophanes piceivittis (60)
Conophis lineatus (60)
Corallus annulatus (9)
Crisantophis nevermanni (60)
Crotalus durissus (60)
Dendrophidion nuchale (60, as *Dendrophidion clarki*)
Dendrophidion percarinatum (60)
Dipsas bicolor (60)
Dryadophis dorsalis (60)
Dryadophis melanolomus (60)
Drymarchon corais (60)
Drymobius cloroticus (60)
Drymobius margaritiferus (60)
Drymobius melanotropis (60)
Elaphe flavirufa (60)
Enulius bifoveatus (27)
Enulius flavitorques (60, [in part])
Enulius roatanensis (27)
Erythrolamprus mimus (60)
Ficimia publia (60)
Geophis damiani (58)
Geophis fulvoguttatus (33)
Geophis hoffmanni (60)
Hydromorphus concolor (60)
Imantodes cenchoa (60)
Imantodes gemmistratus (60)
Imantodes inornatus (60)
Lampropeltis triangulum (60)
Leptodeira annulata (60)
Leptodeira nigrofasciata (60)
Leptodeira septentrionalis (60)
Leptodrymus pulcherrimus (60)
Leptophis ahaetulla (60)
Leptophis mexicanus (60)
Leptophis modestus (60)
Leptophis nebulosus (60)
Leptotyphlops goudotii (60)
Loxocemus bicolor (60)
Masticophis mentovarius (60)
Micrurus alleni (24)
Micrurus browni (33)
Micrurus diastema (60)
Micrurus nigrocinctus (60)
Micrurus ruatanus (60)
Ninia diademata (60)
Ninia espinali (34)
Ninia maculata (42)
Ninia sebae (60)
Nothopsis rugosus (46)
Omoadiphas aurula (22)
Oxybelis aeneus (60)
Oxybelis brevirostris (60)
Oxybelis fulgidus (60, [in part])
Oxybelis wilsoni (51)
Oxyrhopus petola (60)
Pelamis platurus (60)
Pliocercus elapoides (60; see reference 49, as *Urotheca elapoides*)
Porthidium nasutum (60, as *Bothrops nasuta*)
Porthidium ophryomegas (60, as *Bothrops ophryomegas*)
Pseustes poecilonotus (60)
Rhadinaea godmani (60)
Rhadinaea kinkelini (60)
Rhadinaea lachrymans (39)
Rhadinaea montecristi (60)
Rhadinaea tolpanorum (10)
Rhinobothryum bovallii (60)
Scaphiodontophis annulatus (60)
Scolecophis atrocinctus (60)
Senticolis triaspis (60, as *Elaphe triaspis*)
Sibon anthracops (60)
Sibon carri (60)
Sibon dimidiatus (60)
Sibon longifrenis (42)
Sibon nebulatus (60)
Spilotes pullatus (60)
Stenorrhina degenhardtii (60)
Stenorrhina freminvillii (60)

Storeria dekayi (60)
Tantilla impensa (57)
Tantilla lempira (60)
Tantilla melanocephala (60)
Tantilla schistosa (60)
Tantilla taeniata (60, [in part])
Tantilla tritaeniata (57)
Tantillita lintoni (60)
Thamnophis fulvus (60)
Thamnophis marcianus (60)
Thamnophis proximus (60)
Tretanorhinus nigroluteus (60)
Trimorphodon biscutatus (60)
Tropidodipsas fischeri (60, as *Sibon fischeri*)
Tropidodipsas sartorii (60, as *Sibon sartorii*)
Typhlops costaricensis (53)
Typhlops stadelmani (60, as *Typhlops tenuis*; see reference 40)
Ungaliophis continentalis (60)
Urotheca guentheri (42)
Xenodon rabdocephalus (60)

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An Exceptionally Large Natural Assemblage of Female Copperheads (*Agkistrodon contortrix*)

HENRY S. FITCH
and
ANNA L. CLARKE
Natural History Museum and Biodiversity Research Center and Department of Ecology and Evolutionary Biology The University of Kansas, Lawrence, Kansas 66045, USA

On 5 August 1998 at 1530 h, ALC noticed an extraordinary aggregation of adult copperheads *(Agkistrodon contortrix).* She was following a well-used hiking trail in Clinton State Park near the city of Lawrence in Douglas Co., Kansas, USA. The snakes lay in resting coils on both sides of the trail, 0.6–3 m from its edge, among loose rocks of a limestone outcrop. Seven snakes were closely associated in a group, touching one another or separated by less than 5 cm; there were four in another such group 1 m away; and a twelfth snake was located about 1.5 m from its nearest neighbor. The sky was overcast after light rain and the temperature was 24°C. After 5 min, seven of the snakes took refuge in three holes that were 0.1–0.3 m apart. At 1810 h, when ALC rechecked the site just after two bicyclists had passed on the trail, four snakes remained—three in shade and one in sunshine.

At 1500 h on 6 August, ALC and HSF returned and captured all snakes that could be found—10 from the site discovered on 5 August, and 4 from a site about 100 m farther west on the same outcrop. On 9 August, ALC returned at 1140 h and caught two more at the site of the large aggregation, and at 1500 h she caught one more 2 m away. On 10 August at 0945 h she returned again and caught three more copperheads at the same site, while a fourth escaped. Except for one adult male, all these snakes proved to be gravid females. Thus, the large aggregation contained at least 17 snakes (15 gravid females, 1 male, and 1 individual that escaped), and four gravid females were found (and captured) in the smaller group. These snakes subsequently produced their litters in captivity. On 6 and 12 September, females and neonates were returned to the park and released at sites well removed from the trails and other places of concentrated human activity.

Allen (1868) first documented aggregating behavior of gravid female copperheads, citing A. C. Bennett, who had killed female copperheads found in several different groups in Massachusetts—five on 5 July, seven later in July, and six in September. In Connecticut, Finneran (1948, 1953) found five groups of female copperheads (4, 4, 5, 7, and 9) on a wooded hilltop in 1941, 1942, 1946, and 1947. Minton (1944) reported associations of pairs and threes in Indiana, and Fitch (1960) recorded associations of two, three, and four in Kansas. Over a 50-yr period (1948–1998) at The University of Kansas Natural History Reservation, HSF captured 335 gravid females in mid–late summer (July, August, and early September), of which 275 (82%) were found singly (many

in traps) and 55 others were in associations of two to five (mean ± SE = 2.39 ± 0.84).

Our observations, as well as literature accounts (e.g., Finneran 1953), indicate that when gravid females are found together, they are associated with a "den" (hole in the ground, rock crevice, hollow log) into which they can escape from predators or unfavorably low or high temperatures. They are also in areas exposed to sun for part of the day, permitting them to bask. These associations apparently stem from mutual affinity because the snakes might be gathered tightly although nearby locations that appear to be equally suitable are unoccupied (Fitch 1999). Mutual security might lead females to associate because a predator attacking one of them would be at risk of bites from others lying within striking range. Furthermore, the association between parturient females and neonates, and that between neonates of the same or different litters, might confer some benefit in mutual security.

The association of 16 gravid females with the prospect of about 100 neonates in an area of perhaps 0.0065 ha would reduce each snake's opportunity to feed. A female could stay with her litter for several days and the neonates may remain at the birthing site even longer. Although females take little or no food during late pregnancy, and thus would not compete for food during this time, they are somewhat emaciated after the birth of their litters, and are ready to take prey. The neonates shed their skins when they are about a week old; by then they are using up their store of abdominal egg yolk and are ready for their first meal. There is usually little overlap between adults and neonates in sizes of prey animals taken and in kinds of prey (Fitch 1960, 1999), but barring rapid and long-distance dispersal, intense competition seems inevitable within each age class at such high density.

This unusually large aggregation could have resulted from a high population density in a habitat with few optimal brooding sites. Exploration of the rock outcrop revealed other sites with exposed rock, but these did not seem to receive as much sun during the day as the site occupied (ALC observation). That this locality could sustain a dense snake population is given support by comparing these females with those from two other populations located in areas that differ in food abundance. The average length and embryo count of the females from Clinton Lake were 635.8 ± 11.2 mm SVL and 6.65 ± 0.24 embryos, respectively. These values are intermediate but on the high side in comparison with females from two other locations: The University of Kansas Biotic Succession Area, a seemingly ideal habitat with a high population of prey *(Microtus ochrogaster)*, and The Natural History Reservation, an area of dense forest where prey is much less available (Fitch 1999). The average length and embryo count of 15 gravid females taken from the succession area between 1986 and 1997 were 644.8 ± 8.3 mm SVL and 7.13 ± 1.15 embryos. In comparison, a 40-yr sample (1958–1998) of Reservation snakes had an average SVL of 606.5 ± 4.8 mm and contained 5.37 ± 0.17 embryos. Although no effort was made to estimate copperhead population density at the Clinton Lake site, population density is correlated with size and fecundity of females, probably through the joint causal factor of food availability (Fitch 1999).

We cannot state conclusively why these snakes formed such a large aggregation. It is unprecedented in the literature and, in light of our current knowledge of the biology of these snakes, could have social or environmental causes.

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Burrow Use by Tiger Salamanders (*Ambystoma tigrinum*) at a Black-Tailed Prairie Dog (*Cynomys ludovicianus*) Town in Southwestern South Dakota

JASON J. KOLBE[1]
BRIAN E. SMITH[2]
and
DAWN M. BROWNING[3]
U.S. Geological Survey, Northern Prairie Wildlife Research Center
8711 37th Street SE, Jamestown, North Dakota 58401-7317, USA

Current addresses:
1. Department of Biology, Campus Box 1137, Washington University
St. Louis, Missouri 63130-4899, USA

2. Department of Biology, Black Hills State University, 1200 University Street
Unit 9044, Spearfish, South Dakota 57799-9044, USA
e-mail: BrianSmith@bhsu.edu

3. New Mexico Cooperative Fish and Wildlife Research Unit
New Mexico State University, P.O. Box 30003, Department 4901
Las Cruces, New Mexico 88003, USA
e-mail: dbrownin@nmsu.edu

Correspondence and reprint requests to Brian E. Smith

Reports of amphibians utilizing the burrows of other vertebrates are common. Several species of amphibians are found in gopher tortoise burrows (Lips 1991), and ambystomatid salamanders are often observed in association with small mammal burrows (Douglas and Monroe 1981; Gordon 1968; Hamilton 1946; Loredo et al. 1996). We report the use of black-tailed prairie dog (*Cynomys ludovicianus*) burrows by a population of tiger salamanders (*Ambystoma tigrinum*) at a prairie dog town at Wind Cave National Park (WICA) in southwestern South Dakota. We also provide some evidence for commensalism and suggest future studies to determine if this type of relationship exists between these salamanders and prairie dogs.

During a herpetological survey of WICA in 1996, we observed several tiger salamanders at a prairie dog town at Bison Flats, WICA (Fig. 1). The prairie dog town at Bison Flats surrounds a temporary pond used in 1996–1998 by breeding tiger salamanders (Fig. 2). Based on these observations we designed a sampling protocol to determine 1) the number of burrows used by salamanders, 2) the total number of salamanders using burrows, and 3) the pattern of salamander activity in burrows through the spring and summer. In 1998, we also wanted to determine if salamanders used specific burrows continually through the summer and determine the spatial extent of salamanders in burrows in relation to the pond. For comparison, we also visited the Pringle prairie dog town (WICA) and the Custer prairie dog town at Custer State Park (CSP) in 1996 and 1997 (Fig. 1). In 1998, we focused only on the Bison Flats prairie dog town and expanded the area of our survey to determine if the 1996–1997 surveys were missing occupied burrows farther from the pond.

During the spring and summer 1996–1998, we conducted a total of 17 surveys of prairie dog towns (Table 1). Surveys were conducted between 2045–2400 h and varied in duration from 19–156 minutes. Night air temperatures to the nearest 0.5°C were taken within the prairie dog town at the beginning of each survey using a hand-held thermometer one meter above the ground. During night surveys at each prairie dog town, we systematically checked from 100–187 (five surveys, mean = 161.6) burrows in 1996, 90–113 (five surveys, mean = 106.4) burrows in 1997, and 117–491 (seven surveys, mean = 264.4) burrows in 1998. We shined a light into the entrance of each burrow, and recorded whether tiger salamanders were present. Because the surveys were conducted at night, it is possible that we missed burrows or checked the same burrow twice. When salamanders were found in a burrow, the light caused them to retreat quickly into the burrow and out of view. Therefore, if a burrow was checked a second time, a false unoccupied burrow would be recorded. Although we do not believe that this occurred often, it would serve to underestimate the number of burrows occupied. Bison Flats prairie dog town became the focus of this study after we noticed high levels of salamander activity at this prairie dog town during studies of the adjacent pond.

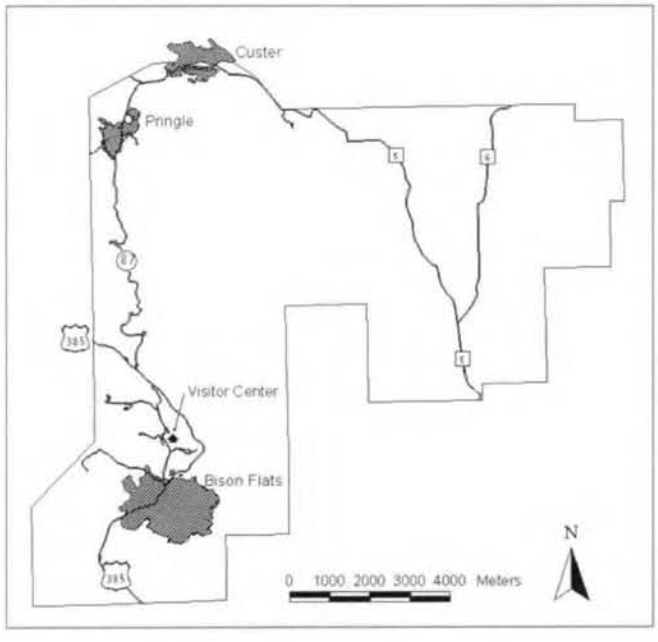


FIG. 1. Map of Wind Cave National Park indicating the location of the Bison Flats, Pringle, and Custer prairie dog towns surveyed in 1996–1998.

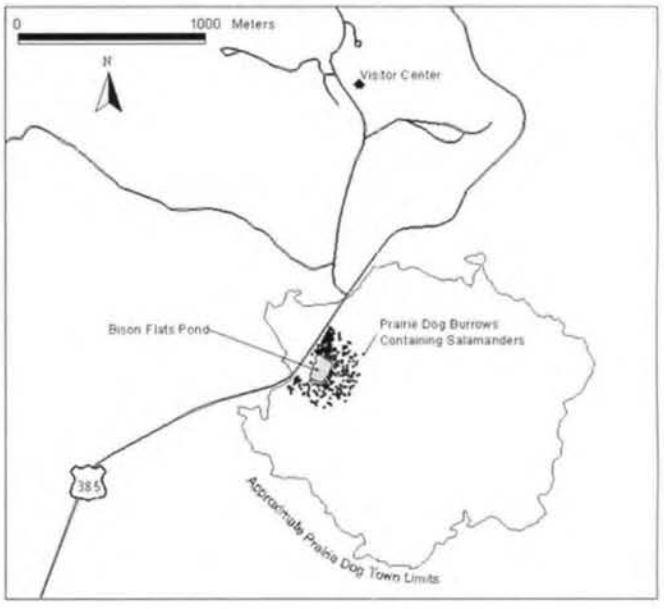


FIG. 2. Map of the Bison Flats prairie dog town showing the location of the pond, burrows occupied by salamanders in 1998, and the approximate extent of the prairie dog town limits.

We compared the number of burrows occupied and percentage of burrows occupied per survey with the date, temperature at the start of each survey, and the number of days since the last rain using linear regression (SAS Institute Inc. 1997). Percentages were arcsine transformed prior to analyses. Date was used to determine if the pattern of burrow occupancy changed during the spring and summer. Temperature and number of days since the last rain were used because salamander activity could be associated with these environmental variables. Because of the intentional increase in the number of burrows checked at Bison Flats in 1998, that is, an average of greater than 100 more burrows were checked in 1998 than the previous years, percentages of burrows occupied are lower for 1998. Therefore, we present analyses of both the number of burrows occupied and percentage of burrows occupied at Bison Flats from 1996–1998. Finally, we used ANOVA to determine if the number of burrows occupied was different among the three years.

In 1998, we marked burrows that were occupied by salamanders with a stake for future identification and measured the distance from the center of the pond to each of these burrows. To evaluate the spatial extent of burrow use, we used a chi-square test to determine if the number of occupied burrows in each 30 m-wide concentric ring around the pond was different (Sokal and Rohlf 1995). The expected number of occupied burrows was calculated based on the area of each successively larger concentric ring (i.e., 30–60 m, 60–90 m, 90–120 m, and 120–150 m) divided by the total area. The 0–30 m area was not included because the pond inundated it. The zero point was defined as the deepest point of the pond. We also monitored marked burrows in subsequent surveys to determine if salamanders used the same burrows.

Night air temperatures during surveys ranged from 15–25°C

TABLE 1. Results of tiger salamander surveys at three prairie dog towns in Wind Cave National Park and Custer State Park 1996–1998.

Prairie Dog Town	Date	Temp. (°C)	Number of Burrows with 0–5 Salamanders Per Burrow						Number of Burrows Occupied	Total Number of Salamanders	% of Burrows Occupied
			0	1	2	3	4	5			
Bison Flats	17 May 96	16.0	134	36	10	1	0	0	47	59	26.0
Bison Flats	10 Jun 96	17.0	124	35	6	3	0	0	44	56	26.2
Bison Flats	4 Aug 96	21.0	169	3	0	0	0	0	3	3	1.7
Pringle	24 Jun 96	23.5	181	6	0	0	0	0	6	6	3.2
Custer	26 Jun 96	25.0	100	0	0	0	0	0	0	0	0.0
Bison Flats	16 Jun 97	19.5	64	21	2	3	0	0	26	34	28.9
Bison Flats	18 Jun 97	17.0	81	24	3	3	0	0	30	39	27.0
Bison Flats	19 Jul 97	23.5	85	17	4	1	0	0	22	28	20.6
Bison Flats	4 Aug 97	24.5	88	21	1	1	0	0	23	26	20.7
Pringle	17 Jun 97	15.0	111	2	0	0	0	0	2	2	1.8
Bison Flats	20 Jun 98	—	275	35	2	1	0	0	38	42	12.1
Bison Flats	11 Jul 98	—	437	46	6	2	0	0	54	64	11.0
Bison Flats	23 Jul 98	16.0	335	19	2	0	1	0	22	27	6.2
Bison Flats	3 Aug 98	16.0	207	34	2	3	0	0	39	47	15.9
Bison Flats	13 Aug 98	15.5	161	4	0	0	0	0	4	4	2.4
Bison Flats	26 Aug 98	18.5	104	12	0	0	0	1	13	17	11.1
Bison Flats	18 Sep 98	21.0	159	3	0	0	0	0	3	3	1.9

(Table 1). Tiger salamanders were found in few burrows at the Pringle prairie dog town in 1996–1997 and in no burrows at the Custer prairie dog town in 1996 (Table 1). For May–July of all three years, 22–54 prairie dog burrows were occupied by salamanders at Bison Flats, clearly many more than at the Custer or Pringle prairie dog towns (Table 1). In 1996 and 1998, there were drops in occupancy of varying magnitudes in August (Fig. 3), a month when the ephemeral pond at Bison Flats usually tended to dry. However, burrow occupancy by salamanders remained consistent through early August in 1997. The number of burrows occupied was negatively correlated with date for the three years combined ($r = -0.73$, $P = 0.003$, N = 14) as was the percentage of burrows occupied ($r = -0.75$, $P = 0.002$, N = 14). A similar negative relationship was detected for each year separately with a significant result for the number of burrows occupied in 1998 ($r = -0.77$, $P = 0.04$, N = 7), but not in 1996 ($r = -0.97$, $P = 0.15$, N = 3) or 1997 ($r = -0.80$, $P = 0.20$, N = 4). There was also a negative relationship between percentage of burrows occupied and date with a significant relationship in 1997 ($r = -0.90$, $P = 0.05$, N = 4), but not in 1996 ($r = -0.95$, $P = 0.20$, N = 3) or 1998 ($r = -0.52$, $P = 0.23$, N = 7). Non-significant results in 1996 and 1997 were likely because of small sample sizes as both correlations were strong. Overall, burrow occupancy by tiger salamanders decreased through the course of the spring and summer (Fig. 3). There was no relationship between the number of burrows occupied and the temperature at the start of each survey ($P = 0.26$, N = 12) nor with the percentage of burrows occupied and temperature ($P = 0.98$, N = 12). Furthermore, there was no relationship between the number of burrows occupied and the number of days since the last rain ($P = 0.44$, N = 14) nor with the percentage of burrows occupied ($P = 0.29$, N = 14). There was no difference among years in the number of burrows occupied ($F_{2,11} = 0.15$, $P = 0.86$).

More occupied burrows than expected were found in the 60–90 m and 90–120 m areas, less burrows than expected in the 120–150 m area, and the same number as expected in the 30–60 m area ($\chi^2 = 56.46$, df = 3, $P < 0.0001$). We marked 86 occupied burrows from 11 July to 13 August 1998. Of these marked burrows, 72 were checked in subsequent surveys and 38.9% had at least one salamander present. Thus, repeated use of the same burrows existed to some degree at Bison Flats.

Our data show the spatial extent and temporal pattern of black-tailed prairie dog burrow use by tiger salamanders during the spring and summer. The pond at the center of the Bison Flats prairie dog town may explain the higher percentage of burrow occupancy compared with Pringle and Custer prairie dog towns. At Bison Flats, salamander burrow occupancy was consistent in May–August 1997 when the pond still held some water, but in 1996 and 1998 burrow occupancy dropped when the pond dried during August of each year (Fig. 3). Even though burrow occupancy numbers were low in September 1998, salamanders were still present (Table 1; Fig. 3). Additionally, an anecdotal observation on 3 October 1998 found three salamanders in burrows (D. Frankfort, WICA, pers. comm.). The negative relationship between burrow occupancy and date could represent either decreasing activity levels or migration out of the area. We do not know whether tiger salamanders were still present, but inactive, at the prairie dog town after our surveys concluded.

We cannot discern whether the drop in the number of salamanders observed in 1996 and 1998 was because of decreased activity or migration from the study area. Post-breeding dispersal distances have been reported for other species of ambystomatid salamanders. California tiger salamanders (*Ambystoma californiense*) leaving breeding ponds traveled a mean distance of 35.9 m (range = 8–129 m) and settled in ground squirrel burrows

83% of the time (Loredo et al. 1996). Two studies of post-breeding dispersal in *Ambystoma maculatum* documented mean dispersal distances of 192 m (range = 157–249 m) (Kleeberger and Werner 1983) and 150 m (range = 6–220 m) (Douglas and Monroe 1981). Migration out of the study area is unlikely because of the distance from this area to other suitable habitat (i.e., ~1.5 km to the nearest wooded cover and ~1.75 km to the nearest permanent water). Radio-tracking of a subset of individuals is needed to determine if salamanders hibernate in prairie dog burrows or if they migrate out of the area.

Almost 40% of burrows marked and subsequently rechecked had salamanders present. Though we did not mark individuals, use of the same burrow during more than one survey indicates repeated or continual use by one or more salamanders and suggests the salamanders might be residents for at least the spring and summer. However, mark and recapture studies are needed to determine if salamanders occupy one or more burrows over the course of the summer. The expansion of sampling efforts in 1998 resulted in checking nearly twice the number of burrows, yet the number of burrows occupied did not increase (Table 1). This relationship is reflected in the analysis that showed there were more occupied burrows than expected between 60–120 m and less occupied burrows than expected beyond 120 m. Salamander activity might be restricted to close proximity to the pond.

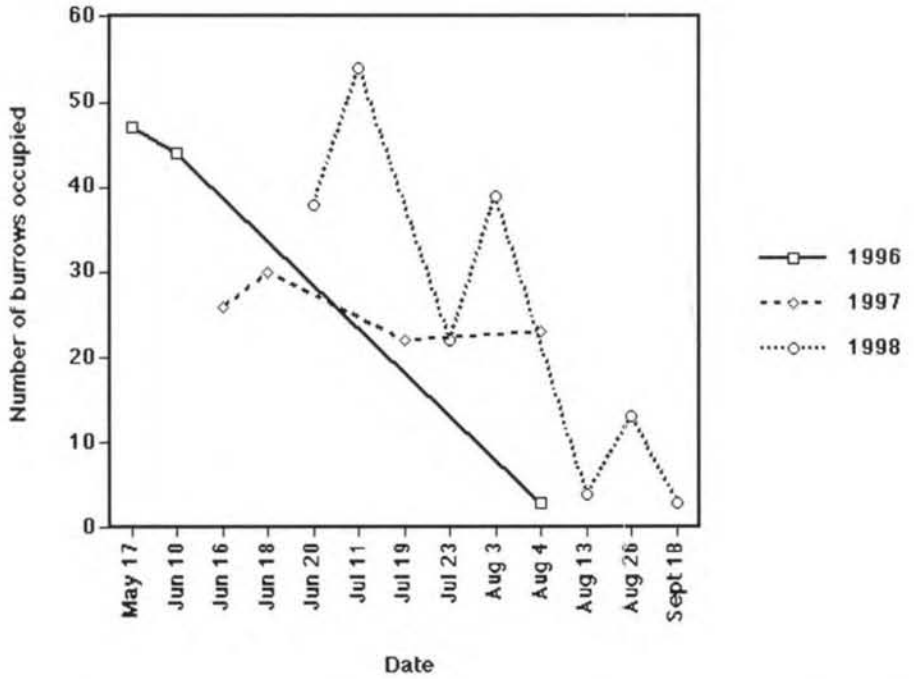


FIG. 3. Number of burrows occupied by date for surveys conducted at the Bison Flats prairie dog town in 1996–1998.

The potential benefits for tiger salamanders living in prairie dog burrows at Bison Flats include an abundance of burrows to use as shelters or hibernation sites, proximity of water for breeding, and a potential source of invertebrate prey attracted to prairie dog feces. Black-tailed prairie dog burrows are remarkably stable environments, with winter temperatures ranging from 5–10°C, summer temperatures from 15–25°C, and a relative humidity that is generally higher within burrows than on the surface (Hoogland 1995). Hoogland (1995) recorded an average relative humidity of 88% in burrows. The benefits of such stable temperatures and humidity levels are important in habitats such as the prairies of western South Dakota, where summers can be hot and dry and winters extremely cold. In summer, access to burrows would allow salamanders to remain underground during the day and become active above ground at night. This potentially decreases the risk of predation and desiccation for tiger salamanders. The use of prairie dog burrows for hibernacula would also offer advantages, such as relatively high and constant temperatures and humidity. Additionally, prairie dogs have anti-predator behaviors, such as mobbing potential predators and plugging holes (Hoogland 1995), which might benefit tiger salamanders.

Lips (1991) suggested that gopher tortoise feces retained within the burrow chamber might attract insects and subsequently insect-feeding amphibians. We observed both fecal pellets and insects around the entrances of prairie dog burrows. Salamanders might forage in close proximity to burrows, where insect abundance might be higher and there is shelter nearby. Future studies comparing the characteristics of burrows occupied by salamanders versus unoccupied burrows might provide important information concerning salamander requirements.

We have documented the spatial extent and temporal pattern of tiger salamander burrow use in a black-tailed prairie dog town over three years. These observations provide a starting point for investigations into a commensal relationship benefiting salamanders at Bison Flats prairie dog town. Additionally, observations of multiple salamanders per burrow (Table 1), often stacked on top of one another, raise interesting questions concerning previously documented territorial behavior in ambystomatid salamanders that warrant further study (Ducey 1989; Ducey and Ritsema 1988; but see Martin et al. 1986). This tiger salamander aggregation at Bison Flats presents an opportunity to study intraspecific and interspecific interactions of *A. tigrinum* in the field.

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Epizootic Disease and High Mortality in a Population of Eastern Box Turtles

C. REED ROSSELL, JR.
IRENE M. ROSSELL
MARIE M. ORRACA
Environmental Studies Department, University of North Carolina
Asheville, North Carolina 28804, USA
e-mail (CRRJ): rrossell@unca.edu

and

JAMES W. PETRANKA
Department of Biology, University of North Carolina
Asheville, North Carolina 28804, USA

Little is known about diseases affecting wild populations of box turtles (*Terrapene* spp.). To our knowledge, there are only three published reports. Evans (1983) diagnosed two *T. carolina* with chronic bacterial pneumonia. Both individuals died after exhibiting signs of emaciation, discharge of a cream-colored exudate from the nares, and marked respiratory distress characterized by open-mouth breathing. A mixture of gram-negative bacteria, including *Morganella morgani*, *Acinetobacter calcoaceticus*, *Serratia marcescens*, and *Pseudomonas* sp. was isolated from both turtles. The collective mixture was considered the etiological agent of the pneumonia. Schwartz et al. (1984) reported ear infections in some individuals of a population of *T. ornata*. The etiology of the infections was undetermined. Tangredi and Evans (1997) documented 19 *T. carolina* from scattered locations on Long Island, New York, with one or more of the following signs: listlessness, ocular and nasal discharge, conjunctivitis, swollen eyelids, and inflammation of the middle ear. No single etiologic agent was identified from either microbiologic or histopathologic investigations. The authors speculated, however, that the pathogenesis of the infections might have resulted from low-level exposure to organochlorines.

Recently, *Mycoplasma agassizii* was isolated from a wild *T. c. bauri* with upper respiratory tract disease (URTD) in Florida (M. Brown, pers. comm.). *M. agassizii* is known to cause URTD in wild desert tortoises (*Gopherus agassizii*, Brown et al. 1994) and gopher tortoises (*G. polyphemus*, Smith et al. 1998). Upper respiratory tract disease is contagious and may be a major source of mortality in many tortoise populations (Berry 1997). Clinical signs of URTD include intermittent serous, mucoid, or purulent nasal discharge, ocular discharge, conjunctivitis, swollen eyelids, eyes recessed into the orbits, and dull skin and scutes (Brown et al. 1994; Jacobson et al. 1991).

From May 1997 to October 2000, a population of *T. c. carolina* was monitored using radio telemetry in a southern Appalachian wetland. During the study period, high mortality occurred in this population, apparently as a result of an infectious disease. In this paper we report the general characteristics of the disease, necropsy results from two individuals that died, and blood tests that detect exposure to *Mycoplasma* sp.

The study area is a 95-ha floodplain of Tulula Creek in Graham Co., North Carolina, USA (elev. 785–800 m). A complete description of the site is in Rossell et al. (1999). Each year a maximum of ten turtles with carapace lengths > 10 cm (measured using calipers) were radio-tagged with 15 g transmitters (Wildlife Materials, Inc.). Transmitters were mounted on the rear edge of the carapace with galvanized wire and never exceeded 7% of the mass of any turtle.

Sex and age of turtles were recorded when possible, using eye color and plastron shape (Schwartz et al. 1984; Stuart and Miller 1987). Age was estimated by the mean number of growth rings on four randomly selected carapace scutes (Ewing 1939). All turtles were permanently marked by notching marginal scutes (Cagle 1939).

Turtles (N = 34) were located at least weekly from mid-May through mid-August and biweekly from mid-August until they entered their hibernacula. Twenty-two turtles (64%) were monitored ≤ 1 yr, eight turtles (24%) were monitored 1–2 yr, and four turtles (12%) were monitored 2–3 yr. Because turtles did not start dying from disease until mid-September 1997, individuals were not regularly examined for signs of disease until 1998. Transmitters were removed from six animals with no signs of disease during the study because they moved long distances outside the study area. Transmitters were placed on new individuals as they were encountered in the field.

Of the 34 *T. c. carolina* (20 M, 12 F, 2 unknown) that were radio-tagged, seven (21%) died while being monitored. Five turtles (2 M, 2 F, 1 unknown) died in 1997, one male died in 1998, and one male died in 2000. Turtles that died in 1997 and 1998 all exhibited clear ocular and nasal discharge, and swollen eyelids prior

to death. Clear ocular and nasal discharge also were observed in ca. 50% (N = 14) of turtles that did not die during 1997 and 1998. These signs generally manifested during the summer and disappeared within 1–4 weeks after the initial observation prior to hibernation. The turtle that died in 2000 exhibited labored breathing, coughing, and discharge of a large amount of yellowish exudate. This turtle also appeared listless and moved very little 1–2 d prior to death.

In 1997 and 1998, one recently deceased *T. carolina* was taken each year to the Western Disease Diagnostic Laboratory in Arden, North Carolina, for necropsy. Necropsies included preserving major organs in 10% buffered formalin, examining tissues histologically for signs of disease, and culturing aerobic bacteria from lungs, kidneys, spleens, intestines, and subcutaneous abscesses.

Gross examination of turtle 1, a 20-year old female, revealed a 1.5 cm nodule containing laminated caseous exudate on the side of the neck. The lungs, trachea, and upper respiratory tract all were unremarkable, as were the circulatory, urinary, and reproductive systems. The stomach and most of the intestine were empty. Histological examination of this turtle revealed multiple foci of necrosis in the liver, spleen, and lungs that were associated with thrombosis of small arterioles in each of the organs. Scant inflammatory cells (primarily heterophils) associated with the thrombi also were observed. Bacterial cultures recovered *Enterobacter* sp. and *Proteus* sp. from a subcutaneous abscess, the lungs, and kidneys. *Proteus* sp. also were recovered from the intestines.

Gross examination of turtle 2, a 30-year old male, revealed bluish colored eyes and small ulcerated areas on the skin near the base of the neck. The lungs were mottled, and hemorrhage and necrosis of the oropharyngeal mucosa, as well as foci of hemorrhage along the intestinal mucosa and serosa were evident. Histological examination revealed multiple foci of acute hemorrhagic necrosis and abundant bacterial clusters in the heart, lungs, liver, kidneys, intestines, and spleen. Bacterial cultures recovered *Pseudomonas* sp. from the lungs and kidneys, *Proteus* sp. from the oropharynx, and *Proteus* sp., *Citrobacter* sp., and *Serratia* sp. from the intestines.

In August 1999, blood samples were taken from radio-tagged turtles to determine whether they had been exposed to *Mycoplasma* spp. Approximately 0.25–1.00 ml of blood was collected from seven turtles without any known clinical signs of disease. Samples were drawn and processed for plasma serology following procedures by Raphael and Jacobson (1997). Plasma samples were sent to the Mycoplasma Research Laboratory in Gainesville, Florida, where they were tested for the presence of antibodies to *M. agassizii* using enzyme-linked immunosorbent assay (ELISA) tests (Schumacher et al. 1993). This test has been validated only for *Gopherus agassizii* and *G. polyphemus*. However, ELISA tests are indicative of exposure to *Mycoplasma* sp. in *T. carolina* (M. Brown, Univ. of Florida, pers. comm.). Test results are expressed as ratios between the optical density of a sample and that of a negative control. Samples with ratios > 3 are considered seropositive, ratios > 2 and ≤ 3 are considered suspect, and ratios ≤ 2 are considered seronegative.

Results of ELISA tests indicated that three turtles were seropositive (ratios: 3.84, 5.11, 6.01), three were seronegative (ratios: 1.44, 1.79, 1.85), and one was suspect (ratio: 2.17) for antibodies to *Mycoplasma* sp.

The disease that caused high mortality in this population of *T. carolina* is unknown. Necropsies on recently deceased animals often reveal the underlying cause of death (Marcus 1981). In this study, necropsy results suggest that septicemia possibly caused the death of the two individuals examined. Septicemia is a major disease syndrome in reptiles and is thought to be caused by a variety of gram-negative bacteria, particularly *Aeromonas hydrophila* and *Pseudomonas* sp. (Marcus 1981). Animals usually become infected through skin abrasions from contaminated soil or water (Marcus 1981). Septicemia is generally characterized by small hemorrhages on the skin and on mucosal and serosal surfaces (Marcus 1981). In snakes, clinical signs of this disease include respiratory distress and clear to purulent nasal discharge (Heywood 1968).

Another disease that might have caused mortality is URTD. Six of the seven *T. carolina* that died exhibited clear ocular and nasal discharge prior to death. These signs are the most common clinical signs of URTD in tortoises (Brown et al. 1994; Jacobson et al. 1991). Clear ocular and nasal discharge also were evident in a *T. c. bauri* with URTD in Florida (M. Brown, Univ. of Florida, pers. comm.). In our study, diagnosis of URTD was not possible from necropsied animals, because nasal cavities were not examined and swabbed for isolation of *Mycoplasma* sp.

Results of the ELISA tests also support the possibility that URTD might have been a factor in the deaths of turtles in this study. Three of seven turtles (47%) tested positive for antibodies to *Mycoplasma* sp., indicating that these animals had been exposed to a mycoplasma and had developed a detectable immune response. The ELISA tests, however, do not implicate *M. agassizii* as the organism causing the immune response. Therefore, it is speculative whether URTD caused by *M. agassizii* infected this population.

Iridoviruses are another potential causal agent. Members of the genus *Ranavirus* are known to cause systemic disease in infected fish and amphibians and are associated with high morbidity and mortality (Mao et al. 1997). Additionally, Mao et al. (1997) identified a *Ranavirus* sp. from a *T. carolina*. In light of this finding, the authors expressed concern that local outbreaks of iridoviruses in fish or amphibians could quickly spread to neighboring reptile populations such as box turtles. From 1997 to 2000, the period that encompassed the turtle die-off in our study, we documented mass mortality of wood frog (*Rana sylvatica*) and spotted salamander (*Ambystoma maculatum*) larvae in ponds at the study site. Necropsies of diseased amphibian larvae confirmed *Ranavirus* as the etiological agent of the mass mortality (D. Greene and K. Converse, USGS, National Wildlife Health Center, pers. comm.). However, samples from turtles have yet to be analyzed for viral infections.

Correctly diagnosing the cause of mortality in wild populations of chelonians is challenging because of a lack of detailed information on the etiology of microbial diseases and the association of secondary pathogens such as gram-negative bacteria with diseased animals. Our field data provide strong evidence for mortality due to microbial infections, but further research is needed to demonstrate specific causal agents.

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Veterinary Medicine, University of Florida, for interpreting serological tests and reviewing the manuscript, and D. Green and K. A. Converse at the U.S.G.S., National Wildlife Health Center, for conducting the amphibian necropsies and commenting on the impacts of iridovirus on turtles. R.B. Smith and one anonymous reviewer provided comments that greatly improved the manuscript. Funding was provided by grants from the Center for Transportation and the Environment and the North Carolina Department of Transportation.

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Mycoplasma Testing in the Gopher Tortoise, *Gopherus polyphemus*, Along a Pipeline Transect in Mississippi

DAVID THOMAS
ENSR, 4155 Shackleford Road, Suite 245
Norcross, Georgia 30093, USA
e-mail: dthomas@ensr.com

and

EMMETT BLANKENSHIP
Sandy Springs Emergency Animal Hospital
228 Sandy Springs Place, Atlanta, Georgia 30328, USA
e-mail: emmettdvm@netzero.net

Upper respiratory tract disease (URTD) was first described in California desert tortoises, *Gopherus agassizii*, in 1988 (Jacobson et al. 1991). Following Koch's postulate, a causative organism was soon found to be *Mycoplasma agassizii* (Brown et al. 1994). URTD is an infection known to occur in certain species of tortoises (Lawrence and Needham 1985), and more recently has been reported in natural populations of gopher tortoises, *Gopherus polyphemus* (Jacobson 1992). The symptoms of disease include, but are not limited to: serous or mucopurulent nasal discharge, epiphora, conjunctivitis, lethargy, and anorexia (Jacobson 1992). The course of the disease is usually chronic and can end in death (Jacobson 1992). This disease has received much attention in recent years because of the decline of the desert tortoise (U.S. Fish and Wildlife Service 1989) and the gopher tortoise (Auffenberg and Franz 1982) in their natural habitats. A cause and effect of disease on declining populations of gopher tortoises has not been clearly established (Smith et al. 1998). Here, we provide additional data on the occurrence of exposure of wild populations of *G. polyphemus* to *M. agassizii*.

Materials and Methods.—Destin Pipeline Company, L. L. C. (Destin) recently completed construction of a large diameter natural gas pipeline in southern Mississippi. The pipeline originates from a new offshore gathering platform in the Gulf of Mexico, travels ca. 122 km north, and makes landfall southeast of Pascagoula in Jackson Co., Mississippi. The pipeline then cuts a corridor northward for ca. 193 km in Jackson, George, Greene, Wayne, and Clarke counties to a terminus near Enterprise, Mississippi (Fig. 1).

Prior to construction, Destin was required to remove tortoises from its construction corridor (22.9–38.1 m wide) and relocate them into unoccupied gopher tortoise burrows adjacent to the right-of-way. Occupancy of burrows was determined using a camera designed for tortoise burrow inspection. These tortoises were prevented from returning to the right-of-way during construction by the use of silt fence barriers, and were monitored by biologists during construction. We collected blood samples for analysis from adult tortoises displaced from the construction of the project right-of-way (ENSR 1998). Approximately 1 cc of whole blood was taken from the brachial venous sinus or the femoral sinus. The blood was immediately placed in heparinized vacutainer tubes and placed on ice, but not frozen. The sample was allowed to separate overnight. The plasma was drawn off, placed on ice, and shipped



FIG. 1. Destin Pipeline Co. natural gas pipeline and gopher tortoise transect.

within 24 h to the Department of Pathobiology of the College of Veterinary Medicine at the University of Florida, Gainesville, for analysis. An enzyme-linked immunosorbent assay (ELISA) specific for *M. agassizii* antibody was performed on each sample (Schumacher et al. 1993).

We also collected samples from *Gopherus polyphemus* specimens immediately adjacent to the right-of-way in Jackson and George counties, where tortoises were not found on the construction corridor. By including these additional tortoises, it was possible to obtain samples from each county along a north-south transect from the Gulf Coast near Pascagoula, Mississippi to the northernmost edge of the range of *G. polyphemus* in Wayne Co., Mississippi.

Results.—A total of 26 tortoises (9 males, 17 females) were tested for exposure to *M. agassizii* (Table 1). Samples were taken from gopher tortoises in Jackson (N = 1), George (N = 4), Greene (N = 15), and Wayne (N = 6) counties. All but one tortoise tested negative for exposure to *M. agassizii* (Table 1). The test results indicated a suspect level of antibodies in tortoise #116, which showed no clinical signs of the disease. This tortoise was recaptured eight days later and tested again. The second test sample was negative.

Only one tortoise (#115) showed evidence of the clinical signs of URTD (a serous oronasal discharge). However, on 22 May 1998 it tested negative and was released. This same tortoise was later recaptured on 6 June 1998, and showed none of the symptoms previously seen. The URTD signs seen could have been related to capture stress (pers. obs.), which can easily be confused with signs of disease (McLaughlin 1997).

Discussion.—No gopher tortoises in this study tested positive for antibodies to *M. agassizii*. The sample size was small (N = 26) considering the distance of the transect (193 km). However, gopher tortoise populations are known to be sparse in the western portion of the range (Auffenberg and Franz 1982). This study is intended to provide baseline data for future monitoring of antibody levels to *M. agassizii*. This type of monitoring coupled with follow-up studies could help determine the distribution of the disease. A progressive trend toward exposure to URTD in a population would support the possibility that the disease is still spreading, and therefore might be new to *G. polyphemus*. However, if the disease is naturally occurring and essentially has always been present, then exposure and subsequent immune responses might have reached a balance in natural populations.

Like many other diseases, there might be more than one causative organism and other factors might be involved in producing URTD (Diemer Berish et. al. 2000). One such question is the role of *Pasturella* sp. and other gram-negative organisms in the disease process (Jacobson 1992). Certain organisms act synergistically to produce disease and consequently the presence of other species of bacteria could affect the severity of the disease. It is also likely that factors resulting in stress such as drought, starvation, and habitat degradation play an important role in the disease process (Jacobson 1992). Therefore, it is important to realize that a positive ELISA test for *M. agassizii* in tortoises simply indicates the animal has been exposed to the organism and now has antibodies against it. A positive test does not equal a positive URTD status.

URTD is an important disease within certain tortoise populations. It has been known to affect large portions of *G. agassizii* populations (Jacobson et al. 1991) and has been associated with high mortality rates. Within the past decade, antibodies against *M. agassizii* have been found within free-ranging gopher tortoise populations (Diemer Berish et al. 2000; Smith et al. 1998). The long-term effect URTD will have on tortoise populations is still unknown. Although Smith et al. (1998) found 100% exposure to URTD in a wild population of *G. polyphemus* in Mississippi, we found 0% in our study. The question of how populations of *G. polyphemus* become exposed to *M. agassizii* is fundamental and necessary to understanding how to manage tortoise populations in the future. Whereas Smith et al. (1998) recorded data from a population of tortoises in a protected wildlife management area, we recorded our data from tortoises scattered across the range, mostly from isolated individuals or small groups. Smith et al. (1998) postulate that a possible source of infection in their study might have been the introduction of an infected individual or individuals and that the disease might be spreading to uninfected populations. If this is the case, the incidence of URTD infection in Mississippi might still be restricted to certain populations or regions. Regarding the management of free ranging tortoises, some researchers have recommended not releasing previously-ill tortoises or tortoises having a positive titer to *M. agassizii* back into their natural range, thereby preventing spread of disease or introduction to naive populations. This strategy might only be prudent if the infection is introduced. However, if it occurs naturally, and outbreaks occur sporadically in populations, then logic would suggest that

TABLE 1. Gopher tortoises (*Gopherus polyphemus*) tested during 1998 for upper respiratory tract disease (URTD) in Mississippi.

Tortoise No.	Sample Date	Sex	CL (cm)	Mass (kg)	County	Location	URTD Test
120	12 June	F	24.1	2.5	Jackson	T4S-R6W, S9	neg
115	22 May	M	25.7	3.3	George	T1S-R7W, S6	neg
116	27 May	F	27.1	4.2	George	T1S-R7W, S6	suspect*
117	1 June	F	25.7	3.3	George	T1S-R7W, S6	neg
118	3 June	F	27.5	3.6	George	T1S-R7W, S6	neg
101	9 April	F	27.4	3.8	Greene	T4N-R8W, S25	neg
102	9 April	F	27.3	4.0	Greene	T4N-R8W, S35	neg
103	10 April	F	29.3	4.3	Greene	T4N-R8W, S35	neg
104	12 April	M	23.7	2.8	Greene	T3N-R8W, S23	neg
105	6 April	M	22.9	2.65	Greene	T4N-R8W, S25	neg
106	17 April	F	26.1	3.8	Greene	T5N-R8W, S1	neg
107	18 April	M	24.0	3.1	Greene	T4N-R8W, S35	neg
108	20 April	F	24.2	3.0	Greene	T5N-R8W, S11	neg
109	22 April	F	28.2	4.4	Greene	T4N-R8W, S14	neg
110	23 April	M	23.3	2.7	Greene	T4N-R8W, S24	neg
113	21 May	M	26.4	3.6	Greene	T1N-R7W, S7	neg
114	21 May	M	23.8	2.7	Greene	T1N-R7W, S7	neg
134	23 July	F	28.2	4.0	Greene	T4N-R8W, S13	neg
135	27 July	F	26.2	3.7	Greene	T4N-R8W, S13	neg
136	23 July	M	24.0	2.4	Greene	T4N-R8W, S13	neg
112	4 May	F	24.3	2.7	Wayne	T7N-R7W, S20	neg
121	13 June	F	25.7	3.2	Wayne	T6N-R7W, S20	neg
126	17 June	F	26.6	3.5	Wayne	T6N-R7W, S20	neg
127	29 June	F	29.4	4.5	Wayne	T6N-R8W, S36	neg
128	29 June	F	27.9	4.0	Wayne	T6N-R8W, S36	neg
122	10 June	M	25.4	2.6	Wayne	T6N-R8W, S36	neg

* tested negative on 4 June

recovered individuals could be returned or translocated to natural populations. We hope that data regarding the exposure of free ranging tortoises to *M. agassizii* will be helpful in answering some of these questions.

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that the group was composed of 2.2 adults is correct, then two females are capable of producing at least 61, and possibly more, offspring in a single breeding season

Hatchlings are capable of attaining near adult size in less than a year (Fig. 1). Growth rates of the sirens maintained indoors at a relatively constant temperature of 25–27°C were greater than those maintained outdoors and subjected to seasonal fluctuations in temperature. As far as we could determine, the density of hatchlings per enclosure had little effect on growth and mortality as long as there was adequate supplemental feeding.

Wild-caught *Pseudobranchus s. striatus* collected as juveniles reproduced in their fourth year. Captive conditions in earlier years might not have provided appropriate stimulus for reproduction. Nevertheless, F_1 offspring kept under identical conditions to those under which the adults bred had not yet reproduced by their third year. Two of the six original, wild-caught sirens, presumed to be 1.1, were continually housed indoors in a transparent plastic aquaria. To facilitate observation, the aquaria were maintained with clear water, few plants, and only a gravel substrate. Although this arrangement apparently did not compromise husbandry, no attempts at reproduction were ever observed. The oviposistion period for *P. striatus* was mid-June through August. The oviposition period for wild *P. axanthus* is reported to last from early November through March (Petranka 1998). The maximum length attained by a captive-raised *P. striatus* is 230 mm TL, slightly exceeding the published maximum length of 220 mm (Petranka 1998). No published data regarding longevity of *Pseudobranchus* could be found. At RZG, two captive-raised *P. s. striatus* are seven years old at the time of writing and still alive.

Unfortunately, conditions that stimulated reproduction in *Pseudobranchus*, e.g. turbid water, dense mats of vegetation and substrate, also prevented ready observation of some behaviors such as courtship and fertilization. Searching for eggs and offspring involved draining the tank, capturing the sirens and sorting through the vegetation and substrate. It was believed that this level of disturbance might compromise animal health and inhibit reproduction, hence frequent and continuous observations were not made. Nevertheless, these might represent the only observations for size and age at first reproduction as well as growth, fecundity, oviposition, and longevity for this species.

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NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their note (e.g., Reproduction, Morphology, Habitat, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send two copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover): Marc P. Hayes (lizards, amphisbaenians, crocodilians, *Sphenodon*); Charles W. Painter (amphibians); or Brian Butterfield (snakes, turtles). Authors are requested to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a Rich Text Format (RTF) version of the file. Alternatively, authors may submit manuscripts electronically, as e-mail attachments. Figures can also be submitted electronically as JPG files, although higher-resolution TIFF files may be requested for publication.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Crother (2000. *Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding*. Herpetol. Circ. 29:1–82); for Mexico as it appears in Liner (1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herpetol. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

AMBYSTOMA LATERALE (Blue-spotted Salamander) and ***AMBYSTOMA MACULATUM*** (Spotted Salamander). **PREDATION**. Predation by wood frog (*Rana sylvatica*) tadpoles on *A. maculatum* egg masses has been described in detail (Petranka et al. 1995. Herpetologica 54:1–13). However, nothing has been written on *R. sylvatica* predation on *A. laterale*. In Maine, all three species commonly breed in the same temporary woodland pools, where *R. sylvatica* hatch first, then *A. laterale*, then *A. maculatum*. *Ambystoma laterale* masses have fewer eggs, and are encased in jelly that is less dense than that of *A. maculatum* (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.).

On several occasions during Spring 2001, in woodland ponds in northern and central Maine, we observed *R. sylvatica* behavior that suggested preferential predation on egg masses of *A. laterale* over those of *A. maculatum*. A single predation event witnessed in captivity confirmed that *R. sylvatica* does attack and ingest larval *A. laterale*.

On 7 May 2001 between 1655 and 1725 h, two observers counted all egg masses in an approximately 900 m^2 temporary pool (44°57.72'N, 68°32.61'W) in Sunkhaze Meadows National Wildlife Refuge, Maine, USA. Average counts of two observers resulted in the following estimated egg mass numbers: *A. maculatum* (372), *A. laterale* (260), and *R. sylvatica* (172). Many of the *R. sylvatica* masses had already hatched. We observed *R. sylvatica* tadpoles "swarming" around egg masses of *A. laterale*. The same behavior was not observed on masses of *A. maculatum* eggs. Swarming consisted of many tadpoles on and inside a mass, some making violent, alternating, side-to-side motions of the head and body, apparently tearing at the egg mass. This behavior was much more active than typical algae grazing behavior. We observed several tadpoles using the same behavior eating tissue of a dead, submerged gray tree frog (*Hyla versicolor*). In contrast to their abundance on *A. laterale* egg masses (50+/egg mass), we observed very few on or near the *A. maculatum* egg masses in the pond and none of the tearing motions.

Similar behavior was observed on 15 May in a pool ca. 200 miles north, and a week later at a third pool close to the first. Between 1355 and 1500 h on 15 May at 44°11.89'N, 68°39.28'W one observer counted 128 *A. maculatum* egg masses and 546 *A. laterale* egg masses. *Rana sylvatica* had recently emerged. Another observer counted 132 egg masses prior to hatching. Again, *R. sylvatica* were observed in great numbers around *A. laterale* egg masses (with some penetrating the interior), and in small numbers at *A. maculatum* masses. On 22 May at 44°53.17'N, 68°41.11'W, the same behavior was observed. On 5 May, at this same pool, 705 *A. laterale*, 22 *A. maculatum*, and 82 *R. sylvatica* egg masses were counted.

Observations in captivity confirmed that *R. sylvatica* does ingest newly emerged *A. laterale* larvae, and suggest differences in composition of the ambystomid egg masses that might explain this differential predation observed in the field. On 11 May, *R. sylvatica* tadpoles, newly emerged *A. laterale*, *A. laterale* egg masses (ca. stage 37) (Harrison 1969. Organization and Development of the Embryo. Yale University Press, New Haven. 290 pp.) and 2 *A. maculatum* egg masses were placed in a light colored basin for close observation. Almost immediately, a tadpole was observed ingesting a larval *A. laterale*. The *A. laterale* eggs within the masses were a much brighter shade of green (denser concentration of algae) than those of *A. maculatum*.

Thanks to the U.S. Fish and Wildlife Service and the Department of Plant, Soil, and Environmental Sciences, University of Maine for Spring 2001 field support.

Submitted by **ROBERT F. BALDWIN** and **ARAM J.K. CALHOUN**, Department of Plant, Soil, and Environmental Sciences, University of Maine, Orono, Maine 04469, USA; e-mail: (RFB): rob_baldwin@umenfa.maine.edu.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). **REPRODUCTION**. Observations on nesting of *Hemidactylium scutatum* have indicated an overall seasonal progression from south to north (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Instit. Press, Washington, D.C. 587 pp.). On 4 Feb 2001 in Jasper County, Georgia, we discovered three female *H. scutatum* communally nesting in a moist, rotten log overhanging shallow water at the edge of a beaver pond. The locale, Monticello Glades, Oconee National Forest (33°14'N, 83°42'W), is on the lower Piedmont Plateau of Georgia, and is a complex of marsh, shrub, and forested wetlands immediately surrounded by upland hardwood forests, some mixed with pine. Sphagnum moss is scarce within the complex. Insofar as we can determine, this is the earliest range-wide date for which nesting has been recorded for this species (Petranka, *op cit.*). Additionally, it is the first record of *H. scutatum* nesting in Georgia. Communal nesting appears to be common for this species throughout much of its range (Petranka, *op cit.*).

In addition to the nesting females, several other individuals were observed underneath logs in the immediate vicinity. One female was photographed beside the communal nest. The photograph was deposited in the Georgia Museum of Natural History (GMNH 46761). This individual and one other (GMNH 46762; both verified by M.E. McGhee) represent the first vouchered records for *H. scutatum* in Jasper County (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. Savannah Science Museum Special Publication No. 3. 712 pp.).

Submitted by **MATTHEW J. ELLIOTT**, Georgia Gap Analysis Program, Institute of Ecology, University of Georgia, Athens, Georgia 30602, USA (e-mail: melliott@arches.uga.edu), **STACY N. SMITH**, Warnell School of Forest Resources, University of Georgia, Athens, Georgia 30602, USA (e-mail: ascaphus@mindspring.com), and **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

PLETHODON GLUTINOSUS (Slimy Salamander). **TREE CLIMBING**. Observation of climbing activity in *Plethodon glutinosus* is limited to reports describing rocky substrates (Brode and Gunter 1958. Herpetologica 13:279–280; Cliburn and Porter 1986. J. Mississippi Acad. Sci. 31:91–96). However, we observed plant climbing by this species at a barrow pit east of Westall Swamp (35°24'N, 86°05'W), Arnold Engineering and Developing Center (AEDC), Coffee County, Tennessee, USA. On the evening of 4 June 2001 at 2230 h, we discovered an adult *P. glutinosus* on the limb (19 cm diameter) of a mature loblolly pine (*Pinus taeda*) at a height of 53 cm. The air temperature was 22°C. The forest floor litter, tree limbs, and leaf surfaces were wet following a brief period of rainfall that ended less than an hour before our arrival, thus our observation supports Jaeger's (Copeia 1978:686–691) conclusion that plant–climbing activity occurs almost exclusively during wet nights. With the aid of its prehensile tail, *P. glutinosus* frequently ascends cavern walls (Brode and Gunter, *op. cit.*) and enters sandstone cliff crevices using near-horizontal connections with the base of the cliff (Cliburn and Porter, *op. cit.*). Although the salamander might have vertically ascended the trunk to its position on the limb, the end of the arched limb contacted the ground ca. 4 m from the base of the tree and also provided a sloped, near horizontal, route of entry.

Submitted by **KURT J. REGESTER** and **STEVE T. SAMORAY**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

ANURA

ELACHISTOCLEIS ERYTHROGASTER (Red-bellied Oval Frog). **DEFENSIVE BEHAVIOR.** *Elachistocleis erythrogaster*, a small microhylid endemic to the southeastern *Araucaria* plateau of Rio Grande do Sul, southern Brazil, was recently described by Kwet and Di-Bernardo (1998. Stud. Neotrop. Fauna Environ. 33:7–18). On 15 January 2001, six *E. erythrogaster* were collected at a pond near the CPCN Pró-Mata reserve, municipality of São Francisco de Paula, Rio Grande do Sul (960 m elev.). They were carried to the laboratory and kept in a terrarium. On 18 January, one individual was placed on a wooden table to be photographed. Immediately, the frog inflated its lungs, stretched out the hindlimbs and elevated the posterior part of the body. This posture was maintained for about one minute and it was possible to trigger this behavior several times by touching lightly. Of the six specimens tested, five demonstrated this defensive behavior when handled.

The antipredator behavior of presenting a larger image to potential predators is common among heavy-bodied anurans, although this is the first record for a New World microhylid. Puffing up the body and outstretching the limbs makes *E. erythrogaster* larger and should help protect against ingestion. Additionally, this microhylid produces a whitish, sticky skin secretion that might be toxic to predators. When handled, *E. erythrogaster* did not expose the aposematic ventral coloration consisting of bright red or orange-red spotted with black; therefore the function of the red and black ventral coloration remains unclear.

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Submitted by **AXEL KWET**, Zoologie, Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, D-70191 Stuttgart, Germany (e-mail: axel.kwet@uni-tuebingen.de) and **MIRCO SOLÉ**, Zoologisches Institut, Universität Tübingen, Auf der Morgenstelle 28, D-72076 Tübingen, Germany (e-mail: mirco.sole@uni-tuebingen.de).

ELEUTHERODACTYLUS COQUI (Puerto Rican Coqui). **IMMOBILIZATION.** The plant *Urera baccifera* (Urticaceae) is a common nettle in the rain forest at the El Verde Field Station (350–400 m elev.) in the Luquillo Mountains of northeastern Puerto Rico. When touched by humans it produces minor irritation and itching. Both leaves and stems are covered with stinging thorns, which are ca. 3–4 mm in height on the upper surface of the leaves. Extracts of this plant have known acute toxicities in mice and rats (Badilla et al. 1999. Revista de Biologia Tropical 47[4]:723–727). I (GRT) have observed *E. coqui* for many years in the Caribbean National Forest surrounding the El Verde Field Station and have rarely seen *E. coqui* or other vertebrates on this plant. When I have observed frogs that have either accidentally jumped or fallen on this plant, they immediately leap off.

On the evening of 29 May 2001 at 2250 h in the forest 0.5 km northeast of the El Verde Field Station, we found an adult male *E. coqui* immobilized on the upper leaf surface of *U. baccifera*. When we approached, the frog was unresponsive, and remained stationary with its ventral surface flat to the leaf. Furthermore, it did not move when touched on its dorsum. After approx. one minute, the frog was gently removed from the leaf and it was immobilized. This state of immobility lasted for 3–4 minutes. After this time, the frog jumped into the forest vegetation. When we tried to capture it, it appeared to be functioning normally, and jumped upon detecting our approach. Steward (1985. J. Herpetol. 19:391–401) noted that *E. coqui* parachutes or falls from trees to the ground. Therefore, *U. baccifera* could be a potential hazard, possibly causing injury or death via immobilization. Further, if parachuting frogs were impaled on its thorns, they could be vulnerable to predation. Although Steward (*op. cit.*) reported no instance of *E. coqui* landing on this plant, we believe that this poses potential danger. It is not clear whether this immobilization was the result of the plant's chemical toxin, shock from the fall, or other consequences. However, because *E. coqui* is rarely seen on *U. baccifera*, and the plant has physically threatening spines with a known irritant, we conclude that immobilization was the result of abusive contact with *U. baccifera*.

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Submitted by **GARY R. TEN EYCK**, Department of Psychology, Biopsychology Area, 525 East University, University of Michigan, Ann Arbor, Michigan 48109-1109, USA, and **LORI E. KRUGER**, Institute for Tropical Ecosystem Studies, El Verde Field Station, P.O. Box 1690, Luquillo, Puerto Rico 00773, USA.

HYLA NANA (Dwarf Tree Frog). **PREDATION**. Metamorphosing anurans are common prey for a variety of vertebrate and invertebrate predators. Spiders have been considered one of the most important predators of small terrestrial anurans (Hayes 1983. Biotropica 15:74–76) and numerous authors have reported them feeding on metamorphosing and adult hylid frogs.

On 27 Nov 2000 at 2300 h, we collected a *Hyla nana* metamorph at a swamp located in the Department of Itapúa, Alto Vera, San Pedro Mí, Paraguay (26°31'25"S, 55°48'19"W). The *H. nana* (TL ca. 10 mm) was being eaten by a juvenile spider (cephalothorax-abdomen length ca. 12 mm) of the genus *Thaumasia* (Araneae:



FIG. 1. A pisaurid spider, *Thaumasia* sp., shown with *Hyla nana* metamorph, following preservation.

Pisauridae). At the time of collection, the spider had the frog in its jaws and was sitting ca. 30 cm above the water on vegetation growing at the perimeter of the swamp. The frog was dead upon discovery and continued to dissolve prior to preservation. Both specimens were collected and deposited at the Museo Nacional de Historia Natural del Paraguay (MNHNP, CR [counter reference] #2061). The spider and the remaining frog prey were photographed after preservation (Fig. 1). To our knowledge, this is the first account of a pisaurid (*Thaumasia* sp.) feeding on a metamorph *H. nana*.

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Submitted by **JENNIFER B. PRAMUK** and **HUGO ALAMILLO**, Division of Herpetology, Natural History Museum and Biodiversity Research Center, University of Kansas, 1345 Jayhawk Boulevard, Lawrence, Kansas 66045-7561, USA; e-mail (JBP): pramuk@ku.edu.

LEPTODACTYLUS FUSCUS (NCN). **PREDATION**. Snakes of the genus *Liophis* are known to prey upon frogs, including species of *Leptodactylus* (Michaud and Dixon 1989. Herpetol. Rev. 20(2):39–41). Herein is the first report of *Liophis meridionalis* feeding upon *Leptodactylus fuscus* that we are aware of. On 7 Dec 2000 (1500 h), at Clube Caça e Pesca Itororó de Uberlândia (Uberlândia, Minas Gerais, Brazil: 18°59'S 48°18'W), workers cleaning the grasses around a dry pond killed a snake while it was preying on a frog. We identified the snake as an adult female *Liophis meridionalis* (610 mm SVL; UFU 1107, Museu de Biodiversidade do Cerrado, Universidade Federal de Uberlândia) and the frog as an egg-bearing female *Leptodactylus fuscus* (45 mm SVL; AAG-UFU 2250). In the laboratory we examined the digestive tract of the snake and found two feet of other adult *L. fuscus*. In the summer, adult *L. fuscus* congregate around ponds to reproduce, and if conditions are not appropriate for egg laying, the females might wait for rains, thus becoming more susceptible to predation by snakes.

Submitted by **MARCELO N. DE. C. KOKUBUM** and **ARIOVALDO A. GIARETTA**, Instituto de Biologia Universidade Federal de Uberlândia, 38400-902, Uberlândia, Minas Gerais, Brazil.

PHYLLOMEDUSA ATELOPOIDES (Purple Leaf Frog). **REPRODUCTION**. Little is known about the natural history of many recently discovered neotropical frogs. The recently described *Phyllomedusa atelopoides* is the only terrestrial member of the arboreal hylid subfamily Phyllomedusinae. Arboreal phyllomedusine frogs typically lay their eggs on leaves above forest pools, however only one clutch of *P. atelopoides* has been reported (Duellman et al. 1988. Herpetologica 44:91–95). Herein we report new observations on reproduction in *P. atelopoides*.

Observations were made during the rainy season from 28 Dec 2000 to 14 Jan 2001 in the seasonally dry rainforest of the Reserva Cuzco Amazónico on the north bank of the Río Madre de Dios, ca.15 km ENE of Puerto Maldonado, Departamento Madre de Dios, Peru (see Duellman and Koechlin 1991. Occas. Pap. Mus. Nat. Hist. Univ. Kansas 142:1–38). An amplectant pair of *P. atelopoides* was discovered by eyeshine at 2300 h on 29 Dec 2000. The pair was located in terra firma forest, ca. 10 m W of Trail B ca. 750 m from Cuzco Amazónico lodge. The nesting site was ca. 20 m east of a slow moving stream, the Quebrada Mariposa. The amplectant pair was laying eggs and wrapping them in a leaf on a short (ca. 30 cm) herbaceous plant with 3 leaves. The plant was isolated from other low-lying vegetation by ca. 2 m, but was under an enclosed tree canopy. The nesting plant was located on the bank, ca. 30–45 cm from water's edge of a small (1 m x 2.5 m), shallow (ca. 30 cm max. depth), temporary pool. The adult frogs were gone at 2400 h and could not be found. Two days later (31 Dec) at 1700 h, the leaf enclosing the eggs was opened to reveal 25 yellow eggs adhered to the leaf in a clear gelatinous-like substance. The leaf was then closed. By 3 Jan 2001 the nest remained intact but the pool had completely disappeared, with only wet earth remaining. The eggs were present and showed signs of development at 1620 h on 8 Jan. On the following day (9 Jan) at 2148 h only 9 eggs remained, and on 10 Jan the leaf was found open with only two eggs remaining.

These observations are consistent with those reported previously for *P. atelopoides* and corroborate their terrestrial habitat preference. This species has never been reported to be more than 30 cm above the ground, and the only other observed amplectant pair was laying unpigmented eggs in a wrapped leaf 5 cm above the ground at the edge of a shallow pool (Duellman et al., *op. cit.*). The clutch size reported herein of 25 eggs is close to the number reported for the only previously known clutch that had 20 eggs (Duellman et al. *op. cit.*). We suspect that the disappearance of the eggs was not because of hatching. When last observed, development of the eggs was not very advanced and only twelve days had elapsed since they were laid. Furthermore, there was no evidence of hatchlings in the vicinity. We suspect that the disappearance may have been the result of predation, as snakes (e.g., *Leptodeira* spp.) are known to prey on phyllomedusine clutches.

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Submitted by **JOEL E. BLOCK, JULIE K. MOONEY, STACEY L. UNSER,** and **ERIK R. WILD**, Department of Biology, University of Wisconsin-Stevens Point, Stevens Point, Wisconsin 54481-3897, USA; e-mail (ERW) ewild@uwsp.edu.

PHYSALAEMUS BILIGONIGERUS* and *PHYSALAEMUS GRACILIS (Weeping Frog and Graceful Dwarf Frog). **REPRODUCTIVE BEHAVIOR.** In contrast to explosive breeders, in anurans with a prolonged breeding season males typically remain stationary at calling sites waiting for females. In such lek-like mating systems, females move through choruses and freely select mates with little interference from males. Therefore, heterospecific amplexus is rarely found in nature in species with female choice. Herein I report amplexus between specimens of two species of lek-breeding dwarf frogs of the genus *Physalaemus*.

On 25 December 1997 at 2300 h, I observed an amplectant pair of a male *P. gracilis* (Stuttgarter Museum für Naturkunde, Germany, SMNS 9190) and a female *P. biligonigerus* (SMNS 9189) at a flooded pasture near Lamí, municipality of Porto Alegre, Rio Grande do Sul, southern Brazil. At this locality, males of both species were calling. The heterospecific pair was photographed and carried to the laboratory. During the night, the frogs maintained the axillary amplexus but did not construct a foam nest as frequently observed in conspecific pairs of this genus kept together in a small container. Next morning both specimens were separated. Although the dissected female contained eggs, no spawning had occurred. *Physalaemus gracilis* and *P. biligonigerus* are morphologically different species, belonging to different species groups. However, they possess similar advertisement calls that are nearly indistinguable to the untrained human ear. It may be assumed that the female *P. biligonigerus* was misled, being attracted by the call of the heterospecific male *P. gracilis*. Although call discrimination by the females of these species may not always function, I found no evidence of hybridization.

Submitted by **AXEL KWET**, Zoologie, Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, D-70191 Stuttgart, Germany; e-mail: axel.kwet@uni-tuebingen.de.

PSEUDACRIS BRACHYPHONA (Mountain Chorus Frog). **VERIFICATION OF HISTORICAL OCCURRENCE.** The last confirmed record of *Pseudacris brachyphona* within North Carolina was on 20 February 1954: North Carolina State Museum (NCSM 11123–11125); Charleston Museum (Ch.M. 54.32.11). However, on 25 and 26 February and 9 March 2001, several choruses were observed within Cherokee County, North Carolina (35°02'30"N, 84°03'08"W). Males were observed calling from a flooded roadside ditch adjacent to an upland slope containing *Pinus virginiana* and *P. echinata*. *Juncus* sp., *Andropogon virginicus*, and other vegetation were growing within the roadside ditch. Males were seen calling from the base of vegetation at or slightly above the surface of the water. Calling males were also observed within an adjacent, regularly cut field that contained temporary puddles near a small stream. These temporary puddles were sparsely vegetated and had fine woody debris and bark along the margins. Males were seen calling among the debris. *Pseudacris crucifer* were often heard calling with *P. brachyphona*. Clemson University (CUSC 987 [vocal recording: accession # 987]; specimen photographs: catalog #s 2065, 2066). H. LeGrand (North Carolina Natural Heritage Program) and J. Beane (NCSM) provided documentation of the last confirmed report of *P. brachyphona* within North Carolina.

Submitted by **THOMAS M. FLOYD** and **ERAN S. KILPATRICK**, 261 Lehotsky Hall, Box 340331, Department of Forest Resources, Clemson University, Clemson, South Carolina 29634-0331, USA; e-mail (TMF): tfloyd@clemson.edu.

PSEUDACRIS CRUCIFER (Spring Peeper). **PREDATION.** Observations of predation on *Pseudacris crucifer* have identified odonate and beetle larval or nymphal stages, fish, and salamanders as predators of tadpoles (e.g., Skelly 1996. Copeia 1996:599–605), and snakes as predators of adults (e.g., Rowe et al. 2000. Herpetol. Nat. Hist. 7:145–152). Little is known about predators on metamorphs. On 21 June 2001 at 0830 h, I observed a ground beetle (*Scarites subterraneus*: Carabidae) consuming a metamorph *P. crucifer*. The beetle and metamorph were found under a board near a temporary pond in the Taylor-Ochs section of the Denison University Biological Reserve, Granville, Licking County, Ohio. This observation suggests that terrestrial insects may be a potentially overlooked source of mortality for metamorphic anurans.

Submitted by **GEOFFREY R. SMITH**, Department of Biology, Denison University, Granville, Ohio 43023, USA; e-mail: smithg@denison.edu.

SCINAX CRUENTOMMA (NCN). **PREDATION.** Although some information is available concerning the predation of frogs, fewer data exist concerning species-specific predators. Herein we report an adult *Scinax cruentomma* (Hylidae) being preyed upon by a wolf spider (Lycosidae). This small (25–31 mm) frog is generally found in forests and clearings, and breeding occurs in temporary pools where males call from leaves or blades of grass above the water (Rodriguez and Duellman 1994. Guide to the Frogs of the Iquitos Region, Amazonian Peru, Asociacion De Ecologia Y Conservacion. 48 pp.).

On 9 May 2000, at 2130 h, a breeding aggregation of ca. 50 *S. cruentomma* was discovered at the ExplorNapo Lodge Reserve ca. 75 km northeast of Iquitos, Departamento Loreto, Peru. The individuals were in flooded forest adjacent to the Guebrada Grande on the western border of the reserve.

A single adult *S. cruentomma* was observed as it was being consumed by a large wolf spider on the side of a small tree ca. 1 m above the ground. When disturbed, the wolf spider carried the frog underneath a log.

Submitted by **BRIAN AUCONE** and **WINSTON CARD**, Dallas Zoo, Department of Herpetology, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA; e-mail (BA): herper1@hotmail.com.

TESTUDINES

CARETTA CARETTA (Loggerhead Sea Turtle). **NESTING BEHAVIOR**. The general nesting process is essentially the same in all species of sea turtles, including the steps involved in excavating the egg chamber. Using her rear flippers, the female turtle typically digs a flask-shaped egg chamber with a narrow neck and wider bottom. The turtle accomplishes this excavation through a methodical series of steps that result in a single-chambered egg chamber with a single opening at the top (Hailman and Elowson 1992. Herpetologica 48:1–30). Variations in the shape of the egg chamber are observed most often in response to variations in sand type (Miller 1997. *In* Lutz and Musick [eds.], The Biology of Sea Turtles, pp. 51–81. CRC Press, Inc., Boca Raton, Florida), however the general shape of one egg chamber with one surface opening is consistent. A nest of two conjoined egg chambers with one common opening has previously not been reported. During the 1997 nesting season, however, researchers with the University of Florida's Cooperative Fish and Wildlife Research Unit observed

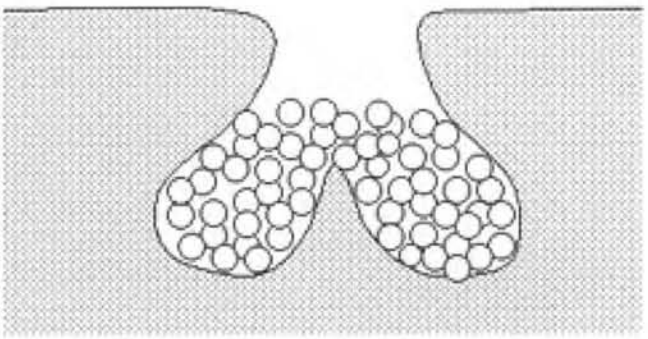


FIG. 1. Diagrammatic representation of double-chambered nest of *Caretta caretta* from Cape San Blas, Florida.

two loggerhead sea turtle (*Caretta caretta*) nests that each had two conjoined egg chambers with a single common opening (Fig. 1). Discussions of this phenomenon with other sea turtle monitoring groups in Northwest Florida revealed that double-chambered nests had been observed on four other occasions on panhandle nesting beaches.

Since 1994, the UFL Coop Unit has been conducting daily morning nesting survey along three miles of beach owned by Eglin Air Force Base (EAFB) on Cape San Blas, Florida, USA. Surveys are conducted on foot or all-terrain vehicles, and data are collected on false and nesting crawls. Nests threatened by erosion or water inundation are relocated to a more protected site along the EAFB beach. Nests are screened and staked to prevent depredation and marked with signs and flagging. Incubating nests are monitored daily for signs of hatchling emergence and are excavated to determine hatching success 72 hours after emergence or after 85 days of incubation.

During the 1997 nesting season, two separate nests possessing double-chambered egg chambers were observed at Cape San Blas. On 3 July 1997, at 0635 h, a *C. caretta* nest (designated as nest 33) was located at mile marker 2.55 along the north beach of EAFB property on Cape San Blas. Due to threats of water inundation and erosion, the nest was relocated. While excavating the nest for relocation, it was observed that the nest had two egg chambers connected with one common opening. Eggs were located in both sides and in the common neck of the chamber. Several weeks later it became apparent that this had not been a unique event along Cape San Blas. On 20 June 1997, a *C. caretta* nest (designated as nest 15) was located at mile marker 2.56 along the north beach and 60 eggs were relocated to the east beach. At the time of excavation it was noted that the egg chamber was narrow and tilted to one side. On 20 August 1997, while obtaining GPS coordinates for the original site of nest 15, eggshells and hatchling tracks were observed. Upon investigation, it was determined that nest 15 also had a double egg chamber, but only one side of the chamber had been discovered originally. One half of the nest (containing 36 eggs) had inadvertently been left *in situ* along the north beach (15a), and the other half had been relocated to the east beach (15b).

There are four other known occurrences of double-chambered nests in Northwest Florida between 1996 and 1998. In 1996, a double-chambered nest was found on St. Vincent Island (reported by Thom Lewis, St. Vincent National Wildlife Refuge) that contained 106 eggs, with 30 in one chamber and 76 in the other. In 1997 a double-chambered nest was found during hatching success evaluation on the St. Joseph Peninsula (reported by Joe and Carolyn Hooper, Gulf County Turtle Patrol) only a few miles north of Cape San Blas. This nest contained 96 eggs with 34 in one side and 60 in the other. Two double-chambered nests were found on Panama City Beach during the 1998 nesting season (reported by Martha Maglothin and Bob Gilmore, St. Andrew Bay Resource Management Association). The first nest was found on 29 May and contained 159 eggs. The distribution of the eggs between the two chambers is unknown. The second nest was found on 13 June and contained 142 eggs with 79 in one chamber and 63 in the other. Hatching success for each of the double-chambered nests is summarized in Table 1.

Upon examination of the data from the nests at Cape San Blas, it appears the same turtle laid both double-chambered nests. The primary difference between the two nests was crawl width, which could be attributed to variation in weather and sand conditions. The 13-day inter-nesting period and the proximity of the two nests are supportive of the theory that a single female laid both nests. It is also possible that this same female laid the double-chambered nest found on St. Joseph Peninsula on 28 July 1997. Similarly, the 14-day period between the laying of the double-chambered nests found on Panama City Beach in 1998 indicates one female may have been responsible for both.

It is unknown how female turtles dug the double-chambered egg chambers. The shape of a sea turtle's egg chamber is influenced by several factors including buried debris, variations in substrate, and flipper physiology and function (Miller, *op. cit.*). Because the nests described were laid in close geographic proximity to typically shaped nests, debris and substrate variations appear to have had little influence. Also, the shape of each individual chamber within the double-chambered nests was typical, and the crawls had a normal appearance. Therefore, it does not seem likely that this situation could be attributed to abnormal shape in the rear flippers. The depth/length of the dual chambers seemed to indicate no truncation of flipper length, however this cannot be ruled out as a mechanism without direct observation of the animals. Most likely, the double-chambered egg chambers are a result of abnormal function of the rear flippers. Normal digging is accomplished by reaching inward and scooping outward. The right rear flipper is placed into the hole

TABLE 1. Hatching success of double-chambered *Caretta caretta* nests in Florida.

Location	Nest Number	Date Laid	Date Hatched	Percent Hatching
St. Vincent Island	9637	17 July1996	—	0.0
Cape San Blas	15a	20 June 1997	19 August 1997	97.2
Cape San Blas	15b	20 June 1997	20 August 1997	90.0
Cape San Blas	33	3 July 1997	30 August 1998	72.7
St. Joseph Peninsula	H110	28 July 1997	25 September 1997	97.9
Panama City Beach	1	29 May 1998	26 July 1998	59.0
Panama City Beach	7	13 June 1998	10 August 1998	56.0

medially and used to scoop downward, forward and to the left. The right flipper excavates the left side of the hole and the left excavates the right side. The observed digging aberration could be achieved by the female shifting laterally to a greater degree as she places her flippers into the hole, and allowing a "septum" to develop between the digging efforts of the two flippers. This may result from a behavioral or kinesiological deviation by the nesting female.

Hatching success indicated that eggs laid in the double-chambered nests had no greater disadvantage than those laid in a typical single-chambered nest. Whatever abnormality the female turtle had did not prevent her from laying viable eggs. In nest 15, eggs left in the original nest had hatching success comparable to eggs that were relocated; indicating the structure of the individual chambers within each nest was adequate for successful incubation and hatching conditions. Although double-chambered nest construction appears to be anomalous, there may be adaptive value in this pattern of egg deposition. Nest predators may be fooled into excavating only one side of the cavity, as were the researchers. Lack of observed deleterious effects from the clutch splitting enhances the usefulness as a possible strategy to limit predation and maximize production.

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Submitted by **MARTHA L. MAGLOTHIN, MARGARET M. LAMONT**, and **RAYMOND R. CARTHY**, Florida Cooperative Fish and Wildlife Research Unit, University of Florida, P.O. Box 110450, Gainesville, Florida 32611, USA; e-mail (MLM): MarthaMaglothin@worldnet.att.net).

LACERTILIA

AMEIVA ALBOGUTTATA (Mona Island Ameiva). **ARBOREAL ACTIVITY**. Lizards in the genus *Ameiva* commonly are characterized as actively foraging ground-dwellers (e.g., Sproston et al. 1999. J. Herpetol. 33:131–136). However, on 19 October 1999 near Playa Sardinera, Isla Mona, one of us (RP) observed a juvenile *A. alboguttata* 4 m above the ground on the trunk of an Australian Pine (*Casuarina equisetifolia*). At 4 m, the trunk diameter was ca. 60 cm. With binoculars it was evident that this lizard was following an ant trail, periodically taking a prey item while continuing to climb until it disappeared in foliage at a height in excess of 6 m. Careful examination around the base of the tree (to > 2 m) failed to reveal the presence of ants. This observation suggests that these typically terrestrial lizards may occasionally (and intentionally) climb in order to exploit food resources not readily available or evident at ground level. We are unaware of any published accounts of *Ameiva* climbing to find food, but one of us (EJC) has observed adult *A. corax* on Little Scrub Island feeding on prickly pear cactus flowers and fruits at heights approaching 2 m and *A. plei* on Anguilla ascending tree trunks to heights of ca. 1 m in search of land snails.

Miguel A. Garcia, Department of Natural Resources, Puerto Rico, facilitated the visit by RP to Isla Mona in association with the West Indian Iguana Specialist Group.

Submitted by **ROBERT POWELL**, Department of Biology, Avila College, Kansas City, Missouri 64145-1698, USA (e-mail: powellr@mail.avil.edu), and **ELLEN J. CENSKY**, Connecticut State Museum of Natural History, University of Connecticut, Storrs, Connecticut 06269, USA (e-mail: censky@uconnvm.uconn.edu).

EMOIA CAERULEOCAUDA (Pacific Blue-tailed Skink). **BEHAVIOR**. Males of *Emoia caeruleocauda* exhibit a high frequency of intraspecific conflicts in captivity (McCoid et al. 1997. Herpetol. Rev. 28:202; Porej, unpubl. data), which often lead to injuries and death. Here I report observations on display and combat behavior in male *E. caeruleocauda* in the wild. Observations of adult male *E. caeruleocauda* were made on the island of Rota in September 1999, on a wide, sunny concrete support wall at the Teteto Beach. An adult male approached another basking male to a distance of ca. 40 cm, and both individuals started head-bobbing with their tails slowly waving. After less than 10 s both individuals highly arched their backs, and started to rapidly flick their tails. This was followed by a series of ca. 25 short, side-to-side and forward bouncing jumps with all four limbs fully extended. As they approached each other, they turned more and more sideways until they were facing away from each other, with their tails almost touching. Then they slowly backed toward each other such that their slowly waving tails were directly over their opponent's head. When one of the combatants would bite the opponent's tail the other lizard would spin and bite its now exposed head or neck. A melee would then ensue, which lasted until the lizard bitten on the neck broke the grip on its neck. At that point the combatants would assume their original positions. This sequence repeated four times, except for the initial head bobbing which was not observed again.

The conflict was interrupted twice by other *E. caeruleocauda*, which were not collected, but whose sex I am inferring from their size, color pattern, and head width. In field conditions, males of *E. caeruleocauda* can be distinguished from females by their larger maximum SVL (52.8 mm males, 47.8 mm females), loss of yellow dorsal stripes and blue tail coloration in larger males (the largest striped male had a SVL of 43 mm in my sample of 253 individuals from Rota), and broader heads. Based on the same sample, regression analysis indicates that males have significantly broader heads (measured at the widest point) than females ($p<0.0001$, two-sided t-test), and the difference in the means after accounting for body size is estimated to be 0.74 mm (0.62–0.86 mm, 95% C.I.), which is 15–18% of the average female head width.

The first inquisitive individual was considerably smaller than the two combatants, was blue-tailed and striped with a relatively narrow head and thus assumed to be a female. Although it came very close to the two combatants, and at one point even passed between them, they appeared to ignore it. The second individual to approach the combatants was only slightly smaller than the two of them, but had a broad head and was uniform gray in dorsal coloration and thus, assumed to be a male. Because it was climbing the wall, this individual did not notice the two fighting at the top. It stopped and then immediately started retreating upon see-

ing them. Although the combatants were well into the "jumping" stage, it was chased, grabbed, and violently shaken, then thrown off the wall by one of the two, after which the original combat resumed. There was no head bobbing in this case.

The observed ritual might represent the introductory part of a conflict between two established (and possibly neighboring) males whereas wandering intruders might be encountered with a much more aggressive approach. This suggests that males of *E. caeruleocauda* might be territorial, a behavior observed in its congener *E. physicae* in New Guinea (Zwickel and Allison 1983. Can. J. Zool 64:752–755), but rarely observed in other skinks (Stamps 1983. *In* R. B. Huey et al [eds.], Lizard Ecology: Study of a Model Organism, Harvard Univ. Press, Cambridge, Massachusetts. 512 pp.). Specimens are deposited at the Ohio State Museum of Biological Diversity, Columbus, Ohio.

Submitted by **DENI POREJ**, Department of Ecology, Evolution, and Organismal Biology, Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210, USA; e-mail: porej.1@osu.edu.

IGUANA DELICATISSIMA (Lesser Antillean Iguana). **ACTIVITY.** The genus *Iguana* is native to the Lesser Antilles, and both recognized species are known from the region. *Iguana iguana* is associated largely with the southern islands, although a natural introduction to the northern island of Anguilla has been documented (Censky et al. 1998. Nature 395:556). *Iguana delicatissima* has a more northerly distribution. Extant populations, some critically endangered, occur on the islands of Anguilla, St.-Martin/St. Maarten, St.-Barthélémy, St. Eustatius, Martinique, Dominica, Basse Terre and Grande Terre (Guadeloupe), and Désirade. Populations on St. Kitts, Nevis, Barbuda, Marie-Galante, Antigua, and Les Îles des Saintes have been extirpated (Malhotra and Thorpe. 1999. Reptiles & Amphibians of the Eastern Caribbean. Macmillan Educ. Ltd., London and Oxford, 134 pp.).

The critically endangered population of *Iguana delicatissima* on Anguilla has had to cope with an exceedingly xeric climate and periodic hurricanes. Since European colonization, additional pressures have been imposed in the form of habitat alteration and competition with, and predation by, introduced mammals. Recent estimates of population size suggest that fewer than 100 animals survive (Gerber 1997. Unpubl. rept., Fauna & Flora Internatl., Anguilla Natl. Trust, 22 pp.; E. J. Censky, pers. comm.). The recent arrival of *I. iguana* on Anguilla may represent a threat to the genetic integrity of the population. Day and Thorpe (1996. *In* Powell and Henderson [eds.], Contributions to West Indian Herpetology: A Tribute to Albert Schwartz, pp. 436–437. SSAR Contrib. Herpetol. Vol. 12. Ithaca, New York, 457 pp.) detected hybridization between *I. iguana* and *I. delicatissima* on Les Îles des Saintes through multivariate analysis of morphological characteristics and DNA testing. However, contact between the two species on Anguilla has not been documented.

Anguilla has an area of ca. 90 km^2. *Iguana delicatissima* utilizes only about 2 km^2 (3% of the total island area) along the northern coast of the island, from Little Bay west to the Brimigen Coast (Gerber, *op. cit.*). In the past, *I. delicatissima* had a much broader distribution along most of the northern coast, from Road Bay to Island Harbour (E. J. Censky, in litt., 26 July 2000). Despite the precarious state of the population, little is known about its natural history, although Gerber (*op. cit.*) noted habitat associations and diet. In an effort to begin documenting daily activities, focal animal observations were conducted over a three-week period in June 2000. We visited the entire current range of *I. delicatissima* on Anguilla; however, most observations occurred in the western portion, a ca. 100-m wide strip of land along the coast between Little and Limestone bays. This area consists of rocky limestone cliffs that rise to 25 m above sea level. Many of the iguanas that were observed used crevices and caves in the vertical faces of these cliffs as burrows. The dry thorn scrub vegetation above the cliffs rarely exceeded 3 m in height. Most of the area is relatively undisturbed by human activity, although some homes are present and the secluded beaches often attract tourists.

These iguanas are extremely secretive and sensitive to disturbance. Many Anguillians have never seen a wild iguana and the impression that this population had been extirpated was widespread as recently as the mid-1980s (E. J. Censky, pers. comm.). During >260 person-hours in the field, we spent ca. 47 hours observing animals. Some additional observations (all < 2 min in duration) consisted primarily of escape behavior in response to our presence and were not included in total observation time. Forty sightings were made of at least eleven different individuals (1 iguana/6.5 hr). Only five animals were observed for extended periods, most by a single observer using binoculars or a spotting scope to minimize the likelihood of altering behavior.

During the observation period, iguanas spent most of their time basking on rocks (86.0%) and considerably less time basking in trees (6.5%). Other activities included non-reproductive interactions (4.0%), courtship or mating (2.0%), roaming (1.8%), and feeding (0.2%). Additional time (0.4%) was spent in extended (> 2 min) responses to an observer. Variation was substantial among the five individuals observed for extended periods (Table 1). For example, some individuals were seen basking only in trees, whereas most were observed on rocks. We observed animals as early as 0700 h and as late as 1830 h, corresponding to about one hour after sunrise to sunset. No peaks in activity were observed; however, individuals were seen in trees primarily from 1100–1300 h.

Our observations are, at best, preliminary. Time spent feeding may have been underestimated in the context of general behavior, because individuals may have been more concerned about repro-

TABLE 1. Percent time spent per individual and total time spent per category: basking on rock (BR), basking in tree (BT), feeding (FF), non-reproductive interaction (NR), courtship and mating (CM), roaming (RR), and extended response to observer (RO).

Individual Observed (Minutes Observed)	Activity						
	BR	BT	FF	NR	CM	RR	RO
Lizard 1 (580)	79.0	0.0	1.0	12.0	6.0	0.0	0.0
Lizard 2 (1911)	97.0	0.7	0.1	1.0	2.0	0.5	0.0
Lizard 3 (33)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Lizard 4 (80)	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Lizard 5 (201)	8.0	67.0	0.0	0.0	0.0	20.0	5.0
All (2805)	86.0	6.5	0.2	4.0	2.0	1.8	0.4

duction than feeding during the mating season. Also, the overwhelming amount of time spent basking may merely reflect the fact that animals felt most secure and were most readily observed at those times.

Ellen J. Censky facilitated our work on Anguilla, helped in the field, and commented on an earlier draft of this note. Karim Hodge, Anguilla National Trust, helped us initially locate areas where animals were known to exist. Cleophis Gumbs kindly allowed us access to his property. Fieldwork was supported by Grant No. DBI-9732257 awarded by the National Science Foundation to RP.

Submitted by **STESHA A. PASACHNIK**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA (e-mail: pasacst@earlham.edu), **JUSTIN J. SHEW**, Department of Biology, Truman State University, Missouri 63501, USA (e-mail: jjshew@hotmail.com), **JOSIAH H. TOWNSEND**, Department of Biology, Miami-Dade Community College, Kendall Campus, Miami, Florida 33176, USA (current address: Department of Biology, University of Florida, Gainesville, Florida 32611, USA; e-mail: joetownsend@earthlink.net), and **ROBERT POWELL**, Department of Biology, Avila College, Kansas City, Missouri 64145, USA (e-mail: powellr@mail.avila.edu).

KENTROPYX PAULENSIS (NCN)**. REPRODUCTION.** The terrestrial teiid lizard *Kentropyx paulensis* occurs in open habitat formations of central and southeastern Brazil (Gallagher and Dixon 1980. Copeia 1980:616–620). Data on natural history of species of the *K. paulensis* Group (*K. paulensis*, *K. vanzoi*, and *K. viridistriga*) are scarce. Here we describe reproductive information from five gravid female *K. paulensis* collected in a protected area of cerrado (savanna-like formation; 22°12'30"S, 47°54'45"W, 760 m elev.) at Itirapina Ecological Station (IES), municipality of Brotas, São Paulo State, southeastern Brazil. Three of the females laid eggs in the laboratory after collection. The first female (Zuec 02483; SVL = 70.0 mm; tail length = 137.8; mass = 10.5 g), collected on 27 August 1999, laid four white calcareous shelled eggs (15.2 x 8.8 mm, 15.3 x 8.8 mm, 14.5 x 9.8 mm, and 9.4 x 8.7 mm) on 1 September 1999; the total mass of the four eggs was 2.6 g (Relative Clutch Mass [RCM] = 0.25). The second female (SVL = 73.0 mm; tail length = 130.0; mass = 12.4 g), collected on 13 March 2000, laid five eggs on 17 March 2000; the total mass of the five eggs was 3.5 g (RCM = 0.28). The third female (SVL = 63.8 mm; tail length = 124.0 mm; mass = 9.0 g), collected on 13 February 2001, laid four eggs between 28 February and 1 March 2001. Afterwards the latter two females were marked and released in the field. Two additional females (Zuec 02485 and 02486; SVL = 71.3 and 73.0 mm; tail length = 123.0 and 139.0 mm; mass = 10.0 and 10.5 g; respectively) collected on 16 March 2000 and 17 February 2001 respectively, were preserved. They had three and five vitellogenic ovarian follicles respectively. Our data indicate that females of *K. paulensis* lay few (3–5) but large (RCM = 0.25–0.28) eggs. Teiid lizards generally have relatively low RCMs (0.11–0.21) which may be related to their widely foraging mode (Vitt and Price 1982. Herpetologica 38:237–255). The RCM for other species of the genus *Kentropyx* ranges from 0.15 to 0.22 (Vitt et al. 1995. Can. J. Zool. 73:691–703). The comparatively high RCMs we found for *K. paulensis* are among the highest within the Teiidae and the genus *Kentropyx*, which lead us to hypothesize that this species may have lower foraging intensity than other teiids.

The voucher specimens of *K. paulensis* cited above are deposited in the Museu de História Natural, Universidade Estadual de Campinas (ZUEC). D. Zanchetta and the staff of Instituto Florestal allowed and facilitated our fieldwork at IES. FAPESP provided grants to LAA (99/09125-1) and RJS (99/05664-5), and CNPq to MCK (146442/1999-7). We thank P. R. Manzani for laboratory assistance; V. R. Ariedi-Jr., V. Bonato, C. A. Brasileiro, C. Monteiro and F. Spina for field assistance; C. F. D. Rocha and M. Martins for suggestions. This is publication number 7 of the project Ecology of the Cerrados of Itirapina.

Submitted by **LUCIANO ALVES DOS ANJOS** (e-mail: mabuya@bol.com.br), **MARA C. KIEFER** (e-mail: kiefer@unicamp.br) and **RICARDO J. SAWAYA** (e-mail: sawaya@unicamp.br), Departamento de Zoologia, Universidade Estadual de Campinas, CP 6109, 13083-970 Campinas, SP, Brazil.

LIOLAEMUS PETROPHILUS (NCN). **SAUROPHAGY**. *Liolaemus petrophilus* is a tropidurid lizard found in the central massif of northern Patagonia (Chubut and Rio Negro Provinces), in Argentina. Data concerning biology and ecology of this species are scarce and diet of this species is unknown. Here we report an observation of interspecific saurophagy by an adult male *L. petrophilus* on a hatchling *L. bibroni*. On 29 January 2000, during the course of a herpetological trip carried out in central Rio Negro Province, we collected by hand from a small crevice situated on a rocky outcrop, an adult male L. *petrophilus* (FML 09145, SVL 84.5 mm, TL 224.0 mm, weight 20.35 g). We hand-captured the lizard and as we sought a more secure hold, the head of another lizard protruded from its mouth. We grasped the head and pulled out a complete, dead hatchling *L. bibroni* (FML 02170, SVL 23.6 mm, tail broken, weight 0.33 g). The stomach of the *L. petrophilus* was subsequently examined and found to be empty. Previous saurophagous behavior in *Liolaemus* lizards of Argentina has been documented under natural conditions for *L. koslowskyi* in northern La Rioja Province (Avila and Belver 2000. Herpetol. Rev. 31:174). *Liolaemus petrophilus* and *L. bibroni* are common and widespread in the Patagonian steppe and occasionally share similar microhabitats, such as rocky outcrops with spiny bushes. The frequency of predation on hatchlings of *L. bibroni* by adult *L. petrophilus* may thus be potentially common in this region.

Lizard identifications were verified by Fernando Lobo and specimens were deposited in the Herpetological Collection of the Instituto de Herpetología, Fundación Miguel Lillo, San Miguel de Tucumán, Tucumán, República Argentina (FML).

Submitted by **LUCIANO JAVIER AVILA** and **MARIANA MORANDO**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, C.P. 5301, Anillaco (La Rioja), Argentina; e-mail (LJA): lavila@crilar.com.ar.

MABUYA BISTRIATA (NCN) **DIET.** *Mabuya bistriata* is a diurnal, forest-dwelling species that occurs on tree trunks, large limbs, and leaf litter; it feeds on a variety of invertebrates as well as vertebrates (Vitt and Blackburn 1991. Copeia 1991:916–927). Eco-

TABLE 1. Diet of 27 *Mabuya bistriata* from Silvânia, Brazil: (f) represents absolute frequency of each prey taxon in the sample; (f%) is relative frequency of each prey taxon; (C) is constancy or total number of stomachs in which each prey taxon was found; and (C%) is percentage of the total number of stomachs in which each prey taxon was found.

Categories	f	f%	C	C%
Unidentified Arthropoda	1	0.7	1	3.7
Unidentified Arachnida	7	5.0	6	22.2
Araneida	7	5.0	6	22.2
Scorpionida	4	2.9	2	7.4
Blattoidea	1	0.7	1	3.7
Coleoptera	16	11.5	9	33.3
Diptera	1	0.7	1	3.7
Hymenoptera (Formicidae)	28	20.1	2	7.4
Hymenoptera (excluding Formicidae)	3	2.2	1	3.7
Isoptera	20	14.4	6	22.2
Orthoptera	46	33.1	21	81.5
Insect eggs	4	2.9	1	3.7
Gastropoda	1	0.7	1	3.7
Total	139	100	58	218.5

logical data on the scincid genus *Mabuya* in the cerrado are scarce, other than a few data for *M. frenata* (Vitt 1991. J. Herpetol. 25:79–90); Vrcibradic and Rocha 1998. J. Herpetol. 32:229–237). We examined the stomach contents of 27 *M. bistriata* collected September 1997 to August of 1998, from the cerrado at Estação Florestal de Experimentação do IBAMA, Silvânia municipality, State of Goiás, Brazil (16°39'26"S, 48°16'16"W). Table 1 summarizes the data. We found some plant material in the stomachs of 5 lizards (18.5%), but we considered it to be of incidental ingestion. We also found nematodes infecting 7 (25%) of the lizards. Orthopterans, ants, termites and beetles dominated the diet numerically, with orthopterans being the most numerous taxon in the diet of *M. bistriata*.

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Submitted by **RAFAEL F. JULIANO** and **ROGÉRIO P. BASTOS**, Depto. de Biologia Geral - ICB- UFG, Campus II, Caixa Postal 131, 74001-970, Goiânia, Goiás, Brazil (e-mail [RFJ]: rafa@icb1.ufg.br), **MARTA RUA LOPEZ**, Depto. Biloxía Animal, Biloxía Vexetal e Ecoloxía, FC, Univ. de A Coruña, La Coruña, Spain, and **JOSÉ AUGUSTO DE O. MOTTA**, IBAMA, Rua 229, n. 95, St. Universitário, 74605-080, Goiânia, Goiás, Brazil.

MICROLOPHUS ALBEMARLENSIS (Galapagos Lava Lizard). **CANNIBALISM**. Hamilton's Rule (Hamilton 1972. Ann. Rev. Ecol. Syst. 3:193–232) predicts that cannibalism should occur when the individuals involved are not likely to be closely related. On small islands, cannibalism may be selected against due to increased relatedness of individuals. Islote Punta Bowditch Norte is a small islet (2.9 ha, 0°31'57.7"S, 90°31'1.7"W) near the center of the Galapagos Archipelago, Ecuador. On 4 February 1994, while conducting a census of lizards, we observed a female lava lizard, *Microlophus albemarlensis*, eating a juvenile. The female was eating the juvenile head-first, with the back legs and tail of the juvenile protruding from the female's mouth. Our presence did not interrupt the interaction and neither lizard was captured or collected. The female moved away and out of sight within two minutes, before completing ingestion of the juvenile. The female appeared to be normal size for this island (ca. 73 mm SVL) and the juvenile appeared to be a young of the year (ca. 40 mm SVL). The only other lizards on this island are the marine iguana (*Amblyrhynchus cristatus*) and the gecko (*Phyllodactylus galapagoensis*), neither of which are in the size range of the juvenile. Thus, the identification of the juvenile is certain. Stebbins et al. (1967. Ecology 48:839–851) collected the tail of a juvenile *M. albemarlensis* from the stomach of a male *M. albemarlensis* on the large island of Santa Cruz, but because of tail autonomy it is not clear if this was cannibalism or scavenging. Werner (1978. Z. Tierpsych. 47:337–395) reported cannibalism in *M. delanonis* on the large island Española, and Carpenter (1970. Herpetologica 26:377–386) reported cannibalism in *M. habelii* on the large island of Marchena. Our observation is noteworthy because it is the first record of cannibalism in *M. albemarlensis*, and because the cannibalism occurred on such a small island.

Submitted by **PAUL A. STONE**, Department of Biology, University of Central Oklahoma, Edmond, Oklahoma 73034, USA (e-mail: pstone@ucok.edu), and **HOWARD L. SNELL**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, and Charles Darwin Research Station, Puerto Ayora, Isla Santa Cruz, Galapagos Islands, Ecuador.

PHELSUMA MADAGASCARIENSIS KOCHI (Madagascar Day Gecko). **DIET**. *Phelsuma* are conspicuous diurnal gekkonids which comprise more than 20 species living on Madagascar. During a long-term fieldwork project in the Ankarafantsika Reserve, western Madagascar (Ampijoroa Forest Station, 16°20'S, 46°47'E, altitude ca. 70 m above sea level) one of us (GG) had the opportunity to observe the behavior of the large species *P. madagascariensis kochi* (up to 305 mm total length; Glaw and Vences 1994. Fieldguide to the Amphibians and Reptiles of Madagascar, second edition. Serpents T, Köln. 480 pp.). Although mostly diurnal,



FIG. 1. *Phelsuma madagascariensis kochi* capturing a *Hemidactylus* specimen (probably *H. frenatus*) at Ampijoroa forestry station.

these geckos showed regular nocturnal activity, especially when living in or close to human settlements with artificial light at night. On a white wall, specimens were observed regularly at night hunting other geckos (*Hemidactylus* sp.). Under a roof constructed by leaves of Baobao (*Raphia farinifera*) and Satrana (*Hyphaene shatan*) palms at Ampijoroa forestry station, the otherwise nocturnal *Hemidactylus* were sometimes seen during the day, and then were also actively hunted by *Phelsuma*. One such act of predation was photographed (Fig. 1). *Phelsuma* may be one of the most important predators of *Hemidactylus* under such conditions at Ampjoroa.

Submitted by **GERARDO GARCÍA**, Durrell Institute of Conservation and Ecology, University of Kent, Canterbury, Kent CT2 7NS, U.K. (e-mail: gerardo.garcia@wanadoo.fr, and **MIGUEL VENCES**, Laboratoire des Reptiles et Amphibiens, Muséum National d'Histoire Naturelle, 25 rue Cuvier, 75005 Paris, France (e-mail: m.vences@t-online.de).

TROPIDURUS NANUZAE (NCN). **DEATH FEIGNING**. The saxicolous lizard *Tropidurus nanuzae* is a small tropidurid restricted to parts of the Espinhaço Mountain Range, Brazil, at altitudes above 1200 m (Rodrigues 1988. *In* Heyer and Vanzolini [eds.], Proceedings of a Workshop on Neotropical Distribution Patterns, pp. 305–315. Academia Brasileira de Ciências, Rio de Janeiro). Present knowledge of the natural history of this species is scarce. Here we describe a new antipredator behavior for this species.

From 9 to 12 July 2001, during field work at the Serra do Cipó (19°0'S, 43°40'W), Minas Gerais, Brazil, we observed that, during manipulation, five young and one adult *T. nanuzae* extended their limbs upward and closed their eyelids, remaining motionless for several seconds while laying belly-up (for one individual, we registered a duration of 50 sec for such behavior). Some young also feigned death when placed inside plastic bags to be weighed.

Death feigning or thanatosis is a relatively widespread defensive tactic among lizards, being observed in species of different families (Greene 1988. *In* Gans and Huey [eds.], Biology of the Reptilia, vol. 16. Allan R. Liss, Inc., New York. 672 pp.). Death feigning has been previously observed in another tropidurid, *Liolaemus lutzae* (Rocha 1993. Ciência e Cultura 45:116–122), and is here reported for a second species of this family.

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Submitted by **CONRADO ALEKSANDER BARBOSA GALDINO,** Setor de Ecologia, Departamento de Biologia Animal e Vegetal, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-13, Rio de Janeiro, RJ, Brazil (e-mail:galdinoc@zaz.com.br), and **EMILIANE GONÇALVES PEREIRA,** Museu de Ciências Naturais, Pontifícia Unieversidade Católica de Minas Gerais, Av. Dom José Gaspar 500 Dom Cabral 30535-610, Belo Horizonte, MG, Brazil.

TROPIDURUS TORQUATUS (Calango). **DIET.** *Tropidurus torquatus* is a terrestrial, heliophilous lizard (Giaretta 1996. Herpetol. Rev. 27:80–81) that feeds mostly on mobile prey (Bergallo and Rocha 1994. Aust. J. Ecol. 19:72–75). Studies of its food habits in the cerrado (neotropical savanna) are scarce. We

TABLE 1. Diet of *Tropidurus torquatus* in Silvânia, Brazil: (f) represents absolute frequency of each prey taxon in the sample, (f%) is relative frequency of each prey taxon, (C) is constancy or total number of stomachs in which each prey taxon was found), and (C%) is percentage of the total number of stomachs in which each prey taxon was found.

	Gallery Forest (N = 10 lizards)				Cerrado *sensu stricto* (N = 22 lizards)			
Categories	f	f%	C	C%	f	f%	C	C%
Unidentified Arthropoda	3	3.5	3	30	11	2.3	7	31.8
Unidentified Arachnida	0	0	0	0	3	0.6	2	9.1
Araneida	4	4.7	2	20	9	1.9	8	36.4
Scorpionida	0	0	0	0	2	0.4	2	9.1
Blattoidea	0	0	0	0	2	0.4	2	9.1
Coleoptera	39	45.3	9	90	69	14.5	19	86.4
Diplopoda	0	0	0	0	1	0.2	1	4.5
Diptera	1	1.2	1	10	10	2.1	5	22.7
Hemiptera	0	0	0	0	2	0.4	1	4.5
Homoptera	0	0	0	0	2	0.4	2	9.1
Hymenoptera (Formicidae)	27	31.4	8	80	259	54.3	19	86.4
Hymenoptera (excluding Formicidae)	0	0	0	0	2	0.4	1	4.5
Isoptera	5	5.8	3	30	74	15.5	8	36.4
Larvae	1	1.2	1	10	3	0.6	3	13.6
Lepidoptera	1	1.2	1	10	0	0	0	0
Orthoptera	3	3.5	2	20	12	2.5	8	36.4
Insect eggs	2	2.3	1	10	15	3.1	2	9.1
Insect Pupae	0	0	0	0	1	0.2	1	4.5
Total	**86**	**100**	**31**	**310**	**477**	**100**	**91**	**413.6**

examined the stomach contents of 32 specimens collected from September 1997 to August of 1998 from the cerrado and in a gallery forest, at the Estação Florestal de Experimentação (16°39'26"S, 48°16'16"W), Silvânia municipality, State of Goiás, Brazil. Table 1 summarizes the data. The diet of *T. torquatus* was similar in both habitats: Coleoptera, Formicidae, and Isoptera were the dominant food items. The niche breadth (*sensu* Pianka 1986. Ecology and Natural History of Desert Lizards. Princeton University Press, Princeton, New Jersey. 208 pp.) was also very similar (cerrado = 2.92; gallery forest = 3.19).

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Submitted by **RAFAEL F. JULIANO** and **ROGÉRIO P. BASTOS**, Depto. de Biologia Geral - ICB- UFG, Campus II, Caiman Postal 131, 74001-970, Goiânia, Goiás, Brazil (e-mail [RFJ]: rafa@icb1.ufg.br) and **JOSÉ AUGUSTO DE O. MOTTA**, IBAMA, Rua 229, n. 95, St. Universitário, 74605-080, Goiânia, Goiás, Brazil.

SERPENTES

AGKISTRODON PISCIVORUS PISCIVORUS (Eastern Cottonmouth). **DIET**. Data on the diet of the eastern cottonmouth were collected opportunistically at Back Bay National Wildlife Refuge

TABLE 1. Summary of stomach contents collected from 56 adult *Agkistrodon p. piscivorus* at Back Bay National Wildlife Refuge, Virginia Beach, Virginia, USA. Mean mass or volume and associated standard errors are given where appropriate.

Category	Natural marsh males (N = 23)	Natural marsh females (N = 9)	Anthropogenic marsh males (N = 15)	Anthropogenic marsh females (N = 9)
Fish				
Lepomis spp	N = 2 mass = 12.0 g SE = 0.01	N = 1 mass = 28.0 g	N = 1 mass = 35.1	N = 0
Amphibians				
Rana clamitans	N = 2 mass = 26.5 g SE = 23.24	N = 1 mass = 22.5 g	N = 1 mass = 10.0 g	N = 2 mass = 18.2 g SE = 3.20
Rana utricularia	N = 2 mass = 31.0 g SE = 12.55	N = 0	N = 0	N =1 mass = 20.0 g
Reptiles				
Nerodia sipedon	N = 1 mass = 28.02 g	N = 0	N = 0	N = 0
Turtle (unidentifiable)	N = 2 1. 40 x 40 mm 2. 54 x 40 mm	N = 0	N = 0	N = 0
Mammals				
Microtus spp.	N = 0	N = 0	N = 1 mass = 8.46 g	N = 0
Insects				
Unidentifiable	N = 0	N = 0	N = 1	N = 0
Miscellaneous				
rock	N = 0	N = 0	N = 1 mass = 5.0 g	N = 1 mass = 7.2 g
sand/dirt	N = 3	N = 3	N = 4	N = 2
wood material	N = 1	N = 0	N = 1	N = 0
plant material	N = 3	N = 1	N = 2	N = 0
Liquid (volume)	N = 4 (11.3 ml) SE = 1.25	N = 3 (16.8 ml) SE = 2.84	N = 7 (11.3 ml) SE =2.67	N = 5 (12.0 ml) SE = 3.00
Stomachs containing food items (including liquid)	N = 13 57%	N = 5 56%	N = 11 73%	N = 8 89%
Empty stomachs (no gut contents)	N = 8 35%	N = 4 44%	N = 4 27%	N = 1 11%

(Refuge Headquaters: 36°40'19"N, 75°54'55"W) in Virginia Beach, Virginia, USA, from September 1995 through May 1998. This study was undertaken as part of an extensive ecological investigation of heretofore unstudied populations of the eastern cottonmouth in southeastern Virginia in order to compare the ecology of this species in two very different marsh habitats: (1) a 1200 ha relatively undisturbed marsh containing mostly late successional vegetation (natural marsh) and (2) a 1900 ha actively managed series of waterfowl impoundments kept at a low seral stage via burning, plowing, dredging activities, and seasonal manipulations of water depth (anthropogenic marsh) (Cross 1998. Ph.D. dissertation. Old Dominion University, Norfolk. 164 pp.).

Stomach contents were obtained from 56 adult cottonmouths captured as part of a mark-recapture study; additionally, three snakes found dead on the Refuge were dissected to obtain stomach contents. After cottonmouths were captured and marked by scale-clipping, snakes were secured by placing their head and ca. 10 cm of their neck into an appropriately sized clear acrylic tube. Stomach contents were gently palped by finger pressure to within a few centimeters of the head (see Fitch 1987. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 143–164. McGraw-Hill, New York.), after which the snake was placed into a squeeze box (Cross 2000. Herpetol. Rev. 31:34) where the food was regurgitated. Items were collected, bagged, sealed, labeled for future identification, and frozen. Contents were later weighed, measured, and identified in the laboratory.

A majority (66%) of the stomachs examined contained food items or liquid material; 30% of examined stomachs were empty. Green frogs (*Rana clamitans*) were the most common food item, followed closely by sunfish (*Lepomis* spp.) and southern leopard frogs (*R. utricularia*). Reptilian prey items were found in three stomachs; one contained a northern water snake (*Nerodia sipedon*) and two contained turtles (evidenced from the shape of the food bolus; they were not palped out of stomachs due to the possibility of injuring the snakes). Only one stomach contained mammalian remains (*Microtus* sp.). Twenty stomachs contained liquid with a slurry of nearly fully digested, and hence unidentifiable, prey. Twenty-two snakes contained non-food items, including rocks, sand, dirt, vegetation, and wood material (Table 1). A large male snake was seen in a slow and presumably predatory approach of a plover (*Charadrius* spp.), but the bird escaped before a strike was made. A large female cottonmouth was seen swallowing a large *Rana clamitans*. The frog, which was being swallowed by the posterior end first, was still alive and delivered a loud distress call.

I thank A. H. Savitzky for helpful suggestions and support throughout this investigation. I thank J. B. Gallegos, J. Stasko, F. G. James, and all of the other BBNWR staff that assisted in this project. Partial funding for this research was provided by a grant from the U.S. Fish and Wildlife Service, Back Bay National Wildlife Refuge. I thank D. Bradford for making useful comments on earlier versions of this manuscript. *NOTICE*: The research described here was developed by the author prior to his employment with the U.S. Environmental Protection Agency's Office of Research and Development. The manuscript has been subjected to administrative review but the conclusions drawn are solely those of the author. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA for use.

Submitted by **CHAD L. CROSS**, Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266, USA. Present address: U.S. EPA, ORD/NERL/ESD, Landscape Ecology Branch, 944 East Harmon Avenue, Las Vegas, Nevada 89119, USA.

CROTALUS VIRIDIS OREGANUS (Northern Pacific Rattlesnake). **COSTS OF FEEDING**. In cases where locomotion is a critical aspect of predator avoidance and the ingestion of prey items reduces locomotor performance, the eating of a large meal should reduce the ability to escape from a predator. Reduction in snake locomotor capacity after the ingestion of a large meal has been documented in juvenile garter snakes (*Thamnophis* sp.)(Garland and Arnold 1983. Copeia 1983:1092–1096; Ford and Shuttlesworth 1986. Copeia 1986:999–1001). In these studies, the impact of prey items up to 50% of the snakes' body mass was examined. In crotalines, the ability to consume prey up to 156% of the snakes' weight has been documented (Greene 1983. Amer. Zool. 23:431–441). However, only a single anecdotal account suggests how locomotory capabilities of these vipers may be impacted by the ingestion of such large prey items. Fitch reported that the movements of a young *C. v. oreganus* were so hampered after consuming a pocket mouse (*Perognathus*) that it was unable to reach its usual shelter before dying of exposure to sunshine (1949. Amer. Midl. Nat. 41:513–579).

Here we report on an observation of a juvenile female *C. v. oreganus* (272.5 mm SVL, 296.5 mm TL, 11.91 g mass with prey item removed) that was found at 1300 h on 6 May 2000 at Stebbins Cold Canyon Reserve, Solano Co., California, USA. Although the snake was found alive, it had recently sustained a presumably lethal wound after the consumption of a large meal. The wound extended the length of 12 ventral scales (16.1 mm, ca. 6% of TL) and the height of eight dorsal scale rows (10.1 mm, ca. 25% circumference), and it included the loss of a section of skin, ribs, and stomach. The remaining hole revealed the left hind limb and a portion of the ventral surface of a male *Sceloporus occidentalis* (66.9 mm SVL, 153.7 mm TL, 9.04 g). The relative prey mass of this meal is 0.76. The *S. occidentalis* was swallowed headfirst and exhibited only a minor degree of decomposition.

Based upon the severity of the wound and the removal of the large section of tissue, we infer that the wound did not result from prey capture but from a predatory attack, possibly due to the reduced escape ability of the engorged *C. viridis*. Mobility may also have been reduced by weather conditions. The temperature was ca. 15°C with a light rain falling. However, a second juvenile *C. v. oreganus*, found ca. 200 m upstream, was capable of reaching a nearby shelter after being disturbed. As a result, we suggest that the greatest contributing factor to a reduction in escape ability, and therefore an increase in predation risk, was the ingestion of the large prey item.

The specimen was collected under California Department of Fish and Game Permit 803027-01 to GBP and deposited at the University of California, Davis Museum of Zoology (UCDMZ 12277). We thank H. Bradley Shaffer for support and helpful comments on this note.

Submitted by **GREGORY B. PAULY**, Section of Evolution and Ecology, University of California, Davis, California 95616, USA, and **MICHAEL F. BENARD**, Center for Population Biology, Section of Evolution and Ecology, University of California, Davis, California 95616, USA.

LEIOHETERODON MADAGASCARIENSIS (Madagascar Menarana Snake). **DIET**. The diet of captive *Leioheterodon madagascariensis* (Colubridae) includes fish, frogs, reptiles, birds, and rodents (Campbell and Murphy 1977. J. Herpetol. 11:228–230; Conant 1938. Zoologica 23:389–393; Dathe and Dedekind 1996. Zool. Garten 66:69–76; Groves and Groves 1978. Herpetol. Rev. 9:19–20; Henkel and Schmidt 1995. Amphibien und Reptilien Madagaskars der Maskarenen, Seychellen und Komoren. Eugen Ulmer, Stuttgart. 311 pp.). However, only frogs are reported as prey of wild individuals (Preston-Mafham 1991. Madagascar, A Natural History. Facts On File, Oxford. 224 pp.).

During a field study at the Jardin Botanique A of Ampijoroa, Madagascar, we recovered stomach contents from six individuals of *L. madagascariensis* by forced-regurgitation. All snakes were collected while they were crawling on trails in the dry forest. The stomach contents consisted of eggs of a lizard, *Oplurus cuvieri cuvieri* (Opluridae), partially digested adult rodents (Nesomyinae), and tufted feathers of an adult, unidentified bird (Table 1). The eggs were identified based on their size, shape, coloration, and roughness of the shells (Randriamahazo, unpubl. data).

This study was financially supported by Grants-in-Aid under the Monbusho International Scientific Research Program (Field Research, nos. 06041093 and 11691183). We thank Shigeki Asai for collecting a snake and the staff of Parc Botanique et Zoologique de Tsimbazaza for their assistance in the field study.

TABLE 1. Stomach contents of *Leioheterodon madagascariensis* collected in Ampijoroa, northwestern Madagascar.

Collection Time	Collection Date	SVL (mm)	Body Mass (g)	Stomach Contents
0832 h	10 Nov	1245	—	3 eggs of *Oplurus c. cuvieri*
1800 h	13 Nov	1430	1892	feathers
0830 h	16 Nov	1170	—	4 eggs of *O. c. cuvieri* and 1 nesomyine mammal
0955 h	16 Nov	1090	—	4 eggs of *O. c. cuvieri*
1718 h	19 Nov	1050	546	4 eggs of *O. c. cuvieri*
1618 h	3 Nov	1310	718	1 nesomyine mammal

Submitted by **AKIRA MORI** and **HERILALA JEAN AIMÉ RODOLPH RANDRIAMAHAZO**, Department of Zoology, Graduate School of Science, Kyoto University, Sakyo, Kyoto, 606-8502 Japan; e-mail [AM]: gappa@zoo.zool.kyoto-u.ac.jp.

LEIOHETERODON MODESTUS (Madagascar Brown Snake). **DIET**. On 2 November 1999, at 0815 h, an adult male *Leioheterodon modestus* (Colubridae) was captured crawling out of a burrow on an ant mound in the dry forest at the Jardin Botanique A of Ampijoroa, Madagascar. The snake (886 mm SVL, 347 g mass) was force-regurgitated, and a snake egg was recovered from its stomach. Dissection of the egg revealed a fully developed embryo of the colubrid snake, *Mimophis mahfalensis* (156 mm SVL, 1.3 g mass).

Blanc (1984. *In* Jolly et al. [eds.], *In* Madagascar, pp. 105–114. Pergamon Press, Oxford) noted that *L. modestus* hunts lizards. Preston-Mafham (1991. Madagascar, A Natural History. Facts On File, Oxford. 224 pp.) observed this species foraging on the forest floor and detecting a frog hidden in the sand. The egg of *M. mahfalensis* was obviously ingested in its oviposition site, indicating that the snake employed a widely foraging tactic.

This study was financially supported by Grants-in-Aid under the Monbusho International Scientific Research Program (Field Research, no. 11691183). I thank the staff of Parc Botanique et Zoologique de Tsimbazaza for their assistance in this field study.

Submitted by **AKIRA MORI**, Department of Zoology, Graduate School of Science, Kyoto University, Sakyo, Kyoto, 606-8502 Japan; e-mail: gappa@zoo.zool.kyoto-u.ac.jp.

MASTICOPHIS FLAGELLUM FLAGELLUM (Eastern Coachwhip). **DIET**. On 1 June 2000 at 1430 h (air temperature = 30°C), as one of us (DJS) approached a drift fence in longleaf pine (*Pinus palustris*)-turkey oak (*Quercus laevis*) sandhill on the Fort Stewart Military Installation, Bryan County, Georgia, USA, a male *Masticophis f. flagellum* (914 mm SVL; 1226 mm TL) crawled rapidly away from the fence. A few seconds later the snake paused ca. 15 m from the fence; a moderate-sized lump, presumed to be a prey item was evident in the throat of the snake. When captured, the snake immediately disgorged the item that was an adult male six-lined racerunner (*Cnemidophorus sexlineatus*; 69 mm SVL). The snake weighed 130 g after regurgitating the lizard. The racerunner, examined immediately after being disgorged, was putrid and had ca. 20 live red imported fire ants (*Solenopsis invicta*) clinging to its body near a hole (8 x 6 mm) which extended into its neck from the dorsum. A pitfall trap close to where the snake was first observed contained 1 live and 1 dead adult *C. sexlineatus*, as well as fire ants.

These observations indicate that this *C. sexlineatus* was already dead and had been partly consumed by fire ants before being eaten by the coachwhip. We believe it is likely that the snake took the dead lizard from a pitfall trap along the drift fence. Although western subspecies of *M. flagellum* have been reported to feed on carrion, including a dead snake (Small et al. 1994. Herpetol. Rev. 25:28) and a dead bird (Cowles 1946. Herpetologica 3:121–122), this is the first report of carrion feeding by *M. f. flagellum*, as far as we are aware.

Submitted by **DIRK J. STEVENSON** and **KAREN J. DYER**, Fort Stewart Fish and Wildlife Branch, Directorate of Public Works, 1113 Frank Cochran Drive, Fort Stewart, Georgia, 31314-4940, USA; e-mail (DJS): stevensond@emh5.stewart.army.mil.

MICRURUS FULVIUS (Eastern Coral Snake). **PREY**. *Micrurus fulvius* has been documented to feed on a variety of vertebrates including mammals, anurans, amphisbaenids, anguids, iguanids, scincids, teiids, leptotyphlopids, colubrids, viperids, and other elap-

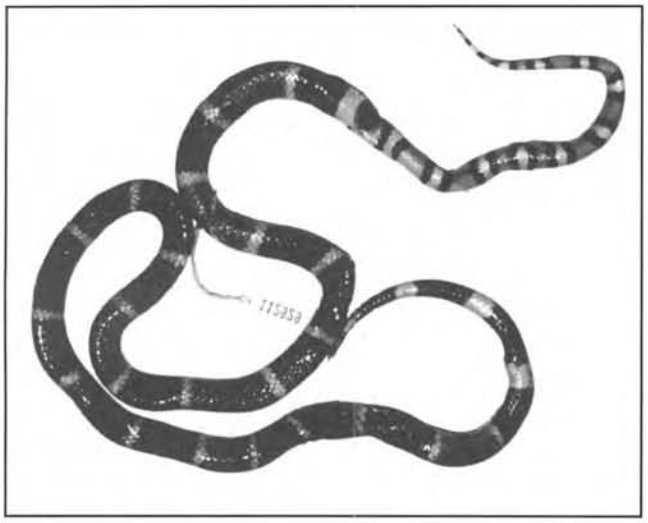


FIG. 1. *Micrurus fulvius* feeding on *Lampropeltis triangulum elapsoides*, Gilchrist Co., Florida.

ids (Jackson and Franz 1981. Herpetologica 37:221–224; Greene 1984. Spec. Publ. Univ. Kansas Mus. Nat. Hist.10:147–162; Tennant et al. 1997. A Field Guide to the Snakes of Florida. Gulf Publ. Co., Houston, Texas. 272 pp.). Here we report a prey item not previously recorded.

On 4 April 1998, a neighborhood dog near Newberry, Gilchrist County, Florida, USA, killed an adult male *M. fulvius*. This snake was in the process of eating an adult scarlet kingsnake (*Lampropeltis triangulum elapsoides*)(Fig. 1). Both snakes were deposited in the Florida Museum of Natural History (UF 112929). This note demonstrates the predation of an ophiophagous, Batesian mimic (*L. t. elapsoides*) by its ophiophagous model (*M. fulvius*), as well as conservation implications associated with domestic carnivores.

We thank M. A. Nickerson for helpful suggestions on this note.

Submitted by **KENNETH L. KRYSKO** and **KAREEM R. ABDELFATTAH**, Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA; e-mail (KLK): kenneyk@flmnh.ufl.edu.

MORELIA AMETHISTINA (Scrub Python). **DIET**. *Morelia amethistina* is Australia's largest snake and feeds on a wide range of vertebrates, mainly birds (Loop 1995. Mem. Qld. Mus. 38[2]:504) and mammals (Shine and Slip 1990. Herpetologica 46:283–290.). Although it is reported that *M. amethistina* commonly feeds on large macropods, quantification of this aspect of their feeding ecology is rudimentary (Greer 1997. The Biology and Evolution of Australian Snakes. Surrey Beatty & Sons. NSW, 358 pp.).

On 30 March 2001, I was requested to remove a large *M. amethistina* which was in the process of constricting a wallaby at a residential property at Balgal Beach (19°01.540'S, 146°24.334'E), 50 km north of Townsville, northeast Queensland. The snake had already commenced ingestion of an adult female agile wallaby (*Macropus agilis*) when I arrived (Fig. 1). The wallaby was estimated to weigh 10 kg. Several days later, an adult female *M. agilis* of very similar dimensions was examined as a road kill and found to weigh 10.2 kg with a head/body length of 63 cm, which is typical for adult females of this taxon (Strahan 1995. The Mammals of Australia. Reed Books. Sydney, 756 pp.). The wallaby was attacked from the ground on the edge of a narrow path through dense, woody vegetation. The path is regularly used by *M. agilis* individuals when entering the property for feeding by the owner. The wallaby was attacked shortly before 1910 h and the property owner reported a violent struggle before the wallaby succumbed. This was corroborated by the presence of two large wounds in the anterior venter of the snake, the largest of which (4 cm x 3 cm) penetrated the snake's body cavity, exposing underlying structures, particularly the trachea (Fig. 2). The long and powerful fourth toe of the wallaby's right hind foot was covered in blood but exhibited no apparent injury and appeared to be responsible for the wounds inflicted on the snake.

Ingestion was completed at 2125 h with the snake apparently undisturbed at being watched by torch light and flash photographed at numerous intervals. The peculiar bulbous body shape of large macropods appeared to be responsible for most of the time that elapsed between initiation and completion of ingestion. The snake made rapid progress until it reached the wallaby's pelvic region. During ingestion of this portion of the carcass the snake took long pauses between attempts to draw more of the prey into its mouth and could be heard exhaling heavily through its protruding glottis. The snake appeared to be continually working its coils in an attempt to laterally compress the carcass at its widest diameter to facilitate swallowing.

At the request of the property owner, the snake was removed shortly after ingestion and returned to Townsville for further observations. The snake was placed in a 120 x 60 x 60 cm cage and maintained at ambient temperatures in a room of a brick house with an easterly aspect. Cage temperatures were recorded with a digital thermometer five times each day and night (between 0900 and 2400 h) during the digestive period. Mean diurnal temperature was 29.8°C (range 27.8–31.1°C) and mean nocturnal temperature 28.1°C (range 26.8–29.2°C).

Digestion of such a large prey item was rapid, with the snake passing large uric acid deposits on April 1, 3, and 4. A large stool was produced on the evening of April 5. By April 6, the snake's mid-body bulge was greatly reduced and it was decided to manually remove the snake from the cage for cleaning. The same evening, the remaining portion of the wallaby was regurgitated,



FIG. 1. Adult *Morelia amethistina* ingesting an adult female agile wallaby (*Macropus agilis*).



FIG. 2. Prey bolus in adult *M. amethistina* following ingestion of adult *Macropus agilis*. Note gaping wound in anterior venter of snake inflicted by claw of wallaby's large fourth toe.

possibly in response to handling. The regurgitation consisted of a 1.6 kg portion of rump and two femurs. Forty-eight hours later the snake was sexed, weighed, and its dimensions recorded: female, 3705 mm SVL, 625 mm tail, 260 mm mid-body girth, 13.5 kg, 95 mm head length along lower jaw, from tip of snout to posterior edge of quadratearticular projection, 64 mm head width at base of skull, 37 mm head width between eyes). Body length was determined by stretching the snake along a tape measure, head measurements were obtained with Vernier calipers, and sex was determined with a sexing probe.

Morelia amethistina is one of the world's largest snakes and macropods are the most abundant and readily available large prey resource throughout the snake's Australian range (Strahan 1995, *op. cit.*). Mark/recapture and radiotelemetric evidence (SF, research in progress) indicates that mature *M. amethistina* specifically target macropods (particularly *Macropus agilis* and red-legged pademelons, *Thylogale stigmatica*) and spend long periods of time waiting in ambush at localities frequented by these mammals.

The wounds inflicted on the snake in this report are very similar to those described for a 3.3 m *M. amethistina* that appeared to be specifically targeting Bennett's tree kangaroos (*Dendrolagus bennettianus*) near Cooktown, northeast Queensland (Martin 1995. Herpetol. Rev. 26:74–76). The snake in this report, in addition to the fresh wounds described, also displayed recently-healed scars in the same region of its neck. The presence of such wounds and scars may be a reliable indicator of recent predation on large macropods. Wounds and scars from biting inflicted during intraspecific male combat in this taxon are of a very different configuration, occurring dorsally at various places along the body and taking the form of clean cut, straight-edged parallel striations (pers. obs.).

Sincere thanks to D. Seabright for bringing the snake to my attention. Thanks also to J. Elliott, D. Frier, S. Patane, and D. Trembath for assistance with snake handling and data collection. D. Barton and R. W. Hansen commented on the manuscript. This work was conducted under permit number F1/000330/00/SAA from the Queensland Environment Protection Agency and James Cook University Ethics Approval Number A594-00.

Submitted by **SIMON FEARN**, School of Biological Sciences, James Cook University, Townsville, Queensland, Australia, 4811; e-mail: simon.fearn@jcu.edu.au.

SISTRURUS CATENATUS EDWARDSII (Desert Massasauga). **MAXIMUM LENGTH.** Boundy (1995. Bull. Chicago Herpetol. Soc. 30:109–122) reports the maximum length of this subspecies as 530 mm TL based on a specimen originally reported by Gloyd (1955. Bull. Chicago Acad. Sci. 10:83–98). I have examined two specimens from the San Bernardino Valley, Cochise County, Arizona, USA, which exceed this length. A live male collected 27 July 1994 measured 578 mm TL (534 mm SVL) and a male collected 24 July 1995 (DOR) measured 588 mm TL (541 mm SVL). The former was marked (1F30491E4A) and released; the latter resides in the Arizona State University vertebrate collection (ASU 30622).

Submitted by **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA; e-mail: holycow@asu.edu.

THAMNOPHIS RADIX (Plains Garter Snake). **BROOD SIZE.** Brood sizes for *Thamnophis radix* show much geographical variation (Fitch 1985. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 76:1–76). While brood sizes can range up to 60 (Fitch, *op. cit.*; Collins 1993. Amphibians and Reptiles in Kansas. Univ. Kansas Mus. Nat. Hist., Lawerence, Kansas, 397 pp.), the brood sizes reported for Colorado have fallen far short of this. Hammerson (1999. Amphibians and Reptiles in Colorado, Second Edition. University Press of Colorado, Niwot, Colorado, 480 pp.) observed brood sizes in Colorado of 16–21 (N = 9), with a mean of 16. Rossman et al. (1996. The Garter Snakes: Evolution and Ecology. University of Oklahoma Press, Norman) reported a range of 5–20 (N = 8) for Colorado, and a brood of 20 was recorded by Ellis and Henderson (1913. Univ. Colorado Studies 10:39–129). Other records include brood sizes of 7, 9, 14, 20, and 21 (Hammerson, *op. cit.*).

On 23 July 2000 we captured a gravid 58 cm SVL female *T. radix* near Spring Ck in Fort Collins, Colorado, USA. By the morning of 24 July she had given birth to 32 young. The time of year for appearance of young appeared typical (Hammerson, *op. cit.*), but the brood size was substantially (50%) in excess of the maximal brood size previously reported for Colorado.

Submitted by **RICHARD M. ENGEMAN**, National Wildlife Research Center, 4101 LaPorte Avenue, Fort Collins, Colorado 80521-2154, USA, **ISABEL M. ENGEMAN** and **ALEXANDER N. ENGEMAN**, 3902 Carrick Road, Fort Collins, Colorado 80525, USA.

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Crother 2000. *Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding*. SSAR Herpetol. Circ. 29:1–82; for Mexico as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*. Herpetol. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al. 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985[3]:802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen *only* when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*; available from the SSAR Publications Secretary) to make sure you are not duplicating a previously published record.

Please submit any geographic distribution records in the **standard format only** to one of the Section Co-editors: **Alan M. Richmond** (USA & Canadian records only), Biology Department, Morrill IV South, 611 North Pleasant Street, University of Massachusetts, Amherst, Massachusetts 01003-9297, USA; **Jerry D. Johnson** (Mexico and Central America, including the Caribbean islands), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA; **Hidetoshi Ota** (all Old World records), Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-01, Japan; or **Gustavo J. Scrocchi** (South American records), Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina. Short manuscripts are discouraged, and are only acceptable when data cannot be presented adequately in the standard format. **Submissions by e-mail are encouraged where possible**. Refer to inside front cover for e-mail addresses of section editors.

Recommended citation for new distribution records appearing in this section is: Marques, O. A. V., and G. Puorto. 1996. Geographic Distribution. *Chironius laevicollis*. Herpetol. Rev. 27:212.

CAUDATA

DESMOGNATHUS WRIGHTI (Pigmy Salamander). USA: NORTH CAROLINA: Jackson Co: Panthertown Valley, a 2700-hectare management 5 area within the Nantahala National Forest Highlands Ranger District in a *Rhododendron maximum* thicket along an unnamed headwater tributary of Greenland Creek, ca. 1280 m (35°8.42'N, 82°59.81'W). 12 October 1997. Joseph Bernardo and Pamela T. Plotkin. Frostburg State University (JB 9712), NCSM 62157–158. All verified by Alvin Braswell. Extends verified range to just north of the Tennessee Valley Divide along the Southern Blue Ridge, ca 19.7 km SSE Rough Butt Bald (Great Balsam Mountains), which is north of Tuckasegee River and Tanasee Gap, and 37.2 km SSW Blackrock Mountain (Plott Balsam Mountains), which is also north of Tuckasegee River. Within Cowee Mountains, this locality extends range SE of the low elevation valley (ca. 710 m) that contains Savannah and Watauga Creeks. SE of the West Fork of Tuckasegee River (750–800 m), and 37.8 km SE of the Cowee Bald locality reported by Bruce (J. Herpetol. 11:244–246).

Submitted by **JOSEPH BERNARDO**, Department of Biology, Frostburg State University, 101 Braddock Road, Frostburg, Maryland 21532, USA; e-mail: jbernardo@frostburg.edu.

NECTURUS MACULOSUS (Common Mudpuppy). USA: IOWA: Scott Co: Bettendorf, Pleasant Valley Township, foot of 4th Street bridge. 20 April 1957. Bob Alex. HDW-NIU 1830; Davenport, Davenport Township. 16 October 1965. Gladys McGrath. HDW-NIU 1919. Verified by Christine Chandler. (Christiansen 1998, Proc. Iowa Acad. Sci. 105[3]:109–114) records the last specimen having been taken before 1950 in eastern Iowa, whereas, these records give indications of isolated populations still present in the Mississippi River. Christiansen (*op. cit.*) noted that populations have declined or have been extirpated from downstream regions in Iowa. This also holds true for southwestern Wisconsin where a commercial fisherman, Jim Hagensick, has informed me that "this species was taken in set lines during the winter and early spring months, although for the past few years only one or two specimens are taken each year." The floods of 1995 and 2001 have drastically altered the flow of the Mississippi, as have locks and dams, which have added to the siltation problem.

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

NECTURUS MACULOSUS (Common Mudpuppy). USA: ILLINOIS: Kane Co: Aurora, Fox River. 12 May 1952. J. D. Barton, Jr. HDW-NIU 766. Verified by Phil Senter. Validates a previous record cited without a voucher specimen by Smith (1961, Bull. Illiinois Nat. Hist. Surv. 28:1–298) and Phillips et al. (1999, Illinois Nat. Hist. Surv. Manual 8:1–282).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

NOTOPHTHALMUS VIRIDESCENS (Eastern Newt). USA: MICHIGAN: Charlevoix Co: Garden Island (N45°47.90' W85°30.39'), under a log on West Side Trail near the Native American Cemetery. 15 May 2001. Kenneth D. Bowen. Verified by Nancy E. Seefelt. Central Michigan University Museum of Culture and Natural History (CMU A-1610). First verified record of this animal for Garden Island.

Submitted by **KENNETH D. BOWEN** and **JAMES C. GILLINGHAM**, Department of Biology, Central Michigan University, Mt. Pleasant, Michigan 48859, USA.

NOTOPHTHALMUS VIRIDESCENS (Eastern Newt). USA: LOUISIANA: Cameron Parish: Lowry area; 4 mi S jct. Hwy 14 and Hwy 3056, Lacassine National Wildlife Refuge. 25 June 2001. Elizabeth Johnson and Bradley Bordelon. Seale Museum of Louisiana, McNeese State University (SML 9327–9). Verified by Steve Shively. First Parish record. This record extends the State distribution south from Calcasieu Parish and west from Vermilion

Parish as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

ANURA

AMOLOPS SPINAPECTORALIS (Spinyback Torrent Frog). VIETNAM: QUANG NAM PROVINCE: Ngoc Linh Mountain Range, Tra My District, 980–1020 m elev. (15°11'41"N, 108°02'25"E). Nguyen Quang Truong. Verified by Nikolai Orlov. American Museum of Natural History (AMNH) A-163707. First provincial record for Quang Nam (Inger et al. 1999. Fieldiana Zool. 92, pp.12–13, Fig. 4).

Submitted by **RAOUL BAIN**, Center for Biodiversity and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA, and **NGUYEN QUANG TRUONG**, Department of Zoology, Institute of Ecology and Biological Resources, Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

ANODONTHYLA BOULENGERI. CORRECTION OF LOCALITY RECORD: MADAGASCAR: MAROJEJY. Verified by Annemarie Ohler. Marojezy (current spelling: Marojejy) in northeastern Madagascar was the northernmost record of this species (Blommers-Schlösser and Blanc 1991. Amphibiens (première partie). Faune de Madagascar 75[1]:1–379) but has not been verified in recent surveys (pers. obs., and Raselimanana et al. 2000. Fieldiana Zoology 97:157–174). The locality records of Blommers-Schlösser and Blanc (*op. cit.*) were almost exclusively based on the collections of the Muséum national d'Histoire naturelle, Paris (MNHN) and the Zoölogisch Museum Amsterdam, which we have recently revised. Two vouchers originating from Marojejy and catalogued as *Anodonthyla boulengeri* were found, namely MNHN 1972.688 ("Marojezy 1300 m," collected on 2 December 1972) and MNHN 1975.2309 ("Marojezy 1700 m," collected on 1 December 1972). Both are juveniles of 10.4 and 12.0 mm snout–vent length which cannot be reliably determined at species level. However, they have a fifth toe which is only slightly shorter (MNHN 1972.688) or even longer (MNHN 1975.2309) than the third toe, while in *A. boulengeri* the fifth toe is always much shorter than the third toe. Therefore, these specimens clearly are not *A. boulengeri*. All species of *Anodonthyla* are characterized by a reduced first finger without an evident terminal disc, a state already recognizable in juveniles (e.g., *A. rouxae*, MNHN 1973.634, SVL 10.5 mm). The two Marojejy vouchers do have a normal-sized first toe, and we therefore refer them to the genus *Platypelis*.

The next northernmost record (and the only other record in the northeastern biogeographic region) of the genus *Anodonthyla* is Anjanaharibe-Sud (Raxworthy et al. 1998. Fieldiana Zoology, n.s. 90:79–92). However, our re-examination of vouchers from this locality in the Museo Regionale di Scienze Naturali, Torino, showed that they belong to undescribed cophyline species which are likely to be assigned to the genus *Platypelis*. Similarly, the only voucher from Anjanaharibe in the Museum of Zoology of the University of Michigan (UMMZ 214153) has been re-determined by S.-H. Wu as undescribed species of *Platypelis* (G. Schneider, pers. comm., September 2001). Further surveys at several sites in northeastern Madagascar (e.g., Ambolokopatrika, Besariaka, Tsararano) carried out by one of us (FA) did not yield specimens of *Anodonthyla*. This also includes sites in the Masoala reserve (e.g., Ambatoledama, Beanjada, Ilampy, Menamalona), although *A. boulengeri* was observed at Nosy Mangabe Island, close to Masoala and to the northern limit of the eastern region. We therefore propose to consider the Marojejy record for *A. boulengeri* as erroneous and the Anjanaharibe record as in need of confirmation. As a conclusion, the species and the whole genus is currently not known from the northern biogeographic regions, confirming that its centers of diversity and endemism are in the southern part of Madagascar.

Submitted by **MIGUEL VENCES**, Laboratoire des Reptiles et Amphibiens, Muséum National d'Histoire Naturelle, 25 rue Cuvier, F-75005 Paris, France (e-mail: m.vences@t-online.de), **FRANK GLAW**, Zoologische Staatssammlung, Münchhausenstr. 21, D-81247 München, Germany (e-mail: Frank.Glaw@zsm.mwn.de), and **FRANCO ANDREONE**, Museo Regionale di Scienze Naturali, Via Giolitti 36, I-10123 Torino, Italy (e-mail: frand@tin.it).

HYLA CALCARATA (Rana de Espolones). VENEZUELA: ESTADO DELTA AMACURO: Caño Guaramo, tributary of Caño Ibaruma, lower Delta del Orinoco. 23–28 February 1995. J. C. Señaris. Museo de Historia Natural La Salle, Caracas (MHNLS 13056, 13106). Verified by César Molina. In Venezuela this species has been reported to the upper Orinoco River in the Colombian-Venezuelan border (Duellman 1973. Copeia 1973:515–533) and to middle Caura River Basin in Bolívar State (Molina 2001. Herpetol. Rev. 32:114). Donnelly and Myers (1991. Am. Mus. Novitates 3017:1–54) reported this species from Cerro Guaiquinima, and Barrio (1998, Acta Biol. Venez. 18[2]:1–93) observed the species in Río Aguas Negras, south Cerro Santa Rosa, in Bolívar State. The specimens reported here represent the first state record and extend the known range for this species ca. 300 km to the NE from the nearest locality, Río Aguas Negras, Bolívar state (Barrio, *op. cit.*). This finding corroborates the occurrence of Upper Amazonian herpetofauna in the delta of the Orinoco River, and supports the hypothesis that this region acts as an Amazonian corridor to NE Venezuela and Trinidad.

Submitted by **JOSEFA CELSA SEÑARIS**, Museo de Historia Natural La Salle, Caracas (e-mail: celsas@mixmail.com), and **CÉSAR LUIS BARRIO**, Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com).

HYLORINA SYLVATICA. ARGENTINA: NEUQUÉN: DEPARTAMENTO LÁCAR: Lanín National Park, Yuco, N side of Lácar Lake, 40°10'06"S, 71° 31'37"W, ca. 700 m elev., 9 January 2000. Marcelo L. Ochoa. Fundación Miguel Lillo, Tucumán, Argentina (FML 10373, color slide). Adult. Verified by N. G. Basso. Lanín National Park, Escondido Lake, 40°14'S, 71°33'W, 940 m elev., 31 March 1977, M. Gentili, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN 35795). Verified by G. Carrizo. The specimen from Yuco was found at night crossing a dirt road, in a temperate and shady

forest of *Nothofagus obliqua* and *N. dombeyi*, with an open understory dominated by the bamboo *Chusquea culeou*. The species is endemic to the austral forests of Chile and Argentina with a narrow distribution along the eastern slopes of the Andes. In Chile, this species is distributed from the western slopes of the Cordillera de Nahuelbuta (37°18'S, 73°17'W) (Ortiz et al. 1990. Comun. Mus. Reg. Concepción 4:31–43) to Laguna San Rafael (46°40'S, 74°00'W) (Williams and Díaz-Páez 1999. Research and Conservation News [20]). In Argentina, it has thus far been recorded for a few localities at the Nahuel Huapi National Park, in southern Neuquén Province and northwestern Río Negro Province (40°47' to 41°11'S) (Vellard 1947. Acta Zool. lilloana 4:145–153; Gallardo 1962. Rev. Mus. Arg. Cienc. Nat., Bs. As. Zoología 8 [10]:113–122; Barrio and Rinaldi de Chieri 1971. Physis 30[81]:673–685), and at Los Alerces National Park in northern Chubut Province (42°50'S, 71°52'5"W) (Vellido and Úbeda 2001. Herpetol. Rev. 32:54). These two vouchers represent the first records for the Lanín National Park and extend the known range of species in Argentina ca. 70 km air line N from the previously northernmost vouchered citation, at Villa Angostura, Neuquén (Barrio and Rinaldi de Chieri, *op. cit.*). Further, this record decreases the distributional hiatus between the northern distribution limit in Chile and Argentina. The area where the voucher specimens were found is relatively rich in amphibians, and is also inhabited by *Pleurodema thaul*, *Batrachyla leptopus*, *B. taeniata*, *Eupsophus calcaratus*, *Alsodes monticola*, *Rhinoderma darwinii*, and *Bufo variegatus*.

Submitted by **MARÍA SOL MUT COLL** (e-mail: solapio@hotmail.com), **MARCELO L. OCHOA** (e-mail: mochoa@millic.com.ar), Administración de Parques Nacionales, Argentina, and **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Prov. de Río Negro, Argentina (e-mail: cubeda@bariloche.com.ar).

***MANTIDACTYLUS KLEMMERI*. CORRECTION OF LOCALITY RECORD.** MADAGASCAR: CHAÎNES ANOSYENNES. Verified by Annemarie Ohler. This mantellid frog has been described from the Marojejy Massif (under the name Marojezy) in northeastern Madagascar (Guibé 1974. Bull. Mus. natn. Hist. nat. Paris 171:1171–1192). A second locality for the species, the Anosy Massif (Chaînes Anosyennes) in far southeastern Madagascar was later added (Blommers-Schlösser and Blanc 1991. Amphibiens [première partie]. Faune de Madagascar 75[1]:1–379). This was based on a voucher specimen in the Muséum national d'Histoire naturelle, Paris, catalogued as MNHN 1975.781 (Vences Glaw and Andreone 1997, Alytes 14:130–146). Later surveys failed to confirm the presence of *M. klemmeri* in this area. According to old notebooks of J. Guibé available in the MNHN the specimen was collected by Ch. P. Blanc and originally given the field number F2060. However, Blanc used a repeated numbering system in his expeditions to the Marojejy and Anosy Massifs. While one F2060 originated from "Camp IV et IIIbis" in the Chaînes Anosyennes, a second voucher with that field number came from "Marojezy 1300 m." One of these specimens was catalogued as *M. klemmeri*, a second one as *Mantidactylus microtympanum* according to Guibé's notes. Since *M. microtympanum* is a conspicuous species endemic to the southeast and has never been found in Marojejy, we are convinced that this specimen was correctly catalogued as originating from the Anosy Massif (Chaînes Anosyennes). As a conclusion, the *M. klemmeri* individual was wrongly given that locality and actually originated from the Marojejy Massif at an elevation of 1300 m. This removes one further biogeographic anomaly from the distributions of Malagasy frogs and emphasizes the high degree of endemism of the Marojejy Massif.

Submitted by **MIGUEL VENCES**, Laboratoire des Reptiles et Amphibiens, Muséum National d'Histoire Naturelle, 25 rue Cuvier, 75005 Paris, France (e-mail: m.vences@t-online.de), and **FRANK GLAW**, Zoologische Staatssammlung München, Münchhausenstr. 21, 81247 München, Germany (e-mail: frank.glaw@zsm.mwn.de).

NYCTIXALUS PICTUS (Spotted Treefrog). MALAYSIA: PENINSULAR MALAYSIA: PULAU TIOMAN; along Tekek-Juara trail (02°49'N, 104°08'E; ca. 100 m), calling while perched on leaf of sapling ca. 20 cm above ground. 16 July 2001. Tzi Ming Leong and Karen M. Crane. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.1.8268, male, SVL 31.1 mm). Verified by Kelvin K. P. Lim. New island record; represents the third rhacophorid species on the island (Lim and Lim 1999. Raffles Bull. Zool. Suppl. 6:131–155). This species is also known to inhabit other islands of comparable size, such as Penang in the north, and Singapore in the south (Manthey and Grossmann 1997. Amphibien & Reptilien Südostasiens. Natur und Tier - Verlag, Münster, Germany. 512 pp.).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg), and **KAREN M. CRANE**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

PHYSALAEMUS CENTRALIS (Central Dwarf Frog). BRAZIL: MINAS GERAIS: UBERLÂNDIA MUNICIPALITY (18°59'S and 48°18'W). 18 September 1999. Ariovaldo A. Giaretta. Museu de Biodiversidade do Cerrado of Universidade Federal de Uberlândia (AAG-UFU 2289). Verified by Ariovaldo A. Giaretta. Adult male (SVL 39.3 mm). First record for the state of Minas Gerais. This record confirms the presence of this species in Minas Gerais state (Brandão et al. 1997. Herpetol. Rev. 28:93). Known distribution was in the states of Mato Grosso and São Paulo, Brazil, and in northeastern Paraguay (Frost 1995. Amphibian Species of the World. Version 2/95. Electronic Manuscript. Herpetologists' League). All the reports confirm the presence of this species in Cerrado Bioma Domain and not in the Atlantic Forest Domain (Duellman 1999. *In* Duellman [ed.], Patterns of Distribution of Amphibians. A Global Perspective, pp. 255–328. Johns Hopkins Univ. Press).

Submitted by **MARCELO N. DE C. KOKUBUM** and **MARCELO MENIN**, Laboratório de Ecologia e Sistemática de Anuros Neotropicais, Programa de Pós-Graduação em Ecologia e Conservação de Recursos Naturais, Universidade Federal de Uberlândia, 38400-902, Uberlândia, Minas Gerais, Brazil; e-mail (MNK): mkokubum@bol.com.

POLYPEDATES COLLETTI (Hourglass Treefrog). MALAYSIA: PENINSULAR MALAYSIA: JOHOR; 7 km east of Jemaluang (02°16'N, 103°50'E; ca. 50 m), forest beside road, perched low on

understory vegetation. 6 July 2001. L. Lee Grismer and Jesse L. Grismer. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.1.8228, female, SVL 73.2 mm; ZRC.1.8229, male, SVL 51.5 mm; ZRC.1.8230, male, SVL 48.3 mm). Verified by Kelvin K. P. Lim. New state record, in addition to Selangor, Pahang, and Negri Sembilan (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.). Southeasterly range extension of ca. 185 km (from Pasoh Forest Reserve, Kuala Pilah, Negri Sembilan).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg), **L. LEE GRISMER** and **JESSE L. GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

PSEUDACRIS CRUCIFER. USA: WISCONSIN: KEWAUNEE CO: NW 1/4 Sec. 8, T23N, R24E, Lipsky Swamp State Wildlife Area (44°28'45"N 87°37'15"W). 14 April 2001. Melissa Saeland. UWSP Herp 3933 - female and UWSP Herp 3934 - male. Verified by Erik Wild. Specimen 3933 had a SVL of 33.2 mm, weight = 1.9 g; specimen 3934 had a SVL of 24.6 mm, weight = 1.7 g. First county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum. 87 pp.).

Submitted by **MELISSA J. SAELAND**, Department of Biology, University of Wisconsin - Stevens Point, Stevens Point, Wisconsin 54481, USA (e-mail: msael739@uwsp.edu), and **MARK W. DOPERALSKI**, University of Wisconsin - La Crosse, La Crosse, Wisconsin 54601, USA.

PSEUDACRIS MACULATA. USA: MONTANA: GLACIER CO: Glacier National Park, temporary wetland (48°24'55"N, 113°14'48"W) in the Railroad Creek drainage. 15 July 2001. B. H. Hossack and K. J. Yale. Deposited in the Glacier National Park Museum (GLAC 22540). Verified by P. S. Corn. *P. maculata* had not previously been found in Glacier National Park (Marnell 1997. Northwest. Nat. 78:17–33), although it had been collected outside the park less than 5 km from the current collection site. Specimen was collected under permit GLAC-2001-SCI-0004.

Submitted by **BLAKE R. HOSSACK** and **KATHLEEN J. YALE**, Division of Biological Sciences, University of Montana, Missoula, Montana 59812, USA, and Aldo Leopold Wilderness Research Institute, 790 East Beckwith Avenue, Missoula, Montana 59807, USA.

RANA ATTIGUA. VIETNAM: QUANG NAM PROVINCE: Ngoc Linh Mountain Range, Tra My District, 860 m elev. (15°11'41"N, 108°02'25"E). Nguyen Quang Truong. Verified by Nikolai Orlov. American Museum of Natural History (AMNH A-163692). First provincial record for Quang Nam (Inger et al. 1999. Fieldiana Zool. 92, pp. 14–16, Fig. 5).

Submitted by **RAOUL BAIN**, Center for Biodiveristy and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA, and **NGUYEN QUANG TRUONG**, Department of Zoology, Institute of Ecology and Biological Resources, Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

RANA CATESBEIANA (Bullfrog). MÉXICO: MÉXICO: Municipio de Villa Guerrero: 5 km S Villa Guerrero (18°55'18"N, 99°38'00"W), 1990 m elev. 22 July 1999. X. Aguilar, R. Cruz, and G. Casas. Colección Nacional de Anfibios y Reptiles del Instituto de Biología, Universidad Nacional Autónoma (IBH 13292–294). Verified by Fausto R. Méndez de la Cruz. First record for the state (Camarillo-R and Smith 1992. *In* Strimple and Strimple [Eds], Contributions in Herpetology, pp. 39–41. Greater Cincinnati Herpetological Society. 111 pp; Casas et al. 1997. Anfibios y Reptiles, Lista Taxonómica de los Vertebrados Terrestres de Estado de México. Univ. Autón. Edo. México, Cienc. Tec. No. 32:9–53).

Submitted by **GUSTAVO CASAS-ANDREU**, Instituto de Biología, UNAM, Apdo. Post. 70-153, 04510 México, D.F., México (e-mail: gcasas@servidor.unam.mx), **RICARDO CRUZ-AVIÑA** and **XOCHITL AGUILAR MIGUEL**, Facultad de Ciencias Universidad Autónoma del Estado de México, Instituto Literario #100, 50000 Toluca, Estado de México, México.

RANA CLAMITANS (Green Frog). USA: MICHIGAN: CHARLEVOIX CO: Garden Island (N45°47.90' W85°30.39'), small creek feeding the eastern side of Indian Harbor. 10 July 2001. Christopher Zurenko. Verified by Nancy E. Seefelt. Central Michigan University Museum of Culture and Natural History (CMU A-1609). First verified record of this animal for Garden Island.

Submitted by **KENNETH D. BOWEN** and **JAMES C. GILLINGHAM**, Department of Biology, Central Michigan University, Mt. Pleasant, Michigan 48859, USA.

RANA FORRERI (Forrer's Grass Frog). MÉXICO: CHIHUAHUA: Arroyo El Camuchil, Batopilas (27°01'34.1"N, 107°45'44.5"W), 435 m elev. 17 July 2000. Julio A. Lemos-Espinal. Herpetological collection of Unidad de Biología, Tecnología y Prototipos (UBIPRO 5923). Verified by Richard L. Holland. First record for Chihuahua, extending range ca. 160 airline km NE from Estación Don, Sonora, and 175 km NE from Camajoa, Sinaloa (Frost and Bagnara 1976. Copeia 1976:335).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Herpetología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, UNAM, Apdo. Post. 314, Avenida de Los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 5409 México (e-mail: lemos@servidor.unam.mx), **DAVID L. AUTH**, 4425 N.E. 7th Street, Gainesville, Florida 32601 USA (e-mail: davidauth@hotmail.com), **DAVID L. CHISZAR** and **HOBART M. SMITH**, Univeristy of Colorado Museum, Boulder, Colorado 80309, USA (e-mail: hsmith@spot.colorado.edu).

RANA NEOVOLCANICA (Transverse Volcanic Leopard Frog). MÉXICO: MÉXICO: Municipio de Villa de Allende: Granja Garidosac, Km 12 carr. Toluca Zitácuaro, entre Bosencheve y Casitas (19°24'35"N, 100°08'30"W), 2550 m elev. 30 May 1999. R Cruz A. Colección Nacional de Anfibios y Reptiles del Instituto de Biología, UNAM (IBH 13284–291). Verified by Fausto R. Méndez. First record for state (Hillis and Frost 1985. Occas. Pap. Mus. Nat. Hist. Kansas [117]:1–14; Camarillo-R and Smith 1992. *In* Strimple and Strimple [Eds.], Contributions in Herpetology, pp. 39–41. Greater Cincinnati Herpetological Society. 111 pp.).

Submitted by **GUSTAVO CASAS-ANDREU**, Instituto de

Biología, UNAM, Apdo. Post. 70-153, 04510 México, D.F., México (e-mail: gcasas@servidor.unam.mx), **RICARDO CRUZ-AVIÑA** and **XOCHITL AGUILAR MIGUEL**, Facultad de Ciencias Universidad Autónoma del Estado de México, Instituto Literario #100, 50000 Toluca, Estado de México, México.

RHACOPHORUS BIPUNCTATUS (Twin-spotted Treefrog). MALAYSIA: PENINSULAR MALAYSIA: SELANGOR-PAHANG border, Genting Highlands (03°46'N, 101°47'E; ca. 1750 m). June 2001. Oh Kim Sang. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.1.8061, male, SVL 40.2 mm; ZRC.1.8062, female, SVL 61.9 mm; ZRC.1.8063, female, SVL 57.7 mm; ZRC.1.8064, female, SVL 60.1 mm; ZRC.1.8065, female, SVL 61.8 mm). Verified by Kelvin K. P. Lim. Previously known from only three montane localities: Bukit Larut (Perak), Cameron Highlands (Perak-Pahang border), and Fraser's Hill (Selangor-Pahang border) (Berry 1975. The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.). This is a new montane locality record and represents a southerly range extension of ca. 40 km (from Fraser's Hill).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg), **NORSHAM SUHAINA YAAKOB**, Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia, and **BOO LIAT LIM**, Department of Wildlife and National Parks (Peninsular Malaysia), Km 10, Jalan Cheras, 561000 Kuala Lumpur, Malaysia.

RHACOPHORUS EXECHOPYGUS (Spinybottom Tree Frog). VIETNAM: QUANG NAM PROVINCE: Ngoc Linh Mountain Range, Tra My District, 980–1020 m elev. (15°11'41"N, 108°02'25"E). Nguyen Quang Truong. Verified by Robert F. Inger. American Museum of Natural History (AMNH A-163707). First provincial record for Quang Nam (Inger et al. 1999. Fieldiana Zool. 92, pp.12–13, Fig. 4).

Submitted by **RAOUL BAIN**, Center for Biodiveristy and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, NY, 10024, USA, and **NGUYEN QUANG TRUONG**, Department of Zoology, Institute of Ecology and Biological Resources, Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

RHOMBOPHRYNE TESTUDO. CORRECTION OF LOCALITY RECORD. MADAGASCAR: RÉUNION. Verified by Annemarie Ohler. This endemic Malagasy microhylid frog has been reported from Réunion Island (Guibé 1978. Les Batraciens de Madagascar. Bonn. zool. Monogr. 11:1–140) but this locality was later doubted (Blommers-Schlösser and Blanc 1991, Amphibiens [première partie]. Faune de Madagascar 75[1]:1–379). However, the source of this confusion has never been clarified. The record was almost certainly based on a voucher in the Muséum National d'Histoire Naturelle, Paris (MNHN 1829), recently revised by us. According to the original entry in the regular catalogue, it originated from "Île de la Réunion," but according to the glass label from "Nossi Bé: Mus. de Saint-Denis." Nosy Be is the type locality of *R. testudo*. An old catalogue in the Paris museum refers to the same specimen (entry 1869.104) as originating from "Nossi-Be et Nossi-Cumba (Madagascar)" and having been granted in exchange by the "Commission Scientifique de Bourbon" (Bourbon being an old name of Réunion). Apparently this information was omitted when the data were copied to the regular catalogue. We therefore conclude that the species does not occur outside Madagascar. The locality "Sambava-Andapa" in the map of Blommers-Schlösser and Blanc (1991) is corroborated by the well-preserved specimen MNHN 1973.576, confirming that *R. testudo* is not restricted to its type locality. However, the locality "Marojezy" given by the same authors and by Guibé (1978) is not corroborated by any voucher and probably refers to the same specimen MNHN 1973.576 which is catalogued as originating from "Sambava, km 17 route d'Andapa (massif Marojezy)," having been collected on 19 December 1972 (see also Blommers-Schlösser and Blanc 1991, p. 92).

Submitted by **FRANK GLAW**, Zoologische Staatssammlung München, Münchhausenstr. 21, 81247 München, Germany (e-mail: frank.glaw@zsm.mwn.de) and **MIGUEL VENCES**, Laboratoire des Reptiles et Amphibiens, Muséum National d'Histoire Naturelle, 25 rue Cuvier, 75005 Paris, France (e-mail: m.vences@t-online.de).

SCAPHIOPUS COUCHII (Couch's Spadefoot). USA: ARIZONA: NAVAJO CO: 2 specimens: State Hwy 87, 14.5 km NE of Jct. with I-40 (at Winslow N35°6.37' W110°31.64', 1600 m elev.), UTA A-53914; and 28.6 km NE of jct. with I-40 (N35°12.03' W110°26.32', 1700 m elev.), UTA A-53915. 10 August 1999. Daniel G. Mulcahy and Kirk W. Setser. Verified by Paul C. Ustach. Both specimens were found alive on the road, during a light rain at 2237 and 2305 h respectively. These specimens represent new county records. Closest known record is one specimen (MVZ 66242) collected in 1957 on U.S. Hwy 260, near Petrified Forest, Apache Co., Arizona (ca. 70 km). These specimens represent the second and third records of this species found north of the Mogollon Rim in Arizona, which may indicate this species is more widespread in this portion of the Colorado Plateau as indicated by Stebbins (1985, Peterson Field Guide to Western Reptiles and Amphibians, Second ed. Houghton-Mifflin, Boston, Massachusetts. 336 pp.). On this same evening, the following anurans were also collected along this highway and deposited at UTA: *Spea bombifrons* (A-53919–20), *S. multiplicata* (A-53918) and *Bufo cognatus* (A-53921–22). These species have all been collected at ca. 30 km to the east, along Hwy 77 north of I-40, Navajo Co., Arizona (specimens at CAS).

Submitted by **DANIEL G. MULCAHY** (e-mail: dmulcahy@biology.usu.edu) and **KIRK W. SETSER** (e-mail: setser@biology.usu.edu), Department of Biology, Utah State University, Logan, Utah 84322-5305, USA.

SCAPHIOPUS HOLBROOKII (Eastern Spadefoot). USA: INDIANA: POSEY CO: 2.0 Km N Griffin. 5 June 2001. Eugene Mumford. Carnegie Museum Natural History (CMNH Accession 36774). Verified by John Weins. Adult male photographed—one of several recent records from loess hill uplands of Bethel Township, near Wabash River. New county record and first record for southwestern "pocket" of Indiana (Minton 2001. Amphibians and Reptiles of Indiana. 2nd ed., revised. Indiana Acad. Sci. 404 pp.) and first record from adjacent region of Illinois (Phillips et al. 1999. Field Guide to Amphibians and Reptiles of Illinois. Illinois Natural History Survey Manual 8. 300 pp.) and from the adjacent

western coal field of Kentucky (John R. MacGregor, pers. comm.).

Submitted by **MICHAEL J. LODATO**, 925 Park Plaza Drive, Evansville, Indiana 47715-4428, USA, and **BISHOP MUMFORD** and **EUGENE MUMFORD**, P.O. Box 50, Griffin, Indiana 47616, USA.

TESTUDINES

CHELYDRA SERPENTINA (Common Snapping Turtle). USA: MICHIGAN: Charlevoix Co: Garden Island (N45°47.90' W85°30.39'), washed up (deceased) on the far eastern shore of Indian Harbor. 14 May 2001. Kenneth D. Bowen. Verified by Nancy E. Seefelt. Central Michigan University Museum of Culture and Natural History (CMU R-1558). First verified record of this animal for Garden Island.

Submitted by **KENNETH D. BOWEN** and **JAMES C. GILLINGHAM**, Department of Biology, Central Michigan University, Mt. Pleasant, Michigan 48859, USA.

CHRYSEMYS PICTA (Painted Turtle). USA: MICHIGAN: Charlevoix Co: Garden Island (N45°47.90' W85°30.39'), found trapped (deceased) in a fishing net in Indian Harbor. 21 June 2001. Michael Sieder. Verified by Nancy E. Seefelt. Central Michigan University Museum of Culture and Natural History (CMU R-1561). First verified record of this animal for Garden Island.

Submitted by **KENNETH D. BOWEN** and **JAMES C. GILLINGHAM**, Department of Biology, Central Michigan University, Mt. Pleasant, Michigan 48859, USA

KINOSTERNON HERRERAI (Herrera's Mud Turtle). MÉXICO: MÉXICO: Municipality of Temascaltepec, El Tule, on the bank of Temascaltepec River (19°00'N, 100°05'W), 1520 m elev. 17 May 1999. Vicente Mata-Silva and Martín Paredes-Flores. Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos, FES-Iztacala, Universidad Nacional Autónoma de México (VMS 235). Verified by Edmundo Pérez-Ramos. First record for the state of México (Camarillo-R. and Smith 1992. *In* Strimple and Strimple [Eds.], Contributions in Herpetology, pp. 39–41. Greater Cincinnati Herpetological Society, Cincinnati, Ohio. viii + 111 pp.). Closest record for this species is from the Gulf lowlands in the state of Hidalgo (Iverson 1992. A Revised Checklist with Distribution Maps of the Turtles of the World. Privately printed, Richmond, Indiana. viii + 363 pp.).

Submitted by **VICINTE MATA-SILVA, AURELIO RAMIREZ-BAUTISTA, MARTIN PAREDES-FLORES**, and **MANUEL ESPINO-OCAMPO**, Laboratorio de Ecología, UBIPRO, Facultad de Estudios Superiores-Iztacala, UNAM, Apdo. Post. 314, Avenida de Los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México; e-mail (AR): raurelio@servidor.unam.mx.

MACROCLEMYS TEMMINCKII (Alligator Snapping Turtle). USA: LOUISIANA: Calcasieu Parish: Little River, a small tributary of the West Fork Calcasieu River (N30°19.342, W93°17.843). 23 June 2001. Avery A. Williams. Louisiana State University at Eunice Vertebrate Collection (LSUE 583). Verified by Steve Shively. First Parish record as mapped by Dundee and Rossman (1989. The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.). Although commercial and recreational trappers in Southwest Louisiana have commonly collected this species, the above record represents the only known museum specimen from Calcasieu Parish. This specimen was trapped in a turtle hoop net baited with canned sardines.

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

LACERTILIA

DAREVSKIA VALENTINI (Caucasian Rock Lizard). USA: OHIO: Van Wert Co: west Delphos at Kill Brothers Equipment Company on Ohio Rt. 697. August 1986. KU 206727. Misidentified as *Podarcis muralis;* was re-identified by comparing size and scale counts to other members of the genus. SVL 70 mm; exceeds that of *P. muralis*. *Darevskia* is distinguished from *Podarcis* by alternating narrow and broad whorls of scales around tail and keeled scales on tibia and tail. Home range of *D. valentini* comprises southern Georgia, Armenia, and northeastern Turkey at elevations from 1700–3000 m. (Conant and Collins 1998. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Company, Boston, Massachusetts. 616 pp.; Darevsky 1967. Skalnye jasczcerizy Kawzaka. Akademii Nauk, Leningrad, 214 pp.; Bischoff and Deichsel, ms. in prep.)

Submitted by **GUNTRAM DEICHSEL**, Friedr.-Ebert-Str. 62, Biberach an der Riss, Germany D-88400 (e-mail: guntram.deichsel@bc.boehringer-ingelheim.com) and **WOLFGANG BISCHOFF**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, Bonn, Germany D-53113 (e-mail: w.bischoff.ZFMK@uni-bonn.de).

DRACO QUINQUEFASCIATUS. SINGAPORE: Bukit Timah Nature Reserve. 13 March 2001. Tim Youmans, Jesse Grismer, and Geoff Powels. La Sierra University Photo Collection (LSUPC) L-3296-97. Verified by L. Lee Grismer. Previously known from West Malaysia, southern Thailand, Sumatra, Pulau Singkep, Pulau Belitung, and Borneo (Manthey and Grossmann 1997. Amphibien and Reptilien Südostasiens. Natur und Tier-Verlag, Münster, Gemany. 512 pp.). New island record. One male was found during mid-afternoon on a large dipterocarp tree (at a position ca. 2 m from the ground) along a walking trail in the primary forest with closed canopy. This individual was captured, photographed, and released.

Submitted by **JESSE L. GRISMER** (e-mail: jessgris@lasierra.edu), **GEOFF POWELS**, and **TIM YOUMANS**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

HEMIDACTYLUS FRENATUS (Common House Gecko). EL SALVADOR: LA LIBERTAD: Rancho Belmar near La Libertad. Unknown date. M. Mueke. LACM 9375. Verified by Roy McDiarmid. New record for El Salvador (Dueñas et al. 2001. *In* Johnson et al. [eds.], Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation, pp. 93–99. Centennial Museum Spec. Publ. No. 1, The University of Texas at El Paso, El Paso).

This introduced species has been reported from several Central American countries, but the closest locality is from the Pacific versant of Guatemala (Stuart 1963. A Checklist of the Herpetofauna of Guatemala. Misc. Publ. Mus. Zool. Univ. Michigan [122]:1–150).

Submitted by **ELI GREENBAUM**, Division of Herpetology, Natural History Museum and Biodiversity Research Center, The University of Kansas, 1345 Jayhawk Blvd., Lawrence, Kansas 66045-7561, USA; e-mail: elig@ku.edu.

HEMIDACTYLUS TURCICUS. USA: NEW MEXICO: SIERRA Co: Downtown Truth or Consequences, The Charles Motel and Spa, 601 Broadway, New Mexico, USA; N33°7.718' W107°15.491'. Adult and juvenile. 18 September 1999. Don S. Sias and Pete E. Humphrey. University of New Mexico Museum of Southwestern Biology (MSB 62809–810). Verified by Charles W. Painter. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque, xix + 431 pp.). Extends the distribution in New Mexico approximately 101 km to the NNW from the Las Cruces population (Painter et al. 1992. Herpetol. Review 23:62). Thirty additional individuals were observed of all size classes in the vicinity of the hotel.

Submitted by **DON S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, and **PETE E. HUMPHREY**, University of New Mexico School of Medicine, Albuquerque, New Mexico 87131, USA

OPHISAURUS SOKOLOVI (Sokolov's Glass Lizard). VIETNAM: QUANG NAM PROVINCE: Ngoc Linh Mountain Range, Tra My District, 860 m elev. (15°11'41"N, 108°02'25"E). Nguyen Quang Truong. Verified by Nikolai Orlov. Institute of Ecology and Biological Resources, Hanoi, Vietnam (IEBR 102). First provincial record for Quang Nam (Darevsky and Nguyen 1983. Zool. Zh. 62[12]:1827–1837).

Submitted by **RAOUL BAIN**, Center for Biodiveristy and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, New York, 10024, USA, and **NGUYEN QUANG TRUONG,** Department of Zoology, Institute of Ecology and Biological Resources, Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

TROPIDURUS HISPIDUS. BRAZIL: PARÁ: Municipio de Monte Alegre, Serra do Erere, Morro da Lua (2°01'49"S and 54°12'21"W, 135 m), left bank of the Rio Amazonas. J. G. da Frota and R. N. Yuki. 23 September 2001. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Pará, Brazil (LPHA 1819–1820, LPHA 1830–31). Verified by Andrei G. Guedes. For Amazonia, the species is known from Manaus city (Amazonas State), eastern limit of Maranhão and eastern Pará; for enclaves of open vegetation north of the Amazon River, in Roraima, southern part of French Guiana (Tumuc-Humac Mountains), Suriname, Guyana, and Venezuela. These specimens represent the first record from western Pará and fill a distributional gap of ca. 1359 km between the known localities. Enlarges the known distribution ca. 688 km from Castanhal to the west, ca. 672 km from Manaus to the east; and ca. 567 km from Tumuc-Humac Mountains at south, and corroborates the hypothesis of Rodrigues (1987. Arq. Zool. 31[3]:105–230), that all *Tropidurus* populations north of the Rio Amazonas are *T. hispidus* (Ávila-Pires 1995. Lizards of Brazilian Amazonia (Reptilia: Squamata). Zool. Verh. [299]:1–706).

Submitted by **MÁRCIA LIA DE SOUSA ABREU**, **JOSSEHAN GALÚCIO DA FROTA** and **RUBENS NOBUO YUKI**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200; e-mail (MLS): marcialiaa@bol.com.br.

TROPIDURUS OREADICUS. BRAZIL: PARÁ: Municipio de Santarém, Barreira do Tapará (02°10'S and 54°31'W), left bank of the Rio Amazonas. M. S. S. Neves, 6 October 2001. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Santarém, Pará State (LPHA 1858). Verified by Rubens N. Yuki. In Brazil, this species occurs in the cerrados of Mato Grosso, Mato Grosso do Sul, Minas Gerais, Goiás, Maranhão, and Rondônia. Along the lower Tocantins River to Belém (Pará). It also occupies some enclaves of open vegetation in the Amazonian region south of the Amazon River (e.g., in Serra dos Carajás, southern Pará). These specimens represent the first record north of the Amazon River, western Pará, enlarges western distribution ca. 540 km (airline) from reservoir area of hydroelectric dam Tucuruí and ca. 580 km (airline) east from Porto Velho. (Ávila-Pires 1995. Lizards of Brazilian Amazonia (Reptilia: Squamata). Zool. Verh. [299]:1–706; Rodrigues 1987. Arq. Zool. 31[3]:105–230).

Submitted by **ALFREDO PEDROSO DOS SANTOS, JR.** (e-mail: alphredojr@mailbr.com.br), **MÁRCIA LIA DE SOUSA ABREU**, and **JOSSEHAN GALÚCIO DA FROTA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200.

SERPENTES

ANILIUS SCYTALE. VENEZUELA: MÉRIDA: CBX 13 Island, Borde Seco Dam (07°44'30"N, 71°32'50"W). 21–22 September 2001. Grupo Ecología Animal 2001. Colección de Vertebrados, Universidad de los Andes, Facultad de Ciencias (CVULA IV-6344–45). Verified by D. Cadena. First state record, north of Orinoco River and westernmost in Venezuela, ca. 430 km NW of the closest record, sector Gavilán, Puerto Ayacucho, Amazonas (Rodríguez-Acosta and Fuentes 1995–96. Terra 11–12:77–84). *Anilius scytale* was known from several localities in Venezuela, all south of the Orinoco River (Roze 1966. La Taxonomía y Zoogeografía de los Ofidios de Venezuela. Ediciones de la Biblioteca, Universidad Central de Venezuela, Caracas. 360 pp; Lancini 1979. Serpientes de Venezuela. Armitano Ed., Caracas; Lancini and Kornacker 1986. Die Schlangen von Venezuela. Verlag Armitano, Caracas). This locality shows a wider distribution in Venezuela, not restricted to the southern Orinoco area ("región guayanesa" and "región deltaica" in Barrio (1998. Acta Biol. Venez. 18[2]:1–93), as expected in Hoogmoed (1979. *In* Duellman (ed.), The South American Herpetofauna: its Origin, Evolution and Dispersal, pp. 241–279. Mus. Nat. Hist. Univ. Kansas Monogr. 7). Rainforests in piedmont of the Cordillera de Mérida

(Venezuelan Andes) between 250 m and 1000 m, show a wide biogeographical array, with elements shared from four very different bio-regions: "región andina, región orocostense, región llanera," and "región amazónica," as pointed out by Barrio (*op. cit.*) for amphibians.

Submitted by **CÉSAR LUIS BARRIO**, Fundación AndígenA, Apartado Postal 210, 5101-A, Mérida, Venezuela (e-mail: cesarlba@yahoo.com), **ANDRÉS CHACÓN** and **AMELIA DÍAZ DE PASCUAL**, Facultad de Ciencias, Universidad de los Andes, Mérida, Venezuela (e-mail: aecortiz@yahoo.com and adiaz@ciens.ula.ve).

CHIRONIUS EXOLETUS (Green Keeled Racer). BRAZIL: PARÁ: Municipio de Monte Alegre, Serra do Erere, Morro da Lua (2°01'49"S, 54°12'21"W, 148 m), left bank of the Amazônas River, J. G. da Frota, 23 September 2001. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1818; female; 1340 mm). Verified by Andrei G. Guedes. The species was known from the east coast of Brazil, northeastern Argentina, and equatorial South America including Amazonian Brazil (is common in the east and south of the state of Pará), Bolivia, eastern Peru and Surinam, and French Guiana; it also occurs at higher elevations in western Ecuador and Colombia, Panama, and Costa Rica. This specimen represents the first record for northwestern Pará, and the distribution of the species becomes more homogeneous. Using airline distances, the Monte Alegre record is between three localities known for the species: it is to the northeast of the Comunidade de São Luis do Tapajós (ca. 349 km); is to the west of the city of Belém (ca. 639 km), and is to the southwest of the city of Cayenne (ca. 801 km) (Cunha and Nascimento 1982. Bol. Mus. Para. Emílio Goeldi, Nov. Sér. Zool. [119]:1–17; Dixon et al. 1993. Revision of the Neotropical Snake Genus *Chironius* Fitzinger [Serpentes, Colubridae] – Monografie XIII. Torino: Museo regionale di scienze naturali, 1–279).

Submitted by **JOSSEHAN GALÚCIO DA FROTA** (e-mail: jgfrota@mailbr.com.br) and **RUBENS NOBUO YUKI**, Linha de Pesquisa em Herpetologia da Amazônia (LPHA), Laboratório de Pesquisas Zoológicas (LPZ), das Faculdades Integradas do Tapajós (FIT), Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200.

CROTALUS HORRIDUS (Timber Rattlesnake). USA: LOUISIANA: Calcasieu Parish: The area of Sabine River Bridge (Hwy I-10). June 1992. A. Nelly. Seale Museum of Louisiana, McNeese State University (SML 9273). Verified by Steve Shively. First parish record. This specimen represents the southern and westernmost record in the state as mapped by Dundee and Rossman (1989. The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

DRYMOBIUS RHOMBIFER. VENEZUELA: BARINAS: Barinitas city, 550 m. 7 July 2001. H. Sánchez. Colección de Vertebrados, Universidad de los Andes, Mérida (CVULA 6427). Verified by Yoel Morales. This rare species is known in Venezuela from two disjunct localities, the Sierra de Perijá in NW extreme of the country, bordering with Colombia, and the Amazon rainforest (Lancini 1979. Serpientes de Venezuela. Armitano Ed., Caracas; Lancini and Kornacker 1986. Die Schlangen von Venezuela. Verlag Armitano, Caracas; Roze 1966. La Taxonomía y Zoogeografía de los Ofidios de Venezuela. Ediciones de la Biblioteca, Universidad Central de Venezuela, Caracas). This locality reduces the gap between these very different bio-regions. Thus, *D. rhombifer* shows a wider distribution in Venezuela than previously considered, from the Amazon to Perijá along rainforests in Andean foothills.

Submitted by **DANIEL CALCAÑO**, Serpentarium Los Llanos, Barinitas, Barinas, Venezuela (e-mail: reprecal@cantv.net) and **CESAR L. BARRIO-AMORÓS**, Fundación AndígenA. Apartado Postal 210. Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com).

EPICRATES CENCHRIA MAURUS (Rainbow Boa). BRAZIL: PARÁ: Municipio de Almeirim, Missão Jesuita Tiriós (02°15'N, 55°59'W). 19 October 1979. Verified by V. J. Germano. Herpetological Collection "Alphonse Richard Hoge" of Instituto Butantan, São Paulo, S.P., Brazil (IB 42745, sub adult and IB 42746, juvenile). First record of this subspecies from Brazil. The nearest localities are: Caiena, French Guiana, ca. 420 km NE and, in the vicinity of Nickerie city, Surinam, ca. 410 km NW (Abuys 1989. Litteratura Serpentium 9[3]:126–128; Chippaux 1986. Les Serpents de la Guyane Française. Paris, Orstom. 156 pp.; Roze 1966. La Taxonomia y Zoogeografia de los Ofídios en Venezuela. Caracas, Biblioteca Central Univ. Central Venezuela. 362 pp.)

Submitted by **PAULO PASSOS**, Museu Nacional, Quinta da Boa Vista, CEP: 20940-040, Rio de Janeiro, R.J., Brazil (e-mail: ppassos@mn.ufrj.br) and **FRANCISCO LUÍS FRANCO**, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brazil, 1500, CEP: 05503-900, São Paulo, S.P., Brazil (e-mail: flfrancobuta@hotmail).

GONATODES CONCINNATUS LIGIAE: VENEZUELA: APURE: 7 km NE La Victoria, distrito Páez. 29 April 1987. R. Rico. Colección de Vertebrados, Universidad de los Andes, Mérida (CVULA 5032). An adult male verified by Gilson Rivas. First state record and third for the country, ca. 160 km SSE of previous published records for Barinitas and Reserva Forestal Ticoporo, in the state of Barinas (Rivero-Blanco 1967 "1968." Mem. Soc. Cien. La Salle 27:104–119). This subespecies was predicted to occur in Apure (Rivero-Blanco 1979. The Neotropical Lizard Genus *Gonatodes* Fitzinger [Sauria: Sphaerodactylinae]. Ph.D. dissertation, Texas A&M University. 224 pp.). The species inhabits all piedmont rainforest and gallery forest areas in adjacent Llanos from Perú to Venezuela (Peters and Donoso-Barros 1986. Catalogue of the Neotropical Squamata. Part II. Lizards and Amphisbaenians. Smiths. Inst. Press. Washington, D.C.).

Submitted by **CARLOS RIVERO-BLANCO**, C.R.B. Ecólogos Consultores C.A., Apartado 63011, Chacaito, Caracas 1067-A, Venezuela (e-mail: carivero@telcel.net.ve) and **CÉSAR L. BARRIO-AMORÓS**, Fundación Andígena, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com).

HYPSIGLENA TORQUATA. (Night Snake) USA: IDAHO: Cassia Co: CR G3 (Rock Creek Rd.), 20 m N of Sawtooth National Forest, Rock Creek, (N42°19.93' W114°16.80'), 1400 m elev. 28

August 1999. Kirk W. Setser. UTA R-51097. Verified by Paul C. Ustach. Specimen was found alive on the road at 2148 h. The road went through mixed grass/sagebrush with scattered rocks and was within 30 m of Rock Creek. It was partly cloudy, and between 18–21°C. This is a new county record (Laurence and Reynolds 1984. Great Basin Nat. 44[2]:313–316). Most distribution maps show this species continuous from Pocatello, Idaho to Oregon. The closest actual records are from: Pocatello, Bannock Co., Idaho (ca. 160 km); near Craters of the Moon Nat'l. Mon., Blaine Co., Idaho (ca. 120 km); near Grand View, Elmore Co., Idaho (ca. 160 km) (Linder and Fichter 1977. The Amphibians and Reptiles of Idaho, Idaho State Univ. Press, Pocatello, Idaho; Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest, Univ. of Idaho Press, Moscow, Idaho). This species' range is probably continuous throughout this area, however records are lacking.

Submitted by **DANIEL G. MULCAHY** (e-mail: dmulcahy@biology.usu.edu) and **KIRK W. SETSER** (e-mail: setser@biology.usu.edu) Department of Biology, Utah State University, Logan, Utah 84322-5305, USA.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: MICHIGAN: Charlevoix Co: Garden Island (N45°47.90' W 85°30.39'), found under a large sheet of plastic on the north side of Graham's Point. 14 May 2001. Kenneth D. Bowen. Verified by Nancy E. Seefelt. Central Michigan University Museum of Culture and Natural History (CMU R-1562). First verified record of this animal for Garden Island.

Submitted by **KENNETH D. BOWEN** and **JAMES C. GILLINGHAM**, Department of Biology, Central Michigan University, Mt. Pleasant, Michigan 48859, USA.

LEPTOTYPHLOPS DULCIS (Texas Blind Snake). USA: NEW MEXICO: Lincoln Co: Adjacent to north side of Highway 70/380 mile marker 298 (.5); N33°20.454', W105°4.352'. Three snakes. 16 June 1999. Don S. Sias. University of New Mexico Museum of Southwestern Biology (MSB) 62812–14. Verified by Charles W. Painter. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque, xix + 431 pp.). Extends range west into the Sacramento Mountain foothills from Pecos River Valley records.

Submitted by **DON S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

LIOPHIS EPINEPHELUS OPISTHOTAENIUS. VENEZUELA: FALCÓN: Municipio Petit: Curimagua. 1 August 1982. M. González Sponga. Museo de Ciencias Naturales, Caracas (MCNC 7705). Verified by L. F. Navarrete. First state record and northeasternmost locality in South America (Dixon 1983. *In* Rhodin and Miyata [eds.], Advances in Herpetology and Evolutionary Biology, pp. 132–149. Mus. Comp. Zool., Harvard Univ.; Mijares-Urrutia and Arends. 2000. Smithson. Herpetol. Infor. Serv. 123:1–30). In Venezuela, this species was known from Cordillera de Mérida, Venezuelan Andes (Roze 1966. La Taxonomía y Zoogeografía de los Ofidios en Venezuela. Univ. Central de Venezuela. Edic. Biblioteca. Caracas, 362 pp.). This locality reveals a wider distribution of this species throughout the Venezuelan Coastal Range (including now the Lara-Falcón mountain system), east of the Andes (Dixon, *op. cit.*).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado Postal 1930, Caracas 1010-A, Venezuela (e-mail: gilsonrivas@mixmail.com), and **OSWALDO FUENTES**, 19135 US 19 North, Apt. J8, Clearwater, Florida 33764, USA.

LIOPHIS MILIARIS CHRYSOSTOMUS. BRAZIL: PARÁ: Municipio de Tirios. A. Silva-Filho. 2001. Linha de Pesquisa em Herpetologia da Amazônia (LPHA), Laboratório de Pesquisas Zoológicas (LPZ), Faculdades Integradas do Tapajós, Santarém, Pará State (LPHA 1854). Verified by R. Nobuo Yuki. Species known from dense rainforests of lowland Amazonian parts of Brazil, Colombia, Ecuador, and Peru. First record from northern Amazonas River in the Pará, enlarges the known distribution ca. 420 km airline from the nearest record (Municipio Obidos), also in Pará. (Dixon 1983. Copeia 1983:791–802; Dixon 1989. Smithson. Herptol. Infor. Serv. 79:1–28).

Submitted by **JOSSEHAN GALÚCIO DA FROTA** (e-mail: jgfrota@mailbr.com.br) and **ALFREDO PEDROSO DOS SANTOS, JR**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200.

LIOPHIS POECILOGYRUS SCHOTTI. VENEZUELA: AMAZONAS: Puerto Ayacucho: Atures, 75 m. 14 September 1979, P. Piñate. Museo de la Estación Biológica de Rancho Grande, Aragua (EBRG 1157, adult male); specimen without date, J. Sánchez and F. Guánchez (EBRG 1750, adult female); 28 July 1985, J. Sánchez. (EBRG 1916, adult female); 23 August 1982, J. Sánchez and P. Piñate (EBRG 1652, adult male); 19 November 1978, E. Armas (EBRG 1543, adult female). Mavaca, upper Orinoco River, May 1979, J. Finkers (EBRG 3048, juvenile). First state records. All specimens verified by César R. Molina. EBRG 3048 is the southernmost known record in Venezuela. *Liophis poecilogyrus* was mentioned as a possible inhabitant in Venezuela by Dixon (1989. Smithson. Herpetol. Inform. Serv. 79:1–28). Dixon and Markezich (1992. Texas J. Sci. 44:131–166), pointed out in their map two points in Bolívar state, without locality data. Later, Fuentes and Barrio (1999. Herpetol. Rev. 30:54) confirmed its presence in Bolívar state. In this note we assign the Venezuelan population to the subspecies *L. p. schottii* and expand the known range about 600 km to the southwest. Puerto Ayacucho is a town surrounded by Guianan savanna. *Liophis poecilogyrus* is a savanna dweller, but Mavaca is the first Amazon rainforest locality for this species in Venezuela.

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado Postal 1930, Caracas 1010-A, Venezuela, **OSWALDO FUENTES**, 19135 US 19 North, Apt. J8, Clearwater, Florida 33764, USA, and **CÉSAR L. BARRIO**, Fundación AndígenA, Apartado Postal 210, 5101-A Mérida, Venezuela.

MASTICOPHIS FLAGELLUM TESTACEUS (Western Coachwhip). MÉXICO: CHIHUAHUA: Cañon de Barrera, Ejido El Álamo, 1.0 km NW Rancho El Fortín, by Río Conchos (29°32'36.4"N, 104°52'23.0"W), 939 m elev. 20 June 2000. Herpetological collection of Unidad de Biología, Tecnológico y Prototipos (UBIPRO 5497). Verified by Richard L. Holland. First

record for Chihuahua and a slight range extension from localities in the Big Bend region of Texas (Wilson 1970. Tulane Stud. Zool. Bot. 16:31–99), although an intergrade with *M. f. lineatulus* farther southwest was reported by Lemos-Espinal et al. (2000. Bull. Chicago Herpetol. Soc. 35:19–24). All other records for Chihuahua are for *M. f. lineatulus*.

Submitted by **JULIO A. LEMUS-ESPINAL**, Laboratorio de Herpetología, UBIPRO, Escuela Nacional de Estudíos Profesionales Iztacala, UNAM, Apdo. Post. 314, Avenida de Los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e-mail: lemos@servidor.unam.mx); **DAVID L. AUTH**, 425 N.E. 7TH Street, Gainesville, Florida 32601, USA (e-mail: davidauth@hotmail.com); **DAVID CHISZAR** and **HOBART M. SMITH** (e-mail hsmith@spot.colorado.edu), University of Colorado Museum, Boulder, Colorado 80309, USA.

PHILODRYAS PATAGONIENSIS. BRAZIL: RONDÔNIA: Município de Ouro Preto do Oeste (10°44'S 62°13'W). October 1983. E. Roppa. Museu Nacional, Rio de Janeiro, Brazil (MNRJ 8445, young specimen). Verified by R. Fernandes. First state record, extends the known distribution ca. 830 km northeast of Cochabamba, Bolivia (Thomas 1976. Unpubl. Ph.D. thesis, Texas A&M University, College.Station).

Submitted by **PAULO PASSOS** (e-mail: ppassos@mn.ufrj.br) and **DANIEL S. FERNANDES** (e-mail: danfer@acd.ufrj.br), Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Quinta da Boa Vista s/n, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

PSAMMOPHIS SIBILANS SIBILANS (African Beauty Snake). EGYPT: SUEZ CANAL AREA: ISMAILIA PROVINCE: Al-Ababdah, Serapeum (30°29'44"N, 32°19'02"E). 2 June 2001. Adel A. Ibrahim. Muséum National d'Histoire Naturelle, Paris (MNHN 2001.0601). Verified by Ivan Ineich. A female (660 mm SVL) freshly killed by a farmer at site immediately close to a creek. Two other individuals were also observed in July 2001 at Suez City (29°58'05"N, 32°32'12"E), and at Al-Ganayen, ca 10 km N of Suez City (31°05'47"N, 33°40'06"E). In Egypt, this snake is well known from the Nile Delta as far as Aswan in the upper Egypt. In western desert, only a single record was reported from Matruh (Marx 1968. Checklist of the Reptiles and Amphibians of Egypt. U.S. Naval Medical Research Unit No. III, Cairo, 51 pp.). First record for the Suez Canal area (Saleh 1997. Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. XI, 234 pp.).

Submitted by: **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt; e-mail: aibrahim@ismailia.ie-eg.com.

PSOMOPHIS JOBERTI. BRAZIL: AMAZONAS: Município de Benjamin Constant (4°22'S 70°02'W). 1942. A. Parko. Museu Nacional, Rio de Janeiro, Brazil (MNRJ 1293, adult male 241 mm SVL, 65 mm TL). Verified by R. Fernandes. First state record, extends the known range ca. 2310 km northwestern of Barra do Tapirapés, state of Mato Grosso and about 2200 km west of Marajó Island, state of Pará (Myers and Cadle 1994. Am. Mus. Novitates 3102:1–33).

Submitted by **PAULO PASSOS** (e-mail: ppassos@mn.ufrj.br) and **DANIEL S. FERNANDES** (e-mail: danfer@acd.ufrj.br), Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Quinta da Boa Vista s/n, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

THAMNOPHIS MELANOGASTER CHIHUAHUAENSIS (Chihuahuan Black-Bellied Garter Snake). MÉXICO: DURANGO: ca. 2 air km N and 12 km W Teneraca (Tepehuan village) (23°05'N, 104°45'W), in Arroyo de las Cuevas at streamside campsite locally known as Platanillos, 1600 m elev. 24 November 1970. Robert G. Webb. UTEP 11946. Verified by Roger Conant. Found in a clear-water stream surrounded by subtropical vegetation. New record for Durango, and located about 500 air km SE of the nearest records from southwestern Chihuahua in the vicinity of Río San Miguel-Río Verde (Tanner 1985. Great Basin Nat. 45:615–676). Color photographs of this snake, both captioned "Durango," appear on Plate 8 in Rossman et al. (1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman Oklahoma. xx + 332 pp.), but its occurrence in Durango was not otherwise indicated in their text or maps.

Submitted by **ROBERT G. WEBB**, Department of Biological Sciences, The University of Texas at El Paso, El Paso, Texas 79968-0519, USA; e-mail: rgwebb@utep.edu.

TRIMORPHODON BISCUTATUS (Lyre Snake). USA: NEW MEXICO: GRANT CO: Burro Mountains; Saddle Rock Canyon; N32°47.363', W108°30.181'. Juvenile. 15 November 2000. Eric M. Brand. University of New Mexico Museum of Southwestern Biology (MSB 62811). Verified by Charles W. Painter. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque, xix + 431 pp.). Fills a large gap in range records from surrounding counties in New Mexico (Hildago, Luna, Sierra, Catron).

Submitted by **DON S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, and **ERIC M. BRAND**, 11 UT Drive, Silver City, New Mexico 88061, USA.

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New Distribution Records of Reptiles from Western Venezuela

ALLAN L. MARKEZICH
Department of Natural Sciences & Engineering
Black Hawk College, 6600 34th Avenue, Moline, Illinois 61265-5899, USA
e-mail: markezicha@bhc1.bhc.edu

The composition and geographic distribution of the herpetofauna of the central portion of western Venezuela is poorly understood primarily because of the limited amount of previous work there. This area is ecologically and physiographically diverse, including several Andean ecosystems at various elevations bordered by a relatively flat upper llanos system to the east of these (Reaud-Thomas 1989). The distributions of many Venezuelan reptilian species depicted in commonly used references (e.g., Roze 1966)

often exhibit gaps or other anomalies in this region, and only sparse and scattered records exist in the literature. This situation clearly precludes assessments of herpetofaunal species richness, diversity indices, percentage endemism, and other ecological parameters that are often important and relevant to current conservation and preservation efforts. The Andean area of western Venezuela has been shown to be very important with respect to the total diversity (i.e., species richness) of mammals and birds in Venezuela (Rodríguez and Rojas-Suárez 1996) but the inadequate knowledge of the this area's herpetofauna does not yet permit such conclusions about its contribution to the herpetofaunal diversity of Venezuela.

I have investigated various aspects of the west central Venezuelan herpetofauna in the field and in museum collections since 1990. This paper reports new regional records, new state records, and geographic range extensions for 44 species of reptiles (29 snakes, 13 lizards, and 2 amphisbaenians), mainly from llanos and piedmont physiographic areas in the state of Portuguesa and adjacent states of Barinas, Lara, and Trujillo. Previous geographic records of species were established by reference to works that document specimens from specific localities and/or from works involving comprehensive local checklists. I have refrained from referring to works that show only stippling or shading on distribution maps to represent a species range since the depicted range usually represents an inductive hypothesis (Tucker 1995) if not based upon evidence from specific records. Many recent works that document regional geographic distributions of reptiles and amphibians (e.g., Phillips et al. 1999) take the empirical approach used in the present paper.

The scant previous herpetological research in west central Venezuela is evident from the absence of specimens from this region in most museum collections. Over the years however, I have had the opportunity to examine the herpetological collection at the Museo de Ciencias Naturales (MCNG), Guanare, Estado Portuguesa, Venezuela. This museum is on the campus of the Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora (UNELLEZ; coordinates 9°03'50"N, 69°48'30"W), which is a few kilometers from the west/northwestern edge of Guanare, the capital of the state of Portuguesa. It has a modest and well-curated herpetological collection containing specimens that have been collected primarily in the state of Portuguesa and secondarily in adjacent states since 1979. It also has specimens collected on various expeditions to other areas in Venezuela and type specimens from recently described species (e.g., Markezich and Taphorn 1994). All of the specimens reported upon in this paper are housed in this collection.

In this paper, subspecific names are used only if there has been a recent comprehensive variational study of the species (e.g., *Chironius carinatus* by Dixon et al. 1993), and taxa of uncertain affinity, several of which are currently under investigation by the author and others, have been omitted. Only one specimen of a conspecific series is listed from one locality, and separate localities within a state are reported if they represent significantly different geographic, physiographic, and/or ecological areas. Geographic coordinates have not been inferred from locality data, and are given only where directly recorded. Distances via roads are designated as such in this paper, and other distances between two points are linear. For brevity, I have used the abbreviation "Edo." for the phrase "the state of" in many cases. For ease of reference, the following information and coordinates are for two localities near Guanare that frequently appear in the list of species but may be difficult to locate on some maps: La Colonia (9°03'19"N, 69°48'58"W), 3 km westnorthwest of northwestern edge of Guanare; Mesa de Cavacas (cited as "Mesa Cavaca" on some maps; 9°04'22"N, 69°48'42"W), 7 km north of northwestern edge of Guanare on the road to Biscucuy. I have also refrained from comments pertaining to variation and taxonomy of the specimens reported upon in this paper, except in one case, and have examined all of the listed specimens.

Anomalepidae

Liotyphlops albirostris. PORTUGUESA: Municipio Guanare: Guanare. 31 May 1979. No collector listed in catalogue. Verified by J. R. Dixon. MCNG 836. First record from Portuguesa, ca. 170 km ENE of nearest record from Mérida, Edo. Mérida, where the only other specimens in west central Venezuela are known (Dixon and Kofron 1983).

Boidae

Boa constrictor. BARINAS: Municipio Bolivar: Rancho Luna, Barinitas. 30 June 1981. D. Gonzalez. MCNG 540; PORTUGUESA: Municipio San Genaro de Boconoito: San Nicolás. 13 November 1983. B. Busto and C. Ramo. MCNG 716. All specimens verified by T. Horger. First record from Barinas and range extension of 80 km S of nearest record from Aparición in Portuguesa (Roze 1966).

Corallus ruschenbergerii. PORTUGUESA: Municipio Guanare: La Colonia. 20 July 1983. S. Reid. Verified by D.C. Taphorn. MCNG 732. First record from Portuguesa, ca. 160 km WNW of record from Edo. Barinas (Henderson 1997).

Epicrates cenchria. BARINAS: Municipio Rojas: Hato San Pancracio, Santa Rosa. 28 May 1981. B. Busto and C. Ramo. MCNG 495; PORTUGUESA: Municipio Papelón: 20–40 km (road) SE Guanare on Guanare-Guanarito Rd. 8 July 1993, 2100–2300 h. A. L. Markezich and O. J. León. MCNG 1480. All specimens verified by T. Horger. First records from Barinas and Portuguesa, extending range ca. 200 km E of the first records from west central Venezuela in Edo. Mérida (La Marca and Soriano 1995; Roze 1966).

Colubridae

Atractus univittatus. PORTUGUESA: Municipio Guanare: La Colonia. 11 December 1990. D. C. Taphorn. MCNG 1239; Municipio Guanare: 12 km (road) S Rio Guanare bridge on Guanare-Biscucuy Rd. 7 July 1993. A. L. Markezich and O. J. León. MCNG 1479. Both specimens verified by J. R. Dixon. First records from western Venezuela. This species was previously known only from the holotype from the Caracas region and one specimen from Estado Miranda, ca. 400 km NW of the records reported here. The two MCNG specimens recorded above and two others in MCNG from the same area in Portuguesa match the original description of Jan (1862) and that given by Roze (1966) in most details of scalation and color pattern of this species. However, there is an inconsistency in reported infralabial number in the literature. The figured type specimen of Jan (1862, 11th Livr., PL. II) and the specimens from Portuguesa have seven infralabials while Roze (1966) and other general references have cited six for this species apparently

based upon the specimen from Edo. Miranda that he examined. Thus the species should be considered to have 6–7 infralabials, a common range of variation in this character in colubrids. The temporal number of 2+2 figured and cited by Jan (1862) for the holotype was also a variant, as the specimen examined by Roze (1966) and the series examined here from Portuguesa have 1+2 temporals. Thus, this species should be considered to have 1+2 or 2+2 temporals.

Chironius carinatus spixi. PORTUGUESA: Municipio Guanare: UNELLEZ campus. 21 November 1990, 0900 h. A. L. Markezich. MCNG 1251; Municipio San Genaro de Boconoito: San Nicolás. 16 August 1981. G. Rios. MCNG 538; Municipio undetermined: carretera Guanare-Guanarito. 19 October 1980. B. Busto and C. Ramo. MCNG 105. All specimens verified by T. Horger. Dixon et al. (1993) reported several specimens from the northern part of this state near Acarigua, and another was recently reported from Biscucuy in the northwestern piedmont of the state (Esqueda and La Marca 1999). The specimens reported here extend the range 75 km from these records and document the existence of this species in central and southwestern Portuguesa.

Dipsas variegata. PORTUGUESA: Municipio Monseñor José Vicente de Unda: Chabasquen, Cerro Mollejon. 30 September 1983. B. Busto and C. Ramo. Verified by P. Pacheco. MCNG 787. First record from western Venezuela, ca. 350 km WSW of nearest known records from Distrito Federal (Roze 1966).

Erythrolamprus bizonus. BARINAS: Municipio Antonio Jose de Sucre: Socopo. 22 March 1981. M. Soto. Verified by P. Pacheco. MCNG 943; PORTUGUESA: Municipio Guanare: UNELLEZ, Mesa de Cavacas. 6 August 1984. B. Busto and C. Ramo. Verified by P. Pacheco. MCNG 866; Municipio Guanare: Guanare, Jardin "Centro de Bellas Artes." 29 October 1986. R. Zapata. Verified by P. Pacheco. MCNG 942; TRUJILLO: Municipio Boconó: 28 km (road) SW Campo Elías on road to Boconó, 9°18'16"N, 70°10'03"W, 1580 m elev. 27 May 1998, 1100 h. A. L. Markezich and O. J. León. Verified by T. Horger. MCNG 1601. First records from Barinas and Portuguesa, filling the middle of a previous range gap of ca. 500 km from north central Venezuela to Edo.Táchira in southwestern Venezuela (Roze 1966).

Helicops angulatus. PORTUGUESA: Municipio Papelón: 40 km (road) SE Guanare on Guanare-Guanarito Rd. 10 July 1993, 1030 h. A. L. Markezich and O. J. León. MCNG 1498. First record of this locally common species from Portuguesa and only record of this species in western Venezuela other than those cited by Roze (1966) from Edo. Zulia, ca. 300 km west. The nearest llanos record is from Edo. Apure, ca. 230 km SE of the Portuguesa locality reported here (Staton and Dixon 1977).

Helicops pastazae. BARINAS: Municipio Ezequiel Zamora: upper reaches of Rio Caparo. 13 February 1983. B. Busto and C. Ramo. Verified by D. A. Rossman. MCNG 737. New record from Barinas. Markezich and Rossman (1992) incorrectly reported the locality of this specimen as being in Edo. Portuguesa due to an error in the MCNG catalogue. The locality in Barinas is ca. 130 km NE of the only other known record of this species in west central Venezuela cited by these authors from Edo. Táchira.

Imantodes cenchoa. PORTUGUESA: Municipio Papelón: 24 km (road) SE Guanare on Guanare-Guanarito Rd. 9 July 1993, 2350 h. A. L. Markezich and O. J. León. Verified by P. Pacheco. MCNG 1489. Second record from west central Venezuela, ca. 200 km ENE of nearest record from Edo. Mérida (Esqueda and La Marca 1999).

Leptodeira annulata ashmeadi. BARINAS: Municipio Barinas: Barinas. 29 January 1980. E. La Marca and G. Carrillo. MCNG 437; Municipio Rojas: Hato San Pancracio, Sta. Rosa. 31 December 1982. B. Busto and C. Ramo. MCNG 547; PORTUGUESA: Municipio Guanare: La Colonia. 13 July 1993. D. C. Taphorn. MCNG 1503; Municipio Guanarito: Palmar de Morrones, Guanarito. 30 September 1981. Busto and C. Ramo. MCNG 427; Municipio San Genaro de Boconoito: represa de Tucupido. 12 May 1989. M. Guttiererez. MCNG 1083; Municipio San Rafael de Onoto: San Rafael de Onoto. 12 May 1984. MCNG 1255; Municipio undetermined: 20–40 km (road) SE Guanare on Guanare-Guanarito Rd. 8 July 1993, 2200 h. A. L. Markezich and O. J. León. MCNG 1483. All specimens verified by P. Pacheco. First records of this common species from Barinas and Portuguesa, with most distant Portuguesa and Barinas records ca. 250 km ENE and 180 km E, respectively, of nearest record from Edo. Mérida (Duellman 1958; Roze 1966).

Leptophis ahaetulla. PORTUGUESA: Municipio Guanare: Guanare, carrera 6 frente a Malariologia. 8 May 1987, 0900 h. J. V. Paez. MCNG 990; Municipio Monseñor José Vicente de Unda: Chabasquen. 5 November 1983. B. Busto and C. Ramo. MCNG 729. Both specimens verified by P. Pacheco. First records from Portuguesa, ca. 180 km SSW of nearest record from Edo. Yaracuy (Roze 1966).

Liophis lineatus. PORTUGUESA: Municipio Guanare: La Colonia. 19 December 1990. D.C. Taphorn and L. M. Page. MCNG 1250; Municipio Guanarito: N of Guanarito, 5.3 km (road) E of Guanare-Guanarito Rd. on road to La Trinidad, 8°43'33"N, 69°11'44"W, 50 m elev. 1 May 1998. A. L. Markezich and O. J. León. Verified by T. Horger. MCNG 1609. Known from Acarigua in northern Portuguesa (Roze 1966), these specimens extend the range 80 km SW and 100 km S in this state. Records from Portuguesa are apparently rare, as Michaud and Dixon (1987) did not include specimens from this state in their recent comprehensive revision of this species.

Liophis melanotus melanotus. PORTUGUESA: Municipio Sucre: 4 km (road) N Las Guafas, 21 November 1990, 1500 h. A. L. Markezich and O. J. León. MCNG 1608; Municipio Guanare: Guanare. 17 November 1983. B. Busto and C. Ramo. All specimens verified by T. Horger. Localities are 75 km SW and SSW of documented specimens from the Acarigua area of northern Portuguesa (Dixon and Michaud 1992).

Mastigodryas bifossatus. BARINAS: Municipio Rojas: Hato San Pancracio, Santa Rosa. 31 December 1982. B. Busto and C. Ramo. MCNG 545; PORTUGUESA: Municipio Guanare: 15 km E Guanare, Finca Robalito. 29 November 1990. C. Lileystron. Verified by P. Pacheco. MCNG 467; Municipio Guanare: La Colonia. 29 July 1991. D. C. Taphorn. MCNG 1388. All specimens verified by P. Pacheco. First records from west central Venezuela, representing the westernmost records in Venezuela, ca. 250 km WSW and W of nearest records from Edo. Guárico (Roze 1966).

Ninia atrata. PORTUGUESA: Municipio Guanare: UNELLEZ campus, Mesa de Cavacas. February 21, 1984. A. Garcia. Verified by

P. Pacheco; MCNG 740. First record from Portuguesa, filling the middle of a significant range gap of ca. 500 km from north central Venezuela to Edo. Táchira in southwestern Venezuela (Roze 1966).

Oxyrhopus petola. PORTUGUESA: Municipio Guanare: La Colonia. 23 October 1983. MCNG 767; Municipio Monseñor José Vicente de Unda: Chabasquen, Cerro Mollejon. 20 May 1983. B. Busto and C. Ramo. MCNG 765; Municipio Papelón: 27 km (road) SE Guanare on Guanare-Guanarito Rd. 9 July 1993, 2300 h. A. L. Markezich and O. J. León. MCNG 1486. All specimens verified by P. Pacheco. First records from Portuguesa extending range ca. 200–225 km NE and E of first record from west central Venezuela in Edo. Mérida (Esqueda and La Marca 1999; Roze 1966).

Pseudoboa neuwiedii. PORTUGUESA: Municipio Guanare: UNELLEZ campus, pabellon "E." 11 February 1991. O. J. León. MCNG 1328; Municipio Papelón: 22 km (road) SE Guanare on Guanare-Guanarito Rd. 13 July 1993, 2130 h. A. L. Markezich and O. J. León. MCNG 1504. All specimens verified by T. Horger. First records from Edo. Portuguesa, ca. 150 km SW of nearest record from Edo. Yaracuy (Roze 1966).

Sibon nebulata. BARINAS: Municipio Rojas: Hato San Pancracio, Sta. Rosa. 17 August 1980. B. Bockma and C. Ramo. MCNG 67; PORTUGUESA: Municipio Monseñor José Vicente de Unda: Cerro Mollejon, Chabasquen. 25 March 1983. B. Busto and C. Ramo. MCNG 784; Municipio Papelón: 26 km (road) SE Guanare on Guanare-Guanarito Rd. 10 July 1993, 2030 h. A. L. Markezich and O. J. León. MCNG 1496. All specimens verified by P. Pacheco. Roze (1966) reported the nearest record from Agua Blanca near the northernmost tip of Portuguesa. The specimens represent a new state record from Barinas, ca. 150 km S of Agua Blanca, and range extensions in Portuguesa of 80 km WSW and 90 km SSW of Agua Blanca.

Spilotes pullatus. BARINAS: Municipio Rojas: Hato San Pancracia, Sta. Rosa. 31 May 1981. B. Busto and C. Ramo. MCNG 546; PORTUGUESA: Municipio Guanare: La Colonia. 27 April 1980. B. Busto and C. Ramo. MCNG 775; Municipio Ospino: 7.8 km (road) N Estación, 9°25'01"N, 69°32'55"W, 960 m elevation. 26 May 1998. A. L. Markezich. MCNG 2004; Municipio undetermined: carretera Guanare-Guanarito. 3 September 1980. B. Bockma and C. Ramo. MCNG 89. All specimens verified by T. Horger. First record from these states, ca. 120–180 km E of nearest records from Edos. Mérida and Trujillo (Roze 1966; La Marca and Soriano 2000).

Tantilla melanocephala. PORTUGUESA: Municipio Guanare: UNELLEZ campus, Mesa de Cavacas. 16 June 1981. C. Briceno. Verified by P. Pacheco. MCNG 831; Municipio Sucre: 22 km (road) N Mesa de Cavacas. 23 July 1991, 2200 h. A. L. Markezich and O. J. León. Verified by T. Horger. MCNG 1603. This is only the second report of this species in west central Venezuela, ca. 170 km ENE of nearest record from Edo. Mérida (Wilson and Mena 1980).

Elapidae

Micrurus isozonus. PORTUGUESA: Municipio Guanare: UNELLEZ campus. 28 November 1983. B. Busto and C. Ramo. Verified by D.C. Taphorn. MCNG 725; Municipio Ospino: Esparanza, 10.6 km (road) N of intersection with road to Estación, 9°27'27"N, 69°30'49"W, 780 m elev. 10 May 1998, 0900 h. Verified by T. Horger. A. L. Markezich and O. J. León. MCNG 1610. These specimens extend the range of this species in Portuguesa ca. 65 km SSW of nearest known record from Aparición (Roze 1966).

Micrurus mipartitus. PORTUGUESA: Municipio Monseñor José Vicente de Unda: Chabasquen, Cerro Mollejon. 30 November1983. B. Busto and C. Ramo. Verified by P. Pacheco. MCNG 776; Municipio Sucre: Biscucuy. 1989. A. Mejias. Verified by T. Horger. MCNG 1344. First records from Portuguesa filling a range gap of ca. 300 km between previous records from Edo. Yaracuy and Edo. Mérida (Roze 1966, 1996).

Leptotyphlopidae

Leptotyphlops albifrons. LARA: Municipio Iribarren: Barquisimeto. 31 March 1979. B. Bockma. MCNG 834; PORTUGUESA: Municipio Guanare: Guanare. 31 May 1979. No collector listed in catalogue. MCNG 833. Both specimens verified by J. R. Dixon. First record from west central Venezuela, ca. 250 km SSW of nearest record from Edo. Falcón (Roze 1966).

Leptotyphlops macroplepis. PORTUGUESA: Municipio Guanare: Mesa de Cavacas. 9 September 1990. J. L. Atuve. Verified by J. R. Dixon. MCNG 1124. This specimen extends the range of this species in Portuguesa 65 km SSW of the nearest record from Aparición in this state (Roze 1966).

Typhlopidae

Typhlops reticulatus. BARINAS: Municipio Antonio Jose de Sucre: Socopo. 22 March 1981. E. La Marca. MCNG 943. Verified by P. Pacheco; PORTUGUESA: Municipio Papelón: 5 km (road) SE Papelón, Finca Palma Sola, 8°42'18"N, 69°13'02"W, 70 m elev. 28 April 1998. O. Castillo. Verified by T.H. Horger. MCNG 1604. First record from Barinas and a range extension of 80 km S of a recently reported specimen from Acarigua in Portuguesa (Rivas et al. 2001). This species has seldom been recorded from Venezuela, and these specimens represent the second and third ones from the upper llanos of western Venezuela (Dixon and Hendricks 1979).

Viperidae

Bothrops venezuelensis. PORTUGUESA: Municipio Monseñor José Vicente de Unda: Chabasquen, Cerro Mollejon. 29 February 1984. B. Busto and C. Ramo. Verified by P. Pacheco. MCNG 874. First record from Portuguesa. Campbell and Lamar (1989) pointed out conflicts in the literature with respect to the geographic distribution of this species and listed several states in Venezuela from which it is reliably known including Lara, adjacent to Portuguesa, without mentioning specific localities. A specific record from Lara was recently reported (Esqueda and La Marca 1999) from a locality ca. 30 km NE of the specimen from Portuguesa recorded here.

Crotalus durissus. PORTUGUESA: Municipio Guanarito: Palmar de Morrones. 31 January 1983. B. Busto and C. Ramo. Verified by P. Pacheco. MCNG 735. First record from Portuguesa ca. 150 km SW of nearest record from Edo. Trujillo (Roze 1966).

Gekkonidae

Gonatodes vittatus. PORTUGUESA: Municipio Monseñor José Vicente de Unda: Paraiso de Chabasquen, 9°25'56"N, 69°56'48"W, elevation 590 m. 22 April 1998, 1530 h. A. L. Markezich. Verified by T. Horger. MCNG 1605. First record from Portuguesa, ca. 125 km

NE of records from Edo. Mérida (Rivero-Blanco 1979).

Hemidactylus palaichthus. BARINAS: Municipio Bolivar: Barinitas, 8°45'21"N, 70°24'48"W, 440 m. 18 May 1998, 1030–1200 h. A. L. Markezich and O. J. León. Verified by T. Horger. MCNG 1613; PORTUGUESA: Municipio Guanare: Barrio La Arenosa, Guanare. 19 June 1981. H. Cuevas. Verified by A. Bauer and T. Russell. MCNG 417; Municipio Guanarito: Palmar de Morrones. 21 November 1983. B. Busto and C. Ramo. Verified by A. Bauer and T. Russell. MCNG 676. First records from west central Venezuela, ca. 150 km WNW and 130 km NNW of nearest records from near Bruzual, Edo. Apure (Staton and Dixon 1977).

Phyllodactylus ventralis. PORTUGUESA: Municipio Guanare: La Colonia, 9°03'19"N, 69°48'58"W. 2 November 1987. D.C. Taphorn. MCNG 1127; Municipio Guanare: Guanare. 19 July 1983. B. Busto and C. Ramo. MCNG 674; Municipio San Genaro de Boconoito: represa del Rio Boconó. 22 November 1982. B. Busto and C. Ramo. MCNG 401. All specimens verified by P. Pacheco. These specimens extend the range 50–80 km SW of nearest records from the Acarigua and Aparición areas of northern Portuguesa (Dixon and Huey 1970).

Iguanidae

Iguana iguana. PORTUGUESA: Municipio Guanarito: Guanarito. 6 July 1980. B. Bockma and C. Ramos. MCNG 48; Municipio Guanare: Guanare, Barrio Colombia, 26 June 1983. Y. Hernandes. MCNG 442. All specimens verified by P. Pacheco. While it is generally recognized that this species occurs in much of Venezuela, documented records are scarce (Avila-Peres 1995). This is apparently the first record of it from west central Venezuela, 130 km NNW of records near Bruzual, Edo. Apure (Staton and Dixon 1977).

Polychrotidae

Anolis auratus. PORTUGUESA: Municipio Guanare: Guanare, Urb. Hato Modelo. 17 March 1980. B. Bockma and C. Ramo. MCNG 22; Municipio Guanare: UNELLEZ, Mesa de Cavacas. 6 September 1983. B. Bockma and C. Ramo MCNG 853. All specimens verified by E. E. Williams. First records from Portuguesa, 80 km S of nearest record from Edo. Barinas (Avila-Peres 1995; Donoso-Barros 1968).

Anolis nitens nitens. PORTUGUESA: Municipio Guanare: Mesa de Cavacas. 22 April 1980. MCNG 802; Municipio San Genaro de Boconoito: Rio Tucupido, arriba represa. 8 April 1983. MCNG 800. Both specimens collected by B. Busto and C. Ramo and verified by E. E. Williams. First records from Portuguesa, ca. 200 km SW of nearest records from Edo. Yaracuy (Vanzolini and Williams 1970).

Polychrus marmoratus. PORTUGUESA: Municipio Guanare: UNELLEZ campus. 20 June 1991. M. Gonzalez. Verified by P. Pacheco. MCNG 1357. First record from west central Venezuela, ca. 250 km SE of nearest record from Edo. Carabobo (Avila-Peres 1995).

Tropiduridae

Tropidurus hispidus. BARINAS: Municipio Rojas: Hato San Pancracia, Sta. Rosa. 27 November 1983. B. Busto and C. Ramo. MCNG 651; PORTUGUESA: Municipio Guanare: Fundo Sabana Grande, Tucupido. 26 June 1983. B. Busto and C. Ramo. MCNG 649; Municipio Guanare: Guanare. 15 May 1982. C. A. Rodriguez. MCNG 647; Municipio Guanarito: El Palmar de Morrones, Guanarito. 21 November 1983. MCNG 657. All specimens verified by P. Pacheco. First records from Portuguesa. The Portuguesa records are 80 km NNE and the Barinas records 80 km E of nearest record from Barinas in Edo. Barinas (Avila-Peres 1995; Donoso-Barros 1968).

Teiidae

Ameiva ameiva. PORTUGUESA: Municipio Guanare: Fundo Sabana Grande, Tucupido. 26 June 1983. MCNG 620; Municipio Guanare: La Colonia. 17 June 1984. MCNG 793; Municipio Guanarito: Guanarito. 21 November 1983. MCNG 588. All specimens collected by B. Busto and C. Ramo and verified by P. Pacheco. First records from Portuguesa, ca. 80 km NNE of nearest record from Barinas in Edo. Barinas (Avila-Peres 1995; Donoso-Barros 1968).

Cnemidophorus gramivagus. BARINAS: Municipio Sosa: Puerto de Nutrias, just E of lower portion of Rio Apure bridge. 22 June 1996, 1800–1900 h. A. L. Markezich and O. J. León. Verified by C. J. Cole. MCNG 1606; PORTUGUESA: Municipio Guanare: Urb. Fundaguanare, Guanare. 23 April 1981. C. Briceno. Verified by T. Horger. MCNG 328; Municipio Guanarito: 9.7 km (road) SW Guanarito. 21 June 1996, 1800–1900 h. A. L. Markezich and O. J. León. Verified by C. J. Cole. MCNG 1607. First records from Barinas and Portuguesa and previously known only from Edo. Apure in Venezuela. These specimens extend the range ca. 150 km NNW of nearest Apure record (McCrystal and Dixon 1987).

Tupinambis teguixin. PORTUGUESA: Municipio Guanare: La Colonia. 17 June 1984. B. Busto and C. Ramo. Verified by P. Pacheco. MCNG 796. First record of this species from Portuguesa, ca. 130 km NNW of nearest record from Edo. Barinas (Donoso-Barros 1968).

Gymnophthalmidae

Bachia heteropa lineata. PORTUGUESA: Municipio San Genaro de Boconoito: Rio Tucupido, arriba represa. 2 February 1983. B. Busto and C. Ramo. Verified by J. R. Dixon. MCNG 750. First record from Portuguesa, extending the range (distance undetermined) N of record from western Edo. Barinas (Dixon 1973).

Gymnophthalmus speciosus. PORTUGUESA: Municipio Guanare: La Colonia. 19 December 1990. A. L. Markezich and D. C. Taphorn. Verified by C. J. Cole. MCNG 1249; UNELLEZ campus. 18 March 1985. R. Thourex. Verified by P. Pacheco. MCNG 1316. Specimens extend range 90 km S of nearest record from the Acarigua area of Portuguesa (Cole et al. 1990).

Amphisbaenidae

Amphisbaena alba. BARINAS: Municipio Ezequiel Zamora: Pedraza. 25 April 1981. E. La Marca. MCNG 860; LARA: Municipio Urdaneta: 12 km (road) W Santa Inés. 27 November 1990. A. L. Markezich. MCNG 1128; PORTUGUESA: Municipio Guanare: Colonia. 21 November 1990. A. L. Markezich. MCNG 1115; Municipio Sucre: Biscucuy. 20 August 1983. B. Busto and C. Ramo. MCNG 553. All specimens verified by P. Pacheco and D. C. Taphorn. First records from these three states in west central Venezuela representing distances of ca. 225 km SSW, 150 km NE, and 80 km SE of nearest record from Edo. Trujillo in this region

(Donoso-Barros 1968; Esqueda and La Marca 1999; Gans 1962). *Amphisbaena fulginosa*. PORTUGUESA: Municipio Sucre: 4 km (road) N Las Guafas on Guanare-Biscucuy Rd. 21 November 1990, 1500 h. A. L. Markezich and O. J. León. Verified by D. C. Taphorn. MCNG 1116. First record of this species in west central Venezuela, ca. 250 km SE of nearest records from Edo. Falcón (Donoso-Barros 1968; Vanzolini 1951).

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Noteworthy Records for Introduced Reptiles and Amphibians from Florida, USA

JOSIAH H. TOWNSEND
KENNETH L. KRYSKO
ANTHONY T. REPPAS
and
COLEMAN M. SHEEHY III
Florida Museum of Natural History, Division of Herpetology
University of Florida, Gainesville, Florida 32611, USA
e-mail (JHT): joetownsend@earthlink.net

Florida is well known for its non–native herpetofauna (King and Krakauer 1966; Wilson and Porras 1983). The substantial trade in exotic plants and animals and the humid subtropical environment in Florida have been instrumental in perpetuating populations of exotics.

From May 2000 through March 2001, we surveyed areas in Florida where introduced species have been reported and other areas that contained suitable habitat. We utilized a variety of diurnal capture methods including blowguns with corks, fishing rods with barbless hooks (Krysko 2000) and nooses (Strong et al. 1993). In nocturnal situations we searched areas around houses and buildings. Representative voucher specimens were deposited in the Florida Museum of Natural History (FLMNH), Gainesville, Florida. Additionally three new county records were kindly provided by the California Academy of Science (CAS). All of the following records were collected by the authors unless otherwise noted.

Anura

Osteopilus septentrionalis (Cuban Treefrog). HERNANDO Co: Brooksville, North Avenue. 21 June 1995. CAS 199808–10. Collected by P. G. Frank. First county record.

Testudines

Trachemys scripta elegans (Red-eared Slider). VOLUSIA Co: South Daytona, Reed Canal Park. 25 November 2000. UF 122517. These turtles are the most commonly observed species in area ponds and canals, and additional specimens of adults and juveniles were collected 17 March 2001 (UF 122784–6) and 24 June 2001 (UF 124767–8).

Lacertilia

Anolis cybotes (Largehead Anole). MIAMI-DADE Co: Key Biscayne, near the grounds of the old Crandon Park Zoo. 17 December 2000. UF 121416 and 121450. Previously only known from a limited area in northeastern Miami-Dade County (Ober 1973; Wilson and Porras 1983).

Anolis sagrei (Brown Anole). LEE Co: Gasparilla Island (26°42'371"N, 82°16'360"W). 21 December 2000. UF 121462–63. First record from Gasparilla Island. These lizards are common on Gasparilla Island and have likely been established there for some time. GILCHRIST Co: Fanning Springs, Rt. 19, across from entrance to Fanning Springs State Recreation Area. 3 March 2001. UF 122516. New county record. LEVY Co: Chiefland, 1285 Highway 19. 3 March 2001. UF 122515. New county record. MARTIN Co: Lake Okeechobee, jct. CR 71 and US 441. 2 March 2001. UF 122463. New county record. Found in Australian pine tree (*Casuarina equisetifolia*) stand. This record fills a gap in distributional records between St. Lucie and Palm Beach counties. *Anolis sagrei* has now been collected in all 12 Atlantic coastal counties. TAYLOR Co: Econfina River State Park (30°03'31.9"N, 83°54'23.8"W). 20 April 2000. CAS 214327. Collected by R. Lawson, P. G. Frank, N. Frank, and J. Frank. New county record.

Hemidactylus garnotii (Indo-pacific Gecko). CHARLOTTE Co: Gasparilla Island (26°47'677"N, 82°16'706"W). 21 December 2000. UF 121506. New county record. Found under bark of *Casuarina equisetifolia.*

Hemidactylus mabouia (Tropical Gecko). LEE Co: Gasparilla Island (26°42'371"N, 82°16'360"W). 21 December 2000. UF 121464 and 121468–502. New county record. Found in debris and under the bark of *Casuarina equisetifolia.*

Hemidactylus turcicus (Mediterranean Gecko). CITRUS Co: Inverness, Withlacoochee Walking Trail (28°50'16.9"N, 82°19'47.3"W). 2 October 1999. CAS 210987. Collected by R. Lawson, P. G. Frank. New county record.

Iguana iguana (Green Iguana). BROWARD Co: Davie, SW 76 Avenue, 0.4 mi S Griffin Road. 25 March 2001. UF 123126. Davie, Taft Street, 100 yards W of NW 85th Way. UF 123127. 25 March 2001. Both collected by S. B. Thompson. New county record.

Leiocephalus schreibersi (Red–sided Curlytail Lizard). BROWARD Co: Hollywood, 5920 Thomas Street. 16 December 2000. UF 121397–99. New county record.

Serpentes

Ramphotyphlops braminus (Brahminy Blind Snake). ALACHUA Co: Gainesville, 1700 SW 23rd Drive. 17 March 1998. (UF 111650). Collected by Calvin Teele. New county record. Collected from under debris at USDA Laboratory.

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BOOK REVIEWS

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Reptiles & Amphibians of the Smokies, by Stephen G. Tilley and James E. Huheey. 2001. Great Smoky Mountains Natural History Association, Gatlinburg, Tennessee. vii + 143 pp. Softcover. US $9.95. Available from Great Smoky Mountains Natural History Association, 115 Park Headquarters Road, Gatlinburg, Tennessee 37738, USA.

C. KENNETH DODD, JR.
Florida Caribbean Science Center, U.S. Geological Survey
7920 N.W. 71st Street, Gainesville, Florida 32653, USA
e-mail: ken_dodd@usgs.gov



The Great Smoky Mountains are an important center of herpetofaunal diversity, especially for amphibians. With more than 40 species of amphibians and 35 species of reptiles, Great Smoky Mountains National Park, the focus of this short, descriptive guide, is also the most visited national park in the United States. Through the years, the Great Smoky Mountains Natural History Association has produced a number of pocket-sized field guides (e.g., on birds and trees) which allow visitors to quickly identify the fauna and flora of the park. *Reptiles & Amphibians of the Smokies* is the latest in this series of guidebooks. The audience for which it is written is the casual visitor who has some interest in amphibians and reptiles, and may wish to identify animals observed during a visit to the park. It does not present detailed information on the natural history of the herpetofauna specifically pertaining to the park, such as contained in Huheey and Stupka's (1967) long outdated, but still very informative, book, and it does not purport to be a regional field guide.

The book is organized into basically two parts. The first part contains an introduction on how to use the book, sections on amphibian and reptile diversity within the park, notes on life histories and interesting facts about the biology of amphibians and reptiles, and several pages each on the ecological and geological settings of the Great Smokies and the need for the preservation of biodiversity. The style of writing and the information content is extremely basic, that is, for the non-biological public, and the authors have done a fine job of presenting information in a very readable and non-technical format. I found little to quibble with in this section, but there are a few inconsistencies.

The authors state that 12 anurans are found in the park on p. 21, but include 13 species accounts and use the figure 13 elsewhere in the book. Actually, both figures are correct in a sense. Whereas 13 species have been reported from the park, *Acris crepitans* probably never occurred within its boundaries despite its inclusion in previous checklists (e.g., Huheey and Stupka 1967). The authors use the spelling Pygmy in some places, but Pigmy (e.g., for the Pigmy Salamander) elsewhere. I would quibble with a few statements here and there, such as that Four-toed Salamanders are uncommon "even where they do occur;" actually, this species can be found in good numbers at certain times of the year and at specific localities. Such minor criticisms are few, however, and do not detract from the book's purpose to inform the general public.

The second part of the book (84 pp) is composed of species accounts: 30 salamanders, 13 frogs, 7 turtles (plus one miscellaneous "other turtles" account), 8 lizards (*Eumeces fasciatus* and *E. inexpectatus* are treated in a single account), and 23 snakes. Although the Green Salamander (*Aneides aeneus*) is known historically from the park, its status is discussed only in the introduction and not in a specific species account. One page is devoted to each account, and about half the page consists of a beautiful full-color photograph. Although not stated explicitly, the animals photographed did not necessarily originate from the park, as the authors used generic photos at least for the rare or recently discovered species. The remainder of the account consists of the briefest of descriptions, information on habitat and life history, and similar species. Space limitations preclude much detail, but the general information provided probably is enough for a casual park visitor.

After conducting intensive surveys in the Great Smokies during the last four years, I can find a number of statements in the species accounts with which I disagree. For example, Hellbenders have been found in Deep Creek and Oconaluftee River, despite the authors' assertion that there are no recent records outside of Little River; Eastern Painted Turtles no longer occur in Gum Swamp (no sightings in four years or more, despite intensive surveys); Northern Map Turtles occur at least to the vicinity of the Abrams Creek Ranger Station, not just near the mouth of Abrams Creek; the Mud Salamander in the park is clearly not the Midland Mud Salamander (*Pseudotriton montanus diastictus*). What really disturbs me, however, are the data presented for the first time without attribution: the first report of Stinkpots from the park (although there are no specimens or photographs of the actual turtle found); the data on current distribution of Seepage and Junaluska Salamanders; the sighting at Abrams Creek of *Rana sphenocephala* in 2000. This information was collected by U.S.G.S. survey crews, not the authors, and is contained in reports to the park. Although public information, it would have been nice to acknowledge the source, and the potential biases, of the data. As it stands, a reader is left with the impression that the information results solely from the authors' observations. New records or sightings of species thought extirpated from public lands should be properly reported in the published, including popular, literature only when accompanied by specimens or unequivocal photographs.

Despite these criticisms, the book fulfills the goals of the Great Smoky Mountains Natural History Association to provide the layman with a generally high-quality and technically accurate overview of the amphibians and reptiles of the Great Smoky Mountains National Park. The color plates, in particular, are certain to pique interest and appreciation of the diverse herpetofauna. The

price is reasonable. However, professional biologists should delve deeper into the origin of distributional and life history information relating to the amphibians and reptiles of the park, and verify the accuracy of records and observations. What really is needed for the Smokies, and indeed for all major national parks, is a field guide of the quality of Koch and Peterson's (1995) guide to the amphibians and reptiles of Yellowstone and Grand Tetons national parks.

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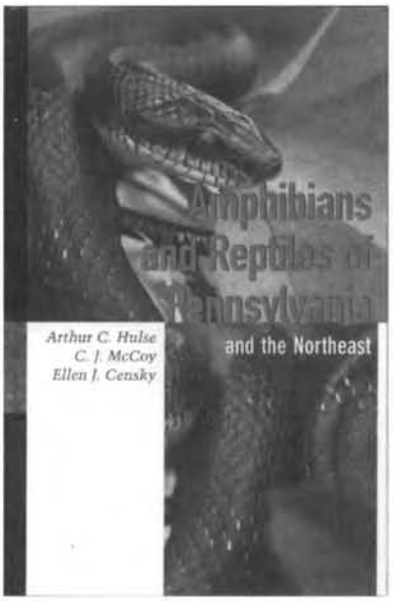
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Amphibians and Reptiles of Pennsylvania and the Northeast, by Arthur C. Hulse, C. J. McCoy, and Ellen J. Censky. 2001. Cornell University Press, Ithaca, New York. xi + 419 pp, Hardcover, US $39.95. ISBN 0-8014-3768-7.

JOHN J. MORIARTY
Ramsey County Parks, 2015 North Van Dyke Street
Maplewood, Minnesota 55109, USA
e-mail: john.moriarty@co.ramsey.mn.us



Amphibians and Reptiles of Pennsylvania and the Northeast is the first complete treatment of the amphibians and reptiles in the state. McCoy (1982) provided excellent maps, and a bibliography, but did not report on the ecology, natural history and conservation. The classic accounts by Surface (1906, 1907, 1908, 1913) did not include all the species and were limited to the knowledge of the day.

This book covers the 76 species found in Pennsylvania, plus nine additional species found in other northeastern states. A checklist of the species by state is not included. This would be a helpful tool. The one group not covered, or even mentioned, is the sea turtles. Sea turtles are covered in recent works on Connecticut (Klemens 1993), Maine (Hunter et al. 1999), and New York (Breisch et al. 1998).

Amphibians and Reptiles of Pennsylvania and the Northeast consists of an introduction, amphibian accounts, reptile accounts, and appendices. The Introduction includes good information on the landforms, climate, and vegetation of Pennsylvania. Information on the other northeastern states is general, and lacks the detail provided for Pennsylvania. There are numerous times when the authors mention a particular county in the state to highlight their description. Unfortunately, there is NO map of the state showing the names of the counties. This oversight makes it difficult to follow the information in the introduction and throughout the book. A map placed on the inside front cover would be a nice addition when this book is reprinted.

Species accounts include a Description, Confusing Species, Habitat and Habits, Reproduction, Remarks, and Distribution, along with a map, and are complete for most species. However, the section headings are in the same font and style as the text, making it difficult to quickly locate specific information.

I found the Distribution section troubling, in part because of the absence of a state map for reference. The range maps were a disappointment, as they cover the northeastern states only with a general indication of range, largely derived from the maps of Conant and Collins (1991). However, the maps for Pennsylvania show county lines and contain point locality data of several types. Unfortunately, the Pennsylvania map is so small it is hard to make out the symbols. I would have preferred a larger Pennsylvania map, as this is the main area of the book, with a smaller inset map depicting the northeast region.

Moreover, the maps for areas outside of Pennsylvania could have been rendered more accurate if the authors had consulted various state and regional works. For several species, the ranges depicted are much larger than known distributions (e.g., Eastern Spadefoot, Eastern Box Turtle, Red-bellied Snake, Timber Rattlesnake).

A highlight of many of the newer state works has been the inclusion of high quality photographs. One of the best is *The Amphibians and Reptiles of Missouri* (Johnson 2000), in which the photos are positioned with the species accounts. I realize that it is more expensive to place the photos throughout the book, rather than in one signature, but it makes for a more user-friendly book. There are many nice photos in this book, but unfortunately there are just as many that are too small. Two examples are photos 3 and 33, which if properly cropped would be more effective. Although I was pleased to see photographs of salamander larvae, those for tadpoles were missing.

The only species account that fell short of the mark was that for the gray treefrogs (*Hyla chrysoscelis* and *H. versicolor*), combined into a single account, despite different habitat requirements and behaviors (Oldfield and Moriarty 1994; Vogt 1981). *Hyla chrysoscelis* is restricted to the southern edge of Pennsylvania and not found in any of the New England states or New York (Breisch 1998; Hunter et al. 1999; Klemens 1993; Cline, *in press*; Taylor 1993), while *H. versicolor* is the dominant species in these areas. These species should have separate accounts as was done for *Ambystoma laterale* and *A. jeffersonianum*.

The Mensural and Reproductive Data tables should have been incorporated into the species accounts. The appendix seems to have been an academic exercise without a lot of practical application. The Glossary covers most of the technical and specialized terms and is well organized. The Literature Cited is extensive, and although not a complete bibliography to Pennsylvania herpetology, it comes close.

Amphibians and Reptiles of Pennsylvania and the Northeast does

a very good job on Pennsylvania, but not the northeast. All measurements and ecological observations pertain to Pennsylvania specimens. It seems as if the other northeastern states were an afterthought, quickly tacked on the original manuscript. I recommend this book for anyone interested in or working on Pennsylvania reptiles and amphibians. For those interested in other northeastern states check out Klemens (1993) for Connecticut, Rhode Island, and southern Massachusetts; Hunter et al. (1999) for Maine and adjacent New Hampshire; and Breisch (in prep.) for New York.

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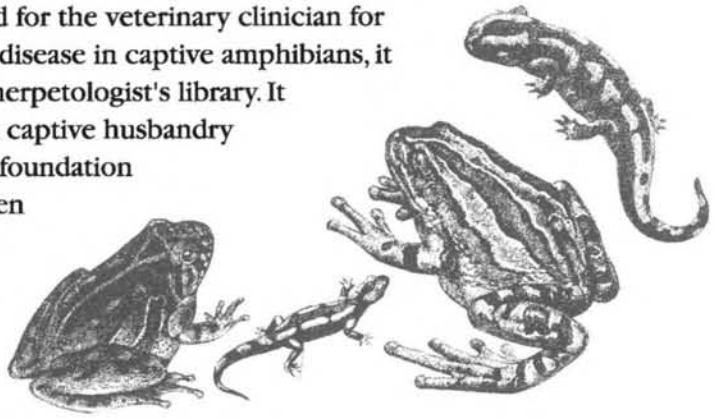
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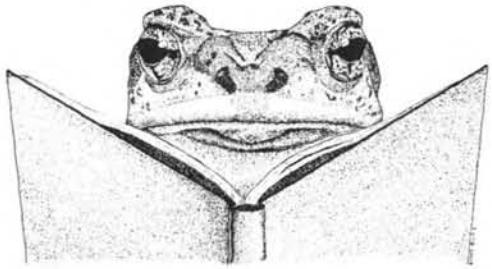
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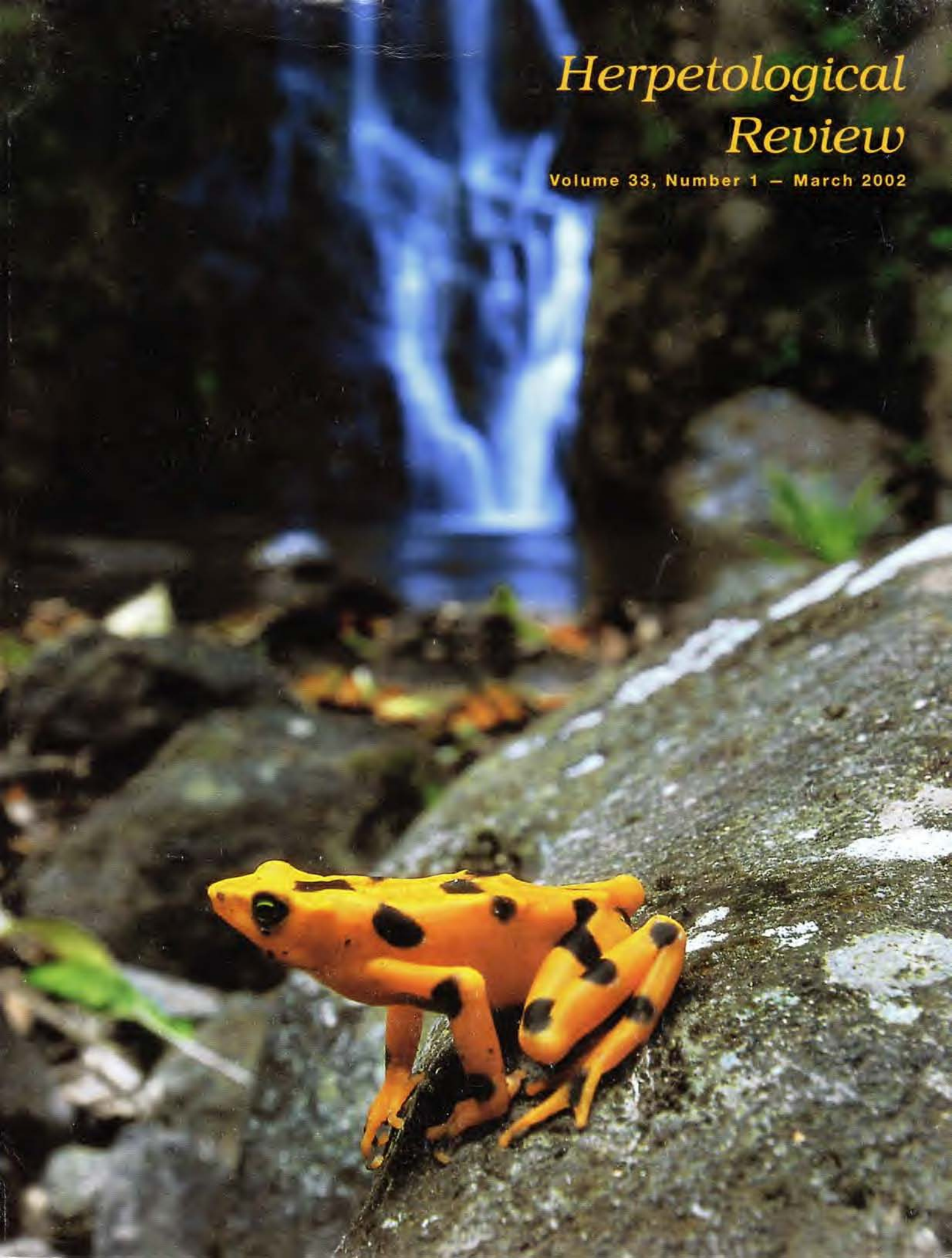
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Humboldt State University
sbm1@axe.humboldt.edu

GUNTHER KÖHLER
Forschungsinstitut und
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gkoehler@sng.uni-frankfurt.de

DARYL R. KARNS
Hanover College
karns@hanover.edu

PAUL A. STONE
University of Central Oklahoma
pstone@ucok.edu

DEANNA H. OLSON
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dede.olson@orst.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
aaron.bauer@villanova.edu

Geographic Distribution
ALAN M. RICHMOND
Biology Department, Morrill IV South
University of Massachusetts
611 North Pleasant Street
Amherst, Massachusetts 01003-9297, USA
alanr@bio.umass.edu

Geographic Distribution
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Instituto de Herpetología
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Geographic Distribution
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Zoo View
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jjohnson@utep.edu

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BRIAN P. BUTTERFIELD
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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

www.ukans.edu/~ssar



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2002 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Theodora Pinou, SSAR Treasurer, Department of Ecology & Evolutionary Biology, Osborn Memorial Labs, Yale University, 165 Prospect Street, New Haven, Connecticut 06520-8106, USA. Fax: (203) 432-5176; e-mail: theodora.pinou@yale.edu

Future Annual Meetings

2002 — Crown Center Hotel, Kansas City, Missouri, USA. 3–8 July (with ASIH, HL)
2003 — Hotel Tropical, Manaus, Brazil (with ASIH, HL)
2004 — University of Oklahoma, Norman, Oklahoma (with ASIH, HL)

Society for the Study of Amphibians and Reptiles
2002 Annual Meeting
together with
The Herpetologists' League
and
American Society of Ichthyologists and Herpetologists

3 – 8 July 2002
The Westin Crown Center Hotel
Kansas City, Missouri, USA

Keynote Address: "In and Across the Deep Blue Sea: Ages of Seaturtles and Dispersal of Oceania Lizards," by George Zug (Smithsonian Institution), The Herpetologists' League Distinguished Herpetologist for 2002.

SSAR Presidential Travelogues: "Between Rain Forest and Desert: Herpetofaunal Travels in West and Central Africa," by Prof. Dr. Wolfgang Böhme (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany); "Travels in Kenya: Pondscape with Frog," Prof. Dr. David M. Green (Redpath Museum, McGill University, Montreal, Quebec, Canada).

Symposium: "Contemporary Herpetological Research: A Tribute to Robert Jaeger as 20-year Editor of *Herpetologica*." *Organizers:* Susan C. Walls, U.S. Geological Survey (susan_walls@usgs.gov) and Sharon E. Wise, Stephens College (swise@wc.stephens.edu).

Symposium: "Ecology and Evolution of Phytotelmic Anurans." *Organizer*: Richard Lehtinen, University of Michigan (rmlehtin@umich.edu).

Symposium: "Mixing Faunas: An Overview of Introduced Non-Indigenous Fishes, Amphibians, and Reptiles." *Organizer:* Walter Courtenay, Florida Atlantic University (courtenw@fau.edu).

Special Presentation to Commemorate The Herpetologists' League 50th Anniversary: "Phylogenetic Relationships, Behavioral Oddities, and Paedomorphic Tendencies Among the First Half Century of HL Herpetologists," by Whit Gibbons, Savannah River Ecology Laboratory (gibbons@srel.edu).

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day throughout the conference.

SSAR Student Travel Awards: Awards of US $200 each are available. An applicant must be a student and a member of SSAR. Refer to page 210 of the December 2001 issue of *HR* for details.

Student Paper Awards: Henri Seibert prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the official Meeting Announcement for details and to *HR* 28(4):175 for recommendations to students entering the Seibert competition.

Social Activities: General Reception in the Century Ballroom, SSAR Herp Silent Auction, Graduate Student Reception, Saturday night Barbecue Dinner at historic Union Station Plaza, Graduate Student Reprint & Book Scavenge, SSAR/HL Auction, Joint Meeting Banquet.

HL Graduate Student Workshop: "Publishing in Scientific Journals: Process, Do's and Don'ts" (Tom Jenssen and Ken Dodd).

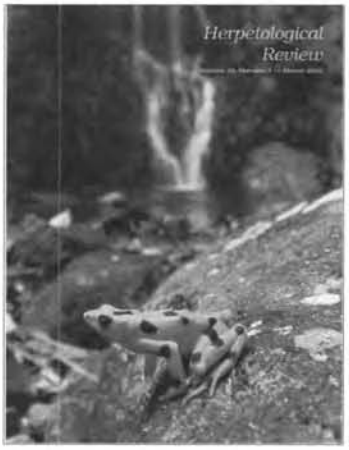
Multimedia Presentations: "Amphibians of the Appalachians," and "Herpetology of the West," by David Dennis and Eric Juterbock.

Costs: Preregistration US $285 regular, US $175 student, US $110 accompanying person. After May 3, 2002, costs are US $325, US $225 student. Online registration available at: <www.dce.ksu.edu/dce/cl/2002jointmeeting/>

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Further Details: The Meeting Announcement/Call for Papers was mailed to all members of SSAR, HL, and ASIH in January. It is also available as a PDF file at <www.dce.ksu.edu/dce/cl/2002jointmeeting/>. Anyone unable to download the PDF file may contact Henry Mushinsky, Department of Biology, University of South Florida, Tampa, Florida 33620-5150, USA; Tel. 813/974-5218, fax 813/974-3263; e-mail: Mushinsk@chuma1.cas.usf.edu.

About Our Cover: *Atelopus zeteki*



The endangered Panamanian Golden Frog (*Atelopus zeteki*) is restricted to streams along montane slopes of the Central Cordilleran cloud forests of western-central Panama (Lindquist & Hetherington 1998. Herpetologica 54:370–376). "Project Golden Frog" is the featured subject of a new section—"Zoo View"—making its debut in this issue of *HR* (see pages 10–12). Aside from its considerable conservation interest, *A. zeteki* plays an important cultural role in the lives of Panamanian people. Pre-Columbian indigenous people revered Golden Frogs and crafted gold and clay talismans in a variety of forms (frogs, people, jaguars) known to contemporary Panamanians as huacas/huacos. These ancient objects are sought by amateur archaeologists ("huaqueros"), and in turn are often sold to collectors for very high prices. Replicas are commonly found in jewelry stores in Panama. Local legend holds that chieftains of the Guaymí tribe would ascend the Pacific slope to the mountains of Gaital, Pajita, and Caracoral (in El Valle de Antón) annually as a sacred rite. This legend and others evolved into the myth that the Golden Frog would transform into gold huacas upon death. Hence, anyone seeing or possessing the frog alive would have good fortune visited upon them. Despite its status as a national symbol in modern Panama, few Panamanians have ever seen these frogs. Golden Frogs grace everything from t-shirts to lottery tickets. The above information is taken from the Project Golden Frog web site (http://ranadorada.org).

The genus *Atelopus* contains about 67 species, collectively known as "harlequin frogs." Although *A. zeteki* was originally described by Dunn (1933. Occas. Pap. Boston Soc. Nat. Hist. 8:65–79) as a subspecies of the highly variable *A. varius*, later study of skin toxins (Brown et al. 1977. Toxicon 15:115–128) and male vocalizations (Cocroft et al. 1990. Copeia 1990:631–643) supported recognition as a distinct species.

Lindquist and Hetherington (*op. cit.*) have provided evidence to support the hypothesis that coloration and behavior of juveniles is correlated with the absence of toxic skin compounds. Metamorphs and juveniles are cryptically colored, their dark green and dark brown to black dorsal markings closely matching their mossy boulder habitat. Adults are brightly marked—either uniformly yellow, or yellow with black bands or spots (as in the frog on our cover). This ontogenetic change in coloration—from cryptically-colored juveniles to gaudy, aposematic adults—is apparently accompanied by acquisition of highly toxic skin compounds, presumably the product of either dietary or symbiotic bacterial uptake (Daly et al. 1997. Toxicon 35:705–709). Further, non-toxic juveniles are secretive, while the conspicuously marked adults are diurnal, commonly observed in the open (Cocroft et al., *op. cit.*).



Our cover image was taken by **Guido Sterkendries**, one of Belgium's finest wildlife photographers. The adult frog was observed at one of the Project Golden Frog study sites east of El Valle de Anton, Panama. Sterkendries captured this image under natural light, using a Nikon F5 with a 17–35mm Nikor lens and Fuji Provia film (100 ASA). Because he wanted to show the frog in its native habitat, he used an aperture setting of f.8, which allowed the frog to be the main subject. Additional images of frogs and other subjects may be viewed at <www.sterkendries.com>. Separation and imaging of Sterkendries' photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

SSAR Election Results

Results of the recent SSAR election are as follows:

Secretary ..... John Matter (unopposed).
Treasurer ..... Theodora Pinou (unopposed).
Board of Directors (Class of 2004) .....
..... Joseph R. Mendelson and Gabriela Parra Olea.

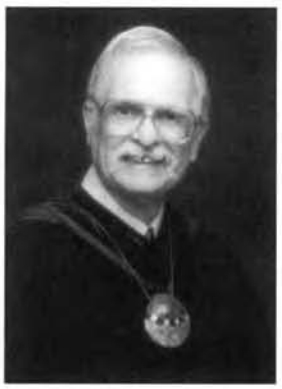
HR Staff Changes

Recent changes to the editorial staff of *Herpetological Review* include the "retirements" of Joseph T. Collins (Section Editor, Geographic Distribution), Brian Hauge (Section Editor, Natural History Notes), Adam Summers (Associate Editor), Jennifer Pramuk (Copy Editor), Winston Card (Section Editor, Herpetological Husbandry), Jennifer Garrison (Section Editor, Current Research), and Travis Ryan (Section Editor, Legislation & Conservation). Collins' twelve-year tenure as Section Editor is especially noteworthy; in addition to this most recent tour of duty, Joe previously served as *HR* Editor and in various other capacities for SSAR. On behalf of the SSAR Board, the editors thank these folks for outstanding service to their colleagues and wish them well in future endeavors.

Joining the editorial team during 2001–2002 are Omar Torres-Carvajal (Current Research), Marc Hayes (Section Editor, Natural History Notes), Alan Richmond (Geographic Distribution), Robert Espinoza (Associate Editor), Ruston Hartdegen (Herpetological Husbandry), and Hugo Alamillo (Copy Editor).

NEWSNOTES

Carr Medal Awarded to Jay Savage



In late October 2001, the Florida Museum of Natural History presented the Archie F. Carr Medal to Jay M. Savage. The Carr Medal recognizes outstanding national and international contributions to the knowledge, understanding, and appreciation of our natural heritage. The award was named in honor of the late Archie Carr, University of Florida zoology professor and world authority on sea turtles. Recipients are chosen by a seven-member jury appointed by the director of the Museum. In conjunction with the award, Savage gave a public lecture, entitled "Le Sacre Du Printemps or Why Archie Always Liked Frogs."

As noted in the press release associated with this award, Savage is one of the world's leading herpetologists, field biologists, and

tropical conservationists. His 50-year career has added enormously to our knowledge of the classification and biogeography of amphibians and reptiles. His contributions are reflected in many ways, including a long list of important publications, and no fewer than 15 species of vertebrates named "*savagei*" in his honor by other biologists. A respected teacher and administrator, he has played a key role in building and supporting many of the most important organizations of present-day evolutionary biology, such as the Organization for Tropical Studies and the Society of Systematic Biologists. Past Carr Medal recipients include Edward O. Wilson, Thomas Eisner, Peter Raven, Jared Diamond, Thomas Lovejoy, and Michael Soulé.

SSAR and the herpetological community congratulate Jay Savage for this high honor.

Herpetological Review, 2002, 33(1), 3–5.
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Fourth World Congress of Herpetology: 3–9 December 2001, Bentota, Sri Lanka

C. KENNETH DODD, JR.
Florida Caribbean Science Center, U.S. Geological Survey, 7920 N.W. 71st Street, Gainesville, Florida 32653, USA
e-mail: ken_dodd@usgs.gov

and

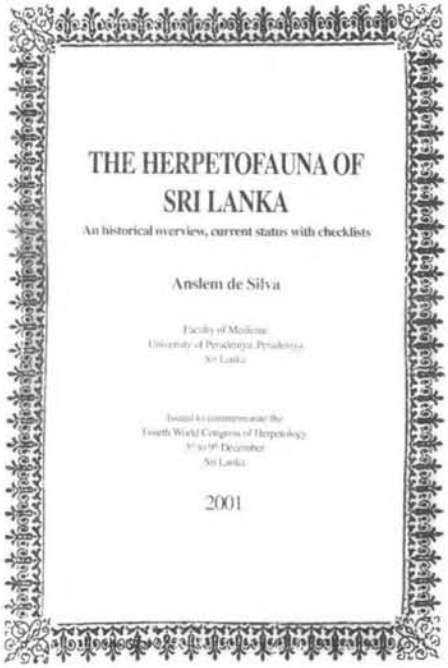
BRECK BARTHOLOMEW
P.O. Box 58355, Salt Lake City, Utah 84158, USA
e-mail: breck@herplit.com

The World Congress of Herpetology held its fourth meeting in December 2001 at the five-star Taj Exotica Hotel Resort at Bentota on the southwestern coast of Sri Lanka. Despite almost insurmountable national and international events that affected scheduling and disrupted travel plans (the Tamil Tiger terrorist attack on Sri Lanka's international airport last summer, the events of September 11 in the United States, and the dissolution of Sri Lanka's parliament and scheduling of national elections on December 5), the Congress convened on schedule in an idyllic tropical beach setting. Approximately 208 delegates from 34 countries (Table 1) attended six days of meetings, followed by a day of field trips to the nearby wetland preserves of Muthurajawela or Madhuganga.



First day cover of four endemic amphibian stamps issued (3 December 2001) to commemorate the Fourth World Congress of Herpetology. Featured are *Philautus femoralis, Rana gracilis, Theloderma schmarda,* and *Polypedates longinasus*.

After the Congress, delegates departed for cultural sites and national parks and preserves around the country. Attendees probably wished for more time to see Sri Lanka's biotic diversity and to enjoy the friendliness of its people.


THE HERPETOFAUNA OF SRI LANKA

An historical overview, current status with checklists

Anslem de Silva

2001

A new book covering the herpetofauna of Sri Lanka, authored by Conference Director Anslem de Silva, was issued to coincide with the meeting.

The purpose of the World Congress of Herpetology (WCH) is to bring together scientists and others, from all parts of the world, interested in the biology of amphibians and reptiles so that ideas and techniques may be exchanged and collaboration fostered. Previous Congresses were held in Canterbury (United Kingdom) in 1989, Adelaide (Australia) in 1993/4, and Prague (Czech Republic) in 1997. As highlights of the Congresses, internationally recognized scientists present plenary lectures featuring state-of-the-art knowledge, both as a retrospective of a distinguished career and as a stimulus for further thought and research. Past Congresses have emphasized plenary speakers and specially organized sessions, with contributed talks and posters given by other researchers as time and space permitted. At the Fourth World Congress, a similar protocol was followed but, due to last-minute changes in travel plans, several sessions and a number of talks had to be canceled. Most papers fell into the contributed category, but only after approval by the WCH Scientific Programme Committee. No more than two concurrent sessions were ongoing during any part of the Congress. Fortunately, the plenary lectures were excellent, and the reduced number of delegates allowed for much discussion and inter-personal interaction.

The Congress opened on the morning of 3 December with a procession featuring Sri Lankan dancers in traditional costumes playing drums, brass rams' horns, and finger cymbals. The procession was followed by the lighting of a ceremonial oil lamp by Congress organizers, visiting dignitaries (including Mrs. Shiranee Yasaratne, IUCN Country Representative for Sri Lanka), and representatives of the Executive Committee (EC). A special 4WCH first day cover and a set of postage stamps featuring four endemic Sri Lanka amphibians were issued, and a presentation was made of a special book on the herpetofauna of Sri Lanka from its author, Anslem de Silva, to Michael Tyler, Secretary General of the WCH. After brief introductions by members of the local committee and Michael Tyler, the Congress began with its first plenary lecture.

There were five plenary lectures: Anita Malhotra (Evolution of Asian vipers); Yehuda Werner (Foraging behavior in gekkonomorph lizards); Wolfgang Wüster (Pit vipers and South



Conference director Anslem de Silva chatting with Frankie Bossuyt.

American biogeography); David Warrell (Current trends in toxinology); Walter Hödl (Visual communication in anurans). Special sessions were held on the frog fauna of south Asia, habitat fragmentation and the conservation of herpetofauna, behavioral and morphological asymmetries, social aggregation in lizards, molecular ecology and evolution in lizards, and applied herpetology. Of special note is the launching of a new journal, *Applied Herpetology*, which will focus on applied or practical research involving amphibians and reptiles, such as methods to reduce the impacts of habitat fragmentation and mitigate threats to herpetofauna, veterinary or medical applications of herpetology, forensic herpetology, and new research and sampling techniques. Interested contributors or subscribers should contact Michael Lambert at the Natural Resources Unit of the University of Greenwich (m.r.k.Lambert@gre.ac.uk).

As might be expected from a Congress held in south Asia, many talks focused on the herpetofaunal diversity of southeast Asia, southern India (especially the eastern and western Ghats), and Sri Lanka. Many New World herpetologists are aware of Neotropical anuran diversity, especially within the genus *Eleutherodactylus*, but few may have been as aware of the high diversity of anurans in south India and Sri Lanka (see Dubois 1999). For example, 100 or more species within the family Rhacophoridae are estimated to be present on Sri Lanka alone, especially in the genus *Philautus* (or *Pseudophilautus*) (e.g., Bossuyt and Dubois 2001). Indeed, Sri Lanka may eventually be found to be inhabited by as many as 250 amphibian species (Das 2001). Other than a regional focus, no one discipline seemed more represented than others. Conservation themes were quite evident, although fortunately the amphibian faunas of south and southeast Asia do not appear to be undergoing the serious population declines that have affected amphibians in Australia, Central America, and elsewhere.

The business meeting of the Fourth World Congress was held on 5 December, but it was much more casual, even disorganized (disheveled?), than previous WCH business meetings. The financial arrangements in support of the Sri Lanka local committee (loans; travel by EC members) seem to have seriously challenged the WCH bank account, although organizers hope that the repayment of loans and proceeds from the Congress will eventually balance the books. Nominations for the International Herpetological and Executive committees were read but, because so few Executive Committee members were present, voting on the new candidates will take place at a later time. No venue or date was agreed upon for the Fifth World Congress of Herpetology, although Brazil, Singapore, and Japan were mentioned. The outgoing Secretary General, whose term ends in March 2002, stated that North Americans seemed not to have a serious interest in hosting a future Congress because of the number and size of existing herpetological meetings there; he would be delighted if a Central or South American organization made a formal proposal for the next Congress. The next WCH should take place in 2005 or sooner. There were no resolutions, and no new business was undertaken.

Social activities were more limited than at previous Congresses, due in part perhaps to the general curfew in effect during the elections. Even the sale of alcohol was banned during the elections, of perhaps modest concern to many herpetologists (known, as they are, for their consumption of grains and grapes during meeting socials). Evening films by Mark O'Shea and Rom Whitaker were shown, but most evenings were free for discussion, moonlit walks on the beach, or hunting frogs around a small pond on the hotel grounds. Day excursions were made by many delegates to Galapata Vihara, a 12th Century Buddhist temple, local sea turtle hatcheries, the spice gardens in a nearby village, and various diving and snorkeling locations. On 8 December, a buffet banquet was held on the lawn overlooking the Indian Ocean; a group of Sri Lankan traditional dancers entertained participants by performing acrobatic and story-telling dances accompanied by Sri Lankan music. A long auction followed.

TABLE 1. The number of delegates, by country, attending the Fourth World Congress of Herpetology, Bentota, Sri Lanka, 3–9 December 2001.

Austria	4
Australia	20
Belgium	1
Brazil	3
Canada	3
Czech Republic	2
Egypt	2
Finland	1
France	6
Germany	8
Hungary	4
India	13
Iran	2
Israel	7
Italy	2
Japan	16
Lebanon	2
Malawi	1
Malaysia	2
Netherlands	6
New Zealand	3
Poland	1
China (incl. Taiwan)	3
Russia	3
Singapore	2
South Africa	4
Spain	2
Sri Lanka	24
Sweden	7
Switzerland	1
U.A.E.	2
U.K.	29
U.S.A.	21
Venezuela	1

Six publications were issued just prior to or in conjunction with the Fourth World Congress, in addition to a hard cover 143 page book featuring 182 abstracts:

BAMBARADENIYA, C. N. B., AND V. N. SAMARASEKARA (EDS.). 2001. An Overview of the Threatened Herpetofauna of South Asia. IUCN Sri Lanka and Asia Regional Biodiversity Programme. Colombo, Sri Lanka. vi + 118 pp.

DE SILVA, A. 2001. The Herpetofauna of Sri Lanka. An historical overview, current status with checklists. Amphibia and Reptile Research Organization of Sri Lanka (ARROS). Peradeniya, Sri Lanka. 91 pp.

_____. (ED.). 2001. The Amphibia of Sri Lanka: Recent Research. Lyriocephalus (Special Issue) 4(1–2):1–173.

FERGUSON, W. 1877 (2001). Reptile Fauna of Ceylon. Facsimile Reprint. Society for the Study of Amphibians and Reptiles. Ithaca, New York. v + 42 pp.

RATHNAYAKE, N. D. 2001. An account of monitor lizards in Sri Lanka: status and distribution. Occasional Papers of the Amphibia and Reptile Research Organization of Sri Lanka. (1):1–10.

SOMAWEERA, R., K. UKUWELA, AND S. KARUNARATNE. 2001. Menikdena: a local herpetofauna hotspot. Occasional Papers of the Amphibia and Reptile Research Organization of Sri Lanka. (2):1–8.

In addition, three full color posters (Amphibians, Snakes, Reptiles) of Sri Lankan herpetofauna were available.

Despite incredible distractions which occurred at the most inopportune times, the local committee of the Fourth World Congress of Herpetology deserves high praise for organizing and carrying on with an enjoyable and instructive scientific program. I doubt most of us would have been able to rearrange the venue (from Colombo to Bentota) and program so completely, at a moment's notice, as did Anslem de Silva and his associates. One can only hope that the next World Congress will face fewer difficulties and be better attended. Herpetologists who did not come to Sri Lanka missed a memorable meeting, and a beautiful country and people.

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DAS, I. 2001. Amphibian diversity and the status of research in Sri Lanka. Lyriocephalus 4(1–2):6–7.

DUBOIS, A. 1999. South Asian amphibia – a new frontier for taxonomists. Journal of South Asian Natural History 4:1–11.

Kansas Herpetological Society Annual Meeting

The KHS held its 28th Annual Meeting at Topeka Collegiate School in Topeka, Kansas, on 3–4 November 2001. Over 100 participants attended scientific paper sessions to listen to 28 talks on amphibians and reptiles by scientists and students from across the nation.

Megan Kearney, graduate student at Emporia State University, received the Howard K. Gloyd/Edward H. Taylor Scholarship, honoring the memory of two great biologists with strong ties to Kansas. The first Alan H. Kamb Grant for Research on Kansas Snakes to Curtis Schmidt, graduate student at Fort Hays State University, received the first Alan H. Kamb Grant for Research on Kansas Snakes. Daniel D. Fogell, University of Nebraska, Omaha, received the "The Suzanne L. & Joseph T. Collins Award for Excellence in Kansas Herpetology." "The Big Croaker Awards," sponsored by the Kansas Department of Wildlife and Parks, are given in recognition of diligent monitoring of amphibian populations in conjunction with the Kansas Amphibian Monitoring Program. This year's recipients were Mark and Kathy Sexson and Stanley D. Roth.

In 2002, the Society will meet in Lawrence, Kansas.

MEETINGS

Meetings Calendar

5–7 April 2002—Current Research on Herpetofauna of the Sonoran Desert II, Tucson, Arizona, USA. http://tucsonherpsociety.org.

18–20 April 2002—3rd International Symposium on *Emys orbicularis*, Kosice, Slovak Republic. Hosted by Vychodoslovenske Muzeum Kosice in association with Museum fur Tierkunde Dresden and DGHT Rheinbach. Information: Peter Havas, e-mail: havasp@vakke.slposta.sk or www.cassovia.sk/emys.

3–8 July 2002—45th Annual Meeting, Society for the Study of Amphibians and Reptiles, together with HL and ASIH. Crown Center Hotel, Kansas City, Missouri, USA. Refer to page 1 of this issue of *HR* for details.

18–21 July 2002—26th Annual Meeting of the International Herpetological Symposium, Sheraton Westport Hotel Plaza, St. Louis, Missouri, USA. Information: www.kingsnake.com/ihs/26meeting.html.

SSAR Seeks New Webmaster

After serving the Society since 1993 in this capacity, George Pisani has decided to pursue other interests more like his research and recreation! Specific qualities of the webmaster we hope to find to replace him are:

- experience and demonstrated capability in designing sites which emphasize high-quality content; and, ease of delivery of that content to a broad constituency worldwide, who frequently lack the latest hardware, software and net-backbone structure.
- demonstrated ability in tasteful design, which is as important as coding ability.
- able to complete site update work on a continual timely basis, while home or travelling.
- ability to work as part of a group, and to provide good IT counsel to the Board.
- familiarity with structuring and maintaining searchable online databases.
- familiarity with establishing and maintaining secure-transaction "shopping cart" web interfaces.

Some examples of the things the Society hopes to accomplish are: searchable database of *Herp Review* natural history notes archives, searchable database of *Herp Review* geographic distribution, society directory, online subscription service, online book orders, online dues renewal, tables of contents of our publications, and more.

There is funding to assist in the accomplishment of certain of these things, which may be used by the webmaster to secure outside help if needed.

Interested parties should e-mail [in RTF format, please] a CV and letter of interest to both: Breck Bartholomew <breck@herplit.com> and to George Pisani <gpisani@falcon.cc.ku.edu>. Be certain to include URLs of your current sites.

OBITUARIES

Herpetological Review, 2002, 33(1), 6–7.
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Edwin H. Colbert
1905–2001

MARK A. NORELL
Division of Paleontology, American Museum of Natural History
Central Park West at 79th Street, New York, New York 10024-5192, USA
e-mail: norell@amnh.org



Dr. Edwin "Ned" Colbert passed away during the night of 15 November 2001 at the age of 96. Although not ill, his frailty and age made his death not unexpected. Ned Colbert had a lifelong fascination with dinosaurs and prehistoric life in a career that spanned over 75 years. He was active right up to the end, recently informing members of the staff of the Museum of Northern Arizona (where he has worked since his retirement at the AMNH) with what he hoped to accomplish over the next ten years. A report in an Arizona paper has him sitting up in bed and delivering his last lecture on paleontology minutes before his death.

I first met Ned when I was an undergraduate in the late 1970's on my way home from a fossil collecting trip to Colorado. While travelling through Flagstaff we stopped in at the Museum of Northern Arizona. Ned greeted us with enthusiasm, showed us his collections from Antarctica, *Coelophysis* from Ghost Ranch and the recently discovered *Scutellosaurus*. He was generous with his reprints—most of which I still have. It wasn't until years later, after I assumed his old position of dinosaur curator at the American Museum of Natural History that our paths crossed again.

One of my first activities at the museum was involvement in the dismantling and reorganization of the dinosaur halls. Colbert had overseen the renovation of the existing galleries. Colbert organized the old halls along temporal lines with a Hall of Jurassic or early dinosaurs followed by a Hall of Late Dinosaurs. The old halls were dimly lit with lumbering sauropods and a Godzilla-like Tyrannosaurus. Colbert's wife Margaret (daughter of William Diller Matthew) had drawn the chalk murals on the walls of the Early Dinosaur Hall. The old halls were Ned's—and they were New York icons.

The renovation of the 90's was a source of discord between the contemporary AMNH curatorial staff and Ned. The old halls were completely demolished, and replaced by brightly lit ones. The new halls were arranged cladistically—a methodology which Colbert never ascribed to. Yet, it is notable that shortly before his death, and in one of his last publications (a paper on drepanosaurs based on specimens from New Jersey) a cladogram appears.

After this rocky beginning our common interest in fossil specimens, fieldwork, questions about the past, and our fondness for the American Museum allowed our relationship to progress. I spoke to him about some of his reminiscences of the fabled AMNH fossil hunter Barnum Brown, about the direction of the department of which he had served as chair, and of several other matters only shortly before his passing.

During his career Colbert's published over 400 scientific papers on a broad range of themes. Although Colbert is thought of mostly as a dinosaur paleontologist (specializing in the early history of these reptiles), some of his greatest achievements were in other areas. In 1969, soon before retirement, Colbert led a NSF-sponsored team to Antarctica in search of fossil remains. There he collected remains of several Triassic animals including the reptile-like mammal *Lystosaurus*. As *Lystrosaurus* specimens were also known from South Africa and South America, this discovery provided powerful corroboration for the emergent theory of continental drift. This work was highlighted in his 1973 book "Wandering Lands and Animals."

Colbert was something of an innovator in the field of paleobiology as well. In the 1960's he became interested in empirically addressing the question of the weights of dinosaurs. Cleverly he constructed models of these animals and measured their displacement volume, scaled them up and multiplied them by a density calculated from living animals to arrive at a value for mass. He also examined the question of heterothermy in large animals by doing experiments on captive alligators.

Colbert will be most remembered to those outside the microcosm of dinosaur science as a great popularizer of paleontology. He wrote several books on the topic, keeping busy well into his 80's. Colbert's first book was "The Dinosaur Book: the Ruling Reptiles and their Relatives" in 1945. This was followed by several more on dinosaurs and fossil reptiles (notably "The Age of Reptiles" in 1965), on the history of paleontology and dinosaur collections (the biography of William Diller Matthew in 1992 and "The Great Dinosaur Hunters" in 1968) and the autobiographical "A Fossil Hunter's Notebook" (1980) and "Digging into the Past" (1989). Colbert also wrote the widely used textbook "Evolution of the Vertebrates" in 1991. Many of Colbert's writings are still in print.

Colbert started at the American Museum in 1929, shortly after receiving his Ph.D. at Columbia University in 1928 under the supervision of William King Gregory. The American Museum of that era was an exciting place—with paleontologists like Granger, Simpson, Matthew, and Brown recovering specimens from across the globe. Roy Chapman Andrews was finishing in Central Asia and coming back to take on an administrative role in the museum. Ned Colbert was one of the last tangible links to that era. His tenure at the museum started as a protegé of Henry Fairfield Osborn, founder of the Department of Vertebrate Paleontology. Osborn was an iconic (but in Colbert's own words "difficult") figure who new Marsh, Cope, worked with Huxley and met Darwin. Colbert's early work was almost totally restricted to fossil mammals, and he assisted Osborn ("did the donkey work") on Osborn's well-known "Proboscidea" monograph and other projects.

It was not until the 1940's that Colbert began his work in the Mesozoic. Some of his early trips were to East Texas accompany-

ing Al Romer. His most notable dinosaur was the excavation of the Ghost Ranch *Coelophysis* quarries in the 1950's. At these quarries Colbert's team excavated a tremendous sample of the primitive theropod dinosaur *Coelophysis*. This work was documented in the popular book "The Little Dinosaurs of Ghost Ranch" in 1995.

Dr. Colbert was a member of the National Academy of Sciences. His students are many and include John Ostrom of Yale, Eugene Gaffney of the American Museum of Natural History, and Dale Russell. He is survived by his wife Margaret and several grand- and great-grandchildren.

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Ned Colbert

RICHARD G. ZWEIFEL
P.O. Box 16354
Portal, Arizona 85632, USA

Ned Colbert's career spanned 40 productive years at the American Museum of Natural History and following his retirement, another 20 years in association with the Museum of Northern Arizona, Flagstaff. Although best known for his work with fossil reptiles, Ned's administrative and research paths crossed those of Recent herpetology.

In 1943, Albert Parr, newly appointed Director of the Museum, abolished the existing departmental arrangement and instituted a vertical organization in which curators dealing with fossil and Recent organisms of a given sort were to be integrated into a single department. The curatorial staff expressed considerable disagreement with this new order but to no avail. Thus, Ned became Chairman of the Department of Amphibians and Reptiles with Charles M. Bogert the only other Curator in residence (James Oliver was in the Navy). Fortunately, Colbert and Bogert got along well and the departmental reorganization was rescinded not long after its implementation.

Ned got in his herpetological field time with a genus that transcended the fossil boundary, *Alligator*, when he joined Bogert and Raymond B. Cowles in a study of the beast's temperature tolerances (Colbert et al. 1946; see also Myers and Zweifel 1993, fig. 3). In another contribution (Colbert 1967), Ned studied the morphology of *Draco* in order to illuminate the analogous gliding mechanism of a Triassic reptile (Colbert 1966).

Ned's was a life well spent, and I am proud to have been within his broad circle of friends and colleagues.

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_____. 1967. Adaptation for gliding in the lizard *Draco*. Amer. Mus. Novitates 2283:1–20.

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Myers, C. M., and R. G. Zweifel. 1993. Biographical sketch and bibliography of Charles Mitchill Bogert, 1908–1992. Herpetologica 49(1):133–146.

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Marvin Max Hensley (1922–2000)

DEAN PREMO
White Water Associates, Inc., 429 River Lane, P.O. Box 27
Amasa, Michigan 49903, USA
e-mail: dbpremo@up.net



Some biologists never get the knack of catching a snake. The slightest hesitation results in a missed opportunity. Even in his later years, however, Max Hensley would drop to both knees with surprising quickness and come up with his scaly target gently cradled for companions to appreciate and photograph. It is a curious irony that today's scientific community values biodiversity more and more, yet produces fewer and fewer biologists with the ability to identify organisms and understand their ecology. Dr. Marvin M. Hensley (Max) was such a biologist and he shared his knowledge and enthusiasm with many students and friends.

Max Hensley was born 4 April 1922 in Keyesport, Illinois. After a rural growing-up, he received his AB degree at Greenville College in the natural sciences in 1946. He went on for a MS at University of Illinois (1948), and a Ph.D. at Cornell (1951). Max's zoological education was interrupted by a stint in the Navy, serving from 1943 to 1946. Max achieved the rank of Lieutenant Junior Grade and he was quietly proud of his service during World War II.

Dr. Hensley began his teaching career as an Assistant Professor of Biology at Gettysburg College in 1951. He had been an Associate Professor for about a year at Gettysburg when Michigan State University hired him as an Assistant Professor in Zoology in 1956. At MSU, he was an Associate Professor from 1959 through 1961 and Professor from 1962 until his retirement in 1986. During the early years of his career, he interacted a great deal with Sherman Minton of Indiana University and Phillip Smith of the Illinois Natural History Survey. Once, the three men made a collecting trip to Mexico. In fact, Max made several collecting trips to this part of the world and, in later years, traveled to Africa and the Galapagos Islands. His 35mm slides and stories of those travels greatly benefitted his students in zoology and biogeography.

Dr. Hensley authored or coauthored 24 scientific papers, but always viewed teaching as his most important job. He was loved by his herp undergraduate and graduate students and was not only a good teacher to them, but advisor and friend. His honest advice and careful criticism were valued. His lectures were full of information and his examinations were challenging. Max felt it was important to know historical figures in science and often his exams required descriptions of scientific contributions of several

people. Humor was there too, and sometimes in unexpected places (Max stumped me by one name in a list of "scientists" during my written comprehensive exams—Adolph Coors). As a tribute to his dedication to teaching, the College of Natural Science Alumni Association awarded Dr. Hensley the Distinguished Faculty Award in 1985.

Max was a longtime member of the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, Society for the Study of Amphibians and Reptiles, American Ornithological Union, and American Society of Mammalogists. At herp meetings, Max was especially gregarious and a favorite person with whom to visit. At scientific meetings and in the classroom, Max was careful not to intimidate students with his knowledge and was always encouraging and friendly.

Max was an excellent field herpetologist. His colleague for many years at Michigan State University, J. Alan Holman, remembers trips to Michigan's Upper Peninsula with Max. Max would ferret out good collecting places in this northern land and quickly find ring-necked snakes, red-bellied snakes, eastern fox snakes, four-toed salamanders, and more. Dr. Hensley's herp class field trips were legendary for their organization and success. All captured animals were photographed and carefully returned to the proper habitat. Max had no use for herpetologists that over-collected and was always very good to the environment where he was collecting. He replaced every log and bunch of leaves to the proper place and taught his students to do the same. When Max kept live herps, they were exceedingly well cared for and lived long healthy lives. Perhaps his most famous pet was a Mexican beaded lizard (*Heloderma horridum*) that impressed thousands of students over the years and lived exclusively on a diet of raw eggs that it rather indelicately licked from a bowl.

Max loved music of all kinds, but none more than an old- time music jam session (with guitars, fiddles, mandolins, and so on). Whenever such impromptu concerts happened at his house, he would produce a homemade contraption composed of a washboard, cowbell, squeeze horn, wood blocks, and other soundmakers. Max played this "swamp fiddle" with all the flair and moves of a great bassist.

Dr. Hensley was generous of more than his time. In 1995 he established the "Dr. Marvin Hensley Endowed Scholarship in Zoology." In 1995 he also established, "The Dr. Marvin Hensley Endowed Fellowships in Science" with selections made by the College of Natural Science at MSU. Max also created the "Dr. Marvin Hensley Endowment for Vertebrate Collections in the Museum," a generous fund dedicated to the care of the vertebrate collections at MSU Museum. Over the years, Max contributed many valuable herp specimens to the Museum, not only from Michigan but from Mexico, Appalachia, and Arizona. Max was also a dedicated fan of college wrestling and created an endowment to the Ralph Young Fund at MSU for that purpose.

Max Hensley died 19 February 2000 from a heart attack and complications associated with diabetes. He was living in Sarasota, Florida. He is sorely missed by his friends and fellow zoologists, but his memory always invokes smiles and pleasant thoughts of time spent with this humble and generous person.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres-Carvajal**; postal and e-mail addresses may be found on the inside front cover.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Systematics and Histocompatability of a Parthenogenetic Teiid

Cnemidophorus laredoensis is a diploid parthenogenetic lizard that arose from a hybrid between the gonochoristic species *C. gularis* and *C. sexlineatus*. The authors used skin grafting to measure the extent of homogeneity in *C. laredoensis*, and to assess whether this taxon represents a single species or a complex of species derived from two or more parthenogenetic hybrids. The authors collected 20 live lizards from six sites in Texas, maintained them in a laboratory, transplanted skin grafts between selected taxa, and monitored the animals until they died. Thirteen of the 20 individuals were tested for ploidy level. Individuals of *C. laredoensis* rejected grafts from *C. gularis* and *C. sexlineatus* after18–95 days; both of the latter species rejected grafts from *C. laredoensis*. Several hybrid individuals were tested as well, with differing results. Reciprocal grafts among 17 individuals of *C. laredoensis* from several localities were accepted; three individuals rejected some or all of their grafts. The results suggest that *C. laredoensis* is derived from a single hybrid ancestor (*C. gularis* x *C. sexlineatus*), and postformational mutations may explain the unidirectional rejections. The authors contend that the name *C. laredoensis* should be restricted to populations in Texas and Mexico that are "diagnostically distinct" with the parthenogenetic species described in 1973.

ABUHTEBA, R. M., J. M. WALKER, AND J. E. CORDES. 2000. Genetic homogeneity based on skin histocompatibility and the evolution and systematics of parthenogenetic *Cnemidophorus laredoensis* (Sauria: Teiidae). Canadian Journal of Zoology 78:895–904.

Correspondence to: James M. Walker, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA; e-mail: jmwalker@comp.uark.edu.

The Smallest Amniote is a Gecko

The West Indies are considered to be a "hotspot" of biodiversity because of the large number of endemic species and rapid rate of deforestation. The authors describe a new gecko of the genus *Sphaerodactylus* from the province of Pedernales in the Dominican Republic. The new species (*S. ariasae*) is most closely related to *S. streptophorus*. The gecko was collected in leaf litter of xeric woods over limestone substratum. The new species and *S. parthenopion* are tied for the distinction of world's smallest

amniote—the dwarf chameleon *Brookesia tuberculata* is a close second. The small body size of these species creates problems with water loss. These animals have circumvented the physiological constraint by living in humid microhabitats.

HEDGES, S. B., AND R. THOMAS. 2001. At the lower size limit in amniote vertebrates: a new diminutive lizard from the West Indies. Caribbean Journal of Science 37:168–173.

Correspondence to: S. Blair Hedges, Department of Biology, 208 Mueller Lab, The Pennsylvania State University, University Park, Pennsylvania 16802-5301, USA; e-mail: sbh1@psu.edu.

An Internet Database of Crotaline Venoms

Many snake venoms contain disintegrins, metalloproteinases, and fibrinolytic enzymes—these proteins may have important applications to the treatment of cancer, cardiovascular problems, and cerebromuscular disorders. North American crotaline venom studies have been limited to a handful of taxa because some species are rare or endangered, and difficult to obtain. The authors created a database with information about snakes in their serpentarium, including: (1) locality, weight, length, and sex; (2) feeding; (3) history of weight and length; (4) venom storage; (5) biochemical properties of venom samples, including electrophoretic filtration, anion and cation exchange chromatography, hemorrhagic assay, antihemorrhagic assay, fibrinolytic activity, antifibrinolytic activity, hide powder azure assay, gelatinase assay, and monoclonal antibody production. Detailed instructions are given for database queries, and biochemical venom properties are given for eighteen taxa. The Natural Toxins Research Center Database (http://ntri.tamuk.edu/snake_database/snake.lookup.html) has information about 250 snakes, which represent 11 species and 20 subspecies.

PEREZ, J. C., M. R. MCKELLER, J. C. PÉREZ, E. E. SÁNCHEZ, AND M. S. RAMÍREZ. 2001. An internet database of crotaline venom found in the United States. Toxicon 39:621–632.

Correspondence to: J. C. Pérez, Department of Biology, Texas A & M University-Kingsville, MSC 158, Kingsville, Texas 78363-8202, USA; e-mail: kfjcp00@tamuk.edu.

Edge Effects on Costa Rican Anoles and Frogs

Habitat destruction and fragmentation are two of the leading causes of herpetofaunal declines worldwide. The authors' objectives were to see how edge effects: (1) change the abundance of *Eleutherodactylus* frogs and *Norops* lizards; (2) affect parasite infestations of *Norops*; and (3) change the temporal (daily and seasonal) distribution of all encountered amphibians and reptiles. The authors placed 44 pairs of 10 x 10 m plots in small, medium, and large forest fragments; plots were located close to forest edges or in the center of forest fragments. Data on numerous habitat variables were collected from each plot. Overall, 784 individuals of reptiles and amphibians (18 species) were collected during the study. Two species of *Norops* were abundant in edge plots during the dry season, but switched their preference to interior plots during the wet season. More ectoparasites were present on lizards examined from interior plots. Two species of *Eleutherodactylus* (*E. podiciferus and E. cruentus*) were significantly less abundant in edge plots than in interior plots. Three other species of this genus (*E. ridens, E. stejnegerianus,* and *E. vocator*) were more evenly distributed, but became more abundant in interior plots during the rainy season. There are numerous hypotheses to explain the observed seasonal shifts.

SCHLAEPFER, M. A., AND T. A. GAVIN. 2001. Edge effects on lizards and frogs in tropical forest fragments. Conservation Biology 15:1079–1090.

Correspondence to: Martin A. Schlaepfer, Section of Ecology and Evolutionary Biology, Corson Hall, Cornell University, Ithaca, New York 14853-2701, USA; e-mail: mas50@cornell.edu.

Antipredator Behavior of an Australian Gecko

Previous studies have documented variation in the way populations of a given species cope with differences in predation. In many cases, local adaptation to predation pressure is possible, but can be constrained by gene flow among populations. The authors examined antisnake responses of populations of velvet geckos (*Oedura lesueurii*) to the broad-headed snake (*Hoplocephalus bungaroides*), a species that feeds primarily on geckos. The phylogenetic relationships of 15 populations of velvet geckos from coastal New South Wales, Australia were examined with 35 allozymes to identify genetic groups. Wild-caught (predator experienced) and captive-born (predator naive) geckos were tested for their reactions to unscented rocks, rocks scented with cologne, and rocks scented with integumentary chemicals from broad-headed snakes. Behavioral data was analyzed with ANOVA and log-linear models. Geckos exhibited a higher rate of tongue flicking and spent significantly more time crawling and stationary while pressed against the surface of snake-scented rocks if they were from populations that were sympatric with populations of broad-headed snakes. Other antipredatory behaviors did not vary across populations of geckos. Phylogenetically independent contrasts suggested snake distribution might have driven the evolution of antisnake behavior in velvet geckos. These results suggest local adaptation to predation pressure, which is not constrained by gene flow in the studied populations of velvet geckos.

DOWNES, S. J., AND M. ADAMS. 2001. Geographic variation in antisnake tactics: the evolution of scent-mediated behavior in a lizard. Evolution 55:605–615.

Correspondence to: Sharon J. Downes, Division of Botany and Zoology, Australian National University, Canberra, ACT 0200, Australia; e-mail: sharon.downes@anu.edu.au.

Trophobiosis Between Geckos and Insects in Madagascar

Behaviors performed by ants can serve as a stimulus for certain insects to secrete honeydew—this type of interaction is known as trophobiosis. The authors observed trophobiosis between planthoppers of the family Flatidae and three species of *Phelsuma* (*P. madagascariensis kochi, P. mutabilis, P. abbotti*), three unidentified species of *Lygodactylus,* and *Homopholis sakalava.* Geckos rhythmically bounced their heads on the back of a tree to produce vibrations; this stimulus caused cicadas to secrete honeydew from their abdomens, which was licked off by the geckos. It is likely that the geckos are exploiting a preexisting

trophobiosis interaction between ants and the cicadas.

FÖLLING, M., C. KNOGGE, AND W. BÖHME. 2001. Geckos are milking honeydew-producing planthoppers in Madagascar. Journal of Natural History 35:279–284.

Correspondence to: Markus Fölling, Department of Morphology and Systematic, University of Bielefeld, Morgenbreede 45, D-33615 Bielefeld, Germany.

Dewlap and Dorsal Color Variation in an Anole

Studies on guppies have demonstrated that differences in spectral sensitivity can undergo selection for color patterns that minimize predator detection while remaining conspicuous to conspecifics. The dewlap of *Anolis conspersus* reflects light near ultraviolet wavelengths, but its ancestor (*A. grahami*) has a long wavelength-reflective dewlap. The author studied variation in dorsal coloration of adult male *A. conspersus* and its relationship to light conditions and background color. He also compared how dorsal and dewlap coloration affects crypsis, and how the colors may have evolved. The author collected data about dorsal and dewlap radiance with a spectrophotometer, and ambient habitat light with a hemispherical cosine receptor. Data were analyzed with PCA, DFA, ANOVA tests, and the color segment method. Three color morphs were identified (brown, green, blue), and each had relatively consistent patterns of dorsal and dewlap reflectance. However, the blue morph was found to overlap with the other two morphs in several characteristics. The evolution of the dewlap color may be a result of selection against evaporative water loss and not salience within low-light habitats. Although many body regions were inconspicuous against natural backgrounds, some areas (e.g., brightly colored heads) contrasted with background tree bark and leaves.

MACEDONIA, J. M. 2001. Habitat light, colour variation, and ultraviolet reflectance in the Grand Cayman anole, *Anolis conspersus*. Biological Journal of the Linnean Society 73:299–320.

Correspondence to: Joseph M. Macedonia, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee 37996, USA; e-mail: jmacedon@utk.edu.

Causes of Frog Declines in California

Declines of *Rana aurora* populations of western North America have been attributed to global warming, UV radiation, airborne contaminants, disease, and introduced species. The authors examined hypotheses of climate change, UV radiation, pesticides, and habitat destruction because each has specific predictions for spatial patterns of declines. Historical records of distribution were collected from museums, literature records, field surveys, and correspondence with local naturalists. Localities were mapped onto ArcView version 3.0 GIS software, and mean annual precipitation was derived from a Teale Data Center digital precipitation map of California. Data also were collected about wind direction, proximity to agricultural areas, and agricultural land use. Statistical analyses were performed with Mann-Whitney rank tests, χ^2, Pearson product-moment correlations, and multiple logistic regressions. A number of additional analyses were made to test the robustness of the results to possible data errors. Results indicated that frog populations show a clear elevational gradient, with fewer frogs at higher elevations—this observation is consistent with UV radiation as a causal factor for declines, but further research is needed. Wind-borne agrochemicals may be an important factor in frog declines as well. Efforts to test whether disease or introduced species are affecting frog populations are exacerbated by the dearth of available information.

DAVIDSON, C., H. B. SHAFFER, AND M. R. JENNINGS. 2001. Declines of the California red-legged frog: climate, UV-B, habitat, and pesticides hypotheses. Ecological Applications 11:464–479.

Correspondence to: Carlos Davidson, Department of Environmental Studies, California State University, 6000 J Street, Sacramento, California 95819, USA; e-mail: cdavidson@csus.edu.

ZOO VIEW

Editor's Note: With this issue, we introduce a new feature to our readers—"Zoo View." The Section Editor is James B. Murphy. From 1966 to his retirement thirty years later, Murphy was in charge of the Department of Herpetology at the Dallas Zoo. Currently, he is a Smithsonian Research Associate in the Department of Herpetology at the National Zoological Park in Washington, DC. He has published three books on captive management of herpetofauna and a number of papers, book chapters, and bulletins on topics such as the natural history of Mexican rattlesnakes, ethological and reproductive studies on a variety of amphibians and reptiles, zoo history and philosophy, and husbandry. Murphy's long involvement in the zoo world and with academic research make him uniquely qualified to oversee this new column. Below, he provides an introduction.—RWH.

During the past few years, I have been working on a book, which will be published by SSAR, focusing on the history of zoo herpetology. As I searched the literature, it became clear that zoo and aquarium workers were involved in a number of interesting and important projects. It was also apparent that many of these initiatives were not well known to other herpetologists outside the zoo community. To remedy this situation, this column featuring zoo and aquarium programs and issues relevant to zoo personnel will be a regular section in *Herpetological Review*.

My plan is to invite colleagues worldwide to highlight those areas which are important to them and share their experiences and insights with our entire community. I foresee future columns addressing conservation, education, captive and medical management, history, philosophy, book reviews, announcements of upcoming events, and biographical sketches of important zoo and aquarium workers. Some columns may include tours of amphibian and reptile facilities. Periodically, academic colleagues will be asked to provide guidance to improve zoo programs, such as beginning a research investigation which will lead to publishable results and that can be accomplished in a zoo setting. My hope is that publicizing these elements broadly will lead to improved communication among all subsets within our discipline, resulting in meaningful collaborations.

Before attending the HL/SSAR meeting last year, I traveled to the Detroit Zoological Institute to see the recently opened National Amphibian Conservation Center. This edifice is superb and I encourage all herpetologists to visit—an entire building has been dedicated to amphibians and their biology for the first time. Excited zoo goers pack the public area. Clearly, amphibians are exceedingly popular and the zoo administrators at the Institute, especially Director Ron Kagan, deserve credit for taking a risk to show something other than a charismatic mega-vertebrate. Curator Dr. Kevin Zippel is justifiably proud of the many accomplishments already achieved and, as he explained the work with the Panamanian golden frog, I am convinced that this undertaking is a worthy introduction for this column.

I invite all colleagues to submit materials to me for future columns. My e-mail and postal addresses are listed on the inside cover of this issue.

—James B. Murphy, Section Editor

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Conserving the Panamanian Golden Frog: Proyecto Rana Dorada

KEVIN ZIPPEL
National Amphibian Conservation Center , Detroit Zoological Institute
8450 West Ten Mile Road, Royal Oak, Michigan 48068-0039, USA
e-mail: ZippelK@zoo.ci.detroit.mi.us

Proyecto Rana Dorada (a.k.a., Project Golden Frog) is a proactive conservation initiative with the primary goal of preventing the extinction of one of the world's most recognizable, culturally significant, and endangered amphibians, the Panamanian golden frog (*Atelopus zeteki*). Wild populations are currently threatened with habitat loss and fragmentation, illegal collection for national and international pet trades, and a fungal epizootic (chytridiomycosis) that is extirpating mid- and high-elevation amphibian populations in Central America and throughout the world. Extrapolation of current trends suggests this species might be extinct within the next five years; all *Atelopus* in neighboring Costa Rica are apparently already gone from these same threats.

Our conservation efforts fall into three main areas: field studies, captive propagation, and education.

1. We have established three study sites within the protected boundaries of a national park to investigate various aspects of the species' biology, such as habitat requirements, seasonal activity patterns, territoriality, reproductive behavior, and dispersal. A four-wheel-drive vehicle was recently purchased to allow our Panamanian field researchers to collect data at each of these sites weekly. In addition, data loggers continuously monitor humidity and air and water temperatures. This information helps us understand how the frogs use their environment and provides vital data for the captive husbandry program. Our field team has collected invaluable photo-and video-documentation of golden frog behaviors, habitats, human impacts, and project progress. From our personal observations and personal communications with Karen Lips, we believe that chytridiomycosis has not yet arrived in golden frog habitat, but that it is currently threatening the last stronghold of the next western congener (*Atelopus varius*) with extinction. Ideally, a conservation program for this species should be initiated as well, as it is in imminent danger of disappearing from Panama and from the planet.



In addition to the threat of encroaching disease, the golden frog is also being threatened by overcollection for illegal national and international pet trades, and by habitat degradation/fragmentation in what little habitat remains.

2. As a precautionary measure against extinction of golden frogs, small assurance populations are being maintained and bred in captivity. We have already produced hundreds of offspring, which are being distributed to AZA-accredited zoos participating in the breeding program. Our intent is to utilize captive-bred specimens for reintroduction programs, in the event that (and only if) wild populations become extinct. To alleviate pressure on wild populations, we would also like to develop a breeding program in Panama where we can extend our captive expertise to Panamanian biologists. Together we will work toward the establishment of a breeding and educational facility, potentially at the El Nispero Zoo in El Valle.

3. Project educators are working to disseminate information from the field studies and captive program to raise awareness among



The golden frog inhabits cool, clear, cascading streams or 'quebradas' in low- to mid-elevation primary rainforest.



Project members scout potential golden frog habitat from atop a cleared hilltop.



Project members prepare to 'dust' a frog in fluorescent powder for tracking studies.

the Panamanian public regarding the plight of this culturally important animal. Informative fliers describing the golden frog's natural history and conservation status are being designed for distribution to Panamanian zoos and schools, and a bilingual Project website <www.ranadorada.org> disseminates information and progress internationally. A fundamental aim of this project is to provide opportunities for Panamanian and U.S. students to be trained and actively involved in population monitoring and public education. Students work closely with professional biologists within Panama's national parks to establish a continuous amphibian population-monitoring program. We are also raising funds to host a workshop for school teachers in Panama to provide them with detailed curricula to teach their students about the cultural history and conservation plight of their golden frog.

PGF recently received a US $25,100 grant from Disney's Animal Kingdom. Thanks to their generosity, we will be able to support another year of continued field studies and initiate our in-country education program. PGF would like to thank Disney and the other institutions and individuals that have generously given funds and/or institutional support to the Project: American Zoo and Aquarium Association, Autoridad Nacional del Ambiente de Panamá, Baltimore Zoo, Bay Foundation, Cincinnati Zoo, Círculo Herpetológico de Panamá, Cleveland Metroparks Zoo, Columbus Zoo, Detroit Zoo, Indiana University, Jennifer Nolan, John Ball Zoo, Lee University, Miami Metrozoo, Oklahoma City Zoo, Potawatomi Zoo, Riverbanks Zoo, Roger Williams Park Zoo, Smithsonian Tropical Research Institute, St. Louis Zoo, Wildlife Conservation Society, and the Woodland Park Zoo. For further information on PGF, please contact Project Coordinator Kevin Zippel (e-mail: kzippel@detroitzoo.org). Wildlife photographer Guido Sterkendries, whose photographs accompany this article, has been documenting the project. Check out his website at <www.sterkendries.com> for some spectacular images of herps.

In addition to coordinating this important effort for the golden frog, the Detroit Zoological Institute financially supports publication of *Froglog*, newsletter of the Declining Amphibian Populations Task Force. I am proud to say that zoo and aquarium workers have been the major contributors sustaining Task Force operations since the beginning.

POINTS OF VIEW

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"Intraspecific Variation of the Hemipenis," A Correction, with Comments on Other Erroneous Descriptions

HERNDON G. DOWLING
Rendalia Biologists, 1811 Rendalia Motorway
Talladega, Alabama 35160-4573, USA
e-mail: hdowling@coosavalley.net

The morphology of the snake hemipenis has been found to be an excellent indicator of snake relationships at many taxonomic levels. Utilized mainly at the level of genera and higher categories (e.g., Bogert 1940; Cope 1895; Dunn 1928), it has also proven to be a valuable guide at the level of species and subspecies. It was with this background that I stated (Dowling 1967) that hemipenes "may give better information on the genetic relationships [of snakes] than some habit- or habitat-correlated characteristics." Recent molecular studies have tended to confirm this statement (e.g., Vidal et al. 2000).

Thus, I was surprised to find that Zaher and Prudente (1999), after quoting the above observation, stated that "Such a belief is here viewed with caution." They stated that interspecific variation is common, and that intraspecific variation is well known. These, of course, are not new findings. As noted above, minor interspecific hemipenial variation is often used as one of the characters for the recognition of the individual species in a genus (e.g., Duellman 1958). Also, although intraspecific variation is usually found in minor characters (size of spines, numbers of calyces; e.g., Keiser 1969) and has not often been studied in detail, it has been recognized for many years and it occasionally has been used as a taxonomic feature for the recognition of subspecies (e.g., the description of *Coluber constrictor priapus* Dunn and Wood 1939). [The degree of intraspecific variation reported for the hemipenis (and female cloaca) in *Calamaria lumbricoidea* (Inger and Marx 1962) has not been found in any other taxon, and may be unique.] I wondered, therefore, what had led Zaher and Prudente to question the inherent stability of hemipenial characters.

The basis of their comment was to be found in their descriptions of hemipenial variation in two genera of Neotropical xenodontid snakes, *Siphlophis* and *Tripanurgos*, and I here offer an explanation for their observations of major "interspecific and intraspecific variations" in these two genera.

From their examination of 27 specimens, Zaher and Prudente (1999) described two apparent morphological states in the everted hemipenes of five species of *Siphlophis* and in the monotypic genus *Tripanurgos*. They labeled these the "Y-shaped condition" and the "T-shaped condition." If, indeed, hemipenes of individual species varied so widely as their illustrations suggest, hemipenes would lose much of their value as taxonomic characters. Fortunately, this is not the case.

Although "[They] reject the possibility that these different types are due to a preservation artifact ...," in fact, this is what the "T-

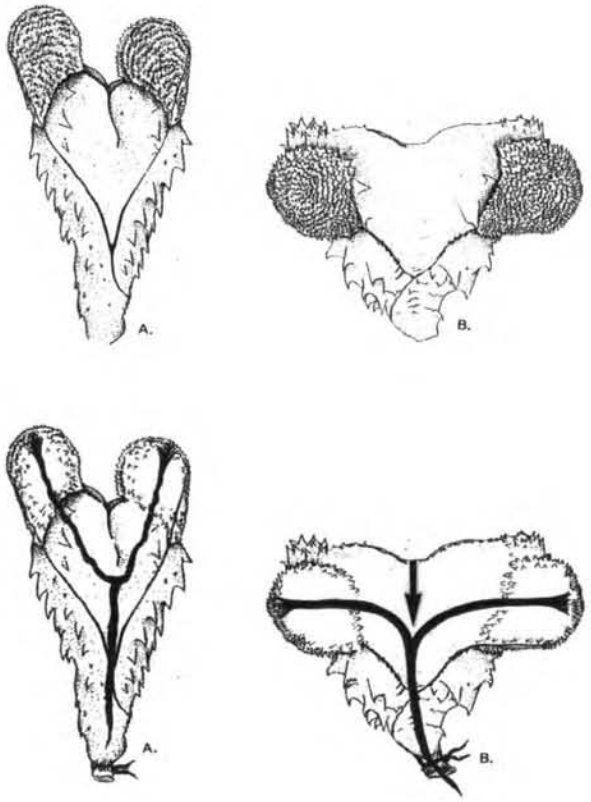


FIG. 1. "Y-shaped" (A) and "T-shaped" (B) hemipenes of *"Tripanurgos" [= Siphlophis] compressus*. UPPER: as presented in Fig. 2 of Zaher and Prudente (1999). LOWER: Redrawn from this figure (with basal ends added to show the presence of the restricting ties) to show trends of retractor muscles. Note especially the much shorter and wrinkled hemipenial body and the irregular sulcus spermaticus in the "T-shaped" organ, both of which are caused by the restricted retractor muscles.

shaped condition" is: an artifact of technique. The "Y-shaped condition" reflects the morphology of a better-prepared hemipenis.

Although hemipenis morphology is a valuable taxonomic feature of snakes, the proper preparation of everted hemipenes is a difficult process that requires some experience and skill. Most field-

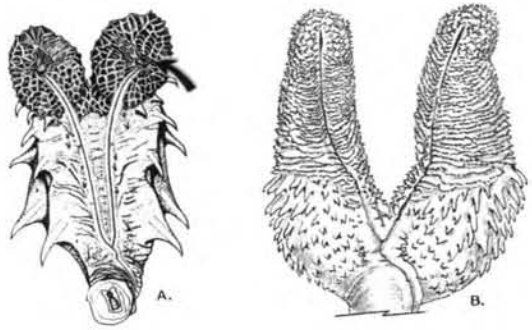


FIG 2. Zaher (1999: 15) noted that the drawing of the hemipenis of *Trimeresurus stejnegeri* presented by Mao et al. (1984) (A) differed from that of vipers in general by having much shorter apical lobes. As shown by the disappearance of the forks of the sulcus into the apparent middle of the lobes (arrow), they are incompletely everted. A drawing of the hemipenis of *Crotalus horridus* (HGD-HISS 897; AMNH [Amer. Mus. Nat. Hist] 97641) is provided for comparison (B).

everted hemipenes are incompletely everted. The preparation is best done on freshly killed specimens, although, with considerable effort, it is possible to evert the hemipenes to some degree from museum material (Pesantes 1994).

The critical element of preparation pertinent to the present discussion is that the skin of the tail must be slit on the ventral midline for a short distance (~2–3 subcaudals) from the cloaca to the point(s) of attachment of the retractor muscle (*m. retractor penis magnus*) to the inverted hemipenis. For proper eversion of the hemipenis, the retractor muscles must then be cut in two. The attachment of the muscle to the tip of the hemipenis is single in those taxa with cylindrical or slightly bilobed organs (e.g., *Coluber, Elaphe*), but in those with extensive bilobation (e.g., viperoids, most xenodontids) the retractor muscle is divided at some point to attach to the end of each of the two lobes. In these snakes the retractor muscle must be cut between the end of the hemipenial lobe and the point of division of the muscle. If this element of the procedure is neglected (cutting the retractor muscle too far posteriorly—or not cutting it at all) the divided retractor muscle will form a loop in the "lobular crotch" between the two lobes of the hemipenis. This will impede the complete eversion of the lobes, thus giving them a false appearance.

But the "T-shaped" figures shown by Zaher and Prudente (upper drawings in their Figs. 1 and 2) also demonstrate the distortions caused by an additional problem in executing proper hemipenial eversion. Not only does the internal loop of the retractor muscle restrict eversion of the lobes, but also when thread was tied at the base of the hemipenis to preserve the pressure of the fluid injected to inflate it, the retractor muscle was inadvertently tied in and bound to the base. The short and convoluted hemipenial body and the distortion of the sulcus spermaticus in the "T-shaped" figures are clear indications that the retractor muscle was included in and restricted by the tied base. Although the problems resulting from this may not be apparent during the process of preparation, they become visible later when the action of the preservative causes the retractors to shrink, thus distorting the lengths and shapes of the external hemipenial membranes (Fig. 1). No matter how much pressure is exerted on the injected preservative, the muscles resist and the entire organ gradually curves over toward the sulcate side.

This was the case in the beautiful (but unidentifiable) drawing of the hemipenis used in the description of the xenodontid genus *Psomophis* Myers and Cadle (1994: Fig. 3). My reexamination of the specimen drawn (USNM 331437) showed the hemipenis to be far from "fully everted," and so badly distorted that the drawing showed an apical (rather than a sulcate-side) view of the partly-everted lobes. The relationships of *Psomophis* cannot be determined from this drawing.

This is not a new problem in hemipenis descriptions, or one unique to Zaher and Prudente or to Myers and Cadle. Among many errors in the literature, I will describe only two, one of which is mine.

(1) The hemipenis of *Trimeresurus stejnegeri* was depicted by Mao et al. (1984: Fig. 6) as having the apical lobes much shorter than the hemipenial body. In contrast, the hemipenis of *T. stejnegeri* was described by Pope and Pope (1933) as "extending to 13–14th [sub-] caudal plate, forked opposite 7–8th," e.g., having long hemipenial lobes. The difference between the two descriptions is explained by the "disappearance" of the sulcus in the middle of

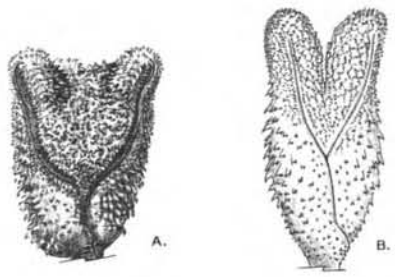


FIG 3. The hemipenis of *Philodryas olfersi*: (A) UMMZ (Univ. Michigan Mus. Zool.) 108988 as shown in Dowling (1969); (B) as drawn in 1971 (HGD-HISS; AMNH 88587). It is notable that A was noted to be 8 SC (subcaudals) in length, whereas B was recorded as 12 SC.

the lobes in the figure presented by Mao et al. This feature shows that the hemipenial lobes are incompletely everted, due to the restriction of the divided retractor muscle (Fig. 2).

Zaher (1999: 15) had mentioned this figure as being in contrast to the general rule that viperids have hemipenial lobes "two or more times longer than the hemipenial body." Rather than *T. stejnegeri* having a different hemipenial morphology, however, it is the drawing that is in error because of incomplete eversion of the organ.

(2) My own major entry into errors of description is the "correction" of previous figures of the hemipenis of *Phylodryas olfersi* (Dowling 1969). As shown here (Fig. 3), the "correction," although in the right direction, is far from an accurate depiction of the fully-everted hemipenis.

I must admit that it took me many years to recognize these problems and to determine their solution. Thus, they are not mentioned in the early paper by Dowling and Savage (1960), and sadly, many of the "beautiful and detailed drawings" done for me in late 1960s and 70s I now recognize to be of incompletely everted organs (Fig. 4).

The above corrections and comments do not affect Zaher and Prudente's (1999) relegation of *Tripanurgos compressus* Fitzinger (1843:27) to the synonymy of *Siphlophis* Fitzinger (1843:27). They appear to be correct in this decision—and it has the additional benefit of deleting two more monotypic genera from the Neotropical snake fauna.



FIG 4. Incomplete and irregular hemipenis drawings from the Dowling (HISS) collection (1969–1973). A. *Conophis vittatus* AMNH 66337: Apical discs omitted (*fide* Auth et al. 1998). [Also true of Zaher 1999: Fig. 41, upper. Photo of same specimen.] B. *Hydrops martii*, AMNH 36161: Distal lobes inverted (cf. Zaher 1999: Fig. 52, upper). C. *Phyllorhynchus browni*, UMMZ 58386: Distal lobes inverted (personal observation).

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A Re-Evaluation of the Evidence for a Mid-Pleistocene Mid-Peninsular Seaway in Baja California: A Reply to Riddle et al.

L. LEE GRISMER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
e-mail: lgrismer@lasierra.edu

Riddle et al. (2000) utilize mitochondrial DNA (mtDNA) sequence data from *Bufo punctatus* and five rodents to construct intraspecific gene phylogenies (phylographies) in order to test historical biogeographical scenarios proposed for the herpetofauna of Baja California by Murphy (1983), Grismer (1994), and Upton and Murphy (1997). Riddle et al. (2000) test a late Pleistocene through Holocene dispersal model and a late Neogene vicariance model, noting that each should have a signature phylogeography: the dispersal model should show widely distributed species with little or no genetic differentiation among populations from different regions whereas the vicariance model should show (given that enough time has emerged) reciprocally monophyletic phylogroups (groups of closely related individuals) on opposite sides of a presumptive barrier, either historical or contemporary. They present their results as a series of area phylograms which display intriguing patterns of organismal relationships, and note that all six species exhibit multiple geographically separated phylogroups. However, their analyses are not fully explanatory, segments of their results allow for multiple interpretations, and alternate hypotheses remain unaddressed.

Riddle et al. (2000) note that there are separate northern and southern peninsular phylogroups in all five rodents with divergences ranging from 1.8 to 4.1%. They attribute this to a mid-Pleistocene transpeninsular seaway. For four of these species, a mid-peninsular vicariant model appears to be the most parsimonious hypothesis.

In support of their hypotheses, Riddle et al. (2000) utilize published data from additional reptiles which include *Pituophis vertebralis* (Rodríguez-Robles and de Jesús-Escobar 2000), *Petrosaurus repens* (Aguilar-S. et al. 1988), *Urosaurus nigricaudus* (Aguirre-L. et al. 1999), and *Uta stansburiana* (Upton and Murphy 1997). It is here I believe alternate hypotheses exist. Riddle et al. (2000) state that genetic structuring in all these species is consistent with a mid-peninsular vicariant event, even though their own criteria of reciprocal monophyly is met in only one of those species, *Uta stansburiana* (Upton and Murphy 1997). Regarding *Pituophis vertebralis*, Grismer (2001) demonstrated that its phylogeographic relationships (Rodríguez-Robles and de Jesús-Escobar 2000; Fig. 5b), were consistent with a dispersal-based model, and Rodríguez-Robles and de Jesús-Escobar (2000) stated that their data did not unequivocally support a mid-Pleistocene vicariant event. Three of the five allozyme character states listed on the tree of *Urosaurus nigricaudus* (Aguirre-L. et al. 1999: Fig. 2) were incorrectly mapped (compare their Fig. 2 with Table 3 for sAat-A, Pep-A^2, Pep-B^2) and thus, do not support a mid-peninsular vicariant event. Additionally, one of the population samples of *Urosaurus* was the genus *Uta* (see Grismer 2000a) which further confounded the results. For *Petrosaurus repens* (Aguilar-S. et al. 1988), Augirre-L. et al. (1999) indicate that these data are not consistent with a mid-peninsular seaway. Additional molecular data sets (allozymes and/or mtDNA) from five other lizards having transpeninsular distributions (*Sauromalus ater* [Petren and Case 1997]; *Callisaurus draconoides* [Adest 1987]; *Sceloporus zosteromus* [Grismer and McGuire 1996]; *Cnemidophorus hyperythrus* and *C. tigris* [Radtkey et al. 1997]), one other snake (*Chilomeniscus cinctus* [Wong et al., in prep.]), and one frog (*Bufo punctatus* [Riddle et al. 2000]) show no significant statistical support in their respective trees that are consistent with a mid-peninsular vicariant event.

Riddle et al. (2000) provide support for the previously hypothesized (Grismer 1994; Murphy 1983) northern Gulf and Cape Region vicariant events in three species with divergences of 7.5–8%. They purport that these events occurred approximately three million years ago (mya) and following Upton and Murphy (1997), suggest that the mid-peninsular vicariant event occurred approximately 1 mya. At 1 mya, the geomorphology of the peninsula was essentially the same as it is today: all mountain ranges had reached their current altitude, the Gulf of California had receded to its current position as a result of the uplift of mountains in southern California, and fluvial deposits from the Sierra de la Giganta had created a land positive connection with the Cape Region and the rest of the peninsula (Gastil et al. 1975, 1983; Stock and Hodges 1989). Sea levels, however, fluctuated greatly (Everenden and Everenden 1970) which would be the only way by which a mid-peninsular seaway would have formed. However, for a seaway to cross any portion of central Baja California during that time period or later, it would have had to have risen at least 300 m in elevation above its current level. This would have re-inundated most of southeastern California (portions of which are currently below sea level) and the Isthmus of La Paz, which reaches 10 m above sea level at its highest point. Geological evidence for mid-Pleistocene re-inundations of this magnitude do not exist. Furthermore, based on the current distribution of various phylogroups (Murphy 1983; Riddle et al. 2000; Upton and Murphy 1997), the location of this presumptive mid-peninsular seaway has ranged 360 km, from near Puertecitos to near Loreto. Riddle et al. (2000) had to infer the age of this proposed seaway from Upton and Murphy (1997) and from the percentage of sequence divergence in the taxa they examined because there is little geological evidence in support of this seaway's age, location, or existence. However, the data from other authors are not in wholesale agreement, placing the age of this alleged seaway at one million (Upton and Murphy 1997) to 13.2 million years (Rodríguez-Robles and Jesús-Escobar 2000).

Despite the various interpretations of age and location of this hypothesized seaway, Riddle et al. (2000) have made a valuable contribution to the biogeography of the terrestrial vertebrates of Baja California in supporting previously proposed hypotheses. Their interpretation of the mtDNA analyses highlights the important concern that unrecognized vicariant events may be embedded within intraspecific phylographies of widely distributed species (Grismer 2000b). However, they overstate this by noting that "sole-reliance on species level taxonomy...has obscured...biodiversity" even though Grismer (1994) utilized the intraspecific relationships of 15 species in hypothesizing some of the same scenarios that Riddle et al. (2000) discuss and support. As for the presence of a

mid-peninsular seaway, both the geological and biological data are still unclear as to when, where, or even if it occurred.

An alternate hypothesis for the mtDNA patterns observed in a number of species from central Baja California may involve the abrupt change in habitat and weather patterns that occur in central Baja California. In the vicinity of San Ignacio, which is almost exactly one-half of the way down the peninsula, the Vizcaíno Phytogeographic Region of the north changes into the Magdalena Phytogeographic Region of the south (Wiggins 1980). Geographically concordant with this transition is the transition of a granitic substrate in the north to a volcanic substrate in the south (Grismer 1994). Lastly, this area is the general southern limit of northern winter storms and northern limit of southern summer storms (Turner and Brown 1982). These three major environmental factors all converging in central Baja California may have contributed to the genetic substructuring currently observed. However, the mechanisms by which such events would promote reciprocal monophyly in phylogroups are not obvious. Clearly, more genetic studies of transpeninsular taxa and geological studies of the tectonic history of central Baja California are warranted before any sound hypothesis is to emerge.

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Forest for the Frogs, Frogs for the Forest

KYLE SUMMERS

Department of Biology, East Carolina University
Greenville, North Carolina 27858, USA
e-mail: summersk@mail.ecu.edu

The alarming pace with which the rainforests of the neotropics (among other places) are disappearing is well known (Laurance and Bierregaard 1997). The adaptation of populations to specific habitats, as well as historical and geographic contingencies, ensure that different patches of rainforest often support different species or subspecies (Terborgh 1992). This, in part, is responsible for the extremely high biodiversity associated with the neotropical rainforests, and the dramatic loss of diversity associated with deforestation. Certain representatives of the exquisite beauty and diversity of lifeforms in the neotropical rainforests have become symbols recognized worldwide, such as the toucan and the *Heliconius* butterfly. Poison frogs of the family Dendrobatidae have also become icons of the neotropical rainforests. One can hardly walk into a gift shop without seeing postcards and posters depicting these small but beautifully colored frogs. Plastic models, puzzles, and many other toys representing these frogs have flooded the U.S. and European markets. At the same time, there has been an explosion in interest on the part of hobbyists to keep these frogs in terraria. Their beautiful coloration, combined with complex behavioral repertoires that can be easily observed in captivity, make them very popular as pets. This popularity has unfortunately led to frequent illegal collection and trade of poison frogs on the pet market.

In my research on a number of species of dendrobatids, I have worked in several localities where the abundance of these frogs appears to have been negatively affected by the activities of illegal collectors. In talking to local residents, it is not uncommon to hear

them say they have been employed by "gringos" (usually from the U.S. or Germany) to find frogs, which were then placed in small containers (such as film canisters), an obvious sign that the frogs were to be smuggled out of the country. In recognition of this problem, these frogs are included on CITES lists and their collection and sale is regulated. In spite of this, illegal collection and trade is alarmingly common.

Recognition of this problem among hobbyists has led to admonitions to buy only captive-bred frogs. This response is admirable, but unfortunately it has not resolved the problem of illegal collecting and trading, and captive breeding brings its own problems as well. For example, captive breeding of poison frogs is a difficult enterprise for many species, and the occurrence of nutritional problems, such as spindle leg disease, and of pathogenic infections, is all too common in captive populations (Heselhaus 1992). This problem is exacerbated by the small population sizes of captive breeding colonies, which may lead to a reduction in genetic diversity (Templeton et al. 1996) and an increase in problems associated with the lack of such diversity (Barrett and Charlesworth 1991; Gabriel et al. 1994).

Recently, Rainer Schulte, a biologist living in San Martin Province in central Peru, has been attempting to simultaneously address the problem of tropical deforestation and that of illegal trade in poison frogs. San Martin is a mountainous province spanning the transition between the high Andes and the lowland Amazonian rainforest. The complex topography of the region has apparently produced a high diversity of poison frog species and subspecific variants, including some of the most beautiful and expensive species. Schulte has developed a plan to save these frogs from extinction.

Schulte's idea is to engender the management and production of poison frogs in the very rainforests where they live. To do this, he is recruiting the people who live in the forest where the frogs occur. The main factor causing deforestation in the neotropics is not increasing urbanization, which is confined to restricted areas, but rather the colonization of large tracts of rainforest by impoverished subsistence farmers (Kahn and McDonald 1997). As new roads are cut into the forest, farmers move in and begin to convert the surrounding forest into fields for the production of crops such as plantain and manioc. Because rainforest soils rapidly become depleted once the original rainforest is removed, these farmers are forced to continually cut new swaths of land to grow new crops.

Poison frog management holds out the possibility of making pristine rainforest an economic asset to the people who live in the forest. With individual frogs of some species (such as *Dendrobates fantasticus*) commanding prices of as much as US$ 100–150 in the U.S. and Europe, these frogs represent a substantial untapped economic asset for poor Peruvians living where the frogs live. But in order to utilize these frogs as a sustainable natural resource, it is necessary to manage them in an ecologically sound manner. This requires maintaining their primary rainforest habitats. Schulte's management method is simple and employs materials available to even the poorest people. Poison frogs (particularly those of the genus *Dendrobates*, which includes the most sought after species) have an unusual mode of reproduction. Eggs may be laid in the leaf litter or on a leaf, but once they reach the tadpole stage they are transported on the back of a "nurse frog" (the male in most species) to small pools of water that form in leaf axils of bromeliads and other forest plants.

Reproduction and population density can be limited by the availability of pools (Donnelly 1989). Increasing the number of available pools leads to increased breeding activity, such that additional tadpoles are produced, at least in some species (Schulte 1997). Schulte increases pool density using artificial pools constructed from discarded plastic soda bottles. These artificial pools are readily accepted by the frogs and used to deposit tadpoles. Hence, by installing such pools in a rainforest plot, local people can obtain a steady supply of young, healthy frogs from the rainforest. Naturally, the adult frogs must not be collected or disturbed, and a certain percentage of the young frogs must be allowed to remain in the forest to provide the next generation of adults.

This management program allows the local people to earn a substantial income, while at the same time providing an economic incentive for them to preserve primary rainforest. Cooperative associations of local people can combine their rainforest plots and preserve substantial areas of rainforest in particular regions. The variation of each species from region to region makes it viable to carry out this program in many different localities. In Schulte's home region near Tarapoto, he has recently formed an association of some 25 local residents (ASPRAVEP), who together are managing an area of some 250 hectares of primary rainforest fragments. Schulte claims that ASPRAVEP can produce a sustainable yield of several hundred juvenile *Dendrobates* (particularly *D. imitator*, *D. variablis*, and *D. fantasticus*) each year, and higher numbers of juvenile *Epipedobates* (*E. bassleri*, *E. trivittatus*, *E. pongoensis*, and *E. hanheli*). Given the high prices commanded by these frogs in the U.S. and Europe, the income from their export and sale will substantially exceed the income these local residents can obtain by cutting the forest and farming the cleared land, thereby providing an incentive for them to preserve the tracts of primary rainforest under their care.

Recently there has been considerable debate concerning methods for the preservation of tropical biodiversity (Mooney 2000). Some researchers argue that the best approach is to set aside large tracts of land as parks that are managed by professional caretakers equivalent to park rangers in the U.S. (Terborgh 1999). Others argue that the best way to ensure the long term preservation of biodiversity is to involve local residents in management, and to provide economic incentives by allowing sustainable forms of use (Janzen 1996). At this point, the debate concerning the creation of large parks is academic in much of South America, as many countries do not have the resources to create new parks or the ability to effectively manage those already in existence (Kahn and MacDonald 1997). Much of the rainforest in the neotropics has already been divided into forest fragments that exist in a mosaic with farmland and residential areas, and this is likely to become more common in the future (Laurance and Bierregaard 1997). Hence it is critical to discover ways to encourage local residents to preserve remaining fragments.

Schulte's effort is similar to other projects that are attempting to return the economic benefits of preserving the rainforest to the people who actually live there. Another example is the creation of laboratory facilities in Panama for the analysis of plant samples to identify potentially important new chemicals for the pharmaceutical

industry. Todd Capson and Phyllis Coley, in collaboration with the Smithsonian Tropical Research Institute, are spearheading this project, in which Panamanians are trained to carry out important chemical assays (such as those for anti-cancer and anti-HIV properties). By identifying such properties before the plants (or plant extracts) are sold to the pharmaceutical companies, their economic value to the people of the country of origin is vastly increased. The recent development of an extremely potent painkiller from the toxins of a poison frog from Ecuador (Bradley 1993) highlights the benefits that the identification of potentially useful compounds from the tropical forest could provide to people from the countries of origin, if they are able to participate in the process of discovery.

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ARTICLES

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Notes on the Distribution of *Dyscophus insularis* (Anura: Microhylidae)

MIGUEL VENCES
Muséum national d'Histoire naturelle, Laboratoire des Reptiles et Amphibiens
25 rue Cuvier, 75005 Paris, France
Address for correspondence: Zoologisches Forschungsinstitut und Museum
Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany
e-mail: m.vences@t-online.de

FRANK GLAW
Zoologische Staatssammlung, Münchhausenstr. 21
D-81247 München, Germany
e-mail: Frank.Glaw@zsm.mwn.de

and

BRIAN L. FISHER
Department of Entomology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118, USA
e-mail: bfisher@calacademy.org

Dyscophus insularis is one of three species in the endemic Malagasy genus *Dyscophus*, which together with the Asian genus *Calluella* forms the subfamily Dyscophinae (family Microhylidae). While *D. antongili* and *D. guineti* are exclusively known from humid eastern Madagascar, *D. insularis* is largely a species of the seasonal dry areas of western Madagascar. It was recorded from five western localities by Blommers-Schlösser and Blanc (1991): the type locality Antsohy near Trabouzy, Belo (type locality of the synonym *beloensis*), Tsimanampetsotsa and Soalala (localities of the type series of the synonym *quinquelineatum*; Soalala being the locality of the lectotype), and Ankarafantsika. Glaw and Vences (1994) added two additional records, Ambanja in the north-west (voucher specimen in Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn: ZFMK 52757) and Kirindy in the west (based on personal communications; vouchers collected in 1995: ZFMK 59982–59984). Emanueli and Jesu (1995) recorded the species from the Tsingy de Bemaraha, Goodman et al. (1997) from the Vohibasia forest. One additional locality in Blommers-Schlösser and Blanc (1991) does not fit into this distributional pattern, namely Marojezy in the rainforest area of north-eastern Madagascar. This locality was based on specimens in the Muséum National d'Histoire Naturelle, Paris (MNHN) already mentioned by Guibé (1978).

In the MNHN collection, we located five specimens of *D. insularis* with the origin Marojezy (MNHN 1973.577–581). Altitude of the collecting locality is given as 1300 m in the catalogue (not 300 m as reported by Guibé 1978) and collecting date as 2 July 1972. In the catalogue, this series is immediately followed by nine specimens (MNHN 1973.582–590) from Ankarafantsika (Ampijoroa), collected on 5 February 1973. No information on the collector(s) is given. According to entry notes of J. Guibé available in the MNHN, the specimens belonged to a large series of microhylids from "Massif de Marojezy et autres lieux" which were collected by C. P. Blanc. The *Dyscophus* specimens had the provisional numbers 2084–2092 and 2094–2098 and are marked in the

notes with the locality information "region Ouest." In a second notebook containing a list of the provisional numbers, the whole series 2082–2092 and 2094–2118 (comprising also other species) are explicitly stated to originate from Ankarafantsika, collected on 5 February 1973. Apparently, the locality information Marojezy for *D. insularis* is thus an error that occurred when the specimens were catalogued. To evaluate further evidence on the locality of these specimens, we examined the respective vouchers in more detail.

All specimens of both series are very similar regarding their (good) state of preservation, fixation, external morphology, and coloration. MNHN 1973.578 is an adult female (SVL 52.8 mm) containing 1100 mature blackish oocytes of 1–1.2 mm diameter, indicating that at least this specimen was captured during the reproductive season. Examining stomach contents, we observed three conspicuous items present in specimens from both series: a) Remains of a large ensiferan orthopteran in MNHN 1973.581 (Marojezy) almost certainly corresponding to undetermined but better preserved prey items in MNHN 1973.585 and 586 (Ankarafantsika); b) In MNHN 1973.578 (Marojezy) we found three abdomina of a tenebrionid coleopteran which were identical to a remain in MNHN 1973.590 and to a completely preserved specimen in MNHN 1973.587 (both Ankarafantsika); the beetle was determined as *Parecatus machloides* (Tenebrionidae: Asidinae), a conspicuous form which we did not see in any other stomach of about 200 Malagasy frogs examined from different localities; c) Stomach of MNHN 1973.579 (Marojezy) contained remains of the ant *Aphenogaster swammerdami*, a species that was also found in MNHN 1973.586 and 1973.588–589 (Ankarafantsika). Stomachs of specimens of both series contained sand.

Dyscophus insularis is a species breeding in lentic water and is known mainly from open areas of sandy soils. The ant *Aphenogaster swammerdami* is a species limited to open areas and is very common in the western dry forest habitats, although it also can be found in disturbed and secondary grassland habitats in the eastern high plateau (BLF, unpublished data). Marojezy is a mountain massif largely covered by primary rainforest; only above 1800–2000 m altitude the forest is replaced by open ericoid heathlands (Raselimanana et al. 2000). The MNHN *Dyscophus* specimens from Marojezy are reported as originating from altitudes of 1300 m (MNHN catalogue) or 300 m (Guibé 1978), which are covered by forest. It is very unlikely that this information is correct, considering the habitat preferences of *D. insularis* and its prey *A. swammerdami*. Furthermore, it also is not probable that an explosive breeder like *D. insularis* would reproduce in the cold and dry season (July) as suggested by the presumed collecting date and the oocytes found in MNHN 1973.578. The intensive surveys of Raselimanana et al. (2000) failed to record *D. insularis* from Marojezy, despite the use of pitfall trapping which is suited for the capture of terrestrial microhylids. Considering also the conspicuous agreement between stomach content composition, there is overwhelming evidence that the Marojezy entry in the MNHN catalogue is erroneous, and that the respective *D. insularis* specimens belong to the same series as MNHN 1973.582–590 and were thus collected at Ankarafantsika.

This removes one anomalous biogeographic pattern in the distribution of Malagasy anurans. It also stresses the endemism of the amphibian fauna of western Madagascar, and bears relevance for conservation. If *D. insularis* is not present in the Marojezy reserve, it is currently known from only three officially protected areas, namely Ankarafantsika, Tsingy de Bemaraha, and Tsimanampetsotsa (although its occurrence within the boundaries of the latter reserve are still to be confirmed).

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Advertisement Call and Breeding Period of the Frog, *Kaloula pulchra* (Microhylidae)

RAVISHANKAR D. KANAMADI
Department of Zoology, Karnatak University, Dharwad-580 003, India
e-mail: karuni@gbl.vsnl.net.in

GIRISH G. KADADEVARU
Department of Zoology, Karnatak University, Dharwad-580 003, India

and

HANS SCHNEIDER
Zoologisches Institut, University of Bonn, Bonn, Germany
e-mail: Dr.Schneider@gmx.net

The Western Ghats region of India has been identified as one of the 18 biodiversity hot spots of the world (WCMC 1988), and harbors 205 species of amphibians (Daniels 1992). *Kaloula pulchra* is a medium-sized burrowing frog (mean male SVL = 67.3 mm, N = 10) distributed in parts of Western Ghats. Although *K. pulchra* is a common microhylid of this region, we have limited knowledge about this species from the Western Ghats. In particular, very little is known about its reproductive biology. We investigated the

breeding period and advertisement call of this species.

Both field observations during the breeding season and characterization of the male call parameters were conducted near Dharwad (15°27′N, 75°05′E). From 1989 to 1997, we recorded male calls with directional microphones (AKG, D- 707/190 C, D- 1000 I) and tape recorder (AKAI AJ 490 FS, 4.8 cm/s) at water temperatures of 19–21°C and relative humidities between 90 and 93%. We used a LUTRON SL 4001 SPL meter (fitted with Bruel & Kjaer multi-function acoustic calibrator, 4226) to measure the sound pressure level (re 20 μPa, "fast" root-mean-square [RMS], C weighing) from a distance of 1 m. Calls of 20 males were analyzed by the acoustic analyzer computer program MOSIP® spectro analysis V6 8, 41/89, MEDAV GmbH, at Zoological Institute, University of Bonn, Germany; statistical analysis was carried out with Statgraphics (STSC, Statistical Graphic Corp., Knoxville, Tennessee, USA).

Calling activity began after the first two to three heavy pre-monsoon showers (April/May) during 1990, 1991, 1992 and 1996. When the pre-monsoon rains failed to occur during 1993, 1994, 1995, and 1997, the calling began with the onset of monsoon rains (June/July) and continued until August. Observations over a period of eight years indicated that the males emit the advertisement call from April to August. During the same period amplected pairs also were observed in the field. Hence, in the absence of reports on the gonadal cycles, we suggest that April to August may be the breeding period of *K. pulchra*. The calls were given while males floated on the water surface. Calling was in chorus, however adjacent calling males alternated their calls (N = 50). Advertisement calls were emitted in series with variable call intervals. Each call occurred in a single pulse group of 28–56 pulses (mean ± SE, 42 ± 1; Fig. 1A) and the number of pulses per second varied between 54 and 114 (mean ± SE, 84.2 ± 6.1). The pulse interval was very short and could not be recorded. The amplitude varied slightly from call to call (Fig. 1B). The call began with a pulse of low amplitude and reached the maximum after the 6th to 10th pulse (Fig. 1A). Subsequently it decreased gradually. The call duration, call interval, and the call period varied from 318 to 932 ms (mean ± SE, 579 ± 14; N = 20), 207 to 1078 ms (mean ± SE, 541 ± 27; N = 20) and 797 to 1672 ms (mean ± SE, 1140 ± 31; N = 20), respectively. The frequency spectra ranged between 50 and 1760 Hz with two bands (Fig. 1C). The dominant frequencies were between 400–1220 Hz (mean ± SE, 704.8 ± 85.1; N = 10). The sound pressure level measured from a distance of 1 m from the frog varied between 54 and 60 dB.

The advertisement calls of breeding male anurans have two main functions: a) intrasexual competitive interactions for calling stations, which in some species are also oviposition sites, and for active (acoustic) space; and b) intersexual attraction of mates (Littlejohn 1977). Additionally, calling sites and call parameters may reflect mechanisms for reproductive isolation among species. Acoustic communication studies in Western Ghat microhylids are limited to *Microhyla ornata* (Hiremath 1991), *M. rubra* (Kanamadi et al. 1994), *Ramanella variegata* (Kanamadi et al. 1993), and *R. montana* (Kadadevaru et al. 1998).

Kaloula pulchra, R. variegata, M. ornata, and M. rubra are sympatric microhylid species at Dharwad. Calling sites of *M. rubra* are on land in open fields near water bodies (Kanamadi et al. 1994), whereas those of *M. ornata* are depressions in muddy areas, and

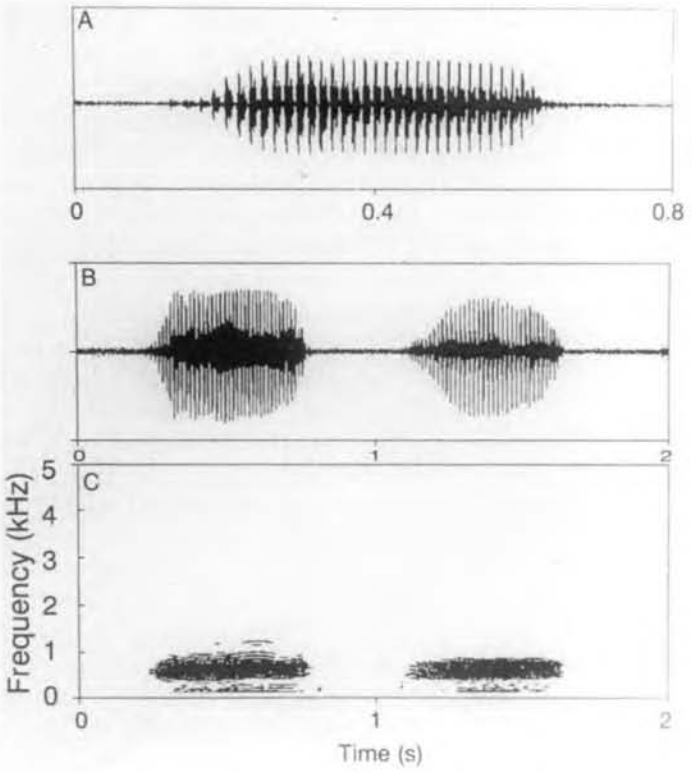


FIG. 1. (A) Oscillogram of a single advertisement call of *Kaloula pulchra* (66 mm SVL) showing amplitude modulation. Oscillogram (B) and sonagram (C) of two advertisement calls of *K. pulchra* (66 mm SVL) showing call interval and frequency spectra respectively. Recorded in Dharwad, India. Water temperature 20°C.

also in spaces under the grass (Hiremath 1991). The advertisement call of *M. rubra* consisted of 66–135 pulses/s (mean ± SE, 108 ± 2.4; N = 39). The call duration varied from 138 to 228 ms (mean ± SE, 168 ± 3.2; N = 39) and the number of pulses ranged between 15 and 21 (mean ± SE, 18.0 ± 2.4; N = 40). In *M. ornata*, the advertisement call comprised 33–40 pulses/s (mean ± SE, 30.0 ± 0.3; N = 28). The call duration varied from 13 to 77 s (mean ± SE, 33.2 ± 5.3; N = 14) and the pulse number ranged between 10 and 14 (mean ± SE, 12.8 ± 0.30; N = 28). Males of *K. pulchra* call from the surface of water bodies, similar to those of *R. variegata* (Kanamadi et al. 1993). It is likely that the different calling sites of *M. rubra* and *M. ornata* contribute to spatial separation of these sympatric species from *K. pulchra* and *R. variegata.* The advertisement call of *R. variegata* consisted of 359–385 pulses/s (mean ± SE, 369 ± 4.6; N = 5). The call duration varied from 187 to 234 ms (mean ± SE, 214 ± 3.6; N = 10) and the pulse number ranged between 74 and 137 (mean ± SE, 96 ± 5.6; N = 11). Its frequency spectra ranged between 300 and 4300 Hz with harmonics and a distinct fundamental frequency (Kanamadi et al. 1993). In the present study of *K. pulchra*, the pulse number (28–56) and the frequency range (50–1760 Hz) are much lower. Although males of both species share common calling sites, the species-specific pulse number and the variation in the frequency range may help in attracting conspecific females.

The call duration of *K. pulchra* from Thailand (Heyer 1971) ranged from 560 to 600 ms, consisted of 32–35 pulses/s with 18–21 pulses/call, and the frequency spectra had a dominant band at 250 Hz. Our study of the same species shows differences in the

call duration, pulses/s, pulses/call, and the frequency range. The differences in the call parameters may reflect geographic variation, as described in *Rana ridibunda* (Schneider 1973; Nevo and Schneider 1983; Kuhn and Schneider, 1984; Schneider and Sofianidou 1985), *Bombina orientalis* (Akef and Schneider 1985; Schneider et al. 1986), and *M. ornata* (Hiremath 1991).

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Seasonally Skewed Sex-Ratios of Road-Collected Texas Horned Lizards (*Phrynosoma cornutum*)

WADE C. SHERBROOKE
Southwestern Research Station
American Museum of Natural History
P.O. Box 16553, Portal, Arizona 85632, USA
e-mail: wcs@amnh.org

Road surfaces, paved and nonpaved, are modern landscape features that have been utilized by herpetologists for collecting for decades (Klauber 1939). In the case of snakes, both their positive thermoregulatory features and their negative dead-on-road (DOR) aspects are well appreciated, the latter having conservation implications (Rosen and Lowe 1994; Rudolph and Burgdorf 1997; Rudolph et al. 1999). Less is known about the effects of roads and their adjacent landscape features on lizard behavior and survival. For example, roadside features may influence harvester ant populations (DeMers 1993), which are an important food of *Phrynosoma* spp. (Pianka and Parker 1975).

Fair and Henke (1997a) evaluated methods of collecting *P. cornutum* in southern Texas (including roads). Henke and Montemayor (1998) presented evidence of seasonal and diel use patterns of roads by this species in southern Texas. They did not comment on sex ratio. In their study area of sparse vegetation the sex ratio did not deviate from 1:1 female/male (Henke and Montemayor 1998; S. Henke, pers. comm.). Vegetative habitat characteristics can affect horned lizard abundance and foraging activity (Whiting et al. 1993; Fair and Henke 1997b).

Here I present evidence that in Texas horned lizards (*Phrynosoma cornutum*), a threatened species in Texas (Price 1990; Donaldson et al. 1994), the sex ratio of lizards occurring on roads along the Arizona and New Mexico border is seasonally skewed. In interpreting these data, I hypothesize that seasonal use of roads as a landscape feature by Texas horned lizards is related to their mate-seeking behavior, and because of vehicle-caused mortality this behavior may contribute to local and regional extirpation.

The range of Texas horned lizards encompasses much of the Chihuahuan Desert, shortgrass prairies, and desert grasslands of western North America (Price 1990) where it may encounter dense desertshrub and grassland communities (Brown 1982). Between 1983 and 2000 (18 years), 452 Texas horned lizards were collected on paved road surfaces in southeastern Arizona (Cochise Co.) and southwestern New Mexico (Hidalgo Co., a few from Grant Co. and Luna Co.). Most lizards were collected during a morning drive (0800–1200 h), traveling at about 60 kph from Portal, Arizona, east to New Mexico Highway 80, north to New Mexico Highway 9, east to Animas and then to the Playas Valley, then south to the Playas Smelter (Phelps Dodge Corporation) and/or north on New Mexico Highway 113 to Interstate Highway 10, and then back to Portal (210 km). Road cruising conditions allowed easy identification of Texas horned lizards on the road well before they could flee, including possible juveniles (many additional captures were of the smaller species *Phrynosoma modestum*). Capture rate of lizards seen on the roadway was very high, >95%, both those "freezing" on the road surface and those running off the road into

TABLE 1. Seasonal sex-ratios (F = female, M = male), by 15- and 16-day half-month periods, of road-collected adult Texas horned lizards (*Phrynosoma cornutum*) in Arizona and New Mexico, 1983–2000. Collection effort was not equal throughout the months.

Month	April	May	May	June	June	July	July	Aug	Aug	Sept	Sept	Nov
Days	16–30	1–15	16–31	1–15	15–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15
N = F/M	0/1	6/14	32/178	21/137	10/15	7/0	1/1	1/0	1/1	7/2	4/1	1/0
ratio F/M	—	1:2.33	1:5.56	1:6.52	1:1.5	—	1:1	—	1:1	1:0.29	1:0.25	—

adjacent vegetation where they stop and "freeze." Seasonal abundance of lizards on highways facilitated collecting for behavioral and other studies. Most lizards were later released at sites of capture or placed in Southwestern Research Station collections.

Location, date of capture, sex, mass (g), and snout-vent length (SVL, mm) were recorded. The prime collecting time was late May (16–31) and early June (1–15), 81.4% of lizards collected (Table 1), when effort was maximal in terms of number of collecting days and kilometers driven. For analysis, lizards were grouped into adults and juveniles, and into 15 or 16-day (half-month) capture periods throughout the collecting season (Table 1). Most animals were adults (≥ 68 mm SVL), N = 438, 96.9%; 14 juveniles (≤ 67 mm SVL) comprised 3.1% (for size of adults see Ballinger 1974 and Howard 1974). Snout-vent lengths of juveniles were (May 1–15) 36 mm, (May 16–31) 37, 39, 54, 66, 67 mm, (June 1–15) 40, 47, 53, 57, 58 mm, (June 16–30) 56, 62 mm, (August 16–31) 65 mm. All were above hatchling size of about 17–25 mm SVL (Blaney and Kimmich 1973; Burrow 2000; WCS, pers. observ.). Juveniles were not included in the sex-ratio analysis.

For each 15- or 16-day collection period the number of females and males, and the female-to-male sex ratio are presented (Table 1). During the one-month period (May 16–June 15) 368 adult lizards were collected, 14.4% female and 85.6% male: males were 85% of road-collected lizards in the May 16-31 period and 87% in the June 1–15 period. During this month the female/male sex ratio was close to 1:6. This period encompasses the peak of the mating season (Ballinger 1974; Howard 1974). Immediately before (May 1–15; N = 20) and immediately after (June 16–30; N = 25) the male preponderance was much less, female/male 1:2.3 and 1:1.5 respectively. In contrast to May 16–June 15, during the three-month post-mating-season of July 1–September 30, when 26 lizards were collected, the sex ratio became highly skewed in favor of females, 1:0.24 (females 80.8% and males 19.2%). Egg laying occurs in July (Sherbrooke 2000; Sherbrooke, unpubl. data for 2000, three additional nestings). Females may increase movement activities while seasonally searching for appropriate nesting sites (Burrow 2000; WCS, pers. observ.).

The seasonal switch in sex ratio suggests that the skewed male preponderance in late May and early June is not because of a population-based sex ratio that differs from 1: 1, in agreement with reports from other areas (Whiting et al. 1993; Henke, see above). One explanation for the May 16–June 15 skewed sex ratio is that males, possibly seeking mates by increasing movement, encounter roads more frequently than do more sedentary females. Additionally, or alternately, males once encountering road surfaces may linger on open roads for extended periods of time. The result in both behavioral scenarios would be a male-bias sex-ratio in samples of road-collected lizards. I discount the possibility that sex differences in emergence times from hibernation is the causal factor for the sex bias; males and females in this area seem to emerge simultaneously between 19 April 1998 and 3 May 1998 (Sherbrooke, unpubl. data; N = 8). The difference observed in seasonal sex-ratios on roads between south Texas (1:1, see Henke above) and this study in Arizona-New Mexico (1:6) may be because of differences in populations of lizards, features of the landscape, or unidentified factors. Whiting et al. (1993) and Burrow (2000) noted that partially, versus densely, vegetated habitat facilitates locomotion, foraging, and thermoregulation in *P. cornutum*.

In Oklahoma, *Phrynosoma cornutum* males have been shown to travel greater distances than do females during the mating season (Stark 2000; Stark and Fox 2000). This seasonal behavior by males may explain the male-bias sex-ratio during May 16–June 15 in Arizona and New Mexico, but the second hypothesis that males remain on roads when encountered also could be valid. Although roads prove to have negative survival value (DORs), they might be attractive to male lizards because of the expanse they provide for visually locating females. Roads, in this sense, mimic positive features of natural landscapes such as open wash beds and other disturbed sites that provide expansive visual openings that may aid in mate location in desertshrub and grassland communities with dense vegetation where ground-level shrubs, grasses, and herbaceous plants inhibit visibility.

The size dimorphism in horned lizards, males smaller than females, may have evolved because smaller, early-reproducing males are more successful in finding dispersed mates (Zamudio 1998). Male horned lizards may have larger home ranges than females (Lowe 1954; Baharav 1975; Turner and Medica 1982), although perhaps not always (Burrow 2000). Although the lack of territorial defense and applicability of the term home range to the movement activities of Texas horned lizards has been studied and debated (Whitford and Whitford 1973; Munger 1984 a,b,c), it seems that males of this species may expand or abandon home ranges during the breeding season when they exhibit increased movement activities (Fair and Henke 1999; Stark 2000; Stark and Fox 2000). Munger (1984a) suggested that non-receptive females could modify movements so as to avoid contact with males seeking copulations. The duration of receptivity by females is unknown, but from captive studies it may be brief (Montanucci and Baur 1982). Perhaps non-receptive females seasonally avoid visually open areas.

If the male mate-seeking hypothesis to explain the seasonally-skewed sex ratio was true, and open vistas enhance encounters with females, one would expect to encounter pairs of lizards on the road during the mating season. During this study four pairs of

copulating *P. cornutum* were encountered: female/male, (1) 22 May 1984 (109/87 mm SVL); (2) 31 May 1992 (88/89 mm SVL); (3) 30 May 1994 (94/79 mm SVL); 7 June 1994 (92/78 mm SVL). In addition, two pairs of two males were found socially interacting on the road, presumably visually attracted to one another: male/male, (1) 23 May 1984 (85/84 mm SVL); (2) 28 May 2000 (90/87 mm SVL). The seasonal presence of these pairs of *P. cornutum* on roads is in agreement with the male mate-seeking hypothesis, but not conclusive. Also to be considered, once pairs find each other they may move off of road surfaces into adjacent vegetated landscapes during precopulatory-pursuit behaviors (Tollestrup 1981; Montanucci and Baur 1982; Sherbrooke 1988), thus reducing road encounters of pairs. Multiple mating of captive pairs of *Phrynosoma ditmarsi* (Montanucci 1989) and *P. douglassi* (= *P. hernandesi*) (Montanucci and Baur 1982) have been recorded. Nothing is known as to repeated copulations by pairs in the field, but an individual female *P. cornutum* mated following a first nesting, presumable mating a second time (Burrow 2000).

Henke and Montemayor (1998) noted an increase in breeding-season occurrence of lizards on roads in South Texas. They suggested this increase in activity was the result of mate-seeking behavior. Although the sex ratio in the road-encountered samples was not the same in Arizona-New Mexico and in South Texas, the conclusion as to the cause of increased activity is similar. The increased occurrence of lizards on roads is related to increased lizard movement through habitats because of mate-seeking behavior. In addition to this general seasonal factor, here I argue that during the mating season in areas where the sex ratio of highway-encountered populations is skewed in favor of males, 1) it is the males that are moving more, and 2) the males may linger on road surfaces because of the increased possibility of mate encounter. Alternately, females could avoid roads. These hypotheses, and others for explaining the seasonally-skewed sex ratios encountered, may be testable using radiotelemetry or other tracking methods (Stark and Fox 2000) to study microhabitat movements of male and female Texas horned lizards during the breeding season.

Fair (1995) documented vehicle-inflicted road deaths in areas of south Texas. Depending on road traffic conditions, the presence of *Phrynosoma cornutum* on roads during the breeding season (May 16–June 15 in this study) can lead to various levels of male-biased mortality. Although I have not specifically collected data on DORs, I estimate that observed DORs are equal to between 25% and 50% of the collected and reported live population on these sparsely traveled roads. These mortality estimates are potentially depressed by carcass removal from the highways by turkey vultures (*Cathartes aura*) and Chihuahuan ravens (*Corvus cryptoleucus*) (WCS, pers. observ.). Clearly there is a seasonally-elevated mortality on roads that is male-sex biased in Arizona-New Mexico.

In certain regions this seasonally-increased mortality may threaten the existence of local populations of *Phrynosoma cornutum* . I have not noticed obvious population decline over the 18 years. But in regions where landscapes are increasingly dominated by human activities, with dense networks of roads and intensive vehicular use, local road mortality may not be offset by immigration and resulting population declines then become one factor leading to local extinctions. Such a scenario of increasing human demographics may have contributed to the decline of Texas horned lizards in eastern and central Texas. Although other factors such as direct effects of introduced ants or the indirect effects of these exotic ants on native insect communities (Donaldson et al. 1994; Suarez et al. 2000), that are important to horned lizard feeding (Pianka and Parker 1975), may have played a role in the decline of Texas horned lizards.

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Field Observations of Aggressive Encounters Between Male Sleepy Lizards (*Tiliqua rugosa*)

GREGORY D. KERR
and
C. MICHAEL BULL*
School of Biological Sciences, Flinders University, GPO Box 2100 Adelaide, South Australia 5001, Australia

**Author to whom correspondence should be addressed*
e-mail (GDK): greg.kerr@flinders.edu.au
e-mail (CMB): michael.bull@flinders.edu.au

The sleepy lizard, *Tiliqua rugosa*, is a large scincid from southern Australia. Males have broader heads than females, a sexual dimorphism that may have resulted from selection favoring males with enhanced fighting ability (Bull and Pamula 1996). In spring, adults of this species usually form monogamous pairs that remain in close contact (males less than 1 m from females) with each other over eight weeks before mating (Bull et al. 1998). Although fights are infrequently observed, evidence has suggested that males fight over access to females. Bull (1990) observed nine cases of males fighting in over 11,000 random encounters with lizards over seven years. In six cases a female was observed nearby. Fights can last over fifteen minutes with each male biting the head and attempting to flip the other male over (Bull and Pamula 1996).

From September to November 2000, we followed the daily activity of 30 radio-tagged lizards (14 females and 16 males) in an area of chenopod shrubs and open grassland (34°06'S; 139°26'E), approximately 20 km north of Mt Mary in South Australia. The lizards were sexed based on morphometric differences (Bull and Pamula 1996) and the application of pressure behind the cloaca to evert the hemipenes in males.

A gravel road runs from south to north through one part of the study area. The five adult lizards involved in the following observations had all been resident in the area for at least the three previous years. The centers of the home ranges of two male lizards, A and B, were on either side of the gravel road although both home ranges crossed the road and overlapped. Male A (625 g, SVL 305 mm, head width 67 mm, jaw length 60 mm) to the west was slightly lighter than male B (670 g, SVL 305 mm, head width 66 mm, jaw length 60 mm) to the east. In early September we observed that male A had extensive new damage to scales across the head, lower jaws, and back. At that time adult female E (725 g, SVL 30.0 cm) was active within the home range of male A.

Two weeks later, on 19 September, female E moved across to the eastern side of the road and into the home range of male B. On the next afternoon, males A and B were observed fighting on the eastern road verge. When first observed there were extensive scuffle marks in the gravel, indicating that fighting had been ongoing for some time. They stopped fighting when they were approached. However, male A had already sustained additional damage from this new fight, to scales across the top of its head, to both sides of its lower jaw, and along its back and tail. The damage was extensive and bleeding was evident from all these areas. Lizard B had no external damage, but bruising and some bleeding were evident inside the mouth. Female E was found 73 m away 30 min after the

fight.

During daily radio-locations, female E was found within 30 m of male B over the next six days, but was never observed to be paired with that male. Other paired lizards in the area were commonly found in body contact or within 1 m of each other. After six days female E moved away from male B and back to the western side of her home range. Over the week following the fight, male A had moved further west, up to 300 m outside its previous home range and nearly 400 m from where the fight took place. A week later male A briefly re-entered the home ranges of female E and male B. No further interactions were observed but further damage to the scales of male A was evident. Male A remained to the west and out of the home ranges of male B and female E for the remainder of the season.

On 3 October, female E had again moved to the eastern side of the road, back into the home range of male B. But in that area, over the next seven days, she was recorded as closely paired with male C (540 g, SVL 30.5 cm, head width 60 mm, jaw length 57 mm). Male C was lighter than male B and had a smaller head. Male C was with female E on the morning of 10 October. In the afternoon of 10 October males B and C were observed in a very aggressive fight for about 15 min. This fight took place in a small depression (30 cm radius, 20 cm deep). Male B was found basking next to this depression at 0900 h that morning. When first observed the lizards were already fighting. Initially they were circling each other with the head of one lizard next to the tail of the other. After 5 min the fighting developed into a head-to-head conflict with each lizard biting the head, mouth, and body of the other. The larger male B inflicted extensive superficial damage and injuries to the scales on the head and body of male C. During this part of the fight it is probable that male C sustained a broken right mandible. This break was not detected until closer examination the next day so the exact timing is uncertain. The break, two-thirds of the way down the jaw line, resulted in a vertical displacement of 3 mm in the jaw line. After 12 min, the head-to-head fighting stopped and the lizards circled each other for about 2 min. Finally male B, in a short tussle, obtained a firm hold on the front left leg of male C. At this point male C broke off fighting and retreated into a small hole at the side of the depression. After a pause, male B pursued and strongly bit the tail of male C a number of times. Male B then moved off. Female E was located within 10 m of the site 3 min later.

The injured male C moved to a 20 cm deep, 15 cm diameter sinkhole about 100 m away from the fight site, but still on the eastern side of the road. It was found within 5 m of this hole over the next nine days. The mandible of male C had not set three months later. The lizard was eating at this time. Male C remained out of the home ranges of male B and female E for the rest of the breeding season. Male C was alive eight months later. After the fight, female E initially moved into the same area as C, but within four days (14 October) had moved over 400 m, returning to the western side of the road and to its original home range. Male B also moved across the road into this area, although the two lizards were not observed together at any time during this period. Six days later (20 October) male B had moved 200 m, back to the central home range area on the eastern side of the road.

On 23 October female E was found paired with another small male D (530 g, SVL 29.0 cm, head width 62 mm, jaw length 57 mm) on the western side of her home range. This pairing started late in the season at a time when some established pairs in the region had already mated and separated. At this time male D showed no evidence of scale damage. Female E was paired with male D over the next seven days, but on 26 October they had moved to the eastern side of the road. On 30 October at 1000 h, male D and female E were found paired on the eastern side, with male B 30 m away. At 1700 h male D was found 360 m away, by itself, back on the western side of the road. Since the morning observation, it had sustained significant damage to scales on both sides of its body, on its head, lower jaw, back, rump, belly, and three legs. Bleeding was evident from a number of these areas. No fight was observed, but male B had fresh bruising in the back of its mouth and had some new scale damage predominantly along its left side. Male B again appears to have been the aggressor in this instance. Male D remained out of the home ranges of male B and female E for the remainder of the study period.

Female E once again had moved back to the western side of her home range the next morning. Male B also moved over to the western side of the road. Again, no interaction or close contact was observed between these two lizards at this stage, and on 1 November, female E moved nearly 300 m to the east, across the road. On 6 November, male B and female E were found paired on the western side of the road and they were then found together on four occasions over the next three days. At the study site the mean date for pairs to first form was 29 September. The mean date for pairs to be last recorded together was 4 November. Thus, pairing started at the time most lizards in the area were mating and separating.

Most of the radio-tracked males formed monogamous partnerships with females over the period September–November, the usual pattern for this species (Bull 1988; Bull et al. 1998). Over the same period ten other males, among the 16 tracked, were found with freshly-damaged scales and bleeding from the head, indicating they also had been involved in recent fighting, although none as severe as those described above. There were also several other observations of two males circling each other, on one occasion watched by the female partner of one of them. Thus although fights were rarely observed, and apparently rarely reached intense levels, they seemed to occur relatively frequently among males during the time of pairing. A number of males in the study group have offset lower jaws. It is postulated that the cause of this may have been breakages sustained during fights. These observations support the suggestion that one function of monogamous pairing in the period before mating is for males to guard their female partners (Bull 2000). Results from fights involving male B suggest that large size and perhaps associated large head size help males win fights, as suggested by previous observations of sexual dimorphism in head size (Bull and Pamula 1996) and of smaller males being displaced from partnerships (Bull 1990).

However, in the case of male B it was not clear if the fights were over access to a female or over access to home range area. Male B apparently initiated and won disputes with three other males, but did not gain immediate access to the female partner of those males. The observations lead to two conclusions. First, there are occasional males in the population that are much more aggressive than other males. This is not necessarily a function of male size because other larger males were involved in fewer disputes.

Second, although defeated males in this study fled from the scene of the fight and from their female partner, females did not automatically pair up with the victor. The female appears to make choices. In this case, female E associated with three other males before finally pairing with the victorious male B, when most other pairs had already mated and split up.

It was unusual to observe aggressive interactions of other males. The low frequency of aggression in the population could be related to the long-term, stable pair bonds that are formed in this species.

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Revised Checklist and Comments on the Terrestrial Herpetofauna of Pulau Tioman, Peninsular Malaysia

L. LEE GRISMER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
e-mail: lgrismer@lasierra.edu

JIMMY A. McGUIRE
Museum of Natural Science, Louisiana State University
Baton Rouge, Louisiana 70803, USA

ROLAND A. SOSA
Department of Natural Sciences, Loma Linda University
Loma Linda, California 92350, USA

and

HINRICH KAISER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA

Pulau Tioman is the largest island of the Seribuat Archipelago and lies 48 km off the southeast coast of Peninsular Malaysia in the South China Sea. It is approximately 22 km in length and reaches 11 km in width at its widest point near its southern end. Characterized by steep-sided mountainous terrain reaching over 1110 m in elevation, the island supports a lowland mixed dipterocarp forest on its foothills and hill dipterocarp forest above 300 m, with its coastline and low-lying periphery dominated by mangrove and coastal vegetative communities (Latiff et al. 1999). Exposed granitic outcroppings in the form of large boulders define much of the island's rugged topography and its hillsides are cut by a number of boulder-strewn, fast-flowing streams. Because of its significant topographical relief and concomitant environmental diversity, this small island supports a remarkably diverse herpetofauna with perhaps as many as 83 species: 1 caecilian, 20 frogs, 1 turtle, 24 lizards, and 20 snakes are now confirmed, with an additional frog, 6 lizards, and 9 snakes represented by unconfirmed sightings (Table 1).

Prior to the first comprehensive herpetofaunal reports for Pulau Tioman by Hendrickson (1966a, b), the only other treatments of this island's hereptofauna were Boulenger's (1912) record of *Dogania subplana*, Smith's (1930) listing of 12 species, and de Haas' (1949) record of *Rhabdophis chrysargos*. Subsequent to Hendrickson's (1966a, b) reports, an unpublished report by Day (1990) added 4 species of amphibians and 16 species of reptiles. The most recent comprehensive treatment was Lim and Lim (1999), who added two species of amphibians and two species of reptiles to Pulau Tioman, and Leong (2000) and Leong and Tan (2000), who added one amphibian and one snake, respectively.

Three of us (LLG, RAS, and HK) visited Pulau Tioman from 2 to 6 November 2000 to assess its potential to serve as a site for a summer course in field biology. It came as a surprise that we were able to observe and confirm an additional five species of lizards and three species of snakes (Table 1) based on such a short visit, especially in light of the amount of research done on this island throughout the last century (see Ng et al. 1999 for a review). We also report our observations of three additional species of lizards which we were unable to confirm with voucher photographs or specimens, and provide comment on the unconfirmed records of previous authors (Table 1). Indraneil Das identified all voucher photographs which have been deposited in the La Sierra University Photographic Collection (LSUPC).

NEW RECORDS AND CONFIRMED SIGHTINGS OF PREVIOUS AUTHORS

Cyrtodactylus quadrivirgatus (Marbled Slender-toed Gecko). Manthey and Grossmann (1997) reported this species as occurring on Pulau Tioman but referenced no specimen or voucher photograph. On 2 November at 1000 h, we observed a single specimen (LSUPC L3313–17) sitting on a leaf approximately 1.5 m above the ground along the cross-island trail from Kampung Tekek to Kampung Juara at an elevation of approximately 600 m in hill dipterocarp forest.

Gekko monarchus (Spotted House Gecko). On 2 November at 0800 h, we observed a single specimen (LSUPC L3073) sitting head down on the vertical surface of a large boulder approximately 1 m above the ground along the cross-island trail at an elevation of approximately 100 m in lowland mixed dipterocarp forest. On 4 November, we saw at least eight individuals on large boulders in lowland mixed dipterocarp forest on the beach 1 km south of Kampung Tekek. Two of the females observed were gravid.

Cosymbotus platyurus (Flat-tailed Gecko). On 2 November at 1200 h, we observed two adults and one juvenile 4–5 m above the ground on the trunk of a large tree (ca. 1.5 m diam) along the

TABLE 1. Checklist of the terrestrial herpetofauna of Pulau Tioman, Peninsular Malaysia.

Species	Comments
AMPHIBIANS	
Frogs	
Megophryidae	
Leptolalax gracilis	
Megophrys nasuta	
Bufonidae	
Ansonia tiomanica	
Bufo asper	
Bufo melanostictus	
Bufo parvus	
Pelophryne brevipes	
Microhylidae	
Chaperina fusca	
Kaloula baleata	
Kaloula pulchra	
Rhacophoridae	
Philautus aurifasciatus	
Philautus vermiculatus	Unconfirmed listing (Berry 1975)
Polypedates leucomystax	
Ranidae	
Limnonectes blythii	
Limnonectes hascheanus	
Rana cancrivora	
Rana chalconota	
Rana doriae	
Rana erythraea	
Rana hosii	
Rana signata	
Rana sp.	Possibly undescribed species (Hendrickson 1966b)
Apodans	
Ichthyophiidae	
Ichthyophis sp.	Unidentified larva (Lim and Lim 1999)
REPTILES	
Turtles	
Trionychidae	
Dogania subplana	
Lizards	
Agamidae	
Acanthosaura armata	
Aphaniotis fusca	
Bronchocela cristatella	
Draco melanopogon	
Draco sumatranus	
Gonocephalus chamaeleontinus	
Gonocephalus grandis	
Uromastycidae	
Leiolepis belliana	Unconfirmed sighting (Day 1990)
Gekkonidae	
Cnemaspis kendallii	
Cnemaspis sp.	Formerly *C. nigridius* (Denzer and Manthey 1991)
Cosymbotus craspedotus	Unconfirmed sighting; this report
Cosymbotus platyurus	
Cyrtodactylus quadrivirgatus	Manthey and Grossman's (1997) unconfirmed record confirmed here
Cyrtodactylus tiomanensis	
Gehyra mutilata	
Gekko monarchus	Day's (1990) unconfirmed sighting confirmed in this report
Gekko smithii	
Hemidactylus frenatus	
Lepidodactylus lugubris	Confirmed new record
Ptychozoon kuhli	Unconfirmed sighting; this report
Scincidae	
Dasia olivacea	
Emoia atrocostata	Unconfirmed sighting (Hendrickson 1966a)
Lipinia surda	
Lipinia vittigera	Unconfirmed sighting (Lim and Lim 1999)
Lygosoma bowringi	Unconfirmed sighting; this report
Mabuya longicaudata	Manthey and Grossman's (1997) listing confirmed in this report
Mabuya multifasciata	
Sphenomorphus scotophilus	
Varanidae	
Varanus nebulosus	
Varanus salvator	
Dibamidae	
Dibamus cf. *alfredi*	Possibly an undescribed species (Day 1990)
Snakes	
Typhlopidae	
Ramphotyphlops braminus	
Pythonidae	
Python reticulatus	
Colubridae	
Ahaetulla prasina	
Boiga cynodon	Unconfirmed sighting (Day 1990)
Calamaria lumbricoidea	
Calamaria pavimentata	
Cerberus rhyncops	
Chrysopelea ornata	Unconfirmed sighting (Day 1990) see (Lim and Lim 1999)
Chrysopelea pelias	
Dendrelaphis caudolineatus	
Dendrelaphis formosus	
Dendrelaphis pictus	
Dryocalamus subannulatus	
Elaphe flavolineata	Unconfirmed sighting (Day 1990)
Elaphe porphyracea	Unconfirmed sighting (Day 1990)
Enhydris enhydris	
Enhydris plumbea	
Gonyosoma oxycephalum	Unconfirmed sighting (Day 1990)
Lepturophis albofuscus	

TABLE 1. Continued.

Liopeltis tricolor	
Lycodon effraenis	Unconfirmed record (Manthey and Grossman 1997)
Oligodon purpurascens	
Oligodon signatus	Possibly and undescribed species (Day 1990)
Psammodynastes pulverulentus	
Rhabdophis chrysargos	
Zaocys carinatus	
Elapidae	
Ophiophagus hannah	Unconfirmed sighting (Hendrickson 1966a)
Naja sumatrana	Unconfirmed sighting (Hendrickson 1966a)
Maticora intestinalis	
Viperidae	
Trimeresurus cf. *popeiorum*	See Lim and Lim (1999) for discussion

cross-island trail at an elevation of ca. 650 m in hill dipterocarp forest. All escaped before being photographed. On 5 November at 0130, one adult (LSUPC L5907–08) was observed on the wall of an outdoor restaurant in Kampung Tekek.

Lepidodactylus lugubris (Maritime Gecko). On 4 November at 1400 h, we observed a single specimen (LSUPC L5909–10) sitting head-up on a small tree approximately 2.5 m above the ground outside a store in Kampung Tekek, at the turn-off to the cross-island trail. At 1430 h we observed another individual approximately 3 m above the ground on a coconut tree in the coconut grove 1.5 km east of the cross-island trail turn-off. On 5 November at 1200 h, we observed an individual on the illuminated police station sign in Kampung Tekek.

Mabuya longicaudata (Long-tailed Sun Skink). Manthey and Grossmann (1997) reported this species as occurring on Pulau Tioman but referenced no specimen or voucher photograph. On 5 November at 1300 h and again at 1630 h, we observed several specimens (LSUPC L4004–07) sunning themselves on rocks and logs in a cleared grassy area along the banks of Sungai Air Besar in Kampung Tekek. All observations occurred at sea level.

Dendrelaphis pictus (Common Bronzeback Snake). On 2 November at 1530 h, we observed a single specimen (LSUPC S2781–82) on the ground along the cross-island trail at an elevation of approximately 250 m in lowland mixed dipterocarp forest.

Dryocalamus subannulatus (Malayan Bridle Snake). On 4 November at 2100 h, we observed one individual (LSUPC S2756–65) crawling horizontally on the vertical face of a large granitic boulder approximately 1.5 m above the ground. The boulder was part of a large outcropping situated below the canopy of lowland mixed dipterocarp forest on the beach 1 km south of Kampung Tekek.

Zaocys carinatus (Keeled Rat Snake). On 3 November at 1400 h, we observed one adult (LSUPC S2774–80) crawling on the forest floor along the cross-island trail at an elevation of ca. 500 m in hill dipterocarp forest.

In addition to our confirmed sightings, we add the sight records of *Cosymbotus craspedotus* (Frilly Gecko), *Ptychozoon kuhli* (Kuhl's Gliding Gecko), and *Lygosoma bowringi* (Bowring's Supple Skink) as unconfirmed reports. On 5 November at 1200 h, we observed a single *C. craspedotus* approximately 5 m above the ground on a coconut tree in the coconut grove at the base of the cross-island trail, 1.5 km east of Kampung Tekek. The specimen was approximately 60 mm SVL, and had a grayish ground color with three pairs of obscure dark paravertebral blotches. A fringe along the side of the body and a large fringe coming off the posterior margin of each hind limb were visible. The hands and feet were webbed and the anterior half of the tail was as wide as the body and the fringes were not crenulated.

At 1500 h at an elevation of approximately 600 m along the cross-island trail in hill dipterocarp forest, we observed (through binoculars) a single *P. kuhli* sunning itself head down on the trunk of a large tree (ca. 1 m diameter), ca. 7–8 m above the ground. The specimen was ca. 100 mm SVL. It had a grayish ground color with a pattern of darker transverse sinuous bands and a distinctive dark postorbital stripe. The hands and feet were distinctly webbed and a large fringe coming off the posterior margins of the hind limbs was visible. The caudal fringes were deeply crenulated. We consider this individual to be *P. kuhli* rather than *P. lionatum* based on its color pattern. The latter usually lacks distinct body bands and a dark postorbital stripe (Manthey and Grossman 1997).

At 1600 h along the same trail, but in lowland mixed dipterocarp forest at 200 m in elevation, we saw a single *L. bowringi* foraging on the forest floor. The specimen was ca. 40 mm SVL, had an elongate body and tail with relatively short limbs, and a shiny brownish body with a dark dorsolateral stripe bordered below by reddish coloration on the flanks.

COMMENTS ON OTHER SPECIES

Berry (1975) listed *Philautus vermiculatus* (Vermiculated Bush Frog) as occurring on Pulau Tioman. Lim and Lim (1999) speculate that Berry's listing may have stemmed from Hendrickson's (1966b) indecisive identification of an adult male from Pulau Tioman as *P. aurifasciatus* and that Berry (1975) may not have had access to specimens to confirm Hendrickson's (1966b) listing of this species. Therefore, Lim and Lim (1999) did not include *P. vermiculatus* as part of the island's herpetofauna. However, Berry (1975) also listed *P. aurifasciatus* from Pulau Tioman. Both are montane species and we (JAM and LLG) have observed them in sympatry at Bukit Larut in Perak, Peninsular Malaysia. Thus, the potential for both species to occur on the island exists. We list both species as present, with *P. vermiculatus* as unconfirmed because Berry (1975) cited no material, and *P. aurifasciatus* as confirmed based on Hendrickson's (1966b) specimen. Clearly, a series of *Philautus* needs to be collected from the montane regions of this island to resolve the issue.

Cnemaspis cf. *nigridia* (Dark Round-eyed Gecko) was first reported from Pulau Tioman as *Cnemaspis* sp. by Hendrickson (1966a), but was later referred to *C. nigridia* (Denzer and Manthey 1991; Manthey and Grossman 1997; Lim and Lim 1999). Hendrickson (1966a), however, noted that this population is distinguished from *C. nigridia* by "important differences in scalation" as well as in lacking femoral pores. This population is currently being described by Indraneil Das of the Institute of Biodiversity and Environmental Conservation, Universiti Malaysia, Sarawak and LLG as a new species. *Cnemaspis nigridia* occurs in Sarawak and the Natuna Islands but is not known from Peninsular Malaysia (Das and Bauer 1998).

Discussion

The new records reported here together with the recent works by Day (1990) and Lim and Lim (1999) indicate that the herpetofauna of Pulau Tioman almost certainly remains incompletely known. The steep, mountainous interior and rocky coastline of this island are relatively inaccessible and large tracts of forest remain unexplored. Thus, it is probable that a number of forest-dwelling species, especially small secretive taxa, remain to be discovered. Equally important is the fact that many of the reported species are known from only one or two specimens, and some of these, as well as others known from larger series, show morphological differences from their mainland counterparts (Day 1990; Hendrickson 1966a,b; Lim and Lim 1999). Thus, it is important that series of specimens of each species be obtained and that appropriate morphological and molecular comparisons be made to their Malayan and Bornean counterparts to assess the actual levels of diversity and endemism. As previously noted, potentially undescribed species include *Rana* sp. (Hendrickson 1966b), *Cnemaspis* sp. (Das and Grismer, *in prep.*), *Dibamus* cf. *alfredi*, *Oligodon signatus* (Day 1990), and *Trimeresurus popeiorum* (see Lim and Lim 1999). Known endemics include *Ansonia tiomanica* (Hendrickson 1966b) and *Cyrtodactylus tiomanensis* (Das and Jim 2000).

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TECHNIQUES

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In situ Measurement of Larval Salamander Growth Using Individuals Marked with Acrylic Polymers

BRENT R. JOHNSON*
Department of Entomology, University of Georgia
Athens, Georgia 30602, USA

and

J. BRUCE WALLACE
Institute of Ecology and Department of Entomology
University of Georgia, Athens, Georgia 30602, USA

**Current address: Kentucky Division of Water*
Water Quality Certification Section
14 Reilly Road, Frankfort, Kentucky 40601, USA
e-mail: brent.johnson@mail.state.ky.us

Mark-recapture studies are often used to provide valuable life history information for animal populations. However, long-term marking of larval amphibians has been problematic because of their small size, delicate skin, and ability to regenerate tissues (Cecil and Just 1978; Donnelly et al. 1994; Seale and Boraas 1974). Procedures that have been used to mark larvae include fin-clipping (Turner 1960), whole-body staining with neutral red (Guttman and Creasey 1973; Herreid and Kinney 1966), injection of mineral oil and petroleum jelly mixtures (Seale and Boraas 1974), application of fluorescent pigments with gas pressure (Ireland 1989; Taylor and Deegan 1982) or heat brands (Ireland 1973), and application of a Congo red and dimethyl sulfoxide paste (Ireland 1989). However, these methods are cumbersome, inhibit growth (Travis 1981), do not produce unique marks, or are only useful for short-term studies. Passive integrated transponder (PIT) tags have been used to mark newts and spadefood toads (Fasola et al. 1993; Jehle and Hodl 1998) as well as metamorphic ambystomid salamanders (Ott and Scott 1999). However, these tags are too large for many larval amphibians. Toe-clipping has been the traditional method for marking amphibians (Ferner 1979), but some larvae may regenerate toes too quickly (<1 mo.) for use in long-term studies. In addition, larvae sometimes suffer toe injuries that make identification difficult (Ott and Scott 1999). As a result of these problems, field experiments that require the individual identification of amphibian larvae have been limited.

Subcutaneous injection of acrylic polymers is a method that has been successful for long-term marking of fish (Kelly 1967; Lotrich and Meredith 1974), adult salamanders (Ireland 1989; Wooley 1973), and tadpoles (Anholt et al. 1998; Cecil and Just 1978). These polymers are non-toxic and the marks can remain visible for a year or more. Each individual can also be given a unique mark by using several different colors and multiple mark locations. This method is efficient and cost-effective. However, it has yet to be tested on larval salamanders.

Larval salamanders are an important component of first order high-gradient streams because they are often the top predators in these fishless systems. The Blue Ridge two-lined salamander, *Eurycea wilderae* Dunn, is the most abundant larval salamander in the headwaters of the study region (Bruce 1985) and is the focus of our study. In these streams, hatchlings of *E. wilderae* appear in April or May, and the larval stage lasts one or two years (Bruce 1982, 1985, 1988; Voss 1993). The specific objectives of our study were to evaluate the polymer injection method in field trials and to use mark-recapture data to determine individual growth rates of larval *E. wilderae*.

This study was conducted in a first order stream that drains catchment 53 at the Coweeta Hydrologic Laboratory, Macon County, North Carolina. Vegetation consists of mixed hardwoods with a dense riparian understory of rhododendron (*Rhododendron maximum*). This stream was treated with the insecticide methoxychlor in 1980 to examine the role of invertebrates in processing organic matter (Cuffney et al. 1984; Wallace et al. 1982; Wallace et al. 1986). However, following treatment, the stream quickly recovered to reference conditions (Lugthart and Wallace 1992; Wallace et al. 1982; Wallace et al. 1997). Detailed descriptions of the Coweeta basin are provided by Swank and Crossley (1988). In addition to *E. wilderae*, four other salamander species are common in the headwaters at Coweeta: *Desmognathus quadramaculatus*, *D. monticola*, *D. ocoee*, and *Gyrinophilus porphyriticus*.

The entire wetted area of a 100-m reach was sampled for *E. wilderae* larvae approximately every month from November 1997 through June 1999. The stream was sampled at night with a head lamp and aquarium dip net (15.5 × 12 cm). Only loose cover objects (e.g., cobble, wood, leaves) were turned over when searching for larvae to minimize disturbance to the stream. Captured larvae were placed in individual 20 mL plastic vials filled with stream water. Vials were then placed on ice in a cooler.

In an on-site laboratory, each larva was anesthetized in Petri dishes containing 0.1% tricaine methylsulfonate (MS-222) (Beachy 1994). Snout-vent length (SVL) was measured to the posterior margin of the vent to the nearest 0.5 mm using a dissecting scope and vernier calipers. The anesthetized larvae were then placed on a damp paper towel under a dissecting scope. A Liquitex® acrylic polymer emulsion (available at most art supply stores) was injected into the tail using a 3 cc syringe with a 26 gauge 16 mm needle as described by Cecil and Just (1978). Initially, six different colors were used: blue, green, red, white, purple, and yellow. However, yellow was abandoned because it was difficult to see. Marks were inserted just under the skin of the tail immediately behind the hind legs. This insertion point left a mark that was visible if the tail was subsequently lost. Two discrete marks could be placed on either side of the tail, a feature that allowed the same color to be used twice on one side (Fig. 1). Marking newly hatched larvae (<14 mm SVL) was more difficult but still possible. After some practice, each larva could be measured and marked within five min. The five colors and four mark locations allowed for ca. 3,000 unique combinations. Following placement of a mark, larvae were revived in stream water, returned to their plastic vials, refrigerated overnight, and released at the point of capture the following morning or evening.

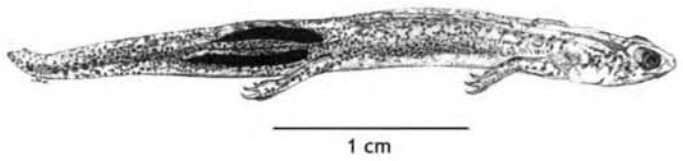


FIG. 1. A marked *Eurycea wilderae* larva demonstrating the location of color bands.

To determine growth, SVL was first converted to ash-free dry mass (AFDM) using a length-weight regression derived for *E. wilderae* in the study stream:

$$M = 0.0023L^{3.09} \quad (r^2 = 0.96, p<0.001, N = 22)$$

where M is larval mass (mg AFDM) and L is SVL (mm) (Lugthart 1991). Ash-free dry mass is a more accurate measure of growth than SVL or wet weight because it accounts for inorganic matter in guts. Individual daily growth rate (g) was then calculated as:

$$g = \ln(M_2/M_1)/t$$

where M_1 = initial larval mass, M_2 = final larval mass, and t = time interval in days (Romanovsky and Polishchuk 1982). Exponential growth was assumed. Average growth was also determined by plotting the mean biomass by sample date beginning after the hatchlings appeared in May 1998. In addition, we tested for differences in mean SVL of marked and unmarked larvae for each sample date throughout the study period using t-tests. We used a Mann-Whitney U-test when data failed to meet the assumption of normality.

To assess mark duration, 20 larvae were collected from an adjacent headwater stream and returned to the laboratory. These larvae were marked following the procedure described above and maintained in an aerated 37.9 L aquarium in a laboratory cold room at 5°C. Though this temperature is lower than the average annual temperature in the stream, these temperatures are encountered in winter and the larvae remain active. Moss-covered stones were collected from the stream and added to the aquarium for refuge. Water was changed weekly and larvae were fed freeze-dried *Daphnia* sp. However, *Daphnia* sp. consumption was not directly witnessed during laboratory study period. Larvae were checked regularly for any fading of marks or mortality. After one year, surviving larvae were returned to the stream where captured.

A total of 428 *E. wilderae* larvae were captured, marked, and released during this study. Ninety-eight individuals were recaptured and used for growth determination (~23% of the total marked). Of the 98 recaptured larvae, 32 were recaptured on more than one sample date. Though growth slowed slightly in the winter, growth was nearly linear over the year (Fig. 2). The average individual daily growth rate for *E. wilderae* larvae was 0.0024 d^{-1} (± 0.0002 S.E).

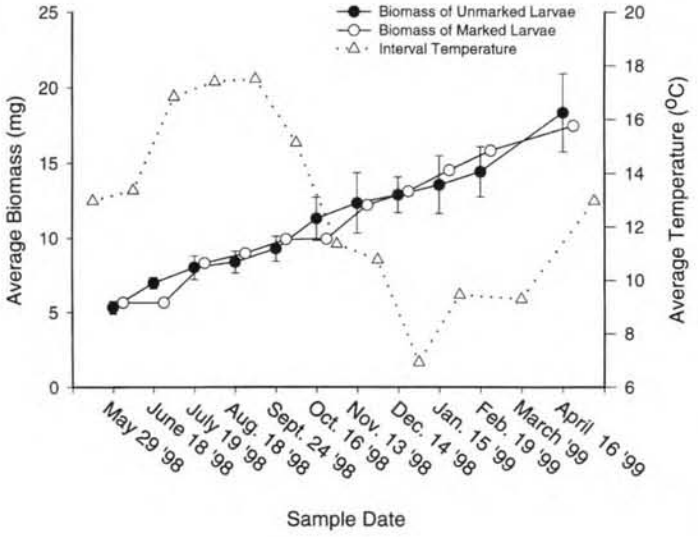


FIG. 2. Average biomass (mg) for all marked and unmarked (± 95% C.I.) *Eurycea wilderae* larvae by collection date beginning when hatchlings first appeared in spring. Stream temperature is plotted as the average between sample events.

Given their delicate appearance, the larvae were surprisingly durable during marking. They typically recovered from the anesthetic within ten minutes of returning to vials of stream water. A poorly placed mark resulted in the death of one larva, but all others were alive at the time of release with no apparent change in behavior from pre-marking. Larvae were recaptured up to eight months after marking (Fig. 3). The average biomass and SVL of marked larvae was not significantly different from unmarked larvae on all but one date ($p>0.05$)(Fig. 2) when recapture sample size was low ($N = 1$). This indicates that marking had little, if any, effect on growth. In the laboratory aquarium, all 20 marked larvae survived at least six months and 17 survived for a full year. Fading of marks was sometimes evident in both the field and laboratory but individual identification was always possible.

Amphibian larvae typically show reduced growth during winter (Beachy 1997), but our results show that *E. wilderae* growth was nearly linear throughout the year. Beachy (1997) found a similar linear growth pattern for larval *E. wilderae* in cage experiments. Our daily individual growth rate of 0.0024 d^{-1} agrees closely with a previous study that determined *E. wilderae* larval growth using chambers in a nearby headwater stream. In that study, the average individual growth rate from three different field trials was 0.003 d^{-1} (Lugthart 1991). However, results from chamber experiments must be interpreted with caution because larval densities and prey availability can influence growth rate (Petranka and Sih 1986; Scott 1990; Smith 1990).

By using acrylic marks, we were able to determine growth rates for individual, free-ranging larvae. Travis (1981) found that whole body staining with neutral red reduced growth of tadpoles and warned that any marking method might adversely affect growth. However, the acrylic polymers are non-toxic and there were no discernable differences in SVL or biomass between marked and unmarked larvae by sample date. There is therefore no evidence to indicate that marks affected growth.

The high survival rates of marked larvae both in the field (up to eight months after marking) and laboratory (up to one year) also indicated the marks had a negligible effect on survivorship. Our laboratory aquarium survival rate (85% after 1 yr) was much higher than those reported for *Eurycea* spp. in artificial streams over shorter time periods (27% over ~ 4 mos. in Resetarits 1991; 39% over ~2 mos. in Gustafson 1993; and 31% over ~3 mos. in Gustafson 1994). However, our higher survival rate could be partially attributed to reduced metabolic demand associated with lower laboratory temperature. The recapture time interval curve (Fig. 3) is indicative of the Type III survivorship curve (Deevey 1947) that has been previously documented for *E. wilderae* (Bruce 1988). The slope of this line may therefore be attributed to natural mortality or emigration rather than mark effects.

This study demonstrates the effectiveness of subcutaneous acrylic polymer injection for long-term monitoring of larval salamander populations. This method provides a practical and cost-efficient way to conduct field studies of the top predators in small, fishless streams. Because unique marks can be generated quickly, the method can easily be used not only to assess larval growth, but also population size and individual movements. Individual growth data can also be used to determine secondary production (Benke 1984; Waters 1977). Mark-recapture studies offer several additional advantages over cage experiments. For example, growth can be determined under natural conditions with realistic prey levels. In addition, natural movements can be measured and thus add to our understanding of species colonization and dispersal.

According to Ferner (1979) an ideal mark or tag should: 1) not affect individual survivorship or behavior, 2) uniquely identify individuals, 3) remain over the individual's lifetime, 4) be easily discernable, and 5) be easily applied in both field and laboratory studies. In addition, the marking or tagging method should be cost-effective and limit handling time of an individual (Ott and Scott 1999). Acrylic polymer injection meets most of these criteria and is currently the only viable method for *E. wilderae* larvae. A potential problem with this method is that the marks may increase larval visibility and thereby increase predation pressure from larger salamanders such as *D. quadramaculatus, D. monticola,* and *G. porphyriticus*.

Choice of an appropriate marking or tagging method should

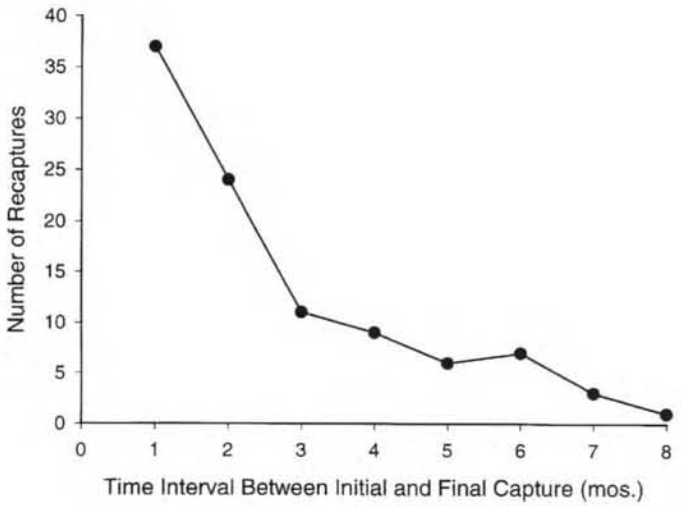


FIG. 3. Time interval between initial marking and final recapture for all *E. wilderae* collected from November 1997 to June 1999.

depend on the individual species, life history stage, and duration of the study period. Any one or a combination of polymer injection, PIT-tagging, and toe-clipping should be suitable for most amphibians. Polymer injection has proven an effective method for long-term marking of amphibian larvae and small-bodied adults, while PIT-tagging and toe-clipping remain effective in marking larger animals. The latter two methods have the added benefit of near invisible marks. In some cases, it may be desirable to use a combination of marking methods on the same individuals. For example, polymer injection could be used to mark individuals throughout the larval stage and, following metamorphosis, PIT-tags or toe-clips could replace the polymer marks. Such a long-term study design would provide valuable life history information and potentially aid amphibian conservation efforts.

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A Comparison of Aquatic Surveying Techniques Used to Sample *Ambystoma opacum* Larvae

CHRISTOPHER L. JENKINS*
e-mail: christolj@hotmail.com

KEVIN McGARIGAL
e-mail: mcgarigalK@forwild.umass.edu

and
LLOYD R. GAMBLE
e-mail: lgamble@forwild.umass.edu

Department of Natural Resources Conservation, University of Massachusetts Amherst, Massachusetts 01003, USA

**Current address: Department of Biological Sciences, Box 8007 Idaho State University, Pocatello, Idaho 83209, USA*

Effective survey methods are needed for the marbled salamander (*Ambystoma opacum*) because of the species' rarity in the northeastern United States (DeGraaf and Rudis 1983) and increasing residential development that is affecting their upland habitats. Terrestrial surveys for adults are either impractical given the species' fossorial lifestyle (Petranka 1998) or costly (e.g., drift fences and pitfall traps; Dodd and Scott 1994). Larval surveys may be optimal because larvae can remain in pools for up to 7–9 months in some years (pers. observ.; Stewart 1956), creating a long window of opportunity for surveys. Aquatic funnel traps have been used successfully to capture other larval amphibians (Adams et al 1997; Bury and Major 1997; Fronzuto and Verrell 2000; Richter 1995; Wilson and Pearman 2000) and nocturnal visual surveys are a standardized transect surveying method commonly used in amphibian studies (Crump and Scott 1994; Thoms et al. 1997). We evaluate these two techniques for larval marbled salamanders. Specifically, we: (1) compare the results of each technique for determining presence and an index of relative abundance of marbled salamander larvae; (2) quantify the effect of time of year and survey intensity on the results of nocturnal visual surveys; and (3) describe the costs and logistical constraints associated with each technique.

We selected a sample of vernal pools in western and central Massachusetts using a hierarchical approach. We used the Massachusetts Natural Heritage Program's database to identify known marbled salamander sites within the study region. From this distribution, we selected five initial sampling areas that were well-distributed throughout the study region. Each initial sampling area consisted of a 3 km radius circular area roughly centered on one or more known marbled salamander sites. Within this 3 km circle, we mapped land cover and delineated all wetlands using aerial photographs (1991 color infrared, 1:40,000). We classified all temporary wetlands (e.g., vernal pools) as potential marbled salamander breeding habitat. Within each 3 km circle, we positioned a 1 km radius circle around the highest density cluster of potential breeding habitat, regardless of whether it contained any known marbled salamander sites. These five 1 km radius areas represented our final sampling areas.

We sampled a total of 97 pools distributed among the five sampling areas (Table 1) using both surveying techniques during the winter and spring of 1998. Each pool represented a separate observation (i.e., experimental unit) in the analyses described below. We sampled pools using bottle traps (Richter 1995) for 13 days between February 1 and March 1, when larvae were approximately 5 to 6 months old. The number of bottle traps placed in each pool was proportional to the surface area of the pool. We placed two traps per 10 m^2 (range 1–5 traps/pool), which represent a more intensive survey than recommended by Adams et al. (1997). Traps were randomly located within the pools at water depths between 0.5 and 0.75 m. If necessary, trap location and height were adjusted in response to fluctuations in water levels during the trapping period. Traps were baited with shrimp-scented salmon eggs and checked approximately every other day. Amphibian captures were recorded and released.

We conducted nocturnal visual surveys between March 1 and May 1. Each pool was sampled once during this period and all pools within a sampling area were surveyed on the same night. Each survey began shortly after dark and continued until all pools within the sampling area were surveyed. Pools were surveyed using transects; two observers walked parallel to one another, roughly 10 m apart, across the deepest section of the pool and then in opposite directions around the entire periphery of the pool approximately 2 m from the shore. Each observer utilized a high-powered flashlight to search and counted larvae within a 4 m wide swath.

After the 1998 season, we chose one of the five sampling areas to conduct more intensive tests evaluating the effect of timing and frequency of nocturnal visual surveys. During 1999, nocturnal

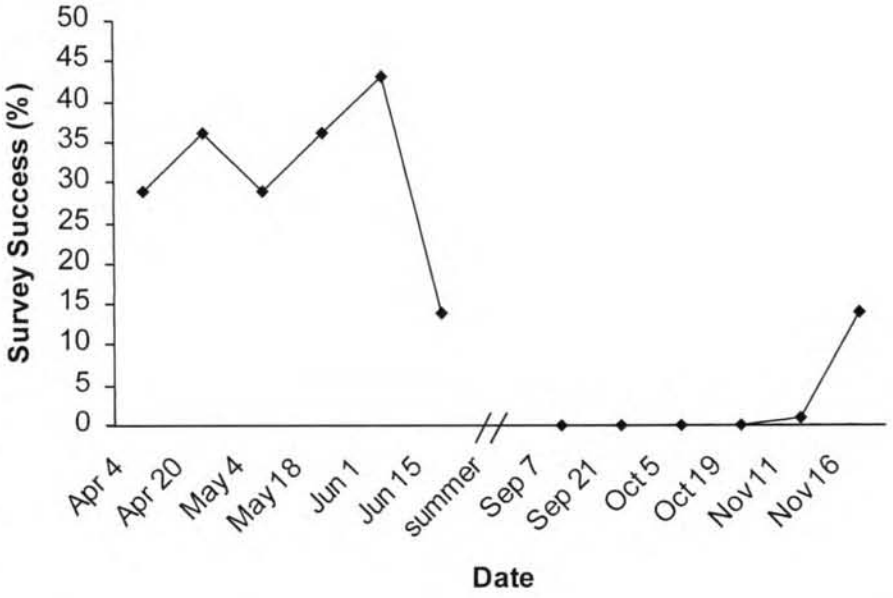


FIG. 1. Success (% occupied pools with detections) of nocturnal visual surveys at detecting marbled salamander larvae in relation to survey date in South Hadley, Massachusetts, during spring and fall sampling seasons, 1999. The break in the horizontal axis represents the summer period when pools were dry.

TABLE 1. Marbled salamander presence and total abundance in vernal pools distributed across 5 sites in Massachusetts during 1998 using two sampling techniques aquatic bottle traps and nocturnal visual surveys. The numbers in 'presence' columns represent the number of pools with marbled salamanders present at a given site. The numbers in 'abundance' columns represent the total abundance across pools at a given site.

		Presence		Abundance	
Site	No. Pools	Bottle Trap	Nocturnal Visual Survey	Bottle Trap	Nocturnal Visual Survey
Charlton	15	0	0	0	0
Holyoke	22	7	7	69	387
Leverett	24	0	2	0	116
South Hadley	19	6	6	22	448
Sutton	17	0	0	0	0
Totals	97	13	15	91	951

visual surveys (as described above) were conducted on a bi-weekly basis at 14 pools within the South Hadley sampling area, except during periods when the pools were iced over or dry.

We quantified the effectiveness of each survey technique at determining presence and an index of relative abundance of marbled salamander larvae. We conducted a Chi-square test of independence using all pools with and without marbled salamanders, testing the null hypothesis that there is independence between techniques in determining presence/absence. Also, we computed a Pearson's product-moment correlation in larval abundance for the two survey methods using pools with marbled salamanders, as determined by either technique, as independent observations. To compare efficacy of the survey techniques, we described the logistical constraints associated with each technique and compared the mortality rates between techniques.

To evaluate the effectiveness of nocturnal visual surveys in relation to the time of year and sampling intensity (i.e., number of surveys), we plotted survey success against time of year and sampling frequency for the 14 pools intensively sampled in the South Hadley sampling area. To construct the latter plot, a sampling intensity of one represented a single survey; success for a single survey was computed as the number of pools in which larvae were detected on that survey divided by the total number of pools with known marbled salamander populations. The mean survey success for a sampling intensity of one was computed as the average success rate for all the surveys (N = 12). A sampling intensity of two represented every possible combination of two consecutive surveys; success for each two consecutive surveys was computed as the number of pools in which larvae were detected by either survey divided by the total number of pools with known marbled salamander populations. The mean survey success for a sampling intensity of two was computed as the average success rate for all the 2-survey combinations (N = 11). This procedure was repeated for each sampling intensity between 1 and 12. Note that this procedure results in decreasing sample sizes as sampling intensity increases.

Nocturnal visual surveys were slightly more effective than bottle traps at determining the presence of marbled salamanders (Table 1), although the detection of presence was not independent between techniques ($\chi^2 = 82.08$; df = 1; $P = < 0.005$). Larvae were detected by both survey techniques at 13 of 97 (13.4%) pools. At an additional two pools (3% of total, 13% of pools with salamanders), larvae were detected by nocturnal visual surveys only. In addition, higher counts of marbled salamander larvae were recorded from nocturnal visual surveys (Table 1). Despite differences in absolute relative abundance, the results from these two survey methods were highly correlated after removing one outlier ($N = 14$; $R^2 = 68\%$; $P = 0.005$), indicating that both procedures can be used to derive a similar index of relative abundance. The outlier pool was excluded from analysis because thick vegetation throughout the pool prevented us from effectively conducting nocturnal visual surveys.

There were logistic constraints with both methods. Bottle traps caused higher direct mortality (5 adult *Ambystoma maculatum*, 2 adult *Rana sylvatica*, and 8 adult *Notopthalmus v. viridescens*) by exposing individuals to predation and freezing temperatures during cold nights. No mortality was observed with nocturnal visual surveys. Unobserved mortality may have been caused by walking through pools (both methods). Based on the number of days required to conduct each survey method, the effort required to bottle trap one pool was approximately three times greater than that required for visual surveys.

The effectiveness of nocturnal visual surveys varied with time of year. Spring surveys were more successful than autumn surveys (Fig. 1). The highest success occurred immediately prior to metamorphosis into terrestrial juveniles (June 1, Fig. 1), although previous studies found marbled salamanders at intermediate sizes to be more active then older larvae (Anderson and Graham 1967; Hassinger et al. 1970). There are a couple possible explanations for the relatively low effectiveness of autumn surveys. Immediately after hatching in the autumn, larvae have been observed spending proportionately more time in the pond bottom at night where they would be undetectable with nocturnal visual surveys (Anderson and Graham 1967; Hassinger et al. 1970). In addition, early autumn rains associated with Hurricane Floyd caused the pools to completely fill before all adults had migrated to the pools. Consequently, it is possible that reproductive success was partially or totally affected, leading to lower detection rates. Given that detection rates change with time, our earlier results comparing nocturnal visual surveys and bottle traps may be biased because of differences in the timing of surveys (bottle traps February–March, and nocturnal visual surveys March–May).

The effectiveness of nocturnal visual surveys also varied in relation to sampling intensity. Specifically, the success rate increased non-linearly with increasing sampling frequency (Fig. 2). Eight surveys were needed to detect salamanders in 91.6% of the pools where they were known to occur. These trends may reflect the fact that three pools had the presence of larvae detected during only one or two surveys. When these pools were removed the relation-

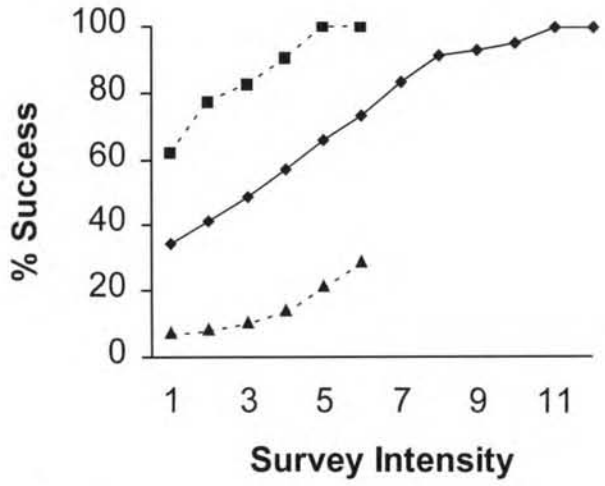


FIG. 2. Success (% occupied pools with detections) of nocturnal visual surveys at detecting marbled salamander larvae in relation to survey intensity (i.e., number of surveys; see text for details) in South Hadley, Massachusetts, during 1999. The diamonds represent the combined spring and fall surveys (N = 12); the squares and triangles represent the spring (N = 6) and fall (N = 6) surveys, respectively.

ship became more linear. Sampling intensity required to achieve the same level of success was much lower in spring than autumn (Fig. 2).

Given the increasing impacts of anthropogenic disturbance (e.g., urban development) on marbled salamander breeding habitat, there is growing interest in methods to identify and protect critical habitat. Determining marbled salamander presence is prerequisite to developing a better understanding of the species' habitat needs and in providing justification for protecting vernal pools from human impacts. Our findings suggest that nocturnal visual surveys were the least intrusive and expensive, and are slightly more accurate at detecting presence. Both methods provide an index of relative abundance, although nocturnal visual surveys may give counts that are closer to the true population abundance. We also show that the timing and intensity of surveys are important considerations; multiple site visits in late spring may be optimal.

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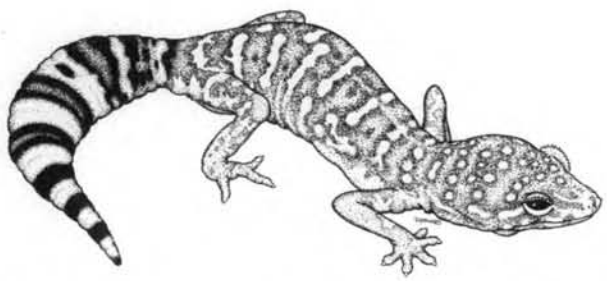
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Coleonyx switaki, male (Switak's Banded Gecko). USA: California: San Diego Co. Illustration by Thad A. Howard.

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An Assessment of Hydrocarbon Contamination Derived From Roofing Material Coverboards

KRISTI MINAHAN
GARY MILLS[1,2]
SUSAN HAYDEN[1]
and
J. WHITFIELD GIBBONS
Savannah River Ecology Laboratory
[1]*Advanced Analytical Center for Environmental Sciences*
University of Georgia, Drawer E, Aiken, South Carolina 29802, USA
[2] *Corresponding author; e-mail: mills@srel.edu*

Coverboards have been a standard sampling tool for herpetologists for over a decade. Although wooden or tin coverboards are useful in augmenting time-constrained sampling (Grant et al. 1992), they also can be cumbersome and awkward to carry to sampling sites, thus restricting their use in field sites that are not easily road-accessible. An alternative material that has proven effective and cost-efficient is heavy-grade rolled roofing material. Confirmation that this material is environmentally safe for sampling could ease concerns regarding its use for capturing reptiles and amphibians.

Roofing material is a less costly and more convenient alternative to wood or tin coverboards (Table 1). Weighing approximately 2.7 kg per 90 cm^2 sheet, roofing coverboards are considerably lighter and easier to transport than particle board, which weighs 7.1 kg per coverboard, and are approximately equal in weight to plywood. Although tin is lighter, weighing 1.8 kg per coverboard, it, like wood, is difficult to carry because of its rigidity. One roll of roofing material weighs 34.7 kg and yields twelve 90 cm^2 pieces. Depending on a person's strength, a whole or half roll can be hoisted over a shoulder, carried into the field, and cut into sections on site using a carpet knife.

Roofing coverboards also seem to be comparable to wood and tin in sampling effectiveness. Fourteen roofing coverboards were monitored at Ellenton Bay and Bulldog Bay on the Savannah River Site (SRS, Gibbons and Semlitsch 1991), near Aiken, South Carolina for approximately two weeks in May 1999 and June 1999, respectively. Positioned at the water's edge, they yielded encounters with individuals of nine species, including snakes (*Farancia abacura, F. erytrogramma, Agkistrodon piscivorus, Nerodia fasciata*), frogs (*Acris gryllus, Rana utricularia, Gastrophryne carolinensis*), salamanders (*Ambystoma talpoideum*, primarily metamorphs), and hatchling turtles (*Kinosternon subrubrum*).

However, because roofing material is synthesized from petroleum products, the environmental safety of its use in wetland areas may be a source of concern. An oily sheen was often present on the water's surface in wetlands on the SRS where roofing coverboards were in use for herpetological monitoring studies. Therefore, whether roofing decomposes in the field and leaches harmful petroleum substances into surrounding waters needs to be addressed to ensure that the method is not detrimental to the environment and organisms being studied.

Certain concentrations of petroleum can be detrimental to amphibian development. Mahaney (1994) evaluated hatching rate, larval growth, and success of metamorphosis of *Hyla cinerea* exposed to used crankcase oil. Low level (10 mg/L, 55 mg/L) exposure to used crankcase oil had no effect on these parameters, but tadpoles raised in higher concentrations (100 mg/L; equivalent to levels produced by runoff from service stations) had a significantly reduced growth rate and never proceeded to metamorphosis. Lefcort et al. (1997) compared the effects of motor oil and silt on fitness parameters in the salamander *Ambystoma t. tigrinum*. They found that larvae raised in large outdoor tubs with concentrations of 7.6 ml oil/L water exhibited significantly lower body size, weight, length, and head width. In their laboratory studies, however, where larvae were fed fresh algae, there was no developmental variation between larvae reared in oil-contaminated and control tubs. This difference was attributed to the diminished levels of algal growth in the contaminated outdoor tubs, which reduced food availability.

The toxicity of some petroleum products to wildlife has been shown to intensify with exposure to sunlight. Oris and Giesy (1985, 1987) found that 6 of 12 polycyclic aromatic hydrocarbons (PAHs) were found to be acutely toxic to fathead minnows only when they were exposed to sunlight. Other studies have also shown that sunlight can magnify the toxicity of petroleum products. For example, Boese et al. (1997) recently demonstrated the photoinduced toxicity of fluoranthene to benthic crustaceans. And in an earlier study, Oris and Giesy (1985) found that anthracene, a linear 3-ring PAH formerly thought to be nontoxic to aquatic organisms, is acutely toxic to juvenile sunfish when exposed to sunlight.

Our study focuses on whether roofing material leaches detectable levels of petroleum products (particularly PAHs) in water when exposed to sunlight and May/June temperatures typical of South Carolina (mean minimum ~16°C, mean maximum ~31°C). Iridescent surface films (microlayers) were skimmed from the surface of wetlands where roofing was in use and analyzed to determine the presence of contaminant hydrocarbons. We previously sampled the surface microlayer in riparian pools located in Upper Three Runs Creek and in the Steel Creek Delta at the SRS.

Roofing material, water leachates, and surface films were analyzed by using a modification of the EPA Method 8100 (USEPA 1998). Solvent extracts of the various samples (described below) were reduced in volume to 1 ml using rotary, vacuum evaporation. Silica gel liquid chromatography separated the aliphatic fraction (f1) containing *n*-alkanes from the polyaromatic (f2) fraction. Hydrocarbon analyses of both the f1 and f2

TABLE 1. Weights and costs of various coverboard materials. Costs are derived from prices at Lowe's Home Improvement Warehouse, Athens, Georgia (May 1999). Different coverboard materials are sold in different bulk quantities.

Coverboard type	Dimensions (cm)	Weight (kg)	Cost (US $)/Coverboard
Roofing materials	90 x 90	2.7	$0.99
Particle board	61 x 122 x 1.6	7.1	$1.23
Plywood	61 x 122 x 1.0	2.2	$1.23
Tin	66 x 122	1.6	$1.93

fractions were performed on a Hewlett Packard (Atlanta, Georgia) 5890 Series II gas chromatograph equipped with a flame ionization detector (GC-FID), splitless injection, electronic pressure control (EPC), and autoinjector. Separations were achieved using a 30 m DB-5 (0.25 mm I.D., 0.25 µm film thickness) capillary chromatographic column (J&W Scientific, Folsom, California). Diesel range organics and PAH standards were used as retention time markers for compound identification.

Roofing material used for this study was Globe® Mineral Surfaced Roofing, which is coated on one side with white asphalt pebbles. Hydrocarbon analysis of the unweathered roofing material was completed by extraction and sonication (Tekmar®) of three replicates of a 5-gram sample in 100 ml of methylene chloride:acetone.

The first leaching experiment was conducted in borosilicate Erlenmeyer flasks (UV cutoff 290 mm, Zepp 1982) containing 100 ml of Milli-Q water. Three flasks containing 4–5 cm^2 (6–7 g) of submerged roofing were set in the sun for one week. Following the leaching period, the solutions were filtered through a funnel with glass wool (solvent rinsed) to remove any particulate material and the filtrates extracted three times with methylene chloride in a separatory funnel. The solvent extracts were combined and reduced in volume using rotary-evaporation, then analyzed for aliphatic and polyaromatic hydrocarbons. A second leaching experiment was conducted in Rubbermaid bins aligned along the edge of a Carolina bay (A Bay) at the SRS. Each bin contained 15 L of bay water (15 cm depth) and contained 30 cm x 45 cm of submerged roofing material. Sample and control bins (two each) were sampled after 28 days and analyzed as described above.

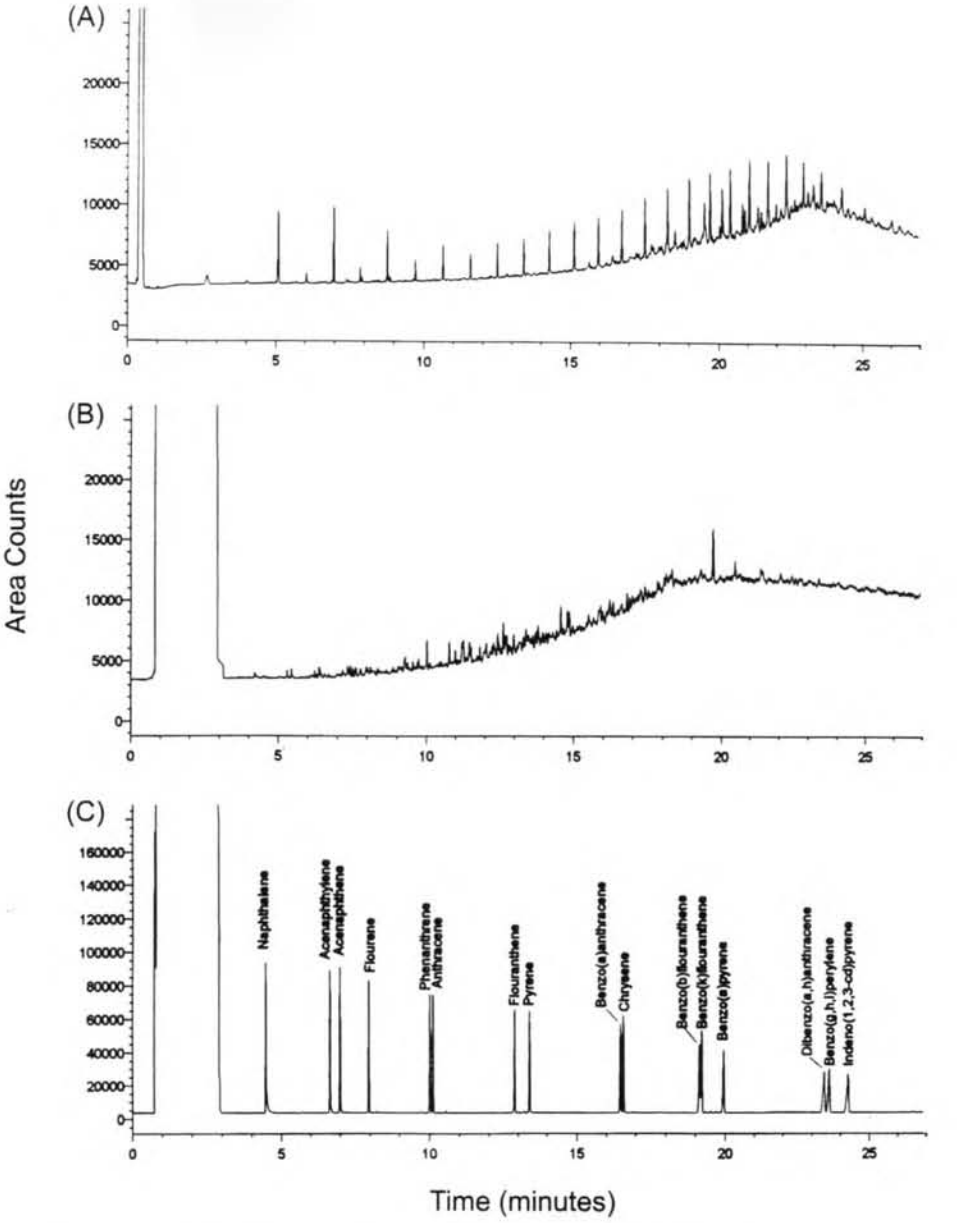


FIG. 1. Gas chromatograms with flame ionization detection of the aliphatic (A) and aromatic (B) hydrocarbon fractions isolated from roofing material, and a PAH standard (C). The x-axis represents increasing time.

To assess whether the iridescent sheens observed in the field were associated with nearby roofing or were a result of natural factors, microlayer sheens were collected from the water's surface in a Carolina bay where roofing coverboards had been adjacent to or partially submerged in water for three months. Microlayers were collected in solvent-cleaned glass jars and analyzed as previously described for the leachate experiment.

The roofing material was composed primarily of high molecular weight aliphatic hydrocarbons ranging from C_{22} to C_{40} (Fig. 1a). Much of the material was part of the chromatographically unresolved complex mixture of components characteristic of petroleum products. A small amount of material was observed in the aromatic fraction of the extract, mostly composed of unresolved components (Fig. 1b). Resolved aromatic components were present in concentrations <0.10 µg L^{-1} and none of these components had retention times corresponding with the EPA priority pollutant PAHs (Fig. 1c).

Although the three flasks containing submerged roofing contained aliphatic hydrocarbons, none contained detectable levels (>0.10 µg L^{-1}) of any of the 18 EPA priority pollutant PAHs. Likewise, the water samples taken from the bin exposures after the 28-day soaking period showed no evidence of PAH contamination.

In common field use, these coverboards are not wholly submerged; rather, they are placed at the water's edge or partially overlapping into the water. In such a setting, contact with soil microbes may play a role in further decomposition, but it seems unlikely that roofing would contribute PAHs to the surrounding environment. Chemical analysis of the iridescent microlayers from

wetlands where roofing had been in use showed that they did not contain any petroleum products.

Surface sheens are common in many wetlands where high inputs of detrital carbon generate surface-active compounds that accumulate as a thin film at the air-water interface. Humic substances, lipids, and proteins originating from higher plants and microorganisms have been shown to be components of the film (Mills et al. 1996).

In conclusion, roofing material has several logistical advantages for use in field studies in which coverboards are suitable. The finding that no chemical hazard is created for the animals that use roofing material for shelter or that are present in surrounding waters adds value to its use as a monitoring technique in some situations.

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Transcutaneous Amphibian Stimulator (TAS): A Device for the Collection of Amphibian Skin Secretions

JACQUALINE B. GRANT*
and
BRUCE LAND
Department of Neurobiology and Behavior, Mudd Hall
Cornell University, Ithaca, New York 14853, USA
e-mail (JBG): jbw1@cornell.edu
e-mail (BL): BRL4@cornell.edu

** Author to whom correspondence should be addressed*

Amphibians, despite their vulnerable appearance, possess a veritable armamentarium of integumental defenses against both vertebrate and invertebrate predators. Chief among these are skin secretions, the major components of which have long intrigued biologists, chemists, and pharmacists alike. Researchers have employed a variety of methods to harvest skin secretions, some more invasive than others. Among the more invasive techniques are the injection of neurotransmitters (Barthalmus 1994; Bols et al. 1986) and whole skin extraction (Daly 1998; Das et al. 2000; Morikawa et al. 1992; Roseghini et al. 1976; Roseghini et al. 1986; Roseghini et al. 1988; Zasloff 1987). Whole-skin extraction (the removal and maceration of an entire amphibian skin) has two major disadvantages: introduction of contaminants to the sample and fatal outcome for the amphibian. Contaminants introduced by macerating whole skins can complicate sample cleanup, while the current worldwide decline in amphibian populations demands that they be treated as non-renewable resources. Fortunately, amphibian skin has an anatomy that permits simple harvest of its secretory products without injury to the animal itself.

Amphibian skin contains both mucous and granular glands (Pough et al. 2001). Granular glands produce the defensive compounds of interest. Each granular gland is encircled by a muscle responsive to electrical stimuli. Such stimulation results in ejection of the glandular contents onto the skin's surface, where they are readily collected. Researchers have used this technique to advantage and claim to have obtained results comparable to those of the whole-skin technique (Tyler et al. 1992).

Although others have used this electro-stimulation technique, they have relied upon commercially available but expensive devices (Tyler et al. 1992), or have not specified what equipment was used (Barteczko and Kuziemski 1970; Dockray and Hopkins 1975; Flucher et al. 1986; Lábler et al. 1968). We present here for the first time instructions for the assembly of a Transcutaneous Amphibian Stimulator (TAS), an affordable alternative to commercially available acupuncture units. It is a small handheld unit that is easily adapted for an individual researcher's needs in the field or in the laboratory. Powered by two 9-volt batteries, the TAS is an excellent device for collecting amphibian epidermal granular gland products without causing harm to the amphibian.

The TAS stimulation parameters were based upon those of the modified acupuncture unit used by Tyler et al. (1992). Pulsewidth of the stimulus is set at 2.5 or 5 msec, with a single-pole/double-

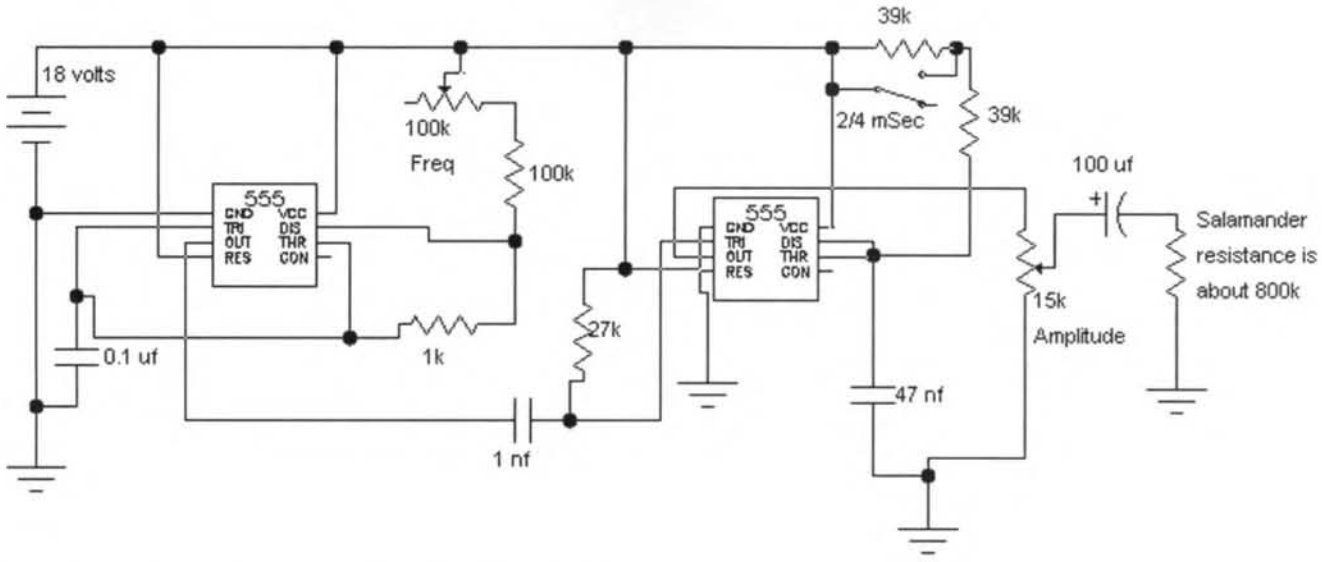


FIG. 1. Circuit diagram for the Transcutaneous Amphibian Stimulator (TAS).

throw switch, in conjunction with an ICM7555 timer in the monostable operation mode. A 15 kOhm potentiometer permits adjustment of the voltage from 0 to 18 volts. Frequency is adjusted within the range of 60 to 130 Hertz by use of a 100 kOhm potentiometer combined with an ICM7555 timer in the astable operation mode. The stimulus is harmlessly delivered by silver-silver chloride disk-electrodes (4.0 mm or 8.0 mm diameter; Warner Instrument Corporation, Hamden, Connecticut, USA). This type of electrode is ideal because of its lack of toxicity and non-abrasive surface. A less expensive alternative is the bare silver wire electrode, but it entails the risk, if of too narrow gauge, of perforating the amphibian's skin. Standard binding posts connect either type of electrode to the circuit. The TAS circuit can be built for approximately US $100 with commercially available parts (Mouser Electronics, Inc., Ottawa, Canada) by following the circuit diagram provided (Fig. 1). We housed our completed circuit in an 80 mm x 160 mm x 60 mm ROLEC watertight polycarbonate transparent Techno Case (Hammond Manufacturing, available through Mouser Electronics, Inc., Ottawa, Canada). Watertight cases with rubber O-ring-sealed fittings are recommended for fieldwork, but cheaper, non-watertight cases may be substituted for laboratory purposes.

Extraction of skin secretions is accomplished by first lightly moistening the animal with deionized water then gently massaging its skin with the activated TAS electrodes for 10–20 seconds (Fig. 2A). For our research we adapted the technique for the animals at hand, massaging anurans (with the exception of *Bufo americanus*) laterally and dorsally from neck to thigh; *Bufo americanus* directly on parotoid glands (Fig. 2B, showing production of the milky white secretion); and urodeles along base of tail. Coincident with stimulation, the animal is rinsed with deionized water. The aqueous solution is collected in a vessel held beneath the animal. Preparation of the secretion at this point varies with the intended purpose of the extraction.

The technique has any number of applications: the determination of evolutionary trends within different populations of a single species (Steinborner et al. 1996a; Steinborner et al. 1996b), differentiation of morphologically indistinguishable species (Daly 1998), in biochemical taxonomy (Cei et al. 1967; Cei et al. 1968 ; Cei et al. 1972), in pharmacology (Roseghini et al. 1986), in medi-

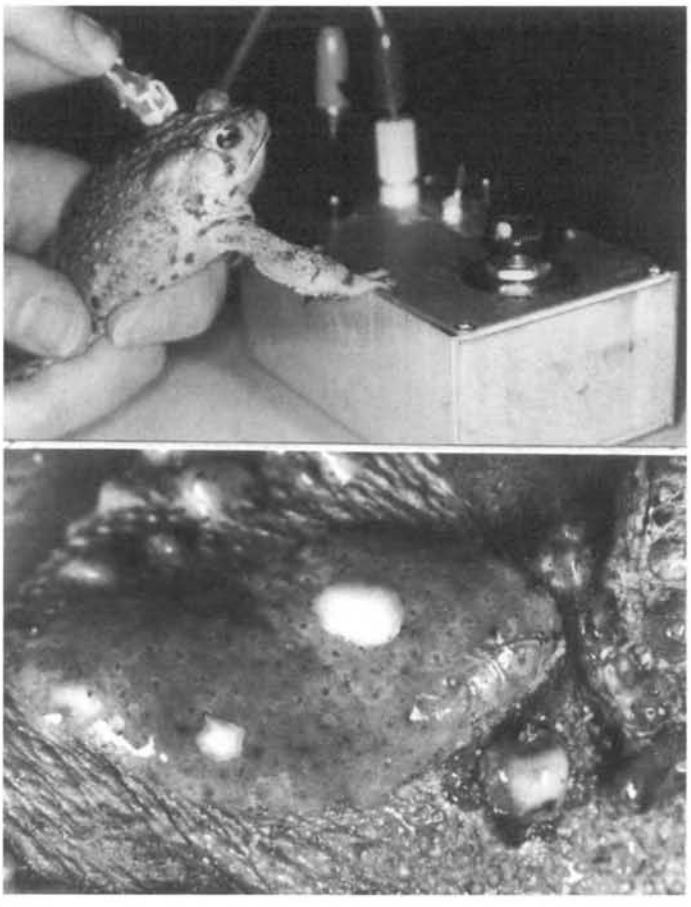


FIG. 2. A. The Transcutaneous Amphibian Stimulator (TAS) and a study subject (*Bufo americanus*). B. TAS-elicited defensive secretion (milky-white spots) from the parotoid gland of *B. americanus*. Photos by Tom Eisner.

cine (Barteczko and Kuziemski 1970; Bradford et al. 1996; Zasloff 1987), in chemistry and chemical ecology (Clarke 1997; Daly et al. 1987), and in behavioral studies including pheromonal (Wabnitz et al. 2000) and predator-prey interactions (Barthalmus and Zielinski 1988; Barthalmus 1994, Brodie 1983; Brodie and Gibson 1969). The TAS has also been used in our lab to study the production and chemical composition of amphibian-produced volatile compounds (unpublished data).

In our current studies of amphibian chemical ecology, we have used the TAS to collect secretions from the following species: *Ambystoma maculatum, A. tigrinum, A. jeffersonianum* complex, *B. americanus, Hyla chrysoscelis, H. gratiosa, Osteopilus septentrionalis, Plethodon cinereus, P. glutinosus, Rana catesbeiana, R. clamitans clamitans, R. c. melanota, R. pipiens, R. palustris, R. septentrionalis, R. sylvatica,* and *Scaphiopus holbrookii*. We have found that smaller amphibians require <10 V, <75 Hz, and 2.5 msec pulsewidths for induction of glandular emission, while larger animals require >10 V, >60 Hz, and 5 msec pulsewidths. No species required the use of >15 V to elicit granular gland discharge. Despite their size, ambystomatids require minimal settings (<10 V, 60 Hz, 2.5 msec) to elicit appropriate granular gland response. Among the species under study in this lab, secretory yields ranged from 10 to 100 mg per animal with the exception of the ambystomatids, which produced copious amounts (in excess of 200 mg per animal).

In conclusion, the TAS is a portable and inexpensive device for "milking" amphibians of their skin secretions. By being minimally harmful to the test organism, it is a distinct improvement over alternative techniques relying on whole-skin analysis or injection of epinephrine or acetylcholine. It is an ideal technique in chemical studies because the samples collected are relatively free of impurities and therefore in a condition requiring minimal preparation (filtration) prior to chromatographic and spectral analysis.

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Minimizing Fungal Invasion During the Artificial Incubation of Sea Turtle Eggs

ANDREA D. PHILLOTT
School of Biological and Environmental Sciences
Central Queensland University, Rockhampton QLD 4702, Australia
e-mail: phillota@cqu.edu.au

The artificial incubation of sea turtle eggs has become increasingly common for research purposes. It usually involves the collection of eggs, transport to a laboratory (potentially long distance), then incubation within a container and/or incubator on sand or an artificial substrate such as vermiculite. During incubation it may be necessary to inspect eggs to monitor development and mortality, and maintain moisture conditions.

At all stages during these procedures, eggs are exposed to infectants which have the potential to kill a proportion, or all, of the eggs. To minimize egg mortality, precautions can be taken to reduce egg exposure to microbiota.

Collection.—Collecting eggs directly from the ovipositor minimizes their exposure to fungal spores dispersed during the turtle's body-pitting and egg-chambering. Eggs may be caught by a gloved hand placed in the rear of the egg chamber (part of the chamber may need to be widened). Though some species are more tolerant than others, care must be taken not to disturb the turtle by use of excessive light, or by touching the ovipositor and hind flippers. If eggs cannot be collected during oviposition, they may be excavated after laying has concluded, but this method increases contact with soil microbiota. Some workers have attempted to place a collection bag in the egg chamber during oviposition. This often disturbs the turtle, resulting in nest abandonment, collapse of the egg chamber during bag insertion, and difficulty removing it when full. This method may be more successful with species that do not dig a deep body pit and/or on beaches with relatively moist sand, where the rear of the chamber may be excavated completely for easier insertion and retrieval.

Eggs should be placed directly into sterile bags; autoclave disposal bags (e.g., Sarstedt®) are recommended because of their strength. Placing the bag inside a bucket helps support the weight of the eggs and prevents weakening and tearing of the bag under stress. The neck of the bag should be twisted and folded over before securing. Prior to transport or incubation, eggs can be washed in sterile distilled water or a solution such as Aricide® (Hibberd 1996) to remove microbes from the egg exterior. However, washing removes the cloacal mucous and its potential anti-fungal properties (Phillott, unpubl.). After washing, the exterior of the egg should be patted dry using a clean disposable cloth to remove excess water and prevent ice-crystal formation and disruption of the shell structure during low-temperature transport.

Transport.—Eggs may be transported long distances by following the procedures of Harry and Limpus (1989). Eggs depressed to 7–10°C (within 2 h of oviposition) may be held for 48 h, allowing collection of multiple clutches over several nights and subsequent transport. It is recommended that eggs remain in the collection bags during this time to minimize exposure to microbes. The bags should be arranged so that they are stable, and air spaces filled with clean, expanded polystyrene pellets for support and insulation.

Handling.—To minimize movement induced mortality, egg orientation should be maintained (Limpus et al. 1979; Parmenter 1980). Single-use sterile gloves should be worn, and eggs handled in a room or area with minimal air flow or disturbance. If the area is to be used permanently for incubation purposes, a dual door system with an intermediate isolation area minimizes air disturbance during entry and exit. Workers must wait in the isolation area until the first door has completely closed before opening the second.

Incubation.—Prior to egg collection, incubators should be cleaned with a 5% sodium hypochlorite bleach solution, then rinsed with a 5% solution of disinfectant. Incubation containers (which will hold the eggs) may be sterilized by autoclaving at 121°C for 15 mins with the mouth covered in aluminium foil, or with a 5% bleach solution followed by a sterile water rinse.

If incubating on sand, it should be collected from areas relatively free of organic material. Sand can be sterilized by autoclaving in small lots. Thermal sentinels (e.g., Thermalog® S strips) should be used to ensure effective heat sterilization at the core. These checks can be ceased when the performance of particular autoclaves, sand types, etc., is quantified.

Labels on cardboard or other biodegradable material should not be placed in or on the substrate during incubation as they provide nutrient sources for mycobiota. Instead, the exterior of the container should be labeled. The required moisture conditions are maintained by adding sterile water either from clean spray bottles, or by use of a sterile water, sub-surface trickle irrigator (as described by Phillott and Parmenter 2001). If the plastic tubing from the latter is to be re-used, it should be first be cleaned with a commercial algaecide (used in cleaning swimming pools) then rinsed with sterile water.

When removing eggs (to weigh, measure, candle, etc.) wear sterile, single-use gloves and ensure the equipment is clean and that air flow around the area is minimal. If eggs are to be weighed, sand can be removed using a soft brush that will not damage the eggshell. Using a cloth to remove sand has the potential to drag sand across the egg surface, disrupting structural integrity of the eggshell. Eggs that fail to develop a white spot, that show signs of yellowing, or have fungal growth on the exterior should be re-

moved. Mass egg mortality often follows fungal contamination of a single moribund egg as hyphae spread to adjacent viable eggs (Phillott and Parmenter 2001). This potential spread can be minimized by ensuring eggs are not in contact with each other, though this is not always practical.

In the event of egg invasion, species of fungi can often suggest the source of the contamination. *Fusarium oxysporum*, *F. solani* and *Pseudallescheria boydii* have been regularly isolated as soil-borne pathogens on the exterior of failed eggs (Phillott et al. 2001). In contrast, *Aspergillus* spp. have been contracted by air-borne contamination (unpubl.). Identification of the fungi may lead to its point of source, allowing protocols to be modified so as to eliminate contamination.

Acknowledgments.—Sincere thanks to: C. J. Parmenter and C. J. Limpus for advice on handling and transport of eggs; Central Queensland and Queensland Turtle Research volunteers who assisted in egg collection, handling, and transport; and C. Elder for advice on maintenance of incubators.

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Captive Reproduction and Growth of the Broad-Striped Dwarf Siren (*Pseudobranchus s. striatus*)

CHARLES SCOTT PFAFF
and
KATHY BELL VAUSE
Riverbanks Zoo and Botanical Garden, PO Box 1060
Columbia, South Carolina 29202, USA
e-mail (CSP): spfaff@riverbanks.org

Dwarf sirens (*Pseudobranchus*) are aquatic salamanders endemic to the southeastern United States. There are two extant species, the southern dwarf siren (*P. axanthus*) and the northern dwarf siren (*P. striatus*). The northern dwarf siren consists of three subspecies (*P. s. striatus*, *P. s. lustricolus* and *P. s. sphenisus*) one of which, the broad-striped dwarf siren (*P. s. striatus*), is indigenous to South Carolina (Moler and Kezer 1993; Petranka 1998). The broad-striped dwarf siren inhabits cypress swamps and ponds in acid pine flatwoods, flooded ditches, marshes and other permanent and semi-permanent aquatic habitats from southeastern South Carolina to northern Florida (Conant and Collins 1991; Moler and Kezer 1993; Petranka 1998). Habitat loss and fragmentation as a result of development, agriculture, and silvaculture may be responsible for a decline of this salamander in South Carolina (S. Bennett, pers. comm.) Because of this, the South Carolina Department of Natural Resources has listed *P. striatus* as a state threatened species.

Most of the published life history data for *Pseudobranchus* species concerns *P. axanthus*. Although the life history of *P. striatus* may be similar to that of *P. axanthus*, for both species there is a general lack of data for growth rates, size and age at first reproduction, and many aspects of the juvenile and adult stages (Petranka 1998). According to Petranka (1998) there is "an almost complete lack of information on the natural history of *P. striatus*."

In 1994, Riverbanks Zoo and Garden attempted to establish a self-sustaining captive population of *P. striatus*. In July 1994, 0.0.6 *P. striatus* were collected in Hampton County, South Carolina and donated to RZG by the South Carolina Department of Natural Resources. Although the age of the specimens at the time of collection is unknown, it was latter determined that their small size corresponded with that of captive born young-of-the-year.

Husbandry.—The salamanders were initially housed in various glass and plastic aquaria ranging in size from 31 x 18 x 21 cm (LxWxH) to 50.8 x 25.4 x 34.2 cm. De-chlorinated tap water with a pH of ~ 7.0 was added to a depth of ~15.0 cm. Water temperatures were maintained between 23°C and 27°C. There was no mechanical, chemical, or biological filtration on any of the aquaria; however, 50% water changes were made weekly. Aquatic plants including duck weed (*Lemna* sp.) and bladderwort (*Urticularia* sp.) were added to all of the aquaria. A layer of substrate 2–4 cm deep consisting of small gravel, sphagnum moss, or leaf litter was added to some aquaria while others contained no substrate. Artificial lighting consisting of a 15-watt full spectrum fluorescent bulb and a 40-watt incandescent bulb was used on a single aquarium while the others had no supplementary lighting.

A variety of commercial, dry, flake fish food and live food was offered to the sirens ad lib. 3x/week. The preferred food item proved to be live blackworms (*Lumbriculus variegatus*) which were later fed exclusively. Live tubifex worms (*Tubifex* sp.) were not accepted as a food item.

The six wild-caught sirens readily acclimated to a captive environment and grew rapidly (Fig. 1). As far as could be determined, no one particular aquarium set-up proved to be more advantageous than another in terms of survival or growth rate.

Reproduction.—In May 1995, all individuals were assumed to be near adult size and an attempt was made to stimulate reproduction. *Pseudobranchus* are not considered sexually dimorphic. However, Petranka (1998) reports that "female *P. striatus* are on average slightly larger than males." Netting and Goin (1942) reported that in *P. axanthus*, the average total length (TL) of the five longest females they collected was 28% greater than that of the five longest males. The two longest animals at RZG (RZ 1260 and 1265), presumed to be females, and the two shortest (RZ 1261 and 1263), presumed to be males, were placed together in a 50.8 x 25.4 x 34.2 cm glass aquarium. Ambient water temperatures were

maintained between 25° and 27°C. The aquarium was located in a room with a glass skylight that provided natural photoperiods. Because *Pseudobranchus* are known to attach single eggs to underwater vegetation (Goin 1947; Netting and Goin 1942) live aquatic plants (*Utricularia* sp.) and plastic aquarium plants were maintained in the water column at all times. During the summer and fall of 1995, no breeding or courtship behavior were observed, nor did we observe any eggs. Noble (1930) reported that captive *Pseudobranchus* will eat the eggs of conspecifics so it is possible that eggs were laid but consumed.

In late October 1995, an attempt was made to ascertain if seasonal thermal and photoperiod cycling would stimulate reproduction. The group was moved into a hibernaculum where the air and water temperature was gradually lowered to 12°C and the photoperiod was reduced to 8/16 (L/D) h per day. Individuals were maintained under these conditions until early March 1996 when the temperatures were gradually raised to 27°C and the photoperiod increased to 14/10 (L/D) h per day. During the remainder of 1996, no reproduction or attempts at reproduction were observed. The same seasonal thermal/photoperiod cycle was again duplicated between October 1996 and March 1997. As in the previous year, no evidence of courtship or reproduction were observed during 1997.

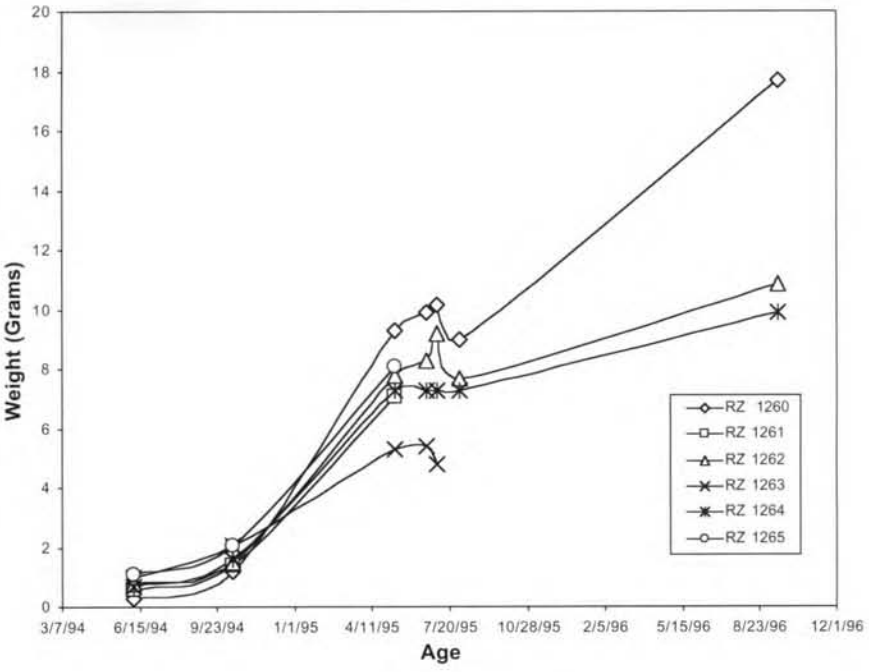


FIG. 1. Growth rates of six *Pseudobranchus s. striatus* collected as juveniles.

Beginning in October of 1998, the same group of four adult sirens was placed in a 107 x 74 x 30 cm plastic stock tank and moved outdoors. Unfiltered, untreated water from the lower Saluda River, which supplies the zoo's river water system, was added to the tank and fluctuated between 15 and 20 cm deep. A layer of dead leaves and other detritus was added to the bottom of the tank. Bladderwort (*Utricularia* sp.) thrived in the outdoor tank and soon created a dense mat of roots and stems. The water in the outdoor tank had a pH of ~ 5.7. The group was subjected to the natural fluctuations in temperature, rainfall, and photoperiod of Columbia, South Carolina. They continued to be fed blackworms, ad lib. 3x /week and we assume that they might have also fed on the many aquatic insects and other invertebrates that colonized the tank.

The tank was checked infrequently over the winter and spring but no eggs or hatchlings were seen until 13 July 1998, when 19 hatchlings and four single eggs were found in the tank with the adults. The single eggs were attached to both *Utricularia* and plastic plants and were removed from the tank for closer observation. One of the eggs ruptured while being removed. The other three hatched four days later. The three neonates measured 13, 14, and 15 mm TL. Additional fertile eggs were observed scattered among the vegetation through August 1998. No new eggs were seen after that time. As of October 1998, there were 61 juvenile sirens in addition to the four adults, living in the tank. Roughly half of the juveniles were the same relative size as the three hatchlings measured on 17 July, and were assumed to be recently hatched.

All of the 1998 F_1 juveniles were separated from the adults and established in a plastic stock tank under identical conditions as the adults. The tank of adult sirens was again checked infrequently for eggs. No new eggs were seen until 25 June 1999 when seven eggs and 10 hatchlings were observed. On 2 August 1999 there were a total of 38 hatchlings in the tank. No eggs were seen after that date even though the females had deposited eggs through August of the previous year. Daily daytime high temperatures for the last two weeks of July had exceeded 37°C, which may have had a negative effect on reproduction. The mean weights and lengths of the largest, and presumably oldest, 1999 juveniles were 1.13 g (N = 6, range 1.01–1.31 g) and 73 mm TL (N = 6, range 69–79 mm).

The 1998 hatch F_1 sirens were near adult size in June 1999, however, no eggs or hatchlings were ever observed in the F_1 tank that year. The 1999 F_1 juveniles were separated from the adults and again maintained under identical conditions. On 18 May 2000 the mean weight of the 1999 F_1's was 1.75 g (N = 10, range 0.9–3.4 g) and total length was 91.3 mm (N = 10, range 60–123 mm).

In Spring 2000, the 0.0.4 adult founders disappeared from their tank before reproduction had begun and it was assumed that they fell victim to predation by garter snakes (*Thamnophis* sp.). A total of 0.0.12 1998 F_1's in two, separate outdoor holding tanks and 0.0.10 1999 F_1's in a single tank had been maintained outdoors since the fall of 1999. No evidence of reproduction was observed in any of these groups during 2000.

In March 2001 three 1998 F_1's weighed 4.0, 4.0, and 3.5 g and had a TL of 140 mm, 145 mm, and 150 mm, respectively. The single remaining 1999 F_1 weighed 3.5 g and had a TL of 135 mm.

Discussion.—During two breeding seasons, no fewer than 99 (61, 38) dwarf sirens were produced. Considerable mortality among the hatchlings was observed although the cause of death could not be determined. Considering the difficulty of locating the hatchlings among the dense vegetation and substrate, and how rapidly the deceased hatchlings could be consumed or decompose, the actual number of offspring produced may have been much higher. The sex ratio of the breeding group is unknown. If our initial assertion

that the group was composed of 2.2 adults is correct, then two females are capable of producing at least 61, and possibly more, offspring in a single breeding season

Hatchlings are capable of attaining near adult size in less than a year (Fig. 1). Growth rates of the sirens maintained indoors at a relatively constant temperature of 25–27°C were greater than those maintained outdoors and subjected to seasonal fluctuations in temperature. As far as we could determine, the density of hatchlings per enclosure had little effect on growth and mortality as long as there was adequate supplemental feeding.

Wild-caught *Pseudobranchus s. striatus* collected as juveniles reproduced in their fourth year. Captive conditions in earlier years might not have provided appropriate stimulus for reproduction. Nevertheless, F_1 offspring kept under identical conditions to those under which the adults bred had not yet reproduced by their third year. Two of the six original, wild-caught sirens, presumed to be 1.1, were continually housed indoors in a transparent plastic aquaria. To facilitate observation, the aquaria were maintained with clear water, few plants, and only a gravel substrate. Although this arrangement apparently did not compromise husbandry, no attempts at reproduction were ever observed. The oviposistion period for *P. striatus* was mid-June through August. The oviposition period for wild *P. axanthus* is reported to last from early November through March (Petranka 1998). The maximum length attained by a captive-raised *P. striatus* is 230 mm TL, slightly exceeding the published maximum length of 220 mm (Petranka 1998). No published data regarding longevity of *Pseudobranchus* could be found. At RZG, two captive-raised *P. s. striatus* are seven years old at the time of writing and still alive.

Unfortunately, conditions that stimulated reproduction in *Pseudobranchus*, e.g. turbid water, dense mats of vegetation and substrate, also prevented ready observation of some behaviors such as courtship and fertilization. Searching for eggs and offspring involved draining the tank, capturing the sirens and sorting through the vegetation and substrate. It was believed that this level of disturbance might compromise animal health and inhibit reproduction, hence frequent and continuous observations were not made. Nevertheless, these might represent the only observations for size and age at first reproduction as well as growth, fecundity, oviposition, and longevity for this species.

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NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their note (e.g., Reproduction, Morphology, Habitat, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send two copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover): Marc P. Hayes (lizards, amphisbaenians, crocodilians, *Sphenodon*); Charles W. Painter (amphibians); or Brian Butterfield (snakes, turtles). Authors are requested to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a Rich Text Format (RTF) version of the file. Alternatively, authors may submit manuscripts electronically, as e-mail attachments. Figures can also be submitted electronically as JPG files, although higher-resolution TIFF files may be requested for publication.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Crother (2000. *Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding*. Herpetol. Circ. 29:1–82); for Mexico as it appears in Liner (1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herpetol. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

AMBYSTOMA LATERALE (Blue-spotted Salamander) and ***AMBYSTOMA MACULATUM*** (Spotted Salamander). **PREDATION**. Predation by wood frog (*Rana sylvatica*) tadpoles on *A. maculatum* egg masses has been described in detail (Petranka et al. 1995. Herpetologica 54:1–13). However, nothing has been written on *R. sylvatica* predation on *A. laterale*. In Maine, all three species commonly breed in the same temporary woodland pools, where *R. sylvatica* hatch first, then *A. laterale*, then *A. maculatum*. *Ambystoma laterale* masses have fewer eggs, and are encased in jelly that is less dense than that of *A. maculatum* (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.).

On several occasions during Spring 2001, in woodland ponds in northern and central Maine, we observed *R. sylvatica* behavior that suggested preferential predation on egg masses of *A. laterale* over those of *A. maculatum*. A single predation event witnessed in captivity confirmed that *R. sylvatica* does attack and ingest larval *A. laterale*.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 32, Number 1 (March, 2001).

CAUDATA

AMBYSTOMA LATERALE (Blue-spotted Salamander). USA: MINNESOTA: Houston Co: near Houston (43°46'23.33"N, 91°29'43.19"W). 21 June 2000 and 6 July 2001. Joshua M. Kapfer and Shane N. Jones. Bell Museum of Natural History (JFBM 14237). Verified by J. J. Moriarty. First records for county (Oldfield and Moriarty 1994, Amphibians and Reptiles Native to Minnesota. Univ. Minnesota Press, Minneapolis, Minnesota. 237 pp.).

Larval individuals were collected with dip nets in June 2000 and July 2001 from the same roadside ephemeral wetland. One specimen was collected in 2000 and preserved in the field (JFBM 14237). Of the two specimens taken in 2001, one was preserved, and the other was cultured through metamorphosis in the laboratory to determine species identification. The wetland from which these specimens were collected was surrounded on three sides (west, south, and east) by mixed hardwood and conifer woodlots, with the north edge having a paved road adjacent (ca. 5 m from wetland). Dominant emergent vegetation was *Carex* sp. and dominant submergent vegetation was *Ceratophyllum* sp. The individual collected in 2000 was dip netted during daylight hours on the southern edge of the wetland. The individuals collected in 2001 were dipnetted during daylight hours from the northwestern edge of the wetland. All individuals were collected from shallow water (<0.25 m). Although the adjacent woodlots were searched, no adults were found. *Ambystoma laterale* is widely distributed in adjacent Wisconsin (Vogt 1981, Natural History of Amphibians and Reptiles in Wisconsin. Publ. Milwaukee Pub. Mus., Wisconsin. 205 pp.), occurs in an isolated population in east-central Iowa (Iowa DNR Nongame Tech. Ser. No. 3:1–24), and is found in central and northern Minnesota, with an isolated southern population 115 km to the west in Mower County (Oldfield and Moriarty, *op. cit.*).

Submitted by **JOSHUA M. KAPFER**, River Studies Center, Department of Biology, University of Wisconsin at LaCrosse, LaCrosse, Wisconsin 54601, USA (e-mail: jnjkapfer@hotmail.com), and **JEFFREY R. PARMELEE**, Department of Biology, Simpson College, Indianola, Iowa 50125, USA (e-mail: parmelee@simpson.edu).

AMBYSTOMA MACULATUM (Spotted Salamander). USA: TENNESSEE: Henry Co: floodplain woods along Nanney Road (Cowpath Road on the 1950 7.5 minute topographic quadrangle), 0.16 mi NE of Holly Fork Creek (36°23'44"N, 88°13'47"W). 28 February 2001. Bob Brinkman, Theodore Ives Jr., and Susan Fletcher. Austin Peay State University Museum (APSU 4008). Verified by A. Floyd Scott. Two adults found under logs. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **BOB BRINKMAN, THEODORE IVES JR.**, and **SUSAN FLETCHER**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

AMBYSTOMA MACULATUM (Spotted Salamander). USA: TENNESSEE: Houston Co: woodlot just E of Cedar Valley Rd. 1.0 km S of Tennessee Highway 49, 5.6 air km E of Erin (36°17'47"N, 87°38'28"W). 1 September 1999. Scott and Hunter Sutton. Austin Peay State University Museum (APSU 6050). Verified by Joseph T. Collins. Adult under decaying log. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **A. FLOYD SCOTT, SCOTT SUTTON**, and **HUNTER SUTTON**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

AMBYSTOMA MACULATUM (Spotted Salamander). USA: WISCONSIN: Jackson Co: Green Bay and Western RR right-of-way, within 75 m W of Bartell Road and ca. 100 m north of Wisc. Rt. 54, W of City Point (Sec. 34, T22N, R1E). 12 May 2001. Andrew G. Cochran and Philip A. Cochran. MPM 33142. Verified by Gary Casper. First documented record from the county (Casper 1996, Geographic Distribution of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum, Wisconsin). Casper (*op. cit.*) expected this species in all Wisconsin counties north of the Tension Zone, as depicted by Curtis (1959, The Vegetation of Wisconsin. Univ. Wisconsin Press, Madison); extends the known range into the Tension Zone itself.

Submitted by **ANDREW G. COCHRAN** and **PHILIP A. COCHRAN**, Biology Department, Saint Mary's University, Winona, Minnesota 55987, USA.

AMBYSTOMA TIGRINUM (Eastern Tiger Salamander). USA: TEXAS: Bastrop Co: Griffith League Ranch, a 5000-acre site owned by the Capitol Area Council of the Boy Scouts of America (30°12'58.6"N, 97°14'30.6"W). 25 May 2001. Todd Swannack and Michael R. J. Forstner. Verified by R. Kathryn Vaughn. TCWC 84707. Collected from a trap in a herpetofaunal array; new county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press. 421 pp.).

Submitted by **MICHELE GASTON** (e-mail: mg45447@swt.edu), **TODD SWANNACK, LEE AHLBRANDT**, and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA.

EURYCEA CIRRIGERA (Southern Two-Lined Salamander). USA: TENNESSEE: Moore Co: tributary to West Fork Mulberry Creek along Bagley Hollow Road at Charity Church (35°19'18"N, 86°28'17"W). 14 March 2001. Christine Abbey-Carlton, Susan Fletcher and Bob Brinkman. Austin Peay State University Museum of Zoology (APSU 4175). Verified by A. Floyd Scott. Two adults under rock at spring. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **CHRISTINE ABBEY-CARLTON, SUSAN FLETCHER**, and **BOB BRINKMAN**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

EURYCEA LONGICAUDA LONGICAUDA (Longtail Salamander). USA: TENNESSEE: Claiborne Co: Lincoln Memorial University campus, stream feeding Blanton Lake (36°34'50"N, 83°39'52"W). 20 April 2001. Susan Fletcher and Bob Brinkman. Austin Peay State University Museum of Zoology (APSU 4280). Verified by A. Floyd Scott. One adult under flat rock at edge of stream. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **SUSAN FLETCHER** and **BOB BRINKMAN**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

GYRINOPHILUS PORPHYRITICUS PORPHYRITICUS (Northern Spring Salamander). USA: TENNESSEE: Fentress Co: Colditz Cove State Natural Area near Northrup Falls (36°21'30"N, 84°52'19"W). 20 April 2001. Bob Brinkman and Susan Fletcher. Austin Peay State University Museum of Zoology (APSU 3262, digital photo). Verified by A. Floyd Scott. One adult and one larva found under rocks along trail leading to waterfall. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **BOB BRINKMAN** and **SUSAN M. FLETCHER**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: GEORGIA: Greene Co: Oconee National Forest at point where FS Road 1246 crosses unnamed creek, 11.3 km NW Greensboro. 21 January 2001. Matt Elliott and Stacy Smith. GMNH 46757–758. Verified by M. E. McGhee. Under logs adjacent to beaver pond. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **MATTHEW J. ELLIOTT**, Georgia Gap Analysis Program, Institute of Ecology, University of Georgia, Athens, Georgia 30602, USA, and **STACY N. SMITH**, Warnell School of Forest Resources, University of Georgia, Athens, Georgia 30602, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: GEORGIA: Jackson Co: Boscoe Creek, adjacent to Thompson Mills State Forest, 4.8 km WNW Braselton. 4 February 2000. Stacy Smith, Rhett Jackson, and Gary Grossman. GMNH 45152. Verified by M. E. McGhee. In boggy area adjacent to stream. First vouchered county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1-712). Neill (1957, Copeia 1957:43–47) observed this species in Jackson County, but did not secure a voucher specimen.

Submitted by **STACY N. SMITH**, Warnell School of Forest Resources, University of Georgia, Athens, Georgia 30602, USA, and **MATTHEW J. ELLIOTT**, Georgia Gap Analysis Program, Institute of Ecology, University of Georgia, Athens, Georgia 30602, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: INDIANA: Jackson Co: Muscatatuck National Wildlife Refuge in the Muscatatuck Seep Springs Research Natural Area on Chestnut Ridge. 20 April 2001. Vicky J. Meretsky. Verified by Joseph T. Collins. University of Kansas Natural History Museum (KU Color Slides 11833–834). First county record (Minton 1972, Amphibians and Reptiles of Indiana. Indiana Acad. Sci. Monogr. 3, Indianapolis, Indiana).

Submitted by **VICKY J. MERETSKY** and **SARA M. PYLES**, School of Public and Environmental Affairs, Indiana University, Bloomington, Indiana 47405, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: TENNESSEE: Henry Co: floodplain woods along Nanney Road (Cowpath Road on the 1950 7.5 minute topographic quadrangle), 0.16 mi NE of Holly Fork Creek (36°23'44"N, 88°13'47"W). 28 February 2001. Theodore Ives Jr., Susan Fletcher, and Bob Brinkman. Austin Peay State University Museum of Zoology (APSU 4149). Verified by A. Floyd Scott. One adult under dead log. New county record and first record of the species in Tennessee west of Kentucky Lake (impounded lower Tennessee River) (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **THEODORE IVES JR.**, **SUSAN FLETCHER**, and **BOB BRINKMAN**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

HYDROMANTES PLATYCEPHALUS (Mount Lyell Salamander). USA: CALIFORNIA: Tulare Co: Sequoia National Forest, Bullfrog Lakes: NE 1/4 of NW 1/4 of section 6, T18S, R32E; 36°23'54.6"N, 118°33'10.4"W, 3365 m. 31 August 1997. Ronald Gonzales. MVZ 230238–239. Verified by Robert W. Hansen. One adult (65 mm SVL, 101 mm TL) and one subadult (43 mm SVL, 72 mm TL) found under granite slabs on bedrock and decomposed granite gravel with icemelt seepage, along creek just above upper lake. Extends range 1.8 km SSW of southernmost published locality (Franklin Pass area; Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. 2nd ed., Houghton Mifflin Co., Boston, Massachusetts. 336 pp.), but more importantly, this is the first record for the Little Kern/Kern River drainage, and southernmost record for the western slope of the Sierra Nevada.

Submitted by **RONALD GONZALES**, 921 East Kaweah Avenue, Visalia, California 93292, USA.

PLETHODON GLUTINOSUS (Northern Slimy Salamander). USA: TENNESSEE: Moore Co: deciduous woods just East of US Highway 241, 0.3 miles N Chestnut Ridge (35°20'17"N, 86°32'05"W). 14 March 2001. Bob Brinkman, Christine Abbey-Carlton, and Susan Fletcher. Austin Peay State University Museum of Zoology (APSU 4192). Verified by A. Floyd Scott. One adult under log in woods. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **BOB BRINKMAN**, **CHRISTINE ABBEY-CARLTON** and **SUSAN FLETCHER**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

ANURA

ACRIS CREPITANS (Northern Cricket Frog). USA: TENNESSEE: Moore Co: In tributary to West Fork of Mulberry Creek along Bagley Hollow Road at Charity Church (35°19'15"N, 86°28'14"W). 14 March 2001. Christine Abbey-Carlton, Susan Fletcher, and Bob Brinkman. Austin Peay State University Museum of Zoology (APSU 4161). Verified by A. Floyd Scott. One adult collected in vegetation along edge of stream. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. No. 12:1–94).

Submitted by **CHRISTINE ABBEY-CARLTON, SUSAN FLETCHER,** and **BOB BRINKMAN**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

AMOLOPS CREMNOBATUS (Roughback Torrent Frog). VIETNAM: Ha Tinh Province: Huong Son District, Huong Son Nature Reserve, Rao An Region, 200 m (18°22'N, 105°13'E). David Kizirian. AMNH A-161150. Verified by Nikolai Orlov. First record for Vietnam (Inger 1998, Raffles Bull. Zool. 46[1]:29–34).

Submitted by **RAOUL BAIN**, Center for Biodiversity and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA, and **NGUYEN QUANG TRUONG**, Department of Zoology, Institute of Ecology and Biological Resources, Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

BUFO GLABERRIMUS: VENEZUELA: ESTADO TACHIRA: Municipio Uribante: Campamento Siberia, 28 km S Pregonero, Doradas and Uribante rivers (7°53'N, 71°45'W), 650–950 m. Colección de Vertebrados, Universidad de Los Andes, Facultad de Ciencias (CVULA-IV 3570, 3658, 3686–87, 3699, 3800, 5637, 5803 and 6302) and Unidad de Ecología y Calidad Ambiental, Compañía Anónima de Administración de Fuente Eléctrica (CADAFE), (UECA-H-28 and 147). All verified by A. Acosta. First country record and northernmost known locality. Previously reported from flanks of northern Andes in Colombia (Cochran and Goin 1970. USNM Bull. 288:113).

Submitted by **ANDRES CHACÓN-ORTIZ** and **AMELIA DIAZ DE PASCUAL**, Facultad de Ciencias, Universidad de Los Andes, Venezuela (e-mail: aecortiz@yahoo.com and adiaz@ciens.ula.ve), and **FRANCISCO GODOY**, Desarrollo Uribante Caparo, filial de CADAFE, Táchira, Venezuela (e-mail: cuencaparo@telcel.net.ve).

BUFO HOUSTONENSIS (Houston Toad). USA: TEXAS: Lee Co: 4.3 km S jct Lee County Road 331 and CR 333 on CR 333 (30°18'46.1"N, 97°09'08.9"W). 2 April 2001. James R. Dixon and Michael R. J. Forstner. Verified by R. Kathryn Vaughn. TCWC 84556. DOR; represents first recorded occurrence of this endangered species in Lee County (Dixon 2000, Amphibians and Reptiles of Texas. Second ed. Texas A&M Univ. Press. 421 pp.).

Submitted by **MICHELE A. GASTON** (e-mail: mg45447@swt.edu) and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA, and **JAMES R. DIXON**, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, USA.

BUFO ICTERICUS (Yellow Cururu Toad). BRAZIL: GOIÁS: Municipality of Corumbá. 23 October 2000. C. Fernandes Canêdo. Centro de Estudos e Pesquisas Biológicas, Goiânia - GO (CEPB 6573, SLV 117.7 mm). Verified by M. Trefaut Rodrigues. Right bank of Corumbá River in Cerrado vegetational formation next to Corumbá Falls. Species is widespread in the Atlantic rainforest of south, eastern and southeastern Brazilian regions (Lynch 1979, The Amphibians of the Lowland Tropical Forests. *In* Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution, and Dispersal, pp. 189–215; Cei 1980, Monit. Zool. Ital. [N.S.], Monogr. 2:1–609; Heyer et al. 1990, Arq. Zool. Univ. São Paulo 31[4]:231–410), usually in elevated forests but also in grassland (Kwet and Di-Bernardo 1999, Pró Mata - Anfíbios. EDIPUCRS. 107 pp.). First record for state of Goiás; expands distribution up to 600 km N (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.) and 640 km W (Haddad and Sazima 1992, Anfíbios Anuros da Serra do Japi. *In* Morellato [org.], História Natural da Serra do Japi: Ecologia e preservação de uma área florestal do Sudeste do Brasil, pp. 188–210. Unicamp Ed.) from previously known range.

Submitted by **IVAN FRANÇA E SOUZA, WILIAN VAZ SILVA, HÉLDER LÚCIO RODRIGUES DA SILVA**, and **NELSON JORGE DA SILVA, JR.**, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Avenida Universitária 1440, Setor Universitário, 74.210-010, Goiânia, Goiás, Brazil (e-mail [IFS]: souzai@terra.com.br).

ELEUTHERODACTYLUS JOHNSTONEI. COLOMBIA: SANTANDER: Bucaramanga (7°7'28"N, 73°06'41.6"W), 1041 m. J. Jerez, Colección Herpetológica, Museo de Historia Natural, Universidad Industrial de Santander (UIS A346–350, mean SVL = 21.79 ± 1.8 mm, N = 5). Verified by John D. Lynch. Found calling on ornamental vegetation of house gardens at east edge of city, but not in the neighboring patches of vegetation, suggesting a microhabitat preference for the frequently watered garden vegetation. Specimens of this colonizer frog are sold by gardeners and house watchmen to "adorn" yards, and in this way are dispersed to a wide residential sector of the city. Numerous specimens were captured after a complaint to the environmental authority of the city from a resident complaining of environmental contamination by the noise (calling frogs) during a rainy night. Specimens represent the second record for Colombia; extend known range of the species from Barranquilla (500 km airline).

Submitted by **JESUS E. ORTEGA, ADRIANA JEREZ**, and **MARTHA PATRICIA RAMIREZ-PINILLA**, Colección Herpetológica, Universidad Industrial de Santander, Bucaramanga, Colombia (e-mail: mpramir@uis.edu.co).

ELEUTHERODACTYLUS JUIPOCA. BRAZIL: GOIÁS: Municipality of Silvânia, Floresta Nacional de Silvânia (16°39'S, 48°36'W, 900 m). 4 April–5 May 1997. R. P. Bastos. Museu Nacional, Rio de Janeiro (MNRJ 26415–416). Verified by U. Caramaschi and C. A. G. Cruz. Previously reported from vicinity of type locality in Sousas, Campinas, São Paulo (Frost 1985, Amphibian Species of the World. A Taxonomic and Geographical Reference. Allen Press, Inc., Lawrence, Kansas. vi + 732 pp.). Also cited as occurring in Serra da Canastra (20°10'S, 46°30'W, 900–1496 m), Municipality of São Roque de Minas, Sacramento,

and, Delfinópolis, Minas Gerais (Haddad et al. 1988, Brasil Florestal 64:9–20) and Morro do Ferro (21°48'S, 46°35'W, 700 m), Municipality of Poços de Caldas, Minas Gerais (Cardoso et al. 1989, Rev. Brasil. Biol. 49[1]:241–249). First state record; extends known geographical distribution ca. 490 km to the north.

Submitted by **ROGÉRIO P. BASTOS**, Departamento de Biologia Geral, ICB, Universidade Federal de Goiás, Caixa Postal 131, 74001-970 Goiânia, Goiás, Brazil, and **JOSÉ P. POMBAL, JR.**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Brazil.

ELEUTHERODACTYLUS LUTITUS. COLOMBIA: SANTANDER: Piedecuesta Municipality, corregimiento Sevilla, Estación Experimental y Demostrativa El Rasgón (7°3'N, 72°57'W), 2180 m. A. Jerez, S. Arroyo. Colección Herpetológica, Museo de Historia Natural, Universidad Industrial de Santander (UIS-A-625, 627, 645, 796, 910, 1174, 1178; SVL range 22–24 mm). Verified by John D. Lynch. Previously known only from type locality (Lynch 1984, Milwaukee Publ. Mus. Contrib. Biol. Geol. 60:10–12). Extends distribution north 108 km (airline).

Submitted by **ADRIANA JEREZ, SANDY ARROYO**, and **MARTHA PATRICIA RAMIREZ-PINILLA**, Colección Herpetológica, Universidad Industrial de Santander, Bucaramanga, Colombia (e-mail: mpramir@uis.edu.co).

ELEUTHERODACTYLUS MARNOCKII (Cliff Chirping Frog). MÉXICO: CHIHUAHUA: Grutas de Coyame, 6 km S Coyame. 22 June 1980. J. Reddell, O. McKenzie, and M. Shumate. KU 187788. Verified by Richard L. Holland. First record from México; extends known range more than 160 km from the closest reported locality in Pecos County, Texas (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.). However, if M. J. Forstner's remarks, as presented in Dixon (*op. cit.*), are correct, then all *Eleutherodactylus guttilatus* records from the Big Bend region of Texas would in reality refer to *E. marnockii*. If so, the range extension would decrease to about 25 km from the Grutas de Coyame record to the closest reported locality in Presidio County, Texas (Dixon, *op. cit*).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autonoma de México, Apartado Postal 314, Tlalnepantla, México, México 54090 (e-mail: lemos@servidor.unam.mx), and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail [HMS]: hsmith@spot.colorado.edu).

ELEUTHERODACTYLUS MEROSTICTUS. COLOMBIA: SANTANDER: Piedecuesta Municipality, corregimiento Sevilla, Estación Experimental y Demostrativa El Rasgón (7°3'N, 72°57'W), 2180 m. A. Jerez, S. Arroyo. Colección Herpetológica, Museo de Historia Natural, Universidad Industrial de Santander (UIS-A-622, 624, 642, 731, 734, 759, 864, 865, 915, 964, 1016, 1032, 1043; SVL range 14.4–22.64 mm). Verified by John D. Lynch. Previously known only from type locality (Lynch 1984, Milwaukee Publ. Mus. Contrib. Biol. Geol. 60:10–12). Extends distribution north 122 km (airline) on the Cordillera Oriental of the Colombian Andes.

Submitted by **ADRIANA JEREZ, SANDY ARROYO**, and **MARTHA PATRICIA RAMIREZ-PINILLA**, Colección Herpetológica, Universidad Industrial de Santander, Bucaramanga, Colombia (e-mail: mpramir@uis.edu.co).

EPIPEDOBATES BRACCATUS. BOLIVIA: SANTA CRUZ: El Portón (18°10'S, 60°08'W, ca. 550 m). 3 March 1954. Carl Gans. LACM 44399, male, SVL 25.4 mm; LACM 60976, cleared and stained, SVL 31.0 mm). Gans (1960, Ann. Carnegie Mus. 35:283–314) reported the collection of 32 specimens of *Epipedobates flavopictus* from El Portón, Santa Cruz, Bolivia, that were deposited in the MCZ (17 specimens) and CM (15 specimens). Two specimens (MCZ 29824 and CM 36155F) noted above were later donated to LACM. Silverstone (1976, Nat. Hist. Mus. Los Angeles Co., Sci. Bull. 27:1–53) reviewed the Bolivian material mentioned above and included them as a population within pattern 1 (formed by *E. braccatus* and *E. flavopictus*) of *E. pictus*. Since Silversone's publication (*op. cit.*), it has not been clear which species, *E. braccatus* or *E. flavopictus*, is present in Bolivia (Haddad and Martins 1994, Herpetologica 50:282–295; De La Riva et al. 2000, Rev. Esp. Herpetol. 14:19–164). I examined the two LACM specimens and identified them as *E. braccatus,* making them the first record from Bolivia.

Submitted by **VICTOR R. MORALES**, Department of Wildlife and Fisheries Sciences and Texas Cooperative Wildlife Collection, TAMUS 2258, Texas A&M University, College Station, Texas 77843-2258, USA.

EPIPEDOBATES FEMORALIS (Brilliant-thighed Poison Frog). BRAZIL: GOIÁS: Municipality of Piranhas, 5 km from Piranhas River (16°36'09"S, 51°47'49"W). 26 March 2001. D. Fenolio. Centro de Estudos e Pesquisas Biológicas, Goiânia - GO (CEPB 6575, tadpole). Collected at night in a small pond (30 m in diameter) in an anthropic area. Two young specimens were also collected (16°35'04"S, 51°47'57"W) on 29 May 2001 (CEPB 6576, SLV 13.6 mm; CEPB 6577, SLV 16.7 mm) by V. Oliveira dos Santos. All specimens were verified by M. Trefaut Rodrigues and were collected on the west bank of the Piranhas River. This species has been mentioned in descriptions of the South American herpetofauna (Duellman 1978, Univ. Kansas Mus. Nat. Hist. Misc. Pub. 65:1–352; Duellman and Salas 1991, Univ. Kansas Mus. Nat. Hist. Occ. Pap. 143:1–13; Rodriguez and Duellman 1994, Guide to the Frogs of the Iquitos Region. Lawrence, Kansas. 80 pp.) as always being found within the Amazon rainforest limits. The records reported herein come from a region previously occupied by Cerrado vegetational formation and they are the first records for the state of Goiás, expanding its distribution up to 740 km S from the previously known range (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.).

Submitted by **IVAN FRANÇA E SOUZA, WILIAN VAZ SILVA, RAFAEL SILVEIRA RIBEIRO, HÉLDER LÚCIO RODRIGUES DA SILVA**, and **NELSON JORGE DA SILVA, JR.**, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Avenida Universitária 1440, Setor Universitário, 74.210-010, Goiânia, Goiás, Brazil (e-mail: souzai@terra.com.br).

FROSTIUS PERNAMBUCENSIS (Bromeliad Toad). BRAZIL: Bahia: Municipality of Santa Terezinha–Pedra Branca (12°51'S,

39°28'W). 17 October 1997. M. Freitas and F. A. Juncá. Laboratório de Animais Peçonhentos e Herpetologia da Universidade Estadual de Feira de Santana (LAPH-UEFS 33). Verified by O. L. Peixoto and C. A. G. da Cruz. Previously known only from the Reserva Dois Irmãos, Recife, state of Pernambuco, this little known species had its range extended ca. 170 km SW to Murici, state of Alagoas, 20 years after the original description (Peixoto and Freire 1998, Herpetol. Rev. 29:172). Herein, we report the first record in Serra da Jibóia, state of Bahia, extending the distribution of this species ca. 450 km south. As with the discovery in the state of Alagoas, this population was found at ca. 850 m, in typical Atlantic Forest vegetation.

Submitted by **FLORA ACUÑA JUNCÁ**, Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana, 44031-460 Feira de Santana, Bahia, Brazil, and **MARCOS DE FREITAS**, Grupo Ambientalista da Bahia, Avenida Lucaia, ed. Rv Center, 1o andar, Rio Vermelho, Salvador, Bahia, Brazil.

HYLA MICROPS (Nova Friburgo Treefrog). BRAZIL: BAHIA: Porto Seguro Municipality, Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). January 2000. D. L. Silvano. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 26463–64); September 2000. B. V. S. Pimenta. MNRJ 26465–66. All verified by Ulisses Caramaschi. According to Frost (1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.), distribution was the Atlantic rainforests of the southeastern region of Brazil, later extended to the state of Rio Grande do Sul (Kwet 1998, Herpetol. Rev. 29:49). Three males were collected on vegetation at the margins of a temporary pool inside the forest. New record for the state of Bahia and for northeastern Brazil; represents the northern limit of the distribution for this species.

Submitted by **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net) and **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

HYLA NANA. BRAZIL: RIO GRANDE DO SUL: Municipality of Itaqui: nearness Ibicui River bridge at BR 472 Road (29°20'S, 56°38'W). Between December 1999 and January of 2001. L. O. M. Giasson and S. T. Z. Cechin. Herpetology Collection, Departamento de Biologia, Universidade Federal de Santa Maria, Santa Maria (ZUFSM 2355–56, 2710–12). Verified by P. C. A. Garcia and C. F. B. Haddad. No previous voucher specimen for this frog was available from the state of Rio Grande do Sul, despite its being widespread in adjacent areas of Argentina and Uruguay (Klappenbach and Langone 1992, Anales del Museo Nacional de Historia Natural 8:163–222).

Submitted by **LUÍS O. M. GIASSON**, Departamento de Zoologia, Instituto de Biociências, Universidade Estadual Paulista, C. P. 199, 12506-900, Rio Claro – SP, Brazil (e-mail: olimpio@biologo.mailbr.com.br) and **SONIA T. Z. CECHIN**, Departamento de Biologia, Universidade Federal de Santa Maria, faixa de camobi, km 9, campus, Camobi, cep: 97105-900, Santa Maria, Rio Grande do Sul, Brazil (e-mail: cechinsz@ccne.ufsm.br).

HYLA PRASINA (Burmeister´s Treefrog). BRAZIL: RIO GRANDE DO SUL: São José dos Ausentes, Silveira (28°50'S, 50°00'W), Fazenda Cachoeirão dos Rodrigues (ca. 1200 m). 18 February 2001. A. Kwet and T. Miranda. Museu de Ciências e Tecnologia da PUCRS, Porto Alegre, Brazil (MCP 4613–14). Verified by M. Di-Bernardo. This new record for the state of Rio Grande do Sul represents the southernmost locality known for this species in the mountains of southeastern Brazil (Minas Gerais, Rio de Janeiro and São Paulo) and extends known distribution ca. 300 km south from previous records. Two males were found calling at a pond in syntopy with abundant *Hyla pulchella*, *H. minuta* and *Pseudis cardosoi*.

Submitted by **AXEL KWET**, Zoologie, Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, D-70191 Stuttgart, Germany (e-mail: axel.kwet@uni-tuebingen.de), and **TATIANA MIRANDA**, Laboratório de Pesquisas Biológicas, PUCRS, Avenida Ipiranga, 6681, CEP 90619-900 Porto Alegre, Brazil (e-mail: tatimiran@hotmail.com).

HYLA SENICULA (Corcovado Treefrog). BRAZIL: BAHIA: Porto Seguro Municipality, Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). March 2000. B. V. S. Pimenta and P. H. C. Cordeiro. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 25622–24). Verified by Ulisses Caramaschi. Published distribution for the species is the coastal region of Rio de Janeiro and Espírito Santo states (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.) and the continental state of Minas Gerais (Caramaschi and Cruz 1996, Herpetol. Rev. 27:208–209). Specimens were collected on perches at the margins of a pool on the borders of a forest after heavy rain; northernmost record for the species.

Submitted by **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net) and **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

HYLA SOARESI. BRAZIL: GOIÁS: Municipality of Mambaí (14°29'S; 46°06'W, 709 m). 3 March 2001. R. F. Juliano and R. Lingnau. Museu Nacional, Rio de Janeiro (MNRJ 26417). Verified by U. Caramaschi and C. A. G. Cruz. Previously recorded from states of Piauí, Picos, Ceará, Santana do Cariri, Paraíba, Areia Branca, Minas Gerais, Manga (Gomes and Peixoto 1996, Iheringia, ser. Zool. 80:33–38) and Bahia and Jandaíra (Gomes and Peixoto 1991, Acta Biol. Leopoldensia 13:141–162). First state record; extends known distribution ca. 270 km to west.

Submitted by **RAFAEL F. JULIANO**, **RODRIGO LINGNAU**, and **ROGÉRIO P. BASTOS**, Departamento de Biologia Geral, ICB, Universidade Federal de Goiás, Caixa Postal 131, 74001-970 Goiânia, Goiás, Brazil, and **JOSÉ P. POMBAL JR.**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Brazil.

PHYLLODYTES MELANOMYSTAX. BRAZIL: SERGIPE: Serra de Itabaiana, Municipality of Areia Branca (10°45'S, 37°19'W, 160 m). 10 May 1997. C. M. Carvalho. Museu de Zoologia, Universidade de São Paulo (MZUSP 88968–969). Verified by José P. Pombal, Jr. Previously known only from type-

locality on the southern coast of the state of Bahia, Brazil (Caramaschi et al. 1992, Copeia 1992:187–191; Frost 2000, Amphibian Species of the World: An Online Reference V2.20 [1 September 2000] http://research.amnh.org/herpetology/index.html] First state record; extends range NW ca. 350 km airline from the type-locality and range west ca. 50 km airline from the coast line.

Submitted by **ULISSES CARAMASCHI**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Rio de Janeiro, Brazil, and **OSWALDO LUIZ PEIXOTO**, Departamento de Biologia Animal, Universidade Federal Rural do Rio de Janeiro, 23851-970 Seropédica, Rio de Janeiro, Brazil.

PLEURODEMA THAUL (Sapito de Cuatro Ojos). ARGENTINA: NEUQUEN: Departamento Minas: W shore of Laguna Superior de Epulafquen, 36°49'30"S, 71°5'48"W, ca. 1400 m. 21 January 2000. Carmen Úbeda. Museo de Ciencias Naturales de La Plata, La Plata, Argentina (MLP A. 2274). Juvenile specimen collected in a shallow pond near a temperate deciduous forest of roble pellín (*Nothofagus obliqua*). Juveniles were also present 3 km W in La Negra pond. CHUBUT: Departamento Río Senguer: Land between La Plata and La Plata Chico lakes, 72°00'S, 44°48'50"W, ca. 1000 m. 12 January 2000. Carmen Úbeda. Mature female (SVL 47 mm). (MLP A. 2275). Specimen was collected in a *Sphagnum* peat bog in a cold-temperate humid deciduous forest of lenga (*Nothofagus pumilio*). Tadpoles and juveniles were also present. Both verified by Néstor G. Basso. Species is known from Chile and Argentina, with a narrow distribution area along the eastern slopes of the Andes, and occupies a variety of habitats. In Chile, it is distributed from Río Copiapó (III Region) to Aysen Province (XI Region) (Cei 1962, Batracios de Chile. Ediciones de la Universidad de Chile, Santiago de Chile. 128 pp. + cviii). In Argentina, it has been reported, without coordinate precision, for "the Andean-Antarctic region, from the high valleys of Neuquén (Neuquén River) to upper Chubut" (Cei 1980, Amphibians of Argentina. Monit. Zool. ital. [N.S.] Monogr. 2:[i–xii] + 1–609). The two records reported herein represent new latitudinal extremes for distribution east of the Andes. The Laguna Superior de Epulafquen locality represents the northern and warmer manifestation of the Andean-Patagonic forests east of the Andes, where *P. thaul* co-exists with *Bufo spinulosus*. The La Plata lake locality represents a forest with cold and very humid conditions, where the species co-exists with *Batrachyla antartandica* and *Bufo variegatus*.

Submitted by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Province de Río Negro, Argentina.

PROCERATOPHRYS AVELINOI. BRAZIL: SANTA CATARINA: Municipality of Ipuaçu: near Chapecó River (26°37'53"S, 52°27'18"W), 720 m. 11–12 April 2001 and 6 June 2001. L. O. M. Giasson and P. A. Hartmann. Departamento de Zoologia, Universidade Estadual Paulista, Rio Claro (CFBH 3816–18). Verified by C. F. B. Haddad. First record for state of Santa Catarina; extends range ca. 150 km east from known distribution in Misiones, Argentina (Kwet and Faivovich 2001, Copeia 2001:203–215).

Submitted by **LUÍS O. M. GIASSON** (e-mail: olimpio@biologo.mailbr.com.br), **PAULO A. HARTMANN** (e-mail: pahart@rc.unesp.br), and **PAULO C. A. GARCIA** (e-mail: pcgarcia@rc.unesp.br), Curso de Pós–Graduação em Zoologia, Instituto de Biociências, Universidade Estadual Paulista, Caixa Postal 199, 12506-900, Rio Claro, São Paulo, Brazil.

PROCERATOPHRYS SCHIRCHI (Horned Toad). BRAZIL: BAHIA: Jussari Municipality, Reserva Particular do Patrimônio Natural (RPPN) Serra do Teimoso (15°08'S, 39°31'W). July 2000. B. V. S. Pimenta. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 26456–58); Guaratinga Municipality, Fazenda Vista Bela (16°35'S, 39°54'W). September 2000. B. V. S. Pimenta. MNRJ 26459–60; Nilo Peçanha Municipality, Fazenda São João (13°41'S, 39°14'W). December 2000. R. T. Moura. MNRJ 26461. All verified by Ulisses Caramaschi. All specimens, except those at RPPN Serra do Teimoso, were found on forest litter by day. Species was previously known from the states of Espírito Santo and Rio de Janeiro (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.) in southeastern Brazil; the records reported herein extend its distribution to the north.

Submitted by **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net) and **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: WISCONSIN: Kewaunee Co: NW 1/4 Sec. 8, T23N, R24E, Lipsky Swamp State Wildlife Area (44°28'45", 87°37'15"). 14 April 2001. Melissa Saeland. UWSP Herp 3933 (female, SVL of 33.2 mm, weight = 1.9 g) and UWSP Herp 3934 (male, SVL of 24.6 mm, weight = 1.7 g). Verified by Erik Wild. First county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum. 87 pp.).

Submitted by **MELISSA J. SAELAND** (e-mail: msael739@uwsp.edu) and **MARK W. DOPERALSKI**, Department of Biology, University of Wisconsin at Stevens Point, Stevens Point, Wisconsin 54481, USA.

RANA CHAPAENSIS (Chapa Frog). VIETNAM: Ha Tinh Province: Huong Son District, Huong Son Nature Reserve, Rao An Region, 200 m (18°22'N, 105°13'E). David Kizirian and Nguyen Quang Truong. Department of Herpetology, American Museum of Natural History (AMNH A-161150). Verified by Amy Lathrop. First provincial record for Ha Tinh (Bourret 1942, Les Batraciens de L'Indochine; Frost 2000, Amphibian Species of the World: An Online Reference, Vol. 2.1 [http://research.amnh.org/herpetology/amphibia]).

Submitted by **RAOUL BAIN**, Center for Biodiversity and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA, and **NGUYEN QUANG TRUONG**, Department of Zoology, Institute of Ecology and Biological Resources, Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam.

SCINAX ALTERUS. BRAZIL: BAHIA: Porto Seguro Municipality, Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). March 2000. B. V. S.

Pimenta and P. H. C. Cordeiro. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 25630). Verified by J. P. Pombal, Jr. Species was previously known from the coastal region between the states of Espírito Santo and Paraná (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). The record reported herein extends its distribution, and represents the northern limit of its range.

Submitted by **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net) and **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

SCINAX ARGYREORNATUS. BRAZIL: BAHIA: Porto Seguro Municipality, Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). January 2000. D. L. Silvano. Museu de Ciências Naturais at PUC Minas (MCN 1929–32); March 2000. B. V. S. Pimenta and P. H. C. Cordeiro. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 25602–12); September 2000. B. V. S. Pimenta. MCN 2222–23, MNRJ 26462; Guaratinga Municipality, Fazenda Vista Bela (16°35'S, 39°54'W). September 2000. B. V. S. Pimenta. MNRJ 26467–70. All verified by J. P. Pombal, Jr. Distribution of this species was the coastal region in the states of Espírito Santo, Rio de Janeiro and São Paulo in southeastern Brazil (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). The records reported herein extend its range to the north.

Submitted by **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net) and **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

SCINAX CUSPIDATUS. BRAZIL: BAHIA: Porto Seguro Municipality, Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). March 2000. B. V. S. Pimenta and P. H. C. Cordeiro. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 25625–26, MNRJ 25629, MNRJ 25631, MNRJ 25656). Verified by J. P. Pombal, Jr. Males of this species were heard calling in a variety of different enviroments, from forest (or their borders, where this male was found) to wet cow pastures. Species was originally known from the lowlands of the coastal region of Espírito Santo and Rio de Janeiro, southeastern Brazil (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). The records reported herein represent the northern range limit for this species.

Submitted by **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net) and **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

SCINAX HUMILIS BRAZIL: MINAS GERAIS: Municipality of Belmiro Braga (22°01'57"S, 43°29'09"W), ca. 600 m. 9 March and 27 August 2001. C. Canedo and N. R. Canedo. Museu Nacional, Rio de Janeiro (MNRJ 27359–60). Verified by José P. Pombal Jr. Previously known from the lowlands of of the state of Rio de Janeiro (Lutz 1973, Brazilian Species of *Hyla*. Univ. Texas Press, Austin. Pp. 194–195) and one locality in north lowlands of the state of São Paulo (Carvalho e Silva and Carvalho e Silva 1998, Reveu fr. Aquariol. 25[1–2]: 47–52). First state record; represents the most inland record and highest elevational occurrence.

Submitted by **CLARISSA CANEDO** (e-mail: canedo@powerline.com.br) and **GUSTAVO M. PRADO** (e-mail: gmprado@ig.com.br), Departamento de Vertebrados, Museu Nacional, Rio de Janeiro/UFRJ, 20940-040 Rio de Janeiro, Brazil.

SCINAX NASICA. BRAZIL: RIO GRANDE DO SUL: Municipality of Itaqui: near Ibicui River bridge at BR 472 Road (29°20'S, 56°38'W). Between December 1999 and January of 2001. L. O. M. Giasson. Herpetology Collection, Departamento de Biologia, Universidade Federal de Santa Maria, Santa Maria (ZUFSM 2358, 2421, 2480, 2700–01, 2703). Verified by P. C. A. Garcia. No previous voucher specimen was available for the state of Rio Grande do Sul, despite this species being widespread in adjacent areas in Argentina and Uruguay (Klappenbach and Langone 1992, Anales del Museo Nacional de Historia Natural, 8: 163–222).

Submitted by **LUÍS O. M. GIASSON**, Departamento de Zoologia, Instituto de Biociências, Universidade Estadual Paulista, Caixa Postal 199, 12506-900, Rio Claro, São Paulo, Brazil; e-mail: olimpio@biologo.mailbr.com.br.

SPHAENORHYNCHUS PALUSTRIS. BRAZIL: BAHIA: Porto Seguro Municipality, Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz (16°23'S, 39°10'W). March 2000. B. V. S. Pimenta and P. H. C. Cordeiro. Museu Nacional at Universidade Federal do Rio de Janeiro (MNRJ 25592–94); September 2000. B. V. S. Pimenta. Coleção Célio F. B. Haddad (CFBH 3702–03) at Universidade Estadual Paulista (UNESP-Rio Claro). All verified by Ulisses Caramaschi. Species was known only from the type locality, Sooretama at Linhares, Espírito Santo (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.); represents a new record for the state of Bahia. Specimens were found in a pool at the borders of a forest on emerging vegetation. Discovery of this population extends the distribution of this species to the north ca. 302 km.

Submitted by **BRUNO V. S. PIMENTA** (e-mail: brunopimenta@softhome.net) and **DÉBORA L. SILVANO** (e-mail: dsilvano@softhome.net), Laboratório de Manejo de Fauna, D. Zool./ICB, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil.

TESTUDINES

APALONE MUTICA CALVATA (Gulf Coast Smooth Softshell). USA: ALABAMA: Perry Co: Cahaba River, 1 km upstream (north) of County Road 6 crossing. 29 June 2001. Peter V. Lindeman. Verified by Joseph T. Collins. KU Color Slide 11832. Gravid adult female (SCL 269 mm) captured in the act of digging a nest cavity on a flat sand and gravel beach. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **PETER V. LINDEMAN**, Department of Biology and Health Services, 150 Cooper Hall, Edinboro University of Pennsylvania, Edinboro, Pennsylvania 16444, USA; e-mail: plindeman@edinboro.edu.

APALONE MUTICA MUTICA (Midland Smooth Softshell). USA: ARKANSAS: Hempstead/Miller County line: vic. Fulton off US Rt. 67 at Red River access. 8 July 2001. Timothy L. Eddings. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26236). Verified by Stanley E. Trauth. New county record for Hempstead; extends range 18 km NW of previous localities in the Red River watershed of Arkansas (Trauth et al., in prep., The Amphibians and Reptiles of Arkansas). Species has also been reported from neighboring Bossier and Caddo parishes, Louisiana (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.). Interestingly, there are as yet no records of this turtle from adjacent NE Texas (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **CHRIS T. McALLISTER** and **TIMOTHY L. EDDINGS**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA.

HYDROMEDUSA TECTIFERA (South American Snakeneck Turtle). BRAZIL: Rio de Janeiro: Duque de Caxias: Cidade das Meninas (2 juvs). 8 October 1941. A. Passarelli. Museu Nacional, Brazil (MNRJ 1049); October 1944. A. Passarelli. MNRJ 2483. City of Niterói: São Francisco. 1923. MNRJ 3792. All verified by Ronaldo Fernandes. Easternmost records for the species and first records for the state of Rio de Janeiro, where it lives in sympatry with *Hydromedusa maximilliani* (Ernst and Barbour 1989, Turtles of the World. Smithsonian Institution, Washington).

Submitted by **MARTA D. R. CARDOSO**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista s/n, Rio de Janeiro, Rio de Janeiro 20940-040, Brazil; e-mail: mdrcardoso@hotmail.com

KINOSTERNON FLAVESCENS (Yellow Mud Turtle). USA: TEXAS: Lee Co: 12.8 km S jct. Lee County Roads 331 and CR 333 on CR 333 (30°19'04.7"N, 97°08'10.9"W). 20 April 2001. Michele Gaston, Ellen Gaston, James R. Dixon, and Michael R. J. Forstner. Verified by R. Kathryn Vaughn. TCWC 84562. DOR; new county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press. 421 pp.).

Submitted by **MICHELE GASTON** (e-mail: mg45447@swt.edu), **ELLEN GASTON**, and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos Texas 78666, USA, **JAMES R. DIXON**, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, USA, and **LEE SHERROD**, Horizon Environmental Services, Inc., Austin, Texas 78716, USA.

MACROCHELYS TEMMINCKII (Alligator Snapping Turtle). USA: FLORIDA: Franklin Co: St. Vincent Island (St. Vincent National Wildlife Refuge), Rattlesnake Slough at Oyster Pond, (N29.64383° W85.14850°). 15 August 2000. Thomas E. Lewis. Sternberg Museum of Natural History, Ft. Hays State University, Hays, Kansas (MHP 6811). Verified by Lisa K. Irwin. Adult male found dead on margin of dried up freshwater pond. Sex determination based on combination of size (ca. 455 mm median straight-line carapace length) and presence of an intercostal fontanelle distance ca. 35–40 mm (Pritchard 1989, The Alligator Snapping Turtle: Biology and Conservation. Publ. Milwaukee Pub. Mus., Milwaukee. 104 pp.). Carapace exhibited evidence, based on scrapes and gouges in the scutes and one instance of bone perforation, of either pre- or post-mortem predation/scavenging by *Alligator mississippiensis*. Syntopic species associates observed at this locality in January 2000 included *Apalone ferox*, *Pseudemys nelsoni*, and *Alligator mississippiensis*. Definitively establishes first record for interior freshwater pond system of St. Vincent Island and first record for Apalachicola Bay Barrier Islands (Blaney 1971, Herpetologica 274:406–430; Christman 1984. Natural History of St. Vincent Island, Florida. Progress Rep. No. 1, covering the period January 1983–December 1983. Unpubl. Report. Denver Wildl. Res. Center Ecol. Section, Gainesville, Florida. 25 pp.). On 8 April 1997, T. E. Lewis found the skeletal remains of an adult individual at West Pass Beach (N29°37.8268' W85°06.7558') on St. Vincent Island, an outlet from Apalachicola Bay into the Gulf of Mexico. The carapace measured 620 mm (median curved carapace length) and was missing most of the scutes, although the skull was present and still attached to shell (KU Color Slides 11828–11831). Verified by Joseph T. Collins and Travis W. Taggart. We speculate that this occurrence is a result of post-mortem transport by currents out of the Apalachicola River and/or Bay and does not represent an individual from the island population. This species has been reported as inhabiting brackish waters; however, the locality at West Pass is generally considered to be hyper-saline.

Submitted by **THOMAS E. LEWIS**, St. Vincent National Wildlife Refuge, P.O. Box 447, Apalachicola, Florida 32329, USA, and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA; e-mail: kirwin@agfc.state.ar.us.

TERRAPENE NELSONI KLAUBERI (Northern Spotted Box Turtle). MEXICO: CHIHUAHUA: mountains on N side of Arroyo El Camuchil, Batopilas, 435 m. 17 July 2000. Julio A. Lemos-Espinal. Herpetological collection of Unidad de Biología, Tecnología y Prototipos (UBIPRO 5921–22). Verified by Richard L. Holland. First records for Chihuahua and a slight range extension eastward from Guirocoba, Sonora (Smith and Smith 1979, Synopsis of the Herpetofauna of Mexico, Vol. VI: Guide to Turtles, Bibliographic Addendum III. John Johnson, North Bennington, Vermont. xviii + 1044 pp.).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Herpetología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autonoma de México, Apartado Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e-mail: lemos@servidor.unam.mx), and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA; e-mail (HMS): hsmith@spot.colorado.edu.

TRACHEMYS SCRIPTA (Slider). USA: TEXAS: Lee Co: 3.6 km W jct. Lee County Road 310 and CR 309 on CR 309 (30°20'46.1"N, 97°06'52.7"W). 20 April 2001. Michele Gaston, Ellen Gaston, James R. Dixon, and Michael R. J. Forstner. Verified by R. Kathryn Vaughn. TCWC 84560–61. Collected AOR; new county record (Dixon 2000, Amphibians and Reptiles of Texas.

Second Ed. Texas A&M University Press. 421 pp.).

Submitted by **MICHELE GASTON** (e-mail: mg45447@swt.edu), **ELLEN GASTON**, and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos Texas 78666, USA, **JAMES R. DIXON**, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, USA, and **LEE SHERROD**, Horizon Environmental Services, Inc., Austin, Texas, 78716, USA.

LACERTILIA

BACHIA FLAVESCENS. VENEZUELA: ESTADO AMAZONAS: Helipuerto 4 (H4), Alto Río Orinoco (02°05'N, 64°05'W), 290 m. 26 October 1991. Nélida Abab. Museo de la Estación Biológica de Rancho Grande (MEBRG 2645). Captured under leaf litter on forest floor; Helipuerto 5 (H5), 5 km N Río Orinoco (02°14'35"N, 64°02'32"W), 410 m. 22 October 1991. César Molina. Museo de Historia Natural La Salle (MHNLS 14121). Captured under leaf litter on forest floor near small creek. All verified by Gilson Rivas. First state records; previously known only from Bolívar (Gorzula and Señaris 1998, Scientia Guaianæ 8:1–270 pp. + 32 color plates). These new records suggest that this taxon has a wider distribution in Venezuela than was previously suspected.

Submitted by **CÉSAR MOLINA**. Museo de Historia Natural La Salle, Sección de Herpetología, Apartado postal 1930, Caracas 1010-A, Venezuela; e-mail: crmolina@mixmail.com.

BACHIA GUIANENSIS. VENEZUELA: ESTADO BOLÍVAR: Marabá (06°19'10"N, 63°31'35"W), 290 m. 15 May 1992. César Molina. Museo de Historia Natural La Salle (MHNLS 14565). Captured in soil under leaf litter in a gallery forest near a creek. Verified by Gilson Rivas. Partially fills gap in distribution between Gurí (07°46'N, 63°00'W) (Hoogmoed and Dixon 1977, Zoologische Mededelingen 51[2]:25–31), Hato La Yeguera, 18 km E El Manteco (07°23'N, 62°24'W, 230 m) (Gorzula and Señaris 1998, Scientia Guaianæ 8:1–270 pp. + 32 color plates), and the Serranía de los Pijiguaos in Bolívar (06°10'N, 66°50'W, 650 m) (Señaris 1998, Amphibia-Reptilia 19:303–310).

Submitted by **CÉSAR MOLINA**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado postal 1930, Caracas 1010-A, Venezuela; e-mail: crmolina@mixmail.com.

CERCOSAURA OCELLATA OCELLATA (Black-striped Shade Lizard). VENEZUELA: ESTADO BOLÍVAR: Reserva Forestal de Imataca, (07°31'N, 61°08'W) 180 m. 15 May 1990. Luis Balbas. Museo de la Estación Biológica de Rancho Grande (MEBRG 2712–13). Extends known distribution east ca. 160 km (Gorzula and Señaris 1998, Scientia Guaianæ 8:1–270 pp. + 32 color plates). ESTADO AMAZONAS: Cerro Parú (04°34'N, 65°30'W) 480 m. Mario Palacios. Museo de Historia Natural La Salle (MHNLS 12032). Both verified by Gilson Rivas. First state record and the southwesternmost locality in Venezuela, extending the distribution ca. 465 km from the nearest locality (Gorzula and Señaris 1998, *op. cit.*). These new records suggest that this taxon has a wider distribution in Venezuela than was previously suspected.

Submitted by **CÉSAR MOLINA**. Museo de Historia Natural La Salle, Sección de Herpetología, Apartado postal 1930, Caracas 1010-A, Venezuela; e-mail: crmolina@mixmail.com.

CNEMIDOPHORUS LACERTOIDES. ARGENTINA: BUENOS AIRES: Partido de Bahía Blanca: Bahía Blanca (38°44'S, 62°15'S). 25 March 2001. C. H. F. Perez and C. M. Grassini. Fundación Miguel Lillo Herpetological Collection, San Miguel de Tucumán, Argentina (FML 10359). Verified by L. J. Avila. Southernmost citation for this poorly known teiid species; extends known range 100 km SW of La Ventana Mountains (Cei 1993, Mon. XIV, Mus. Reg. Sci. Nat. Torino. 949 pp). The lizard was found in a human-disturbed site, inside urban limits of Bahia Blanca City along a railroad edge with dumped debris and scattered small shrubs of exotic and native plants.

Submitted by **CRISTIAN HERNAN FULVIO PEREZ**, Agustin Alvarez 1182 A, 8000, Bahía Blanca, Buenos Aires, Argentina (e-mail: liolaemu@criba.edu.ar), and **CARLOS MARIO GRASSINI**, Cátedra de Biología General, Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur, San Juan 640, 8000 Bahía Blanca, Buenos Aires, Argentina.

CNEMIDOPHORUS SEXLINEATUS (Six-lined Racerunner). USA: ILLINOIS: Henry Co: Mineral Marsh State Nature Preserve (41°26'36"N, 89°53'14"W). 7 June 2001. R. Todd Bittner. INHS 17395. Verified by Christopher A. Phillips. DOR. Incomplete specimen (head and tail missing) salvaged from dirt truck path. A live individual was also observed at the site, which is a degraded sand prairie. New county record (Phillips et al. 1999, Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8:1–282).

Submitted by **TONYA D. BITTNER**, P.O. Box 34, Bradford, Illinois 61421, USA, and **R. TODD BITTNER**, Illinois Department of Natural Resources, Division of Natural Heritage, IVCC E. Campus Building 11, 815 North Orlando Smith Road, Oglesby, Illinois 61348-9691, USA (e-mail: tbittner@theramp.net).

COLEODACTYLUS SEPTENTRIONALIS (Pigmy Gecko). VENEZUELA: MONAGAS: Municipio Sotillo: Campamento El Merey, Morichal del río Uracoa, 09°00'N, 62°21'W, 30 m. 5 April 1989. Ramón Rivero. Museo de la Estación Biológica de Rancho Grande, Venezuela (EBRG 2322). Verified by J. Celsa Señaris. Adult female collected on leaf litter at 1205 h. First record for Estado Monagas and North Orinoco River. Another record for Venezuela reported from Los Castillos de Guayana, state of Delta Amacuro, 08°31'N, 62°22'W, 50 m (Avila-Pires 1995, Zoologische Verhandelingen 299:1–706). Donoso-Barros (1968, Carib. J. Sci. 8[3–4]:105–121] and Rivero-Blanco (1967 "1968," Mem. Soc. Cienc. Nat. La Salle 77:103–119) mentioned *C. meridionalis* for "La Gran Sabana," and for "San Pedro de las Bocas, La Paragua," 06°53'N, 62°52'W (state of Bolívar), respectively, although we think these specimens are probably *C. septentrionalis*. However, the specimens reported by Donoso-Barros (*op. cit*) apparently lack vouchers, thus it is difficult to confirm their identity.

Submitted by **GILSON RIVAS FUENMAYOR** (e-mail: gilsonrivas@mixmail.com) and **CESAR R. MOLINA** (e-mail: crmolina@mixmail.com), Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela.

HEMIDACTYLUS TURCICUS TURCICUS (Mediterranean Gecko). MÉXICO: CHIHUAHUA: La Perla (28°18'21.4"N, 104°33'7.3"W), 1610 m. 8 August 2000. Julio A. Lemos Espinal. Herpetological collection of Unidad de Biología, Tecnología y Prototipos (UBIPRO 6341–49). Verified by Richard L. Holland. First record for Chihuahua (McCoy 1970, Cat. Amer. Amphib. Rept. 87:1–2), although predicted in the Coyame area (Morafka 1977, A Biogeographic Analysis of the Chihuahuan Desert Through Its Herpetofauna. Biogeographica, Vol. IX., Dr. W. Junk B. V. Publs., The Hague. viii + 313 pp.).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Herpetología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autonoma de México, Apartado Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e-mail: lemos@servidor.unam.mx), and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail [HMS]: hsmith@spot.colorado.edu).

HEMIDACTYLUS TURCICUS TURCICUS (Mediterranean Gecko). MÉXICO: DURANGO: Municipio Tlahualilo, Ejido San Dionisio (26°12'9.1"N, 103°41'47.2"W), 1111 m. 2 August 2000. Julio A. Lemos-Espinal. Herpetological Collection of Unidad de Biología, Tecnología y Prototipos (UBIPRO 6057–58). Verified by Richard L. Holland. First record for Durango (McCoy 1970, Cat. Amer. Amphib. Rept. 87:1–2).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Herpetología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autonoma de México, Apartado Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e-mail: lemos@servidor.unam.mx), and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail [HMS]: hsmith@spot.colorado.edu).

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: FLORIDA: Franklin Co: Apalachicola, Seafood-To-Go, 123-A Water Street (N29.64383° W85.14850°). 4 April 2001. Tracy Evans and Royce Evans. Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas (MHP 6861, adult; 6862 newborn; 6863 egg). Verified by Walter E. Meshaka, Jr. and Travis W. Taggart. County record (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. expanded. Houghton Mifflin Co. Boston, Massachusetts).

Submitted by **JOSEPH T. COLLINS**, The Center for North American Herpetology, 1502 Medinah Circle, Lawrence, Kansas 66047, USA (e-mail: jcollins@ku.edu), and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

LIOLAEMUS BIBRONI. ARGENTINA: RIO NEGRO: Departmento General Roca: Chichinales (39°06'S, 66°56'S). 13 January 2001. C. H. F. Perez and D. Perez. Verified by L. J. Avila. Fundación Miguel Lillo Herpetological Collection, San Miguel de Tucumán, Argentina (FML 10360). Northeasternmost record for this species in Rio Negro Province; extends range 160 km NE from previous record (Cei 1986, Mon. IV, Mus. Reg. Sci. Nat. Torino. 527 pp). Specimen was found in a typic "Monte" habitat, but the species is common from the Patagonian steppe and ecotonal zones between both phytogeographic formations.

Submitted by **CRISTIAN HERNAN FULVIO PÉREZ**, Agustin Alvarez 1182 A, 8000, Bahia Blanca, Buenos Aires, Argentina (e-mail: liolaemu@criba.edu.ar), and **DANIEL R. PEREZ**, Instituto Superior de Formación y Perfeccionamiento Docente de Villa Regina, San Luis 327, 8336 Villa Regina, Río Negro, Argentina.

LIOLAEMUS NITIDUS. CHILE. Atacama Region: Llanos de Challe National Park (28°00'S, 71°03'W). 500 m. 9 October 1998. Museo de Zoología, Universidad de Concepción (MZUC 26054–55); Llanos de Ferreira, Vallenar (28°35'S, 70°46'W), 300 m. 15 January 1987. MZUC 26050–53; Huasco Bajo (28°28'S, 71°11'W) 200 m. 8 December 1988. MZUC 26047–49. All collected by Rodrigo Moreno M. and Jorge Moreno. All verified by Pedro Victoriano. Previously known from Coquimbo (30°10'S, 71°15'W) as far as Bío-Bío (37°45'S, 72°00'W) Regions (Donoso-Barros 1966, Reptiles de Chile. Ed. Universidad de Chile, Santiago, Chile. 458 pp.). First records for Atacama Region and the northernmost records for Chile.

Submitted by **RODRIGO MORENO** and **JUAN CARLOS ORTIZ**, Departamento de Zoología, Universidad de Concepción, P.O. Box 160-C, Concepción, Chile, **JORGE MORENO M.**, Atacama Regional Museum, P.O. Box 134, Copiapó, Chile, and **FERNANDO TORRES-PÉREZ**, Departamento de Zoología, Universidad de Concepción, P.O. Box 160-C, Concepción, Chile.

SCELOPORUS MERRIAMI ANNULATUS (Big Bend Canyon Lizard). MEXICO: CHIHUAHUA: Municipality of Ojinaga: vicinity of Sierra Virulento (28°45'50.5"N, 104°19'12.8"W). 17–19 June 2000. Julio A. Lemos-Espinal. Herpetological collection of Unidad de Biotecnología, Tecnología y Prototipos (UBIPRO 5385–97, 5417–23, 5434–67). Verified by Richard L. Holland. First records for Chihuahua; extend known range southwestward ca. 75 km from the Big Bend region of Texas (Olson 1979, Cat. Amer. Amphib. Rept. 227:1; Lemos-Espinal et al. 2000, Bull. Maryland Herpetol. Soc. 36:87).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autonoma de México, Apartado Postal 314, Tlalnepantla, México, México 54090 (e-mail: lemos@servidor.unam.mx), **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail [HMS]: hsmith@spot.colorado.edu), and **DAVID L. AUTH**, 425 NE 7th Street, Gainesville, Florida 32601, USA.

SERPENTES

AGKISTRODON TAYLORI (Taylor's Cantil). MÉXICO: HIDALGO: Coyolapa, Municpality of Atlapexco, ca. 2.5 km N Atlapexco (21°01'24"N, 98°20'50"W), ca. 160 m. 13 July 2000. Héctor Tovar-Tovar. Verified by Sol de Mayo Mejenes-López. Colección Herpetológica, Instituto Tecnológico Agropecuario de

Hidalgo (ITAH 535). First record for state; extends the range ca. 200 km SE of the closest known locality at Naranjo, San Luis Potosí (Gloyd and Conant 1990, SSAR Contrib. Herpetol. 6:1–614). The snake was found DOR in secondary vegetation in an area containing tropical deciduous forest.

Submitted by **HÉCTOR TOVAR-TOVAR** (e-mail: tovar.hector.12@correoweb.com) and **FERNANDO MENDOZA-QUIJANO** (e-mail: mendozaq@mail.ibiologia.unam.mx), Instituto Tecnológico Agropecuario de Hidalgo, Km 5.5 Carr. Huejutla-Chalahuiyapa, Apartado Postal 94, Caixa Postal 43000, Huejutla de Reyes, Hidalgo, México.

ANILIUS SCYTALE (Blind Coral Snake). BRAZIL: CEARÁ: Municipality of Crato. 1942. A. R. Hoge. Instituto Butantan, São Paulo - SP (IB 20013). Specimen found in humid forest enclave within dry Caatinga vegetational province. TOCANTINS: Municipality of Arapoema: 25.5 km E Araguaia River. 5 June 1972. Collector unknown. IB 33317. Specimen found in transitional area between Amazon rainforest and Cerrado vegetation province; Municipality of Dianópolis: 15 km NW of Palmeiras River. 9 January 1968. Collector unknown. IB 28010. GOIÁS: Municipality of Niquelândia. 10 February 1990. Collector unknown. Centro de Estudos e Pesquisas Biológicas, Goiânia-GO (CEPB 4145). Specimen found in Gallery forest formation on the west bank of Bagagem River; Municipality of Uruaçu: within city limits. 6 May 1993 Collected by staff of Secretaria Municipal de Saúde de Uruaçu. CEPB 2275. MATO GROSSO: Municipality of Barra do Garças: 1.2 km E Araguaia River within city limits. 25 March 1977. Collector unknown. IB 41188; Municipality of Cuiabá: within city limits. 28 February 1981. Collector unknown. IB 43806; Municipality of Tesouro: Batovi River. 12 March 1982. Collector unknown. IB 44238; Municipality of Nova Brasilândia: 194 km NE Cuiabá, Manso River. 1988. A. Sebben. Universidade de Brasília, Brasília-DF (UnB 1350). All verified by W. W. Lamar.

Species was mentioned by several authors in accounts of the herpetofauna of South America (Roze 1966, La Taxonomia y Zoogeografia de los Ofidios de Venezuela, Edit. Biblioteca, Caracas. 362 pp.; Hoge 1967, Actas Simp. Biota Amazonica 5:217–279; Peters 1972, Bull. Mus. Comp. Zool. 122[9]:491–541; Dixon and Soini 1977, Bull. Milwaukee Publ. Mus. 12:1–154; Cunha and Nascimento 1978, Mus. Par. Emílio Goeldi Publ. Avulsas 51:1–218; Duellman 1978, Misc. Publ. Mus. Nat. Hist. Univ. Kansas 65:1–352; Hoogmoed 1979, *In* Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution, and Dispersal, pp. 241–279; Hoogmoed 1982, Mem. Inst. Butantan 46:219–254; Abuys 1982, Litt. Serpentium 2[3]:112–133; Chippaux 1986, Les Serpents de La Guyane Française. Coll. Faune Tropicale 27. Editions de l'Orstron, Paris. 165 pp.; Lancini 1986, Serpientes de Venezuela [Armitano, Ed.], 262 pp.; Vanzolini 1986, Levantamento Herpetológico da Área do Estado de Rondônia sob a Influência da BR 364. CNPq, Relatório de Pesquisa 1, Brasília. 50 pp.; Rodriguez and Cadle 1990, *In* Gentry [ed.], Four Neotropical Rainforests, pp. 410–425. Yale Univ. Press, New York; Zimmerman and Rodrigues 1990, *In* Gentry [ed.], Four Neotropical Rainforests, pp. 426–454. Yale Univ. Press, New York; Duellman and Salas 1991, Univ. Kansas Mus. Nat. Hist. Occ. Pap. 143:1–13), always restricted to the rainforests of Ecuador, Colombia, Peru, Guianas, Venezuela, and Brazil. The records from Dianópolis and all of Mato Grosso are from typical Cerrado vegetation formation. These discoveries extend distribution of this taxon 900 km E (Ceará), 1050 km SW (Mato Grosso) and 685 km S (Goiás) from previously known range (Souza et al. 1999, SSAR Annual Meeting, abstr., p. 209).

Submitted by **NELSON JORGE DA SILVA, JR.** (e-mail: njsj@ucg.br), **IVAN FRANÇA E SOUZA**, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Avenida Universitária 1440, Setor Universitário, 74210-010, Goiânia, Goiás, Brazil and **GIUSEPPE PUORTO**, Coleção Herpetológica, Instituto Butantan, Avenida Vital Brasil 1500, Butantan, 05503-900, São Paulo, São Paulo, Brazil.

APOSTOLEPIS QUIROGAI. BRAZIL: RIO GRANDE DO SUL: Municipality of Santo Ângelo (28°18'S, 54°08'W). 16 March 2001. L. H. Cappellari. Verified by Marcos Di-Bernardo. Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP 12185). First state record; extends known range 180 km SE from Posadas, Misiones, Argentina (Giraudo and Scrocchi 1998, Herpetologica 54:470–476).

Submitted by **THALES DE LEMA** and **LIZE HELENA CAPPELLARI**, Laboratório de Herpetologia, Departamento de Biologia, Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga, 6681, CEP 90619-900, Porto Alegre, Rio Grande do Sul, Brazil.

BOA CONSTRICTOR IMPERATOR (Mexican Boa Constrictor). MÉXICO: CHIHUAHUA: Arroyo El Camuchil, Batopilas (27°01'34.1"N, 107°45'44.5"W), 435 m. 14 July 2000. Julio A. Lemos-Espinal. Herpetological collection of Unidad de Biología, Tecnología y Prototipos (UBIPRO 5901). Verified by Richard L. Holland. First record for Chihuahua; extends range 45 airline km ENE of Sierra de Choix, Sinaloa (USNM 46503) reported by Smith (1943, Proc. U.S. Nat. Mus. 93:393–504).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Herpetología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autonoma de México, Apartado Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México (e-mail: lemos@servidor.unam.mx), and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA (e-mail [HMS]: hsmith@spot.colorado.edu).

COLLORHABDIUM WILLIAMSONI (Williamson's Reed Snake). MALAYSIA: PENINSULAR MALAYSIA: Selangor-Pahang border, Genting Highlands (3°46'N, 101°47'E), ca. 1750 m). May 2001. Oh Kim Sang. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.2.4997, SVL 190 mm; total length 217 mm). Verified by Kelvin K. P. Lim. Previously known from only two montane localities: Maxwell's Hill (Perak) and Cameron Highlands (Perak-Pahang border) (Tweedie 1983, The Snakes of Malaya. Third Ed. Singapore National Printers. 167 pp.); represents a southeasterly range extension of ca. 130 km (from Cameron Highlands).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-

mail: scip0132@nus.edu.sg), and **BOO LIAT LIM**, Department of Wildlife and National Parks (Peninsular Malaysia), Km 10, Jalan Cheras, 561000 Kuala Lumpur, Malaysia.

CONIOPHANES BIPUNCTATUS (Two-spotted Snake). COSTA RICA: HEREDIA: 38 km NE Puerto Viejo de Sarapiquí, Tres Marías, northern Caribbean versant. 1996. Miguel Solano. University of Costa Rica Museum of Zoology (UCR 13039); ca. 13 km S Puerto Viejo de Sarapiquí, La Conquista. 5 June 2001. Alejandro Solórzano. UCR 15400. Both verified by Gerardo Chaves. First records for Costa Rica (Savage and Villa R. 1986, Herpetofauna of Costa Rica. SSAR Contrib. Herpetol. 3:1–207). These records also bridge a distributional gap between Nicaragua and Panamá (Villa et al. 1988, Middle American Herpetology: A Bibliographic Checklist. Univ. Missouri Press, Columbia. i-xxxv + 131 pp.). UCR 13039 was found in lowland rainforest and UCR 15400 was DOR on highway connecting Puerto Viejo and Río Frío.

Submitted by **ALEJANDRO SOLÓRZANO**, Serpentario Nacional, P.O. Box 2157-1002, San José, Costa Rica; e-mail: asolorz@racsa.co.cr.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: LOUISIANA: St. Martin Parish: Sherburne Wildlife Management Area, Happy Town Road, ca. 0.4 km E Louisiana Rt. 975. 27 April 2001. Chris Wanko. Discovered in mesic, bottomland hardwood forest. LSUMZ 83635. Verified by Jeff Boundy. First record for parish (Dundee and Rossman, 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp).

Submitted by **MICHAEL A. SEYMOUR**, 9150 Ventura Drive, Baton Rouge, Louisiana 70815-8855, USA; e-mail: caprimulgus@earthlink.net.

LAMPROPELTIS MEXICANA (San Luis Potosí Kingsnake). MÉXICO: AGUASCALIENTES: Municipality of San José de Gracia: Arroyo Los Timones, 1 km S of Santa Rosa (22°01'14" N, 102°34'30" W), 2352 m. 10 October 1998. Héctor Avila Villegas, J. Jesús Sigala Rodriguez, and Gustavo Ernesto Quintero Díaz. Museo de Zoología "Alfonso L. Herrera" Facultad de Ciencias, UNAM (MZFC 13655); same area (22°01'13"N, 102°34'23"W), 2350 m. 11 October 1998. Gabriel González Adame. Museo de Zoología, Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VR 273). Both specimens verified by Hobart M. Smith. First records for Aguascalientes; extend range ca. 74.3 km south of the previous northern record (MCZR 162279) from 2.74 km south of Troncoso, Zacatecas (Liner and Dundee 1977, Herpetol. Rev. 8:85). Both specimens were found in oak savanna and are referable to the "greeri" population as characterized by Webb (1961, Copeia 1961:326–333) and Garstka (1982, Breviora 466:1–35).

Submitted by **GUSTAVO QUINTERO-DÍAZ** and **GABRIEL GONZÁLEZ ADAME**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, Aguascalientes, Aguascalientes 20100, México, **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño, S. A. de C. V., Avenida Aguascalientes Sur 203, Fracc. Prados del Sur, Aguascalientes, Aguascalientes, 20280, México, **J. JESÚS SIGALA RODRÍGUEZ**, Department of Ecology and Evolutionary Biology, Corson Hall, Cornell University, Ithaca, New York 14853-2701, USA, **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Box C-64, Alpine, Texas 79832, USA, and **GERARD T. SALMON**, 30 Appletree Drive, Rhinebeck, New York 12572, USA.

LIOPHIS FESTAE. BRAZIL: PARÁ: Santarém (54°42'W, 2°26'S), right bank of the Amazonas River, locality São Braz. 2001. S. Santos. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1558). Verified by Andrei G. Guedes. Previously known from Ecuador and Peru. First record for Brazil; increases known distribution ca. 2815 km by airline from the nearest record (2°30'S, 80°00'W) in Peru (2000, Dixon, Copeia 2000:482–490).

Submitted by **JOSSEHAN GALÚCIO DA FROTA** (e-mail: jgfrota@mailbr.com.br) and **RUBENS NOBUO YUKI**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha 335, Santarém, Pará, Brazil, CEP: 68.010-200.

MASTIGODRYAS BODDAERTI. BRAZIL: GOIÁS: Municipality of Campinaçu, E bank Maranhão River (14°03'34"S, 48°29'72"W). 27 February 1997. C. Amaral Souza. Centro de Estudos e Pesquisas Biológicas, Goiânia - GO (CEPB/SM 26118, SVL 1180 mm, body weight: 165 g). Verified by M. Trefaut Rodrigues. Specimen was found in a gallery forest within the Cerrado vegetational formation. During the faunal rescue operation (Operação Lobo Guará), owing to the flooding of Serra da Mesa hidroeletric power plant reservoir, this taxa was collected in significant numbers by the rescue staff from October 1996 to December 1998, in all the municipalities affected by the reservoir flooding (Niquelândia, Minaçu, Uruaçu, Campinorte, Colinas do Sul, and Barro Alto). Species has been mentioned in comments about the South American Herpetofauna (Gasc and Rodrigues 1980, Bull. Mus. natn. Hist. nat., Paris, 4ª série, 2, A [2]:559–598; Cunha and Nascimento 1978, Publ. Avuls. Mus. Paraense E. Goeldi, n° 102:1–20; Lancini 1986, Serpientes de Venezuela, [E. Armitano Ed.], 262 pp.; Pérez Santos and Moreno 1988, Boll. Mus. reg. Sci. Nat. Torino. 517 pp.), as having its distribution limited in the Amazon Basin Rainforest to Colombia, Bolivia, French Guiana, Venezuela, Ecuador, and Brazil. It was also reported to be present in the northern part of the Atlantic forest (Dixon 1979, *In* Duellman [ed.], The South American Herpetofauna: Its Origin, Evolution, and Dispersal, pp. 217–240) and as an isolated colony in the state of Bahía, Brazil (Peters and Orejas 1986, The Catalogue of Neotropical Squamata Part I. Revised Ed. Smithsonian Institution. 293 pp.). The presence of this taxon in Brazil was also reported in Manaus, INPA/WWF Reserves, Samuel and Balbina hydroeletric power plants in the state of Amazonas, and in the Tucuruí power plant in the state of Pará (Silva and Sites 1995, Conserv. Biol. 9[4]:873–901). In Rondônia, this species was observed in an open vegetational formation similar to Cerrado vegetational province called *Capoeira*. Specimen reported herein is the first record for the state of Goiás; extends geographic distribution of this taxa 1815 km SE (Vanzolini 1986, Levantamento Herpetológico as àrea do Estado de Rondônia sob a Influência da Rodovia BR 364,

Relatório de Pesquisa 1, Brasília: CNPq, Assessoria Editorial. 50 pp.) and 1035 km S (from Pará) (Silva and Sites 1995, *op. cit.*) from previously known range limits.

Submitted by **IVAN FRANÇA E SOUZA** (e-mail: souzai@terra.com.br) and **NELSON JORGE DA SILVA, JR.**, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás, Avenida Universitária 1440, Setor Universitário, 74.210-010, Goiânia, Goiás, Brazil.

MICRURUS DUMERILII CARINICAUDA: VENEZUELA: ESTADO MÉRIDA: Cerro La Hechicera, Mérida. 1700 m. 15 September 1991. P. Durant. Colección de Vertebrados, Universidad de los Andes (CVULA IV-6108). Verified by Walter Schargel. First voucher specimen from Estado Mérida and highest elevation record; species had been mentioned as occurring in Estado Mérida by Roze (1989, Amer. Mus. Novit. 2932:9), but without locality data. Roze (1996. Coral Snakes of the Americas. Biology, Identification and Venoms. Krieger Publ. Co., Malabar, Florida. 328 pp.) also gave an altitude range of 100–800 m. Habitat surrounding the locality of the specimen reported herein consisted of cloud forest, where *Micrurus mipartitus semipartitus* also is found.

Submitted by **CÉSAR LUIS BARRIO**, Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Venezuela; e-mail: cesarlba@yahoo.com.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). MÉXICO: AGUASCALIENTES: Municipality of Jesús María: Maravillas, in garden next to house (21°57'05"N, 102°20'01"W), 1900 m. 23 March 1993. Fernando Franco Veloz. Museo de Zoología, Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VR 254). Municipality of Aguascalientes: garden in downtown Aguascalientes (21°53'30"N, 102°17'57"W), 1850 m. 5 September 1998. Erasto Pérez Pedraza and Gustavo Quintero-Díaz. UAA-VR 270. Both specimens verified by Hobart M. Smith and Fernando Mendoza Quijano. First records for Aguascalientes; extends range from *ca.* Querétaro, Querétaro (Minton de Cervantes and Minton 1975, Herpetol. Rev. 22:26) and from Apatzingán and Arteaga, Michoacán (Duellman 1961. Univ. Kansas Publ. Mus. Nat. Hist. 15:88).

Submitted by **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño S. A., Avenida Aguascalientes Sur 203, Fracc. Prados del Sur, Aguascalientes, Aguascalientes 20280, México, and **GUSTAVO QUINTERO-DÍAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, Aguascalientes, Aguascalientes 20100, México.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). THAILAND: RAYONG PROVINCE: Ko Samet (Samet Island). 27 March 2001. Patrick Grootaert (PG field no. 21026). IRSNB 15597. Verified by Van Wallach. DOR being attacked by ants when found in the morning on a forest path near a cliff overhanging the sea by about 50 m. First island record and second provincial record (Niyomwan 1999, Species Diversity, Morphology and Habitat Types of Blind Snakes [Family Typhlopidae] in Thailand. Master of Science Thesis, Dept. Biology, Faculty of Science, Chulalongkorn University, Bangkok. vi +141 pp. [in Thai with English summary]). In Thailand, species has already been recorded from 36 of the 76 provinces scattered over the country, but not yet from Roi Et and surrounding provinces in the easternmost part (Niyomwan, *op. cit.*). This is probably due to a lack of collecting effort there, because *R. braminus* is widely distributed in the area just east of Thailand, such as Cambodia and Laos (Welch 1988, Snakes of the Orient: A Checklist. Krieger Publ. Co., Malabar, Florida. vii + 183 pp.).

Submitted by **OLIVIER S. G. PAUWELS**, Department of Recent Vertebrates, Institut Royal des Sciences naturelles de Belgique, Rue Vautier 29, 1000 Brussels, Belgium (e-mail: osgpauwels@hotmail.com), **PATRICK GROOTAERT**, Department of Entomology, Institut Royal des Sciences naturelles de Belgique, Rue Vautier 29, 1000 Brussels, Belgium (e-mail: grootaert@kbinirsnb.be), and **PIYAWAN NIYOMWAN**, Department of Biology, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand (e-mail: npiyawan@hotmail.com).

REGINA RIGIDA (Glossy Crayfish Snake). USA: LOUISIANA: VERNON PARISH: Fort Polk Military Reservation, Cantonment area. 11 January 2001. Beau B. Gregory. Seale Museum of Louisiana, McNeese State University (SML 9326). Verified by Jeff Boundy. First parish record; fills the gap between the northern parishes, Sabine and Natchitoches, and the southern parishes, Beauregard and Allen, as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **BEAU B. GREGORY**, Environmental and Natural Resource Management Division, Directorate of Public Works, Fort Polk, Louisiana 71459, USA.

REGINA SEPTEMVITTATA (Queen Snake). USA: TENNESSEE: HUMPHREYS CO: Big Richland Creek at Lockhart Road bridge, 3.2 km W Tennessee Highway 13 (36°09'N, 87°48'W). 28 April 2001. Scott Williamson. Austin Peay State University Museum of Zoology (APSU 3265). Verified by A. Floyd Scott. One adult in shallow pool. New county record; previously reported from the western middle Tennessee counties of Stewart (Scott and Zirkle 1992, Herpetol. Rev. 23:27), Montgomery (Scott and Snyder 1968, J. Tennessee Acad. Sci. 43:79–84) and Lawrence (Lawson 1987, J. Herpetol. 21:140–157).

Submitted by **SCOTT WILLIAMSON**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

SPILOTES PULLATUS MEXICANUS (Tropical Rat Snake). MÉXICO: HIDALGO: Municipality of Huejutla, Chalahuiyapa, ca. 5.5 km NE of Huejutla (20°08'N, 98°25'W), 170 m. 8 March 1998 and 22 March 1999. Baltazar Hernández-Hernández. Verified by Sol de Mayo A. Mejenes-Lopéz. Colección Herpetológica, Instituto Tecnólogico Agropecuario de Hidalgo (ITAH 120, 125). Adult and juvenile males found dead, the former in tropical deciduous forest and the latter in an adjacent pasture; Municipality of Orizatlán, on highway San Felipe-Huejutla ca. 2.3 km E San

Felipe Orizatlán (21°N, 98°W), 160 m. 4 October 1999. Felipe Barragán-Torres. Verified by Sol de Mayo A. Mejenes-López. ITAH 326. A juvenile found DOR in secondary vegetation. First state records for species and bridges three distributional gaps of 1) ca. 56 and 85 km SE respectively, from the closest known locality in San Luis Potosí (Taylor 1953. Univ. Kansas Sci. Bull. 35:1587–1614), 2) ca. 70 and 96 km SW respectively, from the closest known locality in Veracruz (Pérez-Higareda and Smith 1991, Ofidiofauna de Veracruz, Análisis Taxonómico y Zoogeográfico. Publ. Espec. Inst. Biól. UNAM 7:122), and 3) ca. 160 km SW of the closest locality in Tamaulipas (Smith and Taylor 1945, USNM Bull. 187:1–239).

Submitted by **FERNANDO MENDOZA-QUIJANO** (e-mail: mendozaq@mail.ibiologia.unam.mx) and **BALTAZAR HERNÁNDEZ-HERNÁNDEZ**, Instituto Tecnolólogico Agropecuario de Hidalgo, Km 5.5 Carr. Huejutla-Chalahuiyapa, Apartado Postal 94, Caixa Postal 43000, Huejutla de Reyes, Hidalgo, México.

STENORRHINA DEGENHARDTI. VENEZUELA: ESTADO BARINAS: Barinitas, 550 m. 14 July 2001. H. Sánchez. Colección de Vertebrados, Universidad de los Andes, Mérida (CVULA 6312). Verified by Yoel Morales. Previous authors (Roze 1966, La taxonomía y Zoogeografía de los Ofidios de Venezuela. Ediciones de la Biblioteca, Univ. Central de Venezuela, Caracas; Lancini 1979, Serpientes de Venezuela. Armitano Ed. Caracas; Lancini and Kornacker 1986, Die Schlangen von Venezuela. Verlag Armitano, Caracas) considered this species confined to the coastal range. First record for the state and the Andes; westernmost record in Venezuela. Habitat was rainforest in Andean piedmont. Biogeographically, area shares elements from different bio-regions: Amazonian, Andean, Llanos, and Coastal range (see Barrio 1998, Acta Biol. Venezuela 18[2]:1–93 for a biogeographic view).

Submitted by **CESAR L. BARRIO**, Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com) and **DANIEL CALCAÑO**, Serpentario Los Llanos, Barinitas, Barinas, Venezuela (e-mail: reprecal@cantv.net).

STENORRHINA FREMINVILLII (Alacranera). MÉXICO: MICHOACÁN: Colola, Marine camp (near sea turtle nesting beach). 23 September 1977. Clayton J. May. UTEP 12461. Verified by Carl S. Lieb. First record for Michoacán, extending known range ca. 383 km NW of Acapulco, Guerrero (MVZ 78757).

Submitted by **JERRY D. JOHNSON** (e-mail: jjohnson@utep.edu) and **ROBERT G. WEBB**, Department of Biological Sciences, University of Texas at El Paso, El Paso, Texas 79968, USA.

STORERIA DEKAYI (Brown Snake). USA: WISCONSIN: Jackson Co: DOR, Wisconsin Rt. 54, ca. 5 km E of North Bend (Sec. 24, T19N, R6W). 13 October 2000. Andrew G. Cochran, Joseph A. Cochran, and Christopher D. Knight. MPM 33146; Green Bay and Western RR right-of-way at Bartell Road, ca. 100 m N of Wisconsin Rt. 54, W of City Point (Sec. 34, T22N, R1E). 26 April 2001. Philip A. Cochran. MPM 33143. Both specimens verified by Gary Casper. These records, from opposite ends of the county (ca. 62 km apart), substantiate an earlier record from the SE corner of the county based on a specimen not examined by Vogt (1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum, Wisconsin). Casper (1996, Geographic Distribution of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum, Wisconsin) stated that *S. d. texana* and *S. d. wrightorum* intergrade in a band that passes through Wood County immediately to the east. Although both Jackson County specimens had a dorsal pattern typical for *S. d. texana*, the North Bend snake had a dark vertical streak posterior to the eye, similar to *S. d. dekayi*, whereas the City Point snake had a dark horizontal temporal line, similar to *S. d. limnetes* (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. xx + 450 pp.).

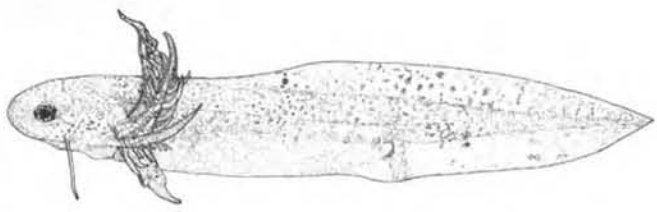
Submitted by **ANDREW G. COCHRAN**, **PHILIP A. COCHRAN**, **JOSEPH A. COCHRAN**, and **CHRISTOPHER D. KNIGHT**, Biology Department, Saint Mary's University, Winona, Minnesota 55987, USA.

STORERIA OCCIPITOMACULATA (Redbelly Snake). USA: ILLINOIS: La Salle Co: Marseilles State Fish and Wildlife Area (NE 1/4 SE 1/4 Sec. 30, T33N, R5E). 22 August 2001. R. Todd Bittner. INHS Photographs 2001.12–13. Verified by Christopher A. Phillips. Juvenile found on edge of degraded dry-mesic upland forest near small intermittent stream. New county record (Phillips et al. 1999, Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8:1–282).

Submitted by **R. TODD BITTNER**, Illinois Department of Natural Resources, Division of Natural Heritage, IVCC E. Campus Building 11, 815 North Orlando Smith Road, Oglesby, Illinois 61348-9691, USA, and **TONYA D. BITTNER**, P.O. Box 34, Bradford, Illinois 61421, USA (e-mail: tbittner@theramp.net).

TYPHLOPS RETICULATUS (Blind Worm Snake). VENEZUELA: YARACUY: Municipio Bruzual: between the villages of Chivacoa and Cumaripa, ca. 68°51'N, 10°10'W, 240 m. 20 September 1996. Edward Camargo S. Museo de la Estación Biológica de Rancho Grande, Venezuela (EBRG 3821). Verified by Ramón Rivero. Adult female. Represents the first known record for Estado Yaracuy in westernmost Venezuelan Coastal Range (Dixon and Hendricks 1979, Zoologische Verhandelingen 173:1–39).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela; e-mail: gilsonrivas@mixmail.



Hynobius lichenatus, Stage 45 larva. Illustration by Masato Hasumi.

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Additions to the Mozambique Herpetofauna: Two New Lizards from the Namuli Massif

BILL BRANCH
Port Elizabeth Museum, P.O. Box 13147
Humewood 6013, South Africa
e-mail: pemwrb@zoo.upe.ac.za

and

PETER G. RYAN
Percy FitzPatrick Institute, University of Cape Town
Rondebosch 7701, South Africa
e-mail: pryan@botzoo.uct.ac.za

The herpetofauna of central and northern Mozambique is poorly known. The early studies of Peters (1882) were mainly restricted to coastal areas and the Lower Zambezi region, as have other more recent studies (Broadley 1990, 1992). The Namuli Massif (15°22'S, 37°02'E) is the largest mountain range in northern Mozambique and forms the main watershed for the region (Vincent 1933a). The nearest montane area of similar stature is Mount Mulanje, southeastern Malawi, some 160 km to the southwest. The Namuli Massif is a series of spectacular granitic outcrops that tower over the relatively flat, 800 m high plateau of northern Mozambique. The highest peak, Mount Namuli, is 2412 m high, and several other peaks are over 2200 m.

Few faunal collections have ever been made from the Namuli Massif. Vincent (1933a) gives a general account of the region visited when he collected birds in northern Mozambique during 1931–1932 (Vincent 1933b, 1936). As part of a survey (November–December 1998) of the avifauna of the Namuli massif (Ryan et al. 1999), three lizards were collected opportunistically. As two represent important additions to the herpetofauna of Mozambique, they are described below.

Chamaeleonidae

Rampholeon platyceps (Mulanje Leaf Chameleon). ZAMBEZIA PROVINCE: Ukalini Forest, Namuli Massif (15°22'S, 37°04'E, ca. 1550 m). 30 November 1998. PEM R14921. An adult female collected by a local guide in the forest that nestles under the south face of the main Namuli peak. Previously considered endemic to the sub-montane seasonal rain forests of Mt. Mulanje (1000–1800 m), although a population is also known from Mchese Mountain, adjacent to Mt. Mulanje (Tilbury, pers. comm.). The Namuli specimen inhabits similar habitat and is the first record of the species from Mozambique.

The female is gravid with seven almost spherical eggs (largest diameter 4.1–4.5 mm, four in the left oviduct and three in the right oviduct) that lack obvious embryonic development. The stomach contained insect fragments, including a coleopteran elytra.

Another small chameleon, possibly referable to this species, was seen being carried by a Crowned Hornbill *(Tockus alboterminatus)* that was flying over the canopy of Ukalini Forest on 29 November.

Gekkonidae

Lygodactylus rex (Regal Dwarf Gecko). ZAMBEZIA PROVINCE: ridge leading up to the knife-edge Murukuni Ridge, Namuli Massif (15°22'S, 37°03'E; 1800 m). 30 November 1998. PEM R14922. An adult female collected on rock in an open grassy area adjacent to the Ukalini Forest on the south flank of Mt. Namuli. The habitat comprises a large granite whaleback with shallow, dry peaty soil that, after a prolonged dry period, had pulled back in areas from the rock. Another individual, presumed to be the same species, was seen on a dead tree stump in similar habitat bordering the forest edge on the southern flank of Peseni at 2000 m (15°23'S, 37°02'E) on 3 December 1998.

No new material of this species has been reported since its description from Lujeri, Mt. Mulanje (Broadley 1963). The Namuli specimen differs in a number of features from the type series; i.e., in having 8 not 7 upper and lower labials, three postmentals (usually two), and only two nasals (usually three). In addition, the distinctive eyespot above the shoulder (Broadley 1963) is very reduced in extent and intensity in the Namuli female. Broadley (in litt. May 1999) notes that in Mulanje material both sexes have a white spot above the shoulder, and in males this has a broad black border which makes it very conspicuous. The Namuli female is the first record for Mozambique.

Scincidae

Mabuya varia (Variable Mabuya). ZAMBEZIA PROVINCE: southern flank of Peseni, Namuli Massif (15°23'S, 37°02'E; 2000 m). 3 December 1998. PEM R14923. An adult female. This species was common in habitat similar to that of *Lygodactylus rex*, from at least 1500 m to 2000 m elev.

We are aware of no other herpetological collections from the Namuli region. Two of the three lizards in the current small collection are new records for Mozambique. Both specimens show subtle variation from the Mulanje populations, and further material is required to assess whether these differences are consistent and worthy of taxonomic recognition. It is probable that other Malawi endemics (e.g., *Platysaurus mitchelli*, *Lygodactylus bonsi*, *Proscelotes mulanjensis*, and *Chamaeleo mulanjensis*) occur in the montane grasslands and relict forests of the Namuli massif.

Acknowledgments.—We thank Don Broadley (Bulawayo) and Colin Tilbury (Jwaneng) for their comments on the Namuli material. Carlos Bento, Callan Cohen, John Graham, Vincent Parker, and Claire Spottiswoode conducted the avifaunal survey with PGR and assisted with the capture of reptiles.

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New County Records of Amphibians and Reptiles from Indiana

ROBERT BRODMAN
Biology Department, Saint Joseph's College
Rensselaer, Indiana 47978, USA
e-mail: bobb@saintjoe.edu

Distribution records of amphibians and reptiles of Indiana have been documented by Minton (1972) and Minton et al. (1982). However, distribution records are lacking in many sections of Indiana. Voucher specimens of new county records are reported here from Adams, Jay, Miami, Fulton, Floyd, Posey, Dubois, Spencer, Monroe, Owen, Daviess, Sullivan, and Greene counties. Identification of *Ambystoma* was verified electorphoretically by James P. Bogart. All other specimens were verified by Alan Resetar. All voucher specimens, call recordings, and color photographs are deposited in the Saint Joseph's College zoological collection (SJCAM = amphibians; SJCRP = reptiles). Unless otherwise noted, all specimens were collected by the author.

Caudata

Ambystoma jeffersonianum (Jefferson Salamander). ADAMS Co: Hanna-Nuttman Park. 2 April 1999. SJCAM 201. Four larvae taken and raised to metamorphosis in the lab; several egg masses seen in the field. All four specimens from this site were LJJ triploids. WELLS Co: Ouabache State Park. 23 March 2000. Robert Brodman SJCAM 240. Five larvae taken and raised to metamorphosis in the lab; two were JJ and three were LLJ. Many egg masses seen in the field.

Ambystoma laterale (Blue-spotted Salamander). JAY Co: Bell-Croft Woods Nature Preserve. 12 April 1999. SJCAM 202. Five larvae taken and raised to metamorphosis in the lab; several more seen. Four were LJJ triploids and one was a pure LL diploid. Extends the range ca. 80 km south of Steuben County and east of Kosciusko County.

Ambystoma opacum (Marbled Salamander). OWEN Co: Jordan Seeps Nature Preserve. 27 February 2000. SJCAM 203. Two larvae taken. Fills distribution gap in northwest Indiana between Monroe and Vigo counties.

Ambystoma texanum (Small-mouthed Salamander). SPENCER Co: Bloomfield Barrens Nature Preserve. 4 March 2000. SJCAM 204. Five larvae taken and raised to metamorphosis in the lab; dozens of egg masses seen in the field. Extends range into southcentral tip of the state. SULLIVAN Co: 1 km W of Minnehaha Fish and Wildlife Area. 19 March 2000. SJCAM 205. Five larvae taken; three were raised to metamorphosis in the lab. Extends the range ca. 50 km west of Cass County and ca. 70 km northeast of Warren County. GREENE Co: 1 km E of Hillenbrand Fish and Wildlife Area. 23 April 2000. SJCAM 206. Five larvae taken and raised to metamorphosis in the lab. The Greene and Sullivan county records fill the gap between records from the southwest and west central sections of the state. WELLS Co: Ouabache State Park. 23 March 2000. SJCAM 241. Two adult males taken from breeding pond. STARKE Co: Koontz Lake Nature Preserve. 28 April 2001. SJCAM 248. Four larvae taken and raised to metamorphosis in the lab. Fills gap between between Jasper, LaPorte, and Marshall counties.

Ambystoma tigrinum (Eastern Tiger Salamander). JAY Co: Bell-Croft Woods Nature Preserve. 12 April 1999. SJCAM 207. Four larvae taken; many others seen. SULLIVAN Co: 1 km W of Greene-Sullivan State Forest. 19 March 2000. SJCAM 208. Four larvae taken; dozens of egg masses seen. Fills gap between Vigo and Knox counties. FULTON Co: Lake Manitou. 2 April 1999. SJCAM 238. One adult taken from the road. WELLS Co: Ouabache State Park. 23 March 2000. SJCAM 242. Two larvae taken and raised to metamorphosis in the lab. Many egg masses seen in the field.

Hemidactylium scutatum (Four-toed Salamander). STARKE Co: Koontz Lake Nature Preserve. 28 April 2001. SJCAM 249. Four adults were seen under logs; two were taken. Fills gap between between LaPorte and Marshall counties.

Plethodon glutinosus (Northern Slimy Salamander). STARKE Co: Koontz Lake Nature Preserve. 28 April 2001. SJCAM 250. Four adults and three juveniles were seen under logs; two were taken. Fills gap between between Jasper, Porter and Marshall counties.

Notophthalmus viridescens (Eastern Newt). FLOYD Co: Hardin Ridge Nature Preserve. 24 February 2000. SJCAM 209. Two voucher specimens taken; many more seen. Fills gaps between Harrison and Clark counties.

Siren intermedia (Lesser Siren). SULLIVAN Co: 1 km W of Minnehaha Fish and Wildlife Area. 23 June 2000. SJCAM 210. One adult was taken from a pond. Fills gap between Greene, Knox and Vigo counties.

Anura

Bufo americanus (American Toad). STARKE Co: Jasper-Pulaski Fish and Wildlife Area. 9 April 1998. SJCAM 246. Two adult males taken from two medium sized choruses. Completes series in northwest Indiana.

Bufo fowleri (Fowler's Toad). SULLIVAN Co: 1 km S of Minnehaha Fish and Wildlife Area. 23 April 2000. SJCAM 212. One adult was taken from the road. Fills gap between Greene, Knox, and Vigo counties.

Scaphiopus holbrookii (Eastern Spadefoot). OWEN Co: Watasch Lake. 25 June 2000. SJCAM 239. A small chorus was videotaped. Extends the range northeast and fills a gap between Bartholemew and Vigo counties.

Acris crepitans (Northern Cricket Frog) ADAMS Co: Hanna-Nuttman Park. 2 April 1999. SJCAM 213. One adult taken from a pond. Fills gaps between Wells and Jay counties. MIAMI Co: 1 km S of Frances Slocum State Forest. 11 May 1999. SJCAM 213. One adult taken from a small chorus. Fills gaps between Fulton and Wabash counties. GREENE Co: 1 km E of Hillenbrand Fish

and Wildlife Area. 23 April 2000. SJCAM 214. One adult male taken from a large chorus. Fills gap between adjacent counties.

Pseudacris crucifer (Spring Peeper). ADAMS Co: Hanna-Nuttman Park. 2 April 1999. SJCAM 215. One adult male taken from a moderate sized chorus. Fills gaps between Allen and Jay counties. DUBOIS Co: Buffalo Pond Nature Preserve. 25 February 2000. SJCAM 216. One adult male taken from a large chorus. Fills gap among adjacent counties. GREENE Co: 1 km E of Hillenbrand Fish and Wildlife Area. 23 April 2000. SJCAM 217. One adult male taken from a large chorus. Fills gap between adjacent counties. SPENCER Co: Bloomfield Barrens Nature Preserve. 4 March 2000. SJCAM 218. One adult male taken from a small chorus. Fills gap between Warrick and Perry counties.

Pseudacris triseriata (Western Chorus Frog). WELLS Co: Ouabache State Park. 23 March 2000. SJCAM 243. One adult male taken. Three large choruses and two small choruses were heard. Fills gaps between Huntington, Adams and Jay counties.

Hyla chrysoscelis (Cope's Gray Treefrog). POSEY Co: Twin Swamps Nature Preserve. 27 May 2000. SJCAM 219. One adult male taken from a moderate sized chorus. The chorus was audiotaped. DAVIESS Co: 1 km W of Glendale Fish and Wildlife Area. 30 May 2000. SJCAM 220. One adult male AOR. SULLIVAN Co: 1 km S of Minnehaha Fish and Wildlife Area. 23 April 2000. SJCAM 221. One adult male taken from a small chorus. The chorus was audiotaped. GREENE Co: 1 km E of Hillenbrand Fish and Wildlife Area. 23 April 2000. SJCAM 222. One adult male taken from a small chorus. The chorus was audiotaped. These records nearly complete a series in southwestern Indiana.

Hyla versicolor (Eastern Gray Treefrog). STARKE Co: Koontz Lake Nature Preserve. 28 April 2001. SJCAM 247. Two medium sized choruses were heard and one adult male was taken. Completes a series in northwest Indiana.

Rana catesbeiana (Bullfrog). FULTON Co: Lake Manitou. 6 June 1999. SJCAM 223. One adult taken from small chorus. Extends range into the Upper Wabash Valley. MONROE Co: Lemon Lake. SJCAM 224. One adult taken from small chorus. DAVIESS Co: 1 km W of Glendale Fish and Wildlife Area. 30 May 2000. SJCAM 225. One juvenile taken AOR. SULLIVAN Co: 1 km S of Minnehaha Fish and Wildlife Area. 23 April 2000. SJCAM 226. One adult was taken from a small chorus. GREENE Co: 1 km E of Hillenbrand Fish and Wildlife Area. 23 April 2000. SJCAM 227. One adult male taken from a small chorus. These records nearly complete a series in southwestern Indiana.

Rana clamitans (Green Frog). ADAMS Co: Hanna-Nuttman Park. 2 April 1999. SJCAM 228. One adult male taken from a puddle. WELLS Co: Ouabache State Park. 24 June 2001. SJCAM 244. One adult male taken from a large chorus. MIAMI Co: 1 km S of Frances Slocum State Forest. 11 May 1999. SJCAM 229. One adult taken from a small chorus. These records complete a series in northeast Indiana. DAVIESS Co: 1 km W of Glendale Fish and Wildlife Area. 30 May 2000. SJCAM 230. One adult male taken AOR. SULLIVAN Co: 1 km S of Minnehaha Fish and Wildlife Area. 23 April 2000. SJCAM 231. One adult was taken AOR. GREENE Co: 1 km E of Hillenbrand Fish and Wildlife Area. 23 April 2000. SJCAM 232. One adult male taken from a small chorus. SPENCER Co: Bloomfield Barrens Nature Preserve. 4 March 2000. SJCAM 233. One adult male taken from a small chorus. These records nearly complete a series in southwestern Indiana.

Rana pipiens (Northern Leopard Frog). WELLS Co: Ouabache State Park. 24 June 2001. SJCAM 245. One adult male taken from a small chorus. Completes a series in northeast Indiana.

Rana sylvatica (Wood Frog). FULTON Co: Manitou Island Conservation Area. 2 April 1999. SJCAM 234. One adult taken from small chorus. Fills the gap between Marshall and Cass counties. DAVIESS Co: 4 km N of Glendale Fish and Wildlife Area. 26 February 2000. SJCAM 235. One adult male taken AOR. Fills the gap between Martin and Knox counties. POSEY Co: 2 km SE of Harmonie State Park. 3 March 2000. SJCAM 236. One adult female taken AOR. FLOYD Co: Brock-Sampson Nature Preserve. 24 February 2000. SJCAM 237. One adult male taken from a small chorus. These records fill gaps in the distribution along the Ohio river.

Testudines

Chrysemys picta (Painted turtle). SULLIVAN Co: Greene-Sullivan State Forest. 23 June 2000. SJCRP 201. One adult male was seen and photographed AOR. GREENE Co: Greene-Sullivan State Forest. 29 May 2000. SJCRP 202. One juvenile was captured and photographed in a roadside ditch. DAVIESS Co: Glendale Fish and Wildlife Area. 30 May 2000. SJCRP 203. One male was seen and photographed in a pond.

Terrapene carolina (Eastern Box Turtle). SULLIVAN Co: 2 km W of Dugger. 23 June 2000. SJCRP 204. Male was seen and photographed AOR. SPENCER Co: Bloomfield Barrens Nature Preserve. 29 May 2000. SJCRP 205. One female was seen and photographed along edge of woods and corn field. DAVIESS Co: Capehart Sand Flat Nature Preserve. 30 May 2000. SJCRP 206. One male was seen and photographed in a mud patch. DUBOIS Co: 2 km NW of Buffalo Pond Nature Preserve. 28 May 2000. SJCRP 207. One female was seen and photographed along the edge of the road.

Lacertilia

Eumeces fasciatus (Five-lined Skink). SPENCER Co: Bloomfield Barrens Nature Preserve. 29 May 2000. SJCRP 208. One male seen and photographed while it ate winged termites emerging from a log.

Serpentes

Diadophis punctatus (Northern Ringneck Snake). STARKE Co: Koontz Lake Nature Preserve. 19 June 2001. Robert Brodman and Michael Parrish. SJCR 209. One adult taken from a rotting log. Fills a gap between Fulton and Porter counties in northern Indiana.

Nerodia sipedon (Northern Water Snake). SULLIVAN Co: 1 km W of Greene-Sullivan State Forest. 23 June 2000. SJCRP 210. DOR male.

Thamnophis sirtalis (Common Garter Snake). DUBOIS Co: 1 km W of Buffalo Pond Nature Preserve of Greene-Sullivan State Forest. 30 May 2000. SJCRP 211. DOR juvenile.

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New Texas County Records of Amphibians and Reptiles

TRAVIS J. LADUC
and
C. R. INFANTE*
Section of Integrative Biology and
Texas Memorial Museum of Science and History
The University of Texas at Austin, Austin, Texas 78712-1064, USA
e-mail (TJL): travieso@mail.utexas.edu

**current address of CRI:*
Museum of Comparative Zoology
Herpetology Department, Room 115, 26 Oxford Street
Harvard University, Cambridge, Massachusetts 02138, USA
e-mail: los@oeb.harvard.edu

The Texas Natural History Collection (TNHC) of the Texas Memorial Museum of Science and History (TMMSH) currently contains over 60,000 dry, frozen, and fluid preserved amphibian and reptile specimens. Although the collection contains significant holdings from localities around the world (notably southeast Asia, Africa, and South America), the majority of specimens in the TNHC are from Texas. Of these 35,000+ Texas specimens, most were collected between the mid-1940's and late 1960's by W. Frank Blair and his students from localities throughout the state, including significant and sizable collections from Brewster, Hutchinson, Presidio, Terrell, and Travis Counties. In the spring of 1999, a National Science Foundation Collections Improvement Grant was awarded to the TMMSH for the verification of all TNHC specimens cataloged prior to 1991 (the date from which new collection information was kept on computer databases). This grant has allowed us to verify not only the presence of these specimens within the TNHC, but to verify and examine the associated locality information from the written ledgers that served as the official record from the 1940's until 1991. To date, we have verified over 52,000 specimens, including all Texas specimens in the collection (Texas specimens cataloged after 1991 included as well). As a result, we have discovered 33 new Texas county records which either fill in distributional gaps or expand the known ranges of certain taxa (Dixon 2000). Information regarding the holdings of the TNHC can be found at

http://www.utexas.edu/depts/tnhc/herps/

Specific inquiries can be directed to David Cannatella at catfish@mail.utexas.edu or Jessica Rosales, collections manager, at rosales@mail.utexas.edu. It should also be noted that the herpetological holdings of Texas Tech University (TTU; 11,500 specimens) were acquired by the TNHC in March 2001; the TTU data and specimens will be incorporated into the main collection during the 2001–02 academic year.

Caudata

Ambystoma maculatum (Spotted Salamander). TITUS CO: SWEPCO site on Swauano Creek near Cason. 18 September 1973. J. Grubb. TNHC 55414.

Ambystoma opacum (Marbled Salamander). TITUS CO: SWEPCO site on Swauano Creek near Cason. 21 June 1973. J. Grubb. TNHC 55413.

Plethodon albagula (Western Slimy Salamander). WALKER CO: New Waverly, 11 mi NW in Sam Houston National Forest. 7 October 1950. UT Zoology 336 Class. TNHC 12079.

Anura

Bufo americanus (American Toad). COOKE CO: Muenster, ca. 10 mi NNE. 6 April 1991. J. H. Yantis. TNHC 55542–55.

Bufo debilis (Green Toad). CALDWELL CO: Luling, 5.7 mi N on Hwy [likely U.S. Hwy 183]. 15 May 1951. R. W. Axtell et al. TNHC 14199. DICKENS CO: FM 193, 4.7 road mi W King County line (also 10 road mi E FM 265 on FM 193). 30 June 2000. T. LaDuc. TNHC 60350. GUADALUPE CO: Kingsbury, 2 mi NW. 19 June 1962. No collector given. TNHC 30969.

Bufo punctatus (Red-spotted Toad). ERATH CO: Thurber, 3 mi SW at old coal mine. 7 July 1950. Allen and Mann. TNHC 12489–96.

Bufo speciosus (Texas Toad). REAL CO: Near Leakey. 31 August 1958. R. Worthington. TNHC 28973.

Eleutherodactylus marnockii (Cliff Chirping Frog). CALDWELL CO: Lockhart, 4 mi NE. 14 Novmber 1953. Trevino. TNHC 20753.

Hyla squirella (Squirrel Treefrog). ATACOSA CO: Lytle, 7 mi SE, on Kirn Ranch. 8 July 1949. Miller. TNHC 7270–2.

Pseudacris crucifer (Spring Peeper). TITUS CO: SWEPCO site on Swauano Creek near Cason. 20 June 1973. J. Grubb. TNHC 55405; SWEPCO site on Swauano Creek near Cason. 18 September 1973. J. Grubb. TNHC 55406; SWEPCO site on Swauano Creek near Cason. 19 June 1973. J. Grubb. TNHC 55411.

Pseudacris streckeri (Strecker's Chorus Frog). CHEROKEE CO: Jacksonville, ditches along 1601 Canada Street. 26 December 1979. K. Tedin and J. Sharp. TNHC 49850–63; no specific locality. 26 December 1979. K. Tedin. TNHC 49965–77. TITUS CO: SWEPCO site on Swauano Creek near Cason. 28 March 1974. J. Grubb. TNHC 55407 (2 specimens). WALLER CO: Brookshire, 6 mi W. 25 May 1957. Hermes. TNHC 28889.

Pseudacris triseriata (Western Chorus Frog). TITUS CO: SWEPCO site on Swauano Creek near Cason. 19 June 1973. J. Grubb. TNHC 55412.

Rana berlandieri (Rio Grande Leopard Frog). JACKSON CO: Ganado, 12.5 mi E. 24 October 1964. Adler. TNHC 57288.

Rana palustris (Pickerel Frog). RUSK CO: Owens and Barnhardt Creeks, N of Nacogdoches. February 1962. C. Hubbs. TNHC 49255.

Rana sphenocephala (Florida Leopard Frog). ATACOSA CO: Lytle, 7 mi SE on Kirn Ranch. 26 February 1949. Blair. TNHC 5729. Same locality. 15–16 October 1949. UT Zoology 336 class. TNHC 9259.

Scaphiopus hurterii (Hurter's Spadefoot). TITUS CO: SWEPCO site on Swauano Creek near Cason. 28 March 1974. J. Grubb. TNHC 55392–5; SWEPCO site on Swauano Creek near Cason, "old field." 19 June 1973. J. Grubb. TNHC 55419–23; SWEPCO site on Swauano Creek near Cason. 25 May 1973. J. Grubb. TNHC 55425. WALLER CO: Monaville. 27 April 1959. M. D. Sabath. TNHC 30920.

Testudines

Terrapene ornata (Ornate Box Turtle). STONEWALL CO: U.S. Rt. 83, 5.8 mi N jct with U.S. Rt. 380, 33°15'43"N, 100°14'53"W. 7 May 1995. A. H. Price. TNHC 55601.

Lacertilia

Eumeces obsoletus (Great Plains Skink). FANNIN CO: Honey Grove. 1 May 1959. Tamsitt. TNHC 26172.

Eumeces septentrionalis (Prairie Skink). HOUSTON CO: Crockett, 2.5 mi W, Halls Bluff Road, Spence Ranch. 8 April 1950. Wootters. TNHC 28852.

Eumeces tetragrammus (Four-lined Skink). CULBERSON CO: Guadalupe Mts., 2 mi NNW Pine Springs in "The Bowl," 8000+ ft. elev. 2 June 1953. Mecham. TNHC 16289–90; Guadalupe Mts., "The Bowl" near Pine Springs. 29 April 1953. Mecham. TNHC 17993–18000.

Sceloporus olivaceus (Texas Spiny Lizard). ANGELINA CO: Rockland, 3 mi N. 16 October 1965. J. Baker. TNHC 50040; MONTGOMERY CO: FM 1097, 2 mi W FM 149 [on] William Gay Ranch. 3 October 1965. R. McKown. TNHC 50042.

Sceloporus variabilis (Rose-bellied Lizard). CALDWELL CO: Palmetto State Park, Ottine. 27 November 1964. Slama. TNHC 46334.

Serpentes

Arizona elegans (Eastern Glossy Snake). AUSTIN CO: U.S. Rt. 90, 2 mi W Brazos River. 27 June 1960. M. D. Sabath. TNHC 29255.

Coluber constrictor (Eastern Racer). HOUSTON CO: Crockett, 3 mi W [on] Halls Bluff Road. 6 June 1958. Willingham. TNHC 28707.

Crotalus atrox (Western Diamondback Rattlesnake). CRANE CO: Crane, 5 mi S. 8 June 1959. M. D. Sabath. TNHC 29040.

Drymarchon corais (Western Indigo Snake). GOLIAD CO: FM 2442, 3.5 road mi SW Texas Rt. 239. 25 August 1999. T. LaDuc. TNHC 60228. Specimen collected as heavily scavenged DOR.

Nerodia cyclopion (Mississippi Green Water Snake). POLK CO: near Livingston. May 1963. Mitchell. TNHC 28921.

Acknowledgments.— We thank J. H. Malone for verifying the identity of all specimens whose records are presented here (save *Eumeces septentrionalis,* confirmed by T. Reeder) and J. R. Dixon for verifying that the records reported herein are in fact new. This work was supported by NSF Grant 9876830.

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New Records of Squamate Reptiles in Central Brazilian Cerrado II: Brasília Region

CRISTIANO DE CAMPOS NOGUEIRA
Departamento de Ecologia, Universidade de São Paulo
R. do Matão, 321, trav. 14. CEP 05508-900
São Paulo, São Paulo, Brazil

The Cerrado is the second largest Neotropical ecosystem, covering over 2,000,000 km^2 in central Brazil (Eiten 1972). However, this region remains poorly known in zoological terms (Colli et al. 1998). Species lists providing voucher specimens for central Brazilian squamate reptiles are available only in Amaral (1935) and Hoge (1952a, b). The central Brazilian Cerrado harbors a rich but poorly studied squamate fauna, deserving intensive and detailed field work and research. Such studies are even more compelling due to the ongoing high rates of destruction of the Cerrado's natural landscapes.

New distributional records of squamate reptiles for central Brazil are presented herein as partial results of squamate diversity studies started in 1997 in the Brasília region, encompassing an area of 100 km radius from the center of Brasília. Some additional records in the northeastern state of Goiás (Paranã River valley and Chapada dos Veadeiros regions) are also included. A snake species list for the Brasília region is available in Silva and Sites (1995), including some taxa treated herein. However, the presence of these taxa in the studied area was only confirmed in the present study, after the designation of voucher material. According to unpublished preliminary results, and based also on the records presented herein, the Brasília region (31,400 km^2; 100 km radius around Brasília, excluding Chapada dos Veadeiros and Paranã valley regions, NE Goiás state) harbors a rich squamate fauna composed of over 90 squamate reptiles, including at least 63 snakes (CN, unpublished data), 24 lizards (G. R. Colli, pers. comm.), and four amphisbaenians.

The present study adds to the list of new records for central Brazil in the Emas National Park region (Valdujo and Nogueira 2001). All records are based on specimens deposited in the herpetological collections of Instituto Butantan (IB, verified by F. L. Franco), Museu de Zoologia da Universidade de São Paulo (MZUSP, verified by C. C. Mello and P. E. Vanzolini) and Coleção Herpetológica da Universidade de Brasília (CHUNB, verified by G. R. Colli).

Amphisbaenia

Amphisbaena anaemariae. DISTRITO FEDERAL: Brasília municipality, Área Alfa (Brazilian navy training area) in arboreal savanna (cerrado sensu-stricto), 16°00'S, 47°56'W, 1100 m elev. C. Nogueira and P. H. Valdujo. 8 December 2000. MZUSP 88130. Previously known only from the type series, collected in Serra da Mesa region, and from a specimen collected in Anápolis, both in the state of Goiás (Vanzolini 1997). Although this species has recently been recorded for Nova Ponte and Indianápolis in Minas Gerais (Vrcibradic and Soares 1999), thereby extending the range ca. 500 km S of Brasília, this specimen is the first record of the species in Distrito Federal and fifth known locality record for the

taxon.

Amphisbaena mensae. DISTRITO FEDERAL: Brasília municipality, Área Alfa (Brazilian navy training area) in arboreal savanna (cerrado sensu-stricto) and sparse savanna (campo cerrado), 16°00'S, 47°56'W, 1100 m elev. 11 January 2000. P. H. Valdujo and C. Nogueira. MZUSP 88127; 18 May 2000. C. Nogueira. MZUSP 88129; 17 May 2000. C. Nogueira. MZUSP 88131. This taxon is known only from type locality, in Minaçu, Serra da Mesa region, northeastern Goiás (Castro-Mello 2000). Our specimens extend range 250 km S of type locality.

Leposternon microcephalum. DISTRITO FEDERAL: Brasília municipality, disturbed site close to cerrado grassland (campo sujo), close to Água Limpa farm, 15°54'S, 47°57'W, 1050 m. 20 November 2000. C. Nogueira and P. H. Valdujo. MZUSP 88123. Extends range ca. 600 km NW of Rio das Velhas (close to Belo Horizonte, Minas Gerais) and ca.1000 km W of Andaraí, in the Chapada Diamantina region (Gans 1971), both in the borders of the Cerrado domain.

Lacertilia

Enyalius bilineatus. DISTRITO FEDERAL: Brasília municipality, Área Alfa (Brazilian navy training area), inside gallery forest of Saia Velha River, 16°00'S, 47°56'W, 1050 m elev. 22 October 1999. C. Nogueira. CHUNB 21813 and 21815. First record for central Brazil and northernmost record for the species. Extends range ca. 600 km NW of nearest locality, Lagoa Santa, Minas Gerais, southeastern Brazil (Jackson 1978).

Colobosaura modesta. DISTRITO FEDERAL: Brasília municipality, Área Alfa (Brazilian navy training area), inside gallery forest of Saia Velha River, 16°00'S, 47°56'W, 1050 m elev. 20 October 1999. C. Nogueira. CHUNB 21806. 24 October 1999. C. Nogueira. CHUNB 21807. First records for central Brazil, extending range ca. 450 km NW of nearest locality, Morro da Garça, Minas Gerais (Vanzolini 1977).

Serpentes

Leptotyphlops koppesi. MINAS GERAIS: Unaí municipality, Fazenda Cafundó, 16°15'S, 47°03'W, 615 m elev., in disturbed area close to sparse savanna (campo cerrado). 30 September 1999. C. Nogueira. CHUNB 20348. Known only from type locality (Peters and Orejas-Miranda 1970; McDiarmid et al. 1999) and from the Emas National Park region (Valdujo and Nogueira 2001). The present record extends distribution ca. 650 km NE of Emas National Park.

Boiruna maculata. GOIÁS: Terezina de Goiás municipality, Paranã River valley region, northeastern Goiás. GO 118 Highway, Km 253, close to 13°36'S 47°11'W, near Amutafo River, Paranã tributary. 1 January 2000. C. Nogueira and P. H. Valdujo. CHUNB 20375. Extends range ca. 550 km N of Ouvidor, nearest known locality in Goiás and former northernmost record for the species (Zaher 1996). DISTRITO FEDERAL: Brasília municipality. Collector unknown. CHUNB 03853 and 03863.

Drymoluber brazili. DISTRITO FEDERAL: Brasília municipality. 1 November 1988. Collector unknown. CHUNB 03748. Previously known only from southcentral Brazil. Extends range ca. 450 km N of Uberaba, Minas Gerais, southeastern Brazil, type locality for the species (Peters and Orejas-Miranda 1970).

Helicops modestus. DISTRITO FEDERAL: Brasília municipality, Planaltina. 10 October 1987. A. Sebben. CHUNB 03730, 03732, 03736. Although the presence of this snake in central Brazil was previously cited in Rossman (1970), these are the first vouchered records for the entire Cerrado domain. Extends range ca. 600 km N of previous record in southeastern Brazil (Rossman 1970).

Helicops leopardinus. DISTRITO FEDERAL: Brasília municipality, Gama. 20 November 1970. Collector unknown. CHUNB 03741. Extends range ca. 600 km SE of Ilha do Bananal, Tocantins (formerly Goiás); single previous record for central Brazil (Hoge 1952a).

Imantodes cenchoa. GOIÁS: São João d'Aliança municipality, Fazenda Fortaleza, 14°30'S, 47°31'W, in disturbed area close to cerrado savanna (cerrado sensu-stricto). 1 April 1997. C. Nogueira. CHUNB 20339. First state record, ca. 550 km E of the single previous vouchered record for the Cerrado, in Xavantina, Mato Grosso (Hoge 1952b).

Liophis paucidens. DISTRITO FEDERAL: Brasília municipality, SMPW, close to Núcleo Bandeirante district. May 2001. A. Bocchiglieri. CHUNB 24448. Tenth known specimen. First record for the Brasília region and sixth locality record for the taxon, all within the Cerrado domain (including Terezina, Piauí, in Cerrado/Caatinga contact, see map in Michaud and Dixon 1987). Recorded also for Emas National Park, southwestermost locality record for the taxon (Valdujo and Nogueira 2001).

Oxybelis aeneus. DISTRITO FEDERAL: Brasília municipality, Estação Ecológica de Águas Emendadas, disturbed area close to cerrado savanna (cerrado sensu-stricto). March 2001. F. França and P. H. Valdujo. CHUNB 24394. Probably the southernmost record for this wide ranging taxon, as no distribution map is available. In Brazil, this species is known only from localities in Amazonia (Keiser 1970). First vouchered record for the studied region and for the entire Cerrado.

Philodryas patagoniensis. GOIÁS: Alto Paraíso municipality, Chapada dos Veadeiros region, 14°13'S, 47°29'W, in cerrado grassland area (campo limpo). May 1986. C. Nogueira. CHUNB 19336. DISTRITO FEDERAL: Brasília municipality. 10 December 1971. Collector unknown. IB 32747. According to the distribution map in Thomas (1976), the record in the Chapada dos Veadeiros is the northernmost record for the species in Brazil. Extends range 750 km NE of single accurate record in Goiás, in Emas National Park and former northernmost record for the species (Valdujo and Nogueira 2001).

Pseudablabes agassizii. GOIÁS: São João d'Aliança municipality, Fazenda Fortaleza, 14°30'S, 47°31'W, 1050 m elev., in cerrado shrubby grassland (campo sujo). 9 April 1997. C. Nogueira. CHUNB 20357. Northernmost record for the species. First vouchered record for central Brazilian Cerrado. Extends range ca. 700 km NW of nearest known locality, Serra do Cipó National Park, Minas Gerais, southeastern Brazil (Kiefer 1998).

Rhachidelus brazili. DISTRITO FEDERAL: Brasília municipality. 16 December 1991. Collector unknown. CHUNB 03886. Northernmost record for the species, previously known only from southern and southeastern Brazil. First vouchered record for central

Brazilian Cerrado, extends range 1000 km from type locality, in the vicinity of the city of São Paulo, state of São Paulo, southeastern Brazil (Peters and Orejas-Miranda 1970).

Taeniophallus occipitalis. DISTRITO FEDERAL: Brasília municipality, Brasília National Park, in cerrado grassland (campo limpo). January 1999. C. Nogueira. CHUNB 20368. 30 February 1962. Collector unknown. IB 21447. Previously recorded from uncertain Brazilian localities (see list of examined specimens in Myers 1974). This record and the one in Emas National Park (Valdujo and Nogueira 2001) are the first for central Brazilian Cerrado.

Xenopholis undulatus. DISTRITO FEDERAL: Brasília municipality. 29 November 2000. F. França. CHUNB 20620. Although Peters (1970) mentions the presence of this taxon in the states of Goiás and Mato Grosso (no precise localities), our specimen represents the first vouchered record for central Brazil, extending range ca. 700 km NW of previously known locality records, all in Minas Gerais, southeastern Brazil, according to Peters and Orejas-Miranda (1970).

Acknowledgments.—I thank IBAMA for allowing me to collect in the studied region. The Brazilian Navy kindly allowed access to the preserved Cerrado in Área Alfa, a military training site close to Brasília where many collections were made. C. Castro-Mello and P. E. Vanzolini identified the amphisbaenians and kindly shared their knowledge on the group. F. L. Franco (IB), M. T. Rodrigues and P. E. Vanzolini (MZUSP) and G. R. Colli (CHUNB) allowed the examination of preserved specimens under their care. This work was partially funded by the CNPq (Brazilian Research Council) and FAPESP (São Paulo state research foundation), which provided fellowships.

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The Apparent Persistence of *Crotalus horridus* in the Western Piedmont of North Carolina

DAVID A. STROUPE
and
MICHAEL E. DORCAS
Department of Biology, Davidson College
Davidson, North Carolina 28036, USA
e-mail (DAS): dastroupe@davidson.edu
e-mail (MED): midorcas@davidson.edu

Timber Rattlesnakes (*Crotalus horridus*) are imperiled over much of their range and efforts are underway to protect them in many states (Brown 1993). Consequently, documentation of remaining populations is vital for their conservation. In North Carolina, most extant populations of *C. horridus* occur in the mountainous (western) and coastal (eastern) regions (Palmer and Braswell 1995). Legislation is proposed that will make the snake a "Species of Special Concern" in North Carolina, affording protection from wanton killing and collection (R. Wilson and A. L. Braswell, pers. comm.).

The Piedmont of North Carolina has experienced extensive development since initial European settlement resulting in the extirpation of most *C. horridus* populations (W. H. Martin, pers. comm.). In the Western Piedmont of North Carolina, the only documented records of *C. horridus* are from Crowder's Mountain State Park in western Gaston County, Morrow Mountain State Park

in eastern Stanly County, central Union County, and an observation regarded as reliable from eastern Lincoln County (Brown 1992; Palmer and Braswell 1995). Here we document the apparent persistence of *C. horridus* in the western Piedmont of North Carolina by reporting two new county records from northern Mecklenburg County and adjacent, western Cabarrus County.

Crotalus horridus (Timber Rattlesnake). MECKLENBURG Co: Ramah Creek Conservation Easement, 3.0 km S of U.S. Rt. 73 on McAuley Road (UTM Zone 17: N3920589m, E0519984m). August 1997. Gary Sitton. NCSM 61877. Verified by Jeffrey C. Beane. New county record. The specimen was obtained by Sitton, who placed the specimen in a freezer until 28 May 2001, when we obtained it. The individual is a female measuring 1.37 m long and resembles Coastal Plain ("canebrake") forms. An additional specimen was found during June 1997 in the vicinity of the first animal (ca. 2.5 km S of U.S. Rt. 73 on McAuley Road—UTM Zone 17: N3920575m, E0519978m) in June 1997 by Margaret Zimmerman. This specimen was killed and all but its rattle discarded. The Ramah Creek Conservation Easement, where both of these specimens were found, encompasses 202 ha of undeveloped land and represents one of the largest undeveloped areas in northern Mecklenburg County. Habitat consists of mixed hardwoods and pine interspersed with a few feed plots established for deer and quail. We searched the area extensively during 2000 and 2001, and failed to find additional specimens.

CABARRUS Co: 8480 Bradford Road, Concord, North Carolina, 1.5 km N of North Carolina Rt. 73 (UTM Zone 17: N3924608m, E0526246m). 22 September 2000. Debbie Bradford. NCSM Color Slide WMP 5346. Verified by Jeffrey C. Beane. New county record. The specimen was reported in the *Concord Independent Tribune* to be between 1.3 and 1.5 m long. A second specimen was killed adjacent to North Carolina Rt. 73 on a boat ramp between LA Forest Road and Rankin Road (UTM Zone 17: N3924589m, E0526220m). July 2000. Deputy Sheriff Rick Coker. NCSM Color Slide WMP 5347. Verified by Jeffrey C. Beane. From photographs, this specimen appears to also be between 1.3 and 1.5 m long. As with the Ramah Creek specimens, these animals resemble more closely the Coastal Plain ("canebrake") form of this species. The area where these two specimens were found is comprised of a mosaic of various habitats, consisting of small farms interspersed with forested areas and stream floodplains.

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BOOK REVIEWS

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Amphibians and Reptiles of the Hashemite Kingdom of Jordan. An Atlas and Field Guide, by Ahmad M. Disi, David Modry, Petr Necas, and Lina Rifai. 2001. Edition Chimaira, Frankfurt am Main. 408 pp. Hardcover. 68 DM (approx. US $30). ISBN 3-930612-12-7.

STEVEN C. ANDERSON
Department of Herpetology, California Academy of Sciences
San Francisco, California, USA
and
(Mailing address)
Department of Biological Sciences, University of the Pacific
Stockton, California 95211, USA
e-mail: asaccus@aol.com

In the last few years, the quality of field guides has taken a quantum jump, thanks largely to new photographic and computer printing and publishing technologies. This has been particularly noticeable for herpetological guides for Third World countries. This guide to the herpetofauna of Jordan is an outstanding example of this new trend. The cover, which is decorated with handsome photographs, front and back, appears wear-resistant, a necessity for any field guide, and the binding seems reasonably sturdy.

As Wolfgang Böhme points out in his Preface to the book, Professor Disi is the founder of modern herpetology in Jordan. Dr. Modry and Petr Necas are Czech researchers who have spent field time in Jordan, and Lina Rifai represents the next generation of herpetologists in Jordan. This has proven a fortunate collaboration of long familiarity with the fauna with access to up-to-date literature published in the West. The photographs, which are appropriately integrated with the text are all of high quality; most are by David Modry, supplemented by a few of comparable quality by other prominent herpetologists/photographers. The printed reproduction of the photographs is of exceptionally high resolution and color rendition, and the fact that the entire book is published on paper of photographic quality has permitted the intimate association of text and illustration.

The section "Introduction and technical notes" adequately sets out the plan of the book, the purpose of which is to present current knowledge of distribution of species in Jordan and to permit the accurate identification of individual specimens. Species accounts include the current Latin names, the original name under which the species was described, along with authors' names and dates of publication. Type localities are stated. Vernacular names are given in English, German, and French; in an appendix, Arabic names are given for each species, both in Arabic script and transliterated into Roman alphabet. Subspecific designations are presented in a "Systematics" paragraph for each account. There is a "General distribution" paragraph giving the total range of the species and a "Local distribution" paragraph giving the known distribution within Jordan. A gazetteer appendix listing all localities mentioned in the text is particularly valuable. For each species account there are paragraphs for "Habitat," "Description," "Notes on biology," and "Remarks." Because this is a field guide, rather than a scientific

treatise, researchers will be greatly aided by the "Pertinent literature" at the end of each account, which refers the reader to the bibliography containing the technical literature available for the species. Each species account typically includes at least two color photographs of the animal, one showing the entire animal, another a close-up of the head showing details of scalation and color pattern. Sometimes both male and female are illustrated.

The distribution maps for each species merit special mention. The authors have overlain an outline map of Jordan with a grid of squares, 15 minutes on each side. Each square in which a particular species has been recorded is occupied by a solid black dot. Although this may not be as precise as individual locality symbols, it is particularly appropriate in a field guide that can also be used in comparing distribution patterns and in making inter-area faunal comparisons. In their introduction, the authors present a map summarizing all of the squares in which any species have been recorded. It is immediately apparent that a bit less than half of the area of the country remains unexplored herpetologically. It is reasonable to assume that few or none of the occupied squares have been thoroughly canvassed.

Following the Introduction, the book begins with a brief chapter on the geography and climate of Jordan. The authors recognize four general physiographic regions: the Rift Valley, Mountain ranges along the eastern flank of the Rift, the Eastern Desert, and the marine environment of the Gulf of Aqabah. This chapter includes habitat photos and maps showing prominent physiographic features and temperature and rainfall distribution. The two-page chapter on biogeography attempts to give a brief descriptive overview of the ecological occurrence of the herpetofauna. The authors recognize four "ecozones," the Mediterranean ecozone, Irano-Turanian ecozone, Saharo-Arabian ecozone, and the Afrotropical (or Sudanian) ecozone. They list characterizing vegetation and representative species of amphibians and reptiles for each of these regions. A brief chapter covers the history of herpetological research in Jordan. Suggestions for the observation and collecting of amphibians and reptiles form a chapter, and a chapter on conservation includes descriptions of the protected areas in Jordan. Reptiles and amphibians in the cultural heritage of Jordan constitute a short chapter, in which some account of folklore is presented, along with a Bedouin recipe for cooking and serving *Uromastyx aegyptius*.

A longer chapter on venomous snakes and snakebite is well illustrated with photographs of the venom apparatus of the principal venomous snakes, some account of snake venoms, and brief accounts of each of the venomous species: *Cerastes gasperettii, Pseudocerastes persicus, Echis coloratus, Vipera palaestinae, Macrovipera lebetina, Atractaspis engaddensis*, and *Walterinnesia aegyptia*. Symptoms and treatment of snakebite along with folk medicine and practices are covered in this chapter.

Following these general chapters, which occupy 74 pages, are the keys to amphibians and reptiles of Jordan. Key characters are illustrated primarily with photographs rather than with the more traditional line drawings (with a few exceptions, such as line drawings of the heads of lizards and snakes and turtle shells, where the names of scales and plates appear). Interestingly, in the case of amphibians, only a single species in each of five families occurs in Jordan, and so family keys to both adults and larvae suffice. The dichotomous keys to the reptiles appear to be quite workable for specimens in the hand. Field identification of living amphibians and reptiles will be possible in most cases through examination of the photographs in the species accounts.

The authors list 89 species, 4 frogs, 45 lizards, 34 snakes, and 6 turtles for Jordan, with another 9 species of possible occurrence or doubtful status. Each species is beautifully illustrated with color photographs of the living animals, and each account has a distribution map. The nomenclature used is current, and the pertinent literature section for each account is sufficient to track down nomenclatural history in most cases. I have no argument with the specific usage here, although for each taxon there are those more expert than I, and I leave such criticism to them. The up-to-publication-date bibliography is extensive and appears to be complete for those references pertaining strictly to Jordanian herpetology and to adjacent regions as appropriate.

It seems to be a tradition of reviewers to find fault, however minor, with some aspect of a publication, in order to be "helpful" in future revisions. As none of the authors is a native speaker of English, the language will seem not quite idiomatic to many readers, although the meaning is clear. There is no index, a minor inconvenience, since the table of contents and the arrangement of species accounts will quickly lead the reader to the desired information.

This book will be a necessary and welcome addition to the library of all zoologists working on the fauna of Southwest Asia and to any museum collection that includes herpetological material from the region. It will be a valuable field tool to those with conservation management responsibilities in Jordan and for zoology courses in Jordanian universities. One may hope that there will be an Arabic version, also. The book will also be of interest to anyone looking for a model for state-of-the-art field guides. It would be a blessing if it were the prototype for a series of field guides to the various zoological taxa of the region.

As with all areas of Asia, systematic and natural history studies are far from complete, and I would expect that there will be future revised editions of this guide. It is fortunate, if ironic, that we have entered an age of beautifully executed field guides just as studies of morphological and adaptive characters are falling out of favor, and natural history studies are seen as beneath the dignity of "real" scientists. One wonders if there will be future generations trained to make the necessary emendations to current field guides, so necessary to the conservation of biological diversity.

Herpetological Review, 2001, 32(4), 289–290.
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Amphibians of Argentina: A Second Update, 1987–2000, by Esteban O. Lavilla and José M. Cei. 2001. Monographie XXVII, Museo Regionale di Scienze Naturali Torino, Via Giolitt 36, 10123 Torino, Italy. Hardcover. 35,000 Lira (about US $18). ISBN 88-86041-41-1.

WILLIAM E. DUELLMAN
Natural History Museum and Biodiversity Research Center
The University of Kansas, Lawrence, Kansas 66045, USA
e-mail: duellman@ku.edu

The amphibian fauna of Argentina was documented comprehensively by the indefatigable field naturalist and herpetologist José M. Cei in 1980; therein he provided keys,

accounts of all of the genera and species, distribution maps, many line drawings of tadpoles and structures of adults, and 24 plates that are composites of color paintings by the late Sylvana S. Cei. This outstanding work initiated a new phase of herpetological research in Argentina by scores of young investigators. Cei also continued an active field program in Argentina and in 1987 published a lengthy update to his earlier monograph.

One of the young investigators inspired by Cei is Esteban O. Lavilla, who has collaborated with Cei to bring us a new update of the amphibians of Argentina. This new volume of 177 pages contains updated accounts of all of the genera and species and 24 very good color photos of living individuals, mostly of species previously not illustrated in color; these are grouped on eight plates at the end of the volume. Comments on conservation status are included in the accounts of some species. An appendix of 11 pages contains transcriptions of original descriptions of Argentinean anurans published in 1987–1997, and a second appendix of 19 pages is an addendum to the main text in that it contains a review of the literature published in late 1997 through mid-2000.

Essentially, the species accounts are updates from the previously published works. Thus, for some species the account consists of nothing more than "No additional data reported since 1987." Most accounts, are more lengthy and include information on taxonomy, distribution, life history, or descriptions of larvae. Nearly all of the information has been synthesized from the literature, much of which has been published in Argentina. The literature cited is fragmented in that references appear at the end of the accounts of individual genera. The work is indexed thoroughly.

The quality of the paper and binding is excellent, as is characteristic of the monographs of the museum in Torino. In general, the writing is clear and concise, but the manuscript would have benefited by careful editing by a person whose native language is English.

In the two decades since the original work was published, the known amphibian fauna of Argentina has increased significantly—from two genera and two species of caecilians and 31 genera and 119 species of anurans to three genera and four species of caecilians and 36 genera and 155 species of anurans. By comparison with the tropical countries to the north, the amphibians fauna is proportionately small in Argentina, inasmuch as the Patagonian and Pampas-Monte regions of the country are semiarid. However, a significant part of the anuran fauna is endemic to Patagonian Argentina or to the austral forests of southern Argentina and adjacent Chile.

This publication provides an entrée to the recent literature on Argentinean amphibians and is an important update to the previous works by Cei. As such, it is an indispensable book for anyone interested in the amphibian fauna of austral South America.

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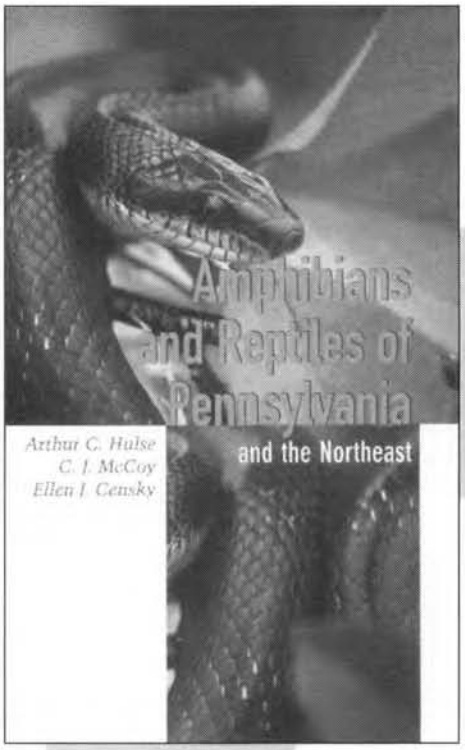
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El Camaleón en Andalucía. Distribución Actual y Amenazas para su Supervivencia, by Jesús Mellado, Lola Giménez, Juan J. Gómez, and Marieta Sanjuán. 2001. Fundación Alcalde Zoilo Ruiz-Mateos. Rota, Cádiz, Spain [orders to Juan Pedro Caballero, Fundación Alcalde Zoilo Ruiz-Mateos, c) Charco, 15, Rota E-11520 Cádiz, Spain; fax: 34 956 813450). 147 pp. Softcover. 2500 pts or 15.02 Euro (approx. US $13.50) + postage and packing. ISBN 8487960-31-6.

This large format (30 x 21 cm) book provides a current overview of the common chameleon in Andalusia, southern Spain. Included is information about ecology, distribution, population density and conservation. The book includes 21 geo-referenced maps, 20 tables, 40 text figures, and 7 color plates. It presents a fine-scale analysis based on a seven-year study (1993–1999). Threats to the remaining populations are identified and evaluated including road deaths, translocations, and, most importantly, habitat modification and destruction. The authors propose a new conservation status for the chameleon in Spain and make suggestions for its management and future conservation.

Die Schildkröten des Indischen Subkontinents, by Indraneil Das. 2001. Edition Chimira, Frankfurt am Main. 181 pp. Hardcover. 68 DM (approx. US $30). ISBN 3-930612-35-6.

This book is a German translation of the 1995 book *Turtles and Tortoises of India* by Das (not to be confused with the 1991 book *Colour Guide to the Turtles and Tortoises of the Indian Subcontinent* by the same author). The bulk of the book is devoted to species accounts for each living chelonian in the Indian region (including India, Pakistan, Sri Lanka, Bangladesh, Nepal, Bhutan, and Maldives). There is also a short section covering fossil turtles of the region, an illustrated key to species, a glossary, and index. The translation by Thomas Wilms is accurate, but not exact. Some sections have been shortened and others have been augmented by new information. In addition, the book includes shaded distribution maps (not present in the original) and many new photographs. Recent taxonomic changes have been incorporated and the bibliography has been updated with numerous references that have appeared since 1995. The sturdy hardcover is an improvement over the softbound original as is the quality of photographic reproduction. An entirely new section (pp. 10–18) on the captive care of Indian turtles has also been added. The numerous updates make this volume substantially different than its parent English language edition and will provide German language readers with a concise and current guide to the turtles of South Asia.



Amphibians and Reptiles of Pennsylvania and the Northeast

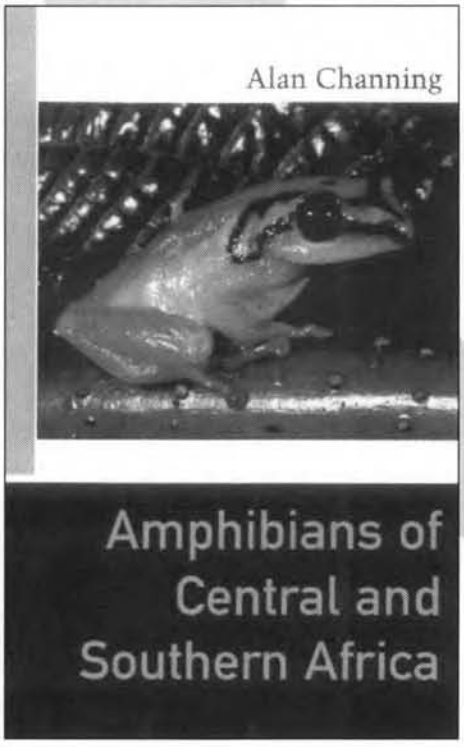
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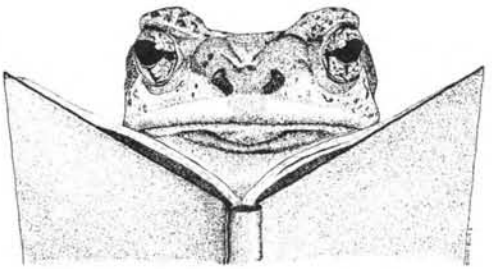
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mating period is shorter (about 24 h). Throughout the mating period the pair stay in close contact. Eggs are buried in the substrate, usually at night (despite the 24 h light cycle). They are removed immediately and incubated in a 1:1 mixture by weight of perlite and water. Initially clutches were incubated at a constant 30.6°C. Under these conditions eggs of all species hatched after 90–100 days (exceptionally 65–110 days). Subsequently, incubation temperatures were allowed to fluctuate between 28.5°C and 32.5°C. Incubation times for individual species under these conditions are given below.

Varanus kingorum has been maintained since 1993. During this time six generations of captive animals have been produced. Clutch size is typically two but as many as six eggs have been laid. Up to 14 clutches of eggs have been produced by a single female in as many months. Incubation takes 65–80 days under the conditions described above. Hatchlings have a total length of about 15 cm. Both sexes become sexually mature at four months of age. Males are removed from enclosures after egg laying to allow females to regain condition.

Since 1996 *V. glauerti* have produced a total of five generations of captive bred animals. Females produce up to 68 fertile eggs in eight clutches over eight months; eggs hatch after 90–110 days. Average clutch size is nine with a maximum of 12 eggs. Hatchlings measure approximately 18 cm total length and can reach maturity at around seven months of age. Males are separated from females after egg laying.

Since 1997 three generations of *V. pilbarensis* have been produced. Clutch size averages four eggs, with a maximum of six. Up to six clutches are produced per year, usually laid two weeks apart over 2–3 months followed by a pause of nine months. Eggs typically hatch after 80 days, sometimes as quickly as 65 days. Hatchlings measure approximately 13 cm total length and can reach sexual maturity as early as eight months of age. It has not been necessary to separate sexes after egg laying because females regain condition rapidly.

Three generations of *V. caudolineatus* have been produced since 1997. Typically 5–6 clutches of eggs are produced over four months, followed by an eight month pause. Clutch sizes of 2–3 eggs are common, however a maximum of five eggs have been laid. The eggs hatch between 65 and 80 days and reach sexual maturity at the age of five months. It has not been necessary to separate sexes after egg laying.

Although multiple clutches have been recorded many times in captive monitor lizards (Card 1994; Horn and Visser 1990, 1997; Vincent and Wilson 1999) and occasionally in wild populations (Shine et al. 1996), the numbers of clutches reported here are much higher than those previously reported for any captive monitor lizard. Similarly, the ages at maturity reported here are much lower than those in the literature. The results suggest that, given conditions of almost unlimited access to food and heat, these lizards are capable of much higher rates of growth and reproduction than had been previously supposed. They further suggest a capacity for rates of metabolism that are at present undocumented.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 32, Number 1 (March 2001). Submissions should be directed to one of the section editors (contact information located on inside front cover of this issue), as follows: amphibians (Painter); lizards, amphisbaenians, crocodilians, *Sphenodon* (Hayes); snakes and turtles (Butterfield).

CAUDATA

BATRACHOSEPS STEBBINSI (Tehachapi Slender Salamander). **ATTEMPTED PREDATION.** Examples of predation are known for only a few species of *Batrachoseps*, and none has been reported for *B. stebbinsi*, a species with a very restricted distribution in the Tehachapi Mountains of south-central California, USA (Hansen and Wake, *in press*. *In* M. J. Lannoo [ed.], Status and Conservation of U.S. Amphibians. University of California Press, Berkeley).

On 18 March 2000, two of us (TB, SW) observed a female *Diadophis punctatus* (190 mm SVL) attempting to constrict an adult *B. stebbinsi* (54 mm SVL). Both were located beneath small rocks at the base of a north-facing talus slope. The snake had seized the salamander just anterior to the hind limbs and was attempting to encircle the salamander's body with coils, but with little success. The snake appeared rather thin, perhaps having recently emerged from winter dormancy. After a ca. 15 minute struggle, the salamander dislodged the snake by dragging it down among smaller rock fragments and escaped. This observation was made at 1400 h at an air temperature of 20°C within Caliente Canyon, Kern County, California.

Ringneck snakes readily consume *Batrachoseps* in captivity (Hubbard 1903. Univ. California Publ. Zool. 1:157–170; RWH, pers. obs.). As the distribution of *D. punctatus* overlaps the ranges of most species of *Batrachoseps*, several authors (e.g., Stebbins 1954. Univ. California Publ. Zool. 54:47–124) have suggested that ringneck snakes likely are natural predators.

Submitted by **TIMOTHY BURKHARDT** and **SAMANTHA WINEGARNER**, 49 Blossom Drive, San Rafael, California 94901, USA (e-mail: TriprionCO@aol.com) and **ROBERT W. HANSEN**, 16333 Deer Path Lane, Clovis, California 93611-9735, USA (e-mail: rwh13@csufresno.edu).

EURYCEA LONGICAUDA LONGICAUDA (Long-Tailed Salamander). **PREDATION**. Little is known about predation pressures faced by long-tailed salamanders. On 17 Sept 2000, we col-

lected an adult *Pseudotriton ruber ruber* (62 mm SVL) during a field survey in Wayne County, Ohio, USA. The *P. ruber* was found under a small sandstone slab on a hillside adjacent to a small spring-fed stream. The salamander was brought back to the laboratory, anestisized in a 0.2% chloretone solution, and preserved in 10% formalin. While in the anesthesia the *P. ruber* regurgitated an adult *Eurycea longicauda*. Although the body was partially digested, the body just anterior to the rear legs to a point midway down the tail was intact allowing for a positive identification. *Pseudotriton ruber* are opportunistic foragers known to prey on invertebrates and other species of salamanders. A literature review of salamander predation by *P. ruber* found that two Ohio juveniles had each consumed *Plethodon cinereus* (Bock and Fauth 1992. Herpetol. Rev. 23:58) and a specimen from New York had also consumed *P. cinereus* (Bishop 1941. Salamanders of New York. New York State Mus. Bull. 324:1–365). This is the first report of predation on *E. longicauda* by *P. ruber* of which we are aware.

Female *E. longicauda* move to breeding sites in seepages or streams in the late autumn (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press. 587 pp.). *Pseudotriton ruber* also congregate near springs during the late fall (Bishop. 1941, *op.cit.*). Given the considerable overlap in the ranges of the two species in eastern North America, and their similar habitat selection during the fall season, adult *P. ruber* may be one of the major predators of *E. longicauda* at these spring localities.

This project was funded by the Wildlife Diversity and Endangered Species Program of the Ohio Division of Wildlife and managed by the Ohio Biological Survey. The *P. ruber* and the regurgitated *E. longicauda* were deposited at the Cleveland Museum of Natural History (catalog number 8817).

Submitted by **JARET S. REBLIN** and **CARL D. ANTHONY**, Department of Biology, John Carroll University, University Heights, Ohio 44118, USA.

PLETHODON CINEREUS (Red-backed Salamander). **SITE ATTACHMENT.** *Plethodon cinereus* is commonly found under logs, leaf litter, and rocks (Harding 1997. Amphibians and Reptiles of the Great Lakes Region. Univ. Michigan Press, Ann Arbor. 378 pp.) in late-successional deciduous forests of northeastern North America (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.). *Plethodon cinereus* are most active at night, when they leave their cover objects to forage on the forest floor (Adler 1969. Science 164:1290–1291; Adler 1970. J. Herpetol. 4:99–112). Upon completion of their nocturnal wanderings, *P. cinereus* have been found to regularly return to the same cover objects (Gergits and Jaeger 1990. J. Herpetol. 24:91–92), which indicates site attachment. Further evidence for the occurrence of site attachment in *P. cinereus* was provided by Placyk (2000. Sensory Mediation of Foraging Behavior in *Plethodon cinereus*, the Redback Salamander. M.S. Thesis, Northern Michigan University. 72 pp.), who recaptured 78% of 50 *P. cinereus* from the same home sites that they had originally been collected from one month prior to recapture. It is possible that this site attachment by *P. cinereus* may occur across seasons, but there are no data to support such a hypothesis.

On 10 August 1998, while hiking along the Little Garlic River in Marquette, Marquette County, Michigan, USA, one of us (JSP) encountered an adult *P. cinereus* with a missing tail, under a log adjacent to the hiking trail. The animal was toe-clipped for future identification and placed back under the same log. On 3 September 1999 the same *P. cinereus* was rediscovered by JSP under the same log. The salamander was identified by the presence of the correct toe-clipping code and a freshly regenerated tail. After identifying the salamander, it was placed under the same log. This is the first observation of long-term site attachment in *P. cinereus* and provides support for the hypothesis that *P. cinereus* maintain the same home site across seasons. This observation warrants more detailed studies that fully explore the occurrence and function of long-term site attachment in this species.

Submitted by **JOHN S. PLACYK, JR.**, Department of Ecology and Evolutionary Biology, 569 Dabney Hall, University of Tennessee, Knoxville, Tennessee 37996-1610, USA (e-mail: jplacyk@utk.edu), and **BRENT M. GRAVES**, Department of Biology, Northern Michigan University, Marquette, Michigan 49855, USA.

PLETHODON JORDANI (Jordan's Salamander). **VOCALIZATION.** Several species of North American salamanders are known to vocalize, including species within the families Ambystomatidae (*Ambystoma gracile*, *A. maculatum*, and *A. texanum*), Plethodontidae (*Ensatina eschscholtzi, Aneides lugubris*, and *Plethodon glutinosus*), Dicamptodontidae (*Dicamptodon ensatus*), and Salamandridae (*Taricha torosa*) (Brodie 1978. Copeia 1978:127–129; Brodie et al. 1979. Copeia 1979:270–274; Davis and Brattstrom 1975. Herpetologica 31:409–412; Neill 1952. Copeia 1952:195–196; Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington. 587 pp.; Wyman and Thrall 1978. Herpetologica 28:210–212). Each of these species uses vocalizations as a component of defensive displays, but vocalizations may have other functions as well (Wyman and Thrall, *op. cit.*). Although its defensive behavior has been studied in the laboratory, vocalizations by *Plethodon jordani* have not been reported (Brodie et al., *op.cit.*). In this note we report the observation of vocalization in two adult *P. jordani*.

On 25 July 2000 at ca. 1115 h, two adult *P. jordani* were captured during an amphibian survey in Great Smoky Mountains National Park (GSMNP), North Carolina, USA. Both salamanders were gray-cheeked individuals and had white flecking along their sides, indicating that these individuals may be members of the recently elevated taxon *P. metcalfi* (*sensu* Highton and Peabody 2000. In Bruce et al. [eds.], The Biology of Plethodontid Salamanders, pp. 31–93. Kluwer Academic/Plenum Publishers, New York), or possible hybrids of *P. jordani* and *P. oconaluftee* (Petranka, *op. cit.*). Both salamanders were found beneath cover objects along Beech Gap Trail (Luftee Knob Quadrangle, 33°38'05"N, 83°12'20"W) at an elevation of ca. 1267 m. At the time of the observation the air temperature was 18.8°C and the relative humidity was 71%. Skies were partly cloudy.

When captured, each of the two individuals responded with the same behavior. While held in the hand, the salamanders produced a faint chirping and slapping sound that appeared to be produced by a combination of thoracic muscle contraction and mouth movements. The slapping sound appeared to be produced by the mouth opening and closing. It is unclear, however, what the origin of the

chirping noise was and whether the thoracic contraction played a role in sound production. Both sounds were produced simultaneously and only a few times by each salamander. When released, both individuals discontinued the vocalization behavior.

Although vocalization has not previously been reported in *P. jordani*, this species is known to produce noxious tail secretions and engage in tail displays (Brodie et al., *op. cit.*). It is possible, therefore, that vocalizations are one component of an aposematic display that also includes visual displays involving the tail and the bold coloration seen in many populations of *P. jordani*. However, since the taxonomic status of these individuals from GSMNP is uncertain (i.e., whether they represent *P. jordani, P. metcalfi*, or *P. jordani* x *oconaluftee*) and both individuals came from the same population and locale, it cannot be concluded that this behavior is typical of *P. jordani*. Future studies of defensive behavior of *P. jordani, P. metcalfi, P. oconaluftee*, and their respective hybrids may clarify the phylogenetic origin of the behavior reported here.

These observations were made in conjunction with the USGS Southeastern Amphibian Research and Monitoring Initiative under permits from Great Smoky Mountains National Park (GRSM 00-025) and the North Carolina Wildlife Resources Commission (No. 0100). We are grateful for suggestions and advice from C. Kenneth Dodd, Jr. and Lora L. Smith.

Submitted by **KEVIN G. SMITH** and **WILLIAM J. BARICHIVICH**, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA.

ANURA

ATELOPUS TRICOLOR (Three-colored Stubfoot Toad). **NOCTURNAL CALLING**. Anurans belonging to the neotropical bufonid genus *Atelopus* are regarded as primarily diurnal animals (Lotters 1996. M. Vences & F. Glaw Verlags GbR, Koln.143 pp). Reduced ear structures, as well as the preferred habitat of swiftly flowing streams (McDiarmid 1971. Bull. Los Angeles Co. Mus. Nat. Hist. Sci. 12:1–66), have led previous authors to investigate the role of visual communication in this genus (Crump 1988. Anim. Behav. 36: 1064–1077; Jaslow 1979. J. Herpetol. 13:141–145; Peters 1973. Smithson. Contr. Zool. 145:1–49). Auditory signals and reception of sound in *Atelopus* have been looked at in less depth (Jaslow and Lombard 1996. Copeia 1996:428–432; Lindquist and Hetherington 1996. J. Herpetol. 30:347–354), but have noted the importance of vocalization in the genus.

Atelopus tricolor (Boulenger 1902; Lötters and De la Riva 1998) is dark brown with two yellow dorsolateral stripes, a yellow venter spotted with brown, and vividly contrasting vermilion palms, soles, and vent. This coloration is consistent with the visual communication systems described in other species (Crump 1988, *op. cit.*; Lötters 1996, *op.cit.*). During herpetological surveys conducted along the Paucartambo-Pilcopata road, Departamento Cuzco, Peru, *A. tricolor* were most frequently found sleeping on streamside vegetation less than 1 m in height.

On the night of 12 Jan 2000, a chorus of male *A. tricolor* was located at the base of a small cascade within primary cloud forest at 1525 m elev. The stream is a tributary of Union Creek, a larger body of water in which the rheophilic tadpoles of *A. tricolor* were found. Eight individuals occupied conspicuous positions on boulders protruding from the pool of water at the base of the cascade, and continued to call for more than two hours. Other anuran species calling in the area included *Hyla phyllognatha, H. balzani*, and *Cochranella trubae*. The chorus was relocated and observed on 13 and 14 Jan 2000.

Previous authors have theorized a correlation between reduction of vocal communication and increased visual signaling in areas of high background noise (Lindquist and Hetherington 1996, *op. cit.*). It is unusual that we documented a diurnal, aposematic toad calling nocturnally at the base of a waterfall.

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Submitted by **C. SEABIRD McKEON**, 55 Main Street, Sandwich, Massachusetts 02563, USA and **THADAIGH A. D. BAGGALLAY**, 82 12th Street, Orange Grove, Johannesburg 2192, South Africa.

BUFO OCCIDENTALIS (Pine Toad). **DEATH FEIGNING.** Little is known about the natural history of the endemic Mexican toad *Bufo occidentalis* (Oliver-López et al. 2000. Herpetol. Rev. 31:39–40). Herein we describe a possible antipredator behavior of *B. occidentalis*.

At 2034 h on 29 Sept 2000 at "El Charcote" ca. 6 km SW of Zapotitlán Salinas (18°20'N, 97°26'W; 1600 m elev.), Puebla, México, we collected a juvenile male *B. occidentalis* (KAB 031; 40 mm SUL) hidden in an algal mat in a small pond ca. 2.4 m deep. Upon capture the specimen became immobile with its limbs rigid, and breathing was not apparent for 4.5 minutes. When the rigid limbs were stretched and released, they were withdrawn tightly against the body. The toad was then placed on the ground where it remained in a belly-up position until it righted itself ca. 2.5 min later. Another juvenile male (KAB 039; 58.6 mm SUL) collected from near the same area at Rio Salado ca. 8 km N of "El Charcote," assumed the same behavior for a shorter time (90 sec). Other juveniles collected that were <60 mm SUL exhibited this same death-feigning behavior, however 14 males and 3 females >60 mm SUL did not.

Submitted by **KARLA ABBADIÉ-BISOGNO**, **LUIS OLIVER-LÓPEZ**, and **AURELIO RAMÍREZ-BAUTISTA**, Laboratorio de Ecología: Unidad de Biotecnología y Prototipos (UBIPRO), Escuela Nacional de Estudios Profesionales-Iztacala, UNAM, Av. De los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Edo. de México, C.P. 54090, A.P. 314, México.

HYLA RANICEPS (NCN). **DIET.** Although many aspects of ecology of *Hyla raniceps* (Cope, 1862) were discussed by Cei (1980. Amphibians of Argentina. Monitore Zoologico Italiano (NS). Monog 2:609) and Contreras and Contreras (1982. Ecosur 9[17]:29–66), the diet has not been investigated. Twenty-seven individuals were collected during the summer at the following localities: Paraná city (31°43'S, 60°30'W) (7 males, mean = 60.27 mm ± 4.05 SVL), Resistencia city (27°27'S, 58°59'W) (3 males, mean = 60.58 mm ± 1.63; 5 females, mean = 60.08 mm ± 2.73 SVL), Formosa province (25°02'S, 58°12'W) (4 males, mean =

TABLE 1. Prey items consumed by *Hyla raniceps*. N = total number of organisms found in the 27 stomachs; %Total = percentage of each category in the total number of prey; % Vol = percentage of each prey volume (mm^3); Freq = absolute frequency in the stomach; % FO = occurrence frequency percentage.

Items	N	% Total	% Vol. (mm^3)	Freq.	%FO
INSECTA					
Hymenoptera	20	46.51	22.98	12	44.40
Coleoptera	17	39.53	21.07	8	29.62
Homoptera	1	2.32	1.91	1	3.70
Orthoptera	1	2.32	5.74	1	3.70
Hemiptera	1	2.32	11.49	1	3.70
Apterygota					
Diplura	1	2.32	0.95	1	3.70
ARACHNIDA	2	4.65	5.74	2	7.40
Plant Material	-	-	1.34	2	7.40
Animal	-	-	19.15	12	44.40
Mineral	-	-	9.57	3	11.10
TOTAL	43	100 %	100 %		

55.67 mm ± 1.81; 1 female, 59.65 mm SVL), Santa Fe province (29°27'S, 60°23'W) (3 males, mean = 65.7 mm ± 1.89; 1 female, 75 mm SVL), Misiones province (25°39'S-54°20'W) (3 males, mean = 54.45 mm ± 1.44 SVL). Table 1 summarizes data collected during this study. The most frequently taken prey were hymenopterans (N = 20, 46.5 %), followed by coleopterans (N = 17, 39.5 %). These results indicate that *H. raniceps* exhibits prey-capture behavior intermediate between specialist and non-specialist ("sit-and-wait").

We thank Pedro M. Cacivio for providing some of the material used in this study.

Submitted by **PAOLA M. PELTZER** and **RAFAEL C. LAJMANOVICH,** National Institute of Limnology (INALI-CONICET), José Maciá 1933 (3016) Santo Tomé, Santa Fe, Argentina; e-mail: inali@arcride.edu.ar.

LIMNODYNASTES TASMANIENSIS (Spotted Grass Frog) and ***LITORIA LESUEURI*** (Leseur's Frog). **ENDOPARASITES.** *Limnodynastes tasmaniensis* (Myobatrachidae) is widely distributed throughout Australia: Tasmania, Victoria, eastern South Australia, New South Wales and eastern Queensland. *Litoria lesueuri* (Hylidae) occurs in eastern Australia from northern Queensland to Victoria (Cogger 2000. Reptiles and Amphibians of Australia. 6th ed. Ralph Curtis Books. Sanibel Island, Florida. 808 pp.). Barton (1994. Rec. S. Aust. Mus. 27:13–30) published a checklist of helminth parasites of Australian Amphibia. The purpose of this note is to add new helminth host records for *L. tasmaniensis* and *L. lesueuri* to that list. Twenty frogs from the herpetology collection of the Natural History Museum of Los Angeles County, Los Angeles (LACM) were examined: ten *L. tasmaniensis,* five from Victoria (LACM 41469, 41471–41474), five from New South Wales (LACM 41475, 41476, 41478, 41480, 41481) and ten *L. lesueuri* (LACM 41287–41296) from Victoria. The body cavity was opened with a mid-ventral incision. The lungs, urinary bladder and digestive tract were removed for helminthological examination. The body cavity was also examined for helminths. Nematodes were removed, cleared in a drop of concentrated glycerol and identified under a compound microscope. Two species of nematodes were found in *L. tasmaniensis* from Victoria: *Oswaldocruzia limnodynastes* and *Parathelandros limnodynastes;* two species of nematodes in *L. tasmaniensis* from New South Wales: *Parathelandros limnodynastes* and *Rhabdias hylae;* and two species of nematodes in *L. lesueuri* from Victoria: *P. limnodynastes* and *R. hylae.* Voucher specimens of these helminths were deposited in the United States National Parasite Collection, Beltsville, Maryland, (USNPC): *L. tasmaniensis*, *O. limnodynastes* (USNPC 91188), *P. limnodynastes* (USNPC 91189), *R. hylae* (USNPC 91190); *L. lesueuri, P. limnodynastes* (USNPC 91191), *R. hylae* (USNPC 91192). Prevalence of infection (number frogs infected/number frogs examined x100) and mean intensity (mean number of nematodes per infected frog ± 1 SD) and range by helminth species for *Limnodynastes tasmaniensis* was *O. limnodynastes* 10%, 2.0, (1 infected frog), *P. limnodynastes* 50%, 3.4 ± 2.9, 1–8; *R. hylae* 30%, 2.0 ± 1.0, 1–3, respectively; prevalence, mean intensity and range by helminth species for *Litoria lesueuri* was *P. limnodynastes* 50%, 8.2 ± 8.7, 1–23; *R. hylae* 10%, 1.0 (1 infected frog), respectively.

Oswaldocruzia limnodynastes is known from *Limnodynastes dorsalis* from South Australia, *Litoria aurea* from New South Wales and *Litoria peronii* from South Australia; *Parathelandros limnodynastes* in *Limnodynastes dorsalis* from South Australia; and *Rhabdias hylae* from 22 species of anurans across Australia (Barton, *op. cit.*). *Limnodynastes tasmaniensis* represents a new host record for *O. limnodynastes* and *P. limnodynastes*. *Litoria lesueuri* represents a new host record for *P. limnodynastes*.

We thank David A. Kizirian (LACM) for permission to examine *L. tasmaniensis* and *L. lesueuri.*

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA and **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA.

PSEUDACRIS STRECKERI ILLINOENSIS (Illinois Chorus Frog). **DYSFUNCTIONAL VOCAL SAC.** On 15 Feb 2001 at ca. 2130 h we visited a breeding chorus of *Pseudacris streckeri illinoensis* in the vicinity of Nimmons, Clay County, Arkansas, USA. A male was observed by BAW with his vocal sac protruding out of the water causing him to float at the surface, and unable to submerge. The frog was collected and returned to the Arkansas State University Herpetology Museum for observation. The vocal sac remained inflated through 1 March 2001. This anomaly is interesting as individuals would be highly susceptible to predation and their reproductive potential is likely reduced. This male appeared incapable of calling to attract mates. It is also unlikely this frog could grasp a female because the frog floated with the body hung below the surface while the vocal sac floated on the water's surface. The specimen usually was observed on its back, unable to right itself until the vocal sac deflated. The specimen is being held alive at the museum for return to the collection site or later depo-

sition in the ASU herpetological collection.

Submitted by **MALCOLM L McCALLUM** (e-mail mmccallu@navajo.astate.edu) and **BENJAMIN A. WHEELER** (e-mail bwheeler@navajo.astate.edu) Environmental Sciences Ph.D. Program, P.O. Box 847, Arkansas State University, State University, Arkansas 72467 and **STANLEY E. TRAUTH** (e-mail strauth@navajo.astate.edu) Department of Biological Sciences, P.O. Box 599, Arkansas State University, State University, Arkansas 72467, USA.

GYMNOPHIONA

ICHTHYOPHIS KOHTAOENSIS (Kho-Tao Caecilian). **MAXIMUM LENGTH**. Taylor (1969. Univ. Kansas Sci. Bull. 48:297–305) gave a total length of 330 mm for an adult *Ichthyophis kohtaoensis*. He classified the caecilian as a rather large ichthyophiid (Taylor 1968. The Caecilians of the World. Univ. Kansas Press, Lawrence. 845 pp.). We found two gravid females reaching a total length of almost 400 mm. The first female (TL 398 mm; 60.5 g) was captured on 23 January 2000 near the city of Khemerat (Province Ubon Ratchathani, Northeastern Thailand, 16°5'N, 105°15'W). It was excavated from the soil near a small brook (depth 12 cm, soil temp 21°C). The second specimen (TL 396; 57.2 g) was found on 23 September 2000 on a road near a suburb of Hat Yai (Province Songkhla, Southern Thailand, 6°55'N, 100°15'W).

Submitted by **ALEXANDER KUPFER**, TU Darmstadt, Institut für Zoologie, AG Himstedt, Schnittspahnstr. 3, D-64287 Darmstadt, Germany (e-mail kupfer@hrz3.hrz.tu-darmstadt.de) and **HENDRIK MÜLLER**, Museum für Naturkunde der Humboldt Universität zu Berlin, Institut für Systematische Zoologie, Invalidenstr. 43, D-10115 Berlin, Germany (e-mail hendrik.mueller@rz.hu-berlin.de).

TESTUDINES

CARETTA CARETTA (Loggerhead Sea Turtle). **ABNORMAL NESTING BEHAVIOR**. Loggerhead sea turtles have very stereotypical nesting behaviors (Hailman and Elowson 1992. Herpetologica 48:1–30). After a female has dug the nest chamber, she lays her eggs, fills the chamber with sand, camouflages the nest, and returns to sea. Herein we report unusual nesting behavior observed in two loggerheads nesting on Busca Vida Beach, Bahia, Brazil. These turtles dug an egg chamber and commenced ovipositing, then started covering the eggs with sand only to stop and recommence ovipositing. This procedure was repeated ca. five times by one female and ca. nine times by the other female. The straight carapace lengths (= distance from middle of nuchal to pygal tip) of the loggerheads were 95.3 cm and 90.1 cm. The larger female laid a clutch of ca. 145 eggs including one unusually large egg, which was broken by her hind flippers, and an abnormal L-shaped egg that measured ca. 14.6 cm in length. The smaller turtle laid ca. 127 eggs, two of which were joined together. Fourteen broken eggs were found in the larger clutch, and one broken egg was found in the smaller clutch. The females broke the eggs with their flippers. No data on hatching success are available.

Some chelonians such as the map turtle, *Graptemys geographica*, separate egg layers with thin layers of mud (Ernst and Barbour 1972. Turtles of the United States. University of Kentucky Press, Lexington, Kentucky. 347 pp.; Ehrenfeld 1979. *In* Harless and Morlock [eds.], Turtles: Perspectives and Research, pp.417–434. Wiley and Sons, New York), but this behavior has been recorded only once for sea turtles (Caldwell 1962. Quart. J. Florida Acad. Sci. 25:287–302). Caldwell (*op. cit.*) recorded similar behavior in two loggerheads on Jekyll Island, Georgia, but these turtles only separated two layers of eggs by one layer of sand. Caldwell (*op. cit.*) hypothesized that these animals were young, inexperienced nesters because of their small body sizes, small clutches, early nesting, and unusual behavior. However, the body size and clutch size of the larger female we observed do not support this hypothesis. The mean carapace length reported for the Brazilian loggerhead population is 92.9 cm and the mean clutch size is 130.5 eggs (Tiwari and Bjorndal 2000. Herpetologica 56:343–356). Additionally, the smaller female had been observed to produce a normal nest two weeks prior to this event.

Shifts among the phases of the nesting sequence may result from external stimuli (Hailman and Elowson, *op. cit.*). For instance, the shift from digging the egg chamber to ovipositing is apparently triggered when the hind flippers come up without sand on at least two consecutive digging attempts. Termination of oviposition may be controlled by an external stimulus when the cloacal tip touches the egg pile, or by an internal stimulus, possibly depletion of eggs (Hailman and Elowson, *op. cit.*). It is difficult to ascertain what triggered the aberrant behavior we observed.

Submitted by **MANJULA TIWARI**, Archie Carr Center for Sea Turtle Research, University of Florida, P.O. Box 118525, Gainesville, Florida 32611, USA, and **ALEX SILVEIRA**, Fundação Pró-Tamar, Caixa Postal 2219, Salvador, Bahia, CEP 40210-970, Brazil.

CHELONIA MYDAS* and *CARETTA CARETTA (Green Turtle and Loggerhead Turtle). **OUT-OF-SEASON TAG RETURNS**. During the early and mid-1980s a number of hatchling sea turtles were head-started as part of a sea turtle project operated by The Conservancy of Southwest Florida. The hatchlings released as a result of this program included both green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles.

On 12 November 1984, 6 seven-week old green turtles were acquired from The House of Refuge at Jensen Beach, on Florida's Atlantic Coast. Their straight carapace lengths (SL) and weights were 7.1–7.4 cm and 54–56 g, respectively. They were raised in captivity until 8 May 1985, when all six were released just south of Wiggins Pass in Collier Co., Florida, USA. The smallest, NNK880, measured 13.2 cm SL, 10.54 cm straight width, and weighed 344.2 g. This animal was recaptured ca. 27 October 1998, ca. 2 km off the Cuban coast and ca. 2 km north of Purta Lucrecia (Fig. 1). The captors considered the animal to be in 'good health' with an estimated weight of 45 kg.

While information on long-distance tag returns is received only sporadically, such data provide insight into the location of areas that may afford suitable foraging habitat for both juvenile (NNK880) and adult turtles. Tag returns from loggerhead turtles captured in Cuba and Mexico suggest that a percentage of the post-nesting females from Florida's southwest coast migrate to these

TABLE 1. Non-nesting loggerhead tag returns from Southwest Florida, USA.

Tag # tagged	Date	Location tagged	Date recaptured	Country
AAV836	26 Jun 87	Keewaydin Is.	1 Nov 88	Cuba
PPS574	29 July 88	Casey Key	9 Jan 91	Mexico
QQE610	24 July 90	Casey Key	15 Mar 96	Cuba
QQP188	8 Jun 93	Manasota Key	14 Sept 93	Cuba

areas after the reproductive season (Table 1). Fig. 1 depicts the approximate locations where these turtles were captured. Unfortunately, the information on the tag return from Mexico indicated only that the animal had been captured off the coast of Yucatan.

The data from these tag returns provide some insight into the migratory movements of post-nesting loggerheads from southwest Florida. In particular, the extent and geographic location of the Cuban coastline suggest that it offers suitable foraging habitat for at least some portion of the loggerhead turtles that nest in southwest Florida. Though limited in number, the tag return data presented here support this suggestion. Undoubtedly, studies utilizing satellite telemetry will more clearly delineate the migratory routes and foraging areas of the loggerhead turtles which nest on Florida's west coast. From another perspective, this information is also valuable in that it clearly demonstrates the need for international cooperation when addressing conservation issues related to sea turtle protection. Without such cooperation, sea turtle populations worldwide are more likely to face an uncertain future.

We thank Jerris Foote (Mote Marine Laboratory) and John McCarthy (Sarasota County Community Services, Parks and Recreation Unit) for allowing us to use their tag return data. We also thank Julio Gomez Gonzalez, Carlos Tamayo Hernandez, and Jose Ottenwalder for their willingness to send the tag data from the recaptured turtles to the National Marine Fisheries Service in Miami. Thanks to the many field technicians and volunteers who, over the years, have tagged many turtles on nesting beaches in southwest Florida. We also appreciate the assistance of Peter Eliazar of the University of Florida's Archie Carr Center for Sea Turtle Research.

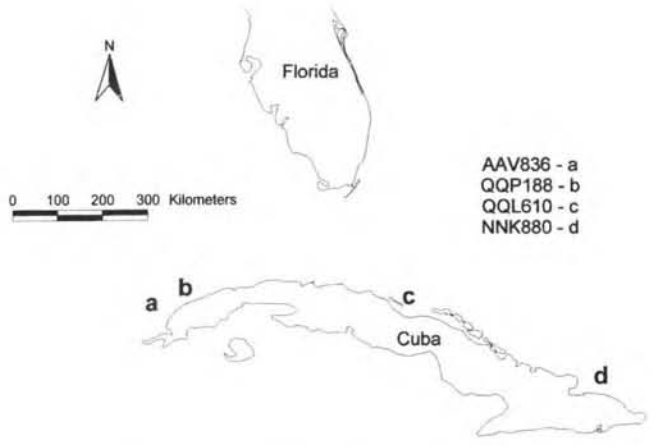


FIG. 1. Map indicating capture locations of tagged sea turtles.

Submitted by **DAVID S. ADDISON**, The Conservancy of Southwest Florida, 1450 Merrihue Drive, Naples, Florida 34102, USA (e-mail: davea@conservancy.org), and **MAURA KRAUS**, Collier County Natural Resources Department, 3301 East Tamiami Trail, Naples, Florida 34112, USA (e-mail: MauraKraus@colliergov.net).

TRIONYX MUTICUS (Smooth Softshell Turtle). **FORAGING.** At 1000 h on 24 June 1998, I observed through binoculars 10 softshell turtles, *Trionyx muticus* and *T. spiniferus*, in the Canadian River at the NM 419 bridge in San Miguel County, New Mexico, USA. I hand captured two of the *T. muticus*, a male 80 mm plastron length and a juvenile female 88 mm plastron length, in a small (~1 x 3 m), shallow sandbar pool separated from the main stream by ca. 10 m. Also in the pool were one partially eaten fresh carcass of a hatchling cliff swallow (*Petrochelidon pyrrhonota*), on which the turtles were observed feeding, and two cliff swallow eggshells. Another freshly killed hatchling cliff swallow was on the sand ca. 30 cm from the pool. *Trionyx* tracks led from the pool to and around the partially eaten carcass. Both the hatchlings and eggshells apparently had fallen from the numerous active cliff swallow mud nests attached to the underside of the bridge directly above.

Although *Terrapene carolina* is known to feed on passerine birds killed at TV towers (Alsop and Wallace 1978. J. Tennessee Acad. Sci. 53:134), the identified prey in most reports of turtles eating birds are young waterfowl (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington D.C. 578 pp.). Smith (1956. Handbook of Amphibians and Reptiles of Kansas, Univ. Kansas Mus. Nat. Hist. Misc. Publ. No. 9) stated that the diet of *Trionyx muticus* included "perhaps young birds." However, Webb (1962. Univ. Kansas Publ. Mus. Nat. Hist. 13:429–611) thought Smith's statement erroneous and in fact likely referred to waterfowl eaten by *T. ferox*, as they are known to do (Webb, *op. cit.*). *Trionyx muticus* is known to feed on a large variety of terrestrial and aquatic invertebrate, vertebrate, and plant prey (Webb, *op. cit.*; Plummer and Farrar 1981. J. Herpetol. 15:175–179). For male *T. muticus* in the Kansas River, >65% of the diet consisted of terrestrial invertebrates that had fallen into the water (Plummer and Farrar, *op. cit.*). Feeding on hatchling terrestrial birds appears to be yet another expression of the highly opportunistic feeding behavior of this primarily carnivorous species.

I thank Charles Painter for comments on the manuscript.

Submitted by **MICHAEL V. PLUMMER**, Department of Biology, Box 12251, Harding University, Searcy, Arkansas 72149, USA.

CROCODILIA

ALLIGATOR MISSISSIPPIENSIS (American Alligator). **WINTER MORTALITY.** Restoration of the American alligator within its presumed historical range in Arkansas began following its protection in 1972 and extended through the early 1980s (Arkansas Game and Fish Commission [AGFC], unpublished data). Approximately 2800 alligators were released into 42 Arkansas counties, producing an enhanced species range (see Conant and Collins. 1991. Reptiles and Amphibians of Eastern and Central North

America. Third Edition. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.) that far exceeds the currently-depicted natural distribution in the state (Ross and Ernst 1994. Cat. Amer. Amph. Rept. 600.1–600.14).

On 17 March 2001, at ca. 1630 h, an adult male *A. mississippiensis* measuring 312 cm in length was found dead within the riparian zone of Buffalo Slough, a tributary of the Cache River, 2.4 km SW of Egypt (T14N, R1E, S14), Craighead County, Arkansas, USA. This location lies at the northwestern extreme of the species' range in the United States (Conant and Collins, *op. cit.*). The alligator, discovered by two local youths (Joey Graham and Tim Lamb), was reported to an AGFC wildlife officer (Butch Wilkins) who immediately transported the specimen to Arkansas State University within the same county. The specimen, which had begun necrosis but exhibited no external wounds or signs of decay, was placed in a freezer at the Department of Biological Sciences at 2030 h. AGFC biologist Sam Barkley (who was involved with the alligator restocking program and who examined the specimen), stated that this alligator was not one of the original juvenile specimens released in this part of the state. Presumably, the animal died from exposure during a flooding episode and subsequent cold snap that occurred in the area one week prior to its discovery. This alligator represents the largest specimen ever reported from northeastern Arkansas.

The alligator was deposited into the Arkansas State University Museum of Zoology herpetological collection (ASUMZ 25591). We thank Sam Barkley for allowing us to salvage the alligator and for providing insight into its demise.

Submitted by **STANLEY E. TRAUTH** and **MALCOLM L. McCALLUM***, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467-0599; *Address of MLM: Environmental Science Ph.D. Program, P. O. Box 847, Arkansas State University, State University, Arkansas 72467, USA (e-mail [SET]: strauth@mail.astate.edu).

PALEOSUCHUS TRIGONATUS (Schneider's Smooth-fronted Caiman) **NESTING.** Natural history and nesting patterns of forest-dwelling caimans is remarkably lacking due to the difficulty of finding and studying these animals in their remote habitats. In this contribution we document the characteristics, development, and hatching of a *Paleosuchus trigonatus* nest found near the Tiputini River in the Ecuadorian Amazon Basin.

The nest was discovered serendipitously on 30 September 1999 while walking in a sector of *terra firme* forest at least 2 km away from the main river and 4.5 m from a shallow stream ca 1 m wide. The nest was at the base of a tree that had a broken branch, producing a gap in the canopy. This resulted in the nest being located under ca. 82% canopy coverage in the area that received the most direct sunlight.

The nest was built with decomposing leaf litter, small branches, and soil. Small roots were found throughout, indicating that it was not recently constructed. The nest was of typical size for caimans, with a diameter of 1.40 m, and a height of 39 cm. The egg chamber was located in the center of the leaf pile and was 18 cm long, 22 cm wide, and 31 cm deep at its deepest point. The nest contained 16 fertile eggs that were on average 68.65 ± 3.3 cm long, 43.61 ± 0.61 cm wide and 73.75 ± 3.11 g in weight; and one infertile egg that was 50.8 cm long, 41.7 cm wide and 47 g. By the time of discovery, no band was evident when examining the eggs against a flashlight, but they were opaque enough to assume that the eggs were developing. The bands probably went all the way to the poles.

Daytime temperature was monitored regularly during the first month showing an average of 27°C on the surface and 30°C at the egg chamber. On 27 November the nest was found to have hatched. All the eggs appeared to have hatched successfully (the infertile egg was removed upon discovery). In the shells there were numerous ants that were eating the remains of blood and yolk attached to the shells, which suggests a very recent hatching (probably the previous day at the earliest). On 19 March 2000 we found five juvenile dwarf caimans within 100 m from the nest (see measurements in Table 1) and no other crocodilian was found in the creek.

The juveniles were found spread out in both directions of the creek, not clumped in a group and when they were caught they were very feisty and not prone to exhibit distress calls, unlike other juvenile caimans. Day and night surveys of the small creek as far as 500 m in both directions failed to reveal the presence of any adult caiman suggesting that the female did not guard the nest or neonates.

It is difficult to speculate about the survival of the clutch as there was a large flood at about the time of hatching (and before we found the hatchlings) that could have moved some of the hatchlings down the river. However, tiger herons (*Tigrisoma lineatum*) do occur in the area and were often seen in this same habitat in hunting position. It is interesting that the placement of the nest was right below a gap in the canopy such that it received direct sun during some hours of the day. Such combination of a gap in the canopy and proximity to a creek might be important cues that the female uses in order to built a successful nest.

Data were collected during the activities, and as a byproduct, of a course in tropical ecology offered by Boston University and Universidad San Francisco de Quito at Tiputini Biodiversity Station. We thank Mayer Rodriguez, Hendry Navaez, Franklin Narvaez, Jaime Guerra, and Bradley Kline for their help in the field, and K. Swing, T. Kunz, and D. Romo for editorial comments on the manuscript.

TABLE 1. Mean measurements, standard deviation, minimum and maximum measurements of 5 juvenile *Paleosuchus trigonatus* found in the basin of the Tiputini River in the Ecuadorian Amazon. SVL = Snout-vent Length, TL = Total Length, HL = Head Length, HW = Head Width.

	Weight (g)	SVL (cm)	TL (cm)	HL (mm)	HW (mm)
Mean	103	17.34	31.62	52.65	20.83
SD	13.27	0.67	1.14	1.5	1.85
Min	85	16.1	29.9	50.09	17.28
Max	120	18	32.8	54.21	22.27

Submitted by **JESÚS A. RIVAS**, **SEVIMA A. AKTAY**, and **RENEE Y. OWENS**, Venezuela Nature Tours, 17126 Lawson Valley Road, Jamul, California 91935, USA.

PALEOSUCHUS TRIGONATUS (Schneider's Smooth-fronted Caiman). **HABITAT**. Current information on the habitat of *Paleosuchus trigonatus* indicates that, in the central Amazonia region of Brazil, this species is restricted to small forest streams. Magnusson (1985. Amazoniana 9:193–204) suggested that individuals of this species are found in large rivers only near the mouths of small forest streams and that such individuals may be transient or might be colonizing habitats from which other species have been extirpated by humans and that most such transients should be juveniles and adult males (Magnusson 1985, *op. cit.*; 1989. *In* Crocodiles: Their Ecology, Management and Conservation, pp. 101–109. Spec. Publ. IUCN/SSC Crocrocodile Specialist Group). Here I report on the presence of several male and female *P. trigonatus* on a medium-sized river (20–40 m wide) in central Amazonia. These observations were made while accompanying the Waimiri Atroari Indians on hunting trips as part of my Ph.D. fieldwork on subsistence hunting and its effects on wildlife populations.

The Alalaú (00°19'072"S, 60°18'359"W) is a navigable river located almost entirely inside the Waimiri Atroari Indigenous Reserve. Several rapids and waterfalls are present along its course and are visible during the low water periods in the region (September to January). The shore consists primarily of "terre firme" (upland) forest. Lakes occur only at the river mouth and there is a portion of flooded forest (Igapó forest) located 20 km downstream from where my observations took place. *Caiman crocodilus crocodilus*, *P. palpebrosus* and *Melanosuchus niger* also occur inside the Reserve area but *M. niger* is not found in the portion of the river where these observations were made. *Caiman c. crocodilus,* and *P. palpebrosus* are known to occur only in the Igapó forest. All caiman species are eaten without preference by the Waimiri Atroari.

On the night of 14 September 1999, four Waimiri Atroari Indians and I canoed a 7 km section of the Alalaú River, located nearly 100 km upstream from the river mouth, in search of caimans. Estimated river width ranged from 20 to 30 m in this portion of the river. Hunting took place from 1935 h to 0100 h. Caimans were sighted with the help of hand lights and killed with harpoons and shotguns (16–20 gauge). Fourteen caimans were spotted and the Indians managed to kill six, all of which were *P. trigonatus*. This sample consisted of four males and two females. The size of the individuals killed indicated the presence of juvenile and adult males and females in the Alalaú River (Males TL [cm]:157, 121, 136, 113; females: 100, 103). Three out of four caimans killed by the Waimiri Atroari in a separate hunting trip in the Igapó forest (20 km downstream) in September 1998 were male *P. trigonatus* (3.5, 7.6 and 9 kg) indicating that this species also occurs here. The fourth individual was *P. palpebrosus.*

These observations agree with some of Magnusson's findings (Magnusson 1985, *op. cit.*) at least regarding the Igapó forest. The frequent occurrence of adult male and female *P. trigonatus* in a large river surrounded by "terra firme" forest, however, indicates that this species may occur in broader habitat types in the central Amazon region than previously thought. In Suriname, adult *P. trigonatus* are known from large rivers (Ouboter 1996. Ecological Studies on Crocodilians in Suriname: Niche Segregation and Competition in Three Predators. SBP Academic Publishing, 147 pp.), much like my observations here.

Caiman crocodilus crocodilus seemed to be much rarer in this part of the river than in portions close to the mouth and in other rivers inside the Reserve where I did some night searches. Data on habitat characteristics of *C. c. crocodilus* for the central Amazon region indicate that this species prefers open, grassy habitats (Ouboter 1996, *op cit.*). These habitats are not present in the upper Alalaú River where *P. trigonatus* were hunted. Although in Suriname *P. trigonatus* and *C. c. crocodilus* are found syntopically in some places, habitat segregation between these species implies competition (Ouboter 1996, *op.cit.*). In the case of the Waimiri Atroari area, the absence of suitable habitat for *C. c. crocodilus* in some portions of the Alalaú River might have favored the occurrence of a population of *P. trigonatus* in a large river.

I thank the Waimiri Atroari people for kindly allowing me to work in their area and participate in their hunting trips, and Bill Magnusson for revising the manuscript. Part of this research was funded by the Brazilian Research National Council (CNPq) and by the World Wildlife Fund-Programa Natureza e Sociedade.

Submitted by **ROSÉLIS REMOR DE SOUZA-MAZUREK**, Department of Biological Sciences, University of Illinois Chicago, 845 West Taylor Street, Chicago, Illinois 60607-7060, USA.

LACERTILIA

ANOLIS LOYSIANUS (NCN). **DIET**. *Anolis loysianus* is endemic to Cuba, found islandwide, but is scarce. Its food habits in nature are unknown (Rodríguez Schettino 1999. *In*: L. Rodríguez Schettino [ed.], The Iguanid Lizards of Cuba, University Press of Florida, Gainesville. 384 pp.). Reviewing the herpetological collection of the Instituto de Ecología y Sistemática, La Habana, Cuba, I found three female *A. loysiana* (CZACC 4.1603–4.1605) which were collected on 20 October 1956, at Soroa, Sierra del Rosario, Pinar del Río province (22°47'N, 83°01'W). Because of the scarcity of information regarding this species, I examined the stomach contents of these three specimens.

The lizards were measured (SVL, head length [HL], and head width [HW]) and dissected to open the stomach. Prey items were identified to the lowest taxon possible. For each food item obtained I measured length using an ocular micrometer.

The lizard measurements (mm) are as follows: specimen 4.1603

TABLE 1. Prey items consumed by three female *Anolis loysiana* from Soroa, Sierra del Rosario, Pinar del Río province, Cuba. Numbers indicate the number of items found in each lizard (length of the items in mm).

Prey Type	Lizard Specimen Number		
	CZACC 4.1603	CZACC 4.1604	CZACC 4.1605
Hymenoptera:			
Formicidae	6 (1.5)		4 (1.5)
Coleoptera:			
Cucujidae	1 (1.5)		
Cantharidae		1 (5.0), 1 (6.0)	
unidentified		3 (2.0)	
Larva	1 (4.0)		
Arachnida:			
Araneae			1 (3.0)
Pseudoscorpionida	1 (3.0)		

(SVL = 37.5, HL = 10.7, HW = 7.3); specimen 4.1604 (SVL = 37.1, HL =11.0; HW = 7.3); specimen 4.1605 (SVL = 40.5, HL = 11.3, HW = 7.7). All of these specimens were considered adults, as the smallest had one egg in its right oviduct (4.4 mm long, 3.0 mm wide).

The dietary data obtained are presented in Table 1. Ants (Hymenoptera, Formicidae) were the most frequently consumed prey (10 items in two lizards), followed by Coleoptera (7 items in two lizards). In this very small sample, the largest female ate the smallest prey, and the smallest lizard, the biggest prey. This is contradictory to the general rule that predator and prey sizes are positively correlated (Schoener 1971. Ann. Rev. Ecol. Syst. 2:369–404), but the small sample size must be taken into account.

I thank Ileana Fernández García for identification of the prey items and Ada Chamizo Lara, Vilma Rivalta González, and Luis de Armas Chaviano for their helpful comments on the manuscript.

Submitted by **LOURDES RODRÍGUEZ SCHETTINO,** Departmento de Vertebrados, Instituto de Ecología y Sistemática, C. de Varona km 3.5, Boyeros, CP 10800, AP 8029, La Habana, Cuba; e-mail: ecologia@unepnet.inf.cu.

ANOLIS MESTREI (NCN). **THERMAL HABITAT.** *Anolis mestrei* is an interesting and beautiful species that lives mainly on rocks in shaded sites of the westernmost region of Cuba. The only previous data concerning temperature preperences of this endemic to Cuba is the mean air temperature of 26°C at Sierra de la Güira in April (Rodríguez Schettino 1999. *In*: L. Rodríguez Schettino [ed.], The Iguanid Lizards of Cuba, University Press of Florida, Gainesville. 384 pp.).

During field work at Soroa, Sierra del Rosario, Pinar del Río Province (22°47'N, 83°01'W) on 15 June 1995, between 1100 h and 1400 h, we captured a small sample of *A. mestrei*. The collecting site is a secondary evergreen forest, very wet and shaded, with limestone cliffs and outcrops running along the Manantiales River.

Lizards were captured and their body temperatures were obtained with a cloacal quick-reading thermometer (0–50°C) at the place of capture. Using the same thermometer, the air temperature was obtained as near as possible to the site that each lizard was first seen. Additionally, the type of substrate and the illumination condition over the site were recorded for each lizard, seen or captured. No running or escaping lizards were considered for the temperature analysis.

Lizards were found on rocks (79%) and on tree trunks adjacent to cliffs (219%). All but two lizards were seen in shaded sites. The two not found in shaded sites were both males found under filtered sun.

There were no statistically significant differences between air and body temperatures for males or females, or between sexes (Table 1). This suggests that *A. mestrei* is a thermopassive lizard that maintains its body temperature passively from its thermal habitat in a place where the cost of thermoregulation should be high due to a scarcity of available sites for basking.

We thank Kevin de Queiroz and Jonathan B. Losos for logistical support of this research and Vilma Rivalta González and Luis F. de Armas for their useful comments on the manuscript.

Submitted by **LOURDES RODRÍGUEZ SCHETTINO** and **ADA R. CHAMIZO LARA,** Departmento de Vertebrados, Instituto de Ecología y Sistemática, C. de Varona km 3.5, Boyeros, CP 10800, AP 8029, La Habana, Cuba; e-mail: ecologia@unepnet.inf.cu.

TABLE 1. Air temperature and body temperature in °C for male and female *Anolis mestrei* from Soroa, Pinar del Río province, Cuba. N = number of lizards; Sx = standard error of the mean; *p* = probability of error (from estimated Student t-test); s = significance; n.s. = no significant difference; numbers between parentheses = range of temperatures.

	Air Temperature			Body Temperature				
Males	N	Mean	Sx	N	Mean	Sx	*p*	s
	7	28.1 (26.2–29.6)	0.39	7	28.2 (26.4–29.4)	0.40	0.18	n.s.
Females	8	28.2 (26.2–28.8)	0.30	8	28.0 (27.4–28.8)	0.15	0.59	n.s.

ANOLIS SAGREI (Brown Anole). **PREDATION.** I witnessed an adult great egret (*Casmerodius albus*) foraging on *Anolis sagrei* lizards in a flower bed between a busy Publix grocery store parking lot and U.S. 441 near the junction of NW 39th Avenue, Gainesville, Florida, USA, on 3 November 2000. My attention was drawn initially to the bird at 0955 h (EST) as it moved through a bed of giant border grass (*Liriope muscari*). I walked within 5 m of the animal, after realizing it was feeding on lizards that it grabbed from the leaves of these 0.8 m tall plants. The egret was deliberate in its movements as it stalked each lizard. It moved between the rows of plants and grabbed and swallowed four, live, medium-sized lizards, either non-territorial males or mature females, within 5 minutes. The bird wandered off at 1000 h, continuing its foraging behavior, along a 1.3 m tall, severely-trimmed hedge row of Indian hawthorn (*Rhaphiolepis* cf. *indica*) immediately adjacent to the parking lot. Neither my presence, nor that of traffic in the parking lot or the busy street, seemed to affect the bird's behavior. The most striking aspect of this observation was that this native wading bird was feeding on an exotic lizard, in exotic vegetation, in a completely exotic terrestrial environment, near an active parking lot and one of the busiest roads in Gainesville, Florida.

I thank Barry Davis, Herbarium, Florida Museum of Natural History, for plant identifications.

Submitted by **RICHARD FRANZ**, Florida Museum of Natural History, University of Florida, P.O. Box 117800, Gainesville, Florida 32611-7800, USA; e-mail: dfranz@flmnh.ufl.edu.

CTENOSAURA OEDIRHINA (Roatán Spiny-Tailed Iguana). **BEHAVIOR.** During habitat surveys for reptiles on 4 July 2000 at ca. 1100 h, we searched a portion of the mangrove swamps on the eastern end of Isla Roatán, Islas de la Bahía, Honduras. The particular area where we made our observations is on the island's southern shore near the center of the mangrove expanse (ca. 4 km

x 2 km). According to our boat captain, this is an area rarely, if ever, visited by humans because of the lack of economically attractive features and a high density of biting sand flies. During our foray deeper into the mangrove growth, we encountered a group of ca. six *Ctenosaura oedirhina* of various sizes which were basking on mangrove branches and the sandy substrate. Our arrival was quiet enough to allow us to come within ca. 10 m of one of the larger individuals. When it became aware of the intrusion, it issued a loud squawk from its basking position on the sandy substrate, turned, and fled through a shallow saltwater pool (depth ca. 0.3–0.7 m) into a waterlogged cluster of mangrove roots, where it disappeared from sight. At the issuance of the squawk by the first individual, all other individuals fled, some splashing through the same saltwater pool as the squawker, some along mangrove branches. Based on the sequence of events, we consider the escape of the group to be a direct result of the vocalization, and not of our movement or the movement of the vocalizing individual. The total time elapsed from vocalization to disappearance of the last animal from sight was less than 15 s.

Our observation of a vocalization by a spiny-tailed iguana is unusual for three reasons. Firstly, iguanas in general are not known to issue vocalizations of any kind, even when in distress from predator pressure. If any vocalization such as the one we observed should occur in green iguanas, for example, it should have been noticed by iguana researchers and hunters throughout the neotropics. In work with *Ctenosaura similis*, Paul Gier (pers. comm.) observed only hissing during handling and observed no vocalizations during male combat or reproductive behaviors. Secondly, the use of this vocalization as an apparent warning cry may indicate a greater degree of social involvement by these iguanas than previously assumed. Sudden appearance of a predator in *C. similis* habitat results in the scattering behavior we observed (Paul Gier, pers. comm.), but this response was presumably the result of individual positioning and visual contact with the predator, as observed in *C. pectinata* (Richard Durtsche, pers. comm.), and not caused by a warning call. It is possible that a vocalization is advantageous to *C. oedirhina* for timely escape in a habitat comprising dense mangrove root tangles and foliage that impede the lizards' visual ranges. Lastly, several of the lizards escaped into a saltwater pool whose depth could only be overcome by noisy splashing and floating towards a root tangle on the far side of the pool. Based on the habitat substrate characteristics, it was obvious that the entire mangrove patch was occasionally inundated by salt water, though it was above the regular tide line. A certain degree of tolerance to salt water has been described in iguanian lizards that occasionally foray into salty or brackish areas (e.g., *Uta tumidarostra*; Hazard et al. 1998. Copeia 1988:231–234) and this capacity is highlighted by the behavior and food choices of marine iguanas (Wikelski and Hau 1993. J. Biol. Rhythms 10:345–360). In order to be effective in this type of mangrove habitat, this population of *C. oedirhina* has an obvious advantage if it is better adapted to salty conditions, since much of its food source and much of its activity revolve around salty conditions. Escape into the dark root tangles makes for an effective hiding strategy as the damp hideaway might prevent potential avian or mammalian predators from further pursuit.

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Submitted by **HINRICH KAISER** (e-mail: hkaiser@lasierra.edu), **CASEY COLE, ALVIN B. MATTESON, THOMAS A. MAYER, AMBER-LOUISE SIMPSON, JULIE D. WRAY**, and **L. LEE GRISMER** (e-mail: lgrismer@lasierra.edu), Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

DRACAENA PARAGUAYENSIS (Paraguayan Caiman Lizard). **REPRODUCTION**. *Dracaena paraguayensis* is one of the largest South American teiids. It is oviparous, with semi-aquatic and semi-arboreal habits. Its diet is very specialized, consisting mainly of large snails (Pough et al. 1998. Herpetology. Prentice Hall, Upper Saddle River, New Jersey. 577 pp.). The genus *Dracaena* contains two species: *D. guianensis* from Amazonian rain forest and *D. paraguayensis*, restricted to parts of the Pantanal subject to flooding by the Alto Paraguai River in the states of Mato Grosso and Mato Grosso do Sul, Brazil and in Paraguay (Vanzolini and Valencia 1966. Arq. Zool. 13:7–35; Strüssmann 1997. Herpetol. Rev. 28:151).

Little is known about the reproductive biology and natural history of these species. The available information concerning *D. guianensis* has been acquired in captivity, including aspects of reproduction (Vanderhaege 1984, Bull. Chicago Herpetol. Soc. 20:56–57), foraging behavior (Vanzolini 1961. Papéis Avulsos Dep. Zool. Sec. Agr. S. Paulo 14[25]:237–242; Vanzolini 1964. Herpetologica 20:207), measurements of eggs (Goeldi 1902, cited in Avila-Pires 1995. Lizards of Brazilian Amazonia. Nationaal Natuurhistorich Museum, Leiden, The Netherlands. 706 pp.). The only report relating to reproduction in *D. paraguayensis* describes courtship behavior (Strüssmann 1997, *op. cit.*).

On 6 February 1999, in the area of Jacadigo Bay, municipal district of Corumbá (19°01'S, 57°38'W), western Pantanal of Mato Grosso do Sul, David de Almeida and Luís Wagner de Almeida collected five *D. paraguayensis* eggs. The eggs were found in the cavity of an inactive termite nest (ca. 40 cm diam) fixed ca. 1.5 m above the soil to a tree regionally called "canjiqueira" (*Byrsonimia*, Malpighiaceae). According to the collectors, the location of the tree is not subject to flooding, but it is close to Jacadigo Bay.

I measured the mass, length, and width of the eggs. The eggs of *D. paraguayensis* appear similar to those reported for *D. guianensis* by Vanderhaege (1984, *op. cit.*) and Goeldi (1902, cited in Avila-Pires, *op.cit.*) (see Table 1).

The eggs were incubated in a lidded, plastic container, semi-buried in moist powdered "xaxin." An external lamp was used as a heat source and the container was regularly monitored to check humidity, temperature and presence of fungi in the substrate. The substrate was replaced twice when a proliferation of small insects was detected. Two eggs, which seemed dehydrated when found, subsequently turned a dark and were attacked by fungi and small insects. These were removed from the container and dissected on 19 April (after ca. 73 days). I verified that they contained no embryos.

The three remaining eggs hatched on 7, 8 and 11 June, at 121, 122 and 125 days after the eggs were collected. It is important to note that since the date of oviposition is not known, we can only

TABLE 1. Measurements of eggs from *Dracaena paraguayensis* (N = 5) and *D. guianensis*. Data are mean (range, standard deviation).

	D. paraguayensis (N = 5)	*D. guianensis* (N = 5)*	(N = 2)**
Length (mm)	71.62 (69.7–73.6, SD = 1.61)	75	74.5
Width (mm)	37.5 (36.27–38.52, SD = 0.92)	32	38.25
Mass (g)	54.71 (53.83–55.48, SD =0.69)	—	—

* Goeldi (1902 cited in Avila-Pirea 1995. Lizards of Brazilian Amazonia. Nationaal Natuurhistorich Museum, Leiden, The Netherlands. 706 pp.).
** Vanderhaege (1984. Bull. Chicago Herpetol. Soc. 20[2]:56–57).

infer that the incubation time of the eggs of *D. paraguayensis* is at least four months. At hatching, the hatchlings were not aggressive and were easily handled. An "egg tooth" remained for nearly seven days. At hatching and after ca. 70 days, the following measurements were taken: head length (from anterior edge to the posterior area of the tympanum), SVL, tail length, TL, and body mass (see Table 2).

The aquatic gastropods *Pomacea caniculata* and *P. scalaris* (Pulmonata) were used as food for the hatchlings. These snails are found in great abundance in the area where the eggs were collected and the probability that they constitute the main dietary resource of *Dracaena* in its natural environment is high. Mollusks offer high protein and caloric content (Bezerra et al. 1997. Rev. Cient. UFMS 4[1]:10–17). All three specimens are being maintained in the zoology laboratory of Centro Universitário de Corumbá (UFMS).

Eggs found inside termite nests were also reported for *D. guianensis* (Goeldi 1902, cited in Avila-Pires, *op. cit.*). Oviposition inside termite nests is common among Neotropical lizards (Fitch 1970, Univ. Kansas Mus. Nat. Hist. Misc. Publ. 52, 247 pp.). Since this is the first report of oviposition of *Dracaena* in a natural environment, it is important that further studies be made before assuming that this is a pattern for the genus.

Two eggs of *D. guianensis* laid in captivity hatched with incubation times of 179 and 192 days (mean of 185 days or about six months), with hatchlings measuring 260 and 270 mm TL and each weighing 28 g (Vanderhaege 1984, *op. cit.*). These hatchlings were smaller than the *D. paraguayensis* reported here (compare with Table 2).

TABLE 2. Measurements of hatchlings from *Dracaena paraguayensis* (N = 3). Data are mean (range, standard desviation). All length measurements in mm.

	First day	After 70 days
Body mass (g)	53.7 (52.3–54.5, SD = 1.26)	66.7 (57.1–72.5, SD = 8.42)
Head length	35.5 (35–36, SD = 0.71)	38.37 (36.99–39.54, SD = 1.29)
Snout–vent length	109 (105–115, SD = 5.13)	128 (120–135, SD = 7.64)
Tail length	177.7 (176–179, SD = 1.53)	202.67 (188–210, SD = 12.7)
Total length	287 (281–293, SD= 6)	331 (308–345, SD= 20.1)

The reproductive activity and cycle of *D. paraguayensis* are unknown. Courtship behavior was observed in January (Strüssmann 1997, *op. cit.*). No information regarding development period before oviposition, number of eggs, or number of clutches per reproductive season is known. Considering Strüssmann's observation, we can infer that oviposition would occur in the middle of the year and that a second reproductive attempt is possible. In the Pantanal, the climate is typically tropical with winter being dry and warm. Even though there is little rainfall in the winter, there is still a period of flooding, which could induce a second reproductive attempt. Cases of more than one annual reproductive investment are expected in the tropics (Fitch 1970, *op. cit.* and Pough et al. 1998, *op. cit.*) but further studies on the biology of the species should be carried out to determine if this is true for *Dracaena*.

I thank David de Almeida and Luís Wagner de Almeida for collection of eggs; Christine Strüssmann for incentive and providing important literature; José Ragusa Netto for giving suggestions and looking after the hatchlings; Janaína O. Arruda and Simone Y. Benites Silva for laboratory assistence; Maria Angélica O. Bezerra and Iria H. Ishii for loan of equipment.

Submitted by **VANDA LÚCIA FERREIRA**, Depto. de Ciências do Ambiente, Centro Universitário de Corumbá, Universidade Federal de Mato Grosso do Sul, Caixa Postal 252, 79301-970 Corumbá, Mato Grosso do Sul, Brazil; e-mail: vanda@pantanalnet.com.br.

HELODERMA HORRIDUM (Beaded Lizard). **REPRODUCTION.** The purpose of this note is to report on a histological examination of testes from four *Heloderma horridum* and to comment on the reproductive cycle of this species. The beaded lizard is known from the Mexican states of Sonora, Sinaloa, Nayarit, Jalisco, México, Michoacán, Colima, Morelos, Guerrero, Oaxaca, and Chiapas (Flores Villela and Gerez. 1994. Biodiversidad y Conservación en México: Vertebrados, Vegetación y Uso del Suelo, Comision Nacional para el Conocimiento y uso de la Biodiversidad y Universidad Nacional Autónoma de México, 439 pp.). There are reports of mating occurring in the fall (Alvarez del Toro. 1982. Los Reptiles de Chiapas. Tercera Edición, Colección Libros de Chiapas, Serie Especial, Publicacion del Instituto de Historia Natural, Tuxtla Gutiérrez, Chiapas, México, 248 pp.; Ramírez Velázquez and Guichard Romero. 1989. El Escorpión Negro: Combates Ritualizados. Instituto de Historia Natural, Tuxtla Gutiérrez, Chiapas, México, 20 pp.) and male combat in the fall (Beck and Ramírez-Bautista. 1991. J. Herpetol. 25:481–484; Alvarez del Toro, *op. cit;* Ramírez Velázquez and Guichard Romero, *op. cit*). However there is, to our knowledge, no histological information on the time of sperm formation (spermiogenesis).

Testes were formalin fixed and preserved in alcohol. They were dehydrated in ethanol, cleared in xylene and embedded in paraffin. Histological sections were cut at 5 µm and stained with hema-

toxylin followed by eosin counterstain. Two *H. horridum* were from the herpetology collection of the University of Arizona, Tucson, (UAZ). One, UAZ 35420 measured 343 mm, snout-vent length, SVL and was a road-kill collected 4 September 1956, 18 km (by rd) SE Elota, Sinaloa. This testis was undergoing spermiogenesis and the tubules of the epididymis were enlarged and contained sperm. The second, UAZ 37847 measured 320 mm SVL and was collected 3 August 1973, ca. 32 km N Manzanillo, Colima. This testis was in early recrudescence (proliferation of cells for the upcoming spermiogenesis) and contained mainly primary spermatocytes. Testes from two additional *H. horridum* road-kills collected by the junior author were also examined. One, from Alamos, Sonora collected 6 August 1989, measured 355 mm SVL and contained regressed testes with spermatogonia the predominant cells. Some primary spermatocytes were present suggesting the next spermatogenic cycle was starting, but not yet fully underway. Tubules of the epididymis were small and did not contain sperm. The second, from Chamela, Jalisco, measured 444 mm SVL and was collected 1 October 1987. This testis had undergone autolysis making it impossible to interpret cellular composition. However, the large sizes of the seminiferous tubules and great numbers of intratubular cells suggested spermiogenesis was in progress. The vas deferens was packed with sperm.

The finding of one road-kill spermiogenic male from September, along with observations of autumn mating (Alvarez del Toro, *op. cit.,* Ramírez Velázquez and Guichard Romero, *op. cit.*) and male combat (Beck and Ramírez Bautista, *op cit.* Alvarez del Toro, *op. cit;* Ramírez Velázquez and Guichard Romero, *op. cit.)* indicate that *H. horridum* indeed breeds during autumn. This is in marked contrast to the reproductive cycle of the Gila monster, *H. suspectum* in which sperm formation occurs in May and June (Goldberg and Lowe. 1997. J. Herpetol. 31:161–166) and mating occurs in the spring (Lowe et al. 1986. The Venomous Reptiles of Arizona. Arizona Game and Fish Department, Phoenix, 115 pp; Beck. 1990. J. Herpetol. 24:54–68).

We thank Charles H. Lowe (University of Arizona) for permission to examine *H. horridum.*

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA and **DANIEL D. BECK,** Department of Biological Sciences, Central Washington University, Ellensburg, Washington 98926, USA.

MABUYA MACRORHYNCHA (NCN) **ENDOPARASITES**. Reports of helminths infecting the Brazilian skink *Mabuya macrorhyncha* are presently restricted to nematodes (Ribas et al. 1998. An. Sem. Reg. Ecol. VIII, São Carlos - vol. II: 883–894; Vrcibradic et al. 2000. Amphibia-Reptilia 21:307–316). Here we present data on helminths associated with *M. macrorhyncha* from a locality where this species has not yet been studied.

During a study of the herpetofauna of a "restinga" (coastal sandy habitat) area in Trancoso (16°39'S, 39°06'W), Bahia, Brazil, carried out in November 1999, we collected eight adult *M. macrorhyncha* (three males and five females; SVL range 66–77 mm). Seven of them (87.5%) were infected by helminths. The number of helminth species per individual host varied from one to five (most frequently three) and was not related to lizard SVL ($r = 0.18$; $p = 0.7$). Seven helminth species were recovered from the lizards: one acanthocephalan (unidentified Echinorhynchidae; found only as cystacanths), one pentastomid (*Railietiella* sp; found in larval stage), one trematode (*Paradistomum parvissimum*, Dicrocoellidae), one cestode (*Oochoristica ameivae*, Linstowiidae), and three nematodes (*Parapharyngodon sceleratus*, Pharyngodonidae; *Physalopteroides venancioi*, Physalopteridae; and *Hexametra boddaertii*, Ascarididae; the latter found only as larvae). Voucher specimens of helminths were deposited at the U.S. National Parasite Collection (USNPC 90522–5) and at the Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC 34421–3). Data on prevalences and infection intensities (*sensu* Bush et al. 1997. J. Parasitol. 83: 575–583) for each helminth species and their respective sites of infection are given in Table 1. *Mabuya macrorhyncha* represents a new host record for *P. parvissimum*, *O. ameivae*, the genus *Raillietiella* and the family Echinorhynchidae.

In spite of the small sample size, our data suggest that the population of *M. macrorhyncha* studied here has a relatively high frequency of helminth infection, with the nematode *P. sceleratus* and the cestode *O. ameivae* being the most prevalent among them.

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Submitted by **DAVOR VRCIBRADIC, CARLOS FREDERICO D. ROCHA,** and **MONIQUE VAN SLUYS,** Setor de Ecologia, Departamento de Biologia Animal e Vegetal, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-019, Rio de Janeiro, RJ,

TABLE 1. Prevalence (in percentage and absolute values) and intensity of infection (mean ± standard deviation, with range in parentheses) of helminths found in *Mabuya macrorhyncha* (N = 8). Species marked with an asterisk were represented only by immature stages.

Helminth	Prevalence (N)	Mean intensity (range)	Site of infection
Acanthocephala			
Echinorhynchidae*	50.0% (4)	3.0 ± 3.4 (1–8)	Stomach wall
Pentastomida			
Raillietiella sp.*	12.5% (1)	1.0 (0–1)	Encysted near lung
Trematoda			
Paradistomum parvissimum	37.5% (3)	8.7 ± 6.7 (1–13)	Gall bladder
Cestoda			
Oochoristica ameivae	62.5% (5)	9.8 ± 3.9 (6–14)	Small intestine
Nematoda			
*Hexametra boddaertii**	12.5% (1)	8.0 (0–1)	Body cavity
Parapharyngodon sceleratus	75.0% (6)	1.8 ± 1.3 (1–4)	Intestines
Physalopteroides venancioi	12.5% (1)	4.0 (0–1)	Stomach

Brazil, and **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA.

PHRYNOSOMA CORONATUM (Coast Horned Lizard). **PREDATION and TELEMETRY.** As part of a four-year study on the ecology of *Phrynosoma coronatum* on the SW Riverside County Multi-Species Reserve, California, USA, 45 horned lizards were tracked by radio telemetry (PD-2, Holohil Systems, Ltd.). The radios were attached to the lizards using a modified backpack design (Fisher and Muth 1995. Herpetol. Rev. 26:139–140). Rather than gluing the radio to bicycle inner tubing (Richmond 1998. Herpetol. Rev. 29:220–221), the radios were sewn (using Spectrafiber, Izorline Intl.) via suture tubes embedded in the radio to a piece of ripstop nylon, cut slightly larger than the radio (25 x 25 mm). Two 6 mm-wide elastic straps were placed over the shoulders, crossed over the ventrum, wrapped under the opposite leg, and sewn in place to the top of the nylon, adjusting to fit the size of the lizard. The straps were also sewn to each other at the crossover point to prevent the animal's escape.

During the study, several individuals were lost to predation, to both verified and unknown causes. For one lizard, a definitive snake predation was observed. On 3 July 1997, while tracking an adult male (47 g, 80.5 SVL) fitted with our backpack and transmitter, we flushed a large (> 1 m) coachwhip (*Masticophis flagellum)* from under a yellow bush penstemon (*Keckiella antirrhinoides*). The radio signal moved with the snake, for a distance of 6 m, at which point the snake retreated into a wood rat (*Neotoma* sp.) nest and evaded capture. During the next seven days, we located the snake twice in a system of impenetrable rodent holes 59 m from the wood rat nest. On 14 July, the radio backpack unit, apparently defecated, was recovered on the surface within 5 m of this site. No other fecal material was found nearby. The radio and backpack were still connected, although the materials appeared fused in a streamlined, longitudinally elongated shape. Lizard scales and toenails were also found adhered to the backpack (Fig. 1).

On two additional occasions (4 June 1996, female, 54 g, 87.2 mm SVL and 20 August 1997, male, 42 g, 87.2 mm SVL), radio assemblies were recovered from the field with identical characteristics to those seen on 14 July 1997. Although the predators were not observed, we believe these lizards also were eaten by snakes, based on their striking similarity to the verified occurrence. Observed predations of horned lizards by birds leave the radio assembly unmolested and, in some cases, the disemboweled lizard has been found still wearing the backpack.



FIG. 1. Remains of *Phrynosoma coronatum blainvillei*, radio, and backpack defecated by *Masticophis flagellum*.

In contrast to LaBonte (this issue), at least three snakes were able to successfully pass the radio and backpack materials. In light of our observations, radio telemetry studies of small lizards should consider the size and texture of the attachment materials relative to their impact on potential predators.

Submitted by **TANDORA D. GRANT** and **ALLISON C. ALBERTS**, Center for Reproduction of Endangered Species, Zoological Society of San Diego, San Diego, California, 92112, USA; e-mail (TDG): tandora@sandiegozoo.org; (ACA): aalberts@sandiegozoo.org.

PHRYNOSOMA CORONATUM (Coast Horned Lizard). **PREDATION AND TELEMETRY.** During a long-term radio-tracking study of *Phrynosoma coronatum*, a clear case of predation by *Masticophis flagellum* was observed. On 8 July 1998, at the University of California Elliot Chaparral Reserve, adjacent to USMCAS Miramar, San Diego County, California USA, an adult horned lizard (male, 22.5 gm, 78.0 mm SVL), fitted with a backpack (Richmond 1998. Herpetol. Rev. 29:220–221) and radio transmitter (PD-2, Holohil Systems, Ltd.), was located on bare ground in the shade of a chamise bush (*Adenostoma fasciculatum*). On 11 July the lizard's signal was tracked to a rodent hole 187 m from the lizard's previous location. We carefully dug into the rodent hole to ca. 50 cm below the surface and found a large *M. flagellum*. The snake evaded capture by entering a system of rodent holes beneath nearby asphalt. On 13 July the signal was tracked to another rodent hole 173 m from its previous location. We carefully excavated to ca. 25 cm and successfully captured the snake (female, 550 gm, 147 cm SVL). In order to retrieve the transmitter, the snake was retained in captivity. On 15 July the snake was x-rayed to determine the location of the transmitter and backpack in the snake's digestive tract. The x-ray showed the transmitter in the area of the snake's stomach with no discernable evidence of the *P. coronatum*. The snake shed and produced a scat on 22 July. Examination of feces revealed undigested leaf litter and digested animal matter but no signs of the transmitter or backpack. The transmitter could be felt in the snake in the same location as on 15 July. On 10 August the transmitter had not passed and was surgically removed from the snake's stomach. The transmitter and backpack were still attached to each other and, therefore, had caused the whole assembly to become lodged. The snake was allowed to recover in captivity and released at the point of capture in good health on 15 September. On 26 May 1999, it was sighted, identified by the surgical scar, basking on an asphalt road 20 m from its point of capture. The snake appeared to be in good health.

It is apparent from this observation that even a large snake may have difficulty passing a transmitter attached to a backpack. In order to minimize this risk, future designs may attempt to reduce the size of the backpack component when attaching transmitters to lizards.

I thank Ted Case and Andrew Suarez for permitting me to report this observation. Jeff Tracey performed the surgical removal of the transmitter from the snake. Jon Richmond and Sam Sweet provided helpful comments and suggestions.

Submitted by **JOHN P. LABONTE**, Department of Biology, University of California, San Diego, 9500 Gilman Drive, La Jolla, California 92093-0116, USA. Present address: Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara, Santa Barbara, California 93106, USA; e-mail: labonte@lifesci.ucsb.edu.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard). **MOVEMENT**. There have been only two studies that utilized radio-telemetry to track the movements of the Texas horned lizard. Fair and Henke (1999. J. Herpetol. 33:517) tracked 7 lizards for less than 50 days, 3 lizards for 116 days, and 1 lizard for 139 days and Munger (1984a. Oecologia. 62:351–360) tracked 47 horned lizards for up to 72 days. Therefore, although other aspects of this lizard have been widely studied (for review, see Sherbrooke 1981. Horned Lizards: Unique Reptiles of Western North America. Southwest Parks and Monument Assoc., Globe, Arizona. 48 pp.), little information is available on movements of this lizard, particularly in the northern part of its range.

Two lizards (one male, one female) from Two Buttes State Wildlife Area, Prowers County, Colorado, USA, were radio-tracked during the summer of 1997. Holohil BD-2GI (Holohil Systems Ltd., Carp, Ontario, Canada) radios were attached externally on the dorsal surface of the lizards using silicone sealer, similar to Munger (*op. cit.*), but with the antenna extending posteriorly. The silicone method was employed instead of the backpack method (Fisher and Muth 1995. Herpetol. Rev. 26:139–140) to prevent lizards from becoming entangled in vegetation. Although neither of our lizards was lost to predation, this method of radio attachment may also have the advantage of being passable by snake predators (see Fisher and Muth, *op. cit.*; Labonte, this issue). The obvious disadvantage of this method is that the radio is shed with the skin during ecdysis. Lizards were tracked daily or every other day using a Custom Electronics CE12 148MHz to 149.2 MHz radio receiver (Custom Electronics, Urbana, Illinois).

The female lizard was tracked from 24 June 1997 to 6 November 1997. We tracked this lizard at least every third day until she appeared dormant (was buried relatively deep underground) late in the season, when we located her less frequently until the end of telemetry. This lizard (B97-230) was an adult measuring 79.8 mm SVL and 30.4 mm tail length. She moved a minimum straight-line distance of 744.2 m in 105 days. She moved within a relatively small area, often returning to the same location until 26 July 1997 when she started her longest movement in any given interval (343.1 m in two days). Her longest movement took her away from the immediate area of the roadside ditches she was occupying to an area dominated by sandsage and yucca, where she eventually hibernated. The female lizard was ca. 5 cm underground when tracked on 7 October 1997; however, when tracked on 6 November 1997 she had moved to a new location, ca. 25 cm away, where she had buried ca. 8 cm underground and appeared to be dormant.

The male lizard was tracked from 24 July 1997 to 17 September 1997 when the radio failed. This lizard (B97-374) was an adult measuring 68.6 mm SVL and 33.3 mm tail length. He moved a minimum straight-line distance of 48.3 m in 56 days. This lizard never left the immediate area of the roadside ditches during the telemetry period. The longest movement in any given interval was 15.4 m in two days.

Large movements from foraging grounds to hibernation areas seem likely considering that the primary food source of these lizards are harvester ants (*Pogonomyrmex* sp.) that invade disturbed areas with little vegetation (Tabers 1998. The World of Harvester Ants. W. L. Moody , Jr., Nat. Hist. Ser., No. 23, Texas A&M Univ. Press. 213 pp.) like roadside ditches. Moving to areas with higher vegetation density and a greater amount of ground litter would provide better insulation for buried lizards during hibernation. However, this large movement was not seen in the male radioed lizard.

These lizards may be utilizing optimal foraging, as described by Munger (1984. Amer. Nat. 123:654–680) by moving between different foraging sites within an area in order to increase efficiency of foraging. Optimal foraging was suspected in the radioed lizards as they would often return to previous foraging sites after spending days away from them. Although these lizards did not move great distances (usually less than 5 m) away from an area, they would often return to the exact location.

Submitted by **CHAD MONTGOMERY**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (e-mail: chad_mont@yahoo.com) and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

PSEUDOCORDYLUS MELANOTUS MELANOTUS (Drakensberg Crag Lizard). **COPULATION and AGGRESSION.** Although the reproductive cycles of both male and female *Pseudocordylus melanotus melanotus* have been reported by Flemming (1993, J. Herpetol. 27:103–107; 1993, J. Herpetol. 27:473–478), there have been no observations of mating behavior reported in the literature. At 1320 h on 26 April 2000, I observed a copulation in Suikerbosrand Nature Reserve (between 26°27' and 26°34'S, 28°09' and 28°21'E), ca. 40 km SE Johannesburg, South Africa. The male approached the female who turned away from him. The male then seized the female's right hind leg and shifted his grip to her neck. Copulation was observed for ca. two minutes during which time the female showed no sign of resistance.

Male-male aggression, usually associated with mate guarding and territoriality, is also evident in this population. I observed two males fighting on 2 June 2000 at ca. 1500 h. They were biting each other in the head and neck region, to the extent that one individual was bleeding freely from wounds on his head.

Pseudocordylus melanotus exhibits an asynchronous reproductive cycle; males store sperm in the epididymi until late winter/spring, when the females ovulate (Flemming, *op.cit.*). Mouton and van Wyk (1993. Can. J. Zool. 71:1715–1723) note the existence of unpublished data of mating occurring in fall only (suggesting sperm storage), but also cite Mackay (1993) who found no evidence of sperm storage in females of this species. They also indicate, however, that the population used in their study could be assigned to the subspecies *P. m. subviridis*.

My observation suggests one of two possibilities that need not be mutually exclusive. Either female *P. m. melanotus* in this population ovulate in autumn/winter (coinciding with copulations); and/or they are storing sperm until ovulation occurs in the spring. The intense male-male combat I witnessed further suggests that males are competing for mates in autumn/early winter.

Thanks to Martin Whiting and Hannes van Wyk for valuable input on this note.

Submitted by **SUZANNE MOON**, Communication Biology Research Group, Department of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private bag 3, Wits 2050, South Africa; e-mail: suem@gecko.biol.wits.ac.za.

TARENTOLA ANNULARIS (White-spotted Gecko). **DIET.** On 29 April 2000 a case of cannibalism was observed for *Tarentola annularis* at Ismailia, Suez Canal University (Old campus: 30°36'41"N, 32°16'37"E), Ismailia Province, Egypt. At 1955 h, an adult (ca. 110 mm SVL) *T. annularis* was observed on the wall of a building ca. 7 m above the ground. The adult lizard was holding a conspecific juvenile (ca. 40 mm SVL) in its jaws. The anterior portion of the body of the juvenile was engulfed, while the posterior half of the body, oriented ventral side up, was suspended from the mouth. A drop of blood was visible on the side of the upper jaw of the adult. The adult made no attempt to hide while under observation, but moved about 10 cm down the wall from where it was first observed. It remained in this position for about 15 minutes, still holding the prey. When the observer moved back some distance and watched the lizard with binoculars, it resumed swallowing its prey. It was recommended by Flower (1933. Proc. Zool. Soc. London 1:735-851) not to house this gecko with other lizards because of its possible cannibalistic tendencies. This is the first record of diet for this species in Egypt (see Saber et al. 1995. J. Egyptian Soc. Parasit:395–406).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt; e-mail: aibrahim@ismailia.ie-eg.com.

THECADACTYLUS RAPICAUDA (Turnip-Tail Gecko). **BEHAVIOR**. The turnip-tail gecko is commonly seen in forested habitats, on tree trunks, and inhabiting abandoned human habitations in the Caribbean (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville. 720 pp.), although it lives associated with inhabited human-made structures in the western Amazon (Vitt and Zani 1997. Herpetologica 53:165–179). At Simla, the research station maintained by the Asa Wright Nature Center in Trinidad, two male *Thecadactylus rapicauda* live in a habitat unusual for this species the Caribbean, the eaves of the main residence. There, they share space near a valuable resource: a powerful mercury lamp is mounted above the entrance to the house and operates nightly to attract insects for collection. Beebe (1944. Zoologica, N.Y. 29:145–160) reported that *T. rapicauda* were attracted by light fixtures, but did not consider them residents near them. The lamp at Simla is suspended from the eaves via a broad attachment that divides the eaves into two sections to either side of the fixture. The two male *T. rapicauda* have established territories in these sections on either side of the light from which they forage along the wall of the house for the attracted insects. The geckos have been reliably found in their territories night after night over a period of several years, and we have observed several instances of feeding on insects attracted by the mercury lamp.

On 7 September 2000 at 2230 h, both males were observed in the territory to the left of the lamp, about two body lengths apart. The resident male began an agonistic encounter within seconds of the arrival of the intruder by issuing a sharp, loud hiss that occurred almost simultaneously with a sudden, jerky forward movement in the intruder's direction. A physical encounter that clearly involved head-butting and biting by both males followed the initial threat display. The intruder retreated to the right side of the lamp ca. 60 s after the encounter began.

Our observations support the notion of Vitt and Zani (*op. cit.*) that fighting occurs with some frequency in *T. rapicauda* and may result in injury or tail autotomy. However, no vocalization during agonistic encounters was reported by these authors. Underwood (1962. Carib. Affairs, N.S. 1:1–192) described the call of *Thecadactylus rapicauda* as "a diminishing series of chirps," Turvey and Cooper (1999. Bull. Brit. Herpetol. Soc. 69:20–30) called it a "harsh barking call," and Beebe (*op. cit.*) referred to it as "chock-chick-chick." Johnson (1946. Copeia 1946:108) noted that these geckos emit a "bat-like squeak" when captured. Clearly, none of these reports refers to the hiss we observed. In general, hissing among gekkonine geckos is a response only elicited by a threat (A. M. Bauer, pers. comm.). We submit that this type of vocalization is commonly used by these geckos in agonistic encounters but has not been reported because of the relative scarcity of individuals establishing territories in inhabited buildings.

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Submitted by **HINRICH KAISER** (e-mail: hkaiser@lasierra.edu) and **RAUL E. DIAZ** (e-mail: frog_diaz@hotmail.com), Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

TRIBOLONOTUS GRACILIS (Crocodile Skink). **MATERNAL CARE**. Parental care of ova and neonates has been reported in a variety of scincids. For example, North American skinks of the genus *Eumeces* are known to stay with their eggs throughout the incubation and even defend them against predation by small rodents (Porter 1972. Herpetology. W. B. Saunders Co., Philadelphia, Pennsylvania. 534 pp.). Evans (1959. Copeia 1959:103–110) reported egg brooding, and grooming of neonates by female *E. obsoletus*. Herein, we report the protective maternal care of ova and neonates by three female *T. gracilis* in captivity at the Dallas Zoo.

Little information has been published concerning the behavior of *T. gracilis*, and parental care has never been reported for this species or genus. *Tribolonotus gracilis* is a small black scincid (184 mm mean total length) endemic to New Guinea. This spe-

cies, as well as several other members of the genus, have only one functional ovary and typically invest all their reproductive energy into the production of a relatively large, elongated (21 mm average length) single egg.

On three separate occasions, between 12 October 1999 and 24 February 2000, eggs (usually removed for artificial incubation) were intentionally left in three enclosures, each housing a pair of *T. gracilis*, thus enabling observers to watch for evidence of parental care. Each female deposited one egg under a four-inch piece of cork bark and buried it with sphagnum moss. The cork bark was lifted once a day to check for positioning of the females and their ova for the duration of incubation (ca. 60 days). In all cases the females were found curled around the eggs. In addition to checking female and egg positions, observers touched the eggs to elicit a protective response. In every trial the females responded by lunging and attempting to bite the offending finger. In approximately half of the trials the females vocalized during the attacks. This defensive behavior lasted the duration of the incubation. On 12 different occasions the eggs were left unburied after the trials, but by the next day's observation the eggs had been reburied. After hatching, two neonates were allowed to stay with their parents. The females attempted to protect their offspring using the same behavior as for the eggs. For two weeks the neonates stayed within one centimeter of the females, and on several occasions the neonates were observed resting on the dorsum of the females.

The males remained in the enclosures with the females and their ova, and later the neonates. No male was ever observed guarding an egg or a neonate, and we observed no evidence of aggression by a male directed toward a neonate.

Special thanks to Ardell Mitchell and the staff of the Dallas Zoo Department of Herpetology for their helpful comments on this manuscript.

Submitted by **RICHARD D. REAMS**, Dallas Zoo Department of Herpetology, Dallas Texas 75216, USA, and **DEAN A. URBANEK**, P.O. Box 150, Three Rivers, Texas 78071 USA; e-mail (RDR): Hylareams@aol.com.

TROPIDURUS PLICA (Spiny Tree Lizard). **BEHAVIOR.** At Simla, the research station maintained by the Asa Wright Nature Center in Trinidad, there is a 5 m drop from the kitchen window to the rainforest below. The window opening is used to dispose of organic refuse, which serves as a food source for the local fauna and disappears quite rapidly. The partially overgrown vertical wall beneath the window is an attractive territory for *Tropidurus plica* during the day and for *Hemidactylus mabouia* at night. We frequently observed individuals of *T. plica* active on the kitchen wall, which provided excellent cover as well as a resource worthy of defense.

On 8 September 2000 at 0945 h, we observed two adult male *T. plica* in an agonistic encounter. This encounter took place in a small tree near the kitchen wall described above, along a branch used by a resident male. The intruder approached the resident's branch from along the trunk. The resident began the characteristic iguanian aggressive display involving lateral compression and a display of its black dewlap (Debusk and Glidewell 1972. J. Herpetol. 6:139–141) while turning to face the intruder. It then descended two body lengths down the branch for the encounter. The intruder paused in its advance while the resident raised its body and began to head-bob. After only a few head-bobs, the intruder suddenly attacked the resident and delivered a firm bite to the left thigh. The resident bit back with similar intensity at the same spot on his opponent and a tangle ensued. During the tangle, the males clawed at each other with their front limbs while still biting the opponent's thigh. As a consequence of the intense struggle, neither individual was able to maintain a firm foothold and they fell from the branch. They tumbled a distance of 1.5 m, still connected by their bites, but released the hold on each other upon hitting the ground and disappeared into the vegetation. Throughout this encounter, no vocalization was heard.

This report is the first for agonisitic behavior of *T. plica* in the wild, and it confirms some of the findings of Debusk and Glidewell (*op. cit.*). In their laboratory study, Debusk and Glidewell noted similar displays with slight nuances in sequence, but no biting was recorded. We submit that the intensity of the struggle we observed might be connected to the unique food resource below the Simla kitchen window.

We thank Ronnie Hernandez for confirming the species identification and Laurie Vitt and Aaron Bauer for providing input on the manuscript. Funding was provided by the University Research Council of La Sierra University.

Submitted by **HINRICH KAISER** (e-mail: hkaiser@lasierra.edu) and **RAUL E. DIAZ** (e-mail: frog_diaz@hotmail.com), Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

TUPINAMBIS MERIANAE (Tegu Lizard). **LONGEVITY.** Report of maximum age in reptiles is largely based on specimens kept in captivity and, for lizards, considerable variation in longevity is reported among species (Porter 1972. Herpetology. W. B. Saunders Co. 524 pp.). For *Tupinambis merianae*, the maximum age reported is 13 years (Goin et al. 1978. Introduction to Herpetology. W. H. Freeman, San Francisco, California. 378 pp.). In January 1982, one of us (ASA) received an adult male *T. merianae*, captured at nearby Campinas, São Paulo state, southeastearn Brazil. This animal was an adult male, ca. 330 mm SVL. Based on size and observed growth rate of captive tegus (pers. obs.), this animal was at least three years old. During most of its life this lizard was kept in an outdoor pen (160 m^2), fed twice a week (chicken, rats, beef, fruit), and had free access to water. Over the years, the lizard was kept in a breeding group and grew slowly. In 1992 the lizard was unable to engage in reproductive activity and was separated from the females. A year later, this lizard started progressively to lose muscle mass and its movements became slower and less coordinated. In 1996, its eyes became cloudy and we determined that the lizard would be unable to survive in nature. In captivity, however, he was able to survive until April 1999 (SVL 452 mm; mass 3345 g). Therefore, this specimen lived for a minimum of 17 years, possibly as much as 20 years. In either case, this represents the maximum age reported for the species. The animal was deposited in the collection of the Zoology Department, Universidade Estadual Paulista, Rio Claro, SP, Brazil (DZRC-976).

We thank José Perez Pombal Jr. for the donation of the Tegu specimen.

Submitted by **SIMONE P. BRITO, AUGUSTO S. ABE**, and **DENIS V. ANDRADE**, Departamento de Zoologia, Universidade Estadual Paulista, UNESP, Av. 24-A, 1515, Caixa Postal 199, CEP 13506-900, Rio Claro, São Paulo, Brazil; e-mail (SPB): spbrito@rc.unesp.br.

VARANUS GRISEUS (Desert Monitor). **TOXICITY**. Bites received from many varanid lizards during prey acquisition or in defense may result in significant wounds and secondary bacteremia, producing illness in 1 to 3 days. Except for *Heloderma*, reports on salivary toxins capable of producing immediate systemic effects are generally lacking in Lacertilia. In a case report (Sopiev et al. 1987. Turkmenistan Acad. Sci. 598:615, in Russian) on the toxic effects of a bite from a male *Varanus griseus* (mass = 900 g, SVL = 400 mm, TL = 550 mm), a male keeper was bitten on the right middle finger. The lizard secured its bite for 60 s with a chewing motion. Within 30 minutes the victim reported symptoms including muscular weakness, dizziness, lack of appetite, pain in the eyes, aches and pains in all muscles especially the bottom of the mouth cavity, and pain when swallowing. Difficulty in breathing through the mouth was also noted although no edema was present in the soft palate. One hour post-bite additional symptoms included lymph node pain at the right elbow and arm pit and an increased pulse rate. Here we report two new cases of bites by *V. griseus* with similar physiological effects.

A female keeper at Central Florida Zoological Park was bitten by a *V. griseus* (176 g, 220 mm SVL, 530 total length) as it was being removed from an enclosure after sustaining injuries from a conspecific cage mate. The keeper was bitten on the right hand between the thumb and index finger. Attempts to disengage the bite resulted in a tighter, chewing reflex. The lizard released after ca. 75 s. The wound was immediately cleansed and disinfected with betadine. Within 20 minutes the victim experienced dysphagia, tightness of the chest muscles, and dyspnea. Muscle soreness became generalized during the next hour, progressing downward into the lower extremities. By 1 hour 20 minutes post-bite the facial bones, particularly the frontal, zygomatic, maxilla and mandibular bones became very painful when the skin over them was touched. Within 1 hour 35 minutes post-bite symptoms included dizziness, difficulty in walking due to muscle soreness, and an increase in respiration. The dysphagia and chest tightness increased steadily. By 5 hours 20 minutes post-bite the symptoms began to stabilize. At 16 hours all symptoms had dissipated except muscle soreness in the hands and arms, and a feeling of euphoria was experienced for an additional 4 hours. The bite site remained unremarkable with no swelling, discoloration, or bacterial infection.

A second incident occurred (D. Blanchard, pers.comm.) at Detroit Zoological Park when a male keeper was bitten on the left forearm by a *V. griseus* (ca. 530 mm total length). The duration of the bite was ca. 15 s. Moderate bleeding was noted at the bite site. Within 20 minutes the victim experienced dysphagia and "could hardly swallow." The victim sought clinical treatment one hour post-bite and received epinephrine which relieved the symptoms. The bite wound healed uneventfully.

Auffenberg (1994. The Bengal Monitor. Univ. Press of Florida, Gainesville, 561 pp.) reviewed the mandibular gland as a source of salivary toxins in anguinomorphs and indicated that venom production is suspected in at least some individuals of *V. g. caspius*. Gorelov (1971. Izv. Akad. Nauk. Turkman, SSR, 1:75–76, in Russian) experimentally induced an "intoxificated state" in sparrows and rats following the injection of *V. griseus* saliva (Auffenberg, *op cit.*). In the two new cases reported here, both victims were experienced herpetologists who had received previous bites from other varanid species with no resulting systemic effects. Neither were aware that toxic effects have been suspected in bites from *V. griseus*. We believe that this decreases the likelihood that the symptoms were psychogenic. As salivary peptides, proteins, and enzymes have not been characterized in varanid lizards, research on the toxicity of *V. griseus* may reveal salivary constituents which are effective in prey acquisition or in defense.

We thank David Blanchard for his case report and Fred Bohler, Andrew Snider, George Van Horn, and Tim Walsh for their assistance.

Submitted by **VICKIE BALLARD** and **FREDERICK B. ANTONIO**, Department of Herpetology, Central Florida Zoological Park, P.O. Box 470309, Lake Monroe, Florida 32747, USA; e-mail (FBA): fbantonio@hotmail.com.

SERPENTES

ARRHYTON EXIGUUM (Puerto Rican Garden Snake). **DIET**. The Puerto Rican garden snake is a small species that reaches ca. 45 cm in total length. It is terrestrial and has secretive habits. It is found under logs, rocks, tree stumps, and in termite nests. It actively forages during the day (Henderson and Crother 1989. *In* Woods [ed.], Biogeography of the West Indies: Past, Present, and Future, pp. 479–518. Sandhill Crane Press, Gainesville, Florida).

Here I report an observation of an individual *Arrhyton exiguum* feeding on an *Anolis* sp. egg at night. The egg (21 x 11 mm) was probably from the giant anole (*A. cuvieri*) based on its size. The observation occurred in a haystack hill located in the Sabana Seca area of Bayamón, Puerto Rico, on the northern karst belt of the island. Previous diet records include frogs (*Eleutherodactylus*), lizards (*Anolis*), worm-like lizards (*Amphisbaena*), and adults and eggs of blind snakes (*Typhlops*) (Rivero 1998. Los Anfibios y Reptiles de Puerto Rico. Editorial de la Universidad de Puerto Rico, San Juan, Puerto Rico. 510 pp.). This observation represents the first record for the island of a snake preying on an *Anolis* egg.

Submitted by **ALBERTO R. PUENTE-ROLÓN**, Box 1112, Ciales, Puerto Rico 00638-1112, USA; e-mail: culebron@atenas.com.

BOA CONSTRICTOR (Boa Constrictor). **DIET.** *Boa constrictor* is a widely distributed, large-bodied generalist, feeding on diverse types of prey items including mammals, birds, and lizards (Green 1983. *In* Janzen (ed.), Costa Rican Natural History, pp. 380–383. The University of Chicago Press, Chicago.), yet little is known of its life history. Boa constrictors have been documented to eat a wide variety of prey; however, only a few rodents have been listed, including "spiny rats," black rats (*Rattus rattus*), agoutis (*Dasyprocta*), and a juvenile tree porcupine (*Coendou rothschildi*) (Beebe 1946. Zoologica 31:11–52; Davis and Smith 1953.

Herpetologica 8:133–43; Mole and Urich 1894. Proc. Zool. Soc. London 1894:499–518; Tschambers 1949. Herpetologica 5:141). Here we report an additional rodent prey item, an adult big-eared climbing rat (*Ototylomys phyllotis*; Rodentia: Muridae). This rat plus an unidentifiable immature rat were obtained from an immature *B. constrictor* (84 cm SVL, 450 g without prey item) on 10 February 2000 at Parque Nacional Palo Verde, Guanacaste Province, in northwestern Costa Rica, at ca. 30 m elevation (10°21'N, 85°20'W). The snake was captured late in the afternoon near the intersection of the main road and the Cerro Calizos trail and placed in a cloth bag, where it regurgitated its stomach contents during the night. The snake was released at the point of capture after data were collected. Both prey items were well digested and identified from their teeth. The immature rodent was perhaps only a few days old and would have been dependent on its mother and possibly the offspring of the adult *O. phyllotis*. One of us (RMT) observed boas consuming additional prey items at Palo Verde, including a subadult opossum (*Didelphis virginiana*) (13 June 1982) and an adult male ctenosaur (*Ctenosaura similis*) (January 1991).

Ototylomys phyllotis is a common species of small, nocturnal rat that is found in a wide variety of habitats, often around rocks, caves, sink holes, or fallen trees. This species forages both on the ground and among vines and low vegetation, usually 3 m or less from the ground. Nests are found at ground level among rocks, under logs, or in low tree holes (Emmons 1990. Neotropical Rainforest Mammals: A Field Guide. The University of Chicago Press, Chicago. 281 pp.). This is the first record of predation by any species on *O. phyllotis*, and the first report of boas consuming *D. virginiana*.

We thank Andres Vaughan for capturing the snake, the Ministerio del Ambiente y Energia and Sistema Nacional de Areas de Conservación for providing us with the opportunity to work at Parque Nacional Palo Verde, and we especially thank Javier Guevara S. for facilitating our research permits. Deedra McClearn and the Organization for Tropical Studies provided outstanding logistic support for this project.

Submitted by **KRISTIN A. BAKKEGARD**, Department of Biological Sciences, Auburn University, Auburn, Alabama 36849, USA, and **ROBERT M. TIMM**, Natural History Museum and Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, Kansas 66045, USA.

CROTALUS WILLARDI AMABILIS (Del Nido Ridgenose Rattlesnake). **DIET**. We obtained fecal remains from a female *Crotalus willardi amabilis* (560 mm SVL, 151.6 g mass) collected 21 July 2000 in the Sierra del Nido, Chihuahua, México. The specimen was collected in a high elevation (2727 m) valley above Cañon del Alamo near a grassy meadow among sparse oak (*Quercus* spp.) and pine (*Pinus* spp.). Examination of these remains revealed dorsal guard hairs, claws, and the partial skull (with teeth) of the southern pocket gopher (*Thomomys umbrinus*).

The only published diet record for *C. w. amabilis* is of unidentified mammal hairs in the scat of wild-caught specimens (Armstrong and Murphy 1979. The Natural History of Mexican Rattlesnakes. Univ. Kansas Mus. Nat. Hist. Special Publ. 5:1–88). In their review of diet records for *C. willardi*, Holycross et al. (*in press. In* Schuett et al. [eds.], Biology of the Vipers. Biol. Sci. Press, Carmel, Indiana) cited only one record of pocket gopher consumption. In addition, Holycross et al. (*op. cit.*) did not discover remains of pocket gophers among 95 prey of *C. w. obscurus*, though nine of these records were identified only as "small mammals." However, Holycross et al. (*in press*. Southwest. Nat.) reported finding the remains of *T. u. emotus* in the stomach of a predated *C. w. obscurus*.

We thank Deron Hartman, Javier Banda, and Ray Queen for their assistance in the field.

Submitted by **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA (e-mail: rbry860@sulross.edu), and **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu).

DIADOPHIS PUNCTATUS (Ringneck Snake). **ARBOREAL BEHAVIOR**. On 1 April 2000, I was looking for small arboreal crickets along St Hwy 38, N of jct. St Hwy 9 and St Hwy 38, Santa Clara Co., California, USA. While banging the end of my insect net against the branches of the trees along the highway in order to dislodge insects, I knocked a black-colored ringneck snake from a maul oak (*Quercus chrysolepis*). This snake is typically found on the ground under cover objects (bark, leaves, etc.) and is not known to have arboreal habits (Fitch 1975. Univ. Kansas Mus. Nat. Hist. Misc. Pub. 62:1–53). However, this individual (158 mm SVL, 189 mm total length) was on a branch ca. 1.5 m above the ground and at least 1 m away from the trunk. Once the snake hit the ground, it immediately coiled its tail in a distraction display and then crawled under my boot. The only other animals knocked out of the tree were 4–5 mm long ants, unlikely food items.

Submitted by **THOMAS A. STIDHAM**, Department of Integrative Biology, Museum of Paleontology, and Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA.

ELAPOMORPHUS QUINQUELINEATUS (Raddi's Lizard-eating Snake). **REPRODUCTION.** *Elapomorphus quinquelineatus* is a small, nocturnal, fossorial snake, that is occasionally found in leaf litter. It is distributed in forested areas of southeastern Brazil, from eastern Minas Gerais and Espirito Santo south to Rio Grande do Sul (Peters and Orejas-Miranda 1970. Catalogue of the Neotropical Squamata: Part I. Snakes. Bull. U.S. Natl. Mus. 297:1–347; Ferrarezzi 1993. Sistematica Filogenetica de *Elapomorphus*, *Phalotris* e *Apostolepis* (Serpentes: Colubridae: Xenodontinae). Dissertação de Mestrado, Depto. De Zoologia da Universidade de São Paulo. 199 pp.). It feeds on snakes, lizards, amphisbaenians, frogs, earthworms and insects.

On 9 November 1999, five specimens were collected in a pasture on the left bank of the Rio Itabapoana at the site of the new hydroeletric dam at Rosal, near Guaçuí, Espirito Santo, Brazil (20°55'S, 41°42'W). On 27 December 1999, a female (790 mm SVL, 880 mm total length) laid one egg and on 7 January 2000, she laid a second egg.

The eggs were whitish and elongate. They were incubated in a covered plastic box (15 x 11 x 6 cm), at ca. 24 ± 2°C, on moist soil. The first egg was lost to fungal infestation. The second egg

hatched after 74 days. The hatchling was a female (195 mm SVL, 220 mm total length, 4.30 g). It was kept in a glass box (30 x 20 x 14 cm) with soil, and a bowl of water. It remained buried most of the time; when on the surface it actively explored the environment. Earthworms and mealworms were offered but not accepted. It was force-fed weekly with snake tails but steadily lost weight and died at 43 days of age (215 mm SVL, 240 mm total length) having lost about 40% (1.8 g) of its birth weight. It went through two ecdyses. The specimen is now number 62471 in the Instituto Butantan collection.

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Submitted by **SILVIA R. TRAVAGLIA CARDOSO, MARISA M. TEIXEIRA DA ROCHA**, Laboratório de Herpetologia, Instituto Butantan, and **GIUSEPPE PUORTO**, Museu Biológico do Instituto Butantan, Av. Dr. Vital Brazil, 1500, CEP 05503-900, São Paulo, Brazil; e-mail (STC): silcardoso@zipmail.com.br.

HYPSIGLENA TORQUATA (Night Snake) and ***OXYBELIS AENEUS*** (Brown Vine Snake). **ENDOPARASITES.** To our knowledge, there are no reports of endoparasites for *Oxybelis aeneus*. There is a report of plerocercoids of tapeworms of the Order Proteocephalidea in *Hypsiglena torquata* (Diller and Wallace 1986. Southwest. Nat. 31:55–64). The purpose of this note is to report the presence of larval spiny-headed worms (Acanthocephala) in the body cavities of *H. torquata* and *O. aeneus*.

One hundred seventy-one *H. torquata* from Arizona (herpetology collections of Arizona State University [ASU], Natural History Museum of Los Angeles County [LACM], and University of Arizona [UAZ]), and 40 *O. aeneus* from Arizona and Mexico (LACM and UAZ) were examined for helminths. A mid-ventral incision was made in the body wall; organ surfaces and mesenteries in the posterior portion of the body cavity were visually examined for helminths. Oblong, whitish bodies, ca. 1 mm x 3 mm, were occasionally seen and these proved upon microscopic examination to be oligacanthorhynchid cystacanths. Infected *H. torquata* were from Maricopa County (ASU 2256, 2263, 2316) and Pima County, Arizona (UAZ 25003, 25027, 30619–30621, 31631, 42683, 47167). Infected *O. aeneus* were from Santa Cruz County, Arizona (UAZ 47314) and Puebla (UAZ 27050) and Sonora, México (UAZ 46662, 49265). Prevalence of infection (infected snakes/sample examined x 100) was 6% for *H. torquata* and 10% for *O. aeneus*. Specimens were deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland as: *H. torquata* USNPC 90584; *O. aeneus* USNPC 90585.

The presence of oligacanthorhynchid cystacanths in *O. aeneus* and *H. torquata* are new host records. Oligacanthorhynchid cystacanths have previously been reported in the colubrid snake, *Rhinocheilus lecontei* (Bolette 1997a. Southwest. Nat. 42:232–236; Goldberg et al. 1998. J. Helminthol. Soc. Washington 65:262–265) which is sympatric with *H. torquata* and *O. aeneus*. Oligacanthorhynchid cystacanths are also known from seven species of *Crotalus* from western North America (Bolette 1997a, *op. cit.;* Bolette 1997b. J. Parasitol. 83:751–752; Bolette 1998. J. Helminthol. Soc. Wash. 65:105–107; Goldberg and Bursey 1999. Herpetol. Rev. 30:44–45; Goldberg and Bursey 2000. Herpetol. Rev. 31:104) and the elapid snake, *Micruroides euryxanthus* (Goldberg and Bursey 2000. Herpetol. Rev. 31:105–106).

We thank Robert L. Bezy (Natural History Museum of Los Angeles County), Michael E. Douglas (Arizona State University), and Charles H. Lowe (University of Arizona) for permission to examine specimens.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu), and **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA (e-mail: cxb13@psu.edu).

LAMPROPELTIS TRIANGULUM TRIANGULUM (Eastern Milk Snake). **ANTIPREDATOR BEHAVIOR**. Many colubrid species use tail displays as antipredator mechanisms (Greene 1973. J. Herpetol. 7:143–161). *Lampropeltis triangulum* is one of the species that engages in some form of tail display, generally tail-rattling. Herein, I report the observation of a different form of display, pseudocephalism, in *L. t. triangulum* from Essex Co., Massachusetts, USA.

On 1 July 1998 at ca.1400 h, a gray-phase *L. t. triangulum* (660.4 mm SVL, 749.3 mm TL) was captured in an ornamental garden within a rural neighborhood. The weather was mostly sunny, and air temperature was ca. 24°C. During capture, this individual engaged in thrashing, tail-rattling in vegetation, and the release of musk. Once the individual's head was restrained, this activity ceased and the snake began to move its tail through the ground cover, as if undulating tail first. This "tail-leading" gave the appearance that the concealed body part moving through the substrate was the cranial portion of the snake. Occasionally, the tail stopped moving in this manner and was coiled into a tight ball and held aloft. This behavior closely resembles the behavioral pseudocephalism described in some snake species, notably *Micrurus fulvius* (Mount 1975. The Reptiles and Amphibians of Alabama, Auburn Printing, Auburn, Alabama, 347 pp.) and, to my knowledge, has not been reported in this genus. Defensive behavior such as this may be used to direct predatory strikes away from the cranial region. Diverting predatory strikes to the tail may be highly adaptive; the post-anal tail in snakes is anatomically and physiologically less vital than the cranium, and attacks directed to this area can be further deterred by defensive bites and the release of musk.

Two conspecific individuals captured in this area have exhibited a horn-like and a button-like termination to the tail (698.5 mm SVL, 822.8 mm TL and 685.8 mm SVL, 774.7 mm TL, respectively). In the former individual, this unusual tail tip retained a 10 mm segment of old shed skin. Such unusual tail morphologies may increase the efficacy of rattle displays (particularly when shed skin is retained) and may also allow for ease of movement during tail-leading or rattling behavior (Tiebout 1997 J. Herpetol. 31:290–292). This anecdote may demonstrate the plasticity in antipredator behavior of this species, and additional studies of such behavior may provide insight into the evolution of tail displays.

Submitted by **KEVIN G. SMITH**, U.S. Geological Survey,

Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA.

MICRURUS SURINAMENSIS SURINAMENSIS (NCN). **ABOREALITY**. At 2139 h on 11 January 2000, while walking a trail through secondary forest at the Madre Selva II Biological Research Station in Loreto, Peru (3°37.175'S, 72°14.873'W, GPS error = 13.5 m), we observed a *Micrurus surinamensis surinamensis* coiled on a vine which was wrapped around a vertical tree trunk ca.1.35 m above the ground. The snake had an SVL of 25.5 cm, a TL of 3.5 cm, and weighed 11.5 g. The surface temperature of the snake's resting site was 27°C. *Micrurus surinamensis surinamensis* inhabits lowland tropical forests in or near rivers in the Amazon. These snakes are known for their aquatic habits and primarily feed on fish and eels (Roze 1996. Coral Snakes of the Americas: Biology, Identification, and Venoms. Krieger Publ. Co., Malabar, Florida. 328 pp.). Arboreal behavior has been reported in three other species of *Micrurus*: *M. circinalis* (Sajdak 2000. Herpetol. Rev. 31:105), *M. fulvius* (Carr 1994. A Naturalist in Florida: A Celebration of Eden. Yale University Press, New Haven, Connecticut. 264 pp.), and *M. nigrocinctus* (Schmidt and Smith 1943. Publ. Field Mus. Nat. Hist., Zool. Ser. 12:129–134.).

Submitted by **RUSTON W. HARTDEGEN** and **BRIAN AUCONE**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA; e-mail (RWW): ruston17@yahoo.com.

NERODIA SIPEDON SIPEDON (Northern Water Snake). **FORAGING**. A recent study suggests that juvenile *Nerodia sipedon sipedon* employ a "mixed foraging strategy," engaging in both active and sit-and-wait type predation (Balent and Andreadis 1998. J. Herpetol. 32:575–579). Here I present anecdotal evidence suggesting that adult *N. s. sipedon* may employ sit-and-wait foraging tactics, in addition to the active foraging tactics already documented (Ernst and Barbour 1989. The Snakes of Eastern North America. George Mason University Press, Fairfax, Virginia. 282 pp.).

On 13 July 2000 I observed an adult female *Nerodia s. sipedon* (571 mm SVL, 176 g) hunting bluegill (*Lepomis macrochirus*) in the shallows on the north shore of Barney's Lake, located on Beaver Island, Charlevoix Co., Michigan, USA. The area of the lake where the observation took place was exposed to the sun and was ca. 30 cm deep. The lake bottom was strewn with abundant sticks and tree branches.

When I began observing the snake, it was sitting motionless near a bluegill nest. Within a very short time three bluegills could be seen approaching the nest. When this occurred, the snake immediately began chasing the fish with mouth agape. The fish retreated and the snake quickly broke off the chase and returned to a spot near the nest where it again became motionless. This scene repeated itself three times over a period of ca. 10 min. At one point the snake briefly came up to breathe, and at another point it took up position under a large branch near the nest. At no time was the snake observed to be successful in capturing a fish.

Several studies have characterized *N. s. sipedon* as a generalist (Drummond 1983. Behavior 86:1–30; Meyer 1992. Foraging, Thermal and Spatial Ecology of the Northern Water Snake [*Nerodia s. sipedon*]. M.S. thesis. Central Michigan Univ., Mt. Pleasant. 64 pp.), which might favor a variety of foraging tactics if different prey have different habits (as suggested by Balent and Andreadis, *op. cit.*). It is unclear whether this observation represents an aberration, but it does seem clear that further work with adult *N. s. sipedon* in the field is warranted.

I thank J. C. Gillingham for comments on the manuscript.

Submitted by **KENNETH D. BOWEN**, Department of Biology, Brooks Hall, Central Michigan University, Mt. Pleasant, Michigan 48859, USA; e-mail: bowen1kd@cmich.edu.

PORTHIDIUM DUNNI (Dunn's Hognosed Pitviper). **DIET**. *Porthidium dunni* is endemic to Mexico where it inhabits the tropical dry forest of the Pacific Coast (Campbell and Lamar 1989. The Venomous Reptiles of Latin America. Cornell University Press, Ithaca, New York. 425 pp.). To date, nothing is known about its diet (Campbell and Lamar, *op. cit.*).

On 26 August 1999 an adult female (305 mm SVL, 40 mm tail length, 32.7 g) was collected at El Chorro Santiago Astata (15°52'31"W, 96°00'77"N), Oaxaca, Mexico, at an elevation of 140 m by Silvia Salas. The snake was humanely killed by freezing, fixed in 10% formalin, and preserved in 70% ethanol. It was dissected and its stomach contents were removed. Its stomach contained an adult *Sceloporus siniferus* (52.0 mm SVL, 115.0 tail length, 5.3 g). Both the snake (SS004) and lizard were deposited in the collection SERBO (Sociedad para el Estudio de los Recursos Bióticos de Oaxaca) de Huatulco, Oaxaca. This note provides new information on the natural history of *P. dunni*.

We thank Aurelio Ramírez-Bautista for his suggestions on the manuscript and for identification of the snake and lizard.

Submitted by **FELIPE CORREA-SANCHEZ** (e-mail: scorrea@servidor.unam.mx) and **MARIA ANTONIETA CASARIEGO-MADORELL** (e-mail: madorell@hotmail.com), Laboratorio de Herpetología (Vivario) ENEP-Iztacala, UNAM, Av. de Los Barrios S/N, Los Reyes Iztacala, Tlalnepantla, Edo. México, C.P. 54090, and **FLORENCIO LUNA-CASTELLANOS**, Sociedad para el Estudio de los Recursos Bióticos de Oaxaca (SERBO), Calle Porfirio Diaz No. 211, C.P. 533, Oaxaca, Oaxaca, 68000 México (e-mail: serbo@prodigy.net.mx).

SIBON SARTORII SARTORII (Sartor's Snail Sucker). **PREDATION**. There is no documentation of predation by the domestic cat, *Felis catus*, on *Sibon sartorii*. On 23 August 2000 at 0920 h, ARH encountered a juvenile *F. catus* in a house ca. km 212 on the highway Pachuca-Tampico, Hidalgo, México, feeding on a juvenile *S. s. sartorii* . The cat had bitten off a 66 mm portion of the snake's tail when ARH attempted to rescue the snake. On 26 August 2000 at 0600 h, the cat caught and partially ate another juvenile *S. s. sartorii*. The uneatten portion of the snake was 117 mm in length and had several puncture wounds. The temperature on both days was <25°C. The only recorded predator of *S. s. sartorii* is *Micrurus* sp. (Kofron 1988. Amphib.-Rept. 9:145–168).

Submitted by **ALEJANDRA RAMIREZ HERNANDEZ** and **FERNANDO MENDOZA QUIJANO,** Instituto Tecnológico

Agropecuario de Hidalgo, km. 5.5 Carr. Huejutla - Chalahuiyapa, Apdo. Post. 94, Huejutla de Reyes, Hidalgo, 43000 México; e-mail (FMQ): mendozaq@mail.ibiologia.unam.mx.

SISTRURUS CATENATUS EDWARDSII (Desert Massasauga). **ENDOPARASITES.** *Sistrurus catenatus* occurs from southern Ontario, Canada, diagonally through the central United States to Texas, New Mexico and extreme southeastern Arizona (Minton 1983. Cat. Amer. Amphib. Rept. 332.1–332.2). To our knowledge, there are no reports of endoparasites in this species. The purpose of this note is to report parasitism by the ascarid nematode *Hexametra boddaertii* and the presence in gut contents of larval physalopterid nematodes (*Physaloptera* sp.) and a cyst containing a larval spirocercid nematode (*Physocephalus* sp.) in *S. c. edwardsii*. The body cavities and guts of 57 *S. c. edwardsii* from the Museum of Southwestern Biology, Albuquerque, New Mexico, USA, were examined. A mid-ventral incision was made in the body wall; organ surfaces, mesenteries, and body cavity were inspected for helminths. Contents of the stomach and intestines were examined for helminths using a dissecting microscope. Stomach contents of MSB 54414 collected in Chaves County, New Mexico, USA (33°16'N, 103°58'W), May 1992 contained 2 third stage larvae of *Physaloptera* sp.; stomach contents of MSB 56580 collected in Chaves County, New Mexico, USA (33°16'N, 104°02'W), May 1993 contained 1 third stage larva of *Physaloptera* sp. and 1 cyst containg a larva of *Physocephalus* sp. Within the stomach musculature of MSB 56580 was found 1 female and 2 male *H. boddaertii*. Nematodes were deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland, USA: *Hexametra boddaertii* USNPC 89791, *Physaloptera* sp. USNPC 89792, *Physalopteroides* sp. USNPC 89793.

Sistrurus c. edwardsii represents a new host record for *H. boddaertii* and the second North American rattlesnake reported to harbor this nematode that was previously reported from *Crotalus cerastes* from California (Bursey et al. 1995. J. Helminthol. Soc. Wash. 62:78–80). New Mexico is a new locality record for *H. boddaertii*. Explanation of the larval nematodes found in the stomach contents is more problematic. Species of *Physaloptera* and *Physocephalus* utilize insects as intermediate hosts (Anderson 2000. Nematode Parasites of Vertebrates: Their Development and Transmission, 2nd Edition, CABI Publishing, CAB International, Wallingford, Oxon, U.K. 650 pp.). Insectivorous lizards comprise over half of the prey items consumed by *S. c. edwardsii* (Holycross, unpublished data). Thus, we believe the larval nematodes found in this study are a byproduct of diet and do not represent parasites of *S. catenatus*.

We thank J. Tom Giermakowski and Charles W. Painter at the Museum of Southwestern Biology for specimen loans and assistance and the Wallace Research Foundation for funding.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, and **ANDREW T. HOLYCROSS**, Department of Biology, Arizona State University, Tempe, Arizona 85287-1501, USA.

THAMNOPHIS ERRANS (Mexican Wandering Gartersnake). DIET. Members of this genus prey on a variety of vertebrates and invertebrates, including small mammals, amphibians, fish, lizards, slugs, earthworms, and leeches (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman, Oklahoma. 332 pp.). Little published data exist on the natural history of *Thamnophis errans* (*op. cit.*). The only prey item reported for this species is a shrew (Baker and Webb 1976. Herpetol. Rev. 7:112).

A small adult *T. errans* (ca. 400 mm TL) was collected in Cañon el Mesteño (2570 m elevation) in the Sierra del Nido mountains, Chihuahua, México on 23 July 2000. The specimen had a noticeable mid-body bulge and after palpation regurgitated a juvenile anguid lizard, *Barisia levicollis* (ca. 70 mm TL). This represents the second recorded prey item for *T. errans*.

We thank Deron Hartman, Javier Banda, and Ray Queen for their assistance in the field and Bob Webb for sharing his knowledge on this species.

Submitted by **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA, and **DAVID LAZCANO**, Laboratorio de Herpetología, Universidad Autónoma de Nuevo León, Apartado Postal – 513, San Nicolas de los Garza, Nuevo León, C.P. 66450, México.

THAMNOPHIS HAMMONDII (Two-striped Garter Snake). **PREY**. We documented foraging by *Thamnophis hammondii* around a seasonal pond (ca. 50 m L x 18 m W x 1 m D) located in Dulzura, San Diego Co., California, USA (32°37'N, 116°46'W) on property managed by the Bureau of Land Management. *T. hammondii* is often observed actively foraging in the pond or basking among the metavolcanic andesite outcroppings on the northern shore from as early as February to as late as October. Visual observations of *T. hammondii* at this study site were restricted to periods when the pond contained water, which is highly variable from year to year. The aquatic breeding amphibian community at this seasonal pond consists of *Spea hammondii*, *Bufo boreas*, *Hyla regilla*, and the non-native *Xenopus laevis* (ELE., pers. obs.; RNF and T. J. Case, unpubl.).

Reported herein as novel prey for *T. hammondii* are *S. hammondii* and the introduced species from South Africa, *X. laevis*. We also report *H. regilla* as prey of *T. hammondii* from this site. Documentation of prey items in all three cases was achieved by examination of stomach contents. On each occasion the snake was gently hand-palped until the stomach contents were disgorged. All snake weights reported were acquired subsequent to removal of stomach contents.

On 4 April 1998, a large female *T. hammondii* (308 g, 68.5 cm SVL) was observed crawling slowly in a serpentine fashion 20 m away from the perimeter of the stock tank. Upon hand capture and processing, one large adult *S. hammondii* (5.3 cm SUL) was recovered. One 35 mm slide print photo documented the snake and food item. It is noteworthy that *S. hammondii* has not previously been reported as a prey item for *T. hammondii* in spite of naturally co-occurring in many locations.

Little is known regarding predation on *X. laevis* in extralimital populations by native species. Crayon and Hothem (1998. Herpetol.

Rev. 29:165–166) reported predation on *X. laevis* by the black-crowned night heron (*Nycticorax nycticorax*) in Los Angeles Co., California, USA. Here, we report documentation of a native reptile using a non-native amphibian as a food resource. On 13 August 1998, a large female *T. hammondii* (163 g, 62.9 cm SVL) was hand captured while it was shore cruising in sparse emergent vegetation (*Eleocharis* sp.). One *X. laevis* (4.5 cm SUL) was recovered. The frog was deposited in the California Academy of Science (CAS 212359). On 22 October 1998, a juvenile *T. hammondii* (4.3 g, 20.5 cm SVL) was captured within 30 m from waters edge. One recently transformed *X. laevis* (2.6 cm SUL) was recovered (frog voucher CAS 212360).

Juvenile and adult *Thamnophis hammondii* are highly aquatic and primarily feed on fish eggs, fish, tadpoles, and small anurans (Fitch. 1940. Univ. California Publ. Zool. 44:1–50; Jennings and Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. California Dept. Fish Game. 255 pp.). Additionally, because post-metamorphic *X. laevis* occupy a benthic environment, they are at great risk from predation by *T. hammondii* and only safe when large enough to exceed the gape of the snake. *T. hammondii* has been observed at the majority of aquatic habitats that support established populations of *X. laevis* in southern California (ELE, pers. obs.). The effectiveness of skin secretions from the non-native frog (*X. laevis*) as an anti-predator mechanism to deter predation from the native snake (*T. hammondii*) has not yet been examined or determined. From 1995 to present, we studied *T. hammondii* / *X. laevis* interactions in lentic and lotic habitats under various hydrologic regimes in southern California. Our data suggest that *T. hammondii* does not serve as an agent for controlling *X. laevis* populations. Consequently, it is unlikely to provide an effective barrier for the colonization and establishment of *X. laevis* in new aquatic habitats.

Larval and post-metamorphic *Hyla regilla* are often reported as a food item for *T. hammondii*. An additional record from this site is as follows; on 14 March 1996 a large female *T. hammondii* (163 g, 62.9 cm SVL) was captured and one gravid *H. regilla* (3.9 cm SUL) was recovered (frog voucher CAS 212361).

Special thanks to Joe Funk, BLM Ranger, for assisting with logistics, Ed Camp, for providing his knowledge of the local area, and Milan Mitrovich, Ron Pulido, Carlton Rochester, and Daniel Soper for assistance in the field.

Submitted by **EDWARD L. ERVIN** and **ROBERT N. FISHER**, U.S. Geological Survey, Department of Biology, San Diego State University, San Diego, California 92182-1015, USA.

THAMNOPHIS SCALARIS (Mexican Alpine Blotched Garter Snake). **DIET**. *Thamnophis scalaris* is an endemic Mexican species, occuring in the high-elevation conifer forest of the central Mexican Plateau (Smith 1942. Zoologica 27:97–123). Here, we report the stomach contents of eight *T. scalaris* collected between June and September, 1999, at the Area de Conservación e Investigación Ecológica El Bordo, Las Maravillas (99°41'W, 19°24'N), 17 km NW of Toluca City, México (elevation 2550 m). All snakes were measured, weighed, sexed and forced to regurgitate. Data are reported as mean ± SD. We obtained earthworms from seven *T. scalaris* (4M:3F, 328.7 ± 10.74 mm SVL, 38.5 ± 12.5 g, stomach contents 2.5 ± 0.8 g). One female (400 mm SVL, 42 g) consumed a deermouse (*Peromiscus maniculatus*, 10 g), ingesting the posterior legs first.

Very little is known about the biology of this species and this is the first report of wild *T. scalaris* feeding on earthworms or deermice. The only other stomach contents data for *T. scalaris* are two *Sceloporus* sp. (Fouquette and Rossman 1963. Herpetologica 19:185-201), and an adult anguid lizard, *Barisia imbricata* (Lemos-Espinal and Ballinger 1992. Herpetol. Rev. 23:117).

Submitted by **CRYSTIAN SADIEL VENEGAS-BARRERA** and **JAVIER MANJARREZ**, Laboratorio de Biología Evolutiva, Centro de Investigación en Recursos Bioticos, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario No. 100. CP 50000, Toluca, Estado de México, México (e-mail: sadiel@cibnor.mx).

THAMNOPHIS VALIDUS CELAENO (Mexican Pacific Lowlands Garter Snake). **MAXIMUM SIZE and REPRODUCTION**. *Thamnophis validus celaeno* is known only from the Cape Region of Baja California Sur, Mexico. The maximum size reported for *T. v. celaeno* is 730 mm SVL, with a tail length of 228+ mm (Conant 1969. Bull. Am. Mus. Nat. Hist.142:1–140). On 8 June 2000, AD and TAF collected a female *T. v. celaeno* at the Presa El Chorro, 2 km west of Agua Caliente, BCS, Mexico. Under Conant's (*op. cit.*) categorizations of color patterns, this snake was a "Group C" animal or, more generally, a member of the "Dark Populations." The animal was kept in captivity at the University of Colorado, Boulder, USA, and was measured on 20 July and 1 August 2000. These measurements averaged 777 mm SVL and 249 mm tail length. The snake gave birth to six live males, six live females, one dead female, and two partially developed embryos on 29 or 30 July 2000. The 13 offspring (including the dead female but not the partially developed embryos) averaged 155.1 mm SVL (SD = 8.5; range 135–165 mm) and 3.1 g (SD = 0.4; range 2.0–3.5 g). After parturition, the female had a mass of 169.4 g. This is the first record of a litter for *T. v. celaeno*.

The adult snake was collected and exported with permission from La Direccion General de Vida Silvestre (collecting permit FAUT-0030 and exportation authorization 11658). The adult female and offspring will be deposited in the University of Colorado Museum.

Submitted by **ALAN DE QUEIROZ**, **TARA A. FORBIS**, and **CHRISTY L. MANTANONA**, Department of Environmental, Population and Organismic Biology, University of Colorado, Boulder, Colorado 80309, USA; e-mail (AD): dequeiro@stripe.colorado.edu.

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rwh13@csufresno.edu

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abauer@mail.villanova.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey–Foley Hall
The University of Kansas
2021 Constant Avenue
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jcollins@ukans.edu

Geographic Distribution
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soniak@unt.edu.ar

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CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
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cpainter@state.nm.us

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otorres@ku.edu

Geographic Distribution
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Tropical Biosphere Research Center
University of the Ryukyus
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ota@sci.u-ryukyu.ac.jp

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Geographic Distribution
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The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Herpetological Husbandry
RUSTON HARTDEGEN
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
rustonh@sprintmail.com

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

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2002 — Crown Center Hotel, Kansas City, Missouri, USA. 3–8 July 2002 (with ASIH, HL)

About Our Cover: *Phyllomedusa camba*



The hylid frog genus *Phyllomedusa* ranges from Costa Rica to Argentina, and contains a number of large, colorful species, including *P. camba*, the Lowland Monkey Frog. Although only recently described as a "new" species (De la Riva 1999. Revista Española Herpetología 13:123–131), herpetologists have long known of this frog. Cannatella (1983. Proceedings of the Biological Society of Washington 96[1]:59–66) recognized that at least two species were represented within the geographically variable and widely distributed *P. boliviana*,and other workers have reported additional observations for this species under the names *P. boliviana* or *P.* sp.

This new species is relatively common and widespread. It occurs in the southwestern Amazon Basin, from southeastern Peru and western Brazil to eastern Bolivia, with a straightline distance of ca. 1200 km between endpoints. Although the ranges of *P. camba* and *P. boliviana* are mostly parapatric, examples of microsympatry are known in some parts of the Bolivian lowlands.

Phyllomedusa camba is an inhabitant of primary and secondary rainforests, spending much of its time above ground, both in low vegetation and in the canopy. Exclusively nocturnal, calling and breeding activity start with the first heavy rains and extend from November to March. Sexual dimorphism is evident with females reaching a snout–vent length of 84 mm, while males may reach 70 mm SVL. Eggs are deposited within folded leaves overhanging pools. Tadpoles are undescribed for this species.

The specimen on our cover was collected in May 1989 from rainforest habitat near Tarapoto, Peru, by Anthony Wisnieski for the National Aquarium in Baltimore, where it was photographed by **Will Brown**. This animal differs in some respects from other individuals of *P. camba*, notably in eye color, but is tentatively allocated to this species. Brown used a Nikon N70 with a 105mm macro lens and dual SB23 strobes, recording the image on Fuji Velvia film. After a brief period of working with wolves and big cats, Brown joined the staff of the National Aquarium as a herpetologist. Currently, he is affiliated with University of Virginia's Biology Department, where he conducts research on amphibian reproductive biology and genetics.

Separation and imaging of Brown's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

Joseph B. Slowinski (1962–2001)

Joseph Slowinski, Curator of Herpetology at the California Academy of Sciences, died on 12 September 2001 in Myanmar after being bitten by a Multi-Banded Krait (*Bungarus multicinctus*). A full obituary will be published in *Copeia* 2002(1). Meanwhile, a tribute to Joe appears at the following website: http://www.doctorbugs.com/Joseph_Slowinski.html.

SSAR BUSINESS

New Officers for SSAR

In recent years, the duties of Treasurer (an elected office) and Publications Secretary (an appointed office) have been handled together by Robert Aldridge (with the able assistance of his wife, Linda). Aldridge is "retiring" from these positions and the operations are once again being divided. SSAR is grateful to Bob and Linda Aldridge for their many years of outstanding service to the herpetological community.

Effective 1 October 2001, Breck Bartholomew took over as SSAR Publications Secretary. The new address for SSAR Publications is:

Breck Bartholomew
SSAR Publications Secretary
P.O. Box 58517, Salt Lake City, Utah 84158, USA
e-mail: ssar@herplit.com
Phone/fax: 801/453-0489

Effective 1 January 2002, the new Treasurer will be Theodora Pinou. Her contact information is:

Theodora Pinou
SSAR Treasurer
Department of Ecology & Evolutionary Biology
Osborn Memorial Labs, Yale University
165 Prospect Street, New Haven, Connecticut 06520-8106, USA
e-mail: theodora.pinou@yale.edu
tel. 203/432-5028; fax 203/432-5176

Previously, the Treasurer's Office handled membership transactions. In an effort to streamline this important societal function, a new membership office has been established. Matters concerning new memberships, renewals, or address changes should be communicated to:

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Director, SSAR Membership Office
P.O. Box 253, Marceline, Missouri 64658, USA
e-mail: ssar@memsys.com
tel./fax: 606/256-3252

Seibert Award Winners for 2001 Announced

The tenth annual Seibert Awards were presented at the 44th Annual Meeting of the SSAR in Indianapolis, 27–31 July 2001. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). In recognition of outstanding student presentations at the annual meetings. Awardees received a check for US $200 and a book from Academic Press. The winners:

Systematics: **Emily Moriarty**, Section of Integrative Biology, University of Texas at Austin, "Phylogenetic relationships of North American chorus frogs (*Pseudacris*)."

Physiology/Morphology: **Travis LaDuc**, Department of Integra-

tive Biology, University of Texas at Austin, "Effects of body size on the predatory strike of the western diamondback rattlesnake."

Ecology/Evolution: **Daniel Warner**, Department of Biology, Virginia Polytechnic and State University, "Phenotypes and survival of hatchling lizards."

Conservation: **John Marshall**, Department of Biology, Indiana-Purdue University, "Movements and macrohabitat selection in fen wetlands by the eastern massasauga rattlesnake."

The judges also acknowledged additional outstanding presentations as Honorable Mention recipients:

Systematics: **Si-Min Lin**, National Taiwan Normal University, "Molecular phylogeny and biogeography of the grass lizards, genus *Takydromus* (Reptilia: Lacertidae), of eastern Asia."

Ecology/Evolution: **Jason Kolbe**, Washington University, "Nest-site selection in natural and disturbed habitats: adaptive or an ecological trap?"

Ecology/Evolution: **Vanessa Quinn**, Indiana State University, "Male-male competition and female choice: consequences of the loss of a male signaling trait."

Conservation: **Kristie Gianopulos**, University of South Florida, "Response of the threatened sand skink (*Neoseps reynoldsi*) to controlled burning and clear-cutting in Florida scrub habitat."

The judges were Marion Preest, chair (The Claremont Colleges), Steve Adolph (Harvey Mudd College), Robin Andrews (Virginia Polytechnic and State University), David Chiszar (University of Colorado), Lisa Hazard (UCLA), Diana Hews (Indiana State University), Meredith Mahoney (AMNH), Kirsten Nicholson (Washington University), Ann Paterson (Williams Baptist College), and Chuck Peterson (Idaho State University).

SSAR Henri Seibert Award for 2002

The Henri Seibert Award was initiated in 1992 to provide recognition for the best student papers given at the annual meeting of the SSAR. To be eligible, the presented paper must be the results of research conducted by the presenter. The research must have been done while the student was in either an undergraduate or graduate degree program. The presentations will be judged by the SSAR student prize committee. One Seibert Prize of US $200 may be given in each of the following four categories: Conservation, Ecology/Evolution, Physiology/Morphology, and Systematics. Consult Herpetological Review 28(4): 175 for recommendations to students entering the Henri Seibert competition. Students entering the competition must be members of SSAR. Students can win the Henri Seibert competition only once. Please indicate the category to which you are submitting your abstract on the abstract form in the Call for Papers.

SSAR Student Awards Fundraiser: 2001 Results and Call for 2002 Donations

We are disappointed to announce that NO travel grants were awarded for the 2001 Indianapolis SSAR/HL meeting, because we received NO applications. The money raised will be rolled over to the Brazil meeting in 2003.

We thank all who donated items to the 2001 silent auction at Indianapolis: Mike Cardwell, Harold Dundee, Harry Greene, Julian Lee, Jacqualine Grant, Joseph Mendelson III, Bob Reed, Harold Cogger, Rick Shine, Karen Lips, Roger Birkhead, Arthur Echternacht, Auburn Herpetological Society, Paul Gritis, Peter Meylan, Chuck Crumly, Kraig Adler, Nicole Sloan, Ricardo Javier Torres Cervantes, Scott Boback, Breck Bartholomew, Norm Scott, Alan Savitzky, Barbara Savitzky, Katy Kyle, Jennifer Ferri, and to any we may have missed. The Seventh Annual Frameable Art Silent Auction at Indianapolis raised $1495.00 for future student travel awards. On behalf of the SSAR, thanks to all who helped, including Matt Williams and Matt Greene, Auburn University, Henry Mushinsky, and the University Place Conference Center and Hotel. Special thanks for a job well done to the SSAR STAC Chairman, Scott Boback.

The SSAR STAC announces the Eighth Annual Frameable Art Silent Auction to be held at the 2002 SSAR meeting at Kansas City. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *Glen Lubcke and John Campbell, Biology Department, California State University, Chico, California 95929, USA; e-mail: gmlubcke@pacbell.net; tel. 530-898-6303.*

SSAR Student Travel Awards Call for Applications

Awards of US $200 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author (or co-author, see below) of a paper or poster to be presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that states: he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Student Travel Awards Committee are excluded from applying for a travel award.

APPLICATIONS MUST BE POSTMARKED BY 15 MAY 2002. Award recipients will be notified by 1 June 2002 and award checks will be disbursed at the meeting. Direct requests for information to: *Glen Lubcke or John Campbell, Biology Department, California State University, Chico, California 95929, USA; e-mail: gmlubcke@pacbell.net or tel. 530-898-6303.*

Help Us Send You Undergrad Students

SSAR gets many requests from USA high school students regarding colleges offering coursework in herpetology as part of a biology-related degree. Many times, students are interested in remaining within their home state for undergrad degree work.

If you teach classes, and/or offer undergrads participation in research in herpetology, please e-mail the following to George Pisani (gpisani@ku.edu):

Institution name and address AND home page URL
YOUR name and contact info (e-mail, home page, postal address, phone/FAX)
Your research interests
Your class offerings

We'll try to match these with the interests sent by prospective students. While thus far we have not had such inquiries from outside the USA, we'll gladly incorporate ALL such info into the database in order to assist any who inquire.

2001 Annual Meeting: Indianapolis

The 44th annual meeting of SSAR took place from 27 to 31 July 2001 in Indianapolis, Indiana. This year's meeting was held jointly with The Herpetologists' League and was hosted by Henry Mushinsky and Indiana University-Purdue University Indianapolis (IUPUI). All meeting activities were conducted at the IUPUI University Place Conference Center and Hotel, an impressive and comfortable conference facility. More than 300 presentations, about two-thirds of them oral, were scheduled for twenty sessions held throughout the four days of formal meetings. Two symposia provided focused topical presentations. On Sunday, 29 July, "Herpetologcial Research in Zoos: The Academic Connection" was coordinated by Hugh Quinn and John Groves. This symposium was dedicated to the memory of the late Sherman A. Minton, Jr., and acknowledges the contributions Minton made to zoological park research on amphibians and reptiles, incorporating a collection of 20 talks from members of the academic and zoological park communities. "Amphibian Population Declines" addressed that topic in a two-day symposium (30–31 July) examining numerous issues related to amphibian population concerns. This symposium was organized by David Green and Karen Lips, supported by SSAR and The Herpetologists' League, and brought together experts in many areas to discuss research findings and conservation recommendations in a series of 32 presentations.

Social Programs

A variety of social events served as lively diversions from the daily scientific presentations. Friday, 27 July 2001, was a day reserved for the board meetings of the two societies. Friday evening marked the return of the SSAR President's Travelogue to the annual meeting. Slide presentations featuring regional amphibians, reptiles, and the people who study them were laced with humorous commentary. Presenters included Patricia Burrowes (Peurto Rico), Tim Halliday (South Africa), John Wilkinson (provided a world-wide herpetological perspective), Ross Alford (Australia), Hinrich Kaiser (Caribbean Islands), and Mike Lannoo (who proved beyond a shadow of a doubt that there are no amphibians or reptiles in Antarctica). Slide presentations were followed by a cash-bar social at the University Place Sports Bar, allowing attendees the opportunity to socialize at their leisure. The Opening Plenary Session, the morning of 28 July, opened with an introduction by Local Committee Chair Henry Mushinsky. David L. Stocum, Dean of the School of Science at IUPUI, greeted meeting attendees. To open the meeting, Kraig Adler and David Hardy made comments honoring the late Sherman A. Minton, M.D., a long-time supporter of SSAR and Indianapolis resident. The Herpetologists' League Distinguished Herpetologist Lecture was given by Bill Branch, Curator of Herpetology at the Port Elizabeth Museum, who spoke on "Herps and Hopes: Africa in a New Millennium." Following the Opening Plenary session, most attendees gathered in the courtyard of the University Place Conference Center and Hotel to pose and squint for the meeting photograph. This year's photo was included in the conference registration fee and attendants had the opportunity to pick up their prints during the latter half of the meeting.

On Saturday and Sunday, 28–29 July, meeting attendees had the opportunity to view and photograph an impressive assemblage of amphibians and reptiles native to Indiana. The live exhibit was organized by Daryl Karns and Dennis Brown of the Hoosier Herpetological Society and marked a welcome return of this popular aspect to the annual event. Also during these two days, SSAR sponsored the Silent Auction to raise funds to benefit student travel expenses. Scott Boback supervised and coordinated this successful activity that saw active bidding on numerous items of herpetological art, literature, and culture. Saturday evening culminated with an "Icebreaker" in the University Place Ballroom. Drinks, snacks, and light appetizers provided the catalyst for this social gathering. Sunday morning, early risers enjoyed a bird watching opportunity to Eagle Creek Park guided by Greg Watkins-Colwell. During the afternoon of 29 July, the release of a new two-volume SSAR publication resulted in much excitement and attention. The launching of the 2nd edition of "The Hylid Frogs of Middle America" by William E. Duellman, with many new watercolor renderings by David Dennis, saw the author and artist signing copies of this revised and updated herpetological classic. Additionally, original David Dennis artwork from the publication was available.

The evening of 29 July saw participants gathering under tents and on the lawn adjacent to the University Place Conference Cen-



A highlight of this year's meeting was the unveiling of William Duellman's *Hylid Frogs of Middle America*. A book signing took place, with author and illustrator (David Dennis) on hand to inscribe books. Shown here, from left to right, are David Dennis, Bill Duellman, Ronald Javitch (benefactor of this revised edition), and Kraig Adler (editor).



Bill Duellman was kept busy signing copies of his new book.

ter and Hotel for the Annual Barbecue. A variety of picnic side dishes complemented fried chicken and barbecued ribs. Following the meal, the annual meeting Auction was cosponsored by SSAR and HL with proceeds from the event being split between the two societies. David Morafka and John Moriarty conducted the auction with assistance provided by Ken Dodd, Julian Lee, and Craig Nelson. Active bidding on a variety of herpetological items carried activities well into the evening and provided significant financial support for this year's meeting.

Monday, 30 July, saw the return of the SSAR Herpetological Quiz compiled and organized by Marty Crump and Julian Lee. Monday evening provided meeting participants with the opportunity to view the latest versions of the David Dennis and Eric Juterbock slide presentations of regionally distinct herpetofauna, coupled with a historically oriented slide show by Dennis, Juterbock, and Kraig Adler. Always a visual and auditory treat, this year's installments pleased a packed crowd in the conference center auditorium.

Business Meeting and Board Meeting Summary

Society President David Green called the Annual SSAR Business Meeting to order at 1820 h in Room 118 of the IUPUI University Place Conference Center and Hotel on Monday, 30 July 2001. The Business meeting was well attended, with approximately 50 Society members present. The SSAR Board meeting was held on Friday 27 July 2001 at the Conference Center.

President Green summarized reports to the SSAR Board of Directors by focusing on several key issues. Concerning efforts to reach the international herpetological community through involvement with SSAR. To that end, membership brochures have been produced in Spanish, Portuguese, and French. A German version of the brochure is in the works. Regarding personnel changes within the Society, the pending resignation of Robert Aldridge from the Treasurer's position necessitated finding worthy candidates to this important Board seat. To aid in the search process, President Green appointed Julian Lee to head an effort to identify candidates. President Green proposed the possibility of splitting the duties of the Treasurer into two positions: A) the traditional financial tasks of the Treasurer and B) a Membership Secretary to coordinate membership efforts. President Green appointed Karen Lips to head up a nominating committee to seek candidates for the 2001 elections and appointed Julian Lee to do the same for 2002. During his first year in office, President Green (with Board approval) also appointed the following individuals to positions within the Society: Brian Miller – Caudata Section Editor for the *Catalogue of American Amphibians and Reptiles*; Breck Bartholomew – to take the post of Publications Secretary as of 1 October 2001 (to replace the outgoing Robert Aldridge). Green also announced that Steve Corn has requested a replacement editor be sought for *Herpetological Conservation.* All outgoing editors and officers were thanked for their thoughtful service to the Society.

The Board considered electronic publishing options for SSAR and joined with the HL Board in a special joint Board meeting session to hear representatives from Allen Press and Blackwell Science explain the options and answer questions. Acknowledging that electronic publishing, in some format, is an eventuality for the Society, the SSAR Board felt strongly that we should move the Society forward—electronically publishing its journal while also continuing to produce a paper version. As there are many pros and cons to be addressed with electronic publishing, including issues of generating revenues and organizational management, the Board did not debate at this time precisely how SSAR will embrace this technology. Instead, a joint Task Force with members of The Herpetologists' League, who are facing similar decisions, has been struck with a report on options expected next year.

Society Treasurer Robert Aldridge reported that SSAR remains financially viable with total assets of $219,000 in restricted accounts. Aldridge reported that the sale of SSAR publications totaled nearly $69,000. The appointment of Breck Bartholomew as Publications Secretary was announced and Breck noted that his responsibilities in this Society position would be separate and distinct from his personal enterprise as a book dealer. Bob reports that SSAR membership continues to remain stable, at 2384 for FY 2001.

Journal of Herpetology Editor Brian K. Sullivan (*in absentia*) submitted a report indicating a number of personnel changes. The addition of Jean Bann, as Copy Editor, to the *Journal* staff has helped in formatting electronic versions of submissions to Allen Press. Additional changes in the editorial staff include Stephen Busack, as Associate Editor (replacing the outgoing Aaron Bauer), and John Wiens (Editorial Board). Brian reported that submissions to the *Journal* were up slightly in 2000 from the previous year at 262. Of these submissions, 90 were accepted, representing a 34% acceptance rate. Submissions as of June 2001 were running 20% higher than a comparable date in recent years, and could reach record levels. Sullivan reported that publication lag times of 9–12 months could be expected for accepted manuscripts, noting that decreasing that time could incur significant costs for the Society. Sullivan endorsed several recommendations made by the Publications Task Force that had been chaired by William Cooper: 1) Changing the *Journal of Herpetology* to a glossy paper stock; 2) Increasing the font size of the *Journal* from its current 9 pt (for Article text) and 8 pt (for citations and Shorter Communications) to 10/9 pt (for text and citations in Articles) and 9 pt (for Short Communications). Sullivan estimated that increasing font size represents a potential increase in page numbers that would result in

added publication costs; and 3) Implementing the addition of abstracts to Shorter Communications. The Board approved the idea of adding abstracts to Shorter Communications and of moving to glossy paper as it would represent a minimal increase in cost to the Society for the increased "professional" appearance of the publication. However, the Board believed that more information was needed before deciding on the issue of increased font size for the *Journal of Herpetology*.

Herpetological Review Editor Robert Hansen reported personnel changes including the addition of Eli Greenbaum and Omar Torres as Section Editors (Current Research), and Chris Sheil as Index Editor (a new *HR* position). *Herp Review* seems to be able to maintain its current, expanded production size—272 pages in four issues for Volume 31—a 6% increase from Volume 30. Bob reported that the addition of a new Herpetological History section to *HR* has seen several submissions. Hansen noted that submissions can expect a lag time from acceptance to publication of 3 months (for geographic distribution notes) to 6–9 months (for articles and natural history notes). Bob also said that efforts to electronically index *HR* articles are being developed.

Robert Powell, Editor of the *Catalogue of American Amphibians and Reptiles* (*CAAR*), submitted a report on the status of this publication effort. Bob reported that the 2000 contributions to *CAAR* consisted of 20 accounts (Nos. 701–720; 7 salamander, 1 frog, 8 lizard, and 4 snake accounts), for a total of 80 printed pages. Color plates were included in 16 of the accounts. Bob expects the completion of 20 accounts for 2001 (with 17 of these having color photographs), has plans for another 20 accounts for 2002, and would like to see this number maintained annually, as long as sufficient number of individuals submit species accounts. Digital technology continues to be used to archive *CAAR* accounts on CD-ROM.

Kraig Adler (Editor), submitted reports on the activities of two Society publication series, *Contributions to Herpetology* and *Facsimile Reprints in Herpetology*. Recent publications include "Herpetofauna of New Caledonia and Surrounding Islands," by Aaron Bauer and Ross Sadlier (November 2000), "Herpetological Illustrations from the Spencer Research Library, University of Kansas," compiled by Sally Haines (December 2000), and "Hylid Frogs of Middle America," by William E. Duellman with new illustrations by David Dennis (July 2001 – see comments above). Upcoming and newly completed offerings include several significant publications. "Amphibians of Honduras," by James R. McCranie and Larry David Wilson is due in December 2001 and will feature accounts on 116 species from this significant Central American region. "Reptile Fauna of Ceylon," by William Ferguson is expected in December 2001. This monographic publication is the first systematic list of Sri Lankan herpetology and is being issued to commemorate the Fourth World Congress of Herpetology (December 2001 in Colombo, Sri Lanka). Also expected in late-2001, or early-2002, is a reprinting of "Anatomy of the Salamander," by Eric T. B. Francis. Originally published in 1934, this work will have a new introduction by James Hanken. Anticipated by mid-2002 is "Herpetology of Cuba," by Thomas Barbour and C. T. Ramsden. This reprint will include new text and additional photographic plates, with an introduction by Blair Hedges expected. Adler reported that three additional projects are in the works and should be published in the next year or two. These include "Field Guide to Amphibians and Reptiles of the West Indies," by S. Blair Hedges, "Lizards of Southern Africa," by William Branch and Aaron Bauer, and "Biology of the Reptilia, Volume 20 (Morphology)," edited by Carl Gans and Abbot Gaunt. Also anticipated by the summer of 2002 is a comprehensive index to "Biology of the Reptilia," by Ernie Liner. This will represent Volume 21 in the series and may be available in a searchable CD-ROM format. Adler reported that the transition of his duties as Editor of the *Facsimile Reprints* to Aaron Bauer has already begun, and he has complete faith that the series will be in good hands.



The annual barbecue afforded attendees opportunities for discussions in a more relaxed setting. From left to right, Steve Morey, Roland Knapp, Carlos Davidson, Norm Scott, and Dave Bradford contemplate amphibian declines in the American West.

Herpetological Circulars Editor John Moriarty reported on the status of three publications in that series. *Herpetological Circular No. 30* – "Amphibian Monitoring in Latin America: A Protocol Manual," by Karen Lips, Bruce Young, Jamie Reaser, and Roberto Ibáñez was expected in August 2001. This contribution is being produced as a bilingual publication (Spanish and English) with production costs being covered by a National Science Foundation grant to the Nature Conservancy. The authors will receive 300 copies for distribution in Latin America. *HC No. 31* – "Conservation Guide to the Eastern Diamondback Rattlesnake," by Walt Timmerman and Marty Martin is planned for 2002. "Herpetological Collecting and Collections Management, revised edition," (*HC No. 32*) by John Simmons will be a revision of *Herp Circular No. 16* and is anticipated for 2002.

Stephen Corn, Editor of *Herpetological Conservation*, reported that progress on Volume 2, "Ecotoxicology of Amphibians and Reptiles," has continued to see difficulties. A proposed Volume 3, "Conservation and Status of Reptiles in Canada," has received solid backing by The Canadian Amphibian and Reptile Conservation Network. The lead editor for the publication is Carolyn Seburn, who has promised reviewed manuscripts, but Corn reports that this volume likely will not be ready until 2002. Other projects are in the planning phase, but will require the direction of another editor as Corn has requested to be relieved of this duty.

Brian Crother (Chair), on behalf of the Standard English and Scientific Names Committee, reported that the completion and publication of *Herp Circular No. 29* was a successful endeavor. The Board recommended that this publication should be recognized as the accepted reference for nomenclature of amphibians and reptiles in North America. President Green stated that this point has been acknowledged by ASIH and HL, and that it had also been accepted by Canadian herpetological organizations.



Fearless Dave Morafka once again demonstrated his willingness to sell just about anything, as evidenced by this attempt to auction old luggage.

Mike Plummer, Chair of the Conservation Committee, reported that the committee continues to focus on informative efforts. To date, 32 of 50 U.S. state agencies have contributed material to the SSAR Conservation Website. Members of the committee include Kurt Buhlmann, Ken Dodd, Mike Dorcas, Lee Fitzgerald, John Jenssen, Andy Price, Steve Sheffield, and Mike Sredl. Other efforts for the year consisted of sending a position letter to the U.S. Fish and Wildlife Service (USFWS) supporting a "Threatened" listing under the Endangered Species Act for the Chiricahua leopard frog, *Rana chiricahuensis*. A second position letter to USFWS was submitted supporting an "Endangered" listing under the ESA for the Mississippi gopher frog, *Rana sevosa*. The committee also endorsed a letter-writing campaign, to Congressmen, supporting the Conservation and Reinvestment Act (CARA) in several states. A letter from the committee to Mr. Abe Blank praised the education and conservation efforts through his El Serpentario y Centro de Educacion Medio Ambiental de La Paz. Mr. Blank's serpentarium was a featured destination during last year's meeting in La Paz, B.C.S., Mexico. Sadly, Mr. Blank was killed in the months following the 2000 meeting, under mysterious circumstances.

Membership Committee Chair Theodora Pinou reported that several initiatives aimed at increasing SSAR membership have been investigated and implemented. Pinou outlined several strategies: 1) Active recruitment at regional and local herpetological meetings. Whenever possible and appropriate, Pinou would like to know about and assist with membership recruiting efforts. Associated with these membership activities, Pinou has worked with other Society members to identify areas that will result in increased foreign membership. Spanish and Portuguese versions of the online membership form are available. Electronic membership capabilities would be of significant benefit, not only to international members, but also to the Society at large. Primary concerns are related to website security and electronic maintenance of memberships. 2) An alternative membership dues structure for international members. The possibility of lowered dues for international members was discussed, but no solid recommendations were made in the face of increased postal rates and operational costs. 3) Direct solicitation of invitations for membership from individuals identified from the "Combined Directory of Herpetologists" that did not indicate SSAR membership. Pinou reported that it is difficult to gauge the effectiveness of this effort, but stated that 11% of contacted individuals subsequently joined the Society. Future efforts of the Membership Committee will attempt to identify the origin of members' registration to target effective strategies.

Several outstanding student projects received recognition during the past year. Robert Gatten reports that the Kennedy Award Committee selected the best student paper, from 10 eligible contributions published in 2000. The committee selected "Nest site selection, larval hatching, and advertisement calls of *Rana arathooni* from Southwestern Sulawesi (Celebes) Island, Indonesia," by Rafe M. Brown and Djoko T. Iskandar (*Journal of Herpetology* 34:404–413) for this annual award. Bob recognized the efforts of the Kennedy Award Committee in thanking Robin Andrews, Terry Schwaner, Lynnette Sievert, and Sam Sweet for their diligence and service.

Marion Preest announced winning selections in the Seibert Award competition for the 2001 meeting: Emily Moriarty (University of Texas-Austin), Travis LaDuc (University of Texas-Austin), Daniel Warner (Virginia Polytechnic Institute and State University), and John Marshall (Indiana-Purdue University-Fort Wayne) were chosen as the best student presenters in four categories (see below for details on Seibert Award winners).

Several students received support to the SSAR 2001 Meeting through Sherman Minton Student Travel Awards (David Hardy, Chair). These awards provided $200 to each winner and included the following individuals: Omar Attum (University of Louisville), Philip J. Bergmann (University of Calgary), Angelo Bufalino (Saint Louis University), Amanda Crnkovic (Louisiana State University—Shreveport), Caren S. Goldberg (University of Arizona), Sarah M. Holt (University of Guelph), Ulrich Kuch (University of Frankfurt), Richard M. Lehtinen (University of Michigan), Owen M. Lockhart (Indiana University of Pennsylvania), Michael N. Marchand (University of New Hampshire), Jason R. Rohr (Binghamton University), Michael J. Rubbo (Pennsylvania State University), Stacy N. Smith (University of Georgia), Rebecca Symula (East Carolina University), Ricardo Torres-Cervantes (Universidad Nacional Autónoma de México), Mark E. Walvoord (University of Oklahoma), and Christopher R. Wilson (Appalachian State University).

Henry Mushinsky presented information on future meeting events. The SSAR Board accepted meeting invitations for the next several years. These meetings will be joint events with the American Society of Ichthyologists and Herpetologists (ASIH) and The Herpetologists' League (HL). ASIH President Al Savitzky provided details for future dates and venues: 2002 – Kansas City, Missouri (3–8 July) to be held at the Westin Crown Centre Hotel; 2003 – Manaus, Brazil (in early June), planned for the Hotel Tropical Manaus along the banks of the Rio Negro; 2004 – Norman, Oklahoma (27 May–2 June); and 2005 – Tampa, Florida (date not set). At the Board meeting, Savitzky showed slides of the facilities in Kansas City and Manaus, and promised a good venue for both destinations. Accommodation packages are being arranged for the Brazil meeting and should represent a good opportunity for international travel. President Green announced that undistrib-

uted funds from SSAR student travel awards for 2001 would go towards offsetting travel costs to the 2003 meeting destination for those student members who apply for support.

Akira Mori summarized the activities of the Task Force for Non-US Members. Together with Karen Lips and Carlos Navas, Mori addressed several areas that the Task Force feels would better serve non-US members in the Society and help make SSAR a more internationally inviting organization. He summarized the ways in which SSAR may increase its international appeal with the following suggestions: 1) include more non-US reviewers and editors for Society publications; 2) create guidelines for editors of manuscripts submitted from non-English speaking authors that would result in positive comments; 3) expand the international scope of topical coverage in *Herp Review*; 4) hold the annual meeting at locations outside the United States; 5) create mirror, alternative-language websites for the Society homepage; 6) reduce the dues rate to non-US members to make it more financially attainable; and 7) advertise (in *Herp Review*) the willingness to embrace non-US member opinions. Speaking on behalf of SSAR editors, Bob Hansen stated that publication editors and reviewers already address grammatical and vocabulary concerns in a constructive fashion during the review process when dealing with manuscripts submitted from authors where English is a second language. Kraig Adler said US members should take an active role in reaching out to the international herpetological community. He encouraged US members to subsidize or sponsor non-US membership in SSAR. President Green asked all members working internationally to try and promote SSAR and increase international involvement of the Society.

George Pisani, SSAR Webmaster, reported that the SSAR website (http://www.ukans.edu/~ssar/SSAR.html) continues to see a lot of "hits" in terms of web visitation. Attempts to bring alternate language versions of the website are complicated and cumbersome, but progressing slowly—a Portuguese version is in the offing. President Green and members of the Board feel that the webpage should be enhanced to increase the delivery of the Society's mission and information. There was much discussion about online publication issues and how this may be linked to an expanded website for the Society. These and other approaches are being explored. President Green stated that a strong webpage would help to increase international involvement through computer access to the Society.

In other business, Al Savitzky motioned from the floor that SSAR should join the AIBS. After a brief debate by the membership, the motion was approved by a majority of those present.

—Respectfully submitted by John M. Matter, SSAR Secretary

2001 Resolutions

Smithsonian Institution

WHEREAS, the National Museum of Natural History, Smithsonian Institution, has played a long and important role in the activities associated with the academic and professional scientific community, and

WHEREAS, the collections of the National Museum of Natural History are the largest in the world, document national and international biodiversity, are studied by hundreds of museum and university scientists every year, both professional and student, either through loans of material or personal visits, are critical to research on systematics and biodiversity studies worldwide, and are crucial to the advancement of science, and

WHEREAS, the excellence and diversity of the staff of the National Museum of Natural History, their many significant contributions to the increase and diffusion of knowledge, their critical role in basic research, and their support of scientific research worldwide, that contribute to the advancement of scientific knowledge; therefore,

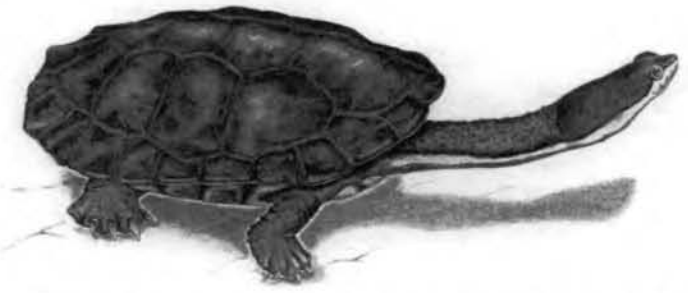
BE IT RESOLVED that The Herpetologists' League, at their 49th Annual Meeting, and the Society for the Study of Amphibians and Reptiles, at their 44th Annual Meeting, in Indianapolis, Indiana 27–31 July 2001, urge the Regents of the Smithsonian Institution to review carefully any plans to restructure science at the Smithsonian's National Museum of Natural History, to ensure that the collections continue to be maintained at world-class standards and are made available for study by the international scientific community, and to ensure that the Museum's pivotal role in research in systematics, biogeography, comparative morphology, ecology, and conservation biology in the natural sciences is maintained and supported well into the future.

Adopted by the Society for the Study of Amphibians and Reptiles at its Annual Business Meeting, 30 July 2001.

Minton Travelling Fellowship Fund Donors

The following individuals, organizations, and institutions contributed to the Sherman A. Minton Travelling Fellowship Fund:

Kraig Adler, Robert Aldridge, Steven Anderson, Bern and Bette Bechtel, Charles Carpenter, Chicago Herpetological Society, Hal Cogger and Tim Cogger, Roger Conant, Carl Gans, J. Whitfield Gibbons, Itzchak Gilboa, Harry Greene, David and Billie Hardy, Hoosier Herpetological Society, John and Sheila Iverson, Daryl Karns and Pam Middleton, Kentucky Reptile Zoo, Bruce Kingsbury, Krieger Publishing Company, Michael Lodato, Madge R. Minton, Paul Moler, Robert Norris, Steve Perrill, Chris Phillips, Alan Resetar, David Sever, Hobart Smith, Margaret Stewart, and Richard Zweifel.



Hydromedusa tectifera (South American Snake-necked Turtle). Illustration by Gladys E. Sala.

NEWSNOTES

Congdon Wins International Award

Justin Congdon, a senior research ecologist with the Savannah River Ecology Laboratory in Aiken, South Carolina (USA), has been awarded the 2000 Longevity Prize by the Fondation IPSEN, a French organization that supports work in the field of longevity. Since 1997 the annual prize has gone to researchers in such fields as biology, genetics, gerontology, demography, and statistics. Congdon is the first ecologist to win the award. Congdon received 100,000 French francs and delivered a lecture based on his work with longevity in Blanding's turtles in July 2001 at the World Congress of Gerontology in Vancouver, Canada.

"It is an honor, and quite a surprise, to be recognized by the Foundation IPSEN and scientists studying aging," said Congdon. "It is not often that a biologist working on a field study of life history evolution gets this kind of recognition, or any kind or recognition for that matter."

Congdon's research on the life histories of turtles is well known to the herpetological community. Over the past 26 years he has followed the lives of about 12,000 *Emydoidea blandingii* at the University of Michigan's E. S. George Reserve. The first 1,000 turtles were marked there between 1953–1957, so he has been able to follow the lives of both young and old individuals. He said, "I think that the demonstration that 60–70-year-old Blanding's turtles have traits that support hypotheses based on evolutionary theory better than those predicted by the senescence theory is what caught the eye of the scientists at the foundation."

SSAR congratulates Congdon for this notable accomplishment.



Savannah River Ecology Laboratory scientist Dr. Justin Congdon (right) receives the 2000 Longevity Prize, given by the Fondation IPSEN, a French organization that supports work in the field of longevity. Shown with him is Yves Christen of IPSEN Foundation. Congdon is the first ecologist to win the award. Congdon is shown at the World Congress of Gerontology in Vancouver where he received 100,000 French francs and delivered a lecture based on his work with longevity in Blanding's turtles.

Ohio Department of Natural Resources Honors Conant

The Ohio Department of Natural Resources recently awarded its highest honor to Roger Conant, by inducting him into the ODNR Natural Resources Hall of Fame. Conant spent nine years studying Ohio's herpetofauna during the Great Depression for his book, *The Reptiles of Ohio*, still an essential regional reference. Through his research, writing, and legendary correspondence, he has influenced several generations of herpetolgists.

A sample of previous Hall of Fame honorees include the legendary Johnny Appleseed, physician-naturalist Jared P. Kirtland, Ohio-born explorer John Wesley Powell, botanist Lucy Braun, and conservationist/novelist Louis Bromfield.

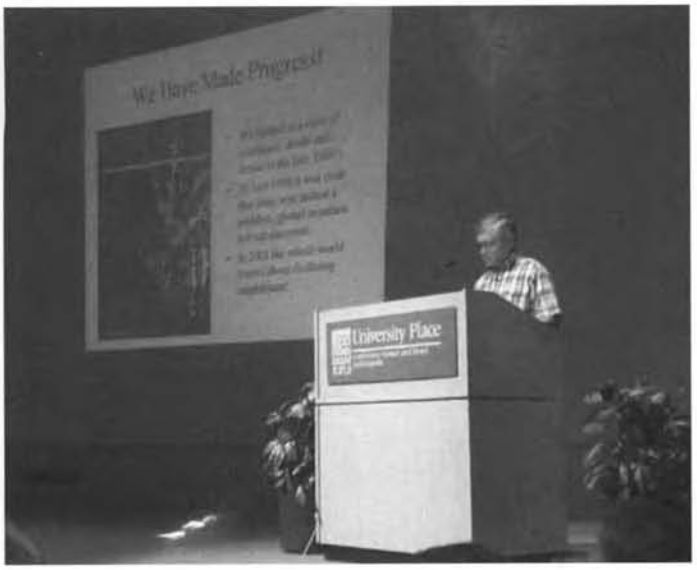
Graduate and Post-Graduate Research Grants

The Biological Research Station of the Edmund Niles Huyck Preserve (www.huyckpreserve.org) offers grants (max. = $2500) to support biological research which utilizes the resources of the Preserve. Among the research areas supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2000-acre Preserve is located on the Helderberg Plateau, 30 miles southwest of Albany, New York. Habitats include northeast hardwood-hemlock forests, conifer plantations, old fields, permanent and intermittent streams, 10 and 100-acre lakes, and several waterfalls. Facilities include a wet and dry lab, library, and houses/cabins for researchers. Deadline = 1 February 2002. Application material: *Dr. Richard L. Wyman, Executive Director, E.N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, New York 12147, USA.*

Declining Amphibian Populations Task Force

The Declining Amphibian Populations Task Force (DAPTF) has continued its well recognized role in promoting and coordinating international scientific efforts to assess the scope of amphibian declines worldwide and to identify the causes for this decline. DAPTF Seed Grants during 2000–2001 distributed over US $40,000 to researchers. The number of regional and issue-based working groups continued to grow, and now stands at more than 100. At this last summer's SSAR/HL annual meeting in Indianapolis, Karen Lips (Southern Illinois University) and David Green (McGill University, Canada) organized on behalf of DAPTF a very successful two-day international symposium on amphibian declines. The symposium was extremely well attended and received considerable media attention. A similar symposium will take place at the Fourth World Congress of Herpetology in Sri Lanka in December.

DAPTF efforts for 2002 will maintain all ongoing activities (e.g., *Froglog*, seed grants, working groups), as well as several new initiatives. The latter include DAPTF's participation and assistance with an ambitious Global Amphibian Assessment, which is being spearheaded by the Center for Applied Biodiversity Science at Conservation International.



At the Amphibian Population Declines Symposium in Indianapolis, David Wake reviewed the history of amphibian declines and summarized recent developments and new initiatives.

Pride in DAPTF's continued success is tempered by our growing understanding that the declining amphibian phenomenon is far more pervasive and severe than was appreciated only a few years ago. Yet, these facts only make the work of the Task Force more important. DAPTF's ability to assist scientific studies of declining amphibians and to work with governments and conservation organizations to devise sound strategies for saving natural populations is, to a considerable extent, a direct function of the amount of financial support received. Today, more than ever before, the Task Force depends critically on the donations received from private individuals. Persons or organizations wishing to make a donation to DAPTF should make checks payable to "Brookfield Zoo" and sent to: *DAPTF, Museum of Comparative Zoology, Department of Herpetology, 26 Oxford Street, Cambridge, Massachusetts 02138, USA.*

For U.S.-based donors, contributions to DAPTF are fully deductible for federal income tax purposes. Please contact the DAPTF headquarters (e-mail: Daptf@open.ac.uk) for information regarding payment in other currencies. Additional information about the Declining Amphibian Populations Task Force may be obtained from the DAPTF website: www.open.ac.uk/daptf/.

MEETINGS

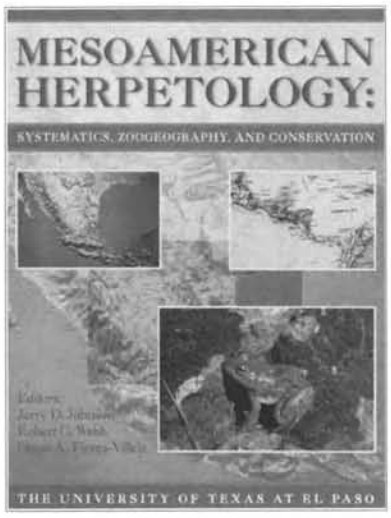
Meetings Calendar

21–24 March 2002—The Desert Tortoise Council 27th Annual Meeting and Symposium, Palm Springs, California, USA. http://www.deserttortoise.org/.

5–7 April 2002—Current Research on Herpetofauna of the Sonoran Desert II, Tucson, Arizona, USA. http://tucsonherpsociety.org.

18–20 April 2002—3rd International Symposium on *Emys orbicularis*, Kosice, Slovak Republic. Hosted by Vychodoslovenske Muzeum Kosice in association with Museum fur Tierkunde Dresden and DGHT Rheinbach. Information: Peter Havas, e-mail: havasp@vakke.slposta.sk or www.cassovia.sk/emys.

3–8 July 2002—45th Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists. Crown Center Hotel, Kansas City, Missouri, USA. Details will be available in the March 2002 issue of *HR* and will be posted on the SSAR web site: www.ukans.edu/~ssar.



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MESOAMERICAN HERPETOLOGY:
Systematics, Zoogeography, and Conservation

Jerry D. Johnson, Robert G. Webb, Oscar A. Flores-Villela
Editors

MESOAMERICA IS THE LANDMASS CONTAINING MÉXICO AND THE SEVEN COUNTRIES OF CENTRAL America. It has been the object of herpetological investigations for several centuries and continues to attract herpetologists from each of those countries and from foreign researchers as well. The high biotic diversity, including amphibians and reptiles, is well known, and is due to the large assortment of geological features and tropical environments found within the area. New information about various aspects of the herpetofauna continues to be produced and most certainly will be increased in the coming years.

Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation is the result of a symposium, sponsored by the Texas Herpetological Society and the University of Texas at El Paso, which was dedicated to increasing our knowledge about the herpetofauna of Mesoamerica. Authors of all 12 included papers are acknowledged experts in the field.

200 pages, 8 x 11 inches, b&w illustrations, maps. US $28.00 + 4.00 shipping & handling
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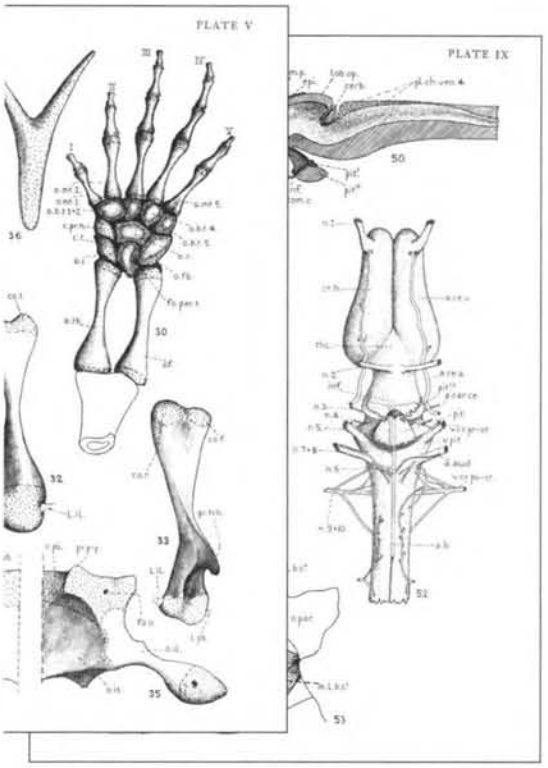
Two New Facsimile Reprints from the Society for the Study of Amphibians and Reptiles

THE ANATOMY OF THE SALAMANDER

by Eric T. B. Francis

Francis remains the starting place for virtually any rigorous study of salamander comparative or functional anatomy, and is an indispensible reference for studies of urodele developmental anatomy, endocrinology, and physiology.

—JAMES HANKEN, from the Foreword



FRANCIS'S *ANATOMY OF THE SALAMANDER*, PUBLISHED IN 1934, REMAINS one of the standard references in the herpetological and anatomical literature. It covers the anatomy of the European fire salamander, *Salamandra salamandra*, in 11 detailed chapters including external features, skeleton, muscles, nervous system, vascular system, urogenital system, ductless glands, and the skin and sense organs. The accounts are extremely thorough. For example, that on cranial nerve V (trigeminal) is six pages long; the branches of the systemic arch take another five pages; and each muscle is described in terms of its anatomy, invervation, synonymy, function, and homology. An added benefit is that Francis lists the relevant literature for each organ system; nearly 850 references are cited. He discusses homologies between structures in *Salamandra* and those in other salamanders and other vertebrates. He also covers the taxonomy, distribution, and life history of the salamanders of the genus *Salamandra*.

James Hanken, a leading vertebrate morphologist at Harvard University, provides an extensive foreword that puts Francis's book in historical context and reviews the relevant current literature. The book is illustrated with 25 highly detailed plates containing 84 fully labeled figures. There is an extensive index and a long historical introduction that reviews the classical literature on salamander biology beginning in the sixteenth century.

Specifications: 465 pages, 7 x 10 inches, 25 plates, colored frontispiece, clothbound. ISBN 0–916984–50–8. To be published February 2002.

REPTILE FAUNA OF CEYLON

by William Ferguson

THIS BOOKLET, ORIGINALLY PUBLISHED IN 1877, REPRESENTS THE FIRST COMPREHENSIVE AND FULLY ANNOTATED LIST OF the herpetofauna of Sri Lanka. It includes 41 species of amphibians and 139 of reptiles. It also gives a list of the Sinhalese common names. Two new and still-recognized species are described in this booklet: a gecko and a colubrid snake. A biography of Ferguson, a British surveyor and amateur naturalist who worked in Sri Lanka during 1839–1887, is added together with a list of his herpetological publications. This reprint is issued to commemorate the Fourth World Congress of Herpetology, to be held in Colombo, Sri Lanka, in December 2001.

Specifications: 48 pages, 5.5 x 8.5 inches, cardboard cover. ISBN 0–916984–59–1. To be published December 2001.

PRICES AND SHIPPING COSTS:

• FRANCIS: Pre-publication to SSAR members US$50; Institutions, non-members $60 • *Shipping*: USA address, add $4; non-USA $6.
• FERGUSON: Pre-publication to SSAR members US$6; Institutions, non-members $8 • *Shipping*: USA address, add $3; non-USA $4.

SEND ORDERS TO: Breck Bartholomew, P.O. Box 58517, Salt Lake City, Utah 84158–0517, USA (*telephone and fax*: area code 801, 453–0489; *e-mail*: ssar@herplit.com). Please make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks or by International Money Order. Orders may also be charged to MasterCard or VISA (please provide the account number and card expiration date). SSAR membership information and a complete list of all Society publications can be obtained on request to Mr. Bartholomew.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres-Carvajal**; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Systematics of West Indian Toads

The *Bufo peltocephalus* Group is composed of 11 species of toads that are restricted to the Greater Antilles. A monophyletic origin of the group has been questioned because of disparate morphology, behavior, and ecology of the different species. The authors examined three mitochondrial genes (12S, 16S, and cyt *b*) from 8 West Indian toads and 10 outgroup bufonids to address the monophyly, relationships, and biogeography of the *B. peltocephalus* Group. Sequence alignment was performed with the CLUSTAL option in Sequence Navigator (version 1.01) and corrected by eye. Phylogenetic analyses were conducted with neighbor-joining by MEGA (version 2.0b2), and with parsimony and maximum-likelihood by PAUP* (version 4.0b4). All trees supported the monophyly of the *B. peltocephalus* Group. The data suggest support for a Cuban clade, and the sister-group relationship of *B. guentheri* (Hispaniola) with *B. lemur* (Puerto Rico). A New World origin for the West Indian clade of toads also is suggested by the data. Data from this study and others suggest overwater dispersal of this group, and not a late Cretaceous vicariant event.

Pramuk, J. B., C. A. Hass, and S. B. Hedges. 2001. Molecular phylogeny and biogeography of West Indian Toads (Anura: Bufonidae). Molecular Phylogenetics and Evolution 20:294–301.

Correspondence to: Jennifer B. Pramuk, The University of Kansas Natural History Museum & Biodiversity Research Center and Department of Ecology and Evolutionary Biology, 1345 Jayhawk Boulevard, Lawrence, Kansas 66045-7561, USA; e-mail: pramuk@ku.edu.

Aging in an Emydid Turtle

The Relative Reproductive Rate Hypothesis contends that older individuals of long-lived species should possess traits that enhance reproductive success. The Senescence Hypothesis suggests that older individuals will experience a decline in reproductive success. The authors studied Blanding's turtle (*Emydoidea blandingii*) to address these hypotheses, and examined whether age and body size contribute to indeterminate growth with associated longevity. Turtles were marked, weighed, measured, and recaptured for years as part of this long-term study. Data on reproduction, nesting, predation, and mortality were collected as well; statistical analyses included Spearman's Rank Correlation, Wilcoxon tests, and survivorship curves (PROC LIFETEST). Results indicated that the oldest group of turtles had larger clutch sizes, but larger egg size was not associated with any age group. Older females had a significantly higher reproductive frequency than younger females. Older female nests experienced the lowest frequency of predation, but these nests had a higher likelihood of failure attributable to developmental problems. Survivorship did not differ significantly between the sexes, but older individuals survived longer than younger age groups. A strong relationship between body size and age was not found—body size does not appear to be a mechanism for increased reproductive output in older females. Although the data support both hypotheses, the authors contend that the Relative Reproductive Rate Hypothesis is best supported by the results.

Congdon, J. D., R. D. Nagle, O. M. Kinney, and R. C. van Loben Sels. 2001. Hypotheses of aging in a long-lived vertebrate, Blanding's turtle (*Emydoidea blandingii*). Experimental Gerontology 36:813–827.

Correspondence to: J. D. Congdon, Institute of Ecology, University of Georgia, Athens, Georgia, USA; e-mail: congdon@srel.edu.

Effects of Agricultural Disturbance on Lizard Diversity

Numerous studies have documented detrimental effects of ecological disturbance on biodiversity. The authors studied the effects of agricultural disturbance on lizard diversity in the Dominican Republic. Twenty-four plots representing 6 habitats ranging in complexity from abandoned pasture to *mogote* top were established in a protected national park. These plots were compared with 9 plots of active, agriculturally-disturbed habitats on the periphery of the park. Glue traps were utilized to capture lizards within the study plots. Species richness was analyzed with rarefaction; richness and eveness were analyzed together with Hulbert's Probability of Interspecific Encounter and the log series index (μ). Species richness was higher inside the park compared to the sites on the periphery of the park; active agricultural habitats exhibited the lowest diversity. The *mogote* sites are identified as the most species-rich habitat.

Glor, R. E., A. S. Flecker, M. F. Benard, and A. G. Power. 2001. Lizard diversity and agricultural disturbance in a Caribbean forest landscape. Biodiversity and Conservation 10:711–723.

Correspondence to: Richard E. Glor, Department of Biology, Campus Box 1137, Washington University, St. Louis, Missouri 63130-4899, USA; e-mail: glor@biology.wustl.edu.

Feeding Mechanisms of Gopher and King Snakes

The simple body forms of snakes limit their movements to various axial bends and twists. Recent studies have suggested kinematic similarity between undulations associated with swallowing and lateral locomotion—including the use of the same muscles in some cases. The author examined the activation patterns and kinematics of swallowing in the epaxial muscles of five gopher snakes (*Pituophis melanoleucus*) and one king snake (*Lampropeltis*

getula). For experimental trials, snakes were placed in open glass aquaria, offered live mice, and videotaped at 30 frames s^{-1}. Measurement TV and Fin software was used to digitize the vertebral midline of the snakes, and calculate bending angles, respectively. Electrodes were surgically implanted into the snakes for electromyographic (EMG) readings; EMG readings were amplified and recorded on FM tape. Plethysmography was used to measure the pressure exerted by snakes on their prey. A multiple regression analysis was used to examine the relationship between muscle activity and vertebral bending. Three distinct stages of swallowing (snout shifting, concertion bending, and ventral flexion) were observed in relation to intraoral transport, and one distinct stage (undulatory bending) was noted for esophageal transport. Peak pressures (0.93–4.8 kPa) were noted at the commencement of a bend after a short hiatus in movement. These results suggest the epaxial muscles are integral lateral flexors to movement that involve large-radius bending, including locomotion and swallowing.

Moon, B. R. 2000. The mechanics of swallowing and the muscular control of diverse behaviours in gopher snakes. The Journal of Experimental Biology 203:2589–2601.

Correspondence to: Brad R. Moon, Department of Radiology, Box 357115, University of Washington Medical Center, Seattle, Washington 98195-7115, USA; e-mail: bmoon@u.washington.edu.

The Hyolingual Apparatus of Chameleons

Since 1733, anatomists and functional morphologists have studied the tongue projection mechanism of chameleons. The authors examined the hyolingual apparatus of seven species of chameleons (*Brookesia armorata, B. supraciliaris, Chameleo calyptratus, C. fischeri, C. jacksonii, C. oustaleti, and C. pardalis*) in order to increase knowledge of the muscles involved in tongue projection. Selected specimens were cleared and stained or sectioned for histological examination. Specific muscles were separated from specimens and stained for examination with a dissecting microscope, polarized light microscope, or scanning electron microscope. A detailed description of the hyoid apparatus, origin and insertion of hyolingual muscles, distribution of motor endplates, and histochemical properties of selected muscles is discussed. A thick connective tissue sheet between the tongue and hyoid apparatus was identified as a potential source of elastic strain energy—this structure may be responsible for tongue recoil. The results of this study suggest that the hyolingual apparatus is more complex than previously assumed in other functional morphology studies of chameleons.

Herrel, A., J. J. Meyers, K. C. Nishikawa, and F. De Vree. 2001. Morphology and histochemistry of the hyolingual apparatus in chameleons. Journal of Morphology 249:154–170.

Correspondence to: A. Herrel, Biology Department, University of Antwerp, Universiteitsplein 1, B-2610 Antwerp, Belgium; e-mail: aherrel@uia.ua.ac.be.

Antipredatory Adaptations of *Chamaeleo chamaeleon*

Many species of animals with reduced locomotory abilities use camouflage as the main tactic to avoid predatory attacks. The authors studied the effects of camouflage on escape decisions in the common chameleon, *Chamaeleo chamaeleon* by performing experiments with humans as would-be predators. Effects of background vegetation and individual size of chameleons on the ability of a predator to detect the chameleons were analyzed both in the field and by examination of photographs. Probability of detection was significantly influenced by background and size of chameleons. Based on these results, the authors then analyzed how risk perceived by an individual chameleon influenced its escape decisions. They found that the type of defensive display was different for individuals of different sizes and in different conditions. The results of this study indicate that camouflage has a significant effect on individual escape decisions and that some antipredatory responses are size-dependent.

Cuadrado, M., J. Martín, and P. López. 2001. Camouflage and escape decisions in the common chameleon *Chamaeleo chamaeleon*. Biological Journal of the Linnean Society 72:547–554.

Correspondence to: Mariano Cuadrado, Estación Biológica Doñana-CSIC, Avda. de María Luisa s/n Pabellón del Perú, E-41013 Sevilla, Spain; e-mail: macuagu@cica.es.

Systematics of Skinks in the Genus *Eumeces*

The scincid genus *Eumeces* is composed of over 50 morphologically and ecologically variable species occurring throughout most of the Holarctic region of the world. The authors conducted a phylogenetic analysis of the genus *Eumeces*, and included the genera *Scincopus* and *Scincus* in their ingroup. Because of the lack of knowledge regarding basal scincid phylogenetic relationships, the authors included nine genera of the family Cordylidae in the outgroup. However, general comparisons were made between the ingroup and other scincid taxa. The phylogenetic analysis was conducted with 16 morphological characters (14 unambiguously polarized), and heuristically analyzed using PAUP* version 4.0b1. One fully resolved, most parsimonious tree (19 steps) was obtained from the analysis. The analysis indicated: 1) the *Pariocela* species group (39 species) is monophyletic; 2) the *schneiderii* (5 species), *schwartzei* (3 species), and *taeniolatus* (2 species) species groups are more closely related to each other and the *Scincopus* and *Scincus* genera than they are to the *Pariocela* species group; 3) *Scincopus*, *Scincus* and the *schneiderii* and *taeniolatus* species groups form a monophyletic group; 4) the *schneiderii* species group shows several synapomorphies with *Scincopus* and *Scincus*; and 5) *Scincopus* and *Scincus* share a common ancestor. The authors propose a new subfamily (Eumecinae) solely for the genus *Eumeces* (39 species), recognition of the genus *Eurylepis* for the *taeniolatus* species group, the new genus *Mesoscincus* for the *schwartzei* species group, and the new genus *Novoeumeces* for the *schneiderii* species group.

Griffith, H., A. Ngo, and R. W. Murphy. 2000. A cladistic evaluation of the cosmopolitan genus *Eumeces* Wiegmann (Reptilia, Squamata,

Scincidae). Russian Journal of Herpetology 7:1–16.

Correspondence to: Robert W. Murphy, Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, Canada; e-mail: drbob@rom.on.ca.

Genetic Divergence of Chinese Giant Salamanders

The Chinese giant salamander (*Andrias davidianus*) is the largest species of amphibian in the world, and it is restricted to mainland China in the Yellow, Yangtze, and Pearl rivers. This species is currently listed under CITES Appendix I because of habitat destruction and human consumption. The authors utilized isozyme electrophoresis (40 loci) and two mt DNA genes (ATPase 6 and cyt *b*) to assess the genetic diversity of 6 populations of salamanders, and to test the null hypothesis that all the populations represent a single species. Results from allozyme data indicated a deficiency in individual heterozygosity, and that *A. davidianus* is not a panmictic species. Genetic divergence levels did not indicate recognition of more than one species, although one population from Huangshan possessed three unique, non-homoplastic synapomorphies (mtDNA) and unique alleles at two loci (isozymes). Lack of geographic correlation is a likely consequence of human relocation of salamanders. The authors suggest a conservation strategy that preserves the maximum amount of genetic diversity.

R. W. Murphy, J. Fu, D. E. Upton, T. de Lemas, and E. Zhao. 2000. Genetic variability among endangered Chinese giant salamanders, *Andrias davidianus*. Molecular Ecology 9:1539–1547.

Correspondence to: Robert W. Murphy, Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, Canada; e-mail: drbob@rom.on.ca.

Phylogenetic Relationships of Lissamphibia

The morphological diversity and poor fossil record of living amphibians has complicated efforts to reconstruct the phylogenetic relationships of these animals. Although most modern studies have accepted the monophyly of Lissamphibia (salamanders, caecilians, and frogs), the identification of the sister group and ingroup relationships remains contentious. To address the issue of amphibian monophyly, the authors sequenced the entire mitochondrial genomes of a salamander (*Mertensiella luschani*) and a caecilian (*Typhlonectes natans*); these sequences were compared to the mt genome of the frog *Xenopus laevis* and 9 other tetrapod taxa. Nucleotide sequences were aligned with CLUSTAL X and refined by eye. Maximum parsimony with heuristic searches, neighbor-joining, and maximum likelihood analyses were performed with PAUP* version 4.0b4a. All three analyses produced the same tree topology, which confirmed the monophyly of Lissamphibia and placed salamanders and frogs in a sister group relationship; this study supports the Batrachia (Caudata+Anura) hypothesis. These results can be utilized in future studies to: 1) examine phylogenetic relationships within salamanders and frogs; 2) compare vertebral development in salamanders and caecilians; and 3) compare brain development and limb morphology in Lissamphibia.

Zardoya, R., and A. Meyer. 2001. On the origin of and phylogenetic relationships among living amphibians. Proceedings of the National Academy of Sciences 98:7380–7383.

Correspondence to: Rafael Zardoya, Museo Nacional de Ciencias Naturales, José Gutiérrez Abascal, 2, 28006 Madrid, Spain; e-mail: mcnr154@pinar2.csic.es.

Tail Loss and Vulnerability of the Skink *Lampropholis guichenoti* to Predation

Tail loss is an effective defense mechanism used by many species of lizards to evade predators. However, tail autotomy may reduce an individual's subsequent fitness and ability to avoid predators. The authors examined how predatory interactions between the common garden skink *Lampropholis guichenoti* and two snake predators are influenced by behavioral shifts induced by tail autotomy of the prey. A series of experiments were performed to estimate nonrandom consumption vs. active selection of tailed and tailless skinks by the diurnal snake *Demansia psammophis* and the nocturnal snake *Rhinoplocephalus nigrescens*. In addition, the differential vulnerability to predation of tailed and tailless lizards was analyzed. The experiments with the diurnal predator resulted in tailless skinks being more susceptible to predation than tailed skinks. In contrast, experiments with the nocturnal predator indicated that skink vulnerability was not affected by tail autotomy. Reduced escape speed of tailless skinks may have increased vulnerability to predation by the diurnal snake, whereas selection of overnight shelters by skinks affected the probability of predation by the nocturnal snake. This study demonstrates that snake-lizard systems are good predator-prey models that can be used in ecological studies.

Downes, S., and R. Shine. 2001. Why does tail loss increase a lizard's later vulnerability to snake predators? Ecology 82(5):1293–1303.

Correspondence to: Sharon Downes, Institute of Nature Conservation, Klinekstraat 25, B-1070 Brussels, Belgium.

Use of Cover Objects for Sampling Snakes

One of the most effective sampling methods for amphibians and reptiles is the use of artificial cover objects. This method minimizes disturbance of microhabitats and is very useful in ecological studies. The authors tested the effectiveness of three kinds of covers by sampling the secretive snake *Contia tenuis* and three species of *Thamnophis*. Black asphalt, corrugated tin, and plywood were used to build more than 50 cover-stations in the Gulf Islands, British Columbia. Differences in the use of the three cover types were analyzed using contingency tables and the Chi-square test. The snakes used plywood covers less frequently than asphalt and tin covers—probably because the latter two materials heat up rapidly in the sun and become a good source of heat. Artificial cover objects were found to be useful in studying secretive snakes. However, this sampling method might contain biases, such as the sampled individuals not being representative of the population. Thus, potential biases of this method need to be examined in population studies.

ENGELSTOFT, C., AND K. E. OVASKA. 2000. Artificial cover-objects as a method for sampling snakes (*Contia tenuis* and *Thamnophis* spp.) in British Columbia. Northwestern Naturalist 81:35–43.

Correspondence to: Christian Engelstoft, Department of Biology, University of Victoria, British Columbia, Canada V8W 3P6 and Alula Biological Consulting, 1967 Nicholas Road, Saanichton, British Columbia, Canada V8M 1X8.

Lizard Abundance in Guana

Despite the importance of accurate population density estimates in ecology, many studies of lizard abundance are biased because selection of study sites is commonly based on the high density of the species studied. The authors quantified absolute population densities of lizards with four 10 x 10 m forest removal plots in Guana Island, British Virgin Islands. Early successional and mid-successional forests were surveyed, and the results were compared with data of a previous study made in the island of Guam, Mariana Islands. Of the 1401 lizards obtained, 94.5% corresponded to the diurnal gecko *Sphaerodactylus macrolepis*, which was found primarily in leaf litter. With a density of 67,600 ha^{-1}, *S. macrolepis* was found to be the densest terrestrial species among non-aggregated vertebrates. Therefore, this lizard represents an excellent model organism for ecological studies in spite of its secretive habits and small size. Lizard assemblages in Guana are similar to those in Guam only in that litter insectivores are the densest species. The main difference between Guam and Guana is that Guana lacks nocturnal species, whereas in Guam nearly half of all terrestrial vertebrate individuals correspond to nocturnal species. This dissimilarity between guild abundances in Guana and Guam contrasts with the significant overlap in assemblage structure between both islands. The authors concluded that some process other than community adaptation significantly influences ecological roles and potential abundances.

RODDA, G. H., G. PERRY, R. J. RONDEAU, AND J. LAZELL. 2001. The densest terrestrial vertebrate. Journal of Tropical Ecology 17:331–338.

Correspondence to: Gordon H. Rodda, USGS Midcontinent Ecological Science Center, 4512 McMurry Avenue, Fort Collins, Colorado 80525, USA.

Dipteran Parasites of Loggerhead and Green Sea Turtle Nests

Larvae of the dipteran families Phoridae and Sarcophagidae have been found in marine turtle nests in many parts of the world. The authors studied dipteran infestation of loggerhead *Caretta caretta* and green sea turtle *Chelonia mydas* nests in northern Cyprus. Dipteran larvae were found and collected during nest excavation in 1996 and 1997, and were identified by keeping some larvae in jars until adult flies emerged. Eleven species of Diptera were found in nests of both turtle species; however, loggerhead nests had more diversity and abundance of dipteran parasites than green turtle nests. By examining developmental periods of three dipteran species, the authors found that larvae developed in loggerhead nests faster than in green turtle nests. The levels of infestation found in northern Cyprus are lower than those of other species of marine turtles reported from other areas in the world. Although dipteran infestation seems to have no effect on the hatching success of nests, the authors recommend further study given the endangered status of sea turtles in the Mediterranean.

MCGOWAN, A., A. C. BRODERICK, J. DEEMING, B. J. GODLEY, AND E. G. HANCOCK. 2001. Dipteran infestation of loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtle nests in northern Cyprus. Journal of Natural History 35:573–581.

Correspondence to: A. McGowan, Evolutionary Ecology Group, Department of Animal and Plant Sciences, University of Sheffield, Sheffield S10 2TN, United Kingdom; e-mail: A.McGowan@sheffield.ac.uk.

Chemical Alarm Cues of the Ravine Salamander *Plethodon richmondi*

Many animals reduce the probability of encountering a predator by adopting avoidance behaviors after detecting the predator through chemical alarm cues. These substances are released upon physical injury by members of the same species or prey guild to communicate the presence of danger. The authors examined the ability of the ravine salamander *Plethodon richmondi* to detect and respond to chemical alarm cues from autotomized tails of conspecifics and of zigzag salamanders (*P. dorsalis*). All individuals were collected in Madison County, Kentucky, and six substrate-choice tests were conducted on consecutive nights. Ravine salamanders detected and avoided chemical cues released from autotomized tails of conspecifics and this response was independent of size and sex. Alarm cues released by zigzag salamanders were not avoided. Thus, ravine salamanders increase their chances of survival by avoiding areas where a conspecific has been injured.

HUCKO, J. A., AND P. V. CUPP. 2001. Avoidance of chemical alarm cues released from autotomized tails of ravine salamanders (*Plethodon richmondi*). Ethology 107:315–322.

Correspondence to: Jeffery A. Hucko, Department of Biology, University of Louisiana at Lafayette, Lafayette, LA 70504, USA; e-mail: jhucko@rocketmail.com.



Scaphiopus couchii (Couch's Spadefoot). USA: Texas: Webb County. Illustration by R. Michael Burger.

ARTICLES

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Secondary Sexual Characteristics of the Salamander *Salamandrella keyserlingii*: Throat Coloration

MASATO HASUMI
Biological Institute, Faculty of Science
Niigata University, Niigata 950-2181, Japan
e-mail: mhasumi@sc.niigata-u.ac.jp

Assessment of sex is essential to many ecological studies. Among amphibians, sexually dimorphic traits include size, vocalizations, and coloration. Males of many frog species develop pigmented vocal sacs during the breeding season (Duellman and Trueb 1986). In calling males of several hylids (e.g., *Pseudacris crucifer*: W. Duellman, pers. comm.) and the bullfrog *Rana catesbeiana* (Howard 1981), the throats become bright yellow. In the cave frog *Eleutherodactylus cooki*, males with the greatest reproductive success have throats with yellower color than their average ventral coloration (Burrowes 2000). Although yellow throat coloring is unknown in urodeles (but mental glands are sometimes distinguishable in plethodontid salamanders; Houck and Sever 1994), I found white (September–October) and yellow (April–May) pigmented patches in the throat region of adult males of the migratory salamander *Salamandrella keyserlingii* (Hynobiidae). Here I propose how to distinguish sex of this species visually during the terrestrial phase, focusing on seasonal fluctuations of both throat coloration in adult males and development of "ovisacs" (sensu Hasumi 1996b) in adult females. I further present a description of increased head width, tail height, and body mass in aquatic-phase males, similar to those of *Hynobius nigrescens* (Hasumi and Iwasawa 1990).

I studied *S. keyserlingii* inhabiting a wetland in Otanoshike, Kushiro-shi, Hokkaido Prefecture, Japan (43°01'02"N, 144°17'38"E; 4 m elevation). I captured 40 aquatic adults by netting from a fen (oviposition site: Hasumi and Kanda 1998) during the April–May breeding season (1995, examined for 15 days), and 633 terrestrial individuals near the fen during the April–May breeding season (1996–1997, 56 days) and the June–October nonbreeding season (1995–1997, 141 days), using a large grid of 160 pitfall traps within a 100 x 55 m area, composed of forest and marsh. I recorded sex, sexual maturity, age class (i.e., juvenile or adult), and visual characteristics of each individual (see below). I weighed each individual for body mass (M) with a portable beam balance (to within 0.05 g), and measured snout–vent length (SVL, distance from the tip of the snout to the posterior angle of the vent), broadest head width (HW), and maximum tail height (TH) with digital calipers (to within 0.01 mm) by a modification of Wise and Buchanan's (1992) method without using anesthesia. I marked 30 aquatic adults and 516 terrestrial individuals by toe-clipping, and released them either to the fen or near the pitfalls where they were trapped. Subsequently, 105 animals (70 adult males, 30 adult females, 1 unsexed individual, and 4 juveniles) were recaptured in pitfall traps. In one instance, I found only an adult-size tail (from base to tip) in a pitfall trap; it was classified as an unsexed individual. I compared mean SVL between adult males having brilliant and pale yellow throats during the April–May terrestrial phase, and mean HW, TH, and M between terrestrial- and aquatic-phase males, using the Aspin-Welch test when exhibiting unequal variances (Snedecor and Cochran 1980) or Student's t-test ($\alpha = 0.05$, two-tailed).

A tubercle at the anterior angle of the vent (Hasumi et al. 1990; Sato 1943) was never discernible in either sex throughout the year, even during the aquatic phase, and therefore was a poor predictor for distinguishing adult males from others. In contrast, the throat region was a reliable predictor of sex. In adult males, this region assumed a translucent, grayish color from June–August (Table 1). It was translucent white during September and changed into an opaque, white patch during October. This patch turned a brilliant or pale yellow during the terrestrial phase of the April–May breeding season or during breeding immigration. However, some variation in male throat color occurred during this period; when 3 adult males which had a brilliant yellow throat were recaptured during April–May, their throats showed a pale yellow color (dates of capture and recapture, 28 April 1996 and 6 May 1996, 28 April 1996 and 10 May 1996, 30 April 1996 and 22 April 1997). A male's whole body, including this yellow coloring of the throat, became somewhat dusky during the aquatic phase. In terrestrial individuals other than adult males, the throat region took on a translucent, grayish color with or without a pinkish tinge throughout the year.

All size measures differed between males of different phases of the life cycle. First, males with brilliant yellow throats were larger than pale yellow males (SVL; brilliant: N = 110, mean = 56.65 mm, SD = 4.72, range = 46.21–66.75; pale: N = 18, mean = 53.46 mm, SD = 4.63, range = 47.18–62.14; t = 2.668, df = 126, $P = 0.009$). Head width of terrestrial-phase males, including breeding immigrants (HW: N = 317, mean = 9.23 mm, SD = 0.64, range = 7.46–11.01), was smaller than that of aquatic-phase males (N = 39, mean = 11.34 mm, SD = 0.85, range = 9.73–13.76; t = 15.015, df = 43, $P < 0.001$). Similarly, a tailfin never developed in terrestrial-phase males, including breeding immigrants (TH: N = 317, mean = 7.13 mm, SD = 0.72, range = 5.47–9.24), but was enlarged in aquatic-phase males (N = 39, mean = 9.41 mm, SD = 0.90, range = 7.49–11.95; t = 15.153, df = 44, $P < 0.001$). Around the end of each breeding season (mid-May), the tail assumed a fin-like appearance in 9 emigrating males. In early June, after breeding activity ceased, a slightly developed tailfin was found in 6 trapped salamanders (classified as adult males because of an undeveloped tailfin in females). Lastly, adult male body mass differed between the terrestrial phase (M: N = 317, mean = 4.58 g, SD = 1.06, range = 2.50–8.20) and the aquatic phase (N = 39, mean = 5.60 g, SD = 0.91, range = 2.50–8.35; t = 5.745, df = 354, $P < 0.001$).

Ovisac development was a reliable predictor of gravid females. A pair of beige ovisacs were visible through the skin of the ventral side of the torso near the hindlimbs (without holding females up to a light) during September, October, and the April–May breeding season (118 females examined). In general, the ventral region tended to assume a pinkish color in adult females and a dark brown color in adult males throughout the year with the exception of both sexes having an intermediate venter color with or without

many white dots. I verified this propensity during September–May, and applied it to distinguishing sex during June–August.

I identified sex and sexual maturity visually in 476 terrestrial adults (317 males, SVL mean = 57.51 mm, SD = 4.57, range = 46.21–69.49; 159 females, SVL mean = 61.99 mm, SD = 4.75, range = 52.00–72.33) by examining secondary sexual characteristics such as throat coloration, ovisac development, tailfin remaining (during September–May and early June), and venter color (during June–August). However, 5 terrestrial individuals captured from September–May and 19 terrestrial individuals captured from June–August did not show any clear sexually dimorphic trait, and therefore were classified as unsexed individuals (SVL: N = 24, mean = 55.50 mm, SD = 3.76, range = 52.24–66.67). I used SVL to distinguish unsexed individuals (SVL ≥ 52.00 mm) from juveniles (SVL < 52.00 mm) by applying the adult female's minimum SVL (52.00 mm; for comparison, the adult male's minimum SVL = 46.21 mm). Additionally, 67 juveniles (SVL: N = 67, mean = 46.60 mm, SD = 3.66, range = 37.43–51.85) and 65 metamorphs (N = 63, mean = 31.18 mm, SD = 3.05, range = 23.11–39.77; measures were not obtained from 2 metamorphs) were captured in pitfall traps.

TABLE 1. Seasonal color changes in the throat region in 317 adult males of *Salamandrella keyserlingii* during the terrestrial phase of the April–May breeding season (1996–1997, examined for 56 days) and the June–October nonbreeding season (1995–1997, 141 days).

Time of year	Translucent gray	Translucent white	Opaque white	Pale yellow	Brilliant yellow
April	0	0	0	5	99
May	0	1	1	13	11
June	19	1	0	0	0
July	11	0	0	0	0
August	15	0	0	0	0
September	0	99	16	0	0
October	0	0	23	3	0

Little literature exists on seasonal changes in throat coloration in urodeles. My observations on *S. keyserlingii* may be the first to report seasonal color changes in the throat region of urodeles from translucent gray, through opaque white, to brilliant yellow. It is unknown whether the absence of a prior description of this type in *S. keyserlingii* (Borkin 1999; Kuzmin 1999) reflects geographic variation in throat color. The intense yellow coloring of the throat is a striking secondary sexual characteristic in mature males, and may play an important role in sexual selection. Male throat color may be a signal for mate attraction and stimulation (Emlen and Oring 1977; Verrell 1991) or it may be involved in aggressive signalling between breeding males (Halliday and Tejedo 1995), which defend spawn sites on dead leaves of sedges.

In lentic-breeding hynobiids, a tubercle at the anterior angle of the vent is generally seen in breeding males (Sato 1943). Such a tubercle is evident in adult male *H. nigrescens* throughout the year except from May–July when ventral glands are underdeveloped (Hasumi et al. 1990), but is always lacking in adult females (Hasumi 1996a). This structure is a target for androgen (Hasumi et al. 1993), and may control ejaculate expenditure or fertilization duration during scramble competition among males for mates (Hasumi 2001). In contrast, although *S. keyserlingii* appears to have morphological characteristics of lentic-breeding hynobiids (Sato 1943), males lack this tubercle. It is unknown whether this exception reflects differences between genera.

An increased head width is unknown in urodeles other than hynobiids. The male head, body, and tail become swollen and inflated with water during the aquatic phase in *H. nigrescens* (Hasumi and Iwasawa 1990). This was evident in *S. keyserlingii*. Mating ball duration (i.e., fertilization duration) is shorter when males with increased head widths monopolize egg sacs during scramble competition in *H. nigrescens* (Hasumi 1994). Although there is no evidence for this in *S. keyserlingii*, which also forms a mating ball, it is likely that an increased head width in these species is involved in male–male competition for mates.

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Color Pattern, Predator Avoidance, and Foraging Behavior in the Golden Frog *Colostethus beebei* (Anura: Dendrobatidae)

GODFREY R. BOURNE
Department of Biology, University of Missouri-St. Louis
St. Louis, Missouri 63121-4499, USA
e-mail: bourne@jinx.umsl.edu

Grafen (1991) indicated that animals are elusive prey, efficient foragers, or efficient predators, so they are maximizers of one sort or another. Thus, in this paper I focus on qualitative descriptions of color pattern, predator avoidance and foraging behavior in *Colostethus beebei*, a small, diurnal, presumably nontoxic member of the neotropical poison frog family Dendrobatidae. This species lives and breeds only on the giant terrestrial tank bromeliad, *Brocchinia micrantha*, in Guyana, South America (Bourne et al. 2001). Because *C. beebei* is a small, apparently nontoxic frog, it may be the target of many vertebrate and invertebrate predators. Thus, natural selection should favor the ability to avoid detection and minimize predation. The specific objectives of this observational study were to document: (1) color-pattern polymorphism (the simultaneous occurrence of two or more discrete, genetically-based phenotypes in a population, in which the frequency of the rarest type is higher than can be maintained by recurrent mutation; Ford 1975), crypsis, and fleeing and hiding behaviors of *C. beebei*; and (2) diet and methods of prey acquisition.

Materials and Methods.—I studied an individually marked population of 180 toe-clipped (Hero 1989) *C. beebei* on the tepui *Brocchinia* spp. glades of Kaieteur National Park, Guyana. The study was periodically conducted over 14 visits, of 1 to 7 days, from March 1993 to March 1999 (Bourne et al. 2001). My study site was the 455 m plateau near Kaieteur Falls (05°10'23"N; 59°28'52"W). I used focal animal sampling (Altmann 1974) of 30 randomly selected frogs to observe and record predator avoidance and foraging behaviors, and averaged 2.4 ± 0.6 h on each frog. Randomization was accomplished by placing the identification numbers of each frog in a paper bag and blindly choosing the frogs to be observed on a given day. Observations were initiated at 0530 h and ended at 1800 h, and were sometimes aided by binoculars. I spent over 281 h in these activities. Each of the 180 hand-captured *C. beebei* adults was assigned to one of five color-pattern types. Frogs were compared to color standards of Smithe (1975) between 1000 and 1200 h on cloudless days to subjectively differentiate among polymorphic types. I also used Smithe's (1975) color nomenclature to describe color variation among morphs.

Active antipredator behavior was evaluated primarily by observing and describing the responses of adult and larval *C. beebei* to human approaches and hand captures. Antipredator behavior was also elucidated through fortuitous observations of encounters between *C. beebei* and a colubrid snake, and three incidences of graspid crab attacks on an adult, tadpole, and nonaquatic eggs (Bourne et al. 2001). Death-feigning was observed in *C. beebei* after some frogs were persistently pursued during futile attempts to hide in more than two locations.

Leaf colors (green or brown) associated with the leaf-sitting *C. beebei* morphs (brilliantly colored or brownish) were evaluated by Chi-square tests of independence (Sokal and Rohlf 1995), along two 200-m transects on 16 June 1994 and 25 March 1999. The June transect was adjacent to the falls and was constantly bathed in the falls' mist, and the March transect was to the north of the landing strip and 805 m from the falls (Bourne et al. 2001).

To determine whether these conspicuous, yellow *C. beebei* sitting on green leaves reflected infrared light (700–900 nm; Schwalm et al. 1977), I used a qualitative method of assessment in October 1999. A captive *C. beebei* was photographed on a *Canna glauca* leaf with Kodak Infrared Ektachrome through a Y-2 yellow filter. Furthermore, in March 2000 a brown morph of *C. beebei* was photographed on both brown and green *B. micrantha* leaves. The Y-2 yellow filter excludes blue light, causing a shift in colors such that green objects appear blue, red objects appear green, and infrared reflectance appears red (Mason 1970; Schwalm et al. 1977).

In 1993, I noticed that the base color (the dominant color of the dorsum below the brown stippling) in captive *C. beebei* was fading. To determine whether their fruit fly (*Drosophila melanogaster*) diet supplied enough carotenes, I added 2% paprika to commercial fruit fly medium and subsequently evaluated color changes in the frogs. Six experimental frogs were maintained on fruit flies fed the paprika-enriched medium during their larval development, and six control frogs were fed flies reared on unfortified medium. Color acquisition by experimental frogs was evaluated visually, and control frogs were fed fruit flies maintained on 2% paprika

after 4 mo.

Results.—Colostethus beebei exhibited color-pattern polymorphism with base colors ranging from spectrum orange, orange yellow, buff-yellow, cream to spectrum yellow (color nomenclature; Smithe 1975). Some individuals were uniformly colored, but many had variable amounts of brown stippled on their dorsal surfaces, whereas others had oblique lateral stripes (*sensu* Edwards 1974) accented by ventral lines of dusky brown running from the posterior nares through the eye to the groin. Most individuals (80% of N = 180 frogs) had distinct oblique lateral stripes extending from the posterior margin of the eye toward the tip of the urostyle that did not dip down to groin (but see Noble 1923). The skin on the dorsum was smooth, somewhat granular on the sides, and smooth ventrally. Rings around the nares were either jet black or dusky brown, and horizontal pupils were set off by gold-colored irises with zero to two black flecks.

I recognized five discrete color patterns in the 180 *C. beebei* examined in this study, of which the first three morphs listed were brilliantly colored (Table 1): (1) spectrum yellow overall with suffuse dusky brown stippling on the dorsum. Bilateral but distinct cream colored oblique lateral stripes outlined ventrally by much narrower dusky brown lines running from the nares to the groin. Twenty-four percent or 43 frogs represented this morph; (2) this morph was similar to the proceeding morph, but the base color was spectrum orange to orange yellow, 19% or 35 frogs belong to this morph; (3) 20% or 36 frogs had a cream base color without distinct oblique lateral stripes; (4) buff-yellow base color, distinct oblique lateral stripes, and much dusky brown stippling dorsally just anterior to the vent, and distally on the dorsal surfaces of thighs and shanks (18% or 33 frogs); and (5) 18% or 33 frogs had a base color of spectrum yellow, with heavy even brown stippling on the entire dorsum and flanks, giving the appearance that these individuals were dusky brown. Frogs in this category also had distinct oblique lateral stripes. Although most morphs were conspicuously colored, a crude bioassay, a taste test for the presence of skin alkaloids (Daly et al. 1997), suggested that *C. beebei* was not toxic. However, infrared color photography indicated that this species reflected light in the near-infrared region (700–900 nm), as did the green and brown leaves on which these frogs sat.

Spectrum orange through spectrum yellow morphs with little or no brown stippling, and those with much brown stippling, were territorial on differently colored leaves of *B. micrantha*. Brilliantly colored individuals were more often seen on live, green leaves, while brown stippled frogs were recorded on the lower, dead, brown leaves of bromeliads (June 1994, $\chi^2 = 59.04$ with Yates correction, df = 1, $P < 0.0001$; March 1999, $\chi^2 = 8.34$ with Yates correction, df = 1, $P = 0.004$).

Active antipredator behavior included a high degree of wariness combined with rapid jumping into water at the base of bromeliad leaves. This was followed by complete submersion and wedging between the two leaves forming an axil. *Colostethus beebei* tadpoles also employed wedging behavior when approached by a potential predator. When persistently pursued by humans, 2% (N = 180 frogs) of adult *C. beebei* became limp, but with hind limbs stiffly extended (see Garcia 1999), and floated to the surface motionless. These individuals appeared to be dead. One death-feigning individual remained in this posture for at least 31 min. I fortuitously observed active predation of *C. beebei* on four occasions. The first predation episode consisted of a 1030 mm snout-vent length colubrid snake, *Imantodes cenchoa*, that pursued and caught a wedged adult *C. beebei* in a bromeliad pool. This snake swallowed the frog head-first in 38 sec. The other three predation episodes involved an unidentified species of graspid crab; each crab ate a live adult frog, a live stage 42 tadpole (*sensu* Gosner 1960), and a clutch of four foliar eggs, respectively.

Colostethus beebei was primarily a sit-and-wait predator, and foraging was closely linked to calling and sentinel behaviors on all-purpose territories (Bourne et al. 2001). Some food was captured after short distance hopping pursuit of crawling prey such as ants (Formicidae), mites (Acari), and small spiders (Araneae). However, most of the observed feeding events suggested that much of the diet consisted of intercepted emerging imagoes of mosquitoes (*Anopheles* sp., *Culex* sp., *Trichoprosopon* sp., *Wyeomiya* sp.), and midges (Chironomidae) as they left the surface of phytotelmata. Unidentified Drosophilidae flies attracted to nonaquatic clutches of *C. beebei* were also readily eaten.

Colostethus beebei apparently owed its brilliant base color to diet-derived carotenes. In captivity the brilliant spectral yellows and oranges faded in a few months. Six experimental frogs, fed fruit flies on a paprika-fortified diet, began regaining bright coloration after 2.5 wk. Six control frogs, maintained on a fruit fly diet without paprika, continued to lose color. Yet, these controls regained bright coloration when fed paprika-fortified fruit flies after 4 mo into the experiment.

Discussion.—I found five color-pattern morphs in *C. beebei*, a situation not unlike that for *C. taeniatus* in Ecuador (Edwards 1974), the unrelated *Eleutherodactylus coqui* in Puerto Rico (Pough et al. 1996), as well as 225 other frog species (Hoffman and Blouin 2000). What are the benefits of color polymorphism in prey organisms? Hoffman and Blouin (2000) indicated that the main explanation for the maintenance of color-pattern polymorphisms is direct selection by visually-oriented predators. One plausible hypothesis is that when a visual predator discovers a prey item it may form a search image for that particular color pattern and concentrate on seeking additional prey that look the same (Dawkins 1971; Pietrewicz and Kamil 1977, 1981). Thus, if all members of the population exhibit the same color pattern, then all individuals are at risk of easy detection. Alternatively, the presence of multiple color patterns decreases the chances of detection by a predator using a search image for a single morph. Pietrewicz and Kamil (1977, 1981) tested this hypothesis by randomly projecting a series of polymorphic prey slides to blue jays (*Cyanocitta cristata*). They corroborated the hypothesis because jays encountering polymorphic prey had difficulty forming an effective search image, and so could not easily switch to different prey morphs (Pietrewicz and Kamil 1977, 1981). Thus, polymorphism can reduce the risk of predation on individuals in mixed-morph populations (Pietrewicz and Kamil 1977, 1981), and may similarly benefit the color-based polymorphic *C. beebei*.

In addition to the apparent benefits of reduced predation accruing from color polymorphism, brightly colored *C. beebei* morphs were seen more often on live green leaves, and brown stippled morphs were encountered more often on dead brown leaves. Cryptic animals can minimize chances of detection by selecting appropriate backgrounds. To some extent, concealing coloration (Norris and Lowe 1964), especially of the brown morphs, may have pro-

tected them from high rates of predation, as suggested by experiments conducted by Tordoff (1980) and Morey (1990). Both of these laboratory experiments demonstrated that substrate matching significantly increased the survival of stationary frogs (Tordoff 1980; Morey 1990). It is more difficult to make this argument for the benefits of concealing coloration for yellow morphs of *C. beebei* on green leaves because they seemed conspicuous. However, it cannot be assumed that animals which do not appear cryptic to us are necessarily conspicuous to other animals. For example, snakes and birds, two groups that include frogs in their diets, can detect near-infrared radiation (Bradbury and Vehrencamp 1998). Yellow morphs of *C. beebei* are similar to other species of leaf-sitting *Centrolenella* and *Agalychnis* that reflect near-infrared light, and accrue protection because infrared reflectance from green leaves matches the frogs to the leaves (Schwalm et al. 1977). Even brown *C. beebei* morphs reflected near-infrared light as did their green and brown leaf substrates. Moreover, at this time I cannot rule out a role for minimizing predation due to the effects of mimicry and aposematic coloration of yellow morphs. However, there are no syntopic unpalatable yellow dendrobatids in Kaieteur National Park, except the much larger, terrestrial, and toxic *Dendrobates tinctorius* which has much yellow on its dorsum (Bourne et al. 2001).

TABLE 1. Characteristics used to assign 180 golden frogs, *Colostethus beebei*, to five discrete polymorphic types (color nomenclature from Smithe 1975).

Basic color	(N)	Dusky brown stippling	Oblique lateral stripes
*Spectrum yellow	43	suffuse on dorsum	present and distinct
*Spectrum orange	35	absent	present and distinct
*Cream	36	absent	present and indistinct
Buff-yellow	33	just anterior to vent	present and distinct
Spectrum yellow/Brown	33	heavy on dorsum and flank	present and distinct

*brilliant morphs

In addition to search image disruption accruing from color-pattern polymorphism and crypsis, *C. beebei* relied on rapid jumps combined with either hiding or death-feigning behaviors to minimize predation. The antipredator response of diving-and-wedging in phytotelmata by both adults and tadpoles made it relatively easy for humans to hand capture *C. beebei*. However, as with foliar eggs of other species, those of *C. beebei* were sometimes attacked by larvae of drosophiline (Villa 1980) or phorid flies (Villa and Townsend 1983). Foliar eggs and adults of many species of arboreal frogs are also eaten by graspid crabs (Hayes 1983; Krügel 1993) and colubrid snakes (Duellman 1958), as I observed for *C. beebei*.

In conclusion, this observational study of color morphs, predator avoidance, and foraging behavior in a bromeliad-specialist dendrobatid frog, *C. beebei*, suggested that it had at least five color morphs. These morphs ranged in color from a brilliant orange to cream, and with varying degrees of brown stippling. The base yellow coloration of *C. beebei* was derived from carotenes that faded in captive frogs. Color was restored to frogs by feeding them insects maintained on carotene-rich fortified commercial medium. Color polymorphism may be adaptive in this frog through disruption of predator search images. In addition to the potential benefits due to the disruption of predator search images, brilliantly colored morphs were found more often on green leaves of *Brocchinia micrantha* bromeliads whereas predominantly brown morphs were found on dead brown, basal leaves. Although brightly colored morphs on green leaves were easily detected by humans, all *C. beebei* morphs, as well as green and brown leaves, reflected near-infrared light when examined by infrared color photography. Thus, infrared reflectance may be adaptive because of infrared cryptic coloration. *Colostethus beebei* also relied on vigilance and rapid jumping combined with either hiding behavior or death-feigning to minimize predation. Furthermore, *C. beebei* was an opportunistic sit-and-wait predator whose diet included many small arthropods, but especially mosquitoes and midges.

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Time in Captivity as a Confounding Variable in Herpetological Research: An Example from the Metabolic Physiology of Treefrogs (*Scinax*)

CARLOS A. NAVAS
and
FERNANDO R. GOMES
Departamento de Fisiologia, Instituto de Biociências
Universidade de São Paulo, Rua do Matão – Travessa 14 No 321
Cidade Universitária – CEP 05508-900, São Paulo, SP, Brazil
e-mail (CAN): navas@usp.br

The study of ectothermic tetrapod physiology and behavior frequently utilizes comparison among related species (Huey 1987). Such research may include the use of animals kept in captivity for variable periods of time; moreover, animal maintenance in the lab may be part of experimental protocols. A common assumption related to this approach is that the physiological or behavioral responses of interest are either unaffected or affected in a similar way by time in captivity. However, we argue that time in captivity may be a potentially influential variable, and that the above assumption may be invalid under a variety of circumstances. We support our argument with data on oxygen consumption of hylid frogs in the genus *Scinax* (Duellman and Wiens 1992).

Oxygen consumption relates to energy expenditure and is one of the most informative physiological parameters in herpetology (Pough et al. 1992). The data presented here were obtained in the context of a study of the evolutionary physiology of *Scinax*, and have been used collaterally to examine hypotheses regarding time of captivity. Our research involves routine measures of standard metabolic rate (resting at a given temperature) and during intense forced locomotion. We attempted to test frogs within two weeks of capture, but this was not always possible. Because the time interval preceding metabolic measurements varied, our data allowed for study of the relationship between time in captivity and metabolic rate. Despite some limitations of the data when analyzed in this context, we report conspicuous patterns that illustrate a useful point in the study of amphibians, many of which are very sensitive to physical changes in their milieu.

We report data on males of five *Scinax* species that are common in southeastern Brazil: *Scinax crospedospilus* (mean body mass ± SE, 1.59 ± 0.028 g; N = 10) is very active and inhabits ponds and lakes in the Atlantic forest or somewhat disturbed habitats; *S. fuscovarius* (4.04 ± 0.096 g; N = 14) is a large and widespread species, and occupies various lentic habitats; *S. perereca* (3.01 ± 0.051 g; N = 16) is found near permanent ponds in open areas or forest borders; *S. g. perpusillus* (0.36 ± 0.010 g; N = 20) reproduces in bromeliads and requires rather well-preserved patches of Atlantic forest; and *S. hiemalis* (0.84 ± 0.008 g; N = 32), which calls mainly in the winter and lives near rivulets that are used for reproduction. In the laboratory, frogs were maintained in individual plastic containers with moist paper towels and artificial vegetation. Photoperiod was 12:12. Diet varied with body size and consisted of crickets, fruit flies, cockroaches, and mealworms.

Metabolic rate was measured between 10 and 30°C using standard techniques (Navas 1996). Standard metabolic rate was measured before 1700 h. Briefly, frogs were placed in humid and aerated chambers, and maintained at the experimental temperature for 2 h. Flow rate was set to maintain pre-experimental oxygen concentration inside chambers at 20.95%. Chambers then were closed for 2 to 6 h, and subsequently re-opened and washed with fresh air. The resulting air mixture was then expressed across a Drierite-Ascarite filter into a Sable Systems PA-1 oxygen analyzer at 130 ml/min, and metabolic rate was calculated from the integrated area under the curve of oxygen concentration versus time (Bartholomew and Lighton 1986) using Datacan 3.0 (Sable Systems). Activity metabolism was measured after 1800 h with a similar approach, but using smaller rotating chambers made out of 50 cc syringes and limiting tests to 3.5 min. Data were log-transformed to improve homoscedasticity and normality.

To isolate effects of time in captivity we used residuals of an ANCOVA in which metabolic rate (ml O_2/h) was the dependent variable, and mass (g) and temperature (C) were independent variables. We used regression analysis of the residuals to test for an effect of time in captivity. Given the nature of the data, individu-

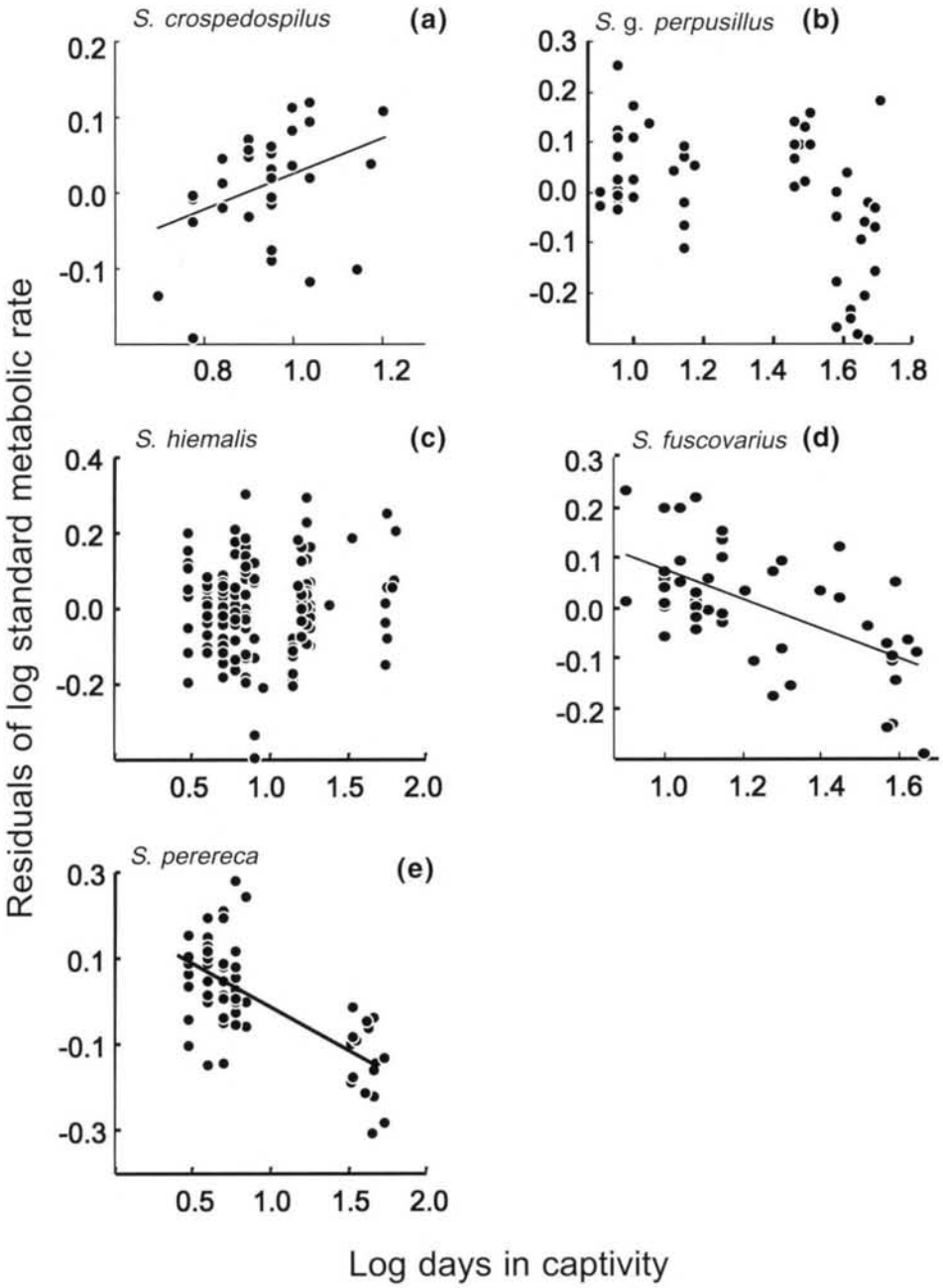


FIG. 1. Residuals of log standard metabolic rate on log body mass and temperature as a function of log-time in captivity in five species of *Scinax*. Regression lines are shown for heuristic purposes and illustrate tendencies of data for which correlation tests are significant. a) *Scinax crospedospilus*, r = 0.486, P = 0.014; b) *S. g. perpusillus*, r = –0.006, P = 0.972; c) *S. hiemalis*, r = 0.145, P = 0.143; d) *S. fuscovarius*, r = –0.472, P = 0.027; and e) *S. perereca*, r = –0.561, P = 0.001.

als exhibiting outlying metabolic rates and measured over a short time interval had a disproportionate influence on overall tendencies. We evaluated this problem using influence plots (SYSTAT 1992) and deleted from the analysis an individual with a very low standard metabolic rate.

Time in captivity related to very different trends of change in standard metabolic rate among species (Fig. 1a–e). *Scinax crospedospilus* (Fig. 1a) showed an increased standard metabolic rate, *S. g. perpusillus* (Fig. 1b) and *S. hiemalis* (Fig. 1c) showed no obvious pattern, and *S. fuscovarius* (Fig. 1d) and particularly *S. perereca* (Fig. 1e) exhibited a significant reduction in standard metabolic rate. Similar trends were absent when activity metabolic rate data were analyzed. Accordingly, time in captivity may influence in different manners the metabolic status of even congeneric sympatric species, but we do not know whether the observed changes involve return to, or departure from a normal situation. Simple general explanations, such as seasonal variation or differences in the rate of physical deterioration, do not hold. Metabolic

rate is related to season in some temperate frogs (Rome et al. 1992) and at least one subtropical anuran (Glass et al. 1997). However, *S. hiemalis* remained longest in captivity, was sampled at different times of year, and its rate of metabolism did not change in captivity. Additionally, loss of body mass, which would reflect physical decay, was not reported for any species during standard metabolic rate measures.

In some anuran species, capture and transport to the lab raises plasma corticosterone, and also may reduce circulating sex steroids (Coddington and Cree 1995; Paolucci et al. 1990). Experimental manipulation of these hormones is coupled with changes in energy expenditure in birds (Wikelski et al. 1999) and calling behavior in frogs (Penna et al. 1992). Because of their effects on behavior, plasmatic corticosteroids and sex-hormones may be part of a control mechanism for energy expenditure (Marler and Ryan 1996). It is possible, then, that the patterns reported in our study are related to captivity-induced hormonal and behavioral shifts that vary from species to species. These patterns may be affected by interspecific differences in energetic status at time of capture, and may lead to different metabolic trends according to the intensity of stress responses to changes in surrounding milieu, reduced social stimulation, or others.

Independent of the nature of the metabolic changes observed, the message we convey is that captivity may induce species-specific changes in amphibian physiology and behavior. Accordingly, researchers should not assume homogeneous effects of time of captivity when engaging in interspecific studies. Doing so may add an uncontrolled confounding variable to the study and may lead to equivocal conclusions in diverse research contexts (e.g., Feder et al. 1984). An extreme case may occur when individuals of a given species are more likely to die in captivity than others, so that final samples compared are not random. These considerations may be important for taxa other than amphibians and for within-species studies. Any investigation that relies on sequential data from individuals along a significant period of time may need to consider time in captivity as a possible confounding variable. To address this problem, researchers may maintain a detailed record for individuals (including dates of capture and tests), perform preliminary tests, or use experimental designs that consider time in captivity as a potentially confounding variable (e.g., Zolman 1993).

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On the Origin of the Common Wall Lizards *Podarcis muralis* (Reptilia: Lacertidae) in Cincinnati, Ohio, USA

GUNTRAM DEICHSEL
Friedrich-Ebert-Str. 62
Biberach on the Riss D-88400, Germany
e-mail: Guntram.Deichsel@bc.boehringer.ingelheim.com

and

DANIEL H. GIST
Department of Biological Sciences, University of Cincinnati
Cincinnati, Ohio 25221-0006, USA
e-mail: daniel.gist@uc.edu

The European common wall lizard (*Podarcis muralis*) was introduced in Cincinnati, Ohio (USA) circa 1950; a population now exists in southeastern urban Cincinnati covering an area of more than 6 km^2 with an expanding tendency. Hedeen and Hedeen (1999) report the present status and the role of railroad tracks in the natural expansion of the population. Because of the ease with which *P. muralis* can be maintained in captivity, they have been introduced

to numerous other parts of the metropolitan area. Some of these subpopulations have persisted. Presently, reproducing subpopulations are found in the Eden Park and Fairview Park areas of the city. J. G. Davis, (Cincinnati Museum of Natural History, pers. comm.) mentions a population on the grounds of the Cincinnati Zoo. Conant and Collins (1998) listed a population in Van Wert County, Ohio, 190 km north of Cincinnati, from which a voucher specimen is available at the University of Kansas Natural History Museum (KU 206727). Recently Davis (pers. comm.) was unable to confirm the continued existence this population. Further, the lizards have been released south of the Ohio River in Kentucky by owners of private gardens (Draud and Ferner 1994). Ferner (pers. comm.) confirms this pattern of colonization south of the Ohio River as a continuing process. However, in other, interior parts of its range, population densities are in decline due to habitat destruction as unmortared stone walls are replaced with concrete walls, refuse piles are removed, and other improvements associated with urbanization are made. The lizards and their varying population density have received attention from the popular press (e.g., Eckberg 1989; Snyder 1993). They have also been the subject of scientific investigations ranging from reproduction to behavior (Brown, Gist, and Taylor 1995; Brown, Taylor, and Gist 1995; Hedeen 1984; Hedeen and Hedeen 1999; Kwiat and Gist 1987; Vigle 1977).

The expansion of *P. muralis* in the New World is of interest to European herpetologists because it is known to be an aggressive species with the potential to influence the range of native herpetofauna. For instance, Henle (in Gruschwitz and Boehme 1986), reports *Podarcis muralis* not tolerating *Podarcis sicula* on walls occupied by *P. muralis*. Although walls are a preferred habitat of *P. sicula*, it retreats to grass-covered areas below the walls whenever *P. muralis* is present. C. Bender (pers. comm.) observed that male *P. muralis* attacked adult sand lizards (*Lacerta agilis*), a European species whose SVL exceeds that of *P. muralis* by 45%.

Reported History of Introduction of *Podarcis muralis*

In the local press of Cincinnati, there are several articles from the 1970's to the 1990's providing contradictory information regarding the details of the introduction of the "famous Lazarus lizards" from Switzerland or Italy in the 1940s or 1950s by member(s) of the Lazarus family, a family well-known in Cincinnati. Accounts also vary in the scientific literature. Hedeen (1984) and Hedeen and Hedeen (1999) reported that two *P. muralis* were released by a Cincinnati resident in the backyard of her home in September 1951. Vigle (1977) states the year of introduction as 1948. The animals had been caught during a family visit to Europe in the Lake Como area of northern Italy. Hedeen (1984) found that the climates of Cincinnati and Milan, Italy, only 40 km distant from Lake Como, have almost identical annual temperature and precipitation patterns, and concluded that excellent conditions existed for a rapid settlement of this species. In Europe, *P. muralis* is reported to be the lizard best adapted to live in human settlements (Arnold and Burton 1978).

A Hitherto Disregarded Document

As a reaction to one of the newspaper articles, a member of the Lazarus family, George Rau, wrote a letter to one of us (DG; letter on file at the Cincinnati Museum of Natural History) on 29 June 1989 in which he stated that, as a child, he was the one who brought approximately ten specimens of *P. muralis* to Cincinnati from Lake Garda in the northern lake section of Italy in 1951 or 1952. As part of a study investigating the status of European lacertids introduced in the USA (Deichsel and Miller 2000), GD gained access to this letter during a recent visit to Cincinnati. A review of the letter prompted an assessment of its contents from the perspective of European herpetology and the writing of the present article. In what follows, we list the key statements in the letter followed by our comments.

Approximately ten specimens of the *P. muralis*, obtained from Lake Garda, Italy were released by George Rau at his parental home on Torrence Court in eastern Cincinnati in September 1951 or 1952. About 1958, he released at the same location another ten lizards with "an absolutely solid blue stomach" obtained from the small island of Vedrá off the southwest coast of Ibiza, Spain. He further states that as a consequence of interbreeding between these two groups, progeny with a series of blue spots on the venters resulted. To support this conclusion, he states that he had never observed lizards with blue spots on the venters prior to releasing the ten specimens from Vedrá.

Despite the passage of time, we attribute a higher credibility to the first person statement of Rau that approximately 10 lizards were released in Cincinnati over second-hand accounts that two lizards were released (Hedeen 1984; Hedeen and Hedeen 1999). The collection site of the first group of lizards in the vicinity of Lake Garda, about 120 km from Milan, Italy, identifies their subspecific status as that of the nominate form, *Podarcis muralis muralis*. Judging from their origin, the second group of lizards released by Rau is *Podarcis pityusensis vedrae*, a cyanistic subspecies of the Ibizan wall lizard (Salvador 1986). The home archipelago of *P. pityusensis* is well separated from the natural range of *P. muralis*. Further, analysis of mitochondrial DNA of *Podarcis* (Harris and Arnold 1999) places these two species in different lineages within the genus. In addition, *P. muralis* does not interbreed with a sister species, *P. sicula*. Thus, the likelihood of Cincinnati *P.muralis* interbreeding with *P. pityusensis* seems remote but could be confirmed by DNA analysis.

It is unlikely that *Podarcis p. vedrae* survived in Cincinnati. This lizard normally lives on two small Mediterranean islands (Vedrá <0.5 km^2, Vedranell <0.2 km^2) whose maritime climate differs greatly from Cincinnati's continental climate. Like other subspecies of *P. pityusensis* from small islands, *P. p. vedrae* does not hibernate in the winter and is hence not likely to endure the more severe Cincinnati winters. Dietary factors also may have contributed to their extirpation. Approximately 50% of the diet of a comparable subspecies of *P. pityusensis* is plant material. Salvador (1986) reports that stomachs of *P. p. karlkochi*, a denizen of the neighboring small island of Conillera, contained almost 40% flowers in the month of January. If the diet of *P. p. vedrae* is similar to its con-subspecifics from small islands, then absence of a continuing plant-based food supply during the winter may have contributed to its demise.

A Comment on Ventral Color Polymorphism

Ventral coloration of *P. muralis* warrants further consideration because it is subject to conspicuous variation, ranging from white, greyish, yellow and orange, to red. Such variation is known even

in small, isolated European populations (Dexel 1986) and is reflected in the Cincinnati population. Brown (pers. comm.) investigated a sample of 77 lizards with 88% white, 7% yellow and 5% red venters, but was unable to correlate ventral color polymorphism of the Cincinnati *Podarcis* with allelic variation at 14 allozyme loci. He attributed the absence of allozyme variation to a founder effect, and the results remain unpublished. It is likely that the blue spots on the belly noted by Rau were actually on the flanks. These spots are particularly pronounced on males, and the intensity of these spots is subject to individual, seasonal, and sexual variation (Gruschwitz and Boehme 1986).

Conclusion

As the result of a letter written by one of the individuals involved in the introduction of common wall lizards to Cincinnati, Ohio, we believe we have evidence that the Cincinnati population of *P. muralis*, now covering more than 6 km^2, originated from ten specimens introduced by George Rau approximately fifty years ago. This information may be useful for researchers analyzing genetic variability in this isolate. The introduced lizards originated from Lake Garda, ca. 120 km distant from Milan, Italy. This location identifies the subspecific status as that of the nominate form, *Podarcis muralis muralis*. Another group of lizards introduced by Rau was identified as *P. pityusensis vedrae* and did not survive.

Acknowledgments.—We wish to express our sincere thanks to the following persons: Carolin Bender provided general information on *Podarcis muralis* and made useful comments on the manuscript. Rafe Brown, Jeffrey Davis, and John Ferner contributed details on the *Podarcis* population in and around Cincinnati. The comments of two reviewers improved the quality of this paper.

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The Ornate Box Turtle, *Terrapene ornata*, in Southern Indiana

MICHAEL J. LODATO
925 Park Plaza Drive, Evansville, Indiana 47715, USA
e-mail: mlodato229@aol.com

and

THOMAS K. HULVERSHORN
6014 Indianola Avenue, Indianapolis, Indiana 46220, USA
e-mail: tkhulver@iquest.net

The ornate box turtle, *Terrapene ornata*, reaches the eastern limit of its distribution in Indiana, USA (Conant and Collins 1998; Ernst et al. 1994). Here it occurs in two widely separated populations. The larger and better known of these occurs in the sand prairie in the Kankakee Basin in northwestern Indiana (Minton 1972). A single record exists for southern Indiana, from Daviess County, in the southwestern corner of the state, as reported by Minton (1972:168). This specimen was collected on 13 September 1950, "... five miles south of Plainville, Daviess County" (List 1951) and was deposited in the University of Illinois Museum of Natural History collection (UIMNH 18038). Minton accepted this record as valid, presumably because (a) the species had been reported from not too distant colonies to the west in southern Illinois (Smith 1947, 1961); (b) the location was a relatively large area of sand prairie not unlike that in northwestern Indiana where the species is known to occur; and (c) other species of the herpetofauna partial to sand prairies in the Midwest, including those of *Cnemidophorus, Ophisaurus*, and *Pituophis*, have been reported from nearby sandy sites proximate to Daviess County (Minton 1972; Minton et al. 1982).

On 13 May 2000, MJL collected a specimen of *Terrapene ornata* in Steele Township, Daviess County, 7 km north of the town of Washington, and about 1 km west of Indiana State Route 57. This turtle, an adult male, was found sliced in two by an agricultural disc at the margin of an area of rank grassland immediately adjacent to a field being prepared for row crops. This specimen represents only the second record of *T. ornata* from southern Indiana, and corroborates List's earlier collection from Daviess County fifty years ago. The specimen has been deposited in the herpetological collection at the University of Michigan Museum of Zoology

(UMMZ 226738).

It is noteworthy that both of the southern Indiana specimens of *T. ornata* came from Steele Township in Daviess County. List's original collection was of a turtle found on Indiana Route 57 (J. C. List, pers. comm.), while the most recent specimen was collected about 1 km west of Indiana Route 57. When plotted on a DeLorme topographic map (Indiana 1998:49, 56), the two collection stations nearly overlie each other, and we surmise that the two specimens were part of the same relict population. This portion of Daviess County consists mainly of gently rolling to flat plains, with sandy soils. There is intensive agriculture, with melon production, orchards, and various row crops. The area from which both specimens of *T. ornata* were collected is a small zone of some fairly well-developed dune topography, where current land use includes pasture in small tracts, perhaps only a few hectares each. The persistence of *T. ornata* at this site over the last half century is remarkable. Other species collected or observed by the authors at the site where *T. ornata* was taken include the following: *Bufo fowleri, Hyla versicolor* complex, *Pseudacris crucifer, Pseudacris triseriata, Scaphiopus holbrookii, Rana clamitans* and *Rana utricularia, Eumeces fasciatus, Coluber constrictor, Elaphe obsoleta, Heterodon platirhinos, Lampropeltis calligaster*, and *Thamnophis sirtalis.*

The Indiana Department of Natural Resources (IC 14-22-34 and Rule 312 IAC9-5-4) lists *Terrapene ornata* as endangered within the state. While not officially listed as endangered or threatened in adjoining Illinois, populations there are apparently now much reduced. Smith (1961) once observed that ". . . the species is common in many parts of Illinois." However, Phillips et al. (1999:162), commenting on its population status forty years later, concluded that *T. ornata* was "uncommon to rare in much of its range in Illinois."

A small tract from the area where *T. ornata* was most recently collected in Daviess County was acquired in 1999 by the Indiana Department of Natural Resources for the establishment of a nature preserve by the Division of Nature Preserves (L. Casebere, pers. comm.). The recent discovery of *Terrapene ornata*, a state endangered species, will enhance the value of this site in affording some protection for at least one of the state's rarest vertebrates.

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TECHNIQUES

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The Benefits of Transparency: Candling as a Simple Method for Determining Sex in Red-Backed Salamanders (*Plethodon cinereus*)

JENNIFER R. GILLETTE*
and
MEGAN G. PETERSON
*Department of Biology, P.O. Box 42451, University of Louisiana at Lafayette, Lafayette, Louisiana 70504-2451, USA***
and
Mountain Lake Biological Station, University of Virginia, 240 Salt Pond Road, Pembroke, Virginia 24136-9724, USA

**Author to whom all correspondence should be addressed; e-mail: prokyon33@hotmail.com*
***Address to which all correspondence should be sent*

Gender-specific studies require an accurate technique for sexing individuals. Research on the red-backed salamander (*Plethodon cinereus*) has included many studies that may have gender-biased results, including homing abilities (e.g., Kleeberger and Werner 1982), territorial and agonistic behavior (e.g., Jaeger 1984; Jaeger et al. 1986), and reproduction (e.g., Sayler 1966). Some recent studies have focused on interactions between males and females (e.g., Guffey et al. 1998; Gillette et al. 2000). Sexing adult salamanders using external characteristics is relatively simple when the animals are in courtship condition. Males have mental glands (visible as a whitish area on the chin), square snouts (due to enlarged premaxillary teeth), and a whitish, slightly enlarged region immediately lateral to the cloaca. Females, however, have rounded snouts, lack mental glands, and have no whitish region around the cloaca. The eggs of gravid females are easily visible through the abdominal wall once they reach a diameter of approximately 2 mm. External morphology, however, is not reliable when males are not in breeding condition, and it cannot be used on sexually immature animals.

Sexing animals by invasive internal inspection (e.g., Jaeger et al. 1982) has obvious drawbacks for behavioral or field ecological studies. Quinn and Graves (1999) suggested using the distance between nares at the tip of the snout (inter-nares distance: IND) to sex red-backed salamanders because it is sexually dimorphic and does not change with breeding condition. In the sample examined by Quinn and Graves, however, there was small (0.03 mm) overlap between sexes in the IND; six of the 95 salamanders identified

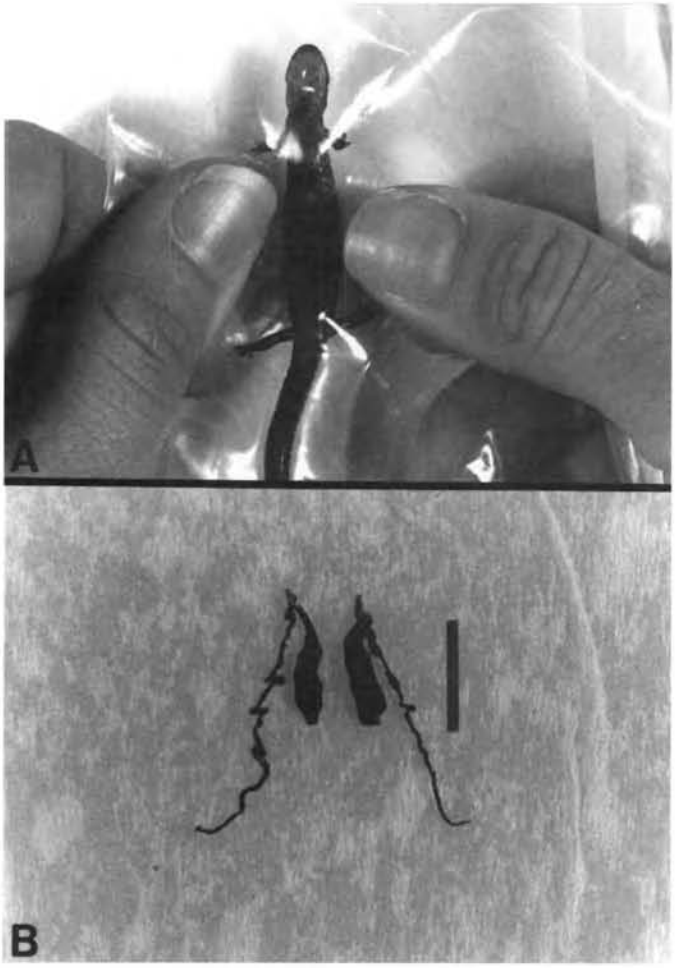


FIG. 1A. Correct position of a salamander to be candled. Thumbs and index fingers should grip the clear plastic bag on either side of the abdomen and gently flatten the animal. B. Testes and vas deferens from a salamander as they appear in an intact animal. Scale bar = 5 mm.

fell into the range of overlap. This suggests that there is a 6.3% chance of making erroneous sex determinations if they are based solely on IND. Furthermore, measuring the IND on a non-anesthetized, live salamander may be difficult. We present here an unambiguous, quick, and non-lethal method for sexing red-backed salamanders by a process generally known as candling.

Candling red-backed salamanders can be used as a reliable means of determining sex because internal organs, particularly the testes (in males), eggs (in females), and intestines, are easily visible through the abdominal wall in a slightly compressed animal that is illuminated from behind. Because candling renders the animal effectively transparent, dissection is unnecessary. We have used this technique for over three years, during which time we have accurately determined the sex of 3000 red-backed salamanders, both in the forest and in the laboratory.

To sex a salamander, we first place it in a small, clear plastic bag. We then manipulate the salamander until its abdomen faces toward us and grip the bag between thumbs and index fingers on either side of the lower abdomen. Next, we gently flatten the animal by stretching the plastic between our fingers (Fig. 1A). This restricts the movements of the animal and compresses it so that light may pass through the abdomen. Stretching the bag immobilizes the animal and increases visibility of its internal anatomy, but too much pressure can cause serious internal damage. Finally, we hold the animal up to a light (e.g., the sun, a flashlight, a standard electric light, or even an overcast sky) so that the light shines through the animal and we can view its internal anatomy through its abdomen. With some manipulation, it is easy to determine in adults (>35 mm snout–vent length (SVL)) whether testes are present or absent; if absent, the animal is female. In gravid females, eggs (as small as 1 mm) appear as whitish circles along either side of the abdomen. Females may have 1–16 eggs, with the average being 7–8 (Sayler 1966). Occasionally, transparency may be greatly reduced by large quantities of material in the gut. In such cases, the animal can be held in a laboratory for a few days until its gut has cleared.

Testes and vas deferens that have been removed from a red-backed salamander illustrate their relative positions to each other (Fig. 1B). The vas deferens is a convoluted tube originating at the anterior tip of the testes, curving posteriorly, and ending at the cloaca, where the sperm are delivered. Although the vasa are not easily distinguishable from the testes while within an intact salamander, they are sometimes visible. Within the body cavity, testes are positioned side-by-side, but their general appearance may vary. However, testes are always in pairs, and are the only paired, black structures in the lower abdomen. Fecal matter, if present, appears as a single black pellet in the lower abdomen and, unlike testes, will break into small pieces if manipulated. If the animal is not aligned so that it is straight from snout to cloaca as it is held in the bag, the testes may not be lateral to each other (i.e., one may be more anterior than the other). However, with gentle manipulation, it is possible to bring both testes back to their normal positions.

The testes of most adult males are obvious and are typically black, large, and slightly pointed on both ends (Fig. 2A). In some

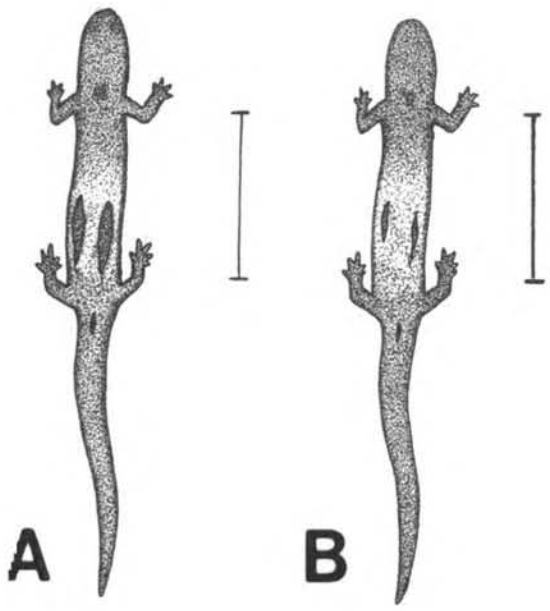


FIG. 2. Relative position and size of testes in red-backed salamanders. A. Most adult males have large, easily detected testes. B. Some testes may be shorter and narrower than others. Scale bars = 20 mm.

adult males, however, often including those held in the laboratory for extended periods of time, testes are relatively short and narrow (Fig. 2B). Testes of immature males (generally < 35 mm SVL) can be more difficult to detect but are identifiable with practice. Such testes have reduced amounts of pigmentation and thus appear gray, with the amount of pigmentation increasing as the animal matures. The testes of immature males are also proportionally much narrower and shorter than those of adult males. We have identified testes in males less than one year old and as small as 22 mm SVL. Ultimately, the appearance of testes represents a continuum, and some may be intermediate to those described in this manuscript.

This technique should prove effective for many researchers requiring a quick, reliable, non-lethal method for sexing red-backed salamanders. In addition, although the specific details concerning male internal morphology may not be applicable in all other salamanders, candling may prove to be especially useful for researchers who wish to sex other species, especially light-bellied plethodontids. With practice, accurate sex determination using this method can take just a few seconds per animal. This simple technique may not only encourage more studies that examine behavioral and ecological differences between male and female red-backed salamanders, but may also spur new research on other species of salamanders.

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Durability of Silt-Fencing for Drift-Fence Arrays at a Tropical Site

GEORGE R. ZUG
Department of Systematic Biology, National Museum of Natural History
Smithsonian Institution, Washington, D.C. 20560-0162, USA
e-mail: zug.george@nmnh.si.edu

WIN ZAW LHON[2]
THAN ZAW MIN[2]
KYAW KYAW[2]
THIN THIN[3]
HTUN WIN[3]
MYA THAN DA NYEIN[2]
KYI AUNG[2]
and
KYAW TIN TUN[2]

[2]*Chatthin Wildlife Sanctuary*
Nature and Wildlife Conservation Division
Insein, Yangon, Myanmar

[3]*National Herpetological Inventory*
Nature & Wildlife Conservation Division, Insein, Yangon, Myanmar

In 1997, we began to inventory and monitor amphibians and reptiles at the Chatthin Wildlife Sanctuary in north-central Myanmar. One objective was to obtain seasonal activity patterns and abundance estimates of the sanctuary's herpetofauna. Drift-fence arrays seemed a likely method to obtain some of these data.

Aluminum flashing is widely used in the United States for drift-fences (e.g., Corn, 1994). Such material is unavailable or prohibitively expensive in developing nations. It also is costly to transport, i.e., excess baggage charges. Searching for a substitute, one of us (GRZ) read Enge's discussion (1997) and recommendation of silt fencing, and decided to use it, at least for the first year, in the Chatthin herpetofauna monitoring project. Although not avail-



Fig. 1. A local pottery water pot used as pitfall traps for the drift-fence arrays. These containers hold approximately 3.5 liters of water and are about 25 cm high and 30 cm in diameter.

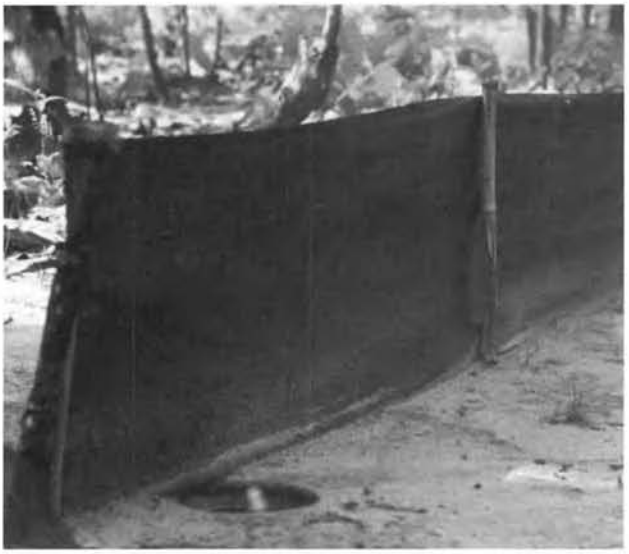


FIG. 2. One arm of the upland array, photographed 6 May 2000, 33 months following fence installation.

able in Myanmar, 100 ft rolls are easily transported in luggage and inexpensive to purchase stateside.

The question of durability remained a major concern. We can now report its high durability and recommend its use. We erected three Y-arrays in early August 1997. The arrays used the local pottery water containers (Fig. 1) as pitfall traps and stakes from locally cut saplings. We stapled the silt fencing to the stakes. As of 6 May 2000, the drift fences are in good condition (Fig. 2) and will remain in operation for one more field season. Each array was placed in a different microhabitat within the dipterocarp forest of the Sanctuary. Canopy cover at the three sites range from approximately 50 to 80%, so the fencing is exposed to some sunlight each day. Temperatures range from daily highs of 45° to 46°C in the premonsoon season to nocturnal lows of 5° to 6°C in midwinter. All sites experience sheet flooding during the heavy rains of the monsoon, one site even in moderate rains. In spite of the range of weather conditions, the silt fencing has not torn or frayed and has not been damaged by large animals.

The arrays have proved a valuable sampling tool, especially for inventorying frogs and lizards and monitoring seasonal movement of these animals. From the beginning, we placed funnel traps, constructed of window screen, at the end of each arm of the array. These traps captured a variety of the larger snake species. The funnel and pitfall traps are opened at the beginning of each month for seven days and checked twice each day, about one hour after sunrise and one hour before sunset. The pitfall pottery usually must be bailed out each morning and evening during the monsoon. When not in use, the pitfalls are covered by a board held in place by a brick; the funnel traps are flattened and stood upright.

Our success recommends silt-fencing drift fences for field studies at other tropical sites.

Acknowledgments.—We thank the entire Chatthin W. S. staff for their support of our field studies and especially the members of the education and ranger teams for their assistance in the initial installation of the drift-fence arrays. U Khin Maung Zaw, U Myint Aung, and U Uga of the Nature and Wildlife Division, Forestry Department, Myanmar, have encouraged us and have provided administrative and personal support for our inventory and monitoring projects. Financial support has been provided by British Airways and the Smithsonian's National Museum of Natural History Biodiversity Inventory and Survey Program. C. Wemmer is a constant source of encouragement; he offered valuable guidance in establishing the Chatthin program.

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The Visible Implant Elastomer Marking Technique in Use for Small Reptiles

KRISTEN M. PENNEY*
KRISTIE D. GIANOPULOS
EARL D. McCOY
and
HENRY R. MUSHINSKY
Department of Biology, University of South Florida
Tampa, Florida 33620–5150, USA

**Corresponding author; e–mail: kpenney@chuma.cas.usf.edu*

Mark and recapture studies are used widely in ecology to facilitate the collection of demographic information. Mark and recapture studies of amphibians and reptiles have employed several marking techniques, such as toe clipping (Clarke 1972; Donnelly et al. 1994), scale clipping (Blanchard and Finster 1933; Brown and Parker 1976), shell notching (Cagle 1939), subcutaneous dye injecting (Donnelly et al. 1994), external skin dying (Brown 1997), external fluorescent skin dusting (Nishikawa and Service 1988), tattooing (Joly and Miaud 1989–1990), branding (Clark 1971; Sutton 1996), and internal and external tags such as Passive Integrated Transponders (PIT tags) (Jemison et al. 1995; Prentice et al. 1990) and coded wire tags (Beukers et al. 1995; Hale and Gray 1998; Maynard et al. 1996). Often, body size or anatomical features of the study organism limit the choice of marking techniques. For example, toe clipping is practical only for organisms with several digits and dye injection for organisms that have sufficiently translucent skin. The options are especially limited for marking small species.

We have been involved in a relatively long–term mark and recapture study of the federally threatened sand skink, *Neoseps reynoldsi* Stejneger, in which we have monitored the persistence of individuals on research sites. The sand skink is a small, slender, fossorial lizard with maximum snout–vent length of about 68 mm and a maximum total mass of about 3 g (Conant and Collins 1991). The sand skink has four reduced limbs, with only one toe per front limb and two toes per hind limb. The sand skink's small size, fossorial habits, and limb reduction render most marking techniques virtually useless. PIT tags are too large to implant safely, toe clip-

ping yields only a few unique marks, and external paint marks rub off in the abrasive sand through which the sand skink travels.

The only marking technique that has been used with some success on the sand skink is branding (Hill 1999; Sutton 1996). In 1995, when we began our research on the sand skink, we judged branding to be the best available marking technique. Branding was judged to be more useful than other techniques because brands could be very small and would not rub off. We discovered that branding was not useful for relatively long–term studies, however. Brands became difficult to read over time because of shedding and growth (Hill 1999; Sutton 1996), and remained readable for six months or less in fast growing juveniles (Sutton 1996). We required an alternative marking technique for our relatively long–term study, and we selected the injectable Visible Implant Elastomer (VIE) marking technique. Here, we explain the use of the VIE technique to mark the sand skink, and compare safety, reliability, ease of use, and cost of the VIE technique to the branding technique that we employed previously.



FIG. 1. Diagram of marking locations on the sand skink.

VIE, a fluorescent marking material, was developed by Northwest Marine Technology, Inc. for marking juvenile migratory fish for later identification. VIE also has been used for marking other aquatic or partially aquatic organisms, such as juvenile crustaceans and larval and adult anurans (Table 1). The marking technique involves mixing a liquid elastomer with a curing agent, placing it in a syringe, and injecting a small amount (approximately 1 µl) of the mixture subcutaneously. The mixture hardens within a few hours into a flexible mark. Often, the mark can be recognized with the unaided eye or, if necessary, through polarized glasses under black light. At present, the elastomer is available in four different fluorescent colors, green, orange, pink, and yellow. By using multiple positions on the body and different color combinations, it is possible to mark hundreds of individuals uniquely.

We needed to ensure that the VIE marking technique was effective and innocuous before applying it to the rare sand skink. We used the common ground skink, *Scincella lateralis* Say, a species similar in body size to the sand skink, to examine survival, behavior, and mark visibility. Six individuals were marked and maintained in the laboratory for six weeks. All individuals survived the procedure and retained readable marks for the six–week period. No change in behavior or locomotory ability was observed. Although the marks were seen more easily through the light ventral skin, marks also could be seen through the more darkly pigmented dorsal skin when illuminated by black light.

Following successful preliminary testing of the VIE marking technique, we began marking individuals of the sand skink in 1998. Each captured individual was cooled until it no longer exhibited a righting response and then injected with the elastomer at fixed positions on the body. We chose six separate fixed positions on the ventral side of the sand skink for marking, but limited the number of marks on an individual to three (Figure 1). We have used the VIE marking technique on more than 250 individuals over three years (1998–2000).

We examined our ability to identify recaptured individuals and, when present, the extent of mark migration. We found after one year that the pink elastomer appeared yellowish to the unaided eye on 3 of the 28 recaptured individuals (10.7%) that had been marked with the pink elastomer. The same problem was noted in two earlier studies with other organisms (Godin et al. 1996; Willis and Babcock 1998). We could easily distinguish the pink color with a black light, however. Although we found that some individuals experienced minor mark migration from the exact injection point after one year, it did not reduce our ability to identify them. We suspect the mark migration was caused by growth of the individuals, because most individuals that experienced mark migration were juveniles or small adults when marked. We found after two years that most marked individuals still were readily identifiable. We recaptured 13 individuals that had been marked for two years and the marks of 12 of these individuals were readable. Obvious mark migration occurred in six of the 13 individuals, but in only one case did migration render the marks unreadable, because the marks had broken apart and dispersed widely. We suggest that mark migration is more likely to occur the longer an individual is marked. If care is taken to separate marks widely, misidentification because of mark migration can be minimized.

Because we used branding in previous mark and recapture studies of the sand skink, we compared safety, reliability, ease of use, and cost of the branding and VIE techniques. We judged safety by the apparent effect of the techniques on health and survival of marked individuals. We judged reliability by our ability to recognize recaptured individuals. We judged ease of use by the time it took us to train others to use the techniques.

The VIE technique appeared to be at least as safe a technique as branding. We observed no increase in mortality or weight loss when we began using the VIE technique. The VIE technique makes infection less likely than branding, is less invasive, and allows for quicker healing. Branding leaves a relatively large wound and even carries a risk of burning through the body wall. Despite the relative safety of the VIE technique, care still needs to be employed in using it. Inserting needles to inject the elastomer raises the possibility of introducing and/or transferring infection. To avoid this possibility, we suggest wiping needles with alcohol or changing needles before new individuals are marked. We observed no signs of infection of recaptured sand skinks marked with the VIE technique.

The VIE technique appeared to be a more reliable technique than branding. We judged relative reliability first by comparing recapture frequencies in years (1995–1997) when branding was used as the marking technique and in years (1998–2000) when VIE was used. If the two techniques were equally reliable, then using the same capture regime would yield equal recapture fre-

TABLE 1. Comparison of previous studies that have used the Visible Implant Elastomer (VIE) marking technique.

Study	Species	Size range of marked individuals	Maximum length of study	Percentage mark retention	Changes in survival	Multiple marks/colors	Mark recognition	Other
Bonneau et al. 1995	bull trout (*Salvelinus confluentus*); cutthroat trout (*Oncorhynchus clarki*)	bull trout: <100 to >400 mm; cutthroat trout: <200 to >200 mm	4 months	2 months 100% 4 months 98.8%	not measured	yes/?	not measured	
Dewey and Zigler 1996	bluegill (*Lepomis macrochirus*)	juveniles 34–55 m; adults 73–133 mm	6 months	99% in lab	"no effect"	yes/yes	"good field recognition 98%"	No growth effect (p>.05)
Haines and Modde 1996	Colorado squawfish (*Ptychocheilus lucius*)	average 48.9 mm	142 days	85%	No different than other tested techniques (no p value given)	no/no	some problems noted after 142 days	No difference in predation (p = .20) between marking techniques
Uglem et al. 1996	Lobster (*Homarus gammarus*)	20–24 mm carapace length	16 weeks	100%	92%	yes/yes		little tag migration
Godin et al. 1996	Shrimp (*Penaeus vannamei*)	juvenile = 1.63 g; adult = 38.22 g	10–14 weeks	juvenile 100, 99.9%; adults 100%	juvenile 90.5%, 93%; adults 92.6%	no/yes		differences in tag color recognition
Fredrick 1997	7 species of reef fish	8–55 mm	lab 76 days; field 130 days	lab 100%; field: 2 individuals observed last day	not measured	no/yes	some recognition problems	
Haines et al. 1998	razorback suckers (*Xyrauchen texanus*) Colorado squawfish (*Ptychocheilus lucius*)	X. texanus = 127 mm; *P. lucius* = 150 mm	15 months			yes/yes	*X. texanus* 74%; *P. lucius* 60% after 11 months	did not believe this technique was suitable for their species in excess of 1 year

TABLE 1. Continued.

Willis & Babcock 1998	snapper (*Pagrus auratus*)		2 weeks	93%	100%	no/yes	difference between color recognition
Linnane & Mercer 1998	lobster (*Homarus gammarus*)		3 molts	1.5 months old 100%; 7 months old 100%	1.5 months old 68%; 7 months old 97%		some tag migration
Hale & Gray 1998	brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*)	*S. trutta* (142–254 mm); *O. mykiss* (80–314 mm)	24–30 days	94–99%	not measured	yes/yes	
Bailey et al. 1998	salmon (*Oncorhynchus kisutch*)	mean length 108 mm	7 months	73%	not measured		
Anholt et al. 1998	Larval anurans (*Rana lessonae* & *R. esculenta*)	≥ 8 mm	5 weeks maximum	85%	100%	yes/yes	no difference in predation (two separate tests; $p = 0.65$, $p = 0.4$)
Malone et al. 1999	*Coryphopterus nicholsii* *Lythrypnus dalli*	*C. nicholsii* 30–40 mm; *L. dalli* 20–30 mm	short lab predation test	not tested	not measured	no/no	no difference in survival to predation ($p = .836$, $p = .20$)
Nauwelaerts et al. 2000	Adult anuran *Rana esculenta*		8 months in lab	100%	not measured	yes/yes	some marks decreased in size as much as 20%

quencies, as long as the probability of recapturing a marked individual did not change. For the population we studied, trapping devices (drift fence–pitfall trap arrays) and trapping effort (number of trap–days) remained the same in all years, and no differences in mean frequency of movements or distance of movements, or in immigration and emigration rates, were detected between any pair of years (Penney unpubl.). Recapture frequency of individuals marked with the VIE technique was about twice (30% vs. 17%) that of individuals marked by branding (log likelihood ratios with William's correction to G–tests, $p < 0.001$). Another, stronger, measure of relative reliability is the relative likelihood of identifying marked individuals. Of the recaptured individuals, researchers were unsure of the identity of 18% of branded individuals (Hill, unpubl.), but unsure of the identity of only 1% of individuals marked with the VIE technique. Both measures of relative reliability indicate that the VIE technique facilitated better recognition of recaptured individuals than branding. This difference probably arose because brands tend to become less recognizable with time (Sutton 1996).

The VIE technique clearly was easier to master than branding. Learning how to inject the elastomer correctly took less time than learning how to brand individuals correctly, and it caused less harm to individuals in the process. Branding was difficult to master, and individuals may have been injured while researchers learned the technique (Sutton, pers. comm.). Neither technique could be used very easily in the field because they both required ice to immobilize individuals.

The startup cost for branding was less than that for the VIE technique. The hand held cauterizers used for branding cost about $10 each, but a starter VIE kit costs from $425 to $1000. Individual cauterizing units could be used to mark 25–35 individuals before they had to be disposed of (Sutton, pers. comm.), but the $1000 starter VIE kit could be used to mark at least a few thousand individuals. The costs per individual for branding and the VIE technique would be comparable (about $0.40 per individual) if 2000 individuals were marked with the VIE starter kit. The minimum amount of elastomer that must be mixed is more than could be used for marking only a few individuals even when the minimum amount recommended by Northwest Marine Technologies is halved. For this reason, we suggest that the VIE technique probably is cost prohibitive for marking only a few individuals at a time. We were able to keep the elastomer in a liquid state on ice or in a freezer for approximately one week, however, although it sometimes hardened beyond usefulness, and others have stored it in the freezer for two to three weeks (Nauwelaerts et al. 2000).

Our results extend the usefulness of the VIE technique beyond apparent limits. Previously, the VIE technique was thought not to be useful for experiments that extended more than one year (e.g., Haines et al. 1998). Our results suggest that the VIE technique can be reliable for at least two years in some organisms. Previously, the VIE technique has been used, as far as we know, only for aquatic and partially aquatic species. Although the VIE technique has been used to mark the terrestrial phase of anurans (Nauwelaerts et al. 2000), our results demonstrate that use of the technique can be extended to completely terrestrial species.

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The Writings of Sherman Bishop: Part II. Conservation

TODD W. HUNSINGER
New York State Museum, 3140 Cultural Education Center
Albany, New York 12230, USA
e-mail: Hunsitod@hvcc.edu

The end of the twentieth century was met with a flurry of activity to address issues of amphibian and reptile declines. Herpetologists and conservationists concerned by the growing reports of species losses formed organizations such as the Declining Amphibian Population Task Force (DAPTF) and Partnership in Amphibian and Reptile Conservation (PARC). While these efforts have lead to many studies, status assessments, and advances in species conservation, concern over the loss of habitat for amphibians and reptiles and abuses faced by individual species are not new endeavors. Origins of herpetofauna conservation can be traced to an earlier period. One prominent voice in the attempt to raise awareness of this often-maligned group of organisms was Sherman C. Bishop (1887–1951). Bishop was a prominent herpetologist and naturalist working primarily in New York State during the first half of the twentieth century. Bishop's principal legacy lies in his contributions to the knowledge of the life history and developmental biology of salamanders (Grobman 1952; Hunsinger 2000). What has been overlooked in discussions of Bishop was his passion for species and habitat conservation.

Sherman Bishop addressed issues of conservation in publications, lectures, and personal letters. He also worked very hard to try to educate and raise awareness and interest in the natural history of amphibians and reptiles, particularly salamanders. From his lecture notes on salamanders, Bishop stated in the introduction,

> "Among all the little creatures of the woods and streams none have been so neglected as the salamanders and none are of greater interest. And there still remains the opportunity for those who have the interest and persistence, to make valuable contributions to our knowledge of the group."

Bishop's interests in education and public awareness are exemplified in one of his favorite stories which concerned the mythology that surrounded the Mudpuppy (*Necturus maculosus*), a species that Bishop researched extensively (Bishop 1926). In lectures he relayed the following account:

> "The first salamander I wish to talk about…is the Mudpuppy or water-dog. It should be known as the newspaperman's perrenial [sic] friend, for it provides a news item at least once a year in all parts of the range of the animal. This is always the 'strange animal unknown to science' notwithstanding it was first described in 1799 and given a name in scientific literature as early as 1818.



FIG. 1. Bishop's library stamp, drawn by friend Hugh P. Crisp. This depicts Bishop's array of interests including scientific literature, amphibians, reptiles, fish, spiders, and his boyhood home in the Finger Lakes Region of New York. (Courtesy of Beth Bishop Flory)

> Once while I was at the State Museum in Albany, a reporter for one of the local papers brought to me a living Mudpuppy taken that day in the nearby Hudson. Here I thought, is a reporter that wishes some information and may be expected to tell the truth when he knows it. So I took the time to tell him all about the animal, where they live, what they eat and something about their nearest relatives. Among other things, I told him that their nearest relatives were found in some of the caves of Europe. I looked in the paper the next day and here again was the old story about the 'strange animal unknown to science,' a fish with four legs and with its ear split into three parts and believed by zoologists at the State Museum to be of European origin having reached the Hudson by way of an underground channel from Bavaria."

Bishop lectured on salamanders throughout the northeastern United States during the 1930s and 1940s. In a letter to long-time colleague W. P. Alexander at the Buffalo Museum of Science, dated 19 May 1937, Bishop wrote:

> "I will be glad to talk on salamanders. I have given this same lecture in Boston and at fair Harvard where it was received with acclaim at the Boston Society of Natural History and with sadness at Harvard. At the last named institution, my talk revealed to one of the graduate students that he had written a doctor's dissertation dealing with one species of salamanders which he had misidentified and confused with another."

Cornell professor and lifetime friend Albert H. Wright undoubtedly influenced Bishop's interest in conservation. As an undergraduate, Bishop traveled to the Okefenokee Swamp in 1912 with Wright and co-authored his first paper (1915) on the snakes of the region. Wright is credited with helping to preserve the Okefenokee Swamp. Wright's influence is seen in Bishop's first publication on salamanders. In his lengthy account of the four-toed salamander (*Hemidactylium scutatum*), Bishop (1919) cited Wright (1918), who stated, 'The four-toed salamander...is vanishing with the drying up or draining of sphagnum bogs and feather bed swamps." Bishop continued the discussion of habitat alteration by stating, "It is certain that the final conversion of sphagnum areas will mark the extirpation of the species in such localities." It is worth noting that Wright (1918) was writing about the decline of habitat of the Bog Turtle (*Clemmys muhlenbergii*), a species that is currently one of the most imperiled turtles in the northeastern United States. The expanding use of gasoline-powered engines in the early 1900s must have rapidly accelerated the rate of wetland dredging and filling as backhoes and bulldozers were able to make the efforts of men much easier. This obviously did not go unnoticed by Bishop and Wright.

In *The Amphibians and Reptiles of Allegany State Park* (Bishop 1927), Bishop again struck a conservationist tone. In the introduction he stated, "The amphibians are timid and inoffensive. Some, as the toad, are beneficial because of the noxious insects, slugs, etc., that they destroy."

Bishop (1927) also tempered some of the common misconceptions about the impact of nongame species on game species that has been prevalent in state management agencies. He wrote, "A few, the Water snake and Garter snake among them, are harmful when under certain conditions they kill too many valuable food fishes and toads." Bishop's comments were quite benign when compared to those of his colleague Elon H. Eaton. Eaton (1928) wrote, "I believe the water snake should be destroyed by all sportsmen whenever they have the opportunity." Bishop and Eaton were more than just casual acquaintances. They went on collecting trips for Timber Rattlesnakes (*Crotalus horridus*) together in 1925 (NYSM 2623, 2627), and worked summers on the New York State Watershed Surveys conducted by the Conservation Department. Eaton also authored the text *Birds of New York* (Eaton 1910, 1914), published by the State Museum just preceding Bishop's tenure as Zoologist. Despite their close professional relationship, their attitudes towards reptiles could not have been farther apart. Eaton (1928) also wrote:

> "The softshell turtle (*Amyda spinifera*) which inhabits Keuka, Seneca, and Cayuga is a predacious species which frequently feeds on fish. The same is true of the generally distributed snapping turtle."

The account also included a photograph of a snapping turtle with an inscription similar to a federal warrant, stating "Soft shell (sic) turtle (*Amyda spinifera*), enemy of shallow water fish." Although the photo was incorrectly identified, the view towards these species could not be mistaken.

The plight of the Timber Rattlesnake (*C. horridus*) was also of concern to Bishop in his accounts of the herpetofauna of Allegany State Park. It is evident from his remarks that he was fully aware of the dangers that a population faced when confronted with increased human activity. Bishop (1927) wrote in the introduction:

> "The Timber Rattlesnake is found in numbers in several restricted areas in the park and surrounding reservation. Confined, as they are, to the out-of-the-way places where they are not likely to be encountered by the camper and tourist, they may be expected to persist for years as one of the most striking and interesting animals of the region."

Bishop reinforces this sentiment in the species accounts, stating:

> "The Timber Rattlesnake has never been found in any section of the park set aside for the use of campers and tourists. It is therefore not likely to be encountered and can not be regarded as a source of danger to those visiting the region."

In the description of the regions of the park, Bishop again returned to the theme of human pressure on rattlesnakes by writing:

> "Limestone Hollow is locally celebrated because of the work of 'Rattlesnake Pete' of Rochester who secured many specimens from the region."

It is hard to determine if it was Bishop's quest for scientific accuracy (an attribute that was evident in all his work and the review of his work by others) or his naiveté of the extent of the pressures this species faced, but his detailed description of the den areas may have hastened the decline of rattlesnakes in the park. In describing the area of Peters Run he wrote:

> "The cracks and cavities in this conglomerate ledge are noted among the inhabitants of the region as being the denning up place for the Timber Rattlesnake. Peters Run is one of the few localities where rattlesnakes occur in numbers within the park area."

Thirty years later, rattlesnakes were rarely seen in the park. Stewart (1961) wrote about her 1957 field work, "Most of the 'snake stories' that the natives tell of seeing rattlers in the park are from years ago; few people have seen a live rattler in recent years, except near the den sites." Recent work indicates that the species is extirpated from the park and surrounding area.

Bishop was decades ahead of the rest of the northeast in attempts to educate the public and conserve the Timber Rattlesnake.

Many counties of New York State offered bounties on rattlesnakes for many decades after Bishop's account. In the 1940s, the State Conservation Department attempted an experimental eradication program for rattlesnakes in Essex County that involved using dynamite to blast the main den areas (Stechert, in Brown 1993). A high school science textbook in use in New York State (Wood and Carpenter 1938) in the decade following Bishop's remarks stated, "Rattlesnakes, copperheads, and cobras are the worst enemies of man." It was thirty years between Bishop's writings and the next published account expressing concern about the plight of the Timber Rattlesnake in New York (Wright and Wright 1957). It was not until 1984 that the state protected rattlesnakes from the type of extirpation feared by Bishop, long after it had disappeared from Allegany State Park.

Bishop's strongest statements about habitat alteration during his work in Allegany State Park did not appear in his publication, but rather in a letter written to Charles Adams, Director of the New York State Museum. On 18 August 1926 Bishop wrote from his camp:

> "Some fine collecting places have been destroyed in the process of 'improving' the park and among them one of the two known streams for the Red Salamander. It seems to me that conditions might be improved at the park if someone would direct the efforts of the laborers engaged in clearing certain areas for the use of campers."

The Red Salamander (*Pseudotriton ruber*) was taken in the area Bishop referred to on 3 August 1922 (NYSM 3205). Recent attempts to find *P. ruber* in the Park have failed (unpubl. data).

Bishop also acknowledged the decline of the Box Turtle (*Terrapene carolina*) in the greater Albany, New York area. In response to a letter received at the State Museum inquiring about a turtle that had been seen in Victory Mills, New York, Bishop wrote on 13 July 1928:

> "Judging from your interesting account, I believe the turtle you have found is a Box-turtle. Formerly the Box-turtle was common at Albany but the frequent burning over of the sand plains has probably wiped it out."

Fire was a natural occurrence in the Albany Pine Bush prior to European settlement and fire suppression. Although it is hard to tell what role these changes played, if any, in the decline of the Box Turtle, we must recognize Bishop as one of the earliest herpetologists to address the decline of this overharvested species. Bishop (1923a) noted this decline in his accounts on the herpetology of Albany County a few years earlier.

Bishop left the State Museum in August 1928 to take a position at the University of Rochester. His concern for habitat alteration continued to grow during this period. His harshest comments on this topic are found in a letter to Charles Adams dated 12 June 1929. Bishop wrote:

> "The Mendon Ponds area is being developed for park and picnic purpose. I was sorry to see that wide boulevards are being constructed all through the place so that auto tourists will be able to get in and pick all the curious flowers."

A Bog Turtle from Mendon Ponds on 26 June 1931 (NYSM 2220) was placed in the collection of the now defunct University of Rochester Museum of Natural History. This is the only report of their occurrence in the park.

In the same letter to Adams, Bishop continued, "Bergen Swamp, which I visited for the first time last week, is a remarkable place and should be preserved just as it is. I wish you could stop off long enough some time to visit the place with me." Bishop would spend the rest of his life working to ensure the preservation of Bergen Swamp as an active member of the Rochester Academy of Sciences (RAS), for which he served as the president in 1946–1947, and the Bergen Swamp Preservation Society, which formed in 1912. Bergen Swamp is one of only two localities of the Massasauga Rattlesnake (*Sistrurus catenatus*) in the state and supported a population of Bog Turtles during Bishop's life. At the time of Bishop's death it was written in the Museum Service Bulletin (1951) that, "He had been one of the most active supporters of the Rochester Academy of Science and the Bergen Swamp Preservation Society." Bishop was appointed Fellow of the Rochester Museum of Arts and Sciences in 1946 "for his attainments as a scholar, and for his contributions to this community in promoting a broader appreciation of the place of science in life." Bishop's strong interest in conservation was a perfect match for RAS, as its members were instrumental in helping to establish the Everglades National Park as well.

Bishop was a man of many talents and interests. It would be incorrect to categorize him only as a herpetologist, considering that he authored or co-authored more than 100 papers on spiders (Adler 1989) and spent seven summers working on the watershed surveys of New York State documenting fish distribution (see Fig. 1). Due to his diverse, yet accurate, knowledge of the natural world, Bishop has deservedly been called a field naturalist (Adler 1989). His concern for species preservation outside of herpetology was voiced just as strongly. A paper entitled "More Bird Protection Needed" (Bishop 1923b) states in part:

> "An additional large number hunted in and out of season, killing nongame birds and game birds greatly in excess of the legal limit. This is the wholesale drain on the wild life of a limited region; if the record is extended to cover the country, the result is appalling.
>
> In fixing the limits of the reproductive capacity of birds Nature did not take into consideration the automatic shot gun or the ability of man to construct nets and snares."

Still, Bishop's most vocal efforts centered on the effect of habitat destruction on salamanders, a group of organisms he spent his life studying. Bishop (1941) wrote in the introduction to *The Salamanders of New York*:

> "If any justification is needed for the publication of the detailed records accompanying the accounts of the species, it is to be found in the rapidly changing conditions which, in various parts of the state, have brought about the extermination of certain species over wide areas. These changes may be expected to continue and exert an ever-increasing pressure as swamps and marshes are drained, and land cleared."

Bishop was no clairvoyant, yet his prediction of salamander declines in regions of New York are being realized. Recent attempts to locate Mudpuppies in Salmon and Black Creeks (Monroe County) were unsuccessful (T. W. Hunsinger and W. L. Hallahan, unpubl. data, 2000 survey). Bishop (1941) cites many specimens from these localities spanning a decade.

Bishop again took the role of advocate for the study of the natural history of salamanders in the preface to his major work, *Hand-*

book of Salamanders (Bishop 1943). The first lines of the text are an invitation to advance the scientific knowledge of the group. In it he writes:

> "It is hoped that this handbook may be of help to the growing number of persons interested in salamanders and perhaps lead some of them to more detailed studies of many of the forms than I have been able to make."

Sherman Bishop was a rare combination of dedicated scientist with an insatiable thirst for an understanding of the natural world and advocate for species and habitat conservation at a time when few people were thinking about, let alone advancing, the issue. He took full advantage of every opportunity to try to educate others and share his enthusiasm for amphibians and reptiles with any audience. After his death it was written in the Museum Service Bulletin (1951), "With all that he was a very human person who liked outdoor life, and shared his enthusiasm with all who came in contact with him, giving encouragement to the student and amateur alike."

Perhaps the passing of Sherman Bishop was best expressed in a letter from D. L. Gamble of Ward's Natural Science Establishment to Karl P. Schmidt concerning the shipment of Bishop's specimen collection from Rochester to the Chicago Natural History Museum (Field Museum of Natural History) dated 2 October 1951. Gamble wrote, " I miss Sherm Bishop very much. I talked with him just a week or so before his death. His death was a great loss to zoology and we can ill-afford to lose men of his calibre (sic)." Indeed. Bishop's death silenced a passionate voice for the advancement of knowledge and conservation for this group of "neglected" animals, as Bishop frequently referred to them.

Acknowledgments.—I thank Kraig Adler, Robert Daniels, Beth Bishop Flory, Bill Hallahan, Alan Resetar, and Roy McCaig (RAS) for their assistance in researching this paper. Robert Daniels and Kimberley Corwin Hunsinger reviewed drafts of the manuscript and provided insightful comments. This is contribution number 826 of the New York State Museum and Science Service, the last in the series.

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Multiple Generations, Multiple Clutches, and Early Maturity in Four Species of Monitor Lizards (Varanidae) Bred in Captivity

FRANK RETES
Goanna Ranch, P.O. Box 85036
Tucson, Arizona 85754-5036, USA

and

DANIEL BENNETT*
Department of Zoology, University of Aberdeen
Tillydrone Avenue, Aberdeen, AB24 2TZ, U.K.
e-mail: mampam@mampam.com

**Corresponding author*

We report on the successful reproduction of four species of monitor lizard (*Varanus glauerti, V. kingorum, V. pilbarensis*, and *V. caudolineatus*) maintained by the senior author. All are currently assigned to the subgenus *Odatria* (King and Green 1999). There are no previous literature reports of captive breeding of these species. All species are housed under the same conditions. The animals are kept in pairs or trios in enclosures approximately 130 x 60 x 80 cm (L x W x H), with 30-cm deep substrate (loam and grit), and stacked boards to provide hiding places. Water is added to the substrate in sufficient quantities to ensure that the lower levels are always moist. Temperatures in the enclosures range between 28°C and 66°C, maintained 24 hours a day. Heat is provided by spotlights and heating mats. The animals are fed crickets of various sizes dusted with a 3:1 by volume mix of Rep-Cal® and Herptivite® and small mice. Food is provided generously.

Initial copulations are observed more or less continuously over three to five days. Prior to production of subsequent clutches the

mating period is shorter (about 24 h). Throughout the mating period the pair stay in close contact. Eggs are buried in the substrate, usually at night (despite the 24 h light cycle). They are removed immediately and incubated in a 1:1 mixture by weight of perlite and water. Initially clutches were incubated at a constant 30.6°C. Under these conditions eggs of all species hatched after 90–100 days (exceptionally 65–110 days). Subsequently, incubation temperatures were allowed to fluctuate between 28.5°C and 32.5°C. Incubation times for individual species under these conditions are given below.

Varanus kingorum has been maintained since 1993. During this time six generations of captive animals have been produced. Clutch size is typically two but as many as six eggs have been laid. Up to 14 clutches of eggs have been produced by a single female in as many months. Incubation takes 65–80 days under the conditions described above. Hatchlings have a total length of about 15 cm. Both sexes become sexually mature at four months of age. Males are removed from enclosures after egg laying to allow females to regain condition.

Since 1996 *V. glauerti* have produced a total of five generations of captive bred animals. Females produce up to 68 fertile eggs in eight clutches over eight months; eggs hatch after 90–110 days. Average clutch size is nine with a maximum of 12 eggs. Hatchlings measure approximately 18 cm total length and can reach maturity at around seven months of age. Males are separated from females after egg laying.

Since 1997 three generations of *V. pilbarensis* have been produced. Clutch size averages four eggs, with a maximum of six. Up to six clutches are produced per year, usually laid two weeks apart over 2–3 months followed by a pause of nine months. Eggs typically hatch after 80 days, sometimes as quickly as 65 days. Hatchlings measure approximately 13 cm total length and can reach sexual maturity as early as eight months of age. It has not been necessary to separate sexes after egg laying because females regain condition rapidly.

Three generations of *V. caudolineatus* have been produced since 1997. Typically 5–6 clutches of eggs are produced over four months, followed by an eight month pause. Clutch sizes of 2–3 eggs are common, however a maximum of five eggs have been laid. The eggs hatch between 65 and 80 days and reach sexual maturity at the age of five months. It has not been necessary to separate sexes after egg laying.

Although multiple clutches have been recorded many times in captive monitor lizards (Card 1994; Horn and Visser 1990, 1997; Vincent and Wilson 1999) and occasionally in wild populations (Shine et al. 1996), the numbers of clutches reported here are much higher than those previously reported for any captive monitor lizard. Similarly, the ages at maturity reported here are much lower than those in the literature. The results suggest that, given conditions of almost unlimited access to food and heat, these lizards are capable of much higher rates of growth and reproduction than had been previously supposed. They further suggest a capacity for rates of metabolism that are at present undocumented.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 32, Number 1 (March 2001). Submissions should be directed to one of the section editors (contact information located on inside front cover of this issue), as follows: amphibians (Painter); lizards, amphisbaenians, crocodilians, *Sphenodon* (Hayes); snakes and turtles (Butterfield).

CAUDATA

BATRACHOSEPS STEBBINSI (Tehachapi Slender Salamander). **ATTEMPTED PREDATION.** Examples of predation are known for only a few species of *Batrachoseps*, and none has been reported for *B. stebbinsi*, a species with a very restricted distribution in the Tehachapi Mountains of south-central California, USA (Hansen and Wake, *in press*. *In* M. J. Lannoo [ed.], Status and Conservation of U.S. Amphibians. University of California Press, Berkeley).

On 18 March 2000, two of us (TB, SW) observed a female *Diadophis punctatus* (190 mm SVL) attempting to constrict an adult *B. stebbinsi* (54 mm SVL). Both were located beneath small rocks at the base of a north-facing talus slope. The snake had seized the salamander just anterior to the hind limbs and was attempting to encircle the salamander's body with coils, but with little success. The snake appeared rather thin, perhaps having recently emerged from winter dormancy. After a ca. 15 minute struggle, the salamander dislodged the snake by dragging it down among smaller rock fragments and escaped. This observation was made at 1400 h at an air temperature of 20°C within Caliente Canyon, Kern County, California.

Ringneck snakes readily consume *Batrachoseps* in captivity (Hubbard 1903. Univ. California Publ. Zool. 1:157–170; RWH, pers. obs.). As the distribution of *D. punctatus* overlaps the ranges of most species of *Batrachoseps*, several authors (e.g., Stebbins 1954. Univ. California Publ. Zool. 54:47–124) have suggested that ringneck snakes likely are natural predators.

Submitted by **TIMOTHY BURKHARDT** and **SAMANTHA WINEGARNER**, 49 Blossom Drive, San Rafael, California 94901, USA (e-mail: TriprionCO@aol.com) and **ROBERT W. HANSEN**, 16333 Deer Path Lane, Clovis, California 93611-9735, USA (e-mail: rwh13@csufresno.edu).

EURYCEA LONGICAUDA LONGICAUDA (Long-Tailed Salamander). **PREDATION**. Little is known about predation pressures faced by long-tailed salamanders. On 17 Sept 2000, we col-

NATURAL HISTORY NOTES

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CAUDATA

CHIOGLOSSA LUSITANICA (Golden-striped Salamander). **REPRODUCTION.** Amphibians display a great diversity of oviposition strategies, laying their eggs in an array of microhabitats. *Chioglossa lusitanica* is a slender-bodied streamside salamander, endemic to the northwestern Iberian Peninsula. This species is reported to lay eggs in small clusters in deeply submerged holes along stream margins, and attached to the undersides of stones or against rocks in slowly flowing water (Arntzen 1981. Amphibia-Reptilia 1:187–203). However, there are actually few reports where these oviposition sites have been described. The first *C. lusitanica* eggs were found in the 1960's in a mine gallery located in the surroundings of Porto (northern Portugal) by Gonçalves (1962. Naturalia 8:1–3). Moreover, in a national survey of the species' distribution, no eggs were found in streams (Teixeira et al. 1999. Estudos de Biologia e Conservação da Natureza. 22. ICN. Lisboa. 33 pp.). In contrast, in some mines it is common to see hundreds of eggs, where clusters from one or more females are found on moist walls and attached to the submerged parts of walls or stones (Arntzen 1981, *op. cit.*; Faria et al. 1996. Livro de Resumos. IV Congresso Luso-Espanhol de Herpetologia: 82).

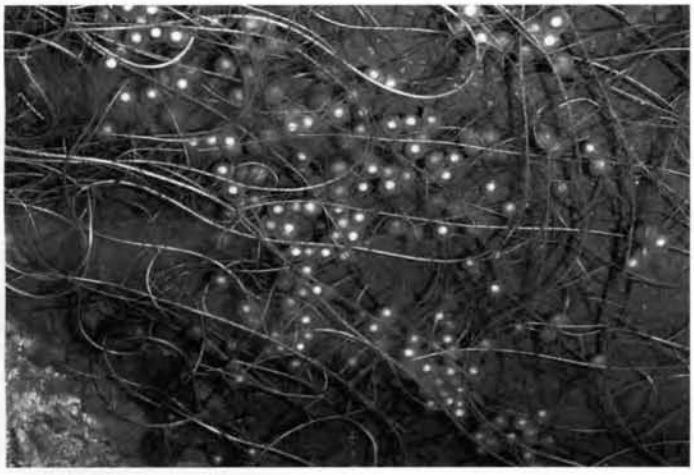


FIG. 1. Egg masses of *Chioglossa lusitanica* submerged among roots of aquatic vegetation.

On 10 October 2000 during a visit to the mine gallery of Inferno or "upper mine" (see Arntzen 1981, *op. cit.* for a detailed description) near Porto (UTM 29TNF45), in addition to the typical egg-laying substrates found in that mine, we observed masses of eggs in mats of submerged roots (Fig. 1). The number of eggs found in the mine during this project, as well as in previous literature reports, are summarized in Table 1.

The visits to this mine showed a similar diversity of oviposition substrate among years. Based on this, and the substantial increase of the number of eggs found in 2000, we hypothesized that the main cause for the observed egg clusters in a different oviposition substrate was because the normal oviposition sites used by *C. lusitanica* females in this mine were already occupied.

TABLE 1. Number of eggs found in the upper or Inferno mine gallery from 1994 to 2000.

Year	Number of eggs	Source
1994	2536	Lima (1995. MSc thesis, Faculty of Sciences, University of Porto)
1995	2050	Faria et al. (1996. Livro de Resumos. IV Congresso Luso-Espanhol de Herpetologia: 82)
1996	781	Faria et al. (1996. Livro de Resumos. IV Congresso Luso-Espanhol de Herpetologia: 82)
1999	2100	This study
2000	3732	This study

Submitted by **FERNANDO SEQUEIRA**, **JOSÉ TEIXEIRA**, and **HELENA GONÇALVES**, Centro de Estudos de Ciência Animal, ICETA – Universidade do Porto, Campus Agrário de Vairão, Rua do Monte (Crasto) – Vairão, 4485-661 Vairão, Portugal.

GYRINOPHILUS PORPHYRITICUS DANIELSI (Blue-Ridge Spring Salamander). **BEHAVIOR**. Tree-climbing behavior has been reported for relatively few salamander species, and is unknown for members of the plethodontid genus *Gyrinophilus* (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.). Herein, we report arboreality in a primarily aquatic and terrestrial salamander, *Gyrinophilus porphyriticus danielsi*.

On 27 June 2000 at ca. 1130 h, two *G. porphyriticus danielsi* were observed in trees in Great Smoky Mountains National Park, North Carolina, USA. The salamanders were found near the convergence of Beech Flats Prong and Peruvian Branch (Clingmans Dome Quadrangle 35°36'N, 83°24'W) at an elevation of ca. 1183 m. The first individual (64 mm SVL) was perched on a snag branching from the trunk of a small red spruce (*Picea rubens*) 82 cm above the ground. The second individual (68 mm SVL) was perched 15 cm above the ground on a horizontal trunk of a striped maple sapling (*Acer pensylvanicum*). At the time of the observation, skies were heavily overcast. Heavy rain occurred the previous night, and rain began again shortly after the observations were made. The air temperature was 19.5°C. Both specimens were within 5 m of the habitat typically reported for adult *G. porphyriticus*: small, rocky seeps that are tributaries of montane streams.

These observations are novel not only because this species has not previously been observed climbing, but also because two individuals were found in trees in nearly the same location and at

essentially the same time. Arboreality may be environmentally or phenologically triggered when conditions are appropriate, particularly during or in temporal proximity of rainfall. Since arboreality has not been reported in any eastern salamander with great frequency, there have been few suggestions as to the cause or importance of this behavior.

These observations were made in conjunction with the USGS Southeastern Amphibian Research and Monitoring Initiative under permits from Great Smoky Mountains National Park (GRSM 00-025) and the North Carolina Wildlife Resources Commission (No. 0100). We thank Lora L. Smith and C. Kenneth Dodd, Jr. for comments.

Submitted by **W. JAMES BARICHIVICH, KEVIN G. SMITH**, and **JAYME L. WALDRON**, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA.

HYDROMANTES PLATYCEPHALUS (Mt. Lyell Salamander). **BEHAVIOR**. Little information is available concerning the behavior of *Hydromantes platycephalus*, a bolitoglossine plethodontid salamander known only from the Sierra Nevada of California. This is probably due to their nocturnal activity, patchy distribution, and remote, generally high elevation range (up to 3660 m). Discovered by accident in Yosemite National Park (Camp 1916. Univ. California Publ. Zool. 17:11–14), this species is commonly associated with wet granitic talus slopes. Typical microhabitats are downslope from melting snowfields on granite bedrock, usually with a thin film of flowing water and scattered cover consisting of granite boulders. Individuals also have been found under moss on wet rock faces, under pieces of wood, or under rocks on the edges of streams or in moist decomposed granitic soil (Adams 1942. Univ. California Publ. Zool. 46:179–204). In 1999 we discovered a new population at 3500 m elev. in Kings Canyon National Park (36°49'41"N, 118°26'9"W). The site is characterized as glacially carved granite with a small stream (75 cm wide, 1–10 cm deep, flow rate ca. 1.5 m/sec in mid to late summer) flowing over granitic bedrock. The stream flows out of a lake (0.4 ha SA) over a 100 m flat stretch (ca. 4–9° incline), then over a cliff, cascading nearly vertically for 60 m. Salamanders were found under large slabs of granite (60 x 40 x 12 cm) in direct contact with the water and hiding along the edges of the entire waterfall in moist fissures. One specimen was collected at the site in 1999 (MVZ 230961), but other animals were either caught and released, or observed and not handled. We found many more individuals when the site was visited at night (35 in one nocturnal visit versus 15, 7, 4, 8, 13, 9 in six diurnal visits). In diurnal visits, salamanders were found exclusively under large pieces of granite. The animals were in direct contact with the water, on the edge of the flowing stream. No salamanders were found away from the wet areas even though many rocks were turned. In sharp contrast to the diurnal surveys, in the nocturnal survey we encountered salamanders out in the open both in the water and on dry land, sometimes as far as 2–3 m from the stream. Additionally, many of the salamanders were seen clinging to the granite bedrock (with their feet and their tail) in the middle of the stream, usually with their heads above the water surface and the rest of the body immersed. One was crawling upstream along the edge of the stream in the water, but froze in our light, then drifted downstream about 10 m before clinging to the bedrock in the middle of the creek. When startled by our presence, another salamander made a short swim using its tail. *Hydromantes platycephalus* has not been reported previously in lotic habitats, which we believe may be a common habitat type, especially at high elevations (>3500 m) where moisture-retaining soil is sparse or lacking altogether. This behavioral observation stresses the importance of moist microhabitats for *H. platycaphalus* (especially in areas lacking soil) and suggests that the specialized morphology (cupped feet and prehensile tail) may aid the animal in lotic locomotion.

Submitted by **VANCE VREDENBURG, TATE TUNSTALL, HIEN NGUYEN, JOHN ROMANSIC**, and **SEAN SCHOVILLE**, Museum of Vertebrate Zoology, University of California, 3101 Valley Life Sciences, Berkeley, California, USA, 94720; email (VV): vancev@socrates.berkeley.edu.

PLETHODON SERRATUS (Southern Red-backed Salamander). **INTRASPECIFIC AGGREGATION**. On 4 November 2000 we found an aggregate of nine individual *Plethodon serratus* inside a rotting log that was lying on the floor of a ravine covered by deciduous forest in the Cherokee National Forest near Rafter, Monroe County, Tennessee, USA. All salamanders were within 5 cm of all other members of the group. Two of them were small juveniles (< 25 mm SVL), whereas the others appeared to be adults or larger immatures. The log was ca. 15 cm in diameter. The cavity where the salamanders were found was wet although underneath the log was dry. Nine additional *P. serratus* were found under logs in the vicinity (within 100 m), although most logs were also dry underneath. There was never more than a single individual under any of these logs. Several individuals were tightly coiled in a posture to help prevent water loss (Ray 1958. Ecology 39:75–83). There had been no measurable rain for 38 days. The air temperature was ca. 18.5°C, and had reached similar temperatures every day for the previous two weeks.

Overwintering aggregations have been reported for species of *Desmognathus* and *Pseudotriton* (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press. Washington, D.C.). In addition, *P. cinereus* has been reported from winter hibernacula in ant mounds (Caldwell and Jones 1973. Am. Midl. Nat. 90:482–485). The relatively warm air temperatures, the number of single-occurring *P. serratus* in the immediate area, and the fact that the salamanders were above ground lead us to believe that we did not observe a winter aggregation. Although *P. cinereus* has been reported to aggregate in small groups for mating (Placyk et al. 2000. Herpetol. Rev. 31:167), the presence of two small juveniles suggests that this aggregation was not related to mating. Due to the dryness of the region and the water-conserving posture seen in several of the single individuals, we presume that this clump was a behavioral mechanism to prevent desiccation. Petranka (*pers. comm.*) has observed 10–12 *Desmognathus wrighti* in a clump under similar dry conditions, and several species of *Ambystoma* have been reported to exhibit clumping behavior during drought (Petranka, *op cit.*).

Submitted by **W. BEN CASH**, Department of Biology, Maryville College, Maryville, Tennessee 37804, USA and **CARLOS D.**

CAMP, Department of Biology, Piedmont College, Demorest, Georgia 30535, USA.

PSEUDOEURYCEA GOEBELI (Goebel's False Brook Salamander). **DIET**. Plethodontid salamanders, in particular those in the tribe Bolitoglossini, use ballistic tongue projection to apprehend prey (Deban et al. 1997. Nature 389:27–28). Few data are available on prey size in bolitoglossine salamanders (e.g., Maglia 1996 Copeia 1996:576–586; Bille 2000 Alytes 17:114–124). However, the majority of their diet consists of small arthropods such as Coleoptera and Hymenoptera; large prey items, though rarely taken, are usually long and thin (D. Wake, unpubl. data). In a preserved male *Pseudoeurycea goebeli* in the Museum of Vertebrate Zoology (MVZ 102783; SVL 52.1 mm, head length 12.7 mm, head width 7.9 mm), I found a hymenopteran (*Tiphia*; 10.1 mm x 1.5 mm) and a lepidopteran larva (Arctiidae; 21.7 mm x 5.2 mm) (Fig. 1). The prey items filled the salamander's stomach and body cavity such that the internal organs were pressed flat against the body wall. This record indicates that bolitoglossines are capable of taking larger, heavier prey items than previously thought. Although relatively large items are likely rare in the diet of bolitoglossines, they may be energetically significant (see Greene 1986. Fieldiana Zool. 31:1–12).

I thank E. Richard Hoebeke for identification of the prey items.

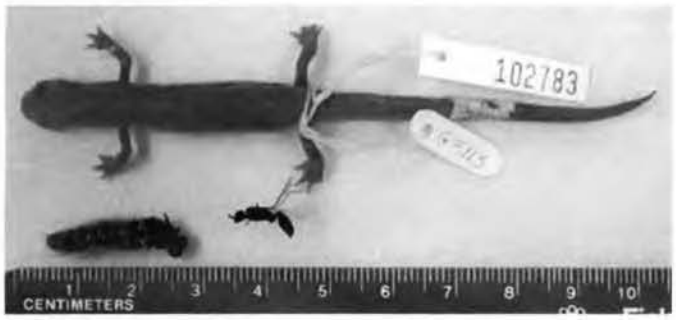


FIG. 1. Adult *Pseudoeurycea goebeli* with two prey items found in the stomach; a larva in the family Arctiidae (bottom left), and the hymenopteran, *Tiphia* (bottom right).

Submitted by **LAUREN M. CHAN**, Department of Ecology and Evolutionary Biology, Corson Hall, Cornell University, Ithaca, New York, 14853; e-mail: lmc36@cornell.edu.

ANURA

ATELOPUS CARBONERENSIS (La Carbonera Harlequin Toad; Sapito Arlequín de La Carbonera). **SURVIVORSHIP**. La Marca and Reinthaler (1991. Herpetol. Rev. 22:125–128.) were the first to report population declines of species in the genus *Atelopus* in Andean Venezuela. The last reported sightings of *A. carbonerensis* were in October 1990 and January 1995 (La Marca and Lötters 1997. Herpetologia Bonnensis 207–213). The species was thought to be extinct, although at one time it was common at the type locality (La Carbonera, Estado Mérida, Venezuela) and surrounding areas (see Barrio 1996. Reptilia 8:26–28; 1998. Acta Biol. Venez. 18[2]:1–93). The decline of *A. carbonerensis* has occurred so drastically in the last decade that Rodríguez and Rojas-Suárez (1999. Libro Rojo de la Fauna Venezolana. 2nd edición. PROVITA, Fundación Polar. Caracas, Venezuela. 472 pp.) listed the species as "Critical Danger," the highest category of endangerment for the Venezuelan fauna. However, on 13 August 1998 at 1500 h, Nancy Chacín, Richard Gavidia, and Carlos Dávila observed and photographed a healthy adult *A. carbonerensis* in the vicinity of "Páramo El Tambor" (8°41'N, 71°12'W), Miraflores hamlet, Mérida state, very close to the type locality. The toad was found above a fallen *Cyathea* tree fern "trunk" within the cloud forest environment (ca. 2200 m elev.). Although *A. carbonerensis* and other harlequin toads in Venezuela and throughout many neotropical realms appear to have declined, we suggest additional survey efforts are needed in localities near historical sites of each species.

Submitted by **DENIS A. TORRES** and **CÉSAR L. BARRIO** Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Estado Mérida, Venezuela; e-mail: andigena@usa.net (DAT) and cesarlba@yahoo.com (CLB).

BUFO BOREAS (Boreal Toad). **PHORETIC HOST**. On 27 June 2000, we conducted a survey for *Bufo boreas* at a known breeding site in Sayre's Gulch, Chaffee County, Colorado, USA. From the edge of the main breeding pond, we observed several *B. boreas* tadpoles in shallow water, a small number of which were thrashing violently. Upon closer observation, we noted that leeches were attached to the thrashing tadpoles, and after a short time the vigorous movement dislodged the leeches. We selected a 0.5 x 0.5 m area containing about 200 tadpoles and observed them for 20 minutes. During this time, five tadpoles were attacked by leeches, with four attacks directed onto the ventral surface of the tadpole's body and one onto the tail. Once attacked, tadpoles required a mean time of 66 ± S.E. 35 s (N = 5; range 21–107 s) to remove the leeches. We collected samples of these leeches as well as a leech on one of the adult toads. The total lengths of four leeches fixed on slides ranged from 6 to 9 mm (University of Colorado Museum UCM 2394). These were identified as immature *Erpobdella punctata* (Hirudinea: Erpobdelllidae). This leech is distributed throughout North America (Herrmann 1970. Amer. Midl. Nat. 83:1–37). In South Carolina, this leech has been reported to use *Ambystoma maculatum* as a phoretic host (Khan and Frick 1997. J. Nat. Hist. 31:157–161). To our knowledge, this is the first report of this leech attempting to attach to tadpoles or attaching to adult *B. boreas*.

At a site along Pole Creek, Summit County, Colorado, a *Helobdella stagnalis* (Hirudinea: Glossiphoniidae) was attached to an adult male *B. boreas*. This leech occurs through much of Colorado (Hermann, *op.cit.*). While the previous species is non-predatory, *H. stagnalis* probably was feeding on the toad. Leeches have been mentioned as parasitizing metamorphosed *B. boreas* (Hammerson 1999. Amphibians and Reptiles in Colorado. University Press of Colorado, Niwot, Colorado), but their specific identities were not noted.

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Submitted by **LAUREN J. LIVO**, Environmental, Population, and Organismic Biology, University of Colorado, Boulder, Colo-

rado 80309-0334, USA and Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526, USA (e-mail: ljlivo@aol.com) and **BRAD A. LAMBERT**, Colorado Natural Heritage Program, Room 254 General Services Building, Colorado State University, Fort Collins, Colorado 80523, USA (e-mail: blambert@holly.colostate.edu).

BUFO MARINUS (Giant Toad). **ASSOCIATION WITH OSCARS** (*Astronotus oscellatus*). Ecologists have long been concerned about the negative impacts that some non-native species have on native ecosystems. Many urban and island ecosystems are now largely composed of anthropogenically-assembled communities, with a large diversity of species either intentionally or unintentionally introduced from a variety of regions of the world (Bright 1998. Life Out of Bounds: Bioinvasion in a Borderless World. World Watch Institute, New York. 287 pp.; Mooney and Hobbs 2000. Invasive Species in a Changing World. Island Press, Washington, D.C. 457 pp.; Ota 1993.). Despite the increasingly high profile of invasive alien species (National Invasive Species Management Plan 2000; Invasive Species Executive Order 1998), few studies have been conducted on the evolving relationships among "fortuitously sympatric" vertebrates.

The flora and fauna in Honolulu, Hawaii comprise an assembly of species from many continents (Cox 1999. Alien Species in North America and Hawaii. Island Press, Washington, D.C. 387 pp.; Oliver and Shaw 1953. Zoologica 38:65–95). Between 7 and 10 June 1999, I observed the relationship between an aggregation of ca. 2000 *Bufo marinus* tadpoles and 3 adult oscars (*Astronotus oscellatus*; ca. 40 cm TL; gender unknown) in a large pond (22 x 4 m; 10–50 cm deep, average depth 30 cm) of the East-West Center's ornamental aquatic gardens in Honolulu, Hawaii.

Over the four-day period, I observed the tadpoles and fish for ca. 2.6 h (1030–1040 h and 1245–1315 h each day) and make two "spot checks" (quick look to determine their location only) at different times each afternoon. During all observations, the three oscars swam immediately alongside or above the foraging aggregation of tadpoles. As the tadpoles moved throughout the pond, the aggregation continuously divided and remerged into 1–4 closely associated clusters. When the tadpoles were in a single aggregation, all of the oscars remained with the cluster. If the tadpoles broke into two or three closely associated clusters, the oscars each occupied a cluster. In the one instance that the tadpoles were in four clusters, two oscars each occupied a cluster and the third oscar continuously swam between the other two clusters (ca. 0.5 m apart).

It was not apparent whether the oscars derived any benefit from the close association with the tadpoles. The oscars fed on mosquito fish and juvenile *Tilapia*, but not the tadpoles. *Bufo marinus* tadpoles are known to be unpalatable to predatory fish (Azevedo-Ramos and Magnusson 1999. Copeia 1999:58–67; Crossland and Alford 1998. Aust. J. Ecol. 23:129–137; Lawler and Hero 1997. Wildl. Res. 24:327–334). On the three occasions that tadpoles were engulfed when an oscar ate a fish, the tadpole was immediately released, apparently unharmed. The tadpoles did not appear to be attracting or scaring up prey for the oscars. On one occasion a tadpole was observed to "clean" the sides of an oscar for ca. 30 sec.

This may be a case of mistaken identity. Cichlids (including oscars) are well-studied ethologically (Beeching 1997. Behav. Processes 39:85–93), and unlike most other fish families, cichlids care for their eggs, larvae, and young (McKaye and McKaye 1997. Evolution 31:674–681), which form aggregations (Keenleyside 1991. Cichlid Fishes: Behavior, Ecology and Evolution. Kluwer Academic Publishers, New York).

Many cichlids are known to adopt conspecific or heterospecific young, with seemingly incidental benefits to the parents (Nelson and Elwood 1997. Am. Behav. 54:803–809; Ochi and Yanagisawa 1996. Env. Bio. Fishes 45:141–149; McKaye 1985. Oecologica 66:358–363). The mechanical similarities between tadpoles and many fish species are very strong (McDiarmid and Altig 1999. Tadpoles: The Biology of Anuran Larvae. University of Chicago Press, Chicago, Illinois). Perhaps the aggregation behavior of the tadpoles (Mares 1972. Texas J. Sci. 23:433–435; McDiarmid and Altig, *op.cit.*), triggered a guarding response in the oscars (Keenleyside, *op. cit.*). The oscars were frequently aggressive (charging, gaping, biting) toward one another, as well as koi and adult *Tilapia*. Given that the tadpoles are unlikely to be palatable to other fish in the pond, the oscars probably did no harm but also provided no advantage to the tadpoles.

Submitted by **JAMIE KRISTINE REASER**, U.S. Invasive Species Council, 1951 Constitution Ave, NW, Suite 320, South Interior Building, Washington, D.C. 20240, USA (e-mail: jamie_reaser@doi.gov) and **WENDY FOX KNIGHT**, Center for Conservation Biology, Department of Biological Sciences, Stanford University, Stanford, California. 94305, USA (e-mail: wfox@leland.stanford.edu).

ELEUTHERODACTYLUS ABBOTTI (NCN). **PATTERN POLYMORPHISM**. Species in the genus *Eleutherodactylus* are frequently polymorphic (Savage and Emerson 1970. Copeia

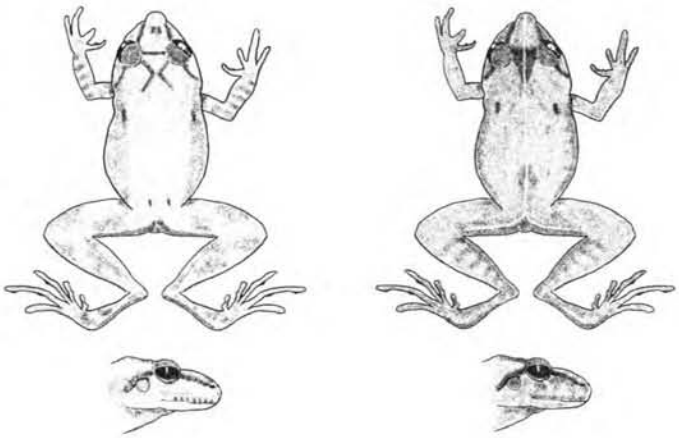


FIG. 1. Pattern polymorphism in *Eleutherodactylus abbotti* from the eastern Sierra de Baoruco, Dominican Republic. Drawings are composites of numerous specimens for the purpose of representing variable pattern elements in four geographically proximate localities (Table 1). The specimen on the left illustrates a dorsal pattern with contrasting sides; narrow, hourglass-shaped interocular bar with corresponding ridge pattern; distinct eyeline and tympanic stripe; headpatch restricted to frons; banded arm pattern; mottled leg pattern; distinct side and sacral spots, the latter confined to ridges; dark arch mark; banded lip line; and lack of a middorsal stripe. The specimen on the right illustrates a uniformly dark dorsal pattern; wide, filled interocular bar; distinct eyeline and tympanic stripe; uniform arm pattern; banded leg pattern; distinct side spots; scapular spots not confined to ridges; ridges scattered; lip line mottled; and narrow middorsal stripe extending onto thighs.

TABLE 1. Pattern polymorphism in *Eleutherodactylus abbotti* from the eastern Sierra de Baoruco, Dominican Republic. Population 1 consisted of four localities on the northeastern slope above the city of Barahona (elev. 300–450 m); population 2 of three localities on the northern slope above the town of Cabral (700–850 m); population 3 of two localities on the southeastern slope above the town of Enriquillo (250–380 m); and population 4 of five localities on an eastern ridge (Loma Remigio; 1050-1150 m). The first three populations are in moist upland rainforests and the fourth in cloud forest. However, all sites have been severely altered by human activity. Asterisks (*) indicate traits for which counts differed significantly from expected Hardy-Weinberg frequencies (Contingency tests; _ = 0.05); note that we tested only traits for which three phenotypes exist. Crosses (†) designate traits for which interpopulational differences cannot be explained by chance.

Trait (Fig. 1)		Population			
		1 (N = 23)	2 (N = 40)	3 (N = 15)	4 (N = 77)
Dorsal pattern	uniform	12	18	9	49
	contrasting sides	3	2	3	3
	mottled	8	20	3	25
Interocular bar *	narrow	1	5	0	1
	wide	2	6	0	7
	hourglass	20	29	15	69
Interocular bar *	filled	11	16	11	47
	partially-filled	5	9	3	11
	open	4	4	1	11
Eye line	dark	19	31	15	54
	faint	4	9	0	23
Tympanic stripe	dark	23	40	15	76
	faint	0	0	0	1
Tympanic spot	present	9	13	5	29
	absent	14	27	10	48
Head patch * †	confined to frons	11	14	8	31
	beyond the orbits	2	9	0	1
	absent	10	17	7	45
Arm pattern * †	uniform	4	4	2	5
	mottled	19	36	13	37
	banded	0	0	0	35
Leg pattern * †	uniform	11	11	4	10
	mottled	12	20	5	15
	banded	0	9	6	52
Scapular spot †	complete	5	15	6	32
	confined to ridges	14	17	9	43
	absent	4	8	0	2
Side spots †	dark	0	14	1	20
	faint	11	18	10	28
	absent	12	8	4	29
Side lines *	dark	15	29	10	56
	faint	6	4	1	14
	absent	2	7	4	7
Arch mark	dark	4	12	5	21
	faint	13	14	5	29
	absent	6	14	5	27
Sacral spots	dark	12	26	11	41
	faint	10	10	4	31
	absent	1	4	0	5
Ridge pattern *	scattered	0	4	5	12
	parallel	19	28	7	43
	hourglass	4	8	3	22
Lip line * †	banded	2	4	2	35
	mottled	18	34	9	34
	absent	3	2	4	8
Middorsal stripe	narrow	10	10	5	13
	wide	0	2	1	2
	absent	13	28	9	62
Middorsal stripe	extends to thighs	8	9	5	13
	does not extend	2	3	1	2

1970:623–644). The two most common species in the Sierra de Baoruco, Dominican Republic, are *E. abbotti* and *E. armstrongi* (Howard et al. 1997. Herpetol. Nat. Hist. 5:77–82). Dorsal color of the latter ranges from "brown or tan to clear yellow, orange, orange-red, or yellow-green" (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville), but an examination of over 200 specimens revealed very little variation in pattern. In contrast, *E. abbotti*, despite a broader distribution throughout both the North and South paleoislands of Hispaniola, is considerably less variable in color, ranging from "grayish green to tan, rarely reddish tan to brown" (Schwartz and Henderson, *op. cit.*). However, both Cochran (1941. Bull. U.S. Natl. Mus. [177]:398 pp.) and Schwartz (1977. Cat. Amer. Amphib. Rept. 191.1-191.2) commented on the variability of the dorsal pattern. An examination of 18 pattern elements of 155 frogs from four geographically proximate populations in the eastern Sierra de Baoruco revealed considerable variation both within and between populations (Table 1, Fig. 1). Only the tympanic stripe was consistently present and distinct. This character is diagnostic of these populations.

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Submitted by **SUSAN SIFERS**, Department of Biology, Washington University, St. Louis, Missouri 63130, USA, **MELISSA L. YESKA**, Department of Biology, Wayne State College, Wayne, Nebraska 68787, USA, and **ROBERT POWELL**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145, USA; e-mail (RP): powellr@mail.avila.edu.

ELEUTHERODACTYLUS COCHRANAE (Coquí Pitito). **REPRODUCTION**. We report observations of two *Eleutherodactylus cochranae* nests. On 22 July 1996, we found a double egg clutch in a bromeliad leaf, 30 cm above ground, in a patch of ground bromeliads located at the University of Puerto Rico, Río Piedras Campus. This double clutch had no attending adult at the time it was found. One clutch had five eggs in an intermediate stage of development. The second clutch had four recently hatched individuals, (mean SVL 7.1 mm; SD 0.21, range 6.9–7.3), and two eggs in an advanced stage of development. The diameter of one of these eggs was 6.2 mm and both embryos had a bifid egg tooth. The double clutch was deposited in the Museo de Biología, Universidad de Puerto Rico-Recinto de Río Piedras (UPRRP–5750). On 20 February 1998, we found another clutch in the same area that was attended by an adult male (SVL ca. 20 mm) brooding the eggs. This clutch was laid in a folded bromeliad leaf, that together with the leaf above it, provided cover and protection by enclosing both the egg clutch and the attending adult. The egg clutch had seven eggs, all together in two parallel rows. The adult was brooding the eggs. Two days later, the clutch hatched and the adult stayed with the juveniles for 4–5 days. Eight days after hatching, the juveniles were not found and presumably had dispersed. Because egg clutches were found in February, July, and October, and gravid females were observed in March, September, and October we think that *Eleutherodactylus cochranae* breeds all year around (Joglar 1998. Los Coquíes de Puerto Rico: Su Historia Natural y Conservación. Editorial de la Universidad de Puerto Rico. San Juan. 232 pp.). We are grateful to Neftalí Ríos, Vilmarie Rentas, Loema Jaramillo and Jorge Billoch for their assistance in the field.

Submitted by **LUIS J. VILLANUEVA-RIVERA** and **RAFAEL L. JOGLAR,** Departamento de Biología, Universidad de Puerto Rico–Recinto de Río Piedras, Apartado 23360, San Juan, Puerto Rico 00931-3360.

HYLA CINEREA (Green Treefrog). **PRE-HIBERNATION LIVE BODY WEIGHT**. Little is known about the live body mass of Arkansas green treefrogs prior to hibernation. These frogs require fat stores to survive winter hibernation. Hibernation appears to occur from the last week in October through mid-March/early April depending upon fluctuations in seasonal weather patterns (unpubl. data). These data may be important for comparisons to other regions with different length hibernation periods as well as for comparisons to other habitat types. On 14 October 2000 we collected 198 *Hyla cinerea* by spotlighting vegetation between 2300 and 2330 h along agricultural ditches. The site was located ca. 6.4 km S Jonesboro on St. Hwy. 1, Craighead County, Arkansas, USA. Specimens were collected by hand and stored in an ice chest over night. The next day living specimens were weighed with an electronic analytical balance to the nearest 0.01 g. The mean prehibernation body mass was 1.95 g, SD = 0.7277. The maximum body mass was 4.69 g and the minimum observed body mass was 0.58 g. Fifty percent of specimens weighed more than 1.82 g, 75% weighed more than 1.43 g, and only 25% weighed more than 2.32 g. The 95% confidence interval was between 0.75 g and 3.37 g. Body lengths were not recorded for these individuals because the specimens were to be used in other studies, and we desired to minimize the stress experienced by the animals.

Submitted by **MALCOLM L. McCALLUM**, Environmental Sciences Ph.D. Program, P.O. Box 847, Arkansas State University, State University, Arkansas 72467, USA and **STANLEY E. TRAUTH**, Department of Biological Sciences, P.O. Box 599, Arkansas State University, State University, Arkansas 72467, USA.

NYCTIBATRACHUS MAJOR (Large Wrinkled Frog). **FOOD HABITS.** *Nyctibatrachus major* is an aquatic, stream-dwelling ranid endemic to southwestern Ghats of India. Although information on occurrence, habitat features, larval morphology, and femoral glands are available (Daniels 1997. Cobra 28:1–14; Krishnamurthy et al. 1992. J. Indian Inst. Sci. 72:385–393; Krishnamurthy 1997. Froglog 20:2; Pillai 1978. Bull. Zool. Surv. India 1:135–140), there is no information available on the food habits of this species. This is the first note on the food habits, especially predation of *N. major* on sympatric ranids.

During an amphibian survey in Kudremukh National Park of Western Ghats on 22 May 1998, the predation of *N. major* on an aquatic frog was noted. This stimulated us to examine the food habits of this species. Stomach contents of 48 adult and 8 subadult *N. major* (mean SVL = 34.18 mm, SD = 16.25 mm, range = 13–54 mm; mean mass = 7.86 g, SD = 6.12 g, range = 2–26.7 g) were examined from 14 different localities. Thirty-one adults contained partly-digested subadult *Limnonectus limnocharis, Rana cyanophlyctis,* and adult *Micrixalus saxicola*. Among the remaining specimens examined, insect larvae predominated: *Ophiogomphus* sp. (Gomphidae), *Psephenus* sp. (Psephenidae), *Enochrus* sp. (Hydraenidae), *Neides* sp. (Neididae), *Sminthurinus* sp. (Sminthuridae), and members of Dytiscidae and Haliplidae. Organic debris was noted in some cases and in two adults and six subadults the stomachs were empty.

Analysis of amphibian diversity at all 14 localities revealed the following frogs sympatric with *N. major*: *L. limnocharis, M. saxicola, R. brevipalmata, R. temporalis, R. semipalmata, R. cyanophlyctis, Tomopterna rufescens, Microhyla rubra, M. ornata, Philautus sp.* and *N. pygmaeus*. Among these, *R. cyanophlyctis, R. temporalis, L. limnocharis,* and *M. saxicola* represented 50, 40, 30, and 20% of the total observations. Among these species, *R. cyanophlyctis, L. limnocharis,* and *M. saxicola* were confined to the microhabitat of *N. major*, while *R. temporalis* was confined to the litter mats at the periphery of the microhabitat. Hence, the high degree of predation by *N. major* on *R. cyanophlyctis* and *L. limnocharis* could be related to the microsympatry of these species and the selective feeding of *N. major*.

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Submitted by **S.V. KRISHNAMURTHY, K. V. GURURAJA,** and **A. H. MANJUNATHA REDDY**, Department of P.G. Studies and Research in Environmental Science, Kuvempu University, Jnana Sahyadri, Shankaraghatta – 577 451, Karnataka, India; e-mail root@shikuv.kar.nic.in.

RANA AURORA DRAYTONII (California Red-Legged Frog). **PREDATION**. Although the introduced bullfrog (*Rana catesbeiana*) has long been suspected as a predator of the federally threatened California red-legged frog (*R. aurora draytonii*)

[e.g., see Moyle 1973. Copeia 1973:18–22], there have been no published field observations to support this contention. Since the bullfrog is now widely established within the historical range of the California red-legged frog, it is important to determine the degree of threat presented by this introduced predator. We therefore provide the first documented evidence of adult bullfrogs feeding on larval and juvenile California red-legged frogs in the wild.

On 10 July 1996, a pair of 104 mm and 113 mm SUL adult bullfrogs were collected ca. 2200 h from "Detjen Pond," located ca. 1 km SE of Livermore, Alameda County, California, USA. These bullfrogs were among 156 others removed over a 1.5-yr period from the permanent 0.3-ha pond that also contained dozens of California red-legged frogs of all sizes. Both bullfrog specimens contained a juvenile (28 and 30 mm SUL) California red-legged frog. The only other prey item found was one giant water bug (Belostomatidae). The bullfrogs and their stomach contents have been deposited in the herpetology collection of the California Academy of Sciences (CAS 204240–242).

On 8 and 11 July 1997 at Ledson Marsh, Annadel State Park, Sonoma County, California, three larval California red-legged frogs (Gosner stage 37–39) were flushed from the stomachs of two adult female bullfrogs (180 and 185 mm SUL). Although the skin of the tadpoles had largely been digested, species determination was based on concurrent live-trapping of red-legged frog larvae of the same size and development stage (bullfrog tadpoles at Gosner stage 37 were not found in the marsh until the middle of August). A single larval Pacific treefrog (*Hyla regilla*) was also recovered. Ledson Marsh is an 11-ha ephemeral wetland that has reproducing populations of at least 127 adult California red-legged frogs and 27 adult bullfrogs (Cook 1997. Microhabitat Use and Reproductive Success of the California Red-legged Frog [*Rana aurora draytonii*] and Bullfrog [*Rana catesbeiana*] in an Ephemeral Marsh. Unpubl. M.A. Thesis, Sonoma St. Univ., Ronhert Park, California).

It is well known that bullfrogs feed on a wide variety of anurans including conspecifics (Bury and Whelan 1984. U.S. Fish Wildl. Serv., Res. Publ. [155]:1–23). More recently, bullfrogs have been documented to eat larval and juvenile northern red-legged frogs (*R. a. aurora*) in the field (Twedt 1993. A Comparative Ecology of *Rana aurora* Baird and Girard and *Rana catesbeiana* Shaw at Freshwater Lagoon, Humboldt County, California. Unpubl. M.A. Thesis, Humboldt St. Univ., Arcata, California) and under experimental conditions (Kiesecker and Blaustein 1995. The Wildl. Soc. Second Ann. Conf. Abstracts, Portland, Oregon). Our observations indicate that adult bullfrogs will also readily eat larval and juvenile California red-legged frogs when the two species come into contact. Therefore, resource managers should continue their efforts to limit the spread of bullfrogs into remaining red-legged frog habitats.

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Submitted by **DAVID COOK**, Biology Department, Sonoma State University, 1801 East Cotati Avenue, Rohnert Park, California 94928-3613, USA, and **MARK R. JENNINGS**, Rana Resources, 39913 Sharon Avenue, Davis, California 95616-9456, USA, and Research Associate, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-9961, USA.

RANA PALUSTRIS (Pickerel Frog). **PRODUCTION OF ODOR**. Odor production has been reported in at least three species of North American ranids, *Rana septentrionalis* (Harding 1997. Amphibians and Reptiles of the Great Lakes Region. Univ. Michigan Press, Ann Arbor 378 pp.), *R. capito* (Richter, pers. comm.), and *R. muscosa* (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, Massachusetts. 336 pp.). To my knowledge, odor production has not been reported in the pickerel frog, *R. palustris*. During July 2000, I collected three adult pickerel frogs along a road in Shindagin Hollow State Forest, Tompkins County, New York, USA (42°18'N, 76°18'W). As the first frog was handled, it began to emit a distinctive odor that was likened to that of alfalfa sprouts or the inside of a latex glove. All three frogs eventually produced the odor while being handled in the field. This odor is distinctly different from that of mink frogs. I was able to induce the production of this odor repeatedly in the laboratory, by handling or with an electrostimulation device. The pickerel frog's distasteful secretions protect it from attack by the shrew, *Blarina brevicauda* (Formanowicz and Brodie 1979. Amer. Midl. Nat. 101:456–457). The odor was noticeable, but not overtly aversive to humans. Given the noxious nature of pickerel frog secretions, I suggest that this odor is an olfactory aposematic cue.

Submitted by **JACQUALINE B. GRANT**, Department of Neurobiology and Behavior, Seeley G. Mudd Hall, Cornell University, Ithaca, New York, 14853, USA.

RANA SEPTENTRIONALIS (Mink Frog). **LARVAL PREDATION**. Heeden (1970. The Ecology and Life History of the Mink Frog, *Rana septentrionalis*, Baird. PhD Diss., Univ. Minnesota. 129 pp.) reviewed those vertebrates reported as predators of mink frog tadpoles. Among birds, he listed only the great blue heron (*Herodia ardeas*) and other Ciconiformes, and speculated that the belted kingfisher (*Megaceryle alcyon*) might also take mink frog tadpoles. Although Mallory and Larivière (1998. Canadian Field-Nat. 112:714-715) reported 4.5 cm mink frogs in the diet of the wood duck (*Aix sponsa*), there seems to be no report of mink frog tadpoles in the diet of North American waterfowl known to prey on vertebrates, specifically the hooded merganser (*Lophodytes cucullatus*). Bent (1923. US Nat. Mus. Bull 126) and Johnsgard (1978. Ducks, Geese, and Swans of the World. Univ. Nebraska Press, Lincoln) listed tadpoles (species unidentified) as items in the hooded merganser diet without citing references. Bellrose (1978. Ducks, Geese, and Swans of North America. Stackpole Books. Pennsylvania) stated that the diet of the hooded merganser is poorly known and reviewed seven feeding studies for this species, none of which listed tadpoles in this ducks diet.

Here we document two hooded mergansers feeding on mink frog tadpoles. On 2 October 1995, local hunter Mark Cougle shot two immature hooded mergansers (1 male, 1 female) while the

birds were feeding on Belvidere Lake, Kings County, New Brunswick, Canada (45°17'N, 66°17'W). During preparation of the birds for addition to the New Brunswick Museum (NBM), three Gosner stage 40 *Rana septentrionalis* tadpoles were taken from the esophagus of these birds (Gosner 1960. Herpetologica 16:183–190). The stomachs were empty. Total lengths for two of the tadpoles were 98 and 101 mm. Although all tadpoles had been swallowed intact, decomposition prevented measurement of one. Identification of tadpoles was based on comparison with collections in the New Brunswick Museum. Tadpoles taken from the hooded mergansers have been retained among stomach samples in the bird collection of the New Brunswick Museum (NBM 9913; NBM 9917).

Submitted by **DONALD F. McALPINE, BRIAN COUGLE,** and **TIMOTHY J. FLETCHER**, Natural Science Department, New Brunswick Museum, 277 Douglas Avenue, Saint John, New Brunswick, Canada, E2K 1E5.

RANA TEMPORARIA (European Common Frog). **DIET**. The European common frog is widespread, and although many aspects of its biology have been studied, very little is known about most northern populations. Stomach contents of 21 *Rana temporaria* (SVL 23–66.4 mm) collected July 1999 from Kandalakscha Bay (White Sea; Russia; 66°17'N, 33°40'E) were examined. Other population characteristics were reported by Borczyk and Malak (2000. *In* Zamachowski (ed.), Biology of Amphibians and Reptiles, pp. 13–15. WSP Kraków). Table 1 summarizes data collected during this study.

TABLE 1. Stomach contents of 21 *Rana temporaria* from Kandalakscha Bay.

Items	N	% Total	Vol (cm^3)	% Vol.	Freq.
INSECTA					
Hymenoptera	28	9.62	0.4	6.78	13
Coleoptera imago	33	11.34	0.6	10.17	14
Coleoptera larvae	24	8.25	1	16.95	16
Diptera imago	32	11.00	0.4	6.78	12
Diptera larvae	15	5.15	0.3	5.08	1
Lepidoptera larvae	2	0.69	0.6	10.17	2
ARACHNIDA					
Araneae	35	12.03	0.2	3.39	10
MOLLUSCA					
Gastropoda	18	6.18	0.4	6.78	10
PLANTS	79	27.15	1.2	20.34	12
UNIDENTIFIED	25	8.59	0.8	13.56	10
TOTAL	291	100	5.9	100	

Submitted by **BARTOSZ BORCZYK**, Students' Herpetological Association, Zoological Institute, University of Wroclaw, Sienkiewicza 21, 50 – 335 Wroclaw, Poland.

TESTUDINES

CHRYSEMYS PICTA (Painted Turtle). **TRAPPING**. Hoop traps and basking traps have long been used to capture turtles. Papers on turtle trapping are usually examinations or modifications of one type of trap (Cagle 1950. Ecol. Monogr. 20:31–54; Frazer et al. 1990. Copeia 1990:1150–1152). Thomas et al. (1999. J. Herpetol. 33:511–515) used differential hoop and basking trap success to evaluate seasonal patterns of behavior in the red-eared slider (*Trachemys scripta*). Otherwise, I know of no study that compares the efficiency of the two types of traps. This note makes such a comparision, using data from painted turtles (*Chrysemys picta*).

Two three-ring hoop traps (91 cm diam, 2.5 cm mesh) and one five-ring hoop trap (61 cm diam, 2.5 cm mesh) were placed in a pond at the University of Toledo's Stranahan Arboretum (Sylvania Township, Ohio, USA) from 26 May to 30 June 1999. Traps were anchored and partially submerged in areas where large populations of painted turtles were seen basking and foraging. Traps were baited with salmon heads and checked daily. Bait was replaced as needed, usually every other day, to prevent rotting. The area where the traps were set was not disturbed, other than the daily check. After five weeks, two snapping turtles (*Chelydra serpentina*) had been caught. The bait was intact in all the traps, except those that caught the snapping turtles, suggesting that no painted turtles entered the traps and subsequently escaped. On 9 June 1999, two weeks after the hoop traps were set, two basking traps were placed in the same pond, in the same area as the hoop traps. The basking traps were constructed from four pieces of 5.12 cm diam PVC pipe glued with plumber's compound. Extending out at angles from the sides was chicken wire (2.5 cm mesh). The wire was attached to the sides at the bottom with a series of cable ties to form a basket. The unbaited basking traps were checked daily. In 21 days of trapping with basking traps, I recorded 54 captures of 46 individual painted turtles, a rate of ca. 2.6 captures per day. Captured turtles represented all age cohorts, including hatchlings, and an almost equal sex ratio. This suggests that, unlike hoop traps, the presence of one sex does not increase or decrease the likelihood of trapping the other sex (Frazer et al., *op. cit.*), nor does the presence of a large turtle seem to deter a small turtle from being captured.

Chysemys picta were more readily captured in this pond using basking traps rather than hoop traps. Additional benefits of the basking traps include the wide range of sizes and sexes captured, the low cost (less than US $5/trap), and ease of deployment.

I thank the University of Toledo's Stranahan Arboretum, Sandra Stutzenstein, and Elliot Tramer for their support.

Submitted by **KERRY C. McKENNA**, Department of Earth, Ecological and Environmental Sciences, University of Toledo, 2801 West Bancroft, Toledo, Ohio 43606, USA; e-mail: kerrymckenna@yahoo.com.

ERECTMOCHELYS IMBRICATA (Hawksbill Turtle). **NESTING.** Adult hawksbill turtles have been sighted in the waters of the southern islands of Singapore (Ng and Wee 1994. The Singapore Red Data Book. The Nature Society Singapore, 343 pp.). However, records of turtle nesting on the island are scarce.

Here we report the first record of nesting by a hawksbill turtle on the rocky shore at Labrador Beach Park (01°17.7'N, 103°45'E), Singapore, the last beach-cum reef left in this island republic (Lim et al. 1995. Rhythms of the Sea: The Life and Times of Labrador Beach, Nanyang Technological University & National University of Singapore. 165 pp.).

On 20 July 1999, a hawksbill turtle was observed emerging from the sea, fronting the rocky shore during mid-high tide (1.0 m, Year 2000 Singapore Tide Table & Port Information, Marine and Port Authority of Singapore. 220 pp.) at 2300 h, an hour before moonrise. The turtle crawled up the beach to where the base of the hill meets the shoreline and a concrete embankment. Unable to move further up the shore, the turtle proceeded to dig a shallow pit and laid its eggs. The beach substrate at the nest site was pebbly and sandy; the shore with large protruding boulders is inundated by tidal waters at high tide up to the base of the precipitous sea-facing wall of the hill.

The eggs in the nest were examined three days later on 23 July 1999 to assess their condition. The eggs were creamy in color and their shells were depressed. None of the eggs had a chalky white spot on the shell. A white spot appears on marine turtle eggs soon after eggs are laid, and its progressive development over the eggshell is indicative of embryonic development. Only viable eggs develop a white spot (Chan 1989. Copeia 1989:42–47; Diong et al. 1999. Sarawak Mus. J. 54:301–308). Two eggs were dissected but failed to show any sign of embryonic development. The eggs appeared to have drowned. The nesting site at the base of a precipitous sea-facing wall is subjected to flooding during high tides. We abandoned a plan to fence the nest for *in situ* incubation. Instead, the eggs were transferred into a Styrofoam box containing sand moistened with artificial seawater.

Nest depth (to top of egg chamber) was 27 cm, and 56 cm to bottom of chamber. Clutch size was 99 eggs. A sample of 22 eggs were measured (Mitutoyo calipers) and weighed (Ohaus) on site. Eggs averaged 34.44 ± 0.62 mm (range: 33.50–36.60 mm) in diameter and 23.56 ± 0.86 g (22–24 g) in weight. The styrofoam box with eggs was transferred to a laboratory incubator at 30°C to assess, as a precautionary measure, if there was further development in any of the eggs. Eggs examined a week later showed no external signs of embryonic development. Five eggs were dissected but had no signs of life.

This nesting record is important for Singapore whose original coastline with natural sandy beaches, mangroves, and coral reefs has been either altered or destroyed through massive land reclamation for housing, port, and infrastructure development. Designated as a nature reserve in 1951 but downgraded to a nature park in 1973, Labrador Beach Park including the parkland and rocky shore where the nesting occurred, has reason now to be redesignated as a nature reserve.

We thank Ian Turner and Cheryl Lim of the National Parks Board, Singapore for field assistance. Eggs are deposited at Zoological Reference Collection (ZRC.2.4761), Department of Biological Science, National University of Singapore. Fred H. C. Chua, Senior Curator, Underwater World Aquarium Pte. Ltd., Singapore, verified color photographs of the turtle. Photographs of nesting and video recording of nest excavation are deposited at National Parks Board, Singapore.

Submitted by **C. H. DIONG, S. L. LIM**, and **W. H. TAN**, Natural Sciences Academic Group, NIE, Nanyang Technological University, 1 Nanyang Walk, Singapore 637616, Republic of Singapore.

GOPHERUS POLYPHEMUS (Gopher Tortoise). **USE OF ABANDONED BURROWS BY JUVENILES**. During July 1999, a number of juvenile gopher tortoises were excavated from supposedly "abandoned" adult burrows found on two different tortoise relocation sites located on the Brooksville Ridge, Citrus County, Florida, USA. The Florida Fish and Wildlife Conservation Commission's (FFWCC) current definition of an abandoned burrow is based on the statement made in Auffenberg and Franz (1982. *In* Bury [ed.], North American Tortoises: Conservation and Ecology, pp.95–126. U.S. Fish and Wildlife Service, Wildl. Res. Rep. 12) describing an "old" burrow as one in which the mouth has been washed in or covered with debris. All the "abandoned" burrows we excavated on these sites did match the description of appearing "washed in or covered with leaves" and had no outer indications of habitation by tortoises. However, we put a number of small twigs across the mouths of some of these burrows where the floor still appeared to be somewhat flat. Subsequent checks of these twigs indicated that something had gone into some of these burrows. Using a flashlight to carefully scrutinize the burrow floor beyond the mouth, tracks of tortoises could be seen in three of the burrows. Therefore, we decided to excavate these supposedly abandoned burrows. These burrows ranged from 200 mm to 290 mm in horizontal width indicating that they were made by and at one time used by adult tortoises.

All burrows on the sites were excavated using a backhoe. On the first site, a total of 11 "abandoned" burrows were excavated and 3 (27%) contained juvenile tortoises ranging in carapace length from 84 mm to 154 mm. The mean burrow length at the first site was 9.2 m with a vertical depth of 2.8 m. On the second site, 18 "abandoned" burrows were excavated, with 3 (17%) of the burrows containing juvenile tortoises with a carapace length ranging from 86 mm to 141 mm. The mean burrow length at the second site was 8.7 m with a vertical depth of 2.4 m.

The number of juvenile tortoises found on each site (3 each) compared to the number of juvenile-sized burrows indicates that perhaps abandoned burrows may play a significant role in providing shelter for tortoises from juvenile through the subadult size classes. This is further indicated in our four-year survey of burrows and tortoises on the Institute's 100-acre preserve (also on the Brooksville Ridge) where we have collected and marked 17 juvenile tortoises (less than 180 mm CL) yet we have only been able to locate 5 appropriately-sized burrows in five semi-annual burrow surveys, including two which have been conducted immediately after summer burns. Under the current FFWCC definition, the 29 burrows of which 6 contained juvenile tortoises would all have been considered abandoned and would not have been excavated. Based on these preliminary findings, we believe that the definition of an abandoned burrow should be redefined as a burrow that has lost its "half moon shape" becoming circular or very irregular in shape with rooted vegetation (live or dead) occurring at or near the base of the burrow mouth.

Submitted by **RAY E. ASHTON, JR.** and **PATRICIA S. ASHTON**, Ashton Biodiversity Research & Preservation Institute, 14260 West Newberry Road, Gainesville, Florida 32669, USA; e-mail: Tortfarm2@aol.com.

SERPENTES

GRASSLAND SNAKES. DIET. Although dietary habits of North American snakes have been relatively well documented during the last 50 years, little information exists on the diet of snakes inhabiting grasslands or prairies (Cavitt 2000. Herpetol. Rev. 31:47–48). Two of the three species encountered during our study, the common garter snake (*Thamnophis sirtalis sirtalis*) and blue racer (*Coluber constrictor foxii*), are known opportunists and diet is influenced by prey availability (Smith 1961. Bull. Illinois Nat. Hist. Surv. 28:1–298). Therefore, dietary studies carried out in different habitat types may be insufficient for comparison to one another.

We collected diet-related data at Prairie Ridge State Natural Area (PRSNA) in Jasper County, Illinois, USA. PRSNA is a 640 ha restored grassland maintained by the Illinois Department of Natural Resources. Predation events were recorded for snakes encountered during an avian nest study during the months of August through July 1996 to 2000. In addition, 276 snakes were captured in 2000. Of these, 4.3% produced dietary results from stomach contents. Snakes were captured by walking transects (2.0 m wide) and by the use of cover boards (0.6 m x 2.0 m sheets of corrugated metal barn roofing) to attract snakes. Total length (TL), snout-vent length (SVL), weight after regurgitation (WT), head width (HW), and gape to the nearest mm or g, were taken at the time of capture. Gape was measured by fully extending the mandibular-maxillary joint between 140 and 160 degrees with calipers. All snakes were forced to regurgitate regardless of stomach distension, using techniques explained by Fitch (1987. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 156–157. Macmillan Publishing Co. New York). Prey items were identified in the field and fed back to the animal. Individuals were scale-clipped for future identification and released at point of capture.

During the five years of field observation, 10 predatory events were recorded for three species of snakes. The majority of these events (67%) involved passerine eggs, nestlings, and fledglings, while small mammals made up 22% of the events. At no time did we witness snakes preying upon invertebrates. In 2000, 276 snakes captured along transects and under panels produced 14 regurgitated samples (Table 1). The majority (50%) of stomach contents were small mammals, and 31% were invertebrates. Only one event was noted for *C. constrictor*.

The *T. sirtalis* at our site appeared to be opportunistic feeders with a diet consisting of 47.4% avian, 31.6% mammal, and 26.3% invertebrate (events are listed as >100% because one stomach contained prey from two of the above classes). Our results differ from diet studies compiled by Ernst and Barbour (1989. Snakes of East-

TABLE 1. Prey items of three grassland snake species as noted from predation events or stomach contents at Prairie Ridge State Natural Area in Jasper County, Illinois, USA. An * indicates a witnessed predatory event. All other records are from stomach contents.

Predator	TL (mm)	SVL (mm)	WT (g)	Gape (mm)	HW (mm)	Prey items
T. sirtalis	—	—	—	—	—	* Three field sparrow (*Spizella pusilla*) eggs
	—	—	—	—	—	* Three dickcissel (*Spiza americana*) eggs
	—	—	—	—	—	* One red-winged blackbird (*Agelaius phoeniceus*) nestling
	792	620	138	50	14	Four red-winged blackbird nestlings
	734	625	117	39	16	One red-winged blackbird nestling
	562	—	—	—	—	* One red-winged blackbird fledgling
	—	—	—	—	—	* One eastern meadowlark (*Sturnella magna*) fledgling
	952	755	264	51	16	One eastern meadowlark fledgling
	—	—	—	—	—	* One eastern meadowlark fledgling
	—	—	—	—	—	* One unidentified small mammal
	—	—	—	—	—	One unidentified small mammal adult
	806	—	186	—	—	One unidentified small mammal adult
	872	675	157	48	16	One southern bog lemming (*Synaptomys cooperi*)
	723	560	108	36	16	One *Peromyscus* sp. adult
	625	494	95	36	14	One *Peromyscus* sp. subadult and one earthworm
	684	536	125	39	12	One earthworm (*Lumbricus* sp.)
	631	491	93	34	13	Two earthworms
	439	335	22	—	—	Two earthworms
	571	433	43	28	12	One leech (Class Hirudinea)
L. calligaster	—	—	—	—	—	One *Peromyscus* sp. adult
	503	432	75	24	10	One *Peromyscus* sp. juvenile
	—	—	—	—	—	* Unidentified small mammal neonates
	969	—	474	—	—	One unidentified small mammal adult
C. constrictor	1305	1018	—	47	21	* One *Thamnophis sirtalis*

ern North America. George Mason Univ. Press, Fairfax, Virginia. 282 pp.) who demonstrated that amphibians and earthworms were the important foods consumed by adults and juveniles (35–90%).

All events recorded from this study for the prairie kingsnake (*Lampropeltis calligaster calligaster*) involved small mammals. This is similar to what has been reported by other investigations. Klimstra (1959. Herpetologica 15:1–5) discovered that prairie kingsnake prey items consisted only of small mammals. Likewise, a study by Fitch (1978. Trans. Kansas Acad. Sci. 81:353–363) found that the prairie kingsnake was primarily a mammal eater, with snakes and lizards making up a small percentage of the food. Heske (1999. Illinois Natural History Survey Final Report for FY 99) found moderate to high numbers of small mammals at PRSNA from 1995 to 1999. Therefore we would expect mammals to be a large portion of the diets of *L. calligaster* and *T. sirtalis*.

Body measurements are presented (Table 1) because size of the snake influences the type or quantity of prey taken. Juvenile snakes will have a high percentage of soft-bodied prey items such as invertebrates or amphibians, while adults will readily consume larger vertebrate species (Mushinsky. 1987. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 302–334. Macmillan Publishing Co. New York; See also Tucker 2000. Herpetol. Rev. 31:106–107).

The information presented here is unique in two ways. First our data show a different prey preference for garter snakes found at PRSNA, as compared to the other studies compiled by Ernst and Barbour (*op. cit.*). This information reinforces findings that opportunistic feeders may have a site specific diet (Kephart 1982. Oecologia 52:287–291; Gregory and Nelson 1991. Can. J. Zool. 69:988–994). Second, the percent of witnessed predation events on birds was much higher than the percent of avian items found in stomachs. This may have occurred because items such as eggs and nestlings would pass quickly through the digestive system, or would not have been a discernable part of the diet when using regurgitation. This could lead to an underestimate of avian items consumed when regurgitation is the only method used.

We acknowledge the financial support of the Illinois Council for Food and Agricultural Research (C-FAR), and the Illinois Department of Natural Resources Division of Natural Heritage Small Wildlife Preservation Fund. We thank Eric Kershner and Jeff Walk for field notes on the observations of predation events, prey identification, and review of this manuscript. We also thank field assistant Nisa Tawjareon for many hours of snake collection.

Submitted by **DANIEL J. OLSON** and **RICHARD E. WARNER**, Department of Natural Resources and Environmental Sciences, University of Illinois, 350 Burnsides Lab, 1208 West Pennsylvania Avenue, Urbana, Illinois 61801, USA.

PHILODRYAS OLFERSII (NCN). **COURTSHIP**. Little is known about courtship and mating aggregations of Neotropical snakes. On 23 March 1998 at 1800 h (air temp = 25°C), we observed courtship behavior involving four adult *Philodryas olfersii*. The snakes were observed on a tree branch ca. 5 m above the ground at CISM (Campo de Instruÿão de Santa Maria, RS, south Brazil, 29°43'S, 53°44'W). A female and two males (SVL 910 mm, 700 mm, 760 mm; ZUFSM 1596, 1597, 1598, respectively; Setor de Zoologia, Universidade Federal de Santa Maria) were captured after a few minutes of observation when they tried to flee. The fourth snake escaped.

Before capture, the males alternately rubbed the female and stayed in direct contact with her. During this process, we observed the following behaviors: undulation, dorsal advance, and dorsal body looping. These behaviors are consistent with the Tactile-Chase phase of courtship (Gillingham 1987. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 184–209. Macmillan Publ. Co., New York). No aggressive behaviors or the latter phases of courtship (tactile alignment, intromission, and coitus) were observed. This appears to be the first record of courtship behavior for *P. olfersii* in the field.

We thank Augusto Shinya Abe for comments on this manuscript.

Submitted by **SONIA T. Z. CECHIN**, Departmento de Biologia, Universidade Federal de Santa Maria, Faix Camobi, KM 09, Camobi, Santa Maria, Rio Grande do Sul, Brazil (e-mail: cechinsz@ccne.ufsm.br), and **PAULO AFONSO HARTMANN**, Pós-Graduaÿão em Ciências Biológicas-Zoologia, Instituto de Biociência, Universidade Estadual Paulista, C.P. 199, 13506-900, Rio Claro, São Paulo, Brazil (e-mail: pahart@rc.unesp.br).

THAMNOPHIS EQUES (Mexican Garter Snake) and ***THAMNOPHIS SCALARIS*** (Mexican Alpine Blotched Garter Snake). **PREDATOR/PREY**. On 7 June 1999 (1115 h), we captured a female *Thamnophis eques* (555 mm SVL, 130 mm TL, 70 g). It was under a rock near a pond, surrounded by *Salix* sp., at the Area de Conservación e Investigación Ecológica El Bordo, Las Maravillas (99°41'W, 19°24'N), 17 km NW of Toluca City, México (elevation 2550 m). The snake was palped and regurgitated one fragment (60 mm, 3.0 g) of a partially digested *T. scalaris* (22 ventral scales). On 29 June 1999, we captured a female *T. eques* (570 mm SVL, 150 mm TL, 140 g) and a female *T. scalaris* (430 mm SVL, 110 mm TL, 40 g). The snakes were placed in the same bag, and after two hours the *T. eques* was observed consuming the *T. scalaris*. The *T. scalaris* was being ingested head first, and 1/4 of its body had been swallowed when we checked the bag.

Snakes have not been reported as prey of any species of *Thamnophis* (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman, Oklahoma. 327 pp.). In addition, our observation represents the first published record of garter snakes (*T. scalaris*) as natural prey of other garter snakes (*T. eques*). Reptiles reported in the diets of *Thamnophis* include lizards and skinks (Clark 1974. Herpetologica 30:372–379; Drummond and Macias-García 1989. Behaviour 108:23–43; Fouquette and Rossman 1963. Herpetologica 19:185–201; Lemos-Espinal and Ballinger 1992. Herpetol. Rev. 23:117).

Submitted by **CRYSTIAN SADIEL VENEGAS-BARRERA** and **JAVIER MANJARREZ**, Laboratorio de Biología Evolutiva, Centro de Investigación en Recursos Bioticos, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario No. 100. CP 50000, Toluca, Estado de México, México (e-mail: sadiel@cibnor.mx).

XENODON NEUWIEDII (Quiriripitá). **DIET.** The colubrid *Xenodon neuwiedii* occurs in central and southern Brazil, Paraguay, and northern Argentina (Peters and Orejas-Miranda 1970. Catalogue of the Neotropical Squamata: Part I. Snakes. Bull. U.S. Nat. Mus. 297:324). This terrestrial, diurnal snake is associated with forested areas and is usually found on the forest floor close to bodies of water (Marques 1998. Composição Faunística, História Natural e Ecologia de Serpentes da Mata Atlântica, na região da Estação Ecológica Juréia-Itatins, São Paulo, SP. Ph.D. dissertation. Instituto de Biociências, Universidade de São Paulo, São Paulo. 135 pp.; Sazima and Haddad 1992. *In* Morellato [ed.], História Natural da Serra do Japi, pp. 212–236. Editora da Unicamp/Fapesp, Campinas). This species is also considered a mimic of *Bothrops jararaca* (Sazima 1992. *In* Campbell and Brodie, Jr. [eds.], Biology of the Pitvipers, pp. 199–216. Selva Publ. Tyler, Texas). It feeds strictly on anurans and mainly on *Bufo* species (Jordão 1996. Estudo Comparativo da Alimentação e da Reprodução de *Waglerophis merremii* e *Xenodon neuwiedii* [Serpentes: Colubridae]. Master's thesis. Instituto de Biociências, Universidade de São Paulo, São Paulo. 93 pp.; Marques, *op. cit.*; Sazima and Haddad, *op. cit.*). Here we report on two hylids from the stomach of one snake found in the wild.

On 29 January 2000, at 1400 h, VXS found an adult male (SVL = 555 mm, tail = 117 mm) moving on the forest floor near a stream at the Estação Biológica de Boracéia, Salesópolis, São Paulo, Brazil (23°38'S, 45°52'W, 900 m elevation). Upon capture it regurgitated two relatively small *Hyla hylax* (Hylidae). The snake and its stomach contents will be deposited at the Museu de Zoologia da Universidade de São Paulo (MZUSP), in São Paulo. Estimated prey/predator mass ratio was 0.04 and 0.06 for each prey item. Estimated prey/predator mass ratios reported for this snake varied from 0.003 to 0.4 (N = 27) (Jordão, *op. cit.*). Individual snakes containing two prey items have been reported four times in the Instituto Butantan collection (IB 41051, 56486, 56491, and 56497; Jordão, *op. cit.*). However, hylids are rare in the diet of this species.

We thank MZUSP for permission and support to study at the Estação Biológica de Boracéia (EBB) and Jaime Bertoluci for comments and suggestions on this manuscript.

Submitted by **VINÍCIUS XAVIER DA SILVA**, Departamento de Zoologia, Instituto de Biociências da Universidade de São Paulo (IBUSP), Caixa Postal 11.461, CEP 05422-970, São Paulo, SP, Brazil (e-mail: vinic@ib.usp.br), and **MIGUEL TREFAUT RODRIGUES**, Museu de Zoologia da Universidade de São Paulo (MZUSP), Caixa Postal 42.594, CEP 04299-970, São Paulo, SP, Brazil (e-mail: mturodri@ib.usp.br).

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 32, Number 1 (March, 2001).

CAUDATA

AMBYSTOMA LATERALE (Blue-spotted Salamander). USA: WISCONSIN: Jackson Co: Green Bay and Western RR right-of-way, within 100 m (west) of Bartell Road and ca. 100 m north of Minnesota Rt. 54, west of City Point (Sec. 34, T22N, R1E). 29 May 2001. Philip A. Cochran, with Andrew G. Cochran. MPM 33144. Verified by Gary Casper. First documented record from the county (Casper 1996, Geographic Distribution of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum, Milwaukee).

Submitted by **PHILIP A. COCHRAN** and **ANDREW G. COCHRAN**, Biology Department, Saint Mary's University, Winona, Minnesota 55987, USA.

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: SOUTH CAROLINA: McCormick Co: Clarks Hill, South Carolina Army National Guard Training Site (SCANGTS) (33°47'16"N, 82°16'52"W). 23 May 2000. T. M. Floyd and E. S. Kilpatrick. Clemson University (CUSC 2079). Verified by Stanley Miller. New county record. Known from localities in the northern Piedmont; first record within the Piedmont from the Savannah River drainage. Extends the range ca. 40 km NW from the nearest known populations in Aiken County, South Carolina (Shoop 1964, Cat. Am. Amph. Rept. 8.1–8.2; Petranka 1998, Salamanders of the United States and Canada. Smithsonian Institute Press, Washington, D.C. 587 pp.). Specimen was captured within an isolated, non-alluvial depression wetland (ca. 0.25 ha) that floods during periods of heavy rain and dries completely by late summer. The majority of *A. talpoideum* captures within this wetland occurred from November 2000 to February 2001.

Submitted by **ERAN S. KILPATRICK**, **THOMAS M. FLOYD**, and **J. DREW LANHAM**, 261 Lehotsky Hall, Box 340331, Department of Forest Resources, Clemson University, Clemson, South Carolina 29634-0331, USA; e-mail (TMF): tfloyd@clemson.edu.

AMBYSTOMA TIGRINUM (Eastern Tiger Salamander). USA: TEXAS: Bastrop Co: Griffith League Ranch, a 5000-acre site owned by the Capitol Area Council of the Boy Scouts of America (30°12'58.6"N, 97°14'30.6"W). 25 May 2001. Todd Swannack and Michael R. J. Forstner. Verified by R. Kathryn Vaughn. TCWC 84707. Specimen collected from a trap in a herpetofaunal array; first record from the county (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **MICHELE GASTON** (e-mail: mg45447@swt.edu), **TODD SWANNACK**, **LEE AHLBRANDT**, and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: WISCONSIN: JACKSON CO: Four specimens: MPM 30246. NW 1/4 SW 1/4 Sec. 5, T22N, R2W, Black River State Forest, ca. 0.8 km N East Clay School Road, 1.6 km E Campground Road. 10 July 1997. Kathryn Kirk; MPM 30303. NE 1/4 Sec. 6, T22N, R2W, ca. 1 km NW jct. East Clay School Road and Jungle Road. 9 June 1998. Gary S. Casper; MPM 30307. SE 1/4 SE 1/4 Sec.11, T20N, R2W, N slope of wetland between Smrekar Road and County Road O. 10 June 1998. Gary S. Casper; MPM 30354. NE 1/4 NE 1/4 Sec. 6, T22N, R2W, under log near East Fork Black River. 10 August 1998. Brian Barbieur; SAWYER CO: SE 1/4 NE 1/4 Sec. 33, T39N, R3W, Flambeau River area in black spruce forest. 22 June 2000. Kathryn Kirk. MPM 32903. All verified by Robert W. Henderson. New county records (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.). Other than one unverified sight record (Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.), the Jackson County specimens are the first published records within Natural Divisions 4a and 4c (Hole and Germain 1994, Natural Divisions of Wisconsin Map. Wisconsin Dept. Natural Resources, Madison) of the Glacial Lake Wisconsin basin, characterized by pine and oak barrens, wet meadow and swamp forest, and sand soils. Salamanders were in communities where broadleaf trees (Maple, Oak, Alder, Birch) were co-dominant with White Pine.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA (e-mail: gsc@mpm.edu), and **KATHRYN KIRK**, Wisconsin Department of Natural Resources, Bureau of Endangered Resources, Box 7921, Madison, Wisconsin 53707, USA.

NOTOPHTHALMUS VIRIDESCENS LOUISIANENSIS (Central Newt). USA: WISCONSIN: CRAWFORD CO: Sec. 19, T8N, R4W, crossing gravel road near oxbow of Kickapoo River. 7 March 2000. Jim Barnes. MPM 31623; MARQUETTE CO: Sec. 6, T16N, R11E, pond 1.75 miles east of Germania on Eagle Road. 12 May 1999. Matt Wright. MPM 30362. Both verified by Robert W. Henderson. New county records (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.; Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.).

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA; e-mail: gsc@mpm.edu.

PLETHODON WEHRLEI (Wehrle's Salamander). USA: NORTH CAROLINA: WILKES CO: 12.2 km NW Traphill. 21 May 2001. J. C. Beane, J. P. Cecil, D. S. Dombrowski, and D. W. Herman. North Carolina State Museum of Natural Sciences (NCSM 61868). Verified by Alvin L. Braswell. One of 11 specimens observed. M. E. Dorcas originally observed and photographed three specimens at this locality on 24 May 1999. New county record; extends range 18 km WSW of nearest records in Alleghany and Surry counties (Beane and Somers 1994, Herpetol. Rev. 25: 31). Species is now known from four counties in North Carolina. Collected under permit NC-2001-ES-40.

Submitted by **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, Research Laboratory, 4301 Reedy Creek Road, Raleigh, North Carolina 27607, USA, **DANIEL S. DOMBROWSKI** and **DENNIS W. HERMAN**, North Carolina State Museum of Natural Sciences, 11 West Jones Street, Raleigh, North Carolina 27601, USA, **JOHN P. CECIL**, North Carolina Wildlife Resources Commission, 91 White Oak Road, Arden, North Carolina 28704, USA, and **MICHAEL E. DORCAS** and **SHANE D. LINDSAY**, Department of Biology, Davidson College, Box 1719, Davidson, North Carolina 28036, USA.

ANURA

BATRACHYLA NIBALDOI (Nibaldo's Wood frog). CHILE: XI REGION DE AYSEN: General Carrera Province, Laguna San Rafael National Park (46°38'S, 73°51'S). 23 January–9 February 1999. H. Díaz-Páez and C. Williams. Museo de Zoología de la Universidad de Concepción (MZUC 25281–91; MZUC 25293–302). Verified by R. Formas. Numerous calling males were found on the humid soil surface along the borders of streams surrounded by dense low vegetation. First record for the Laguna San Rafael National Park; extends the known distribution ca. 153 km SW from type locality at Puente Traihuanca (Formas 1997, Herpetologica 53:6–13).

Submitted by **HELEN DÍAZ PÁEZ**, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile, and **CLAIR WILLIAMS**, Durrell Institute of Conservation and Ecology (DICE), University of Kent, Canterbury, Kent, CT2, United Kingdom.

BUFO HAEMATITICUS: VENEZUELA: ESTADO ZULIA: Río Socuy, Sierra de Perijá. 12 April 1990. Francisco Herrera. Museo de Biología, Universidad Central de Venezuela, Caracas (MBUCV 6630). Verified by John D. Lynch. First record for country and easternmost for the species. *B. hematiticus* is distributed from Central América from eastern Honduras to Costa Rica and Panamá through western and central Colombia to western Ecuador (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). The presence of this species in the eastern slopes of Sierra de Perijá indicates that some Chocoan elements occur in the Maracaibo Lake Basin, as well as some Amazonian elements, like *Lithodytes lineatus* (Barros and Barrio 2001, Herpetol. Rev. *In press*).

Submitted by **CÉSAR L. BARRIO-AMORÓS**, Fundación AndígenA, Apartado Postal 210, 5101-A Mérida, Venezuela; e-mail: cesarlba@yahoo.com.

BUFO HOUSTONENSIS (Houston Toad). USA: TEXAS: LEE CO: 2.7 mi S jct. Lee County Road 331 and CR 333 on CR 333 (30°18'46.1"N, 97°09'08.9"W). 2 April 2001. James R. Dixon and Michael R. J. Forstner. Verified by R. Kathryn Vaughn. TCWC 84556. DOR. Represents first recorded occurrence of this endangered species in Lee County (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **MICHELE A. GASTON**, Department of Biol-

ogy, Southwest Texas State University, San Marcos, Texas 78666, USA (e-mail: mg45447@swt.edu), **JAMES R. DIXON**, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, USA, and **MICHAEL R. J. FORSTNER**, Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA (e-mail: mf11@swt.edu).

ODONTOPHRYNUS LAVILLAI. ARGENTINA: SAN JUAN: Valle Fértil Department, 137.5 km from San Juan (city) on Las Tumanas, Las Tumanas River (30°52'S, 67°19'W, 750 m elev). 25 February 2001. J. H. Villavicencio and M. G. Cánovas. Herpetological Collection Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 545). Verified by Juan Carlos Acosta. First province record; extends the known range ca. 350 km SW from the nearest locality of Sierra de Guasayán, Choya Departament, Santiago del Estero Province, the type locality (Cei 1985, Cuad. Herpetol. 1[5]:1–13).

Submitted by **JOSE HECTOR VILLAVICENCIO** and **MARIA GABRIELA CANOVAS**, Departamento de Geofisica y Astronomía. F.C.E.F. y N. Universidad Nacional de San Juan, Avenida España 400 (N), Caixa Postal 5400, San Juan, Argentina; e-mail (MGC): dgocanovas@sinectis.com.ar.

PSEUDACRIS CRUCIFER CRUCIFER (Northern Spring Peeper). USA: WISCONSIN: Dodge Co: SE 1/4 Sec. 5, T13N, R13E, calling from south of Lake Emily. 20 April 2001. Jack and Holly Bartholmai. MPM 32932. Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.; Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.). Verifies reported observations from Dodge County Wisconsin Frog and Toad Survey Routes (Mossman et al. 1998, *In* M. J. Lannoo [ed.], Status and Conservation of Midwestern Amphibians, pp. 169–198. Univ. Iowa Press, Iowa City).

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA; e-mail: gsc@mpm.edu.

PSEUDACRIS STRECKERI (Strecker's Chorus Frog). USA: ARKANSAS: Pulaski Co: (N34.81341°, W92.40218°), Two Rivers Park. 12 March 2001. K. J. Irwin and L. K. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26099). Verified by Stanley Trauth. Adult male calling in flooded park field. Syntopic species associates were *Pseudacris crucifer* and *Pseudacris feriarum*. First record for county and represents the most southeasterly record for the species in the state. (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **KELLY J. IRWIN**, Arkansas Game & Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us), and **LISA K. IRWIN**, 103 Brooke Drive, Perryville, Arkansas 72126, USA.

RANA GLANDULOSA (Rough-sided Frog). INDONESIA: NATUNA ISLANDS: Bunguran Island (4°00'N, 108°15'E). August 1928. F. N. Chasen. Raffles Museum of Biodiversity Research Zoological Reference Collection (ZRC.1.613, adult female, SVL 84.7 mm). Verified by Kelvin K. P. Lim. New island record; not previously recorded from the Natunas (Van Kampen 1923, The Amphibia of the Indo-Australian Archipelago. E. J. Brill, Leiden, xii + 304 pp.).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260; e-mail: scip0132@nus.edu.sg.

RANA PALUSTRIS (Pickerel Frog). USA: ARKANSAS: Phillips Co: (N34.57202°, W90.59502°), SE 1/4, Sec. 29, R5E, T1S, St. Francis National Forest. 3 March 2001. Ron Bonett, Carol Spence, L. K. Irwin, and K. J. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26098). Verified by Stanley Trauth. Subadult found under leaves on gravel substrate spring outflow at base of eastern versant of Crowley's Ridge. Syntopic species associates were *Acris crepitans, Rana clamitans,* and *Rana sphenocephala*. First record for Phillips County (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **RON BONETT**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA (e-mail: desmog_2000@yahoo.com), **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us), **CAROL SPENCE**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA, and **LISA K. IRWIN**, 103 Brooke Drive, Perryville, Arkansas 72126, USA.

RANA SYLVATICA (Wood Frog). USA: TENNESSEE: Grundy Co: Savage Gulf State Natural Area (35°28'01"N, 85°36'02"W). 3 May 2001. Stephen T. Samoray and Kurt J. Regester. Austin Peay State University Museum (APSU Color Photograph 3273). Verified by A. Floyd Scott. One adult found on Connector Trail ca. 1 km south of Hobbs cabin. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94); extends range ca. 45 km SW of previously recorded limit in Bledsoe County.

Submitted by **STEPHEN T. SAMORAY** and **KURT J. REGESTER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

SCINAX NASICUS. ARGENTINA: CÓRDOBA: Río Cuarto (33°08'S, 64°22'W), 434 m elev. 9 March 2001. N. E. Salas. Herpetological Collection of Universidad Nacional de Río Cuarto, Ecología. (UNRC-ECO 690). Verified by R. Martori. Previously recorded in Argentina from Jujuy, Salta, Formosa, Chaco, Misiones, Córdoba, Santiago del Estero, Tucumán, Corrientes Santa Fe, Entre Ríos, and Buenos Aires (Cei 1980, Amphibians of Argentina. Monit. Zool. Ital. [N. S.], Monogr. 2:1–609; Lavilla et al. 2000. *In* Lavilla et al. [eds.], Categorización de los Anfibios y Reptiles de la República Argentina, pp. 11–34. Asociación Herpetológica Argentina). In Córdoba, was reported from the northeastern departments of Sobremonte, Río Seco, Tulumba, and San Justo (di Tada et al. 1996. *In* I. E. di Tada and E. H. Bucher [eds.], pp. 191–213. Ed. UNRC), and from the eastern departments of General San Martín and Unión (Rozzi Giménez and Gallego 1998, Cuad. Herpetol. 14[2]:169). First report for southern Córdoba and extends distribution 130 km south.

Submitted by **NANCY E. SALAS** and **ISMAEL E. DI TADA**, Departamento de Ciencias Naturales, Facultad de Ciencias Exactas,

Físico-Químicas y Naturales, Universidad Nacional de Río Cuarto, Km 601, Ruta N°36 (X5804BYA), Río Cuarto, Córdoba, Argentina; e-mail (NES): nsalas@exa.unrc. edu.ar.

TESTUDINES

APALONE SPINIFERA SPINIFERA (Eastern Spiny Softshell). USA: WISCONSIN: Vilas Co: SE 1/4 NW 1/4 Sec. 7, T42N, R5E, Benson Lake. 13 August 1997. Jim Cox, Jim Zarzycky, Bruce Bacon. MPM Photograph 657. Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.; Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.); first published record within Natural Divisions 4a and 4c (Hole and Germain 1994, Natural Divisions of Wisconsin Map. Wisconsin Dept. Natural Resources, Madison).

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA; e-mail: gsc@mpm.edu.

CHELYDRA SERPENTINA (Common Snapping Turtle). USA: NEW MEXICO: Debaca Co: Sumner Lake State Park, Pecos River, ca. 0.5 km downstream of dam; E 1/2 Sec. 2, T4N, R24E, UTM Zone 13, E556054, N3828590. Female, 24 cm curved carapace length. 5 May 2001. Charles W. Painter. University of New Mexico Museum of Southwestern Biology (MSB 62058). Verified by J. Tomas Giermakowski. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, **DONALD S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, and **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: TEXAS: Cass Co: 3.2 km SW Hughes Springs off FM 250. 9 June 2001. Beverly K. Allen. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26159). Verified by Stanley E. Trauth. New county record. Helps fill hiatus in extreme northeastern Texas in the Ark-La-Tex region (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **BEVERLY K. ALLEN** and **CHRIS T. McALLISTER**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA.

CLAUDIUS ANGUSTATUS (Narrowbridge Musk Turtle). MEXICO: YUCATAN: Municipality of Celestún, 20 km E Celestún (20°51'36"N, 90°11'40"W). 20 September 2000. René Calderón and J. Rogelio Cedeño-Vázquez. Herpetological Collection, Museum of Zoology, El Colegio de la Frontera Sur campus Chetumal, Quintana Roo (ECO-CH-H 1692, 1710). Verified by Oscar Flores-Villela. Found in a temporary pond surrounded by tropical deciduous forest. First record for Yucatan; northernmost records for the species on the Yucatan Peninsula, extending the range more than 200 km north from the closest records in Campeche and Quintana Roo (Calderon Mandujano et al. *In Press*).

Submitted by **RENÉ CALDERON MANDUJANO**, **J. ROGELIO CEDEÑO-VÁZQUEZ**, and **CARMEN POZO**, Museo de Zoologia, El Colegio de la Frontera Sur, Unidad Chetumal, Apartado Postal 424, Cod. Postal 77000, Chetumal, Quintana Roo, México.

GOPHERUS POLYPHEMUS (Gopher Tortoise). USA: SOUTH CAROLINA: Aiken Co: Aiken Gopher Tortoise Heritage Preserve, a 565-ha scrub oak sandhill habitat located 10–12 km east of Windsor. 7 May 2001. Berkeley Boone. Georgia Museum of Natural History (GMNH 46764). Verified by Steve Bennett. Hatchling specimen (CL = 50 mm; PL = 45 mm). Locality is a northern range extension in South Carolina of more than 120 km (from Tillman Sand Ridge in Jasper County). Neither gopher tortoises nor abundant wiregrass (*Aristida beyrichiana*) were believed to occur between the Savannah River and Columbia, South Carolina (Auffenburg and Franz 1982, *In* Bury [ed.]. North American Tortoises: Conservation and Ecology. Pp. 95–126. U. S. Fish Wildlife Res. Rep. 12), an area of sand hills known as the Fall Line Hills.

Submitted by **ERIN E. CLARK** and **RIA N. TSALIAGOS**, Savannah River Ecology Laboratory, University of Georgia, Aiken, South Carolina 29802, USA (e-mail: clark@srel.edu or tsaliagos@srel.edu), and **ALBERT B. PITTMAN**, South Carolina Department of Natural Resources, Columbia, South Carolina 29202, USA.

GRAPTEMYS PSEUDOGEOGRAPHICA KOHNII (Mississippi Map Turtle). USA: ARKANSAS: Clark Co: Caddo Valley off US 67 bridge in Caddo River. 5 June 2001. Zachary D. Ramsey. Henderson State University Collection (HSU 841). Verified by Stanley E. Trauth. New county record and first specimen from lower Caddo River, a tributary of the Ouachita River and impoundment of DeGray Lake. This turtle is known from the Ouachita River watershed in neighboring Hot Spring County (Trauth, Robison, and Plummer, ms in prep.).

Submitted by **ZACHARY D. RAMSEY**, **CHRIS T. McALLISTER**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA, and **RENN TUMLISON**, Department of Biology, Henderson State University, Arkadelphia, Arkansas 71999, USA.

GRAPTEMYS PSEUDOGEOGRAPHICA KOHNII (Mississippi Map Turtle). USA: VIRGINIA: City of Newport News: Lake Maury. 23 May 1995. David Dowling. Virginia Museum of Natural History (VMNH 8866). Verified by Alan H. Savitzky. Two specimens captured by Virginia Department of Game and Inland Fisheries personnel using electroshocking gear to assay fish populations. One specimen killed and preserved and one held alive in captivity. Existence of established population hypothesized by Mitchell and Reay (1999, Atlas of Amphibians and Reptiles in Virginia. Virginia Dept. Game Inland Fish. Spec. Publ. No. 1:v + 122 pp.). Confirmation of an established population made by observations of basking turtles with a Celestron spotting scope from September 2000 to May 2001 by Barbara A. Savitzky. Verified by Alan H. Savitzky. Found basking throughout Lake Maury, in numbers as high as any native species of emydid turtle. Juveniles, as

well as male and female adults, were observed. First record of an established population in Virginia. This population is well out of the natural range of *G. p. kohnii* and is likely the result of anthropogenic dispersal via the pet trade. Other populations of this species are probable in southeastern Virginia, as specimens have been found elsewhere in Newport News and across the James River in Norfolk, Virginia (Mitchell 1994, The Reptiles of Virginia. Smithsonian Inst. Press, Washington, D.C., viii + 352 pp.).

Submitted by **BARBARA A. SAVITZKY**, Christopher Newport University, Newport News, Virginia 23606, USA, and **JOSEPH C. MITCHELL**, University of Richmond, Richmond, Virginia 23173, USA.

KINOSTERNON FLAVESCENS (Yellow Mud Turtle). USA: TEXAS: LEE CO: 1.75 mi S jct. Lee County Roads 331 and CR 333 on CR 333 (30°19'04.7"N, 97°08'10.9"W). 20 April 2001. Michele Gaston, Ellen Gaston, James R. Dixon, and Michael R. J. Forstner. TCWC 84562. Verified by R. Kathryn Vaughn. DOR; first record from Lee County (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press. 421 pp.).

Submitted by **MICHELE GASTON** (e-mail: mg45447@swt.edu) and **ELLEN GASTON**, Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA, **JAMES R. DIXON**, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, USA, **LEE SHERROD**, Horizon Environmental Services, Inc., Austin, Texas 78716, USA, and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA.

TRACHEMYS SCRIPTA (Slider). USA: TEXAS: LEE CO: 2.25 mi W jct. Lee County Road 310 and CR 309 on CR 309 (30°20'46.1"N, 97°06'52.7"W). 20 April 2001. Michele Gaston, Ellen Gaston, James R. Dixon, and Michael R. J. Forstner. TCWC 84560–61. Verified by R. Kathryn Vaughn. Collected from roadside; first record for the county (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M University Press. 421 pp.).

Submitted by **MICHELE GASTON** (e-mail: mg45447@swt.edu) and **ELLEN GASTON**, Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA, **JAMES R. DIXON**, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, USA, **LEE SHERROD**, Horizon Environmental Services, Inc., Austin, Texas 78716, USA, and **MICHAEL R. J. FORSTNER** (e-mail: mf11@swt.edu), Department of Biology, Southwest Texas State University, San Marcos, Texas 78666, USA.

LACERTILIA

ANISOLEPIS GRILLI. BRAZIL: RIO GRANDE DO SUL: Municipality of Santo Ângelo (28°18'S, 54°08'W). 6 March 2001. L.H. Cappellari. Museu de Ciências e Tecnologia da Pontifícia Universidade do Rio Grande do Sul (MCP 12352). Verified by Thales de Lema. Extends geographic range 175 km SE from Dos de Mayo, Departamento Cainguás, Misiones, Argentina and 280 km NW from Garibaldi, Rio Grande do Sul, Brazil (Etheridge and Williams 1991, Bull. Mus. Comp. Zool. 152[5]:317–361).

Submitted by **LIZE HELENA CAPPELLARI**, **RAFAEL LUCCHESI BALESTRIN**, Laboratório de Herpetologia, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga 6681, CEP 90619-900, Porto Alegre, Rio Grande do Sul, Brazil, and **ELISÂNGELA CRISTINA BEUREN**, Universidade Regional Integrada do Alto Uruguai e das Missões, Santo Ângelo, Rio Grande do Sul, Brazil.

ANNIELLA GERONIMENSIS (Baja California Legless Lizard). MEXICO: BAJA CALIFORNIA: Isla San Martin, 30°29'03"N, 116°06'00"W. 23 January 2001. José Ángel Sánchez-Pacheco. Verified by Lee Grismer. La Sierra University Photographic Collection (LSUPC L5959–60), SVL = 115 mm. Species occurs through a small coastal area across from the island, and on Isla San Gerónimo to the south (Grismer 1993, Herpetol. Nat. Hist. 1[2]:1–10). First record for the island. Specimen was found under a 40-cm rock in a sandy area with sparse Frutilla (*Lycium* sp.) on the northwestern side of the island.

Submitted by **JOSÉ ÁNGEL SÁNCHEZ-PACHECO**, Grupo de Ecologia y Conservación de Islas, Apartado Postal 162, 22791 Punta Banda, Baja California, Mexico, and **ERIC MELLINK**, Centro de Investigación Cientifica y de Educación Superior de Ensenada, Baja California, Apartado Postal 2732, 22800 Ensenada, Baja California, Mexico.

ANOLIS SAGREI (Brown Anole). USA: FLORIDA: CLAY CO: jct. Florida Rt. 21 and Lakeview Road. 24 June 2001. Josiah Townsend. UF 124687. Verified by F. Wayne King. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles, and Crocodilians. Second Ed. Windward Publ., Miami. 176 pp.).

Submitted by **JOSIAH H. TOWNSEND** (e-mail: jtownsend @flmnh.ufl.edu), Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611, USA, and **CORY R. LINDSAY**, Department of Biology, Wayne State College, Wayne, Nebraska 68787, USA.

CNEMIDOPHORUS TIGRIS (Western Whiptail). MEXICO: SINALOA: Farallón de San Ignacio, 25°26'13"N, 109°22'46"W. 6 March 2001. Marco Antonio González-Bernal. Colección de Vertebrados, Universidad Autónoma de Aguascalientes (CZRUAA 299). SVL = 70.9 mm. Verified by Brad Hollingsworth. Species occurs in a wide area of the southwestern United States and western Mexico, including northwestern coastal Sinaloa (Hardy and McDiarmid 1969, The Amphibians and Reptiles of Sinaloa, Mexico. Univ. Kansas Publ. Mus. Nat. Hist. 18:39–252; Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second Ed. Houghton Mifflin, Boston, Massachusetts). First record for the island, where it is common.

Submitted by **MARCO ANTONIO GONZÁLEZ-BERNAL**, Escuela de Biología, Universidad Autónoma de Sinaloa, Culiacán, Sinaloa, Mexico, **ERIC MELLINK**, Centro de Investigación Científica y de Educación Superior de Ensenada, B.C., Apartado Postal 2732, 22800 Ensenada, B.C., Mexico, and **CARLOS PAYÁN-ESQUERRA**, Universidad Católica de Culiacán, Culiacán, Sinaloa, Mexico.

EUMECES FASCIATUS (Five-lined Skink). USA: WISCONSIN: MONROE CO: Three records: MPM 30298. NE 1/4 SE 1/4 Sec. 11, T19N, R1E, west side Crescent Road, ca. 100 m south of Rt. EW. 24 June 1998. Gary S. Casper; MPM Photograph 625; NE 1/4 NW 1/4 Sec. 8, NE 1/4 NW 1/4 Sec. 8, T19N, R1W, along railroad tracks. September 1997. James Burnham; MPM Photograph 626. NE 1/4 SW 1/4 Sec. 1, T19N, R2W, along railroad tracks. September 1997. James Burnham. All verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.). Extends range slightly south and west from records mapped by Vogt (1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.). Within sand soils of Glacial Lake Wisconsin basin, where locality records are clustered.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA(e-mail: gsc@mpm.edu), and **JAMES BURNHAM**, Wisconsin Department of Natural Resources, Bureau of Endangered Resources, Box 7921, Madison, Wisconsin 53707, USA.

EUMECES LATICEPS (Broad-headed Skink). USA: TEXAS: NAVARRO CO: 11.2 km W Corsicana off county road SW 1120 and about 1.6 km from FMR 2452. 7 may 2001. J. Dennis Hawk. Navarro College specimen collection (NC 2001.5.8 1L). Verified by Thomas Vance. Adult male; killed by house cat and mauled, but clearly identifiable; new county record within the hiatus of its central Texas range (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp).

Submitted by **J. DENNIS HAWK**, Department of Science, Navarro College, Corsicana, Texas 75110, USA.

HEMIDACTYLUS GARNOTII (Indo–Pacific Gecko). USA: FLORIDA: FLAGLER CO: on the grounds of the Whitney Laboratory, adjacent to Marineland. 13 June 2001. Jessica Roberts-Misterly. UF 124688. Verified by F. Wayne King. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles, and Crocodilians. Second Ed. Windward Publ., Miami. 176 pp.).

Submitted by **CORY R. LINDSAY**, Department of Biology, Wayne State College, Wayne, Nebraska 68787, USA, and **JOSIAH H. TOWNSEND**, Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611, USA; e-mail: jtownsend@flmnh.ufl.edu.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: FLORIDA: COLUMBIA CO: Ellisville, at jct. U.S. Rt. 441 and I–75. 25 June 2001. A. T. Reppas and J. H. Townsend. UF 124750. Verified by F. Wayne King. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles, and Crocodilians. Second Ed. Windward Publ., Miami. 176 pp.).

Submitted by **JOSIAH H. TOWNSEND** and **ANTHONY T. REPPAS**, Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611, USA; e-mail: jtownsend @flmnh.ufl.edu.

LIOLAEMUS USPALLATENSIS. ARGENTINA: SAN JUAN: Departmento Iglesia, Barrialito, 120 km from San Juan (city) on Ruta Provincial 436 (30°34'42"S, 69°06'26"W) January 2000. R. G. Buff, P. F. Gomez, J. A. Marinero, and H. J. Villavicencio. Herpetological Collection, Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 447–448, 507–508). Verified by J. C. Acosta. Extends known range (Acosta et al. 2001, Cuad. Herpetol. 14[2]:161) ca. 61 km northeast of nearest locality (20 km northwest from Villa Nueva, Calingasta Department, San Juan Province).

Submitted by **RICARDO BUFF**, **PABLO GOMEZ**, **JOSE MARINERO**, and **JOSE VILLAVICENCIO**, Departamento de Geofísica y Astronomía e Instituto y Museo de Ciencias Naturales, F.C.E.F. y N., Universidad Nacional de San Juan, Avenida España 400 (N), Caixa Postal 5400, San Juan, Argentina.

PSEUDOGONATODES GUIANENSIS. VENEZUELA: AMAZONAS: interior valley in Serranía de Unturán, 01°48'65"N, 65°24'20"W, 200 m elev. 27 October 1992. César Molina. Museo de Historia Natural La Salle, Caracas (MHNLS 13980). Verified by Gilson Rivas. Specimen found at 1630 h on leaf litter near a ravine. First state record; extends known distribution 700 km SW inside Venezuela. Previously recorded in Venezuela from northeastern Bolívar (Gorzula and Señaris 1998, Scientia Guaianæ 8:xviii + 302 pp).

Submitted by **CÉSAR MOLINA**, Sectión of Herpetology, Museo de Historia Natural La Salle, Apartado 1039, Caracas 1010-A, Venezuela; e-mail: crmolina@mixmail.com.

SCELOPORUS COZUMELAE (Cozumel Spiny Lizard). MEXICO: CAMPECHE: Municipality of Calkini, Isla Arena Village (20°41'37"N, 90°27'13"W). 24 October 2000. René Calderón and J. Rogelio Cedeña-Vázquez. Herpetological Collection, Museum of Zoology, El Colegio de la Frontera Sur campus Chetumal, Quintana Roo (ECO-CH-H 1731–34). Verified by Oscar Flores-Villela. First record for Campeche; closest previous locality record was a few kilometers north in Celestún, Yucatan (Lee 1996, The Amphibians and Reptiles of the Yucatán Peninsula. Cornell Univ. Press, Ithaca, New York. 500 pp.)

Submitted by **J. ROGELIO CEDEÑO-VÁZQUEZ**, **RENÉ CALDERON MANDUJANO**, and **CARMEN POZO**, Museo de Zoologia, El Colegio de la Frontera Sur, Unidad Chetumal, Apartado Postal 424, Cod. Postal 77000, Chetumal, Quintana Roo, Mexico.

UROSAURUS ORNATUS (Tree Lizard). MEXICO: SINALOA: Farallón de San Ignacio, 25°26'13"N, 109°22'46"W. 6 March 2001. Marco Antonio González-Bernal. Verified by Brad Hollingsworth. Colección de Vertebrados, Universidad Autónoma de Aguascalientes (CZRUAA) 279, SVL = 55.1 mm and CZRUAA 280, SVL = 52.4 mm. Species occurs in a wide area of the southwestern United States and western Mexico, including northwestern coastal Sinaloa (Hardy and McDiarmid 1969, The Amphibians and Reptiles of Sinaloa, México. Univ. Kansas Publ. Mus. Nat. Hist. 18:39–252; Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second Ed. Houghton Mifflin, Boston, Massachusetts). First record for the island, where it is common on rocky outcrops of, at least, the flat top.

Submitted by **MARCO ANTONIO GONZÁLEZ-BERNAL**, Escuela de Biología, Universidad Autónoma de Sinaloa, Culiacán, Sinaloa, Mexico, **ERIC MELLINK**, Centro de Investigación Científica y de Educación Superior de Ensenada, B.C., Apartado Postal 2732, 22800 Ensenada, B.C., Mexico, and **CARLOS PAYÁN-ESQUERRA**, Universidad Católica de Culiacán, Culiacán, Sinaloa, Mexico.

SERPENTES

ARIZONA ELEGANS ARENICOLA (Texas Glossy Snake). USA: TEXAS: Nacogdoches Co: (31°49'50"N, 94°37'57"W). 7 June 1999. TCWC 82778. Verified by R. Kathryn Vaughan. New county record. (Dixon 2000, Amphibians and Reptiles of Texas. Second edition. Texas A&M Univ. Press, College Station. 421 pp.) This snake, and three additional *A. elegans* that were released, were captured in a funnel trap in northern Nacogdoches County in the Carrizo Sand Formation. This record extends the known range ca. 70 km southeast of the nearest historical locality in Smith County. Previous records exist for Henderson and northern Anderson counties on soils derived from the Queen City and Carrizo Sand Formations and from Smith County on soils derived from the Sparta Sand Formation. Extends known range to soils derived from a band of the Carrizo Sand Formation that extends east from northern Nacogdoches County and southern Rusk County. This eastern extension of this chiefly western species is similar to that of other western species (e.g., *Phrynosoma cornutum, Sceloporus olivaceus, Heterodon nasicus,* and *Hypsiglena torquata*) that occur on these sand formations in eastern Texas.

Submitted by **CHRISTOPHER S. COLLINS, D. CRAIG RUDOLPH, DANIEL SAENZ**, and **TONI TREES**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA, and **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

CROTALUS MOLOSSUS (Black-tailed Rattlesnake). USA: ARIZONA: Gila Co: Mogollon Rim, Christopher Creek (Sec. 30, T11N, R13E). 26 June 2000. Dylan Holycross. University of Kansas photo voucher (KU Color Slide 11825). Verified by Andrew T. Holycross. Specimen was photographed in a rockpile in a steep canyon forested in juniper and pinyon; extends range about 20 km northeast (Lowe et al. 1986, The Venomous Reptiles of Arizona. Publ. Arizona Game and Fish Department. 115 pp.).

Submitted by **DYLAN A. T. HOLYCROSS**, 2108 East Colgate Drive, Tempe, Arizona 85283, USA, and **LAWRENCE J. SMITH**, 41 Manor Road North, Hinchley Wood, Surrey, KT10 OAA, England.

CROTALUS MOLOSSUS (Black-tailed Rattlesnake). USA: ARIZONA: Mohave Co: Tuckup Canyon. 27 April 2000. Sally Underwood. UAZ 52983-PSV. Specimen photographed in bed of Tuckup Canyon near confluence with Cottonwood Canyon. Represents third vouchered locality from the North Rim of the Grand Canyon; extends range *ca.* 18 km ENE of nearest vouchered north rim sighting at Tuweep (Koenig 2000, Herpetol. Rev. 31:254–255). The remaining record is from Parashant Canyon (Koenig *op cit.*). Only two other vouchers (both from the south rim) document *C. molossus* from significant depths in the Grand Canyon (Brown 2000, Herpetol. Rev. 31:55; McKee and Bogert 1934, Copeia 1934:178–180). Although *C. molossus* is infrequently encountered within Grand Canyon, these vouchered localities along with sightings from Green Spring Canyon (K. Abbott, pers. comm.) and from the vicinity of Mt. Trumbull (H. Koenig, pers. comm.) suggest the species occurs along much of the rims of the Shivwits and Kanab plateaus and may occur on the Sanup Plateau.

Submitted by **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA.

CROTALUS TIGRIS (Tiger Rattlesnake). USA: ARIZONA: Maricopa Co: Maricopa Mountains, ca. 7 mi N Shawmut (railroad siding). 15 May 2001. James A. Badman. ASU 33150. Verified by A. T. Holycross. Specimen found in east-facing canyon. First record from the Maricopa Mountains (A. T. Holycross, pers. comm.) and a slight westward extension of range as mapped by Lowe et al. (1986, The Venomous Reptiles of Arizona. Publ. Arizona Game and Fish Dept., Phoenix. 115 pp.).

Submitted by **JAMES A. BADMAN**, Animal Care Program, Arizona State University, Tempe, Arizona 85287-0608, USA.

DIADOPHIS PUNCTATUS (Ring-necked Snake). USA: NEW MEXICO: Debaca Co: Sumner Lake State Park; along upper reaches of Pecos Arm of Lake Sumner; T5N R24E SW1/4 Sec 18; UTM Zone 13 E551081 N3834616. Female, SVL 135 mm, tail 25 mm. 5 May 2001. Donald S. Sias. University of New Mexico Museum of Southwestern Biology (MSB 62059). Verified by J. Tomas Giermakowski. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DONALD S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

DIADOPHIS PUNCTATUS (Ring-necked Snake). USA: WISCONSIN: Jackson Co: NW 1/4 SE 1/4 Sec. 31, T20N, R2W. 9 September 1997. James Burnham. Verified by Robert W. Henderson. MPM Photograph 610. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.). Ventral pattern intermediate between *D. p. arnyi* and *D. p. edwardsii*. Ca. 50 km from nearest *D. p. arnyi* records to the southwest, and 75 km from nearest *D. p. edwardsii* records to the north (Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.). In ecotone where the unglaciated southwestern uplands meet the central Glacial Lake Wisconsin plain. Collected in an abandoned shale pit within Oak/Pine community.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA, and **JAMES BURNHAM**, Wisconsin Department of Natural Resources, Bureau of Endangered Resources, Box 7921, Madison, Wisconsin 53707, USA.

DIPSAS LATIFRONTALIS (Venezuelan Snail-eater). VENEZUELA: ESTADO ARAGUA: Municipio Mario Briceño Iragorri, Rancho Grande, Parque Nacional Henri Pittier. 1100 m elev. 17 August 1989. R. García. Museo del Instituto de Zoología Agrícola, Maracay (MIZA 14-487). Verified by Dinora Sánchez; "El Helipuerto," Parque Nacional Henri Pittier, Maracay - Ocumare de la Costa road, 850 m elev. 18 June 2000. Carlos Laucho. Colección de Anfibios y Reptiles, Laboratorio de Biogeografía, Universidad de Los Andes, Mérida (ULABG 4690). Verified by Dinora Sánchez; ESTADO CARABOBO: Municipio Guacara, Vigirima, El Guapo, Parque Nacional San Esteban. 15 August 1995. Marco Natera. ULABG 4147. Verified by Marco Natera; DISTRITO FEDERAL: Municipio Libertador, Boca de Tigre, Parque Nacional El Avila, 1800 m elev. 26 October 1996. Gilson Rivas. Museo de Historia Natural La Salle, Caracas (MHNLS 13305). Verified by Gilson Rivas; ESTADO MIRANDA: Municipio Guaicaipuro, Agua Fría dam, El Jarillo-Lagunetica Road. 22 July 1988. Jesús Manzanilla. MIZA 14-480. Verified by Dinora Sánchez; Municipio Páez, Caño Rico, El Bachiller, El Guapo. 12 August 1979. I. Borsini. MIZA 14-229. Verified by Dinora Sánchez; ESTADO VARGAS: Naiguatá mountains. January 1976. J. Sánchez y H. Ceballos. Museo de Ciencias Naturales de Caracas, Caracas (MCNC 6415, 6453). Verified by Luis Fernando Navarrete. New state records. Taxon was described based on a single specimen from Aricagua, Estado Mérida, in the Venezuelan Andes (Boulenger 1905, Ann. Mag. Nat. Hist., 7[15]:561; Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela. Edic. Biblioteca. Universidad Central de Venezuela, Caracas). Outside the Andes, there are several unvouchered literature records of the species from the Venezuelan Coastal Range, the "Cordillera de la Costa" (Test et al. 1966, Misc. Pub. Mus. Zool. Univ. Michigan 128:1–63; Silva and Valdez 1989, Acta Biol. Venezuelica 12[3–4]:88–97). The specimens reported herein constitute the first documented vouchers for this mountain range. One specimen (MIZA 14-229) represents the easternmost record for the taxon, extending the known range about 600 km NE from the type locality.

Submitted by **JESÚS MANZANILLA**, Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay, Aragua, Venezuela (e-mail: jmanzanil@cantv.net), **ENRIQUE LA MARCA**, Laboratorio de Biogeografía, Escuela de Geografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Apartado Postal 116, Mérida 5101-A, Venezuela (e-mail: lamarca57@cantv.net), and **LUIS FELIPE ESQUEDA**, Centro Universitario Herpetológico Forestal and Laboratorio de Biogeografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Mérida 5101, Venezuela (e-mail: centher@forest.ula.ve).

DRYOCALAMUS SUBANNULATUS (Saddled Tree Snake). INDONESIA: MENTAWEI ISLANDS: Siberut Island (1°20'S, 98°55'E). September 1924. Collector unknown. Raffles Museum of Biodiversity Research Zoological Reference Collection (ZRC.2.3101, total length 565 mm). Verified by Kelvin K. P. Lim. Verification of previous doubtful record for the island (Dring et al. 1990, Indo-Malayan Zool. 6:119–132).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260; e-mail: scip0132@nus.edu.sg.

ELAPHE VULPINA (Western Fox Snake). USA: WISCONSIN: Price Co: NW 1/4 Sec. 7, T35N, R2E, County Road C, 1/8 mile south of RR tracks, just within limits of Village of Prentice. June 1999. Mike Spagnolo. MPM 30385. Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.; Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.).

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA (e-mail: gsc@mpm.edu), and **JAMES BURNHAM**, Wisconsin Department of Natural Resources, Bureau of Endangered Resources, Box 7921, Madison, Wisconsin 53707, USA.

FARANCIA ABACURA (Mud Snake). USA: ARKANSAS: Perry Co: (N34.98921°, W92.76386°), NE 1/4, SW 1/4, Sec. 13, R17W, T4N, on Arkansas Rt. 300, 2 mi ENE jct. of Arkansas Rt. 300 and 9, Harris Brake Wildlife Management Area. 6 May 2001. K. J. Irwin and L. K. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26097). Verified by Stanley Trauth. Adult male found DOR bounded by open, grass-covered dam on one side and bottomland hardwood forest on the other. First record for county and most northwesterly record for the species in the Arkansas River basin. (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **KELLY J. IRWIN**, Arkansas Game & Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us), and **LISA K. IRWIN**, 103 Brooke Drive, Perryville, Arkansas 72126, USA.

FARANCIA ABACURA (Mud Snake). USA: SOUTH CAROLINA: Greenville Co: Duncan Chapel Road at RR crossing, ca. 10 km N Greenville (34°55.209'N, 82°26.835'W), 300.9 m elev. 10 May 1979. Richard F. Trotta. Furman University Vertebrate Zoology Collection (FUVZC 106). Verified by J. Whitfield Gibbons. Male, ca. 61 mm SVL; first record for the county and first record northwest of the Fall Line, separating the Piedmont Physiographic Province from the Atlantic Coastal Plain Physiographic Province. Extends the range ca. 125 km (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Company, Boston. xviii + 450 pp.).

Submitted by **KATE INGRAM**, **TRAVIS W. PERRY**, and **TRAVIS J. RYAN**, Department of Biology, Furman University, Greenville, South Carolina 29613, USA; e-mail (TWP): travis.perry@furman.edu.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: COLORADO: Sedgwick Co: DOR on county road 29, 0.5 mile S jct. with I-76, UTM 0720052, 4533011. UNC-MNH 4098. Verified by Hobart M. Smith and David Chiszar. First county record (Hammerson 1999, Amphibians and Reptiles of Colorado. Second Ed. Univ. Colorado Press, Niwot. xxvii + 484 pp.). Extends known distribution in Colorado northeast by ca. 50 miles. Specimen is an intergrade between *L. t. gentilis* and *L. t. multistriata*.

Submitted by **AMY HOCKING, KRISTEN LUCKE, AMBER LAWSON,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, 501 20th Street, CB 92, Greeley, Colorado 80639-0017, USA; e-mail (SPM): spmacke@bentley.unco.edu.

LAMPROPLETIS TRIANGULUM TRIANGULUM (Eastern Milk Snake). USA: ILLINOIS: FULTON CO: Canton (40°33'N, 90.53'E, Canton Twp.). May 1954. Robert Schroder. HDW/NIU 1829 (former number RE 241, Putnam Musuem of History and Natural Sciences, Davenport, Iowa). Verified by Christine L. Chandler. New county record; not cited by Smith (1961, Bull. Illinois Nat. Hist. Surv. 28:1–298) or (Phillips et al. 1999, Illinois Nat. Hist. Surv. Manual 8:1–182).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

LICHANURA TRIVIRGATA TRIVIRGATA (Mexican Rosy Boa). USA: ARIZONA: MARICOPA CO: North Maricopa Mountains, 33°0'46"N, 112°27'37" W, 543 m elev. 10 May 2001. Thomas C. Brennan and Martin J. Feldner. University of Arizona Color Slide 53399-PSV. Verified by A. T. Holycross. Male (51 cm SVL, 113.4 g) collected at 2215 h in a dry wash surrounded by upland Sonoran Desert vegetation growing among granitic rocks and gravelly soils. A second specimen was captured 14 May 2001 at the same location by Jeff S. Miller and Thomas C. Brennan. Coloration, pattern, and scutellation of both specimens are consistent with descriptions for the nominate race (A. T. Holycross, pers. comm.). Both specimens have very dark chocolate uniform dorsal and lateral stripes, a chocolate "mustache" between the eye and nare, and dark markings around the vent. Both specimens largely lack the ventral stripes formed by mottling on the lateral aspect of the ventrals (often present in *L. t. gracia*). The first specimen has 14 left and right supralabials, 15 left infralabials, 14 right infralabials, has slightly enlarged preoculars, and lacks infraoculars. Recent mtDNA sequence analysis conducted by Dustin Wood (Department of Biology, San Diego State University) confirms that the specimens reported herein are *L. t. trivirgata* (using current taxonomy). Morphology and mtDNA are concordant.

In a recent survey of ca. 63 institutional and private collections, all vouchered specimens of *L. t. trivirgata* from Arizona were collected on Organ Pipe Cactus National Monument (A. T. Holycross, pers. comm.). Fowlie (1965. The Snakes of Arizona. Azul Quinta Press, Fallbrook, California) reported a specimen (no subspecific designation) from the Growler Mountains, but did not provide voucher information. The specimens reported herein represent a northward range extension of ca. 110 km.

Submitted by **THOMAS C. BRENNAN**, 13201 South Wakial Loop, Apt. 2139, Phoenix, Arizona 85044, USA, and **MARTIN J. FELDNER**, 1918 East Redfield Road, Tempe, Arizona 85283, USA.

MASTICOPHIS TAENIATUS (Striped Whipsnake). USA: NEW MEXICO: DEBACA CO: Sumner Lake State Park, East River Campground; NE 1/4 Sec. 2, T4N, R24E, UTM Zone 13 E556229, N3829140. DOR Female, SVL 115.5 cm, tail 44 cm (tail tip missing). 6 May 2001. Charles W. Painter. University of New Mexico Museum of Southwestern Biology (MSB 62057). Verified by J. Tomas Giermakowski. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA, and **DONALD S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

NERODIA SIPEDON PLEURALIS (Midland Water Snake). USA: FLORIDA: LIBERTY CO: Sweetwater Creek (30°30'631"N; 84°54'113"W). 7 April 2001. F. Wayne King. UF 123361. Verified by Dan Janes. New county record (Ashton and Ashton, 1988, Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Second Ed. Windward Publ., Miami. 176 pp.). First verified record of this species from east of the Apalachicola River in Florida.

Submitted by **JOSIAH H. TOWNSEND** and **F. WAYNE KING**, Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611, USA; e-mail (JHT): jtownsend @flmnh.ufl.edu.

RHADINAEA TAENIATA AEMULA (Mimic Pine-oak Snake). MEXICO: MORELOS: Municipio de Tetela del Volcán, 5 km NE of Tetela del Volcán, 2250 m elev. 14 June 1997. A Zaldivar-Riverón. MZFC 11822. Verified by A. Nieto-Montes de Oca. Adult specimen captured at midday while swimming in a small stream near agricultural field around a pine-oak forest. Extends geographic range in the state of Morelos about 60 km east from the nearest records (Myers 1974, Bull. Am. Mus. Nat. Hist. 153:1–262).

Submitted by **ALEJANDRO ZALDIVAR-RIVERÓN** and **EDMUNDO PÉREZ-RAMOS**, Museo de Zoologia, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70–399, México 04510, D.F., Mexico; e-mail (AZR): azr1@hp.fciencias.unam.mx.

STORERIA OCCIPITOMACULATA OCCIPITOMACULATA (Northern Red-bellied Snake). USA: WISCONSIN: MARQUETTE CO: SW 1/4 NE 1/4 Sec. 1, T14N, R10E, on gravel dike road at south side of dam on Grand River, Grand River Wildlife Area. 10 August 1999. Jerry Reetz. MPM 31624. Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 87 pp.; Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee. 205 pp.) within expected range.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA (email: gsc@mpm.edu).

UROMACERINA RICARDINII (Liana Snake): BRAZIL: BAHIA: Municipality of Barra do Choça, Recanto da Adriana farm (14°57'32"S, 40°32'56"W, ca. 850 m elev.). 13 November 1999 to 5 April 2000. J. O. Ruas. Museu de Zoologia da Universidade Estadual de Santa Cruz, Ilhéus, Bahia (MZUESC 97); Municipality of Arataca, Monte Sião farm (15°09'38"S, 39°18'07"W, 500–600 m elev.). 20 March to 10 May 2001. Collector unknown.

MZUESC 1131. Specimens were captured by different collectors but the precise dates of capture are unknown. Dates indicate periods between the visits to the farms. Both verified by Miguel Trefaut Rodrigues. Previously, species was known from the states of Rio de Janeiro, São Paulo, Paraná (Hoge 1957/58, Mem. Inst. Butantan 28:77–82) and Rio Grande do Sul (Lema 1973, Iheringia 44:64–73), with an apparently isolated population in Amazonian forest in the state of Pará (Cunha and Nascimento 1982, Bol. Mus. Para. Emílio Goeldi 113:1–9). In the Atlantic forest, the northern recorded limit was latitude 20°24'36"S in the state of Espírito Santo (Zamprogno 1997, Herpetol. Rev. 284:211). This discovery from northeastern Brazil extends the range in the Atlantic forest 600 km to the north.

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO** Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil; e-mail: ajargolo@hotmail.com.

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New County Records for Amphibians from Bledsoe County, Tennessee

WAYNE H. SCHACHER
Natural Resource Services, 942 Fowler Street
Clinton, Tennessee 37716, USA
e-mail: whschacher@natreserv.com

and

T. HILL HENRY
Regional Natural Heritage Program, Tennessee Valley Authority
Norris, Tennessee 37828-1589, USA

Amphibian species collections and microcassette recordings of anuran vocalizations were made during field work in Bledsoe County, Tennessee, USA. Surveys yielded several new county records that fill gaps in existing ranges or represent range extensions. Lands surveyed lie within the Cumberland Escarpment and Walden Ridge, adjoining the Sequatchie Valley. All collections and recordings were made by WHS. Voucher specimens and recordings were verified by A. Floyd Scott, Department of Biology and Center of Field Biology, Austin Peay State University (APSU). Records for amphibians were considered new if the species in question was not reported from a given county by Redmond and Scott (1996). Nomenclature and common names follow Crother (2000).

Caudata

Ambystoma talpoideum (Mole Salamander). Brushy Pond (35°26'08"N, 85°15'09"W), 12.1 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 16 April 1997. 3 larval specimens (APSU 5587) collected from among submersed and emergent herbaceous and woody vegetation around shallows of 0.2 ha woodland pond. 12 May 1997. 1 larval specimen (APSU 5617) collected from same location and habitat; Laurel Branch (35°24'28"N, 85°16'13"W) 9.8 km E jct. Tennessee Rts. 111 and 28/127, Dunlap. 12 May 1997. One larval specimen (APSU 5606) collected from submerged vegetation and leaf detrital layer in cool, clear, sluggish stream, associated with sphagnum moss wetland in young, hardwood woodland. Horn Branch (35°25'57"N, 85°15'30"W), 11.1 km NE of jct. Tennessee Rts. 111 and 28/127, Dunlap. 12 May 1997. 1 larval specimen (APSU 5613) collected from submersed algal mats and leaf detritus layer of substrate in cool, clear, sluggish stream, associated with sphagnum moss wetland in young hardwood woodland. New county records; represent significant range extension eastward toward Great Appalachian Valley Ecoregion (Tennessee River Valley).

Notophthalmus viridescens viridescens (Red-spotted Newt). Brushy Pond (35°26'08"N, 85°15'09"W, 12.1 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 16 April 1997. 3 larval specimens (APSU 5588) collected from among submersed and emergent herbaceous and woody vegetation around shallows of 0.2 ha woodland pond. 12 May 1997; 3 larval specimens (APSU 5618) collected from same location and habitat. New county record fills gap between adjoining Cumberland, Van Buren, Rhea and Hamilton counties.

Eurycea cirrigera (Southern Two-lined Salamander). Unnamed tributary to McWilliams Creek (35°26'04"N, 85°17'04"), 9.3 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 17 April 1997. 1 specimen (APSU 5593) collected from beneath rotting log associated with leaf litter in hardwood forest, adjacent to stream; downslope from The Big Flat, toward Dry Branch (35°25'25"N, 85°17'05"W), 8.8 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 17 April 1997. 1 specimen (APSU 5596) collected from beneath rotting logs associated with leaf litter in mid-aged hardwood forest; tributary to Laurel Branch (35°24'15"N, 85°15'25"W), 10.8 km E jct. Tennessee Rts. 111 and 28/127 in Dunlap. 12 May 1997. 1 specimen (APSU 5598) collected from beneath rocks in damp stream bed, within hemlock-young hardwood forest; across access road from Brushy Pond (35°26'09"N, 85°15'04"W), 12.2 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 16 April 1997. 1 specimen (APSU 5611) collected from beneath rotting log in saturated soils and leaf litter, in hardwood forest adjacent to headwater stream; unnamed tributary to McWilliams Creek (35°25'39"N, 85°17'44"W), 7.8 km NE jct. Tennessee Rts. 111 and 28/127, Dunlap. 18 April 1997. 1 specimen (APSU 5616) was collected from vertical face of moss-covered, splash-zone of waterfall/rock overhang; Laurel Branch (35°24'18"N, 85°15'33"W), 10.7 km E jct. Tennessee Rts. 111 and 28/127 in Dunlap. 12 May 1997. 1 specimen (APSU 5621) collected from damp area beneath moss-covered rocks comprising man-made wall in woodland adjacent to stream. New county records fill gap between five surrounding counties.

Eurycea longicauda longicauda (Long-tailed Salamander). Dry Branch near Alexander Gap (35°23'38"N, 85°16'35"W), 8.9 km E jct. Tennessee Rts. 111 and 28/127 in Dunlap. 13 May 1997. 1 specimen (APSU 5602) collected from beneath rotting logs and leaf litter in mid-aged hardwood flat along braided stream channel; Laurel Branch (35°24'18"N, 85°15'33"W), 10.7 km E jct. Tennessee Rts. 111 and 28/127 in Dunlap. 12 May 1997. 1 specimen (APSU 5620) collected from damp area beneath moss-covered rocks comprising manmade wall in woodland adjacent to stream. New county records represent eastward range extension toward Great Appalachian Valley Ecoregion (Tennessee River Valley).

Eurycea lucifuga (Cave Salamander). Horn Branch (35°25'57"N, 85°15'30"W), 11.4 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 12 May 1997. 2 larval specimens (APSU 5581) collected from among rootwads and leaf detritus layer of substrate in cool, clear, sluggish stream, associated with sphagnum moss wetland in young hardwood woodland. New county record fills gap among adjoining Cumberland, Van Buren, and Rhea counties.

Hemidactylium scutatum (Four–toed Salamander). Horn Branch (35°25'57"N, 85°15'30"W), 11.2 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 16 April 1997. 1 adult specimen (APSU 5609) collected from within sphagnum moss mat in wetland, adjacent to sluggish stream, in young hardwood woodland. Tennessee listed as *In Need of Management* (Proclamation 94-16). New county record represents eastward range extension toward Great Appalachian Valley Ecoregion (Tennessee River Valley).

Pseudotriton montanus diastictus (Midland Mud Salamander). Across access road from Brushy Pond (35°26'09"N, 85°15'04"W), 12.2 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 16 April 1997. 1 adult specimen (APSU 5610) collected from beneath rotting log in saturated soils and leaf litter, in hardwood forest adjacent to headwater stream; Horn Branch (35°25'57"N, 85°15'30"W), 11.2 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 12 May 1997. 1 larval specimen (APSU 5624) collected from among rootwads and leaf detritus layer of substrate in cool, clear, sluggish stream, associated with sphagnum mass wetland in young hardwood woodland. New county records represent eastward range extension toward Great Appalachian Valley Ecoregion (Tennessee River Valley).

Pseudotriton ruber ruber (Northern Red Salamander). The Big Flat (35°25'27"N, 85°16'38"W), 9.3 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 17 April 1997. 1 specimen (APSU 5595) collected from surface of leaf litter in mid-aged hardwood forest; Dry Branch near Alexander Gap (35°23'38"N, 85°16'35"W), 8.9 km E jct. Tennessee Rts. 111 and 28/127 in Dunlap. 13 May 1997. 2 specimens (APSU 5600) collected from beneath rotting logs and leaf litter in mid-aged hardwood flat along braided stream channel; Horn Branch (35°25'57"N, 85°15'30"W), 11.2 km NE jct. Tennessee Rts. 111 and 28/127 in Dunlap. 16 April 1997. 1 larval specimen (APSU 5608) collected from among rootwads and leaf detritus layer of substrate in cool, clear, sluggish stream, associated with sphagnum moss wetland in young hardwood woodland. 12 May 1997. 1 larval specimen (APSU 5623) collected from same location and habitat. New county records represent eastward range extension toward Great Appalachian Valley Ecoregion (Tennessee River Valley).

Anura

Bufo americanus americanus (Eastern American Toad). Horn Branch (35°25'57"N, 85°15'14"W), 11.3 km NE jct. Tennessee Rts. 111 and 28/127, Dunlap. 16 April 1997. 1 specimen (APSU 5589) buried within sphagnum moss mat in wetland associated with clear, sluggish stream in young hardwood woodland; near Hixon Gap (35°25'48"N, 85°16'09"W), 10.4 km NE jct. Tennessee Rts. 111 and 28/127, Dunlap. 14 May 1997. 1 specimen (APSU 5607) collected from hardwood forest edge and dirt road. New county records fill gap among Cumberland, Van Buren, Rhea, and Hamilton counties.

Acris crepitans crepitans (Eastern Cricket Frog). West of Dry Branch in McWilliams Creek watershed (35°25'28"N, 85°17'35"W), 8.2 km NE jct. Tennessee Rts. 111 and 28/127, Dunlap. 13 May 1997. Microcassette recordings of specimen (APSU 5275) calling from wooded periphery of large, artificial pond. New county record.

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Noteworthy Reptilian State Records and a Lizard Species New to the Herpetofauna of Venezuela

LUIS FELIPE ESQUEDA
Centro Universitario Herpetológico Forestal and Laboratorio de Biogeografía
Facultad de Ciencias Forestales y Ambientales
Universidad de Los Andes, Mérida 5101, Venezuela
e-mail: centher@forest.ula.ve

ENRIQUE LA MARCA
Laboratorio de Biogeografía, Escuela de Geografía
Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes
Apartado Postal 116, Mérida 5101-A, Venezuela
e-mail: lamarca57@cantv.net

MARCO NATERA
Museo de Vertebrados, Universidad Rómulo Gallegos
San Juan de los Morros, Estado Guárico, Venezuela
e-mail: mnatera@latinmail.com

and

PIETRO BATTISTON
Asociación Venezolana de Herpetología
Apartado de Correo 567, Valencia 2001, Estado Carabobo, Venezuela
e-mail: pietrob@viptel.com

The reptilian fauna of Venezuela is becoming taxonomically better known. However, the geographic distribution of many species is poorly known and in need of documentation. In an ongoing effort by the Laboratorio de Biogeografía at the Universidad de Los Andes in Mérida, we provide here 16 new distributional records for Venezuela, one of which is a new species for the country. Twelve of these records are of lizards, while the remainder are those of snakes. Of these new state records, seven come from Carabobo, two each are from Mérida and Yaracuy, with one each from the states of Barinas, Miranda, Sucre, Táchira, and Zulia.

Common names for snakes follow Kornacker (1999), except for those coined recently and not in use by any locals. Common names for lizards are those given by resident people. Acronyms belong to Venezuelan herpetological collections as follows:

CVULA= Colección de Vertebrados de la Universidad de Los Andes, Mérida; CVURG = Colección de Vertebrados de la Universidad Rómulo Gallegos, San Juan de los Morros; ULABG= Colección de Anfibios y Reptiles, Laboratorio de Biogeografía, Universidad de Los Andes, Mérida.

Lacertilia

Ameiva ameiva melanocephala (Mato Real). ESTADO CARABOBO: Municipio Puerto Cabello: Puerto Cabello. 21 April 1994. J. Díaz. ULABG 4124. Verified by P. Kornacker. First state record (Alemán 1953; Donoso-Barros 1968; Peters and Donoso-Barros 1970). ESTADO ZULIA: Municipio: Machiques de Perijá. Serranía de Perijá, river 34 km S El Tukuko, 260 m. elev. 4 March 1985. E. La Marca and J. García. ULABG 1365. Verified by P. Kornacker. First state record and westernmost locality for the subspecies (Donoso- Barros 1968; Peters and Donoso-Barros 1970). Extends range by about 390 km E of previous published record ("La Guayra range"), and 970 km E from type locality (Peters and Donoso-Barros, 1970). This specimen was previously identified as *Ameiva. a. praesignis* in La Marca and García (1987) under the former museum number of CVULA IV-4610.

Anolis squamulatus (Falso Camaleón). ESTADO CARABOBO: Municipio Montalbán: road between Cerro La Pericoca and Temerla. 1000 m. elev., near state border with Yaracuy. 23 March 1999. J. Achuelo. ULABG 4692. Verified by F. Zerpa. First state Record (Donoso-Barros 1968; Peters and Donoso-Barros 1970; extends known range at least 50 km SW of type locality.

Bachia heteropa lineata. ESTADO CARABOBO: Municipio Naguanagua: mountains close to Urbanización La Entrada I, on road to Trincheras, 700 m elev. 25 June 1994. M. Natera and R. Mora. ULABG 4136–4137. Verified by F. Zerpa. These first state records, collected among roots in a evergreen riverine forest at about 100 km SW of the type locality, bridge the previous distribution gap between the state of Yaracuy and the Federal Distrit (Donoso-Barros 1968; Peters and Donoso-Barros 1970).

Gonatodes albogularis albogularis (Limpiacasa). ESTADO BARINAS: Municipio Ezequiel Zamora: Complejo Hidroeléctrico DESURCA C. A., between Santa María de Caparo and Abejales, 23 June 1998. L. F. Esqueda and J. Gámez. ULABG 4418–4424. Verified by F. Zerpa. First records for the state of Barinas and apparently the only documented continental record E of the Cordillera de Mérida. This report extends known range at least 100 km E of Cúcuta, Colombia, the closest geographical locality in the literature (Donoso-Barros 1968; Peters and Donoso-Barros 1970; Rivero-Blanco 1979).

Gonatodes taniae (Largarabo). ESTADO CARABOBO: Municipio Naguanagua: mountains of La Entrada, on road to trincheras, 700 m elev. 25 June 1994. M. Natera and L. F. Esqueda. ULABG 4126–4127. Verified by F. Zerpa. First state records (Donoso-Barros 1968; Peters and Donoso-Barros 1970; Rivero-Blanco 1979). ESTADO YARACUY: Municipio Nirgua: road between Cerro La Pericoca and Temerla. Ca. 1000 m. elev., close to border with state of Carabobo. 23 March 1999. L. F. Esqueda. ULABG 4693. Verified by F. Zerpa. First state record and westernmost locality for the species, extending known range about 90 km W of type locality (Donoso-Barros 1968; Peters and Donoso-Barros 1970; Rivero-Blanco 1979).

Gymnophthalmus speciosus (Falsa Lisa). ESTADO CARABOBO: Municipio Naguanagua: Mountains close to Urbanización La Entrada I, on road to Trincheras, 700 m elev. July 1995. L. F. Esqueda. ULABG 4125. Verified by P. Kornacker. First state record and westernmost locality for the species (Donoso-Barros 1968; Peters and Donoso-Barros 1970; Rivero-Blanco 1979).

Leposoma parietale ESTADO TACHIRA: Municipio Uribante: mountain stream tributary of Doradas river, close to the Uribante-Caparo hidroelectric dam. 24 May 1989. Collector unknown. ULABG 3804. Verified by F. Zerpa. The species was previously known from Peru, Ecuador and Colombia. This is the first record for the species in Venezuela and the northernmost locality for the taxon (Donoso-Barros 1968; Peters and Donoso-Barros 1970; Avila-Pires, 1995). The only other member of the genus previously known for Venezuela was *L. percarinatus* (La Marca 1997).

Plica plica (Cangasapo). ESTADO MIRANDA: Municipio Independencia: Guatopo National Park, sector Agua Blanca. 18 March 1992. M. Natera. ULABG 4134. Verified by P. Kornacker. The specimen, collected on a tree at about 3 m above ground, constitutes the first state record and westernmost northern Venezuelan locality for the species (Donoso-Barros 1968; Peters and Donoso-Barros 1970; Avila-Pires 1979).

Ptychoglossus kugleri. ESTADO CARABOBO: Municipio Naguanagua: Las Trincheras, Las Trincheras river, 500 m elev. 17 August 1993. M. Natera and L. F. Esqueda. ULABG 4148–4149. Verified by F. Zerpa. First state records, bridging distribution gap between states of Falcón and Aragua (Peters and Donoso-Barros 1970; Harris 1994).

Tretioscincus bifasciatus kugleri (Lisa Azul). ESTADO SUCRE: Municipio Montes: Smiths. Hacienda San Fernando. 7 km N Cumanacoa. J. E. García Pérez. 6 August 1985. ULABG 4137. Verified by J. E. García Pérez. First state record (Peters and Donoso Barros, 1970).

Serpentes

Atractus emigdioi (Tierrera). ESTADO MÉRIDA: Municipio Cardenal Quintero: Santo Domingo, near bridge in crossroad to Las Piedras. E. La Marca and D. Briceño. 22 March 1997. ULABG 4335–4336, 4485. Verified by P. Kornacker. First state record for this species, extending known range about 60 km SW of the type locality.

Atractus lancinii (Tierrera). ESTADO CARABOBO: Municipio Naguanagua: Sector Carialinda. S slopes of San Esteban National Park. O. O. Hidalgo. 1994 . CVURG 265. Verified by S. Bolívar. The specimen constitutes the first Carabobo state voucher for this species. This record extends the species range at least 110 km W of the type locality. Since no other museum specimen has been reported in the literature for this taxon, besides the holotype, this specimen, collected on fallen leaves in cloud forest, constitutes the second verified record (Roze 1966). The species range has been stated to include the state of Miranda (Lancini 1979, Lancini and Kornacker 1989), but a voucher specimen is not available at present.

Crotalus durissus cumanensis (Cascabel). ESTADO MÉRIDA: Municipio Libertador: El Morro (Pueblos del Sur), 2000 m. elev. E. Rívas. 25 April 1999. ULABG 4691. Verified by P. Kornacker.

First record for the state and for the Venezuelan Andes. A population of this snake has been regarded as an endangered species, to which the nomen nudum *Crotalus maricela* has been applied (*in* Rodríguez and Rojas Suárez 1995). Close examination of this specimen and others, kept alive, from the same region, suggest that a new name is not warranted, as the scale counts and sizes fall within the range of *C. d. cumanensis* and the pale coloration of some pattern details is common to specimens originating from other semiarid regions in Venezuela. Apparently, this population is restricted to this relatively isolated semiarid pocket in the Venezuelan Andes, ranging from 700 m to at least 2000 m elev. This is one of the highest elevation records for the species (Campbell and Lamar 1989), and the second highest in Venezuela, after a literature citation mentioning it from Pico Naiguatá (Distrito Federal) at 2500 m elev. (Lancini 1979).

Dendrophidion nuchale (Machete). ESTADO CARABOBO: Municipio Guacara: Montañas de Vigirima, on road from El Guapo to Cruz Verde, cloud forest in Southern slope of San Esteban National Park. 25 May 1994. M. Nattera and L. F. Esqueda. ULABG 4143–4144. Verified by P. Kornacker. The specimens, collected by day on the ground, confirm the first state records and northernmost locality for the species, bridging a previous distribution gap of more than 500 km between the states of Zulia and Aragua (Roze 1966, Lancini and Kornacker 1989).

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County Records of Amphibians and Reptiles from Northeastern South Carolina

JEFFREY D. CAMPER
Department of Biology, Francis Marion University
Florence, South Carolina 29501-0547, USA
e-mail: jcamper@fmarion.edu

Surveys of locality data from several collections in the United States show that the herpetofauna of northeastern South Carolina is poorly documented. In this report, I list county records for Chesterfield, Darlington, and Florence counties in the northern coastal plain of South Carolina. The taxonomy of *Pseudemys* follows Seidel (1994). All specimens are stored in the Charleston Museum herpetological collection and were collected by the author unless stated otherwise. All specimens were verified by Albert E. Sanders.

Caudata

Amphiuma means (Two-toed Amphiuma). Darlington Co: Pee Dee Research and Education Center, 7 km N Florence. 16 July 1998. CA 4540.

Ambystoma maculatum (Spotted Salamander). Darlington Co: Great Pee Dee River Heritage Preserve, 19.6 km NNE Florence. 25 March 2000. CA 4544. County record and first record on South Carolina coastal plain north of Francis Marion National Forest.

Notophthalmus viridescens (Eastern Newt). Chesterfield Co: Carolina Sandhills National Wildlife Refuge, 1 km NW jct. Refuge Rd. 7 and Co. Rd. 33. 15 October 1995. CA 4408.

Siren lacertina (Greater Siren). Chesterfield Co: Sand Hills State Forest, 3 km SSE State Forest HQ, Flory Pond. 5 July 1995. CA 4407.

Anura

Scaphiopus holbrookii (Eastern Spadefoot). Darlington Co: Hartsville. 3 February 1998. J. W. Bethea. CA 4543.

Hyla chrysoscelis/versicolor (Gray Treefrog). Chesterfield Co: Sand Hills State Forest, 4.2 km S Patrick, Barefoot Seep. 29 June 1995. CA 4402.

Rana sphenocephala (Southern Leopard Frog). Darlington Co: Pee Dee Research and Education Center, 7 km N Florence. 20 October 1998. CA 4542.

Testudines

Chelydra serpentina (Common Snapping Turtle). Florence Co: Florence. 20 March 1998. CR 2699.

Kinosternon baurii (Striped Mud Turtle). Florence Co: Florence, Jeffries Creek. 10 May 2000. J. E. Krebs slide.

Clemmys guttata (Spotted Turtle). Florence Co: 2 km W Francis Marion University on Co. Rd. SSR 918. 22 May 1998. CR 2697.

Pseudemys concinna (Eastern River Cooter). Chesterfield Co: Sand Hills State Forest, 3 km SSE State Forest HQ, Flory Pond. 25 August 1995. T. K. Knowles and J. D. Camper. CR 2698.

Terrapene carolina (Eastern Box Turtle). Chesterfield Co: Sand Hills State Forest, SC Rt. 102 at NW edge of Patrick. 11 June 1995. CR 2587.

Lacertilia

Ophisaurus ventralis (Eastern Glass Lizard). Chesterfield Co: Sand Hills State Forest, 1 km N State Forest HQ on Truck Trail 141.12 June 1995. CR 2583. Darlington Co: 11.3 km NW Florence on Co. Rd. SSR 13. 6 September 1996. CR 2690.

Serpentes

Coluber constrictor (Racer). Darlington Co: South Carolina Rt. 34 within city limits at W edge of Darlington. 3 June 1996. CR 2675.

Elaphe guttata (Corn Snake). Darlington Co: South Carolina Rt. 102, 7.3 km N Hartsville. 28 April 1997. CR 2680. Florence Co: 1.5 km W Francis Marion University on Co. Rd. SSR 918. 31 October 1994. CR 2688.

Elaphe obsoleta (Eastern Rat Snake). Florence Co: 1 km W Francis Marion University on Co. Rd. SSR 918. 22 June 1997. CR 2662.

Farancia abacura (Mud Snake). Darlington Co: Pee Dee Research and Education Center, 7 km N Florence. 3 September 1998. CR 2656.

Heterodon simus (Southern Hog-nosed Snake). Chesterfield Co: Sand Hills State Forest, Co. Rd. SSR 29, 1.2 km S SC Rt. 1. 2 June 1995. CR 2582.

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Agkistrodon taylori (Taylor's Cantil), juvenile. Illustration by R. Michael Burger.

BOOK REVIEWS

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A Guide to the Reptiles of Belize, by Peter J. Stafford and John R. Meyer. 2000. Academic Press, San Diego, California. 356 pp., softcover. US $59.95. ISBN 0-12-662760-6

DARYL R. KARNS
Department of Biology, Hanover College, Hanover, Indiana 47243, USA
e-mail: karns@hanover.edu

and

JOHN C. MURPHY
Division of Amphibians and Reptiles, Field Museum of Natural History
Chicago, Illinois 60605, USA
e-mail: fordonia@mediaone.net

The Central American country of Belize has become a popular ecotourist destination in recent years. This small country (75 x 174 miles [121 x 280 km], 8867 miles^2 [22984 km^2]), slightly smaller than the state of New Hampshire) is located on the southeastern corner of the Yucatán Peninsula south of Mexico, with Guatemala to the west, and the Caribbean to the east. It is a remarkably diverse place for such a small country, ranging from savanna in the north to broadleaf rain forest in the Maya Mountains to the south. The longest barrier reef in the western hemisphere runs along the Belizean coast. Add to this natural history mixture the rich cultural history of the Maya, archaeological treasures like Caracol and Xunantunich, and a diverse ethnic stew of Garifuna, Mestizo, Mayan, Creole, Asian, and European and the appeal of Belize is obvious.

Stafford and Meyers have produced an excellent general guide to the reptiles of Belize. The authors have worked extensively in Belize and their personal knowledge of the country is evident. The authors point out that 75% of the herpetofauna (ca. 160 species) are reptiles, and this volume will be invaluable for anyone with an interest in the reptile fauna of the region. Karl P. Schmidt published the first checklist of the amphibians and reptiles of Belize in 1941; Neill (1965), Henderson and Hoevers (1975), and many others have expanded on this base. Today there are two comprehensive and complementary treatments of the herpetofauna of the region: Julian Lee's 1996 monograph on the herpetofauna of the Yucátan Peninsuala (recently revised and edited as a field guide: Lee 2000) and Jonathan Campbell's 1998 treatment of the amphibians and reptiles of northern Guatemala, the Yucatán, and Belize. In addition to the reptile guidebook by Stafford and Meyer there are currently three shorter, less detailed guidebooks that deal specifically with the Belizean herpetofauna: Garel and Matola (1995) on snakes, Weyer (1990) on snakes, and Meyer and Farneti Foster (1996) on frogs and toads.

The introductory chapter provides a very useful overview of the physiography, climate, and vegetation of Belize with supporting photographs and maps. There is a brief section on general aspects of the natural history of reptiles for the non-herpetologist. This introduction is followed by four chapters devoted to the major reptilian groups (crocodilians, turtles, lizards, and snakes). Dichotomous keys to families, genera, and species are provided for each of these groups (35 keys in all). These keys are supported by high quality drawings by Stafford. General anatomical drawings illustrate basic features of reptilian anatomy and make the keys user-friendly for the novice; unfortunately, the drawings are not specifically referred to in the keys. A glossary of 100 terms further defines anatomical nomenclature and other technical terms. The species accounts are organized in alphabetical order within genera, and the genera are ordered alphabetically within families. Higher taxonomic categories are listed in phylogenetic sequence. Each species account gives the scientific name and original authority, but no nomenclatural history. The common names used by Belizeans for various species are given (some of these are delightful, such as Wish-willy for *Ctenosaura similis*) as well as English and Spanish common names. Each species account includes a description (external morphology, size, coloration), habitat in Belize, geographic distribution, similar species, general remarks (diet, reproduction, recognized subspecies, interesting natural history), and a key reference for each species. The majority of species accounts run about one page of text in length. Species illustrations are included for all but three of the 122 species, and all but six of these are color photographs. There are multiple illustrations for some species and over 180 photographs in all. The last text section of the book is an essay on the features and treatment of snakebite in Belize by David Warrell (Center for Tropical Medicine, Oxford University). There are 13 pages of literature citations and further reading citations. There are four very useful tables in the book. Chapter 1 contains two tables that show the distribution of reptiles in Belize by physiographic region (northern and southern lowlands, and southern uplands) and their distribution in the region (Yucatán, Honduras, Petén). Appendix I is an ecological summary that provides information for each species in nine categories (e.g., habitat, elevational range, food). Appendix II is a table that shows the distribution of each species in each of the seven political districts of Belize. Under each district for each species specific localities are given; a map and gazetteer, including geographic coordinates, are provided.

The species accounts are accurate and well constructed. They contain the traditional description with sufficient detail to confirm identification after a specimen has been tentatively identified with a key. Casual ecotourists will probably never bother with the keys, although they could be used by the patient novice with the aid of the excellent illustrations. The ecotourist will be able to identify all the common species (or at least place a specimen in the correct taxonomic ballpark) using the photographs alone. The photographs are generally of good quality, and many are excellent, in terms of focus and composition; unfortunately a number of the photos are rather dark in terms of the quality of reproduction (at least in my copy) and the animal blends into the background.

Hard-core herpetologists will wish for more information in some cases, especially on the specifics of diet and reproduction. For example, *Ninia sebae*, the Red Coffee Snake, is said (p. 225) to eat invertebrates, which is true. However, it would have been more accurate to say it feeds primarily on gastropods, specifically slugs. In the remarks section of the *Imantodes cenchoa* account (p. 211) the reader is informed that this snake is oviparous. It would not have taken much more space to say that it lays clutches of one to three eggs. Placing this kind of detail in a field guide does not contribute greatly to its length, but it is the kind of information

that increases the utility of the field guide. It makes the details of natural history more accessible to the casual naturalist and stimulates the collection of useful field observations to expand our knowledge of the fauna. This criticism does not detract from the book's usefulness, it simply is a suggestion for future editions and field guide authors everywhere.

One of us (Karns) is a member of a team that teaches tropical biology in Belize and we are always looking for good natural history references for Belize. We will certainly be taking this volume with us in the future. It is a reasonable size for a field guide and the paper and binding are of good quality and durable—it will survive in a backpack. At $59.95 for a paperback we don't think that this book will be bought by the average ecotourist going to Belize, but they will find it a valuable resource if it is available. Individuals with a serious interest in herpetology will find it a very useful introduction to the reptiles of Belize; they will also want more detailed information, analysis, and synthesis than contained here, but there is only so much that a reasonably-sized field guide can do. We hope and strongly recommend that Belizean natural history guides, resort owners who cater to natural history tours, and student group leaders buy and use this book. We work with wonderful natural history guides in Belize who tend to be particularly knowledgeable about birds and medicinal plants, but who are less familiar with other taxonomic groups. In particular, many lizards, like birds, are diurnal, conspicuous, and frequently seen. We think this guide can be very useful in expanding the natural history repertoire of the people who make a living from introducing people to the natural and cultural history of Belize.

This book belongs to the Academic Press Natural World Series and was published in association with the Natural History Museum, London. This series is a new initiative by Academic Press whose goal, according to their press literature, is to produce "...illustrated books dealing with species identification, ecology, and biology. Beautiful books packed with reliable text and illustrations, prepared by experts for the general and dedicated reader alike." They have largely realized that goal with *A Guide to the Reptiles of Belize*.

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Slithy Toves: Illustrated Classic Herpetological Books at the University of Kansas in Pictures and Conversations, by Sally Haines. 2000. Society for the Study of Amphibians and Reptiles (Contributions to Herpetology, Vol. 16), Ithaca, New York [in Cooperation with the Kenneth Spencer Research Library at the University of Kansas]. vii+180 pp., 84 color plates. Softcover. US $60.00. ISBN: 0-916984-53-2.

ROBERT M. PECK

Academy of Natural Sciences, 1900 Benjamin Franklin Parkway
Philadelphia, Pennsylvania 19103, USA
e-mail: peck@acnatsci.org

One would be hard-pressed to recall many exhibitions—or books—that link the writings of Pliny the Elder and Linnaeus with those of Mark Twain, and Kenneth Grahame, or the scientific offerings of Louis Agassiz with the nonsense verse of Lewis Carroll, but Sally Haines has done just that in *Slithy Toves*. This sumptuous offering of herpetological illustrations and "conversations" about the publications that contain them grew from a 1991 exhibition of books organized by the Kenneth Spencer Research Library at the University of Kansas to celebrate the publication of *A Field Guide to Reptiles and Amphibians* by Roger Conant and Joseph Collins. The exhibition was reconfigured five years later when the Society for the Study of Amphibians and Reptiles met in Lawrence.

Written as a gallery guide to these two exhibitions, the book has the chatty feel of an exhibition tour led by a well-read bibliophile and enthusiastic naturalist who acknowledges at the outset that she is not a specialist in the field of herpetology. In an effort to make her guide more accessible to non-herpetologists, Haines has created her own titles for each of the 69 catalog entries. "Froggie Went a Courtin' " introduces a plate of reproducing frogs from Rosel von Rosenhof's *Historia Naturalis Ranarum Nostratium* (1753–1758), while "We Gott Mit Uns Too" heralds a chameleon plate from an 18th century book by the German naturalist Daniel Meyer. Her other contrived titles include "Crispy Critters," "Reptile Nerds," and "Desert Shield." To give the book a theme and sense of continuity, Haines has also selected a quotation from Lewis Carroll to accompany each bibliographic entry. Like the titles, these tend to trivialize rather than lighten the catalog's content. What seems clever at first, becomes distracting and even annoying when repeated on every page.

Putting aside these extraneous embellishments, the reader will find the book an excellent introduction to the classic illustrated books in herpetology. Although the entries are short—usually no more than a few hundred words devoted to each book—they are filled with useful and interesting information about the eclectic assemblage of authors who created many of the seminal works in the field. (With a few exceptions, books without illustrations were intentionally omitted.)

Kraig Adler, whose groundbreaking work in the history of herpetology is well known to the readers of this journal, served an advisory role to the author of the compilation and contributed a short introduction to the book in which he discusses the artistic challenges of illustrating amphibians and reptiles through time. Following this essay, the book is divided into two chronological

sections and one geographical ("Pre-Linnaean," "Beyond Linnaeus," and "New World Herps"). A section on "Herps as Symbols" constitutes the only non-scientific part of the catalog. The book concludes with chronological and alphabetical checklists of the most important illustrated herpetological works in the Department of Special Collections at the Spencer Library.

Issued in an edition of 1000 by the Society for the Study of Amphibians and Reptiles, *Slithy Toves* is beautifully printed on heavy, coated, acid-free paper. The copious, full-page color reproductions were laser-scanned from 35mm transparencies. Other details about the production are provided in the book's colophon, while a list of patrons and benefactors acknowledges the generosity of those who paid for its publication.

With its unusual contents, its stunning illustrations, and its delightfully readable text, this is a book every natural history book lover and herpetological historian will want to own.

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Atlas des Amphibiens de Guyane, by Jean Lescure and Christian Marty. 2000. Muséum National d'Histoire Naturelle, Paris (publication 45 in the Patrimoines Naturels series). viii + 388 pp. Softcover. FF 240 (approx. 36.59 Euros, US $32.20). ISBN 2-85653-529-1. Available from Muséum National d'Histoire Naturelle, Service des Publications, 57, rue Cuvier, F-75231 Paris Cedex 05, France or via e-mail: dhenry@mnhn.fr.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA
e-mail: aaron.bauer@villanova.edu

Although South America has traditionally been one of the most popular areas for American herpetologists to conduct their fieldwork, the emphasis has decidedly been on Spanish speaking countries. As a consequence of such work, plus the significant output of local herpetologists, the faunas of these countries, as well as that of Portuguese speaking Brazil, are reasonably familiar, if still incompletely known, to herpetologists worldwide. The Guianas of northern South America represent one of the only regions of the mainland Neotropics that is neither Spanish nor Portuguese. The three Guianas (from west to east) were colonized by the British (British Guiana, now Guyana), the Dutch (Suriname), and the French (French Guiana). The herpetofauna of Suriname has been reasonably well documented, largely through the efforts of Marinus Hoogmoed. That of Guyana was explored in the first half of the 20th Century by William Beebe and others, but remains incompletely surveyed and has never been dealt with in book or monographic form. What of French Guiana?

French Guiana remains poorly known to most Americans. Unlike its neighbors, rather than achieving independence, it has become an integral part of France as the largest (approximately 90,000 km^2) of its overseas departments. In that capacity, it has been the site of extensive biological surveys conducted almost exclusively by French researchers. The literature on the amphibians of French Guiana is extensive and much of it has been the work of the senior author, Jean Lescure, who has worked there for more than 30 years. *Atlas des Amphibiens de Guyane*, based on the results of a series of long term investigations sponsored by the Paris Museum and other French research organizations, is, however, the first comprehensive and illustrated publication on the entire batrachofauna of the region.

Following a brief introduction and overview of the methodology of the collecting program that led to the book, a section on the geology, geography and biogeography of French Guiana is presented. In its broader regional context, French Guiana is divided into the central and eastern Guianan regions. On a finer scale, the authors provide a table of distribution that recognizes 14 biogeographic zones within French Guiana, including savannas, coastal marshes, inselbergs, and numerous major river drainages. Despite the extensive survey work of the last 30+ years, there remain several parts of French Guiana that are poorly sampled herpetologically, including parts of the west central region and much of the south (areas where access is poor and infrastructure minimal). In addition to the geographic context of the work, the authors have provided an historical context as well, reviewing 17 naturalists of the past who have contributed to the amphibian biology of the region. These range from Mérian who visited Surinam from 1699 to 1701 to biologists of the early to mid-20th century. Among the more well-known to many herpetologists are Sonnini de Manocourt and Castelnau.

The systematic portion of the book begins with a key to the genera of amphibians. Keys to species within a genus, tribe, or subfamily follow the appropriate general remarks about each higher order group. These often include references to the most recent revisionary systematic works. The keys are, in some cases, illustrated by line drawings and additional illustrations of selected larvae, embryos, pattern variants are scattered throughout the book. Each species account is typically two pages long—one of text and one with a map and photograph. The Latin name, author and date, as well as a French common name head each entry. The accounts themselves are divided into "définition et diagnose," "eco-éthologie," and "répartition." The first of these provides information about size, color and other distinguishing features, the second (which, in some cases, is subsumed under generic accounts rather than specific) includes some aspects of biology as well as information on larval identification and call features. Under "répartition" the distriution of each taxon as a whole is mentioned as is its range within French Guiana. Specific localities are indicated on the adjoining dot maps. These maps show no towns or national or district borders as reference points, only the major river drainages of French Guiana, all of which are identified on a reference map on page 16. An additional "remarques" section in which taxonomic notes, geographic variation, or other topics, are discussed is provided for certain taxa.

Virtually every species is illustrated by a color portrait photograph. These are almost uniformly of good quality, although in a few cases, including several very rare or peripheral species, these are not up to par (e.g., *Atelopus flavescens*, p. 49, image too small; *Colostethus beebei*, p. 85, insufficient depth of field; *Hyla marmorata*, p. 147, poor color reproduction; *Hyla* sp. 1 [identified as *Eleutherodactylus* sp. 1 in the text but corrected in the errata sheet included with the book], p. 217, poor focus; *Synapturanus mirandaribeiroi*, p. 277, preserved specimen).

In total, 103 anuran species and seven caecilians are included in

the fauna. Three of the frogs (*Hyalinobatrachium nouraguensis*, *Hyla guacheri*, *Scinax jolyi*) are described as new. Each of these descriptions provides complete information about the types as well as analysis of calls and other relevant information. Another seven anurans are left unnamed to species, either because they are currently being described by people other than the authors, or because they are insufficiently known. Six species of frogs are added to the fauna of French Guiana and numerous other taxa have been reidentified based on the availablility of new material and/or nomenclatural or phylogenetic revision. These changes are outlined in a one-page English abstract immediately preceding in the index to Latin names.

Five of the seven gymnophione accounts are accompanied by photographs and maps, but these are lacking for *Oscaecilia zweifeli* and *Siphonops annulatus*, both of which are without confirmed precise localities in French Guiana. Here readers may note that the authors have not followed the familial subdivisions of Nussbaum and Wilkinson (1989) that are most commonly adopted in the United States, but have instead used the classification of Lescure et al. (1986), which recognizes the families Oscaeciliidae, Siphonopidae, and Typhlonectidae rather than subsuming these within the Caeciliidae.

A full account (minus map) is also provided for *Adelophryne gutturosa*, which is included as a species of possible occurrence in French Guiana. Text accounts, but no maps or illustrations, are included for *Hyla albomarginata* and *Potomotyphlus kaupii*, which the authors consider to have been erroneously included in the fauna of the country.

The main text concludes with a chapter on amphibian reproductive modes that highlights breeding sites, nest types, developmental patterns and larval strategies, and a notes section providing supplemental information to particular species accounts. A bibliography with more than 225 entries summarizes much of the literature relevant to the amphibians of the Guianas. However, as the authors note, the *Atlas* is not intended as a complete revisionary work, and so the associated literature section is not an exhaustive list of all French Guianan batrachological sources.

Finally, the book concludes with two appendices. The first provides sonograms and tabular summaries of call characteristics (duration, dominant frequency, etc.) for 85 species of frogs. The second provides local names in Creole and a number of other languages in local use in French Guiana. A glossary for the non-specialist defines 45 terms used throughout the text.

The *Atlas des Amphibiens de Guyane* is attractively laid out, with large font size and well-reproduced color photographs, providing large, clear images of each species covered. The book provides a comprehensive introduction to the amphibians of French Guiana and should be considered required for all those working with the amphibian fauna of the Neotropics. Biogeographers and all those interested in the Guianan region as a whole will undoubtedly find the distribution patterns presented of interest and the many herpetologists who are closet historians will certainly appreciate the section on naturalists of the past. The generally very good portraits along with the clear and concise text will provide many herpetologists with their first look at the amphibian fauna of this smallest of South American territories and most exotic of French departments.

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A Guide to the Herpetological Literature of Sri Lanka

INDRANEIL DAS
Institute of Biodiversity and Environmental Conservation
Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia
e-mail: idas@mailhost.unimas.my

and

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: aaron.bauer@villanova.edu

The Fourth World Congress of Herpetology will be held 2–9 December 2001, at the Bandernaike Memorial International Conference Hall, Colombo, Sri Lanka. To help colleagues prepare for the trip, we present below a guide to the literature on the herpetofauna of the island of Sri Lanka. This list is not complete, but does include a diversity of English language works including field guides, checklists, and significant taxonomic works relevant to the Sri Lankan herpetofauna. Although most works cited here date from the 20th Century, several important earlier works are also included. A selection of some rarer works, as well as representative newer publications, and books in Sinhalese (dealing chiefly with snake bite and its treatment) will be on display at the Colombo Museum during the Congress. Further information on the Congress can be obtained from the website: www.4wch.com.

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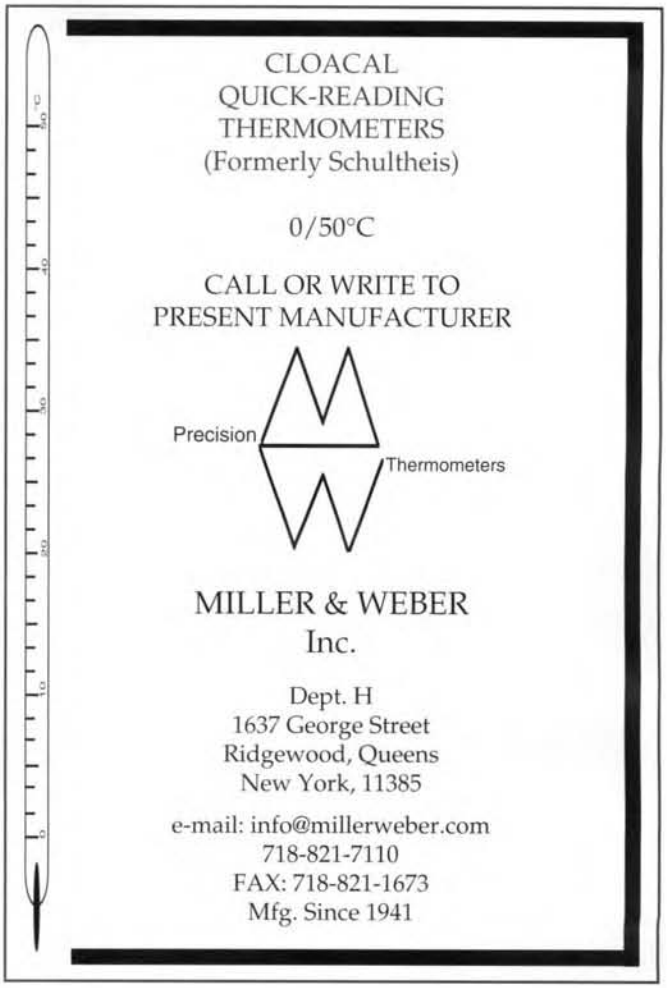
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For the specialist herpetologist, the following local journals have carried substantial papers on herpetology in the recent past: *Lyriocephalus* (published by the Amphibia and Reptile Research Organisation of Sri Lanka), *Journal of South Asian Natural History* (published by the Wildlife Heritage Trust of Sri Lanka) and *Spolia Zeylanica* (published by the Colombo Museum). Although some works from these journals are listed in the bibliography above, many additional papers (including numerous species descriptions) of herpetological relevance have appeared in these periodicals. Additional Sri Lankan references may be found in *Journal of the Bombay Natural History Society* and a diversity of regional and international journals of herpetology, zoology, natural history, and conservation.



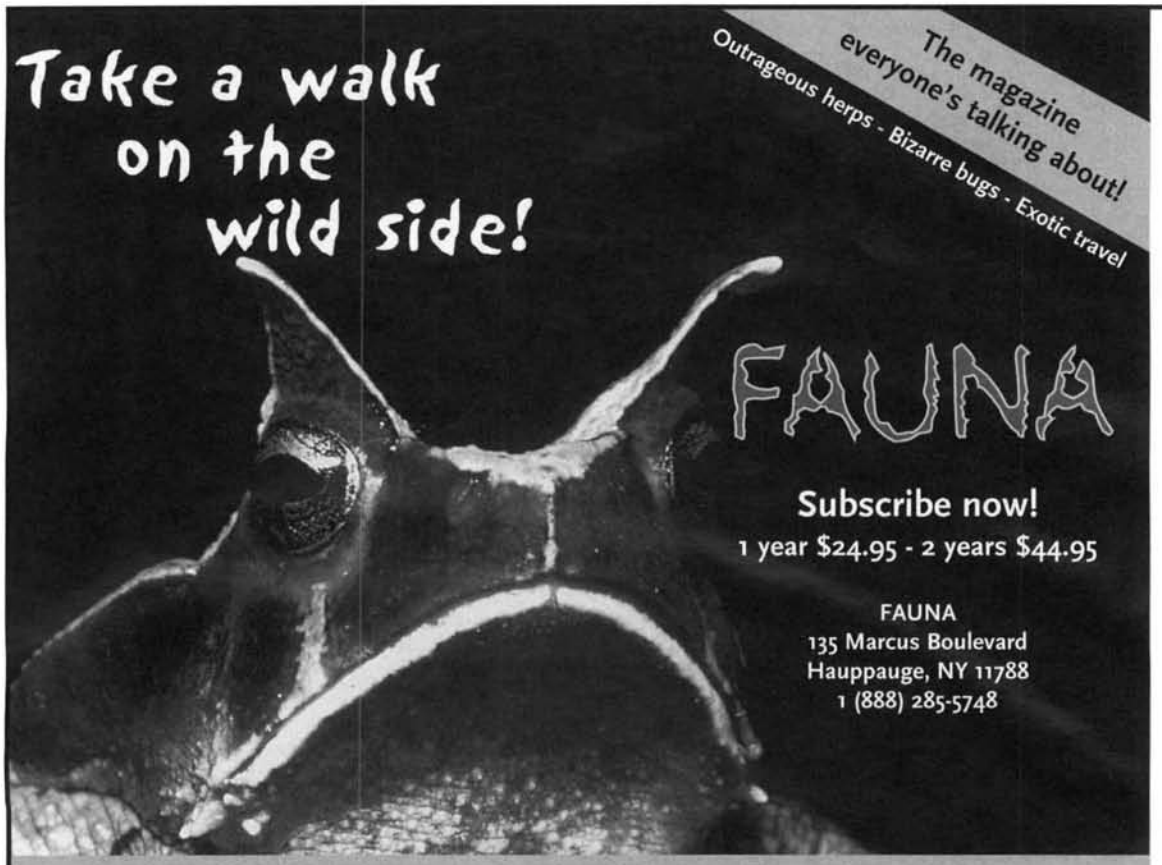
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The Amphibians and Reptiles of Alberta: A Field Guide and Primer of Boreal Herpetology, 2nd edition, by Anthony P. Russell and Aaron M. Bauer. 2000. University of Calgary Press, 2500 University Drive NW, Calgary, AB, Canada T2N 1N4. xii + 279 pp. Softcover. CAN$ 24.95 (approx. US $16.50) plus shipping.

This is a revised version of the 1993 book on the Albertan herpetofauna. In only seven years, five of the 18 species in the province have undergone name changes in association with taxonomic revisions. In addition to a revised bibliography and point locality maps, the new edition features updates to most of the text and new information about the status of amphibians and reptiles in Alberta. Numerous black and white drawings and photographs have been improved from the first edition and the color plates include a number of new images by wildlife photographer Wayne Lynch.

Hybridization Among Western Whiptail Lizards (*Cnemidophorus tigris*) in Southwestern New Mexico: Population Genetics, Morphology, and Ecology in Three Contact Zones, by Herbert C. Dessauer, Charles J. Cole, and Carol R. Townsend. 2000. Bulletin of the American Museum of Natural History 246. 148 pp. US $14.00.

This monograph examines hybridization between *Cnemidophorus tigris punctilineatus* of the Sonoran Desert and *C. t. marmoratus* of the Chihuahuan Desert along a contact zone in the Animas Valley of New Mexico. Data from mtDNA, alleles, and morphology indicate that hybridization occurs across a steep, relatively narrow step-cline that is probably the result of secondary contact following the most recent reconnection of the Sonoran and Chihuahuan Deserts within the last 5000 years. There appear to be no differences in fitness across the hybrid zone. The hybrid zones are described and illustrated in great detail, serving as a baseline for future studies of the contact between the two taxa. The research presented has broader relevance for the understanding of the evolution of parthenogenetic forms of hybrid origin, some of which are derived from *C. tigris*. Overall, this publication makes a significant contribution to the study of the complex picture of the biology and evolution of North American *Cnemidophorus*.



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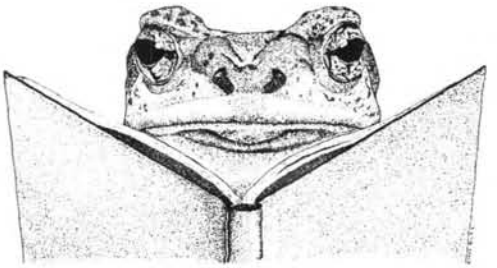
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Meetings
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Nominating
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Resolutions
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Nevada Natural Heritage Program
Department of Conservation & Natural Resources
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Seibert Awards
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Student Travel Awards
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Information for Contributors

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
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Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
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USDA Forestry Science Lab
dede.olson@orst.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

SHARYN B. MARKS
Humboldt State University
sbm1@axe.humboldt.edu

GUNTHER KÖHLER
Forschungsinstitut und
Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

DARYL R. KARNS
Hanover College
karns@hanover.edu

PAUL A. STONE
University of Central Oklahoma
pstone@ucok.edu

ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey–Foley Hall
The University of Kansas
2021 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Current Research
OMAR TORRES-CARVAJAL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
otorres@ku.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Legislation & Conservation
TRAVIS J. RYAN
Department of Biology
Furman University
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travis.ryan@furman.edu

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Current Research
ELI GREENBAUM
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
elig@ku.edu

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

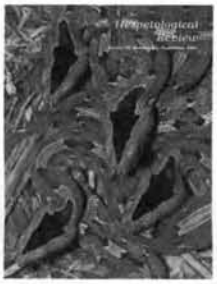
ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2001 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology,* and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@slu.edu.

Future Annual Meetings

2002 — Crown Center Hotel, Kansas City, Missouri, USA. 3–8 July 2002 (with ASIH, HL)

About Our Cover: *Bitis nasicornis*



Characterized by rather stout bodies and heavily keeled scales, the snakes of the genus *Bitis* are among the most spectacular viperids. Ranging from the Arabian peninsula to southern Africa, 14 species are currently recognized (McDiarmid et al. 1999. Snake Species of the World: A Taxonomic and Geographic Reference. Vol. 1. The Herpetologists League, Washington, D.C. 511 pp.). Considerable size variation exists among *Bitis* species. The largest member of the group, the Gaboon Viper (*Bitis gabonica*), reaches lengths of over two meters and weights exceeding 10 kg (Pitman 1974. A Guide to the Snakes of Uganda. Revised ed. Wheldon & Wesley, Codicote, England. 290 pp.). The Namaqua Dwarf Adder (*Bitis schneideri*), the smallest adder in the world, averages just 20–25 cm in total length (Spawls and Branch 1995. The Dangerous Snakes of Africa. Ralph Curtis Books, Sanibel Island, Florida. 192 pp.).

Bitis nasicornis, known as the Rhinoceros Viper due to the horn-like appendages decorating its snout, is one of the more strikingly-patterned forms. Recent phylogenetic analysis based upon mitochondrial DNA sequences corresponds with immunological and morphological evidence in suggesting that it is closely related to *Bitis gabonica*, but not to the other large species within the genus (Lenk et al. 2001. Molecular Phylogenetics and Evolution 19:94–104).

Essentially a denizen of equatorial forest, the Rhinoceros Viper earned the name of 'River Jack' by early naturalists for its affinity for water. This impressive snake also appears to inhabit the dense undergrowth around farms and plantations where its cryptic pattern and colors allow it to remain effectively hidden. The function of the modified rostral projections on its snout is unknown, but may aid in crypsis. Primarily terrestrial in habits, specimens have been found in trees. Climbing however, can present a potential physiological problem for such a large, stout-bodied snake. Larger specimens of *Bitis* are unable to maintain minimal levels of carotid blood flow when tilted at angles exceeding 30°. Fully erect vertical positions cannot be maintained for very long periods without experiencing problems associated with syncope and pulmonary edema (Lillywhite and Smits 1992. *In* J. A. Campbell and E. D. Brodie, Jr. [eds.], Biology of the Pitvipers, pp. 143–154. Selva, Tyler, Texas).

The Rhinoceros Viper is actively hunted in Africa as an important source of protein. In Nigeria, Luiselli et al. (1998. Amphibia-Reptilia 19:223–229) found it was frequently traded in bushmeat markets as food and as "totems" in animistic religious cults. Occasionally featured as "bushmeat of the day" in some restaurants in Cameroon, the Rhinoceros Viper also appears to be used in a dried form by locals as a preventative against snake bite in the field (Lawson 1993. Herpetol. Nat. Hist. 1[2]:27–90).

The 25–28 cm long juvenile *Bitis nasicornis* depicted on the cover were photographed by **R. Michael Burger** at the San Antonio Zoo in 1998. Michael's intent was to capture the symmetry created by the four javelin-shaped cephalic markings against the complexity of the interwoven dorsal patterns, resulting in a directional flow in the photograph. The equipment used in obtaining the image included a Nikon 401x camera with a Sigma 90 mm f2.8 macro lens, a Nikon SB-23 flash, and Fujichrome Provia film. "Seeing the image and actually capturing it on film are sometimes two entirely different things," Michael freely admits, "though *Bitis nasicornis* tend to make good photographic subjects due to their sedentary nature." A member of Dallas Zoo's Department of Herpetology, his pen-and-ink drawings, photography, and articles have appeared in a variety of U.S. and European publications, including *Herpetological Review*. Michael is shown here photographing a *Norops* species at Caño Palma Biological Station near Tortuguero, Costa Rica.



Separation and imaging of Burger's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

NEWSNOTES

Sociedad Herpetológica Mexicana

The Sociedad Herpetológica Mexicana (SHM) is a non-governmental organization founded in 1988. The main objectives of the SHM are the interchange of ideas, attempts to increase knowledge of amphibians and reptiles, and provide communication among herpetologists and other biologists interested in the herpetofauna of Mexico through its publications (SHM *Bulletin*) and biannual meeting. Accordingly, SHM welcomes the donation of relevant books, reprints, or other herp-related materials that would further these aims. Donated materials can be sent directly to: *Aurelio Ramírez Bautista, SHM President, Lab. de Ecología, UBIPRO, FES-Iztacala, UNAM, Av. de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Edo. de México. C.P. 54090, Mexico; e-mail: raurelio@servidor.unam.mx.*

Annual dues are US $30.00 for persons outside of Mexico (this includes delivery costs for the SHM *Bulletin*), and $ 150.00 pesos ($ 75.00 pesos for students) (MN) for residents of Mexico. To become a SHM member, please contact: *M. en C. Guadalupe Gutiérrez-Mayén, SHM Treasurer, Universidad Autónoma de Puebla, Escuela de Biología, Edif. 76, Ciudad Universitaria, 75570 Puebla, Puebla, Mexico; e-mail: mggitier@siu.buap.mx.*

For additional information about the SHM, please visit their website (in Spanish): http://www.ecosur.mx/shm/pagshm.htm.

MEETINGS

Current Research on Herpetofauna of the Sonoran Desert II 5–7 April 2002

The Tucson Herpetological Society (THS) and co-sponsors announce the second meeting of *Current Research on Herpetofauna of the Sonoran Desert* (CRHSD II), to be held at the Four Points by Sheraton Tucson University Plaza, Tucson, Arizona, 5–7 April 2002. The goals of this meeting are twofold: 1) dissemination of information concerning research on the herpetofauna of the Sonoran Desert, the States of Arizona and Sonora, and the Baja California peninsula and associated islands, and 2) the social interaction of everyone attending the meeting. There will be a Friday evening Icebreaker Social, Scientific Sessions on Saturday and Sunday, and a Saturday evening Banquet. Invited speakers are Daniel D. Beck and Harry W. Greene.

Information on the CRHSD II meeting is available on the THS web site <http://tucsonherpsociety.org> and from Roger Repp (tel. 520-318-8210, e-mail: rrepp@noao.edu) or David L. Hardy Sr. (tel. 520-624-8879, e-mail: dhardysr@theriver.com).

Another New Book from the Society for the Study of Amphibians and Reptiles

THE AMPHIBIANS OF HONDURAS

by James R. McCranie and Larry David Wilson

The first complete treatment of the amphibians of any Mesoamerican country . . . . The present work, a product of 15 years of labor, will surely stand as a model in tropical herpetology for completeness, accuracy, attention to detail, and scholarship . . . . A major contribution to our knowledge of Central American herpetology. — JAY M. SAVAGE, from the Foreword.



HONDURAS IS THE SECOND LARGEST OF THE seven Central American countries. Its amphibian fauna, however, has been the least known in the region and numerous studies have referred to the "Honduran hiatus" in distribution and in our understanding of the systematics of indigenous species. The authors, James R. McCranie and Larry David Wilson, who began field work in Honduras in 1976 and 1967, respectively, have made an intensive study of the amphibian fauna and have now produced a





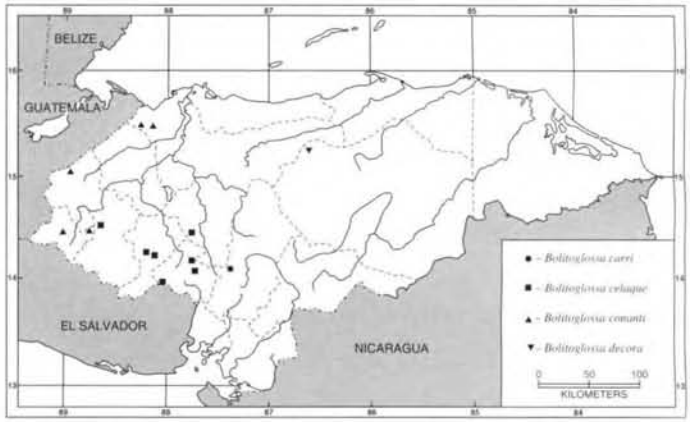
book that will serve to make the amphibian fauna of Honduras one of the best known in the world. They have spent a total of more than 1500 days in the field and have personal field experience with nearly every species. They have examined more than 9500 adult specimens and about 500 lots of tadpoles and egg clutches in researching this book. The result is a model faunal study that will be a welcome reference for scientists and conservationists alike. It will be a reminder of the potential loss of biodiversity in a country in which deforestation and loss of habitat have greatly accelerated over the last decade.

The Honduran amphibian fauna consists of 116 species of caecilians (2 species), salamanders (25), and frogs (89), including members of nine families: Caeciliidae (2), Plethodontidae (25), Bufonidae (8), Centrolenidae (8), Hylidae (31), Leptodactylidae (33), Microhylidae (3), Ranidae (5), and Rhinophrynidae (1). The book has ex-



tensively illustrated identification keys, a discussion of reproductive modes and ecomorphological guilds, distribution, and essays about the human impact on, and future of, the Honduran amphibian fauna. The bulk of the book consists of detailed accounts of the species (each one includes synonymy, range, diagnosis, description of adult [and tadpole where applicable], references to published illustrations, remarks, ecological distribution, natural history, etymology, and specimens examined).

There is a gazetteer of Honduran localities, a glossary, a comprehensive literature cited section, and indexes to authors and taxa. Finally, there are **20 COLOR PLATES** including 24 photographs of habitats and 130 of amphibians.



Map 5. Localities for four species of the Bolitoglossa dunni *group.*

Specifications: about 400 pages, 7 x 10 inches, 123 maps and figures, 33 tables, 20 color plates, clothbound. ISBN 0–916984–57–5. To be published December 2001.

PRICES: Pre-publication to SSAR members US$50; Institutions and non-members US$60. *SHIPPING:* USA address, add US$4; non-USA, US$8

SEND ORDERS TO: Dr. Robert D. Aldridge, SSAR Publications Secretary, Department of Biology, Saint Louis University, 3507 Laclede Avenue, Saint Louis, Missouri 63103–2010, USA (*telephone:* area code 314–977–3916 or 977–1710; *fax:* 314–977–3658; *e-mail:* ssar@slu.edu). Please make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks or by International Money Order. Orders may also be charged to MasterCard or VISA (please provide the account number and card expiration date). SSAR membership information and a complete list of all Society publications can be obtained on request to Dr. Aldridge.

Meetings Calendar

2–4 November 2001—28th Annual Meeting, Kansas Herpetological Society, Topeka, Kansas, USA. http://eagle.cc.ukans.edu/~cnaar/khs/AnnualMeetingInfo.html.

2–9 December 2001—Fourth World Congress of Herpetology, Colombo, Sri Lanka. Details from: 4WCH Promotions Office, 95 Cotta Road, Colombo 8, Sri Lanka; e-mail: admin@4wch.com; http://www.4wch.com.

5–7 April 2002—Current Research on Herpetofauna of the Sonoran Desert II, Tucson, Arizona, USA. http://tucsonherpsociety.org.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres-Carvajal**; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Influence of Antipredator Defenses in the Distribution of Amphibian Prey Species

Species distributions can be influenced by prey antipredator defenses. After a three-year study at the Reserva Florestal Adolfo Ducke in Brazilian Amazonia, Hero et al. described how defenses against predators influence the composition of a tadpole assemblage. The predators analyzed were the fish *Pyrrhulina* sp. and the dragonfly naiad *Gynacantha membranalis*. Unpalatability, an effective defense mechanism of tadpoles against one of the predators (fish), was found to influence the composition of tadpole assemblages within bodies of water. Because unpalatability is not effective against all predators, it is the heterogeneous distribution of fish and insect predators among bodies of water that increases prey species diversity at the community level. Thus, antipredator defenses and predator distribution influence alpha and beta diversity of this anuran community.

Hero, J.-M., W. E. Magnusson, C. F. Rocha, and C. P. Catterall. 2001. Antipredator defenses influence the distribution of amphibian prey species in the central Amazon rain forest. Biotropica 33(1):131–141.

Correspondence to: Jean-Marc Hero, School of Environmental and Applied Sciences, Griffith University Gold Coast, PMB 50 Gold Coast MC, Queensland 9726, Australia; e-mail: M.Hero@mailbox.gu.edu.au.

Prepollex and Prehallux Variation in Anurans

Most anurans have a prepollex and prehallux. Fabrezi investigated the variation of these poorly studied structures in more than 100 species of anurans and analyzed their ontogeny in some neotropical species. The author found that the morphological diversity of the prepollex and prehallux is based on the number and characteristics of the distal elements of these structures. Ontogenetic analysis revealed that the prepollex and prehallux differentiate in a proximo-distal sequence, distal to Element Y. Fabrezi also presents further evidence for non-homology between these structures and true digits. The most widespread morphology of the prepollex/prehallux corresponds to two distinct elements, of which the distal one is more or less developed. Several unrelated species of anurans have well-developed distal elements, which apparently have defined ecological roles. The occurrence of the prepollex and prehallux in other lissamphibians and extinct groups needs to be investigated in order to interpret these structures in the evolution of tetrapod limbs.

Fabrezi, M. 2001. A survey of prepollex and prehallux variation in anuran limbs. Zoological Journal of the Linnean Society 131:227–248.

Correspondence to: Marissa Fabrezi, Museo de Ciencias Naturales, Universidad Nacional de Salta, Mendoza 2, 4400-Salta, Argentina; e-mail: museo@ciunsa.edu.ar.

A New Fossil Caecilian from Africa

The oldest known fossil caecilian is *Eocaecilia* from the Lower Jurassic Kayenta Formation of western Arizona. The authors describe the second oldest fossil of the group from a Lower Cretaceous microfossil locality in the eastern High Atlas Mountains, Morocco. *Rubricacaecilia monbaroni* is described from elements of the mandible, as well as several vertebrae, a palatine, and a possible limb bone. Based on the length of the lower jaw, the authors estimate that the specimen was about 20 cm long. *R. monbaroni* differs from all known caecilians, living and fossil, in several osteological features, one of the most interesting being the retention of a tuberculum interglenoideum on the atlas. The tuberculum interglenoideum is absent in all other caecilians except the fossil *Eocaecilia*; among living amphibians it is present in salamanders only. *Rubricacaecilia* has a unique combination of osteological characters, which place it between *Eocaecilia* and more derived caecilians. The authors conclude that, among Gymnophiona, *Rubricacaecilia* is the most basal taxon after *Eocaecilia*. Whether *Rubricacaecilia* represents the morphological stage of Gondwanan caecilians at the Lower Cretaceous cannot be answered without additional material.

Evans, S., and D. Sigogneau-Russell. 2001. A stem-group caecilian (Lissamphibia: Gymnophiona) from the Lower Cretaceous of north Africa. Palaeontology 44(2):259–273.

Correspondence to: Susan E. Evans, Department of Anatomy and Developmental Biology, University College London, Gower Street, London, WC1E 6BT, UK.

Response of Red-sided Garter Snakes to Pheromones

Pheromones are among the chemical signals used by many animals for orientation. Some snakes make pheromone trails in order to guide conspecifics to the location of potential mates or location of winter hibernacula. The authors investigated the conspecific trailing behavior of *Thamnophis sirtalis parietalis* in a natural environment by carrying out two field experiments within the Interlake region of Manitoba, Canada. The experiments were performed during the breeding season and the period of migration. The authors tested the response of both sexes to conspecific pheromone trails. It was found that only adult males use pheromone trails for locating potential mates. Neither males nor females used the pheromone trails for location of winter hibernacula, which contradicts previous laboratory-based studies. However, this discrepancy might be due to differences in experimental design. In addition, the authors found a significant trend for females to avoid male pheromone trails near the hibernacula during the period of migration. This suggests that females tend to escape male courtship at the winter hibernacula. Trail avoidance behavior is something that requires further study.

LeMaster, M. P., I. T. Moore, and R. T. Mason. 2001. Conspecific trailing behaviour of red-sided garter snakes, *Thamnophis sirtalis parietalis*, in the natural environment. Animal Behaviour 61:827–833.

Correspondence to: M. P. LeMaster, Department of Zoology, 3029 Cordley Hall, Oregon State University, Corvallis, Oregon 97331-2914, USA; e-mail: lemastem@bcc.orst.edu.

Lung-inflation Mechanisms of an Agamid Lizard

Traditional views have stated that amniotes utilize aspiratory pumping as their sole means of breathing. However, recent studies in varanids have demonstrated that lizards can expand the lungs via gular pumping. In order to elucidate the pattern of breathing in agamid lizards, 14 *Uromastyx aegypticus* were collected in Saudi Arabia; electromyogram, electrocardiogram, and plethysmography data were collected. The primary mode of breathing was a triphasic lung inflation and deflation involving the intercostal muscles. When the lizards were prodded or experienced temperatures above 30°C the buccal pump was utilized. This alternate form of breathing involves the sphincter colli and the geniohyoid muscles. The two forms of breathing never occurred simultaneously; buccal pumping invariably followed thoracic breathing after the second expiration. The authors demonstrated that the buccal pump was controlled by a Hering-Breuer reflex. Although it is tempting to classify the buccal pump as a structure with a respiratory role, the authors caution that more research is necessary to confirm this hypothesis.

Al-Ghamdi, M. S. A. D., J. F. X. Jones, and E. W. Taylor. 2001. Evidence of a functional role in lung inflation for the buccal pump in the agamid lizard *Uromastyx aegypticus microlepis*. Journal of Experimental Biology 204:521–531.

Correspondence to: E. W. Taylor, School of Biosciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, United Kingdom; e-mail: e.w.taylor@bham.ac.uk.

Amphibian Colonization of Restored Wetlands

The great loss of wetlands in the United States has led to restoration projects in an attempt to provide habitat for native wetland biota. The authors studied colonization of seven restored wetlands in southern Minnesota by pond-breeding amphibians. The restored wetlands were former agricultural fields or located in an urban area. Chorusing and visual encounter surveys as well as larval sampling were performed to find amphibians in these wetlands. Distance to source ponds, restored wetland size, and dispersal abilities were significant predictors of species richness, whereas restored wetland age and distance to forest patches were not. Four species of amphibians—*Rana clamitans, Pseudacris crucifer, Ambystoma laterale,* and *Notophthalmus viridescens*—occurring in adjacent, unimpacted wetlands, were not found in restored wetlands. The importance of isolation and patch size in restored wetlands supports the idea that many amphibian populations have a metapopulation structure caused by low vagility, philopatry, and patchy breeding habitat. The authors demonstrated that restored wetlands provide adequate habitat for at least some species of pond-breeding amphibians and suggest that factors such as spatial isolation and habitat suitability should be considered in wetland restoration projects.

Lehtinen, R. M., and S. M. Galatowitsch. 2001. Colonization of restored wetlands by amphibians in Minnesota. American Midland Naturalist 145(2):388–396.

Correspondence to: Richard M. Lehtinen, Division of Reptiles and Amphibians, Museum of Zoology, University of Michigan, Ann Arbor, Michigan 48109-1079, USA; e-mail: rmlehtin@umich.edu.

The Midblastula Transition Prevents Apoptosis in *Xenopus* Embryos

Ionizing radiation administered to *Xenopus* embryos results in DNA damage and apoptosis before, but not after, the midblastula transition (MBT). The authors investigated the molecular mechanisms responsible for the prevention of apoptosis after the MBT. Phosphorylation experiments indicated that the serine/threonine kinase Akt (or protein kinase B) may participate in the antiapoptotic signaling pathway of embryos irradiated after the MBT. Constitutively active Akt delayed apoptosis in embryos irradiated before the MBT but did not completely prevent apoptosis from occurring. Results also indicated that two gene products (Bax and Bcl-2) interact to prevent apoptosis after the MBT. Moreover, the cdk inhibitor $p27^{Xic1}$ can arrest cells in the G_1 phase (post-MBT) or bind with cyclin complexes to arrest cells at the G_1/S transition. Apoptosis is prevented after the MBT by the coordinated efforts of these components.

Finkelstein, C. V., A. L. Lewellyn, and J. L. Maller. 2001. The midblastula transition in *Xenopus* embryos activates multiple pathways to prevent apoptosis in response to DNA damage. Proceedings of the National Academy of Sciences 98:1006–1011.

Correspondence to: James L. Maller, Department of Pharmacology, University of Colorado School of Medicine, Box C-236, Denver, Colorado 80262, USA; e-mail: Jim.Maller@uchsc.edu.

Family Structure in an Australian Scincid Lizard

Previous studies have documented the existence of stable family groups in lizards, but none have utilized genetic markers to document the relationship of the members. The authors examined genotypes of six microsatellite loci in a stable group of *Egernia stokesii* from South Australia. Average relatedness was calculated with RELATEDNESS 5.04, genetic distance between pairs of groups was calculated with MICROSAT, and a Mantel test (GENEPOP v3.16) tested for correlations between dispersal of groups and geographic distance. The average relatedness among all lizards of the study was –0.0106; relatedness was not significantly different among members of either sex. Relatedness data indicated that parents and offspring belonged to the same social group in most cases. Average within-group relatedness among the sexes suggested that these lizards have sex-biased dispersal, with males dispersing from social groups more often than females. However, all adults showed a tendency to associate with related individuals. Mantel tests indicated that individuals tended to disperse to proximate groups more often than distant groups—however this correlation was noted as weak. Although the relatedness of members of each group was high, individuals tended to seek out mates that were unrelated. Kin recognition may help these lizards to avoid inbreeding.

GARDNER, M. G., C. M. BULL, S. J. B. COOPER, AND G. A. DUFFIELD. 2001. Genetic evidence for a family structure in stable social aggregations of the Australian lizard *Egernia stokesii*. Molecular Ecology 10:175–183.

Correspondence to: C. M. Bull, School of Biological Sciences, Flinders University, Adelaide, Australia; e-mail: Michael.Bull@flinders.edu.au.

Predation on Frogs and Lizards in a Panamanian Humid Forest

Many trophic relationships of tropical ecosystems are poorly documented, especially predator-prey interactions. The authors studied bird predation on frogs and lizards in a Panamanian humid forest to assess whether: 1) bird species that prey upon vertebrates are larger or more social (when foraging) than those species that do not eat vertebrates; 2) a decrease in arthropod prey will increase the likelihood of eating vertebrate prey; 3) frog-eating species are more selective in their prey choice compared to lizard-eating species. Birds were captured over a 13 month period with mist nets in 8 transects (35 m apart), forced to regurgitate prey items, banded, and released. Relative abundance of frogs and lizards was estimated from diurnal censuses; arthropod abundance was estimated from sweep-net samples in close proximity to the mist net sites. Forward stepwise-computed multiple logistic and linear regression analyses were used to identify vertebrate-eating bird species and factors accounting for frog or lizard intake over time.

Based on regurgitates, birds preyed upon *Anolis*, *Ameiva*, and *Eleutherodactylus*—but not on *Colostethus* and *Bufo* which were the two most common anuran genera. The probability of predation upon lizards was highest when birds followed army-ant swarms; predation on frogs was best explained by the variables of bill length and body length of birds. Breeding activity and arthropod abundance explained seasonal variation in lizard predation; seasonal variation in frog predation was explained by frog abundance.

POULIN, B., G. LEFEBVRE, R. IBÁÑEZ, C. JARAMILLO, C. HERNÁNDEZ, AND A. S. RAND. 2001. Avian predation upon lizards and frogs in a neotropical forest understory. Journal of Tropical Ecology 17:21–40.

Correspondence to: Brigitte Poulin, Station Biologique de la Tour du Valat, Le Sambuc, 13200 Arles, France.

Effects of UV-B Radiation on Diet of Bufonid Tadpoles

Depletion of the ozone layer can lead to increased levels of UV-B radiation and deleterious effects to freshwater ecosystems. The authors tested the effects of UV-B radiation on phytoplankton and its resulting nutritional value to *Bufo boreas* tadpoles. Algae were grown on microscope slides at four localities in Colorado; tadpoles were collected from each locality. Periphyton was grown in glass boxes with mylar-covered, acetate-covered, or open tops to allow different levels of UV-B radiation to enter each box. In general, as altitude increased, protein concentration decreased and chlorophyll concentration increased. Although density of algae did not differ among the treatment groups, the composition of taxonomic groups varied. Open treatment samples were not significantly different from tadpole gut contents. Because tadpoles were not selectively feeding, the nutritional quality of available algae may have affected the development and fitness of these tadpoles.

ROGERS, K., A. SCHMIDT, J. WILKINSON, AND T. MERZ. 2001. Effects of incident UV-B radiation on periphyton in four alpine freshwater ecosystems in central Colorado: impacts on boreal toad tadpoles (*Bufo boreas*). Journal of Freshwater Ecology 16:283–301.

Correspondence to: Karel Rogers, Biology Department, Grand Valley State University, Allendale, Michigan 49401-9403, USA; e-mail: rogersk@gvsu.edu.

Costs of Predator-induced Phenotypes in Ranid Tadpoles

Tadpoles raised in the presence of predators often develop adaptive phenotypes, but the costs of these phenotypes are difficult to quantify. The authors examined the performance of tadpoles with predator-induced phenotypes during and immediately after metamorphosis. Tadpoles of *Rana ridibunda* were raised in outdoor tanks with either no predators or a single late-instar dragonfly larvae confined to a cage. Tadpoles were collected 37 and 46 days after hatching, photographed in lateral and ventral views, and returned to the tanks. These photographs were used to obtain measurements of the tadpoles. Once the tadpoles displayed forelimbs, they were removed from the tanks to facilitate daily measurements and estimate development rate. Froglets were allowed to hop on a flat table to measure hopping performance before preservation in 10% formalin. Results indicated that the morphology of tadpoles differed between treatments, and froglets from the caged-predator tanks developed through metamorphosis slightly faster than the control group. Although froglets from the caged-predator tanks

had short and muscular legs compared to those from tanks without predators, hopping performances did not differ significantly between treatment groups.

VAN BUSKIRK, J., AND G. SAXER. 2001. Delayed costs of an induced defense in tadpoles? Morphology, hopping, and development rate at metamorphosis. Evolution 55:821–829.

Correspondence to: Josh Van Buskirk, Institute of Zoology, University of Zürich, CH-8057 Zürich, Switzerland; e-mail: jvb@zool.unizh.ch.

Egg Activation of the Newt, *Cynops pyrrhogaster*

An increase of intracellular Ca^{2+} levels triggered from fertilizing sperm can activate eggs in many groups of animals. However, an artificial increase of 1,4,5-trisphosphate (IP_3) levels can induce a transient increase of intracellular Ca^{2+} levels as well. The authors studied factors leading to increased intracellular Ca^{2+} levels in the newt, *Cynops pyrrhogaster*. Sperm extract was obtained from adult male newts and injected into adult female eggs. Intra-



SSAR Grants-in-Herpetology

Proposals are now being accepted for the 2002 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include *in situ* behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

6. INTERNATIONAL. Proposals may address needs in any of the above five categories, but applicants must be from countries where herpetological research has historically been underfunded, and where alternative sources of financial support are scarce or nonexistent.

7. BIBLIOGRAPHIC RESEARCH. This special category continues for 2002 thanks to a donation from Itzchak and Carolyn Gilboa. Proposals should address a major need to consult library or other information resources. The project must focus on a herpetological topic. Proposals from individuals only, accompanied by a letter of support from someone knowledgeable about the applicant and about the importance of the project.

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be students AND members of the SSAR with the exception of those applying for support of regional herpetological society projects, or those applying in the international category. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 2001 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. Past recipients of an SSAR GIH award in any category are not eligible for future awards. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) TITLE PAGE giving the title of the project, the name, mailing address, office and home telephone numbers and, if possible, fax number and e-mail address of the applicant. The title page should include a statement indicating that applicants "will comply with all applicable permit regulations, and adhere to all appropriate animal care guidelines in the course of conducting funded projects." (B) BACKGROUND AND OBJECTIVES of the proposed project. (C) METHODS of carrying out the project. (D) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). Include an explicit explanation of how an SSAR award of $500 would be applied toward the objectives of the project, and provide a listing of all current and pending support for the project. (E) BRIEF RESUMÉ of the applicant or project coordinator. (F) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed 1200 words, excluding title page, literature cited, resumé, and budget. Applicants must indicate word count on their application.

Applicants must designate to which of the seven categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than **31 DECEMBER 2001** to be considered. Failure to meet these guidelines may result in elimination of a proposal from consideration. The awards will be announced on or around 1 April 2002. Successful applicants are encouraged to submit the results of their research for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Erik R. Wild, Chair, SSAR Grants-in-Herpetology, Department of Biology, University of Wisconsin - Stevens Point, Stevens Point, Wisconsin 54481-3897, USA. Tel. (715) 346-4269; Fax (715) 346-3624; e-mail: ewild@uwsp.edu.*

cellular Ca^{2+} levels, Ca^{2+} waves, cyclin B1, and BrdU incorporation into DNA was measured. Results indicated that a proteinaceous factor from sperm cytoplasm had the ability to activate eggs via a transient increase in intracellular Ca^{2+} levels. Increased levels of intracellular Ca^{2+} was also caused by the injection of IP3, but ryanodine receptors did not cause a similar effect. It is not yet clear if the sperm cytoplasmic factor is the primary cause of egg activation in newts.

YAMAMOTO, S., H. Y. KUBOTA, Y. YOSHIMOTO, AND Y. IWAO. 2001. Injection of a sperm extract triggers egg activation in the newt *Cynops pyrrhogaster*. Developmental Biology 230:89–99.

Correspondence to: Satoshi Yamamoto, Department of Biological Science, Faculty of Science, Yamaguchi University, 753-8512 Yamaguchi, Japan.

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from

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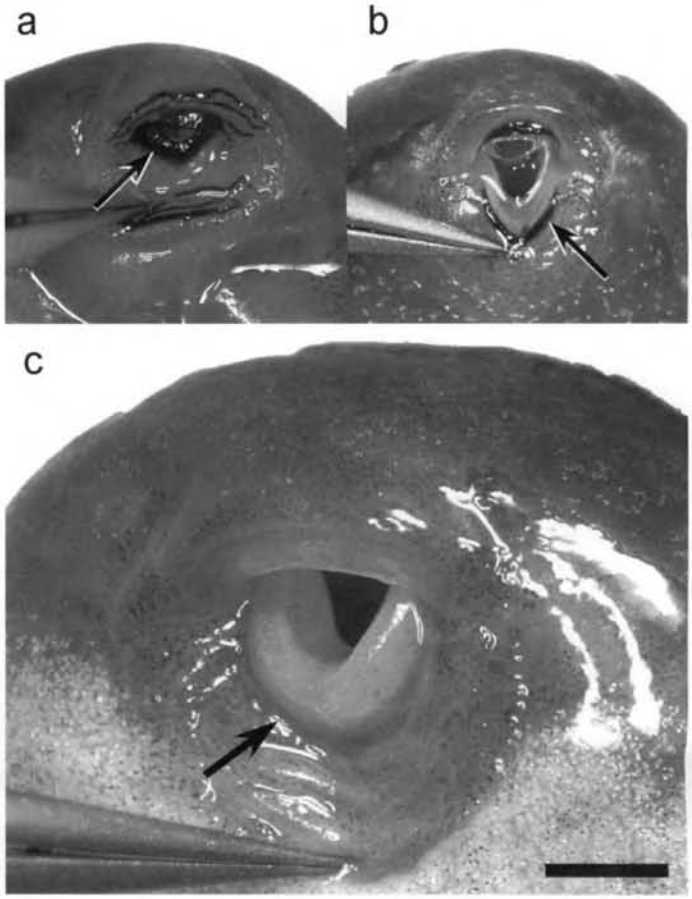
LETTERS TO THE EDITOR

Herpetological Review, 2001, 32(3), 151–152.
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Field Identification of Chytridiomycosis in *Rana muscosa* (Camp 1915)

VANCE T. VREDENBURG
and
ADAM P. SUMMERS
Museum of Vertebrate Zoology, University of California
Berkeley, California 94720, USA
e-mail (VTV): vancev@socrates.berkeley.edu

A chytrid fungus, *Batrachochytrium dendrobatidis*, causes the deterioration of the keratinized mouthparts of tadpoles (Nichols et al. 2001), and has been implicated in amphibian declines in Australia, the Neotropics, and in Europe (Berger et al. 1998; Bosch et al. 2001). The fungus is widespread, and has been identified on six continents: Africa, South America, Central America, North America, Europe, and Australia (Speare and Berger 2000). In California, chytrids have been identified in nine amphibian taxa (*Rana muscosa*, *Rana aurora draytonii*, *Rana aurora aurora*, *Rana boylii*, *Rana catesbeiana*, *Bufo canorus*, *Hyla regilla*, *Spea hammondii*, and *Ambystoma macrodactylum croceum*; Fellers et al., *in press*); however, it is not known whether they are the cause of population declines. Because the fungus grows on keratinized tadpole mouthparts, we believe field assessment of tadpole populations, and the



collection of voucher specimens, will be an important tool in determining the extent and severity of chytrid infection. This should be particularly easy in frogs with large tadpoles such as the mountain yellow-legged frog, *R. muscosa* (Vredenburg et al., *in press*). The symptoms of chytridiomycosis include loss of black pigment from jaw sheaths and tooth rows within 1–3 weeks of infection (Fellers et al., *in press*).

The photograph above shows *R. muscosa* with two potential stages of chytridiomycosis infection b), and c) and one apparently uninfected animal a). The arrow indicates the lower jaw sheath in all three photos. Notice that a) has complete tooth rows and dark jaw sheaths while b) is lacking dark tooth rows and has only a thin dark line on the jaw sheaths. In c) the beak and tooth rows are completely colorless. Tadpole a) was collected in 1976 near Sonora Pass, Alpine County, California, USA (MVZ 137435). Tadpoles b), and c) were collected near Ebbetts Pass, 2 June 2001, Alpine County, California, USA (MVZ, not accessioned). Tadpoles b) and c) are being histologically analyzed. Recently, however, J. Longcore (pers. comm.) cultivated a *Batrachochytrium* fungus from *R. muscosa* in the Sierra Nevada and we expect these will also contain the fungus.

We ask that any herpetologists encountering tadpoles in the Sierra Nevada pay careful attention to tadpole mouthparts and report any occurrences to the authors (e-mail: vancev@socrates.berkeley.edu). If proper permits are attained, a single voucher should be placed in 95% ethanol and sent to the primary author. We will maintain a website with information on the chytrid situation in the Sierra Nevada:

<http://dlp.cs.berkeley.edu/aw/chytrid/>

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Herpetological Review, 2001, 32(3), 152–153.

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Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico: Errata

BRIAN I. CROTHER
Department of Biology, Southeastern Louisiana University
Hammond, Louisiana 70402, USA
e-mail: bcrother@selu.edu

JEFF BOUNDY
Fur and Refuge Division, Louisiana Department of Wildlife and Fisheries
P.O. Box 98,000, Baton Rouge, Louisiana 70898-9000, USA

KEVIN DE QUIEROZ
Department of Vertebrate Zoology, National Museum of Natural History
Smithsonian Institution, Washington, DC 20560, USA

DARREL FROST
Department of Vertebrate Zoology, American Museum of Natural History
Central Park West at 79th Street, New York, New York 10024-5192, USA

This note lists corrections for the most recent list of scientific and standard English names of North American amphibians and reptiles north of Mexico (Crother et al. 2000). To avoid future problems, please mark these corrections on your list.

ANURA

p. 7: *Bufo boreas boreas* Baird and Girard should be dated 1852, not 1853.

pp. 7–8: *Bufo velatus* is placed in both the synonymy of *Bufo fowleri* and as a subspecies of *Bufo woodhousii*. This is in error although the correct placement of the name is inherently controversial. Sullivan, Malmos, and Given, 1996, Copeia, 1996: 274-280, noted that nominal *velatus* sits within the hybrid zone of *Bufo fowleri* and *Bufo woodhousii*, and at this time should not be recognized.

p. 8 *Bufo valliceps*: Populations in the USA and northeastern Mexico should now be called *Bufo nebulifer* according to Mulcahy and Mendelson (2000, Mol. Phylogenet. Evol. 17:173).

p. 10, 2nd line. *Pternohyla* listed twice.

p. 15 *R. sphenocephala*: Change "leaving the unusual situation where the subspecies name *utricularia* has priority over the younger species name *sphenocephala*" to "leaving the unusual situation where the younger species name *sphenocephala* has nomenclatural priority over the older subspecies name *utricularia*."

p. 15 *Rana virgatipes*: Change "Cryptic species are not expected" to "Data presented by Pytel, Herpetologica 42(3):273, suggest that careful evaluation for cryptic species are warranted."

SAURIA

p. 34 *C. arizonae*: Insert "Lowe" (before "op. cit.") at the end of the last sentence of the note. The citation should read "Wright and Lowe (op. cit.)."

p. 35 *C. h. beldingi*: Insert a space after "Grismer" at the beginning of the last sentence of the note.

p. 38 *C. t. stejnegeri*: In the last sentence, delete "endemic" after "*C. t. multiscutatus*" and insert it after "insular." The sentence should read: "Following Maslin and Walker (1981), we have treated *C. t. multiscutatus* (type locality: Isla Cedros, Baja California) as the name of an insular endemic and *C. t. stejnegeri* (type locality: Ensenada, Baja California) as the name of the subspecies occurring in coastal southern California."

p. 49 *Phyllodactylus*: LEAFTOED GECKOS (without a hyphen) should read LEAF-TOED GECKOS (with a hyphen).

p. 53 *S. a. argus*: Insert "by" after "was not reported" in the note. The passage should read: "the subspecific identification was not reported by them but was given..."

p. 54 *S. n. notatus*: Insert "1858" (in parentheses) after "1859" (not in parentheses).

p. 54 *U. microscutatus*: Delete the terminal "s" in "Small-scaled lizards."

SERPENTES

p. 64 *L. g. nigra*: *niger* should be spelled *nigra*.

p. 67 *N. s. sipedon*: Common Watersnake should read Northern Watersnake.

p. 69 *R. braminus*: Insert "b" in front of *raminus*. Should be spelled *R. braminus*.

CROCODILIA

p. 74 *Alligator*: *mississipiensis* should be spelled with two p's: *mississippiensis*.

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CROTHER, BRIAN I. (ed.). 2000. Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding. SSAR Herpetological Circular 29. iii + 82 pp.

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

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Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 2001, with notification by 1 December 2001. Grantees are expected to complete their Academy visit by 15 September 2002. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

The CAS holdings are included in the Department of Herpetology database:

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ARTICLES

Herpetological Review, 2001, 32(3), 153–156.
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New Localities and Natural History Notes on *Bipes canaliculatus* in Guerrero, México

WENDY L. HODGES
Section of Integrative Biology, School of Biological Sciences
University of Texas at Austin, Austin, Texas, 78712-1064, USA
e-mail: camaleones@mail.utexas.edu

and

EDMUNDO PEREZ-RAMOS
Museo de Zoología, Facultad de Ciencias, Universidad Autónoma de México
A.P. 70-399, México D. F., 04510, México
e-mail: epra@hp.fciencias.unam.mx

The genus *Bipes* consists of three species endemic to Mexico. *Bipes canaliculatus* occurs in the states of Guerrero and Michoacán, *B. tridactylus* is only known from a small coastal region of Guerrero, and *B. biporus* occurs on the Baja Peninsula (Alvarez 1964, 1966; Flores-Villela 1993; Papenfuss 1982; Smith and Taylor 1950). *Bipes* are generally found in moist, sandy soils of arroyos, coastal and alluvial plains of river basins, in agricultural or pastoral fields adjacent to rivers, or under or around bushes in sandy areas (Alvarez 1966; Gadow 1905; Papenfuss 1982). One account by Smith (1949) describes how he and E. H. Taylor found *B. canaliculatus* under large, weathered sandstone rocks characteristic of exposed slopes of arroyos. He suggested *B. canaliculatus* might be found more frequently under rocks after heavy rains; however, all other researchers have reported finding them by digging in sandy river soil. While the taxonomy and systematics of *Bipes* has been established (Gans 1967; Papenfuss 1982), the natural history of all *Bipes* remains poorly known despite intensive efforts by Papenfuss (1982). This note describes the discovery of *B. canaliculatus* in new localities and in different microhabitats than previous researchers.

We searched for reptiles and amphibians by turning over large stones and dead trees or breaking logs apart at two localities north of the Río Balsas (also known as Río Mexcala) from 17 to 22 November 1998. The Río Balsas is a large river that flows through central Guerrero, México, and separates the Sierra Madre del Sur from the Cordillera Volcanica. Localities where we searched and found *B. canaliculatus* were recorded using a GPS unit. One locality is across the Río Balsas, north of Tlalcozotitlan, and east of Hueyatl (17°53'38"N, 99°07'28"W, 540–580 m). The second locality is Atzcala, 14 km west of the old Highway 95 crossing at the Río Balsas (17°58'41"N, 99°39'50"W) and 2–3 km north of the river (Fig. 1). Data collected on most specimens at the instance of capture included date, time, habitat description, and body, air, and substrate temperatures (Table 1). All temperatures were recorded with a cloacal thermometer within 0.1°C. Twelve specimens were deposited in the Museo de Zoología Facultad de Ciencias (MZFC 11523–11534) and four live individuals were donated to the herpetarium at the Universidad Nacional Autónoma de México (all died and were later deposited in the MZFC collections, MZFC 11674–11675 and MZFC 12924–12925).



FIG. 1. Previously recorded (solid circles) and new (triangles) localities for *Bipes canaliculatus*.

We collected sixteen *B. canaliculatus* from Guerrero. The two localities where we collected *B. canaliculatus* add to the seven sites where the species has been previously recorded (Fig. 1). The locality near Hueyatl extends the recorded range of *B. canaliculatus* approximately 35 km east. Atzcala is also a new locality but lies between previously known sites along the Río Balsas.

Seven specimens were found near Hueyatl 1–2 km north of the river. Five individuals were found under large rocks on gravel slopes, not sand. One individual was found in an old, dry, rotten *Bursera* sp. trunk, and one individual was found under an unidentified rotted trunk. General habitat consisted of mesquite covered hills separated by flat plains used for seasonal agriculture. Residents at this locality said they often encountered *B. canaliculatus* in their fields while plowing or working. Residents referred to the animals as "culebras con manitas," (snakes with little hands), "culebras con dos patas," (snakes with two feet), and "tlalcocoanetl," (a name in the Nahuatl language).

We found nine *B. canaliculatus* north of Atzcala. Eight were found under large rocks on steep slopes, and one individual was found in a rotten log. The habitat on the hillsides is sparse arid scrub forest and relatively pristine, while the lower valleys are completely cultivated. The altitude of the Río Balsas directly south of Atzcala is approximately 460 m, and we collected specimens up to 810 m in elevation. The specimen collected furthest from the river was located just north of the coordinates 17°59'10"N and 99°39'59"W, which is 3–4 km north of the Río Balsas.

The soil immediately under rocks where we found all the *B. canaliculatus* was hard and coarse, not like the sandy soils near the river. Individuals had burrows that led to the surface of the ground under rocks. They escaped down holes once the rocks were lifted if they were not captured quickly. Once in their burrows, they were difficult to extract because well-developed claws on their forelegs firmly grasp the sides of their tunnels and help pull them under ground.

We extended the known range of *B. canaliculatus* east 35 km, but no one has yet reported collecting them from the state of Puebla, the northeastern limits of the Balsas basin. While we added two new localities to known sites where *B. canaliculatus* occurs, these localities confirm previous suggestions that the species occurs throughout the Río Balsas Basin (Alvarez 1966; Papenfuss 1982; Smith and Smith 1977).

We found *B. canaliculatus* in rocky soils and coarse gravel on hillsides and steep slopes over three kilometers away from the Río Balsas. We also found them in rotten logs. Gadow (1905) considered *B. canaliculatus* to be "bound to sandy soils." Papenfuss (1982) collected the majority of his specimens by paying local residents to dig in the soft soils along the bank of the Río Balsas and in arroyos and fields near the river. He described his study site at Petacalco as having sandy soil interspersed with extensive areas of coarse gravel, but it is not explicit whether he found them in coarse gravel or only in sandy areas. Smith's (1949) experience was similar to ours in that he found *B. canaliculatus* more distant from the river on a hillside and under rocks, but the soils were still described as sandy (Smith and Smith 1977). Ours is the first record where *B. canaliculatus* was found over three kilometers from the river in coarse gravel to rocky soils and inside old, dry, rotten logs. The Atzcala location is particularly interesting because specimens were found high on steep hills in deciduous vegetation, a very different habitat than previously described for the species. Other amphisbaenians are found commonly in upland rocky terrain or forested habitats (Beebe 1945; Gans 1962; Gans and Alexander 1962: Vanzolini 1951).

Our data suggest *B. canaliculatus* can also be found to a much greater extent during the wet season in forested habitats under rocks or in logs without the necessity of digging. Smith (1949) also suggested *B. canaliculatus* might be found under rocks more often during or after the wet season. Localities where we found *B. canaliculatus* have a distinct wet season in the summer and a prolonged dry season lasting five to six months (Flores-Villela 1993). In the Summer and Fall of 1998, extremely heavy rains fell throughout México, especially in southern states. The rains had subsided by November when we were collecting, but the previous

TABLE 1. Recorded Capture Data. Date, time, habitat description, and substrate ($T_{substrate}$), body (T_{body}) and air (T_{air}) temperatures at time of capture for *Bipes canaliculatus* specimens. NA means Not Available: Temperatures were not recorded when handling for a long period of time before obtaining a good reading, or if the microhabitat was destroyed before a specimen was discovered. For example, rotten logs were usually completely broken apart before individuals were encountered. WLH had the thermometer; if EPR collected an individual when separated from WLH, temperature data were not recorded.

Date Collected	Time Collected	Habitat Description	T_{body} (°C)	$T_{substrate}$ (°C)	T_{air} (°C)
Site 1					
17 Nov 1998	1100	Under large rock in gravelly soil, ca. 1 km N of the river on small hillside, 580–600 m	34.2	35.0	33.0
17 Nov 1998	1709	Inside rotten *Bursera*, ca. 2 km N of the river on tall hillsides	32.4	29.3	31.5
18 Nov 1998	1223	Under rock in gravel and dirt on the eastern slope of tall hillsides ca. 2 km from river	NA	30.0	32.8
18 Nov 1998	1423	Under rock in loose dirt, western slope of taller hillsides, ca. 2.25 km from river, 700 m	34.8	26.0	NA
18 Nov 1998	1730	Under a rock, 730 m	NA	NA	NA
19 Nov 1998	1013	In the soil under a dry rotten log on hillsides to the east, 640 m	34.4	29.8	30.6
19 Nov 1998	1535	Under a large rock, 20 cm below the surface of the ground, 640 m	33.0	30.6	37.0
Site 2					
20 Nov 1998	1540	Rocky hillside surrounding Atzcala, 564 m	NA	NA	NA
20 Nov 1998	1711	Inside a dry, old rotten log on the rocky hillsides ESE of Atzcala, 800 m	NA	NA	28.6
21 Nov 1998	1055	Under rock in soft dirt on brushy hillsides to the north of Atzcala	35.2	32.3	34.4
21 Nov 1998	1618	Under a rock in soft dirt, several km north of Atzcala in woodland	32.4	27.4	28.2
22 Nov 1998	1210	Under a rock, steep slopes, several km N of Atzcala in woodland (17°59'10"N, 99°39'59"W, 710 m)	28.6	27.2	32.2
22 Nov 1998	1220	30 m from specimen above, but rock was in the sun	32.0	31.2	32.2
22 Nov 1998	1245	+100 m N of the previous specimens, under a rock with loose soil, steep slopes	32.2	29.6	32.4
22 Nov 1998	1245	Under the same rock as above specimen	33.8	29.6	32.4
22 Nov 1998	1345	N of previous specimens, rocky habitat, closer to the top of a steep hill, 810 m	NA	NA	NA

months' rain may have facilitated our finding the species in unknown habitats more distant from the Río Balsas. This species, and perhaps all *Bipes*, may be much more common and widespread but simply not visible except during the wet season.

In two instances, we found *B. canaliculatus* inside old, dry, rotten *Bursera* sp. trunks, and in one instance, an individual was found underneath an unidentified rotten log. These records are the first reports of finding *B. canaliculatus* inside or associated with rotten logs. Additionally, they were less than one meter from ant nests inside the same logs suggesting they may have been feeding on the ants, larvae, or pupae. Several *Amphisbaena* species have also been found in close association with ants (Beebe 1945; Gans 1962; Gans and Alexander 1962).

Papenfuss (1982) gathered over 900 *B. canaliculatus* specimens from local residents, but only a few (N = 36) had body temperature and substrate temperature data or burrow characteristics where specimens were collected. Papenfuss recorded a mean burrow depth of 19.8 cm, ranging from 2.5 cm to 60 cm. All specimens we collected were in the soil at depths less than 20 cm, which was the measured depth of the largest rock under which a *B. canaliculatus* was found. Our body and substrate data agree with Papenfuss' data: body temperatures were significantly higher ($p < 0.004$) than substrate temperatures for our collected specimens. We also extended thermal data over a longer daily time period compared to Papenfuss (1982).

Bipes canaliculatus was rare in museums until Papenfuss (1982) discovered they could be collected in large numbers by digging in sandy banks and alluvial soils of the Río Balsas. We discovered this species could also be found under rocks on steep slopes and hillsides out of the primary Río Balsas channel. We also discovered them associated with rotten tree trunks and ant colonies, microhabitats previously unknown for *B. canaliculatus*. Increased understanding of this unique reptile's ecology may be acquired by shifting collecting efforts from digging in sandy river banks to searching the hillsides during the rainy seasons of southern México.

Acknowledgments.—This research was supported by a Continuing University Fellowship to WLH by the University of Texas at Austin. Collecting was done under Permit No. FAUT-0015 extended to EPR. Special thanks to A. Nieto Montes de Oca for assisting WLH with obtaining the initial Mexican collecting permit (DOO.750.-5300) that allowed us to take this trip and O. Flores-Villela and M. Benabib who provided additional permits, support, and assistance in Mexico City. Special thanks to the family of A. Adame who let us use one of their buildings as a base camp during the Atzcala portion of our work. Thanks to M. Cardoso, A. Gluesenkamp, C. Guthrie, L. Ramakrishnan, M. Swartz, and two reviewers for comments on this manuscript.

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Overwintering Tadpoles in the California Red-legged Frog (*Rana aurora draytonii*)

GARY M. FELLERS
Western Ecological Research Center, USGS
Point Reyes National Seashore, Point Reyes, California 94956, USA
e-mail: gary_fellers@usgs.gov

ALAN E. LAUNER
Center for Conservation Biology, Department of Biology
Stanford University, Stanford, California 94305, USA
e-mail: aelauner@leland.stanford.edu

GALEN RATHBUN
California Academy of Sciences
and
Western Ecological Research Center, USGS
P.O. Box 202, Cambria, California 93428, USA
e-mail: grathbun@calacademy.org

STEVE BOBZIEN
East Bay Regional Parks District, 2950 Peralta Oaks Court
Oakland, California 94605, USA
e-mail: sbobzien@ebparks.org

JEFF ALVAREZ
The Wildlife Project, 3904 Breda Court
Modesto, California 95356, USA
e-mail: azoologist@aol.com

DAVID STERNER
659 35th Street, Richmond, California 94805, USA
e-mail: davidsterner@home.com

RICHARD B. SEYMOUR
818 Hollenbeck Avenue, Sunnyvale, California 94087,USA
email: richs@neteze.com

and

MICHAEL WESTPHAL
Department of Zoology, Oregon State University
2130 NW Fillmore Street 11-D, Corvallis, Oregon 97330, USA
e-mail: mike_westphal@yahoo.com

In California, overwintering tadpoles have been reported for only two ranid species: *Rana muscosa* (mountain yellow-legged frog) (Stebbins 1985) and *R. catesbeiana* (bullfrog) (Behler and King 1979; Leonard et al. 1993). Storer (1925) states that *R. aurora* spend 4–5 months as larvae with metamorphosis typically taking place between July and September. We report here our observations of *Rana aurora draytonii* (California red-legged frog) tadpoles overwintering at 11 sites spread over four counties in central coastal California. We define overwintering as spending the winter (November–February) in the larval stage (≤ Gosner stage 40; Gosner 1960).

One site is located in a spring-fed pool that drains into Matadero Creek (Santa Clara Co., 37°24', 122°10', 200 m elevation). On Mar 20, 1998 we caught two distinct size classes of tadpoles, five small individuals (approximately 30 mm TL), and two large ones (72 mm and 92 mm TL; Gosner stages 36 and 38 respectively). There was also a recently metamorphosed *R. aurora* (28 mm SVL). On Oct 15, 1999 we found a tadpole with only rudimentary hind limbs (Gosner 36). The pool measured 3 x 5 m and was >1.0 m deep. It was heavily shaded with California blackberry (*Rubus ursinus*), willow (*Salix* sp.), and poison oak (*Toxicodendron diversilobum*).

On Nov 3, 1999 a 65 mm tadpole was caught at one of several pools along a 150 m stretch of Round Valley Creek (Contra Costa Co., 37°52', 121°46', 128 m elevation). The tadpole had only small hind limb buds (Gosner 32). On Dec 15, 1999 an additional three tadpoles (Gosner 36–37) were captured in the same creek, and on Jan 7, 2000 one Gosner stage 39 tadpole was found. The creek ran through an oak savannah woodland, which was seasonally grazed by cattle. Two of the pools were >1.0 meter deep including the one where the tadpole was captured. Prior observations indicate that tadpoles have overwintered at this site each year since 1997. Recent metamorphs have been found in April, much too early to be young of that year because eggs are typically laid at this site during March. During winter storms, the creek carries a substantial amount of water and rises as much as a vertical meter, at least for short periods of time. It is not clear how *R. aurora* tadpoles survive these events.

Four ponds in the Kellogg Creek drainage (Contra Costa Co., 37°47', 121°43', 323 m elevation) have been observed to have *R. aurora* tadpoles during the late fall and winter for each of the last two years. On Nov 5, 1998, 287 tadpoles were caught at an artificial stock pond located in a heavily-grazed grassland. The tad-

poles ranged in size from 19 to 37 mm SVL, and from 39 to 75 mm TL. None of these tadpoles had hind limbs or hind limb buds (< Gosner 26). Subsequent surveys conducted at this pond demonstrated that tadpoles were present well into the winter (Nov 3, 1999 [3 tadpoles, 83–87 mm, Gosner 38–40]; Feb 8, 2000 [3 tadpoles]; and Feb 12, 2000 [1 tadpole]). Three other ponds in the Kellogg Creek drainage were surveyed in early 1999 (37°48', 121°43', 220–277 m elevation), and overwintering tadpoles were captured on the following dates: Jan 21 (14 tadpoles, < Gosner 37), Feb 12 (9 tadpoles, < Gosner 37), and Mar 3 (12 tadpoles, < Gosner 37). All four of the ponds were located in a heavily-grazed grassland with no trees within 1 km.

On Apr 6, 2000 a pond in Morgan Territory (Contra Costa Co., 37°49', 121°48', 607 m elevation) was surveyed and found to have three overwintering tadpoles (Gosner 45).

On Nov 10, 1999 three tadpoles (72 mm, Gosner stages 34–37) were found in a pond near Abbotts Lagoon (Marin Co., 38°7', 122°56', 24 m elevation). The pond was 75 x 10 m, and > 1.0 m in depth. It was surrounded by introduced Mediterranean grasses, while rushes (*Juncus* sp.), sedges (*Carex* sp.), and marsh pennywort (*Hydrocotyle verticillata*) grew in or near the water.

On Jan 16, 2000 tadpoles were seen at Guadalupe Dunes (San Luis Obispo Co., 34°59', 120°38', 37 m elevation) during a nocturnal survey. Ten overwintering tadpoles were captured that ranged from Gosner stage 25 to 42. All tadpoles appeared to be well nourished and healthy. One additional tadpole (stage 37) was captured at a second, nearby pond on Jan 22, 2000. Both ponds were 35–45 cm deep with water temperature of about 15°C. The shores of both ponds were heavily trampled by cattle, and the aquatic vegetation was browsed. These ponds were located only 400 m from the Pacific Ocean.

Sixteen overwintering tadpoles (Gosner stages 25–40) were found at a second locality in San Luis Obispo County (35°27' 120°55', 10 m elevation) on Jan 23, 2000. These tadpoles were in an arroyo about 1 km southeast of the mouth of Villa Creek, north of Cayucos. All the tadpoles were in a 1 x 2-m plunge-pool that was about 70 cm deep and shaded by a willow tree and two-meter high steep banks. The pool was located about 50 m from the ocean in a heavily-grazed grassland dominated by introduced Mediterranean grasses.

We suspect that overwintering is not common in larval *R. aurora*. We were able to find overwintering *R. aurora* tadpoles at only one of six known breeding sites in Marin County and at only two of seven sites in San Luis Obispo County. California's Mediterranean climate may influence the timing of oviposition (winter) and metamorphosis (summer/fall) in *R. a. draytonii*. High-flow events during winter are normal in California creeks, and undoubtedly provide strong selection pressure for 1) frogs to delay egg-laying, and 2) larvae to complete metamorphosis before winter storms. Eggs laid before March in coastal creeks in San Luis Obispo County have been washed away by late winter storms (GR, pers. obs.). Similarly, tadpoles that do not metamorphose before early winter storms risk being lost. Hence, overwintering in *R. a. draytonii* does not appear to be highly adaptive, especially for populations that breed in streams.

Overwintering in *Rana a. draytonii* is probably closely related to water temperature, an important factor in determining the rate of tadpole development (Altig and McDiarmid 1999). We would expect to encounter overwintering tadpoles most frequently in high-altitude regions where the warm summer season is short; in aquatic areas with deep shade that prevents solar radiation from warming the water; and along the narrow coastal strip where cold ocean temperatures, prevailing wind, and summer fog create cool summer conditions. Unusually cool summers, as brought about by La Niña ocean cooling, may exacerbate local influences on summer temperatures. *Rana a. draytonii* tadpoles at all the sites described above were living in ponds, pools, or parts of streams that appear to be cooler than is typical for this species. We are currently monitoring temperature at several sites to evaluate whether temperature is likely to be a contributing factor.

Our observations of overwintering *R. a. draytonii* tadpoles are important in part because this frog is Federally-listed and the US Fish and Wildlife Service is in the process of revising guidelines for conducting formal surveys. Our findings indicate that in some areas, surveys for both tadpoles and recent metamorphs may need to be conducted over a much longer period of time since the length of the larval period can range from 4 (Storer 1925) to 13 months (this study).

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Bufo bufo (Common Toad) tadpoles, newly hatched. Illustration by P. A. Benson.

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A Novel Behavior for Urodeles: Micturition in the Plethodontid Salamander *Aneides lugubris*

NANCY L. STAUB
Biology Department, Gonzaga University, Spokane, Washington 99258, USA
and
Museum of Vertebrate Zoology, University of California
Berkeley, California 94720, USA
e-mail: staub@barney.gonzaga.edu

and
RYAN ANDERSON
Biology Department, Gonzaga University
Spokane, Washington 99258, USA

Micturition, the release of fluid from the bladder, is well known to occur when some species of frogs and toads are handled. Although this behavior is generally considered an antipredatory tactic—it presumably startles the predator and gives the potential prey item additional seconds to escape—there are few data supporting this claim (Buchanan and Taylor 1996; Duellman and Trueb 1986). In one of the few studies to test the advantages of micturition, Buchanan and Taylor (1996) found that squirrel treefrogs (*Hyla squirella*) that emptied their bladders before jumping, jumped significantly farther than frogs that had not emptied their bladders. This result suggests that a function of micturition in frogs is to decrease the frog's weight to enable a more efficient escape.

Micturition during handling has not been previously documented for salamanders. We document this behavior for the arboreal salamander, *Aneides lugubris* (Plethodontidae).

Nine adult *A. lugubris* (6 female, 3 male) were tested weekly for the micturition response (Set 1: 4 animals, 8 trials/animal between September and November 1996; Set 2: 4 animals, 18 trials/animal between March and July 1999; 1 animal: 6 trials between June and July, 1999). The salamanders were collected in Alameda County, California, USA, and were individually housed in 18.5 x 7.5 x 9 cm containers lined with moist paper towels. Temperature was maintained at 15°C with a 12:12 h light:dark cycle. Salamanders were fed crickets *ad libitum*. All applicable institutional animal care guidelines were followed.

For Set 1, a micturition trial involved lifting each salamander out of its container and holding it over a collecting tray lined with plastic wrap. For maximum visibility of the vent region, animals were lifted vertically with the experimenter's gloved hand above and the fingers loosely encircling the animal. Liquid that dripped off the animal and potentially came from the salamander's vent was saved and its pH measured. A sample of water from the salamander's container was collected at the same time and its pH measured as well. Samples were collected using a micropipetter and stored in scintillation vials.

For animals in Set 1, a pH test and a food coloring test were used to distinguish between urine and water from the salamander's container that may have been on the salamander but dripped off during handling. The pH of container water and potential urine samples was measured using the acid-base indicator, phenol red, which turns from yellow to red over the pH range of 6.6–8.0. For the food coloring test, green food coloring was added to the containers of two *A. lugubris* three days prior to a micturition test. The color of the potential urine samples collected when the salamanders were handled was then visually compared to an equivalent volume of the green container water under similar conditions (e.g., lighting, background). We predicted that if we were observing micturition, the color of the potential urine sample would be clear and not green.

For Set 2, animals were lifted and observed for micturition as in Set 1, but no liquid samples were collected. We used a conservative method for scoring micturition. Liquid dripping from the animal was recorded as micturition only if it was released suddenly and came unambiguously from the vent region.

Results support the hypothesis that arboreal salamanders micturate when handled. From the four initial test animals (Set 1), 15 potential micturition events were observed (liquid dripped off salamander in the vent region), 13 samples were successfully collected, and 11 of these turned distinctly red (basic pH) when tested with phenol red. In contrast, all samples of water from salamander containers, collected at the same time as the potential micturition events, turned yellowish-red (neutral pH) when tested. Two of the samples collected from the salamanders did not have a basic pH and thus were not scored as micturition events. Each of the salamanders of Set 1 micturated at least twice during the 8-trial testing period (average number of micturition events per salamander was 2.8; range 2–4). Micturition occurred a minimum of 34% of the time salamanders were handled (11 micturition events/32 trials). The average volume of the collected samples was 154 ± 79.3 ul (range 50–380 ul). It was not evident that any salamander micturated more or less frequently at the beginning or end of the testing period; the salamanders apparently did not habituate to handling.

For the food-coloring test, samples collected from the handled salamanders were clear compared to the green solution from the salamander containers. This result supports the results from the pH tests that the samples collected from the salamanders were not simply water from the salamander containers. Visual observations corroborate results from the pH analyses and the food coloring tests that both male and female *A. lugubris* micturate. When an animal is handled, occasionally there is a sudden release of liquid and the experimenter's hand is suddenly quite wet.

Using our conservative estimate of scoring micturition events, each salamander in Set 2 micturated at least once (6% of the time; range 1–2) during the testing period although liquid dripped off the animals in the region of the vent up to 30% of the time.

Our results show that micturition occurs under laboratory conditions in *A. lugubris*. Each of the nine individuals tested micturated at least once in response to handling. Individuals of *A. lugubris* show this behavior in the field as well (NLS, pers. obs.). Anecdotal reports of micturition in other species of *Aneides* (*A. hardii*, NLS, pers. obs.) and in other plethodontid genera (*Plethodon cinereus*, S. Wise, pers. comm.; *Pseudoeurycea*, *Chiropterotriton*, G. Parra, pers. comm.) suggest that this behavior may be widespread at least among terrestrial plethodontid salamanders. Additional work is necessary to demonstrate the functional significance, if any, of this response. Salamanders exhibit a wide variety of antipredatory strategies such as irritating skin secretions, running, writhing, biting, tail autotomy, toxin-tipped ribs, vocalizations, immobility, and crypsis (Arnold 1982; Brodie 1977, 1978; Brodie

et al. 1974; Brodie et al. 1989; Ducey and Brodie 1983; Nowak and Brodie 1978). Micturition is another potential strategy to include in this diverse set of antipredatory behaviors for salamanders.

Losing the bladder contents may be of significant consequence for a salamander in a water-stressed environment. Frogs that use their bladders to store water are better able to avoid desiccation in water-limited environments than frogs that do not store water (Feder and Burggren 1992; Ruibal 1962). Thus, under certain environmental conditions, micturition may compromise a salamander's survival.

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Proposed Deletion of Two Colubrid Snakes from the Mexican State of Durango Herpetofauna

ROBERT G. WEBB

Laboratory for Environmental Biology and Department of Biological Sciences
The University of Texas at El Paso, El Paso, Texas 79968-0519, USA
e-mail: rgwebb@utep.edu

Coluber constrictor.—Wilson (1966) first reported *C. constrictor* in Durango in referring the Mexican specimens to *C. c. oaxaca*. The status of the one Durango specimen (juvenile, ca. 260+186 mm) was appraised by Smith (1971) as seemingly referable to *C. c. oaxaca*, but by Greene (1983) as sharing features with other subspecies.

Collection data for the Durango specimen (Field Mus. Nat. Hist. 1503) is Coyotes, Sierra Madre, 8000 ft, obtained by Heller and Barber, August 1904; an attached metal tag is etched with the number 482. Smith (1939:31) noted this same museum number (FMNH 1503) assigned to a lot of seven specimens (now FMNH 218615–21) of *Thamnophis macrostemma megalops* (= *T. eques*) with the same collection data. Heller and Barber did visit the Coyotes area of Durango and collect several specimens of other species (FMNH), but they also visited the states of Coahuila, Vera Cruz, Puebla, and Oaxaca in eastern Mexico in 1904 (Smith 1939).

Smith (1971) cast doubt on the occurrence of *Coluber constrictor* on the Pacific slopes of Mexico. Wilson's (1978) map localities are lacking in western Mexico, except for the Coyotes, Durango locale. Heller and Barber's juvenile *C. constrictor* (FMNH 1503) was likely included with the specimens collected from Coyotes, Durango instead of with specimens from one of the aforementioned states in eastern Mexico. A substantial amount of field work by me and colleagues in the Coyotes area in the intervening years, aided by access via paved Highway 40, has not revealed additional specimens of *C. constrictor*. Pending the acquisition of additional geographically pertinent specimens the occurrence of *C. constrictor* in Durango is dismissed.

Conophis vittatus.—Wellman (1963:281, Fig. 5) mapped the northernmost record of *C. vittatus* on the Pacific coast of Mexico in extreme southern Durango (close to Nayarit border) based on Amer. Mus. Nat. Hist. specimen R14217 from "Hacienda de Gabriel." This one and only Durango specimen, ca. 198+56 mm with about 154 ventrals and 74 subcaudals (not sexed), has 7-7 supralabials and the dark four-striped body pattern (paravertebral pair, and each lateral stripe on adjacent parts of third and fourth scale rows) of *C. v. vittatus* (rather than *C. v. viduus*, Smith 1941).

A loose piece of paper in the specimen jar bears the handwritten locality of Hacienda de Gabriel, Durango, Mexico, C. Lopez, and the date 6-1919 (and also the AMNH number of 14217). These same collection data are also transcribed on the jar label (plus "Det. Wellman") and in the AMNH Catalog. The AMNH Accession Record (Number 21766) notes the *Conophis* specimen as part (total of 3 amphibians, 12 reptiles) of an exchange from "Mexico & Lower California" received from Carlos Lopez, Museo de Historia Natural, Mexico City, Mexico, 27 August 1919. Otherwise there are no field notes, field tags, or correspondence.

The locality "Hacienda de Gabriel" cannot be found on any map in the general area plotted for this locality by Wellman, and no such locality in the general area is listed in a U.S. governmental gazetteer (1956). An uninvestigated possibility is that the placename has been changed (e.g., in Durango the old names Estación Coyotes and Sombreretillo [among others] have been changed, respectively, to Morelos and Doce de Diciembre). Baker and Greer (1962:55) listed "Mt San Gabriel" and "San Gabriel" as unknown localities in Durango; however the mammal species associated with these placenames (Baker and Greer 1962:116, 120, 127, 130) all live in grassland habitat in eastern Durango (Rollin H. Baker, in litt., 11 June 1999), which is unsuitable for *C. vittatus*. There also is a San Gabriel in northern Durango just west of Villa Ocampo (off Highway 45), but the area is not appropriately tropical for *Conophis*.

Wellman's impetus for plotting this locality in extreme south-

ern Durango remains unknown. *Conophis vittatus* is not unexpected in this tropical part of southern Durango, an area particularly remote and not easily accessible even today. The species is known from Jalisco, but I am not aware of any specific, published localities in Nayarit (as noted by Zweifel 1959), and the species is not recorded from Sinaloa (Hardy and McDiarmid 1969). Until voucher specimens or other evidence can be obtained, *C. vittatus* is deleted from the Durango herpetofauna.

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The *Nomen Protectum* Rule of the 1999 Code and the Name for the Garter Snake *Thamnophis melanogaster* (Peters)

HOBART M. SMITH
Department of EPO Biology and Museum
University of Colorado, Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

and

DAVID CHISZAR
Department of Psychology, University of Colorado
Boulder, Colorado 80309-0345, USA
e-mail: chiszar@clipr.colorado.edu

Perhaps the most important innovation of the fourth, 1999 edition of the International Code of Zoological Nomenclature, in the context of maintenance of nomenclatural stability, is the adoption of a revised version of the *nomen oblitum* concept, bolstered by the new concept of *nomina protecta*.

The idea of providing exceptions to the Principle of Priority in order to maintain stability of nomenclature has been discussed in official, regulatory assemblages since the late 19th century. Agreement on the means to achieve that end was first introduced into zoological nomenclatural procedures in the first, 6 November 1961 edition of the Code, as the notorious *nomen oblitum* rule of Art. 23(b). That rule was retained in the 1964 second edition, but was rescinded effective 1 January 1973. The term appeared only in the glossary of the third, 1985 edition of the Code, although its objective was reinstated in a widely overlooked Art. 79. That Article allowed petition to the Commission for conservation of long-used names threatened by discovery of earlier synonyms unused for at least 50 years prior to the petition, during which time the junior name was consistently used by at least five different authors in ten different publications. Under those conditions the Commission was empowered to suppress the earlier name in favor of the later nomen conservandum.

During the 1961–1973 interval, nomina oblita were "not to be used unless the Commission so directs" (Art. 23(b)(ii).

The decision to reject Art. 23(b) of the first and second editions of the Code was based importantly on two objections. First, an ancillary provision of that Article (23(b)(i)) was that any unused senior synonym of a junior name in use for 50 years or more was to be submitted to the Commission for action—an intolerable burden on both the Commission and active researchers, involving delays of usually several years. The same objection pertained to the reinstated procedure of the third edition.

Second and equally important, the frequency of usage that was required, first specified in the third edition, did not meet the needs of workers dealing with names rarely cited in spite of their acceptance (e.g., for many invertebrates), as opposed to many vertebrates with far more usages of their names.

In reviving the *nomen oblitum* concept in the 1999 edition of the Code, the first objection to the older rule was countered in Art. 23.9.1, by permitting authors to take action themselves (Art. 23.9.1.1) in dealing with a senior synonym or homonym unused as a valid name after 1899 but that (Art. 23.9.1.2) antedates a junior synonym or homonym that has been used for the taxon concerned with a given frequency. That frequency is usage in at least 25 works, by at least 10 different authors, in the immediately preceding 50 years and encompassing a span of no less than 10 years. The prevailing usage is to be maintained when any author publishes the existence of those conditions.

The second objection to the former *nomen oblitum* rule, involving rarely cited taxa, is countered in the 1999 edition of the Code by the request that, where a question arises in such cases, the Commission should be petitioned to act, following the protocol of Art. 81.

The procedure for implementation of Art. 23.9.1 is outlined in Art. 23.9.2, which provides that

> "An author who discovers that the conditions of 23.9.1 are met should cite the two names together and state explicitly that the younger name is valid, and that the action is taken in accordance with this Article; at the same time the author must give evidence that the conditions of Article 23.9.1.2 are met, and also state that, to his or her knowledge, the condition of

Article 23.9.1.1 applies. From the date of publication of that act, the younger name has precedence over the older name. When cited, the younger but valid name may be qualified by the term *nomen protectum* and the invalid, but older, name by the term *nomen oblitum*. In the case of subjective synonymy, whenever the names are not regarded as synonyms the older name may be used as valid."

An exemplary application of the *nomen protectum* rule of the 1999 Code is suggested by the case of *Thamnophis melanogaster* (Peters, 1864), as thoroughly discussed by Rossman et al. (1996). This name has been universally accepted for over a century as the valid name for its species, whereas Rossman et al. (1996) pointed out that *Tropidonotus* (*Regina*) *mesomelanus* Jan, 1863, beyond any reasonable doubt, is a subjective senior synonym of Peters' name, even though "it has not been used in place of the junior synonym *melanogaster* since the late-19th century."

Ruthven (1908) and Boulenger (1893) were well aware in their monographic accounts that Jan's name applied to Peters' species, but both rejected it. They were not willing to accept Jan's very briefly characterized first proposal (1863) of the name, probably because they regarded it as insufficient—a *nomen nudum*. Smith (1942) and Smith et al. (1950) cited Jan's 1863 name, accepting it as nomenclaturally occupied and not a *nomen nudum* but, as a last resort to maintain nomenclatural stability, the name was categorized in the latter work as a *nomen dubium*, of uncertain allocation, thus clearing the way for the long-accepted *T. melanogaster*. As long as it was so regarded, the latter name would be regarded as valid. No other device at that time would have achieved the same end, under the Code.

Rossman in Rossman et al.(1996:210) rejected the *nomen dubium* subterfuge, inasmuch as the number of scale rows (19), supralabials (8), preoculars (2), and postoculars (2) were given specifically for that species, and the ventral pattern was indicated (a midventral black line).

Therefore, as Rossman et al. (1996) pointed out, both names clearly belong to the same species; Jan's name should not be regarded as a *nomen dubium*. He still did not adopt Peters' name, however, being unwilling to upset a long-established nomenclature or to initiate the long-term process of petitioning the Commission for the conservation of Jan's name.

Fortunately, the 1999 Code provides the means to retain stability with *T. melanogaster* without twisting the meaning of *nomina dubia* to eliminate a change of its name at this late date to *T. mesomelanus*.

Accordingly, under Art. 23.9 of the 1999 Code, we here designate the valid name *Tropidonotus melanogaster* Peters, 1864, a *nomen protectum*, thereby taking precedence over *Tropidonotus* (*Regina*) *mesomelanus* Jan, 1863, a *nomen oblitum* in that context. As stated by Rossman et al. (1996:211), Jan's name has not been used as valid since the late 19th century. An impressive frequency of usage is indicated by 43 different articles with the name *Thamnophis melanogaster* cited in Smith and Smith (1976), and in 77 additional articles cited in Smith and Smith (1991). In the latter work 58 different authors are noted to have used the name within the period covered (mostly 1975–1991). As indicated in Uribe-Peña et al. (1999), usage of *T. melanogaster* persists to the present time. As a *nomen protectum* the name could now be changed officially only by action of the Commission.

Designation of *T. (R.) mesomelanus* Jan (1863) as a *nomen oblitum* removes it from consideration in the context not only of *T. melanogaster* Peters (1864) but also of any of its subspecies.

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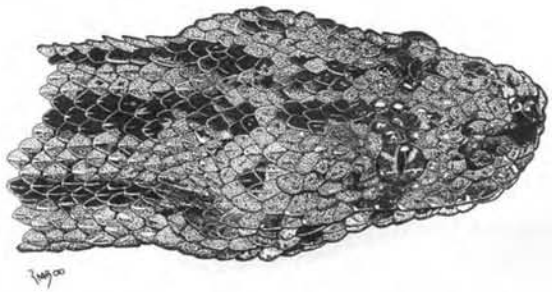
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Trachyboa gularis. Illustration by R. Michael Burger.

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Plastic Netting: An Entanglement Hazard to Snakes and Other Wildlife

JAMES N. STUART
MARK L. WATSON
New Mexico Department of Game and Fish, P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: jstuart@state.nm.us; mwatson@state.nm.us

and
TED L. BROWN
CHRIS EUSTICE
New Mexico Environment Department, Santa Fe, New Mexico 87502, USA

A variety of seemingly innocuous synthetic materials have become commercially available in recent decades, and many of these materials have proven to be harmful to animals when used or discarded in wildlife habitats, particularly marine environments (e.g., Gregory 1991, 1999; Laist 1997; Lucas 1992). Monofilament fishing line and beverage six-pack holders have been observed to entangle and kill birds and mammals (Serena 2000; pers. obs.). Plastic bags and nylon fishing gear are ingested by sea turtles and can result in esophageal and gastrointestinal blockage and death (Fritts 1982; Laist 1997; Lucas 1992; Starbird and Audel 2000). Lightweight, inexpensive monofilament netting constructed of polypropylene or polyethylene plastic has become widely available in recent years for a variety of terrestrial and aquatic uses. A common application for netting is the exclusion of birds and other wildlife from farm fields, gardens, orchards, vineyards, aquaculture ponds, and water bodies containing toxic substances (e.g., Bradford et al. 1991; Curtis et al. 1994; Fuller-Perrine and Tobin 1993; Henny et al. 1994; Lane and Higuchi 1998; pers. obs.). This material, often marketed as "bird netting," comes in a variety of square or rectangular mesh sizes (13–37 mm); most of the netting we have examined is constructed of sturdy, monofilament strands (ca. 0.25 mm thick) that are resistant to degradation from ultraviolet light. Although plastic netting has been reported as an entanglement hazard to birds (Bradford et al. 1991; Fuller-Perrine and Tobin 1993; Twedt 1980), we know of no similar published reports involving reptiles. In this article we report several observations of plastic netting causing entanglement and injury or death of snakes in New Mexico, USA.

During the summer of 1998, while providing a snake relocation service for residents of Placitas, Sandoval Co., one of us (MLW) observed four adult coachwhips (*Masticophis flagellum*) entangled in bird netting. Three of the snakes were encountered and released alive, and the fourth had apparently died from overheating after being trapped in full sunlight. Two of the live snakes (unsexed) were found in the same netting (Fig. 1) and were apparently trapped at the same time, possibly during courtship. All four snakes were heavily entangled, apparently due to the twisting escape behavior characteristic of the species (Degenhardt et al. 1996; pers. obs.), and had suffered lacerations from the tightly-wrapped netting strands. In each case the netting had been placed in yards to protect fruit trees from birds or flower gardens from cats.

Plastic netting is also incorporated in some types of erosion control blankets, used to stabilize and revegetate barren slopes in construction and reclamation projects. Woven mats of seed-implanted jute or straw are layered between two sheets of netting and anchored to a slope (Munshower 1994). The organic ingredients of the blankets decompose within 1–3 years, but the plastic netting may persist in the environment for 4 years or longer (pers. obs.) and pose an entanglement hazard to wildlife. On 27 May 1998, one of us (TLB) encountered a dead adult male *M. flagellum* (162 cm TL) entangled in discarded plastic netting at a dump site near Abiquiu, Rio Arriba Co. (Fig. 2). The netting strands were tightly wrapped around the anterior part of the snake's body and had cut through the ventral and lateral scales. The netting appeared to have been part of a straw erosion control blanket. On two different occasions in summer 1997, one of us (CE) found two adult bullsnakes (*Pituophis catenifer*) that had become entangled in netting (37 x 20 mm mesh) from an erosion control blanket at a reclaimed ore-mill site near Pecos, San Miguel Co. Both snakes were cut loose and released; one appeared unharmed but the other had suffered lacerations from the netting strands and possibly an injured spine during its entrapment. The surrounding hillside was covered with anchored sheets of netting through which grasses had sprouted. We do not know how extensively erosion control blankets with plastic netting are used, although we have observed similar "netted" hillsides associated with roadside revegetation projects throughout northern New Mexico. Use of plastic netting for this

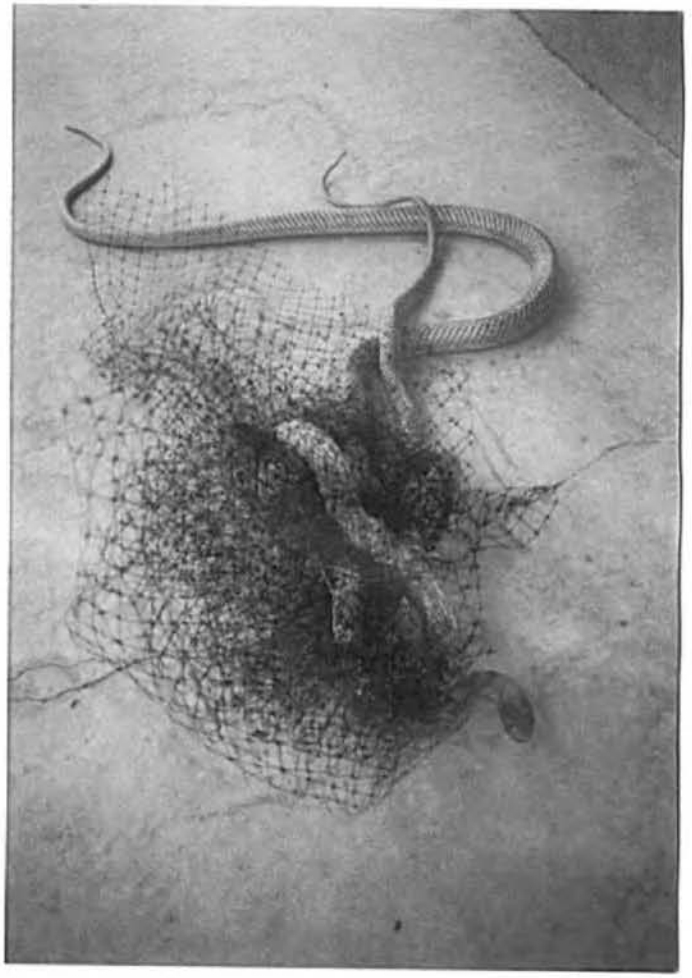


FIG. 1. Two live adult *Masticophis flagellum* entangled in plastic netting used to exclude birds from a fruit tree in Sandoval Co., New Mexico.

application is not necessary, however, as many netting-free varieties of these products are presently marketed. In recognition of netting's potential adverse effect on some species, a manufacturer of erosion control blankets in the United Kingdom recently advertised that its product is made purely of natural fibers and "does not rely on ecologically undesirable plastic netting (which presents a snagging risk to wildlife)" (Hy-Tex [UK] Limited, in litt.).

We believe that plastic netting with greater mesh sizes (e.g., ≥ 37 x 20 mm mesh, such as observed at the Pecos site) may be most hazardous to snakes because it allows large, heavy-bodied individuals with rough scales to become snagged and entangled when crawling between the strands. Large climbing species, such as whipsnakes (*Masticophis* spp.), may also encounter netting more often when it is used to exclude birds from trees and shrubs. Small snakes may not have a similar risk of entanglement in netting, even when the mesh size is small, due to their lighter body weight and smoother scales. Large snakes also may be more prone to entanglement in other man-made net-like materials. Campbell (1950) reported the entanglement of two "average sized" western diamondback rattlesnakes (*Crotalus atrox*) which became wedged in 1-inch (25-mm) mesh poultry ("chicken wire") fencing used in an outdoor quail pen in New Mexico. Similarly, a *C. atrox* and a *P. catenifer* were found entangled in poultry fencing in Arizona (E. Nowak, pers. comm.). Poultry fencing has been extensively used for many purposes for decades, and is still more widely available than plastic netting. However, we believe netting poses a greater entanglement hazard in most situations because of its durable, thin strands, its flexibility, and its placement on the ground or over vegetation where snakes are likely to encounter it.

Our observation that plastic netting is a hazard to reptiles is not unique. In 1999, we inquired via electronic mail if other herpetologists had observed reptiles entangled in bird netting or similar materials. Our inquiry yielded several responses describing snake entanglement, including observations of racers (*Coluber constrictor*) and ratsnakes (*Elaphe obsoleta*) injured or killed in vertically-hung netting in Maryland (F. Gould, pers. comm.); kingsnakes (*Lampropeltis getula*), *E. obsoleta*, and *M. flagellum* entangled and sometimes killed in netting used to exclude snakes from bluebird nest boxes in Texas (N. Ford, pers. comm.); and a *C. atrox* entangled and severely injured in netting at an Arizona home (E. Nowak, pers. comm.). In addition to snakes, specimens of desert spiny lizards (*Sceloporus magister*) were found entangled and killed in netting used to exclude birds from a brick-lined spring in Nevada (A. Heindl, pers. comm.). One respondent noted that this material has been effectively and safely used to capture snakes in Australia, provided that the netting snare is visited frequently (P. Mirtschin, pers. comm.). Plastic netting has also been used in water as a snare for semi-aquatic snakes (Lutterschmidt and Schaefer 1996).



FIG. 2. A dead adult *Masticophis flagellum* entangled in plastic netting from an erosion control blanket in Rio Arriba Co., New Mexico.

The widespread use of plastic netting and the number of documented incidents of snake entanglement, injury, and death warrants examination of its impact on reptile populations and other wildlife. An alarming characteristic of this material is its resistance to degradation, which allows it to persist for years in the environment as an entanglement hazard, even when discarded. Fuller-Perrine and Tobin (1993) noted that stiff plastic netting poses less of an entanglement hazard to birds than the more flexible varieties on the market; it is likely, therefore, that some forms of netting may be relatively "wildlife safe." We encourage other individuals who encounter animals entangled in plastic netting to document the circumstances (i.e., the species, size, and condition of the victim; and the variety, application, and mesh size of the netting) and to inform the manufacturers and users of netting of its potential hazard to wildlife.

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A Breeding Population of American Crocodiles, *Crocodylus acutus*, on Roatán, Islas de la Bahía, Honduras

HINRICH KAISER
ELMER J. R. SIHOTANG
KRISTINE M. MARSON
KAREN M. CRANE
JENNIFER DAYOV
L. LEE GRISMER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
e-mail (HK): hkaiser@lasierra.edu
e-mail (LLG): lgrismer@lasierra.edu

Crocodylus acutus is widely distributed along both the Pacific and Caribbean coastlines of Central America, it has a circum-Caribbean island distribution, and its range extends east along the Caribbean coast of South America to the Orinoco Delta, and south along the Pacific Coast of South America into northern Peru, including some rivers in Colombia (Ernst et al. 1999). It inhabits primarily brackish water habitats, many of which have become heavily impacted by human efforts directed at insect control and coastal development. As a result, *C. acutus* have become extirpated from many historical localities and the species is currently considered vulnerable and monitored by CITES. In general, survey data for *C. acutus* are of poor quality, anecdotal, and patchy (Ernst et al. 1999).

Ernst et al. (1999) indicate the presence of *C. acutus* on the Bay Islands of Utila and Roatán off the northwestern coast of Honduras, but not on the easternmost island, Guanaja. The distributional information for the Islas de la Bahía in Ernst et al. (1999) was extracted exclusively from the seminal paper by Wilson and Hahn (1973) on the Bay Island herpetofauna (C. H. Ernst, pers. comm.), whose records were based on only three specimens, two from Utila (without further locality data) deposited in the United States National Museum of Natural History, and one from "near Roatán" in the Field Museum of Natural History. Other species lists of the Honduran herpetofauna (Meyer and Wilson 1973, Wilson 1983, Wilson and McCranie 1994) and the recent paper by Köhler (1998) provide no further information on the status of *C. acutus* on Roatán or the other Bay Islands. Based on the limited available information and on local anecdotes, Wilson and Hahn (1973) considered crocodiles to most likely have been extirpated on Utila and Guanaja, with the caveat that remote parts of Utila and Roatán might harbor small populations. Scientists conducting marine research in the Bay Islands through the Roatán Institute for Marine Sciences considered observations of crocodiles near Roatán and on Utila to be examples of strays from the well-known populations in the area of the Honduran coastal city of La Ceiba (Jennifer Keck, pers. comm.).

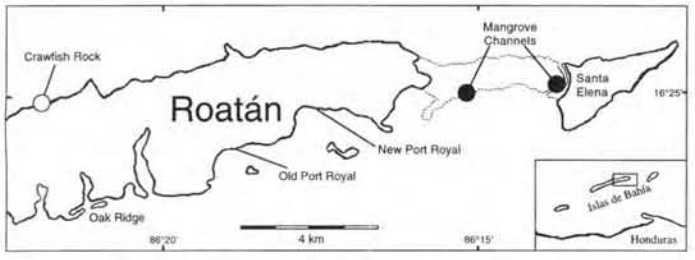


FIG. 1. Map of the eastern end of Isla Roatán, indicating crocodile sightings during 1999 (open circle) and 2000 (closed circles). Crawfish Rock is approximately identified by the open circle.

As part of our annual La Sierra University tropical biology field course we investigated the presence of crocodiles on Roatán, a plan fueled by the display of a small, dried crocodile (estimated SVL 60 cm, no collection data) in one of our accommodations. Our surveys were conducted in two attempts, the first (July 1999) involving a land-based search using information from local fishermen, the second (July 2000) taking into account habitat needs and behavior patterns of the species as well as the suggestion of Wilson and Hahn (1973) to search the undisturbed mangrove swamp at Roatán's eastern end.

Anecdotal information regarding crocodile sightings was easily obtained during our questioning of locals in July 1999, although exact locality data were usually unavailable. A fisherman from Crawfish Rock on the north coast of Roatán (Fig. 1) told of a specimen of approximately 1 m in length in a small brackish embayment ca. 500 m east of the village square that had been captured in 1998 by digging it out of its burrow. He informed us that another, larger crocodile was still in residence at that locality. The entrance to the burrow was on the south-facing side of a shallow estuary and was clearly identifiable by tail-drag markings in the sandy substrate. Looking into the burrow with flashlights revealed a large (estimated total length 200 cm) *C. acutus*. Our attempt to dislodge the animal from its burrow by digging or by capture with nets failed, though we experienced two unexpected encounters with a large snout and teeth in the process. Since we were unable to document the presence of crocodiles via specimen capture and photography, we resolved to take a different approach during the summer of 2000. Upon our return in July 2000 we were informed that the same crocodile we disturbed the previous year was still inhabiting the same burrow.

During our second attempt, we worked from a boat in the mangrove area at the extreme eastern end of Roatán (Fig. 1). Based on general activity patterns for crocodilians reported in the literature (e.g., Grenard 1991) and observations made by local fishermen, we opted to conduct an evening survey of the southern mangrove shoreline east of Old Port Royal and the north–south mangrove channel (Fig. 1) using flashlights and a halogen-enhanced search



FIG. 2. (Upper) The authors hold an adult female *Crocodylus acutus* (total length 206 cm) from the extensive mangrove swamps at the eastern end of Isla Roatán, Honduras. (Lower) Hatchling *C. acutus* from the same locality as the adult female. The hatchling had clearly visible umbilical scars and was found sitting on a mangrove branch with siblings visible within 1–5 m distances.

light. We encountered three individuals in the mangrove channel between approximately 1930 and 2100 h, of which one was observed in its entirety as it rested submerged in a narrow, shallow side channel, from which it subsequently escaped beneath the boat. In a larger side channel near New Port Royal we discovered at least seven hatchlings and an attendant adult female (total length 206 cm; Fig. 2), which was captured and released.

Based on these observations, we can conclude that Isla Roatán is inhabited by a viable, reproductively active population of *Crocodylus acutus* and does not merely harbor occasional mainland strays. Furthermore, our preliminary observations lead us to believe that any mangrove habitat on Roatán is potential habitat for these animals, and that future surveys will show a continuous coastal distribution for crocodiles in Roatán waters.

Anecdotal information regarding the presence of crocodiles on Guanaja indicate that on that island, just as on Roatán, a healthy breeding population existed prior to 1998. This is contrary to the information provided by Wilson and Hahn (1973), who reported that crocodiles had not been seen "for many years." At the time of their report, however, the human population of Guanaja was much less mobile and therefore less able to make observations on an island with a then poorly developed infrastructure. The island was heavily impacted by Hurricane Mitch in October 1998. During this devastating storm almost all mangrove habitats on Guanaja were destroyed, and only remnant mangrove patches in the northeast of the island may now be available as crocodile habitat. While we have no firm data to verify the presence of *C. acutus* on Guanaja at the time of this writing, we fully expect to obtain confirmation during future installments of our field course.

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Occurrence of Growth Marks in the Cross Section of Phalanges and Long Bones of Limbs in Tropical Anurans

SURESH M. KUMBAR
and
K. PANCHARATNA*
Department of Zoology, Karnatak University
Dharwad - 580 003, India

**Corresponding author; e-mail: pancharatnak@yahoo.com*

Bone growth is known to be a cyclical phenomenon in many amphibians and reptiles, particularly in those that inhabit geographical areas experiencing marked annual temperature fluctuations (Castanet and Smirina 1990; Esteban et al. 1996; Hemelaar 1981; Smirina 1994; Wake and Castanet 1995). Furthermore, this cyclicity in osteogenesis results in formation of growth marks in bones which are used as indices for the process of aging (Smirina 1994). The validity and the reliability of the use of bone growth marks in estimating the age and longevity of amphibians have been reviewed thoroughly (Castanet and Smirina 1990; Esteban et al. 1996; Smirina 1994). Experimental studies have confirmed that the formation of these growth marks is annual in temperate amphibians (Hemelaar 1981; Hemelaar and van Gelder 1980; Tejedo et al. 1997). By enumerating bone growth marks in either the phalanges or long bones of limbs, age has been estimated for a number of temperate zone amphibians (references in Castanet and Smirina 1990; Castanet et al. 1996; Esteban et al. 1996; Smirina 1994). Whether similar growth marks also occur in the bones of amphibian species inhabiting areas with less marked annual tem-

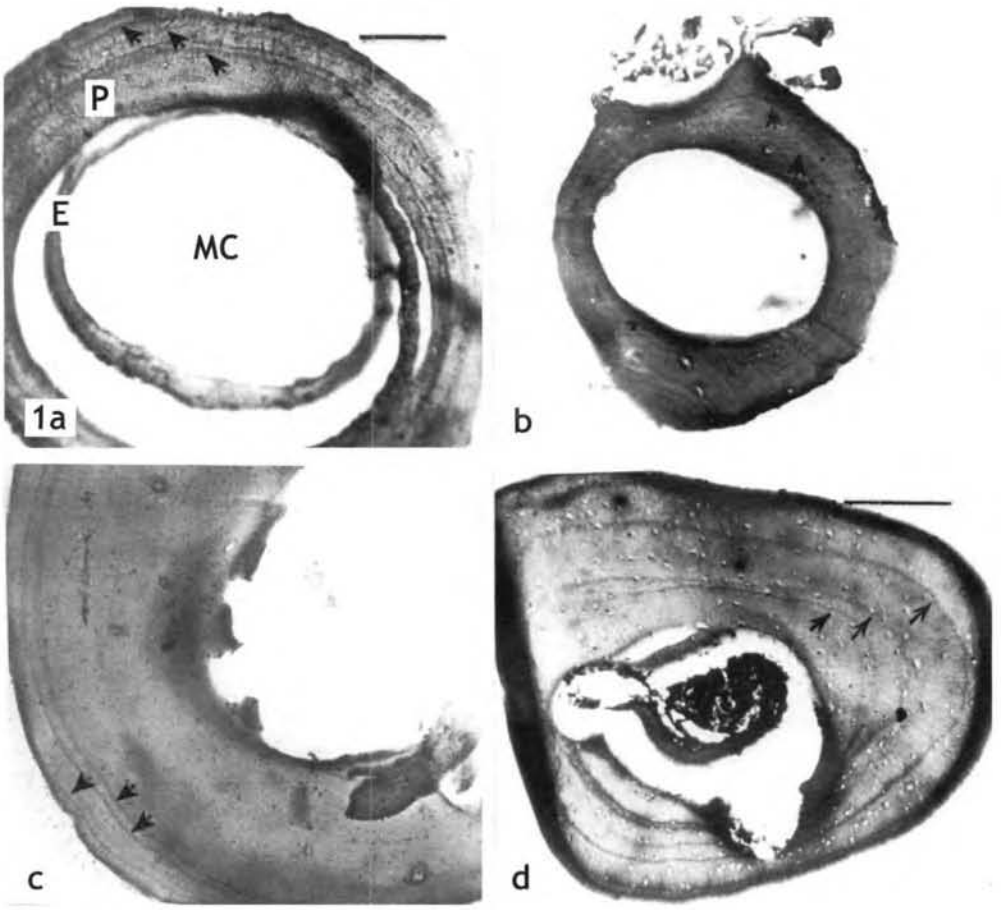


FIG. 1. Cross sections of (A) phalanx of *P. maculatus*,(B) phalanx of *B. melanostictus*, (C) phalanx of *R. tigrina* (scale line = 200 µm) and (D) femur of *M. ornata*. Scale lines = 100 µm. Arrows indicate lines of arrested growth (LAGs). (Abbreviations: MC = marrow cavity; E = endosteal layer; P = periosteal layer).

The hematoxylin stained cross sections of the phalanges/femurs showed a central bone marrow cavity surrounded by an inner narrow endosteal layer and outer relatively broader periosteal bone layer (Fig. 1). In the periosteal layer we observed a series of thin darkly-stained chromophilic lines separated by wider light purple rings with sparsely distributed osteocytes; the former were interpreted as lines of arrested growth (LAGs) and the latter as growth rings (Figs. 1A–D). In the phalanges of *P. maculatus*, 1–3 LAGs were observed located at the periphery close to each other (Fig. 1A); body size and number of LAGs showed a high degree of correlation (r = 0.86). But, in *B. melanostictus* (Fig. 1B), LAGs (1–4) were faintly stained and distributed equidistantly; there was a good correlation (r = 0.75) between body size and LAGs. One to five LAGs were observed in the phalanges of *R. tigrina*, their distribution was as in *P. maculatus* (Fig 1C); the number of LAGs correlated with the body size (r = 0.84). In the femurs of *M. ornata*, 1–4 LAGs were observed that were darkly stained, distinct and located equidistantly (Fig. 1D); body size and number of LAGs were correlated (r = 0.74).

perature fluctuations, such as the tropics, is not known (Esteban et al. 1996). In the present study we attempted to detect the presence of growth marks using skeletochronology in four species of anurans inhabiting Dharwad (15°17'N, 75°3'E) from southern India where annual variation in mean temperature does not normally exceed 10°C.

Specimens of *Rana tigrina* (SVL = 9–17 cm; N = 40), *Polypedates maculatus* (SVL = 3–6 cm; N = 8), *Bufo melanostictus* (SVL = 5–11 cm; N = 50), and *Microhyla ornata* (SVL = 1.5–2.5 cm; N = 40) were collected from areas surrounding Dharwad between June and December 1997. Following capture, the animals were taken to the laboratory where body weight (g) and body size (cm) were recorded. The fourth (longest) toe was removed from both the hind limbs under mild ether anesthesia and fixed in 10% formalin; however, specimens of *M. ornata* were too small so femurs were used for skeletochronology instead of phalanges. Digits/femurs were washed in water for 1–2 h and demineralized in 5% nitric acid. They were washed overnight in water to remove traces of formalin and nitric acid, and then preserved in 70% alcohol before processing for paraffin embedding. The sections (8 µm thick) of distal phalanx/femur were cut on an ordinary microtome and stained with Harris hematoxylin (Pancharatna et al. 2000). The sections were observed under a compound microscope for the presence of growth rings, which were enumerated when present.

Although it is known that the formation of bone growth marks in temperate anurans is a result of annual temperature fluctuations, the presence of similar growth marks is also reported in the limb bones of *Rana perezi* inhabiting the warm temperate climate of the Mediterranean region, which does not experience marked winter or summer inactive periods (Esteban et al. 1996). The recent study of Pancharatna et al. (2000) also reveals the presence of LAGs in the phalanges and limb bones of the Indian skipper frog, *Rana cyanophlyctis*. The results of the present study demonstrate that growth marks comparable to those found in temperate amphibians are detectable in the cross sections of limb bones/phalanges of four species of tropical anurans. The fact that all these anurans exhibit seasonal variation in body mass, fat body mass, gametogenic and breeding activity (Kanamadi and Hiremath 1993; Kanamadi and Jirankali 1991; Kanamadi et al. 1989; Pramoda and Saidapur 1984) suggests that bone growth may be a cyclical phenomenon leading to the formation of LAGs. Further, the positive correlation between body mass and LAGs of these anurans indicates that larger individuals have experienced a greater number of growth cycles and therefore may be older. Further study is required to determine whether growth cycles are strictly annual, and if growth marks can be treated as year rings.

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TECHNIQUES

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A Noose Trap for Catching a Large Arboreal Lizard, *Varanus olivaceus*

DANIEL BENNETT
Department of Zoology, University of Aberdeen
Tillydrone Avenue, Aberdeen AB24 2TZ, Scotland, U.K.
e-mail: d.bennett@abdn.ac.uk

KATIE HAMPSON
Department of Zoology, Oxford University
South Parks Road, Oxford, England, U.K.
e-mail: katie.hampson@st-annes.ox.ac.uk

and

VICENTE YNGENTE
Warden, Polillo Town, Quezon Province, Philippines

Although many ingenious methods for catching arboreal lizards have been described (e.g., Durtsche 1996; Zani and Vitt 1995) none has proved suitable for large cryptic species such as *Varanus olivaceus*, a partly frugivorous monitor lizard from the Philippines. The animals are not attracted to carrion, leading Auffenberg (1988) to suggest that they could only be caught with the use of dogs. However, his results suggest a mortality rate of over 50% using this method which is unacceptable for a fully protected and threatened species. To facilitate future studies of the lizard, methods of capture that could be used repeatedly without significant risk to the animals were assessed around Sibulan Watershed Reserve on Polillo Island, Quezon Province, during July and August 1999. One successful method is the trap described below, which warrants further attention as a potentially useful tool for non-destructive studies of *V. olivaceus* and other shy arboreal lizards.

The "Mangmaty trap" is based on a traditional trigger-sprung trap used widely in the Philippines. Materials required are rope or vines, a 150-cm length of parachute cord with a running noose tied at one end ("noose string"), a "loop" 30 cm x 16 cm (or of a diameter sufficient to admit the target animal) made of flexible branches or vines and two 5-cm diameter wooden sticks; 30 cm ("trigger stick") and 4 cm ("short stick") long. A target tree is selected and rope or vines tied round the trunk to which a wall of vegetation is attached, blocking off all but a 30 cm passage on the side of the upward slope (Fig.



FIG. 1. Target tree with barrier attached.

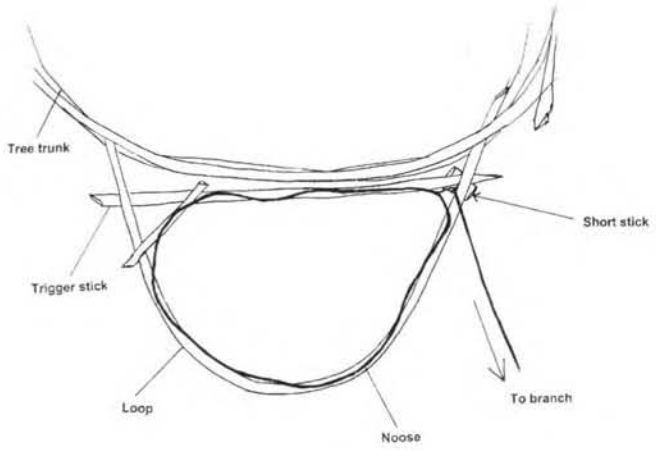


FIG. 2. Trigger mechanism for tree trap.

1). The loop is put over this route, attached to the trunk by wedging it into the ropes or vines that are wrapped around the tree. The noose and trigger mechanism is attached as shown in Fig. 2. The noose string is tied to the 4 cm stick at the base of the fully extended noose and the end tied to a firmly anchored tensioned branch. The short stick is wedged under the loop with the trigger

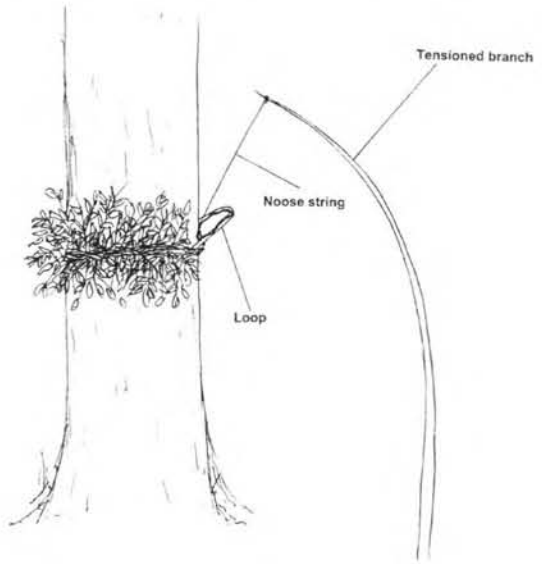


FIG. 3. Tree trap showing angle of loop.

stick. Any corner which the lizard could slip through is blocked with another small stick that rests on the trigger and support. An animal passing through the loop and putting pressure on the trigger stick will cause the small rod to come free, tightening the noose. Setting the loop at an angle on the trunk (Fig. 3) greatly increases the sensitivity of the trap and ensures that the noose closes around the torso rather than the neck. The tensioned branch to which the noose string is tied is bent only enough to ensure the noose is pulled tight, not to pull the animal off the tree. The illustrations show a trap designed to catch animals descending the trunk. By setting the trap upside down, ascending animals can be targeted, or two traps set per tree. Spool and line tracking of *V. olivaceus* indicated that they usually climb and descend trees on the side facing the higher slope of the ground (Fig. 1). Setting traps on this side of the trunk may therefore increase the likelihood of capture.

Acknowledgments.—Thanks to Matias, Pido, and Ricky Bulalacao, and Augusto Zafe for help with field work. Thanks to DENR, Polillo, Mrs. Doris Almeda, L. Afuang, A. T. Dans, J. C. Gonzales, and W. Oliver for logistical support. This work was part of the Oxford University/University of the Philippines at Los Banos Polillo Expedition 1999, partly financed by a BP Conservation Award.

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Refinement of Neutral Red Staining for the Short-Term Marking of Tadpoles

RAYMOND D. SEMLITSCH*
Division of Biological Sciences, 105 Tucker Hall
University of Missouri, Columbia, Missouri 65211-7400, USA

and
HERBERT KÄHLI
Institute of Zoology, University of Zurich, CH-8057 Zurich, Switzerland

**Corresponding author; e-mail: SemlitschR@missouri.edu*

Many ecological and behavioral studies depend on effective marking techniques to follow the response of individuals or unique cohorts of animals. Although techniques such as toe-clipping, tagging with waistbands, branding, or injection of dyes can be effective for larger-bodied amphibians, especially adults (Donnelly et al. 1992), the marking of small and delicate amphibian larvae has long been problematic. Attempts to solve this problem have led to a number of different techniques, including tail notching (Turner 1960), tail tags (Rice et al. 1998), injecting or spraying of dyes (Anholt et al. 1998; Seale and Boraas 1974; Taylor and Deegan 1982), and staining (Guttman and Creasey 1973; Herreid and Kinney 1966; Travis 1981). Although several of these techniques work well (e.g., Anholt et al. 1998), others may be too labor-intensive for marking large numbers of tadpoles (Rice et al. 1998) or have not been well-evaluated for detrimental effects (e.g., Guttman and Creasey 1973; Taylor and Deegan 1982; but see Travis 1981). In the process of conducting experiments on habitat selection and predator avoidance behavior of anuran tadpoles, we refined the basic technique of using neutral red stain as described by Guttman and Creasey (1973). Here we report the results of an experiment to determine whether the concentration of stain or the immersion time is most important in producing clearly marked tadpoles, and for distinguishing marked from unmarked tadpoles in laboratory aquaria. In addition, we wanted to find a concentration of stain that was effective in marking tadpoles but that did not

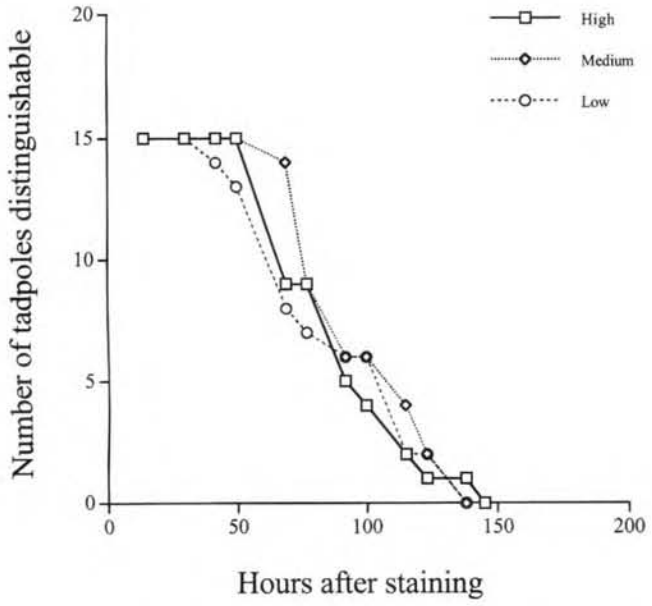


FIG. 1. The number of tadpoles stained at three concentrations that are distinguishable from unstained control tadpoles over time. Each data point represents the cumulative total from three containers of 5 tadpoles each.

compromise their survival (i.e., 8.7% mortality reported by Guttman and Creasey 1973) and minimized effects on growth (Travis 1981).

We manipulated the concentration of neutral red stain (source Chroma-Gesellschaft, Schmid GmbH & Co., Germany) using the lowest concentration (0.002%) reported by Guttman and Creasey (1973) plus two lower concentrations (0.0008%, 0.00125%; the latter was also used by Travis 1981). These solutions were prepared by mixing appropriate amounts of powdered stain in dechlorinated tap water just prior to use. At the same time, we manipulated the immersion time of tadpoles in the stain (1, 2, and 3 hours). Five tadpoles of *Rana temporaria* (Gosner stages 28–30, approx. 100 mg) were stained in each of the 9 treatment combinations. Within a few hours of staining, the five stained tadpoles were placed into white plastic dishpans containing 3 L of clean, aged tapwater along with five unstained tadpoles from the same cohort. Every 12 hours, we counted the number of stained tadpoles of each treatment which we could distinguish from the unstained tadpoles by the naked eye and without handling.

Stained tadpoles appeared reddish-brown in color over their whole body (tail fins appeared brighter red than the body) relative to control tadpoles under standard laboratory lighting. These tadpoles were sluggish immediately following immersion in the stain but resumed normal activity within 10 minutes. No mortality was observed in any test tadpoles. Staining was highly effective at all concentrations for approximately 50 hours, then gradually faded to background levels after 130–140 hours (Fig. 1). The three concentrations of neutral red exhibited similar patterns of fading (ANOVA; $P > 0.05$), indicating that the lowest concentration was just as effective as the highest concentration. However, immersion time did have an effect on stain persistence (Fig. 2). Longer immersion time resulted in tadpoles retaining color longer than tadpoles exposed to short immersion times (ANOVA; $P < 0.05$; Fig. 2). Although all immersion times resulted in tadpoles being highly distinguishable after 40–50 hours, the longest immersion time (3 hours) resulted in effective marking for 130–140 hours whereas the shortest immersion time (1 hour) resulted in complete fading after just 90 hours (Fig. 2). There was no interaction effect of concentration and immersion time (ANOVA; $P > 0.05$).

Our experiment indicated that increasing immersion time was the safest and most effective method for increasing stain persistence time. We avoided using the higher concentrations reported in the literature because our experience has indicated that some mortality can occur at the highest levels (Guttman and Creasey 1973; Travis 1981). Based on these findings, we began using the lowest concentration of neutral red (0.0008%; 8.0 mg per liter of water) in combination with a 2 or 3 hour immersion period for tadpoles in subsequent experiments. To control for any unknown confounding effects that the stain might have on tadpoles in these studies, we observed one stained species cohort and one unstained species cohort at a time and then alternated the stained species with each subsequent replicate observation. We have used these procedures repeatedly and successfully on four species, *Rana temporaria, R. lessonae, R. ridibunda*, and *R. esculenta* in short-term studies ranging from feeding behavior to predator avoidance (e.g., Rist et al. 1997). However, we recognize the potential for interspecific variation in stain retention or harmful effects, thereby suggesting that plans for extensive use of neutral red might include preliminary tests of effectiveness.

Since our experiment we have found that Waldman (1981, 1982, 1984) used neutral red effectively on *Rana sylvatica* and *Bufo americanus* tadpoles at even lower concentrations (0.00025% aqueous solution) with longer immersion times (12 hours) for 5–30 days post-staining. Waldman (1981, 1982, 1984) also used methylene blue (0.00025% aqueous solution with a 12 hour immersion time) and reported it to be effective on *R. sylvatica* and *B. americanus* tadpoles up to four weeks post-staining.

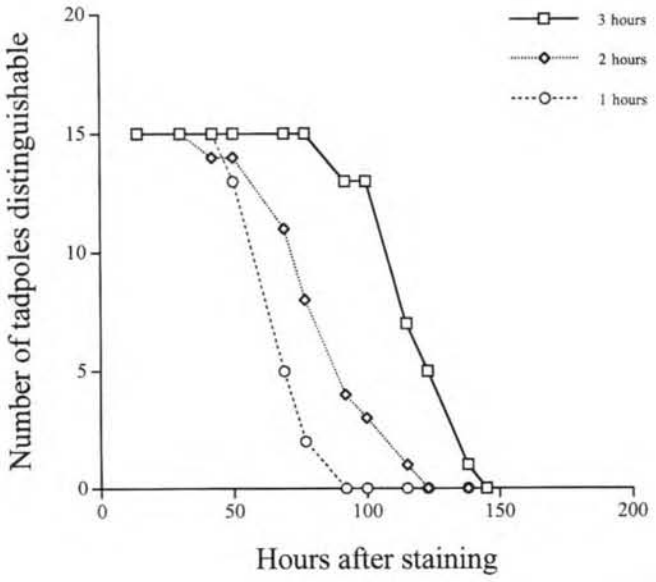


FIG. 2. The number of tadpoles stained at three immersion times that are distinguishable from unstained control tadpoles over time. Each data point represents the cumulative total from three containers of 5 tadpoles each.

Because of neutral red's limited utility in multi-group competition or predation studies, it would be desirable to find other equally suitable stains that would expand the range of colors available and the range of studies possible. Nevertheless, by itself, the neutral red staining technique described here is highly efficient and safe for short-term observations because of the ease of marking large numbers of individuals at one time.

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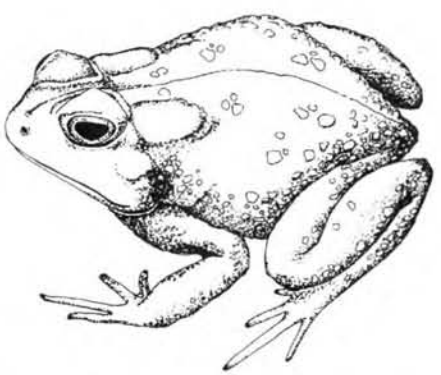
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Bufo woodhousii (Woodhouse's Toad). Illustration by Nikki McClure.

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The Use of Passive Integrated Transponders (PIT Tags) in Snake Foraging Studies

GYLLA A. MACGREGOR*
Clarion University of Pennsylvania, Clarion, Pennsylvania 16214, USA
e-mail: gym2@lehigh.edu

and
HOWARD K. REINERT
The College of New Jersey, Ewing, New Jersey 08628-0718, USA
e-mail: hreinert@tcnj.edu

**Present address: Department of Biology, Lehigh University Bethlehem, Pennsylvania 18015-3190, USA*

Accurately determining prey selection and foraging events is essential for a complete understanding of predator foraging ecology and their impact on prey communities. Obtaining such information from snakes can be exceedingly difficult due to their secretive nature. Generally, diet information is obtained through documented observations or stomach/scat analysis (e.g., McCartney 1989; Reinert et al. 1984; Uhler et al. 1939). Additional methods, such as forced regurgitation (e.g., Diller and Johnson 1988; Fitch 1987; Kephart and Arnold 1982) identify prey items, but this approach may disturb the snake's normal behavior. This paper presents the results of an effort to use Passive Integrated Transponders (PIT tags) as a means of positively determining foraging success and to obtain detailed information on prey selection by free-ranging timber rattlesnakes (*Crotalus horridus*).

PIT tags are small, glass encapsulated microchip transponders that can be easily inserted subdermally, and positively identify individuals through the use of an external PIT tag reader (Ball et al. 1991). PIT tags are energized by the external reader, require no battery, have unique tag numbers, and an indefinite life span. When implanted subcutaneously in ingested prey, PIT tags can be easily read through the body of a snake (MacGregor, unpubl. data). This allows for the determination of a successful foraging event and the precise identification of the ingested prey without handling or disturbing the snake.

As part of a long-term ecological study in the Pine Barrens of Ocean County, New Jersey (USA), 12 *C. horridus* (8 males, 4 females) were surgically implanted with AVM SM1 radio-transmitters (Reinert 1992; Reinert and Cundall 1982). Snakes were located with an AVM Instrument Company LA-12 receiver every 24–48 hours. While monitoring the rattlesnakes, Sherman live traps (58.9 cm x 22.8 cm x 19 cm) were used to capture small mammals. Trapping and tagging of prey occurred in 2 phases. Phase 1 involved trapping at known foraging areas, identified through previous radio-tracking efforts. Twelve grids with 36 traps each were operated for 7 consecutive nights between 15 May and 1 June 1998. All Phase 1 trapping was done prior to the snakes' arrival to the foraging areas. Phase 2 involved trapping with snakes during their active season. Phase 2 was a modified version of King and Duvall (1990), and consisted of 6 traps placed at 5 m intervals in a hexagonal pattern with the snake as the central point. Each time the snake moved, the traps were also moved, and reset in the same hexagonal pattern at the new snake location. Captured small mam-

mals were identified to species, aged, sexed, weighed and implanted with a 14 mm PIT tag (AVID MUSICC Chip™ Identification system #2023) following Ball et al. (1991). An external PIT tag reader (AVID PIT tag reader, model #052563 from AVID, Norco, California 91760-9972) was modified with an extension handle that allowed snakes to be scanned safely without disturbance. Snakes were scanned for the presence of PIT-tagged prey whenever a foraging event occurred or was suspected.

A total of 114 white-footed mice, *Peromyscus leucopus* were captured between May 1997 and August 1998; 82 were implanted with PIT tags. The average mass of all trapped mice was 20.6 g (S.E.= 0.46, N = 114). The PIT tag sample consisted of 56 males and 26 females of which 65 were adults and 17 were sub-adults. Six rattlesnakes consumed a combined total of seven PIT tagged mice. Although all rattlesnakes were observed feeding in at least one of the pre-trapped foraging grids, only one rattlesnake ate a tagged mouse while in the pre-trapped foraging grid. The majority of tagged mice were consumed while trapping with individual snakes. A young male rattlesnake ate a mouse that was PIT tagged during trapping efforts associated with a different snake. All seven mice consumed were male. The average mass of consumed mice was 23.4 g (SE = 1.70, N = 7). The tagged animals were eaten between 2 and 40 days after tagging. In addition, two mice perished during trapping efforts. These mice were implanted with PIT tags and subsequently offered, and eaten, by two snakes. The average rate of digestion (ingestion to defecation) was 15.4 days (SE = 0.80, N = 9). Eleven rattlesnakes consumed prey (as determined by visible food boli) while in one of the pre-trapped foraging grids; however, none of that prey had been PIT tagged. Analysis of scat from one of these snakes indicated that it had eaten a red-backed vole (*Clethrionomys gapperi*).

These results suggest that snake foraging studies can benefit from the use of PIT tags. PIT tags provided information on species, sex, and mass of consumed prey as well as the rate of complete digestion. In the present study, all consumed tagged mice were male despite the fact that trap efforts suggested that approximately one-third should have been females. Statistically, the average mass of consumed mice did not differ from the average mass of all available prey items (One-way ANOVA $F_{(05)\,(1,112)} = 2.3$, P = 0.13); however, consumed prey were among the heavier animals in the sampled population. Information on mass, age, and sex of prey items can be important in understanding selective pressures on prey. Certain individuals or types of prey may exhibit a behavioral or sociochemical susceptibility to predation (Gehlbach et al. 1971; Madison 1978; Reinert et al. 1984). For example, Madison (1978) found that black rat snakes (*Elaphe obsoleta*) and racers (*Coluber constrictor*) did not show sexual preference for meadow voles (*Microtus pennsylvanicus*); however, there was a non-random selection for lactating females and their litters, as well as heavy-bodied males. Female voles have a strong maternal nature and as a result, may remain with young when intruders are present (Madison 1978). This behavior, as well as the probable high activity levels and reproductive activity of large males, may account for their higher predation risk (Madison 1978). Diet studies of this nature are limiting; however, PIT tags could easily provide the necessary detailed information to understand the degree of prey selection.

The use of PIT tags, as described here, may be particularly informative for species that reliably revisit foraging sites during a single active season, or when the interest in foraging activities is restricted to a specific area (Fitch 1982; Kephart and Arnold 1982; Nelson and Gregory 2000). In most cases, vertebrate prey can be easily implanted with PIT tags, particularly when prey monitoring is part of the study (Diller and Johnson 1988; Galligan and Dunson 1979; King and Duvall 1990; Madison 1978; Reynolds and Scott 1982). In this study, the use of PIT tags was most successful while trapping with active individuals; however, such constant activity can be disruptive to normal snake behavior. Although foraging areas (Phase 1 trap sites) were accurately identified, adult rattlesnakes typically visited these sites only once each season (Reinert and Zappalorti 1988). Accordingly, the seasonal pattern of movement by *C. horridus* makes them a less than ideal candidate for PIT-tag foraging studies when prey monitoring is performed ahead of time.

Implanting PIT tags in prey prior to a snake's arrival to an area allows predators to forage naturally. Snakes can be scanned for ingested PIT-tagged prey with minimal or no disturbance and researchers can obtain reliable and detailed data on prey. The resultant information can increase our understanding of ophidian prey preference and its influence on prey, snake foraging ecology, and the interaction between predator and prey.

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Metal Tag Loss in Wild Juvenile Hawksbill Sea Turtles (*Eretmochelys imbricata*)

CLAUDIO BELLINI
Projeto TAMAR-IBAMA
Caixa Postal 50, Fernando de Noronha, PE 53990-000 Brazil
e-mail: cbellini@elogica.com.br

MATTHEW H. GODFREY*
Fundação Pró-TAMAR, Caixa Postal 2219, Salvador, BA 40210-970 Brazil

and

TAISI M. SANCHES†
Fundação Pró-TAMAR, Caixa Postal 50, Fernando de Noronha
PE 53990-000 Brazil

**Corresponding author, current address: Université de Paris XI, Laboratoire d'Ecologie, Systematique, et Evolution, Bâtiment 362, 91405 Orsay, France*
e-mail: matthew.godfrey@epc.u-psud.fr

Identification of individuals within a population is necessary for most behavioral and ecological studies of wild animals. For long lived animals, such as turtles, the ability to recognize and follow individuals over time provides critical information on aspects such as growth, survivorship, residency, and migration. A variety of techniques and tags have been developed to mark individual sea turtles, ranging from subcutaneous passive transponders to autografts of differentially pigmented tissue (Balazs 1999). The greatest challenge in marking sea turtles is durability and readability of the tag over the lifespan of individuals, which can cover decades and involve a great amount of growth. Tag loss can affect estimates of population size, survivorship, and other demographic calculations (Frazer 1983).

Mrosovsky (1983) emphasized the importance of quantifying tag loss, and since then several studies have reported the retention rates of various types of tags and markers for different turtle species (Bjorndal et al. 1986; Frazier 1986; Limpus 1992; Parmenter 1993; van Dam and Diez 1999). In general, the rates of tag loss are particular to specific species and areas. For instance, for loggerhead (*Caretta caretta*) sea turtles in northern Australia, titanium flipper tags outperformed tags made from monel or plastic (Limpus 1992) while for hawksbill (*Eretmochleys imbricata*) sea turtles, plastic tags outperformed both monel and inconel tags (van Dam and Diez 1999). In the current study, we examined the rates of tag loss of two types of commonly used metal tags, monel and inconel, in hawksbill sea turtles found in near-shore habitats in the archipelago of Fernando de Noronha, in the southern Atlantic ocean.

Materials and Methods

The archipelago of Fernando de Noronha (3°50'S, 32°24'W), a Brazilian National Marine Park located approximately 380 km off the coast of Brazil, supports populations of juvenile hawksbill and green (*Chelonia mydas*) sea turtles in feeding areas close to shore. Since 1987, researchers of Projeto TAMAR-IBAMA, the national sea turtle conservation program in Brazil, have been monitoring these populations using a capture, mark, and recapture protocol (Sanches and Bellini 1999). Although turtles have been captured in eight different localities on the island, the majority of captures are made in Sueste Bay, which is easily accessible and contains a relatively large resident population of sea turtles. In all cases, individual animals were captured by hand during free dives with mask and snorkel, after which curved carapace length (CCL) and width, and mass were recorded and tags were placed on the front flippers.

We placed style 681 tags (National Band and Tag Company, Newport, Kentucky, USA) on the trailing edge of each front flipper, proximal of the first large scale immediately adjacent to the axilla (cf. Limpus 1992). Up until 1994, we used only tags made from monel, a nickel-copper alloy. After this, inconel tags (made from a nickel-iron-chromium alloy) were placed on all turtles en-

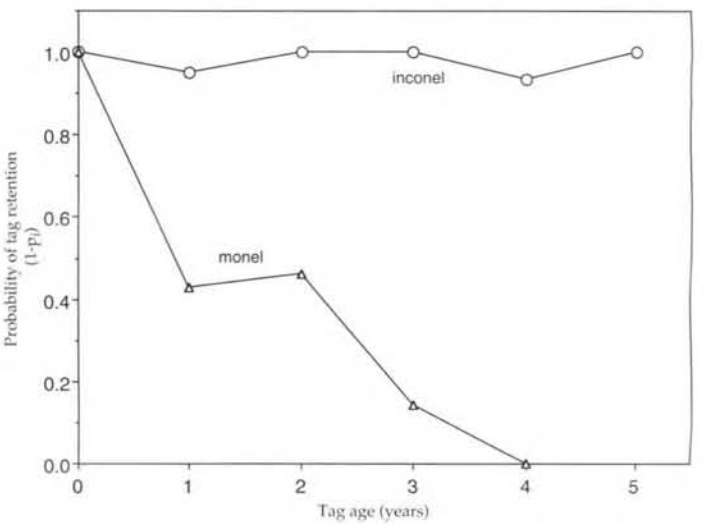


Fig. 1. Estimated probability ($1-p_i$) of tag retention over time for monel and inconel tags used on hawksbill sea turtles in Fernando de Noronha, Brazil.

countered for the first time, while for recaptured turtles, inconel tags replaced monel tags as the latter were found to be lost or unreadable. Recaptured turtles were checked for tags; encountered tags were checked for readability and also for their durability by pulling on the two sides of the tag at the same time. If unreadable, or if they opened when tested, they were considered to be "lost" and replaced with new tags. Probability of tag loss for the two types of tags was calculated using the following equation from Limpus (1992):

$$p_i = b_i/(a_i+b_i)$$

with **i** being the elapsed time in whole years since tag application;

$\mathbf{a}_i$ being the number of tags still present on turtles recaptured after **i** years since being attached; and

$\mathbf{b}_i$ being the number of tags lost on turtles recaptured after **i** years since being attached.

Standard error (SE_{pi}) was derived as: $\sqrt{[p_i(1-p)/(a_i+b)]}$, and the 95% confidence interval of p_i being $\pm$ [$(SE_{pi})(1.96)$]. Elapsed time since application was rounded up or down to the nearest year for recaptured tags. Only turtles recaptured at least once were included in the analysis.

Results

A total of 69 hawksbill turtles, ranging in size from 26.5 to 64 cm CCL at initial capture, have been recaptured one or more times in the near-shore waters of Fernando de Noronha since 1987. A total of 238 tags (145 monel and 93 inconel) have been deployed on these 69 turtles. The average durability of a monel tag was 334 days $\pm$ 24.9 SEM, which was significantly shorter than the average durability of an inconel tag, 851 days $\pm$ 56.5 SEM ($p<0.001$, Mann Whitney test, $U = 3325.5$).

Tag loss increased yearly for monel tags, reaching 1.00 after four years, while for inconel tags it remained low for up to five years (Table 1). The chance of an inconel tag remaining intact over time remained extremely high, whereas the longest duration a monel tag successfully remained on a turtle was three years (Fig. 1).

Both monel and inconel tags on recaptured turtles were susceptible to biofouling by green or red algae, and by calcareous algae, and usually had to be cleaned in order to be read. Monel tags typically displayed corrosion in the locking mechanism; oftentimes when we tested tags on recaptured turtles, the tag opened easily because the locking mechanism had deteriorated (Fig. 2).

Discussion

Because we tested the state of each tag every time a turtle was recaptured, in many cases we were able to record exactly where corrosion, if any, was occurring, and also to replace tags that were likely to have been lost if left in place. Corrosion of the monel tags, particularly in the locking mechanism, appeared to be an important contributor to the failure of these tags (Fig. 2). Monel tags displayed a poor rate of retention in hawksbill turtles feeding in the nearshore waters of Fernando de Noronha. This is consistent with other in-water studies which have also found monel tags to be inferior to tags made from other materials (Limpus 1992; van Dam and Diez 1999; but see Bjorndal et al. 1996 for contrary results for a nesting population).

The probability of tag loss for monel tags varied over time from initial tag application, with two-year-old tags having a slightly greater chance of remaining intact than one-year-old tags (Fig. 1). This suggests that there may be a variety of factors, in addition to corrosion, affecting tag loss in these turtles. For example, locations of the turtles varied, and differences in the seawater chemistry for particular areas may lead to deterioration at different rates. Also, subtle differences in the manufacturing of different batches of monel tags may affect rates of corrosion (Balazs 1999; Bjorndal et al. 1996). In contrast, the low level of tag loss for inconel tags in this study was relatively constant over time, and suggests that continued use of this tag during our study is warranted. Indeed, a nearly five-year-old inconel tag was mistaken for new on a hawksbill turtle tagged in Sueste Bay and recovered in Gabon, because the tag showed no signs of wear or corrosion (J. Fretey, pers. comm.).

Van Dam and Diez (1999) found that plastic tags had a greater retention rate than inconel and other types of tags in hawksbill captured on a feeding ground in the Caribbean. Although we have never used plastic tags, we have avoided them because it has been suggested that plastic tags increase the likelihood that turtles will become accidentally entangled in fishing nets (Nichols et al. 1998; Suggett and Houghton 1998). Although use of such nets is prohibited in the majority of waters around the archipelago of Fernando de Noronha, individuals in our study have migrated to other areas where they are likely to encounter nets (e.g., Bellini et al. 2000). It is interesting that van Dam and Diez (1999) reported that the loss of inconel tags in the Caribbean was restricted to turtles smaller than 35 cm CCL, whereas in our study, the majority of turtles captured were larger than 40 cm CCL (Sanches and Bellini 1999). Similarly, Prince (1996) found that both titanium and inconel tags were shed quickly by smaller juvenile sea turtles. Perhaps inconel tags would not perform well in Fernando de Noronha in smaller hawksbill individuals.

Passive integrated transponder tags, which are placed intramus-

Table 1. Loss of monel and inconel tags used on hawksbill seaturtles at Fernando de Noronha, Brazil. See text for description of p_i and SE_{pi}.

Tag type	Years since applied	Tags present	Tags lost	p_i	SE_{pi}	95% Confidence interval
Monel	1	62	83	0.572	0.041	0.492 – 0.613
	2	12	14	0.538	0.098	0.347 – 0.636
	3	1	6	0.857	0.132	0.598 – 0.989
	4	0	1	1.000	0.000	
	5	0	0			
Inconel	1	78	4	0.049	0.024	0.002 – 0.073
	2	65	0	0.000	0.000	
	3	44	0	0.000	0.000	
	4	29	2	0.065	0.044	-0.022 – 0.109
	5	4	0	0.000	0.000	

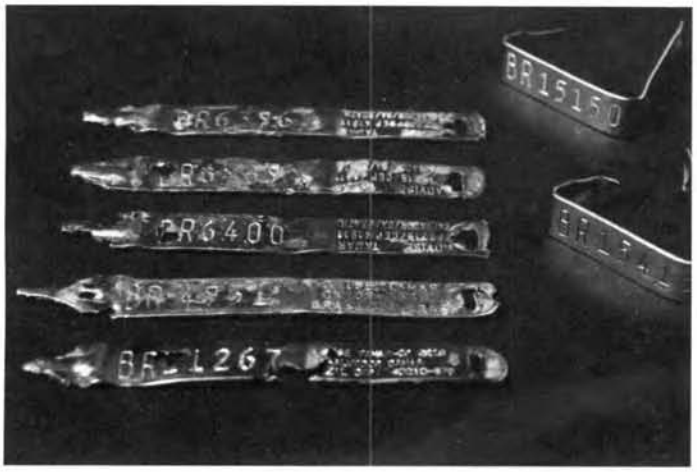


FIG. 2. Example of corrosion of monel tags used in this study. Note the deterioration of the locking mechanism in particular. Tags were fully opened in order to facilitate presentation.

cularly and then recognized with a special scanner, have been used with success in some projects (e.g., McDonald and Dutton 1996; Parmenter 1993; van Dam and Diez 1999). However, the relatively high cost of the tags and scanner and the impossibility of recognizing the tags without a scanner (e.g., by fishermen who accidentally capture sea turtles) have kept us from using them in our study.

Regardless of the efficacy of other tags reported by other sea turtle research projects, we have experienced high level of success with inconel tags (only 6 out of 97 tags have been lost over the past five years), and will continue to use them during our study. Indeed, we are currently replacing all monel tags with inconel on recaptured turtles, independent of the status of the tag, in order take advantage of the longevity of inconel tags. This is especially important for larger individuals, who are likely to migrate to other regions in the near future. Our results show that, as with almost all aspects of management of wild animals, evaluation and assessment should be done independently on a case by case basis. This is particularly important with respect for programs that rely on the tagging of sea turtles. It is highly recommended that each program evaluate the probability of tag loss, rather than extrapolating from other studies.

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HERPETOLOGICAL HISTORY

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The First Record of Reptiles in Alberta: Æmilius Simpson's Journal of 1826

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA
e-mail: aaron.bauer@villanova.edu

and

ANTHONY P. RUSSELL
Department of Biological Sciences, University of Calgary
2500 University Drive, NW, Calgary, Alberta, Canada T2N 1N4
e-mail: arussell@ucalgary.ca

The prairie provinces of Canada: Manitoba, Saskatchewan, and Alberta, were among the last regions of temperate North America to be adequately surveyed herpetologically. Not surprisingly, Manitoba, the easternmost of the provinces, was the first to have its amphibians and reptiles enumerated (Seton 1918). Detailed treatments of the herpetofauna of these provinces did not appear until much later still (Cook 1966—Saskatchewan; Preston 1982—Manitoba; Russell and Bauer 1993—Alberta). For Alberta, even regional herpetofaunal accounts or single species observations were unknown prior to the 20th Century. The first published records of amphibians and reptiles from Alberta are those of Preble (1908),

based on field observations made during 1903. Preble's account focussed on central and northern Alberta, especially herpetofaunally impoverished regions of the province. He recorded only a single reptile, *Thamnophis sirtalis parietalis*, which he stated was "common about Edmonton and along the road to Athabaska Landing." He also indicated that garter snakes (species unconfirmed) were reported to be present in the Peace River Valley, especially around Dunvegan, and "on the plains of Salt River," a tributary of the Slave River near the Alberta/Northwest Territories border. Harper (1931) also reported *T. sirtalis* to be common in the Edmonton area, based on observations made in May 1914.

The first European incursions into Alberta were carried out by the Hudson's Bay Company and the rival North West Company and were chiefly conducted with economic gains in mind. These commenced with the expedition of Anthony Henday in 1754 and continued with the subsequent journeys of Peter Pond (1778), David Thompson (several trips between 1786 and 1808), and Alexander Mackenzie (several trips between 1787 and 1793) (Hitchon 1967). The first expedition in which a naturalist participated was Captain John Franklin's Arctic Expedition of 1819–1822. The zoological results of this expedition were published by John Richardson (1829–1837) as *Fauna Boreali-Americana.* Not surprisingly, as the expedition chiefly investigated the most northerly areas of present day Alberta (incidental to its main focus on the coastal Arctic), this treatise contained no herpetological references. Some years later, however, Richardson (1851) became the first to publish an account of reptiles in the prairie provinces, noting the occurrence of garter snakes (as *Tropidinotus sirtalis*) on Serpent Lake in what is now central west Saskatchewan, not far from the modern Alberta border. Richardson, who had participated in Franklin's earlier voyages, recorded this observation as a member of the Arctic Searching Expedition, sent out to discover the fate of Franklin's ill-fated 1845 expedition in search of the Northwest Passage.

Through the courtesy of Dr. Bill Barr we have been alerted to what we believe to be the earliest reference to reptiles in Alberta. It derives from an unpublished journal by Æmilius Simpson (1826), a relative of Sir George Simpson (governor of the Hudson's Bay Company 1821–1856). Although Æmilius Simpson's place in Alberta history is minor, Port Simpson (now Lax Kw'alaams), on Dundas Island, British Columbia was named for him in 1834 (Galbraith 1957), and he is credited with introducing apples to what is now the state of Washington (Fallgatter 1998). Simpson was in the employ of the Hudson's Bay Company, which until 1870 controlled the present area of central and southern Alberta and much of western Canada. A single reference to reptiles occurs in the manuscript. It is based on observations made on Monday, 4 September 1826 when Simpson and his party were traveling west on the North Saskatchewan River, one of the chief rivers of central Alberta, and then a major trading route to York Factory on Hudson Bay (MacGregor 1972). At 7 AM that morning, Simpson reported passing the Stony River and at noon he took readings indicating his position as 53°45'34"N, 110°40'W. Simpson's journal account reads as follows:

> "Thick Fog in the Morning, followed by very Warm Weather during the Day. Thermometer at Noon 75°. We were favoured with a fair Wind for some hours, which gave our Crews considerable relief from the labour of Tracking. Along the North Banks I observed Boulders or Masses of limestone embeded in Clay. During the heat of the Day we passed great numbers of a small striped Black & green snake swimming from the South to the North Bank of the River & strewed along the Sandy Beach on the North Shore, as if enjoying the powerful influence of the Sun, & it appeared that those crossing were leaving the cold of the Northern aspect to gain the more pleasing heat of the southern exposure. The Evening having become cool we were less troubled by moskitos."

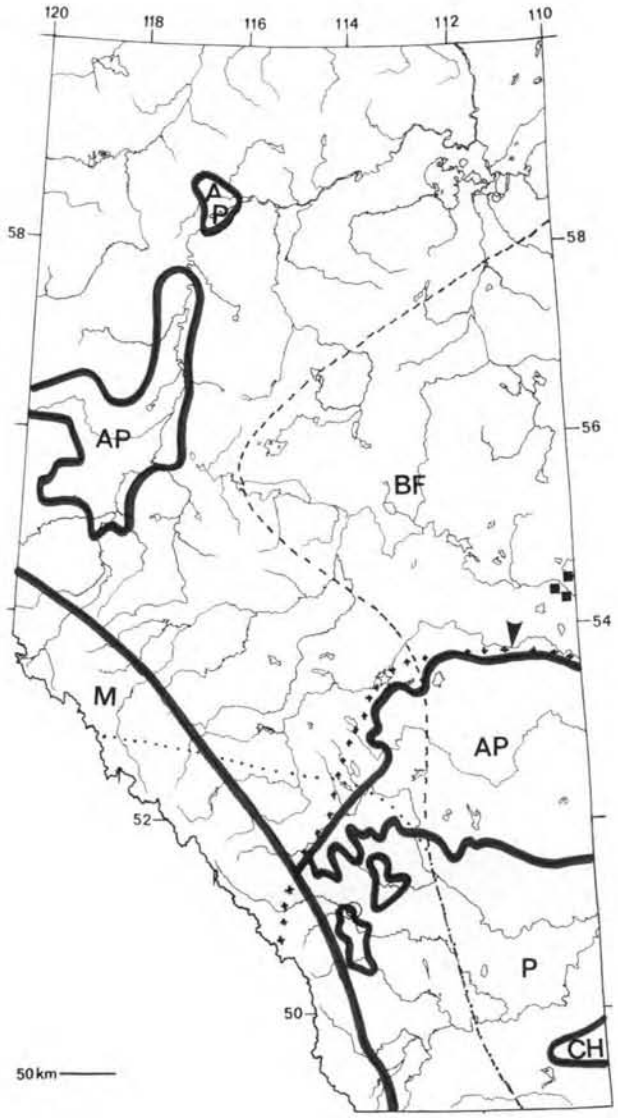


FIG. 1. Map of Alberta showing the location of Simpson's sighting of garter snakes (arrow) on the North Saskatchewan River on September 4, 1826. The present day margins of the continuous ranges of the three species of garter snake occurring in Alberta are depicted as follows: *Thamnophis sirtalis*—dashed line, distribution to the west of this line; *T. radix*— crosses, distribution to the south and east of this line; *T. elegans*— dots, distribution to the south and west of this line. The major biomes of Alberta are demarcated by heavy dark lines and are indicated as follows: AP — aspen parkland; BF — boreal forest; CH — Cypress Hills; M — Rocky Mountains; P — prairie. The only known records of *T. radix* from north of the North Saskatchewan River are indicated by solid black squares. The major Alberta population centers of Calgary and Edmonton are demarcated by a circle and a star, respectively.

Examination of Simpson's narrative and comparison with modern maps indicates that this reported position is slightly erroneous. On the previous day Simpson's party passed Dog Rump Creek, heading west. Dog Rump House, abandoned in 1829, was set up as the Moose Lake outpost of the Hudson's Bay Company in 1822. After abandonment the Hudson's Bay Company geographic names fell into disuse. This creek is now known as Atimosue Creek, and is located south of the town of Elk Point. On the morning of 4 September the party passed "the Stony River" (now known as Siler Creek) at 7 AM, and an island (now known as Fort Island) at noon. It is at this point that Simpson took his readings. The actual coordinates of Fort Island are 53°45'15"N, 111°10'W.

This information pinpoints a stretch of river that courses essentially due west and places the location of the snake observation between Fort Island and the point on the river crossed today by Highway 881 (53°45'15"N, 111°10'13"W). The bridge for this river crossing lies 10 km north of Myrnam, and this stretch of the river is 4.5 km due south of Lake Eliza. The location is situated approximately 117 km ENE of Edmonton.

Among Alberta snakes, the observation clearly must refer to a garter snake. Three species, *Thamnophis radix*, the plains garter snake, *T. elegans*, the wandering garter snake, and *T. sirtalis*, the red-striped garter snake are known from the province (Fig. 1). *Thamnophis elegans* is largely limited to the southwestern portions of the province, chiefly in the Rocky Mountain and prairie biomes. However, specimens are occasionally found much further north, and the species is often associated with rivers. All modern records from the vicinity of Fort Island are attributable to *T. radix*, and most are from localities in aspen parkland or prairie, although a few plains garter snakes have been collected in the boreal forest biome north of the North Saskatchewan River (Fig. 1). There is a large disjunction in eastern Alberta in the range of *T. sirtalis* between the immediate vicinity of Edmonton and the region of Lake Athabasca (north of 58°N) (Fig. 1), but this is likely to be artifactual and in part reflective of the conversion of the southeastern boreal forest biome to intensive agricultural use (Russell and Bauer 2000). Simpson's terse color description could fit either *T. sirtalis* or *T. radix*, and both species are adept swimmers, but the very similar accounts of Preble (1908) and Harper (1914) suggest that *T. sirtalis* may have been the species implied.

Although hardly detailed, and not supported by voucher specimens, Simpson's observations are significant in that they predate the earliest subsequent observations of Alberta reptiles by more than 75 years and constitute the first European record of reptiles in inland western Canada. It is likely that Simpson felt the sighting noteworthy because of the number of snakes involved. Several possibilities exist to explain the observation. The snakes he observed may have represented a late summer aggregation of gravid females comparable to that reported for *T. sirtalis* from the Interlake region of Manitoba (Gregory 1975). Alternatively, they may have been a mixed sex grouping exhibiting an autumn pre-denning aggregation. Finally, the observation may merely reflect high local natural densities in areas of high quality habitat, as have been reported for both *T. radix* and *T. sirtalis* (Rossman et al. 1996).

Acknowledgments.—We thank Bill Barr for bringing Simpson's observations to our attention and W. Leo Smith for providing access to the information in Richardson (1851). Pat Gregory provided useful comments on the manuscript.

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Hynobius lichenatus, Stage 41 larva. Illustration by Masato Hasumi.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 32, Number 1 (March, 2001).

CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). USA: TEXAS: Franklin Co: 8.2 mi N jct. Rt. 67/FM 1896, ca. 2 mi W on White Oak Creek Ranch. 29 April 2000. Toby J. Hibbitts and Terry L. Hibbitts. TCWC 84254–58. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA, and **TERRY L. HIBBITTS**, 602 Hilltop Circle, Wylie, Texas 75098, USA.

AMPHIUMA TRIDACTYLUM (Three-toed Amphiuma). USA: ARKANSAS: Phillips Co: (N34°61.422, W90°61.646). SE 1/4 Sec. 7, T1S, R5E, jct. Phillips County Roads 211 and 239, St. Francis National Forest. 15 January 2001. L. K. Irwin and K. J. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26050–070). Verified by Stan Trauth. A series of 21 "winterkill" individuals found in cypress-tupelo gum slough in bottomland hardwood forest at base of eastern versant of Crowley's Ridge. First record for county (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us) and **LISA K. IRWIN**, 103 Brooke Drive, Perryville, Arkansas 72126, USA.

EURYCEA TYNERENSIS (Oklahoma Salamander). **A CORRECTION**. A new county record for the Oklahoma salamander (*Eurycea tynerensis*) recently extended its geographic range 96.5 km S of Sequoyah County into the southcentral-most part of LeFlore County (Lutterschmidt et al. 1999, Herpetol. Rev. 30:230). Two salamanders were collected from an isolated pool along Cucumber Creek and were verified as *E. tynerensis* by R. D. Durtsche at the Oklahoma Museum of Natural History. Subsequently, the specimens have been re-identified as larval Many-ribbed Salamanders (*Eurycea multiplicata*) rather than *E. tynerensis*.

Distinguishing *Eueycea tynerensis* from larval *E. multiplicata* is extremely difficult and often requires experience in working with these species due to their similar characters and appearance (George Cline, pers. comm.). For example, the costal grooves are quite similar in that *E. tynerensis* have 19 to 21 and *E. multiplicata* have 19 or 20. The presence of external gills and the absence of V-shaped markings down the salamander's back have proved to be inadequate characters for distinguishing *E. tynerensis* from larval *E. multiplicata*. Larval *E. multiplicata* have external gills and do not develop their V-shaped markings until they transform into adults. Our specimens from Cucumber Creek also demonstrated characters of *E. tynerensis*, including whitish spots down the sides of the back, a light unmarked belly, and a distinct high tail fin (Black and Sievert 1989, A Field Guide to Amphibians of Oklahoma. Publ. Oklahoma Dept. Wildlife Conservation, Oklahoma City. 80 pp.). However, larval *E. multiplicata* also demonstrate these characters.

Tumlison et al. (1990, Copeia 1990:242–246) described a canonical discriminant function in which the mean canonical discriminant scores for *E. tynerensis* and *E. multiplicata* were 2.38 and –2.58, respectively. Thus, the discriminant function was used to separate *E. tynerensis* and *E. multiplicata* by yielding a discriminant score of >0.0 or <0.0, respectively. Tumlison examined one of our specimens and found the canonical discriminant score to be quite intermediate (i.e., –0.132) compared to his earlier observations. However, the negative discriminant score, smaller tail fin, and general impression of greater robustness point toward *E. multiplicata* as the more likely identification.

Submitted by **WILLIAM I. LUTTERSCHMIDT**, Department of Biological Science, Sam Houston State University, Huntsville, Texas 77341, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: TENNESSEE: Fentress Co: Pickett State Park, ca. 3 km west Tennessee Rt. 154 along road following SW boundary of park (36°32'N, 84°49'W). 23 November 1994. Vincent A. Cobb and Lisa M. Cobb. Austin Peay State University Museum of Zoology (APSU 5689—color slides). Verified by A. Floyd Scott. Individual was found under fallen log ca. 100 m NE of park boundary road. Specimen was not proximate to an immediate water source although Thompson Creek was within a few hundred meters. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay State Univ. Misc. Publ. 12:1–94).

Submitted by **VINCENT A. COBB**, Department of Biology, Northeastern State University, Tahlequah, Oklahoma 74464, USA (e-mail: cobbva@nsuok.edu), and **LISA M. COBB**, Division of Math and Science, Connors State College, Warner, Oklahoma 74469, USA.

NECTURUS MACULOSUS (Common Mudpuppy). USA: ILLINOIS: Pulaski Co: unnamed tributary of the Ohio River. 1 April 2001. W. J. Poly and J. E. Wetzel. Illinois Natural History Survey (INHS 17077). Verified by C. A. Phillips. One subadult was collected and preserved (82 mm SVL, 125 mm TL, live weight: 10.9 g). The stream is adjacent to a public boat launch (Caledonia Landing) in the town of Olmsted at Ohio River RM 965 (NW 1/4 NE 1/4 Sec. 26, T15S, R1E) (37°10'47" 89°04'18"), USGS 7.5' Olmsted, Illinois-Kentucky topographic map). This salamander has not been reported previously from Pulaski County (Phillips et al. 1999, Illinois Nat. Hist. Surv. Manual 8: xv + 282 pp.), although it has been collected from adjacent Massac County. Specimen was captured with a seine ca. 50 m upstream from the mouth. At the capture site, stream substrate was primarily mud with some woody debris, and stream banks were steep and muddy. The ventral surface of the specimen is lacking pigment almost entirely, and tips of toes are white. A liver sample was removed and sent to Henry L. Bart, Jr. (Tulane University).

Submitted by **WILLIAM J. POLY** and **JAMES E. WETZEL**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901-6501, USA.

ANURA

BATRACHYLA TAENIATA. ARGENTINA: CHUBUT: DEPARTAMENTO FUTALEUFÚ: Los Alerces National Park, S shore Cisne River at its terminus in Menéndez Lake, 42°37'S, 71°54'W, ca. 525 m. 17 January 1995. Carmen Úbeda. Juvenile specimen (SVL 20 mm). Fundación Miguel Lillo, Tucumán, Argentina (FML 09864, color slide). Verified by Néstor G. Basso. Specimen was found in an evergreen temperate rain forest. *Batrachyla taeniata* inhabits austral forests of Chile and Argentina and Chilean Mediterranean sclerophyllous bushes and forests, with a narrow distributional area at the eastern slopes of the Andes Mountains. In Chile, this frog is distributed from the relictual forests of Zapallar and Quintero (32°34'S, 71°28'W) (Sallaberry et al. 1981, Bol. Mus. Nac. Hist. Nat. Chile 38:61–67) to Laguna San Rafael (46°40'S, 74°00'W) (Díaz-Páez and Williams 1999, Res. V Congr. Latinoamericano de Herpetología. Publ. Extra Museo Nacional de Historia Natural, Montevideo, Uruguay 50:54). In Argentina, it has been recorded from Hua Hum, Neuquén Province (40°07'S, 71°40'W) (Gallardo 1962, Rev. Mus. Argentina Cienc. Nat., Bs. As., Cienc. Zool. 8[10]:113–122) to (without coordinate precision) "the lower Province of Río Negro alongside the austral *Nothofagus* forests" (Cei 1980, Amphibians of Argentina. Monit. zool. ital. (N.S.), Monogr. 2: [i-xii] + 1–609). This voucher represents a new record for the province of Chubut and extends known range of species in Argentina ca. 71 km airline S from southern limit of Río Negro Province. Further, this record decreases the hiatus between the distribution in Chile and Argentina. The area where this specimen was found is also inhabited by the frogs *Batrachyla antartandica*, *Pleurodema thaul*, *Eupsophus calcaratus*, and *Alsodes australis*.

Submitted by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Provincia de Río Negro, Argentina.

BUFO AMERICANUS (American Toad). USA: TEXAS: Franklin Co: 8.2 mi N jct. Rt. 67/FM 1896, ca. 2 mi W on White Oak Creek Ranch. 29 April 2000. Brian Fontenot. TCWC 84247. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

BUFO GUTTATUS (Guianan Golden Toad). VENEZUELA: ESTADO APURE: Santa María del Orinoco, ca. 20 km S mouth of Río Cinaruco on the Orinoco River. 21 April 2000. J. C. Paz. Museo de Biología de la Universidad del Zulia (MBLUZ A- 0139). Verified by Andrés Orellana. First state record. Another Amazonian species discovered NW of previous known distribution (Barrio 1998, Acta Biol. Venezuela 18[2]:1–93). The Río Cinaruco apparently constitutes a northern Amazonian reduct into the Llanos ecotone on the northwestern side of the Orinoco River (previously considered a barrier for many species, including amphibians) or is the natural limit for some Amazonian amphibians and reptiles into the Llanos. Northern Amazonian species such as the Bighead Turtle (*Peltocephalus dumerilianus*) (Pritchard and Trebbau 1984, Turtles of Venezuela. Publ. SSAR. 403 pp.), Gladiator Frog (*Hyla boans*) (Arrington and Arrington 2000, Herpetol. Rev 31:170) and Rocky Frog (*Leptodactylus lithonaetes*) (Heyer 1995, Proc. Biol. Soc. Washington 108[4]:695–716) showed similar distributions crossing the Orinoco River and reaching the Cinaruco River to the Northwest.

Submitted by **CÉSAR LUIS BARRIO**, Fundación Andígena, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com), **TITO BARROS**, Museo de Biología, Departamento de Biología, Facultad Experimental de Ciencias, La Universidad del Zulia, Apartado 526, 4001, Maracaibo, Estado Zulia, Venezuela (e-mail: trbarros@cantv.net), and **JUAN CARLOS PAZ**, Departamento de Biología, Facultad de Ciencias, La Universidad del Zulia, Maracaibo, Estado Zulia, Venezuela, Apartado Postal 526 (e-mail: j-c1971@hotmail.com).

BUFO REGULARIS (Egyptian Square-marked Toad). EGYPT: NORTH SINAI PROVINCE: ca. 15 km W Al-Arish City (31°05'47"N, 33°40'06"E). 25 October 2000. A. A. Ibrahim. Muséum National d'Histoire Naturelle (MNHN 2000.5140). Verified by I. Ineich. A large female (96 mm SVL) captured at the backyard of a house near Al-Midan Village at 1000 h. Several other toads were also observed in two pools near the house. Probably introduced from the Nile Delta with foodstuff for sheep and goats, such as fresh clover, often coming from Sharqia Province (information from inhabitants), where *B. regularis* occurs. First record for Sinai Peninsula (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. 11:1–234).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt (e-mail: aibrahim@ismailia.ie-eg.com).

BUFO VALLICEPS (Gulf Coast Toad). USA: TEXAS: BURNET Co: 2 mi SW jct. Co. Rd. 114 and FM 2341, Vol Montgomery Ranch. 15 April 2000. Gage Dayton, Lee Fitzgerald, and Michael Goldstein. TCWC 84174-84176. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **GAGE H. DAYTON** and **LEE A. FITZGERALD**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA, and **MICHAEL I. GOLDSTEIN**, Mendocino Redwood Company, P.O. Box 489, Fort Bragg, California 95437, USA.

CHIRIXALUS VITTATUS (Striped Treefrog). INDIA: ASSAM: Balipara Reserve Forest (92°39'–92°51'E, 26°53'–27°01'N) and Nameri National Park (92°39'–92°55'E, 26°57'–27°03'N). 27 April 2000. S. Sengupta. Arya Vidyapeeth College Museum (AVC 3201, 3204) and Zoological Survey of India, Calcutta (ZSIC A9136), all males. Verified by S. K. Dutta. One specimen was found ca. 28–41 cm up on a fern growing on a bank of a small rivulet; the others were located on a grassy patch on a sandy riverbank ca. 3 m from a waterhole. These sites (ca. 90–100 m elev.) were surrounded by semi-evergreen forests. Species is known from the state of Nagaland, India (Romer 1949, J. Bombay Nat. Hist. Soc. 48:374–

376), and Bhamo Burma, Myanmar (Boulenger 1890, The Fauna of British India, Including Ceylon and Burma. Reptilia and Batrachia. Taylor and Francis. 541 pp). These records extend its range to the northwest by 210 km.

Submitted by **NRIPENDRA K. CHOUDHURY, JAYANTA GOGOI**, and **SAIBAL SENGUPTA**, Zoology Department, Arya Vidyapeeth College, Guwahati 781016, Assam, India (e-mail [SS]: senguptasaibalsen@rediffmail.com).

ELEUTHERODACTYLUS AUGUSTI (Barking Frog). USA: TEXAS: KINNEY CO: Kickapoo Cavern State Park, 38.8 road km N Brackettville on FM 674. 14 June 2000. John H. Malone. TCWC 83949. Verified by James R. Dixon. County record. (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp). Specimen collected during a baseline amphibian and reptile inventory conducted at Kickapoo Cavern State Park. Collected under the authority of TPWD State Park Scientific Study Permit Number 25-00.

Submitted by **JOHN H. MALONE**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA.

ELEUTHERODACTYLUS JUIPOCA. BRAZIL: GOIÁS: Municipality of Silvânia, Floresta Nacional de Silvânia, 16°39'S, 48°36'W, 900 m. 4 April–5 May 1997. R. P. Bastos. Museu Nacional, Rio de Janeiro (MNRJ 26415-416). Verified by U. Caramaschi and C. A. G. Cruz. Previous reported from the vicinity of the type locality in Sousas, Campinas, São Paulo (Frost 1985, Amphibian Species of the World. A Taxonomic and Geographical Reference. Allen Press, Inc., Lawrence, Kansas. vi + 732 pp.). Also, reported from Sierra da Canastra, 20°10'S, 46°30'W, Municipality of São Roque de Minas, Sacramento and Delfinópolis, Minas Gerais 900–1496 m (Haddad et al. 1988, Brasil Florestal 64:9–20) and Morro do Ferro, 21°48'S, 46°35'W, Municipality of Poços de Caldas, Minas Gerais, 700 m (Cardoso et al. 1989, Rev. Brasil Biol. 49 [1]:241–249). First state record; extends known geographical distribution ca. 490 km to the north.

Submitted by **ROGÉRIO P. BASTOS**, Departamento de Biologia Geral, ICB, Universidade Federal de Goiás, Caixa Postal 131, 74001-970 Goiânia, Goiás, Brazil, and **JOSÉ P. POMBAL JR.**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Brazil.

ELEUTHERODACTYLUS ORPHNOLAIMUS. PERU: LORETO: Madre Selva II Biological Station, Iquitos region (03'37.175 S, 72'14.873 W, error = 13.5). 1 January 1998. Ruston W. Hartdegen and Matt J. Russell. UTAVC Color Slide 25722). Verified by J. D. Lynch. First report of species from Peru; third known documentation of the species. Previously, reported from Ecuador (Lynch 1979, Proc. Biol. Soc. Washington 83:221; Duellman 1978, Univ. Kansas Nat. Hist. Mus. Misc. Publ. 65:1–352). Specimen was observed in primary forest, oriented vertically on a small palm tree trunk (ca. 30 cm in diameter), 1.5 m above ground. Ambient air temp was 82°F. *E. orphnolaimus* is thought to be primarily a canopy species.

Submitted by **RUSTON W. HARTDEGEN**, Department of Herpetology, Dallas Zoo, 650 South R.L. Freeway, Dallas, Texas 75203, USA (e-mail: ruston17@yahoo.com), and **MATT J. RUSSELL**, 803 Burr Oak Drive, Lewisville, Texas 75067, USA.

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: FLORIDA: FRANKLIN CO: St. George Island, The Plantation, George Mahr Boy Scout Seabase (N29°63.900, W84°91.648) and St. George Island Airport (N29°64.088, W84°91.213). December 2000. K. J. Irwin, L. K. Irwin, Joseph T. Collins, and Nancy K. Weaver. Department of Herpetology, Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas (MHP 6821–22). Verified by Travis W. Taggart. Several adults and subadults found under board and debris piles at both localities. First record for St. George Island and for Apalachicola Bay Barrier Islands (Blaney 1971, Herpetologica 27:406–430; Means 1974, *In* Livingston et al. [eds.], St. George Island: Biota, Ecology, and Management Program for Controlled Development. Rept. Develop. Regional Impact Franklin County Commission).

Submitted by **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us) and **LISA K. IRWIN**, 103 Brooke Drive, Perryville, Arkansas 72126, USA.

HYLA ANCEPS. BRAZIL: PARANÁ: Telêmaco Borba municipality, Monte Alegre farm (24°04'01"S, 50°41'10"W, ca. 760 m). 14 November 2000. R. A Machado and Sérgio Adão Filipaki. Capão da Imbuia Natural History Museum, Curitiba, Paraná, Brazil (MHNCI 3944–45) and Célio F. B. Haddad collection, deposited in Departamento de Zoologia, Universidade Estadual Paulista, Rio Claro, São Paulo, Brazil (CFBH 3575). Verified by José Perez Pombal, Jr. Collected at night over leaves in a freshwater swamp (ca. 80 x 50 m) dominated by *Tipha latifolia* (Tiphaceae). Previously known from the states of Rio de Janeiro (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas, 732 pp.), Espirito Santo (Haddad et al. 1995, Herpetol. Rev. 26:207), Minas Gerais (Nascimento and Feio 1999, Herpetol. Rev. 30:49–50), and Bahia (Argolo 2000, Herpetol. Rev. 31:109). First record from the state of Paraná and from southern Brazil; extends known range ca. 750 km airline SW from previously cited southernmost locality at Rio de Janeiro.

Submitted by **REGINALDO ASSÊNCIO MACHADO**, Curso de Pós-Graduação em Zoologia, Depto. de Zoologia, Universidade Federal do Paraná, CEP 81531-990, Caixa Postal 19020, Curitiba, Paraná, Brazil (e-mail: anurans@bol.com.br) and **CÉLIO FERNANDO BATISTA HADDAD**, Departamento de Zoologia, I.B., UNESP, Caixa Postal 199, 13506-900 Rio Claro, São Paulo, Brazil (e-mail: haddad@rc.unesp.br).

HYLA BOANS (Giant Gladiator Treefrog) VENEZUELA: ESTADO BARINAS: creek without name in Sector Miraflores, Barinitas. 17 December 2000. Markus Vogt. Colección de Vertebrados, Universidad de los Andes, Facultad de Ciencias (CVULA IV-6294). Verified by Daniel Calcaño. First state record. As has been updated by Barrio (1999, Herpetol. Rev. 30:230), species is known to be widely distributed through the Amazonian basin and lowlands of the Guianan Shield in Venezuela, as well as in the Orinoco Delta, appearing as a characteristic element in the Amazonian rainforests. Barrio (*op. cit.*) showed a broad distribution in the country, expanding its distribution to the Amazonian

reduct in Andean foothills of the Estado Táchira. With this new finding, ca. 210 km NE of the Táchira location, it is conceivable that the Amazonian region reaches the Barinas foothills as well, and the possibility that more Amazonian elements will be founded in that Venezuelan state.

Submitted by **CÉSAR LUIS BARRIO AMORÓS**, Fundación ANDÍGENA, Apartado 210, 5101-A Mérida, Venezuela (e-mail: cesarlba@yahoo.com).

HYLA CALCARATA. VENEZUELA: ESTADO BOLIVAR: Estación Biológica Dedemay, Río Tabaro, tributary to Río Caura, 6°21'18"N, 64°59'48", 120 m. 24 April 1995. César Molina. Museo de Historia Natural La Salle, Caracas, Venezuela (MHNLS 14723–24). Verified by Celsa Señaris. In Venezuela, this species is restricted to the upper Orinoco River in the state of Amazona (Duellman 1973, Copeia 1973:515–533; La Marca 1992, Catálogo Taxonómico y Biogeográfico de las Ranas de Venezuela. Cuadernos Geográficos Universidad de Los Andes, Merida, N° 9). Recently, this treefrog was reported in the adjacent state of Bolívar at two localities: Cara Sur del Cerro Guaiquinina and Río Aguas Negras, sur del Cerro Santa Rosa (Barrios 1998, Acta Biol. Venezuelica 18:1–93); however, these records were based on field observations only. These specimens, which represent the first vouchers, were collected at night, calling on a vine, four meters from the forest floor, along a small stream.

Submitted by **CÉSAR R. MOLINA R.**, Museo de Historia Natural La Salle, Apartado Postal 1930, Caracas 1010-A, Venezuela (e-mail: crmolina@mixmail.com).

HYLA CINEREA (Green Treefrog). USA: TEXAS: Milam Co: 5.4 mi E jct. FM 2095 on US Rt. 79. 1 May 2000. Toby J. Hibbitts, Ryan E. Nelson, and Wade A. Ryberg. TCWC 84243. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, **RYAN E. NELSON**, and **WADE A. RYBERG**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

HYLA NAHDERERI. BRAZIL: PARANÁ: São José dos Pinhais Municipality (25°41'S, 49°03'W, ca. 1020 m). 31 October 1999 (2000 h). C. E. Conte. Célio F. B. Haddad Collection, deposited in Departamento de Zoología, Universidade Estadual Paulista, Rio Claro, São Paulo, Brazil (CFBH 3561). Verified by Paulo C. Garcia. Found at night in low vegetation bordering a lake near disturbed mixed temperate rainforest. First state record for the species; previously known for Serra do Mar from state of Santa Catarina, Brazil, site of the type locality (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). Extends known range of species in Brazil ca. 70 km airline NNE from previously cited northernmost locality at the São Bento do Sul Municipality, state of Santa Catarina.

Submitted by **REGINALDO ASSÊNCIO MACHADO**, Curso de Pós-Graduação em Zoologia, Departamento de Zoologia, Universidade Federal do Paraná, CP 19020, CEP 81531-990, Curitiba-PR, Brazil (e-mail: anfibios@bio.ufpr.br) and **CARLOS EDUARDO CONTE**, Pontificia Universidade Católica do Paraná, CP 16210, CEP 81611-970, Curitiba-PR, Brazil (e-mail: kaduconte@zipmail.com.br).

HYLA SOARESI. BRAZIL: GOIÁS: Municipality of Mambaí (14°29'S, 46°06'W), 709 m. 3 March 2001. R. F. Juliano and R. Lingnau. Museu Nacional, Rio de Janeiro (MNRJ 26417). Verified by U. Caramaschi and C. A. G. Cruz. Previously recorded from the states of Piauí (Picos), Ceará (Santana do Cariri), Paraíba (Areia Branca), and Minas Gerais (Manga) by Gomes and Peixoto (1996, Iheringia ser. Zool. 80:33–38) and Bahia (Jandaíra) by Gomes and Peixoto (1991, Acta biol. Leopoldensia 13:141–162). First state record, extends the known geographical distribution in approximately 270 km to west.

Submitted by **RAFAEL F. JULIANO**, **RODRIGO LINGNAU**, and **ROGÉRIO P. BASTOS**, Departamento de Biologia Geral, ICB, Universidade Federal de Goiás, Caixa Postal 131, 74001-970 Goiânia, Goiás, Brazil, and **JOSÉ P. POMBAL JR.**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Brazil.

HYLA VERSICOLOR (Gray Treefrog). USA: TEXAS: CALLAHAN Co: 20.8 km S Putnam. 4 November 1999. Clay Churchill. Abilene Christian University Natural History Collection (ACUNHC 681). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology, Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

LITHODYTES LINEATUS: VENEZUELA: ESTADO TRUJILLO: La Gira, Betijoque, ca. 700 m elev. 15 December 1990. Tito Barros. Museo de Biología de la Universidad del Zulia (MBLUZ A-074). ESTADO ZULIA: Yegbashí (aldea indígena Barí), Municipio Machiques de Perijá, Aricuaizá River, Sierra de Perijá, 800 m elev. 28 March 1987. A. Viloria. MBLUZ A-027. Hacienda Puerto Nuevo on the way to El Chorro, Municipio Rosario de Perijá, Sierra de Perijá, 400 m elev. 18 March 2000. E. Arrieta. MBLUZ A-137. Sector La Orchila on the way to La Carpa, Municipio J. E. Lozzada, Sierra de Perijá, 300 m elev. 24 April 2000. E. Arrieta. (MBLUZ A-140). First state records. All verified by Andres Orellana. *Lithodytes lineatus* is a distinctive leptodactylid frog showing a wide distribution in Amazonian lowlands (Lynch 1979, *In* Duellman [ed.], The South American Herpetofauna: its Origin, Evolution, and Dispersal. Mus. Nat. Hist. Univ. Kansas Monogr. No. 7, pp. 189–215). Recently, Barrio (1999, Herpetol. Rev. 30:50) extended its distribution in Venezuela to the Táchira Amazonian reduct. Here, we provide the first evidence that this species also inhabits rainforests in the Perijá and Cordillera de Mérida piedmonts on both Andean slopes of the Maracaibo lake basin, from 300 to 800 m elev., outside of the Amazonian basin. We anticipate its discovery in the Maracaibo Lake Basin piedmont of the states of Mérida and Táchira.

Submitted by **TITO BARROS**, Museo de Biología, Departamento de Biología, Facultad Experimental de Ciencias, La Universidad del Zulia, Apartado 526, Zp. 4001, Maracaibo,

Estado Zulia, Venezuela (e-mail: trbarros@cantv.net) and **CÉSAR LUIS BARRIO**, Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com).

MANTELLA NIGRICANS. MADAGASCAR: ANTSIRANANA: Réserve Spéciale de Manongarivo (14°0.0'S, 48°25.7'E), 14.5 km SW Antanambao village, 1240 m. 7 March 1999. S. M. Goodman. Université d'Antananarivo, Département de Biologie Animale (UADBA 12144; SVL 24.1 mm). Extends range 140 km west from the nearest known locality in the massif of Anjanaharibe-Sud in northeastern Madagascar (Vences et al. 1999, Alytes 17:3–72). First record of a species of the *Mantella cowani* group from northwestern Madagascar. Collected in primary montane forest. Specimen was found active during the day on forest floor in a relatively flat area in open understory not far from a stream. Unequivocally identified as *Mantella nigricans* based on the presence of greenish round flank blotches, lack of a horseshoe marking on throat, ventral black color with about 30 small light round markings on throat, belly, and femurs, lack of reddish or orange ventral color on femurs or tibiae, and lack of rostral stripe. Not conspecific with the types of *Phrynomantis maculatus* (synonym of *Mantella baroni*), which erroneously were quoted to originate from Nosy Be in NW Madagascar (Blommers-Schlösser and Blanc 1991, Faune de Madagascar 75:1–379), and which differ from the characteristics listed above.

The rainforest of Manongarivo was until very recently connected with northeastern forest blocks including Marojejy and Anjanaharibe-Sud (both populated by *M. nigricans*) and are regarded as an extension of this forest type to the Malagasy west coast. To the northeast, Manongarivo is connected to the Tsaratanana Massif, where this species has not yet been found. The forests of northwestern Madagascar, including the Manongarivo Massif, contain a flora that is different in composition than areas to the north or south, and is often considered a different phytogeographic region, the Sambirano. In the original definition of the Sambirano Domain by Perrier de la Bâthie (1921, La végétation malgache, Ann. Mus. Colon. Marseille série 3. 9:1–268), this domain included the lowland forest zone below 800 m. More recent botanical inventories along different slopes of the Manongarivo Massif indicate that the zone of transition between the distinct Sambirano flora and that with affinities to the Central Domain occurs at a higher elevation (around 1200 m) (Messmer et al., *in press*, *In* Gautier and Goodman [eds.], Inventaire floristique et faunistique de la Réserve Spéciale de Manongarivo, Madagascar, Boissiera) or just slightly below where our specimen of *M. nigricans* was collected.

The presence of *Mantella nigricans* and other amphibian species across the zone of mid-altitude forest from northeastern to northwestern Madagascar, but not in lowland forests of the Sambirano, supports the recognition of this domain based on faunistic distributions. Further, the lowland forests of this region hold several species not known to occur at higher elevations (e.g., *Boophis jaegeri, Boophis andreonei, Mantidactylus massi*).

Submitted by **DOMOINA RAKOTOMALALA**, Ecology Training Program, World Wide Fund for Nature, BP 738, Antananarivo 101, Madagascar, and Département de Biologie Animale, Faculté des Sciences, BP 906, Université d'Antananarivo, Antananarivo 101, Madagascar (e-mail: etp@wwf.mg), **MIGUEL VENCES**, Muséum national d'Histoire naturelle, Laboratoire des Reptiles et Amphibiens, 25 rue Cuvier, 75005 Paris, France, and **STEVEN M. GOODMAN**, Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, Illinois 60605-2496, USA, and World Wide Fund for Nature, BP 738, Antananarivo 101, Madagascar.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: ILLINOIS: STEPHENSON CO: Freeport, breeding chorus west of Highland Community College soccer field (NW 1/4 NW 1/4 NE 1/4 Sec. 3, T26N, R7E, UTM Zone 16: N4684948m, E279077m). 22 April 2000. M. J. Meyer and K. K. Trester. Illinois Natural History Survey (INHS 16537–38). Verified by L. E. Brown. New county record (Phillips et al. 1999, Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8. Champaign, Illinois. 300 pp.). Collected under IDNR permit A00.0162.

Submitted by **MATHYS J. MEYER**, Department of Biological Sciences, Illinois State University, Normal, Illinois 61790-4120, USA, and **KARYLA K. TRESTER**, Center for Biodiversity, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: TEXAS: Franklin Co: 8.2 mi N jct. Rt. 67/FM 1896, ca. 2 mi W on White Oak Creek Ranch. 29 April 2000. Texas Herpetological Society field trip. TCWC 84263. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

PTYCHADENA MASCARENIENSIS (Mascarene Frog). EGYPT: NORTH SINAI PROVINCE: Khwaitar Farm, ca 17 km SE of Al-Arish City (31°05'47"N, 33°40'06"E). 25 November 2000. A. A.Ibrahim. Muséum National d'Histoire Naturelle, Paris (MNHN 2000.5142). A female (48 mm SVL) captured at a small water pool in a large olive farm; Sheikh Zowaid (31°12'30"N, 34°04'02"E). 9 December 2000. A. A. Ibrahim. MNHN 2000.5143. Unsexed individual (43 mm SVL) captured from an irrigation ditch. Both verified by I. Ineich. Probably introduced from the Nile Delta (presumably from Sharqia Province), with clover for sheep and goats. First record for Sinai Peninsula (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No.11:1–234).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt (e-mail: aibrahim@ismailia.ie-eg.com).

RANA BLAIRI (Plains Leopard Frog). USA: OKLAHOMA: DEWEY CO: five specimens collected 9.6–12 km E Seiling. 7 August 1999. Richard L. Lardie and Gloria E. Brisson. Saint Gregory's University, Shawnee, Oklahoma (SGU 751–55). Verified by Doyle L. Crosswhite. County record (Black 1976, Bull. Oklahoma Herpetol. Soc. 1[1]:6–10), and verifies predicted range (Black and Sievert 1989, A Field Guide to Oklahoma Amphibians. Publ. Okla-

homa Dept. Wildlife Conservation. 80 pp.).

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

RANA CATESBEIANA (Bullfrog). USA: TEXAS: Jeff Davis Co: 16 mi N Alpine on Rt. 118, 30°31'45"N, 103°48'39"W. 19 June 2000. Sul Ross State University (SRSU 1501). Verified by James M. Mueller. SVL 187 mm, weight 787 g. Adult male found stationary on the road. First county record. Numerous other bullfrogs were heard chorusing from nearby Musquiz Creek, suggesting an established population.

Submitted by **BRAD E. PENDLEY**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA.

RANA PALUSTRIS (Pickerel Frog). USA: ARKANSAS: Cross Co: (N35°10.831, W90°40.765), SW 1/4 SW 1/4 Sec. 33, T7N, R4E, jct. Phillips County Roads 211 and 239, St. Francis National Forest. 27 January 2001. R. Bonett, L. K. Irwin, and K. J. Irwin. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26046). Verified by Stan Trauth. Adult found under leaves in small stream on eastern slope of Crowley's Ridge. County record (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **RON BONETT**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA (e-mail: desmog_2000@yahoo.com) and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

SCAPHIOPUS HURTERII (Hurter's Spadefoot). USA: TEXAS: Milam Co: 6.4 mi S jct. FM 3242 on FM 2095. 1 May 2000. Toby J. Hibbitts, Ryan E. Nelson, and Wade A. Ryberg. TCWC 84242. Verified by James R. Dixon. New county record on the western edge of range (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, **RYAN E. NELSON**, and **WADE A. RYBERG**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

SYRRHOPHUS CYSTIGNATHOIDIES CAMPI (Rio Grande Chirping Frog). USA: TEXAS: Brazos Co: College Station Central Park. 23 September 1999. Toby J. Hibbitts. TCWC 84165. Verified by R. Kathryn Vaughan. New county record. (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **CHRISTOPHER S. COLLINS**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA, and **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

TESTUDINES

ACANTHOCHELYS PALLIDIPECTORIS (Chaco Sideneck Turtle). ARGENTINA: Santa Fe: San Cristóbal Department: captured on a dirt road near Aguará Grande at 30°00'S, 60°45'W. 10 January 2001. A. Larriera and C. I. Piña. Herpetological Collection of Centro de Investigaciones Científicas y Transferencia de Tecnología a la Producción, Diamante, Entre Ríos, Argentina (DIAM-R 0010, photographs) and Herpetological Collection Fundación Miguel Lillo, Tucumán, Argentina (FML 10109, photographs). Verified by M. Cabrera and P. Beldomenico. First department record (Cabrera 1998, Las Tortugas Continentales de Sudamérica Austral. Edic. Indep., Córdoba. 108 pp.). One adult female (CCL 18 cm, SCL 17 cm, PL 15 cm, W 550 g). We have used photographs because the species is listed as 'rare' (Fundación Vida Silvestre, Bertonatti 1994, Cuad. Herpetol. 8:164–171) and 'vulnerable (VU - A1c, D1)' (Hilton-Taylor [compiler] 2000, 2000 IUCN Red List of Threatened Species. IUCN/SSC Gland, Switzerland and Cambridge, United Kingdom]. Extends the known distribution of *A. pallidipectoris* 70 km SW from the city of Calchaquí, Santa Fe.

Submitted by **CARLOS I. PIÑA**, C.I.C. y T.T.P. - CONICET, Dr. Matteri y España, Caixa Postal 3105, Diamante, Entre Ríos, Argentina (e-mail: cidcarlos@infoshopdte.com.ar) and **ALEJANDRO LARRIERA**, Proyecto Yacaré, Bv. Pellegrini 3100, Caixa Postal 3000, Santa Fe, Argentina (e-mail: yacare@arnet.com.ar).

APALONE SPINIFERA HARTWEGI (Western Spiny Softshell). USA: OKLAHOMA: Woodward Co: two male specimens (1 adult, 1 juvenile) observed in Travertine Creek, 7.3 km S and 7.8 km W Freedom. 21 May 2000. Richard L. Lardie. Saint Gregory's University, Shawnee, Oklahoma (SGU Color Slides S9-S12). Specimens were also videotaped. Verified by Doyle L. Crosswhite. County record, 31.3 km NW of nearest record at 2.5 mi W Waynoka, Major County (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press. 370 pp.) and verifes previous sight record (Secor and Carpenter 1984, Okla. Herpetol. Soc. Spec. Publ. 3:1–57). Also helps fill distribution gap with more westerly records in Beaver, Texas, and Cimarron counties (Webb 1970, *op. cit.*) in Oklahoma Panhandle, and Wheeler and four other Texas Panhandle Counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: ILLINOIS: Rock Island Co: Milan (Sec 23, T17N, R2W). 4 June 1957. Gene Forett. HDW-NIU 1709–1710 (formerly RE 228, Putnam Museum of History and Natural Sciences, Davenport, Iowa). Verified by Christine Chandler. Validates a previous record cited without a voucher specimen by Cahn (1937, Illinois Biol. Monog. 16:1–218 and Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

CHRYSEMYS PICTA BELLII (Western Painted Turtle). USA: NEW MEXICO: Santa Fe Co: city of Santa Fe, Santa Fe Country Club golf course on Airport Road. 26 October 2000. Isaac Medina. KU Color Slide 11821. Verified by Charles W. Painter. First record for county (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.). Occurrences within the city of Santa Fe (and the Santa Fe River drainage system) are likely the result of introductions.

However, a native population is expected to occur within the county in the Rio Grande, ca. 30 km NW of the city.

Submitted by **JAMES N. STUART**, New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico 87504-5112, USA.

EMYDOIDEA BLANDINGII (Blanding's Turtle). USA: MISSOURI: Holt Co: Squaw Creek National Wildlife Refuge. Three specimens: 1) NE 1/4 Sec. 23, T61N, R39W. 2 October 2000. Male, 10+ years, weight 1447 g. Marked with hole drilled through left marginal scite no. 12. Jacob L. Lehemer. 2) NW 1/4 Sec. 19, T61N, R39W. 17 October 2000. Male 11+ years, 1930 g. Marked with a hole drilled through left marginal scute no. 10. Francis E. Durbian. Verified by Tom R. Johnson. KU color slide 11820. 3) One specimen was captured and released from this site on 13 October 1984 and no population had been verified for this site since that time of capture (Johnson 2000, The Amphibians and Reptiles of Missouri. Second Ed. Missouri Dept. Conserv., Jefferson City. 400 pp.).

Submitted by **FRANCIS E. DURBIAN**, **JACOB L. LEHMER**, Squaw Creek National Wildlife Refuge, P.O. Box 158, Mound City , Missouri, 64470-0158, USA, and **JEFFREY T. BRIGGLER**, Missouri Department of Conservation, P.O. Box 180, Jefferson City, Missouri, 65102, USA.

PSEUDEMYS CONCINNA (Eastern River Cooter). USA: LOUISIANA: Vernon Parish: 5 mi E Pickering, near jct. Rts. 10 and 467. 5 July 2000. Beau B. Gregory. Seale Museum of Louisiana, McNeese State University (SML 9325). Verified by Steve Shively. First Parish record; extends distribution N from Beauregard Parish and W from Rapides Parish as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana State University Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **BEAU B. GREGORY**, Environmental and Natural Resources Management Division, Directorate of Public Works, Fort Polk, Louisiana, 71459, USA.

PSEUDEMYS CONCINNA (Eastern River Cooter). USA: MISSOURI: St. Charles Co: backwater of Mississippi River on Portage Island (T48N, R6E). 8 August 2000. Eric Ratcliff and Eric J. Gittinger. Illinois Natural History Survey (INHS 16207). Verified by C. A. Phillips. New county record and northernmost record in Mississippi River drainage (Johnson 2000, The Amphibians and Reptiles of Missouri. Second Ed. Missouri Dept. Conserv., Jefferson City. 400 pp.). Specimen collected in fyke net set inside backwater.

Submitted by **JOHN K. TUCKER**, **ERIC RATCLIFF**, and **ERIC J. GITTINGER**, Illinois Natural History Survey, Great Rivers Field Station, 8450 Montclaire Avenue, Brighton, Illinois 62012, USA, and **J. BRIAN TOWEY**, Department of Zoology, Eastern Illinois University, Charleston, Illinois 61920, USA.

PSEUDEMYS CONCINNA METTERI (Missouri River Cooter). USA: TEXAS: Cass Co: 8 km N Queen City off US Rt. 59 at FM 2327. 10 May 2001. Chris T. McAllister. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 26090). Verified by Stanley E. Trauth. New county record that helps fill a spotty geographic distribution in northeastern Texas (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **CHRIS T. McALLISTER**, Department of Biology, Texas A&M University at Texarkana, Texarkana, Texas 75505, USA.

PSEUDEMYS GORZUGI (Western River Cooter). USA: Texas: Menard Co: ca. 9 mi W Menard. 31 August 1998. Carl J. Franklin and Richard D. Reams. Adult male basking on the shoulder of Texas Rt. 190. UTACV R 46050. Verified by Jonathan A. Campbell. New county record; suggests that *Pseudemys texana* and *P. gorzugi* are sympatric in portions of their range and that *P. gorzugi* has a wider distribution than previously thought. Extends range ca. 170 km NE of the nearest previously documented locality in Del Rio, Texas (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **CARL J. FRANKLIN**, 1001 Denmark Drive Grand Prairie, Texas 75050, USA (e-mail: herpking@ix.netcom.com), and **RICHARD D. REAMS**, 1402 Ramses Avenue, Dallas, Texas 75216, USA (e-mail: hylareams@aol.com).

PSEUDEMYS NELSONI (Florida Redbelly Turtle). USA: FLORIDA: Franklin Co: St. Vincent Island, St. Vincent National Wildlife Refuge, Rattlesnake Slough at Oyster Pond, (N29°64.383, W85°14.850). 5 August 2000. T. E. Lewis and L. K. Irwin. Department of Herpetology, Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas, (MHP 6812). Verified by Joseph T. Collins. Carcass found in dry pond bottom. First record for St. Vincent Island and first record for Apalachicola Bay Barrier Islands (Blaney 1971, Herpetologica 27:406–430; Christman 1984, Natural History of St. Vincent Island, Florida. Progress Report No. 1, Covering the Period January 1983–December 1983. Unpubl. Report to Denver Wildl. Res. Center, Ecol. Section, Gainesville, Florida. 25 pp.).

Submitted by **THOMAS E. LEWIS**, St. Vincent National Wildlife Refuge, P.O. Box 447, Apalachicola, Florida 32329, USA, **LISA K. IRWIN**, 103 Brooke Drive, Perryville, Arkansas 72126, USA, and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

TERRAPENE CAROLINA TRIUNGUIS (Three-toed Box Turtle). USA: TEXAS: Franklin Co: 8.2 mi N jct. Rt. 67/FM 1896, ca. 2 mi W on White Oak Creek Ranch. 29 April 2000. Toby J. Hibbitts. TCWC 84265–66. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

LACERTILIA

ANOLIS AURATUS (Grass Anole). VENEZUELA: ESTADO ANZOATEGUI: Campamento El Caiman del Orinoco, 17 km NE

Soledad (8°09'N, 63°32'W, 50 m). 26 October 2000. Paul M. Kornacker. Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK 73928). Verified by César Molina. First state record. Nearest known records are from Guri, Estado Bolivar, 80 km S of Orinoco River (Donoso-Barros 1968, Carib. J. Sci. 8[3–4]:105–122; Gorzula and Señaris 1998, Contribution to the Herpetofauna of the Venezuelan Guayana. Scientia Guainae, Caracas. 269 pp.; Kornacker and Meyer zur Heyde 1998, Herpetologische Eindrücke einer Venezuelareise. Teil 3: El Embalse de Guri - der Guri-Stausee. Elaphe 6[4]:61–69).

Submitted by **PAUL M. KORNACKER**, Aachener Strasse 42, D-53359 Rheinbach, Germany; e-mail: pkornacker@aol.com or pakoverlag@aol.com.

ANOLIS CAROLINENSIS (Green Anole). ANGUILLA: Shoal Bay Village. 24 June 2000. James M. Eaton and Kathrine G. Howard. Bobby Witcher Memorial Collection, Avila College (BWMC 06787, adult female; BWMC 06792, adult male). Verified by Robert W. Henderson. First records for the island and for the West Indies (published accounts of *A. carolinensis* in the Bahamas undoubtedly refer to *A. smaragdinus*). Like *Osteopilus septentrionalis*, now firmly established on Anguilla (Townsend et al. 2000, Carib. J.. Sci. 35: *in press*), these anoles most likely were brought to Anguilla in containers of plants from southern Florida used for landscaping purposes, especially in resort areas. We heard anecdotal accounts of "green tree lizards" from employees of several resorts, but did not find specimens at sites other than Shoal Bay Village. Although *Anolis carolinensis* is not known as a particularly effective colonizer (Losos and Spiller 1999, Ecology 80:252–258), it could become a permanent and visible component of the Anguillian herpetofauna because of three important factors that predispose it to success: 1) these anoles probably were accompanied on arrival by plants with which they were already associated; 2) although the island is xeric, suitable mesic habitat on Anguilla is available in resort areas; and 3) *A. carolinensis* is unlikely to compete directly with native *A. gingivinus*.

Submitted by **JAMES M. EATON**, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA (e-mail: eatonjm@slu.edu), **KATHERINE G. HOWARD**, Department of Biology, University of Idaho, Moscow, Idaho 83843, USA (e-mail: howa0550@uidaho.edu), and **ROBERT POWELL**, Department of Biology, Avila College, Kansas City, Missouri 64145, USA (e-mail: poellr@mail.avila.edu).

ANOLIS CAROLINENSIS (Green Anole). USA: TEXAS: Franklin Co: 8.2 mi N jct. Rt. 67/FM 1896, ca. 2 mi W on White Oak Creek Ranch. 29 April 2000. Toby J. Hibbitts. TCWC 84251. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

ANOLIS CAROLINENSIS (Green Anole). USA: TEXAS: Medina Co: 12.39 road km W Bexar County line. July 2000. R. Michael Burger. University of Texas at Arlington (UTA Color Slides 25765-66). Verified by J. A. Campbell. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp).

Submitted by **R. MICHAEL BURGER**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Fwy (I-35), Dallas, Texas 75203, USA.

EUMECES LATICEPS (Broadhead Skink). USA: TEXAS: Franklin Co: 8.2 mi N jct. Rt. 67/FM 1896, ca. 2 mi W on White Oak Creek Ranch. 29 April 2000. Terry L. Hibbitts. TCWC 84250. Verified by James R. Dixon. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA, and **TERRY L. HIBBITTS**, 602 Hilltop Circle, Wylie, Texas 75098, USA.

EUMECES SKILTONIANUS (Western Skink). USA: ARIZONA: Mohave Co: Arizona Strip District, Mount Logan, N of Colorado River, N36°214.488', W113°104.254'. 12 June 1998. Stephen S. Germaine, Heather L. Germaine, and Hans F. Koenig. UAZ 50930-PSV. Verified by Philip C. Rosen. Two adult specimens (6.8–7.0 cm SVL) were collected under decaying logs at ca. 2160 m. The habitat was open Ponderosa Pine-Gambel Oak forest with understory vegetation dominated by sagebrush, *Artemisia*. One specimen deposited five eggs on 4 July 1998. Eggs ranged from 5.4 to 6.5 mm in length, and hatched 11 August 1998 after incubation at 26–27°C. A review of museum specimens revealed one other individual collected on Mount Logan, ca. 2400 m on 18 July 1974 by M. D. Robinson (UAZ 40316). Species was previously known from the North Kaibab Plateau, Big Springs, Coconino County, Arizona (N36°36.07', W112°20.57'. 28 August 1939. D. O. Scott. SDNHM 32548). The Mt. Logan locality extends the range of this lizard ca. 79 km.

Submitted by **HANS F. KOENIG**, Arizona Game and Fish Department, P.O. Box 1269, St. George, Utah 84771, USA, and **STEPHEN S. GERMAINE** and **HEATHER L. GERMAINE**, Arizona Game and Fish Department, 2222 West Greenway Road, Phoenix, Arizona 85023, USA.

HEMIDACTYLUS FRENATUS (House Gecko). BELIZE: ORANGE WALK DISTRICT: on a brick building in Lamanai Field Research Center, Indian Church Village, ca. 150 m west of New River Lagoon (17°45'N, 88°39'W). 19 October 2000. Thomas R. Rainwater. University of Miami Reptile Collection (UMRC 00-002). Verified by Julian C. Lee. District record; fills distribution gap between districts of Corozal and Belize, leaving Toledo as the only district in Belize from which *H. frenatus* has not been confirmed (Stafford and Meyer 1999, A Field Guide to the Reptiles of Belize. Academic Press, New York. 356 pp.).

Submitted by **THOMAS R. RAINWATER**, Lamanai Field Research Center, P.O. Box 63, Orange Walk Town, Belize, and **STEVEN G. PLATT**, Wildlife Conservation Society, P.O. Box 9345, Siem Reap, Cambodia.

HEMIDACTYLUS MABOUIA (Tropical Gecko). VENEZUELA: DISTRITO FEDERAL: Caracas, 900 m elev.. 2 June 1983. F. Provenzano. Museo de Biología, Universidad Central de Venezu-

ela, Caracas (MBUCV 2156, adult male); Urbanización Vista Alegre, calle 7, Caracas, 900 m. 4 October 1992. O. Lasso. Museo de Historia Natural La Salle, Caracas (MHNLS 14188, juvenile). ESTADO VARGAS: Tanaguarenas, 10 m. 4 January 1965. Carlos Galán. MHNLS 1972, adult male. All specimens verified by Enrique La Marca. Extends known distribution of species to coastal area of north-central Venezuela. This taxon was previously known from eastern Venezuela (Rivas and Oliveros 1997, Mem. Soc. Cienc. Nat. La Salle 147:67–80). In Venezuela, *Hemidactylus mabouia* appears to have a broader distribution than previously known.

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela; e-mail: gilsonrivas@mixmail.com.

HEMIDACTYLUS PALAICHTHUS. VENEZUELA: ESTADO ANZOATEGUI: Campamento El Caiman del Orinoco, 17 km NE Soledad (8°09'N, 63°32'W, 50 m). 26 October 2000. Paul M. Kornacker. Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK 73929). Verified by César Molina. First state record. Locality is about 250 km S of the northern population at Península de Paria, Estado Sucre, but only 80 km distant from the locality at Guri-Lake, Estado Bolivar, south of the Orinoco River (Gorzula and Señaris 1998, Contribution to the Herpetofauna of the Venezuelan Guayana. Scientia Guainae, Caracas. 269 pp.).

Submitted by **PAUL M. KORNACKER**, Aachener Strasse 42, D-53359 Rheinbach, Germany; e-mail: pkornacker@aol.com or pakoverlag@aol.com.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: OKLAHOMA: Garfield Co: two adults (one collected live, one found dead) in Mid-Continent Packaging building at 1200 North 54th Street, Enid, Oklahoma. Date unknown. Gloria and Dean Brisson. Saint Gregory's University, Shawnee, Oklahoma collection (SGU 2034–35). Verified by Doyle L. Crosswhite. A second live specimen, a juvenile, was brought to me from the same location. Several others have been observed at this same location. This appears to be the most northerly Oklahoma location reported for this introduced species and is apparently an established, reproducing population. Presumably, this lizard was introduced via trucks from other locations. Species has been reported at locations in Okeene, Blaine County (Mark Howery, Oklahoma Dept. Wildlife, pers. comm.), on the University of Oklahoma campus (OU), Clevland County, Oklahoma Baptist University Campus, Pottawatomie County, and the Univ. Oklahoma Biological Station, Marshall County (Sievert and Sievert 1993, A Field Guide to Reptiles of Oklahoma. Publ. Oklahoma Dept. Wildlife Conservation. 104 pp.). These may also represent the most northerly location reported in North America (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.).

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Collin Co: south-central Plano off Plano Parkway. 26 March 2000. Miguel Sanchez. Navarro College Herpetological Collection 2000. 3. 26. 1L. Verified by Gilbert Gatlin. Juvenile collected in a vegetable garden. New county record; partly fills hiatus of this introduced species in northern Texas range (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **THOMAS VANCE**, Biology Department, Navarro College, Corsicana, Texas 75110, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Medina Co: 12.39 road km W Bexar County line. July 2000. R. Michael Burger. University of Texas at Arlington (UTA Color Slide 25764). Verified by J. A. Campbell. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp).

Submitted by **R. MICHAEL BURGER**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Fwy (I-35), Dallas, Texas 75203, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Taylor Co: 4 km N downtown Abilene, Hardin-Simmons University Greenhouse Building (32°28'41"N, 99°44'02"W). 8 August 2000. Allan J. Landwer. Hardin-Simmons University Collection of Vertebrates (HSUCV 615). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology, Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

HEMIPHYLLODACTYLUS TYPUS (Indo-Pacific Tree Gecko). THAILAND: PHUKET PROVINCE: Kata District: Kata View Point on Road 4233 between Ban Kata (7°49'N, 98°19'E) and Ban Sai Yuan. 3 September 1997. O. S. G. Pauwels. Institut Royal des Sciences naturelles de Belgique (IRSNB 15501). Verified by Ned Gilmore. A single specimen was collected in late afternoon on rocks along the road in strict syntopy with numerous *Hemidactylus frenatus* (IRSNB 15503–10) and a single juvenile *Cosymbotus platyurus* (IRSNB 15502). This specimen represents the first record for both Phuket Island and the Province. The closest known locality is Boi Yai Island in Phang-Nga Province (Pauwels et al. 2000, Dumerilia 4:123–154), situated 45 airline km to the northeast. The species was first recorded from Thailand (as *Lepidodactylus ceylonensis*) by Smith and Kloss (1915, J. Nat. Hist. Soc. Siam 1:337–348), who found a single specimen at Klong Menao (15 mi NW Klong Yai, Trat Province). Taylor (1963, Univ. Kansas Sci. Bull. 44:687–1077) included this species in the Thai fauna, but collected no material himself. The Phuket record appears to be only the third published record of *H. typus* from Thailand.

Submitted by **OLIVIER S. G. PAUWELS**, Department of Recent Vertebrates, Institut Royal des Sciences naturelles de Belgique, Rue Vautier 29, 1000 Brussels, Belgium (e-mail: osqpauwels@hotmail.com) and **AARON M. BAUER**, Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA (e-mail: aaron.bauer@villanova.edu).

HOMONOTA ANDICOLA. ARGENTINA: CATAMARCA: Tinogasta Department: 240 km from city of Catamarca on Chaschuil, Valle de Chaschuil (27°30'S, 70°16'W) 13 January 2001. Juan Carlos Acosta, Graciela Blanco and Juan Manuel Acosta. Herpetological Collection. Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 500–510). Verified by Ricardo Martori. First record for Catamarca Province; extends known range (Torres et al. 1997, Herpetol. Rev. 28:96) ca. 110 km N of nearest locality (Las Chacritas, Alto Jagüe, General Lamadrid Department, La Rioja Province).

Submitted by **JUAN CARLOS ACOSTA** and **GRACIELA BLANCO**, Departamento de Geofísica y Astronomía e Instituto y Museo de Ciencias Naturales, F.C.E.F. y N., Universidad Nacional de San Juan, Avenida España 400 (N) C.P. 5400, San Juan, Argentina; e-mail (JCA): jcacosta@sinectis.com.ar.

LIOLAEMUS LINEOMACULATUS. ARGENTINA: CHUBUT: on Rt. 37, 8 km W jct. Rts. 37 and 3, 45°37'S, 67°42'W, ca. 2150 m. 25 January 2000. Jim Schulte II and Nora Ibargüengoytía. Herpetological Collection Museo de La Plata, Buenos Aires province, Argentina (MLP.S. 2106); on the shore of Aleusco Lake, 43°05'S, 70°26'W, ca. 620 m. 23 November 2000. G. Amico and L. Sympson. MLP.S. 2107. RÍO NEGRO: 2 km from Seccional Ñirihuau, on SE shore of the Ñirihuau river, 41°18'S, 71°15'W, ca. 1150 m. 26 January 2000. G. Amico and L. Sympson. MLP.S. 2108. All specimens verified by J. M. Cei. *Liolaemus lineomaculatus* has been known from Santa Cruz and Chubut provinces. The northernmost locality is at the west corner of Chubut (44°51'S, 71°40'W) at 980 m. (Williams 1997, Cuad. Herpetol. 11:88–89). A population, probably referable to *L. lineomaculatus*, was found associated with the *Araucaria* forest in Primeros Pinos, Neuquén Province (Cei 1986, Museo Regionale di Scienze Naturali, monografia IV. Torino, Italy. 528 pp.). These specimens represent the second record for Chubut and the first record for Río Negro Province, and represent a link between the Chubut and Neuquén populations. The present data extend the known distribution of this species ca. 360 km north from previously known localities.

Submitted by **NORA IBARGÜENGOYTÍA** and **LAURA M. CASALINS**, Centro Regional Universitario Bariloche, Universidad Nacional del Comahue, Provincia de Río Negro, Argentina, **JAMES A. SCHULTE II**, Campus Box 1137, Department of Biology, Washington University, St. Louis, Missouri 63130-4899, USA, **GUILLERMO C. AMICO**, Centro Regional Universitario Bariloche, Universidad Nacional del Comahue, Provincia de Río Negro, Argentina, and **LORENZO SYMPSON**, Km 14, Bustillo, Bariloche, Provincia de Río Negro, Argentina.

MICROLOPHUS THERESIOIDES. CHILE: II REGION DE ANTOFAGASTA: Provincia de Antofagasta, Estación Pampa Unión (23°04'S, 69°30'W), 1413 m. 6 December 2000. J. C. Ortiz, M. Vidal, and M. Hengst. Museo de Zoología de la Universidad de Concepción (MZUC 25814–815). Verified by P. Victoriano. Adults specimens found on *Schinus molle* or among *Atriplex atacamensis*. New country record; extends the southern range of this species on the S Loa River by ca. 55 km from a record at Calama (Ortíz 1980, Actas I Reunión Iberoamericana Zool. Vert., La Rábida, pp. 355–377).

Submitted by **JUAN CARLOS ORTÍZ** and **MARCELA VIDAL**, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile.

OPHISAURUS ATTENUATUS ATTENUATUS (Western Slender Glass Lizard). USA: OKLAHOMA: Woodward Co: AOR, 7.3 km S and 9.1 km W Freedom. 21 May 2000. Richard L. Lardie. Saint Gregory's University, Shawnee, Oklahoma (SGU Color Slides S9–S12. Verified by Doyle L. Crosswhite. County record; extends range 34.4 km W of the nearest record, 12 mi W Alva, Woods County (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press. 370 pp.) and verifies previous sight record (Secor and Carpenter 1984, Oklahoma Herpetol. Soc. Spec. Publ. 3:1–57). Specimen was one of two observed on the road 1.3 km W Travertine Creek. Videotape records were also made of both specimens.

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

PTYODACTYLUS HASSELQUISTII HASSELQUISTII (Fantoed Gecko). EGYPT: NORTH SINAI PROVINCE: Zaranik Protected Area, Sebeeka (31°04'18"N, 33°27'55"E). 11 August 2000. A. A. Ibrahim. The Hebrew University of Jerusalem (HUJ-R 19411-13). Verified by Y. L. Werner. Found in salt factory buildings. Several individuals were also observed in old railway station buildings ca. 20 m from the factory. Six yellowish-white eggs were seen adhering to the ceiling corners, and at the top of the walls in the railway buildings in August. A single individual was also observed in the visitors' center (ca. 430 m from the factory). Old railway buildings in Mazar, west of Zaranik (31°02'36"N, 33°22'56"E), and Midan, E of Zaranik (31°04'35"N, 33°34'51"E) were checked, but the gecko was not found. Individuals in Sebeeka were very pale in color and almost patternless, in contrast to animals in South Sinai Province, which are dark and clearly cross-banded. This may reflect the gecko's ability to change its coloration physiologically, or a consequence of selection on the whitish walls of the factory and railway buildings. In North Sinai Province, the species was considered replaced by *P. guttatus* (Werner and Sivan 1993, Rev. Esp. Herpetol. 7:47–64). First province record (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No.11:1–234).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt; e-mail: aibrahim@ismailia.ie-eg.com.

SPHAERODACTYLUS PARVUS (Anguilla Bank Dwarf Gecko). ANGUILLA: Scrub Island, near Scrub Bay. 12 June 2000. Saul S. Nava and Justin J. Shew. Bobby Witcher Memorial Collection, Avila College (BWMC 02634, 06736, 06738). Verified by John S. Parmerlee, Jr. First records for Scrub Island, although this species (formerly considered a subspecies of *S. macrolepis*) is common on nearby Anguilla (Schwartz and Henderson 1991, Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville).

Submitted by **SAUL S. NAVA**, Department of Biological Sciences, Univeristy of Texas at El Paso, El Paso, Texas 79968, USA

(e-mail: snava@miners.utep.edu), **JUSTIN J. SHEW**, Department of Biology, Truman State University, Kirksville, Missouri 63501, USA (e-mail: jjshew@hotmail.com), and **ROBERT POWELL**, Department of Biology, Avila College, Kansas City, Missouri 64145, USA (e-mail: powellr@mail.avila.edu).

SPHAERODACTYLUS SPUTATOR (Banded Dwarf Gecko). ANGUILLA: Scrub Island, near Scrub Bay. 12 June 2000. Saul S. Nava and Justin J. Shew. Bobby Witcher Memorial Collection, Avila College (BWMC 02635,06737, 06739); Little Scrub Island. BWMC 06790–1. Saul Nava. Both verified by John S. Parmerlee Jr. First records for Scrub and Little Scrub islands, although this species is common on nearby Anguilla (Schwartz and Henderson 1991, Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville).

Submitted by **SAUL S. NAVA**, Department of Biological Sciences, Univeristy of Texas at El Paso, El Paso, Texas 79968, USA (e-mail: snava@miners.utep.edu), **KARIM V. D. HODGE**, Anguilla National Trust, P.O. Box 1234, The Valley, Anguilla, British West Indies (e-mail: axanat@anguillanet.com), **JUSTIN J. SHEW**, Department of Biology, Truman State University, Kirksville, Missouri 63501, USA (jjshew@hotmail.com), and **ROBERT POWELL**, Department of Biology, Avila College, Kansas City, Missouri 64145, USA (e-mail: powellr@mail.avila.edu).

VANZOSAURA RUBRICAUDA. ARGENTINA: CHACO: Departamento General Güemes: jct. of Picada 8 and Picada 60 (25°12'S, 62°08'W). 3 April 1995. Alejandra Hernando. Herpetological Collection, Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 6408). Verified by María Esther Tedesco. First province record (Cei 1993, Mon. Zool. Ital. Mus. Reg. Sci. Nat. Torino. 949 pp.; Avila et al, *In* Lavilla et al. (eds.), Categorización de los Anfibios y Reptiles de la República Argentina, pp. 51–74. Asoc. Herpetol. Argentina, Tucumán, Argentina. 97 pp.).

Submitted by **ROBERTO HUGO AGUIRRE** and **JORGE ABEL CESPEDEZ**, Cátedra de Anatomía Comparada, Departamento de Biología, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, Campus Universitarius, Avenida Libertad 5470, C.P. 3400, Corrientes, Argentina.

XANTUSIA VIGILIS ARIZONAE (Arizona Night Lizard). USA: ARIZONA: PINAL CO: Galiuro Mts., Table Mtn., 1347 m, NW 1/4 SE 1/4 Sec. 4, T7S, R18E. 23 August 1979. T. B. Johnson. UAZ 43478; S side Zapata Mtn., 1350 m, NE 1/4 Sec. 7, T7S, R18E. 21 December 1980. T. B. Johnson, R. L. Bezy, C. R. Schwalbe, R. B. Spicer. UAZ 44027–30. All verified by G. L. Bradley. Extends range in Arizona 95 km SE from the vicinity of Globe, Gila County (Webb 1965, Am. Mus. Nov. 2231:1–16); first records for *X. v. arizonae* south of the Gila River.

Submitted by **TERRY B. JOHNSON**, Nongame Branch, Arizona Game and Fish Department, 2221 West Greenway Road, Phoenix, Arizona 85023, USA, **CECIL R. SCHWALBE**, U.S. Geological Survey, Sonoran Desert Field Station, University of Arizona, Tucson, Arizona 85712, USA, **ROBERT L. BEZY**, Department of Herpetology, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA, **CHARLES H. LOWE**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85712, USA, and **R. BARRY SPICER**, 1239 East Yucca Street, Phoenix, Arizona 85020, USA.

SERPENTES

AGKISTRODON PISCIVORUS LEUCOSTOMA (Western Cottonmouth). USA: TEXAS: GREGG CO: 3.2 km SW Longview off Texas Rt. 31, Sabine River bottoms. 22 April 2001. Sonny Burns and Josh Kessler. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25745). Verified by Stanley E. Trauth. New county record and, except for Rains County, completely fills distributional gap in northeast Texas pineywoods (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.; Werler and Dixon 2000, Texas Snakes: Identification, Distribution, and Natural History. Univ. Texas Press, Austin. 437 pp.).

Submitted by **CHRIS T. McALLISTER and JOSHUA E. KESSLER**, Department of Biology, Texas A&M University at Texarkana, Texarkana, Texas 75505, USA.

ALSOPHIS RIJGERSMAEI (Anguilla Bank Racer). ANGUILLA: Scrub Island, near Scrub Bay. 12 June 2000. Katherine G. Howard, Samantha C. Larimer, and James M. Eaton. Milwaukee Public Museum (MPM, VZP 695). Verified by Robert W. Henderson. Two other specimens were observed during two visits to Scrub Island. This record represents the first voucher for Scrub Island, although Sajdak and Henderson (1991, Unpubl. Rep., Fauna and Flora International, Cambridge, United Kingdom) and Malhotra and Thorpe (1999, Reptiles and Amphibians of the Eastern Caribbean. Macmillan Education, London) subsequently listed Scrub Island within the distribution of this species.

Submitted by **KATHERINE G. HOWARD**, Department of Biology, University of Idaho, Moscow, Idaho 83843, USA (e-mail: howa0550@uidaho.edu), **JAMES M. EATON**, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA (e-mail: eatonjm@slu.edu), **SAMANTHA C. LARIMER**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA (e-mail: larimsa@earlham.edu), and **JOSIAH H. TOWNSEND**, Department of Biology, Miami-Dade Community College, Kendall Campus, Miami, Florida 33176, USA (current address: Department of Biology, University of Florida, Gainesville, Florida 32611, USA)(e-mail: joetownsend@earthlink.net).

APOSTOLEPIS QUIROGAI. BRAZIL: RIO GRANDE DO SUL: Municipality of Santo Ângelo (28°18'S, 54°08'W). 16 March 2001. L. H. Cappellari. Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP 12185). Verified by Marcos Di-Bernardo. First state record; extends known range 180 km SE from Posadas, Misiones, Argentina (Giraudo and Scrocchi 1998, Herpetologica 54:470–476).

Submitted by **THALES DE LEMA** and **LIZE HELENA CAPPELLARI**, Laboratório de Herpetologia, Departamento de Biologia, Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga, 6681, CEP 90619-900, Porto Alegre, Rio Grande do Sul, Brazil.

BOGERTOPHIS SUBOCULARIS (Trans-Pecos Rat Snake). USA: TEXAS: KINNEY CO: Kickapoo Cavern State Park, 38.8 road km N Brackettville on FM 674. 1 June 2000. John H. Malone. TCWC 83941. Verified by James R. Dixon. County record. (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp). Specimen collected during a baseline amphibian and reptile inventory conducted at Kickapoo Cavern State Park. Collected under the authority of TPWD State Park Scientific Study Permit Number 25-00.

Submitted by **JOHN H. MALONE**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA.

CLELIA CLELIA. VENEZUELA: PORTUGUESA: Municipio Guanare: 14 km (by road) N Mesa de Cavacas on road to Biscucuy. 31 July 1991 (2000 h). A. L. Markezich and Donald C. Taphorn. MCNG 1612. Verified by P. Pacheco; Municipio Papelón: 26 km (by road) SE Guanare on Guanare-Guanarito Road. 9 July 1993 (2130 h). MCNG 1492. Verified by T. Horger. First records from Portuguesa, ca. 150 km E and N, respectively, of records from the states of Mérida and Apure, recently reported by Rivas and La Marca (2001, Herpetol. Rev. 32:59).

Submitted by **ALLEN MARKEZICH**, Department of Natural Sciences, Black Hawk College, Moline, Illinois 61265; e-mail: markezicha@bhc1.bhc.edu.

COLUBER CONSTRICTOR (Eastern Racer). USA: TEXAS: CALLAHAN CO: Farm and Market Rt. 2228 near Admiral. 7 July 1977. Collector not given. Abilene Christian University Natural History Collection (ACUNHC 681). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology, Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

CROTALUS LEPIDUS LEPIDUS (Mottled Rock Rattlesnake). MÉXICO: CHIHUAHUA: Cerros Colorados, 11.2 km NW Ojo Caliente on "Rio Grande Road," Municipio Guadalupe Bravos. 27 July 1975. T. R. Van Devender and B. L. Everitt. Sul Ross State University Vertebrate Collection (SRSU 4815). Verified by James F. Scudday. Third precise state record; extends range ca. 300 air km NW from closest recorded locality in Chihuahua (Lemos-Espinal et al. 2000, Herpetol. Rev. 31:113). Lemos-Espinal et al. (*op. cit.*) reported a specimen of *C. l. lepidus* from La Perla as being the first precise locality of record from Chihuahua; Klauber (1952, Bull. Zool. Soc. San Diego 26:51) reported a specimen (UI 22812) from "15 miles north of Escalón in the southeast corner of Chihuahua."

Submitted by **ROBERT W. BRYSON, JR.**, and **JAMES M. MUELLER**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: TEXAS: KINNEY CO: Kickapoo Cavern State Park, 38.8 rd km N Brackettville on FM 674. 14 March 2000. Joel A. Johnson. TCWC 83930. Verified by James R. Dixon. County record. (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp). Specimen collected during a baseline amphibian and reptile inventory conducted at Kickapoo Cavern State Park. Collected under the authority of TPWD State Park Scientific Study Permit Number 25-00.

Submitted by **JOEL A. JOHNSON** and **JOHN H. MALONE**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA.

ELAPHE GUTTATA GUTTATA (Corn Snake). USA: TEXAS: NEWTON CO: ca. 9.7 km NE Burkeville. 27 June 1998. Carl J. Franklin and Richard D. Reams. UTACV R 45194. Verified by Jonathan A. Campbell. Specimen was found DOR on Texas Rt. 63 at 2347 h. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **CARL J. FRANKLIN**, 1001 Denmark Drive, Grand Prairie, Texas 75050, USA (e-mail: herpking@ix.netcom.com), and **RICHARD D. REAMS**, 1402 Ramses Avenue, Dallas, Texas 75216, USA (e-mail: hylareams@aol.com).

ELAPHE OBSOLETA LINDHEIMERII (Texas Rat Snake). USA: TEXAS: GREGG CO: 3.2 km SW Longview off Tex. Rt. 31, Sabine River bottoms. 22 April 2001. Sonny Burns and Josh Kessler. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25744). Verified by Stanley E. Trauth. New county record. Except for Jack and Rains counties, completely fills distributional hiatus in all of east and central Texas (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.; Werler and Dixon 2000, Texas Snakes: Identification, Distribution, and Natural History. Univ. of Texas Press, Austin. 437 pp.).

Submitted by **JOSHUA E. KESSLER** and **CHRIS T. MCALLISTER**, Department of Biology, Texas A&M University at Texarkana, Texarkana, Texas 75505, USA.

ELAPHE OBSOLETA OBSOLETA (Black Rat Snake). USA: ILLINOIS: ROCK ISLAND CO: (Sec. 2, T77N, R2W). 1961. Robert Schroder. HDW-NIU 1745 (formerly RE 22, Putnam Museum of History and Natural Sciences, Davenport, Iowa). Verified by Christine Chandler. New county record; extends range north along the Mississippi River from Hancock County and the disjunct populations in Carroll and Jo Daviess counties (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

ELAPHE OBSOLETA SPILOIDES (Midland Rat Snake). USA: FLORIDA: FRANKLIN CO: St. George Island, The Plantation, St. George Island Airport (N29°64088, W84°91213). 28 December 2000. K. J. Irwin. Department of Herpetology, Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas (MHP 6820). Verified by Lisa K. Irwin. Subadult found at edge of slash pine forest adjacent to airport runway clearing. First record for St. George Island (Blaney 1971, Herpetologica 27:406–430; Means 1974, A Survey of the Amphibians, Reptiles, and Mammals

Inhabiting St. George Island, Franklin County, Florida, with Comments on Vulnerable Aspects of their Ecology. *In* Livingston et al. [eds.], St. George Island: Biota, Ecology, and Management Program for Controlled Development. Rept. Develop. Regional Impact Franklin County Commission).

Submitted by **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA; e-mail: kirwin@agfc.state.ar.us.

HYDROPS TRIANGULARIS. VENEZUELA: PORTUGUESA: Municipio Papelón: Estación Pisciola, Papelón, 8°57'34"N, 69°28'22"W, 69 m. No specific date of collection. Collected by workers at the station. MCNG 1602; Municipio undetermined: Guanare, on road to Barinas. 28 November 1987. B. Busto and C. Ramo. MCNG 1006. Both specimens verified by T. Horger. Second records from west central Venezuela, ca. 140 km SSW of nearest record from the state of Cojedes (Roze 1966, La Taxonomia y Zoogeographia de los Ophidios de Venezuela. Univ. Central de Venezuela, Edic. Biblioteca 28, Caracas. 362 pp.; Rivas and Fuentes 2000, Herpetol. Rev. 31:186).

Submitted by **ALLEN MARKEZICH**, Department of Natural Sciences, Black Hawk College, Moline, Illinois 61265 (e-mail: markezicha@bhc1.bhc.edu).

LAMPROPELTIS MEXICANA (San Luis Potosi Kingsnake). MEXICO: NUEVO LEÓN: 8.6 km E Iturbide on Rt. 58, Municipio Iturbide (24°44'45.5"N, 99°50'61.6"W; 1036 m). 24 July 2000. Gerard T. Salmon, Daniel Vermilya, and Bartholomew B. Bruno. Universidad Autónoma de Nuevo León Herpetological Collection (UANL 5773). Verified by Hobart M. Smith. DOR adult male. Easternmost locality for the species in the state of Nuevo León. Extends reported range ca. 19 air km to the east of TU 16483 (Garstka 1982, Breviora 466:1–35) and to E slope of the Sierra Madre Oriental. Lowest elevation record for the species (Gehlbach 1967, Cat. Am. Amphib. Rept. 55).

Submitted by **GERARD T. SALMON**, 30 Appletree Drive, Rhineback, New York 12572, USA, **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA, and **DAVID LAZCANO**, Laboratorio de Herpetología, Universidad Autónoma de Nuevo León, Apartado Postal 513, San Nicolas de los Garza, Nuevo León, Caixa Postal 66450, México.

LAMPROPELTIS MEXICANA (San Luis Potosi Kingsnake). MÉXICO: SINALOA: 4 km W El Palmito on Rt. 40, Municipio Concordia (23°33'14.2"N, 105°50'47.2"W, 2000 m). 30 June 2000. Robert Bryson, Deron Hartman, and Javier Banda. Universidad Autónoma de Nuevo León Herpetological Collection (UANL 5684). Verified by Robert G. Webb. DOR juvenile. First state record and westermost locality for species. Extends reported range ca. 95 air km to the west (Webb 1984, *In* Seigel et al. [eds.], Univ. Kansas Mus. Nat. Hist. Spec. Publ. 10:1–278) and ca. 10 air km from a previously unreported specimen of *L. mexicana* (FWMSH 6716) from Durango.

Submitted by **ROBERT W. BRYSON, JR.**, Department of Biology, Sul Ross State University, Alpine, Texas 79832, USA, **GERARD T. SALMON**, 30 Appletree Drive, Rhineback, New York 12572, USA, and **DAVID LAZCANO**, Laboratorio de Herpetología, Universidad Autónoma de Nuevo León, Apartado Postal 513, San Nicolas de los Garza, Nuevo León, Caixa Postal 66450, México.

LIOPHIS COBELLA TAENIOGASTER. BRAZIL: PARÁ: Santarém (54°42'W, 2°26'S), margin of the Tapajós River, Comunidade São Bras. S. Santos. Date and collector unknown. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1555 and 1559). Verified by Rubens N. Yuki. This taxon has been recorded from northeastern Brazil, from Isla Bantanal east to coastal Bahia and north to Rio Amazonas (mainly along the south bank). Specimen represents the westernmost record from the state of Pará and extends the known distribution ca. 240 km to the west (Dixon 1983, J. Herpetol. 17:149–165).

Submitted by **JOSSEHAN GALÚCIO DA FROTA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200; e-mail: jgfrota@mailbr.com.br.

MALPOLON MONSPESSULANUS INSIGNITUS (Montpellier Snake). EGYPT: NORTH SINAI PROVINCE: Rafah (31°17'32"N, 34°14'26"E). R. M. Ismail and M. K. Hemdan. Muséum National d'Histoire Naturelle (MNHN 2000.5146 and 2000.4289). Verified by I. Ineich. A large female (ca. 983 mm SVL) and a juvenile (ca. 310 mm SVL) captured near the Sinai-Cisjordan border on 15 July and 24 October 2000, respectively. In Egypt, this species was previously known from Port Said and Domyatt (NE Egypt), the western Mediterranean coastal desert, and the Nile Delta (Marx 1968, Checklist of Amphibians and Reptiles of Egypt. Spec. Publ. U.S. Naval Med. Res. Unit No. 3:1–51; Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. 11:1–234). First record for the Sinai Peninsula (Werner 1982, *In* Scott [ed.], Herpetological Communities, pp. 153–161. U.S. Fish and Wildlife Service Wildl. Res. Rep. 13. Washington, D.C.).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt; e-mail: aibrahim@ismailia.ie-eg.com.

MICRURUS FULVIUS TENER (Texas Coral Snake). USA: TEXAS: CASS CO: 4.8 km NW Kildare off FM 125. 9 March 2001. Michael Harp. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25590); 1.6 km off Texas 59 on county road 3659, vic. Queen City. September 1999. Steve Patterson. ASUMZ 25592 (color print). Both verified by Stanley E. Trauth. New county record and partially fills distributional gap in Arkansas-Louisiana-Texas. Species has been reported previously from NE Texas in adjacent Morris County (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.; Werler and Dixon 2000, Texas Snakes: Identification, Distribution, and Natural History. Univ. Texas Press, Austin. 437 pp.), in SW Arkansas in Lafayette County (Trauth, Robison, and Plummer, in prep., The Amphibians and Reptiles of Arkansas) and NW Louisiana in Caddo Parish (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **EDWARD R. BLACK**, 24 Big Oak Lane, Texarkana, Texas 75503, USA, and **CHRIS T. McALLISTER**, Department of Biology, Texas A&M University at Texarkana, Texarkana, Texas 75505, USA.

OPHEODRYS AESTIVUS (Rough Green Snake). USA: LOUISIANA: VERNON PARISH: Fullerton area, Fort Polk Military Reservation, near jct. Rt. 463 and Jeff McDonald Road (PR 5065). 14 June 2000. Ken Moore, David Plair, and Baeu B. Gregory. Seale Museum of Louisiana, McNeese State University (SML 9324). Verified by Steve Shively. First Parish record; fills the gap between Beauregard and Natchitoches Parishes as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana State University Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **BEAU B. GREGORY**, Environmental and Natural Resources Management Division, Directorate of Public Works, Fort Polk, Louisiana 71459, USA.

OPHEODRYS AESTIVUS (Rough Green Snake). USA: TEXAS: CALLAHAN CO: 28.8 km SE of Abilene. July 1968. Collector not given. Abilene Christian University Natural History Collection (ACUNHC 672). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology, Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

PITUOPHIS CATENIFER DESERTICOLA (Great Basin Gopher Snake). COLORADO: SAN JUAN CO: W of Silverton, adjacent to South Mineral Creek, T41N, R8W. 28 July 2000. Drayton Harrison and Larry Garcia. UCM Ancillary Collection of Herpetological Slides and Prints 150–151. Verified by Hobart M. Smith. First county record and an elevational record at 9500 ft. (2896 m).

Submitted by **CHARLES W. LOEFFLER**, Colorado Department of Natural Resources, Division of Wildlife, 6060 Broadway, Denver, Colorado 80216, USA.

PSEUDOBOA CORONATA (Crowned False Boa). VENEZUELA: SUCRE: Municipio Benítez: Parcelamiento Guaraúnos (10°35'N, 63°37'W). 2 m. 19 November 2000. Irene Fedón. Museo de Historia Natural La Salle, Caracas (MHNLS 15092, subadult male). Verified by César R. Molina. First state record and northernmost locality in Venezuela. The ocurrence of this snake in the state of Sucre was predicted by Rivas and Oliveros (1997, Herpetofauna del Estado Sucre, Venezuela: Lista Preliminar de Reptiles. Mem. Soc. Cienc. Nat. La Salle 147:67–80). The new record provides a range extension of ca. 50 km NW Caripito, state of Monagas (Roze 1966, La Taxonomía y Zoogeografía de los Ofidios en Venezuela. Ediciones de la Biblioteca, Universidad Central de Venezuela, Caracas. 362 pp.) and nearly 700 km NE Puerto Ayacucho, Amazonas state (Gorzula and Señaris 1999, Contribution to the Herpetofauna of the Venezuelan Guayana I. A Data Base. Scientia Guaianae 8, 270 pp.).

These widely separated localities are noteworthy because they suggest that *P. coronata* belongs to the biogeographical region of Venezuelan Guyana (comprising the states of Amazonas, Bolívar, Delta Amacuro, eastern Monagas, and southeastern Sucre, according to Gorzula and Señaris, *op. cit.*). The pattern of distribution of *Pseudoboa coronata* is repeated (e.g., Gorzula and Señaris, *op. cit.*; Rivas and Oliveros, *op. cit.*) by other reptiles such as *Rhinoclemmys punctularia, Gonatodes humeralis, Hemidactylus palaichthus, Chironius scurrulus, Erythrolamprus aesculapii, Liophis cobella, Micrurus lemniscatus diutius,* and *Pseustes poecilonotus.*

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela (e-mail: gilsonrivas@mixmail.com) and **ENRIQUE LA MARCA**, Laboratorio de Biogeografía, Escuela de Geografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Apartado Postal 116, Mérida 5101-A, Venezuela (e-mail: lamarca57@cantv.net).

PSEUDOBOA NEUWIEDII (Neuwied's False Boa). VENEZUELA: ESTADO ANZOATEGUI: Campamento El Caiman del Orinoco, 17 km NE Soledad (8°09'N, 63°32'W, 50 m). 24 October 2000. Paul M. Kornacker. Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK 73930). Verified by Gilson Rivas Fuenmayor. First state record. The nearest known locality is about 80 km south at Lake Guri (Gorzula and Señaris 1998, Contribution to the herpetofauna of the Venezuelan Guayana I. Scientia Guainae, Caracas. 269 pp.; Kornacker 1999, Checklist and key to the snakes of Venezuela. Lista sistemática y clave para las serpientes de Venezuela. Pako-Verlag, Rheinbach, Germany. 270 pp.; Lancini and Kornacker 1989, Die Schlangen von Venezuela. Verlag Armitano Ed. Caracas. 381 pp.; Roze 1966, La Taxonomía y Zoogeografía de los Ofidios en Venezuela. Univ. Central de Venezuela, Edic. Biblioteca. Caracas. 362 pp.).

Submitted by **PAUL M. KORNACKER**, Aachener Strasse 42, D-53359 Rheinbach, Germany; e-mail: pkornacker@aol.com or pakoverlag@aol.com.

REGINA GRAHAMII (Graham's Crayfish Snake). USA: TEXAS: JONES CO: Fort Phantom Road. 1 April 1960. Collector unknown. Abilene Christian University Natural History Collection (ACUNHC 701). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology, Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

SALVADORA GRAHAMIAE (Texas Patchnose Snake). USA: TEXAS: TAYLOR CO: 1.6 km N Lake Abilene. 20 November 1999. Thomas E. Lee, Jr. Abilene Christian University Natural History Collection (ACUNHC 248). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology,

Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

SIPHLOPHIS LONGICAUDATUS. BRAZIL: MINAS GERAIS: Município de Mariléia: Parque Estadual do Rio Doce (IEF) (19°42'S, 42°36'W, 536 m). March 1994. R. N. Feio and M. V. Freitas. Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil (MZUFV 812); October 1996. R. N. Feio and M. V. Freitas. MHNCI 7961. Both verified by Júlio César de Moura-Leite. First state record, ca. 400 km west of the closest previous record. Species is restricted to the Atlantic Forest of southern and southeastern Brazil, from Rio Grande do Sul to Espírito Santo States (Peters and Orejas-Miranda 1970, Catalogue of Neotropical Squamata. Part I. Snakes. Smithsonian Inst. Press, Washington, D.C.).

Submitted by **ANA LÚCIA PRUDENTE**, Museu Paraense Emílio Goeldi, Departamento de Zoologia, Seção de Herpetologia, Caixa Postal 399, CEP: 66040-170, Belém, Pará, Brazil, and **RENATO NEVES FEIO**, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, 36.571-000, Viçosa, Minas Gerais, Brazil.

STORERIA OCCIPITOMACULATA (Redbelly Snake). USA: ILLINOIS: Rock Island Co: Lord Thunder Park, Andalusia (Sec. 27, T17N, R3W). 14 August 1957. Gene Forett. HDW-NIU 1788 (formerly RE 088, Putnum Museum of History and Natural Sciences, Davenport, Iowa). Verified by Christine Chandler. New county record; extends range NW of closest records in Hancock County and Peoria County to the east (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

THAMNOPHIS CYRTOPSIS (Black-necked Gartersnake). USA: ARIZONA: Navajo Co: floodplain of Little Colorado River, ca. 0.8 km ESE Jackrabbit, NW/4 Sec. 15, T18N, R18E, ca. 1506 m elev. 13 June 1999. Trevor B. Persons. UAZ 51740. Red Tank, 22.0 km (by road) S Clear Creek Reservoir bridge on Ariz. Rt. 99. 17 August 1989. Philip C. Rosen. UAZ 49180. Wildcat Canyon at Points of Wildcat. 4 September 1960. R. R. Miller and C. L. Hubbs. UMMZ 121947. 14.9 km (via Ariz. Rt. 77) N Snowflake, then 1.0 km (via dirt road) E. 9 August 1972. C. J. Cole et al. AMNH 109454. Apache Co: 19.6 km (by road) W St. Johns on U.S. Rt. 180. 6 September 1981. Charles H. Lowe and Cecil R. Schwalbe. UAZ 44348. All verified by George L. Bradley, except AMNH 109454 verified by Charles A. Drost. First record for the Little Colorado River, and first records for the Little Colorado River basin other than Lakeside, Navajo County (Milstead 1953, Texas J. Sci. 5:348–379; plotted in Webb 1980, Cat. Am. Amph. Rept. 245.1–245.3; R. G. Webb, pers. comm.), and 2 miles north of Flagstaff, Coconino County, Arizona (MNA Z7.91). The latter location was reported by Aitchison and Tomko (1974, Plateau 47:18–25), but was not plotted by Webb (*op. cit.*; R. G. Webb, pers. comm.). Both previous records are from high elevation sites (>2100 m) straddling the Mogollon Rim. These new records indicate widespread populations in the Little Colorado River basin and suggest a possibility that additional populations might occur in the presently-mapped gap (Rossman et al. 1996, The Garter Snakes. Oklahoma Univ. Press, Norman; Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second Ed. Houghton Mifflin Co., Boston, Massachusetts, 350 pp.; Webb, *op. cit.*) between the Mogollon Rim and the San Juan River basin.

Submitted by **TREVOR B. PERSONS**, USGS Forest and Rangeland Ecosystem Science Center, Colorado Plateau Field Station, Box 5614, Northern Arizona University, Flagstaff, Arizona, 86011, USA, and **PHILIP C. ROSEN**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

THAMNOPHIS CYRTOPSIS (Black-necked Gartersnake). USA: TEXAS: Kinney Co: Kickapoo Cavern State Park, 38.8 road km N Brackettville on FM 674. 5 June 2000. John H. Malone. TCWC 83944. Verified by James R. Dixon. County record. (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp). Specimen collected during a baseline amphibian and reptile inventory conducted at Kickapoo Cavern State Park. Collected under the authority of TPWD State Park Scientific Study Permit Number 25-00.

Submitted by **JOHN H. MALONE**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA.

THAMNOPHIS PROXIMUS PROXIMUS (Western Ribbon Snake). USA: OKLAHOMA: Ellis Co: female and 17 of 18 young, 2.5 km N Fargo. 28 June 1975. Richard L. Lardie. Oklahoma Baptist University, Shawnee, Oklahoma (OBU 1364, 1396–1401). New county record; specimens are considered integrades with *T. s. diabolicus* based on ground color. Grant Co: 8.1 km W and 3.2 km S Medford. 20 May 1990. Mark Meier. Saint Gregory's University, Shawnee, Oklahoma (SGU 277); 1.8 km E Hawley. 19 July 1990. Mark Meier. SGU 295; 10 km S and 7.2 km W Manchester. 19 July 1980. R. Lardie. OBU 1819; 2.6 km E Hawley. 11 September 1989. Mark Meier. OBU 2227. SGU specimens previously verified by Jeffrey T. Burkhart. OBU specimens previously verified by the late Jeffrey H. Black. New county records (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, Oklahoma. 370 pp.) and validate sight records for Ellis County (Secor and Carpenter 1984, Oklahoma Herpetol. Soc. Spec. Publ. 1:1–17). Validates Grant County and voucher records (Meier et al. 1990, Bull. Oklahoma Herpetol. Soc. 14[1–4].

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

THAMNOPHIS PROXIMUS PROXIMUS (Western Ribbon Snake). USA: OKLAHOMA: Major Co: 1.6 km E and 1.7 km S Cleo Springs. 12 June 1989. Lee Frezendall. Saint Gregory's University, Shawnee, Oklahoma (SGU 167); 6.3 km E and 4.8 km S Meno. 19 July 1992. Richard L. Lardie. SGU 329; 6.3 km E and 3.4 km S Meno. 1 July 2000. R. Lardie. SGU 350; 6.3 km E and 6.8 km S Meno. 5 August 1990. R. Lardie. SGU 383; 4.6 km W Isabella. 2 July 1994. R. Lardie. SGU 2000; 3.2 km N and 15.4 km W Fairview. 18 September 1999. R. Lardie. SGU Color Print 13. All verified by Doyle L. Crosswhite. Additional specimens previously collected: 5.1 km E Ames. 27 August 1976. R. Lardie. Okla-

homa Baptist University, Shawnee, Oklahoma (OBU 1468); 12 young born to female collected 1.6 km E and 6.5 km S Cleo Springs (Williams Scout Camp). R. Lardie. OBU 1550; 10.7 km W Orienta. 28 May 1983. R. Lardie. OBU 1605; 3.3 km W and 0.8 km S Ames. 16 June 1985. R. Lardie. OBU 1721; 4.7 km W Ames. 27 September 1975. R. Lardie. OBU 1757. All OBU specimens previously verified by the late Jeffrey H. Black. Specimens are county and verification records (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, Oklahoma. 370 pp.) and validate prior sight records for the county (Secor and Carpenter 1984, Oklahoma Herpetol. Soc. Spec. Publ. 1:1–57). Specimens found west of the Cimarron Gypsum Hills frequently show color characteristics of *T. p. diabolicus* (olive gray to brown ground color) and are considered intergrades between the two subspecies. Those collected from eastern Major County show color characteristics of *T. p. proximus*.

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

THAMNOPHIS RADIX (Plains Garter Snake). USA: ILLINOIS: Stephenson Co: 1.1 km N Freeport, E of Illinois Rt. 26 and S North Van Buren Road in slough (NW 1/4 NW 1/4 NW 1/4 Sec 30, T27N, R8E, UTM Zone 16: N4688046m, E283103m). 10 September 2000. M. J. Meyer and K. K. Trester. Illinois Natural History Survey (INHS 16429). Verified by J. E. Petzing. New county record (Phillips et al. 1999, Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8. Champaign. 300 pp.) and confirmation of Garman's 1892 record from Freeport (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28[1], 287 pp.). Collected under IDNR permit A00.0162.

Submitted by **MATHYS J. MEYER**, Department of Biological Sciences, Illinois State University, Normal, Illinois 61790-4120, USA, and **KARYLA K. TRESTER**, Center for Biodiversity, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

THAMNOPHIS SIRTALIS PARIETALIS (Red-sided Gartersnake). USA: OKLAHOMA: Ellis Co: 2.5 km N Fargo. 28 June 1975. Richard L. Lardie. Oklahoma Baptist University, Shawnee, Oklahoma (OBU 1375) and 10 young (OBU 1379–88). Garfield Co: Douglas. 4 September 1973. Harvey Johnson. OBU 1963; 2.3 km W Enid. 5 July 1992. Saint Gregory's University, Shawnee, Oklahoma (SGU 327); 3.1 km N Lahoma. 5 July 1992. SGU 328; 1.2 km S and 2.6 km E Carrier. 6 August 1995. SGU 498; 1.2 km S and 4.5 km E Carrier. 6 August 1995. SGU 499; 5.6 km E Enid. 1 October 1995. SGU 539; 7.4 km W Enid. 1 October 1995. SGU 531; 7.6 km S and 0.9 km E Carrier. 1 October 1995. SGU 533; 5.6 km S and 0.5 km E Carrier. 11 September 1998. SGU 2027–28; 9.6 km E and 1.6 km S Waukomis. 3 June 1976. OBU 1392; Vance AFB. 1 August 1976. OBU 1474; 9.4 km S and 1.6 km E Fairmont. 25 June 1976. OBU 1549; 12.9 km S and 1.9 km E Covington. 27 June 1987. OBU 271; 4.8 km W Enid. 11 May 1998. SGU 710; 4.8 km W and 3.2 km N Enid. 11 May 1998. SGU 711; 7.5 km W Enid. 1 October 1995. SGU 535; 1.9 km W Enid. 25 April 1994. SGU 576; 8.1 km W Enid. 14 June 1997. SGU 681; 7.8 km W and 0.6 km N Enid. 12 May 1998. SGU 708. Grant Co: 17.7 km N Nash. 7 May 2000. SGU 2017; 7.1 km S Manchester. 25 September 1976. OBU 1535; 3.9 km N Nash. 25 September 1976. OBU 1536; 7.4 km S Manchester. 12 October 1976. OBU 1543; 1.2 km N Nash. 12 October 1976. OBU 1542; 10 km N Garfield-Grant county Line on Okla. Rt. 132. 12 October 1976. OBU 1545; 5.8 km N Nash. 25 September 1976. OBU 1552; 5.7 km N Nash. 25 September 1976. OBU 1553; 9.4 km N Nash. 25 September 1976. OBU 1553; 13.4 km N Nash. 25 September 1976. OBU 1555; 16.6 km N Nash. 25 September 1976. OBU 1556; 13.2 km N Nash. 2 October 1976. OBU 1557; 13.6 km N Nash. 17 September 1976. OBU 1567. Kingfisher Co: 6.2 km W Lacey. 16 April 1989. SGU 367. Major Co: 6.3 km E and 12.5 km S Meno. 15 August 1998. SGU 709; 1.6 km E and 6.5 km S Cleo Springs, Williams Scout Camp. 8 August 1976. OBU 1513 and 16 young (OBU 1514); Williams Scout Camp. 4 August 1976. OBU 1515 and 36 young (OBU 1516); Williams Scout Camp. June 1976. OBU 1517 and 16 young (OBU 1518 & 1519); 9.1 km W Orienta. 28 May 1983. OBU 1605; 3.3 km W and 3.2 km S Ames. 1 July 2000. Specimens were collected by Richard L. Lardie unless otherwise indicated. All SGU specimens were verified by Jeffrey T. Burkhart and Doyle L. Crosswhite. OBU specimens were verified by the late Jeffrey H. Black.

While many of these specimens exhibit color and pattern typical of *T. s. parietalis*, others show characteristics of *T. s. annectens*, as summarized by Collins (1993, Amphibians and Reptiles in Kansas. Third Ed. Univ. Press of Kansas, Lawrence. 397 pp.). These include amount (or lack) of reddish orange between the stripes, color and width of the dorsal stripe (light yellow to bright orange), and uniform dark appearance of the skin, or dark spots arranged in a checkerboard fashion. SGU 2027 with *T. s. annectens* characteristics (no red bars) and SGU 2028, typical *T. s. parietalis*, were collected as they attempted to swallow the same large *Rana blairi*, and there are other examples that verify the two color and pattern variations may be found at the same location. The entire population in northwestern Oklahoma may be intergrades between the two subspecies. Specimens listed above for Ellis, Garfield, Grant, Kingfisher, and Major counties are county records (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, Oklahoma. 370 pp.) and validate prior sight records for those counties (Secor and Carpenter 1984, Oklahoma Herpetol. Soc. Spec. Publ. 1:1–17).

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

TYPHLOPS RETICULATUS (Reticulate Worm Snake). VENEZUELA: BOLIVAR: Maraba (6°19'10"N, 63°31'55"W), 290 m. 16 May 1992. César Molina. Museo de Historia Natural La Salle, Caracas (MHNLS 14543). Verified by Celsa Señaris. Adult female collected at noon after rain in a gallery forest. First state record (Dixon and Hendricks 1979, Zoologische Verhandelingen 173:1–39). PORTUGUESA: Acarigua (09°33'36"N, 69°12'06"W). February 1968. R. Pérez. Museo de Biología, Universidad Central de Venezuela, Caracas (MBUCV 1697). Verified by Luis Fernando Navarrete. First state record as well as the first voucher specimen for the Venezuelan Lowlands known as "Los Llanos" (Rivero-Blanco and Dixon 1979, *In*: Duellman [ed.], Univ. Kansas Mus. Nat. Hist. Monogr. 7, pp. 281–298). Species was documented in Venezuela (Dixon and Hendricks, *op. cit*) for the states of Amazonas (south of Orinoco River) and Falcón (western Venezuela, northern Orinoco River).

Submitted by **GILSON RIVAS FUENMAYOR, CESAR R.**

MOLINA, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela, and **OSWALDO FUENTES**, Universidad Central de Venezuela, Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041-A, Venezuela.

VIRGINIA STRIATULA (Rough Earth Snake). USA: TEXAS: CALLAHAN CO: 4.8 km S Putnam. 20 April 1996. Thomas E. Lee, Jr. Abilene Christian University Natural History Collection (ACUNHC 43–44). Verified by Mark Muhr. New county record (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **ALLAN J. LANDWER**, Department of Biology, Hardin-Simmons University, Abilene, Texas 79698-6165, USA (e-mail: alandwer@hsutx.edu) and **THOMAS E. LEE, JR.**, Department of Biology, Abilene Christian University, Abilene, Texas 79699-7868, USA (e-mail: leet@nicanor.acu.edu).

VIRGINIA STRIATULA (Rough Earth Snake). USA: TEXAS: ROCKWALL CO: Rockwall. Date unknown. Monica Darwin. Adult specimen. UTACV R 46055. Verified by Jonathan A. Campbell. New county record. (Dixon 2000, Amphibians and Reptiles of Texas. Second Ed. Texas A&M Univ. Press, College Station. 421 pp.).

Submitted by **CARL J. FRANKLIN**, 1001 Denmark Drive, Grand Prairie, Texas 75050, USA (e-mail: herpking@ix.netcom.com), and **RICHARD D. REAMS**, 1402 Ramses Avenue, Dallas, Texas 75216, USA (e-mail: hylareams@aol.com).

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New Lizard Records for the Mariana Islands

SCOTT R. VOGT
U.S. Fish and Wildlife Service
P.O. Box 8134, MOU-3, Dededo Guam 96912, USA
e-mail: Scott_Vogt@fws.gov

EARL W. CAMPBELL
National Wildlife Research Center, Hilo Field Station
P.O. Box 10880, Hilo, Hawaii 96721, USA
e-mail: Earl.W.Campbell@usda.gov

ROBERT REED*
U. S. Fish and Wildlife Service
Rota, Northern Mariana Islands 96951, USA

and
GORDON H. RODDA
USGS, Midcontinent Ecological Science Center
4512 McMurry Avenue, Fort Collins, Colorado 80525, USA
e-mail: Gordon_Rodda@compuserve.com

**Present address: School of Biological Sciences, Building A08, The University of Sydney, Sydney, New South Wales 2006, Australia*

The Mariana Islands are a line of 15 small islands in the western Pacific Ocean. The chain extends north from Guam (13°N, 145°E) to Farallon de Pajaraos (= Uracas, 21°N, 146°E). Politically, this portion of the United States is divided into the Territory of Guam (Guam only) and the Commonwealth of the Northern Mariana Islands (all of the others). The larger southern islands—Guam, Rota, Tinian, and Saipan are inhabited, with permanent cities or villages, while most of the far northern islands are uninhabited or have fewer than five families. The islands are oceanic, isolated from continental masses or other large land bodies, and therefore have a rather limited reptile assemblages, with only one endemic species. Interesting variations in the reptile communities among the different islands occur as a product of chance migration and ecological disturbance (natural and human caused), and from the introduction of exotic competitors and predators (Rodda et al. 1991). The most notorious introduced predator is the brown treesnake, *Boiga irregularis*, which colonized Guam shortly after World War II (Rodda et al. 1991, 1999), but the herpetofauna has been greatly influenced by a variety of other introduced species as well, both historically (Fritts and Rodda 1998) and prehistorically (Pregill 1998). The inhabited southern islands are at greatest risk from the brown treesnake and other introductions, several of which have occurred since the last Mariana checklist (Rodda et al. 1991), and are here documented. In addition, recent excursions to the uninhabited far northern islands have produced new island records.

With one exception, voucher specimens were collected and verified by and deposited in the U.S. National Museum (USNM, Smithsonian Institution; hyphenated catalog numbers represent ranges). The exception is a sight record on Farallon de Medinilla of *Emoia caeruleocauda*, which could not be collected because of unexploded cluster bombs in the vicinity (the military escort to this target island was unyielding, and an approaching typhoon terminated all visitation within hours of the sighting). Island names are those given on U.S. Geological Survey maps; where local usage varies, the more widely used name is given parenthetically. We report a total of fifteen new records on seven different islands.

Anolis carolinensis. Tinian Island; immediate vicinity of the Commercial Port. 22 May 1997, Gad Perry. USNM 532060. This record suggests a recent introduction on the basis of its location and because this species was not detected in the area in 1985 by Wiles et al. (1989) and during targeted searches in 1989 by GHR and others. That the species should colonize Tinian is not surprising in light of its presence on all of the other inhabited southern Mariana Islands (Rodda et al. 1991). Tinian has the most disturbed habitats among these islands, and this species thrives in comparable snake-free disturbed habitat on Rota and Saipan.

Carlia fusca. Rota Island; in the immediate vicinity of the Commercial Port. 2 October 1997. Stanley J. Kot. USNM 532102–10. This record suggests a recent introduction, on the basis of its location and because this species was not detected in the area by Wiles et al. (1990) and during targeted searches in 1994 and 1995 by EWC. This species occurs in high densities on the other inhabited southern islands (all established during the 1950s and 1960s: Wiles and Guerrero 1996; Rodda et al. 1991). This, coupled with daily cargo movement between the islands, greatly facilitated an introduction to Rota. Rota has the least disturbed habitats among these islands, and native forests on Rota may limit or slow the spread of this heliophilic skink. This species, exotic to the Mariana Islands, may have a detrimental effect on native skink species (Rodda et al. 1991) and deserves close monitoring.

Cryptoblepharus poecilopleurus. Farallon de Medinilla. 5 November 1996. John Goody. USNM 521932. Rota Island; at overlook above Bird Sanctuary (elevation ca 90m). 3 October 1997. Stanley J. Kot. USNM 532111–15. Saipan, 20 September 1999. North-central end of the island in the Marpi Commonwealth Forest. Scott R. Vogt. USNM 529970. Neither the Rota record (e.g., Wiles et. al. 1990) nor the Saipan record (e.g., Wiles and Guerrero 1996) are new but both are first time records, on each island, for this species away from the vicinity of salt water.

Emoia atrocostata. Aguijan Island (= Aguigan, Goat Island); W end of island in rocky strand and grassy habitat. 24 March 1995. Earl W. Campbell. USNM 348676–9.

Emoia caeruleocauda. Farallon de Medinilla. 5 November 1996. Scott R. Vogt sight record, not vouchered as explained above. Identification was based on the absence of any other species of blue-tailed striped skinks in the region.

Emoia slevini. Sarigan Island (Sariguan Island). June 1996, 13 March 1997, 6 January 1998. Scott R. Vogt. USNM 521970–8. Ground level vegetation was severely degraded by goat overgrazing during the earlier visits; vegetative recovery, after a feral ungulate removal program, was evident during later collections. Based on sticky trap capture rates, population numbers of this species on Sarigan appear to be increasing after the feral ungulate removal program. Pagan Island. 24–31 August 1999. Scott R. Vogt USNM 529972. Documented on the south end of the island with glueboard surveys. The northern region of Pagan was the site of a volcanic eruption in 1981, and this area still has low lizard densities (even in areas with similar vegetation) as compared to the southern end. This species was the subject of extensive (3451 trap hours on Aguijan and 300 on Anatahan) but unsuccessful targeted glueboard surveys and visual searches on Aguijan in March 1995 and on Anatahan in November 1995.

Gehyra mutilata. Aguijan Island (Goat Island). 24–25 March 1995. Earl W. Campbell. USNM 348637–40.

Gehyra oceanica. Anatahan Island; old village area near the NW corner of the island. November 1995. Scott R. Vogt. USNM 534531. Sarigan Island (Sariguan Island); old village area on the NW corner of the island. 13 March 1997. Scott R. Vogt. USNM 521927.

Hemidactylus frenatus. Aguijan Island (Goat Island), in introduced forest. 23 March 1995. Earl W. Campbell. USNM 348652–7.

Lepidodactylus lugubris. Sarigan Island (Sariguan Island); old village area on the Northwest corner of the island in coconut forest habitat. 12 March 1997. Scott R. Vogt. USNM 521930.

Nactus pelagicus. Sarigan Island (Sariguan Island); central area of the island (upper elevations) in native forest stand. 13 March 1997. Scott R. Vogt. USNM 5219298–9.

Perochirus ateles. Rota Island; North-central part of island near the public landfill. June 1998. Robert N. Reed. USNM 521320. This once common Micronesian endemic (Pregill 1998) is no longer present in substantial numbers. Our specimen is the first historical record for Rota. That it was undetected in extensive prior surveys (Wiles et al. 1990, and numerous subsequent collecting trips by each of the authors) indicates that it has become exceptionally rare.

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New Records of Squamate Reptiles in the Central Brazilian Cerrado: Emas National Park Region

PAULA HANNA VALDUJO
Laboratorio de Herpetologia, Instituto Butantan
Avenida Vital Brazil, 1500. CEP 05503-900
São Paulo, São Paulo, Brazil

and

CRISTIANO NOGUEIRA
Departamento de Ecologia General, Universidade de São Paulo
R. do Matão, 321, trav. 14. CEP 05508-900
São Paulo, São Paulo, Brazil

The Cerrado represents the second largest neotropical ecosystem, ocuppying 2,000,000 km^2 in central Brazil (Eiten 1972). However, it remains one of the least explored neotropical regions in terms of zoological studies (Colli et al. 1998). Species lists providing voucher specimens for central Brazilian squamate reptiles are available only in Amaral (1935) and Hoge (1952a, b).

Here we provide a list of sixteen species of lizards, amphisbenians, and snakes from Emas National Park region (ENP, 18°20'S, 53°00'W, 760–880 m elev., ca.130,000 ha), that represent range extensions or first reports for the Brazilian Cerrado. Sampling efforts included an area of 31,400 km^2, covering all the area inside ENP and immediate vicinities, in the states of Goiás, Mato Grosso do Sul, and Mato Grosso.

This work presents part of the results obtained in an ongoing long-term study on the squamate reptiles in the Emas National Park region, having sampled over 70 squamate reptile taxa up to May 2001. The collected specimens cited herein are deposited in the herpetological collections of Instituto Butantan (IB, verified by G. Puorto and F. L. Franco), Museu de Zoologia da Universidade de São Paulo (MZUSP, verified by P. E. Vanzolini), Universidade

de Brasília (CHUNB, verified by G. R. Colli) and Universidade Estadual de Campinas (ZUEC, verified by P. Manzani).

Lacertilia

Bachia cacerensis. Emas National Park, Agua Ruim river region, Jacuba drainage, 15 km from main lodge. 18°08.41'S, 52°44.49'W. 14 February 1999. F. Rodrigues, C. Nogueira, and P. H. Valdujo. CHUNB 11577. First record for state of Goiás. Extends range ca. 450 km SE from nearest record in Cáceres, MT (Castrillon and Strüssmann 1998).

Amphisbaenia

Amphisbaena silvestrii. Emas National Park, close to Jacuba base. M. B. Ramos-Neto. MZUSP 87733. Extends range ca. 250 km S of nearest recorded locality, Aruanã, GO (Vanzolini 1997).

Serpentes

Apostolepis assimilis. Emas National Park, next to Jacuba base. 19 April 1997. M. B. Ramos-Neto. IB 62649. First record in a 300 km radius. Nearest recorded locality is Ilha Solteira, SP (Hoge et al. 1975).

Helicops gomesi. Emas National Park, close to Formoso River bridge. 18°15.65'S, 52°53.32'W. April 1997. M. B. Ramos-Neto. IB 62688. According to Rossman (1970), this species is known from localities along the Tietê River (Paraná drainage) in the state of São Paulo. First record for the state of Goiás.

Leptodeira annulata pulchriceps. Goiás, Chapadão do Céu municipality. 4 May 1997. A. P. Peña. IB 57135. First record for Goiás state, extends range 400 km NE of nearest recorded locality, Aquidauana, in the state of Mato Grosso do Sul (Duellman 1958).

Leptotyphlops koppesi. Emas National Park, P2 point, 20 km N of main lodge. 18°06.53'S, 52°55.20'W. 10 September 1998. N. Hulle, C. Nogueira, and P. H. Valdujo. IB 58708. First state record, extending range ca. 350 km E of single known record in Terenos, state of Mato Grosso do Sul, type locality for the species (McDiarmid et al. 1999).

Liophis frenatus. Goiás, Chapadão do Céu municipality. A. P. Peña. IB 62704. First state record, extending range about 300 km N of nearest recorded locality, Ilha Solteira, state of São Paulo (Hoge et al. 1975).

Liophis maryellenae. Emas National Park, wet grassland in Agua Ruim river region, Jacuba drainage, 15 km from main lodge. 18°08.41'S, 52°44.49'W. April 2000. C. Nogueira. IB 62691. Extends range about 500 km W of nearest recorded locality, Anápolis, state of Goiás (type locality, Dixon 1985).

Liophis meridionalis. Emas National Park, Gloria River region, 10 km from main lodge. 18°17.10'S, 53°00.51'W. 18 February 1999. R. Brandão and C. Nogueira. IB 62681. First record in a 350 km radius. Nearest recorded locality: Terenos, state of Mato Grosso do Sul (Hoge 1952c).

Liophis paucidens. Goiás, Mineiros municipality, assentamento Babilônia. 17°40.90'S, 53°13.20'W. 21 July 2000. P. H. Valdujo. IB 62696. Few known specimens, all from northeastern or central Brazil. Extends range about 550 km W of nearest recorded locality, Ipameri, state of Goiás (Michaud and Dixon 1987).

Liophis reginae macrosoma. Goiás, Chapadão do Céu municipality, Santa Amélia Farm. 23 February 1998. A. P. Peña. IB 62683. New distribution record in a 300 km radius. Nearest recorded locality is Ilha Solteira, state of São Paulo (Dixon 1983; Hoge et al. 1975).

Oxyrhopus petola digitalis. Emas National Park, close to J point, 3 km E from main lodge. 17°35.46'S, 52°38.61'. W. F. Rodrigues. ZUEC 01914. First state record (Bailey 1970).

Oxyrhopus rhombifer rhombifer. Emas National Park, close to B point, 3 km S of main lodge. 18°18.39'S, 52°53.93'. W. F. Rodrigues. ZUEC 1914. First record for state of Goiás (Bailey 1970).

Phalotris nasutus. Emas National Park, close to P2 point, 20 km N of main lodge. 18°06.53'S, 52°55.20'W. November 1994. F. Rodrigues. CHUNB 03892. Extends range ca. 100 km E from nearest recorded locality, Baliza, state of Goiás (Ferrarezzi 1993).

Philodryas patagoniensis. Emas National Park, next to V point, 25 km N of main base. 18°03.33'S 52°56.12'W. 14 October 1999. L. Baumgarten. CHUNB 18440. First precise locality for state of Goiás. Northernmost record for Brazil (Thomas 1976).

Taeniophallus occipitalis. Emas National Park, close to Formoso River bridge. 18°15.65'S, 52°53.32'W. 19 July 1999. P. H. Valdujo. IB 62692. First record for state of Goiás, according to Myers (1974), whose list of examined specimens does not show any precise locality in the country.

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New Records for Amphibians and Reptiles from Departamentos Pasco and Ucayali, Peru

EDGAR LEHR

Forschungsinstitut und Naturmuseum Senckenberg
Senckenberganlage 25, D-60325 Frankfurt am Main, Germany
e-mail: edgarlehr@hotmail.com

The composition of the herpetofauna of the Peruvian Departamentos Pasco and Ucayali is still poorly known. Distribution data for amphibians and reptiles from Pasco (Lehr 2000a; Lehr and Fernandez 2000a), and Ucayali (Duellman and Thomas 1996; Lehr 2000b, Lehr and Aguilar 2000a, b; Lehr and Fernandez 2000b; Lehr and Köhler 2000) were published recently. Here I document 34 new records for amphibians and reptiles from Departamento Pasco, and nine new records for amphibians and reptiles from Departamento Ucayali based on the species lists of Rodríguez et al. (1993), Carrillo de Espinoza and Icochea (1995), and Duellman and Thomas (1996).

All specimens were deposited at Museo de Historia Natural de San Marcos (MHNSM), and Natur-Museum und Forschungsinstitut Senckenberg (SMF). Snakes from the collection of the Centro de Salud San Camilo Pozuzo (PE) were included for Pasco records.

All amphibians were verified by J. Icochea except *Osteocephalus planiceps*, which was verified by K.-H. Jungfer; caiman, tortoises, and lizards were verified by G. Köhler, and snakes were verified by N. Carrillo de Espinoza.

Anura

Eleutherodactylus diadematus (Diadem Robber Frog). UCAYALI: Provincia Atalaya: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 19 June 1998. E. Lehr. MHNSM 20374.

Leptodactylus knudseni (Knudsen's Frog). UCAYALI: Provincia Atalaya: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 2 February 1999. E. Lehr and C. Aguilar. MHNSM 20398.

Leptodactylus rhodonotus (Peru White-lipped Frog). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 25 July 1998. E. Lehr and R. Fernandez. MHNSM 20410–11, SMF 80435–36.

Lithodytes lineatus (Gold-striped Frog). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 20 May1999. E. Lehr. SMF 80438; Puerto Amistad (09°55'41"S, 74°55'25"W, 200 m elev.). 25 May 1999. E. Lehr. MHNSM 20412.

Hemiphractus scutatus (Spix's Horned Treefrog). UCAYALI: Provincia Atalaya: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 31 January 1999. E. Lehr. SMF 80437.

Hyla boans (Rusty Treefrog). PASCO: Provincia Oxapampa: Puerto Amistad (09°55'41"S, 74°55'25"W, 200 m elev.). 25 May 1999. E. Lehr. MHNSM 20336–37, SMF 80349–51.

Hyla calcarata (Troschel's Treefrog). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 18 May 1999. C. Aguilar. SMF 80352.

Hyla geographica (Map Treefrog). PASCO: Provincia Oxapampa: Puerto Amistad (09°55'41"S, 74°55'25"W, 200 m elev.). 25 May 1999. E. Lehr. MHNSM 20339–40, SMF 80355.

Hyla phyllognatha (Roque Treefrog). PASCO: Provincia Oxapampa: Pozuzo (10°04'10"S, 75°31'42"W, 1000 m elev.). 11 July 1998. E. Lehr. MHNSM 20343–44, SMF 80359; Iscozacin/ Cordillera San Matías (10°10'41"S, 75°07'54"W, 410 m elev.). 13 May 1999. E. Lehr and E. Ponce. SMF 80362.

Hyla punctata (Polkadot Treefrog). PASCO: Provincia Oxapampa: Iscozacin/Cordillera San Matías (10°10'41"S, 75°07'54"W, 410 m elev.). 16 May 1999. E. Lehr and E. Ponce. MHNSM 20347.

Osteocephalus planiceps (Slender-legged Treefrog). PASCO: Provincia Oxapampa: Pozuzo (10°04'10"S, 75°31'42"W, 1000 m elev.). 24 February 1999. E. Lehr. SMF 80365; UCAYALI: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 19.06.1998. E. Lehr and R. Fernandez. SMF 80367.

Phyllomedusa vaillanti (White-lined Leaf Frog). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 18 May 1999. E. Lehr and E. Ponce. MHNSM 20355, SMF 80373.

Gymnophiona

Siphonops annulatus (Ringed Caecilian). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 25 July 1998. E. Lehr. SMF 80486.

Testudines

Geochelone denticulata (South American Yellowfoot Tortoise). PASCO: Provincia Oxapampa: Puerto Amistad: (09°55'41"S, 74°55'25"W, 200 m elev.). 24 May 1999. Obtained from locals.

SMF 80080–81.

Lacertilia

Hemidactylus mabouia (Cosmopolitan House Gecko). PASCO: Provincia Oxapampa: Ciudad Constitución (09°50'56"S, 75°00'56"W, 200 m elev.). 24 May 1999. E. Lehr and E. Ponce. SMF 80088.

Anolis fuscoauratus (Brown-eared Anole). PASCO: Provincia Oxapampa: Pozuzo (10°04'10"S, 75°31'42"W, 940 m elev.). 11 July 1998. E. Lehr. MHNSM 20136; Pozuzo (10°04'10"S, 75°31'42"W, 780 m elev.). 26 February 1999. C. Aguilar. MHNSM 20137.

Polychrus marmoratus (Many-colored Bush Anole). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 20 May 1999. Obtained from a local resident. MHNSM 20139.

Alopoglossus angulatus (Northern Teiid). UCAYALI: Provincia Atalaya: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 25 January 1999. E. Lehr. SMF 80100.

Prionodactylus argulus (White-lipped Prionodactylus). PASCO: Provincia Oxapampa: Pozuzo (10°10'23"S, 75°35'13"W, 922 m elev.). 8 March 1999. E. Lehr. MHNSM 20087.

Ptychoglossus brevifrontalis (Boulenger's Largescale Lizard). UCAYALI: Provincia Atalaya: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 12 June 1998. E. Lehr. MHNSM 20088.

Cercosaura ocellata (Ocellated Tegu). PASCO: Provincia Oxapampa: Iscozacin/Cordillera San Matías (10°10'41"S, 75°07'54"W, 580 m elev.). 15. May 1999. E. Ponce. SMF 80103; UCAYALI: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 23 June 1998. E. Lehr. SMF 80102.

Mabuya bistriata (Two-striped Mabuya). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 10 March 1999. E. Lehr. SMF 80133.

Tropidurus umbra (Lava Lizard). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 20 May 1999. Obtained from a local resident. SMF 80237; UCAYALI: Provincia Atalaya: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 11 June 1998. E. Lehr. MHNSM 20231.

Serpentes

Boa constrictor (Boa Constrictor). PASCO: Provincia Oxapampa: Iscozacin (ca. 320 m elev.). 20 May 1999. Obtained from a local resident, who claimed to have caught it south of Iscozacin. SMF 80016.

Corallus caninus (Emerald Tree Boa). PASCO: Provincia Oxapampa: Pozuzo (10°10'23"S, 75°35'13"W, 1000 m elev.). 9 July 1999. D. Schuler. MHNSM 20003, SMF 80017.

Chironius fuscus (Brown Sipo). PASCO: Provincia Oxapampa: Pozuzo (10°10'23"S, 75°35'13"W, 900 m elev.). 9 March 1999. E. Lehr. SMF 80026.

Clelia clelia (Mussurana). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 6 March 1999. E. Lehr. SMF 80027.

Dipsas catesbyi (Catesby's Snaileater). PASCO: Provincia Oxapampa: Pozuzo (10°04'10"S, 75°31'42"W, 940 m elev.). 12 July 1998. E. Lehr. SMF 80028.

Leptodeira annulata (Banded Cat-eyed Snake). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 20 May 1999. SMF 80035.

Liophis reginae (Royal Ground Snake). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 9 July 1999. E. Lehr. SMF 80037.

Oxyrhopus petola (Calico False Coral Snake). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 21 March 1996. J. Lara. PE 1152.

Pseustes sulphureus (Amazon Puffing Snake). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 25 February 1995. J. Lara. PE 1185. 13 May 1995. C. Köhel. PE 1189.

Tantilla melanocephala (Black-headed Snake). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 10 March 1999. Obtained from a local resident. SMF 80060; 9 July 1999. Obtained from a local resident. SMF 80061.

Xenodon rabdocephalus (False Fer-de-lance). PASCO: Provincia Oxapampa: Pozuzo (10°07'01"S, 75°32'11"W, 770 m elev.). 9 July. A. Egg. MHNSM 20007; UCAYALI: Bolognesi (10°06'13"S, 73°49'02"W, 230 m elev.). 26 January 1999. E. Lehr and C. Aguilar. SMF 80063; 31 January 1999. E. Lehr. MHNSM 20066.

Xenodon severus (Amazon False Fer-de-lance). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 21 May 1999. E. Lehr and E. Ponce. SMF 80079.

Xenopholis scalaris (Wucherer's Ground Snake). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 18 May 1999. E. Lehr. SMF 80065.

Micrurus spixii (Amazon Coral Snake): PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 20 May 1999. Obtained from a local. SMF 80069.

Bothriopsis bilineata (Two-striped Forest Pit Viper). PASCO: Provincia Oxapampa: Iscozacin (10°12'05"S, 75°09'23"W, 320 m elev.). 21 May 1999. E. Lehr. SMF 80070.

Crocodylia

Caiman crocodilus (Narrowsnout Spectacled Caiman). PASCO: Provincia Oxapampa: Iscozacin/Río Palcazu (10°12'05"S, 75°09'23"W, 320 m elev.). 21 May 1999. Obtained from a local. MHNSM 20020.

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New Amphibian and Reptile Records in Northwestern Illinois

ALLAN L. MARKEZICH
and
DARRYL J. BECKETT
Department of Natural Sciences & Engineering, Black Hawk College
6600 34th Avenue, Moline, Illinois 61265, USA
e-mail (ALM): markezicha@bhc1.bhc.edu

From the time of Phil Smith's comprehensive work (1961) until the early 1990s, there has been little modification of our understanding of the geographic distribution of much of the Illinois herpetofauna. Recently, increased work in the field and examination of collections has led to a better understanding on both regional (Tucker 1994; Wilson, 1999) and statewide (Redmer and Ballard 1995; Petzing et al. 1998, 2000) levels. Still, the distribution of the herpetofauna in several areas of the state, including relatively populated ones, has largely remained unrevised and unstudied presumably due to the historical absence of workers or organized field work. The northwestern Illinois region involving Rock Island County and adjacent or nearby counties to the south is an example of such an understudied area. Past collection efforts there have been infrequent and sporadic; consequently, many relatively common species in this region are currently undocumented (Phillips et al. 1999), and many of the most recent voucher specimens were collected in the 1940s and 1950s.

In an effort to update our knowledge of distributions in this region of Illinois, we made comprehensive collections of amphibians and reptiles in several counties during the past several years. We relied on Phillips et al. (1999) and specific locality data from museum collections to verify the current knowledge of geographical distributions of species and the recency of previous collections. In this paper we present 14 new county records (abbreviated "NCR" in the text) and 19 updated county records ("UCR") if the species had not been documented for at least twenty years from a particular county, a standard adopted by Phillips et al. (1999). Many of the UCR's we report actually update records that are 40–60 years old. In several cases we report significant range extensions within particular counties, particularly if the species is known from only one previously documented record and the present specimen is in a different and distant locality within the county. Christopher A. Phillips verified identifications of all specimens, and they are housed in the herpetological collections of the Illinois Natural History Survey (INHS). Several anuran specimens reported upon here are also represented by tissue samples in the INHS Herpetological Tissue Collection.

Anura

Bufo americanus (American Toad). HENRY CO: on road 1400N, 0.6 km E of Osco Rd. 16 April 2000. A. L. Markezich. INHS 16780. UCR. DOR adult collected at 2050 h; MERCER CO: jct. Edwards River and U. S. Rt. 67, NE corner. 24 March 2000. A. L. Markezich and D. J. Beckett. INHS 16778. NCR. Adult collected at 2045–2200 h.

Bufo fowleri (Fowler's Toad). HENDERSON CO: Bald Bluff Rd. (Co. Rd. 2650N), 1.6 km E of Keithsburg Blacktop (Co. Rd. 1350E). 16 September 1995. A. L. Markezich. INHS 16781. UCR. DOR adult collected at 1930 h.

Acris crepitans (Northern Cricket Frog). HENRY CO: Izaak Walton Giant Goose Conservation Area, 3.2 km ESE Atkinson. E end Stiner Lake, 14 October 2000, 1600 h. D. J. Beckett. INHS 16764. Adult collected at 1600 h and included because locality is 30 linear km east of county record reported by Petzing et al. (1998).

Hyla chrysoscelis/versicolor (Gray Treefrog complex). MERCER CO: 5 km ENE Viola. 12 May 2000. D.J. Beckett. INHS 16767. NCR. Adult collected at 1900 h.

Pseudacris triseriata (Western Chorus Frog). HENDERSON CO: 5 km N Biggsville, small pond SE jct. Co. Rd. 1850S and Co. Rd. 1675E. 24 March 2000. A. L. Markezich. INHS 16768. NCR. Adult collected at 1530 h; HENRY CO: Izaak Walton Giant Goose Conservation Area, 3.2 km ESE Atkinson. 30 March 2000, A. L. and M. L. Markezich. INHS 16776. NCR. Adult collected at 2040 h; MERCER CO: jct. Edwards River and U.S. Rt. 67, NE corner. 24 March 2000, A. L. Markezich and D. J. Beckett. INHS 16773. NCR. Adult collected at 2045–2200 h; 50 m N of Keithsburg levee, N edge of town. 24 March 2000. A. L. Markezich and D. J. Beckett. INHS 16769. Adult collected at 1845–1925 h and included because locality is in the extreme southwestern portion of county, 35 linear km WSW of the new county record.

Rana blairi (Plains Leopard Frog). HENDERSON CO: Bald Bluff Rd. (Co. Rd. 2650N), 1.9 km E Big River State Forest. 16 September 1995, 2000 h. A. L. Markezich. INHS 16791. DOR adult, included because locality is 33 km north of county record reported by Petzing et al. (1998); HENRY CO: Izaak Walton Giant Goose Conservation Area, 3.2 km ESE Atkinson. E end of Stiner Lake. 18 October 2000. A. L. Markezich. INHS 16795. NCR. Adult collected at 1540–1600 h; MERCER CO: eastern edge of Keithsburg, unimproved road in Pope Creek bottoms. 31 March 2000. A. L. Markezich and D. J. Beckett. INHS 16792. Adult collected at 2105 h and included because locality is in extreme southwestern portion of the county, 31 linear km west of the previous record (Petzing et al. 2000);

ROCK ISLAND CO: 9 km W Andalusia, Loud Thunder recreational area, 40 m from Mississippi River along creek below Lake George. 28 September 2000. A. L. Markezich and D. J. Beckett. INHS 16793. NCR. Adult collected at 1630 h.

Rana catesbeiana (Bullfrog). HENRY CO: SE Atkinson on Co. Rd.1700N, 1.1 km E of Co. Rd. 2350E. 16 April 2000. A. L. Markezich. INHS 16797. NCR. Adult collected at 2015 h; MERCER CO: 50 m N of Keithsburg levee, N edge of town. 24 March 2000, 1845–1925 h. A. L. Markezich and D. J. Beckett. INHS 16796. Adult, included because locality is in extreme southwestern portion of county, 32 linear km west of the previous record (Petzing et al., 2000); ROCK ISLAND CO: 9 km W Andalusia, Loud Thunder Cub Scout Camp. 2 October 2000. A. L. Markezich. INHS 16799. NCR. Juvenile collected at 1715 h; South Moline Twp., ditch bordering Poplar Grove Rd., 1.6 km S of Ill. Rt. 5. 12 October 2000. A. L. Markezich and D. J. Beckett. INHS 16801. Juvenile collected at 1430–1600 h and included because locality is 30 linear km east of new county record.

Rana clamitans (Green Frog). HENRY CO: Izaak Walton Giant Goose Conservation Area, 3.2 km ESE Atkinson. Small pond across road from Stiner Lake. 18 October 2000. A. L. Markezich. INHS 16805. NCR. Adult collected at 1640 h; ROCK ISLAND CO: 9 km W Andalusia, Loud Thunder Cub Scout Camp. 2 October 2000. A. L. Markezich. INHS 16804. UCR. Adult collected at 1745 h.

Rana pipiens (Northern Leopard Frog). HENRY CO: Izaak Walton Giant Goose Conservation Area, 3.2 km ESE Atkinson. 18 October 2000, A. L. Markezich. INHS 16789. UCR. Adult collected at 1540–1600 h; MERCER CO: jct. Edwards River and U.S. Rt. 67, NE corner. 24 March 2000. A. L. Markezich and D. J. Beckett. INHS 16783. NCR. Juvenile collected at 2045–2200 h; ROCK ISLAND CO: 9 km W Andalusia, Loud Thunder Cub Scout Camp. 29 September 2000. A. L. and M. L. Markezich. INHS 16786. UCR. Adult collected at 1630 h; South Moline Twp., ditch bordering Poplar Grove Rd., 1.6 km S of Ill. Rt. 5. 12 October 2000. A. L. Markezich and D. J. Beckett. INHS 16787. Adult collected at 1430–1600 h and included because locality is 30 linear km east of updated county record.

Testudines

Chrysemys picta (Painted Turtle). HENDERSON CO: Big River State Forest Campground. 30 May 1996. A. L. Markezich and A. Weeks. INHS 15687. UCR. Fresh shell, adult.

Serpentes

Coluber constrictor (Racer). HENDERSON CO: 0.8 km E Oquawka on Keithsburg Blacktop, (Co. Rd. 1350E),1.4 km N of Illinois Rt. 164. 15 September 1995. A. L. Markezich. INHS 16808. UCR. DOR adult; HENRY CO: 5.6 km N Orion on Co. Rd. 450 E. 15 May 1992, 1630 h. A. L. Markezich. INHS 16809. UCR. DOR adult. MERCER CO: 2.4 km S Aledo on Ill. Rt. 94. 1 October 1995. A. L. Markezich. INHS 16810. UCR. DOR adult collected at 0930 h.

Elaphe vulpina (Western Fox Snake). HENDERSON CO: Illinois Rt. 94, 0.5 km N jct. Ill. Rt. 164. 26 September 1997. A. L. Markezich. INHS 16813. UCR. DOR juvenile collected at 1345 h; HENRY CO: 4 km N Orion on Co. Rd. 350E. 26 September 1996. A. L. Markezich. INHS 16814. UCR. DOR adult collected at 2015 h; ROCK ISLAND CO: 1.5 km W of U.S. Rt. 67 on 176th Avenue. 29 September 1995. A. L. Markezich. INHS 16816. UCR. DOR adult collected at 1930 h.

Heterodon platirhinos (Eastern Hognose Snake). HENDERSON CO: Keithsburg Blacktop Rd. at entrance to Delabar State Park. 31 May 1996, 1530 h. A. L. Markezich. INHS 15693. UCR. DOR, large adult.

Lampropeltis calligaster (Prairie Kingsnake). HENDERSON CO: SW edge of Gladstone on road to Henderson County Conservation Area. 15 September 1995. A. L. Markezich. INHS 15694. NCR. DOR adult collected at 1300 h; Keithsburg Blacktop (Co. Rd. 1350E) at Hoskins Bend, 5.1 km S Big River State Forest headquarters. 9 July 1996. A. L. Markezich and J. Horger. INHS 15696. DOR adult collected at 1215 h and included because locality is 23 km north of county record, representing the northernmost occurrence of this species in western Illinois.

Lampropeltis triangulum (Milk Snake). ROCK ISLAND CO: W of Andalusia, near Lake George. 13 September 1992. Ken Pratt. INHS 16817. UCR. Juvenile killed in backyard of home in a forested area.

Nerodia sipedon (Northern Water Snake). MERCER CO: 11 km N Rt. 17 on Muscatine-New Boston Rd. 20 September 1996. A. L. Markezich. INHS 15692. NCR. DOR adult collected at 1600 h.

Pituophis melanoleucus (Bullsnake). HENDERSON CO: E edge of Big River State Forest on Co. Rd. 1500E, 1.9 km N of Co. Rd. 2450N. 29 September 1995. A. L. Markezich. INHS 15684. NCR. DOR adult collected at 0900 h.

Storeria dekayi (Brown Snake). HENRY CO: 3.2 km ESE Atkinson on Co. Rd. 2350E. 16 April 2000. A. L. Markezich. INHS 16818. UCR. DOR adult collected at 1950 h; ROCK ISLAND CO: 176th Avenue, 1.4 km E of Co. Rd. 3000E. 13 October 1995. A. L. Markezich. INHS 15688. UCR. DOR adult collected at 1030 h.

Thamnophis radix (Plains Garter Snake). HENRY CO: 1.6 km N Orion on Co. Rd. 350E. 4 May 1999. A. L. Markezich. INHS 16819. UCR. DOR adult collected at 1600 h.

Thamnophis sirtalis (Eastern Garter Snake). HANCOCK CO: Ill. Rt. 9, 3.2 km W Dallas City. 26 September 1997. A. L. Markezich. INHS 16822. UCR. DOR adult collected at 1430 h; MERCER CO: Rt. 94 near Edwards River, 3.2 km N Ill. Rt. 17 in Aledo. 13 October 1995. A. L. Markezich. INHS 15690. UCR. DOR adult collected at 1100 h.

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New Herpetological Records for the Islas de la Bahía, Honduras

L. LEE GRISMER
LACY L. GRISMER
KRISTINE M. MARSON
ALVIN B. MATTESON
ELMER J. R. SIHOTANG
KAREN M. CRANE
JENNIFER DAYOV
THOMAS A. MAYER
AMBER-LOUISE SIMPSON
HINRICH KAISER
Department of Biology, La Sierra University, Riverside, California 92515-8247, USA
e-mail (LLG): lgrismer@lasierra.edu
e-mail (HK): hkaiser@lasierra.edu

The Islas de la Bahía form a small archipelago off the northcentral coast of Honduras. This archipelago consists of three major islands (Utila, Roatán, Guanaja), three smaller islands at the eastern end of Isla Roatán (Santa Elena, Morat, Barbareta), and numerous small, uninhabited cays. The herpetofaunal composition of the Islas de la Bahía was first outlined by Wilson and Hahn (1973) in an effort to present new distributional records and to clarify the taxonomy of reptiles and amphibians from primarily the three major islands. Since that time there have been only a few additions to the herpetofauna of the Bay Islands (de Queiroz 1987; Köhler 1996a, b, 1998a, b; McCranie and Köhler 1999; Villa and McCranie 1995). The herpetofauna of the smaller islands has never been addressed in any detail and we here report the results of a brief survey of Islas Barbareta, Morat, and Big Pigeon Cay, taken on 13 July 2000 as part of the Tropical Field Biology summer course taught on Isla Roatán through La Sierra University. Specimens were photographed (LSUPC = La Sierra University Photographic Collection), tissued, and catalogued in the herpetological collection of La Sierra University (LSUHC). Specimen identifications were verified by Roland Sosa (Department of Natural Sciences, Loma Linda University).

Isla Barbareta

Isla Barbareta (area ca. 506 ha; Fig. 1) is approximately 6 km long and 2 km wide and privately owned. It is the largest of the three smaller Bay Islands, and lies only 4 km off the western end of Isla Roatán. Barbareta's only developments are a small resort on the western end and an abandoned airstrip at the southern tip; overall, it has suffered very little in the way of human disturbances. As a result, it is covered in lush primary forest. Previous records of reptiles from Barbareta are limited to the species list in Wilson and Hahn (1973). Their list was based on material collected in 1947 and 1948 by Arthur C. Twomey and included only *Anolis allisoni* and *Oxybelis aeneus*. Since publication of that list, two taxonomic reassignments are of interest to our listing below. Specimens of *Sphaerodactylus continentalis* were reidentified as *S. millepunctatus* (Harris and Kluge 1984), and *Leptotyphlops phenops* was reassigned to *L. goudotii* (Wilson and Meyer 1985). It is noteworthy that neighboring Guanaja, only 12 km due east, was rendered 99% bare by Hurricane Mitch in October 1998, whereas Barbareta's forests experienced very little defoliation and breakage.

Relative to our observations on Roatán, Utila, and Guanaja, reptiles were more abundant on Barbareta and notable were the large numbers of adult (total length > 1 m) iguanas (*Ctenosaura oedirhina*, *Iguana iguana*), clearly a result of the lack of human predation and perturbation. This "ecological peace" is largely a result of care by one of Barbareta's owners who is rumored to shoot at the motors of boats of mainlanders who intend to poach iguanas on Barbareta. In order to estimate herpetofaunal abundance, we established a collecting transect extending northeast from the southern edge of the central portion of the island near the abandoned airstrip. Our transects ran through coastal vegetation and habitats at the water's edge along part of a forest road serving the airstrip, and then turned sharply into a path through thick primary forest habitat (Fig. 1). The following information is an annotated list of new species records for the island.

Basiliscus vittatus (Striped Basilisk). This species was ubiquitous on the island and was seen in all habitats. All sizes and age classes were abundant (LSUPC 4717–24, LSUHC 3693–94).

Ctenosaura oedirhina (Bay Island Spiny-Tailed Iguana). This species was also ubiquitous on the island and several individuals of all age and size classes were observed. It occurred abundantly on the ground and in all types of vegetation (LSUPC 4725–31).

Gymnophthalmus speciosus (Golden Spectacled Lizard). This species was most often encountered moving about in shaded grassy patches along the forest road near the coast, and in the forest leaf litter. Both adults and juveniles were abundant (LSUPC 4868–87, LSUHC 3689–90).

Iguana iguana (Green Iguana). This species was a very abundant component of Barbareta's herpetofauna. Several large individuals (estimated total length > 1.5 m) were observed 3–10 m above ground, crashing through branches of large trees. The majority were observed only in the thickest portions of the forest in large trees and only occasionally on the ground (LSUPC 4690–95). Anecdotal information available locally praises this island as a haven for green iguanas, which are a delicacy on Roatán and no longer abundant there. This is one reason why Barbareta's ownership has

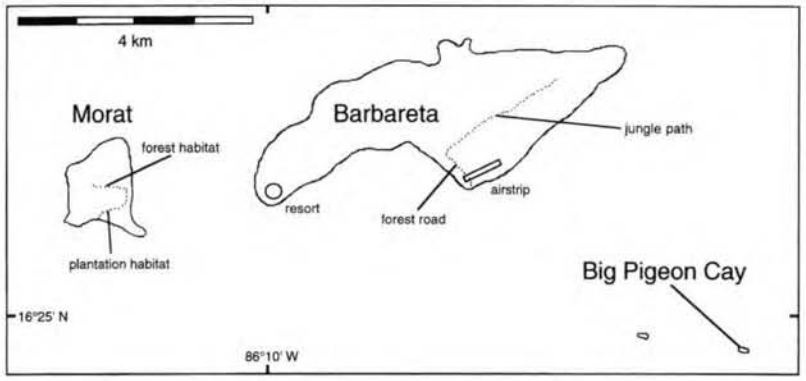


FIG. 1. Map of Barbareta, Morat, and the Pigeon Cays. The dotted line on the larger islands indicates the transects taken.

taken the very strict approach to poaching attempts mentioned above.

Leptotyphlops goudotii (Goudot's Thread Snake). Three specimens of this secretive snake were encountered moving about on leaf litter in shaded conditions. In contrast, on Isla Roatán we found this species to be primarily associated with termite mounds and it was rarely observed moving about during the day (LSUPC 2644–52, LSUHC 3686–88).

Sphaerodactylus millepunctatus (Dwarf Bark Gecko). Several specimens were found during the day moving about on the leaf litter of the shaded forest floor. Others were found within the rotten trunks of various species of trees and beneath various types of surface debris including rocks, logs, and palm fronds. These lizards were observed throughout the transect (LSUPC 4782–84, LSUHC 3695).

Isla Morat

Isla Morat is a small island approximately 0.5 km wide by 1.0 km long (Fig. 1) and lies between Islas Barbareta and Roatán. It is privately owned and settled only by plantation workers on a temporary basis. Some of its coastal areas have been developed for agricultural purposes. Our transect on Morat ran from the plantation habitat at the southern end of the island northeast, then inland for ca. 300 m along a freshly cut path into forest habitat (Fig.1). We visited Morat only briefly from ca. 1600–1800 h. We present the following new records and suspect that with continued surveys additional species will be discovered.

Anolis allisoni (Giant Cay Anole). This species was ubiquitous on the island in both disturbed and natural areas (LSUPC 5796–5804, LSUHC 3696–98, 3703–05).

Gymnophthalmus speciosus (Golden Spectacled Lizard). This species was found moving about through the leaf litter in both disturbed and undisturbed habitats. Only adults were seen (LSUPC 5778–95).

Phyllodactylus palmeus (Palm Leaf-Toed Gecko). This species was found on the ground beneath rocks, logs, palm fronds, and other surface debris in shaded areas, both in disturbed and undisturbed habitats (LSHPC 4769–81, LSUHC 3706–07).

Sphaerodactylus millepunctatus (Dwarf Bark Gecko). Specimens were found during the day moving about on the leaf litter of the shaded forest floor. Others were found within rotten trunks and beneath rocks (LSUPC 4785–87, LSUHC 3710–11).

Sphaerodactylus rosaurae (Rose Bark Gecko). Specimens were found beneath and within rotten trunks of various species of trees in shaded areas in both disturbed and undisturbed habitats (LSUPC 4789–93, LSUHC 3712).

Big Pigeon Cay

Big Pigeon Cay is a small cay no more than 60 m x 20 m in size lying approximately 5 km off the southern edge of Isla Barbareta (Fig. 1). Its periphery consists of sandy beaches and their associated low-growing vegetation. The central portion of the cay maintains scrub vegetation containing small trees and palms. We observed seven individuals (three adults, four juveniles) of *Ctenosaura oedirhina* (LSUPC 5805) within the central portion of the island and their tracks were abundant on the beach. The presence of this species on this cay attests to its capability of overwater dispersal and subsequent colonization.

Acknowledgments.—We wish to thank Pepper Tonsmayer of Isla Barbareta for not shooting at our boats and allowing us access into the interior of the island. We also wish to thank the people of Anthony's Key Resort for their hospitality and their efforts to cater to our special needs. Shawn Hyde, Allan Hyde, and Bucky Weeks were instrumental in facilitating our stay. Collecting permits were issued by Francisco Rosales of the Secretaria de Agricultura y Ganaderia and the Dirección General de Pesca y Agricultura on Roatán. This is Tropical Field Biology Contribution No. 1 from the Department of Biology at La Sierra University.

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BOOK REVIEWS

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Pacific Herpetology 2000

GEORGE R. ZUG
Department of Systematic Biology, National Museum of Natural History
Washington, DC 20560-0162, USA
e-mail: zug.george@nmnh.si.edu

2000 was an exciting year for anyone interested in the herpetofauna of the Southwest Pacific. Some would say a great beginning for the 21st Century, but I view the two books and CD before me as a fine culmination of 20th Century research in the Pacific. I wish to comment mainly on Bauer and Sadlier's review of the herpetofauna of New Caledonia; however, I take this opportunity to call attention to P. Ryan's pictorial and textual review of Fijian animals and M. McCoy's revision of his fieldguide to the Solomon Islands reptiles.

The Herpetofauna of New Caledonia, by Aaron M. Bauer and Ross A. Sadlier, with French translations by Ivan Ineich. 2000. Society for the Study of Amphibians and Reptiles, Ithaca, New York. xii+310 pp. Hardcover. US $60.00. ISBN 0-916984-55-9.

At 26x18x2.5 cm and nearly one kg, this book (THoNC) is not a pocket guide or even guide for your fieldpack. Nonetheless, no one interested in reptiles would set foot on New Caledonia without it in their luggage and likely in their hand-carryon because an initial read-through before venturing far from the plane is advisable. The preceding statement identifies my bias. I find THoNC an excellent book. Yes, I can find items on which to claim fault, but aside from those being minor, Bauer and Sadlier met their two goals: 1) to provide a guide for lab and field identification of the New Caledonian reptiles and 2) to identify aspects of biology and taxonomy requiring additional investigation. The book's coverage extends significantly beyond those goals. While I am being laudatory, allow me to extend my appreciation to the SSAR Contributions to Herpetology series' editors for their continuing production of reasonably priced, attractive, sturdy, easily readable, and topical books with few errors of any sort.

If you were attentive above, you noted that I mentioned only an interest in reptiles. THoNC's title says herpetofauna, but it is barely that. NC has one frog, an Australian *Litoria*. The absence of amphibians indicates the oceanic origin of NC and its ancient and continued wide separation from any amphibian source area. Lizards are much better colonizers of oceanic islands, and the first skink and gecko ancestors likely arrived in the early Tertiary. They gave rise to an amazingly diverse and speciose lizard fauna, currently 68 species of geckos (26) and skinks (42), of which 86% are unique to NC. No other island group of comparable size, even land-bridge islands, can match this diversity. Three snakes complete the terrestrial reptilian fauna, and 12 seasnakes and three seaturtles represent the marine elements. An exciting reptilian fauna from any perspective.

THoNC covers this fauna thoroughly. It is organized into eight textual sections (or chapters), a set of color plates, a bibliography, and a gazetteer. THoNC opens with an ecological geography of NC, concisely summarizing geography-topography, vegetation, geology, and biogeography; although concise, the discussions provide the reader with sufficient detail to understand the complexity of the landscape and its history. The second section provides an overview of the natural history of fauna, concluding with brief descriptions of various "herpeto-communities." The third and fourth sections examine conservation issues and man & NC reptiles; this latter section includes an excellent NC herpetological history. The sixth section is the *raison d'être* of THoNC, 180+ pages of generic and species identification keys and taxonomic accounts. Rightly so, Bauer and Sadlier decided that their audience can differentiate a gecko from a seasnake or treefrog, and they provide only keys to genera and species within taxa with multiple members. The familial and generic accounts provide a quick review of taxonomic history and relationship relative to the NC members. Each species account contains a morphological description, distribution, natural history, conservation status, references, and not infrequently remarks on relationships or other items not appropriate to other sections. Each of the sections is organized similarly from account to account and that permits easy comparison of data; information also is presented concisely and thoroughly. Each account is data rich and, critically for an effective guide, includes a distribution map plotting the exact occurrence of vouchered records for each species. There are relatively few textual illustrations. Although I would have preferred more, the number of illustrations is adequate; they are attractive, accurate line drawings and supportive of the adjacent keys or accounts. The next two sections examine sequentially taxa of incidental and questionable occurrences, and erroneously reported taxa. The final textual section reviews subfossil and fossil reptiles. None of these final sections is long; however, the coverage for each taxon adequately supports the assigned status of the species. A section of 24 color photographic plates follows. The first five plates provide a glimpse of the major habitats, and the remaining plates illustrate the majority of the NC herpetofauna, and many of the endemic NC species have more than one photograph to show geographic variation. Most images are roughly 4 x 7 cm; all, but two or three, clearly depict the animal and will assist with species identification.

An important aspect of THoNC are the sectional French translations. Translations, except for the keys, is somewhat of a misnomer. The heading "sommaire français" for them is most appropriate. These summaries conclude all textual sections but the taxonomic one. In the latter section, a French key follows each English one, and each species account has it own French summary. This organization makes the book a ready resource for the French administrators and populace of New Caledonia and will support the conservation of NC flora and fauna.

The next two Pacific items display the artistry of two biologists, who have become professional photographers and yet continue to contribute to the documentation and conservation of Pacific biodiversity. These items are only briefly described to offer a hint of their usefulness as sources of biological information and the delightfulness of their photography—both are fully in color.

Reptiles of the Solomon Islands, by Michael McCoy. 2000. Zoographics: Kuranda, Qld. CD.

The first edition was published in 1980 as a small handbook by the Bishop Museum's Wau Ecology Institute. It was the first fieldguide to this corner of the tropical Pacific since Loveridge's 1945 *Reptiles of the Pacific World*. The Solomons' guide has remained a useful reference for herpetologists working in the Southwest Pacific but was edging out of date with the discovery of new taxa and new details on the biology of the herpetofauna. The original guide had six small color plates. McCoy wished to add many more color plates as well as to revise the text and keys. Photographs were available, but the production of a full color guide can be mind-boggling expensive per book if the print run is small. The solution was to self-produce a CD revision with many color illustrations and make it available to naturalists inexpensively.

The CD's structure is similar to the original guide and is as easy to use, perhaps more so. You access the guide via any web browser, opening the cover page and then navigating from there. Multiple links move you rapidly from a table of contents to keys or species account, or you can simply leaf page by page or jump around in the guide. The keys remain as serviceable as in the original; the text descriptions, distributions, and natural history notes are updated and data-filled; and the photographs are superb. The widespread Pacific taxa are illustrated by one or two photographs, but the Solomon endemic taxa or regional Melansian ones by several photos. My favorite is—I really don't have a favorite; there are too many excellent ones to favor a single photo. I challenge you to just select one!

Fiji's Natural Heritage, by Paddy Ryan. 2000. Exisle Publishing: Auckland, N.Z. 288 pp.

The first edition of *Fiji's Natural Heritage* was published in 1988. It was in part an outgrowth of Ryan's weekly biology articles in the *Fijian Times* and his growing photographic collection of the Fijian flora and fauna. Neither then nor now is it a collection of news articles, but a series of integrated essays on components of the Fijian biota. Its audience is the general public, whether they are a Fijian local or tourist, a businessman or tour guide, a junior high-school student or college professor. Amphibians and reptiles each have separate chapters, but they are only one of many animal and plant groups covered in text and pictures. The content extends from life in the open seas surrounding the Fijian islands to the mountain tops. A biologist can justify the purchase of this coffee-table style book because it contains new biological observations, including a couple in the herp section, as well as for the outstanding photos of Fijian plants and animals, many never photographed previously. This book is about conservation, and its publication was supported by Seacology and the New Zealand government to promote Pacific conservation. Ryan's photos and text show the beauty and depth of the diversity in the Fijian corner of the immense Pacific.

I strongly recommend all three preceding items to anyone doing herpetological research in the Pacific theatre. They are gold mines of accurate biological information, so even if you are a casual visitor to the Southwest Pacific, your visit will be enhanced by reading them beforehand or during your visit.

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Texas Snakes: Identification, Distribution, and Natural History, by John E. Werler and James R. Dixon. 2000. The University of Texas Press, Austin. xv + 437 pp., 66 color plates, 70 line drawings, 122 maps. Hardcover. US $49.95. ISBN 0-292-79130-5.

ANDREW H. PRICE
Texas Parks and Wildlife Department, Wildlife Diversity Program
4200 Smith School Road, Austin, Texas 78744, USA
e-mail: andy.price@tpwd.state.tx.us

Reviews of most field guides tend to converge toward a common point because the context and content of their subjects are fairly standard; most of the interesting or unique features attendant to their production happen behind the scenes during the writing or publishing phase (ask me sometime over an appropriate beverage about the "missing chapter" in Price 1998). Such is not the case with this unique and oddly-crafted book, a towering achievement in the annals of herpetological natural history and an obvious labor of love by the two authors (as pointed out in the preview on the back cover), who between them possess over a century of first-hand field experience with Texas serpents. John Werler, Curator Emeritus of herpetology at the Houston Zoo, wrote most of the text and Jim Dixon, Professor Emeritus at Texas A&M University, contributed some of the introductory material as well as the checklist, key, and all of the maps. The book had been gestating in the mind of the senior author since his days at the San Antonio Zoo in the late 1940's, with serious work beginning in 1980 and the junior author coming on board in 1984.

The book, as stated in the Preface, was written for a broad readership and directed mainly at those uneducated about snakes in Texas, as well as amateur naturalists and hobbyists. Designed to encourage reporting of natural history information by its readership, this book is a revealing commentary on how little we still know about the life histories of snakes. The book opens with a table of contents and a list of illustrations. Following the preface and acknowledgments comes 43 pages of introductory material which includes sections on conservation, myths and misinformation about snakes, snakebite, a history of Texas herpetology, and a discussion of taxonomic issues. An interesting tidbit occurring on p. 7 is that 4736 citations on Texas snakes (an average of about 67 per species) were published between 1828 and 1996. These are followed by a checklist of and key at the subspecific level to the 72 species native to Texas. The individual subspecies accounts form the bulk of the book, and precede a glossary, bibliography, and indices to common and scientific names. Individual accounts are in turn subdivided into sections labeled description, comparable snakes, size, habitat, behavior, feeding, and reproduction, with the addition of a section on venom where appropriate.

The range maps are far superior to anything that has ever been published on Texas snakes, or any component of the Texas herpetofauna for that matter (with the exception of the privately printed and not yet completed *Atlas of Texas Lizards* by Ralph W. Axtell). They constitute over 10,000 localities representing 46,655 specimens, and were painstakingly compiled by hand. They are a little difficult to see at this size because of the detail included on

the base map and the small size of the locality dots. The dark shapes representing reservoirs can be confusing in some species accounts, especially since a number of the existing ones are not shown. The convention employed in some accounts of presenting the same species map with different shading to represent constituent subspecies ranges is useful but not explained beforehand, creating some initial confusion.

A very nice set of plates accompanies the discussion of aberrant individuals, which follows the section on snake identification. The absence of a general discussion of ontogenetic variation here is surprising to me, especially for a book aimed at the general reader. The remaining photographs illustrating the taxa themselves are grouped together in the middle of the book. They are first-class, as one would expect in anything involving the senior author, and the sequence of shots of death-feigning in *Heterodon platirhinos* is outstanding.

The main body of the book is the species accounts, which provide a gold mine of information for the willing prospector. The accounts are a pleasure to read individually, and the unique writing style transforms the often very dry renderings of morphological detail, habitat descriptions, and behavioral characteristics into smooth prose worthy of London or Melville. The descriptions and comparisons to similar species are for the most part crisp and clear. The text is littered with charming oddities of expression such as "gooey secretions," "puncture the termite's soft body and suck out its fluid contents before discarding the victim's spent carcass," "leafy umbrellas," "streaks away into the brush with a sudden burst of speed that usually leaves its foe momentarily bewildered," "its slender brownish form blending intimately with the layer of dead pine needles that carpets the sandy forest floor," "discharges a musky, cream-colored slime from its cloaca," "may chew viciously as it holds its victim's head in its jaws," "the male is unceremoniously dragged along with her, his engorged, spine-covered hemipenis still firmly held in place within her cloaca," "woodland carnivore," "dashlike spots feebly arranged along the sides of the body as thin, diagonal lines," "the overall effect is that of a daintily jeweled piece of oriental ceramic finished in lacquer," "locks its gaze on the intruder," "bewildering as they may be, a lizard's evasive tactics are brilliantly matched at every turn by the rapid maneuvers of its ophidian pursuer," "braided their trunks together in a corkscrew embrace," and much more; enough, perhaps, to constitute their own number in the Smithsonian Herpetological Information Service series. All add to the overall charm, if not the scientific content, of the book.

It may be surprising to learn, given the preceding comments, that I generated six pages of notes on specific caveats while reviewing this book. Some are factual errors, while others are matters of interpretation and misplaced inference. Space constraints prevent me from discussing them all, but their cumulative effect left me weary, somewhat annoyed, and wondering if anyone reviewed this book prior to its publication (no one is acknowledged as having done so).

Typographical errors are few but nonetheless surprising, as most involve people's names. Thus we have Busak (= Busack), Cantanella (= Cannatella), and Degengardt (= Degenhardt) in the acknowledgments, and toboso (= tobosa) and Gehlback (= Gehlbach) on p. 248. An interesting fact, given the number of published citations on Texas snakes mentioned above, is that the bibliography contains only 402 citations, not all of which are on populations actually occurring in Texas. Perhaps this reflects the authors' extensive first-hand knowledge of their subject. At least two primary natural history papers were missed, however, Sawyer and Baccus (1996) on *Bogertophis* and Rudolph and Burgdorf (1997) on *Pituophis ruthveni*.

Anthropomorphisms in this book are legion. We have *Elaphe bairdi* "apparently aware that they are not easily detected [therefore] mov[ing] rather leisurely" over the ground (p. 106); "discarded" rodent burrows (p. 118); predation by *Farancia* on *Amphiuma* described as "savage, unrelenting, and vicious" (p. 124); *Heterodon nasicus* "nonchalantly" and "leisurely" crawling away after death-feigning (p. 130); *Lampropeltis getula* described as "slothful" (p. 157) while on the same page their infrequent predatory attacks on rattlesnakes described as "vengeful," "violent," and "savage;" "sinister" *Nerodia sipedon* (p. 221) and "insolent" *Crotalus atrox* (p. 370); a reference to the rostral scale of *Salvadora grahamiae* as "unnatural" (p. 252); "even the boldest adversary [of *Crotalus molossus*] sens[ing] the menacing implications of the tongue's slow, deliberate movements" (p. 391), and "infant" snakes of several species scattered throughout the text.

Other miscues reflect to this reader the lack of a careful editorial review by someone knowledgeable about the subject matter and/or by editors at UT Press. On p. 4 we are told that native species of snakes are unaggressive, a statement later contradicted in several species accounts. Among those listed on pages 6–7 as still involved in herpetology are Ben Dial and W.W. Milstead, both deceased. Forests of juniper, ponderosa pine, and oak are referred to on p. 10 as "alpine." Snakes in the genus *Coniophanes* frequently suffer from "tail rot" (p. 89), an unexplained malady. The diameter of a home range is described as being "twice as long" as another on p. 92. On p. 177 the western smooth green snake is referred to as the western smooth snake. Prey of *Salvadora grahamiae* include "whiptail, race runner and scaly lizards;" whiptails (genus *Cnemidophorus*) include the racerunner (*Cnemidophorus sexlineatus*) and, since all lizards are 'scaly,' the authors undoubtedly mean to refer to 'spiny' lizards (genus *Sceloporus*). Included prey of *Crotalus viridis* are "striped gophers" and "slum larks;" I'm confident the former refers to ground squirrels of the genus *Spermophilus*, but neither I nor a couple of ornithologists I've asked know what a "slum lark" is. The habitat of the massasauga is characterized (p. 406) as "estuarine." Cases where the range maps do not match the text descriptions include the nominate and *gloydi* subspecies of *Heterodon nasicus, Lampropeltis getula splendida, L. triangulum celaenops, Nerodia erythrogaster transversa, Regina grahami*, and *Sistrurus catenatus edwardsi*. In discussing the family Elapidae readers are told that there are 54 species of American coral snakes grouped together in the genus *Micrurus* (there are currently 61 recognized species of *Micrurus* and two other genera of coral snakes one of which, *Micruroides*, occurs in the United States; Roze 1996).

More troubling, perhaps, are misinterpretations of published papers. Gehlbach and Baldridge (1987) are cited as providing evidence that *Leptotyphlops dulcis dulcis* possess the ability to climb tree trunks, when in fact the authors of this paper state that these snakes are deliberately carried by owls to their nests. Carr (1940) is cited in the *Nerodia fasciata pictiventris* account as stating that these snakes feed on breeding aggregations of "barking frogs" in

Florida. Barking frogs (*Eleutherodactylus augusti*, Leptodactylidae) do not occur naturally in Florida; they do occur in Texas, but not within the range of this snake. Carr (1940) in fact referred to *Hyla gratiosa,* which he called "bell-frogs," and the current common name for this species is the barking treefrog. One of the prey species attributed to Greene et al. (1994) for the Concho watersnake is the "redhorse shiner;" there is no fish in Texas referred to by that common name, whereas Greene et al. (1994) actually referred to the gray redhorse (*Moxostoma congestum*), a fish very different from shiners (*Cyprinella* and *Notropis*) found in the Colorado River drainage.

Don't read this book for content on current taxonomic practices, evolutionary species concepts, or insightful discourses on evolutionary ecology; the modicum presented is muddled at best. For example, the "western hog-nosed snake alliance" is referred to in the Mexican hog-nosed snake (ssp. *kennerlyi*) account on p. 139. The species *Heterodon nasicus*, to which this common name refers, is a separate entity on its own evolutionary pathway, not a conglomerate made up of discrete particles as one might find in a bag of marbles. The term "niche" is used on pp. 97 and 374 as a discrete place rather than as the term referring to the multidimensional state space encompassing a species' entire ecological characteristics; a term such as "habitat" or "microenvironment" would be more appropriate. Also on this page the terms "species" and "subspecies" are used for the same taxon in the same paragraph. The phrase "two closely related subspecies of *Sonora*" is used in the Great Plains ground snake account; the correct taxonomic hierarchy has genera having species, whereas only species contain subspecies.

I learned a number of things about Texas snakes (or at least that I don't remember knowing) by reading this book: that two of the three subspecies of *Diadophis punctatus* occurring in Texas lay eggs in advanced stages of development; that individual *Elaphe obsoleta* may hibernate underwater in old wells and are well-equipped to remain underwater for more than an hour because of large and numerous air pockets in the lung; that *Heterodon nasicus* find reptile eggs to eat by using the fresh odor of laying females as a location marker; that combat dances between male *Pituophis catenifer* are sometimes over food, not mates; that *Micrurus* thrash about erratically during defensive reactions, occasionally leaving the ground when they do so; that *Crotalus viridis* venom is more virulent than that of *C. atrox*; that burrowing owls are a natural prey item of both *C. atrox* and *C. viridis*; and that toads (*Bufo*) are likely an important dietary component for *Sistrurus catenatus edwardsi*.

The frequent references to scent gland secretion as "loathsome material" or one of several equally pungent phrases seems to me at best an exaggeration and at worst inimical to the favorable treatment of snakes by members of the target audience of this book. Similarly, statements that specimens of *Arizona elegans, Cemophora coccinea*, and other species are "frequently" unearthed by farmers plowing their fields and that this is an indication that these species don't burrow deeply during the active season are meaningless without a frame of reference. To state that the estimated 1400 bites from *Crotalus atrox* inflicted annually on humans have caused a "serious negative impact...on the state's human population" (p. 375) is simply inaccurate.

While UT press is to be commended in some senses for publishing such an unusual book, the structure chosen by the authors has resulted in considerable repetitiveness in the text, both between sections in an account and between accounts. The text could easily have been cut by 1/3 without losing any of its value. My major criticism of this book, however, is that countless statements herein are made as statements of fact integral to the ecological and evolutionary characteristics of a given taxon when they appear to be based (for lack of citation) on no more than a single reference or casual observations and impressions, rather than on careful long-term observations in the field or controlled experiment. I find this most unfortunate in a book aimed at the novice natural historian and people misinformed or uneducated about snakes.

The glossary is very abbreviated, and a number of terms in the text are not defined that should be; these include crown, Jacobson's organ, ambient, trunk, vole, medial, nape, digitaloid, tubercles, papillae, and bleb. In addition, some definitions provided are not very useful; for instance, 'microhabitat' is defined as "a small piece of an animal's habitat."

Some of the repeated authors' names in the bibliography are lined and others are not, and there are occasional problems with indentation of the individual entries. The bibliography would be much easier to read if each citation was separated by a spacer line or a hanging indentation as is commonly done in other books of this kind.

In spite of its shortcomings, this book is a must for anyone interested in Texas herpetology, and will remain the authoritative treatise on Texas snakes for decades to come. It should be in every public, school, and university library as well. The maps and photographs alone are worth the price of the book, which is a bargain thanks to a generous grant from the Zoo Friends of Houston, Inc. Buy it, read it leisurely, and enjoy!

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Fossil Snakes of North America: Origin, Evolution, Distribution, Paleoecology, by J. Alan Holman. 2000. Indiana University Press, Bloomington, Indiana. ISBN 0-253-33721-6. xi+357 pp. US $69.95.

THOMAS C. LADUKE
Department of Biological Sciences, East Stroudsburg University
East Stroudsburg, Pennsylvania 18301-2999, USA
e-mail: tcladuke@po-box.esu.edu

Modern systematic practices often involve molecular or morphological comparison of extant taxa exclusively. But to fully understand the evolution of a higher taxon requires knowledge of its history, and this can only be obtained from the fossil record. This truism is amply demonstrated by a brief perusal of *Fossil Snakes of North America*, which treats the fossil record of all snakes of the continent (north of Mexico), extant and extinct. This book documents the evolutionary rise and fall of various snake families, most of which have living relatives somewhere in the world today, though not necessarily in North America. A few of the taxa covered are entirely extinct. What makes this book unique is its coverage of the fossil record of living snake species, as well as their extinct predecessors. It differs from the *Handbuch der Paläoherpetologie* (Fischer Verlag) series in that it provides revised diagnoses and descriptions for many extinct taxa of fossil snakes as well as detailed descriptions of type material and associated elements.

J. Alan Holman is uniquely qualified to write on fossil snakes. Indeed, much of this book is a synthesis of an important part of his life's work detailing the fossil record of the extant orders of amphibians and reptiles. Holman is one of a select few individuals who has worked extensively with snake fossils, and his contribution has been prodigious as can be seen from the bibliography. Entries for which Holman is first or sole author occupy nearly five pages and the publication dates span a full four decades. Thirty-one of the 108 entries under his name deal exclusively with fossil snakes.

This book is divided into four chapters and a brief epilogue. Chapter One deals with topics that serve as an introduction to the rest of the book. It begins with a précis of the evolutionary history of snakes in North America, and a brief history of fossil snake studies. These topics are followed by a helpful discussion of features of the snake skeleton that are used to identify snake fossils. Special emphasis is placed on vertebrae, which are the most commonly found fossils. A standardized terminology that is used throughout the book is introduced here. Not everyone will agree with the terminology chosen, however. For example, Holman refers to the portion of the trunk that bears hypapophyses in all snakes as the cervical region, whereas I prefer Hoffstetter and Gasc's (1969) conclusion that the cervical region is unrecognizable in limbless squamates because landmarks of the cervico-thoracic boundary become dissociated from one another as the skeleton becomes more elongate. However, as Holman clearly defines his meaning in using this term, and the definition is easily applied, readers may find it more practical to use this term than any more cumbersome descriptions.

Chapter Two consists of systematic accounts of snake taxa described from the fossil record of North America. This will be the most useful chapter to future students of snake paleontology because revised diagnoses of most extinct snake species from North America and detailed descriptions of type material and representative skeletal elements are provided. The fact that the original author of many of the snake genera known from pre-Pleistocene times in North America has here compared and revised the descriptions of contained species will be of immense value, as the addition of new species to a genus will inevitably change one's perception of the type species. Holman also revises diagnoses and descriptions of taxa originally named by other authors, but these changes are primarily intended to produce conformity of terminology. One problem with the design of this chapter is that there are few direct references to the literature. To find all of the references about a given taxon that are in the bibliography one must consult a list of localities under the subsection entitled "Other Material." Here, the age and the state from which each fossil find was reported must be noted, and a locality number referring to an entry in Chapter Three determined. All three of these pieces of information are needed to look up the entry in Chapter Three that deals with the deposit from which the taxon is recorded, and only there will a full list of references to the desired bibliographic entries be found.

Chapter Four is probably the most interesting chapter in the book as it provides a synthesis of material in the preceding chapters and allows one to follow temporal changes in the snake assemblages of North America. The chapter moves through the fossil record, epoch by epoch, detailing the rise and fall of taxa at the generic level. Interpretations of the paleoecology of the assemblages discussed are based on comparison with modern taxa that are the nearest relatives of the fossils. A section entitled "Snakes in the Ice Age," which reviews theories explaining the relative stability of Quaternary snake communities concludes the chapter. Several interesting examples of the effects of Pleistocene glaciation on the distribution of snakes are provided. Most of these are in the form of groups of extralimital records, but a detailed analysis of the repopulation of the state of Michigan after the retreat of the Wisconsinan Glacier is particularly interesting.

An epilogue lamenting the current decline of snake populations and their habitats ends the book. Holman notes the irony of this decline in such a geologically young and vigorously evolving group of organisms as snakes.

The bibliography contains a wealth of references on fossil snakes and the localities where they were found. Some of the references are quite obscure, and in most respects the bibliography appears to be complete. Thus, it is a bit odd that in Chapter Three, when discussing *Paraepicrates* and *Pseudoepicrates* which are both treated as valid genera, Holman does not reference Kluge (1988). In this note, Kluge synonymizes *Paraepicrates* with *Lichanura*, and considers *Pseudoepicrates barbouri* a junior subjective synonym of *Boa constrictor*. These actions are not mentioned by Holman. This is all the more surprising because Kluge acknowledges Holman as a reviewer of the manuscript.

Though Holman has achieved a commendable uniformity of descriptive terminology, he has not done the same for the images of vertebrae presented, and this is, perhaps, the book's weakest point. Most of the images of snake vertebrae in the book, largely

pen and ink drawings, were extracted from previous Holman publications. While some are of high quality, others are not. Many were obviously drawn without the aid of camera lucida and the illustrated proportions are unrealistic. The following examples are especially noticeable: Fig. 76 is a distorted image of a modern *Heterodon platyrhinos* vertebra; in Fig. 94 the neural arch of a *Masticophis flagellum* vertebra extends too far beyond the postzygapophyseal facets in ventral view and this view appears longer than the dorsal view of the same vertebra; in Fig. 117, the condyle of *Rhinocheilus lecontei* is exaggerated, while in Fig. 118, the zygosphene of *Salvadora grahamiae* is inflated. Whereas these illustrations provide one of the few useful synoptic collections of images of fossil and recent snake vertebrae, it would have been more useful to have images of consistently high quality.

An unusual aspect of *Fossil Snakes* is its attempt to appeal to a general audience. The center of the book contains some excellent color plates depicting living examples of snakes of the various taxa discussed in the book. Whereas these photos may be useful to the neophyte, I wonder how many people who have the patience to read dozens of pages of descriptions of vertebrae do not already know what these animals look like. Except for the first three plates, most of the photos have little relevance to the fossil record.

Despite these few criticisms, I recommend this book highly as both a milestone in the field, and a critical reference for anyone interested in the paleontology, evolution, or ecological history of North American snakes. It will also be an important general reference for other vertebrate paleontologists and herpetologists. Its greatest use will be as a guide to those with unidentified snake fossils in hand.

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Amphibians and Reptiles of Madagascar and the Mascarene, Seychelles, and Comoro Islands, by Friedrich-Wilhelm Henkel and Wolfgang Schmidt. 2000. Krieger Publishing Company, Malabar, Florida. viii + 316 pp. Hardcover. US $64.50. ISBN 1-57524-014-9.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA
e-mail: aaron.bauer@villanova.edu

The islands of the southwestern Indian Ocean are among the most herpetologically interesting in the world, supporting a diverse, highly endemic fauna of often bizarre and spectacular animals. The amphibians and reptiles of Madagascar, in particular, are currently being investigated by numerous researchers whose studies have yielded a continuous stream of new species descriptions, rediscoveries, and phylogenetic revisions. Until now the only single volume treatments of the herpetofauna of Madagascar were the two editions of *A Fieldguide to the Amphibians and Reptiles of Madagascar* (Glaw and Vences 1992, 1994) and only *Amphibien und Reptilien Madagaskars, der Maskarenen, Seychellen un Komoren* by Henkel and Schmidt (1995) also dealt with the fauna of the Seychelles, Mascarenes, and Comores. Whereas the former volumes covered the entire Malagasy herpetofauna at some level, the later work highlighted selected species only—chiefly those with which the authors had experience in the field and/or the terrarium.

This book is a faithful English translation of Henkel and Schmidt's (1995) German original. The format of the English edition is somewhat larger than the original, but the layout follows it closely, and the same photographs have been reproduced. There seem not to have been any significant updates made to the text since the original edition. This is evidenced in the bibliography, which covers works through 1993 and lists a 1994 publication as "in preparation." However, some species accounts have been updated by the addition of a "new taxonomy" listing under the species name as published in 1995. In addition, a checklist of species, updated as of 31 December 1997, is provided at the end of the book. Unfortunately this list does not take into account the generic revisions of some groups and, in the case of the Mascarenes, some of the names used are decades out of date. Further, the ongoing work of numerous herpetologists in Madagascar and, to a lesser extent, the other island groups have already made these lists obsolete. Literally dozens of new taxa have been described from the region since 1997.

The book begins with a 25-page overview of the islands covered. Madagascar is the clear emphasis here, with a discussion of 14 pages covering the geology, vegetation, climate, and fauna, supplemented with habitat photographs and a useful map, illustrating numerous localities mentioned in the text. The bulk of the book is devoted to representative species accounts, arranged by family. Each account is one page in length and includes: Latin name, authorship and date of description, type locality, distribution, habitat, size, distinguishing features, biology, and vivarium care. Each of the 240 featured species is illustrated by a color photograph. The text appears to be reasonably accurate, although distributions for many forms are now out of date and the stated type localities do not always match those in the original descriptions exactly. The photos are generally good to very good, but there are problems with depth of field in some cases (e.g., *Tachycnemis seychellensis*, p. 42; *Brookesia bonsi*, p. 98; *Furcifer belalandaensis*, p. 126; *Lygodactylus miops*, p. 176; *Millotisaurus mirabilis*, p. 177), and composition in others (e.g., *Sooglossus seychellensis*, p. 45; *Calumma gallus*, p. 113; *Mabuya aureopunctata*, p. 263).

The Malagasy bias is shown at the outset of the species accounts, as the section dealing with caecilians (limited in this region to the granitic islands of the Seychelles) covers less than one page, provides no individual species accounts, and is not illustrated. In contrast, 55 species of frogs are highlighted, of which three are from the Seychelles, one (introduced) in the Mascarenes, one widespread on Indian Ocean islands, and the remainder are Malagasy. Turtles are represented by seven species including four Malagasy tortoises,

the Aldabra giant tortoise, and two pelomedusids. *Crocodylus niloticus* is also included (note that vivarium care is omitted for this species and the Aldabra tortoise!).

Chameleons are among the best represented taxa, with 40 (of 60+) regional species covered. Six oplurid lizards are treated, as is the agamid *Calotes versicolor* (introduced in the Mascarenes). The Malagasy radiation of gerrhosaurids is represented by 11 species accounts. While this was a reasonable representation of taxa in 1995, the number of recognized species in the group has recently increased substantially. Gekkonids occupy the largest segment of the book, a full 90 pages. Like chameleons, also popular among herpetoculturalists, the species accounts of geckos are often provided with somewhat more detailed vivarium care information than are those of other groups. Eighty-two gecko taxa are treated, with a heavy bias (52 forms) towards the colorful species of day geckos, *Phelsuma*. In contrast, the tiny *Lygodactylus* geckos, which also have an impressive Malagasy radiation (at least 22 species) are represented by only two species (plus the closely allied *Millotisaurus*). The *Phelsuma* section differs from all others in the book in providing a separate set of maps to show distributions. It also includes two species accounts for extralimital species, *P. anadmanense* from the Andaman Islands in the Bay of Bengal, and *P. parkeri* from Pemba Island, off the coast of Tanzania.

Given their high diversity in the Madagascar region (approximately 60 species), skinks are probably the least well covered reptile group, with only 14 species accounts. Of these, the only non-Malagasy taxa, *Mabuya seychellensis* and *M. wrightii*, both from the Seychelles, lack vivarium care notes. Snakes fare slightly better than skinks with 23 species (of approximately 75) covered. The coverage is uneven, however, with no accounts for the blind snakes or sea snakes. The quality of photographs is somewhat lower on average for snakes than for frogs or lizards and vivarium notes are lacking for seven of the featured taxa.

The book finishes with a brief overview of selected Malagasy parks and reserves (including information on entry permits and guides), and the updated list of species mentioned above. The bibliography of 110 works includes a variety of sources, including many general works, species descriptions, and herpetocultural papers. Much of the relevant technical material, however, is lacking.

A major plus for the book is that it presents photos of a large number of interesting, often bizarre forms that have rarely been illustrated in color before (e.g., *Rhombophryne testudo, Brookesia vadoni, Ichycyphus perineti*), including many recently described species. Photographic quality is generally good to very good and even the marginal photographs generally are quite useful for identification. Virtually all images are at least 60 x 80 mm, and most are larger, making them much easier to see and use than the tiny photos in Glaw and Vences (1992, 1994).

I am not in a position to judge the quality of the vivarium notes provided by the authors, but I assume that these are accurate. I did note a number of minor factual errors throughout the text, however. On p. 1 the authors claim a separation of Madagascar from Africa of about 165 million years ago and refer to this as the early Cretaceous (this age would, in fact, be late Jurassic). On p. 4 it is stated that the northern tip of Madagascar lies just south of the Tropic of Capricorn; of course, this is in error for the southern tip. On p. 162 it is claimed that the Gekkonidae evolved from the Jurassic ardeosaurids and bavarisaurids about 50 million years ago; 150 million years ago would appear to be more likely. Not surprisingly, given the age of the German original of the book, a list of the gecko genera occurring in the region does not include some newer taxa, such as the genus *Matoatoa*, erected for the Malagasy "*Phyllodactylus*" by Nussbaum et al. (1998). Inexplicably, however, the list includes both *Gymnodactylus* and *Cyrtodactylus* from the Mascarenes. In reality, both generic names were previously applied to the same species, which was transferred to the new genus *Nactus* (not listed by Henkel and Schmidt) by Kluge (1983). Finally, I note that the photo of *Hemidactylus frenatus* appears to be incorrectly identified, as the illustrated specimen is highly tuberculate, a feature common to other regional *Hemidactylus*, but not this introduced species. Comparable errors may exist for other groups dealt with in the book, but overall, these errors are well within the average encountered in herpetological books intended for a general audience.

Although some specialist information is provided in this volume, it is clearly intended for a popular or semi-popular audience. Despite its drawbacks (see Nussbaum and Raxworthy 1996), the book by Glaw and Vences (1994) is a more detailed and reliable source of technical information for specialists, or those with a particular interest in Malagasy frogs and reptiles. These authors provide keys, a reasonably complete bibliography, sonograms, type specimen data, and point distribution maps for a comprehensive range of taxa. Henkel and Schmidt, on the other hand, make no claims to be comprehensive and their focus on chameleons and geckos over skinks and snakes, as well as the presence of vivarium care notes throughout, highlights the fact that the book was written principally for herpetoculturists. Nonetheless, this is not a "keeper's" book. Rather, the authors have tried to provide an introduction to the natural history of Indian Ocean island frogs and reptiles to readers who may know the animals only in a captive setting. In this they have succeeded. The book's photos will also make it useful to professional herpetologists who are unfamiliar with the Malagasy fauna. Those seeking information regarding the herpetofauna of the Seychelles, Mascarenes, and Comoro Islands, however, may be disappointed, as many groups (especially caecilians) are inadequately represented.

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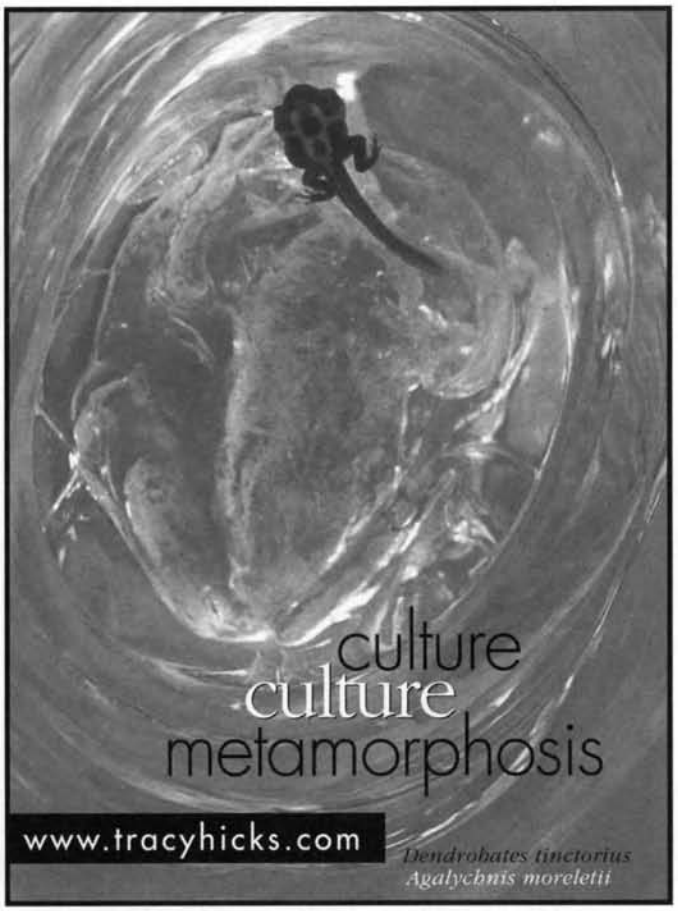
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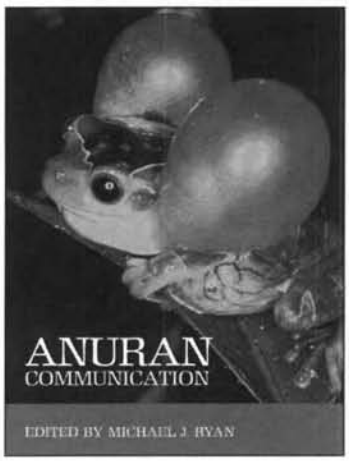
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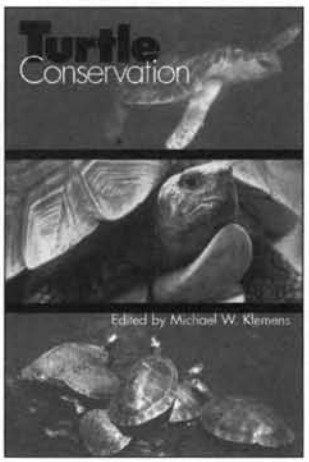


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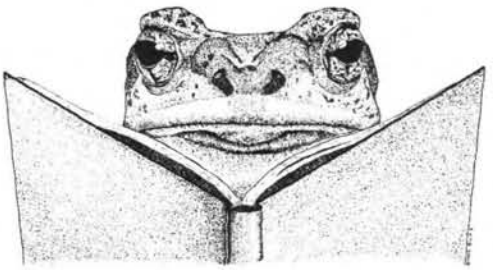
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HENRY R. MUSHINSKY
Department of Biology
University of South Florida
Tampa, Florida 33620-5150, USA

Nominating
HENRY R. MUSHINSKY
Department of Biology
University of South Florida
Tampa, Florida 33620-5150, USA

Resolutions
CARRIE CARREÑO
Nevada Natural Heritage Program
Department of Conservation & Natural Resources
1550 East College Parkway, Suite 145
Carson City, Nevada 89706-7921, USA

Seibert Awards
KELLY J. McCOY
Biology Department
Angelo State University
San Angelo, Texas 76909, USA

Student Travel Awards
STEPHEN RICHTER
Zoology Department
University of Oklahoma
Norman, Oklahoma 73019, USA

Relations with Herpetologists at Zoological Parks
CLARENCE WRIGHT
12616 East Admiral Place
Tulsa, Oklahoma 74116, USA

Membership
THEODORA PINOU
Department of Ecology and Evolution
Yale University
New Haven, Connecticut 06520-8104, USA

COORDINATORS

Elector
MARION PREEST
Joint Science Department
925 North Mills Avenue
The Claremont Colleges
Claremont, California 91711, USA

Symposium Coordinator
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

Information for Contributors

Herpetological Review is a peer-reviewed quarterly that publishes, in English, articles and notes of a semi-technical or non-technical nature, as well as book reviews, institutional features, commentaries, regional and international herpetological society news, research requests of SSAR members, and letters from readers directed to the field of herpetology. Articles reporting the results of experimental research, descriptions of new taxa, or taxonomic revisions are not published in ***HR***, but should be submitted to the ***Journal of Herpetology*** (see inside front cover for Editor's address).

Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings. **Corresponding authors should include an e-mail address (if available); this will facilitate communication with the editors.**

Originals of illustrative material (e.g., tables, photographs, or diagrams) should be submitted with the text, with appropriate precautions taken to ensure delivery without damage. Illustrations should be discussed in the text and numbered sequentially with Arabic numbers. References to illustrations should be placed in parentheses at the end of sentences. Labeling within figures should be in 12 pt. sans serif font, such as Helvetica, Arial, or Geneva. Original photographs should be submitted as black and white glossy prints. For further guidelines, authors should consult *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (6th edition, 1994, Council of Biology Editors, Inc., 11 South LaSalle Street, Suite 1400, Chicago, Illinois 60603, USA).

Submissions for Natural History Notes, Geographic Distribution, Herpetological Husbandry, Current Research, and Legislation & Conservation should be sent directly to the appropriate section editor. Send review copies of books to the Book Review Section Editor. Manuscripts intended for publication as Articles, Points of View, Techniques, Herpetological History, or Recent Population Changes, as well as news notes and other material, should be sent to the Editor. Deadline for receipt of meeting announcements, news notes and related material is two months prior to each issue (e.g., 1 January for March issue).

The receipt of a manuscript by an editor will be promptly acknowledged. Although the advice and assistance of external reviewers will be sought for all manuscripts, the Editor has final responsibility for deciding whether a manuscript is suitable for publication. Notes submitted for publication in Geographic Distribution and Natural History Notes ordinarily will be reviewed by the Section Editors only. The editors reserve the right to edit a manuscript, but substantial alterations will not be made without consulting the primary author.

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The Official News-Journal of the Society for the Study of Amphibians and Reptiles

Herpetological Review

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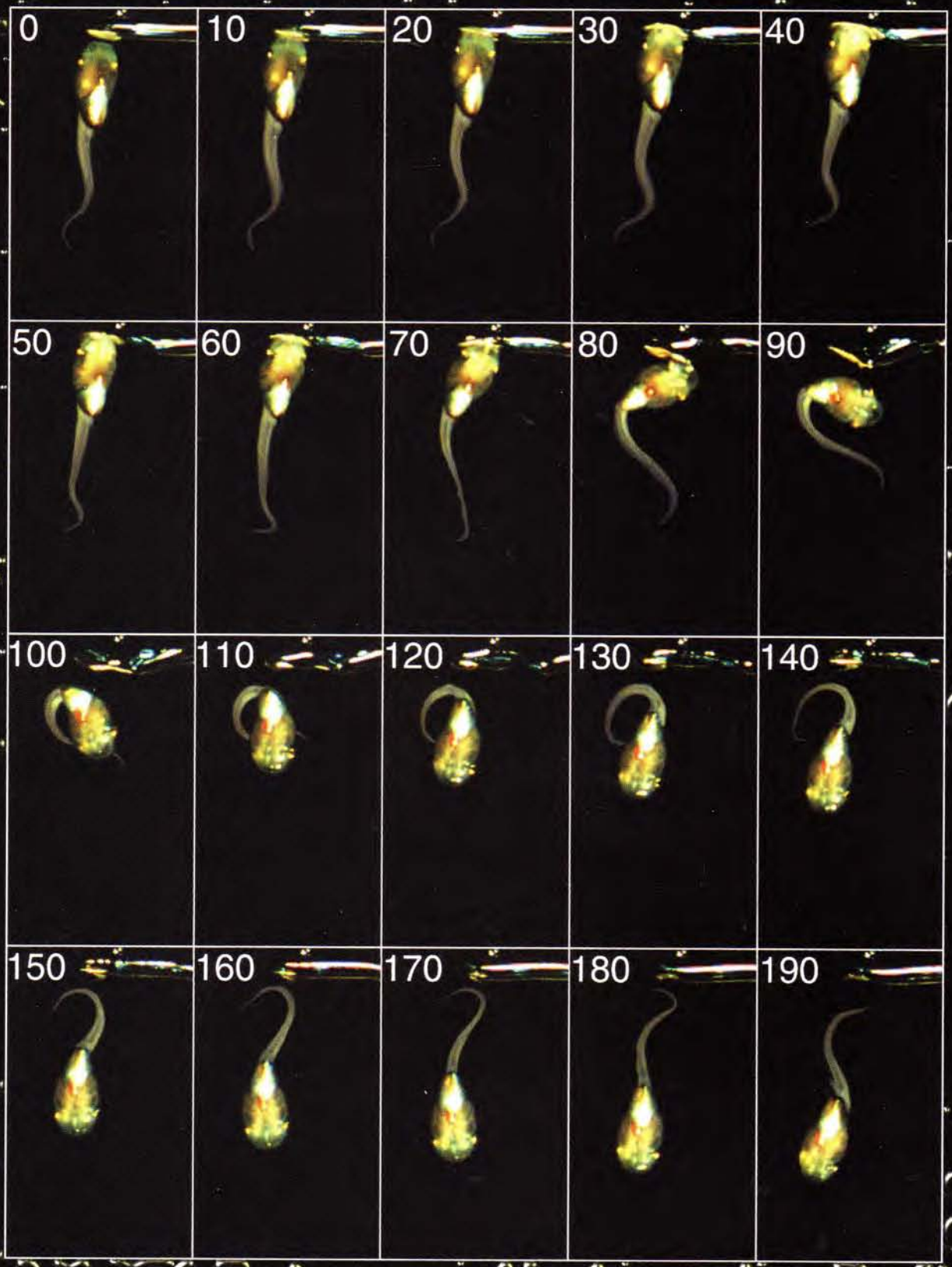
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SSAR Officers (2001)

President
DAVID M. GREEN
Redpath Museum
McGill University
Montreal, Quebec H3A 2K6, Canada

President-elect
JANALEE P. CALDWELL
Oklahoma Museum of Natural History
University of Oklahoma
2401 Chautauqua Avenue
Norman, Oklahoma 73072, USA

Secretary
JOHN M. MATTER
Department of Biology
Juniata College
Huntington, Pennsylvania 16652, USA

Treasurer/Publications Secretary
ROBERT D. ALDRIDGE
Department of Biology
Saint Louis University
3507 Laclede Avenue
St. Louis, Missouri 63103-2010, USA
e-mail: ssar@slu.edu

Immediate Past President
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Directors
MAUREEN DONNELLY (2001)
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KAREN LIPS (2002)
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LINDA FORD (2003)

SSAR Editors

Journal of Herpetology
BRIAN K. SULLIVAN, Editor
Department of Life Sciences
Arizona State University West
P.O. Box 37100
Phoenix, Arizona 85069, USA

WILLIAM S. PARKER, Managing Editor
Division of Science and Mathematics
Mississippi University for Women
Columbus, Mississippi 39701, USA

Contributions to Herpetology **and** *Facsimile Reprints in Herpetology*
KRAIG ADLER, Editor
Section of Neurobiology & Behavior
Cornell University
Ithaca, New York 14853, USA

Herpetological Circulars
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3261 Victoria Street
Shoreview, Minnesota 55126, USA

Catalogue of American Amphibians and Reptiles
ROBERT POWELL, Editor
Department of Natural Sciences
Avila College
Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
University of Florida
bowen@gnv.ifas.ufl.edu

MICHAEL E. DORCAS
Davidson College
midorcas@davidson.edu

DEANNA H. OLSON
USDA Forestry Science Lab
dede.olson@orst.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

SHARYN B. MARKS
Humboldt State University
sbm1@axe.humboldt.edu

GUNTHER KÖHLER
Forschungsinstitut und
Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

DARYL R. KARNS
Hanover College
karns@hanover.edu

PAUL A. STONE
University of Central Oklahoma
pstone@ucok.edu

ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

Current Research
OMAR TORRES CARVAJAL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
otorres@ku.edu

Current Research
ELI GREENBAUM
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-7561, USA
elig@ku.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey–Foley Hall
The University of Kansas
2021 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Legislation & Conservation
TRAVIS J. RYAN
Department of Biology
Furman University
Greenville, North Carolina 29613, USA
travis.ryan@furman.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

Copy Editors: *Eli Greenbaum, Jennifer Pramuk*

Editor-at-Large: *Stephen Deban*

Index Editor: *Christopher Sheil*

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2001 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

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Future Annual Meetings

2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 27–31 July 2001

Society for the Study of Amphibians and Reptiles
2001 Annual Meeting

together with

The Herpetologists' League

27 – 31 July 2001
University Place Conference Center and Hotel
Indianapolis, Indiana, USA

Keynote Address: "Herps and Hopes: Africa in a New Millenium," by Bill Branch, The Hepetologists' League Disntiguished Herpetologist for 2001 (Port Elizabeth Museum).

Symposium: "Amphibian Population Declines." *Organizers:* David M. Green, McGill University (czdg@musica.mcgill.ca) and Karen Lips, St. Lawrence University (klip@music.stlawu.edu).

Symposium: "Herpetological Research in Zoos: The Academic Connection." *Organizers:* John D. Groves and Hugh R. Quinn, Cleveland Metroparks Zoo (hquinn@ix.netcom.com).

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day throughout the conference.

Student Travel Awards: Ten Sherman A. Minton student travel grants of US $200 each will be available for SSAR members. Refer to page 201 of the December 2000 issue of *HR* for details.

Student Paper Awards: Henri Seibert prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the official Meeting Announcement for details.

Social Activities: General Reception in the University Place Ballroom, SSAR Herp Silent Auction, Graduate Student Reception, Sunday night Barbecue Dinner and Auction, Graduate Student Reprint & Book Scavenge, Herpetological Quiz.

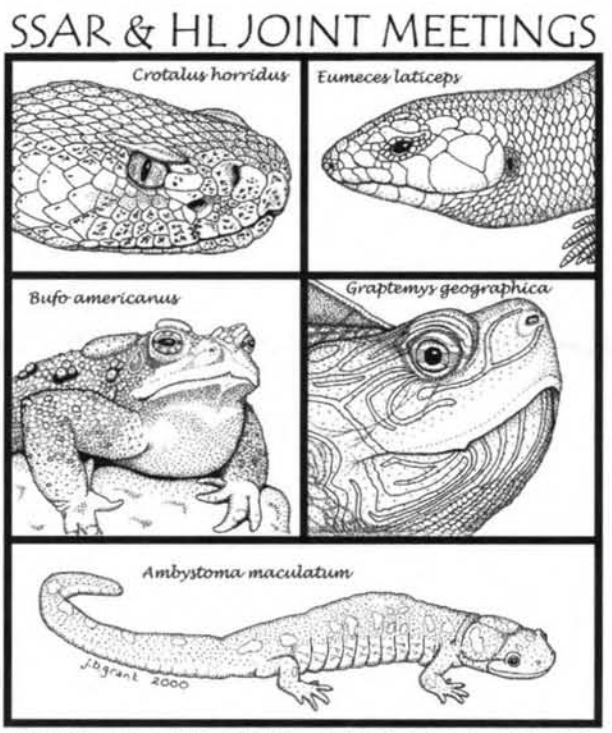
Multimedia Presentations: "Amphibians of the Appalachians," and "Herpetology of the West," by David Dennis and Eric Juterbock. President's Travelogue slide presentations by Patricia Burrowes (Puerto Rico), Tim Halliday (South Africa), John Wilkinson, Ross Alford (Australia), Hinrich Kaiser (Southeast Asia), and Michael Lannoo (Antarctica).

Live Animal Exhibit: Live amphibians and reptiles of Indiana will be on display and available for photography.

Costs: Preregistration US $240 regular, US $175 student, US $120 accompanying person. After June 1, 2001, costs are US $295, US $200 student, US $145 accompanying person.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Further Details: Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of the participating societies. Overseas members wishing to receive this information may do so by contacting Henry R. Mushinsky, Local Chair, Department of Biology, University of South Florida, Tampa, Florida 33620, USA; e-mail: mushinsk@chuma1.cas.usf.edu or telephone 813/974-5218. Please visit the meeting web site at http://www.ukans.edu/~ssar/ind.html for additional and updated information.



About Our Cover



The composite photograph on the cover was made from a series of video frames of an African clawed frog (*Xenopus laevis*) larva surfacing to breathe air. The tadpole is approximately Gosner stage 32 and 3.6 cm in total length. The numbers in the upper left-hand corner indicate elapsed time in milliseconds.

The pictures were taken with a Kodak Ektapro high speed video camera at 500 frames/sec. The camera was equipped with a 105 mm macro lens. Multiple lights placed obliquely overhead were used to illuminate the tadpole and to provide a dark field effect. In addition, a black cloth was wrapped around the aquarium to further darken the background.

Several tricks were used to ensure that tadpoles were in focus when they broke the water's surface. The camera was prefocused on a small area of water just inside the wall of the aquarium. The tadpoles were then constrained to breathe in that area by an inverted half-funnel made of mesh netting anchored to the bottom and front wall of the aquarium. This structure directed tadpoles toward the front of the aquarium as they surfaced to breathe air. The temperature at the water's surface was allowed to rise as high as 28°C and nitrogen was intermittently bubbled into the water to drive the pO_2 down. Both factors encouraged the tadpoles to breathe air.

Overhead video of tadpoles surfacing to breathe air also was taken, using a 45° mirror mounted above the aquarium, and have been published elsewhere (Wassersug and Yamashita 2000. The mechanics of air-breathing in anuran larvae: implications to the development of amphibians in microgravity. Adv. Space Res. 25:2007–2013). Additional information on the photographic methods are provided in Wassersug and Yamashita (*In press*. Plasticity and constraints on feeding kinematics in anuran larvae. Comp. Biochem. Physiol.).

The video sequence reveals two surprising aspects of the tadpole's behavior. First is the speed of the action. The tadpole in this particular sequence spent less than 80 msec with any part of its body above the water's surface. This is, literally, faster than a blink of the eye.

The second surprising aspect of this maneuver is how tightly the tadpole turned. The radius of curvature for the loop in the base of the tadpole's tail, seen at 110 msec, is only a tenth the length of the tadpole. With turns so sharp and tight, the tadpole must swim past its own tail. At 100 and 110 msec the tip of the tail can just be seen sticking out from behind the tadpole.

As a result of the fact that the tail goes behind the tadpole, the thrust generated by the tail is no longer purely along the long axis of the tadpole. Torque is generated, which causes a rolling action on the long axis of the tadpole. In the sequence shown here, this results in a 90° roll for a 180° turn. Note that in both the first and last frames the tadpole's right eye is closest to the viewer. If the turn was a pure yawing (sideways) motion, as suggested at 80 and 90 msec, then upon descent the tadpole's left eye should be closer to the viewer.

The overhead views revealed that *Xenopus laevis* larvae do not begin to open their mouths until their mouths are fully above the water's surface, yet start to descend with their mouths still open. This is in contrast to *Rana catesbeiana* tadpoles, which begin to open their mouths upon ascent, and before they have cleared the water's surface, but then close their mouths completely before the mouth is fully submerged (Wassersug and Yamashita, *op. cit.*). It is not known how tadpoles of either species know when to open their mouths so as to get a mouth full of air and not one of water.

The photo sequence is the work of **Masamichi Yamashita** and **Richard Wassersug**. Yamashita is a Professor in the Division of Systems Engineering at the Institute for Space and Astronautical Science, in Sagamihara, Japan. He has studied a variety of aspects of amphibian behavior and development, particularly as they relate to altered gravity.

Wassersug's primary interest is in the evolution and behavior of tadpoles. He is a Professor in the Department of Anatomy and Neurobiology at Dalhousie University, in Halifax, Nova Scotia. However, this year he is on sabbatical and dividing his time between a post as "Scientist in Residence" at the Discovery Channel in Canada and a "Visiting Scholar" position at the Center for Advanced Studies in the Space Life Sciences, at the Marine Biological Laboratory, Woods Hole, Massachusetts.



Yamashita (left) and Wassersug (right) are shown here collecting frogs in February on Amami Island, Japan. Below their feet, and not shown in the photograph, is a clump of freshly laid *Rhacophorus viridis* eggs. These eggs are laid in foam nests above the water line. The tadpoles wash into the water after hatching.

Separation, imaging, and various compositional challenges were handled by **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

Kennedy Student Award Committee Annual Report

The Kennedy Award Committee has completed its work for Volume 34 of the *Journal of Herpetology*. The Committee has selected "Nest site selection, larval hatching, and advertisement calls of *Rana arathooni* from Southwestern Sulawesi (Celebes) Island, Indonesia" by **Rafe M. Brown** and **Djoko T. Iskandar** (Vol. 34:404–413). The Kennedy Award carries with it a cash prize of US $200 or the winner's selection of any SSAR publications valued at twice that amount.

The Committee encourages each student member of the Society to submit their work to the *Journal*, and encourages each regular member who supervises the work of students to encourage his/her students to submit their work to *JH*. Kennedy Award Committee members were Robin Andrews, Terry Schwaner, Lynnette Sievert, Sam Sweet, and Robert Gatten, Jr. (Chair).

SSAR Grants-in-Herpetology Committee Annual Report (2001)

An award in the amount of US $500 was made to each of the following individuals:

Field Research.—**John P. Labonte**, University of California, Santa Barbara. Project title: "Ontogeny of foraging behavior in the Southern Pacific Rattlesnake (*Crotalus viridis helleri*)."

International.—**Jaime Zaldivar-Rae**, Universidad Nacional Autonoma de Mexico. Project title: "Function of female attendance by males of the teiid lizard *Cnemidophorus costatus*."

Conservation.—**Glen M. Lubcke**, California State University, Chico. Project title: "Movements, habitat use, and mortality rates in the Western Pond Turtle (*Clemmys marmorata marmorata*) at the Sacramento River, Butte Co.,California."

Bibliographic Research.—**Christopher A. Sheil**, University of Kansas. Project title: "Bibliographic survey of type-descriptions of living and fossil amniotes, particularly Reptilia."

Herpetological Education.—**Robert N. Reed**, Auburn University. Project title: "Conservation of Sea Kraits (*Laticauda*) via school and community outreach in Vanatu."

Laboratory Research.—**Todd Castoe**, University of Texas at Arlington. Project title: "Evolution of the Middle American jumping vipers, *Atropoides* Werman 1992, inferred from nuclear and mitochondrial DNA sequences."

Travel.—**Jonathon C. Marshall**, Brigham Young University. Project title: "Applying the cohesion species concept to the *Sceloporus grammicus* complex."

2001 Grants-in-Herpetology Committee.—Chair: Joseph R. Mendelson III. Reviewers: Sharon Wise, Michael Keck, Tod Reeder, Joseph Slowinski, W. Bryan Jennings, and Ronald Gutberlet.

SSAR congratulates the 2001 GIH recipients and thanks the committee members for their efforts.

WILLIAM DUELLMAN'S "HYLID FROGS" TO BE PUBLISHED AT INDIANAPOLIS MEETING



DAVID DENNIS'S WATERCOLORS WILL BE SOLD

SSAR's expanded edition of William Duellman's "Hylid Frogs of Middle America" will be issued on the occasion of the upcoming herpetological conference in Indianapolis, July 27–31. Full details about this spectacular new book were published in the March 2001 issues of *Herpetological Review* (pages 4–5) and *Journal of Herpetology* (page 172). Prepublication prices to SSAR members ($95 for the two-volume, clothbound set, with 1170 pages and 94 plates of which 46 are in color) will remain valid only until the meeting. Thereafter, the price to all will be $125.

A celebration to mark the publication of the new edition will be held on Sunday, July 29, from 3:30 to 5:00 PM in room 208 of the Conference Center. All meeting registrants are welcome to attend the reception, just upstairs from where the paper sessions will take place. **Bill Duellman and Dave Dennis will be present.**

The original watercolors painted by David Dennis for the new edition will be on display and available for sale at prices ranging from $150 to $500 each. Proceeds from these sales will be used exclusively to underwrite the production costs of the book.

NEWSNOTES

MCZ Renovation

The Herpetology Department at the Museum of Comparative Zoology, Harvard University, has been awarded a collections improvement grant by NSF, which will fund physical renovation of two of our five main specimen storage rooms. The renovation will enhance storage capacity and quality for much of the collection and improve the work environment for curatorial staff and visiting scientists. Work will commence summer 2001 and require approximately one year to complete. Much of the herpetological collection will be placed in long-term storage during this time and will be unavailable for shipment as loans or for inspection by visitors. This includes virtually all alcohol-preserved amphibians, snakes, and many turtles, plus the entire osteological collection

(dried skeletons and cleared-and-stained specimens). Anyone planning to require use of these specimens between now and early fall 2002 is urged to submit your request(s) as soon as possible. The collection's electronic database will be maintained and fully available for remote access throughout the construction period, and staff will continue to be available to answer questions and provide specific information that is not available through the department's web site <http://www.mcz.harvard.edu/Departments/Herpetology/>. For additional information, please contact Mr. José Rosado, Collections Manager: jrosado@oeb.harvard.edu.

Gopher Tortoise Council Award

Annually, the Gopher Tortoise Council awards the J. Larry Landers Student Research Award to the best student proposal submitted to the Council. Proposals can address research concerning the biology of the Gopher Tortoise, *Gopherus polyphemus*, or any other relevant aspect of upland habitat conservation. The amount of the award is variable, but has averaged $1000.00 over the last few years. The proposal should be limited to four pages and should include a description of the project, a concise budget, and a brief resumé of the student. Proposals should be submitted to: *Bob Herrington, Chair of Research Advisory Committee, Department of Biology, Georgia Southwestern State University, Americus, Georgia 31709, USA (e-mail: bherring@canes.gsw.edu).* Deadline for receipt of proposals to be considered for the 2001 award is 31 August 2001.

MEETINGS

Meetings Calendar

5–10 July 2001—American Society of Ichthyologists and Herpetologists, 81st annual meeting, Pennsylvania State University, State College, Pennsylvania, USA. Details from: www.outreach.psu.edu/c&i/ichher/.

13–17 July 2001—Societas Europaea Herpetologica 11th General Meeting, Slovenia. Details from: DPPVN/DAPTF Slovenia, Ptujska c. 91, SI-2327 Race, Slovenia; fax: +386 (0)2 788 30 51; e-mail: milan.vogrin@guest.arnes.si.

14–17 July 2001—International Herpetological Symposium 25th Annual Meeting, Detroit Zoological Institute in Detroit, Michigan, USA. Details from: www.kingsnake.com/ihs.

27–31 July 2001—44th Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League (http://www.inhs.uiuc.edu/cbd/HL/HL.html). Indiana University/Purdue University, Indianopolis, Indiana, USA. Details available on page 73 of this issue of *HR* and on the SSAR web site: www.ukans.edu/~ssar/an-mtng.html.

19–23 September 2001—Association of Reptilian and Amphibian Veterinarians, Eighth Annual Conference, Orlando, Florida, USA. Details from: Charles J. Innis, VMD, VCA Westboro Animal Hospital, 155 Turnpike Road, Westboro, Massachusetts 01581, USA; tel. 508-366-1444; fax 508-634-6997; e-mail: clemmys@aol.com.

2–9 December 2001—Fourth World Congress of Herpetology, Colombo, Sri Lanka. Details from: 4WCH Promotions Office, 95 Cotta Road, Colomba 8, Sri Lanka; e-mail: admin@4wch.com; http://www.4wch.com.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Eli Greenbaum** or **Omar Torres**; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Variation of Courtship Pheromones in Three Species of Plethodontid Salamanders

Male plethodontid salamanders typically transmit pheromones to females after initial courtship interactions have commenced. Previous studies suggest that courtship pheromones accelerate female receptivity to spermatophore deposition, thus decreasing potential costs of lengthy courtship rituals. Variation in the main component of the male courtship pheromones (plethodontid receptivity factor, PRF) may affect female receptivity. The authors examined variation in PRF from four allopatric populations of *Plethodon shermani*, *P. cheoah*, and *P. montanus* from North Carolina. Pheromone components were separated with reverse phase HPLC and sequenced to confirm the identity of isoforms. Relative differences were documented for PRF isoform concentrations within populations and some significant differences occurred between populations. Moreover, the presence of PRF isoforms varied between populations. The documented variation may be a result of sexual selection for isoforms that accelerate the onset of receptivity in females. It is not yet known whether female stimulation is a result of one PRF isoform or the synergistic effect of two or more isoforms.

Rollman, S. M., L. D. Houck, and R. C. Feldhoff. 2000. Population variation in salamander courtship pheremones. Journal of Chemical Ecology 26:2713–2724.

Correspondence to: Stephanie M. Rollman, Department of Zoology, North Carolina State University, Campus Box 7617, Raleigh, North Carolina 27695-7617, USA; e-mail: stephanie_rollman@ncsu.edu.

Physiological Changes in Captured *Lepidochelys kempii* Sea Turtles

An understanding of the physiological effects of capture on sea

turtles is essential for the safe return of these endangered species to their natural habitat. Moreover, previous studies have shown that capturing turtles may affect metabolic rate, reproduction, hormone levels, and blood physiology. The authors captured individuals of *Lepidochelys kempii* near Sabine Pass, Texas with nets and took blood samples immediately after capture. Turtles were then transferred to water tanks on a boat or partially submerged cages in the water adjacent to the boat; blood samples were collected after 1 hour in each case. All turtles were then transported to a land-based holding facility where additional samples were collected for 48 hours. Mean lactate concentration was significantly higher in tank-held turtles 1 hour after capture. Both plasma NE and E levels were significantly lower in tank-held turtles 1 hour post-capture compared to initial capture values. Plasma glucose levels at 1–6 hours after capture were significantly lower than initial capture levels for cage-held turtles. No significant changes were noted for Na+ and Cl- concentrations, but K+ increased in the cage-held turtles during the first hour of capture. The authors suggested the higher K+ concentration in tank-held turtles may be a result of buffering the blood for the low pH caused by lactate accumulation.

HOOPES, L. A., A. M. LANDRY JR., AND E. K. STABENAU. 2000. Pysiological effects of capturing Kemp's ridley sea turtles, *Lepidochelys kempii*, in entanglement nets. Canadian Journal of Zoology 78:1941–1947.

Correspondence to: Lisa A. Hoopes, Physiological Ecology and Bioenergetics Laboratory, Texas A & M University, 5001 Avenue U, Suite 105, Galveston, Texas 77551, USA.

Ecology of the Turtle *Phrynops geoffroanus* in Brazil

Recent ecological studies of turtles living in polluted ecosystems have shown that some species benefit from waste products associated with human disturbance. The authors studied a wild population of *Phrynops geoffroanus* in Brazil to determine the diet of this species, the presence of resource partitioning in regard to feeding, and any effects of anthropic influence on turtle density and biomass. Turtles were captured with fish nets and pumped for stomach contents. Morisita and Shannon-Wiener diversity indices and the "census method" were used to generate the results. Diet consisted of mainly unidentified material, although chironomid larvae and pupae, carrion, cockroaches, snails and human-associated foods such as meat and rice were also noted. Differences in the diet between adults and juveniles were noted; this finding may suggest resource partitioning in relation to feeding. The unidentified material may be organic human-associated waste that may account for the large density of turtles noted in the study.

SOUZA, F. L., AND A. S. ABE. 2000. Feeding ecology, density and biomass of the freshwater turtle, *Phrynops geoffroanus*, inhabiting a polluted urban river in south-eastern Brazil. Journal of Zoology, London 252:437–446.

Correspondence to: Franco L. Souza, Departamento de Parasitologia, Instituto de Biologia, Universidade Estadual de Campinas, CP 6109, 13083-970, Campinas, São Paulo, Brazil; e-mail: asabe@rc.unesp.br.

Effects of Reproductive Stage and History on Call Preference in the Toad, *Alytes muletensis*

Numerous factors can affect whether female anurans will choose the same mate repeatedly. The authors tested whether repeatability would be affected by the reproductive stage or history of female midwife toads, *Alytes muletensis*. Female toads differing in the presence of eggs, development of eggs, and mating history were tested for their preference to 1.5 and 1.8 kHz male calls. Results indicated that ovulating females responded to male calls more persistently than recently-mated females. Gravid, unmated females and ovulating females preferred the 1.8 kHz call over the 1.5 kHz call; recently-mated females did not show a significant preference to either call. The results of this study differ from previous behavioral studies of leptodactylid and hylid frogs; this paradox is explained by noting the difference in reproductive biology of *Alytes*. The authors caution against interpretations based on experiments where females are tested only once.

LEA, J., T. HALLIDAY, AND M. DYSON. 2000. Reproductive stage and history affect the phonotactic preferences of female midwife toads, *Alytes muletensis*. Animal Behaviour 60:423–427.

Correspondence to: Jeremy Lea, Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, South Parks Road, Oxford OX1 3PS, United Kingdom; e-mail: j.m.lea@virginnet.co.uk.

Evolution of Caenophidian Snakes Based on Molecular Data

Caenophidian snakes currently include over 2500 species, however, very few clades within the group are well supported. Gravulund examined 12S and 16S mitochondrial ribosomal genes from 45 species of snakes in order to identify groupings within Caenophidia, assess the relationships of the problematic genera *Acrochordus* and *Dasypeltis*, test the monophyly of boigine snakes, and examine the evolution of posterior maxillary dentition and retinal visual cells within the context of the phylogeny. Genes from eighteen species of snakes were sequenced for this study; remaining sequences were obtained from GenBank and a previous study. Pairwise genetic divergences and sequence data were analyzed with PAUP 3.1.1. Because of the large size of the data set, heuristic searches were used to construct phylogenies. This analysis produced two most parsimonious trees with eight clades (1553 steps, CI = 0.313 for each tree). Results indicated that Elapidae is not monophyletic, *Acrochordus* is not a caenophidian, Boiginae is a monophyletic group, and *Dasypeltis* groups within the boigine clade. The author concluded that opistoglyph dentition arose three times in caenophidians and retinal morphology needs revision before clear conclusions can be made.

GRAVLUND, P. 2001. Radiation within the advanced snakes (Caenophidia) with special emphasis on African opistoglyph colubrids, based on mitochondrial sequence data. Biological Journal of the Linnean Society 72:99–114.

Correspondence to: Peter Gravlund, Zoological Museum, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen ø, Denmark; e-mail: Pgravlund@zi.ku.dk.

Phylogeography of the Frog *Ascaphus truei*

The tailed frog (*Ascaphus truei*) represents an ideal taxon for examining the regional phylogeography of the Pacific Northwest because it is endemic to the region, has limited dispersal abilities, and has an ancient history which may be reflected in the genetic structure of this species. Previous workers have noted differences between coastal and inland populations based on morphological and allozyme data. The authors examined sequences from 1530 nucleotides of the mitochondrial cytochrome *b* and NADH dehydrogenase subunit 2 genes from 23 populations throughout the range of this species. Data were analyzed using parsimony, maximum likelihood and nested-clade analyses. Analyses from parsimony and maximum likelihood supported the reciprocal monophyly of inland and coastal haplotypes, respectively. An analysis of molecular variance indicated that these populations have genetic structure; most of the genetic variation within these groups was partitioned among populations. The authors suggested the rise of the Cascade Mountains in the late Miocene and subsequent rainshadow effects in the Pliocene are the best explanation for the current distribution of these organisms. The authors proposed recognition of the inland population as a distinct species, *Ascaphus montanus*.

NIELSON, M., K. LOHMAN, AND J. SULLIVAN. 2001. Phylogeography of the tailed frog (*Ascaphus truei*): implications for the biogeography of the Pacific Northwest. Evolution 55:147–160.

Correspondence to: Marilyn Nielson, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844-3051, USA.

Phylogeography of the Rat Snake, *Elaphe obsoleta*

Subspecific ranks have been used to designate isolated populations that may have the potential to evolve into distinct species. The authors examined sequences of the cytochrome *b* and mitochondrial control region 1 genes from seven subspecies of *Elaphe obsoleta*, in order to assess whether these taxa represent natural groups. Data were analyzed using maximum-parsimony and maximum-likelihood analyses in PAUP* 4.0. Results from the maximum-parsimony analysis identified three clades that are bounded by relatively major geographic landmarks: 1) an eastern clade east of the Appalachian mountains including *Elaphe o. obsoleta*, *E. o. quadrivittata*, *E. o. rossalleni*, *E. o. deckerti*, *E. o. spiloides* and *E. o. williamsi*; 2) a central clade west of the Appalachian mountains including *E. o. obsoleta*, *E. o. lindheimeri* and *E. o. spiloides*; and 3) a clade west of the Mississippi river including *E. o. lindheimeri* and *E. o. obsoleta*. The maximum-likelihood analysis produced a tree that did not show a significant difference from the maximum-parsimony analysis. When the monophyly of each subspecies was constrained, preferred results of a parsimony analysis identified 10,811 trees that were 271 steps longer than the most parsimonious trees. Intraclade comparisons of pairwise genetic distance with pairwise geographic distance did not show a clear relationship. The authors suggest small populations from each clade underwent a rapid range extension as glaciers retreated 18,000 to 6,000 years ago. The authors also suggest that subspecies based on color patterns do not represent natural groups and should be eliminated from the taxonomy of *Elaphe obsoleta*.

BURBRINK, F. T., R. LAWSON, AND J. SLOWINSKI. 2000. Mitochondrial DNA phylogeography of the polytypic North American rat snake (*Elaphe obsoleta*): a critique of the subspecies concept. Evolution 54:2107–2118.

Correspondence to: Frank T. Burbrink, Museum of Natural Science and Department of Biology, 119 Foster Hall, Louisiana State University, Baton Rouge, Louisiana 70803, USA; e-mail: fburbri@unix1.sncc.lsu.edu.

POINTS OF VIEW

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Oil Spills and Glue: a Comment on a Sticky Sampling Problem for Lizards

MARTIN J. WHITING[1]
and
GRAHAM J. ALEXANDER[2]
[1]*Communication Biology Research Group*
[2]*Ecophysiological Studies Research Programme*
Department of Animal, Plant and Environmental Sciences
University of the Witwatersrand
Private Bag 3, Wits 2050, South Africa
e-mail (MJW): martin@gecko.biol.wits.ac.za
e-mail (GJA): graham@gecko.biol.wits.ac.za

Recently, Vargas et al. (2000) reported results from a study comparing survivorship of lizards caught using three techniques: noosing, glue traps and rubber banding. Although their study makes valuable comment on catching lizards, the reader is imparted with a cautionary warning of high fatality rates with glue traps. We have found glue traps to be a very effective, useful and safe tool for capturing fast-moving and wary flat lizards (*Platysaurus*). We have also identified at least one flaw with the Vargas et al. study and take this opportunity to further comment on trapping lizards with glue traps.

The glue trapping technique of Vargas et al. consisted of checking traps every 15 min. In our experience, a lizard left struggling on a glue trap becomes hopelessly stuck and difficult to remove without some handling stress and/or injury. While sampling African flat lizards (*Platysaurus broadleyi* and *Platysaurus intermedius wilhelmi*), we always monitor our glue traps continuously and are usually able to remove the trapped lizard within seconds of capture. Also, in most instances, lizards were only caught by a relatively small portion of their body and therefore easily removed. This is particularly important in hot climates where lizards can quickly expire from hyperthermia on exposed traps (Bauer and Sadlier 1992).

After removing lizards from glue traps, Vargas et al. facilitated glue removal by placing the lizard in a plastic bag with several ml of canola oil (following Bauer and Sadlier 1992). Trapping and glue removal therefore constituted a single treatment and the influence of the glue cannot be separated from that of the oil in their protocol. It is possible that placing the lizard in a plastic bag with oil could contribute substantially to handling stress or that the resulting oil coating could impair physiological function. Rodda

et al. (1993) have also reported lizard fatalities from smothering, after using cooking oil in a plastic bag. Without an appropriate control in the Vargas et al. study, we cannot properly evaluate the impact of oil on lizards. In our studies, we used small amounts of cooking oil, between thumb and fore-finger, to gently massage glue from the lizard's body. If necessary, we also used paper towels to remove excess oil and glue. There was thus no need to place lizards in plastic bags and minimal oil was used. Furthermore, in instances where only a portion of the lizard contacted the trap, we did not always find it necessary to use oil.

Although many of the lizards that we captured (> 1200 *P. broadleyi*; > 40 *P i. wilhelmi*) were released the day following capture and resighted in the field as part of a mark-recapture study, we also transported *P. broadleyi* (N = 30) and *P i. wilhelmi* (N = 28) back to the laboratory for other studies and experienced no fatalities. The *P. i. wilhelmi* were used in two laboratory-based studies (McKinon and Alexander 1999; Alexander et al., in review) and released two years later, without a single fatality. Clearly, trapping these lizards with the use of glue traps had little effect on survival. Thus, although Vargas et al. are likely correct in their assertion that trap-related fatalities have a species-specific component (also see Rodda et al. 1993), we believe that their trap monitoring regime and handling procedure may also have affected their findings.

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RODDA, G. H., M. J. MCCOID, AND T. H. FRITTS. 1993. Adhesive trapping II. Herpetol. Rev. 24:99–100.

VARGAS, G. A., K. L. KRAKAUER, J. L. EGREMY-HERNANDEZ, AND M .J. MCCOID. 2000. Sticky trapping and lizard survivorship. Herpetol. Rev. 31:23.

Indianapolis Meetings Update

Individuals who will be attending the HL/SSAR Joint Annual Meetings in Indianapolis may wish to consult the proposed schedule for ORAL PAPERS and POSTERS. The program is posted as a dowloadable RTF file located at:

www.ku.edu/~ssar/downloads.html.



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Parotoid or Parotid: On the Nomenclature of an Amphibian Skin Gland

MICHAEL J. TYLER
Department of Environmental Biology, The University of Adelaide
South Australia 5005, Australia
e-mail: michael.tyler@adelaide.edu.au

TOM BURTON
Department of English, The University of Adelaide
South Australia 5005, Australia

and

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA
e-mail: abauer@email.villanova.edu

Most amphibians are characterized by the presence of glands dispersed throughout the dorsal skin. Frequently these glands are hypertrophied into prominent aggregations ("macrogland" *sensu* Duellman and Trueb 1985). In anurans most of these macroglands are named according to their location on the head, body, or limbs: rostral, labial, coccygeal, femoral, tibial, mental (Tyler 1987). An exception is the paired glands located upon and behind the head which are variously termed parotid, parotoid, and paratoid. Each of these names has a different meaning and it appears desirable to draw attention to the apparent confusion and suggest a means of, hopefully, achieving a standardization of terminology.

The confusion over the appropriate terminology is exemplified by a recent volume on the amphibian integument (Heatwole and Barthalmus 1994). The index in this work indicates three mentions of the term paratoid. In fact the term is used in only one chapter, whereas the other two use parotid for the same structure.

Parotid glands are large and diffuse salivary glands overlying the angle of the jaws of mammals. They are entirely subcutaneous and of ectodermal origin forming as an outgrowth of the lining of the buccal cavity (Arey 1965). There do not appear to be any homologous structures in lower vertebrates (although the structure now generally referred to as Duvernoy's gland: Taub 1967; Kochra 1978, was formerly called a parotid gland e.g., Phisalix 1922). The function of the salivary secretions is to facilitate the swallowing of food and its subsequent digestion.

In contrast the glands in amphibians often termed parotid are entirely dermal and their secretions discharge upon the outer skin. They are of ectodermal origin and have no communication with the buccal cavity; their contents have a wide range of functions but they have no involvement with digestion. It follows that the anuran structures are not homologous with mammalian parotid glands and the use of this descriptive word is inaccurate.

Definitions provided in the Oxford English Dictionary indicate that *parotis* "the parotid gland" derives from Greek *para* "beside" + *ot* -, the stem for inflected forms of *ous* "ear." *Parotid* as a noun is synonymous with *parotis* "the parotid gland"; as an adjective, meaning "situated beside or near the ear." It is applied particularly (in humans) to the largest of the salivary glands. Parotoid means "having the form, appearance, or nature of the parotid; resembling, related or allied in structure to the parotid, but not identical to it."

Here the Oxford English Dictionary refers specifically to the use of the term in anurans, stating, "applied to certain glands of the skin forming warty excrescences near the ears in some batrachians, or toads." There is no reference to paratoid.

We are aware of seven references to the use of paratoid that refer to these dorsal glands: Günther (1858), Arnold and Burton (1989), Goin et al. (1978), Lim and Lim (1992), Kennedy (1982), Ballasina (1984), Powell et al. (1998). This is not an alternative spelling of parotoid, but is appropriately applied to a different structure defined by Holmes (1979) as "a double row of poison glands extending along the back of certain amphibians, as of salamanders." Holmes states the derivation to be from the Greek word *parateinein*, "to extend along." This is the application of the word used by Francis (1934) in his classical work on salamander anatomy. The homology of these glands with anuran parotoid glands remains unproven.

Early works chiefly misidentified the nature of the glands. In one of the first classic works on frogs, Roesel von Roesenhof (1758) referred to the structures simply as "Wülste" (rolls of fat). LaCepède (1788) also failed to name them, simply describing each gland as "une éminence très-alongée, faite en forme de rein" (a very elongate protuberence in the shape of a kidney). Bonnaterre's (1789) account likewise merely noted the presence of "une excroissance en forme de rein" (an outgrowth in the shape of a kidney) behind each ear, without identifying the structure by name. According to Shaw (1802) the first identification of these dermal structures as parotoid glands was that of Schneider (1799), who included in the generic diagnosis of *Bufo* the phrase "post tympanum parotis magna poris crebris pertusa" (behind the ear a large parotid gland perforated by numerous pores). Similar terminology was used rather consistently throughout the early 19th Century, although vernacular terms were occasionally employed (e.g., Ohrendrüsen; Fitzinger 1826). Tschudi (1838), although he employed the term Parotiden himself, noted that this was not really correctly applied to these structures. Owen (1866) credited Günther (1858) with coining the term parotoid as an appropriate substitute. Although he noted that Günther's intended terminology is unclear, however; paratoid was used consistently throughout his *Catalogue of the Batrachia Salientia* (1858), but he subsequently (1860) reverted to the use of parotids in his description of a new species, *Bufo caeruleostictus*, and shortly thereafter (1864) he employed the term parotoids exclusively in *The Reptiles of British India*. Owen's preferred term, parotoid, was thereafter used in many influential works on amphibians (e.g., Boulenger 1882; Cope 1889) and has since remained the most commonly employed term.

If the meaning of the suffix -oid is assumed to be "like" or "resembling" (as used by Lynch (1971) for leptodactyloid rather than leptodactylid frogs), then parotoid is a misnomer. It does not resemble the parotid in structure, function, position, or embryological origin. It may however be the most frequently used name. To clarify this matter we examined 100 books from several hundred in our libraries. The sample included chiefly 20th century works in a variety of European languages chosen to include general herpetological works, technical morphological treatises, and a variety of regional herpetofaunas. Of those 100 volumes, 71 use parotoid.

A review of anuran references indexed in *Zoological Record* (1978–1999) and of *Biological Abstracts* (1989–1999) yields 13 references to these structures under the term parotoid, eight as parotid, and one as paratoid (Manamendra-Arachchi and Pethiyagoda 1998). An additional two references to salamander parotoid glands were also found.

Peters (1964) lists all three terms, as well as post-tympanal gland, but parotoid is presented as the primary, or preferred term. Ulber et al. (1989) reference the term Paratoide as the correct form, but note that Parotide is sometimes incorrectly applied. Kabisch (1990) admits both terms, but also gives Parotoide as the preferred form.

The English language is riddled with misnomers and it would be unwise to suggest the replacement of parotoid simply because it is inappropriate. "Dorsal cephalo-thoracic sacs" (Peneyra and Masanga 1966) is not a correct description in an anatomical sense and is unlikely to be acceptable. In summary we believe that universality is a highly desirable attribute of any descriptive word, and we propose that the term "Parotid" should be used only in reference to the salivary glands of mammals, "Paratoid" to the paired dorsal rows of glands seen in some salamanders, and "Parotoid" for the hypertrophied cutaneous glands characteristic of most bufonid and some hylid anurans.

Acknowledgments.—We thank both anonymous referees for their constructive comments.

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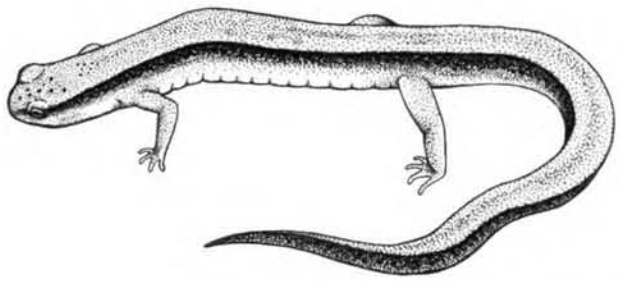
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Southern Two-lined Salamander (*Eurycea cirrigera*). Illustration by Michael Frick.

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Comments on the Taxonomy of Gopher Snakes from Baja California, México: A Reply to Rodríguez-Robles and de Jesús-Escobar

L. LEE GRISMER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
e-mail: lgrismer@lasierra.edu

Rodríguez-Robles and de Jesús-Escobar (2000) recently published a well conceived paper on the molecular genetics of a transcontinental North American species complex within the snake genus *Pituophis*. They presented a revised taxonomy of the *Pituophis melanoleucus* complex based on mtDNA, a review of published morphological characteristics, and a distribution in which they recognize three species: *P. melanoleucus* (Eastern Pinesnakes; *P. m. melanoleucus, P. m. mugitus,* and *P. m. lodingi*), *P. ruthveni* (Louisiana Pinesnake), and *P. catenifer* (Bull and Gopher Snakes; *P. c. affinis, P. c. annectens, P. c. bimaris, P. c. catenifer, P. c. coronalis, P. c. deserticola, P. c. fuliginatus, P. c. insulanus, P. c. pumilus, P. c. sayi,* and *P. c. vertebralis*).

Rodríguez-Robles and de Jesús-Escobar (2000) demonstrated that *melanoleucus, mugitus,* and *lodingi* formed a single, well supported, diagnosable evolutionary lineage based on mtDNA characters (100% bootstrap value) and morphology (Reichling 1995). They argue further that this lineage has achieved independence from the geographically nearest lineage *ruthveni* by means of allopatry due to a broad alluvial plain laid down by the Mississippi River which currently separates the two. Based on these criteria (independence and diagnosability), they followed previous authors (e.g., Cope 1900; Fugler 1955; Klauber 1947; Wright and Wright 1957) and considered Eastern Pinesnakes to form a single species that they referred to as *P. melanoleucus.*

Using these same criteria, Rodríguez-Robles and de Jesús-Escobar (2000) elevated *ruthveni* to species status even though their mtDNA data demonstrated that it was a non-exclusive (sensu Graybeal 1995) lineage. They noted, however, that *P. ruthveni* was allopatric and morphologically diagnosable (Reichling 1995) and therefore chose to follow Reichling (1995) in maintaining its species status. They pointed out, as have others (see Graybeal and references therein), that all lineages must go through a period of non-exclusivity which simply reflects the relative recency of their divergence from their parent lineages. They appropriately noted that the diagnosability and allopatry of *P. ruthveni* demonstrated that it was an independent (i.e., reproductively isolated) evolutionary lineage.

Pituophis catenifer bimaris and *P. c. vertebralis* were considered a single species, *P. vertebralis,* by Grismer (1994, 1997). Grismer (1997) reported on the clinality of color pattern of *P. vertebralis* throughout its range (indicating that it forms a reproductively cohesive unit), and its diagnosability from (Grismer 1997:Table 1), and likely sympatry with, *P. catenifer.* In fact, these species may be sympatric for as much as 180 km (Grismer 1997). Rodríguez-Robles and de Jesús-Escobar (2000:42) implied, and Grismer (1997) demonstrated via sympatry, that *P. vertebralis* and

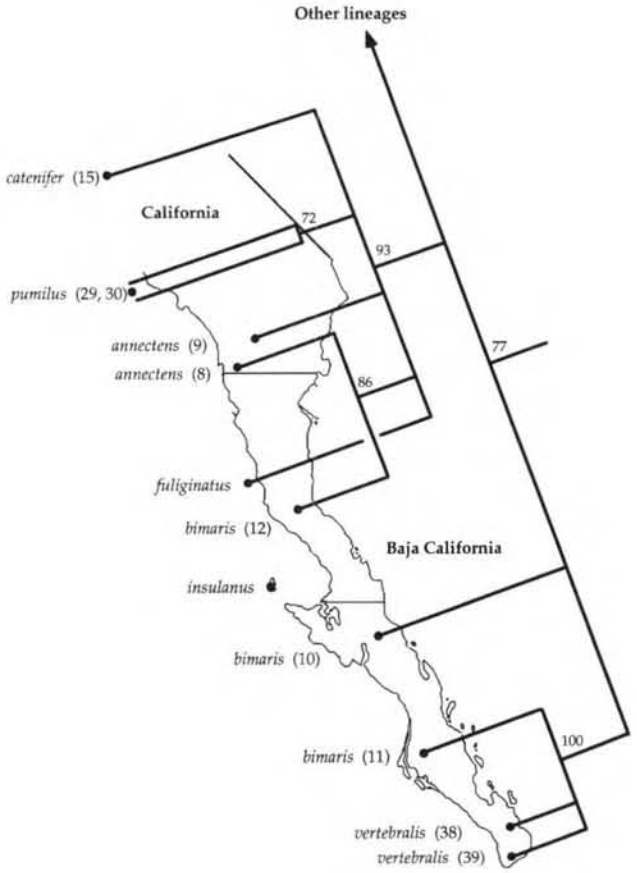


FIG. 1. An area cladogram based on a modified portion of the weighted maximum parsimony consensus tree of Rodríguez-Robles and de Jesús-Escobar (2000:FIG. 5b) containing the individuals of the Baja California gopher snake *P. vertebralis* (*bimaris* and *vertebralis*). All nodes with bootstrap values less than 70% are considered to have a probability of < 95% of being real (see Hillis and Bull 1993) and have been collapsed. All operational taxonomic units (individuals) are arranged geographically. Numbers above the nodes represent bootstrap values based on 100 pseudoreplicates each with 10 random addition iterations. Numbers in parentheses following taxon names correspond to locality data listed in Rodríguez-Robles and de Jesús-Escobar (2000: Table 1). Individuals from the pet trade (*bimaris* [13] and *vertebralis* [40]) lacking locality data could not be placed on the area cladogram and were omitted. This tree was preferred over their unweighted parsimony tree (their FIG. 5a) because the use of differential character weighting has been shown to increase phylogenetic accuracy when substitutional rate variation is present (Huelsenbeck and Hillis 1993), as suggested for these data by the maximum likelihood analysis. Their maximum likelihood tree (their FIG. 6) is similar to their weighted maximum parsimony tree except that it places *bimaris* (10) as the basal lineage in a clade containing the remaining northern lineages (*bimaris* [12] to *catenifer* [15]; FIG. 1). However, the branch length for its placement as the basal member of this clade is short, suggesting that it is weakly supported.

P. catenifer are reproductively isolated from one another (i.e., independent lineages). Rodríguez-Robles and de Jesús-Escobar (2000) synonymized *P. vertebralis* with *P. catenifer* on the basis that some individuals of *P. vertebralis* (*bimaris*) were shown to be more closely related to individuals of *P. catenifer* (*annectens*) than to other *bimaris* (Fig. 1). Their data clearly demonstrate that *P. vertebralis*, like *P. ruthveni*, is a non-exclusive lineage. When their weighted maximum parsimony consensus tree (Rodríguez-Robles and de Jesús-Escobar 2000:Fig. 5b) is redrawn with respect to geography (Fig. 1), it shows that individuals from the northern portion of the range of *bimaris* are more closely related to individuals of the southern portion of the range of *P. catenifer* (*annectens*) than they are to other more geographically distant individuals of *bimaris*. Expectedly, their tree also shows that southern *bimaris* are more closely related to the geographically more proximate *vertebralis* of the Cape Region than to the more distant individuals in the northern range of *bimaris* (Fig. 1). The substructuring of these intraspecific relationships between *P. vertebralis* and *P. catenifer* would be expected of two lineages that may have recently separated. Rodríguez-Robles and de Jesús-Escobar (2000) noted a similar relationship for individuals of *P. c. sayi* and *P. ruthveni*. Rodríguez-Robles and de Jesús-Escobar (2000) also found substantial genetic divergence (6.2%) between the *bimaris* from San Ignacio (sample 10; FIG. 1) and the *bimaris* from Ciudad Constitución (sample 11; Fig. 1). They considered this as evidence for not recognizing *P. vertebralis* (sensu Grismer 1994). However, the geographic gap between these samples in approximately 380 km and the morphology and color pattern of specimens from within this gap exhibits clinal variation, suggesting that there are no genetic breaks. The relevance of the percent sequence divergence between these two samples cannnot be fully appreciated until additional specimens from the intervening 380 km are sequenced. Therefore, using the criteria of Rodríguez-Robles and de Jesús-Escobar (2000) to recognize species level entities within the *P. melanoleucus* complex (i.e., independence and diagnosability), I elect to maintain the species level recognition of *P. vertebralis* on the grounds that it forms a diagnosable lineage that is reproductively isolated from other lineages within the *P. melanoleucus* complex.

Based on biogeography and the close relationship that other insular individuals shared with individuals from the adjacent continent, Rodríguez-Robles and de Jesús-Escobar (2000) hypothesized that *P. insulanus* (sensu Grismer 1994) of Isla de Cedros off the west coast of central Baja California (Fig. 1) should be included within *P. catenifer*. But again, using their criteria for species level recognition within *Pituophis*, I elect to maintain the species recognition of *P. insulanus* because it is a discretely diagnosable allopatric lineage (Klauber 1946). The other insular taxa—*coronalis, fuliginatus* and *pumilus*—do not meet these criteria and the first two have been synonymized with *P. catenifer* (Grismer 2001).

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ARTICLES

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Arboreal Behavior in Timber Rattlesnakes (*Crotalus horridus*)

BRAD COUPE

Department of Evolution, Ecology, and Organismal Biology
Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210, USA
e-mail: coupe.1@osu.edu

Rattlesnakes (*Crotalus* and *Sistrurus*) are typically terrestrial animals. Although many species of rattlesnakes have been observed occasionally in vegetation off the ground (Hollingsworth and Mellink 1996; Klauber 1972, pp. 486–495; Saenz et al. 1996), they are not generally recognized as proficient climbers. Klauber (1972, p. 486) noted timber rattlesnakes (*Crotalus horridus*) as being one of the more arboreal species of rattlesnakes. Here I discuss observations of arboreal behavior in timber rattlesnakes, including an instance of arboreal courtship, from a mixed hardwood forest site in Vinton County, Ohio.

During the 1994, 1995, and 1996 field seasons I radio-tracked (cf. Reinert 1992; Reinert and Cundall 1982) a total of 17 timber rattlesnakes (8 females, 9 males; Coupe 1997). I tracked three snakes (2 females, 1 male) in the late summer and fall of 1994. I tracked the two females the following summer (1995), as well as 14 additional snakes. Tracking effort was substantially reduced in the spring of 1996 as I was completing the study.

Arboreal behavior mirrored the sampling effort as none was observed in 1996, the majority in 1995, and in 1994 only one snake was observed off the ground. During the study, five of the eight females (62.5%) and two of the nine males (22.2%) were seen off the ground in vegetation in 56 of their 425 (13.2%) collective locations (Table 1). The percentage of locations in which I found these seven individuals off the ground in vegetation ranged from 1.8% to 59.5% (Table 1). I found timber rattlesnakes in arboreal locations from May to September, but most instances (35 of 56, 62.5%) were in July and August. I observed individual rattlesnakes at heights from ~ 0.5 m to ~ 5 m off of the ground.

An effort was made to locate individuals every day, but this was not always possible. Data on individuals were not collected more than once per day. Therefore, in the following discussion consecutive locations or observations are on different, but not necessarily consecutive days. Because this makes interpretation of time difficult, I have included actual calendar dates so as to clarify the time periods being discussed. When individuals were located, the species of vegetation in which the snake was found was not recorded, nor was more than a rough estimate of height noted.

Two female snakes demonstrated the greatest number of consecutive arboreal locations (= "run"). A light-phase female (LF2) was located 42 times from 5 June to 10 August 1995. On 25 (59.5%) of those locations she was observed off the ground in vegetation. A run of 21 consecutive observations of LF2 between 22 June and 16 July were arboreal (Table 1). On 29 June she reached her maximum height (~ 5 m) on the top of a broken tree trunk. The rest of the tree was still attached, but hanging down to the ground amidst lower vegetation. She had spent six days above the ground in this lower vegetation (ca. 2 m above ground level) before, presumably, crawling up the broken trunk to its highest point. She was still off the ground, but in a different location, when she was next observed on 1 July. On 13 July her eyes were cloudy. On her last consecutive arboreal location (16 July) her eyes were clearing. By 21 July she clearly had shed although her shed skin was not found. During this 21-day period of consecutive arboreal locations, she was found in three different areas of the study site that required her descent to the ground to travel between them.

After shedding, LF2 was observed off the ground on four more occasions. Most notably, at 1300 hr on 3 August 1995 she was being courted by a dark-phase male (105.8 cm SVL) that was not part of the telemetry study. They were on a steep hill, approximately two meters up in the crown of a large, fallen, dead conifer. She was stretched out on top of the branches and he was draped over her, but they were not copulating. Our presence disturbed LF2, and she moved away. This was the last time that this female was observed in an arboreal site before she was found on the ground on 10 August, dead of unknown causes.

A dark-phase female (DF1) was not located in arboreal locations when she was gravid in 1994, but in 1995 was found in elevated locations in a run of ten consecutive observations from 8 to 19 July. During this time she was located in the branches of a fallen, dead, deciduous tree. On her last arboreal location on 19 July she had cloudy eyes, and by 26 July she had shed. She was not observed in any other arboreal locations during the study.

It is possible that the arboreal behavior observed in these two females was associated with the shedding of their skin. Following long arboreal runs, both LF2 and DF1 shed their skins in the early part of the late summer mating season, a time when ecdysis has been linked to attracting mates (Brown 1995). They might have

TABLE 1. Individual snake measurements and data on arboreal behavior for seven timber rattlesnakes (*Crotalus horridus*) found off of the ground in vegetation during a field study from 1994-1996 in Vinton County, Ohio. All arboreal behavior was observed in 1995 except for observations of DM1 which occurred in 1994. A "run" is a series of consecutive observations; however, consecutive observations were not always on consecutive days (see text).

Snake	Year Radio-tagged	Sex	SVL (cm)	Mass (g)	Number of Arboreal Locations	Number of Total Locations	% of Locations Arboreal	Longest Arboreal Run
DF1	1994–95	F	90.5	385	10	137	7.3	10
DF4	1995	F	90.2	690	5	18	27.8	2
DF5	1995–96	F	89.8	725	1	57	1.8	1
LF1	1994–95	F	88.1	490	7	95	7.4	7
LF2	1995	F	80.1	605	25	42	59.5	21
DM1	1994	M	99.5	675	5	26	19.2	5
DM4	1995–96	M	112.5	1958	3	50	6.0	3
				Totals:	56	425		

been seeking better locations from which to bask in preparation for shedding, although this could in turn increase their visibility to avian predators. Two other snakes, a female (LF1) and a male (DM1) were observed in seven and five day runs, respectively, of arboreal behavior. However, they were not preparing to shed during those times. The female (LF1) did not show signs of ecdysis until 26 days after her last arboreal location, and on 24 September 1994 the male (DM1) was located in his hibernaculum immediately following his arboreal locations. More observations will be needed before a link between arboreal behavior and ecdysis can be made.

Foraging might also account for arboreal behavior in timber rattlesnakes. While I did not observe definitive arboreal foraging behavior in my study, Brown and Greenberg (1992) observed a timber rattlesnake in a vertical foraging posture on the side of a tree. This suggests a tendency to include the vertical dimension of the forest in foraging behavior, although the snake observed in this posture was a male, whereas most arboreal behavior I observed was in females. Timber rattlesnakes are well known to feed on arboreal mammals such as gray squirrels, *Sciurus carolinensis*, and chipmunks, *Tamias striatus* (Uhler et al. 1939; Smyth 1949; Savage 1967; Keenlyne 1972), and numerous species of birds have been observed in their diet (Uhler et al. 1939; Savage 1967; S. Beaupre, pers. comm.). Additionally, Savage (1967) cites Uhler et al. (1939) as including bird eggs in the diet of timber rattlesnakes; however, Uhler et al. do not make this claim. Klauber (1972 pp. 493–495) discussed a controversial painting by Audubon depicting a timber rattlesnake attacking mockingbirds (*Mimus polyglottos*) at their nest as well as an article about rattlesnakes by Audubon. While Klauber discredits many aspects of the painting and of Audubon's description of a foraging rattlesnake, he does agree that it is possible for timber rattlesnakes to feed on birds in trees.

Other researchers have noted arboreal behavior in timber rattlesnakes in different parts of their range. There is considerable variation in the frequency of observation at different sites. This variation could be an artifact of the techniques used in the study (long-term radio-telemetry studies might be more likely to observe arboreal behavior than capture-mark-recapture studies). It might also reflect population or individual level variation in the behavior. In New York, W. Brown (pers. comm.) has not observed arboreal behavior in a capture-mark-recapture study, although it has been observed rarely by E. McGowan (pers. comm.) in a radio-telemetry study. H. Reinert (pers. comm.) has frequently observed timber rattlesnakes in arboreal locations up to three meters high during his radio-telemetry studies in Pennsylvania and New Jersey. In his long-term capture-mark-recapture study, W. Martin (pers. comm.) has observed timbers in arboreal locations outside of hibernacula in West Virginia, and R. Sajdak (pers. comm.) has radio-tracked one female to multiple arboreal locations in Wisconsin. S. Beaupre (pers. comm.) has observed numerous instances of arboreal behavior in radio-tracked timber rattlesnakes in Arkansas; most of these observations were of females. While A. Savitzky and C. Petersen (pers. comm.) have observed arboreal behavior in their radio-telemetry study in Virginia, they suggest that it is rare there because these snakes might be more heavy-bodied in comparison to other populations, making climbing difficult. In North Carolina, J. Sealy (pers. comm.) has observed two radio-tracked females to remain at arboreal locations for more than a week. The behavior also has been observed in Texas (Saenz et al. 1996).

Although arboreal behavior has been reported in timber rattlesnakes (Saenz et al. 1996), I am not aware of a report of an individual timber rattlesnake spending more than half of its time in arboreal locations. Additionally, to my knowledge this is the first report of an arboreal courtship in this species. Arboreal behavior in Ohio was more prevalent in females than in males, and most locations were in or associated with fallen, dead trees or trees with branches low to the ground. Arboreal behavior might be related to skin shedding or foraging, and fallen, dead tree sites could allow for access to arboreal locations, as easily climbable branches are at ground level. These data support Klauber's (1972 p. 486) assessment of timber rattlesnakes as being "among the more persistent climbers."

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Diet Composition of the Rainbow Whiptail, *Cnemidophorus lemniscatus* (Sauria: Teiidae), from Southern Florida

FRED PUNZO
Department of Biology, Box 5F, University of Tampa
Tampa, Florida 33606, USA
e-mail: FredPUT@aol.com

Cnemidophorus lemniscatus is a species that occurs widely in the neotropics (Cole and Dessauer 1993; Lammerée 1970; Markezich et al. 1997) and was introduced into Florida via the pet trade (Bartlett and Bartlett 1999). This species is a member of the *lemniscatus* species complex in which some species are parthenogenetic (Sites et al. 1990). Populations of *C. lemniscatus* that occur in south Florida appear to be entirely bisexual (Bartlett and Bartlett 1999). Although breeding populations have been known in Dade County, Florida for over two decades, little is known concerning the natural history and ecology of this exotic species (Wilson and Porras 1983; Markezich et al. 1997).

These whiptails are common in a number of locations in Dade County and are typically found on heavily pebbled areas of open sandy soil with scattered clumps of grasses and weeds. I have observed these lizards in the field moving quickly over the surface of the ground searching for prey, a common behavior in lizards of this genus (Vitt and Ohmart 1977; Punzo 1990). Periodically, they stop and tongue-flick at the surface of the sand before moving on. During the hottest periods of the day in summer months they frequently seek shelter in a burrow, within rock crevices, or under the shade of a plant or building.

Although it has been reported that this lizard feeds on a variety of arthropods, and less frequently on the flowers of some plants (Sites et al. 1990; Bartlett and Bartlett 1999), no detailed studies have been conducted on the diet composition of this species in Florida. The purpose of the present study was to analyze the stomach contents of *C. lemniscatus*.

Materials and Methods.—The study site was located 1.2 km southeast of the former Florida East Coast Railway Building (N.W. 37th Ave. and 75th St.) (Miami, Dade Co., Florida, USA) in an area adjacent to several occupied and abandoned buildings. The area included an asphalt parking lot overgrown with weeds adjacent to a well-drained and an open sandy area sparsely vegetated with grasses (*Andropogon* spp., *Aristida stricta*), saw palmetto (*Serenoa repens*), and composites (*Aster* spp.). This sandy area was bordered on two sides by a large area characterized by clumped shrubs and an open woodlot. The lizards often entered this area to forage and seek shelter from the sun.

All lizards were collected from 7 March to 30 August 1999 by noosing as described by Fitch (1958). Only the stomach contents from adult lizards were used in this study (snout–vent length [SVL] = 100–123 mm). Following capture, lizards were measured (SVL, to the nearest 0.1 mm) with vernier calipers, weighed (to the nearest 0.01g) on an Ohaus Model 31677 Port-O-Gram electronic balance, and sexed. Stomach contents were collected using the stomach-flushing technique described by James (1990) and Punzo (2001). Lizards were given individual identification marks by toe clipping for future demographic studies and then released at their original collection site. The stomach contents for each lizard were placed in a plastic vial containing 70% ethanol and returned to the laboratory for subsequent identification. Only lizards captured for the first time were used for stomach analyses (N = 30; 16 males, 14 females). Prey items were identified to Order and Family wherever possible.

For each prey item, length (a) and width (b) were measured to the nearest 0.01 mm (excluding legs and antennae) and volume was determined according to the formula for the volume (V) of a prolate spheroid (Dunham 1983; Punzo 1991, 2000; Vitt and Breitenbach 1993): $V = 4/3p\ (a/2)(b/2)^2$.

Results and Discussion.—Adult males exhibited a SVL ranging from 60 to 100 mm, and females ranged from 70 to 105 mm.

Body mass ranged from 16.3 to 19.8 g in males, and 15.4 to 20.7 g in females. In my laboratory I have observed captive females laying 1–2 clutches of eggs per reproductive season, with clutch sizes ranging from 2 to 5 eggs (unpubl. data). Embryonic development is completed after 45–52 days of incubation under controlled conditions (27°C, 75% RH, 14L:10D photoperiod) (unpubl. data).

Prey items (number of prey, percent of total sample, percent volume, and percent frequency) found in the stomachs of *C. lemniscatus* are shown in Table 1. There were no significant differences between sexes (c^2, $p > 0.03$) or between the months during which sampling was conducted (Two Sample Means Test, assuming unequal variance, $p > 0.10$; Sokal and Rohlf 1995).

These lizards are active foragers and consumed a wide variety of arthropod prey suggesting that they are opportunistic predators. Similar results have been reported for other species of *Cnemidophorus* (Best and Polechla 1983; Maya 1989; Paulissen and Walker 1994; Punzo 1990; Smith 1989). Orthopterans and beetles were the most common prey items found in lizards at this study site, together representing 56.9% of the total number of prey items consumed and 71.2% of the total volume of prey consumed. Although ants and termites occurred in 23.3% and 26.6% of the stomachs, respectively, they accounted for a relatively small percentage of the diet by volume. Spiders and lepidopteran larvae are readily consumed by *C. lemniscatus* as well. These lizards are also capable of detecting beetle larvae that are below the ground surface, as well as termites. This has been reported for other species of *Cnemidophorus* (Fitch 1958; Mitchell 1979; Punzo 1990) as well as for other genera within this family (Cooper 1990). Arthropods with well-known chemical defenses such as blister beetles (Meloidae), velvet ants (Mutillidae), and millipedes, which were common at this study site, were not present in any of the stomachs examined.

An insular species within the *lemniscatus* species group (*C. arubensis* from Aruba) was strongly herbivorous (Schall and Ressel 1991), with flowers, fruits, and leaves comprising 80–90% of the diet. This whiptail appeared to actively search for certain (preferred) food types and actively avoided plants that contained large quantities of phenolics, saponin, or alkaloids. Paulissen and Walker (1994) showed that another insular species, *C. nigricolor,* consumed some plant material but not enough to be considered an herbivore.

In summary, *C. lemniscatus* in southern Florida feeds primarily on orthopterans and coleopterans, followed by lepidopteran larvae and spiders. There was little evidence that this whiptail feeds on plant material at this study site. Studies on *C. lemniscatus* from South America indicated that these lizards feed on a wide variety of arthropod prey, including termites, beetles, grasshoppers, katydids, and spiders (Markezich et al. 1997). Although termites comprised only a small percentage by volume of the diet of *C. lemniscatus* from southern Florida, isopterans can account for a larger proportion of the diet (> 10%) in individuals from South America.

TABLE 1. Analysis of stomach-flush samples from *Cnemidophorus lemniscatus* in Florida. A total of 30 stomach samples from different adult lizards were analyzed, all containing food. The results are expressed as the total number of prey items (N) for each taxon for the 30 lizards, the percent that N represents of the total sample of dietary items (percent total number), percent for each taxon by volume, and percent frequency (percent of lizard stomachs containing a particular prey item).

Prey taxon [1]	N	Percent total number	Percent by volume	Percent frequency
Coleoptera				
Carabidae (A)	11	7.0	14.1	45.8
Cicindelidae (A)	5	3.1	10.2	16.6
Scarabaeidae (L)	3	1.9	1.2	10.0
Scarabaeidae (A)	9	5.7	4.8	36.0
Undetermined (A)	8	5.0	2.1	26.6
Hemiptera				
Coreidae (N)	1	0.6	0.7	3.3
Membracidae (A)	2	1.2	0.3	6.6
Undetermined	2	1.2	1.6	6.6
Homoptera				
Cicadellidae (A)	1	0.6	0.5	3.3
Hymenoptera				
Formicidae	12	7.6	2.9	23.3
Isoptera (A)	9	5.7	6.3	26.6
Lepidoptera (L)	12	7.6	9.1	16.6
Neuroptera				
Myrmeleontidae (A)	1	0.6	0.1	1.3
Orthoptera				
Acrididae (N)	17	10.8	10.2	48.7
Acrididae (A)	11	7.0	7.7	30.0
Gryllidae (A)	10	6.3	6.5	10.2
Tettigoniidae (A)	2	1.2	5.2	30.0
Undetermined	14	8.9	9.2	36.6
Araneae	27	17.1	6.1	46.6
Plant material			1.2	1.3
Total:	157			

[1] Prey categories: L (larvae), N (nymphs), A (adults)

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The Jalisco Mud Turtle, *Kinosternon chimalhuaca*, in Northern Nayarit, Mexico

ROBERT G. WEBB

Laboratory for Environmental Biology, and Department of Biological Sciences
University of Texas at El Paso, El Paso, Texas 79968-0519, USA
e-mail: rgwebb@utep.edu

For many years a kinosternid turtle has languished unidentified in the herpetological resource collection of The University of Texas at El Paso (UTEP). The specimen was obtained during field activities of a seven-man crew that visited several sites in northern Mexico in the summer of 1962 (trip alluded to by Milstead and Tinkle 1967).

Around noon on 23 August 1962 we checked into the Hotel Plaza, Acaponeta, Nayarit. Crew members (except Milstead [sick in bed] and Webb [curating backlog of specimens]) left Acaponeta at 1330 h and traveled south on Highway 15, returning at 1830 h. The prime objective, to obtain topotypic *Terrapene nelsoni,* was unsuccessful, but the trip culminated in the capture of three hand-collected kinosternid turtles given to me by D. Tinkle. The three *Kinosternon* included two *K. integrum* (UTEP 3906–07) and the unidentified *Kinosternon* (UTEP 3908). The locality for the three UTEP turtles was recorded as 6.8 mi (11 km) south of Acaponeta, which is about 217 air km north of the northernmost locality of *K. chimalhuaca* (21 km S Puerto Vallarta; Berry et al. 1997:334, 336). The capture site as described by the collectors was along Highway 15 at a roadside flooded grassy area said to have aquatic vegetation, suggesting a permanent pond (but may have been seasonal depending on rainfall). The quiet-water pond site is concordant with the preferred habitat of *K. chimalhuaca*. In this article I tentatively assign this specimen to *Kinosternon chimalhuaca* (Berry et al. 1997; reviewed in Iverson and Berry 1998). However, some morphological differences between UTEP 3908 and those of *K. chimalhuaca*, perhaps significant, exist (see below).

The northern Nayarit *Kinosternon* (UTEP 3908) is a juvenile female (based on short, small tail) with maximal straight-line measurements (Vernier calipers) of 87.3 mm (carapace length, CL), 63.7 mm (carapace width, CW, juncture second and third costals), 70.2 mm (plastron length), and 22.6 mm head width. The carapace is widest posteriorly and shows no carination. The anterior vertebral scute is narrow, well separated from contacting the second marginal scutes. The tenth marginal is slightly higher than the ninth and eleventh marginals. Character codes relating to plastral features used by Berry et al. (1997) are AHW 38.4 mm, BRL 11.0 mm, FEL 11.2 mm, HL 31.4 mm, and PHW 30.8 mm; values for two of their derived ratios, PHW/CW 0.48 and BRL/CL 0.13 (Berry et al. 1997), are extreme, suggesting a narrower posterior lobe of the plastron and narrower bridge in UTEP 3908. The head width/CL of 25.9% also suggests a wider head (Berry et al. 1997). The axillary and inguinal scutes are in broad contact (both sides), but their compactness and reduced contact with marginals seems significant compared to UTEP 3917–18, 3900 (= *K. chimalhuaca*, cited in Berry et al. 1997); the axillary contacts most of the fifth marginal/anterior part of sixth, the inguinal most of the sixth/anterior part of the seventh marginal. There is no anal notch.

The overall dorsal coloration (in life, Webb field notes) of the soft body parts was grayish, but finely marked with buff or yellow-orange. This same pattern occurred on top of the head with more yellow-orange (brighter pattern) on the side of the head (similar to pattern of turtle depicted in Berry et al. 1997). The chin (with one pair of smallish barbels), throat, and soft body parts in the inguinal regions were pale yellow, and the underside of the neck whitish. The ventral soft body parts were mostly flecked with gray. The carapace was dark olive; the bridges, edges of marginals, and plastron were orange-brown.

The most notable differences from the description of southern *K. chimalhuaca* are the much smaller plastron, narrower width of posterior plastral lobe at posterior hinge (PHW), narrower bridge (BRL), configuration of the axillary and inguinal scutes, and the absence of an anal notch. Some differences of UTEP 3908 may reflect juvenile rather than adult features (smallest mature female 99 mm CL; Berry et al. 1997). The possible geographic consistency of these features of a population in northern Nayarit remains to be determined. The coastal lowland habitat and north-south continuity of *K. chimalhuaca* may be interrupted by the elevated western extent of the Transverse Volcanic Range (Neovolcanic Plateau) that is abruptly precipitous to sea level in the Tepic area of Nayarit.

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Silent Auction Returns to Indianapolis

The SSAR Silent Auction will be held again this summer at the annual meeting of SSAR/HL in Indianapolis. Throughout the meeting, herpetology-related artwork will be on display in a central location so that everyone in attendance will have an opportunity to bid on each piece. At the end of the meeting, each piece will be sold to the highest bidder. Funds generated from the Silent Auction are used for SSAR Student Travel Awards. Therefore, SSAR student members need your help! You are invited to donate a print, photograph, line drawing, plate, engraving, or other frameable artwork to the auction. Last year, over $2000 was raised by the Silent Auction to defray travel costs for graduate students presenting papers or posters at the annual meeting. We would like to uphold or surpass the efforts of previous years so that more graduate students may be able to participate in our annual meeting. All donations are tax deductible (for U.S. residents) and more importantly, will provide a financial boost to rising herpetologists. To donate an item or for more information, please contact: *Scott Boback, 331 Funchess Hall, Department of Biological Sciences, Auburn University, Auburn, Alabama 36849-5414, USA; e-mail: bobacsm@auburn.edu.*

TECHNIQUES

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Teflon Tubing as Radio Transmitter Belt Material for Northern Leopard Frogs (*Rana pipiens*)

HEATHER L. WAYE
Department of Zoology, 3029 Cordley Hall
Oregon State University, Corvallis, Oregon 97331, USA
e-mail: wayeh@bcc.orst.edu

Techniques for securing radio transmitters to anurans have included the use of belts made of polyethylene tubing (Bartelt and Peterson 2000) or of beaded chain (Rathbun and Murphey 1996). Both of these designs have been used with success, but also have resulted in some incidence of injury and entanglement of the study animals. Here I present a new material for radio transmitter belts that is potentially less injurious to frogs.

Teflon tubing (TT250/22-25-GRN, Manhattan/CDT/Cole-Flex and Thin Wall Teflon Tubing, Alpha TFT 200 22 NAT) was used to attach radios to *Rana pipiens* at the Creston Valley Wildlife Management Area, near Creston, British Columbia, Canada, in 1998 and 1999. The radios were made by Holohil Systems Ltd. (112 John Cavanagh Road, Carp, Ontario, K0A 1L0, Canada), models BD-2G (1.8 and 3.5 g) and BD-2 (1.3 and 1.0 g), and by AVM Instrument Co. Ltd. (2356 Research Drive, Livermore, California 94550, USA), model SM1 (2 g). Radios were less than 7% of the frog's weight and were built to operate for 9–26 weeks. The tubing was fitted to the frogs such that the loop slid snugly over the adpressed thighs, and was tied using cotton thread pulled through the tubing. Cotton thread should allow unrecovered radios to fall off the frogs when the thread rots and breaks. The frogs were generally caught on shore close to water, in moderately thick reed canary-grass habitat. The pattern of spots on the dorsal surface of the frog was photographed and sketched for later identification.

The effectiveness of Teflon tubing radio transmitter belts was examined with a total of 24 frogs in the field. In 1998, I placed radio transmitters on 13 male frogs, from 23 September to 30 October. There were 189 frog-days of telemetry, with 110 observations of frog locations. In 1999, three males were fitted with radios in June and eight females in September. There were 23 frog-days of telemetry in the summer (10 observations) and 123 frog-days in the fall (to 31 October, 50 observations). To monitor the effects of the belts, frogs were recaptured about every 10 days and their condition recorded.

Most of the frogs did not move more than 100 m during the period they were monitored, and by the end of October all were found along the edges of deeper water bodies. Three radioed frogs went underground into small mammal burrows near the water's edge, and apparently spent the winter there; the belts did not seem to limit the mobility of these frogs. Although there was no evidence that the belts significantly restricted the movements of the frogs, on two occasions I observed a frog trying to back into vegetation under water, and this movement was briefly impaired by the radio unit.

TABLE 1. Comparison of numbers of injuries, deaths, and shed belts between radio telemetry belts made from Teflon tubing and from beaded chain. R&M = Rathbun and Murphey (1996).

Source	No. frogs	No. injuries	No. deaths	No. escapes
R&M	55	6	5	12 (to 22)
This study	24	1*	1*	15

*same frog

Out of 24 frogs fitted with radios, six frogs were refitted to better adjust belt sizing, and 15 resulted in the frog eventually slipping out of the belt. Five of these frogs slipped their belts within 24 hours; three of these were in the first two days of the study, when I was experimenting with the fit of the belt. The average time for belt loss in 1998 was 2.7 days (range 1–11 days) and in 1999 was 9.0 days (range 1–20 days). One male fitted in October 1998 was recovered the following spring without the belt; presumably either the thread had rotted away or the frog had lost enough weight over the winter to slip out of the belt. The maximum length of time a frog carried a belt is unknown, but one belt remained on one frog for over four months.

When I checked the frogs for the fit of their belts, I occasionally saw marks on the skin, especially across the dorso-lateral folds, but these did not deepen to become open wounds. Nine of the 10 frogs examined appeared uninjured. Six had indentations across the dorso-lateral folds, and three had no marks. These indents appeared approximately 12 days after the belt was fitted. One frog sustained deep cuts on its sides from the belt and later died. The frog that was recaptured the following spring without its belt did not have any scars or wounds. There was no evidence that any frog had become entangled in vegetation, and shed skin did not become caught up on the belt.

Rathbun and Murphey (1996) reported the number of radios that were shed by frogs and the number of injuries due to belts made of beaded chain; their data are presented in comparison to the results of this study below (Table 1). I had proportionately more escapes overall (20% of these occurred in the first two days of the project), but fewer injuries and deaths due to the belts. The Teflon tubing was stiffer than polyethylene tubing and tended to stick out from the body of the frog. This might make it more likely to catch on vegetation, but might also make it easier for the frog to slip out of the belt if it becomes entangled. The stiffness of the tubing belt also meant that it touched the skin of the frog at fewer points, and the slick surface of the Teflon seemed to minimize abrasion. Teflon tubing belt material appears to be a suitable material for the attachment of radio transmitters to anurans.

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A Technique for Detecting Eyeshine of Amphibians and Reptiles

CHRIS CORBEN
333 Enterprise Drive, #6, Rohnert Park, California 94928, USA
e-mail: corben@delphi.com

and
GARY M. FELLERS
USGS, Western Ecological Research Center
Point Reyes National Seashore, Point Reyes, California 94956, USA
e-mail: gary_fellers@usgs.gov

Spotlighting has been a standard technique for locating amphibians and reptiles at night. The basic technique is to shine a flashlight at an animal so that the light reflects off of the animal's retina, creating a noticeable eyeshine. The method works well for species with larger eyes such as alligators and ranid frogs, but is fairly ineffective for detecting most medium- and small-sized animals because their eyeshine doesn't stand out sufficiently from the background. A brighter light is of little benefit, because it does not enhance the contrast of a weak eyeshine against the background, and the light is much more likely to cause animals to flee, turn away, or simply close their eyes.

We have used a modification of the basic eyeshine technique so that it allows us to detect animals at a much greater distance and to detect much smaller species. We use binoculars in combination with a moderately bright light. We rest the binoculars on the top of a light, line up the field of view with the light beam, and then move the two in unison while scanning for eyeshine. It generally takes a few hours of practice to effectively coordinate the light and the binoculars, but once mastered, the technique becomes easy to use and greatly enhances an observer's ability to locate animals. We have not quantified the effectiveness of using binoculars while spotlighting, but we estimate that it increases the number of individuals located by two to five fold, with the greatest increase being the more cryptic and smaller species.

Almost any set of binoculars can be used, but some are more versatile. Binoculars that can focus to within < 2.5 m are particularly useful because this allows one to locate nearby animals. The 7 x 26 Bausch & Lomb Custom binoculars and the waterproof Bausch & Lomb Elite 10 x 42 work well.

The choice of light is important for getting the best results. If the light isn't sufficiently bright, it can be difficult to distinguish vertebrate eyeshine from other reflections, especially water droplets. Ambient light has a profound effect. On a dark night, even a low powered flashlight can be used to good effect, whereas bright moonlight will limit the range of even a fairly intense light. If the target animals are only visible over a short range, as when search-

ing in fairly dense vegetation, a light of lower intensity is often advantageous, because it doesn't dazzle your eyes and will be less likely to disturb the subject. If the target animals are likely to be seen at substantial distances, then a brighter light works best. Atmospheric conditions, such as dust in the air or rain, will often limit the effective range. For most purposes, a light of intermediate intensity is a good choice, and a 30-watt spotlight is a good compromise. Table 1 provides a comparison of light output from various lights and Table 2 provides reference data for environmental light conditions that *Rana aurora* might be exposed to when sitting near a pond during the day.

A light should ideally have a beam angle a little greater than the field of view of the binoculars being used. A light that produces even illumination is best.

Just as important are factors that affect comfort. If the light is too heavy, it can quickly become tedious trying to hold it with the binoculars perched on top, and maneuverability will be compromised. Most importantly, it should be easy to hold the binoculars in place on top of the light because the binoculars need to be as close as possible to the beam of light.

One commercially available light that works well is the Nite Sport II (Nite Light, Little Rock, Arkansas, USA, US $70). This light has a rechargeable 6 volt gel cell battery (that can attach to one's belt) and a headlamp unit. The 1.3 m cord connecting the battery to the headlamp is particularly sturdy, so it is not the weak point as it is in many headlamp systems. The light runs about 5 hours on a charge. The optional Halogen bulb (HMP03) increases the light output from 67 to 79 lux (measured at 5 m). A particularly nice feature of the Night Sport II is the built-in rheostat. This allows one to use the full power of the light to locate animals, but then reduce the brightness for the final approach.

We have modified our lights by bolting a Mag-Lite Bite-a-Lite (Mag Instrument, Ontario, California, USA, www.maglite.com) to the clip on the back of the headlamp. Bite-a-Lite is a small plastic part that fits over the end of a AA Mag-Lite so you can hold it in your teeth. By drilling a 3 mm hole through the Bite-a-Lite, a 3.5 cm long bolt and washer can be used to attach the Bite-a-Lite to the Nite Sport. This modification makes the light easy to hold and frees one's hands.

Alternatively, you can assemble a 30-watt light from readily available parts. Night Lite sells a spotlight (W1585) that can be modified by upgrading their 6-volt bulb with a 12-volt H4405 sealed beam lamp (Bulbman, tel. 1-800-648-1163, www.bulbman.com) that produces 1468 lux (at 5 m). You will then need a 12-volt gel cell, charger, and a connector for the light and battery. These parts are available at many electronic stores.

In many situations, vegetation blocks the eyeshine of a particular animal from all but a few viewpoints. This makes it difficult to point out an animal to anyone else or, sometimes, even to keep track of where an animal is as you approach it. We have found that it is often helpful to work in pairs with one person spotting animals and the other doing most of the capturing. In this situation, a laser pointer can be a useful accessory. When an animal is located, a laser pointer can be used to direct a second person's attention to the animal. It is generally not a good idea to place the laser spot right on the animal since the bright light can elicit an escape response. The pointer can be used instead to "draw" a small circle around the animal. A second method is to illuminate a spot about 1 m away from the animal and then move the beam towards it, turning the pointer off just as the spot reaches the animal. Note that lasers come with a range of ratings for light output. The more powerful ones (which claim to reach > 200 m) are generally the most useful. Shorter wavelengths provide better visibility, so a 635 nm laser appears nearly seven times brighter than a 670 nm unit with the same output.

There are a few precautions to keep in mind when spotlighting. When working with a partner to catch more wary species, it is important to make sure that the person approaching an animal is not illuminated from behind since this creates a strong silhouette that immediately alerts the animal to the approaching biologist. Similar precautions are necessary when working under a full moon.

Vertebrates are not the only animals with eyeshine. Spiders have surprisingly bright eyeshine and tend to be very abundant, but their eyes look more point-like than those of vertebrates. Moth eyes and small droplets of pine sap can look extremely similar to vertebrates' eyes. Water droplets become abundant when the temperature drops to the dewpoint, and while water droplets generally are not too difficult to distinguish from vertebrates' eyes, their sheer abundance can be very distracting.

Spotlighting has been used primarily for anuran surveys, but

TABLE 1. Light output measured in lux (=lumens/m^2) at a standardized distance of 5.0 m using a digital light meter (Model 407026, Extech Instruments, Waltham, Massachusetts, USA; www.extech.com).

Light Source	Lux
Q Beam - 200,000 cp	786
100 Watt - sealed beam	653
Q Beam - 100,000 cp	558
30 Watt - sealed beam	358
35 Watt - garden flood	70
Mag-Lite - 3 D-size cells	39
Nite Sport II - Halogen bulb	18
Nite Sport II - Regular bulb	16
Mag-Lite - 2 AA-size cells	1

TABLE 2. Mid-day ambient light levels measured at a *Rana aurora* breeding pond at Point Reyes National Seashore, California. Measurements were taken at eight places where frogs had been observed sitting during the day on previous occasions. The light meter sensor was oriented at three different angles and the range of values is reported for the eight sites.

Light Source	Lux
Full sun	100,000
Full moon	2
Partially shaded pond edge	
Facing toward sun	40,000–80,000
Facing north	7,000–10,500
Facing south	12,500–25,000

the technique is far more broadly applicable. For example, it is particularly effective for terrestrial salamanders, even in areas with moderately dense understory. We regularly spotlight even the more diminutive species such as *Batrachoseps attenuatus*, *Plethodon elongatus*, and *Rhyacotriton variegatus*. In less than one hour (on a rainless night), we were able to spotlight five adult *Dicamptodon tenebrosus* away from water; this is especially notable since this species is generally difficult to find during the day without moving significant amounts of cover. Spotlighting is useful for reptiles as well. One of the authors (CC) originally used the technique in Australia for locating nocturnal geckos, snakes, frogs, and small mammals.

We have found that many species of salamanders in the western U.S. can be found during remarkably dry weather. In such conditions, most animals are found sitting near the entrance to a small burrow or within a crevice, but there are typically a few individuals that are out well away from cover. Spotlighting with binoculars should be considered when looking for amphibians and reptiles in habitats that are easily impacted by more traditional collecting techniques (e.g., moss-covered talus slopes), where it is difficult to turn cover (e.g., searching for geckos on lava flows or on the trunks of trees), or where repeated surveys are necessary and other techniques (e.g., time constrained surveys) would result in unacceptable levels of habitat disturbance.

With an increasing interest in survey techniques, especially for declining amphibians, biologists should include spotlighting with binoculars as one of their tools. It is an efficient technique that is easy to learn and that uses equipment most biologists already possess.

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Evaluating Visual Implant Elastomer Polymer for Marking Small, Stream-dwelling Salamanders

MISTY-ANNE RALSTON MAROLD
Department of Natural Resources Conservation
Holdsworth Natural Resources Center, Box 34210
University of Massachusetts, Amherst, Massachusetts 01003, USA
e-mail: Mralston@forwild.umass.edu

Traditionally, amphibian mark-recapture studies have relied on toe clipping. Although effective for seasonal studies of adults, larval amphibians can regenerate toes quickly, making this technique unsuitable for longer-term studies. Several alternative amphibian marking techniques were reviewed recently by Schlaepfer (1998) and Nauwelaerts et al. (2000). However, the majority of alternative techniques (PIT tags, pressurized fluorescent marking, coded wire tags) may be unsuitable for small larval and adult salamanders. I tested the suitability of Visible Implant Fluorescent Elastomer (VIE) tags on larval and adult *Eurycea bislineata* and *Desmognathus fuscus* (Plethodontidae). As larvae, they are slender bodied, stream forms, and range from 14 to 34 mm snout-to-vent length (SVL) and 1.9 to 3.0 mm head width. These species lack the large fin-fold, common with pond breeding salamanders.

Laboratory Study.—A laboratory study was conducted on 27 larval (18.1–28.4 mm SVL) and 2 adult (26.5 and 27.1 mm SVL) *Eurycea bislineata*. I randomly selected 27 larvae and both adults for marking. They were individually anesthetized with MS-222 (400 mg/L, 1:2500) buffered with equal parts sodium bicarbonate (E. L. Brainerd, pers comm). I identified five potential mark locations on each side of the body (anterior and posterior to foreleg, midbody, and anterior and posterior to hindleg) and four dorsal positions (posterior to leg attachments on dorsal side) for a total of 14 potential mark locations. I tested 1 to 4 marks per individual (8 larvae, 1 mark; 12, 2; 4, 3; 3, 4). To minimize desiccation, salamanders were placed on a water-soaked artificial chamois for the duration of the procedure. I used methods similar to Nauwelaerts et al. (2000) to inject a small dot/line of elastomer under 10x magnification. Although marks were pliable when dried, I avoided placing them near joints to minimize potential mobility impairment. After marking, the salamander was allowed to recover in clean stream water, then returned to an environmental chamber maintained at 12.7 ± 0.5°C. VIE marks were checked each week for 15 weeks by placing the salamander into a ziploc bag and viewing the mark with a 10x magnifying lens. Within the containers, I observed swimming and walking ability to determine if mobility was impaired.

Eurycea bislineata larvae and adults tolerated the tagging procedure with no mortality, limb-loss, or obvious injury. There was complete retention of the VIE marks for 15 weeks in the laboratory. Overall visibility of the marks varied due to skin pigmentation and placement of the VIE. VIE marks in mid-body positions were more difficult to insert and could be confused with adjacent marks; therefore, I decided these were unsuitable. Further, larvae <19.0 snout-to-vent length were too difficult to mark due to their small size relative to the needle.

Field Application.—I utilized the VIE marking technique in a field test from May to September of 1998. Using the 10 body positions identified from the laboratory study, I administered four marks per individual. I captured 132 salamanders, of which only 44 were >19 mm SVL (*Desmognathus fuscus* 1 adult, 15 larvae; *Eurycea bislineata* 3 adults, 25 larvae). Individuals were anesthetized with MS-222, rinsed, placed onto a wet chamois-covered sponge, and marked under 10X magnification. After marking, they were placed into a bucket of clean stream water for recovery and then returned to their capture location. None of the 44 marked individuals was recaptured during the three months of fieldwork, but I attributed this to marking only a relatively small portion of a functionally open population.

Conclusions.—The VIE technique was successfully utilized for *Eurycea bislineata* (lab and field) and *Desmognathus fuscus* (field) ranging from 19.0 mm to 41.1 mm SVL. The elastomer was relatively easy to see under the skin, although a blue light was necessary for darker-pigmented individuals. It only took about 30 s to inject the four marks in the field. The nature of my study was such that I was repeatedly collecting, marking, and replacing individuals over 500 m of a stream. Therefore, I had to mix a batch of elastomer, mark some individuals, then move on. The relatively high air temperatures (27–32°C), tiny quantity injected, and time between marking allowed the elastomer to harden before I actually used it all. I typically had to mix two batches per 10-h field day, despite keeping the material on ice. Each batch of elastomer cost about US $11.00 plus the cost of the handheld injector, blue filtered light, and amber glasses. On average, I used 10 batches of

elastomer a week for three months, which added substantially to material costs for the project. The entire procedure (anesthetization, marking, recovery) took about 20 min per individual, which limited the number of collection sites I could visit each day and return individuals to their capture location. I found the VIE technique to be more appropriate for situations where marking a large number of individuals at once was possible (e.g., laboratories, small closed water-bodies, during mass migration, or other area/time constrained studies). This study suggests that VIE may be a suitable alternative to toe-clipping for small adult and larval salamanders, but is limited by long handling time per individual and increased costs.

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Longevity of Paint Marks and the Lack of Effect on Survivorship and Growth of *Sceloporus* Lizards

VANESSA S. QUINN
Department of Life Science, Indiana State University
Terre Haute, Indiana 47809, USA
e-mail: lsvquinn@scifac.indstate.edu

MICHELLE KLUKOSKY
Department of Biology, William Patterson University
Wayne, New Jersey 07470, USA

and

DIANA K. HEWS
Department of Life Science, Indiana State University
Terre Haute, Indiana 47809, USA
e-mail: lshews@scifac.indstate.edu

The most appropriate and useful techniques for marking free-ranging individuals are those that are long-lasting relative to the duration of the study and have little effect on survival or growth (Jones and Ferguson 1980). Recently, Boone and Larue (1999) reported that side-blotched lizards (*Uta stansburiana*) experienced a dose-related decline in survivorship due to xylene-based paint. Because we use paint marking in our research on lizards, we were concerned whether these results applied to other species.

We repeated aspects of the Boone-Larue experiment using two species of *Sceloporus* but modified several aspects of the protocol. We conducted our experiment during the reproductive season (late May to late June) of these species. We also used a less frequent handling and marking regime (described below). Finally, we measured survivorship of the two species, but each species was marked with a different type of paint. *Sceloporus virgatus* was marked with xylene-based paint, and *S. undulatus consobrinus* was marked with latex-based paint.

Xylene-based paint experiment.—We noosed 23 lizards (11 females, snout-vent length, SVL 40–53 mm; 12 males SVL 44–57 mm) from the Chiricahua Mountains, near the Southwestern Research Station of the American Museum of Natural History, (Portal, Arizona, USA), on 17–21 May 1999. Lizards were housed in the laboratory for two days prior to marking to ensure that no animals died after capture. On the third day, the SVL of each individual was measured to the nearest mm with a transparent ruler, and the mass of each lizard was measured to the nearest gram with a Pesola spring scale. Like Boone and Larue (1999), we used adult animals spanning a range of body sizes. Thus, if there were any dose-related responses, smaller individuals should have been the first to be affected.

We painted six males and six females with a 2 x 12 mm line of green Faber Casteel™ xylene-based paint on the dorsum. We handled the other 11 lizards (six males and five females) in a similar manner and we applied a stripe of water to the dorsum as a control. All *S. virgatus* were maintained in a single large outdoor enclosure (3 x 6 m), until 18 June 1999 and then moved (coinciding with a day seven measurement; see below) to another outdoor enclosure (2 x 1 m). While in both enclosures, lizards were provided with refugia (rocks piles and leaf litter), crickets, and water ad libitum. We re-captured all lizards weekly for four weeks to measure SVL and to check if paint needed to be re-applied.

Four *S. virgatus* (three males and one female) died during the xylene experiment, including one painted male lizard (47 mm) and three control lizards (43, 47, and 50 mm). There was no difference in survivorship between painted and control lizards (χ^2 = 1.011, df = 1, $P > 0.05$). The mean SVL of lizards that died (46 mm) and that survived (50 mm) also did not differ ($t = 0.111$, df = 21, $P > 0.05$). Among the surviving painted and control lizards, growth ($t = 0.486$, df = 21, $P > 0.05$) and mass ($t = 0.759$, df = 21, $P > 0.05$) also did not differ. Except for two individuals, the paint remained on the dorsum of lizards for the four-week study. Paint was re-applied to two individuals, one at the first week and the other at the fourth week. Boone and Larue (1999) reported that application of paint appeared to cause discomfort (i.e., gaping and dorsal-ventral flattening). We did not observe any behavioral differences after applying the xylene-based paint.

Latex-based paint experiment.—For the latex-based paint study we captured 9 males (SVL 52–65 mm) adjacent to the Cave Creek Wash, east of the Foothills Road, in Portal, Arizona, on 7–17 June, 1999. Lizards were housed in aquaria for two weeks prior to marking. We painted all lizards with two abdominal patches (1 x 4 cm) of "blue" or "snow white" latex paint (Tulip Pearl Fabric Paint, Tulip, Clovis, California, USA), and one dot (ca. 1 cm diam) of "snow white" paint on the head or the base of the tail of each male. The males were used in a behavioral study lasting approximately 24 h, and maintained individually in terraria for four weeks.

While in the terraria, lizards were provided with crickets and water ad libitum, and dirt substrate with pieces of bark for perches. No lizards died and the paint remained on the both the dorsal and ventral surfaces of all lizards during the four-week period. Thus, this latex paint when applied over a relatively large proportion of the ventral surface (ca. 80%) had no measurable effect on survivorship of captive male *S. undulatus consobrinus*. Furthermore, the latex paint persisted for at least four weeks on lizards housed with soil and tree bark substrata, which approximated the natural substrates of this species.

Our data show that both xylene- and latex-based paints show no measurable effects on survivorship in two species of *Sceloporus* lizards over the four-week time span of this study. This duration of paint application is within the range of time we use paint marking in our research. In addition, both types of paint remained visible on the dorsum of both species for at least four weeks.

Several important differences may explain why we found no effect of xylene-based paints on survivorship and growth while the earlier study did. *Uta stansburiana* may be more sensitive to xylene than *S. virgatus*. Both studies used a relatively wide range of body size and thus differences in our results are not likely to be attributable to differences in the body size of these two species. Our study was conducted early in the active season, while the *U. stansburiana* study was conducted in October, later in the active season for many species of lizards. In addition, *U. stansburiana* were re-painted up to four times over a two-week period, whereas we painted almost all of our lizards only once (two of 25 required a second application of xylene paint). Frequent markings may have increased exposure to xylene or other toxic substances in the paint beyond some threshold for *U. stansburiana*. Furthermore, we handled lizards once per week for four weeks, whereas *U. stansburiana* were handled at least four times over two weeks. Frequent handling can elevate plasma corticosterone levels in lizards (Abell and Hews 1999; Moore et al. 1991). Thus, differences in handling regimes and stress responses to handling may have contributed to differences in the survivorship of *S. virgatus* and *U. stansburiana*. In summary, the single application of xylene-based paint used in our study had no measurable effect on survivorship over four weeks. However, if experiments require animals to be marked multiple times over a short period, a non-xylene-based paint may be more appropriate. In addition, a latex-based paint may be more desirable because it may be more environmentally friendly than a xylene-based paint.

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Keeping the Frogs Still: Orajel® is a Safe Anesthetic in Amphibian Photography

HINRICH KAISER
Department of Biology, La Sierra University, Riverside, California 92515-8247, USA
e-mail: hkaiser@lasierra.edu

and

DAVID M. GREEN
Redpath Museum and Department of Biology, McGill University, Montréal, Québec H3A 2K6, Canada
e-mail: david.m.green@mcgill.ca

The use of the teething ointment Orajel® has been described twice in herpetological publications (Altig 1980; Chen and Combs 1999). In both of these papers, the authors extol the virtue of Orajel® in providing a humane method of terminal anesthesia for amphibians or even small reptiles. We here describe the utility of Orajel® and Anbesol® in aiding photographers with the challenge of maintaining their photographic subject in a stable position.

Orajel® and Anbesol® are over-the-counter medications that alleviate pain in teething infants or during other mouth- and tooth-related ailments. Both exist as infant and adult versions that differ in the concentration of the active ingredients. Both are available in the United States with benzocaine at concentrations of 7.5% and 20%. The small tubes of Orajel® and Anbesol® (gel content 7.08 g) are easily transported and, as Altig (1980) noted, do not require special permits for international or even national travel, unlike many other anesthetics commonly used by herpetologists and which are listed as controlled substances (e.g., nembutol). Small amounts of Orajel® applied to the head (Altig 1980), the venter, or both (Chen and Combs 1999) have been effective in killing both salamanders and frogs conveniently. Oral application of these products in amphibians may accelerate the anesthesia.

During work on the small Caribbean frogs in the genus *Eleutherodactylus* (Leptodactylidae), we grappled with the problem of photographing specimens in the field as well as in the lab. In the field, the obvious challenge was to keep a frog still in its natural habitat or in a natural setup. In the lab, the challenge was not to lose an escapee behind laboratory benches and equipment while attempting photography in a controlled environment. Both of these challenges were easily alleviated on these small (30–40 mm SVL) frogs by using pinhead-size dollops of Orajel® and the following approach.

Frogs were captured and interned in a small plastic container. After the photo shoot was set up, a frog was removed from the container, and the Orajel® applied to its head by gently distributing the gel in the interocular area. Timing is critical at this point,

especially if the frog is to remain alive. After application of the gel, the frog was placed on the substrate and was encouraged to "take the last step," to position itself naturally. Within 30–60 s of gel application, frogs remained still for photo shoots limited to 2 min. Immediately after the photo shoot, frogs were rinsed gently with water from a spray bottle, and any remaining gel was removed from the head by gentle rubbing. Frogs were allowed to recover on dripping wet paper towels in plastic containers. Full recovery of sometimes motionless individuals occurred invariably within 15 min. This technique was used successfully with frogs in the genera *Bufo, Colostethus, Eleutherodactylus, Flectonotus, Hyla, Leptodactylus, Physalaemus*, and *Scinax*. The largest of these was an adult female *Leptodactylus fallax* (SVL 220 mm), which required two applications, whereas the smallest was an adult male *Eleutherodactylus pinchoni* (SVL 18 mm). It should be noted that our work was carried out on a limited, albeit large, sample of primarily neotropical frogs. No fatalities occurred in our trials, but we cannot overemphasize that the possiblity of an overdose always exists.

Photographers often rinse amphibians to ensure the proper moisture and the appropriate light reflection on the animal. Application of the gel in a thin layer does not provide a distraction to the light, but blends in well. We have occasionally observed some slight skin discolorations after gel applications, and this is undoubtedly due to the release of skin products. However, this seems to be an individual response rather than a species-level response, and our technique has been tested on a large number of frogs. One concern with photography is the stress caused by handling animals frequently in an attempt to position them as desired. Though lacking empirical data, we believe that our technique may reduce handling stress because handling is minimized and the frog is in an anesthetic daze during the photo shoot.

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Ornate Chorus Frog. *Pseudacris ornata*. Illustration by Michael Frick.

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A New Technique for Observing Redback Salamanders, *Plethodon cinereus*, in the Absence of Visual Stimuli

JOHN S. PLACYK JR.*
and
BRENT M. GRAVES
Department of Biology, Northern Michigan University
Marquette, Michigan 49855, USA
e-mail (JSP): jplacyk@utk.edu
e-mail (BMG): bgraves@nmu.edu

**Author to whom correspondence should be addressed. Present address: Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, 569 Dabney Hall, Knoxville, Tennessee 37996-1610, USA*

Salamanders of the family Plethodontidae are found in late-successional deciduous forests of northeastern North America. One representative of the family, *Plethodon cinereus* (the redback salamander), ranges from Ontario and Newfoundland in the north, to Indiana and North Carolina in the south (Petranka 1998). Redback salamanders are found commonly under logs, leaf litter, and rocks (Harding 1997) in habitats that remain moist (Jaeger 1971). *Plethodon cinereus* is believed to be most active at night, and during or directly after rainfall (David and Jaeger 1981). Under the dense canopy of late-successional hardwood forests, night-time light intensities, primarily produced by the moon, obscure or eliminate visual cues. Therefore, the study of the behavior of *Plethodon cinereus* would be facilitated if procedures were developed in which visual observation by human experimenters was possible, but salamanders with intact visual systems could not detect visual cues. This would occur under lighting conditions in which the specific wavelengths provided were detectable by humans, but not by redback salamanders. We hypothesized that black light might provide such wavelengths, and this experiment was conducted to verify that visual stimuli are not detected by *P. cinereus* under black light. The absence of this ability would allow the simulation of "night-time" conditions in future experiments.

Forty redback salamanders were collected from a late successional hardwood forest near the town of Big Bay, Powell Township, Marquette County, Michigan. Upon collection, specimens were placed individually in jars and were transported to laboratory facilities at Northern Michigan University. Salamanders were housed individually in petri dishes lined with damp filter paper and were stored in a controlled temperature chamber at 18 ± 0.5°C with a Light:Dark cycle of 12:12 (Jaeger and Gergits 1979). Salamanders were fed *Drosophila melanogaster* to satiation twice per week. Subjects were maintained under these conditions for a minimum of one week before experimental trials were conducted.

The 40 salamanders were assigned randomly to two groups of 20 for testing, either under fluorescent light (wavelength range of 400–700 nm) or black light (wavelength range of 4-400 nm). Lights were suspended approximately 70 cm above the test arena. Test specimens were placed into the test arena (i.e., a 30 x 24 x 9 cm plastic box) and permitted to acclimate under a petri dish for 1 min, after which the petri dish was removed and the subject was observed for 2 min. A visual stimulus in the form of a black fish-

ing lure hooked to a clear fishing line was bobbed approximately 4 cm in front of each specimen every 30 sec for a total of four times. The experimenter was concealed behind a blind to prevent any additional visual cues. The visual stimulus produced no auditory or chemical cues that could be detected by the observer. Test arenas were moistened with distilled water and washed with a clinical detergent powder (Alconox) after each trial to prevent deposition of chemical cues by subjects.

We predicted that redback salamanders would respond to the visual stimulus under fluorescent light but would show no change in behavior after exposure to the visual stimulus under black light. This would indicate an inability to detect visual cues in the latter condition. Behaviors monitored included changes in direction of movement, stops in movement, looking towards or up at the visual stimulus, and no response. A change in direction occurred when a test subject would alter its original course in response to the visual stimulus. When a salamander would cease movement upon encountering the visual stimulus, the behavior was recorded as a stop in movement. If a test subject lifted or turned its head in the direction of the visual stimulus, the behavior was recorded as looking. If a salamander did not deviate from the behavior it was exhibiting before the introduction of the visual stimulus, the behavior was recorded as no response.

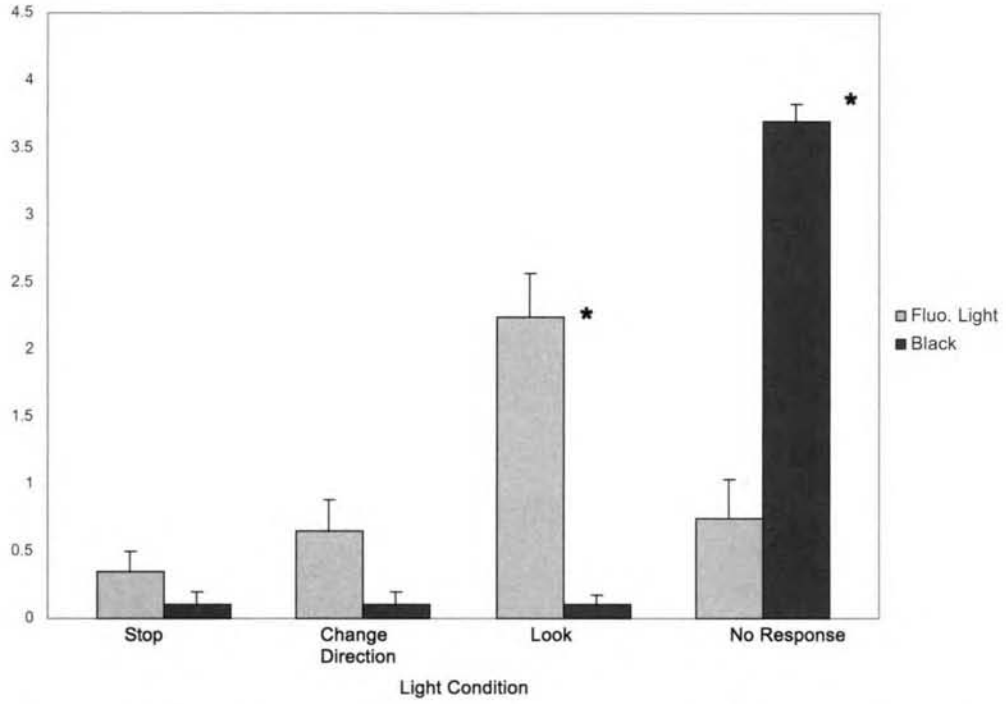


FIG. 1. The mean ± SE number of responses to visual stimulus under fluorescent and black light by *Plethodon cinereus*. An asterisk (*) indicates a significant difference of $P < 0.05$.

Data were not normally distributed. Therefore, responses under the two light conditions were compared using Mann-Whitney Rank Sum Tests (Sokal and Rohlf 1995). Figure 1 shows the mean number of responses ± standard error (SE) for stopping, changes in direction, looking, and no response under fluorescent light and black light. The frequency of stopping ($T = 448.5$; $P = 0.300$) and direction change ($T = 464$; $P = 0.146$) were not significantly different between conditions. Subjects under fluorescent light looked significantly more than salamanders tested under black light ($T = 573$; $P < 0.001$). Salamanders tested under black light exhibited no response to the visual stimulus significantly more often than animals tested under fluorescent light ($T = 235.5$; $P < 0.001$).

This experiment showed that redback salamanders responded to visual stimuli under broad spectrum fluorescent light significantly more than to the same visual stimulus under black light. Under fluorescent light, test subjects looked in the direction of the visual stimulus. Under black light, salamanders continued behaving as before, and appeared oblivious to the visual stimulus. Fifteen of 20 salamanders tested under black light never responded to the visual stimulus during their trials. In comparison, only two out of 20 salamanders tested under fluorescent light did not respond to the visual stimulus ($\chi^2 = 17.28$; $P < 0.001$). Of the five animals that did respond under black light, four of them responded only once out of the four times the visual stimulus was introduced into their test chamber. The stimulus used may have created a breeze as it was swung past the salamanders, which may have elicited a response. These observations and empirical evidence suggest that redback salamanders are unable to detect visual stimuli under black light. This method for eliminating visual cues can be used to simulate "night-time" conditions in the laboratory while allowing observation by experimenters.

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Using a Water Bath to Rear Eggs of the Marbled Salamander, *Ambystoma opacum*

SCOTT D. SMYERS*
and
MICHAEL J. RUBBO
Department of Biology, University of Louisiana at Lafayette
Lafayette, Louisiana 70504-2451, USA

**Corresponding author. Present address: Oxbow Associates, Inc., P.O. Box 971, Acton, Massachusetts 01720, USA; e-mail: smyers@oxbowassociates.com*

Pond-breeding amphibians are commonly used as study organisms in many developmental, behavioral, and ecological studies. Techniques for rearing the eggs of salamanders with complex life-cycles have been described previously (Houck et al. 1985; Vess and Harris 1997). Bernardo and Arnold (1999) described using a device, originally developed for salmonid eggs, to rear eggs of a stream-side salamander, *Desmognathus ocoee*. This device (egg washer) was characterized as a series of interchangeable plastic trays with removable screened lids in which water was pumped up through each tray and continuously circulated through the system. Bernardo and Arnold (1999) tested the egg washer over two seasons with a hatching success of 35.2% for the first and 54.2% for the second season. The use of a mass rearing apparatus for eggs of amphibians can be advantageous for several reasons including low maintenance, application to large numbers of eggs in a homogenous environment, and reduced handling of eggs (Bernardo and Arnold 1999).

We developed a mass rearing technique for the eggs of the marbled salamander, *Ambystoma opacum* (Ambystomatidae). Female *A. opacum* deposit their eggs under cover objects (e.g., logs and rocks) in dry basins of ephemeral ponds. Embryos develop to the hatching stage (stage 46: Harrison 1969) in 9–15 days, but they may remain within the eggs for up to 3–4 months before hatching (Petranka and Petranka 1981). Petranka et al. (1982) demonstrated that the physiological trigger for hatching in embryos of *A. opacum* is oxygen deprivation across the egg membrane. Thus, in natural conditions, hatching occurs when the eggs are inundated as the pond fills. We tested three hypotheses: 1) a well-aerated aquatic environment will not initiate hatching of eggs of *A. opacum*, 2) successful hatching of *A. opacum* embryos is equal in both Petri dishes and a well aerated aquatic environment, and 3) temperature manipulation can be used to control the rate of development.

Our rearing system (see Fig. 1) was comprised of a glass tank (25 x 50 x 30 cm) containing 22 cm of dechlorinated water. A section of tubing was attached to each rear corner of the tank and air stones were fitted to the lower end of each tube 5 cm from the bottom. Separate pumps provided air to each tube. An underwater pump and filter unit (Model 26199, Whisper, Blacksburg, Virginia, USA) was placed on the bottom of the tank in the center, which provided charcoal and particulate filtration. We placed the filter into a plastic container filled with gravel to keep the filter from floating to the surface. A third air pump was used to supply air to the filter.

Eggs from seven clutches (N = 422 eggs) were collected from an ephemeral pond in Evangeline Parish, Louisiana, USA from 25 November–8 December 1999. Because of the weather conditions and migration patterns observed during this season in and around the ephemeral pool, we believe that the clutches we collected were deposited no more than 48 h prior to our collection, thus we believe these clutches were approximately in the same stage of development. We mixed the eggs together to remove any clutch affect from the experiment and randomly (i.e., haphazardly) assigned eggs to each treatment. Eggs were introduced into the tank apparatus (i.e., egg bath) in hinged-lid polyethylene vials (22 x 32 mm; Ward's, Rochester, New York, USA). Prior to placing the eggs into the cylinders, we drilled 10 1-mm holes in both ends and 40 1-mm holes evenly spaced along the edges so that water could flow through the cylinder. We placed 10 eggs in each cylinder and introduced 10 cylinders into the egg bath. When we placed the cylinders into the water, they filled with water but remained floating so that a portion of each cylinder was at the surface of the water. The bubbles from the aeration did not cause enough disturbance to move the cylinders and they remained relatively stationary once placed into the egg bath. We set up two egg baths (100 eggs each), each in a separate environmental chamber (Model 3740, Forma Scientific, Inc., Marietta, Ohio, USA). We maintained one chamber at 11°C and the other at 16°C. We periodically observed each bath and added water as needed to maintain a constant volume. We removed from the cylinders newly-hatched larvae and determined stage of development (Harrison 1969) using a dissecting microscope. Features could be identified without sacrificing the larvae.

Additionally, we evaluated survival and hatching success of eggs reared under normal atmospheric conditions. We placed 10 eggs, each from the same mixed collection as used in the egg bath treatment, into a Petri dish (14.5 x 2.5 cm: N = 20) with a damp filter paper substrate. We rotated and misted the eggs every three days and changed the filter paper periodically. We placed one set of 10 Petri dishes, each with 10 eggs, in the 11°C chamber and the other set of 10 in the 16°C chamber. We monitored the Petri dishes on the same schedule as the egg baths.

We maintained the egg baths and Petri dishes from 8 December 1999–16 March 2000. On 16 March 2000 (Day 99) we removed the eggs from the environmental chambers and placed eggs from each replicate (i.e., cylinder or dish) into separate containers filled with water from the egg bath. We then monitored the number of individuals that hatched in each treatment and removed any visibly dead embryos or hatched individuals. We placed the eggs in the egg bath water, thus allowing the temperature of the water to slowly increase to 23°C, minimizing the stress of changing the temperature on the embryos as well as allowing for the decrease in dissolved oxygen to occur gradually.

We determined that a well-aerated aquatic environment did not initiate hatching of eggs of *A. opacum*. We conducted a two-way ANOVA (PROC GLM; SAS Institute, 1994) with $\alpha = 0.05$, to evaluate the differences in hatching success between Petri dishes and cylinders in each environmental chamber. The results of the ANOVA indicated that there was not a significant interaction effect between temperature and condition ($F_{1, 36} = 0.75$, $P = 0.3911$) on egg survival to hatching. Furthermore, when the interaction

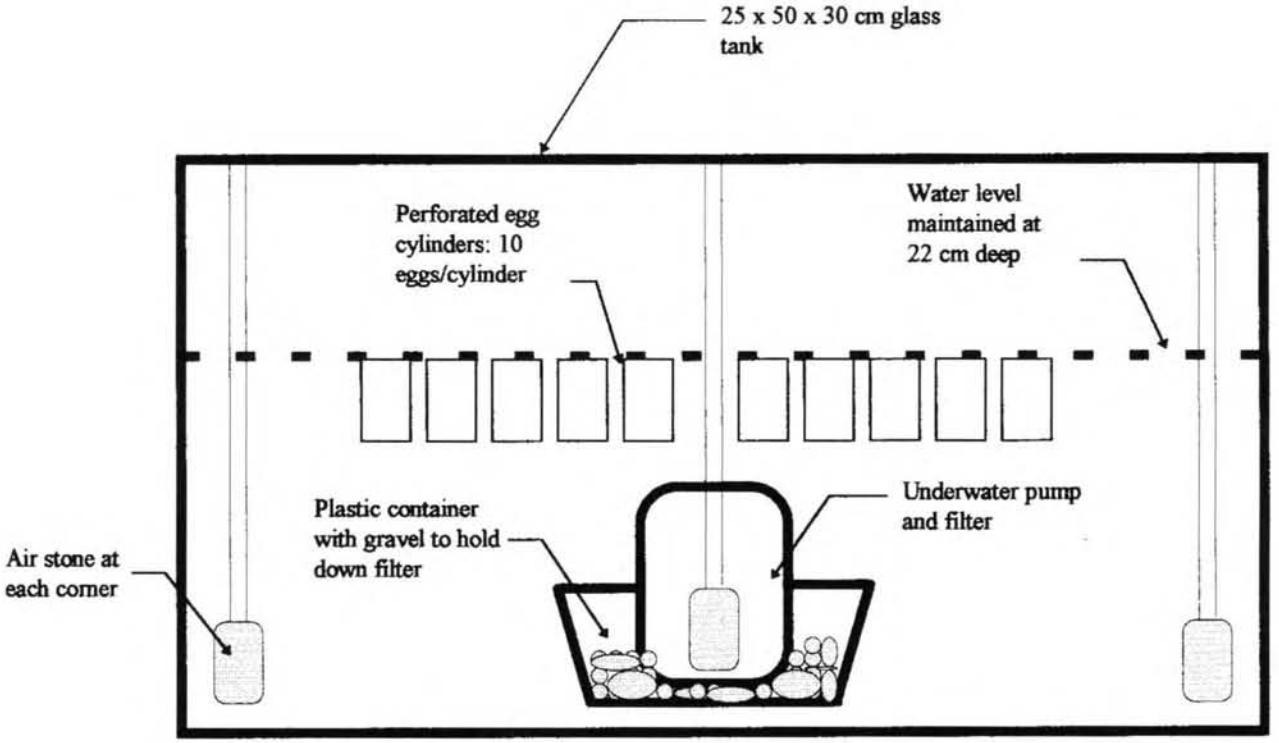


FIG. 1. Schematic diagram of water bath used for rearing eggs of *Ambystoma opacum*.

was removed from the model, temperature did not have a significant effect on egg survival to hatching ($F_{1,37} = 0.76$, $P = 0.3894$). However, environmental condition had a significant effect on egg survival to hatching (mean ± 1 SE; egg bath = 8.5 ± 0.34 larvae per cylinder; Petri dishes = 6.6 ± 0.79 larvae per cylinder) ($F_{1,37} = 5.13$, $P = 0.0295$).

Eggs did hatch prematurely in the egg bath (11 in the 11°C bath and 33 in the 16°C bath). The aqueous environment provided in the bath allowed for survival of larvae until our next observation when we removed any larvae that had hatched. Conversely, prematurely hatching larvae in the Petri dishes (5 in the 11°C chamber and 4 in the 16°C chamber) did not survive. Larvae that hatched before induced hatching in the 16°C egg bath ranged from stage 43 to 46. One individual hatched at stage 43, 25 individuals hatched at stage 45, and 7 individuals hatched at stage 46. Larvae that hatched before induction in the 11°C egg bath ranged from stage 40 to 45, with five individuals at stage 40, two individuals at stage 42, and four individuals at stage 45. Although these data are qualitative, there appears to be a trend in that the stage of development in embryos reared in cooler conditions is earlier than those raised at higher temperatures. We suggest that fewer eggs would have hatched prematurely in the egg baths if our laboratory had not experienced an unexpected power failure on 10 January 2000 (Day 33). Aeration was not operating for approximately 5 h. During that 5 h period, 19 larvae hatched from the 16°C egg bath and 7 larvae hatched from the 11°C egg bath. We returned the eggs to egg baths when the power was turned back on.

The results of this experiment support our prediction that eggs of *Ambystoma opacum* can be reared underwater in well-aerated conditions. We found that embryonic survival in the egg bath was significantly different (higher) than eggs reared on damp filter paper. We also report that embryos reared at 11°C appeared to develop slower than those incubated at 16°C.

We believe this technique could be an inexpensive (approx. US $30 per egg bath) and valuable method for the mass rearing of amphibian eggs for research in developmental biology, for investigations of delayed hatching mechanisms in eggs of amphibians (sensu Martin 1999), and in community ecology experiments using larval amphibians as study organisms where it is important to control the homogeneity and timing of hatching of eggs.

Acknowledgments.—We thank R. Jaeger, V. Townsend, Jr., and J. Marshall for reviewing earlier drafts of this manuscript. Eggs were collected under permit LNHP-99-020 provided by the Louisiana Department of Wildlife and Fisheries. This work was partially supported by funds from the Graduate Student Organization at The University of Louisiana at Lafayette.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 32, Number 1 (March 2001). Submissions should be directed to one of the section editors (contact information located on inside front cover of this issue), as follows: amphibians (Painter); lizards, amphisbaenians, crocodilians, *Sphenodon* (Hauge); snakes and turtles (Butterfield).

CAUDATA

AMBYSTOMA MACULATUM (Spotted salamander). **REPRODUCTION**. Egg masses of spotted salamanders (*Ambystoma maculatum*) can either be clear, white, or intermediate in color depending on the presence of proteins in the outer jelly layers (Hardy and Lucas 1991. Comp. Biochem. Physiol. 100A:653–660; Ruth et al. 1993. J. Herpetol. 27:306–314). Ruth et al. (*op. cit.*) found no adaptive advantage of white versus clear masses, whereas Brodman (1995. J. Herpetol. 29:111–113) found that white masses contained more eggs on average than clear masses. Often the outer jelly membrane surrounding the eggs of *A. maculatum* is colonized by a symbiotic, unicellular green alga (*Oophila amblystomatis)* that increases oxygen supply to the developing embryos (Gilbert 1942. Ecology 23:215–227; Gilbert 1944. Ecology 25:366–369; Gatz 1973. J. Herpetol. 7:137–138; Bachman et al. 1986. Can. J. Zool. 64:1586–1588; Pinder and Friet 1994. J. Exp. Biol. 197:17–30).

Five clear and five white *A. maculatum* egg masses were collected at random on 9 March 2000 from a small seasonal wetland located on the Pine Ridge Country Club in Edgefield County, South Carolina, USA. Color of each mass and eggs was recorded (Table 1). When possible, the number of eggs per mass was counted (Table 1); however counting the number of eggs of larger masses was not possible without destroying the mass. Egg masses were kept in separate containers with fresh water. Within four days after collection some embryos began to hatch. The number of hatchlings from each mass was recorded (Table 1), dead larvae or eggs that were clearly not viable were discarded, and live hatchlings were released.

This study corroborates Brodman's (*op. cit.*) finding that white masses contained more eggs than clear ones. However, in contrast to Ruth et al. (*op. cit.*), this study found that clear egg masses had significantly better success than white masses ($p = 0.04$). Ninety-six larvae hatched from clear masses (mean = 19.2), and 29 larvae hatched from white masses (mean = 5.8).

TABLE 1. Color and number of eggs in *Ambystoma maculatum* egg masses and the number of eggs that hatched from each mass.

Mass No.	Color	No. of eggs	No. hatched
1	clear w/green eggs	31	21
2	clear w/green eggs	19	6
3	white/green	>50	0
4	white/green	>50	4
5	white/green	>50	0
6	clear	22	20
7	white	>50	8
8	clear w/green eggs	>50	9
9	white w/green eggs	>50	17
10	clear	>50	40

Seven egg masses (1–5, 8, and 9) that were colonized by *O. amblystomatis* had little to no success. Only 57 (mean = 8.1, min = 0, max = 21) eggs hatched from these seven masses. Sixty-eight larvae hatched from three masses (6, 7, and 10) that were not colonized by *O. amblystomatis* (mean = 22.6, min = 8, max = 40). Significantly more embryos hatched from the non-colonized masses than from the algae-colonized masses ($p = 0.04$).

Three of the masses (3, 4, and 5) appeared to be completely covered with algae, and only four larvae hatched from these three masses. Possibly the algae could have been one or more species other than *O. amblystomatis* that were detrimental to the development of the embryos. Four masses (1, 2, 8, and 9) that contained colonies of *O. amblystomatis* around individual eggs, but not completely encasing the mass, produced 53 larvae.

One conclusion from this study is that differential success of *A. maculatum* egg masses can be variable among locations and is probably dependent on a suite of environmental conditions that were not measured in any of the studies.

Submitted by **BRIAN METTS**, Savannah River Ecology Lab, Aiken, South Carolina 29801, USA; e-mail: metts@srel.edu

EURYCEA CIRRIGERA (Southern Two-lined Salamander). **LARVAL HABITAT**. Larval two-lined salamanders typically inhabit lotic environments (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press. Washington, D.C. 587 pp.). Larval *Eurycea bislineata* from New York (Bahret 1996. J. Herpetol. 30:399–401) and larval *E. wilderae* from North Carolina (Bruce 1982. Copeia 1982:117–127), however, have been reported from lentic environments. We found larval *E. cirrigera* inhabiting a small farm pond (surface area 177 m^2, max. depth 1.5 m) 2.5 km NNW of Hinton, West Virginia, USA, at 812 m elevation. The pond was located in mesic woods and supported populations of several amphibian species. This note represents the first report of larval *E. cirrigera* inhabiting a lentic environment and the first to provide size at metamorphosis from West Virginia.

Snout-vent lengths (SVL) of larvae were measured to the nearest 0.1 mm and are reported here as means ± 1 SD (range): 11 August 1994 (N = 103) 12.35 ± 1.93 mm (9.8–20.0 mm); 30 October 1994 (N = 51) 20.01 ± 1.61 mm (17.0–23.7 mm); 17 January 1995 (N = 85) 20.05 ± 1.72 mm (16.4–26.0 mm); 19 March 1995 (N = 51) 20.95 ± 2.16 mm (17.6–27.4 mm). Average growth rate for this 220-day period was 0.039 mm/day, however larvae grew very little during the winter months.

Sixty *E. cirrigera* metamorphs were collected in pitfall traps on the banks of the pond between 20 July and 3 August 1993. These recently transformed juveniles were apparently leaving the aquatic environment to inhabit the surrounding forest. Metamorphs measured (SVL) 22.31 ± 1.94 mm (18.3–27.0 mm).

Over 15,000 man-made farm ponds exist in West Virginia (Core 1966. Vegetation of West Virginia. McClain Printing Co. Parsons, West Virginia. 217 pp.), many of which play important roles in the ecology of aquatic and semi-aquatic amphibians (Lively and Bayless 1972. Proc. West Virginia Acad. Sci. 44:89–92). Our observations suggest that farm ponds may play a more important role in the ecology of *E. cirrigera* than previously recognized.

We thank Michele L. Brophy, Peter A. Kramer, and James W. Barron for their assistance in the field and laboratory, and Joseph C. Mitchell for reviewing the manuscript. Voucher specimens were deposited in the West Virginia Biological Survey collection at Marshall University (WVBS 6902–6906). Specimens were collected under WVDNR permit numbers 33-1993, 19-1994, and 52-1995.

Submitted by **TIMOTHY R. BROPHY*** and **THOMAS K. PAULEY**, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755-2510, USA. *Present address: Department of Biology, George Mason University, Fairfax, Virginia 22030-4444, USA.

SALAMANDRINA TERDIGITATA (Spectacled Salamander). **TERRESTRIAL OVIPOSITION.** During research for the Atlas projects of amphibians and reptiles of Latium (Bologna et al. 2000. Anfibi e rettili del Lazio. Palombi, Roma. 159 pp.) and Rome (Bologna et al., *in prep.*), data on *Salamandrina terdigitata* were collected at several localities which included the first record from the urban area of Rome.

The spectacled salamander is protected by national and European laws. It appears to be widespread in the Apennines, especially near Latium where more than 100 localities have been reported. The species occurs at middle elevations (200–1300 m) along river and stream valleys in mesic or submesic forests. A few populations have been reported as low as 20–80 m, three of these near Rome, and another near Tarquinia (Viterbo province).

A population of *S. terdigitata* was reported from the Insugherata Regional Natural Reserve in the NW part of Rome. This population is located in an isolated chestnut woodland of *Castanea sativa* and *Ostrya carpinifolia* at ca. 80 m elev. along a perennial stream. The species was first reported from this site by local people in 1983, its presence was confirmed in November 1997, and the population has been under study since 1999.

On 6 and 10 April 1999 we observed two individuals lay eggs on the ground under a stone 30 m from the water. These clutches of two and three eggs were observed for 15 days until they were attacked by fungus. After that they were transferred to the laboratory and placed in fresh water although none of the eggs hatched.

Salamandrina terdigitata usually spawns in the water, sticking the eggs to the substrate, and the development includes aquatic larvae. This is similar to other genera in the family Salamandridae (Duellman and Trueb 1986. Biology of Amphibians. McGraw Hill, New York. 670 pp.). Eggs are normally laid from March to May, although the reproductive period may extend from late December into early June. At Insugherata, 121 egg clutches have been observed between 2 March and 8 May. All have been deposited in a sandy stream with sparse vegetation. Eggs were deposited under stones, on the sides of stones, or under submerged branches. Hatchings have been observed between 8 April and 30 May and larvae metamorphosed between 15 June and 25 July.

Oviposition on the ground or direct development of young is common in Plethodontidae or in salamandrids of the genus *Salamandra* (*lanzai*, *atra*, *luschani*, and some mountain populations of *salamandra* and *caucasica*). Although it is unknown if hatching and metamorphosis would have been successful, this is the first report of terrestrial oviposition in *S. terdigitata*.

We thank Paolo Macedone for information on the 1983 record, Marzio Zapparoli for the 1997 record and help with field work, Francesca Della Rocca for the research collaboration, and Alberto Venchi for suggestions. We also thank the RomaNatura Board, which administers the Insugherata Regional Park, for permission to conduct research at that site.

Submitted by **LEONARDO VIGNOLI** and **MARCO A. BOLOGNA,** Dipartimento di Biologia, Università degli Studi "Roma Tre", viale Marconi, 446, 00146 Roma, Italy (e-mail: bologna@bio.uniroma3.it).

SIREN INTERMEDIA NETTINGI (Western Lesser Siren). **PREDATION.** Predators of *Siren intermedia* are poorly documented (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press. Washington, D.C. 587 pp.). The following observations from Mingo National Wildlife Refuge, Stoddard Co., Missouri, USA, represent the first documentation of a mink and great egret preying upon *S. intermedia*.

On 21 February 1999 at 1400 h, we observed a mink (*Mustela vison*) on a clump of vegetation in a large pool consuming a *S. intermedia*. After we watched the mink eat for ca. three minutes, the mink placed the uneaten portion of the siren beside it and curled up, presumably to rest. We then disturbed the mink and retrieved the remainder of the still-moving, uneaten siren. The uneaten portion consisted of the posterior end of the animal extending to just anterior of the vent (113 mm and 27 g). Based upon measurements of other individuals, the estimated size of this siren was >300 mm TL and >80 g. The uneaten portion of the siren was catalogued as University of Missouri-Columbia (UMC) 6844.

On 16 April 1999 at 1430 h we observed a great egret (*Casmerodius albus*) eating a lesser siren ca 170–200 mm TL. The egret seemed to have difficulty handling the siren because it was squirming, but eventually swallowed it whole. The event lasted less than one minute. We observed another great egret consuming a lesser siren on 17 April at ca. 1700 h. This siren was larger (ca. 280–320 mm TL) than the one eaten on the previous day. Perhaps due to the increased size of the siren, the egret seemed to have a more difficult time swallowing it. The egret eventually swallowed the siren whole, but it took ca. 3 minutes to consume the animal.

We thank R. F. Wilkinson and A. Mathis for reviewing this manuscript.

Submitted by **PAUL W. FRESE**, Department of Biology, Southwest Missouri State University, 901 South National, Springfield, Missouri 65804, USA (e-mail: pwf035s@mail.smsu.edu) and **ERIC BRITZKE**, Tennessee Technological University, Department of Biology, Cookeville, Tennessee 38505, USA.

ANURA

ACRIS CREPITANS (Northern Cricket Frog). **ATTEMPTED CANNIBALISM.** Cannibalism is an important strategy for resource allocation in any population. Cannibalism in *Acris* can reduce an individual's inclusive fitness through kin selection (Polis. 1981. Ann. Rev. Ecol. Syst.), and reduce individual survivorship

via accumulated toxins and parasites (Pfennig et al. 1991. Oecologia 88:161–166). On 17 July 2000 at 1500 h while on Janes Creek in the vicinity of Ravenden Springs, Randolph County, Arkansas, USA, a large (28.2 mm SVL) adult *A. crepitans* was observed during an attack on a newly metamorphosed (12.4 mm SVL) *A. crepitans*. The juvenile jumped to escape capture, but landed immediately in front of an adult. The adult alertly lifted its body off the ground and flicked its tongue at the juvenile. The adult grabbed the tibio-tarsal portion of the juvenile's left rear leg and proceeded to swallow the juvenile. At this point the juvenile placed the plantar area of its right rear foot on the nose of the adult. The prey then pulled the left leg out of the adult's mouth by straightening the right leg. Immediately upon escaping the grasp of the adult, the juvenile rapidly jumped away. Because juvenile *A. crepitans* emerge in huge numbers (as many as three frogs per 0.3 square meter at this location), it is possible that predation by metamorphic frogs significantly reduces populations of small insect prey utilized by all age classes. In this way, the costs of cannibalism depicted above would be out-weighed by reduced food supply causing adult animals to occasionally prey upon juveniles. The life span of *A. crepitans* is about a year (Gray 1971. Ph.D. dissertation, Illinois State Univ.), and adult populations are quite small during juvenile emergence from streams (*pers. obs.*) suggesting that selective pressure on adults to avoid cannibalism may not be severe. The small numbers of adults compared to metamorphs, combined with this species' high activity levels and erratic jumping patterns may explain why cannibalism has not been previously observed. Whether the juvenile actually forced itself from the adult's grasp, or if the adult let it go, could not be determined. Both specimens are deposited in the Arkansas State University Herpetology Museum (ASUMZ 24724, 24716).

Submitted by **MALCOLM L. McCALLUM** (e-mail: mmccallu@navajo.astate.edu) and **BENJAMIN A. WHEELER** (e-mail: bwheeler@navajo.astate.edu), Environmental Sciences Ph.D. Program, P.O. Box 847, State University, Arkansas 72467, USA, and **STANLEY E. TRAUTH** (e-mail: strauth@navajo.astate.edu), Department of Biological Sciences, P.O. Box 599, Arkansas State University, State University, Arkansas 72467, USA.

ASCAPHUS TRUEI (Tailed Frog). **PREDATION.** Predators of *A. truei* are not well known. Jones and Raphael (1998. Herpetol. Rev. 29:39) reported predation of a metamorphosing *A. truei* by a hellgrammite (Megaloptera), and in a separate observation, a Cope's giant salamander (*Dicamptodon copei*) preying on a metamorphic *A. truei*. Leonard et al. (1993. Amphibians of Washington and Oregon, Seattle Audubon Society, Seattle, Washington. 166 pp.) noted that tailed frog larvae are an important prey species for Pacific giant (*Dicamptodon tenebrosus*) and Cope's giant salamanders.

The observation reported herein was made in a managed forest at McDonald Creek (T10N, R1E, Sec. 5, NE1/4, NW1/4, SE1/4) in Humboldt County, California, USA. McDonald Creek is a NW-facing, second-order, fish-bearing stream. The stream at that location was 1.7 m wide, and 0.2 m deep at thalweg. The air temperature was14.6°C at 1400 h and the stream temperature was 13.7° C at 1415 h. At 1347 h on 23 June 1997, I observed a common garter snake (*Thamnophis sirtalis*) with an *A. truei* in its mouth. The snake was on a log on a gravel bank, 0.5 m from the edge of the creek. The frog was being swallowed headfirst and approximately half of its body was in the snake's mouth. The snake became aware of my presence, dropped the frog, and retreated into the vegetation. The *A. truei* landed on its back and made no attempt to escape. An opaque mucous covered the frog, but the animal was still alive. The frog was an adult male 36 mm SVL. I rinsed the frog and saw no evidence of injury. I released it on the bank, and it escaped into the stream.

All age classes of *A. truei* have been found in McDonald Creek during electrofishing surveys and time-constrained searches for amphibians. *Dicamptodon tenebrosus* larvae and paedomorphs have been detected in the mainstem and *Rhyacotriton variegatus* larvae and adults have been found in the headwaters of McDonald Creek and its tributaries. *Thamnophis sirtalis* have been documented (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest, University of Idaho Press. 332 pp.) feeding on several species of frogs and salamanders, but I found no reports of the species as a predator of *A. truei*.

I thank Hartwell Welsh and Lisa Ollivier for helpful comments on this note.

Submitted by **NANCY E. KARRAKER**, USDA Forest Service, Pacific Southwest Research Station, 1700 Bayview Drive, Arcata, California 95521, USA; e-mail: nkarraker@fs.fed.us.

BUFO BUFO (European Common Toad). **RED ANT PREDATION**. The common toad, *Bufo bufo*, occupies a variety of habitats and is one of the most widely distributed and common amphibians of the Paleartic region (Borkin and Veith 1997. *In*: Atlas of Amphibians and Reptiles in Europe, pp. 118–119. Paris, Societas Europaea Herpetologica and Muséum National d'Histoire Naturelle [IEGP/SPN]). Anuran amphibians are important components of the diet of vertebrates and invertebrates (e.g., Dolce 1983. Atti Mus. civ. Stor. nat. Trieste 35: 313–328; Gleed-Owen 1996. Brit. Herpetol. Soc. Bull. 57: 21–23; Kehr and Schnack 1991. Alytes 9:61–69; Zahn 1997. Salamandra 33:89–91).

Herein I report multiple cases of predation by *Formica rufa* (Insecta: Hymenoptera: Formicidae) on newly metamorphosed common toads (*Bufo bufo*) in a mountain lake of the northeastern Alps. The study area is Lago di Tovel, 1178 m elev., within the Adamello-Brenta Natural Park, Trento province, northeastern Italy. Observations were carried out during 8–9 Aug 1997, from 1030 to 1645 h and from 1115 to 1550 h, with no wind and a clear sky. During this time, hundreds of *Bufo bufo* tadpoles and toadlets lived in the shallow waters and around the lake borders. Most of the tadpoles were nearing metamorphosis and several toadlets were moving around the lake margin and along the forest edge.

Along a transect ca. 50 m long I counted 37 *Bufo bufo* toadlets attacked by one or two *Formica rufa*. In 33 of 37 cases, the ants had attacked the hindlimbs; in the other four instances the ants were at the flanks of the toadlets. All *Bufo bufo* were still alive. In most cases (29 of 37) the ants were within 30–45 cm of a nest opening, so it is likely that the attack occurred a few minutes prior to my observation. The defensive reaction of a toadlet to an ant bite included: 1) an immediate push-back movement of the hind-leg that temporarily stopped the ant attack, and 2) a twisting of the

body to avoid the ant bite again. The ant then successfully repeated the attack and carried the toadlet to the nest opening.

Franco Andreone (Regional Museum Natural History, Turin) and Kurt Grossenbacher (Naturhistorishes Museum, Bern) kindly commented upon a draft version of the manuscript. This short note is dedicated to my young sons Silvia and Claudio, ages 7 and 3.5 yrs, who reported this observation to me.

Submitted by **MARCO A. L. ZUFFI**, Museo di Storia Naturale e del Territorio, Università di Pisa, via Roma 79, 56011 Calci (Pisa)-Italy; e-mail: marcoz@museo.unipi.it.

BUFO CANORUS (Yosemite Toad). **LARVAL CANNIBALISM.** On July 1999, I observed *Bufo canorus* tadpoles eating a conspecific in Inyo National Forest, Mono County, California USA. In a small, shallow pool of water in the meadow along the west edge of Cloverdale Lake (37°33'N, 118°53'W; 3150 m elev.) two tadpoles were consuming a dead conspecific tadpole of the same size. I could not determine if the tadpole was dead prior to cannibalism, or if it was killed by the conspecific tadpoles and then consumed. The dead tadpole showed no signs of decay. Cannibalism occurs among anurans (Crump 1983. Amer. Nat. 281–287) but this is the first report of conspecific predation by *B. canorus* tadpoles.

Submitted by **LAUREN M. CHAN**, Department of Ecology and Evolutionary Biology, Corson Hall, Cornell University, Ithaca, New York, 14850 USA; e-mail: lmc36@cornell.edu.

BUFO PARACNEMIS (NCN). **FEEDING BEHAVIOR.** On 13 April 1998 at 1915 h in the state of Goiás on the upper Tocantins River, Brazil, I observed gorging behavior in which *Bufo paracnemis* (7.76 cm SVL) consumed leaf-cutter ants (*Atta* sp.). The toad approached a line of ants that had used the same path every night for no fewer than 9 nights, traveling from their nest to a tree ca. 50 m away. The toad positioned itself ca. 15 cm from the line of ants and sat motionless for 10 min. An ant strayed from the main line, 5 cm from the toad, and was consumed, eliciting a strong feeding response in the toad. It proceeded to push itself up as high as its front arms would allow and peer at the main line of ants. It then returned to a normal resting position with most of its ventral surface in contact with the ground and oriented toward other stray ants. The toad never moved its position; it only changed its orientation occasionally to redirect its head toward a stray ant. During the next 3.2 h, the toad consumed 113 ants. On seven occasions, the first tongue strike failed to gather the ant and a second tongue strike was required. The last ant was consumed at 2251 h. Occasionally the largest of the worker ants approached the toad and actually climbed onto it. The ants appeared unable to recognize the toad as a threat and crawled off. Several of these walked in front of the toad while leaving and were eaten. On two occasions, ants carrying leaf material were consumed along with their vegetative cargo.

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Submitted by **DANTÉ FENOLIO**, Department of Zoology, University of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73019, USA.

BUFO VALLICEPS (Gulf Coast Toad). **DIET**. Campbell and Davis (1968. Herpetologica 24:327–328) studied the stomach contents of 21 adult *Bufo valliceps* and found the bulk of the food items were coleopterans and isopods. There are few other data published on the diet of this toad. Here we report additions to the diet of *B. valliceps*.

We examined the stomach contents of 36 *B. valliceps* (21 females, 13 males, and 2 juveniles) from Cedar Hill State Park, Dallas Co., Texas, USA. All were collected on park roads between 2030 and 2200 h from 19 May to 3 August 1999. The habitat at the study site is Tall Grass Prairie in middle stages of secondary succession with isolated patches of hackberry, *Celtis laevigata*, and mesquite, *Prosopis glandulosa*. Specimens were stomach flushed (Legler and Sullivan 1979. Herpetologica 35:107–110), and stomach contents were identified to Order. Table 1 summarizes these data.

TABLE 1. Prey consumed by *Bufo valliceps* (N = 36) from Cedar Hill State Park, Dallas County, Texas.

Items	N	% Total	Frequency
ARACHNIDA			
Araneae	4	2.27	4
Opiliones	1	0.57	1
Scorpionida	35	19.89	2
INSECTA			
Blattaria	2	1.14	1
Coleoptera	15	8.52	5
Diptera	1	0.57	1
Hymenoptera	6	3.41	4
Lepidoptera	2	1.14	2
Orthropoda	4	2.27	2
OTHER INVERT.			
Isopoda	103	58.52	18
Diplopoda	1	0.57	1
Totals	176	100	36

A Simpson's diversity index was calculated for the stomach contents of each toad. Although it was expected that females (due to their larger size) would display a higher average diversity of prey items than males, a comparison of the indices revealed no significant difference between the sexes (independent t-test: $t = 0.057$; $p = 0.615$; $df = 32$; ns). The mean diversity of prey items for females was 0.323, and for males 0.248. No correlation could be established between diversity of stomach contents and body weight.

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Submitted by **ROBERT T. McGEHEE**, Biology Department, University of Dallas, Irving, Texas 75062, USA, **RICHARD REAMS**, Dallas Zoo Department of Herpetology, Dallas, Texas 75203, USA, and **MARGARET E. BROWN**, Biology Department, University of Dallas, Irving, Texas 75062, USA.

CERATOPHRYS CRANWELLI (Cranwell's Horned Frog). **PREDATION**. Frogs of the leptodactylid subfamily Ceratophyinae (*Ceratophrys*, *Lepidobatrachus*, *Chacophrys*) are renowned for their aggressive predatory feeding behaviors. Whereas many different vertebrates have been cited as prey (e.g., young chickens by *C. ornata* and toads by *L. asper* [Budgett 1899. Q. J. Microsc. Sci. 42:75–77]; adult frogs by *C. cornuta* (Duellman 1978. Misc. Pub. Mus. Nat. Hist. Univ. Kansas No. 65]), most of these reports are anecdotal and descend from a few original observations in nature. Only recently have more rigorous reports of predation in nature begun to surface (e.g., frogs, reptiles, and mice by *C. cornuta* [Duellman and Lizana 1994. Herpetologica 50:51–64]; frogs by *Chacophrys pierotti* [Pueta and Perotti 1999. 5th CLAH 12–17 Dec 1999]).

Herein I report a natural instance of predation by *Ceratophrys cranwelli* on two other species of anurans. At 2130 h on 30 December 1999, an amplectant pair of *C. cranwelli* (UWSP 3595–96) were collected from an open, manmade lagoon within the city limits of Filadelfia, Departamento Boqueron, Paraguay (22°20.766'S, 60°01.760'W; 190 m). The two frogs were kept overnight in a plastic bag with water. At 1100 h the following morning eggs were found with the frogs. The frogs were then removed to a cloth bag. At 1900 h the following day two partially digested anurans were discovered in the bag. The remains were of a *Dermatonotus muelleri* and a *Physalaemus biligonigerus* (both specimens UWSP 3647). Both were extensively digested anteriorly, but decreasingly so posteriorly indicating anterior-first digestion and perhaps consumption. Identification of *D. muelleri* was possible by the remaining skin and skull, whereas that of *P. biligonigerus* was possible by the presence of keratinized spades on the hind feet, round black spots over the inguinal regions, and markings on the hind limbs. It is unknown if the two dead frogs came from the male (UWSP 3595), the female (UWSP 3596), or both. However, the breeding pair exhibited marked sexual dimorphism (UWSP 3595: SVL = 70.8 mm, Jaw Width = 43.5 mm; UWSP 3596: SVL = 93.0 mm, JW = 56.5 mm) and so it seems more likely that the two frogs came from the female. Comparison of interorbital diameter of the regurgitated specimen of *D. muelleri* (as it was one of the only remaining measurable features) of 5.2 mm, to that of two other specimens collected from Filadelfia (UWSP 3636: IOD = 4.9 mm, SVL = 56.5 mm; UWSP 3637: IOD 5.8 mm, SVL = 54.4 mm) suggests that it was an adult *D. muelleri*, likely >50 mm in length. The two specimens of *C. cranwelli* remain alive in the anuran research colony of the Department of Biology, University of Wisconsin-Stevens Point. Other specimens mentioned, including the regurgitated frogs, are deposited in the Division of Herpetology, Museum of Natural History, University of Wisconsin-Stevens Point, as will be the specimens of *C. cranwelli* upon their death.

Submitted by **ERIK R. WILD**, Department of Biology and Division of Herpetology, Museum of Natural History, University of Wisconsin-Stevens Point, Stevens Point, Wisconsin 54481-3897, USA (e-mail: ewild@uwsp.edu).

HYLA RANICEPS (NCN). **COMBAT**. *Hyla raniceps* has a wide distribution in Argentina, Bolivia, Brazil, French Guiana, and Paraguay (Frost 1985. Amphibian Species of the World. Allen Press, Inc. and Assoc. Systematics Collections. Lawrence, Kansas. v + 732 pp.). Despite this, ecological data for this species are scarce (Lutz 1973. Brazilian Species of *Hyla*. Univ. Texas Press, Austin & London, 260 pp.). Herein we describe agonistic interactions among males of *Hyla raniceps* in a flooded area at the Lagoa Grande farm, 30 km from the municipality of Pontalina (17°31'23"S, 49°26'49"W; 642 m), State of Goiás, Central Brazil.

The observations took place during the nights of 7 Dec 1999 and 13 Jan 2000. On 7 Dec, we observed a male (A) *Hyla raniceps* begin to pursue another male (B) that was ca. 10 cm from A's perch on a bush. When A made physical contact with B, it jumped on B's back, grasped it in an axillary position, and tried to move it off the perch. Male B tried to escape from this embrace by kicking male A with it's hind legs. Both males began kicking each other as they vocalized (encounter call). The combat bout lasted for 20 seconds. After their separation, male (A) began to emit the advertisement call, and B was silent with it's vocal sac inflated. Later, it moved 8 m from the combat site.

On 13 Jan after the above observation, we introduced three males into the territory of a male calling (resident 1) from a bush. The resident male alternated between advertisement calls and territorial calls, moving towards the closest male invader. Soon after, it jumped on the back of the invader kicking it with it's hind legs, and trying unsuccessfully to push it off the branch. The combat lasted for 15 seconds. Another invader at a lower position began to pursue the resident male, jumping on him and managing to push him down into the water. The introduced male assumed the position of holder of the territory (now resident 2), emitting the advertisement call. This interaction lasted for 45 minutes. The experiment continued with the introduction of a new male at the site. This male settled down on a parallel branch, the same height as resident 2. Resident 2 emitted some isolated notes for ca 5 minutes, while the other male remained silent. After this period, resident 2 emitted the advertisement call. After 20 minutes in silence, the introduced male jumped into the water, climbed the bush, and remained silent for more than an hour, apparently adopting a satellite behavior.

In conclusion, the male-male combat in *Hyla raniceps* involved: 1) harassment, 2) embraces and kicks with the hind legs, and 3) possible adoption of a satellite behavior. The results show that combat among males for territory dispute exists in the mating system of *Hyla raniceps*, something that has not reported in this species (Lutz 1973, *op. cit.*.).

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Submitted by **LORENA DALL'ARA GUIMARÃES**, **RAFAEL de FREITAS JULIANO**, and **ROGÉRIO PEREIRA**

BASTOS, Depto. de Biologia Geral - ICB- UFG, Campus II, Caixa Postal 131, 74001-970, Goiânia, Goiás, Brazil; e-mail (LDG): dallara@icb1.ufg.br.

LIMNONECTES MALESIANUS (Malesian Frog). **ECTOPARASITE**: *Limnonectes malesianus* is a moderate-sized (70–150 mm SVL) forest-dependant ranid frog, known from Borneo, Peninsular Malaysia, and Singapore (Inger and Tan 1996. Raffles Bull. Zool. 44[2]:551–574). During an amphibian survey on the night of 29 July 2000, at the Nee Soon Swamp Forest, Central Catchment Nature Reserve, Singapore, a pair of adult *L. malesianus* was observed in axillary amplexus at 2130 h. The male (125 mm SVL) was light brown, while the female (105 mm SVL) was reddish brown. Both were in the middle of a shallow (2.5 cm depth) stream. Water was slowly moving over sandy substrate with scattered detritus. At the moment of encounter, the male was observed to be releasing sperm accompanied with writhing movements of the vent. A number of unpigmented ova (ca. 30, 1.5 mm diameter) had already been deposited in loose clusters posterior to the amplectant pair. The pair was photographed and left undisturbed, but re-visited again an hour later, still at the same locality. This time, a pair of swamp leeches (*Hirudinaria* sp.) was observed swimming towards the amplexing *L. malesianus* with undulations of their dorso-ventrally compressed bodies. Both leeches attached themselves to the region of the left femur of the female frog. After five minutes, one leech was removed and collected, during which the amplexing pair separated. After half an hour, the remaining leech was also removed and collected. Both leeches are deposited at the Raffles Museum of Biodiversity Research Zoological Reference Collection (ZRC 2000.2501, 2502; relaxed lengths 71.5 and 67 mm). During preservation, viscous blood was regurgitated from the anterior sucker by ZRC 2000.2502, which was attached to the host for half an hour, while no blood meal was noticeable from ZRC 2000.2501, which was detached from host after only five minutes. This is a first account of leeches functioning as ectoparasites of this anuran species.

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260; e-mail: scip0132@nus.edu.sg.

PHYLLOMEDUSA DISTINCTA (Leaf Frog). **TADPOLE PREDATION**. Field observations of predation on tadpoles are rare (Bolitho and Retallick 1996. Herpetol. Rev. 27:140–141). Among vertebrates, the predation exerted by fishes is important and well documented (e.g., Katz et al. 1988. Ecology 69:1865–1870). The importance of predation by other vertebrate predators remains little known, although kingfishers and turtles are potentially significant predators (Bolitho and Retallick, *op. cit.*; Heyer and Muedeking 1976. Washington Acad. Sci. 66:235–239).

Between February 1990 and September 1991 during monthly four-day trips, I made observations of tadpole predation by two previously unreported avian predators. These observations were made at a pond ca. 20 x 7 m at the Atlantic Forest Reserve of the Parque Estadual de Carlos Botelho (24°12'S, 47°55'W, 60 m elev.) Sete Barras, São Paulo, southeastern Brazil.

The green kingfisher, *Chloroceryle americana*, and the great kiskadee, *Pitangus sulphuratus*, were observed to feed on the tadpoles of *Phyllomedusa distincta*. The green kingfisher was observed to concentrate its foraging efforts on these tadpoles for long periods of time and was successful at capturing large numbers of tadpoles. Predation by the great kiskadee on tadpoles of other species has been documented previously (Crump and Vaira 1991. Herpetologica 47:316–321; Vaira and Coria 1994. Herpetol. Rev. 25:118).

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Submitted by **LUCIANO MENDES CASTANHO**, Departamento de Zoologia, UNESP, Caixa Postal 199, CEP 13506-900, Rio Claro, SP, Brazil.

RANA CURTIPES (Bicolored Frog). **DEATH FEIGNING**. Death feigning is reported in hylid frogs (Sazima 1974. J. Herpetol. 8:376–378), and in some bufonids (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill, New York. 670 pp.); Zamprogno et al. 1998. Herpetol. Rev. 29:96–97). However, this behavior is unreported for ranids. Herein, we report death feigning behavior in *Rana curtipes* from the western Ghats region in Karnataka, India (15°4'N, 74°33'E).

During May 1998 in western Ghats, we observed hundreds of newly metamorphosed *R. curtipes* (31–42 mm SVL, 1.4–5.5 g) on the bank of a stream. When the froglets were held in hand for observation, they exhibited a peculiar posture. They turned with their belly upwards, folded their limbs close to their body, and remained motionless. They remained in this position from 30 sec to 12 min, after which they tried to flee and often urinated. The frequency of this behavior was reduced with the growth of the froglets (47–50 mm SVL) and was rarely seen in laboratory-reared individuals 3–4 months after metamorphosis (58–60 mm SVL). This behavior has not been reported in the juvenile congeners *R. tigrina*, *R. cyanophlyctis*, *R. temporalis*, or in *Bufo melanostictus*.

Submitted by **N. P. GRAMAPUROHIT**, **B. A. SHANBHAG***, and **S. K. SAIDAPUR**, Department of Zoology, Karnatak University, Dharwad – 580 003 Karnataka, India. *Corresponding author; e-mail unikard@ren.nic.in.

TESTUDINES

KINOSTERNON SUBRUBRUM (Eastern Mud Turtle). **EARLY NESTING**. At 1130 h EDT 15 April 2000, a female *Kinosternon subrubrum* (carapace length, 110 mm) was found at the Mason Neck National Wildlife Refuge, Fairfax Co., Virginia, USA with its body elevated at an angle ca. 45° to the soil surface. We first thought the turtle was emerging from a hibernaculum; *K. s. subrubrum* commonly hibernates underground at Mason Neck, and normally emerges during April (Ernst et al. 1997. Bull. Maryland Herpetol. Soc. 33:1–62). The turtle's shell was clean with no soil adhering to it, as is normal when first emerging from

hibernation; but when the female was picked up, it was apparent that she was excavating a nest cavity with her hindlimbs, not emerging from a hibernaculum. The site was located in full sunlight near the edge of an old field ca. 1.8 m from open, mixed, hardwood-pine woods. The grass litter had been scraped clear, and the flask-shaped cavity had a ca. 10 mm deep x 15 mm wide neck leading to a larger ca. 20 mm deep x 25 mm wide chamber. The female was palped, but no oviductal eggs were detected. Mud turtles normally nest at Mason Neck from 29 May to 22 June (Gotte 1988. Master's thesis. George Mason Univ., Fairfaix. 135 pp.). Richmond (1945. Copeia 1945:217–219) reported nesting on 31 March in southern Virginia, but nesting in April must be considered rare farther north. Normally, female *K. subrubrum* undergo secondary vitellogenesis in March and April before preparing their follicles for ovulation in May and June (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C.).

Submitted by **CARL H. ERNST**, **TERRY R. CREQUE**, and **KERRY A. HANSKNECHT**, Department of Biology, George Mason University, Fairfax, Virginia 22030-4444, USA (e-mail: CErnst@gmu.edu).

LEPIDOCHELYS OLIVACEA (Olive Ridley Sea Turtle) **PREDATION**. Endangered *Lepidochelys olivacea*, *Chelonia mydas agassizi*, and *Dermochelys coriacea* nest on Playa Naranjo, Santa Rosa National Park, Costa Rica (10°45'N, 85°40'W). During our daily and nocturnal investigation of marine turtle activity on the beach between October 1998 and March 1999, we encountered 16 dead adult female *L. olivacea* killed by coyotes in October (3), November (4), December (0), January (5), and February (4). It was evident that the dead turtles had not merely washed up onto the beach and been scavenged by the coyotes because the turtles were attacked mid-crawl prior to or after completion of the nesting process. Injuries inflicted by the coyotes ranged from the removal of large portions of tissue from the neck area to complete disembowelment. We encountered four additional dead *L. olivacea* adults on the beach during our investigation, which we did not attribute to coyote predation, because the turtles showed no obvious external injuries. Coyotes are a well-known and common predator of olive ridley nests at this site, consuming 74% (159 of 215) of the *in situ L. olivacea* nests recorded during our study. However, Cornelius and Robinson encountered no signs of predation on adult *L. olivacea* by coyotes during their studies in 1971–2 and 1983–4 (S. Cornelius, pers. comm.). It appears that only within the past 15 years have coyotes at Playa Naranjo learned to consume adult *L. olivacea* coming ashore to nest.

Submitted by **DANA L. DRAKE**, Department of Bioscience, Drexel University, Philadelphia, Pennsylvania 19104, USA, **MEGHAN A. HAGERTY**, Department of Interior, Washington, DC 20240, USA, **JOCELYN E. BEHM** and **SETH J. GOLDENBURG**, School of Environmental Science, Engineering and Policy, Drexel University, Philadelphia, Pennsylvania 19104, USA.

LACERTILIA

LEIOCEPHALUS CARINATUS VIRESCENS (Exuma Islands Curlytail Lizard). **INTERSPECIFIC AGGRESSION**. Despite its conspicuous nature and widespread occurrence throughout the Exuma Island chain, Bahamas, very little is known about the ecology and behavior of *Leiocephalus carinatus virescens*. Generally, adult male *Leiocephalus* are known to be highly territorial and often react aggressively toward conspecifics (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies. Univ. Florida Press, Gainesville, Florida. 720 pp.). Herein I report an incident of aggressive behavior by an adult male *Leiocephalus* toward an avian species.

On 6 March 1998 at 1100 h, I witnessed two separate acts of aggression between an adult male *L. c. virescens* (ca. 9 cm snout-vent-length) and two Bahamas mockingbirds (*Mimus gundlachii*). The observations occurred on Alligator Cay, Exuma Cays Land and Sea Park, Bahamas (24°23'N, 76°38'W), in shallow dry leaf litter under a sparse, 3 m canopy of narrow-leaf blolly (*Guapira discolor*). The aggressive episodes occurred in the territory of a male *L. c. virescens* and involved the resident, two adult male conspecific intruders, and two Bahamas mockingbirds (ca. 22 cm total length). I observed all aggressive behaviors from a distance of 4 m and my presence appeared to have no effect on the animals involved. The first encounter was between an equal-sized male conspecific that entered the territory of the resident male and approached to within 1 m. The intrusion initiated stereotypical bobbing displays and symmetrical tail coiling (Evans 1953. Copeia 1953:50–54) from the resident male towards the intruder. With tails curled, both males oscillated between bobbing and remaining stationary for ca. 20 seconds, after which the resident male charged the intruder, causing it to flee from the territory and across the leaf litter. Immediately following this incident, a Bahamas mockingbird, perhaps attracted by the commotion, approached the resident lizard from the ground. The presence of the bird caused the resident curlytail to coil its tail but not to perform bobbing displays. When the mockingbird approached to within 1 m of the resident, the curlytail charged the bird causing it to hop away. After ca. 30 seconds, a second, but smaller, adult male *L. c. virescens* entered the same territory and approached the resident curlytail to within 0.7 m. Again, the behavior of these two curlytails oscillated between bobbing and stationary displays while both tails remained curled. Within 30 seconds, the resident charged this second intruder causing it to flee. Immediately following the incident, a second mockingbird was attracted to the commotion and approached the resident curlytail from the ground. Similar to the first encounter, the resident remained motionless with a curled tail until the mockingbird approached to within 0.8 m. Without displaying, the curlytail charged and lunged with an open mouth at the mockingbird, causing it to fly away in retreat.

The frequency of interactions between curlytails and mockingbirds is unknown. It may be that the succession of interactions with other male lizards led to unusually high hormone levels in the focal lizard, and that high hormone levels prompted an unusual aggressive response toward the mockingbirds. Alternatively, aggression between curlytails and mockingbirds may be a routine feature of the natural history of both species.

Submitted by **CHARLES KNAPP**, Department of Conservation, John G. Shedd Aquarium, Chicago, Illinois 60605, USA, and Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA; e-mail: cknapp@ufl.edu.

SERPENTES

ELAPHE PORPHYRACEA LATICINCTA (Malayan Red Mountain Racer). **DIET**. *Elaphe porphyracea laticincta* (*sensu* Schulz and Helfenberger 1998. Sauria 20[1]:25-45) is a subspecies found in the montane regions of Peninsular Malaysia and Sumatra. This species has been known to prey on small mammals such as mice and shrews (David and Vogel 1996. The Snakes of Sumatra – An Annotated Checklist and Key with Natural History Notes. Edition Chimaira, Frankfurt am Maim. 260 pp.). On 25 June 2000 in Cameron Highlands, Pahang, Peninsular Malaysia, a recently road-killed adult specimen was found by one of us (AHBL). It was found amidst tea plantations (elevation 1600 m) on the lower slopes of Gunong Brinchang. It still retained a deep brick-red color. The stomach contents were partially extruded, revealing a partially digested small mammal. Other than fur, mandibular bones, and skeletal parts of a forelimb, only the posterior half of the mammal remained. Upon closer inspection, the prey was identified to be a short-tailed mole (*Talpa micrura*), based on the presence of its characteristic enlarged fore-limb/digging claws. This is the first account of *E. p. laticincta* preying on *T. micrura*. Both specimens are deposited at the Raffles Museum of Biodiversity Research Zoological Reference Collection (*E. p. laticincta*: ZRC.2.4777, SVL 776 mm, tail 114 mm; *T. micrura*: ZRC.4.8102, hind foot 15.8 mm, tail 4.4 mm).

Submitted by **TZI MING LEONG** (e-mail: scip0132@nus.edu.sg), **IMANYUSFIANDI BIN YAT** (e-mail: sci70311@nus.edu.sg) and **ADRIAN H. B. LOO** (e-mail: scip7181@nus.edu.sg), Department of Biological Sciences, National University of Singapore, Singapore 119260.

ELAPHE VULPINA (Fox Snake). **WINTER ACTIVITY and NATURAL DISTURBANCE DURING HIBERNATION**. Winter surface activity at low temperatures by snakes that are normally in hibernation in higher temperate latitudes is rare, and the cause of such unusual behavior is often difficult to discern (see Brown and Brown. 1995. Herpetol. Rev. 26:134–135). This account reports an instance of such activity and a likely reason for it.

On 18 February 2000 one of us (DJB) observed a fox snake active on fresh snow in subfreezing temperatures during the worst snowstorm of the winter in northwestern Illinois. The snake (INHS 15631) was an adult female (735 mm body length, 828 mm total length, 194 g live mass) and was collected on a gravel road at 1515 h at the following locality: USA: Illinois, Mercer Co., Greene Twp., ca. 4 km (linear) NE Viola, 3 km E of Rt. 67 on rural road 1150 N, 41°13'54"N, 90°33'18"W, elevation 240 m. The roadsides consisted of mowed grass sloping to a pasture on the south and unmowed grass sloping upward and bordering a weedy, "set-aside" field on the north.

When discovered during conditions of heavy, drifting snow, the snake was orientated longitudinally in the center of the road on the surface of 18–20 cm of fresh snow and was in a weak, nearly linear, serpentine shape. There was a shallow trail ca. 20 cm long in the snow behind it. The snake was observed for 5 min. and during this time, it moved very lethargically and slowly (ca. 1 cm/min), and appeared disorientated. It also appeared to be searching for a scent, as its tongue flicks were frequent (unmeasured) but very slow, each lasting 4–5 sec. When picked up by hand, it slowly opened its mouth and moved very little. The temperature range that day at the National Weather Service station in Moline, Illinois, ca. 25 km NE of the locality, was –4.4°C to –0.5°C, and the mean daily temperature was –2.2°C. The snake was left outside after being collected and died within several hours.

Brown and Brown (*op. cit.*) reported winter activity by an adult *Elaphe vulpina* on 17 February 1991, on an ice pond in McLean Co. in central Illinois at warmer ambient air temperatures (9.4°C). They hypothesized that warm daily temperatures during the preceding period and/or local disturbance at the pond that day may have been responsible for this snake's activity.

The activity of the fox snake reported here did not involve natural emergence related to early, unseasonably high temperatures. In addition to the subfreezing temperatures on 18 February that were subsequently fatal to the snake, the mean daily temperature (–0.9°C) and the means of daily minimum and maximum temperatures (–4.5°C and 2.8°C) at Moline, Illinois during the preceding five-day period were also low. Road activity by fox snakes is seldom observed before mid-April in this region of Illinois, as recorded in an ongoing, long-term survey of snake activity by one of us (ALM). More importantly, there is little correlation between short-term local temperatures on the surface and early emergence from hibernation by snakes (Gibbons and Semlitsch. 1987. *In* Seigel et al. [eds.], Snakes, Ecology and Evolutionary Biology, pp. 396–421. McGraw-Hill, Inc., New York).

Rather than a thermal response, there is evidence that the snake was active on the surface because of a noxious encounter with a small mammal in its hibernaculum. That the snake was underground was evident from traces of mud on several areas of its body, and postmortem examination revealed several small injuries on its head that were likely caused by bites. These injuries bled slightly during examination, indicating that they were relatively fresh. The most conspicuous was a ragged tear (4.5 mm long) of the left parietal scale, extending obliquely from the anterior medial parietal line postero-ventrally to the upper temporal area, where the musculature was lacerated to the depth of the supratemporal bone. Corresponding to this laceration were 3 distinct and one indistinct shallow grooves, ca. 0.4 mm wide and 1.2 mm long, on the dorsal surface of the parietal bone, which was not penetrated or fractured. The left cornea had a small perforation in the lower half; and the left lower postocular, a puncture wound ca. 1.2 mm long and 1 mm deep. In the snout region, the left posterior nasal scale had a laceration causing a detachment of a portion of this scale from the underlying tissue; the lower right portion of the rostral scale had a similar laceration. Linear distance between the parietal-temporal/ocular area wounds was 6.3 mm; and between rostral/nasal wounds, 6.6 mm. In addition, the mouth had traces of blood and soil between the tooth rows, suggesting

that the snake recently opened its mouth underground because snow covered the soil surface.

It is likely that a small mammal, possibly a rodent or shrew, encountered and bit the snake, which caused it to be driven from the hibernaculum to the surface. Snakes are known to move about in their hibernacula at relatively low temperatures and respond to various stimuli during hibernation (see Sexton and Hunt. 1980. Herpetologica 36:20–26). The hibernaculum used by the snake reported here was not obvious from a subsequent search of the roadsides after snowmelt, but *Elaphe vulpina* is known to use mammal burrows among other microhabitats (Ernst and Barbour 1989. Snakes of Eastern North America. George Mason Univ. Press, Fairfax, Virginia. 282 pp.). Ground squirrels (Rodentia: *Spermophilus tridecemlineatus*) and their burrows are common along roadsides in this area, and fox snakes have been previously observed in the vicinity of such burrows in the spring by one of us (ALM) in adjacent Henry Co., Illinois. The wounds and distances between them were consistent with the snake being bitten in two areas of the head, anteriorly (rostral/postnasal wounds) and posteriorly (parietal-temporal/ocular area wounds) by small upper and lower incisor teeth. The tear of the left parietal scale and the corresponding grooves on the bone below suggest that the mammal was trying to pull off some flesh. Also consistent with a prior noxious encounter is that the specimen opened its mouth when picked up by hand, defensive behavior that we and others (Ernst and Barbour, *op.cit.*) have observed as very unusual in most individuals of this species. The pattern of wounds and circumstances in which the snake was discovered were inconsistent with injuries that would result from a human cause; there was no evidence of human activity in the immediate area or of fresh tire tracks in the snow on the road. Also, the weather conditions and the mud on the snake's body and inside its mouth suggest that an encounter with a small mammal on the surface was unlikely.

The wounds probably would not have been fatal to the snake, but the weather conditions were. The frequency and broader ecological implications of encounters between mammals and hibernating snakes are unknown. Using circumstantial evidence near hibernacula in the spring and fall, Fitch (1999. A Kansas Snake Community: Composition and Changes Over 50 Years. Krieger Publ. Co., Malabar, Florida. 165 pp.) hypothesized that predation upon hibernating snakes by small mammals such as mice and shrews may be somewhat common in years of low resource availability and may represent a significant source of mortality in snake populations.

Submitted by **ALLAN L. MARKEZICH** and **DARRYL J. BECKETT**, Department of Natural Sciences, Black Hawk College, 6600 34th Avenue, Moline, Illinois 61265-5899, USA.

EUNECTES MURINUS (Green Anaconda). **ESCAPE BEHAVIOR and RESPIRATION**. Documented information about the escape behavior of *Eunectes murinus* is scarce. Often it is simply mentioned that this species takes to water to escape predators or other dangers, and remains submerged for extended periods of time. Furthermore, to our knowledge, there are no reports of *E. murinus* burrowing into mud to elude predators. However, during dry seasons, individuals of *E. murinus* burrow into mud to avoid desiccation (Lopez 1984. Fauna Legendaria. Editorial Arte, Caracas; Rivas and Muñoz 1992. unpubl. report; Thorbjarnarson 1995. Americas 47:38–45). In addition, there is little substantiated data concerning the length of time *E. murinus* can refrain from breathing, whether it be while feeding underwater (Mole and Urich 1894. Proc. Zool. Soc. Lond. 1894:505–506; Wehekind 1955. Brit. J. Herpetol. 2:9–13) or when submerged to avoid predators. At best, anecdotal generalizations indicate that this species can suspend respiration for relatively long periods of time. Some reptile species can revert to anaerobic metabolism during times of high-energy demands, such as diving by aquatic reptiles (Bennett 1982. *In* C. Gans and F. H. Pough [eds.], Biology of the Reptilia, Vol. 13, Physiology D, pp. 155–199. Academic Press, London, UK; Seymour 1982. *In* C. Gans and F. H. Pough [eds.], Biology of the Reptilia, Vol. 13, Physiology D, pp. 1–51. Academic Press, London, UK); but overall this physiological activity is not thoroughly understood, and we are unaware of it being studied in *E. murinus*. Herein we report a case of an *E. murinus* burrowing into mud to avoid capture, and subsequently refraining from breathing for an extended period of time, possibly aided by anaerobic metabolism.

On 25 January 2000, a group of 18 people assembled at Quito, Ecuador, to be part of an expedition to search for a large *E. murinus* that had reportedly been seen in the Cuyabeno Wildlife Reserve, Sucumbios Province, Ecuador. The Cuyabeno Wildlife Reserve (ca. 600,000 ha) lies in the Amazon Basin at an elevation of less than 300 m, and straddles the equator (extending from ca. 75°–76°W longitude). Within the Reserve is an elaborate network of rivers, lakes, lagoons, and flooded forest that are markedly affected by seasonal rains. For about nine months out of the year the area



FIG. 1. Team members attempting to extricate a female *E. murinus* (TL = 4.76 m) from soft mud into which it was burrowing. (Photo by Jean-Thomas Bujard)

endures a wet season, with a dry season that extends roughly from December through February. Our fieldwork was performed well into the dry season, so the lakes and rivers in the area were essentially at their lowest levels. As a result, some of the areas we worked in were not covered with water but were extremely muddy.

On 27 January 2000, two team members located an adult, female *E. murinus* (TL = 4.76 m) inside a hollowed out, fallen tree in the exposed muddy bed of Laguna Grande. The specimen was located at 1300h during which the air temperature was 34°C, temperature inside the tree was 27°C, and the snake's external body temperature was 29°C. We believe this *E. murinus* took shelter in the log to avoid the high daytime temperatures associated with the dry season and to wait for the lake's water level to rise during the ensuing wet season. Attempts to remove the *E. murinus* from its lair failed, though it did eventually come out on its own and partially buried itself in the mud, under the root system of the upturned tree. Efforts were made to expose and extricate the *E. murinus* by pulling off sections of the tree's root structure. As this occurred, the specimen started to burrow, almost vertically at times, into the soft mud to escape capture (Fig. 1.). We estimate that the anterior portion of this *E. murinus* reached a depth of ca. 60 cm. The more team members worked to uncover this specimen, the more it burrowed into the mud, until eventually ca. 1.5–2.0 m of its body was buried. As we continued to pull pieces of the root system away and dig out some of the mud, it became clear that the *E. murinus* was not able to breathe, as there were no air pockets in the mud. This became particularly evident when we saw water seeping out from the hole where the *E. murinus* had burrowed.

Eventually we retrieved the specimen (Fig. 2), though it took an appreciable amount of time and effort. We estimate that this *E. murinus* suspended respiration for a period of ca. 40–45 min. This is particularly interesting because the specimen was struggling against the efforts of its captors, which we feel would have resulted in an increased metabolic rate and subsequent tissue oxygen demand. Under these conditions, some reptiles are known to resort to anaerobic metabolism (Bennett and Dawson 1976. *In* C. Gans and W. R. Dawson [eds.], Biology of the Reptilia, Vol. 5, Physiology A, pp. 27–223), and it seems probable that *E. murinus* utilized anaerobiosis while it was submerged in the mud. Furthermore, the *E. murinus* was nearly exhausted from its struggle (i.e., the specimen exhibited no aggression or resistance to handling once captured), which has been reported to be a symptom of reptiles that have utilized anaerobic metabolism (Bennett 1982. *In* C. Gans and F. H. Pough [eds.], Biology of the Reptilia, Vol. 13, Physiology D, pp 155–199. Academic Press, London, UK).

Following capture, we allowed the *E. murinus* to rest for a short period, and then various measurements were made and its general health was assessed (e.g., body weight, presence of ectoparasites and injuries, etc.). When data collection was complete, the specimen was released.

Because *E. murinus* is a species highly adapted to a semi-aquatic existence, it is reasonable to conclude that the ability to suspend respiration for extended periods of time or use anaerobic metabolism would give *E. murinus* an advantage in both predatory and threat-avoidance activities. Since the actual anaerobic capacity of large reptiles is not well understood, well-documented field observations can be an important step in the study of this physiological process.



FIG. 2. Female *E. murinus* after being extricated from mud into which it had burrowed. The specimen was exhausted after the struggle and offered no resistance. (Photo by Jean-Thomas Bujard)

We thank the members of the expedition team for their help and support with regard to the capture and study of the specimen. Bill Cacciolfi (New World Expeditions, Springboro, Ohio), Rudolph Runge (RungeTV, Cologne, Germany), Rudolf Bermel (Mediguard, Bonn, Germany) and Continental Airlines are acknowledged for providing financial and/or other support. Thanks to Jane Strimple, Ritt Enderson, Bill Cacciolfi, and Jean-Thomas Bujard for reviewing the manuscript, and to Frederick Frye for his input on reptile metabolism.

Submitted by **PETER D. STRIMPLE**, 1028 Pine Creek Circle NE, Palm Bay, Florida 32905, USA (e-mail: pstrimple@cfl.rr.com, and **LUTZ DIRKSEN**, Museum A. Koenig, Adenauerallee 160, 53113 Bonn, Germany (e-mail: ldirksen@t-online.de).

EUNECTES MURINUS (Green Anaconda). **JUVENILE PREDATION**. Larger-sized reptiles tend to suffer little from predation, whereas juveniles typically are more exposed to predators and suffer higher mortality rates in their first years. This observation is typical among female green anacondas (Rivas 1999. Ph.D. dissertation. Univ. Tennessee, Knoxville, 287 pp.). However, smaller adult males risk predation by spectacled caimans (*Caiman crocodilus*; Rivas et al. 1999. Herpetol. Rev. 30:101) and by larger female anacondas (Rivas and Owens 2000. Herpetol. Rev. 31:45–46). In this contribution we document predation on juveniles of different sizes. These observations were made in the Venezuelan llanos, Distrito Muñoz, Apure State (7°30'N, 69°18'W).

On 25 April 1995 we observed a female anaconda (187 cm TL; 3.25 kg) being harassed by a crab-eating fox (*Cerdocyon thous*). The snake was on dry land and had adopted a defensive position. The fox repeatedly tried to grab it, but jerked back each time as the snake snapped defensively. We interrupted the interaction and caught the snake, which had numerous ticks (evidence of having been on dry land for a while). If we had not interrupted the fox, the snake probably would have been eaten because she may have become exhausted in a short time and, not having any water nearby, was not likely to have escaped.

On 15 January 1996 we saw a tegu lizard (*Tupinambis teguixin*) carrying a neonate-size anaconda in its mouth. The snake did not have any bite marks or external evidence of having been killed by the tegu, so it was not possible for us to assess whether the tegu killed it or had found it dead. However, because tegus are generalist foragers and often forage near the water, they are likely predators of neonates.

We implanted transmitters in four neonate green anacondas to study habitat use on 9 January 1996. Two of them were found dead on 12 February. We found one of the transmitters at the bottom of a tree that held an active nest of crested caracaras (*Polyborus plancus*: Falconidae). The other transmitter was found among some bushes with the antenna chewed up, but with no other hint regarding identity of the predator. The other two animals were alive at the end of the three-month-long follow-up, but no information on their later survival is available.

The animals reported in this contribution as preying on juvenile anacondas are fairly common in the llanos. This suggests that risk of predation may be an important selection pressure leading to fast growth in juveniles.

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Submitted by **JESÚS A. RIVAS, RENÉE Y. OWENS**, Venezuela Nature Tours, 17126 Jamul, California 91935, USA, and **PAUL CALLE,** Wildlife Conservation Society, Wildlife Conservation Park, 2300 Southern Boulevard, Bronx, New York 10460-1099, USA.

MASTICOPHIS FLAGELLUM (Western Coachwhip). **DIET.** *Masticophis flagellum* is known to feed on a large variety of food items including insects, lizards, snakes, small turtles, birds, and small mammals (Guidry 1953. Herpetologica 9:49–56; Hamilton and Pollack 1956. Ecology 37:519–526; Collins 1974. Univ. Kansas Publ. Mus. Natur. Hist. Publ. Ed. Ser. 1:1–283). Here we report two food items found in the stomach of a *M. flagellum*. On 17 April 1999 at 2230 h, an adult male *M. flagellum* (1186 mm total length, 217 g) was found DOR on US 385 twenty-two miles south of Fort Stockton in Pecos Co., Texas, USA. The stomach of the snake was fully distended indicating recently-eaten prey. An adult *Cnemidophorus marmoratus* (289.1 mm total length, 23.7 g) was palped from the snake. A grasshopper (Orthoptera) was also found in the stomach of the snake. To our knowledge, this is the first report of *C. marmoratus* in the diet of *M. flagellum*. All three specimens were preserved and placed at the University of Texas at Arlington Collection of Vertebrates (*M. flagellum* UTA-R46048, *C. marmoratus* UTA-R46049).

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Submitted by **RICHARD D. REAMS** and **BRIAN AUCONE**, Dallas Zoo, Department of Herpetology, Dallas, Texas 75203, USA; e-mail (RDR): Hylareams@aol.com.

NERODIA FASCIATA (Southern Water Snake). **REPRODUCTION.** *Nerodia fasciata* normally reproduces from June through August with a typical litter size ranging from 9 to 50 (Wright and Wright 1957. Handbook of Snakes of the United States. Comstock, Ithaca, New York. 1105 pp.), but averaging near 15 (Tennant 1997. A Field Guide to Snakes of Florida. Gulf Pub. Co., Houston, Texas. 257 pp.). Herein we report on reproduction in two female *N. fasciata* that exhibited a phenology and fecundity consistent with these values.

On 9 July 1998 at 2240 h, an adult female *N. fasciata* (710 mm SVL, 220 mm tail length) was found on a floating mat of vegetation near the bank of an artificial pond at White Oak Plantation, Nassau Co., Florida, USA (Sec. 43, T4N, R26E). The observation occurred following the second major rain event of the summer. The female was placed in a cloth bag, and retained overnight for measurements. The following day, we discovered that the female had expelled 34 neonates into the cloth bag. Thirteen individuals from this litter were found dead and subsequently were deposited in the Florida Museum of Natural History (UF116347–59). SVL for live young (mean ± SD, 163.5 ± 5.1 mm) and dead young (165.0 ± 3.3 mm) did not differ (t-test, $t = 0.93$, $P = 0.36$). Pooled measurements for all offspring were as follows: SVL 164.1 ± 4.5 mm (range 149.0–172.0 mm); tail length 65.4 ± 3.6 mm (59.0–72.0 mm); mass 5.3 ± 0.5 g (4.2–6.1 g). Although the initial mass of the female was not taken, its post-partum weight was 485.0 g. Live neonates and the adult female were later released at the capture location.

On 22 July at 1235 h, a second female was observed expelling offspring onto the muddy substrate along the shoreline of a small pond at White Oak Plantation; a significant rainfall event also occurred prior to this observation. Temperatures recorded at the time of the observation were 28.4°C substrate, 30.6°C water, and 31.3°C air at 2 m in the shade. Although the adult escaped, five neonates were captured for measurements. Measurements of the young were as follows: SVL 168.6 ± 2.7 mm (range 166–173 mm); tail length 59.2 ± 1.5 mm (57–61 mm); mass 4.7 ± 0.2 g (4.5–4.9 g). The captured neonates were released at the capture location except for one, which we deposited in the Florida Museum of Natural History (UF116360).

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Submitted by **CHRISTOPHER O'BRIEN, RICHARD D. OWEN**, and **RICHARD FRANZ**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA; e-mail (CO): mailcob@ufl.edu.

PITUOPHIS MELANOLEUCUS MUGITUS (Florida Pine Snake). **DIGGING BEHAVIOR**. Adult Florida pine snakes (3 males, 3 females) were radio-tracked for periods of 6–26 months in sandhill habitats at the Katharine Ordway Preserve-Swisher Memorial Sanctuary, Putnam County, Florida, USA. During this period, three tagged males (132.5, 139.7, 142.0 cm SVL) were observed on nine occasions in the act of excavating pocket gopher (*Geomys pinetis*) mounds (Fig. 1). None of the tagged females (129.0, 142.8, 144.5 cm SVL) were found pursuing this activity.

Excavating snakes were successful on eight occasions in removing sand plugs placed by pocket gophers in exit burrows inside the mounds. These plugs probably serve to exclude predators and regulate air flow in burrow systems. Opening these plugs allow pine snakes an access point into the burrow system. On one occasion, a snake prematurely left the excavation site prior to clearing the exit plug, as a direct consequence of my presence. On a second occasion, another snake similarly left a mound following disturbance, but later returned after my departure, and finished the excavation. This snake was located the next morning (0530 h) inside the burrow, positioned about 1.5 m from the snake's access hole.

Snakes were encountered in the process of excavating mounds at 0800 (continuing until 0920), 0845, 0900, 0905 (continuing until 1000), 0920, 1045, 1055, 1145, and 1700 h (EST) in June (2), August (2), September (1), October (2), and November (2). Work at two excavations lasted ca. 55 and 80 minutes following the initial discovery. Both snakes completed excavations and entered burrow systems. The length of time required for snakes to complete an excavation is unknown, since most were encountered after they already had begun work.

Types of disturbances at freshly excavated mounds include scrapings 12–18 cm wide, conical depressions that conform to the shape of the snake's face, and impressions of dorsal and ventral scales. The final access hole is about the diameter of the excavating snake. Except for the holes, most of the marks quickly erode as the sand dries, making interpretation more difficult. However, once researchers see enough of these features, they should be able to distinguish them from other disturbances, which might prove useful as a survey technique for this species.

All of the excavating snakes were observed to use the "spading and scooping" actions, reported by Carpenter (1982. J. Herpetol. 16:394–401) for captive Oklahoma-caught bullsnakes. Carpenter found this behavior in adults of both sexes and in a juvenile, suggesting that this behavior might function in obtaining food or digging nests or retreats. He reported that bullsnakes responded positively to soil from pocket gopher mounds. Based on these observations, I suggest that Ordway pine snakes may have been using rodent odors as cues to accurately locate and dig out the mound plugs.



FIG. 1. Florida pine snake excavating a pocket gopher mound.

Pocket gopher tunnel systems commonly are used by Florida pine snakes as retreats, based on available telemetric data from the Ordway Preserve. These tunnel systems presumably provide safe havens from predators, fires, and adverse weather conditions and may serve as a source for food, particularly in light of Allen and Neill's report (1952. Florida Wildlife March:18–19), which states "...in many areas the pine snakes eat nothing but pocket-gophers, and spend most of their lives down the burrows of these rodents." Neill (1947. Herpetologica 4:29–30) also noted finding a large pocket gopher in the stomach of one pine snake and the remains of others in four other snakes.

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Submitted by **RICHARD FRANZ**, Florida Museum of Natural History, P.O. Box 117800, University of Florida, Gainesville, Florida 32611-7800, USA; e-mail: dfranz@flmnh.ufl.edu.

PITUOPHIS MELANOLEUCUS SAYI (Bullsnake). **DIET**. Between 1988 and 1992, at the Crescent Lake National Wildlife Refuge, Garden Co., Nebraska, USA, 476 bullsnakes were captured by refuge personnel as part of a predator control program, and made available to us for dissection. Only 19.5% of the snakes (N = 93) contained food items (Table 1), with females (29.5%) more likely than males (15.2%) to contain food (Chi-square = 9.1, P = 0.003). Of the snakes with food, almost 90% had recently eaten mammals (mainly voles, *Microtus ochrogaster* or *M. pennsylvanicus*). Although birds or their eggs were found in 20% of the snakes, three times as many males as females contained avian food items (Chi square = 4.9, P = 0.027). This may reflect the greater movements (and therefore greater likelihood of encountering birds nests) made by males (Iverson, unpublished; see also Burger and Zappalorti 1988. Herpetologica 44:48–55). We found only one food type in most snakes, but two did contain two types (a duck egg and a vole in one snake, and a vole and kangaroo rat in another). Gut content data collected on the same refuge in 1938–1942 (Imler 1945. J. Wildlife Mgmt. 9:265–273) also revealed that voles were the principal food item (36% by volume), but that birds (including eggs) and mammals were nearly equally represented in the diet at that time (48 vs. 52% by volume, respectively). It is likely that this apparent drop in bird/egg predation is due to overall reductions in the waterfowl populations since the early 1940's, and to increases in small mammal populations (because of predator removal and reduced grazing/haying in the meadows). These data also confirm that the diet of the closely related gopher snake (*P. catenifer*; Rodríguez-Robles 1998. Copeia

Table 1. Food items recovered from guts (stomachs and intestines) of 93 bullsnakes from Crescent Lake Refuge (1988–1992). Totals of percentages are greater than 100 since some snakes had multiple prey items in their guts.

Food item	Females (N = 43)	Males (N = 50)	Total (N = 93)
Any mammals	40 (93%)	40 (80%)	80 (86%)
Voles (*Microtus*)	21 (49%)	22 (44%)	43 (46%)
Kangaroo rats (*Dipodomys*)	2 (5%)	3 (6%)	5 (5%)
Field mice (*Peromyscus*)	1 (2%)	1 (2%)	2 (2%)
Pocket mice (*Perognathus*)	2 (5%)	0	2 (2%)
Pocket gophers (*Geomys*)	2 (5%)	0	2 (2%)
Cottontail rabbits (*Silvilagus*)	1 (2%)	0	1 (1%)
Unidentified mammals	14 (33%)	14 (28%)	28 (30%)
Any birds	4 (9%)	15 (30%)	19 (20%)
Eggs	4 (9%)	13 (26%)	17 (18%)
Nestling pheasant	0	1 (2%)	1 (1%)
Nestling duck	0	1 (2%)	1 (1%)

1998:463–466) is much more diverse than that of the bullsnake. The only potential record of non-endotherm prey for the bullsnake is a brief mention of "insects" by Wright and Wright (1957. Handbook of Snakes. Comstock Publ. Assoc., Ithaca, New York. 640 pp.); however, they provide no further details.

Submitted by **JOHN B. IVERSON**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA (e-mail: johni@earlham.edu), **THOMAS S. AKRE**, Department of Biology, George Mason University, Fairfax, Virginia 22030, USA.

THAMNOPHIS SCALARIS (Mexican Alpine Blotched Garter Snake). **LITTER SIZE**. On 8 June 1999, a pregnant female *Thamnophis scalaris* (37.0 cm SVL, 8.5 cm tail length (TL), 137 ventral scales), was found in Acambay, state of Mexico (19°56'N, 99°50'W), 17 km N of Toluca, Mexico. Eight offspring were born on 18 June 1999. Each neonate was measured, weighed, and ventral scales were counted. The female and neonates were released six days after parturition. The female's mass before and after parturition was 36.09 g and 23.18 g, respectively. The measurements of the neonates were (mean ± SD, range): 12.95 ± 0.61 cm, 12.0–13.9 cm SVL; 3.77 ± 0.40 cm, 3.1–4.2 cm TL; 1.24 ± 0.07 g, 1.12–1.35 g mass; 130.5 ± 7.65, 122–144 ventral scales. Only four litters of *T. scalaris* have been previously reported. Ramrez-Bautista et al. (1995. Herpetol. Rev. 26:12–13) reported litters sizes of 14 and 16 from two autopsied females. Rossman et al. (1996. The Garter Snakes: Evolution and Ecology. University of Oklahoma Press, Norman, Oklahoma. 256 pp.) reported litter sizes of eight and 15, with total lengths ranging between 16.8 and 18.1, and birth dates of 18 May and 30 May, respectively.

Submitted by **JORGE A. CONTRERAS, CLAUDIA VALDERRABANO, C. GEORGINA CORTES-SOTO** and **JAVIER MANJARREZ**. Laboratorio de Biología Evolutiva, Facultad de Ciencias, Universidad Autonoma del Estado de México. Instituto literario 100, CP 50000, Toluca, Estado de México, México; e-mail (JAC): jcont@miranda.ecologia.unam.mx.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). **COURTSHIP BEHAVIOR**. Male snakes have been shown to track females using predominantly chemical trailing (reviewed in Halpern 1992. *In* Gans and Crews [eds.], Biology of the Reptilia, Vol. 18, pp. 423–523. University of Chicago Press, Chicago, Illinois). Vision has also been shown to be important in semi-natural studies of the courtship behavior of the checkered garter snake, *Thamnophis marcianus* (Perry-Richardson et al. 1990. J. Herpetol. 24:76–78). Here, I report the use of vision by a male *T. s. sirtalis* for localizing a female for courtship in the field. An adult male *T. s. sirtalis*, 30 cm SVL, was observed from 1500–1600 h on 15 April 2000 (23°C, sunny) at Mendon Ponds County Park, Monroe County, New York, USA. This individual was moving through leaf litter on the forest floor, exhibiting rapid tongue flicking and directed movement. After making several loops over 20 min., the individual flushed out a female *T. s. sirtalis* (ca. 45 cm SVL) from under leaf litter. The male proceeded to pursue the female, actively chin rubbing along her back and tongue flicking continuously. After the initial activity, the female managed to move out of view from the male and freeze. At this point, the male raised the rostral third of his body off the ground and began moving his head from side to side, apparently looking for the female. As soon as the female moved, the male pursued her again, repeating the courtship behavior. This series of events (male courtship, female evasion, and male visual tracking) occurred three times over 20 min. Finally, the female evaded the male, who did not locate her after 20 min. of visual and chemical searching in the wrong direction. These observations suggest that male garter snakes will use visual localization to find females after first locating them chemically.

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Submitted by **DAVID A. HOLTZMAN**, Department of Brain and Cognitive Sciences, University of Rochester, Meliora Hall, Rochester, New York 14627, USA; e-mail: holtzman@bcs.rochester.edu.

Erratum

A note concerning nocturnal climbing activity in two species of *Plethodon* (Trauth et al. 2000. Herpetol. Rev. 31:232–233) was inadvertently published again in HR 32:32. Proper citations of this paper should reference its first appearance.

NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their note (e.g., Reproduction, Morphology, Habitat, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send three copies of manuscripts, double-spaced, directly to the appropriate section coeditor (addresses on inside front cover): J. Brian Hauge (lizards, amphisbaenians, crocodilians, *Sphenodon*); Charles W. Painter (amphibians); or Brian Butterfield (snakes, turtles). Authors are requested to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a text-only version of the file.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Crother (2000. *Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding*. Herpetol. Circ. 29:1–82); for Mexico as it appears in Liner (1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herpetol. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

PLETHODON CADDOENSIS (Caddo Mountain Salamander) and ***PLETHODON SERRATUS*** (Southern Redback Salamander). **NOCTURNAL CLIMBING ACTIVITY**. Nocturnal surface activity in the plethodontid salamander genus *Plethodon* has been well documented for a variety of species (Spotila 1972. Ecology 42:95–125; Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.). Observations on the nocturnal climbing abilities of some members within this genus as well as in other plethodontids, however, have appeared less frequently in the literature (Cliburn and Porter 1986. J. Mississippi Acad. Sci. 31:91–96; Jaeger 1978. Copeia 1978:686–691). Herein, we report on nocturnal and climbing activity in two plethodontid species taken from the same study site.

On the evening of 14 April 2000 between 2030–2130 h, a group of 14 observers visited an historical collection site known to harbor large numbers of both *P. caddoensis* and *P. serratus*. The locality is in the Ouachita National Forest along Forest Rd 73 (ca. 0.8 km S St Hwy 8), Montgomery County, southwestern Arkansas, USA (Trauth and Wilhide 1999. J. Arkansas Acad. Sci. 53:125–137). The sky was clear, the air temperature was ca. 17.0°C, and the ground surface litter was dry. This region of the National Forest had received moderate rainfall two days prior to our arrival. The oak/hickory forest habitat is an east-facing, moderately-sloping embankment of small, loose talus; the bank steepens sharply along an intermittent stream. Initially, we utilized an established collection technique involving the removal of surface rock in swaths to reveal salamanders hidden within the interstitial spaces of the top 20–30 cm of rock talus in the riparian zone. Although this method was successful, collectors began noticing both species of salamanders on the exposed surfaces of small-to-intermediate sized boulders. Moreover, 11 of 52 (21%) *P. caddoensis* were taken from the trunks of trees up to a height of 50 cm. In more than one instance, individuals of both species were found together on the tops of boulders. In addition to the 52 *P. caddoensis*, 45 *P. serratus*, and 3 *Eurycea m. multiplicata* were found at this streamside habitat.

Jaeger (1978. Copeia 1978:686–691) noted that terrestrial salamanders (e.g., *P. cinereus*) that climb plants at night consume a significantly larger volume of food than do non-climbing conspecifics. An apparent lack of aggressive behavior between *P. caddoensis*, a larger species (in our sample, average SVL 37.33 ± 10.6 mm; range 16–52) as compared to *P. serratus* (28.16 ± 8.75; range 18–45), presumably allows each species to coexist syntopically both above and below the ground surface.

We thank the Department of Biological Sciences, Arkansas State University, for providing financial support for this field study.

Submitted by **STANLEY E. TRAUTH, MALCOLM L. McCALLUM*, BEN J. BALL**, and **VERNON E. HOFFMAN**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467-0599, USA; *Address of MLM: Environmental Science Ph.D. Program, P.O. Box 847, Arkansas State University, State University, Arkansas 72467, USA; e-mail (SET): strauth@navajo.astate.edu.

SIREN LACERTINA (Greater Siren). **AESTIVATION CHAMBER.** Detailed descriptions of the aestivation chamber and cocoon of aquatic salamanders in the family Sirenidae are known primarily from captive individuals of *Siren intermedia* (Reno et al. 1972. Copeia 1972:625–631) and *S. lacertina* (Etheridge 1990. Herpetologica 46:400–406) that were induced to aestivate in laboratory containers. However, observations of aestivating sirens in the field are limited. Carr (1940. Univ. Florida Publ., Biol. Sci. Ser. 3:1–118) found several *S. lacertina* aestivating beneath the surface of a dried wetland, each in a spherical chamber connected to the surface through a narrow vertical tunnel. Freeman (1958. Herpetologica 14:130) found two *S. lacertina* in a recently dried pond bottom buried in hard, moist mud under a mat of dead water hyacinth (*Eichhornia crassipes*); one individual in a vertical tunnel that extended to the surface and the other 10 cm below the surface in a horizontal chamber slightly longer than the body. Here I report an additional field observation of the aestivation chamber of *S. lacertina* along with associated environmental conditions.

On 2 December 1999 at the Megginnis Arm of Lake Jackson, Leon Co., Tallahassee, Florida, USA, I discovered an adult *S. lacertina* (61 cm TL, 48 cm SVL, 700 g) in its aestivation chamber, which had been uncovered by a bulldozer during a sediment-dredging operation. The chamber was located 30 m from the waterline and ca. 15–20 cm below and parallel to the ground surface in moist organic/silt lake sediments under a dense growth of smart-



FIG. 1. Aestivation chamber of *Siren lacertina*.



FIG. 2. Aestivating *S. lacertina* encased in moisture-conserving cocoon. Note S-shaped body position.

weed (*Polygonum densiflorum*) (Fig. 1). There are no previously published photographs of *Siren* in its aestivation chamber in nature, as the chamber is usually destroyed in the process of digging to find the animals. The siren was alive and inactive within a cocoon that consisted of a thin layer of dry skin that covered the body; the skin under the cocoon was moist and the gills were atrophied. The posterior half of the animal was curled back around so that the tail was in slight contact with the body (Fig. 2). This S-shaped body position and the spherical position observed by Carr (*op. cit.*) may help sirens minimize water loss during extended periods of aestivation.

During 1998 and 1999 northwest Florida experienced drought conditions (1999 rainfall 39.7 cm below normal average; NWS, Tallahassee, Florida) and lake waters had not covered the area above the aestivation chamber for 1–2 yr. Therefore, the individual uncovered in this operation was likely in aestivation for at least one year.

Previous observations of sirens in aestivation chambers are only from completely dried ponds where they apparently became trapped and were forced to aestivate (Carr, *op. cit.*; Freeman, *op. cit.*). In the present observation, the lake level was lower due to drought but a large area of open water (> 1 m deep) with a mud bottom and little aquatic vegetation was still available. This observation suggests sirens may aestivate far above drought-lowered waters in areas that were previously inundated, rather than moving with the slowly receding waters to remain active. Numerous other *S. lacertina* and *Amphiuma means* were uncovered in the same area.

Submitted by **MATTHEW J. ARESCO**, Department of Biological Science, Florida State University, Tallahassee, Florida 32306-1100, USA.

ANURA

ELEUTHERODACTYLUS GUTTILATUS (Spotted Chirping Frog), ***BUFO PUNCTATUS*** (Red-spotted Toad), ***HYLA ARENICOLOR*** (Canyon Tree Frog), and ***RANA BERLANDIERI*** (Rio Grande Leopard Frog). **MITE INFESTATION**. Little is known about the infestation of adult amphibians by chiggers, the parasitic larval stage of mites. Here we report the occurrence of two mite species, *Hannemania hylae* and *Hannemania* sp. (Acari, Leeuwenhoekiidae), on four amphibian hosts. Chiggers were found on spotted chirping frogs, red-spotted toads, canyon tree frogs, and Rio Grande leopard frogs in Big Bend National Park (BBNP), Brewster Co., Texas, USA, from June–October 1998 and from May–September 1999. Chiggers collected for this study are housed at the Florida State Collection of Arthropods.

Rio Grande leopard frogs found along the banks of the Rio Grande (elevation 550 m) were infested with an undescribed species of *Hannemania*. The new species is similar to *H. anurae*, which is known only from anurans in western Mexico (Jalisco, Nayarit, and Sinaloa) (Welbourn and Loomis. 1970. Bull. South. California Acad. Sci. 69:65–73).

Canyon tree frogs infested with *H. hylae* were found in slickrock canyons of the Chisos Mountains (elevation 2000 m). This is the first reported *H. hylae* from BBNP. Spotted chirping frogs from the Chisos Mountains were also infested with *H. hylae*, (see also Gaige 1931. Copeia 1931:63; Jameson 1952. Ph.D. Diss. Univ. Texas, Austin; Lynch 1970. Univ. Kansas Publ. Mus. Nat. Hist. 20:1–45.).

We did not find chiggers on *Rana catesbeiana* (bullfrog, N = 13), *Bufo debilis* (green toad, N = 8), *Bufo speciosus* (Texas toad, N = 48), *Scaphiopus couchii* (Couch's spadefoot, N = 43), or *Gastrophryne olivacea* (western narrow-mouthed toad, N = 7). We did find one of 31 (3%) red-spotted toads infested with mites (51 on throat, abdomen, limbs, and digits), but did not collect mites for identification. This toad was found on 7 June 1999 at 0158 h on the road near Panther Junction. It is likely that the chigger on the red-spotted toad was *H. bufonis*. The range of *H. bufonis* corresponds to that of the red-spotted toad in the southwestern USA.

Infestation rates on anurans at BBNP were similar to previous reports. Seventy-one of 81 (88%) Rio Grande leopard frogs captured along the Rio Grande had chiggers. The average number of chiggers on Rio Grande leopard frogs was 45 (range 3–140). Infestation rates were highest on the hind limbs, particularly the thighs. Likelihood ratio chi-square analyses revealed significant differences in frequencies of no, light (1–10 chiggers), moderate (11–50), and heavy (> 50) chigger infestation between juveniles and adults ($\chi^2 = 8.9$, df = 3, P = 0.032) and between adult males and females ($\chi^2 = 16.1$, df = 3, P = 0.001). Twenty percent of the

juvenile frogs were not infested with chiggers compared to 10% of the adults. More male frogs were heavily infested with chiggers (35%) compared to females (13%). Rio Grande leopard frogs (n=24) captured at springs or along roads away from the Rio Grande did not have mites.

Twenty of 25 (80%) adult and 10 of 12 (83%) recently metamorphosed canyon tree frogs were infested with *H. hylae*. Canyon tree frog adults had 6–105 mites, whereas recently metamorphosed individuals had 3–17 mites, though the difference was not statistically significant (Mann Whitney U = 2.0, df = 1, P = 0.12). *Hannemania hylae* were also found on two of three spotted chirping frogs (67%). Individual spotted chirping frogs were infested with 12 and 38 *H. hylae*.

Chiggers are parasites of vertebrates and feed by secreting histolytic enzymes into the host tissue and ingesting the predigested tissue (Jones 1950. Parasitology 40:247–260). Unlike most chiggers that feed by inserting only their chelicerae into the host tissue, *Hannemania* embeds and encapsulates itself in the dermis of the host (Hyland 1961. Exp. Parasitol. 11:212–215; Duszynski and Jones 1973. Int. J. Parasitol. 3:531–538). The *Hannemania* observed on anurans in BBNP formed reddish-orange bumps on the throat, abdomen, and cloaca and on ventral surfaces of the limbs, digits and webbing of the digits. Heavier chigger infestations in male as compared to female salamanders (Anthony et al. Am. Midl. Nat. 132:302–307) have been documented previously, but our study appears to be the first to document heavier infestations in older as compared to younger anurans. Certainly, heavily infested individuals might exhibit greater physical health problems compared to less infested ones. Welbourn and Loomis (1975. Bull. South. California Acad. Sci. 74:15–19) recaptured 196 of 256 marked and chigger-infested *P. cadaverina* (California chorus frog) at least once over a 24-month study in Joshua Tree National Monument, California, suggesting that *Hannemania* infestations may not be lethal to anurans.

Two hypotheses could be generated why Rio Grande leopard frogs are heavily infested with chiggers along the river but not inland. Higher densities of Rio Grande leopard frogs along the Rio Grande (e.g., an average of 158 frogs along the banks of a 7-km stretch in BBNP, unpubl. data) could elicit higher transmission and densities of parasites. Alternatively, the post-larval instars of *Hannemania* live in the soil and may survive better in certain habitats (e.g., riverine) than in others.

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Submitted by **ROBIN E. JUNG, SHANNON CLAESON, J. ERIC WALLACE,** USGS Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708-4038, USA, and **W. CALVIN WELBOURN, JR.**, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, P.O. Box 147100, Gainesville, Florida 32614-7100, USA (e-mail: robin_jung@usgs.gov).

MANTELLA LAEVIGATA (Climbing Mantella). **ABORTED PREDATION**. Predation on members of the genus *Mantella* is probably rare, due to the presence of toxic skin alkaloids, which they share with the dart-poison frogs (Dendrobatidae). I report observations of a successful predation on *M. laevigata* by the cordylid lizard *Zonosaurus madagascariensis*, and an aborted predation by the boa *Boa madagascariensis*. Both observations involved frogs from marked populations on the island of Nosy Mangabe, Toamasina province, Northeastern Madagascar.

On 26 Feb 1997, I observed an adult zonosaur with a mantella in its mouth. The lizard tossed the frog into the leaf litter and proceeded to lick its lips, and rub its snout and entire head on litter and roots, for ten minutes. The discarded frog appeared to be dead. The lizard found the frog corpse and picked it up in its mouth again, shaking it back and forth furiously, and then dropped it. This sequence was repeated three more times. The fifth time the lizard was observed picking up the *M. laevigata* corpse, it ate it head first, leaving the frog's legs sticking out of its mouth while it rubbed its snout on the ground. I was unable to catch the zonosaur to monitor its health after this predation.

On 12 March 1997, during a courtship between two *M. laevigata*, a boa came out from under the leaf litter and captured the female in its mouth. The male *M. laevigata* dove under the leaf litter, and all frog calling and activity in the area stopped. The snake held the frog in its mouth, occasionally appearing to masticate. After twenty minutes, the snake suddenly released the frog, thrusting its open mouth forward to propel the frog onto the litter, and disappeared back under the leaves. The frog was bloodied on her dorsum and head, but hopped away. The next day the boa had left the area, and was not seen again before my departure in early May. On 20 March, the female frog was observed in courtship again, within 5 cm of where she was attacked by the boa. She was observed in courtship six more times between 20 March and 13 April, two of which resulted in oviposition. On April 13, she was observed to deposit a trophic egg for a tadpole, presumably hers, in a well where she had been seen in courtship on multiple occasions. The aborted predation by the boa thus appeared to have no lasting effects on her health or reproductive success.

Mantella laevigata appear to be severely distasteful to both zonosaurs and boas, which probably explains the usual cohabitation of the densely populated zonosaurs and *M. laevigata*, even though zonosaurs prey on other sympatric frog species.

The zonosaur predation observation would not have been possible without Jessica Metcalf, whom I thank for several months of invaluable field assistance.

Submitted by **HEATHER E. HEYING**, Museum of Zoology, 1109 Geddes Avenue, University of Michigan, Ann Arbor, Michigan 48109-1079, USA.

PHILAUTUS BOMBAYENSIS (Bombay Oriental Shrub-frog). **REPRODUCTION.** The Asian genus *Philautus* contains species of the subfamily Rhacophorinae (Ranidae) that are characterized by direct development, i.e., without an aquatic, free-swimming tadpole. Although 84 species are currently recognized in this genus (Bossuyt and Dubois 2000. J. South Asian Nat. Hist., *in press*), the number of species for which this particular mode of reproduction has been observed is limited. For the Western Ghats of South India, it has been described for only two species, "*P. variabilis*" (Patil and Kanamadi 1997. Current Sci. 73[8]:697–701) and *P. tinniens* (Bossuyt and Dubois, *op. cit.*). We here report on a third

species from the Western Ghats showing such direct development.

During the night of 29 July 1996, we observed axillary amplexus of *P. bombayensis* at an oviposition site in Sakleshpur (12°59'N, 75°43'E), Karnataka. Adult males, sitting on leaves of *Lantana camara* shrubs, were calling from heights between 0.5 and 2 m. The frogs were nocturnal, as no individual was observed during a full day search at this locality.

We observed three clutches, two containing 26 and one 27 eggs, attached to the upper side of leaves (Fig. 1) of *L. camara*, where they were kept humid by the moisture of the dense vegetation. The reproduction of *P. bombayensis* can be referred to mode 20 of the table of reproductive modes in anurans (Duellman and Trueb 1986. Biology of Amphibians: McGraw-Hill, Inc., New York. 670 pp.). This is unlike *P. tinniens* from the Western Ghats, which lays its eggs under stones or tree trunks (mode 17).

Freshly laid eggs of *P. bombayensis* are non-pigmented and uniformly cream colored. This coloration is retained until the forelimbs and hindlimbs are visible as distinct buds (stage 5; Patil and Kanamadi, *op. cit.*). In this stage, the embryos have the head and body arched over the yolk, and are very active in the jelly. They remain in the egg at least until stage 9 (Patil and Kanamadi, *op. cit*) in which the hindlimbs, mouth, eyes, and nasal pits are well developed. In this stage, the tail is slightly longer than the body, and curved along the side of the yolk.

Submitted by **FRANKY BOSSUYT** (e-mail: fbossuyt@vub.ac.be), **KIM ROELANTS**, **LIESBETH SPITHOVEN**, and **MARIE-HERMANDE DARO**, Biology Department, Unit of Ecology and Systematics, Free University of Brussels, Pleinlaan 2, 1050 Brussels.

PSEUDACRIS STRECKERI ILLINOENSIS (Illinois Chorus Frog). **TERRESTRIAL FEEDING**. *Pseudacris streckeri illinoensis* is known for its habit of burrowing with its front limbs (Brown et al. 1972. Herpetologica 34:212–216), its restriction to sandy habitats (Brown and Rose 1988. Illinois Nat. Hist. Sur. Biol. Notes 132:1–13), and its ability to feed underground (Brown 1978. Herpetologica 28:325–328). Little is known about its feeding habits because of its secretive nature. Tucker (1997. Herpetol. Nat. Hist. 5:83–87) described the food habits of this frog from Madison County, Illinois. Frogs in this study were collected in Clay County, Arkansas, USA, near Nimmons. This appears to be the first observation and description of terrestrial feeding in *P. s. illinoensis*.

Several individuals had been housed in a plastic terrarium with a sand substrate since their date of collection (23 Feb 2000). The following is a summary of observations on one animal. The specimen sat motionless as the crickets wandered about the sand substrate. After about a minute, the frog leaped at and grabbed a cricket about 10 cm away. Both the tongue and the forelimbs were utilized to capture the prey. It ate 3 crickets in succession, one of which was grasped only with the forelimbs then shoved into the mouth, then refused to eat more. The use of the forelimbs while feeding has not been previously reported. It is likely that while burrowing in the sand, these frogs would encounter prey. The emphasis on forelimb use during feeding likely evolved as an adaptation to an underground existence, as the tongue would be of little use in the subterranean environment. They probably touch the prey with their forelimbs or nose as they burrow (possibly initially detecting the movement of the invertebrate). They then could grasp the insect from the soil with their forelimbs and shove the prey into the mouth as they do above ground. This hypothesis of subterranean behavior is supported by the observation reported herein. As it grasped the cricket with both limbs, the fingers curled around the insect in a manner making it quite difficult for the insect to escape. The captive frogs in this study leave many open burrows throughout the sand. Often the frogs can be observed sitting motionless within a few cm of the entrance. Occasionally crickets were observed entering burrows without ever exiting. It is quite possible that the behavior of these animals is to wait at the bottom of the burrow until a cricket enters, then lunge forward, grab it, and swallow it without ever being seen. This is a highly secretive frog, and little is known of its natural history. Despite housing 12 animals from late Feb–June 2000, this is the only incidence of above ground feeding we observed, yet all crickets introduced into the terrarium regularly disappeared.

Submitted by **MALCOLM L. McCALLUM**, Environmental Sciences Ph.D. Program, P.O. Box 847, Arkansas State University, State University, Arkansas 72467, USA, and **STANLEY E. TRAUTH**, Department of Biological Sciences, P.O. Box 599, Arkansas State University, State University, Arkansas 72467, USA.

RANA AURORA AURORA (Northern Red-legged Frog). **MOVEMENT**. *Rana aurora aurora* is known to utilize a variety of habitat types, ranging from fully aquatic breeding sites to riparian and mesic upland forests during its post-breeding active season. (e.g., Gomez and Anthony 1996. Northwest Sci. 70:109–119; Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. Univ. Press of Idaho, Moscow, Idaho. 332 pp.). In addition, Licht (1969. Can. J. Zool. 47:1295) implied upland habitats may be used during overwintering at low elevations. Partly as a consequence of these patterns, this species is believed to move large distances. Estimates of the spatial scale of movements are limited to two general statements: Dumas (1966. Copeia 1966:62) stated that "Adult *aurora* are...found...as much as 1,000 yds [≅ 914 m] from the nearest water;" and Nussbaum et al. (*op. cit.*) noted finding *R. a. aurora* in "moist forest situations 200 to 300 m from any standing water." In this note, we provide data illustrating that movements at least 2.6 times the distance of those previously reported can occur, and that movements over 1 km may not be uncommon.

Our observations of *R. a. aurora* movement were made as part of an ongoing study within a Research Natural Area ranging between 500–800 m elevation in the South Umpqua basin of southwestern Oregon, USA. The study area includes a complex of relatively undisturbed mixed coniferous forest interdigitated with savanna-like first- and second-order drainages that convey surface water into early summer. Since initiation of the study in 1999, we have recaptured four PIT-tagged frogs that moved distances greater than those indicated by Dumas (*op.cit.*). On 20 Dec 1999, we captured an adult female *R. a. aurora* (SVL 101.0 mm; mass 75.0 g), at a 0.6-ha pond at which this species breeds. This frog was recaptured on 13 May 2000 in a small (0.05-ha) seasonal pond located 2.4 km (straight-line distance) west of the breeding pond. An adult male (SVL 64.5 mm; mass 19.2 g) recaptured in the same seasonal pond on the same date as the aforementioned female was

originally captured in a mesic draw at a point 1.2 km west of the seasonal pond on 22 April 2000. A second adult male (SVL 60.0 mm; mass 20.5 g), first captured in the same mesic draw as the previous male on 14 Nov 1999, was recaptured in the aforementioned breeding pond 1.3 km to the east on 20 Dec 1999. A third adult male (SVL 70.0 mm; mass 27.6 g), first captured in the breeding pond on 18 Jan 2000, was recaptured in the same mesic draw at a point 1.1 km to the west on 22 April 2000.

Our observations confirm that *R. a. aurora* adults can undertake movements at distances significantly greater than previous estimates. Additionally, since the female was recaptured at a pond that dried within a month after the May survey, the distance of the move we observed may still not represent an active-season maximum. We also emphasize that our observations of *R. a. aurora* movement, which describe distances traveled between capture points regardless of proximity to water, should be distinguished from previous observations referencing only distances to nearest water.

An Oregon Zoo Foundation Grant supported this study; frogs were handled under a Scientific Taking permit from the Oregon Department of Fish and Wildlife.

Submitted by **MARC P. HAYES**, Washington Department of Fish and Wildlife, Habitat Program, 600 Capitol Way North, Olympia, Washington 98501, USA (e-mail: hayesmph@dfw.wa.gov), **CHRISTOPHER A. PEARL**, United States Geological Service, Forest and Rangeland Ecosystem Science Center, 3200 Jefferson Way, Corvallis, Oregon 97331, USA (e-mail: pearl@mail.cor.epa.gov), and **CHRISTOPHER J. ROMBOUGH**, P.O. Box 365, Aurora, Oregon 97002, USA (e-mail: rombough@mailbox.orst.edu).

RANA HECKSCHERI (River Frog). **ECTOPARASITES**. The genus *Argulus* (Crustacea: Branchiura: Argulidae) comprises free-swimming ectoparasites that primarily parasitize fish with few records on amphibians (Bower-Shore 1940. Parasitology 32[4]:361–371; Goin and Ogren 1956. J. Parasitol. 24[2]:172; Sauer 1977. Mikrokosomos 66[1]:19–20). Goin and Ogren (*op. cit.*) reported the occurrence of *A. americanus* on *Rana heckscheri* tadpoles at Newnan's Lake in Alachua County, Florida.

During November 1999, I collected argulid specimens from *R. heckscheri* tadpoles while collecting data about the effects of water depth, vegetation density, and substrate type on argulid parasite intensity of *R. heckscheri* tadpoles. The sites surveyed are borrow pits located in Osceola National Forest northwest of Ocean Pond, Columbia County, Florida, USA. Of the 202 argulids identified, 182 were *A. americanus*, and the remaining 20 were *A. diversus*, which is the first documented occurrence of this argulid species on *R. heckscheri* tadpoles.

I thank Eric B. Anderson for assistance in the field, William J. Poly (Southern Illinois University) for identifying the argulids, and Max A. Nickerson (UF/FLMNH) for his support and guidance.

Submitted by **VALERIE C. CLARK**, Department of Zoology and Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA; e-mail valeriec@ufl.edu.

SPEA HAMMONDII (Western Spadefoot Toad). **ELEVATION RECORD**. The highest elevation reported for *Spea hammondii* was 1380 m (Zeiner et al.1988. California's Wildlife. Vol. 1, California Dept. Fish and Game). The location was presented as "the southern Sierra foothills," although no supporting details were provided. Therefore, it is difficult to assign a level of certainty to this record. Herein we provide documentation of three high elevation populations of *S. hammondii* in southern California.

On 13 April 2000, AEA collected 3 large (Gosner Stage 45) *S. hammondii* larva (California Academy of Science 212367, 212368) from a small ground level cement basin (ca. 2 m diameter by 30 cm deep) at ca. 1410 m at San Diego State University Sky Oaks Research Station at the east portion of Chihuahua Valley, San Diego Co., California, USA (33°22'30"N, 116°37'15"W). There were >100 larva present in the pool at the time of collection. The vegetation was characterized as a red shank chaparral community (*Adenostoma sparsifolium*).

On 2 July 1999, ELE and REM collected one metamorphic *S. hammondii* toadlet (CAS 212369; 3.2 cm SUL) DOR on Chihuahua Valley Rd., San Diego Co. (33°23'00"N, 116°41'49"W). This observation was made on the west end of the valley at 1280 m. North of this location is a gently sloping grassland with interspersed scrub plants and scattered mature oak trees (*Quercus agrifolia*); vegetation on the south is dominated by a red shank chaparral community. On 16 July 1999, TLC and ELE collected six metamorphic *S. hammondii* (CAS 212362–212366) from a pool located in Tierra del Sol, San Diego Co. (32°37'57"N, 116°20'27"W). This small pool, at 1180 m, measured 3 m diameter and 0.5 m deep. Associated vegetation is a red shank chaparral community.

Thanks to Joe Copp and Jeremy Pitman for informing us of calling spadefoots in Chihuahua Valley, and to Robert Fisher who provided encouragement and support.

Submitted by **EDWARD L. ERVIN**, U.S. Geological Survey, Department of Biology, San Diego State University, San Diego, California 92182-4614, USA, **ALISON E. ANDERSON**, Department of Biology, San Diego State University, San Diego, California 92182-4614, USA, **TIMOTHY L. CASS**, 3573 Niblick Drive, La Mesa, California 91941, USA, and **RUBEN E. MURCIA,** Palomar College, Life Science Department, 1140 West Mission Road, San Marcos, California 92065, USA.

XENOHYLA TRUNCATA (NCN). **ANTIPREDATOR BEHAVIOR**. *Xenohyla truncata*, a hylid treefrog from southeastern Brazil, inhabits terrestrial bromeliads in "restinga" environments (see Eiten 1992. Ann. Acad. Bras. Ci. 64, suppl. 1:35–65). The first observation of defensive behavior in *X. truncata* was reported by Silva et al. (1987. Resumos XIV Congr. Bras. Zoologia:123). The authors reported *X. truncata* showed tanathosis when specimens fell to the ground, although did not provide data about the posture adopted by these specimens. An adult *X. truncata* (Museu Nacional/Rio de Janeiro 23472) collected from a terrestrial bromeliad at Barra da Tijuca, city of Rio de Janeiro, State of Rio de Janeiro, Brazil (ca. 22°54'S, 43°12'W), was carried to the laboratory to be photographed. Immediately upon being placed on a table, the specimen assumed a defensive behavior, stretching the hind limbs out, inflating the lungs, and becoming motionless (Fig. 1). A similar posture was observed in *Eleutherodactylus curtipes* (Duellman and



FIG. 1. Defensive stance of an adult *Xenohyla truncata*.

Trueb 1986. Biology of Amphibians. McGraw-Hill Book Company, New York. 670 pp.). Azevedo-Ramos (1995. Rev. Brasil. Biol. 55:45–47) observed a similar behavior in *Hyla geographica* (= *H. semilineata*) from Juréia, State of São Paulo, Brazil, although the outstretching of the hind limbs was not as great and occurred primarily when the frog was held by its head. This observation supports the hypothesis of Azevedo-Ramos (*op. cit.*) that the outstretched limbs, accompanied by the inflation of the lungs may prevent or inhabit the ingestion of the prey. The outstretched hind limbs associated with immobility in *X. truncata* may be a hard-to-ingest-prey posture in a stress situation or a disruptive posture that breaks the outline of the frog in the case of visual oriented predators (Azevedo-Ramos, *op. cit.*; Sazima 1978. Biotropica 10:158).

Submitted by **MARCELO F. NAPOLI**, Departamento de Vertebrados, Museu Nacional/Universidade Federal do Rio de Janeiro, 20940-040 Rio de Janeiro, Brazil; e-mail: napoli@acd.ufrj.br.

TESTUDINES

CARETTA CARETTA (Loggerhead Sea Turtle) and ***ERETMOCHELYS IMBRICATA*** (Hawksbill Sea Turtle). **PREDATION**. Sea turtles are subject to pressures from a wide variety of predators, at many different life stages (Dodd 1988. U.S. Fish Wildl. Serv. Biol. Rep. 88[14]:1–110). Predation pressure seems to be inversely related to age and size of sea turtles— hatchlings are eaten by many species of fish, birds, and mammals while adult turtles at sea apparently have few natural predators, other than sharks and killer whales. Nesting sea turtles face land predators, such as jaguars (Autar 1994. Mar. Turt. Newsl. 67:11–12) and crocodiles (Ortiz et al. 1997. Chel. Conserv. Biol. 2:585–587), not to mention people. Additionally, there have been reports of predation by feral dogs on nesting female sea turtles (Caldwell 1959. Bull. Florida State Mus. 4:319–348; Hendrickson 1958. Proc. Zool. Soc. Lond. 130:455–535). Here, we report domestic dogs attacking and killing nesting sea turtles *Caretta caretta* and *Eretmochelys imbricata*.

Early in the morning of 26 October 1998, the Projeto TAMAR-IBAMA base in Praia do Forte, Bahia, Brazil (12°34'56"S, 38°00'02"W), received a phone call that a large turtle on Guarajuba beach was being attacked by two dogs. Two biologists rushed to the scene, only to find a dead adult *C. caretta*, with its carotid artery punctured. The turtle had begun to dig a nest-hole, but had not successfully laid its eggs before being attacked. The turtle was transported back to the Projeto TAMAR base and necropsied. The gravid female contained 141 eggs in her oviducts. Witnesses identified the dogs and their owner as the same ones responsible for killing a nesting hawksbill (*Eretmochelys imbricata*) on 2 February 1998, during the previous nesting season. Similarly, the *E. imbricata* had been attacked close to sunrise and killed prior to oviposition. This turtle was also necropsied, and 128 unlaid eggs were found in the oviducts. In both cases, the unlaid eggs were washed in fresh water and interred in an open air hatchery at the Praia do Forte station; only the *C. caretta* eggs hatched, producing 43 live hatchlings.

The enforcement authorities at IBAMA and the Institute of the Environment and Natural Renewable Resources of the Federal Government of Brazil were notified, and we expect the owner to face the maximum possible fines. The *C. caretta* carapace now hangs in the museum of the visitor center in Praia do Forte, Bahia, and that of the *E. imbricata* is displayed in visitor center in the archipelago of Fernando de Noronha, Brazil.

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Submitted by **ALEXSANDRO SANT'ANA SANTOS** and **MATTHEW H. GODFREY***, Projeto TAMAR-IBAMA and Fundação Pró—TAMAR, Caixa Postal 2219, Salvador, Bahia 40210-970 Brazil (e-mail: protamar@e-net.com.br). *Current address: Réserve Naturelle de l'Amana, 97319 Awala-Yalimapo, French Guiana.

CHELYDRA SERPENTINA (Common Snapping Turtle) and ***EMYDOIDEA BLANDINGII*** (Blanding's Turtle). **PARASITES**. Nematode and hirudinean parasites have been reported for *Chelydra serpentina* and *Emydoidea blandingii* in North America (see Baker 1987. Mem. Univ. Newfoundland Occas. Pap. Biol. 11:1–325; Watermolen 1996. J. Fresh. Ecol. 11:211–217), but few reports exist from Wisconsin, USA (Gulford 1959. Trans. Wisconsin Acad. Sci. Arts Letters 48:121–124; Amin 1981. Trans. Amer. Micros. Soc. 100:42–51; Watermolen 1996, *op. cit.*). Of these studies, Gulford (*op. cit.*) sampled for helminth parasites among several turtle species, including six *C. serpentina* and one *E. blandingii* from northeastern Wisconsin. Amin (*op. cit.*) reported one *Placobdella parasitica* and three *P. ornata* leeches from a single *E. blandingii* from southeastern Wisconsin, and Watermolen (*op. cit.*) reported *Desserobdella picta*, an amphibian leech, from a snapping turtle from Green Bay, Wisconsin. Here, I report a new locality record for nematodes of *C. serpentina* in Wisconsin and report prevalence and mean intensity data for nematode and leech parasites of *C. serpentina* and *E. blandingii* from eastern Wisconsin.

Turtles were collected by hand or dip-net at the Carroll College field station located in Genesee Depot, Waukesha Co., and at a pond in Wauwatosa, Milwaukee Co. Live-caught turtles were in-

spected for leeches, measured, and released. All leeches were placed in individual vials and relaxed by slowly dripping 95% ethanol into the vial, they were then fixed in 10% formalin. Leeches were identified using a stereo microscope and keys provided by Klemm (1991. Michigan Acad. 24:37–103) and Sawyer (1972. Illinois Biol. Monogr. 46:1–154). Prevalence is the percentage of infected turtles in a sample; mean intensity is the mean number of worms per infected turtle. In addition, three road-killed specimens (two *C. serpentina*, one *E. blandingii*) were collected in Waukesha and Racine Counties, Wisconsin, during 1995–1998. These turtles were inspected for helminth parasites, and were collected within 24 h of death. Upon necropsy, the digestive tract and internal organs were examined for endoparasites for both *C. serpentina* specimens examined. Only the digestive tract was examined from the single *E. blandingii* necropsied because all other organs were badly damaged. All nematodes were fixed in 10% formalin, dehydrated in 70% ethanol, cleared in glycerol, and identified as temporary mounts according to the descriptions of Hedrick (1935a. Trans. Amer. Microsc. Soc. 54:307–335, 1935b. J. Parasit. 21:397–409) and Baker (1986. Can. J. Zool. 64:228–237). Voucher specimens were deposited in the Harold W. Manter Laboratory, University of Nebraska State Museum, Lincoln (accession no. *Placobdella parasitica* HWML 15008, *Placobdella ornata* HWML 15009, *Falcaustra wardi* HWML 15010, *Spiroxys contortus* HWML 15011).

Among the live-caught turtles, five (71%) of seven *C. serpentina* examined were infected with *Placobdella*, with a mean intensity of 21.2 ± 44. Most turtles contained 1–2 *P. parasitica* and/or *P. ornata* with the exception of one immature turtle that contained one adult and 99 young *P. parasitica*. A total of four *E. blandingii* were collected on seven different occasions. A single *P. ornata* or *P. parasitica* was recovered on three out of seven different dates with a intensity of one. A single *E. blandingii* male (carapace length 200 mm) contained one *P. ornata* on 10 June 1998 and one *P. parasitica* when recaptured on 14 June 1998. In total, 103 *P. parasitica* and three *P. ornata* were recovered from *C. serpentina*, and one *P. parasitica* and two *P. ornata* were recovered from *E. blandingii*. All leeches were attached to the ventral surface of the carapace and/or the limbs of the turtles.

Among the road-killed turtles, one immature *C. serpentina* (100 mm carapace length (CL), 172.4 g) was negative for helminths while an adult male (280 mm CL, 3991.6 g) contained four male and five female *Falcaustra wardi* in the large intestine. Gulford (*op. cit.*) previously reported *Spironura affine* (=*Falcaustra affinis*, Baker 1986 *op. cit.*) in Wisconsin snapping turtles. *Falcaustra wardi* is a common parasite of *C. serpentina* (see Baker 1986 *op. cit.*). However, Wisconsin is a new locality record for this nematode. The road killed female *E. blandingii* (210 mm CL, not weighed because of damage) contained four *Spiroxys contortus* nematodes in the stomach, which previously have been reported by Gulford (*op. cit.*) from the northeastern part of the state.

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Submitted by **MATTHEW G. BOLEK**, Department of Biological Sciences, University of Wisconsin—Milwaukee, Milwaukee Wisconsin, 53201, USA. Present Address: School of Biological Sciences, University of Nebraska Lincoln, Lincoln, Nebraska 68588, USA; e-mail: mbolek@unlserve.unl.edu.

CLEMMYS MUHLENBERGII (Bog Turtle). **ECTOPARASITES.** Bog turtles (*Clemmys muhlenbergii*) are known to be parasitized by the leech *Placobdella multilineata* in Virginia (Saumure and Carter 1998. Herpetol. Rev. 29:98). Herein, we report the occurrence of an additional leech parasite of *C. muhlenbergii*, as well as additional occurrences of parasitism by *P. multilineata* on *C. muhlenbergii* in North Carolina, USA. All leech specimens were deposited in the collections of the North Carolina State Museum of Natural Sciences (NCSM).

On 8 June 1996, a female bog turtle (#28: 87.86 mm CL, 119 g) was captured in Wilkes Co., North Carolina. Two leeches (NCSM P-4701) were collected from the turtle's neck. On 8 June 1997, another adult female turtle (#40: 88.66 mm CL, 130 g) was captured at the same site. Three leeches (NCSM P-4704) were collected from the posterior limb sockets. A final sample on 31 August 1997 from two females (#7: 89.20 mm CL, 130 g; #47: 89.56 mm CL, 125 g) belonging to the same population revealed an additional four leech specimens (NCSM P-4705). The examination of four additional bog turtles (2 M, 2 F) from two other sites in Wilkes Co., North Carolina, on 31 May and 1 September 1996 revealed an additional eight leeches (NCSM P-4698, P-4702). All of the aforementioned leeches were identified as smooth turtle leeches (*Placobdella parasitica*). Previously known hosts for this leech species are numerous and include 17 species of turtles belonging to five different families (Watermolen 1996. J. Fresh. Ecol. 11:211–217). Sawyer and Shelley (1976. J. Nat. Hist. 10:65–97) reported collecting *P. parasitica* from *Sternotherus odoratus* in Union Co., North Carolina.

An additional 10 bog turtles (4 M, 4 F, 2 J) captured between 31 May 1996 and 19 June 1999 in Wilkes Co., North Carolina were found to harbor 13 *Placobdella multilineata* (NCSM P-4699, P-4700, P-4703, P-4706 to 4708, P-4711). Three of these turtles were parasitized by two leeches and the remaining seven were hosts to one leech each. The only previous report of *P. multilineata* on a turtle in North Carolina was by Sawyer and Shelley (*op. cit.*) for a *Chelydra serpentina* from Bertie Co.

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Submitted by **RAYMOND A. SAUMURE**, Department of Natural Resource Sciences, McGill University, 21111 Lakeshore Road, Ste-Anne-de-Bellevue, Québec, H9X 3V9, Canada, and **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, Research Laboratory, 4301 Reedy Creek Road, Raleigh, North Carolina, 27607, USA (e-mail: jeff.beane@ncmail.net). Present address (RAS): Shark Reef at Mandalay Bay, 3950 South Las Vegas Boulevard, Las Vegas, Nevada, 89119, USA (e-mail: insculpta@hotmail.com).

KINOSTERNON SONORIENSE (Sonora Mud Turtle). **ATTEMPTED PREDATION**. On 18 September 1999, 1606 h, at Cottonwood Creek, a permanent, intermittent Sonoran Desert stream, Yavapai Co., Arizona, USA, I observed an attempted predation event by *Orconectes virilis* (Virile Crayfish, estimated standard carapace length 55 mm) on a juvenile *Kinosternon sonoriense* (32.98 mm CL, 27.16 mm PL, 6.72 g, estimated 2 yrs old based on plastron rings). The *O. virilis* had seized the *K. sonoriense* transversely in its chelae while the *K. sonoriense* unsuccessfully attempted to swim away. After making the observation, I moved in to capture the turtle, and the crayfish released it and escaped. The turtle was later marked, measured, and released as part of a long-term population study. Taylor et al. (1996. Fisheries 21:25–38) reported *O. virilis* and various other species of crayfish native to north-central and eastern North America have been introduced into Arizona. No crayfish are native to Arizona. The introduction of crayfish has had a devastating impact on all trophic levels in western aquatic communities. Exotic crayfish have reduced diversity of native aquatic plants, invertebrates, and vertebrates in several Arizona streams (Fernandez and Rosen 1996. Effects of the Introduced Crayfish *Orconectes virilis* on Native Aquatic Herpetofauna in Arizona. Arizona Game and Fish Dept., IIPAM Project No. I94054. 56 pp.). At Sycamore Creek, a permanent, intermittent stream at Sunflower, Maricopa Co., Arizona, the population of *K. sonoriense* was large and consistent recruitment occurred prior to the introduction of crayfish in 1985 or 1986 (Rosen 1987. Female Reproductive Variation among Populations of Sonoran Mud Turtles (*Kinosternon sonoriense*). Master's Thesis, Arizona State Univ., Tempe. 80 pp.). Since the introduction of crayfish, there is no evidence of juvenile recruitment into the population of *K. sonoriense* at that location (Fernandez and Rosen 1996, *op. cit.*). Fernandez and Rosen (1996, *op. cit.*) hypothesized that low recruitment of *K. sonoriense* at Sycamore Creek was a result of predation by crayfish upon hatchlings. In laboratory investigations, *O. virilis* killed *K. sonoriense* hatchlings (Fernandez and Rosen 1996, *op. cit.*).

My observation at Cottonwood Creek supports their hypothesis, and demonstrates that juveniles up to two years old, as well as hatchlings, are vulnerable. Not only is this an example of the vulnerability of *K. sonoriense*, but also the vulnerability of entire native communities when exotic species are introduced. Biological invasions are the second leading cause of biodiversity loss in the United States (Enserink 1999. Science 285:1834–1836). The case of crayfish introduction into Arizona may prove to be a good model of how this biodiversity loss occurs.

Submitted by **ANGELA L. SCHWENDIMAN**, Department of Biology, Grand Canyon University, 3300 West Camelback Road, Phoenix, Arizona, 85017, USA; e-mail: aschwendiman@uswest.net.

PODOCNEMIS UNIFILIS (Terecay). **MAXIMUM SIZE**. The maximum straight-line caparace length (CL) of *Podocnemis unifilis* reported by Pritchard and Trebbau (1984. Turtles of Venezuela. SSAR Contributions to Herpetology, No 2. 403 pp.) is 47.5 cm. I report here two turtles from Hato La Trinidad, Rio Guanare Viejo, Departamento Arismendi, estado Barinas, Venezuela, collected by S. Boher, 26 February 1992, with CL measurements of 500 mm and 496 mm. The specimens are deposited in Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 2663–2664 respectively). Other straight-line measurements include: carapace width 353 and 352 mm; shell height of 180 and 180 mm. To my knowledge, these are the two largest *P.unifilis* ever reported in the literature.

Submitted by **CÉSAR LUIS BARRIO AMORÓS**, Fundación ANDÍGENA, Apartado 210, 5101-A Mérida, Venezuela; e-mail: cesarlba@yahoo.com or cesarlba@yahoo.com.

RHYNCHOCEPHALIA

SPHENODON PUNCTATUS PUNCTATUS (Northern Tuatara). **REPRODUCTION**. Tuatara (*Sphenodon*) are found on about 30 offshore islands of New Zealand and are represented by three genetically distinct groups. Populations of the northern tuatara, *Sphenodon punctatus punctatus*, inhabit islands much farther north (35°27' to 37°50'S) than the other two groups, *S. punctatus* ssp. (an undescribed subspecies; Daugherty et al. 1990. Nature 347:177–179) and *S. guntheri*, which inhabit islands in Cook Strait (40°40' to 41°07'S). Although aspects of nesting ecology have been established for the latter two taxa (Cree and Daugherty 1990. New Sci. 1739:22–26; Cree et al. 1991. Tuatara 31:9–16; Thompson et al. 1996. J. Zool., Lond. 238:239–251), this is the first record of nesting activity and egg incubation period for northern tuataras in the wild.

Signs of digging were observed in a grassy clearing on top of Lady Alice Island (35°54'S 174°44'E) during the afternoon of 7 December 1997 (early summer). The soil was dry, hard clay and bore two sets of horizontal claw marks where a fist-sized depression had been dug into the slope. A similar patch of soil, ca.1.5 m away, had been scraped bare. When the clearing was next visited, at dusk on 9 December (2039 h), the nest had been filled with loose soil and vegetation, and on my return at 2316 h, a previously gravid female tuatara was observed sitting next to the now-filled nest burrow. Identification numbers painted on her flanks were still legible. She had originally been caught in this clearing 28 days previously and had been carrying five eggs (determined by X-ray). Loose flanks and dimpling of the skin around the cloaca indicated that she had laid her eggs very recently. Records indicate that she had lost 37 g in mass. Careful excavation of the nest the next night (10 December) showed that it contained five eggs arranged in a single layer, with a thin layer of loose soil in the 1.5 cm gap between the eggs and the hard ceiling of the nest burrow. The small amount of loose soil used to fill the nest may have been the result of the surrounding clay being very hard to break up, and the nest entrance had been filled mainly with vegetation (exotic grasses and weeds scraped from around the entrance). The nest entrance was 8 cm across, with a distance of 2.5 cm from the entrance to the first egg, and 9 cm from the entrance to the back wall. The nest was restored to its original state. At 2211 h that same night, the female tuatara was observed lying on top of the nest site and appeared to be using her hind legs to backfill the nest. She froze in position when she became aware of my presence, and remained there while I moved past her. On 13 December, 5 to 6 nights after the eggs were laid, she was seen within 2 m of the nest site. As the nest was shallow and in a site prone to trampling by visitors to the island, wooden stakes were put in a 1 x 1 m square on 14 December 1997 to mark the site. The site was visually

checked and appeared undisturbed in July 1998. It was raining heavily at the time and water was flowing across the surface of the nest (R. Pierce, pers. comm.). On 15 October 1998, soil subsidence at the entrance and a small air space leading into the nest suggested that the eggs had hatched. Partial excavation revealed that only two eggs remained viable (turgid shells), whereas the other three eggs were empty, crumpled shells with a few 1–2 mm holes in their surface. Two of the dead eggs were removed before the nest was reburied. These turned out to be empty, apart from beetle elytra in one. When the nest was next checked on 5 December 1998, the two viable eggs had apparently hatched (single slit in shell along the long axis with a clean inside surface). The incubation period was therefore longer than 310 days and less than 362 days.

This first report of nesting in northern tuatara reveals many similarities with nesting on islands in Cook Strait, ca. 660–720 km south. On these southern islands, tuatara nest from late October to mid-December, peaking in November. Gravid female tuatara migrate from their home burrows to dig nests in open areas where soil temperatures are warmer. Nests are 10–50 cm deep, the female lays her eggs in a single night and returns to the nest each night for up to a week to fill it with soil and grass and defend it from other female tuatara. Incubation of the eggs takes 11–16 months (Cree and Daugherty 1990. New Sci. 1739:22–26). Northern tuataras do not appear to nest earlier in the year nor to have a markedly shorter egg incubation period than their southern counterparts despite warmer environmental temperatures.

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Submitted by **CLAUDINE TYRRELL**, Department of Zoology, University of Otago, P.O. Box 56, Dunedin, New Zealand.

LACERTILIA

COPHOSAURUS TEXANUS (Greater Earless Lizard). **DIET and BEHAVIOR.** While conducting a carrion insect succession field experiment near Las Cruces, New Mexico, USA, individuals of *Cophosaurus texanus* were observed on three separate occasions consuming *Dermestes* sp. adults and larvae associated with domestic swine (*Sus scrofa*) carcasses, and utilizing the carcasses as basking sites. On 14 July 1998 at 0900 h, a *C. texanus* was observed running up to a carcass and eating *D. maculatus* larvae from beneath it. On both 20 August and 27 August 1998, lizards of the same species were observed basking on the swine carcasses and feeding beneath them. In one instance, a *C. texanus* that was basking on the head of the carcass jumped off and began feeding on *Dermestes* revealed as a human manipulator lifted the other end of the carcass. Although it is well known that *C. texanus* is an insectivore, the consumption of *D. maculatus* has not previously been observed. In addition, this event illustrates the opportunistic use of carrion by these lizards.

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Submitted by **ROBIN N. KASSON,** Department of Anthropology, New Mexico State University, Las Cruces, New Mexico 88003, USA, and **MICHAEL K. ROSS,** Laboratory for Environmental Biology, Department of Biology, The University of Texas, El Paso, Texas 79968, USA.

EGERNIA CUNNINGHAMI (Cunningham's Skink). **ESCAPE BEHAVIOR.** The escape behavior of prey often reflects a tradeoff between predation risk and the cost of executing escape behaviors (Ydenberg and Dill 1986. Adv. Stud. Behav. 16:229–249). Such tradeoffs have been demonstrated for some lizards, with distance from refuges influencing how close an individual allows a potential predator to approach (approach distance) before fleeing (Bulova 1994. Copeia 1994:980–992; Martin and López 1995. Can. J. Zool. 73:129–132; Cooper 1997. Can. J. Zool. 75:943–947). Here, I report that both predator distance and the presence of conspecifics influence the approach distance of the lizard *Egernia cunninghami* (Scincidae).

On 9 December 1998, I studied the escape behavior of *E. cunninghami* on West Island, a small (11 ha) granite outcrop, ca. 5 km from Victor Harbor, South Australia. Using myself as the potential predator, I measured the approach distance for skinks that varied in their initial distance from refuges. Lizards were sighted initially by scanning the shore with binoculars. Upon sighting a lizard, I noted its position and walked towards it at a slow steady pace. When the lizard fled into a crevice, I measured the distances between 1) myself and the lizard's initial position, and 2) the lizard's initial position and the refuge crevice. In some instances, I approached a pair of lizards (lizards within one body length of each other). For pairs, measurements were taken for the first lizard fleeing into the crevice.

Approach distance was significantly influenced by crevice proximity and conspecific presence (General Linear Model: $F = 50.33$, $N = 23$, $r^2 = 0.81$, $P < 0.001$). Approach distance increased with increased initial distance from a refuge ($P = 0.048$). In addition, lizards in pairs had longer approach distances than single lizards (mean ± SD: pairs = 11.9 ± 3.7 m, single lizards = 2.4 ± 1.3 m; $P < 0.001$).

These observations support the generalization that lizards modify escape behavior in response to changes in predation risk and highlight the need for more detailed study of how social factors influence lizard escape behavior. Studies indicate the potential importance of social cues in the expression of escape behavior in *Iguana iguana* (Greene et al. 1978. J. Herpetol. 12:169–176), *Agama stellio* (Zinner 1967. Israel J. Zool. 16:49–58), *Tiliqua rugosa* (Bull and Pamula 1998. Behav. Ecol. 9:452–455), and *Eumeces laticeps* (Cooper, *op. cit.*). While most lizards spend little time in the presence of conspecifics, increased attention may reveal that social factors generally play a role in the expression of escape behavior.

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Submitted by **DOUGLAS EIFLER**, Natural History Museum, University of Kansas, Lawrence, Kansas, 66045, USA.

HOMONOTA FASCIATA (Ututo; South American Gecko). **OVIPOSITION.** On 6 October 1999, a female *Homonota fasciata* was captured with a Sherman small mammal trap at

Establecimiento Río Blanco, 28 km S, 9.3 km W Andalgalá (Andalgalá 27°36'S, 66°19'W), Salar de Pipanaco, Catamarca province, Argentina. The area is located in the "Monte" province, characterized by shrubby xerophytic steppes and marginal forests with low precipitation (between 80 and 200 mm per year).

The specimen (65 mm SVL, 60 mm regenerated tail length) was kept in a terrarium. On 12 October the female laid one egg, which was eaten by her in the same day. Other eggs were laid (one at a time) on 23 November (broken), 17 December, 27 December, 1999 (broken), and on 12 January and 30 January, 2000. At least one of these was viable, the embryo of the egg laid on 17 December 1999 having developed to approximately stage 42 (55–65 days after egg laying; Lemus et al. 1981. J. Morphol. 169:337–349). The embryo was deposited in the Fundación Miguel Lillo herpetological collection (FML 09253). The last two eggs (11.4 x 9.1 mm and 14.25 x 10.7 mm, respectively) have not yet hatched.

Available data for this species indicates a clutch size of only one (Aún and Martori 1994. Cuad. Herp. 8:90–96), with a maximum of two eggs per year (Cruz 1994. Cuad. Herp. 8:119–125). Our observations indicate that this species can have up to six one-egg clutches per year.

Submitted by **SONIA KRETZSCHMAR**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina (e-mail: soniak@unt.edu.ar), and **VIRGINIA ABDALA**, Instituto de Herpetología, Fundación Miguel Lillo, CONICET, Facultad de Cs. Naturales, Miguel Lillo 251, 4000 Tucumán, Argentina (e-mail: virginia@unt.edu.ar).

LIOLAEMUS LEMNISCATUS (Wreath Tree Iguana), ***LIOLAEMUS TENUIS*** (Thin Tree Iguana). **ENDOPARASITES.** *Liolaemus lemniscatus* and *Liolaemus tenuis* (Tropiduridae) are widely distributed lizards in the south-central parts of Chile (Donoso-Barros 1966. Reptiles de Chile, Ediciones de la Universidad de Chile, Santiago de Chile. 458 pp.). To our knowledge there are no published reports of endoparasites for *L. lemniscatus* and *L. tenuis*. The purpose of this note is to report the oxyurid nematode, *Spauligodon maytacapaci* in both lizard species.

Thirty-six *L. lemniscatus* (mean SVL = 46.0 mm ± 0.31 SD, range = 40–53 mm) and 27 *L. tenuis* (mean SVL = 52.4 mm ± 0.46 SD, range = 45–60 mm) were collected December 1999 and January 2000 at Lenga, Talcahuano, VIII Región, (36°45'S, 73°10'W), Chile. Lizards were fixed in 10% formalin and preserved in 70% ethanol. The abdominal cavity was opened and the esophagus, stomach, and small and large intestines were removed, slit longitudinally, and examined under a dissecting microscope. Each helminth was cleared on a glass slide in undiluted glycerol and upon examination with a compound microscope. All were found to represent life stages of the nematode species *Spauligodon maytacapaci*. Lizard voucher specimens were deposited in the Natural History Museum of Los Angeles County, Los Angeles: *L. lemniscatus* LACM 146291–146293; *L. tenuis* LACM 146286–146290. Nematodes were deposited in the United States National Parasite Collection, Beltsville, Maryland: *L. lemniscatus* USNPC 90042; *L. tenuis* USNPC 90043.

Prevalence (percent of infected lizards in sample), total number of helminths (N), mean intensity ± SD (mean number of nematodes per infected lizard) and range for *S. maytacapaci* were: *L. lemniscatus* prevalence = 17%, N = 17, mean intensity = 2.8 ± 2.4 SD, range = 1–7; *L. tenuis* = 70%, N = 81, mean intensity = 4.3 ± 4.1 SD, range = 1–14.

Spauligodon maytacapaci was described from *Leiocephalus* sp. collected in Cajamarca Province, Peru by Vicente and Ibañez (1968. Atas Soc. Biol. Rio de Janeiro 11:185–187) as *Parathelandros maytacapaci.* It was assigned to its current taxonomic position by Barus and Coy Otero (1974. Vest. Cesk. Spol. Zool. 38:1–12). This report of *S. maytacapaci* in *L. lemniscatus* and *L. tenuis* represents new host records. Chile is a new locality record.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **GABRIELA MUÑOZ** and **FELIX GARCIAS,** Facultad de Ciencias, Universidad Católica de la Ssma, Concepción, Casilla 297, Concepción, Chile, and **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard). **DIET.** On 17 July 1999, we observed the foraging behavior of a male *Phrynosoma cornutum* (90 mm SVL) ca.6 km E Portal in Chochise County, Arizona, USA. At 1710 h, he approached a termite (Isoptera: *Gnathamitermes perplexus*) mating exodus and began feeding on alates (winged reproductives) that were emerging from a single ground opening. During a 25-minute span, he consumed 94 termites. When we left the area at 1735 h, he was still feeding, although his rate of feeding had slowed markedly. During these observations, harvester ants (*Pogonomyrmex* sp.) were observed coming to the ground opening and carrying termites away. The *P. cornutum* made no attempts to capture these ants, which our behavioral observations and fecal analysis indicate compose more than 90% (numerically) of *P. cornutum*'s diet in the study area. While termites have been observed to represent a small portion of the diet for *P. platyrhinos* (Pianka 1986. Ecology and Natural History of Desert Lizards. Princeton University Press, Princeton, New Jersey. 208 pp.), we know of no records of *P. cornutum* feeding on termites, and no record of any *Phrynosoma* species feeding on termites at colony openings.

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Submitted by **KRISTIN BOTT**, 1755 Gekeler Lane, Boise, Idaho 83706, USA, **TRACEY BROWN**, CRES, Zoological Society of San Diego, P.O. Box 120551, San Diego, California 92112, USA, and **DOUGLAS EIFLER**, Department of Biology, University of Wisconsin, Stevens Point, Wisconsin 54481, USA.

PHRYNOSOMA (Horned Lizards). **PROTECTION.** While examining the horned lizards *Phrynosoma cornutum* and *P. modestum* collected in Chihuahua, Mexico by the first author during the summer of 1999, we encountered a cloacal structure not described previously. This structure is unique to *Phrynosoma* and presumably serves an important function in minimizing attacks by ants and resisting water loss.

The structure is here designated a squamous anal valve. It consists of a specialized groove dorsal to the anterior lip of the



FIG. 1. Ventral view (anterior to the top) of the squamous anal valve in *Phrynosoma modestum*, UBIPRO UNAM field no. JLE 3666, an adult female 55 mm SVL from Polvorillas (= Piedras Encimadas), mpio. Ojinaga, Chihuahua, Mexico (28°47'36.2"N, 104°13'30.8"W), 1440 m, 7 July 1999. The valve is shown spread somewhat to reveal the grooved anterior border with its pavimentous scales blending into the soft tissue of the cloaca, and the cord-like posterior border fortified by narrow, tightly juxtaposed scales. The black patches at each end of the groove and the central black spot posterior to the anus are present in all specimens examined of this species, but not in other species. Their role is not evident.

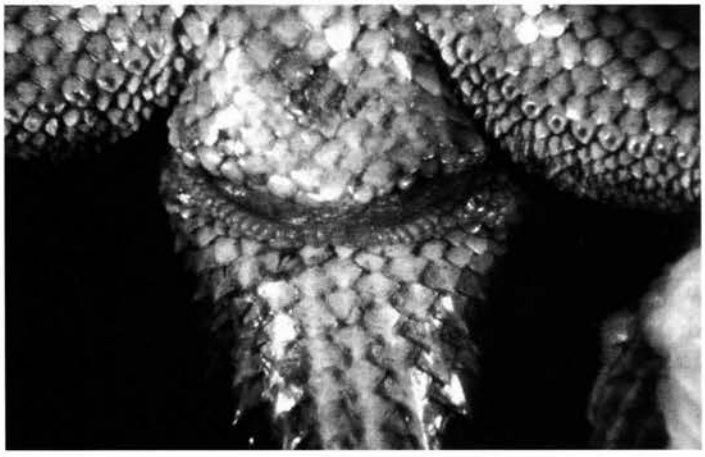


FIG. 2. Ventral view of the anal region (anterior to the top) of *Sceloparus grammicus*, UBIPRO UNAM field no. JLE 3944, an adult female 49 mm SVL, from 8.1 km S Creel, Chihuahua, Mexcio (27°42'6.9"N, 107°35'6.1"W), 21 July 1999. There are no scales posterior (or dorsal) to the anterior lip of the anus, only soft cloacal tissue. The scales on the posterior lip are mostly small; a few are somewhat elongate, but all blend shortly into the soft tissue of the cloaca without forming a distinct cord-like ridge.

anus, receiving a specialized ridge along the posterior lip of the anus. Closed, the valve is as impervious to attack by ants or other invertebrates as are most other surfaces of the body.

The groove distal to the anterior lip of the anus is lined with scales, above and below, although their extent on the dorsal wall of the groove is less than on the ventral wall, which is completely covered. On the dorsal wall the scales diminish in size over a short distance as they blend with the soft flesh of the cloaca. The scales in the groove are pavimentous, flat and juxtaposed, not imbricate.

The scales lining the ridge along the posterior lip of the anus are, in most species of the genus, very narrow and elongate, 2–3 times as long as broad, and they form a solid, dorsoventrally curved cord fitting snugly into the groove of the anterior lip of the anus. No scales lie internal to the ridge scales, which are bordered internally by the soft flesh of the cloaca.

We have examined examples of all species of the genus except *P. douglasi*, finding no fundamental differences among them in the structure of the valve. In some species, the ridge scales on the posterior lip of the anus are less narrow and elongate.

Some members within the genus *Sceloporus* examined exhibit no similar modification of the anal lips, which are less pronounced than in *Phrynosoma*. However, *S. slevini* and both *Urosaurus* and *Uta* have a rudimentary valvular structure, even with the same sort of narrow, elongate scales fortifying the posterior lip of the anus.

We are grateful to Richard R. Montanucci for his advice that the structure here reported merits further investigation, and to William E. Friedman for taking the photographs.

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México, Apartado Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, México 54090, **HOBART M. SMITH** and **DAVID CHISZAR,** University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

SCELOPORUS BELLI (Bell's Spiny Lizard). **PREDATION.** On 28 August 1999, as one of us (JAL) was collecting herps in a large grassland between Rancho La Paloma and Rancho El John, municipio of Coyame, Chihuahua, Mexico (29°47'55.6"N, 105°21'43.7"W), a small skull was spotted impaled on a spine of a large (ca. 2 m tall) *Yucca elata*. The skull (now JEL 4223, in the herpetological collection of Unidad de Biologia, Tecnologia y Prototipos [UBIPRO]) was of an adult *Sceloparus belli* and measured 10.1 mm in width and 10.0 mm in length. A 37 mm grasshopper was also observed impaled on a nearby spine, and a pair of loggerhead shrikes (*Lanius ludovicianus*) was seen flying in the area. This is the first record of predation on this little-known species.



FIG. 1. Skull of *Sceloporus belli* impaled on a yucca spine.

As can be seen in Fig. 1, the yucca spine penetrated the entire skull, through its roof. It would have taken considerable force to impale the lizard, embedding it so firmly that subsequent consumption of the body never released the skull.

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México, Apartado Postal 314, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, México, **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

SCINCELLA LATERALIS (Ground Skink)**. FIELD BODY TEMPERATURES and ECOLOGICAL NOTES.** The ground skink, *Scincella lateralis*, is a small, diurnal insectivore that inhabits forested areas and is commonly encountered foraging in the leaf litter. A few detailed studies of this lizard's ecology (Akin 1998. Can. J. Zool. 76:87–93; Duval et al. 1980. J. Herpetol. 14:121–127; Nicoletto 1985. J. Herpetol. 19:487–491) exist but field temperature data are limited (Brooks 1967. Ecol. Mongr. 37:71–87; Fitch 1956. Univ. Kansas Mus. Nat. Hist. 8:417–476). Therefore, we conducted a short survey of field body temperatures and general ecology observations of an urban population of *S. lateralis*.

Field work was conducted on the grounds of the Dallas Zoo (Dallas County, Texas, USA). The study site consisted of a wooded plot adjacent to the zoo's bird and reptile building, measuring approximately 56.7 m x 30.3 m, with the building acting as eastern border for 30 m. Frequently traveled concrete roadways act as the western and northern borders. The study area is characterized by heavy leaf litter, high density of low level vegetation, and debris (large rotting tree limbs). Leaf litter depth ranged from 1.3 cm to 17.8 cm, with the deepest areas adjacent to the building's exterior wall.

From 20 June to 20 July 1998, morphometric data, temperature data, and general ecological observations were recorded for sixty lizards. After data were collected, specimens were released within 2.0 m of the original capture site. The study site was visited 19 times, no more than twice per day, for a mean period of 41.0 minutes per visit. Data were gathered only once for each lizard, with duplicate data excluded from analysis based on morphometric records. Morphometric data recorded included SVL, tail length, head width, mass, sex, and age class. Measurements were taken with calipers to 0.1 mm. Head width was recorded as the distance between each eye. Mass was measured with a 50.0 g Pesola scale. Sex was determined by the observed presence or absence of hemipenes. Specimens with an SVL of 35.0 mm or greater were classified as adults (Brooks 1967. Ecol. Mongr. 37:71–87). Two specimens (1 male and 1 female) were missing their front left feet. See Table 1 for morphometrics.

Individual body (cloacal) temperatures (T_b) were taken within 10 sec of capture. Air temperature (T_a) was recorded approximately 1.5 cm above the substrate. Both T_b and T_a were recorded with a type k thermocouple and digital thermometer (600-0000, Barnant Company, Barrington, Illinois, USA). Substrate temperatures (T_s) were measured with an infrared thermometer (RAYST2PU, Raynger ST, Santa Cruz, California, USA). Weather conditions and degree of sun exposure (shade, indirect, direct, and mosaic) were documented.

Lizard behavior, upon first sighting, was recorded as still, crawling, running, or basking. Basking was indicated when an individual remained motionless for at least 120 sec in direct sunlight. Microhabitat information such as the type of substrate and relative moisture levels was collected. Moisture level was judged by touch, as dry or moist, while the presence of standing water was recorded as wet.

Male mean $T_b = 27.4 \pm 2.8°C$ (N = 25), female mean $T_b = 27.3 \pm 2.6°C$ (N = 30). Mean body temperature for all skinks examined was $27.4 \pm 2.6°C$ (N = 60). Skinks were active at T_a's ranging from 17.8 to 43.3°C ($25.8 \pm 4.0°C$, N = 60) and T_s's from 21.1 to 49.4°C ($29.6 \pm 6.1°C$). Body temperatures never exceeded 31.1°C.

Substrate conditions varied within the skinks' microhabitat. Forty-three lizards were collected in leaf litter: 14 in dry leaves, and 29 in moist leaf litter. Three skinks were recorded on bare soil: two in dry conditions, one on moist soil. Five lizards were also collected on dry rock substrate. An additional eight skinks were found in other forms of refugia (e.g., under plywood, broken pottery): three in dry conditions, four in moist areas, and one on wet substrate.

The majority (62%, 37) of lizards collected were found running, presumably because of our presence. Twenty percent (12) were found slowly crawling, possibly foraging. Eighteen percent (11) were found motionless under leaf litter or some form of refugia. Only one individual was observed basking. Eighty-two percent (49) of individuals collected were found in shaded areas. Seven percent (4) were found in mosaic areas, 7% (4) in indirect sun, and 4% (3) in direct sunlight.

TABLE 1. *Scincella lateralis* mean morphometrics (SD/N).

	Head Width (mm)	SVL (mm)	Tail Length (mm)	Mass (g)
Male	4.4 (0.2/22)	41.0 (2.2/25)	49.3 (16.8/25)	1.3 (0.3/25)
Female	4.5 (0.1/23)	46.6 (3.6/30)	50.2 (17.2/30)	2.0 (0.5/30)
Juvenile	—	34.5 (—/1)	40.9 (—/1)	1.0 (—/1)
Adults	4.4 (0.2/49)	43.7 (4.2/59)	49.3 (16.9/59)	1.6 (0.5/59)

Submitted by **RUSTON W. HARTDEGEN** and **DAVID T. ROBERTS**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA, and **KATHERINE L. DEADERICK**, Children's Hospital at Medical City Dallas, 7777 Forest Lane, Dallas, Texas 75230, USA.

AMPHISBAENIA

AMPHISBAENA MERTENSI (NCN). **DEFENSIVE BEHAVIOR.** Caudal autotomy—the ability to lose the tail in defensive encounters—is exhibited by some lepidosaurs, salamanders, and a few rodents (Arnold 1988. *In* C. Gans and R. B. Huey [eds.], Biology of the Reptilia, vol. 16, Defense and Life History, pp. 235–273. Alan R. Liss, New York). This behavior is thought to be an important strategy, attracting a predator's attention

to the broken piece of the tail, allowing the prey to escape. Here we report on a provoked predatory encounter between an amphisbaenian, *Amphisbaena mertensi*, and the South American coral snake, *Micrurus lemniscatus*, a natural predator of amphisbaenians (Amaral 1927. Coletânea dos Trabalhos do Instituto Butantan, vol. 2, Oficina do Diário Oficial, São Paulo, 406 pp.). These two species are broadly sympatric over their geographic distribution.

The observations were made with an adult male *A. mertensi* (SVL 284 mm; tail length 47 mm) collected at an animal rescue during the construction of the hydroelectric power plant near Miranda, Patrocínio municipality, Minas Gerais state, Brazil, and an adult female *M. lemniscatus* (SVL 547 mm) collected at Rio Claro municipality region, São Paulo state, Brazil. Both specimens were deposited in the Museum of the Zoology Departament, Universidade Estadual Paulista, Rio Claro, SP (*A. mertensi* under # 974 and *M. lemniscatus* under # 975).

On the evening of 24 May 1999, the animals were placed in a plastic box (73 x 39.3 x 55 cm) with 3.5 cm of soil as substrate and illuminated by a dim infrared light. Thereafter, the animals were left undisturbed and their behavior was recorded by a closed-circuit television system. After 1.5 h, the coral snake directed its head toward the amphisbaenian, moved rapidly toward it, and bit the terminal section of its tail. The tail autotomized at a natural break site immediately following the bite (Vanzolini 1948. Rev. Brasil. Biol. 8:377–400). The movements of the broken piece of the tail attracted the coral snake which spent 3 min inspecting it. After the attack and tail autotomy, the amphisbaenian moved continuously, an activity that, under natural conditions, would probably allow the animal to escape and survive this predation event. Under the experimental conditions, however, the coral snake was able to re-attack 3 h later. At this time, the coral snake again bit the terminal section of the amphisbaenian tail and the amphisbaenian thrashed vigorously, forcing the coral snake to release it. From 19–40 min after this second attack, the *A. mertensi* died, probably due to envenomation from the second attack.

In a sample of 30 *A. mertensi* from the same animal rescue at Miranda, 33% of the individuals had autotomized tails. Assuming that tail loss scars are evidence of survivorship from a predatory encounter, and based on our experimental observations, we conclude that caudal autotomy could serve as an effective defense strategy for *A. mertensi*, resulting in survival from predation in a considerable proportion of individuals.

Submitted by **SIMONE P. BRITO, DENIS V. ANDRADE,** and **AUGUSTO S. ABE,** Departamento de Zoologia, Universidade Estadual Paulista, UNESP, Av. 24-A, 1515, Caixa Postal 199, CEP 13506-900, Rio Claro, São Paulo, Brasil; e-mail (SPB): rc.unesp.br spbrito@rc.unesp.br.

SERPENTES

AGKISTRODON CONTORTRIX CONTORTRIX (Southern Copperhead). **CHEMOTAXIS, ARBOREALITY and DIET.** Flightless larval cicadas emerge from the ground and often climb into vegetation to complete final ecdysis and emerge from the pupal skin. During the ca. two-hour period of emergence, and as adults, cicadas are susceptible to predation by a variety of organisms (Williams and Simon 1995. Annu. Rev. Entomol. 40:269–295). Copperheads (*Agkistrodon contortrix*) are known to consume periodical cicadas during years of peak emergence (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex. SSAR, Oxford, Ohio; Williams and Simon 1995, *op. cit.*; Reid and Nichols 1970. Bull. Maryland Herpetol. Soc. 6:57). Here, we report an observation of a copperhead that climbed into a cedar tree, used chemotaxis to locate an emerging cicada, and consumed it.

On 21 July 1997 at ca. 2130 h, we encountered an adult male *A. contortrix* (68.2 cm SVL, 274.6 g) ca. 1.3 m high, and climbing, in a cedar tree at the Ozark Natural Science Center, Madison Co., Arkansas, USA. The snake's movements were characteristic of chemotaxis described for viperids trailing in search of stricken prey (Chiszar et. al. 1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 369–382. Selva, Tyler, Texas). On a branch ca. 2.2 m off the ground (still about 2 m from the climbing snake), and suspended from the down side, we noticed a single dogday cicada (*Tibicen canicularis*) emerging from its pupal skin. The snake climbed by coiling around the trunk, and using small irregularities on the bark surface and branch remnants (Fig. 1). The cedar tree had multiple trunks arising by splits at ca. 0.5 m. The copperhead climbed a different trunk than the one from which the emerging cicada was suspended. The snake's intensive tongue flicking and head waving suggested that he was trailing the cicada along the same path that the insect took from the ground. The snake climbed up into the branches to a point higher than the cicada and crossed over to the cicada's trunk along a continuous tract of branches. The snake was continuously supported by the trunk or branches, even though bridging the body across gaps would have yielded a more direct path to the cicada. The snake's path would also have been accessible to the crawling cicada nymph. The snake proceeded to a point on the branch directly above the suspended cicada and searched the space below the branch with its tongue until its nose was in contact with the emerging insect. The snake nudged the cicada, which responded with a small movement. Immediately, the snake seized the insect with a quick grasp and swallowed it whole while still suspended from the branch. Use of



FIG. 1. *Agkistrodon contortrix* climbing a straight-trunk cedar tree, tracking a cicada nymph to its point of eclosion. Note use of bark irregularities and branch remnants for climbing.

arboreal habitats while foraging for cicadas has been reported once previously for copperheads (Werler 1978, as cited by Gloyd and Conant 1990, *op. cit.*). Our observation expands this previous report by suggesting that copperheads may use chemotaxis to track and locate recently eclosed cicadas.

Seven nights later, on 28 July 1997, this same snake was observed at 2215 h suspended 1.5 m off the ground in the branches of a cedar tree swallowing another *T. canicularis*. Also, at 2040 h on 28 July 1997, a second *A. contortrix* was observed to climb a small sapling (ca. 1 m in height), knock a cicada off of it, crawl back down, and seize and ingest the cicada on the ground.

Opportunistic ingestion of cicadas by copperheads during years of periodical emergence has been documented (Gloyd and Conant 1990, *op. cit.*; Reid and Nichols 1970, *op. cit.*). Unlike previous reports of copperhead predation on cicadas, our observation did not occur during a peak emergence of a periodical species, but rather seemed a routine predation of annually emerging dogday cicadas. Examination of fecal samples collected from copperheads at our site during July and August 1996 and 1997, revealed that six of seven samples contained remains of cicadas.

Energy density data for *Tibicen* are absent from the primary literature, however, Brown and Chippendale (1973. J. Insect Physiol. 19:607–614) reported that 17-year periodical cicadas (*Magicicada cassini*) in Missouri carry large reserves of lipid and protein upon emergence. The average female *M. cassini* weighed 565 mg wet mass, including 58 mg of lipid and 110 mg of soluble protein. In contrast, the average male *M. cassini* weighed approximately 278 mg, of which 19 mg were lipids and 51 mg were soluble protein. Assuming an energy yield of 38.9 kJ/g for lipids and 17.5 kJ/g for protein (Eckert et al. 1988. Animal Physiology: Mechanisms and Adaptations. 3rd ed. W. H. Freeman & Co., New York, New York. 562 pp.), then the minimum energy content of female and male *Magicicada* would be approximately 4.18 kJ and 1.63 kJ respectively. Temporally abundant, high energy cicadas (especially females), may be an important contribution to the annual energy budgets of copperheads. Other small pit vipers (*Crotalus lepidus*, *C. cerastes*) have annual energy budgets of 1000 to 1300 kJ per year (Beaupre 1996. Copeia 1996:319–329; Secor and Nagy 1994. Ecology 75:1600–1614). Copperheads that gorge themselves on abundant cicadas during summer may acquire significant portions of a similar annual energy requirement.

Submitted by **S. J. BEAUPRE** and **K. G. ROBERTS**, University of Arkansas, Department of Biological Sciences, Fayetteville, Arkansas 72701, USA; e-mail (SJB): sbeaupre@comp.uark.edu.

APARALLACTUS NIGER (NCN). **VARIATION**. *Aparallactus niger* is a fossorial colubrid snake. Previous authors record that the dorsum of this species is uniformly black or blackish-brown (Angel 1933. Les Serpents de l'Afrique Occidentale Francaise. LaRose Editeurs, Paris. 246 pp; Villiers 1950. Les Serpents de l'Ouest Africain. Publications de l'IFAN, Dakar. 148 pp; Wallach 1994. J. Herpetol. 28:95-99). In June–August 1987, I collected 11 *A. niger* from Area J of Yekepa, Nimba County, Liberia. Of these, the dorsum was uniformly black in only four specimens, all more than 30 cm total length (38 cm, 42 cm, 44 cm, and 48 cm). In two other dorsally-black specimens, a light-colored spot was present on each dorsal scale, but the spots were so faint that they were almost invisible; these specimens were also over 30 cm total length (57 cm and 61 cm). In the rest of the specimens, all under 30 cm total length, the dorsal scales exhibited bold dots of the same color as the belly (yellow or light gray). In four of these smaller specimens (21 cm, 21.5 cm, 23 cm, and 25.5 cm), these spots were present only on the anterior portion of the snake. In one small specimen (19 cm), the belly and dorsal spots were gray, while a collar of yellow spots occurred on the nape; this specimen's dorsal spots occurred throughout its length, but some of the anterior dorsals lacked the spot. This sample appears to reveal that juvenile *A. niger* are more boldly marked than adults, and that the coloration of *A. niger* is more varied than had been thought.

I thank Mr. Alfred Yeanay for locating the specimens.

Submitted by **PHIL SENTER**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

BOTHROPS JARARACA (Jararaca Pitviper). **CAUDAL LURING**. Caudal luring involves moving the distal portion of the tail in a manner resembling a vermiform invertebrate, for the purpose of attracting vertebrate prey (Tiebout 1997. J. Herpetol. 31:292–295). Caudal luring has been reported for juveniles of several species of *Bothrops* (*sensu stricto*), including *B. atrox*, *B. jararacussu* and *B. jararaca*. (Sazima 1992. *In*: Campbell and Brodie [eds.], Biology of Pitvipers, pp. 199–206. Selva, Tyler, Texas). On 12 January 2000 at 0900 h, we observed and photographed caudal luring in a juvenile *Bothrops jararaca* at Mata Atlântica (Parque Estadual da Serra do Mar, Núcleo Picinguaba – Ubatuba – SP, Southeastern Brazil). The juvenile male (29 cm SVL) was coiled on the ground at the edge of a streamlet, in the forest. The snake kept its body completely motionless, except for the distal part of the tail. We observed a potential prey item in the streamlet (*Hylodes asper*, Anura, Leptodactylidae). *Bothrops jararaca* has been reported to employ caudal luring twice during early night (Sazima, *op. cit.*). Apparently this is the first record of caudal luring in *B. jararaca* in the morning.

We thank Célio F. B. Haddad for his comments and review of the manuscript.

Submited by **PAULO AFONSO HARTMANN** and **MARíLIA T. DE ALMEIDA**, Pós Graduaÿão em Zoologia, Instituto de Biociências, Universidade Estadual Paulista, C.P. 199, 13506-900, Rio Claro, São Paulo, Brazil; e-mail (PAH): pahart@rc.unesp.br, and matal@rc.unesp.br.

BOTHROPS LEUCURUS (White-tailed Lancehead). **REPRODUCTION**. On 6 October 1998, a female *Bothrops leucurus* from Porto Seguro (16°26'S, 39°03'W), an eastern Brazilian city, was received by Instituto Butantan, São Paulo, Brazil. The snake was individually housed in a cage, where it was offered water and mice. On 19 February 1999, the female (SVL 1030 mm, tail length 130 mm, 535 g) gave birth to 17 living neonates (9 males: 8 females) and one stillborn individual of undetermined sex. The neonates were weighed and measured immediately. Male mass ranged from 5.5–6.5 g (mean ± SD = 6.3

± 0.38 g); male SVL ranged from 209–220 mm (214.9 ± 0.44 mm). Female mass ranged from 3.0–7.0 g (6.0 ± 1.25 g); female SVL ranged from 179–222 mm (209.9 ± 1.36 mm). There were no significant differences in mass (t = 0.54; $P = 0.30$) or SVL (t = 0.99; $P = 0.17$) of male and female neonates. The combined mass of the living neonates was 19.57% of the mother's pre-partum mass. The size of this litter is within the published range for this species (5–20; Lira-da-Silva et al. 1994. Rev. Bras. Biol. 11:187–193).

Submitted by **SÁVIO S. SANT'ANNA**, **KATHLEEN F. GREGO** and **WILSON FERNANDES**, Laboratório de Herpetologia, Instituto Butantan, 05503-900, São Paulo, Brazil; e-mail (SSS): ssanna@originet.com.br.

CROTALUS LEPIDUS LEPIDUS (Mottled Rock Rattlesnake). **DIET**. There are few literature reports of North American rattlesnakes preying upon horned lizards (*Phrynosoma* spp.) in the wild (e.g., *Crotalus atrox* and *P. cornutum*, Beavers 1976. Southwest. Nat. 20:503–515; *C. cerastes* and *P. m'calli*, Funk 1965. Herpetologica 21:15–17; *C. viridis* and *Phrynosoma* sp., McKinney and Ballinger 1966. Southwest. Nat. 11:410–412). Herein, we report *C. l. lepidus* preying upon *P. hernandesi*. On 12 September 1999 in the Davis Mountains, on Hwy 118 between Hwy 17 and Hwy 166, Jeff Davis Co., Texas, USA, one of us (RWD) collected a DOR adult female *C. l. lepidus* (516 mm SVL, 40 mm tail) that contained a partially digested *P. hernandesi* (100 mm SVL) that had been ingested head first. The rattlesnake and horned lizard have been catalogued in the University of New Mexico Museum of Southwest Biology (MSB 61422 and MSB 61423).

Submitted by **ROBERT W. DICKERMAN**, University of New Mexico, Museum of Southwestern Biology, Albuquerque, New Mexico 87131, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA (e-mail: CPainter@state.nm.us).

EUNECTES MURINUS (Green Anaconda). **DIET**. There are few documented reports on the diet or foraging behavior of green anacondas (*Eunectes murinus*). Here we describe green anacondas preying on large mammals in the llanos of Venezuela. All observations were made by XV during a study of wedge-capped capuchin monkeys (*Cebus olivaceus*) in a semi-deciduous gallery forest that extends across two contiguous cattle ranches, Fundo Pecuario Masaguaral (8°34'N, 67°35'W) and Flores Moradas, located 50 km south of Calabozo in Guárico state. The area has well-defined dry (January–April) and wet (June–November) seasons. The gallery forest is characterized by a canopy height of 14–22 m and two permanent watercourses, the Caño Caracol and the Guárico River. A narrow, shallow inlet from the caño penetrates ca. 40 m into the surrounding forest. Three adult anacondas were observed at different times near the distal end of the inlet, in an area well shaded by vines and the forest canopy. The width of the inlet varies depending on water level but is typically 1–1.5 m wide and 10–15 cm deep, whereas the caño is 15–30 m wide and 0.5 m deep. The inlet is filled with leaf litter, fallen twigs, and branches, and at times is covered with a thin layer of floating vegetation (*Lemna* spp.) that may help to conceal the snakes. There is no standing water in the forest at the peak of the dry season, and the caño is the closest source of water for many forest animals.

On 4 March 1998 at 0804 h, capuchin monkeys were observed giving ground-predator alarms at an anaconda that was lying next to and partially beneath a dead adult white-collared peccary (*Tayassu tajacu*, average adult body mass 20 kg). The snake (ca. 5 m TL) fully extended its body, then used its mouth to grab the peccary's snout and drag the body 3 m through the water. While still holding onto the snout, the snake coiled itself round the peccary's torso and squeezed, visibly stretching the peccary lengthwise and forcing out fecal matter (Fig. 1). Stretching large prey may facilitate their ingestion by anacondas. At one point, a muffled crackling sound was heard, resembling that of many bones breaking all at once. The anaconda repeated dragging and stretching the peccary. XV left the inlet at 1128 h to resume following the capuchin monkeys. When the monkeys returned at 1252 h, the anaconda still had not begun to swallow the peccary. The following morning at about 1100 h, both the anaconda and peccary were gone.

On 22 March 1999 at 1331 h, capuchin monkeys were heard giving ground alarms at the same caño inlet. An adult female anaconda (4.0–4.2 m TL) was found with its mouth around the head of an adult lesser anteater (*Tamandua tetradactyla*, average adult body mass 4–6 kg). When next seen at 1456 h, the anaconda had finished swallowing the tamandua.

These are the first documented observations of green anacondas preying on peccaries and tamanduas. In both cases, the anacondas were observed in the same location. On a third occasion, 19 May 1999 at 0923 h, another anaconda (4.5 m TL, and distinguished by photographs of its tail color pattern) was seen within 5 m of the above location, partially submerged and obscured by leaf litter.

These observations of different anacondas in the same inlet suggest that the snakes select this location for foraging and ambushing prey. The shallow, narrow character of the inlet may facilitate the close approach of animals that are foraging or coming to the water for a drink, thus providing a short striking distance for anacondas.



FIG. 1. Adult *Eunectes murinus* (ca. 5 m TL) encircling an adult white-collared peccary.

Submitted by **XIMENA VALDERRAMA**, Department of Anthropology, 1200 Amsterdam Avenue, Mail Code 5523, Columbia University, New York, New York 10027, USA (e-mail: mxv1@columbia.edu), and **JOHN B. THORBJARNARSON**, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460-1099, USA.

EUNECTES NOTAEUS (Yellow Anaconda). **DIET**. Between June and September 1994, the first stage of filling of the Yacyreta Dam Reservoir, located on the Paraná River along the Paraguayan-Argentinian border (ca. 27°30' S, 56°40' W), occurred. During the flooding we had free access to the specimens of *Eunectes notaeus* captured by an official fauna rescue team. Approximately 1500 yellow anacondas were collected from branches of the flooded trees and bamboos and later released in safe places by the rescue team. We randomly selected 100 specimens that were immediately sacrificed, measured, dissected, examined for fresh stomach contents and reproductive condition, fixed, and later deposited in the Herpetology Section of the Museo Nacional de Historia Natural del Paraguay (MNHNP).

Of these 100 specimens, six had fresh prey items in their stomach, one regurgitated an oppossum while being transported in a sac, and one contained bird feathers in its scat (Table 1). The four prey species encountered have not been previously reported as part of the diet of *E. notaeus* (Strüssmann 1997. Biociências, Porto Alegre 5:35–52). The small proportion of individuals containing fresh prey could be explained by the relatively low temperatures prevailing during our field work, which occurred during the local (subtropical) winter season. We note that the conditions during our research were man-induced (dam filling), however, the filling process and the water levels of the reservoir paralleled the periodical large floodings that affect the Paraná River ca. every 10 years. Thus, we do not believe that this man-induced situation has altered qualitatively the usual prey preferences of the yellow anaconda.

We acknowledge Aida Luz Aquino (Paraguay CITES Scientific Authority) for supporting our research, and Marta Motte (MNHNPY Curator of Herpetology) for her cooperation during our field and museum work.

TABLE 1. Prey items of eight *Eunectes notaeus* from the Yacyreta Dam Reservoir, Paraná River, Paraguay and Argentina (TL: Total Length, SC: Stomach Content, S: Scat, R: Regurgited).

Specimen #	Sex	TL (mm)	SVL (mm)	Prey (Type of Sample)	Order:Family
Not identified	F	> 2000		*Lutreolina crassicaudata* (R)	Marsupialia:Didelphidae
MNHNP 6891	F	2310	2020	*Cavia aperea* (SC)	Rodentia:Caviidae
MNHNP 6890	F	2220	1915	*Cavia aperea* (SC)	Rodentia:Caviidae
MNHNP 6848	F	1700	1480	*Scapteromys tumidus* (SC)	Rodentia:Muridae
MNHNP 6920	F	1520	1325	*Scapteromys tumidus* (SC)	Rodentia:Muridae
MNHNP 6923	M	1800	1530	*Scapteromys tumidus* (SC)	Rodentia:Muridae
MNHNP 6925	F	1850	1620	*Agelaius cyanopus* (SC)	Passerines:Icteridae
MNHNP PB86*	M	740	645	Feathers (S)	Passerines

* field number

Submitted by **TOMAS WALLER**, La Pampa 1815 5.B., Buenos Aires, Argentina, CP 1428 (e-mail: tomas@waller.com.ar), ***EMILIO BUONGERMINI P.***, *Museo Nacional de Historia Natural del Paraguay, Sección de Herpetología. Caballero 1060, Asunción, Paraguay, CP 1324, and **PATRICIO A. MICUCCI**, Paraguay 2499 7°B, Buenos Aires, Argentina, CP 1121.*

HELICOPS SCALARIS (Guata). **REPRODUCTION**. *Helicops scalaris* is found aggregated in groups in fresh or brackish waters, where it feeds on amphibians and fish. It is restricted to the Lake Maracaibo basin in Venezuela (Lancini 1986. Serpientes de Venezuela, 2nd ed. Caracas, Venezuela, 262 pp.). On 6 August 1999 two female *H. scalaris* were collected in the coastal portion of northern Lake Maracaibo, Zulia State. Both individuals (950 mm and 1005 mm total length [TL], 570 g and 595 g, respectively) were in late pregnancy. Both snakes were taken to the laboratory for monitoring in captivity. Birth occurred four and one weeks after collection, with litter sizes of 21 and 22, respectively. Offspring from the two litters were similar in size (20.53 ± 0.43 mm TL, 5.22 ± 0.27 g; 20.48 ± 0.35 mm TL, 5.37 ± 0.34 g, respectively). One snake was taken to the snake section of the Aquarium J. V. Seijas in Carabobo State; the other snakes remain alive in the biothery of the Facultad de Ciencias Veterinarias of La Universidad del Zulia, in Maracaibo.

We acknowledge Angel Viloria from the Museo de Biología de La Universidad del Zulia (MBLUZ) for confirming the identity of the species.

Submitted by **TITO BARROS**, Herpetology Section, Museo de Biología de La Universidad del Zulia, Grano de Oro, Facultad de Ciencias, Apdo. 526, Maracaibo 4011, Edo. Zulia, Venezuela (e-mail: trbarros@cantv.net), **JUAN CARLOS LÓPEZ** and **MARYCRUZ ALVARADO**, Unidad de Investigaciones Ofidiológicas (UIO), Facultad de Ciencias Veterinarias, La Universidad del Zulia, Ciudad Universitaria, Apdo. 526, Maracaibo 4011, Edo. Zulia, Venezuela.

HETERODON PLATIRHINOS (Eastern Hognose Snake). **PARASITES**. On 26 April 1998, a 731 mm long (620 mm SVL) *Heterodon platirhinos* was captured 5 km SE of South Roxana, Madison Co., Illinois, USA (NE1/4, Sec. 19, T4N, R8W). The snake regurgitated a partially digested male Fowler's toad (*Bufo woodhousii fowleri*) that weighed 24.9 g. A number of nematodes were observed on and in the open body cavity of the toad at the time of collection. The toad and nematodes were preserved in the field (Illinois Natural History Survey, INHS 14508). The snake was marked and released.

The nematodes were identified in the laboratory as *Physaloptera variegata*. This species was originally described from the stomachs of Florida *Coluber constrictor* (Reiber et al. 1940. Lloydia 3:125–144). They also reported the species from *Thamnophis sirtalis* from Florida and *Lampropeltis getula nigra* from Georgia (Reiber et al., *op. cit.*). Mawson (1956. Can. J. Zool. 34:75–76) reported *P. variegata* from *C. constrictor*, *Heterodon platirhinos*, and *Ophisaurus ventralis*, all from Georgia. Our finding confirms the association between *P. variegata* and *H. platirhinos* and is a new locality record for the nematode.

Physaloptera variegata has never been reported from an amphibian host. We examined the stomachs, intestines, and lungs under 7X magnification for 80 *Bufo woodhousii fowleri* collected in 1999 from this site. Twelve (15%) toads contained from 1 to 28 *Rhabdias bufonis*, a nematode previously reported from *B. w. fowleri* (Goldberg et al. 1996. Great Basin Nat. 56:369–374), but no toad contained *P. variegata* . We thus found no evidence that the toad acted as a vector for *P. variegata*. Rather it seems more likely that the association between the toad and *P. variegata* was coincidental.

Submitted by **JOHN K. TUCKER**, **ROBERT J. COSGRIFF**, Great Rivers Field Station, Illinois Natural History Survey, 8450 Montclaire Avenue, Brighton, Illinois 62012, USA (e-mail: John_K_Tucker@usgs.gov), **WILLIAM G. DYER**, Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901, USA, and **JOHN E. PETZING**, Center for Biodiversity, Illinois Natural History Survey, 607 E. Peabody Drive, Champaign, Illinois 61820, USA.

LAMPROPELTIS PYROMELANA (Mountain Kingsnake). **MORTALITY**. Reports of squirrels defensively attacking snakes are not uncommon (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. Univ. of California Press, Berkeley. 1533 pp.; Coss and Owings 1989. Natural History 98[5]:30–35; Engeman 1994. Herpetol. Rev. 25:125). Less frequently, squirrels have been seen preying on snakes or eating freshly killed snakes (Harriot 1940. J. Mamm. 21:92; Wistrand 1971. Am. Midl. Nat. 88:511–512; Halpin 1983. Am. Midl. Nat. 109:50–54; Cobb and Peterson 1999. Herpetol. Rev. 30:45–46).

On 21 April 1999 at 1450 h one of us (BLC) observed a rock squirrel, *Spermophilus variegatus*, attack a *Lampropeltis pyromelana* (85 g, 675 mm SVL) amid a Gambel oak (*Quercus gambelli*) woodland at ca. 2255 m in the Animas Mountains, Hidalgo Co., New Mexico, USA. The squirrel had paused on a rock when it abruptly bounded over to a patch of dead leaves and appeared to aggressively root around in the leaf pile. With the aid of binoculars it became apparent the squirrel was attacking a *L. pyromelana*. The squirrel was frightened off and the kingsnake collected. The snake sustained extensive injuries from the rodent's incisors. These included 8–9 punctures of the body wall, several with emergent viscera. One wound appears to have seriously damaged the snake's spine. The snake was cold to the touch, although the air temperature (1.5 m above the surface) was 22.5°C. The snake was held for observation, discovered dead the next morning, and subsequently deposited in the Museum of Southwestern Biology, University of New Mexico (MSB 61278). This observation was made in the course of an ongoing mark-recapture investigation of the ecology of this montane snake community. The male *L. pyromelana* was previously captured in the same location on 4 October 1998 at which time it weighed 87 g.

Published accounts of *S. variegatus* encounters with snakes are limited to *Pituophis melanoleucas* and involve a very aggressive attack by the squirrel, with the squirrel kicking debris and/or biting the snake, possibly in defense of young (Haywood and Harris 1971. Texas J. Sci. 22: 427; Knickerbocker 1988. Arizona Highways 64[9]:12–15). In our area *S. variegatus* does not give birth to young until late May at the earliest, and most give birth in June (Ortega 1990. J. Mamm. 71:448–457). In this case, the squirrel clearly initiated an agressive encounter that was not in defense of nestlings. For this reason, and because *S. variegatus* occasionally takes other live vertebrate prey (Hoffmeister 1986. The Mammals of Arizona. University of Arizona Press, Tucson, Arizona. 602 pp., and citations therein) we believe the squirrel was preying on the snake. Prior to this report, the sole published predator of *L. pyromelana* was the Mexican spotted owl, *Strix occidentalis lucida* (Duncan 1992. Herpetol. Rev. 23:81).

Submitted by **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA, and **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu).

LAMPROPHIS FULIGINOSUS (Brown House Snake). **PREDATION**. A number of invertebrates are reported to prey on reptiles (for reviews see Greene 1988. *In* Gans and Huey (eds.), Biology of the Reptilia, vol. 16, Ecology B. pp. 1–152. Alan R. Liss, New York; McCormick and Polis 1982. Biol. Rev. 57:29–58), but no published accounts of spider predation on snakes are known to this author. I report below on two separate occurrences of predation by a geometrid button spider (*Latrodectus geometricus*) on juvenile (less than a year old) brown house snakes.

On 25 March 1999, I observed a *Lamprophis fuliginosus* entangled in a geometrid button spider web. The incident took place in Pretoria North, Gauteng Province, South Africa. The posterior portion of the snake was caught in the web, less than 30 cm above the ground, while the anterior half rested on the ground. The snake had two puncture marks two-thirds of the way down its body. Just posterior to these marks were further bite marks from where the spider was feeding. The posterior half of the snake was paralyzed.

In the other observation, also in Pretoria but recorded fifteen months earlier, the situation was similar, except that the anterior half of the snake was entangled in the web about 20 cm above the ground. The snake had two puncture marks midway along its body from where the spider was feeding. The snake was unable to free itself, since it was almost completely paralyzed.

In the highveld (typical savanna/grassland habitat), both geometrid button spiders and brown house snakes occur in abundance. Wulf Haacke (pers. comm.), herpetologist at the Transvaal Museum of Natural History, once observed predatory behavior of the geometrid button spider on a juvenile herald snake (*Crotaphopeltis hotamboeia*). In these situations, I believe that spider predation on juvenile snakes is opportunistic. Neither the brown house snake nor herald snake is normally a climber and they therefore probably became entangled in one of the catching

cords hanging from the web, resulting in part of its body being pulled up into the web. From its aerial scaffolding, the geometrid button spider spins vertical strands of exceptionally strong, elastic silk which is sticky near the bottom, where it is anchored lightly to the ground. When an animal touches a strand, the strand comes unstuck from the ground and entangles the prey, at the same time drawing the prey upward (see Lamoral 1968. Ann. Natal Mus. 20:1–14).

I thank Wulf Haacke for comments on this note, and Martin Whiting for the identification of *Lamprophis fuliginosus*.

Submitted by **PAUL S. BAYLISS**, Transvaal Museum, P.O. Box 413, Pretoria 0001, South Africa.

LYSTROPHIS DORBIGNYI (Nariguda). **DIET**. The occurrence of reptile eggs in the diet of snakes is known in only a few species of colubrids, among them *Cemophora coccinea* (Dickson 1948. Copeia 1948:216–217; Minton and Bechtel 1958. Copeia 1958:47; Palmer and Tregembo 1970. Herpetologica 26:300–302), *Boiga trigonata* (Greene 1989. Proc. California Acad. Sci. 46:193–207), and *Siphlophis pulcher* (Sazima and Argôlo 1994. Herpetol. Rev. 25:126). Most of the snakes of the tribe Xenodontini have frogs as primary prey, whereas eggs have not been reported (Cadle and Greene 1993. *In* Ricklefs and Schluter [eds.], Species Diversity in Ecological Communities: Historical and Geographical Perspectives, pp. 281–293. Univ. of Chicago Press, Chicago, Illinois.). *Lystrophis dorbignyi* is a diurnal, terrestrial to semifossorial South American xenodontine known to feed on anurans and small lizards (Gudynas 1979. ASRA Journal 1[2]:24–33; Lema et al. 1973. Iheringia, Sér. Divulg. 3:19–33; Orejas-Miranda 1966. Copeia 1966:193–205; pers. obs.). Coleopterans were also reported (Orejas-Miranda, op. cit.), but after an examination of several stomachs containing coleopteran elytra consistently associated with anuran remains, we regard these as having been ingested secondarily.

Here we report on two instances of *L. dorbignyi* feeding on reptilian eggs, one observation being made in captivity and another under natural conditions. Both snakes are from the Municipality of Balneário Pinhal, State of Rio Grande do Sul (30°21'S, 50°17'W). Vouchers are housed in the Museu de Ciências e Tecnologia da PUCRS, Porto Alegre, Brazil (MCP 5180, 5563; MCPAN 759).

One adult female (SVL = 440 mm) captured on 9 November 1996 was kept in a terrarium with sand covering its floor. On 13 December 1996 the snake laid four eggs and swallowed them 17 days later. Examination of the stomach contents of an adult male (SVL = 326 mm) revealed four almost entire eggshells measuring about 15 x 10 mm. The shells show leathery texture and size compatible with that of the lizard *Liolaemus occipitalis* (Verrastro, pers. com.), the most frequent species of lizard that is sympatric with *L. dorbignyi* in the area of study (pers. obs.). There were no remains of other stomach contents, eliminating the possibility of the eggshells being secondary prey.

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Submitted by **ROBERTO BAPTISTA DE OLIVEIRA** and **MARCOS DI-BERNARDO**, Laboratório de Herpetologia, Museu de Ciências e Tecnologia da PUCRS, Av. Ipiranga 6681, CEP 90619-900, Porto Alegre, Rio Grande do Sul, Brazil (e-mail rboliveira@pucrs.br).

MEHELYA CROSSI (West African File Snake). **DIET**. The diet of African file snakes (*Mehelya* spp.) is poorly known but is generally described as consisting of lizards and snakes, and more rarely anurans (e.g., see Cansdale. 1961. West African Snakes. Longmans, London, pp. 72; Wilson. 1965. Puku 3:149–170; Villiers. 1975. Les Serpents de l' Ouest Africain. IFAN, Dakar, pp. 195; Shine et al. 1996. J. Zool. London 240:327–340). During a long-term study on the ecology of forest snakes in southern Nigeria (e.g., see Luiselli et al. 2000. Can. J. Zool. 78:191–198), we had the opportunity to assess the diet of *Mehelya crossi* and contrast our data with published information on this species and other congeners.

Collections were made between September 1996 and May 2000, from several localities of southeastern Nigeria, situated in the territories of central and eastern Niger Delta (Bayelsa and Rivers states), in Anambra State, Enugu State, Abia State, Akwa-Ibom State, Imo State, and Cross River State. The sites where file snakes were found were characterized by patches of rainforest interspersed among large plantations (yam, cassava, cocoa, pineapple, banana, plantain, oil palm, etc). The study region has a typical tropical climate, with a wet season occurring from May to September, and a dry season from October to April.

Free-ranging snakes were constrained and forced to regurgitate by abdominal palpation. Fecal pellets were also collected and later analyzed in the laboratory. In addition, specimens found dead (roadkilled, macheted by farmers, or preserved in collections of local institutions, cf. Luiselli et al. 2000, *op. cit.*) were dissected. Vouchers are deposited in the herpetological collections of the Department of Biological Sciences, Rivers State University of Science and Technology, Port Harcourt, of the Cross River National Park, Akampka, and of the Institute Demetra, Rome.

We examined the stomachs of 31 *Mehelya crossi* specimens and found only five prey items. Although 84% of these specimens had empty stomachs, prey remains were identified from the feces of seven other specimens. Contrary to published information (e.g., see Cansdale 1961, *op. cit.*), we found that three of the five prey items were endothermic organisms. These prey items included a juvenile *Lemniscomys* sp., an adult *Mus minutoides* (= *musculoides*), and a *Crocidura nigeriae*. The remaining two were one *Agama agama* and one *Bufo* sp. (this latter record has been already presented in Luiselli et al. 1998. J. Zool. London 246:125–133). From feces, we identified the following prey remains: *Agama agama* (in three different specimens), Scincidae sp. (in two specimens), Gekkonidae sp. (in one specimen), and an unidentified rodent (in one specimen). The remains of the *Lemniscomys* and *Crocidura* came from specimens that were captured in cassava plantations (at Ahoada and Eket, respectively), whereas the *Mus musculoides* was ingested by a snake from a secondary swamp forest near Calabar. Lizard remains were also found in snakes from suburban habitats (i.e., *Agama* specimens were eaten by snakes captured at Port Harcourt, Ahoada, Uyo, and Calabar), but also in mature forest (Orashi River forest, and Taylor Creek Forest Reserve). The remains of the *Bufo* came from a specimen inhabiting a riverine forest along the Kwa-Ibo River. Thus, there was no

apparent difference in the prey items of snakes inhabiting either altered or forest habitats. Snakes from both habitat types fed on mammals and reptiles.

This note, although preliminary, demonstrates that mammalian prey should be considered approximately as important as reptilian prey for *Mehelya crossi*, thus negating the general opinion that *Mehelya* species prey only on ectothermic animals. In this regard, it is noteworthy that a rodent prey item (*Rattus rattus*) was taken by another *Mehelya crossi* specimen from southeastern Nigeria (Butler and Reid 1990. Niger. Field 55:19–40).

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Submitted by **GODFREY C. AKANI**, Department of Biological Sciences, Rivers State University of Science and Technology, P.M.B. 5080, Port Harcourt, Rivers State, Nigeria (e-mail: gocakani@yahoo.com), **DARIO CAPIZZI**, National Wildlife Institute (I.N.F.S.), via Ca' Fornacetta 9, I-40064 Ozzano Emilia (Bologna), Italy (e-mail: d.capizzi@iol.it), and **LUCA LUISELLI**, Institute of Environmental Studies "Demetra" and F.I.Z.V., via dei Cochi 48/b, I-00133 Rome, Italy (e-mails: lucamlu@tin.it; lucalui@iol.it).

OPHEODRYS AESTIVUS (Rough Green Snake). **HIBERNACULUM**. Little is known about the hibernaculum requirements of *Opheodrys aestivus*. In February 1985 D. B. McCallum, Jr., and I extracted a single *O. aestivus* from a crayfish burrow at the top of a snow-covered, 2 m high earthen levee. The snake's sex and size were not recorded. No crayfish were observed in the burrow. The lake which the levee originally formed was drained in the early 1970's (exact date unavailable). The remaining small stream, about 10 cm deep, did not inundate the levee from August 1978 through May 2000 and probably had not since the pond was drained. The burrow was ca. 0.5 m deep and had a typical mud-clogged chimney about 10–15 cm high. The snake was held in captivity until April and then released near its capture site in Detering Hills Subdivision, approximately 3 km east and 0.5 km north of the junction of Interstate 55/70 and State Route 159, and 2 km south of Maryville, Madison Co., Illinois, USA. I thank Mike Plummer and Stan Trauth for feedback and encouragment to submit this observation.

Submitted by **MALCOLM McCALLUM**, P.O. Box 847, Environmental Sciences Ph.D. Program, Arkansas State University, State University, Arkansas 72467, USA.

PHILOTHAMNUS HETERODERMUS (NCN). **REPRODUCTION**. The reproductive biology of free-ranging *Philothamnus heterodermus* is poorly known, although this species is widely distributed throughout the rainforest region of West Africa (e.g., see Villiers 1975. Les Serpents de l' Ouest Africain. IFAN, Dakar, 195 pp.; Hughes. 1983. Bonn. Zool. Beitr. 34:311–355; Hughes. 1985. Proc. Int. Symp. Afr. Vert. Bonn, pp. 511–530). In this note we provide data to clarify the reproductive seasonality of this snake from the wild.

Four gravid females were collected in lowland swamp forests of the eastern Niger Delta (Port Harcourt, Rivers State). Additionally, a newborn male was collected from the high forest of Iko Esai, ca. 70 km north of Calabar (Cross River State). The four gravid females were collected on 11 October 1996 (total length [TL] = 84 cm, 5 eggs, mean egg size = 24 x 9 mm), 15 October 1998 (TL = 81.2 cm, 4 eggs, mean egg size = 22 x 9 mm), 17 November 1999 (TL = 86.3 cm, 5 eggs, mean egg size = 24.2 x 10 mm), and 1 December 1999 (TL = 76.1 cm, 3 eggs, mean egg size = 21.4 x 8 mm). The newborn male, with a fully-evident umbilical scar, was captured on 11 April 2000, and measured 17.4 cm SVL and 6.1 cm tail length. These specimens are deposited in the herpetological collection of the Institute Demetra (Aquater S.p.A., Rome). The date of capture for two additional gravid females is unknown. These two females measured 80.1 cm and 79.7 cm TL, and contained four eggs (mean egg size = 22.3 x 8.7 mm) and three eggs (mean egg size = 22.2 x 8.8 mm), respectively. Five additional adult females (between 70.5 and 83.7 cm TL) were captured in July, September (3 specimens) and October, but they were not gravid.

Maternal size (TL) significantly influenced the number of eggs produced ($r = 0.911$, $N = 6$, Y-intercept = -14.604; ANOVA $F = 19.556$, $df = 1,4$, $P = 0.011$), and also the mean egg size ($r = 0.94$, $N = 6$, Y-intercept = -1.839; ANOVA $F = 30.436$, $df = 1,4$, $P = 0.005$). At the same time, the number of eggs produced by a female and mean egg size were positively correlated ($r = 0.90$, $N = 6$, Y-intercept = 18.083; ANOVA $F = 17.087$, $df = 1,4$, $P = 0.014$), but this was an effect of the positive influence of maternal size on both variables.

The study region in southeastern Nigeria is tropical, with a pronounced wet season occurring from May to September. Although preliminary, our data clearly demonstrate that this species lays eggs during the dry season, and the eggs hatch during the interphase between end of the dry season and the onset of the wet season. The only other data on Nigerian specimens are from Butler and Reid (1990. Niger. Field 55:19–40). Based on evidence from two specimens, these authors suggested that eggs are laid at the end of the wet season, and hatch in the middle of the dry season or at the start of the wet season. In particular, they captured a newborn from Ibadan on 8 February, and a post-partum female from Calabar on 31 January. Thus, pooling all these data, it becomes obvious that *P. heterodermus* shows a well-marked seasonality in annual reproductive timing, with evident synchronized oviposition and egg hatching among females and among clutches. To better understand the benefits of hatching at the middle of the dry season or at the start of the wet season, it would be necessary to know the dietary habits of the newborns. Currently, we do not have enough data on the feeding behavior of this species; however, the single newborn specimen examined by us from Iko Esai forest north of Calabar had recently ingested a very small, newly metamorphosed toad (*Bufo* sp.).

We thank E.N.I.-Agip Environmental Department, Aquater

S.p.A., Snamprogetti S.p.A., T.S.K.J. Nigeria Ltd., Ecosystem s.r.l., Demetra s.r.l., F.I.Z.V., and Chelonian Research Foundation (Linnaeus Fund), for having financially supported parts of our long-term research in Nigeria. Massimo Capula, Dario Capizzi, and Francesco M. Angelici critically commented on previous drafts of this manuscript and gave important data input. Several colleagues helped us in the field. Authors are listed in alphabetical order.

Submitted by **GODFREY C. AKANI**, Department of Biological Sciences, Rivers State University of Science and Technology, P.M.B. 5080, Port Harcourt, Rivers State, Nigeria (e-mail: gocakani@yahoo.com), **LUCA LUISELLI**, Institute of Environmental Studies "Demetra" and F.I.Z.V., via dei Cochi 48/b, I-00133 Rome, Italy (e-mails: lucamlu@tin.it; lucalui@iol.it), and **ZENA TOOZE**, Cercopan - Forest Monkey Rehabilitation Centre, 4 Ishie Lane, Housing Estate, H. E. P.O. Box 826, Calabar, Cross River State, Nigeria (e-mail: cercopan@compuserve.com).

PHILOTHAMNUS IRREGULARIS IRREGULARIS (Northern Green Snake). **REPRODUCTION**. Pitman (1974. A Guide to the Snakes of Uganda. Wheldon & Wesley, Ltd., Codicote, England. 290 pp.) records two communal nests of *Philothamnus irregularis irregularis*, and records egg dimensions that range from 25 x 14 to 43 x 18 mm. Pitman records that *P. irregularis battersbyi* lays 4–8 eggs in November–December or March–May, but does not provide clutch sizes for *P. i. irregularis*. Menzies (1966. Copeia 1966:169–179) reports a clutch size of six for one *P. i. irregularis*. To my knowledge, these are the only published reports on reproduction from this species. Here, I report observations on reproduction from four more *P. i. irregularis*, all of which were found in Area J of Yekepa, Nimba County, Liberia.

A *P. i. irregularis*, 84 cm total length (TL), found dead on 14 June 1987, contained five eggs, 38 x 10 mm. Another *P. i. irregularis*, 86 cm TL, killed on 14 July 1987, contained five eggs, each 23 mm long; egg width was not recorded. Two other *P. i. irregularis*, collected on 31 July 1987, contained eggs; clutch size is unknown for these two, as one had been badly smashed by an automobile, and the other was released before oviposition.

I thank Alfred and Torseh Yeanay and neighborhood children for finding the specimens recorded here.

Submitted by **PHIL SENTER**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

PSAMMOPHIS PHILLIPSII (Olive Grass Snake). **REPRODUCTION**. *Psammophis phillipsii* is a psammophiine colubrid snake from the West African forest. Few egg-related accounts of this species have been published. According to one account, eight large *P. phillipsii* were found in Liberia, "entwined together" in a hole in the ground which evidently was a communal nest, as it contained more than 52 eggs (Taylor and Weyer 1958. Univ. Kansas Sci. Bull. 38:1191–1229). Butler (1993. J. Herpetol. 27:144–148) records that a *P. phillipsii* from Nigeria laid 11 eggs on 12 January 1983; these hatched on 22 and 23 March 1983. Butler (*op.cit.*) also reports that a clutch of seven *P. phillipsii* eggs from Nigeria hatched on 3 March 1983, and that a clutch of nine from Liberia hatched on 10 April 1983. Broadley (1983. FitzSimons' Snakes of Southern Africa. Delta Books, Johannesburg. 376 pp.) states that "*P. phillipsii*" lays 10 to 30 eggs, with dimensions ranging from 28 x 10 mm to 40 x 20 mm, "in piles of dead leaves or some similar location in midsummer." However, this statement is based on observations of southern African populations which are now referred to *P. mossambicus* (Branch 1998. Field Guide to Snakes and Other Reptiles of Southern Africa. Ralph Curtis Books, Sanibel Island, Florida. 399 pp.).

Here, I report egg-related data from two Liberian specimens of *P. phillipsii* (*sensu stricto*). These data support the conclusions of Butler (*op. cit.*), based on preserved specimens, that *P. phillipsii* oviposits in the dry season. On 6 January 1988, I collected a gravid, 104-cm *P. phillipsii* from the area of Congotown in Monrovia, Liberia. The specimen had been mortally wounded by humans. Dissection revealed that the snake was gravid with 10 eggs, 31 mm x 17 mm. On 6 January 1989, I collected a live, 114-cm *P. phillipsii* from the grounds of the American Cooperative School in the area of Singkor, in Monrovia, Liberia. This was the individual whose bite was recorded by Senter (1998. Herpetol. Rev. 29:216–217). The snake laid one egg on the date of capture, a second egg on 7 January, and nine more eggs on 8 January. The Singkor specimen was released on 12 January 1989. Its eggs were roughly the same size as those in the oviducts of the snake from Congotown.

I thank John Anderson of the American Cooperative School for locating the Singkor specimen. I thank Jayne Cawthon for transporting it to Congotown for me. I thank unidentified individuals for calling the Congotown specimen to my attention.

Submitted by **PHIL SENTER**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

SORDELLINA PUNCTATA (NCN). **REPRODUCTION**. The xenodontine colubrid *Sordellina punctata* occurs mainly in the Atlantic Forest domain in southeastern Brazil (Hoge and Romano 1976/77. Mem. Inst. Butantan 40/41:63–70) and is rare in herpetological collections. This is an elusive aquatic snake whose reproductive characteristics have not been reported. Here I present data on the reproductive cycle, fecundity, and mode of reproduction, based upon dissection of 12 specimens housed in the collection of the Instituto Butantan in São Paulo (IB).

An adult female (IB 25130, 360 mm SVL, 65 mm tail length) collected in September contained four vitellogenic follicles. Two females (IB 22313, 530 mm SVL, 75 mm tail length; and IB 46054, 495 mm SVL, 80 mm tail length) collected in October contained seven vitellogenic follicles each. A fourth snake (IB 10464, 385 mm SVL, 70 mm tail length) collected in February contained three eggs in the oviducts. The size of females and number of follicles or eggs indicate that clutch size appears to be related to maternal body size, as occurs in most snakes (Shine 1994. Copeia 1994:851–867). An additional eight females collected throughout the year contained no vitellogenic follicles or eggs. One presumed hatchling (IB 57875, 180 mm SVL, 30 mm tail length) was collected in June. Thus, the reproductive cycle of *S. punctata* seems to be seasonal; vitellogenesis and ovipositon occurs in the rainy season (October–March), and hatching occurs at the onset of the dry season

(May–June). The data presented here indicate that *S. punctata* is an oviparous species, an unusual reproductive mode for an aquatic snake as most aquatic snakes are viviparous (Shine 1983. *In* Biology of the Reptilia. Vol 15. Development B. C. Gans and F. Billet [[eds.], pp. 605–694. John Wiley and Sons, New York.). However, some aquatic xenodontines such as *Helicops angulatus*, *H. hagmanni*, and *Pseudoeryx plicatilis* present both viviparous and oviparous reproductive modes (Cunha and Nascimento 1981. Bol. Mus. Par. Emilio Goeldi 109:1–20). Therefore, additional data are needed to assess whether *S. punctata* follows this dual pattern. I thank I. Sazima for reviewing this manuscript.

Submitted by **OTAVIO A. V. MARQUES**, Laboratório de Herpetologia, Instituto Butantan. Av. Vital Brazil, 1500, CEP 05503-900, São Paulo, SP, Brazil.

THAMNOPHIS SIRTALIS PARIETALIS (Red-sided Gartersnake) **MALE-MALE COPULATION.** Although male mimicry of females occurs in many animal species (Burley 1982. *In* Alexander and Tinkle [eds.], Natural Selection and Social Behavior, pp. 121–137. Chiron, New York), most cases of male-male courtship do not appear to progress to actual copulation (Bagemihl 1999. Biological Exuberance: Animal Homosexuality and Natural Diversity. St. Martin's Press, New York. 751 pp.). In reptiles, female mimicry apparently leading to homosexual copulation has been reported in one lizard species (*Anolis garmani*, Trivers 1976. Evolution 30:253–269), but with little detailed information. The only well-studied example of female mimicry in reptiles involves red-sided gartersnakes, *Thamnophis sirtalis parietalis*, that overwinter in large communal dens in Manitoba. The snakes court and mate as they emerge in spring. Courting males recognize the sex of other snakes based primarily on lipids in the skin (Mason 1992. *In* Gans and Crews [eds.], Biology of the Reptilia, Volume 18. Hormones, Brains and Behavior, pp. 114–228. Univ. Chicago Press, Chicago). In the Manitoba dens, some males ("she-males") produce female-like pheromones, and thus attract substantial courtship from other males (Mason and Crews 1985. Nature 316:59–60; Shine et al. 2000. Anim. Behav. 59:349–359). In this note, we provide the first example of apparent male-male copulation.

On 17 May 1999, we were conducting ecological research at a large snake den in a gravel quarry 1.5 km N of Inwood, 0.5 km E of Highway 17 (50°31.58'N 97°29.71'W), in southern Manitoba, Canada. While collecting she-males for behavioral trials, we found a male (47.7 cm SVL, 13.2 cm tail length, 33.0 g) being actively courted by four other males. When the she-male was collected, we noticed that it was bleeding from the cloacal area, and that the snake's body contained a hard object a few centimetres anterior to the cloaca. We palpated this object posteriorly and out of the snake's cloaca. It was a gelatinous mating plug (Fig. 1), identical to those deposited in heterosexual matings by this species. The plug weighed 0.035 g, within the size range of plugs from male-female matings (Shine et al., unpubl. data). The she-male showed no overt physical peculiarities. Its sex was confirmed by manual eversion of hemipenes (Fig. 1). The snake and copulatory plug were preserved and deposited in the University of Michigan Museum of Zoology (UMMZ 224312).

Although we did not witness the actual copulation, the presence of the plug strongly suggests that this snake mated with another male. Such behavior must be extremely rare: we have never recorded it during the observation, capture, and handling of many hundreds of she-males over many years. Most probably, the copulated male was moribund and unable to resist copulation. There is no need to invoke his co-operation in this event. Male gartersnakes at the dens frequently mate with dead and dying females, and with females with open wounds (usually, from pecks by crows) in their bodies (pers. obs.). A similar inability to resist mating attempts, because of poor health, may explain cases of interspecific copulations in captive snakes (Klauber 1956. Rattlesnakes: Their Habits, Life Histories and Influence on Mankind. Univ. California Press, Berkeley, California. 1533 pp.; Hardy 1998. Bull. Chicago Herpetol. Soc. 33:258–262).

Although the copulated male was not unusually slender-bodied (his mass relative to SVL was almost exactly average for males in this population; unpubl. data), other aspects support the idea that he was in poor health. He was limp-bodied when picked up and was covered in dirt; both of these traits characterize males that have emerged only recently from their overwinter den (Shine et al., unpubl. data). After we manually everted his hemipenes, he did not retract them. Indeed, they were still extruded when the snake was examined 24 h later, at the time he was killed and preserved.

Male-male courtship is frequently reported in captive snakes, but rarely progresses to copulation (Hardy 1998, *op. cit.*). To our knowledge, ours is the first record of male-male intromission by a free-ranging snake.



FIG. 1. Cloacal region of male gartersnake, showing everted hemipenes (to verify sex) and the cloacal plug partially everted from its vent.

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Submitted by **MICHAEL PFRENDER** and **ROBERT T. MASON**, Zoology Department, Oregon State University, Cordley Hall 3029, Corvallis, Oregon 97331-2914, USA; and **JUBILATION T. WILMSLOW** and **RICHARD SHINE**, Biological Sciences A08, The University of Sydney, NSW 2006 Australia (e-mail: rics@bio.usyd.edu.au).

GEOGRAPHIC DISTRIBUTION

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These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Crother 2000. *Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding*. SSAR Herpetol. Circ. 29:1–82; for Mexico as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*. Herpetol. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al. 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985[3]:802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen *only* when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*) to make sure you are not duplicating a previously published record.

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Recommended citation for new distribution records appearing in this section is: Marques, O. A. V., and G. Puorto. 1996. Geographic Distribution. *Chironius laevicollis*. Herpetol. Rev. 27:212.

GYMNOPHIONA

SIPHONOPS PAULENSIS (Boettger's Caecilian). BRAZIL: MINAS GERAIS: Uberlândia Municipality (18°59'S, 48°18'W). 13 February 1989. Anselmo de Oliveira. Coleção Zoológica da Universidade Federal de Uberlândia, Ariovaldo A. Giaretta 2025. Verified by Ariovaldo A. Giaretta. First record of species and genus for Cerrado region, where the only gymnophionid taxon previously known was *Cthonerpeton perisodus* (Duellman 1999. *In* Duellman [ed.], Patterns of Distribution of Amphibians. A Global Perspective, pp. 255–328. Johns Hopkins Univ. Press). This species also is known from the municipality of Brasília (ca. 424 km NW Uberlândia). Extends range to NW Brazil, beyond the Atlantic forest domain (ca. 600 km).

Submitted by **MARCELO N. DE C. KOKUBUM** and **MARCELO MENIN**, Instituto de Biologia, Universidade Federal de Uberlândia, 38400-902, Uberlândia, Minas Gerais, Brazil.

CAUDATA

AMBYSTOMA PLATINEUM (Silvery Salamander). USA: INDIANA: Randolph Co: Davis Woods, a 50 acre woodlot owned by Purdue University (40°15'30"N, 85°90'30"W). 10 April 2000. Priya Nanjappa. Vertebrate Zoology Section, Milwaukee Public Museum (MPM P-698). Verified by C. A. Phillips. Specimen had SVL of 89 mm and an internarial distance of 4.5 mm, characteristic of *Ambystoma platineum* (Uzzell 1964, Copeia 1964:247–300). New county record (Minton *In Press*, Amphibians and Reptiles of Indiana. Second Ed.).

Submitted by **PRIYA NANJAPPA** and **LAURA (LEININGER) BLACKBURN**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

ENSATINA ESCHSCHOLTZII (Ensatina) USA: WASHINGTON: Kittitas Co: NE 1/4 Sec. 10, T19N, R14E, South Cle Elum Ridge, near Granite Creek, Wenatchee National Forest, 1000 m elev. 9 September 2000. James W. Baugh. MVZ 230987. Verified by David B. Wake. Mature adult (SVL = 70 mm; TL = 117 mm). Locality represents not only a new county record, but also extends range for the species eastward by a distance of ca. 30 km (Washington Department of Fish and Wildlife Herptile Data Base) and is the first recorded occurrence of this species east of the Cascade crest in the state of Washington (Leonard et al. 1983, Amphibians of Washington and Oregon. Publ. Seattle Audubon Society, Washington. 168 pp.; Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press, Moscow. 332 pp.).

Submitted by **DAVID M. DARDA**, Department of Biological Sciences, Central Washington University, Ellensburg, Washington 98926, USA (e-mail: dardad@cwu.edu), and **JAMES W. BAUGH** and **PATRICIA A. GARVEY-DARDA**, Cle Elum Ranger District, Wenatchee National Forest, Cle Elum, Washington 98922, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: WISCONSIN: Door Co: Toft Point State Natural Area (45°04'23.5"N, 87°05'48.8"W). 4 September 2000. Steven J. Price and Russell D. Japuntich. Richter Museum of Natural History (RMNH 513-R). Verified by T. C. Erdman. First county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus., Milwaukee Wisconsin. 87 pp.).

Submitted by **STEVEN J. PRICE**, Department of Natural and Applied Sciences, University of Wisconsin at Green Bay, Green Bay, Wisconsin 54311, USA (e-mail: pricsj07@uwgb.edu).

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: WISCONSIN: Juneau Co: Camp Douglas, Castle Rock Wayside Park. 23 August 1999. Sharon C. Rossman and Douglas A. Rossman. Milwaukee Public Museum Photo Voucher 694. Verified by Gary S. Casper. First record for county (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Museum. 87 pp.). Specimen

was crawling on surface (leaf mulch and sandy soil) adjacent to wooden tie used to stabilize the slope. It had rained a short time earlier and the substrate was quite damp at 1100 h under an overcast sky.

Submitted by **SHARON C. ROSSMAN** and **DOUGLAS A. ROSSMAN**, Department of Biology, Luther College, Decorah, Iowa 52101, USA.

OEDIPINA TAYLORI. HONDURAS: FRANCISCO MORAZÁN: Sabana Grande (13°48'N, 87°16'W), 980 m elev. November 1998. D. M. Rivera. UNAH 3971. Verified by L. D. Wilson. First record for country; closest reported locality is from the vicinity of the city of San Salvador, El Salvador (Brame 1986, J. Herpetol. 2:1–64) about 210 km airline WSW of the Honduran locality.

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157, USA, **GUSTAVO A. CRUZ**, Departamento de Biología, Universidad Nacional Autónoma de Honduras, Tegucigalpa, Honduras, and **DELMY M. RIVERA**, Departamento de Biología, Universidad Nacional Autónoma de Honduras, Tegucigalpa, Honduras.

ANURA

AMOLOPS LARUTENSIS (Larut Torrent Frog). MALAYSIA: PENINSULAR MALAYSIA: Johor: Bekok Forest, Sungai Bantang, cascades over boulders (1°20'N, 103°10'E, 125 m elev.). 27 December 1996. Tzi Ming Leong. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.3470a, SVL 28.6 mm; ZRC.1.3470b, SVL 43.1 mm). Verified by Kelvin K. P. Lim. Represents southernmost extremity of its range in the peninsula. New state record, in addition to Kelantan, Perak, Selangor, Terengganu, and Pahang (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg).

ELEUTHERODACTYLUS JOHNSTONEI (Johnstone's Frog). VENEZUELA: MONAGAS: Caripe, elev. ca. 800 m, found calling in gardens of private residences and on streetside vegetation surrounding the Hotel Venezia near the city center. 13 September 2000. Hinrich Kaiser and L. Lee Grismer, La Sierra University Photographic Collection (LSUPC F-555). Verified by John E. Simmons. Extends the range of this highly adaptable colonizer 75 km airline SE of the coastal city of Cumaná, where the species had been introduced from Caracas in 1967 (Hardy and Harris 1979, Bull. Maryland Herpetol. Soc. 15:124–133). Caripe has been developed into a tourist access point for the famous Cueva del Guácharo in recent years, and the need for a more appealing city appearance has probably facilitated the transport of stowaway *E. johnstonei* on ornamental plants, as has occurred in Venezuela and elsewhere (Gorzula 1989, Herpetol. Rev. 20:56; Kaiser 1997, Biodivers. Conserv. 6:1391–1407). Caripe is the locality for *E. johnstonei* with the greatest elevation outside the Venezuelan Andes; Maturín, elev. ca. 200 m, found calling in empty inner city lots on metal and wood debris and on weeds adjacent to the Hotel Colonial. 17 September 2000. Hinrich Kaiser and L. Lee Grismer. LSUPC F-556. Verified by John E. Simmons. Extends the range of the species 65 km airline SE Caripe, or 165 km north Ciudad Guayana (erroneously reported as Ciudad Guayhana by Gorzula, *op. cit.*). HK also saw the species in the grounds of the Hotel Puerto Viejo in the coastal town of Maiquetía (Distrito Federal), the location of Simon Bolívar International Airport, and it has been reliably reported from the new "Las Casas Botes" development in Puerto La Cruz, Anzoátegui State (Oscar Palis, pers. comm.). The overall distribution pattern of *E. johnstonei* in Venezuela continues to be restricted to population centers of significance along major roads. This leads us to conclude that the species currently expands its range in Venezuela exclusively through human activity.

Submitted by **HINRICH KAISER** (e-mail: hkaiser@lasierra.edu) and **L. LEE GRISMER** (e-mail: lgrismer@lasierra.edu), Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

HYLORINA SYLVATICA. ARGENTINA: CHUBUT: Departamento Futaleufú: Los Alerces National Park, 1 km W Lago del Medio, 42°50'S, 71°52'5"W, ca. 550 m elev. 21 April 1982. Salvador Vellido. Adult. Fundación Miguel Lillo, Tucumán, Argentina (FML 09744). Verified by Néstor G. Basso. Specimen was found on a vertical tree trunk ca. 1 m high in a temperate rain forest of *Nothofagus* spp., where the understory was dominated by the bamboo *Chusquea culeou*; close to this site there are extensive wetlands created by overflow from the Río Stange. This species inhabits austral forests of Chile and Argentina with a narrow distribution along the eastern slopes of the Andes. In Chile, it is distributed from the western slopes of the Cordillera de Nahuelbuta (37°18'S, 73°17'W) (Ortiz et al. 1990, Comun. Mus. Reg. Concepción 4:31–43) to Laguna San Rafael (46°40'S, 74°00'W) (Díaz-Páez and Williams 1999, Res. V Congr. Latinoamericano de Herpetología. Publ. Extra Museo Nacional de Historia Natural, Montevideo, Uruguay 50:54). In Argentina, it has thus far been recorded only for the Nahuel Huapi National Park in southern Neuquén Province and in northern Río Negro Province (40°47' to 41°11'S) (Vellard 1947, Acta Zool. lilloana 4:145–153; Gallardo 1962, Rev. Mus. Argentina Cienc. Nat., Bs. As. Zoología 8[10]:113–122; Barrio and Rinaldi de Chieri 1971, Physis 30[81]:673–685). This voucher represents a new record for the province of Chubut, extends the known range of species in Argentina ca. 183 km air line S from previously southernmost vouchered citation at the base of Mt. Tronador close to the Vaca Overa glacier, Nahuel Huapi National Park (Vellard, *op. cit.*), and decreases the distributional hiatus between the southern distribution limit of this species in Chile and that in Argentina. The area where the specimen was found is also inhabited by *Pleurodema thaul*, *Eupsophus calcaratus*, and *Alsodes australis*.

Submitted by **SALVADOR VELLIDO**, Admistración de Parques Nacionales, Casilla de Correo 64, 4107 Yerba Buena, Provincia de Tucumán, Argentina, and **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Provincia de Río Negro, Argentina.

LALIOSTOMA LABROSUM (formerly *Tomopterna labrosa*). MADAGASCAR: ANTSIRANANA: Montagne des Français, 20 m elev., 12°18'44"S, 49°20'17"E. 13–16 March 2000. M. Vences, F. Glaw, and K. Schmidt. Zoologische Staatssammlung München (ZSM 500–501/2000) and Université d'Antananarivo, Département de Biologie Animale (UADBA cat. nos. pending, four specimens). Verified by Wolfgang Böhme. First record from the biogeographic region of northern Madagascar. Extends range 185 km northwards (Glaw and Vences 1992, A Fieldguide to the Amphibians and Reptiles of Madagascar. Köln Press. 331 pp.). Confirms older dubious records (Mocquard 1895, Bull. Soc. Philom. Paris, ser. 8, 7:112–136; Guibé 1978, Bonn. Zool. Monogr. 11) which were not accepted by Blommers-Schlösser and Blanc (1991, Faune de Madagascar 75:1–379) and subsequent authors.

Submitted by **MIGUEL VENCES**, Muséum national d'Histoire naturelle, Laboratoire des Reptiles et Amphibiens, 25 rue Cuvier, F-75005 Paris, France, and **FRANK GLAW**, Zoologische Staatssammlung, Münchhausenstr. 21, D-81247 München, Germany.

LEPTODACTYLUS COLOMBIENSIS: VENEZUELA: ESTADO TACHIRA: Río Doradas, 28 km South of Pregonero, 630 m. 5 October 1995. Collected by Curso Taxonomía Vertebrados B-95. Colección de Vertebrados, Universidad de los Andes, Facultad de Ciencias (CVULA 5638–42). Verified by Amelia Díaz de Pascual. First country record and northernmost for the species (ca. 7°50'N, 72°10'W). Previously known from flanks of northern Andes in Colombia (Heyer 1994, Smithson. Contr. Zool. 546). Presence of species in the Andean piedmont of Táchira is not surprising, because it is widely distributed through all slopes of the Andes in Colombia, and this locality is close to the Colombian border.

Submitted by **CÉSAR LUIS BARRIO AMORÓS**, Fundación Andígena, Apartado 210, 5101-A Mérida, Venezuela (e-mail: cesarlba@yahoo.com) and **ANDRES CHACON**, Facultad de Ciencias, Universidad de los Andes, Mérida, Venezuela (e-mail: trilobit@ciens.ula.ve).

MANNOPHRYNE COLLARIS. VENEZUELA: ESTADO MERIDA: Municipio Alberto Adriani (8°32'49"N, 71°34'58"W), ca. 10 km SSE El Vigía in submontane forest, 200 m elev. One male on 15 May 1999 and three females on 8 November 2000. Collector unknown. Colección de Vertebrados de la Universidad de Los Andes (CVULA-IV 6174, 6175, 6176, and 6177, respectively). Verified by Enrique La Marca. Species was previously known to occur only between 1100 and 1800 m. This is the westernmost record and the lowest locality known for the taxon, ca. 52 km W and 1000 m beneath the type locality, and suggests a wider distribution for this frog.

Submitted by **CARLOS GOTTBERG**, **PAOLO RAMONI-PERAZZI**, and **MARÍA JOSÉ PRADERIO**, Universidad de Los Andes, Facultad de Ciencias, Departamento de Biología, Mérida 5125, Venezuela (e-mail: gottberg@ciens.ula.ve).

MICROHYLA BORNEENSIS. MALAYSIA: PENINSULAR MALAYSIA: Selangor: Sungai Dusun lowland rainforest, forest floor (3°39'N, 101°18'E, 25 m elev.). 30 March 2000. Tzi Ming Leong. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.3865, adult male, SVL 17.2 mm). Verified by Kelvin K. P. Lim. New state record; known also from Terengganu and Pahang (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.; Manthey and Grossmann 1997, Amphibien and Reptilien Südostasiens. Natur und Tier—Verlag, Germany. 512 pp.). Outside of the peninsula, the species occurs in Singapore, southern Thailand, and Borneo (Brunei, Sabah, Sarawak) (Leong and Chou 1997, Raffles Bull. Zool. 45[1]:97–103).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg), and **ZAINAL ZAHARI BIN ZAINUDDIN**, Department of Wildlife and National Parks, Sungai Dusun, 44010 Kuala Kubu Bharu, Selangor, Malaysia.

MICROHYLA PALMIPES. MALAYSIA: PENINSULAR MALAYSIA: Terengganu: Sekayu waterfalls, forest floor (4°58'N, 102°58'E). 28 October 1998. Heok Hui Tan. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.3488, immature, SVL 12.8 mm). Verified by Kelvin K. P. Lim. New state record; known also from Pahang and Selangor (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp); northeastward range extension in the peninsula. Outside of the peninsula, the species occurs in Sumatra, Nias Island, Java and Bali (Iskandar 1998, The Amphibians of Java and Bali. LIPI Field Guide Series. xix + 117 pp).

Submitted by **TZI MING LEONG** (e-mail: scip0132@nus.edu.sg) and **HEOK HUI TAN** (e-mail: betta@mbox4.singnet.com.sg), Department of Biological Sciences, National University of Singapore, Singapore 119260.

RANA BARAMICA. MALAYSIA: PENINSULAR MALAYSIA: Kedah: Baling (5°41'N, 100°55'E). December 1938. Collector unknown. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.303, SVL 35.4 mm). Verified by Kelvin K. P. Lim. New state record; known also from Pahang, Selangor and Terengganu (Dring 1979, Bull. Brit. Mus. Nat. Hist. Zool. 34[5]:181–241; Manthey and Grossmann 1997, Amphibien and Reptilien Südostasiens. Natur und Tier—Verlag, Germany. 512 pp.). Represents northwestward extension of distribution in the peninsula.

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg).

RANA GLANDULOSA. MALAYSIA: PENINSULAR MALAYSIA: Pahang: Cameron Highlands, Tanah Rata, small stream feeding into main river at Parit waterfalls (4°28'N, 101°23'E, 1300 m elev.). 24–25 June 2000. Tzi Ming Leong et al. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.5157–5188, 32 larvae, Gosner stages 23–27, total lengths 8.5–33.0 mm; ZRC.1.5193, one larva, Gosner stage 41, total length 52.0 mm, bearing diagnostic adult characteristics). Verified by Kelvin K. P. Lim. New highland record for this species; known also from Gunong Bunga Buah and Fraser's Hill (Berry 1972, Herpetologica 28:338–346; Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.).

Submitted by **TZI MING LEONG** (e-mail: scip0132@nus.edu.sg) and **HEOK HUI TAN** (e-mail: betta@mbox4.singnet.com.sg), Department of Biological Sciences, National University of Singapore, Singapore 119260.

RANA HOSII. MALAYSIA: PENINSULAR MALAYSIA: Pahang: Cameron Highlands, Tanah Rata, Parit and Robinson waterfalls, (4°28'N, 101°23'E, 1300 m elev.). 5 May 2000. Heok Hui Tan. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.4093, immature, SVL 45.7 mm); 23–24 June 2000. Heok Hui Tan. (ZRC.1.4972, adult female with unpigmented ova, SVL 97.3 mm, fresh wt. 72 g; ZRC.1.4973, adult female with unpigmented ova, SVL 94.5 mm, fresh wt. 64 g; ZRC.1.4974, juvenile, SVL 26.3 mm). Verified by Kelvin K. P. Lim. Though often found in cascade/waterfall habitat almost throughout the country (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.), the species has not been previously recorded from this particular montane locality (Smedley 1931, Bull. Raffles Mus. 6:105–123).

Submitted by **TZI MING LEONG** (e-mail: scip0132@nus.edu.sg) and **HEOK HUI TAN** (e-mail: betta@mbox4.singnet.com.sg), Department of Biological Sciences, National University of Singapore, Singapore 119260.

RANA PALUSTRIS (Pickerel Frog). USA: MICHIGAN: Tuscola Co: Millington Road, 6.4 km E of SR-15. 12 June 1998. G. M. Fox and Brian Yang. UMMZ 222703. Verified by Arnold G. Kluge. First county record (Schaaf 1971, *Rana palustris*. Cat. Amer. Amphib. Rept. 117.1–117.4).

Submitted by **GLENN M. FOX**, Department of Biology and Division of Reptiles and Amphibians, University of Michigan Museum of Zoology, Ann Arbor, Michigan 48109-1079, USA (e-mail: foxg@umich.edu).

RANA SIGNATA. MALAYSIA: PENINSULAR MALAYSIA: Johor: Gunong Pulai foothills (1°36'N, 103°34'E, 25m elev.). 29 December 1988. Peter K. L. Ng. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.1568, juvenile, SVL 14.4 mm). Verified by Kelvin K. P. Lim. Represents southernmost extremity of its range in the peninsula. Elsewhere, it is known to occur in southern Thailand, Borneo, and Sumatra. (Manthey and Grossmann 1997, Amphibien and Reptilien Südostasiens. Natur und Tier—Verlag, Germany. 512 pp.).

Submitted by **TZI MING LEONG** (e-mail: scip0132@nus.edu.sg) and **PETER K. L. NG** (e-mail: dbsngkl@nus.edu.sg), Department of Biological Sciences, National University of Singapore, Singapore 119260.

SCAPHIOPUS HOLBROOKII HOLBROOKII (Eastern Spadefoot). USA: NEW YORK: Saratoga Co: Wilton, Wilton Wildlife Preserve and Park (43°08'87"N, 73°41'47"W). 29 June 2000. New York State Museum (NYSM 3309). Verified by A. Breisch. Thirteen metamorphs (11–15 mm SVL) found in a drying pond covered with tussocks of *Scirpus* and *Cyperus* in pitch pine-scrub oak mixed forest over sand dunes. Reforested farmland. One photographed and preserved; 12 released. New county record and northern range extension from Albany Pine Bush Preserve, Albany County, of ca. 56 km (Stewart and Rossi 1981, American Midl. Nat. 106:282–292). This is the first record north of the Mohawk River.

Submitted by **DANIEL TIERNEY** and **MARGARET M. STEWART**, Department of Biological Sciences, State University of New York at Albany, Albany, New York 12222, USA.

TESTUDINES

APALONE SPINIFERA PALLIDA (Pallid Spiny Softshell). USA: TEXAS: Bowie Co: 9.7 km S Texarkana off State Line Road. 20 October 2000. Chris T. McAllister. Arkansas State University Museum of Zoology Herpetological Collection (ASUMZ 25367). Verified by Stanley E. Trauth. New county record that helps fill a distributional gap in extreme northeastern Texas (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 421 pp.). This turtle is known from across the state line in the Red River watershed of adjacent Miller County, Arkansas (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **CHRIS T. McALLISTER**, Department of Biology, Texas A&M University at Texarkana, Texarkana, Texas 75505, USA.

CHELYDRA SERPENTINA (Common Snapping Turtle). USA: ARKANSAS: Arkansas Co: NW 1/4, Sec. 1, R2W, T7S, ca. 4 mi SE of Tichnor at jct. Wolf Bayou and Jacks Bay Road, White River National Wildlife Refuge. 18 August 2000. W. B. Blihovde. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25342, skull only). Verified by Stan Trauth. Adult captured in trap. First record for county (Trauth, Robison and Plummer, ms. in prep.).

Submitted by **W. BOYD BLIHOVDE**, White River National Wildlife Refuge, P.O. Box 308, DeWitt, Arkansas 72042, USA, and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA.

TERRAPENE CAROLINA (Eastern Box Turtle). USA: INDIANA: Fayette Co: Mary Gray Bird Sanctuary (39°35'03"N, 85°133'44"W). 21 July 2000. Laura Blackburn. Milwaukee Public Museum (MPM P-697). Verified by M. J. Lannoo. One female was photgraphed among submergent vegetation along the edge of a semipermanent wetland. New county record (Minton *In Press*, Amphibians and Reptiles of Indiana. Second Ed.).

Submitted by **LAURA BLACKBURN** and **PRIYA NANJAPPA**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

LACERTILIA

BASILISCUS BASILISCUS. VENEZUELA: ESTADO TRUJILLO: Hacienda Valerita, Sector Los Algodonales, Monay. 5 August 1983. R. Pérez. Colección de Vertebrados, Universidad de los Andes (CVULA 3481). First state record. ESTADO TÁCHIRA: Río Doradas, 600 m, 28 km S Pregonero. 6 October 1995. Collected by Curso Taxonomía de Vertebrados (B 95), adult male captured using a Victor's (mouse) trap (CVULA 5630); Río San Agatón, Doradas. 4 September 1984. Collected by Proyecto Faunístico Uribante-Caparo, juvenile (CVULA 4448). ESTADO ZULIA: Puerto Concha, Southern Lago de Maracaibo (several

specimens photographed in slide collection of Fundación Andígena: 257–258 and 266). All verified by Andrés Chacón. These reports confirm the continuous range of the species through the Maracaibo Lake basin (abundant populations were observed in diverse habitats such as mangrove, gallery forests, xerophytic riparian edges) and its penetration into the Andes along intramontane valleys up to an altitude of 1600 m. Conversely, it establishes the presence of the species on the SE slopes of the Andes toward the Orinoquian drainage. This has important biogeographic implications, but was not mentioned by La Marca and Milano (1995, Herpetol. Rev. 26:108). This may be the only known population for any member of the genus on the E side of the Andean chain.

Submitted by **CÉSAR LUIS BARRIO** and **ANDRÉS ORELLANA**, Fundación Andígena, Apartado Postal 210, 5101-A, Mérida, Venezuela (e-mail: cesarlba@yahoo.com and aorell@yahoo.com).

COSYMBOTUS CRASPEDOTUS. MALAYSIA: PENINSULAR MALAYSIA: Selangor: Kepong, lowland forest within FRIM (Forest Research Institute Malaysia) from upper trunk of tree (30 m above ground) at canopy walkway (3°14'N, 101°38'E, 300 m elev.). 21 September 2000. Tzi Ming Leong, Norsham Suhaina Yaakob and David K. L. Teo. Raffles Museum of Biodiversity Research, Zoological Reference Collection [ZRC.2.4821, juvenile, SVL 34.3 mm, total length 73.2 mm; one adult (total length ca. 150 mm) was also sighted at same locality, but not collected]. Verified by Kelvin K. P. Lim. New state record; known also from Perak and Penang Islands. Elsewhere, occurs in southern Thailand, Singapore, and Borneo (Manthey and Grossmann 1997, Amphibien and Reptilien Südostasiens. Natur und Tier—Verlag, Germany. 512 pp.).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: scip0132@nus.edu.sg), and **NORSHAM SUHAINA YAAKOB** and **TERESA ONG**, Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur.

DIPLOLAEMUS DARWINI. ARGENTINA: CHUBUT: on Rt. 37, 26 km S of jct. Rt. 37 and Rt. 3, 45°41'S, 67°56'W, 640 m elev. 27 January 2000. Nora Ibargüengoytía and James A. Schulte II. Colección Centro Regional Universitario Bariloche, Universidad Nacional del Comahue, Provincia de Río Negro, Argentina (CH 25). Juvenile (SVL = 51.04 mm). Verified by J. M. Cei. Specimen was found in short scrub vegetation of Patagonian steppe habitat. The northernmost locality for this taxon is the NE corner of Santa Cruz near the border with Chubut (Cei 1986, Mon. IV Mus. Reg. Sci. Nat. Torino. 527 pp.); specimen represents the first record for Chubut Province and extends the known distribution of this species ca. 215 km north from any previously known locality. *Diplolaemus darwini* has been found in sympatry with *Diplolaemus bibroni* in Santa Cruz Province (Cei 1986, *op. cit.*), and this record extends the overlap in this distribution to Chubut Province.

Submitted by **NORA IBARGÜENGOYTÍA**, Centro Regional Universitario Bariloche, Universidad Nacional del Comahue, Provincia de Río Negro, Argentina, CONICET, and **JAMES A. SCHULTE II**, Campus Box 1137, Department of Biology, Washington University, St. Louis, Missouri 63130-4899, USA.

GEHYRA MUTILATA (Stump-Toed Gecko). MÉXICO: JALISCO: Guadalajara City, municipality of Zapopan, 1550 m. 8 August 2000. Paulino Ponce-Campos. Universidad Autónoma de Guadalajara, México (UAGM-R-427, photograph). Verified by H. M. Smith. Range extension; nearest previously known record was 191 km W at Puerto Vallarta (Smith and Grant 1958, Herpetologica 14:18–23).

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**, Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

HEMIDACTYLUS FRENATUS (House Gecko). HONDURAS: ISLA DE LA BAHIA: ISLA DE UTILA, town of Utila, 5 m elev. (16°6'N, 86°54'W). 18 August 2000. G. Köhler. Verified by K. Klemmer. Forschungsinstitut und Naturmuseum Senckenberg (SMF 79856). First record for Isla de Utila (Köhler 1998, Senckenbergiana Biol. 77:139–145).

Submitted by **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Bowie Co: off I-30 and U.S. Rt. 71, 1 Northgate Drive in Texarkana. 7 December 2000. James E. Welsh. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25378). Verified by Stanley E. Trauth. Hatchling specimen (25 mm SVL) represents a new county record and the collection locale is within 300 m of the Texas/Arkansas state line. This gecko has been reported previously from 62 of 254 counties in the state, the nearest being Smith County to the southwest (Dixon 2000, Amphibians and Reptiles of Texas. Texas A&M University Press, College Station, Texas. 421 pp.).

Submitted by **CHRIS T. McALLISTER and JAMES E. WELSH**, Department of Biology, Texas A&M University-Texarkana, Texarkana, Texas 75505, USA.

MABUYA NIGROPUNCTATA. BRAZIL: MATO GROSSO DO SUL: Brasilândia (21°15'S, 52°02'W). August 2000. F. L. Franco and R. A. K. Ribeiro. Museu Nacional, Rio de Janeiro (MNRJ 8023). Verified by D. M. Borges-Nojosa. New state record and southernmost recorded locality. Species is widely distributed throughout Amazonia, but also occurs in "cerrado" areas and was previously known from such habitats in the states of Mato Grosso and Goiás (Araújo 1994, *In* Nascimento, Bernardes, and Cotta [eds.], Herpetologia no Brasil, I. PUC-MG, Belo Horizonte: pp. 58–68; Ávila-Pires 1995, Zool. Verh. 299:1–706).

Submitted by **DAVOR VRCIBRADIC**, Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-011, Rio de Janeiro, Rio de Janeiro, Brazil.

SCELOPORUS JARROVII (Yarrow's Spiny Lizard). USA: ARIZONA: Graham Co: E side of Galiuro Mts., Deer Creek (32°39.37'N, 110°16.86'W; 1450 m elev.). 30 August 2000. E. F. Enderson and R. L. Bezy. UAZ 52117; High Creek Trail, ca 1.6 km above trailhead. 4 June 1965. W. C. Sherbrooke. UAZ 14958-60. Both verified by P. C. Rosen. First records from the Galiuro Mts.; extends range ca 35 km W of Pinaleño (Graham) Mts.

(Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second Ed. Houghton Mifflin, Boston, Massachusetts. ix + 336 pp.).

Submitted by **ERIK F. ENDERSON**, School of Renewable Resources, University of Arizona, Tucson, Arizona 85721, USA, **ROBERT L. BEZY**, Herpetology, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA, **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA, and **GEORGE L. BRADLEY**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

SCELOPORUS UNDULATUS TEDBROWNI (Mescalero Prairie Lizard). USA: NEW MEXICO: Roosevelt Co: 22 specimens: 9.7 km N Portales, 8 June 1965, M. B. Snipes, MSB 15499; 16 km N Portales, 6 June 1965, M. B. Snipes, MSB 1550; 4 km W Floyd, 21 April 1975, C. B. Johnson, MSB 31347; Boone's Draw, 7 September 1976, M. Conway, MSB 55899; 7.5 km S Milnesand, 18 May 1993, M. W. Doles et al., MSB 56538; NM Highway 262 at Texas border, 7.6 km S Lingo, 20 June 1993, M. W. Doles et al., MSB 56559; 3.2 km S Lingo, 20 June 1993, M. W. Doles et al., MSB 56755–9; 0.8 km N & 5.6 km W Milnesand, 20 June 1995, L. A. Fitzgerald et al., MSB 59893; 7.2 km N & 10.5 km W Milnesand, 20 June 1995, L. A. Fitzgerald et al., MSB 59894–6; 3.2 km N & 19.3 km W Milnesand, 21 June 1995, L. A. Fitzgerald et al., MSB 59909; 6.4 km N & 25.7 km W Milnesand, 21 June 1995, L. A. Fitzgerald et al., MSB 59924; 5.6 km N & 2.4 km E Milnesand, 22 June 1995, L. A. Fitzgerald et al., 59927–8; 8.9 km N & 3.2 km E Milnesand, 22 June 1995, L. A. Fitzgerald et al., MSB 59936; 4.8 km N & 18.5 km E Milnesand, 23 June 1995, L. A. Fitzgerald et al., MSB 59940–1. All verified by Richard L. Holland. First records for county, and a range extension of about 130 km N of previously recorded limits in Chaves and Lea counties (Smith et al. 1992, Bull. Maryland Herpetol. Soc. 28:123–149).

Submitted by **HOBART SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0316, USA, **MARK A. JORDAN**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131-1091, USA, and **A. DALE BELCHER**, Rio Grande Zoological Park, 903 Tenth Street SW, Albuquerque, New Mexico 87102-4098, USA.

SERPENTES

BOTHRIECHIS SCHLEGELII (Eyelash Palm Pit Viper). ECUADOR: PROVINCIA DE MANABÍ: Parque Nacional Machalilla: San Sebastián (ca. 1°35'S, 80°40'W), 400–900 masl. 11 October 1992. M. Garilanez. Museo Zoológico de la Pontificia Universidad Católica del Ecuador (QCAZ 1497). Verified by Luis A. Coloma. Extends known range of species 150 km SW, 100 km W, and 110 km NW from published localities in Ecuador (Kuch and Freire 1995, Herpetozoa 8:49–58). Natural vegetation at the locality is coastal cloud forest. This is the first record of *B. schlegelii* for the Machalilla National Park (Zambrano B. and Vargas A. 1998, Parque Nacional Machalilla. Quito, Imprenta Crissan Color. 92 pp.), and the highest elevation known to be inhabited by the species west of the Cordillera Occidental of the Andes in Ecuador.

Submitted by **ULRICH KUCH**, Sektion Herpetologie, Forschungsinstitut und Naturmuseum Senckenberg, Senckenberganlage 25, 60325 Frankfurt am Main, Germany.

BOTHROPS ALTERNATUS (Urutu). BRAZIL: GOIÁS: Mineiros, Emas National Park (18°20'S, 53°00'W, 760-880 m elev.). 4 April 1997. C. Nogueira. Instituto Butantan, São Paulo, Brazil (IB 57085–86). Verified by F. L. Franco. First vouchered record for the state of Goiás and for the cerrado in Central Brazil; extends range about 200 km northward (Campbell and Lamar 1989, The Venomous Reptiles of Latin America, Cornell Univ. Press, Ithaca, New York. p. 181; McDiarmid et al. 1999, Snake Species of the World, Publ. Herpetol. League. p. 253). Both snakes were found in *campo sujo* (shrubby cerrado grassland) habitat, in seasonally dry, xerophytic interfluvial savannas.

Submitted by **CRISTIANO NOGUEIRA**, Laboratório de Ecologia e Evolução de Vertebrados, Departamento de Ecologia, Universidade de São Paulo, Caixa Postal 11461, CEP 05422-970, São Paulo, São Paulo, Brazil (e-mail: crinog@ib.usp.br), and **PAULA H. VALDUJO**, Laboratório de Herpetologia, Instituto Butantan. Avenida Vital Brasil, 1500, CEP 05503–900, São Paulo, São Paulo, Brazil.

CHIRONIUS SCURRULUS (Machete). VENEZUELA: ESTADO AMAZONAS: Ocamo, Río Ocamo. 153 m elev. 29 March 1972. R. Hoogesteijn. Museo de Historia Natural La Salle, Caracas (MHNLS 5698). Juvenile, 335 mm SVL. Lancini (1979, Serpientes de Venezuela. Armitano Ed. 262 pp.) had previously reported a specimen collected in San Carlos de Río Negro, Amazonas, without museum data. The specimen reported herein constitutes the first documented voucher for the state of Amazonas and the southernmost locality in Venezuela. Extends known distribution at least 325 km E of previous locality in Río Paragua (Hoge 1969, Mem. Inst. Butantan 34:85; Lancini and Kornacker 1989, Die Schlangen von Venezuela. Verlag Armitano Editores. 381 pp.). The discovery, on the same day and in the same place, of a juvenile of *C. exoletus* (MHNLS 5700) and an adult of *C. fuscus* (MHNLS 5890), demonstrates sympatry of the three species of this genus. ESTADO BOLIVAR: La Escalera, ca. 800 m elev. 25 May 1989. José Ayarzagüena. Museo de Historia Natural La Salle (MHNLS 11341). Adult male, 1020 mm SVL. All verified by Cesar Molina. Although Hoge (*op. cit.*) first reported the species from Venezuela, based on an uncataloged specimen deposited in the Museo de Biología de la Universidad Central de Venezuela, Caracas, and purported to come from the state of Bolívar, the specimen reported herein is the first documented record for the state. The only other documented records of this taxon in Venezuela are those of Dixon et al. (1993, Mus. Reg. Sci. Nat. Torino. Monog. XIII. 279 pp.) for the state of Monagas, and Rivas and Oliveros (1997, Mem. Soc. Cienc. Nat. La Salle 147: 67–80) for the state of Sucre. These records demonstrated that the snake has a more extensive distribution in Venezuela, but is limited to the Venezuelan Guayana, the latter understood as encompassing the states of Amazonas, Bolívar, Delta Amacuro, eastern Monagas and southeastern Sucre, as defined by Gorzula and Señaris (1998, Contribution to the Herpetofauna of the Venezuelan Guayana I. A data base. Scientia Guaianae 8, 270 pp. + 32 color plates).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela (e-mail: gilsonrivas@mixmail.com) and **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales y Ambientales, Laboratorio de Biogeografía, Colección de Anfibios y Reptiles, Mérida 5101, Venezuela (e-mail: lamarca57@cantv.net).

CLELIA CLELIA (Mussurana). VENEZUELA: ESTADO AMAZONAS: Cunucunuma River, 8 km SW of Acanaña (03°09'82"N, 66°02'82"W). 170 m elev. 15 April 1990. Wilmer Villalobos. Museo de Historia Natural La Salle, Caracas (MHNLS 11761). Adult male, 1420 mm SVL. First state record and southernmost record in Venezuela. ESTADO MERIDA: Caserío la Florida, W of Poblado las Virtudes (09°08'82"N, 70°52'82"W), 950–970 m elev. 28 December 1977. Alfredo Paolillo. MHNLS 7146. Adult male, 1350 mm SVL. First state record and the westernmost locality in Venezuela. First specimen from the Andean Cordillera de Mérida. ESTADO APURE: Hato el Frío, La Apontera (07°44'28"N, 69°02'20"W). 70 m elev. February 1990. José González. MHNLS 11586. Adult male, 1245 mm SVL. First state record and first documented voucher from the Venezuelan Llanos region (Rivero-Blanco and Dixon 1979, *In* Duellman [ed.], Mus. Nat. Hist. Univ. Kansas Monog. 7:281–98). All verified by César Molina. Species had been reported for some localities in the Venezuelan states of Aragua, Bolívar, Carabobo, Guarico, Miranda, Sucre, and Distrito Federal (Zaher 1996, Boll. Mus. reg. Sci. nat. Torino 14[2]:289–337; Roze 1966, La Taxonomía y Zoogeografía de los Ofidios en Venezuela. UCV, Edic. Bibli. 362 pp.; Rivas and Oliveros 1997, Mem. Soc. Cienc. Nat. La Salle 147:67–80). These new records suggest that this taxon has a wider distribution in Venezuela than was previously known.

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Sección de Herpetología, Apartado Postal 1930, Caracas 1010-A, Venezuela (e-mail: gilsonrivas@mixmail.com) and **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales y Ambientales, Laboratorio de Biogeografía, Colección de Anfibios y Reptiles, Mérida 5101, Venezuela (e-mail: lamarca57@cantv.net).

COLUBER FLORULENTUS FLORULENTUS (Flowered Racer). EGYPT: NORTH SINAI: Al-Arish City, (31°07'55"N, 32°45'20"E). 25 October 1999. Adel A. Ibrahim. Muséum National d'Histoire Naturelle, Paris (MNHN 1999.9453). Verified by Ivan INEICH. A juvenile (246 mm SVL) captured from a house in Fawakhreya, one of the oldest districts of the town. Snake was probably introduced from the Nile Delta, and more than likely from the Sharqia Province via cattle fodder and clover vehicles. In Egypt, this species has been recorded from the Nile Valley and Delta, Faiyum and Wadi El Natrun (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. XI, 234 pp.). First record for the Sinai Peninsula (Werner 1982, *In* N. J. Scott, Jr. [ed.], Herpetological Communities, pp. 153–161. U.S. Fish and Wildlife Service Wildl. Res. Rep. 13).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt (e-mail: aibrahim@ismailia.ie-eg.com).

DIADOPHIS PUNCTATUS STICTOGENYS (Mississippi Ringneck Snake). USA: ARKANSAS: Phillips Co: SE 1/4 Sec. 7, R5E, T1S, ca. 100 m N jct. of Phillips County Roads 239 and 211, St. Francis National Forest. 11 November 2000. L. K. Irwin and K. J. Irwin. Arkansas State University Museum of Zoology Herpetological Collection (ASUMZ 25370). Verified by Stanley E. Trauth. Adult female found under ca. 250 mm diameter log in bed of dried cypress-tupelo gum slough in bottomland hardwood forest adjacent to base of eastern versant of Crowley's Ridge. An adult female Marbled Salamander (*Ambystoma opacum*) with egg clutch was under same log, ca.1.3 m spatial distance between individuals. First record for county and second record east of White River basin in Mississippi River floodplain of Arkansas (Trauth, Robison, and Plummer, ms. in prep.).

Submitted by **LISA K. IRWIN**, 355 Granddaddy Lane, Mabelvale, Arkansas 72103, USA, and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA.

DRYMOBIUS RHOMBIFER. BRAZIL: AMAZONAS: Benjamin Constant: Itacuari River between Pedras and Ituhry rivers (04°22'59"S, 70°01'52"W). May 1942. C. Parko. Museu Nacional, Brazil (MNRJ 1549). Verified by Ronaldo Fernandes. Male specimen; third record for Brazil and new state record. Previously known in Brazil from Isle of Maracá, state of Roraima (O'Shea 1998, *In* Maracá: The Biodiversity and Environment of an Amazon Rainforest, pp. 231–262. John Wiley and Sons) and from the state of Rondônia (Vanzolini 1986, Levantamento herpetológico da área do estado de Rondônia sob a influência da rodovia BR 364, Conselho Nacional de Pesquisas, Brasíla, DF. 50 pp).

Submitted by **PAULO PASSOS**, Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Quinta da Boa Vista s/n, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

GYALOPION CANUM (Western Hooknose Snake). MÉXICO: JALISCO: Atotonilco el Alto, municipality of Atotonilco el Alto, 1550–1600 m (20°34'N, 102°31'W). August 2000. Raymundo López-Azpeitia. Universidad Autónoma de Guadalajara, México (UAGM-R-426). Verified by H. M. Smith. Range extension; nearest previously known records were from 145 km SW at Tapalpa, Jalisco (Ponce and Huerta, in prep.) and 191 km W and 3 km S Carapán, Michoacán (Ponce and Huerta 1999, Herpetol. Rev. 30:113).

Submitted by **PAULINO PONCE-CAMPOS**, **SARA M. HUERTA-ORTEGA**, and **HECTOR DE LA MORA-NAVARRO**, Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

HETERODON NASICUS (Western Hognose Snake). **CORRECTION**. USA: ARKANSAS: Polk Co: Skyline Drive on top of Rich Mountain at western boundary of Queen Wilhelmina State Park. 27 June 1975. D. B. Means, J. B. Atkinson, and G. H. Means. UF/FSM 34807. Means (1976, Herpetol. Rev. 7:123) originally recorded this specimen as the first Arkansas record for *Heterodon nasicus*, extending the range 391.5 km from western

Oklahoma or northeastern Texas. Recent examination of the specimen confirms that it is actually a subadult *Heterodon platirhinos,* thus eliminating this species from the herpetofauna of Arkansas. Verified by Joseph T. Collins and Stanley E. Trauth.

Submitted by **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA.

HYDROPS TRIANGULARIS (Triangle Water Snake) BRAZIL: MATO GROSSO: Teles Pires River (07°21'S, 58°03'W). Date and collector unknown. Herpetological Collection of the Instituto Butantan, São Paulo, Brazil (IB 30868). Young male. Several works have listed the snake fauna of the state of Mato Grosso (Amaral 1925, Comissão de linhas telegrafhicas estratégicas de Mato Grosso ao Amazonas; Nascimento et al. 1988, Bol. Mus. Para. Emílio Goeldi, sér. Zool. 4[1]:21–66; Strussmann and Carvalho 1998, Herpetol. Rev. 29:183–185; Strussmann and Sazima 1993, Studies on Neotropical Fauna and Environment 28[3]:157–168) and, until now, none of them had recorded *Hydrops triangularis* for this region. First state record. MATO GROSSO DO SUL: Aquidauana Municipality (20°28'S, 55°48'W). An adult specimen. IB 29171. According to the only list on the snake fauna of the state of Mato Grosso do Sul (Koslowsky 1898, Rev. Mus. La Plata pp. 25–33), this is the first state record. Both verified by Thales De Lema.

Submitted by **NELSON RUFINO DE ALBUQUERQUE**, Linha de Pesquisa em Herpetologia, Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga 6681, CEP: 90619-900, Porto Alegre- Rio Grande do Sul, Brazil.

HYPSIGLENA TORQUATA JANI (Texas Night Snake). USA: TEXAS: Mason Co: Mason County Wildlife Management Area (30°49.204'N, 79°13.422'W). 25 March 2000. Joel McKinney, David Etheredge, and students in an Introductory Wildlife Class collected one specimen from under a prickly pear cactus (*Opuntia*) along the base of a large granite boulder. TCWC 83982. Verified by James. R. Dixon. New county record (Dixon 1997, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station).

Submitted by **JOEL McKINNEY** and **DAVID ETHEREDGE**, Biology Department, South Plains College, Levelland, Texas 79336, USA (e-mail: jmckinne@spc.cc. tx.us).

LIOCHLOROPHIS VERNALIS (Smooth Green Snake). USA: COLORADO: Pueblo Co: the town of Rye, near Rye Elementary School, Sec. 30, T24S, R67W. 5 October 2000. Margaret DiMatteo and Paul J. Hurtado. UCM Ancillary Collection of Herpetological Slides and Prints 148–149. Verified by Hobart M. Smith. First county record (Hammerson 1999, Amphibians and Reptiles of Colorado. Second Ed. Univ. Colorado Press, Niwot. xxviii + 484 pp.).

Submitted by **CHARLES W. LOEFFLER**, Colorado Department of Natural Resources, Division of Wildlife, 6060 Broadway, Denver, Colorado 80216, USA.

LIOPHIS ATRAVENTER. BRAZIL: RIO DE JANEIRO: Teresópolis (22°24'S, 42°57'W). L. Davies. 17 March 1943. Museu Nacional, Brazil (MNRJ 2766). Verified by R. Fernandes. An adult female. Species was originally described by Dixon and Thomas (1985, Herpetologica 41:259–262) based on three specimens from the Biological Station Boracéia, state of São Paulo, Brazil (23°38'S, 45°52'W). The record reported herein represents a new state record and is the fourth known specimen of thes species; extends distribution about 235 kilometers from the type locality.

Submitted by **PAULO PASSOS** and **DANIEL S. FERNANDES**, Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Quinta da Boa Vista s/n, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil (e-mail: danfer@acd.ufrj.br).

LIOPHIS BREVICEPS BREVICEPS. BRAZIL: PARÁ: Itaituba (4°17'S, 55°59'W) on left bank of the Tapajós River. 1996. R. L. M. de Oliveira. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1339). Verified by Rubens N. Yuki. The taxon is known from forested parts of the Amazon Basin in Bolivia, Brazil, Colombia, Perú, and similar areas in French Guiana, Guyana, Suriname, and Venezuela. Represents the first record for the western portion of the state of Pará and fills the distributional gap between previously known localities. Specimen was collected 234 km airline from Santarém, the nearest previous record (Dixon 1983, J. Herpetol. 17:149–165).

Submitted by **JOSSEHAN GALÚCIO DA FROTA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200 (e-mail: jgfrota@mailbr.com.br).

MICRURUS CORALLINUS (Painted Coral Snake). BRAZIL: RIO GRANDE DO NORTE: Natal, Parque Estadual das Dunas (05°47'–5°56'S and 35°10'–35°11'W). 27 April 2000. B. R. A. França. Coleção do Departamento de Botânica, Ecologia e Zoologia, Universidade Federal do Rio Grande do Norte (CDBEZ 407). Verified by Ulisses Caramaschi and Ronaldo Fernandes. In leaf litter of forest among coastal dunes. First record for the state; this specimen extends distribution ca. 1400 km N Minas Gerais and Espírito Santo, Brazil (Roze 1996, Coral Snakes of the Americas. Krieger Publ., Malabar, Florida. p. 150) and ca. 1300 km N Porto Seguro, Bahia, Brazil (Franco et al. 1998, Répteis na Estação Veracruz [Porto Seguro, Bahia]. Veracel, Publ. Técnico-Científica, n. 3, 39 pp.).

Submitted by **ELIZA MARIA XAVIER FREIRE**, Departamento de Zoologia y Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade, 452, Farol, Maceió, Alagoas, 57021-090, Brazil and Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

MICRURUS LEMNISCATUS (South American Coral Snake). BRAZIL: RIO GRANDE DO SUL: municipality of Eugênio de Castro (28°31'S, 54°08'W). 9 April 2000. E. Contry and L. H. Cappellari. Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP 11935). Verified by Nelson Jorge da Silva, Jr. First state record; southernmost record for the species, extending known range 395 km SW from União da Vitória, Paraná, Brazil, and 150 km SE from Puerto Azara, Misiones, Argentina (Jorge da Silva and Sites 1999, Herpetol. Monogr. 13:142–194).

Submitted by **MARCOS DI-BERNARDO**, **MÁRCIO BORGES-MARTINS**, and **LIZE HELENA CAPPELLARI**,

Laboratório de Herpetologia, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga, 6681, CEP 90619-900, Porto Alegre, Rio Grande do Sul, Brazil.

NATRIX NATRIX (Grass Snake). SPAIN: ALMERÍA: River Adra between Majaroba and Potriles (36°47'52"N, 3°00'36"W), 90 masl and 7200 m from the river's mouth. 4 September 2000. Mariano Paracuellos. Consejería de Medio Ambiente, Junta de Andalucía, Almería, Spain, Color Slides 10101–102. Verified by Jesús Mellado. First record for Almería Province (southeastern Spain). Extends range about 50 airline km E from River Guadalfeo, Granada (Santos et al. 1997, *In* Pleguezuelos [ed.], Distribución y Biogeografía de los Anfibios y Reptiles en España y Portugal, pp. 282–284. Universidad de Granada-AHE, Granada; Braña 1998, *In* Salvador [coord.], Reptiles, Fauna Ibérica, Vol. 10, pp. 454–466. Museo Nacional de Ciencias Naturales, CSIC, Madrid). Rarity of this snake in the majority of southeastern Iberia is usually ascribed to the environmental aridity there (Pleguezuelos 1989, Doñana, Acta Vertebrata 16:15–44; Santos et al., *op. cit.*; Braña, *op. cit.*), and Sierra Nevada has been considered to represent the southeastern limit of the range of this species in Spain (Pleguezuelos, *op. cit.*). Though surrounded by semi-arid environments, the fluvial bed where the present specimen was found has superficial water of good quality all year round, giving rise to a diverse composition of aquatic flora and fauna, and a dense vegetation predominated by *Arundo donax* on its banks. Such an environmental condition seems to have enabled the snake to exist in this region.

Submitted by **MARIANO PARACUELLOS**, Consejería de Medio Ambiente, Junta de Andalucía, C. R. Oliveros, bl. Singular, Almería E-04071, Spain; e-mail: paracuellos@larural.es.

OXYRHOPUS CLATHRATUS. BRAZIL: BAHIA: Barra do Choça, Recanto da Adriana farm (14°57'S, 40°33'W). March 1999. J. O. Ruas. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau/CEPLAC (CZGB 8876); 14 October–13 November 1999. J. O. Ruas. CZGB 9378. Both verified by Joaquim Cavalheiro. Previously known in southeastern Brazil from southern Minas Gerais to Rio Grande do Sul and Misiones in northeastern Argentina (Peters and Orejas-Miranda 1970, Bull. U.S. Nat. Mus. 297:231). First record from the state of Bahia and northeastern Brazil.

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO** Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil; e-mail: ajargolo@hotmail.com.

SALVADORA HEXALEPIS (Western Patchnose Snake). USA: CALIFORNIA: Kern Co: Lokern Natural Area, Sec. 29, T29S, R22E. 7 August 2000. Kathy Sharum and Rochelle Germano. LACM Color Slides PC 1340–41. Verified by R. W. Hansen. Specimen represents only the second record for the western portion of the southern San Joaquin Valley, and was found less than 2 km from the previous record (Cameron and Hansen 1994, Herpetol. Rev. 25:34–35). The locality is between the known ranges of the subspecies *S. h. virgultea*, known to occur on the Carrizo Plain to the west, and *S. h. mojavensis*, found ca. 60 km to the E in Bakersfield (Bogert 1945, Amer. Mus. Novitates 1285:1–14; Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, Massachusetts. 336 pp.; Cameron and Hansen 1994, *op. cit.*). Unlike the first record, this specimen was kept and thoroughly examined. Its characters are mostly those of *mojavensis:* undivided loreal scale, no upper labial scales reaching the eye, and the vertebral stripe is three scale rows wide (Bogert 1945, *op. cit.*). However, the sides are more uniformly gray than is typical for *mojavensis*, and thus are similar to *virgultea*.

Submitted by **DAVID J. GERMANO**, Department of Biology, California State University, Bakersfield, California 93311-1099, USA; e-mail: dgermano@csubak.edu.

STORERIA OCCIPITOMACULATA (Redbelly Snake). USA: Arkansas: Arkansas Co: Sec. 14, T7S, R2W, White River National Wildlife Refuge. 10 October 2000. K. J. Irwin and W. B. Blihovde. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25343). Verified by Stan Trauth. Adult male found under log in second growth bottomland hardwood forest. First record for county, the third and most easterly record for the species in the Mississippi River floodplain of Arkansas (Trauth, Robison, and Plummer, *in prep.*).

Submitted by **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA, and **W. BOYD BLIHOVDE**, White River National Wildlife Refuge, P.O. Box 308, DeWitt, Arkansas 72042, USA.

SISTRURUS MILIARIUS (Pigmy Rattlesnake). USA: Arkansas: Arkansas Co: NE 1/4, Sec. 25, R2W, T7S, ca. 1.5 km W of jct. Co. Rt. 44 and Lagrue Bayou. 20 September 2000. Paul Gideon. Arkansas State University Museum of Zoology, Herpetological Collection (ASUMZ 25344). Verified by Stan Trauth. Adult found DOR. First record for county, fourth record for the species in the Mississippi River floodplain of Arkansas (Trauth, Robison, and Plummer, *in prep.*).

Submitted by **W. BOYD BLIHOVDE**, White River National Wildlife Refuge, P.O. Box 308, DeWitt, Arkansas 72042, USA, and **KELLY J. IRWIN**, Arkansas Game and Fish Commission, 915 East Sevier Street, Benton, Arkansas 72015, USA.

STORERIA OCCIPITOMACULATA OBSCURA (Florida Redbelly Snake). USA: FLORIDA: St. Johns Co: Guana River Wildlife Management Area (30°06'17"N, 81°21'12"W). 26 March 2000. Scott Krueger. UF 121360. Verified by F. Wayne King. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Second Ed. Windward Publ., Miami, Florida. 176 pp.). Collected in xeric oak scrub habitat.

Submitted by **JOSIAH H. TOWNSEND** and **KENNETH L. KRYSKO**, Florida Museum of Natural History, Division of Herpetology, Gainesville, Florida 32611, USA, and **SCOTT A. KRUEGER**, 2801 Green Acres Road Extension, St. Augustine, Florida 32084, USA.

TYPHLOPS DEPRESSICEPS (Beaked Blind Snake). PAPUA NEW GUINEA: WEST NEW BRITAIN PROVINCE: Willaumez Peninsula, ca. 17 km S of Talasea and 3 km W of Walindi Plantation,

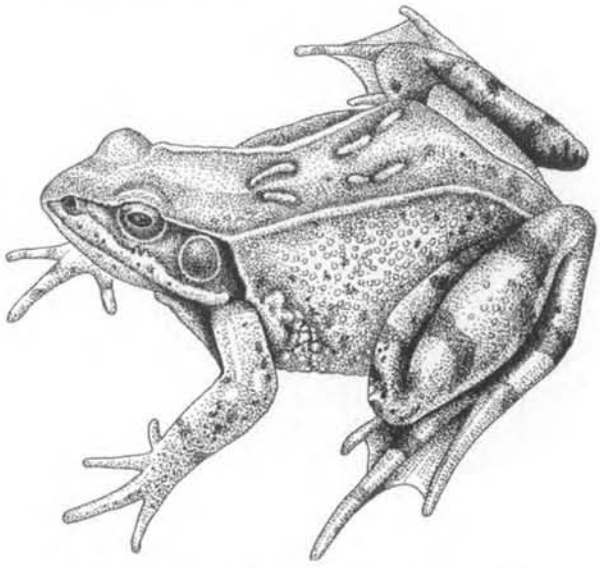
(5°26.04'S, 150°3.46'E) ca. 150 masl. 13 April 1999. Johannes Foufopoulos. University of Wisconsin Museum of Zoology (UWMZ H.23647). Verified by A. Wynn and V. Wallach. First record for the island of New Britain. This lowland species is currently known only from a handful of specimens collected primarily along the north coast of Papua New Guinea and offshore Kiriwina Island. Specimen was found under a rotten log in the immediate vicinity of the Walindi River in mature primary rainforest. The specimen is an immature individual with the following data: 780 middorsals, 29 subcaudals, 22-22-20 scale rows, SVL 220 mm, TL 229 mm, fresh mass weight 1.55 g.

Submitted by **JOHANNES FOUFOPOULOS**, Department of Ecology and Evolutionary Biology, Guyot Hall, Princeton University, Princeton, New Jersey 08544-1003, USA (e-mail: jfoufop@princeton.edu).

Correction

In reviewing literature pertaining to distributions of Georgia herpetofauna, I discovered an error that I wish to correct. Laerm et al. (1996. Herpetol. Rev. 27:91–92) reported three species of amphibians and one reptile that represented new records for Dade County, Georgia. All localities are within the Crocford-Pigeon Mountain Wildlife Management Area, which lies entirely within Walker County. Of the species listed by Laerm et al. (1996, *op. cit.*), *Gastrophryne carolinensis* (Eastern Narrowmouth Toad), *Scaphiopus holbrookii holbrookii* (Eastern Spadefoot Toad), and *Virginia valeriae valeriae* (Eastern Smooth Earth Snake) are county records for Walker County (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Spec. Pub. 3:1–712); however, *Ambystoma talpoideum* (Mole Salamander) was previously reported from Walker County (Jensen 1996. Herpetol. Rev. 27:28).

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA; e-mail: john_jensen@dnr.state.ga.us.



Rana temporaria. Illustration by P. A. Benson.

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Three New Country Records for Honduran Snakes

JAMES R. McCRANIE
10770 SW 164th Street
Miami, Florida 33157–2933, USA

LARRY DAVID WILSON
Department of Biology
Miami-Dade Community College, Kendall Campus
Miami, Florida 33176–3393, USA
e-mail: lwilson@mdcc.edu

and

STEVE W. GOTTE
USGS Patuxent Wildlife Research Center
National Museum of Natural History, Washington, DC 20560–0111, USA
e-mail: gotte.steve@nmnh.si.edu

Field work at two localities in La Reserva de la Biósfera Río Plátano, deptos. Colón and Olancho, Honduras, in 1998 and 1999 resulted in the collection of three species of snakes not previously known to occur in Honduras. The species are discussed below, including their color in life, following the colors and codes of Smithe (1975–1981). Museum abbreviations follow those of Leviton et al. (1985).

Ninia maculata (Peters). A single adult female (USNM 535992; SVL of 186 mm and a total length of 245 mm) was collected at 540 m elevation under a small log at Quebrada Machín, Depto. Colón, on 3 August 1999. The specimen has narrow crossbands on the body (closest to Fig. 2B in Savage and Lahanas 1991), a broad nuchal collar (most similar to Fig. 3B in Savage and Lahanas 1991, although the collar is not divided down the midline), and a strongly checkered venter (pattern most similar to Fig. 4H in Savage and Lahanas 1991). Scalation characters of USNM 535992 are typical of *N. maculata*, as defined by Savage and Lahanas (1991). The overall color pattern and segmental counts (127 ventrals, 52 subcaudals, 179 ventrals plus subcaudals) agree with the Atlantic Lowlands population of *N. maculata*, as defined by Savage and Lahanas (1991). The Honduran specimen represents a range extension of about 160 airline km NNW of the Big Falls, Zelaya (= Depto. Atlántico Norte), Nicaragua, locality in Savage and Lahanas (1991). Color in life of USNM 535992: dorsum of body Burnt Umber (22), with Blackish Neutral Gray (82) dorsal crossbands; dorsum of head Dark Grayish Brown (20); supralabials with pale cream and very dark brown markings; venter pale cream with Dusky Brown (19) checkering; iris gray with darker flecking.

Sibon longifrenis (Stejneger). Six specimens (three males [USNM 535994, 535996, 535998] and three females [USNM 535993, 535995, 535997]) were collected between 540 and 700 m elevation on vegetation 2–3 m above streams at Quebrada de Las Marías, Depto. Olancho (five specimens), and Quebrada Machín, Depto. Colón (one specimen). All specimens were active at night on 1–2 August 1998 and 1 August 1999. Comparison of these specimens to the data provided by Savage and McDiarmid (1992) revealed that they agree with their definition of *S. longifrenis* in most de-

tails. However, the Honduran material differs in ventral pattern from the illustration and description of *S. longifrenis* provided by Savage and McDiarmid (1992) by lacking significant stippling on these surfaces. In fact, the ventral pattern of the Honduran specimens most closely resembles that of *S. argus*, as illustrated (their Fig. 2B) and described by Savage and McDiarmid (1992). Thus, the Honduran material was compared directly to the holotype of *Mesopeltis longifrenis* Stejneger (USNM 38750) from Panama and five specimens from Costa Rica identified as *S. longifrenis* by Savage and McDiarmid (CRE 6701; KU 25703; UF 31787, 77732; UMMZ 117502), as well as the holotype of *Leptognathus argus* Cope (USNM 30656) from Costa Rica and three specimens from Panama identified as *S. argus* by Savage and McDiarmid (KU 75752–53, 112473). *Sibon longifrenis* and *S. argus* differ significantly from each other in head shape, eye size, number of ventrals, and number of subcaudals. The Honduran specimens agree with the specimens we examined of *S. longifrenis* in these significant characters. However, the differences in ventral pattern between the Honduran material and that of *S. longifrenis* from Costa Rica and Panama remain obvious in direct comparison, except that one Costa Rican *S. longifrenis* (UF 77732) has less ventral stippling than the remaining *S. longifrenis*, and approximates the pattern seen in the Honduran material. Thus, we consider the Honduran specimens to be conspecific with *S. longifrenis* from Costa Rica and Panama. The Honduran specimens represent a range extension of about 530 airline km NNW of the Heredia, Costa Rica, localities reported by Savage and McDiarmid (1992).

Savage and McDiarmid (1992) had only nine specimens of *Sibon longifrenis* available for their analysis. Thus, we provide the following pertinent data for the six Honduran specimens: enlarged penultimate supralabial bordering orbit; loreal bordering orbit on 9 of 12 sides, one large preocular present on 3 of 12 sides, 1 small preocular present below loreal on 6 of 9 remaining sides; 1–3 (usually 2) postoculars; 7–7 supralabials (fourth, fifth, and sixth bordering orbit), sixth supralabial enlarged in all; infralabials 6–8, none in contact behind mental; 1+2 (2+3 on one side) temporals; 0–1 postmentals (usually 1 very small postmental present); dorsal scales in 15–15–15 smooth rows, vertebral row not enlarged; ventrals 166–169 (167.3, N = 3) in males, 159–165 (161.7, N = 3) in females; subcaudals 106 in both males with complete tails, 91–98 (95.7, N = 3) in females; total segmental counts 272–275 (273.5, N = 2) in males, 250–263 (257.3, N = 3) in females. The color pattern of the Honduran material agrees well with that provided for *S. longifrenis* by Savage and McDiarmid (1992), except that the ventral surfaces are cream (in preservative) with longitudinal dark brown mottling, mottling not confined to lateral edges of ventrals and not forming a zig-zag pattern. There are 27–41 (34.5) single dorsal ocelli and 0–12 (5.8) paired ocelli. The largest male (USNM 535998) has a SVL of 389 mm and a total length of 577 mm; the largest female (USNM 535997) has a SVL of 368 mm and a total length of 541 mm. Color in life of USNM 535993: dorsum of body Bunting Green (150), with black outlined Ferruginous (41) ocelli crossbands, some of which are broken into dorsal and lateral portions, these crossbands separated laterally by ivory blotches; dorsum of head Bunting Green (150), with black outlined Ferruginous (41) blotches; venter Spectrum Yellow (55) with black longitudinal mottling, mottling streaked with Ferruginous (41); iris pale olive green, with black and rust-red speckling.

Urotheca guentheri (Dunn). Two adult males (USNM 535999–6000; SVL 265 mm and total length 465 mm and SVL 215 mm and tail incomplete, respectively) were collected at 540 m elevation less than 1 m apart inside the same rotten log at Quebrada Machín, Depto. Colón, on 4 August 1999. Both specimens agree well with the description of this species by Myers (1974, as *Rhadinaea*). Both specimens have 140 ventrals and the specimen with the complete tail has 109 subcaudals. USNM 535999 is nearly 30 mm longer than the longest male available to Myers (1974). The Honduran specimens represent a range extension of about 170 airline km NNW of the Eden Mine, Zelaya (= Depto. Atlántico Norte), Nicaragua, locality in Myers (1974). Color in life of USNM 535999: dorsum of body Warm Sepia (221A) between dorsolateral pale stripes, with median row and portions of paravertebral rows with an olive tint; paired dorsolateral stripes Cinnamon (39); lateral field (between dorsolateral and lateral pale stripes) Walnut Brown (221B), heavily flecked with Sepia (219); paired lateral stripes Drab-Gray (119D); lower half of scale row 1 and lateral edge of ventrals Sepia (119); dorsum of head Warm Sepia (221A); pale spot posterior to eye Cream Color (54); spots just posterior to head Cinnamon (39); lower portion of supralabials pale cream, Burnt Orange (116) along lip line on supralabials 4–6; venter Burnt Orange (116); iris rust-red. Savage and Crother (1989) placed the members of Myers' (1974) *Rhadinaea lateristriga* group (to which *R. guentheri* belongs) in the genus *Urotheca* Bibron. Myers and Cadle (1994) concurred with this placement.

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Distribution Records of Georgia Herpetofauna

JOHN B. JENSEN
Georgia Department of Natural Resources
Nongame-Endangered Wildlife Program
116 Rum Creek Drive, Forsyth, Georgia 31029, USA
e-mail: john_jensen@dnr.state.ga.us

The following specimens from the Louisiana State University Museum of Natural History (LSUMZ) represent new Georgia county records (Jensen and Moulis 1997, 1999; Williamson and Moulis 1994). All specimens were verified by Jeff Boundy.

Ambystoma opacum (Marbled Salamander). BARTOW CO: Cartersville. August 1967. C. Wilson. LSUMZ 52189.

Desmognathus monticola (Seal Salamander). CHATTOOGA CO: Unnamed creek feeding lake in James H. "Sloppy" Floyd State Park. 4 June 1993. J. Carlin and D. O'Quinn. LSUMZ 56070.

Plethodon chlorobryonis (Atlantic Coast Slimy Salamander). BANKS CO: 6.5 km E of Baldwin near White House Creek. 15 November 1997. C. Camp. LSUMZ 59688.

Plethodon jordani (Jordan's Salamander). TOWNS CO: Tate Branch Recreational Area. 5 May 1973. G. Hardaway and T. Hardaway. LSUMZ 62532.

Plethodon serratus (Southern Redback Salamander). FLOYD CO: John's Creek at The Pocket, Chattahoochee National Forest. 19 May 1994. J. Carlin. LSUMZ 56600.

Pseudotriton montanus montanus (Eastern Mud Salamander). ROCKDALE CO: Rest Area on I-20, 1.6 km E jct. U.S. Rt. 138. 11 April 1971. D. Marshall. LSUMZ 23975.

Cnemidophorus sexlineatus sexlineatus (Sixed-lined Racerunner). STEWART CO: 4.4 km N of Lumpkin. 18 May 1963. D. Drapalik. LSUMZ 54520. Removed from the stomach of a *Masticophis flagellum* (LSUMZ 6710) collected from the stated locality.

Cemophora coccinea (Scarlet Snake). MUSCOGEE CO: Fort Benning Military Reservation. 7 August 1971. P. Strong. LSUMZ 75950.

Crotalus horridus (Timber Rattlesnake). COBB CO: Vicinity of Marietta. September 1965. H. Morris. LSUMZ 38644.

Elaphe guttata (Corn Snake). BARTOW CO: 6.5 km E of Cartersville. 27 June 1967. C. Wilson. LSUMZ 30017.

Regina septemvittata (Queen Snake). GORDON CO: Pumpkin Vine Creek at US Rt. 41. May 1959. S. Lee. LSUMZ 8848.

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New Records and Natural History Notes for Lizards and Snakes from Patagonia, Argentina

LUCIANO JAVIER AVILA
MARIANA MORANDO
CRILAR-CONICET, Mendoza y Entre Ríos s/n
5301, Anillaco, La Rioja, Argentina
e-mail: lavila@crilar.com.ar
e-mail: mmorando@crilar.com.ar

and

DANIEL ROBERTO PEREZ
ISFPD-Villa Regina, San Luis 327, 8336, Villa Regina, Río Negro, Argentina

Field work in southern Argentina during the austral summer of 2000 and a review of herpetological material deposited in another collection has resulted in new records for six species of lizards and two species of snakes. Gustavo Scrocchi verified the identification of all specimens. All specimens have been deposited at Fundación Miguel Lillo (FML), San Miguel de Tucumán, Tucumán, Argentina. Latitude and longitude were determined with a Garmin GPS 38 global positioning device for the species collected by the first two authors and geographic coordinates for localities of specimens collected by DRP were determined with the Atlas de la República Argentina, I-Parte Política, Instituto Geográfico Militar (1972).

Polychrotidae

Diplolaemus darwini. CHUBUT PROVINCE: Departamento Florentino Ameghino: on Ruta Provincial Número 30, 37 km W Camarones (44°42'05"S, 66°08'54"W). 20 January 2000. L. J. Avila and M. Morando. FML 9143.

First province record and northeasternmost known locality for the species. This record extends the range reported for this species by Cei (1986) ca. 200 km NE (airline). Habitat was shrub-grass steppe. According Cei (1986), the populations north of Santa Cruz-Chubut boundaries are difficult to identify. But this specimen is clearly an individual of *Diplolaemus darwini*, so it is the first documented record for the species in this province.

Pristidactylus fasciatus. RIO NEGRO PROVINCE: Departamento General Roca: 35 km NE Chichinales (38°49'00"S, 66°47'00"W). January 1997. D. R. Perez. FML 9319.

First specific locality record south of La Pampa Province except for the type locality; confirms unvouchered citation for Rio Negro Province (Etheridge and Williams 1985; Koslowsky 1898). Specimen was collected using a pitfall trap made in a depression of sandy substrate. Other species observed at this site were *Liolaemus darwinii*, *Liolaemus gracilis*, *Homonota fasciata*, and *Homonota* cf. *darwinii*.

Tropiduridae

Phymaturus patagonica. RIO NEGRO PROVINCE: Departamento Ñorquinco: on rock boulders along the roadside of Ruta Provincial Número 6, 1 km NW Ojo de Agua (41°32'30"S, 69°51'33"W). 28 January 2000. L. J. Avila and M. Morando. FML 9320–21.

Second record for the province and first record for Departamento

Ñorquinco (Avila et al. 1999). Westernmost locality and extends the range of the species ca. 150 km SW in Rio Negro and more than 300 km for any previously known locality in Chubut province. Specimens of this population exhibit a remarkable chromatic variation, unlike that of other *Phymaturus patagonica*. *Liolaemus* cf *petrophilus*, *Liolaemus rothi*, *Liolaemus bibroni*, *Liolaemus kriegi*, and *Homonota darwinii* were also found at this locality.

Liolaemus cuyanus. LA PAMPA PROVINCE: Departamento Puelen: 7 km NE Casa de Piedra (38°07'26"S, 67°06'19"W). 29 January 2000. M. Morando and L. J. Avila. FML 9146.

Second record for La Pampa Province; constitutes a range extension of ca. 60 km south from previous record (Cruz et al. 1999). Specimens of this population exhibit a remarkable chromatic variation, unlike that from northern populations. Subtrate was loose sand covered with medium-sized bushes, but lacking dunes or extensive open areas. *Liolaemus darwini*, *Liolaemus* cf. *melanops*, *Liolaemus gracilis* and *Cnemidophorus longicaudus* were also found at this locality.

Liolaemus kriegi. RIO NEGRO PROVINCE: Departamento Ñorquinco: on rock boulders along the roadside of Ruta Provincial Número 6, 1 km NW Ojo de Agua (41°32'30"S, 69°51'33"W). 28 January 2000. L. J. Avila and M. Morando. FML 9322.

This species was collected at the same locality as *Phymaturus patagonica* and confirms the presence of *L. kriegi* in western Rio Negro province, considered uncertain by Cruz et al. (1999).

Liolaemus petrophilus. CHUBUT PROVINCE: Departamento Paso de Indios: Valle de los Mártires, on rock boulders along the roadside of Ruta Nacional Número 25, 19 km E jct. Ruta Provincial Número 27 (43°49'41"S, 67°45'21"W). 24 January 2000. M. Morando and L. J. Avila. FML 9323.

Southwesternmost locality; extends the range of this species at least 100 km from any previously known locality in Chubut province (Cei 1986; Scolaro 1993). The range of this species may extend to the southern boundaries of Chubut province, based on our observations in the San Bernardo Mountains.

Colubridae

Phalotris bilineatus. CHUBUT PROVINCE: Departamento Rawson: on Ruta Nacional Número 3, 17 km N Trelew (43°05'52"S, 65°14'17"W). 16 January 2000. M. Morando and L. J. Avila. FML 9324. Southernmost record for the species (Scolaro and Cei 1979) and first departamental record. RIO NEGRO PROVINCE: Departamento El Cuy: Valle Azul, 15 km SE Chichinales (39°07'00"S, 66°56'00"W). January 2000. D. R. Perez. FML 9382. Second vouchered record for Rio Negro Province; extends range reported for the species ca. 150 km to southwest. Closest records are in La Pampa Province and eastern Rio Negro province (Vega and Bellagamba 1994).

Philodryas patagoniensis. RIO NEGRO PROVINCE: Departamento 25 de Mayo; on Ruta Provincial Número 6, 11 km S Ingeniero Jacobacci (41°20'40"S, 69°41'30"W). 28 January 2000. L. J. Avila and M. Morando. FML 9144.

A range extension of ca. 200 km south from the ca. occidental boundaries for the species cited by Cei (1993). In a previous work (Cei 1986), the southern limit for *P. patagoniensis* is stated as "no more south than Rio Negro-Chubut boundaries" and a locality record is shown on the distribution map of the species near the record reported herein. Nonetheless, this is the first vouchered record for southern Rio Negro province.

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New Amphibian Records from the Andes of Venezuela

JAIME E. PÉFAUR
Grupo de Ecología Animal, Facultad de Ciencias
Universidad de Los Andes, Mérida, Venezuela
e-mail: pefaur@ciens.ula.ve

and

NANCY M. SIERRA
Universidad Regional del Carirí, Crato, Ceará, Brazil
e-mail: nsierra@urca.br

While conducting field surveys in valleys of the Andes in the state of Mérida, Venezuela, new amphibians records were documented. Voucher specimens were deposited at the Universidad de Los Andes Vertebrate Collection (CVULA), the Zoological Museum Collection of the Universidade Estadual de Campinas (ZUEC), and the University of Kansas Museum of Natural History (KU).

Adenomera andreae. ESTADO TÁCHIRA: Municipio Uribante: Campamento Siberia (7°53'N, 71°45'W), 1000 m. 28 May 1990. ZUEC 9134. J. E. Péfaur, N. M. Sierra and F. Godoy. Verified by A. J. Cardoso. First Andean record and the westernmost record in Venezuela (Heyer 1973; Péfaur and Díaz de Pascual 1987). Barrio (1998) indicated the presence of this frog in the state of Trujillo (without supporting data).

Hyla microcephala. ESTADO MÉRIDA: Municipio Tovar: Hacienda Cucuchica (8°20'N, 71°44'W), 7 km NE Tovar, 750 m. 29 July 1995. CVULA 5727 and 18 February 1996. ZUEC 9729. N. M.

Sierra and J. E. Péfaur; Municipio Libertador: Mérida (8°35'N, 71°18'W), 1650 m. 2 January 1996. CVULA 5789. N. M. Sierra and J. E. Péfaur; ESTADO TÁCHIRA: Municipio Uribante: Valle del Río Doradas, II Desarrollo de CADAFE (7°48'N, 71°45'W), 650 m. 29 May 1990. ZUEC 9139. J. E. Péfaur, N. M. Sierra and A. Castillo. All verified by A. J. Cardoso. In addition to being the first Andean records, these are elevation records for the species (Rivero 1961; Péfaur and Díaz de Pascual 1982; Barrio 1998).

Scinax rostratus. ESTADO MÉRIDA: Municipio Tovar: Hacienda Cucuchica (8°20'N, 71°44'W), 6 km NE Tovar, 700 m. 9 December 1995. CVULA 5734, ZUEC 9733, KU 223374. N. M. Sierra and J. E. Péfaur. Same locality. 24 June 1996. CVULA 5785. Jaime E. Péfaur. All verified by W. E. Duellman. First record for state and westernmost in Venezuela (Rivero 1968; Duellman 1972; La Marca 1992; Hero and Mijares-Urrutia 1995; Yústiz 1996; Barrio 1998).

Flectonotus pygmaeus. ESTADO MÉRIDA: Municipio Tovar: Hacienda Cucuchica (8°19'N, 71°44'W), 9 km NE Tovar, 800 m. 28 January 1996. CVULA 5699. N. M. Sierra and J. E. Péfaur. Same locality. CVULA 5786. J. E. Péfaur. Both verified by Jesús Manzanilla-Puppo. Mijares-Urrutia and Arends (1993) erroneously indicated a record for the state of Falcón as the westernmost in Venezuela. Previously, Duellman and Gray (1983) had reported this species as present in the three westernmost states of Venezuela: Barinas, Mérida, and Táchira.

Eleutherodactylus lentiginosus. ESTADO MÉRIDA: Municipio Tovar: Hacienda Cucuchica (8°20'N, 71°44'W), 7 km NE Tovar, 800 m. 20 August 1995. ZUEC 9728, 9734. Same locality. 6 August 1995. CVULA 5731. Verified by J. D. Lynch. First state record and easternmost in the Andes (Rivero 1982; La Marca 1992).

Physalaemus pustulosus. ESTADO MÉRIDA: Municipio Andrés Bello: 10 km NW La Azulita, vía Caño Zancudo (8°45'N, 71°28'W), 700 m. 16 June 1990. CVULA 5728. A. J. Cardoso and J. E. Péfaur. Municipio Pinto Salinas, 3 km NE Santa Cruz vía La Victoria (8°25'N, 71°38'W), 600 m. 8 May 1995. CVULA 5729. J. E. Péfaur. Municipio Tovar: Hacienda Cucuchica (8°20'N, 71°44'W), 6–9 km NE Tovar, 700–810 m. 24 July 1995. CVULA 5730, ZUEC 9732. 18 December 1995. CVULA 5731. N. M. Sierra and J. E. Péfaur. All verified by A. J. Cardoso. These are elevation records for the species.

With the exception of *Flectonotus pygmaeus* and *Eletherodactylus lentiginosus*, the rest of the species are common in the lowlands of Venezuela. The members of these higher populations inhabit marshes or temporary ponds located in places where the primary submontane rain forest has been cut and/or has been replaced by pasture. Furthermore, most localities reported herein are along Andean river valleys in the northwestern versants facing the Maracaibo Lake basin. Usually, these and other anuran species reach higher elevations in the northwestern rather than in the southeastern versant of the Venezuelan Andean Cordillera.

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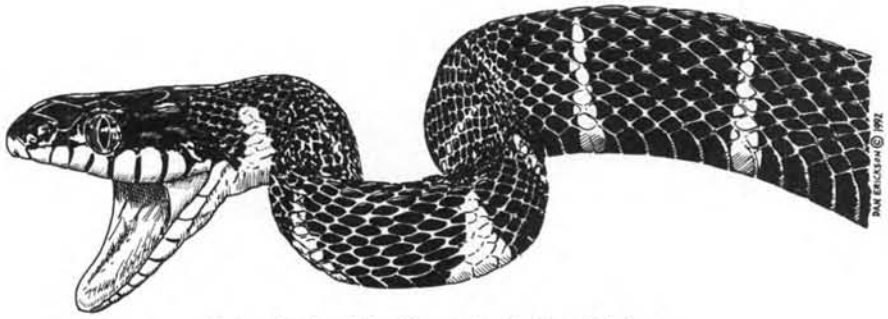
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Boiga dendrophila. Illustration by Dan Erickson.

BOOK REVIEWS

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A Plague of Frogs: The Horrifying True Story, William Souder. 2000. Hyperion Press, New York, New York. xv+299 pp. Hardcover. US $23.95. ISBN 0-7868-6360-9.

JACQUELINE F. WEBB
Department of Biology, Villanova University
Villanova, Pennsylvania 19087, USA
e-mail: jacqueline.webb@villanova.edu

What happens when simple observations made by a group of school kids on a field trip are transformed into awareness of a phenomenon of potential worldwide importance? *A Plague of Frogs* is not just a herpetological tale. It is a well-told and well-documented story of natural history, science, and environmental politics. In *A Plague of Frogs*, William Souder, an award-winning freelance journalist, tells the complex and interesting story of the startling discovery of limb deformities in frogs and the multifaceted investigations into their causes.

In 1995, limb deformities were found in the frogs in Ney Pond in Minnesota. They had missing legs, non-functional legs, extra legs, undersized legs, legs twisted like cork screws, legs attached to the body by webbing. Soon, state and federal agencies initiated investigations into the causes of these deformities and then they were found in other states and in Canada. Interestingly, such deformities are not new—the author notes that records of their occurrence are in the literature from as early as 1740. Today, with awareness of local and global environmental crises, including the worldwide declines in amphibian populations, the questions were straightforward: Are these naturally occurring abnormalities, or were they caused by one or more environmental factors? As the story proceeds, we find out that the general consensus is that the deformities are likely to be caused by environmental factors. Both parasites and chemical contaminants (including pesticides) were shown to cause limb abnormalities in laboratory experiments. Unfortunately, a single environmental cause and underlying developmental/biochemical mechanism could not be identified to account for the diversity of abnormalities observed. After describing all the available evidence, and the experimental data generated to explain the appearance of the deformities through 1999, the book concludes with the idea that limb deformities are the result of the synergism of multiple environmental factors (e.g., parasites, chemical contaminants) acting through multiple mechanisms (e.g., mechanical or biochemical disruption of limb development), and/or the local manifestation of larger global phenomena (e.g., global climate change, increase in UV radiation).

The book is divided into two parts and fourteen chapters. The book is written largely in chronological sequence, which effectively shows science as an intellectual process, and how it is affected by the complexities of politics and personalities. The book reads like an expanded journalistic exposé. This is not suprising, since Souder first reported on the discovery of deformed frogs in *The Washington Post*. Souder tells a good story by gradually adding new information in a way that accurately reflects the course of events, but also provides maximum impact for the reader. He had exclusive access to all of the key players: landowners, government officials and environmental scientists, researchers, and a varied cast of research scientists. He becomes intimately involved in the development of the story not only as storyteller, narrator, interviewer, and observer, but as participant, wader-wearing field assistant, critical reviewer, occasional consultant, and commentator on people and personalities.

Most importantly, Souder clearly communicates the facts and principles underlying the scientific issues at hand. Throughout the first half of the book, he pauses to give remarkably good minilectures on tadpole biology (p. 62), deep evolutionary time (p. 70), evolution of the vertebrate limb (p. 72), cell differentiation and the development of the limb (p. 88), retinoic acid mimics and endocrine disruption (p. 92), and standard assays for chemical contaminants (p. 119). He communicates the essential concepts and provides factual material without resorting to those cute, often trite, analogies that many other writers have used to appeal to the lay reader. He also uses engaging and well-constructed re-tellings of conversations with research scientists and government administrators, and of the proceedings and often colorful debates at scientific conferences as vehicles to explain the different and often conflicting hypotheses for the appearance of limb malformations (e.g., parasites, endocrine disruption) and its potential link with the overall decline in amphibian populations (e.g., UV radiation, the extinction of the golden toad). Throughout the book he is very careful to define scientific terminology, with the clear understanding that he is a non-scientist talking to non-scientist readers. Souder carefully presents the different hypotheses to explain the occurrence of limb deformities, and the data and ideas that support and refute them. He emphasizes the difficulty of evaluating conflicting and sometimes overlapping hypotheses. He also demonstrates a clear understanding, and even compassion, for the people involved, and an appreciation for the problems that arise when the scientific process is overshadowed by personalities, resulting in serious issues of scientific credibility. The nine pages of bibliographic sources, presented at the end of the text, include major textbooks and primary journal articles and provide evidence of the tremendous amount of research that went into the writing of this book.

The story of limb deformities in frogs is a complex one. There are many participants at various levels of the private, scientific, and government sectors, and the answers to the scientific questions posed are not as satisfyingly simple and elegant as one might hope. But, it is the complexity of the story that makes this book an excellent teaching tool for courses in introductory biology, environmental science, scientific ethics, and of course, herpetology. In the process of trying to unravel the complexities of the problem of limb deformities, Souder touches upon a myriad of fundamental issues including: the value of the scientific method as a process, the search for patterns in data and the appropriate use of statistics, ownership of data, the importance of seaching the literature in languages other than English, the importance of communication among scientists, natural history as a source of "natural experiments" that may be informative, the use of correlation versus cause and effect in hypothesis testing, how multiple hypotheses are generated by different people who have observed the same phenomenon through different filters, the value and frustration of being

presented with multiple explanations for what appears to be a single phenomenon, and how the presentation of results can influence the public's perception of a problem. The author also makes several interesting comments on the need for organismal biologists in a world where the "ascendency of molecular biology [is] reducing interest in the natural history of whole organisms to the vanishing point" (p. 139), where "biologists who study animals...are on their way out," and where "zoologists... are an endangered species." In other words, if this trend continues, who will be left to unravel the next mystery?

The book would have benefited from the inclusion of one or more maps of Minnesota and North America to show the approximate locations of the sites where the different types of limb deformities have been found. In addition, the second half of the book could have benefited from additional editing. There were some textual redundancies above and beyond those needed for clarity, and for jogging the memory of the reader. I found myself struggling between anticipation of the punchline and my recognition of the need for a detailed treatment of the development of the scientific ideas and approaches necessary to explain the underlying causes of the limb deformities. It is only in the last few chapters that the story appears to accelerate with the presentation of experimental evidence to support the hypotheses presented. By the last chapter, there is a crying need for an explicit restating of the major scientific issues, conflicting hypotheses and their authors, the data presented to support them, and tentative conclusions (a summary table would have been nice). I admit, even upon writing this review, that I needed to go back for a second reading to pull out the essential questions (and answers) in a concise, presentable way that would be appropriate for a lecture on the subject.

This well-written and informative book is highly recommended for the scientists (specialists and non-specialists) and lay readers who are interested in environmental issues and global biodiversity.

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Ecología de los Vertebrados de Chile, by Fabián Jaksic. 1996 [1997]. Ediciones Universidad Católica de Chile, Santiago. 262 pp. Softback. ISBN 956-14-0440-0.

JAIME E. PÉFAUR
Grupo de Ecología Animal, Facultad de Ciencias
Universidad de Los Andes, Mérida, Venezuela
e-mail: pefaur@ciens.ula.ve

One of the main features of South America is its great biodiversity. The whole territory, north to south, east to west, both terrestrial and aquatic, has an incredible diversity of flora and fauna. Five of the countries included in this continent are considered megadiverse in a worldwide context. Six others have a quite high biotic diversity, but two—Chile and Uruguay—have rather small faunas and floras compared to the rest. The herpetofauna of Chile includes about 42 amphibians and 90 reptiles (Formas 1995; Veloso and Navarro 1988), and that of Uruguay includes 40 species of amphibians (Klappenbach and Langone 1992) and 64 reptiles (Langone, pers. comm.). For comparison, Venezuela has approximately 252 amphibians and 300 reptiles (Péfaur 2000). In Chile, there are no salamanders or caecilians; and reptiles are largely represented by lizards, with a handful of snakes and marine turtles and no crocodilians.

Although restricted, the herpetofauna of Chile has had a significant and fruitful history of study. The early comprehensive works of Cei (1962) and Donoso-Barros (1966) established an excellent base for taxonomic studies of the anurans and reptiles, respectively. Once the most basic taxonomic problems of the herpetofauna had been resolved, the logical next step was to study its ecology. The small size of the Chilean herpetofauna, a result of temporal and geological isolation, benefited the country's student community by providing an excellent natural laboratory where endemism, restricted geographical distribution, a relatively clear separation of biomes and ever-present latitudinal and altitudinal gradients, are the most relevant ecological factors. The result was a quite large assembly of ecological researchers producing keen, in-depth studies on the country's biota.

Ecología de los Vertebrados de Chile is a university text intended to illustrate the vertebrate ecology of the country through a review of the primary literature. In a total of 262 pages, covering 11 chapters and an extensive bibliography, the ecology of five vertebrate classes is treated in sections devoted to biodiversity, autecology and ecology of populations, and community ecology. Amphibians are treated in six pages, and reptiles in 22 pages. Fifty-seven pages are devoted to the bibliography.

Jaksic's chief approach is to review the pertinent ecological literature published mainly in Chile. About 1130 references are used to analyze the ecology of the Chilean vertebrates, with about 60 related to amphibians and 180 pertinent to the reptiles.

Ecological data of Chilean amphibians are scarce—in six pages all the relevant ecological knowledge is summarized. Information about taxonomy, distribution, conservation, ecophysiology, ethology, reproduction, diet, and natural history are provided for some populations and species and niche relationships, species gradients in altitudinal transects, and comparison of continental assemblages are treated in the context of community ecology. However, the handling of information is uneven. For instance, Jaksic indicates that the ecophysiology of the Chilean anurans is almost unknown, but relatively detailed information is given for ecophysiological aspects of several species, most notably *Caudiverbera caudiverbera*, *Bufo chilensis* and *B. spinulosus*. Information is also provided about niche partitioning between *Alsodes tumultuosus* and *A. montanus*, two sympatric species of high Andean leptodactylid anurans. On the other hand, the behavioral ecology and trophic relations of frogs are each covered only by a short sentence.

The reptile chapter follows the same general arrangement as that dealing with frogs, but each section is subdivided, reflecting the more detailed information available for this group. This chapter provides a vast and rich accumulation of data. The references about taxonomy are diverse, but cover mainly the 1980s and 90s. A few additional references are provided for the distribution and conservation of reptiles. The bulk of the ecological information about this group is at the population and community levels. Many of the reptile references are by Jaksic himself, who with his associates and students, has wisely chosen the genus *Liolaemus* to develop, test, and probe ecological theories.

Liolaemus is the most important reptile group in Chile, accounting for more than 50 species or about 60% of the total number of

reptiles. Speciation of these medium-sized lizards is explained by Fuentes and Jaksic (1979) as a result of Pleistocene climatic and environmental changes. Many ecological attributes of this genus have been researched, as is shown by the data presented on, for example, morphological adaptations to elevation, thermoregulation, and dietary changes as adaptations to different environments. The inclusion of relatively few studies of restricted scope based on other lizards highlights the significance of the ecological studies on *Liolaemus*. *Liolaemus* has also been studied in the context of community ecology to examine such patterns as morphological correlates of microhabitat segregation, competition and predation, as well as species replacement in elevational transects. Herpetologists should not ignore the other chapters of the book. That dealing with birds of prey is rich with information about the important role played by *Liolaemus* species as dietary items.

Based on the data presented, it seems that the bulk of the present knowledge of Chilean reptile ecology is derived from lizards and that far less is known about other groups. The ecology of snakes, for instance, is covered by no more than four references, which together hardly provide a sound basis.

I found that the book gathers together most of the ecological information available for Chilean amphibians and reptiles and that the data provided for the rest of the vertebrates are also well documented. Jaksic's goal of summarizing empirical studies to provide a sound basis for the teaching of a course in vertebrate ecology is achieved admirably. Although some references have been omitted, the work of collating and synthesizing has been done carefully and thoughtfully. Anyone teaching about or studying the Chilean herpetofauna will find the majority of the key references dealt with in this volume.

This book reflects the energy and vitality of the Chilean ecological community. In addition to Jaksic and his associates, a variety of other researchers have worked and continue to work to expand the knowledge base on Chilean vertebrate ecology. This book reflects the successful efforts of the dedicated student community in Chile to move the study of the natural history and ecology of Chilean vertebrates from modest beginnings to a world class level. In my opinion, only the efforts of Janzen (1983) and associates to the study of the Costa Rican vertebrates are comparable in Latin America to the Chilean situation. It is a testament to Chilean biologists that several important journals are produced in that country. For example, references to Revista Chilena de Historia Natural, Medio Ambiente, and Boletín del Museo Nacional de Historia Natural appear on every page of the bibliography, reflecting both the high quality and quantity of scientific output. Although the Chilean amphibians and reptiles are not especially numerous, they, along with the other vertebrates of the country, have proved to be excellent models for the solid ecological research reviewed in *Ecología de los Vertebrados de Chile*.

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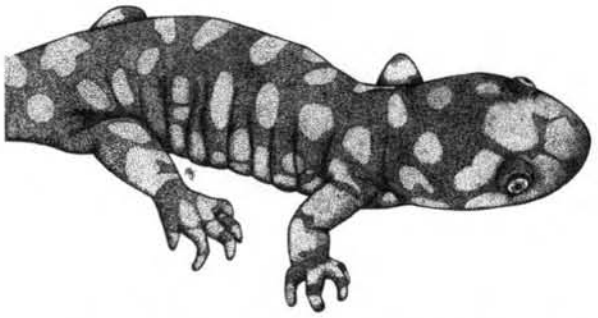
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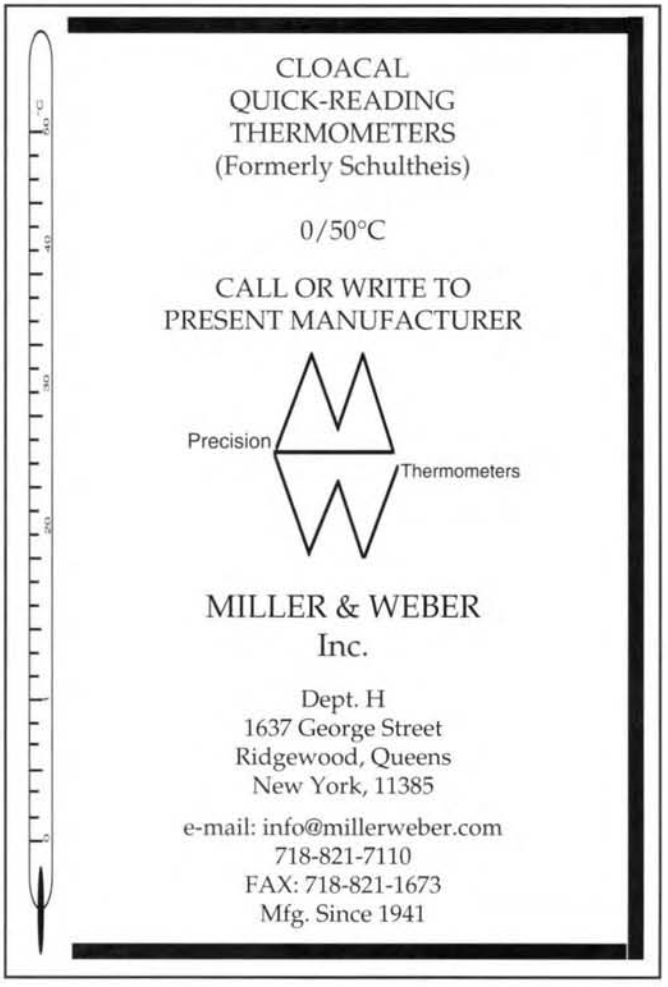
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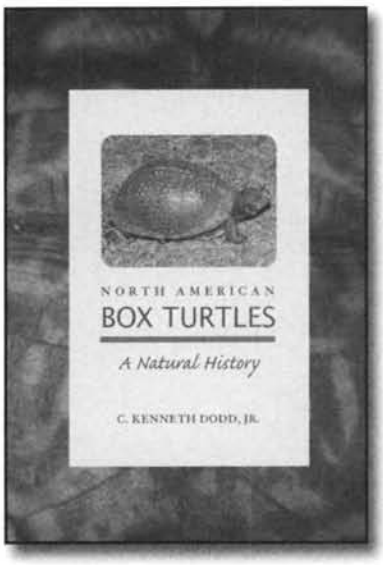
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Ambystoma tigrinum. Illustration by Michael G. Frick.



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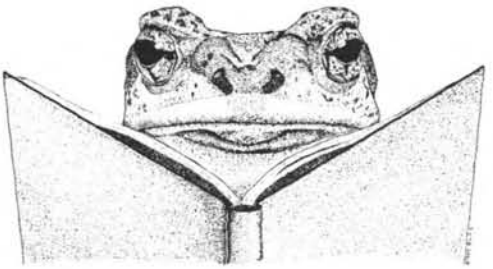
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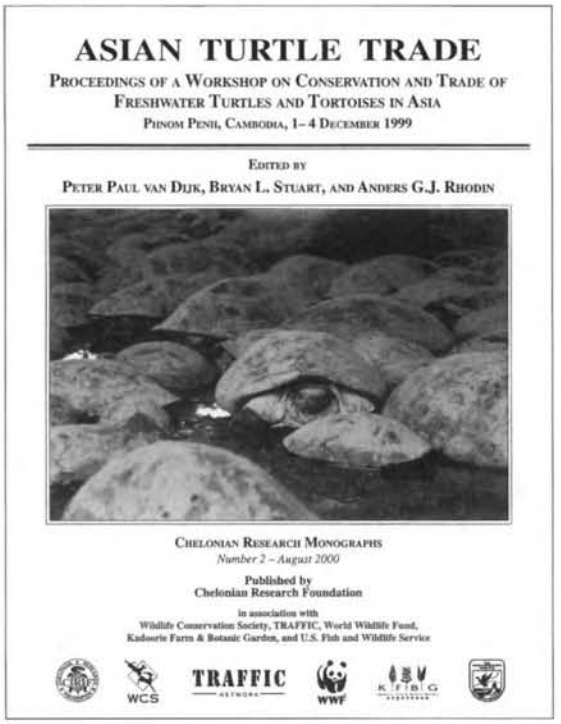


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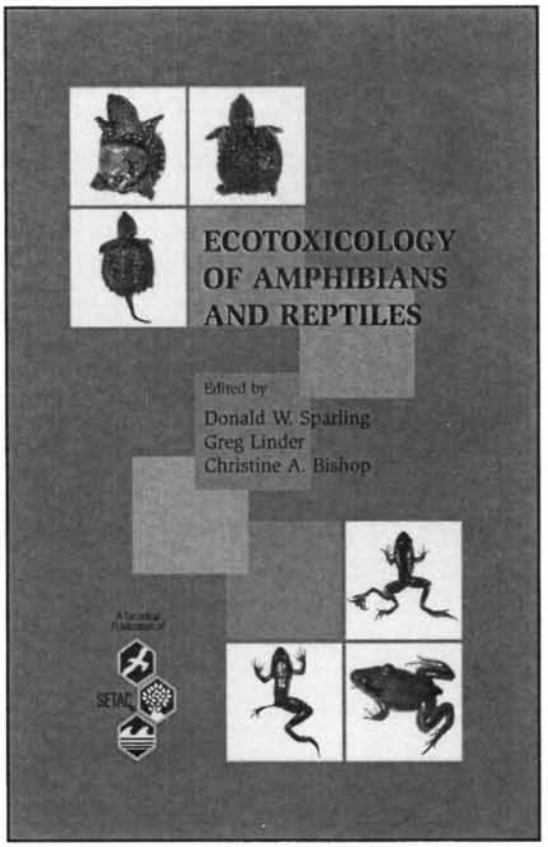
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Herpetological Review

Volume 32, Number 1 March 2001

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SSAR Officers (2001)

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Redpath Museum
McGill University
Montreal, Quebec H3A 2K6, Canada

President-elect
JANALEE P. CALDWELL
Oklahoma Museum of Natural History
1335 Asp Avenue
University of Oklahoma
Norman, Oklahoma 73019-0606, USA

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JOHN M. MATTER
Department of Biology
Juniata College
Huntington, Pennsylvania 16652, USA

Treasurer/Publications Secretary
ROBERT D. ALDRIDGE
Department of Biology
Saint Louis University
3507 Laclede Avenue
St. Louis, Missouri 63103-2010, USA
e-mail: ssar@slu.edu

Immediate Past President
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

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SSAR Editors

Journal of Herpetology
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Department of Life Sciences
Arizona State University West
P.O. Box 37100
Phoenix, Arizona 85069, USA

WILLIAM S. PARKER, Managing Editor
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Mississippi University for Women
Columbus, Mississippi 39701, USA

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Section of Neurobiology & Behavior
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Ithaca, New York 14853, USA

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Catalogue of American Amphibians and Reptiles
ROBERT POWELL, Editor
Department of Natural Sciences
Avila College
Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
University of Florida
bowen@gnv.ifas.ufl.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

DARYL R. KARNS
Hanover College
karns@hanover.edu

MICHAEL E. DORCAS
Davidson College
midorcas@davidson.edu

SHARYN B. MARKS
Humboldt State University
sbm1@axe.humboldt.edu

PAUL A. STONE
University of Central Oklahoma
pstone@ucok.edu

DEANNA H. OLSON
USDA Forestry Science Lab
dede.olson@orst.edu

GUNTHER KÖHLER
Forschungsinstitut und
Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

Current Research
JENNIFER M. GARRISON
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
jmg1@ukans.edu

Current Research
ELI GREENBAUM
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey–Foley Hall
The University of Kansas
2021 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Legislation & Conservation
TRAVIS J. RYAN
Department of Biology
Furman University
Greenville, North Carolina 29613, USA
travis.ryan@furman.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

Copy Editors: *Anna Clarke, Jennifer Pramuk*

Editor-at-Large: *Stephen Deban*

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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2001 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@slu.edu.

Future Annual Meetings

2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 27–31 July 2001

Society for the Study of Amphibians and Reptiles
2001 Annual Meeting

together with

The Herpetologists' League

27 – 31 July 2001
University Place Conference Center and Hotel
Indianapolis, Indiana, USA

Keynote Address: "Herps and Hopes: Africa in a New Millenium," by Bill Branch, The Hepetologists' League Disntiguished Herpetologist for 2001 (Port Elizabeth Museum).

Symposium: "Amphibian Population Declines." *Organizers:* David M. Green, McGill University (czdg@musica.mcgill.ca) and Karen Lips, St. Lawrence University (klip@music.stlawu.edu).

Symposium: "Herpetological Research in Zoos: The Academic Connection." *Organizers:* John D. Groves and Hugh R. Quinn, Cleveland Metroparks Zoo (hquinn@ix.netcom.com).

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day throughout the conference.

Student Travel Awards: Ten Sherman A. Minton student travel grants of US $200 each will be available for SSAR members. Refer to page 201 of the December 2000 issue of *HR* for details.

Student Paper Awards: Henri Seibert prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the official Meeting Announcement for details.

Social Activities: General Reception in the University Place Ballroom, SSAR Herp Silent Auction, Graduate Student Reception, Sunday night Barbecue Dinner and Auction, Graduate Student Reprint & Book Scavenge, Herpetological Quiz.

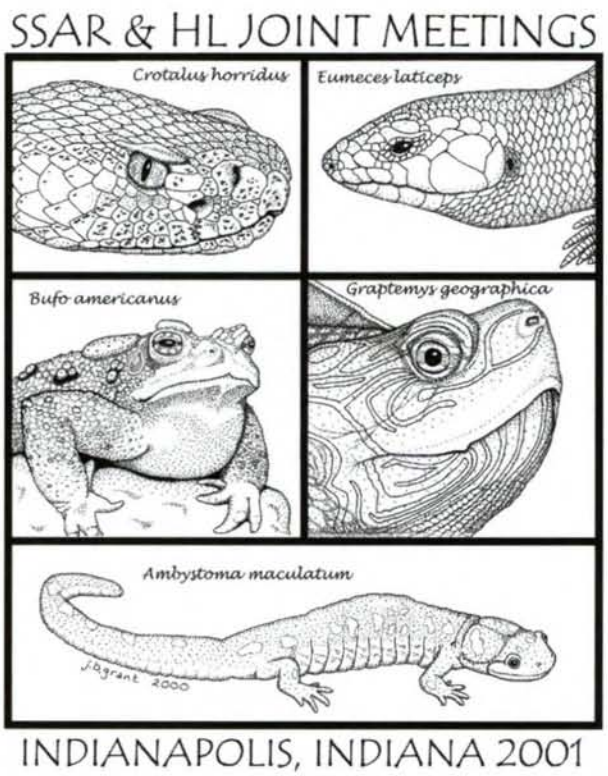
Multimedia Presentations: "Amphibians of the Appalachians," and "Herpetology of the West," by David Dennis and Eric Juterbock. President's Travelogue slide presentations by Patricia Burrowes (Puerto Rico), Tim Halliday (South Africa), John Wilkinson, Ross Alford (Australia), Hinrich Kaiser (Southeast Asia), and Michael Lannoo (Antarctica).

Live Animal Exhibit: Live amphibians and reptiles of Indiana will be on display and available for photography.

Costs: Preregistration US $240 regular, US $175 student, US $120 accompanying person. After June 1, 2001, costs are US $295, US $200 student, US $145 accompanying person.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Further Details: Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of the participating societies. Overseas members wishing to receive this information may do so by contacting Henry R. Mushinsky, Local Chair, Department of Biology, University of South Florida, Tampa, Florida 33620, USA; e-mail: mushinsk@chuma1.cas.usf.edu or telephone 813/974-5218. Please visit the meeting web site at http://www.ukans.edu/~ssar/ind.html for additional and updated information.



About Our Cover: *Agalychnis annae*



Hylid frogs of the genus *Agalychnis* are among the most colorful animals of neotropical rainforests. One species, *A. callidryas*—said to be the most-photographed amphibian—is something of a "poster frog" for rainforest conservation. Other species in the genus remain less well known, however. Among these, *A. annae* is known from a few sites on the Atlantic slopes of Isthmian Central America in moist and wet tropical forest types, up to about 1600 meters elevation (Duellman 1970. The Hylid Frogs of Middle America. Univ. Kansas Mus. Nat. Hist., Monogr. No. 1, xi + 753 pp., 72 plates). At higher elevations, *A. annae* is most commonly encountered along forested streams, and it still occurs in some parts of the city of San José, Costa Rica.

There are eight species in the genus *Agalychnis*, collectively known as "leaf frogs." *Agalychnis*, along with five other genera, comprise the subfamily Phyllomedusinae of the treefrog family Hylidae. Phyllomedusines range from Mexico through Central- and tropical South America.

Leaf frogs live in the canopy and are subject to dessication. To combat this, they secrete a waxy substance which is wiped over the dorsal surfaces before daybreak. When at rest, the limbs are adpressed to the body, reducing the area exposed to drying. These frogs are colored and patterned to resemble the green leaves on which they sleep, thereby reducing the risk of detection by tree-dwelling predators such as monkeys. When perching on leaves, they reflect near-red light in the infrared spectrum, just as do the leaves (Schwalm et al. 1977. Science 196:1225–1227).

Phyllomedusine frogs come down from the canopy to breed. Most species congregate around small forest pools of quiet water, although some breed only in flooded stumps and similar situations. The male advertisement call is typically a somewhat muted "tok" although a large chorus of some species can often be heard at some distance in the forest at night.

Females are larger than males and often are the objects of much attention during breeding aggregations. Males will wrestle with one another in their attempts to mate with an available female. An arboreal nest is constructed by rolling a leaf and depositing an adherent egg mass within. Upon hatching, the larvae ooze from the gelatin and fall into the water, where they develop as tadpoles.

The eggs of leaf frogs are preyed upon by cat-eyed snakes of the genus *Leptodeira*. These arboreal colubrids are always present during phyllomedusine breeding aggregations and are adept at locating and engulfing the egg clutches. Calling males are subject to predation by bats in the genus *Trachops*, which locate their prey by sound.

The specimen on our cover was collected by **Louis Porras** in August 1977 from his home town of San Ramón, Costa Rica. It was photographed on a tabletop in Miami, Florida that same month by **Jim Bridges** (Herpeto, Inc., Hollywood, Florida), using a Canon F1 with a FL 50mm f3.5 macro lens and Kodachrome 25. The lighting was provided by a 400-watt second Norman studio strobe unit, with two flash heads. Each head was bounced off a silver umbrella to produce a soft rainy day-style lighting. As he does for all of *HR*'s covers, Bridges handled the separation and imaging of this photograph as well. Jim is well known in the herpetological and herpetocultural publishing fields, but the majority of his photographic work has been published in books and non-herp magazines, for such organizations as the National Geographic Society, National Wildlife Federation, and Sierra Club.

SSAR BUSINESS

SSAR Election Results

Results of the recent SSAR election are as follows:

President-elect (becoming President in 2003) ..... Janalee Caldwell.
Secretary ..... John Matter (unopposed).
Treasurer ..... Robert Aldridge (unopposed).
Board of Directors (Class of 2003) ..... Linda Ford and Lee Fitzgerald.

Items Needed for SSAR/HL Auction at Indianapolis

The SSAR/HL Auction will be conducted during the joint annual meeting of the Society for the Study of Amphibians and Reptiles and The Herpetologists' League, at the University Place Conference Center and Hotel, Indianapolis, Indiana, July 2001. All proceeds from the auction will be shared equally between SSAR and HL, and will help to continue the production of the diverse publications and services for which the societies are known. Items of value, as well as those of a humorous nature, are welcome as we once again endeavor to separate auction participants from their money through the judicious use of beer and plastic. Auction items may be brought directly to the meeting or sent in advance to: *Dr. Craig E. Nelson, Department of Biology, Jordan Hall 142, 1001 E. 3rd St., Indiana University, Bloomington, Indiana 47405-3700, USA.*

Final Report on the Auction of Joseph R. Bailey's Herpetological Library

SSAR is very pleased to report the final results of its auction of the late Joseph R. Bailey's herpetological library. The auction was announced in the September 1999 issue of *Herpetological Review*. The library was donated to the Society by Professor Bailey's widow. She did so in order to support projects of interest to her husband, in particular, his interest in student research activities and the production of new books. The Board of Directors has established the Joseph R. Bailey Endowment, and interest income from this investment will be used to support these programs in perpetuity.

A total of 374 lots (books and monographs) were auctioned by post. Eighty-four persons (72 in North America, 9 Europe, 2 in Australia, 1 in South America) submitted more than 1600 bids; 79 of the 84 were successful for at least one lot. A detailed account of the auction was published in the December 2000 issue of *Newsletter and Bulletin of the International Society for the History and Bibliography of Herpetology* (for subscription, contact Richard Wahlgren: Richard.Wahlgren@skanska.se). In addition to the public auction, Professor Bailey's collection of herpetological reprints was sold *en bloc* to a dealer.

Total income from the sale of Professor Bailey's herpetological library was $24,532 (books $18,400; reprint collection $6,132). The expenses (postage, printing of lists, telephone, etc.) were $1,287, or 5.2% of the gross income; thus $23,245 has been placed in the Bailey Endowment.

The Society, on behalf of the herpetological community, is greatly indebted to Mrs. Bailey and her family for their generosity. This is the first endowment in SSAR to be established in honor of a former member (Professor Bailey was a member of OHS–SSAR from the earliest days) and it will be our pleasure to regularly associate his name with various Society activities. We also acknowledge with appreciation the volunteer work of Steve Busack and Linda and Bob Aldridge in carrying out the mechanics of the auction.

NEWSNOTES

EMBL Reptile Database: Online Library, CD-ROM

Starting in January 2001, the database now offers a selection of historical reptile papers as PDF files. As a pilot project, about 60 papers from the *Proceedings of the Academy of Natural Sciences of Philadelphia*, published between 1841 and 1899, have been posted on our website. Another 60 will follow in the second quarter of 2001, completing the set of 127 reptile papers that have been published during that time period in the *Proceedings*. Scanning and conversion to PDF files of the reptile papers from the *Annals and Magazine of Natural History (1838–1899)* is currently under way and will be financed by the sale of CD-ROMs. The CD-ROM contains the Reptile Database as a user-friendly application and all reptile papers from the *Proceedings* (March 2001) and is available for US$ 25 on Windows and Macintosh systems. The CD-ROM is free for contributors. For more details visit the web site at http://www.embl-heidelberg.de/~uetz/LivingReptiles.html.

Kansas Herpetological Society Annual Meeting

The Kansas Herpetological Society held its 27th Annual Meeting at the Adam's Mark Hotel in Kansas City, Missouri, USA, on 21–22 October 2000. The meeting was co-hosted by the Missouri Herpetological Association and the Kansas City Herpetological Society. Over 125 participants attended scientific paper sessions to listen to 34 talks on amphibians, turtles, and reptiles by scientists and students from across the nation.

During its business meeting, the KHS voted Suzanne L. Collins (The Center for North American Amphibians and Reptiles, Lawrence) as President-elect, Eric Kessler (Blue Valley North High School) as Treasurer, and Mary Kate Baldwin (Topeka Collegiate School) as Secretary. Mark Ellis (Topeka) took office as President on 1 January 2001. Robert Powell (Avila College) served as President during 2000, and hosted the meeting this year.

Also during the Society business meeting, Powell awarded Kevin Aldrich, a graduate student at Emporia State University, the 2000 Howard K. Gloyd/Edward H. Taylor Scholarship. The scholarship honors the memory of two great biologists with strong ties to Kansas. Gloyd was born in Ottawa and attended both Kansas State University and the University of Kansas, and Taylor graduated from Garnett High School and was a biology faculty member for many decades at the University of Kansas, Lawrence.

The business meeting concluded after Kelly J. Irwin, former KHS president and currently the state herpetologist of Arkansas, presented Eric M. Rundquist, University of Kansas, with the Bronze Salamander Award, the highest recognition given by the Society for distinguished service. Rundquist served as KHS editor for the past decade, and was one of the founding members of the Society.

Prior to the Saturday night KHS auction, Emily C. Moriarty, a graduate student at the University of Texas, Austin, was chosen as the third recipient of *The Suzanne L. and Joseph T. Collins Award for Excellence in Kansas Herpetology.* Moriarty is a former Lawrence, Kansas, resident, and recently graduated with honors from St. Mary's College in Notre Dame, Indiana. At the KHS Silver Anniversary Meeting in 1998, she presented a lecture on the molecular systematics of Western Chorus Frogs in Kansas, and her presentation was judged by the society as the best research on the Kansas herpetofauna during the preceding two years (1998 and 1999). For her work, Ms. Moriarty was given a plaque and a check for $1000.00 by Robert Powell and Travis W. Taggart, Fort Hays State University. *The Collins Award* is the largest biological award given annually in the state of Kansas, and the largest annual presentation made nationally to further research on (even-numbered years) or photography of (odd-numbered years) amphibians, turtles, and reptiles.

Following the first Sunday morning scientific paper session, two other KHS meeting attendees were recognized as the second annual recipients of *The Big Croaker Awards,* sponsored by the Kansas Department of Wildlife and Parks and the Kansas Amphibian Monitoring Program. Established in 1999, the awards are given to those individuals who monitored choruses of frogs and toads with diligence and excellence during the spring of 2000. Margaret Stewart, of Manhattan, Kansas, and Keith Coleman, of the University of Kansas, Lawrence, were each given a commemorative certificate and a check for $100.00 by Linda Weir, coordinator of the North American Amphibian Monitoring Program, Laurel, Maryland, and Ken Brunson, representing the Kansas Department of Wildlife and Parks. Each spring, over 100 KAMP volunteers census choruses of amphibians on over eighty 15-mile routes across Kansas, establishing baseline information that will eventually be used to determine whether amphibian populations are declining, increasing, or remaining stable.

Featured speakers at the two-day event were Robert Wilkinson (Southwest Missouri State University, Springfield), Henry S. Fitch (University of Kansas, Lawrence), Walter Meshaka (State Museum of Pennsylvania, Harrisburg), Ronald Goellner (St. Louis Zoo), Robert W. Henderson (Milwaukee Public Museum), Dwight R. Platt (Bethel College, North Newton, Kansas), Lee Grismer (La Sierra University, Riverside, California), and Robert Aldridge (Saint Louis University).

In 2001, the Society will meet in Topeka, Kansas.

A New Book from the Society for the Study of Amphibians and Reptiles

THE HYLID FROGS OF MIDDLE AMERICA

New and Expanded Edition

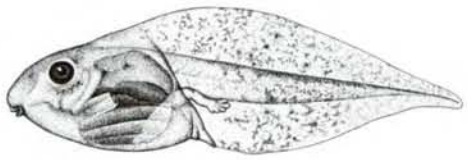
by WILLIAM E. DUELLMAN

illustrated by David M. Dennis

This is a product that current and future researchers will cherish. . . . No one is as knowledgeable, as attentive to organization and detail, and as thorough. . . . Throughout the entire work, high emphasis is placed on quality—accurate data, excellent photography, wonderful artistry. . . . This book has much to tell us concerning the unique amphibian fauna of the region, and will long serve as the fundamental reference source for the hylids.
— DAVID B. WAKE, from the Foreword to the New Edition.

THE SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES IS proud to announce the publication of a new and expanded version of a book that has long enjoyed a classic status. Professor Duellman's *Hylid Frogs* was originally issued in 1970 by the Museum of Natural History of The University of Kansas. As Jay M. Savage wrote in *Herpetological Review* at the time, "In tropical American herpetology, it is likely to remain an unassailable model."

In 753 pages, 324 figures, and 72 plates, the original book surveyed all 115 species of hylid frogs then known from Mexico to Panama, complemented by reproductions of David M. Dennis's highly detailed and life-like watercolors. Hobart M. Smith commented in *Copeia*, "*Hylid Frogs* marks an apogee of achievement; it is the Hope Diamond of technical herpetological literature." The book was an instant success, but it soon went out of print and copies today fetch $300 or more on the secondhand market, when they can be found at all.



During the intervening years until the present, the number of species in this region has risen by 50 to 165, most of them new species from southern Mexico, Guatemala, and Honduras, and all of them from the highland regions. **The expanded edition consists of 1170 pages—a 55% enlargement of the original—and 20 new plates.** The new edition includes a reprint of the original text plus a supplement in which each species account is revised and the new or resurrected species are treated in detail. Similarly, the numbers of figures, tables, and appendices are significantly increased. New spot distribution maps are provided for the new species and also for many others whose distributions have expanded since 1970.

For reproduction of the color plates, **the original watercolors have been laser scanned—not photographically reproduced as in 1970—using the latest technologies.** This has produced images that are brighter, more accurate, and much closer to the original paintings. In addition, Mr. Dennis has produced 55 new watercolors (51 in color, 4 black-and-white). The resulting plates are of the highest standard.

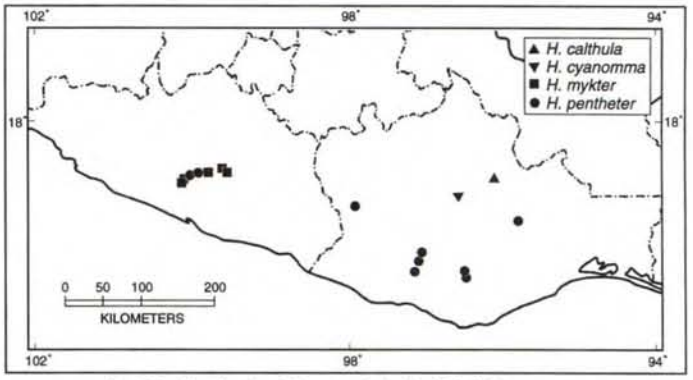
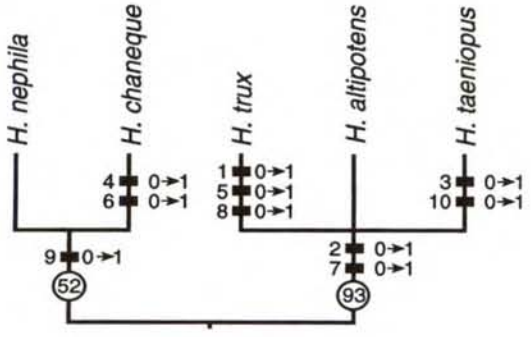


FIG. 402. Distribution of four species in the *Hyla bistincta* group.

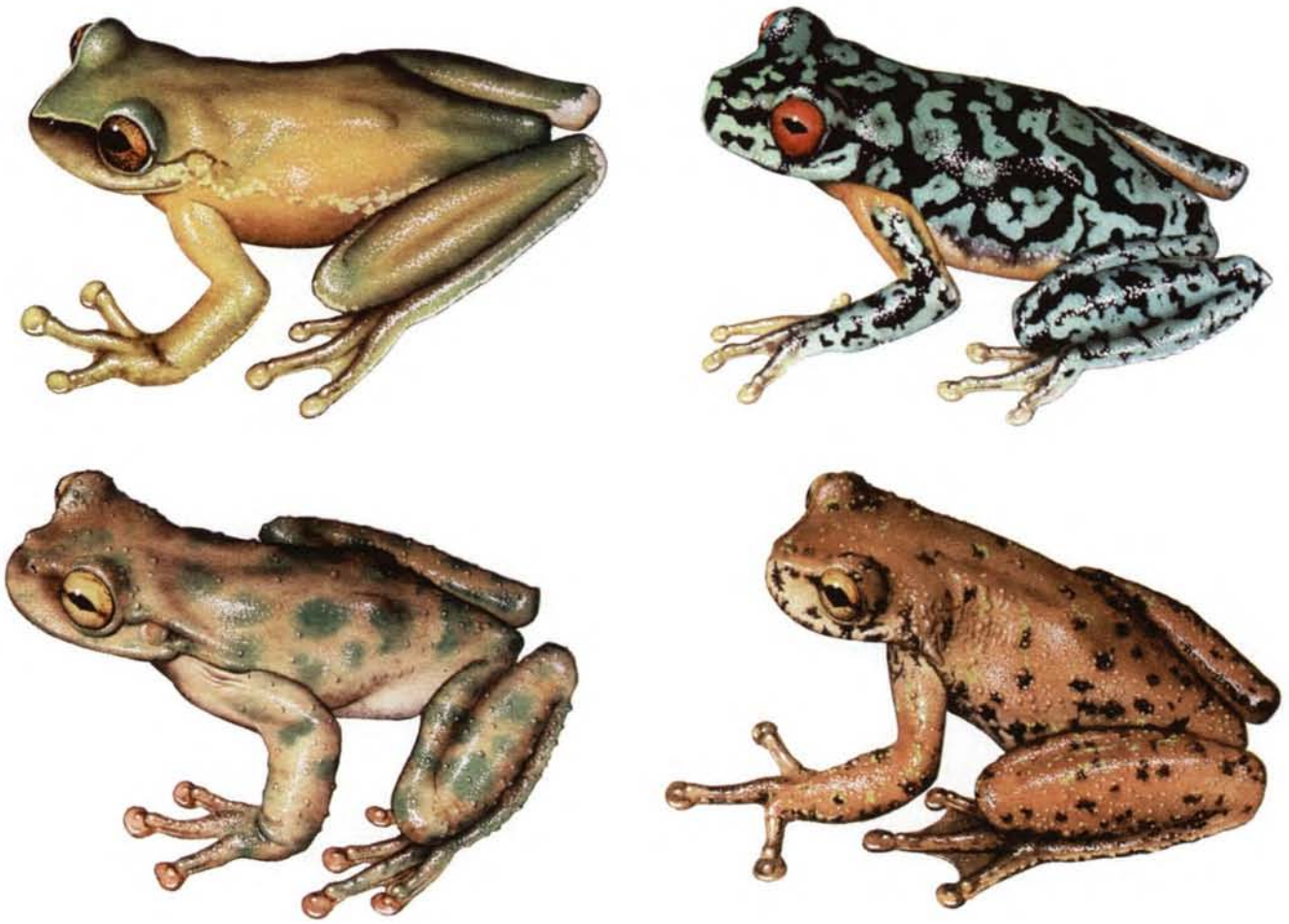
The species accounts are arranged as in the 1970 edition: Synonymy, Diagnosis, Description, Tadpoles, Mating Call, Natural History, Remarks, Etymology, and Distribution. There is a review of the evolutionary history of Middle America including plate tectonics, the evolution and phylogenetic relationships of hylid frogs, a chapter on distribution and diversity, and biogeographic comparisons between hylids and frogs of the genus *Eleutherodactylus* and with bolitoglossine salamanders, the two other large taxonomic and geographic segments of the Middle American amphibian fauna.

There is also a chapter on conservation, keys to adults, and a table of larval characteristics. Results of phylogenetic analyses are provided for most hypothesized lineages. As in the original edition, there are extensive tables showing the distribution of species within ecogeographic regions; altitudinal distribution, habitat, and reproductive sites; and an appendix listing all newly acquired museum specimens.



WILLIAM E. DUELLMAN is Curator Emeritus in the Natural History Museum and Professor Emeritus in the Department of Ecology and Evolutionary Biology at The University of Kansas. He has conducted active field work in the neotropics continuously since 1951. Professor Duellman is the author of numerous papers and monographs on Middle American and South American amphibians and reptiles and the author of several books, most recently of *Biology of Amphibians*, co-authored with Linda Trueb in 1985 (new printing in 1994) and *Patterns of Distribution of Amphibians*, edited by him in 1999.

DAVID M. DENNIS was head of the Biological Illustration Unit of the College of Biological Sciences at The Ohio State University for 30 years but now resides in Sarasota, Florida. He is widely recognized as one of the foremost illustrators of amphibians and reptiles. His award-winning natural history paintings have been displayed in major galleries and exhibits.



Some Newly Described Species of Frogs Illustrated in the Book
Note: These reproductions were made from color slides, but those in the book have been laser-scanned directly from the original watercolors and, therefore, are of a higher quality.

Specifications: 1170 pages, 443 figures including maps, 88 tables, 6 appendices, 92 plates (48 black-and-white, 44 in full color, color frontispiece). Format 8½ by 11 inches (21.5 by 28 cm), clothbound in 2 volumes. ISBN 0–916984–56–7. To be published in July 2001.

PRICES: Pre-publication to SSAR members US$95; Institutions, non-members US$125. ***SHIPPING:*** USA, add US$5; non-USA, US$10.

SEND ORDERS TO: Dr. Robert D. Aldridge, SSAR Publications Secretary, Department of Biology, Saint Louis University, 3507 Laclede Avenue, Saint Louis, Missouri 63103–2010, USA (*telephone:* area code 314, 977–3916 or –1710; *fax:* 314, 977–3658; *e-mail:* ssar@slu.edu). Please make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks or by International Money Order. Orders may also be charged to MasterCard or VISA (please provide the account number and card expiration date). Current SSAR membership information and a complete list of all Society publications can be obtained on request to Dr. Aldridge.

MEETINGS

Meetings Calendar

21–22 April 2001—24th annual All Florida Herpetology Conference, Sheraton Hotel, Gainesville, Florida, USA. Sponsored by Florida Museum of Natural History and Gainesville Herpetological Society. Details from: www.flmnh.ufl.edu/natsci/herpetology/afhc.htm.

5–10 July 2001—American Society of Ichthyologists and Herpetologists, 81st annual meeting, Pennsylvania State University, State College, Pennsylvania, USA. Details from: www.outreach.psu.edu/c&i/ichher/.

14–17 July 2001—International Herpetological Symposium 25th Annual Meeting, Detroit Zoological Institute in Detroit, Michigan, USA. *Refer to meeting announcement above for details.*

13–17 July 2001—Societas Europaea Herpetologica 11th General Meeting, Slovenia. Details from: DPPVN/DAPTF Slovenia, Ptujska c. 91, SI-2327 Race, Slovenia; fax: +386 (0)2 788 30 51; e-mail: milan.vogrin@guest.arnes.si.

27–31 July 2001—44th Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League (http://www.inhs.uiuc.edu/cbd/HL/HL.html). Indiana University/Purdue University, Indianopolis, Indiana, USA. Details available on page 1 of this issue of *HR* and on the SSAR web site: www.ukans.edu/~ssar/an-mtng.html.

19–23 September 2001—Association of Reptilian and Amphibian Veterinarians, Eighth Annual Conference, Orlando, Florida, USA. Details from: Charles J. Innis, VMD, VCA Westboro Animal Hospital, 155 Turnpike Road, Westboro, Massachusetts 01581, USA; tel. 508-366-1444; fax 508-634-6997; e-mail: clemmys@aol.com.

2–9 December 2001 (note change of dates)—Fourth World Congress of Herpetology, Colombo, Sri Lanka. Details from: 4WCH Promotions Office, 95 Cotta Road, Colomba 8, Sri Lanka; e-mail: admin@4wch.com; http://www.4wch.com.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Jennifer Garrison** or **Eli Greenbaum**; postal and email addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Evolution of Ranid Frogs in Madagascar and Asia

The highly conserved body plan of anurans has hindered efforts to demonstrate convergence among ecologically specialized species of frogs. Bossuyt and Milinkovitch sequenced mitochondrial and nuclear DNA sequences of all Madagascan and Asian subfamilies of Ranidae (with the exception of the African subfamily Ptychadeninae) to produce the first phylogenetic hypothesis for this group. Data were analyzed with PAUP*; both maximum parsimony and maximum likelihood analyses were performed. A monophyletic origin for Madagascan ranids is supported by the data. However, monophyly of the genus *Limnonectes* and the subfamilies Rhacophorinae, Tomopterninae, and Ranixalinae is not supported by the data. The authors discuss convergence of larval and adult ecomorphs among Madagascan and Asian ranids and suggest that the relationships of these frogs can be understood within the context of plate tectonics.

Bossuyt, F., and C. Milinkovitch. 2000. Convergent adaptive radiations in Madagascan and Asian ranid frogs reveal covariation between larval and adult traits. Proceedings of the National Academy of Sciences 97:6585–6590.

Correspondence to: Michel C. Milinkovitch, Unit of Evolutionary Genetics, Free University of Brussels (ULB), cp 300, Institute of Molecular Biology and Medicine, rue Jeener and Brachet 12, B-6041 Gosselies, Belgium; e-mail: mcmilink@ulb.ac.be.

Embryological Development of the Turtle, *Carettochelys insculpta*

Standard series of embryological stages are essential for the comparison of embryos incubated under differing conditions and to facilitate comparisons between and among taxa. The authors staged embryos of the turtle *Carettochelys insculpta* and noted differences between the development of this species and that of *Chelydra serpentina* (Stages 12–26). Non-destructive characters useful for staging (e.g., development of the extra-embryonic vitelline circulation) were observed by candling and described within the framework of a 26 stage series. Opaque patch attributes were useful before stage 5, embryo attributes and measurements were used between stages 5–22, and proportion of yolk mass inside the egg was used to estimate stages 23–26. This study will allow future workers to estimate the age of developing embryos without damaging the eggs of this highly threatened species.

Beggs, K., J. Young, A. Georges, and P. West. 2000. Ageing the eggs and embryos of the pig-nosed turtle, *Carettochelys insculpta* (Chelonia: Carettochelydidae), from northern Australia. Canadian Journal of Zoology 78:373–392.

Correspondence to: Arthur Georges, Applied Ecology Research Group and Co-operative Research Centre for Freshwater Ecology, University of Canberra, ACT 2601, Australia; e-mail: georges@aerg.canberra.edu.au.

Olfactory System Histochemistry in the Agamid, *Physignathus lesuerii*

The olfactory system of most terrestrial vertebrates consists of two parts—the olfactory mucosa (receptor cells connect to the main olfactory bulb) and the vomeronasal organ (also known as Jacobson's organ; receptor cells connect to the accessory olfactory bulb). Lectin binding histochemistry was used to elucidate the cell-surface glycoconjugates of both components of the olfactory system in the Australian agamid, *Physignathus lesueurii*. Results of these experiments suggest that the receptor cells of the olfactory and vomeronasal organs contain D-acetylglucosamine and a-D-galactose terminal residues. These residues may be integral to olfaction and could be used to study specific odorant receptors. Previous workers have suggested that glycoconjugates may be important components in olfactory system development and regeneration.

Franceschini, V., M. Lazzari, and F. Ciani. 2001. Lectin-binding patterns in the olfactory system of the lizard, *Physignathus lesueurii*. Journal of Morphology 247:34–38.

Correspondence to: Valeria Franceschini, Department of Biology, Via Selmi, 3 – 40126 Bologna, Italy; e-mail: vfrance@alma.unibo.it.

Anatomy of Venom Expulsion in *Crotalus*

The intraglandular pressure hypothesis states that the m. pterygoides glandulae assists in venom expulsion. The authors tested this hypothesis and investigated functional subdivisions within the extrinsic musculature of the venom gland in rattlesnakes of the genus *Crotalus*. Venom glands and extrinsic musculature were examined in histological sections and via clearing and staining with Sudan Black B. Venom expulsion pressure was measured with a PT300 pressure transducer and a bipolar stimulating tube was used to stimulate muscles. Anatomy and spatial relationships of the m. pterygoides glandulae and m. compressor glandulae are discussed. Venom expulsion pressure (flow) was greatest when the m. compressor glandulae was stimulated on the medial side; stimulation of the muscle on the dorsolateral side yielded the least amount of venom. Stimulation of the m. pterygoides glandulae resulted in more venom flow than the m. compressor glandulae regardless of the side stimulated. The two muscles have different functional roles and produce force vectors that are nearly opposite. The results suggest that the m. compressor glandulae may have several functionally independent muscle compartments, whereas the m. pterygoides glandulae does not. The authors suggest other unidentified factors may contribute to regulation of venom flow.

Young, B. A., K. Zahn, M. Blair, and J. Lalor. 2000. Functional subdivision of the venom gland musculature and the regulation of venom expulsion in rattlesnakes. Journal of Morphology 246:249–259.

Correspondence to: Bruce A. Young, Department of Biology, Lafayette College, Easton, Pennsylvania 18042, USA; e-mail: youngab@lafayette.edu.

Aquatic Funnel Traps Estimate Population Size in *Taricha granulosa*

Aquatic funnel traps may prove useful in estimating and monitoring population size of amphibians in lentic habitats. The authors tested the ability of aquatic funnel traps to capture a constant proportion of a population of *Taricha granulosa* in different densities and whether biases in sampling resulted from the presence of female newts in traps. Data indicated that the number of newts captured increased with population density, and the presence of females in traps increased the number of newts captured. Thus, future workers will need to consider this bias when using aquatic funnel traps in population studies.

Wilson, C. R., and P. B. Pearman. 2000. Sampling characteristics of aquatic funnel traps for monitoring populations of adult rough-skinned newts (*Taricha granulosa*) in lentic habitats. Northwestern Naturalist 81:31–34.

Correspondence to: Christopher R. Wilson, Department of Biology, Appalachian State University, Boone, North Carolina 28608, USA.

Molecular Phylogeny of North American Softshells

Few molecular phylogenetic studies have examined widely distributed taxa in North America. The authors studied the genetic structure of three species of the trionychid genus *Apalone*, a widely-distributed and relatively old taxon. Cytochrome B sequences were obtained from 49 turtles in 35 localities and aligned sequences were analyzed with phylogenetic parsimony and neighbor-joining in PAUP*. Results indicated that *A. ferox* has a low amount of genetic variability and may represent an isolated population from the Pliocene. Genetic variability was high in *A. mutica* and *A. spinifera*; the authors suggest these species shared a vicariant event during the Pliocene or Pleistocene. Reduced genetic variation in northern populations suggests a recent migration into formerly glaciated areas. Although most North American turtles are noted for their slow rate of molecular evolution, the results of this study suggest that *Apalone* has a high rate for reasons that are not clear.

Weisrock, D. W., and F. J. Janzen. 2000. Comparative molecular phylogeography of North American softshell turtles (*Apalone*): Implications for regional and wide-scale historical evolutionary forces. Molecular Phylogenetics and Evolution 14:152–164.

Correspondence to: Fredric J. Janzen, Department of Zoology and Genetics, Program in Ecology and Evolutionary Biology, Iowa State University, Ames, Iowa 50011-3223, USA; e-mail: fjanzen@iastate.edu.

Residency, not Physical Attributes, Predicts Winner in Male-Male Skink Contests

The authors studied Tasmanian snow skinks, *Niveoscincus microlepidotus*, in their natural habitat to determine what factors most influenced the outcome of agonistic interactions between males. This species is not strictly territorial, and some males wan-

der into the overlapping home ranges of other males while searching for prey and mates, resulting in combat. Snow skinks are known to hibernate, and most combat occurs soon after the lizards emerge from hibernacula. Observations of a population were made over a five-year period on the island of Tasmania at 1270 m elevation. Thirty-two interactions were monitored, and all but one of the 49 males were captured and measured for various morphological traits. No consistent difference in SVL or mass/length ratio was measured between "winners" and "losers." However, ownership, or residency, was strongly correlated with success (71.9% of winners were residents).

OLSSON, M., AND R. SHINE. 2000. Ownership influences the outcome of male-male contests in the scincid lizard, *Niveoscincus microlepidotus*. Behavioral Ecology 11:587–590.

Correspondence to: Mats Olsson, University of Gothenburg, Medicinaregatan 18, SW 413 90 Gothenburg, Sweden; e-mail: matsolsson@zool.gu.se.

Regulating Factors Affecting the Loss of External Gills in Red-eyed Tree Frogs

Experiments were conducted using embryos and tadpoles of *Agalychnis callidryas* to determine the effect of oxygen availability on the timing of gill regression. The effects of age at hatching on gill regression were also studied. This species oviposits arboreally, with tadpoles falling into water after hatching. The author found that there was a correlation between gill loss and age at hatching. Cessation of gill circulation was more rapidly accomplished in older embryos (7 days) than in younger embryos (5 days). The amount of egg surface that was exposed to the air had an effect on both gill filament length and circulation. When more egg surface was exposed to air, circulation in external gills ceased by day 7, and gill length was significantly shorter than that observed for "low-exposure" embryos. Those individuals in the low-exposure treatment maintained full gill circulation through day 7. Finally, the author's results show that exposure to hypoxic versus normoxic water also influences gill length and perfusion. In general, gill loss is rapid in *Agalychnis callidryas*—gills that are 60% of the body length and fully perfused at hatching can be bloodless within 5 minutes and completely adducted within 2 hours.

WARKENTIN, K. 2000. Environmental and developmental effects on external gill loss in the red-eyed tree frog, *Agalychnis callidryas*. Physiological and Biochemical Zoology 73:557–565.

Correspondence to: Karen M. Warkentin, School of Biological Sciences, University of Kentucky, Lexington, KY 40506-0225, USA; e-mail: kmwark2@pop.uky.edu.

Phylogeny and Unisexuality of Caucasian Rock Lizards

The authors conducted a molecular study to determine the relationships among Caucasian rock lizards. Allozyme data were used to analyze parentage of 7 unisexual species, define species boundaries, and reconstruct phylogeny. mtDNA sequence data were used to identify parentage and reconstruct the overall phylogeny (including 15 bisexual species) of the genus *Darevskia*. All analyses were perfomed using PAUP* and the outgroups for DNA analysis were *Algyroides fitzingeri, Lacerta media, L. monticola,* and *L. vivipara*. Of the 2851 base pairs of mtDNA sequence data, 769 were found to be potentially cladistically informative. Analysis resulted in a single most parsimonious tree with strong resolution and support. Investigation of 35 allozyme loci yielded 18 informative characters. Analysis of allozyme data resulted in 89 equally parsimonious trees. A consensus tree of both data sets and the hypothesized parentage of the unisexual species is provided. Hybridization leading to unisexuals was found between only two clades (never within clades), and was found to be directional, with certain clades providing only maternal and others only paternal parents. It is hypothesized that certain clades do not contribute to unisexual production because of phylogenetic, genetic, and possibly ecological constraints.

MURPHY, R., J. FU, R. MACCULLOCH, I. DAREVSKY, AND L. KUPRIYANOVA. 2000. A fine line between sex and unisexuality: the phylogenetic constraints on parthenogenesis in lacertid lizards. Zoological Journal of the Linnean Society 130:527–549.

Correspondence to: Robert Murphy, Center for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, M5S 2C6, Canada; e-mail: drbob@rom.on.ca.

Review of Contaminant Effects on Lizard Species

This paper represents an extensive review of available literature regarding organic and inorganic contaminants and their effects on lizard species. Lizard species, while an important part of many ecosystems (e.g. biomass and ecological roles), are often omitted from environmental impact studies. In an attempt to stress the importance of including this type of data when creating realistic ecological models, and to encourage further studies, the authors have summarized data regarding residue, bioaccumulation, and lethal effects of organic, inorganic and radionuclides/radiation contamination on lizard species. Twenty-six families and over three dozen contaminants (organic/inorganic) are included in the extensive tables. Also included are the localities and time periods over which the summarized studies were produced. This study not only encapsulates what is known regarding contaminant effects on lizard species, it also points out where information gaps exist.

CAMPBELL, K. AND T. CAMPBELL. 2000. Lizard contaminant data for ecological risk assessment. Review of Environmental Contamination and Toxicology 165:39–116.

Correspondence to: Kym Rouse Campbell, The Cadmus Group, Inc., 78A Mitchell Road, Oak Ridge, Tennessee 37830, USA; e-mail: kcampbell@cadmusgroup.com.

Phenotypic Plasticity and Treefrogs: Testing Responses to Pond Drying

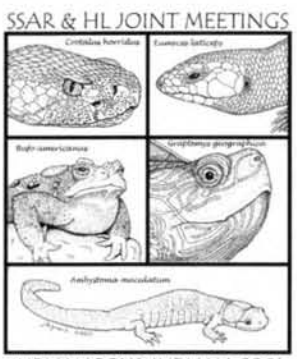
It is often assumed that larval anurans that utilize temporary breeding ponds, once past a critical developmental stage, can respond adaptively to drying habitat by increasing the rate of development towards metamorphosis. The authors investigate this assumption using a 6x6 experimental design and two treefrog species. Adults of the species *Hyla cinerea* most often use permanent bodies of water for breeding, while *H. gratiosa* breed in temporary ponds. It was hypothesized that if a species that often used more ephemeral pools was subject to drying it would be capable of metamorphosing sooner than a conspecific exposed to constant water levels. In addition, permanent pond breeders were predicted to lack the phenotypic plasticity to respond in this way to drying because these species experience little selection pressure from drying. The results of this study show that higher levels of effective density produced longer larval periods and a smaller size at metamorphosis. However, neither species increased its rate of development in response to drying of the pond (as compared with the constant-environment control animals). Several theories regarding primary causative agents for these results are discussed.

LEIPS, J., M. MCMANUS, AND J. TRAVIS. 2000. Response of treefrog larvae to drying ponds: comparing temporary and permanent pond breeders. Ecology 81:2997–3008.

Correspondence to: Jeff Leips, Department of Genetics, North Carolina State University, Raleigh, North Carolina 27695-7614, USA.

SSAR 2001 Graduate Student Reprint and Book Scavenge!

There's no better way to advance graduate education (*and* clean up your offices!) than contributing reprints and other publications to the grad student scavenge at Indianapolis. We are requesting contributions of any and all publications you'd like to donate to this noble cause. The grad student social is greatly enhanced by the opportunity for students to acquire various herp literature. Donated items can be brought directly to the meeting or sent to: V. H. Opell, 640 Terrace Drive, Zionsville, Indiana 46077, USA. Questions? Please contact Kirsten E. Nicholson (e-mail: kirsten_nicholson@yahoo.com).



OBITUARIES

Herpetological Review, 2001, 32(1), 9–10.
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Vale—Hubert Saint-Girons (1926–2000)

DONALD BRADSHAW
Department of Zoology, University of Western Australia
Perth, Western Australia 6907, Australia
e-mail: Don.Bradshaw@uwa.edu.au

XAVIER BONNET
CEBC – CNRS, P.O.Box 14
79360 Villers en Bois, France
e-mail: bonnet@cebc.cnrs.fr

RICHARD SHINE
Zoology A08, University of Sydney, School of Biological Sciences
Sydney, NSW 2006, Australia
e-mail: rics@bio.usyd.edu.au

and
PATRICK T. GREGORY
Department of Biology, University of Victoria
Victoria, British Columbia, V8W 2Y2, Canada
e-mail: thamnoph@uvvm.uvic.ca



Hubert Saint-Girons, 1964.

Hubert Saint-Girons passed away after a short illness on 18 April 2000 in Nantes, not far from his home at Bohallard, close to the small town of Nozay in the west of France. A born naturalist, talented histologist, student of population dynamics, and France's most noted herpetologist, he made an enormous contribution to French science over a period of more than fifty years, starting in 1946. He received his doctorate in 1951, at the University of Paris—the subject being the reproductive biology and ecology of European vipers. This laid the groundwork for his life-long interest in snakes, which he studied with such passion in the grounds of his small château at Bohallard.

As Directeur de Recherche au CNRS he worked for many years at the Centre d'Ecologie at Brunoy, before moving to his base laboratory at the Université Pierre et Marie Curie in the Laboratoire d'Evolution des Etres Organisés in Boulevard Raspail in Paris. From there he carried out all his detailed histological studies during six months of the year—the other six months being devoted to field work at Bohallard.

One of the notable aspects of his distinguished career was his ability to change from one field to another, mastering each new discipline in its turn. His early studies were done in collaboration with Manfred Gabe—perhaps one of the world's finest histologists—and he inherited many of the exquisite skills that he em-

ployed in his morphological research directly from Gabe, who unfortunately passed them to no other. Hubert was also one of the first zoologists to attempt to correlate laboratory with field studies of animals in their natural environment and this led to his interest in, and contribution to, the new field of ecophysiology. His pioneering work on the sources of energy and materials stored by animals prior to reproduction, which he published in the 50s, predates by many years the now highly fashionable field of 'income' versus 'capital breeders.' He also made a major contribution to studies of hibernation in mammals, again combining field and histological studies to unravel the nature of the basic mechanisms involved.

Even a brief look at only a few of Hubert's papers quickly allows one to see that he not only published in a range of disciplines, but he also varied the approach he took to his work. His studies of snakes are especially noteworthy for encompassing both field and laboratory and for pioneering the use of outdoor enclosures as a useful adjunct. Large enclosures allowed Hubert to maintain and study snakes in relatively controlled, but semi-natural, conditions. Many of the observations that he made on snakes in enclosures have produced important conclusions, as well as hypotheses that now can be tested, using newer techniques, on free-ranging animals in the field. Hubert himself, however, was not a heavy user of "high-tech" methods such as radiotelemetry. Instead, he relied on his skills as a naturalist to locate marked animals in the field and draw his conclusions. This is evident even in his most recent field studies from the 1990s.

Hubert's pioneering contributions spanned not only a diversity of taxa, concepts, and methods, but also involved a remarkably broad set of environments. Although his beloved vipers were the centerpiece of his work, he also conducted some of the first rigorous studies of the ecology and reproductive biology of tropical reptiles. In a field that is still dominated by studies of northern temperate-zone species, his research on the snakes of Cambodia and New Caledonia deserve special mention. He worked extensively in the High Atlas of Morocco, collecting and describing new species, among them *Vipera latastei monticola* (now *V. monticola*). One might also cite the major monographs (published with Gabe) on the histology of the rare New Zealand tuatara (*Sphenodon punctatus*) and the detailed cytology of the nasal cavity and Jacobson's Organ of many reptiles.

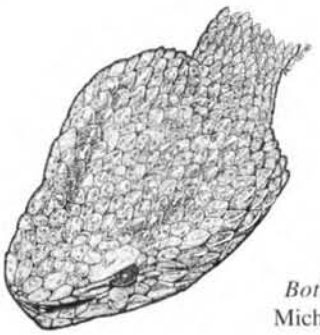
He participated in many important field trips in far-flung parts of the world. One memorable trip to the desert of northwest Australia in 1978 (with other herpetological luminaries such as Carl Gans and Hal Cogger) went well until a wheel on the laboratory-caravan exploded some 200 km from the nearest town! Most of the team were left by the side of the road while the more mechanically minded headed off with the salvaged pieces in search of an expert welder. It was very hot (45°C!) and dusty, and everyone except Hubert became progressively more dishevelled and dirty as time went by. Hubert remained impeccable. Not a speck of dust ever adhered to him! All he ever asked for was a glass of cold white wine at sunset which he drank whilst looking disparagingly at his rather grubby field companions.

Unlike many scientists, Hubert was able to admit when subsequent research showed that he had been wrong in his earlier conclusions. In some early work he, along with many other histologists, misidentified the reptilian corticotroph as a pituitary cell secreting luteinizing hormone instead of adrenocorticotrophic hormone, but corrected this error in a paper published many years later. His work on the cellular structure and secretory capacity of the pituitary gland of reptiles laid the groundwork for later experimental studies by other scientists.

Hubert's work was meticulous and he had evolved a most extraordinary tiny form of shorthand writing that was totally incomprehensible (and indeed, almost invisible!) to others. When correcting the work of other scientists he was positive in his criticisms, suggesting ways of resolving problems and detailing possible future avenues of research. He did not take on students personally but he was always generous with his time and his ideas. Hubert was instrumental in launching the career of many young herpetologists, and not only in France. He was one of the examiners for Rick Shine's PhD thesis in Australia, and doubtless played the same role for others.

He was also an extraordinary host. Legions of foreign scientists have spent some of their best days at Bohallard with Hubert and his gracious wife, Marie-Charlotte, where one became mesmerized by the precision of their wonderful shared life. Marie-Charlotte was also a scientist in her own right (although she insisted that she was a geographer and not a zoologist!) and they shared a unique partnership, starting with their classic paper in *Vie et Milieu* in 1956 on reptilian thermoregulation and continuing with many other papers and translations of books into French over the years. Unfortunately, Marie-Charlotte died a few years before Hubert and his last years were never the same without her.

It is impossible to do justice to Hubert's scientific *œuvre* —he published more than 200 papers, and these are spread over a very wide range of fields. He was, without question, France's most distinguished herpetologist and one acknowledged throughout the world. His greatest regret was not being able to speak English fluently, although he read it with ease. He was, without doubt, a complex personality—witty, charming, and intelligent, an excellent chess player, and a fascinating raconteur capable of dropping penetrating observations on the behavior of others into the conversation when the occasion dictated! We will remember him most for the generosity of his nature. In the English-speaking world, he was not as well recognized as he should have been because most of his papers were published in French and in generally less–well-known journals. Nonetheless, he was almost certainly better appreciated abroad than at home, but this is often the case with exceptional people who do not fit easily into one of the conventional categories. France has lost one of its leading scientists and, seeing the way in which studies in herpetology are discouraged today in that country, we doubt that there will ever be another to replace him.



Bothriechis marchi. Illustration by Michael Burger.

LETTER TO THE EDITOR

Herpetological Review, 2001, 32(1), 11.
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On the First Report of *Ramphotyphlops braminus* from Egypt: How Many Times Can a Flower-pot Snake be Run Over for the First Time?

SHERIF M. BAHA EL DIN
3 Abdala El Katib Street, Dokki, Cairo, Egypt
e-mail: baha@internetegypt.com

In a recent Geographic Distribution note, Wallach (1999) reported what he described as the first country record of *Ramphotyphlops braminus* for Egypt and Africa north of the Sahara. This statement is inaccurate; two other workers had reported the presence of the species from the country beforehand: Baha El Din (1996) and Saleh (1997). It is understandable that these publications did not reach the attention of Wallach, given their rather restricted circulation and limited availability. However, what prompted me to write this letter are the location and circumstances under which the specimen Wallach reported was collected. MVZ 230077 was found as a bicycle casualty in the Cairo suburb of Maadi. Amazingly, the specimen I reported as the first record for Egypt (SMB 212, in my personal collection) was found in the same suburb and it was a traffic casualty as well (Baha El Din 1996). I could not ascertain what kind of vehicle might have killed it, but given the light damage inflicted on the specimen I would not be surprised if it was a bicycle too! *Ramphotyphlops braminus* appears to be well established in the greater Cairo region and probably large areas of the Nile Valley. The earliest specimen seems to have been collected in 1984 from Cairo, but only identified recently (Saleh 1997).

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ARTICLES

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Postural Thermoregulatory Behavior in the Nocturnal Lizards *Christinus marmoratus* and *Nephrurus milii* (Gekkonidae)

MICHAEL KEARNEY*
Department of Biological Sciences, Monash University
Clayton, Victoria 3168, Australia

**Present address: School of Biological Sciences, University of Sydney*
NSW 2006, Australia
e-mail: mkearney@bio.usyd.edu.au

The body temperature of a reptile can influence its ability to perform a variety of activities that affect individual survivorship, growth rate and reproductive success (e.g., sprinting, digestion, social interactions). Thus, temperature regulation may increase a reptile's fitness (Huey 1982). Although reptiles are ectothermic and have only limited physiological scope for controlling body temperature (Stevenson 1985), many reptiles are able to maintain their body temperature within certain limits by behaviorally exploiting spatial and temporal variation in their thermal environment (e.g., Cowles and Bogert 1944).

Diurnal reptiles are well known for their ability to thermoregulate behaviorally, but comparatively little is known about this phenomenon in nocturnal species (reviewed in Huey 1982). Because opportunities for behavioral temperature regulation are restricted at night due to the absence of solar radiation, many nocturnal reptiles forage at low and variable body temperatures (Cowles and Bogert 1944; Pianka and Pianka 1976; Pianka and Huey 1978; Autumn et al. 1994). However, the thermal environments within the daytime retreat sites used by reptiles can offer a wide range of potential body temperatures (Huey et al. 1989a; Webb and Shine 1998a) and there is evidence that some nocturnal reptiles do thermoregulate during the day while sequestered within retreat sites (Bustard 1967; Dial 1978; Kearney and Predavec 2000; Schlesinger and Shine 1994; Webb and Shine 1998b; Werner and Whitaker 1978). For instance, in captivity the nocturnal rock-dwelling gecko *Coleonyx brevis* was observed to raise its body from a cool substrate and into contact with a warm overlying rock to gain heat by conduction (Dial 1978).

In this study, I investigated the thermoregulatory behavior of two species of nocturnal Australian lizards, the marbled gecko *Christinus marmoratus* and the thick-tailed gecko *Nephrurus milii*. Field-active marbled geckos have been demonstrated to regulate their body temperature during the day by choosing a thermally suitable retreat site and then by adjusting their position, and possibly also their posture, within the retreat site (Kearney and Predavec 2000). The behavioral mechanisms by which marbled geckos thermoregulate, however, have not been directly observed. Herein, I report direct laboratory observation of postural thermoregulatory behavior in the marbled gecko and the thick-tailed gecko.

Marbled geckos and thick-tailed geckos were collected from a granite outcrop in central Victoria, Australia (36°27'42"S,

143°45'10"E), where they occur in sympatry and shelter beneath rocks (see Kearney and Predavec 2000 for details of the study site). Marbled geckos are small (adult snout–vent length ≈ 50 mm, adult body mass ≈ 2.5 g), arboreal lizards whereas thick-tailed geckos are larger, terrestrial lizards (adult snout–vent length ≈ 80 mm, adult body mass ≈ 10 g). Four marbled geckos (all adults) and four thick-tailed geckos (two adults and two juveniles) were collected in October 1998. Four additional thick-tailed geckos (two adults and two juveniles) were collected in January 1999. There were even numbers of each sex in adult groups and the sex of juvenile geckos was not determined. Geckos were immediately transported to holding facilities at Monash University and maintained under standard conditions (for more details on gecko husbandry, see Kearney and Predavec 2000).

I used an enclosure to observe thermoregulatory behaviors. It consisted of a glass aquarium (600 x 300 x 300 mm) containing an artificial crevice within which geckos could be readily observed through the aquarium wall. The crevice was composed of two slabs of quarried granite (each 295 x 130 x 15 mm) placed side-by-side and elevated above the floor of the aquarium by blocks of wood. A crevice width of 12 mm was used for marbled geckos and juvenile thick-tailed geckos, and a crevice width of 16 mm was used for adult thick-tailed geckos (these dimensions allowed sufficient room for the geckos to raise their bodies above the crevice substrate and still reach the overlying rock). Temperatures within the crevice were monitored with type-T thermocouples that were taped to the undersides of the slabs and to the crevice substrate. A desk lamp, fitted with a dimmer and a clear 25-W globe, was directed onto one of the granite slabs and heated its underside to a maximum temperature of 32°C. The temperature of the underside of the other, adjacent granite slab did not rise above 17°C, thus providing two thermally distinct regions within the crevice. The aquarium was placed on top of an open, portable fridge which cooled the substrate of the crevice to a minimum temperature of 10°C. The entire enclosure was placed in a constant temperature room set at 17°C with a L:D 14:10 photoperiod. The heat lamp was automatically turned on during the light phase of the photocycle.

Between 19 December 1998 and 6 January 1999, geckos were introduced separately to the enclosure and given 24 hours to become accustomed to the new surroundings. Their behavior was then monitored using a Sony TRV99E video camera from behind a black screen. After a gecko was observed in an erect posture (see below) for at least one hour, it was removed from the enclosure and its rectal temperature was immediately recorded with a type-T thermocouple thermometer and probe. All geckos were returned to the study site upon completion of the experiment.

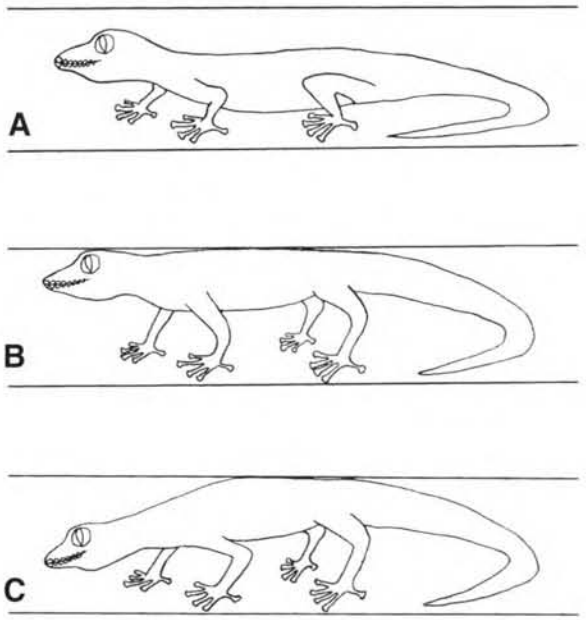


FIG. 1. Thermoregulatory postures assumed by the marbled gecko *Christinus marmoratus* when sequestered in a rocky crevice: (A) resting posture, (B) fully erect posture, (C) semi erect posture. Similar postures were also observed for the thick-tailed gecko *Nephrurus milii*.

When placed in the enclosure, all geckos entered the crevice and assumed an erect posture whereby the body was elevated off the substrate until the dorsal surface contacted the underside of the rock slab (Fig. 1). This posture was very similar to that illustrated for *Coleonyx brevis* in Dial (1978) except that neither marbled geckos nor thick-tailed geckos raised their tails to contact the rock slab. Each of the 12 geckos tested positioned itself

TABLE 2. Mean body temperatures selected by the study species in laboratory thermal gradients and in the present study.

Species	Mean	SD	N	Testing apparatus (range °C)	Reference
Christinus	27.6	0.42	3	Photothermal gradient (25–70)	(Licht et al. 1966)
marmoratus	27.1	0.81	3	Substrate gradient (25–70)	(Licht et al. 1966)
	27.3	0.83	8	Substrate gradient (12–45)	(Daniels 1984)
	27.7	1.33	5	Substrate gradient (5–45)	(Angilletta and Werner 1998)
	24.3	2.11	30	Substrate gradient (11–45)	Kearney, unpubl.
	25.9	0.56	4	Artificial crevice (10–32)	This study
Nephrurus milii	27.3	—	5	Photothermal gradient (25–70)	(Licht et al. 1966)
	21.6	—	12	Substrate gradient (15–30)	(Licht et al. 1966)
	24.2	2.96	4	Artificial crevice (10–32)	This study (adults)
	26.3	1.34	4	Artificial crevice (10–32)	This study (juveniles)

beneath the rock slab that was in direct contact with the heat source before assuming the erect posture. This is very unlikely to have occurred by chance ($\chi^2 = 12$, $df = 1$, $P < 0.001$) and further suggests that this posture plays a thermoregulatory role. There is also indirect evidence that marbled geckos within retreat-sites in the field use such postural thermoregulatory adjustments during the day (Kearney and Predavec 2000). Occasionally, prior to assuming the erect posture, marbled geckos were observed to repeatedly contact the underside of the rock slab with their snout. The density of skin sensory receptors in geckos is highest on the anterior part of the head (Matveyeva and Ananjeva 1995) and this tactile behavior may enable the geckos to choose a thermally suitable position before assuming the erect posture. Snout contact with the rock underside was not observed in thick-tailed geckos.

In addition to raising and lowering the entire body when thermoregulating (cf. *Coleonyx brevis* [Dial 1978]), both species in this study may have used subtle adjustments of the amount of body surface in contact with the rock slab in order to regulate body temperature. Frequently, the geckos would lower their head out of contact with the rock and remain in an arched position for a number of minutes, and then raise their head back into contact with the rock (Fig. 1B & C). The erect posture was typically maintained for periods of at least an hour, with one thick-tailed gecko remaining in this posture for over 5 hours.

The body temperatures of geckos in the erect posture were much higher than the substrate temperature (circa 10°C) and were broadly similar to published values of body temperatures selected in laboratory thermal gradients (Tables 1 and 2). Variation in the mean selected body temperature of the marbled gecko appears to be lower in this study than in other thermal gradient studies (Table 2) suggesting that this may be a useful alternative method of measuring the preferred body temperature of lizards that exhibit distinct postural thermoregulatory behaviors. In contrast, variation in the mean selected body temperature of thick-tailed geckos was large relative to the marbled gecko (Table 2), although this may reflect a seasonal shift in preferred body temperature since all four geckos collected in summer selected higher body temperatures than those collected in spring ($N = 8$, $t = -3.492$, $P = 0.031$; Table 1).

Temperature differentials between the substrate and the "ceiling" of rocky retreat-sites in the field are commonly around 5 to 10°C and can reach as much as 20°C (Webb and Shine 1998a; personal observation). Thus, the erect posture described in this report would be of great thermoregulatory utility to a rock-dwelling gecko, and perhaps also to lizards using other types of retreat-sites such as burrows. However, the same posture appears to be used by geckos in a variety of other situations. For instance, the thick-tailed gecko (personal observation), and at least 11 other species of gecko (Greene 1988) elevate their bodies in a similar manner when confronting potential predators. Similar postures may also be used by foraging geckos to extend their field of view (Werner and Broza 1969). Whether such behaviors were the evolutionary precursors for the thermoregulatory behavior or were secondary applications is unknown.

Although nocturnal lizards are capable of activity at relatively low temperatures, my observations add to the evidence that these lizards possess adaptations to behaviorally maintain high and constant body temperatures during the daytime (Autumn et al. 1994; Bustard 1967; Dial 1978; Kearney and Predavec 2000; Schlesinger and Shine 1994; Werner and Whitaker 1978). Such behavior may be critical in enabling nocturnal lizards to successfully perform many physiological functions, in light of the similarity in thermal preferences, tolerances and sensitivity of performance between nocturnal and diurnal lizards (Autumn et al. 1994; Autumn and De Nardo 1995; Avery 1982; Huey et al. 1989b; Werner and Whitaker 1978). Studies of other nocturnal taxa may reveal additional diversity in the thermoregulatory behavior of reptiles.

TABLE 1. Body temperatures (°C) of geckos in thermoregulatory postures.

Christinus marmoratus (adult)	*Nephrurus milii* (adult)	*Nephrurus milii* (juvenile)
25.1	21.8	25.1
26.3	21.5	25.2
26.2	27.1*	27.0*
26.1	26.4*	27.8*

*Collected in summer (all other individuals collected in spring).

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Attempts to Estimate the Original Size of Partly Digested Prey Recovered from Stomachs of Japanese Anurans

TOSHIAKI HIRAI
and
MASAFUMI MATSUI
Graduate School of Human and Environmental Studies
Kyoto University, Sakyo-ku, Kyoto 606-8501, Japan
e-mail (MM): fumi@zoo.zool.kyoto-u.ac.jp

In most studies of anuran food habits, the number of prey ingested, and less frequently the size in length of prey, have been taken as numerical traits. However, volume or weight of prey are more suitable parameters of prey size for analytical studies such as relative energetic contributions of each prey taxon. The regression formulas between body length and wet weight calculated for some arthropod taxa (Zug and Zug 1979), or for combined arthropods (Rogers et al. 1976, 1977) enabled us to estimate weight of food from its length. However, food items extracted from digestive tracts are usually broken into fragments by digestion, and this makes it difficult to measure the original size of prey itmes, which is necessary for estimating their volume or weight. In this paper, we present regression analysis of body parts that are often undigested or incompletely digested and original total body length for some arthropod prey taxa consumed by several Japanese anuran species.

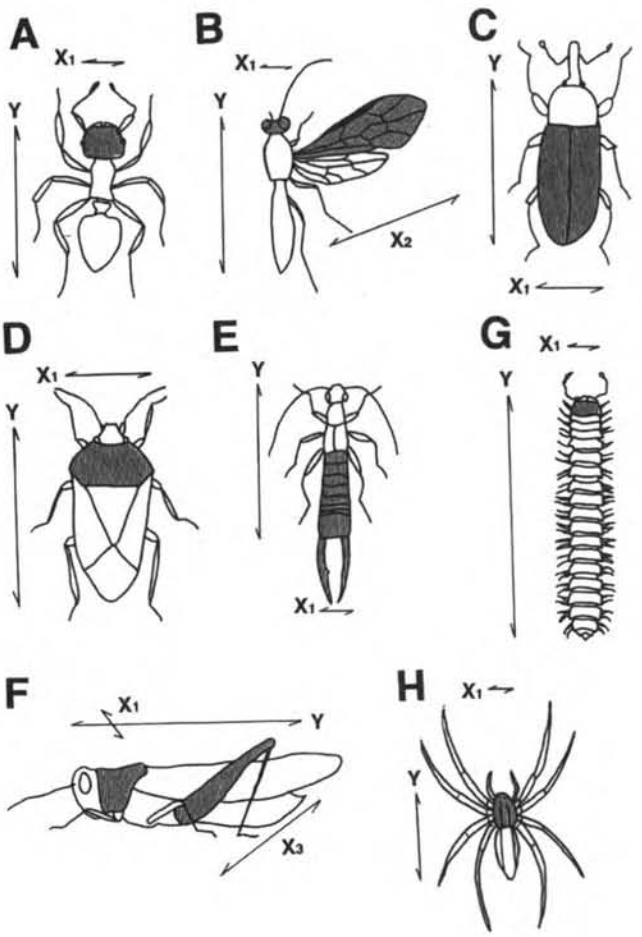


Fig. 1. Measured body parts (Y:body length; X1:width of body part; X2:forewing length; X3:femur length) of representative individuals of types of arthropods taken by frogs. Arrows indicate character dimensions; shaded parts usually remain undigested in frog stomachs. A: ants; B: wasps; C: snout beetles; D: pentatomid bugs; E: earwigs; F: grasshoppers; G: millipedes; H: spiders.

Measurements were made of body parts of prey recovered from stomachs of *Rana nigromaculata*, *R. porosa brevipoda*, *R. rugosa*, and *Hyla japonica* and of those of comparable intact prey animals. Both stomach samples and intact prey animals were collected in rice fields around Kyoto and Otsu, Central Japan. Details about methods of sampling and measurments are given elsewhere (Hirai and Matsui 1999, 2000). Pearson product-moment correlation coefficients (Zar 1999) were calculated between body parts (body width, thigh length, forewing length) and total body length of each prey taxon.

Most of the prey animals extracted from the stomachs were digested and broken into fragments. However, heads of ants and wasps, as well as the abdomens and elytra of beetles, remained intact and their width could be measured (Fig. 1A–C). In the case of crane flies (Tipulidae), fruit flies, moths, pentatomid bugs, water-striders, leafhoppers (deltocephalids), grasshoppers

TABLE 1. Relationships between size of body parts (X in mm) and total body length (Y) of arthropods. X is a corresponding part of body actually measured.

Prey taxa	Formula	X	r^2	N
Ants	Y=4.75X-0.62	X1:Head width	.844	705
Wasps	Y=3.92X+0.73	X1:Head width	.923	39
	Y=1.14X -0.05	X2:Forewing length	.898	23
Larval wasps	Y=5.37X+1.64	X1:Body segment width	.561	52
Ground beetles	Y=2.45X+0.68	X1:Abdomen width	.823	86
Rove beetles	Y=4.57X+0.73	X1:Abdomen width	.810	23
Scarab beetles	Y=1.91X-0.50	X1:Abdomen width	.944	51
Click beetles	Y=3.18X+0.39	X1:Abdomen width	.853	49
Leaf beetles	Y=1.20X+1.96	X1:Abdomen width	.689	32
Snout beetles	Y=2.01X+0.57	X1:Abdomen width	.914	149
Fruit flies	Y=3.57X-0.10	X1:Thorax width	.781	64
	Y=1.08X+0.48	X2:Forewing length	.876	26
Crane flies	Y=5.76X+0.82	X1:Thorax width	.823	160
	Y=0.92X+0.52	X2:Forewing length	.910	52
Moths	Y=2.44X+3.62	X1:Thorax width	.679	44
Caterpillers	Y=4.66X+5.23	X1:Body segment width	.732	272
Pentatomid bugs	Y=1.94X-0.28	X1:Thorax width	.910	51
Reduviid bugs	Y=3.79X-0.17	X1:Abdomen width	.925	13
Water striders	Y=3.58X+2.08	X1:Thorax width	.474	36
Leafhoppers	Y=3.01X+0.32	X1:Thorax width	.935	15
Earwigs	Y=3.66X+3.86	X1:Abdomen width	.814	24
Grasshoppers	Y=7.74X-4.74	X1:Thorax width	.924	28
	Y=1.75X+0.97	X3:Femur length	.943	15
Grouse locusts	Y=3.21X-1.05	X1:Thorax width	.794	30
	Y=2.64X-5.14	X3:Femur length	.856	8
Crickets	Y=3.25X+1.29	X1:Thorax width	.859	11
	Y=1.35X+1.35	X3:Femur length	.943	9
Spiders	Y=2.30X+1.21	X1:Prosoma width	.719	484
Woodlice (Oniscidae)	Y=2.00X+1.38	X1:Body segment width	.870	176
Woodlice (Armadilliidae)	Y=2.06X+0.94	X1:Body segment width	.835	61
Millipedes	Y=9.62X-0.57	X1:Body segment width	.852	64
Centipedes	Y=11.30X-0.86	X1:Body segment width	.863	14

(Locustidae), grouse locusts (Tetrigidae), and crickets (Gryllidae), thoraxes were usually intact (Fig. 1D, F). Abdomens of reduviid bugs and earwigs, and prosoma of spiders were also intact (Fig. 1E, H). We could measure body width of larval wasps, caterpillars, and other arthropods because some body segments usually were partially intact even when other body parts were more digested (Fig. 1G). Forewings of wasps, crane flies, and fruit flies usually remained in the stomach even when the body was absent (Fig. 1B). Similarly, saltatorial legs of orthopterans tended to remain in the stomach, and we could measure their femur length (Fig. 1F).

The regression formulas between body parts (body width, thigh length, forewing length) and total body length are summarized in Table 1. Correlation coefficients obtained were significant for all prey taxa examined, at the level of 0.01%.

Results of this study suggest that we can estimate original body length of digested prey from the size of non- or poorly-digested body parts such as heads of ants, elytra of beetles, and thoraces and thighs of grasshoppers. Food volume can also be calculated from the body length using body width to make the estimate (e.g., Dunham 1983). We can use the estimated value for statistical comparisons of body size and frog gape size (Hirai and Matsui 1999, 2000). The body length estimated in this way will further enable us to calculate food weight using the formulas presented by Zug and Zug (1979) or Rogers et al. (1976, 1977). Hence, these regression formulas are useful to express diet compositions by volume or weight, or eventually to evaluate energetic contributions by each prey taxon.

This study was based on data from diet studies of frogs inhabiting rice fields, but anurans dwelling in different habitats consume different prey taxa. For example, carabid beetles are often taken by *Bufo japonicus*, cave crickets by *Rana tagoi*, and termites by *Microhyla ornata* (Maeda and Matsui 1999). These prey taxa, which we could not include in this study, should be investigated in the future. Furthermore, similar attempts should be made in other geographic regions so as to determine whether or not the present data are applicable to their anuran fauna.

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Ultraviolet Reflectance in the Small Skink *Carlia pectoralis*

SIMON P. BLOMBERG*
IAN P. F. OWENS
and
DEVI STUART-FOX
Deptartment of Zoology and Entomology
University of Queensland, St. Lucia
Queensland 4072, Australia

**Current address for correspondence: Department of Zoology, University of Aberdeen, Tillydrone Avenue, Aberdeen AB24 2TZ, UK*
e-mail: s.blomberg@abdn.ac.uk

Many vertebrates have ultraviolet (UV) vision (Jacobs 1992; Tovée 1995). Among lizards, the anoles (family Polychrotidae) are most well-studied in terms of visual communication involving UV light. In *Anolis carolinensis*, the visual pigments have been characterized and one (SWS1[Ac]), has been found to be most sensitive at 358 nm, in the UV region of the spectrum (Kawamura and Yokayama 1998). Evidence for the behavioral use of UV reflectance comes from a study of the dewlaps of five other *Anolis* species (Fleishman et al. 1993). Two species (*A. krugi* and *A. cristellatus*) had highly UV reflectant dewlaps (Absolute reflectance > 35% at 365 nm), while another two species (*A. evermanni* and *A. gundalachi*) had low UV reflectant dewlaps (< 22%). A further species (*A. pulchellus*) was intermediate in dewlap reflectance (25%). Importantly, the species with highly UV reflectant dewlaps live in microhabitats exposed to direct sunlight, while the two low reflectant species live in closed-canopy forest, suggesting a strong link between UV visual communication and environmental light regimes. However, UV sensitivity of photoreceptors only broadly matched the spectral radiance of the habitats, suggesting only a modest amount of coevolution between the dewlap 'signal' and the photoreceptor 'receiver' (Fleishman et al. 1997). Also, the desert iguana (*Dipsosaurus dorsalis*) produces femoral gland secretions that are highly reflectant to UV, and behavioral experiments suggest that that species is visually sensitive to the near UV and can locate UV reflectant markers (Alberts 1989). To our knowledge, UV reflectance and communication has not been reported in any other group of lizards.

The small, leaf-litter dwelling Australian skink, *Carlia pectoralis*, is a member of a genus that exhibits considerable sexual dichromatism (Greer 1989). In this species, breeding males possess orange lateral stripes which attract females and are also used in aggressive contests with other males (Blomberg and Owens, unpubl.). Interestingly, however, breeding males also have a grey-blue gular (throat) region. Because *C. pectoralis* lives in open sunlight and appears to rely heavily on color in social interactions, we hypothesized that the gular region, which is dull in the visual part of the spectrum, may be reflective in the UV.

We measured the UV reflectance of the gular region, midlateral stripe, and brown dorsal region of a breeding male *C. pectoralis* using an S2000 optical spectrometer (Ocean Optics, Dunedin, Florida, USA), with a dual deuterium-tungsten lamp. The deuterium lamp is optimized for wavelengths between 200 and 400 nm, while the tungsten lamp is optimized for wavelengths between 350 and 750 nm. A 'labsphere' certified standard was used as the white standard. All measurements were taken in a darkened room in order to minimize interference from extraneous light sources. Measurements were taken at 45° to the skin, over an area of 3 mm in diameter.

As predicted, the gular region of male *C. pectoralis* is highly reflectant in the ultraviolet region, with a peak at 338 nm, whereas other regions of the body show negligible UV reflectance (Fig. 1). Our results are important for two reasons. Firstly, UV reflectance may be much more prevalent than previously expected, and may not be limited to groups that are thought to rely primarily on vision (UV or visual spectrum) for communication, such as anoles. Our

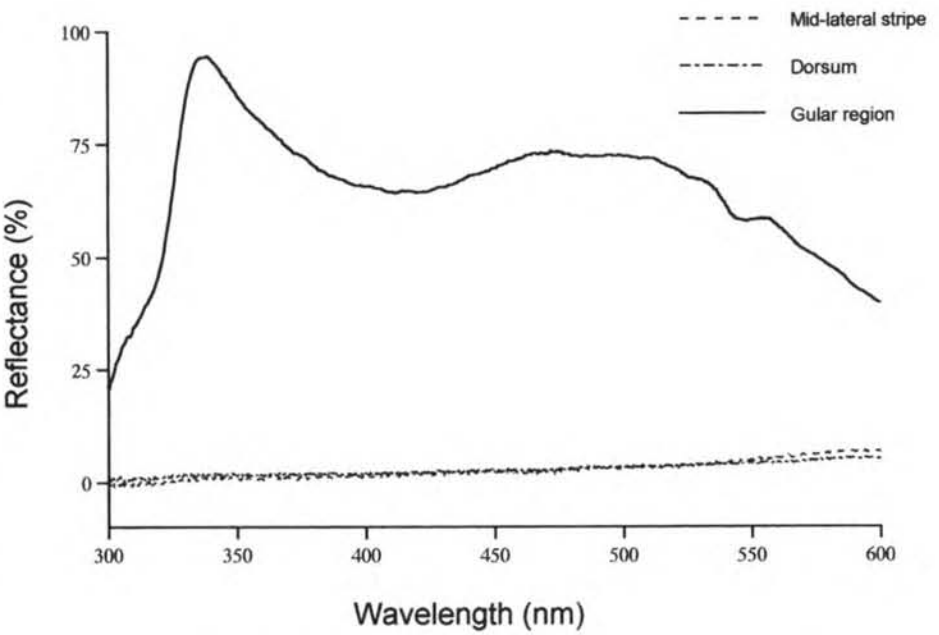


FIG. 1. Ultraviolet reflectance plot for body regions of the small skink, *Carlia pectoralis*.

results suggest that skinks, which are known for their use of chemoreception (e.g., Cooper and Vitt 1984; Cooper and Vitt 1986a, b, c; Nicoletto 1985), can also be highly visually oriented, and may use UV reflectant regions of the body for communication. Secondly, our results suggest that communication in *C. pectoralis* is more complex than previously suspected. Previous studies have concentrated on the adaptive significance of coloration of the orange lateral stripes, which are not UV reflective (Fig. 1; Blomberg and Owens, unpubl.). The role of the gular region in *C. pectoralis* behavior is not known. Casual observation of skinks in the field suggests that it could be related to the "head-nodding" behavior, perhaps as an "amplifier" trait that allows the head nod to be seen over a wider area by flashing in the UV spectrum (Zahavi and Zahavi 1997).

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HERPETOLOGICAL HISTORY

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A Clarification of the Type Locality and Collector of the Holotype of *Sauromalus obesus* (Baird) 1858

RICHARD R. MONTANUCCI
Department of Biological Sciences, Clemson University
Clemson, South Carolina 29634-0326, USA
e-mail: rrmnt@clemson.edu

The western chuckwalla, *Sauromalus obesus*, was originally named *Euphryne obesus* by Spencer F. Baird in 1858, and later properly emended to *Euphryne obesa* (Baird 1859). The genus *Euphryne* was eventually synonymized with *Sauromalus* by Cope (1875). In a recent comprehensive study of the genus *Sauromalus*, Hollingsworth (1998) placed *S. obesus* in the synonymy of *S. ater*. As an aside, while I accept the conspecificity of these two nominal taxa, I argue elsewhere (Montanucci 2000) that the name *S. obesus* should be given precedence over *S. ater*.

In Baird's original description (1858:253), the only collection information is the following: "Abundant in the canons of the Colorado, of California, collected by Maj. Thomas, Mex. Boundary Survey, and Lt. Ives' Expedition. Type No. 4172." One might reasonably conclude from Baird's brief statement that the type locality is "canons of the Colorado, of California" and that Major Thomas is the collector. Subsequently, Baird (1859:6) listed USNM 4172 from Fort Yuma without explicitly stating it was the type specimen. He also listed A. Schott as the collector of this specimen, and Major Thomas as the collector of USNM 2774, also from Fort Yuma. Hence, Baird's two published works are incomplete and seemingly contradictory in regards to the type locality and collector of the type specimen (Fig. 1).

***Euphryne obesus*, Baird.**—**Width of head nearly equal to distance from nose to ear. Tail shorter than the body. General color of the young, olive green, with five broad transverse bars above from head to base of tail, and about as many on the tail; these rings yellow, dotted with red. Beneath pea green dotted with black. With increasing age, the bands become obsolete and disappear, the general color becoming reddish olive.**

The largest and heaviest of American *Iguanidæ*, sometimes exceeding a foot in length. Abundant in the canons of the Colorado, of California, collected by Maj. Thomas, Mex. Boundary Survey, and Lt. Ives' Expedition. Type No. 4172

21. EUPHRYNE OBESA, Baird.

PLATE XXVII.

Euphryne obesus, BAIRD, Pr. A. N. Sc. Dec. 1858.

SP. CH.—Width of head nearly equal to distance from nose to ear. Tail shorter than the body. General color of the young, olive green, with five broad transverse bars above from head to base of tail, and about as many on the tail; these rings yellow, dotted with red. Beneath, pea green, dotted with black. With increasing age the bands become obsolete and disappear, the general color becoming reddish olive.

2774 Fort Yuma. Major Thomas.—4172. Do. A. Schott.

FIG. 1. Upper: Description of *Euphryne obesus* from Baird (1858). Lower: Description from Baird (1859). The dash serves to divide the two USNM specimens and their respective collectors. Do. is an abbreviation for "ditto" in reference to the locality. The absence of a period after 2774 is an omission; other numbers on the page are followed by a period. USNM 2774 was erroneously assigned to a chuckwalla specimen; see text for further explanation. Courtesy: David H. Lewis.

In the original ledger at the National Museum of Natural History "Fort Yuma" is given as the locality for USNM 4172. The date of entry is 1858. The names of Major G. H. Thomas and A. Schott appear next to this entry. The name "A. Schott" was penciled into the ledger as the collector after the specimen was catalogued, but when this was done is not exactly known. Thomas is now listed in the computer records as the donor of the specimen. The ledger information is consistent with Baird (1859:6) in indicating that Arthur Schott was the collector of the holotype. Unfortunately, Schott's field journals were not available to me and apparently have been lost (Fontana 1983).

TABLE 1. List of specimens used by Baird (1858) in the description of *Euphryne obesus*.

USNM number	Collector	Locality	Sex	SVL
4172 (holotype)	A. Schott*	Fort Yuma, CA	F	162 mm
11810 (paratype)	H. B. Mollhausen**	Colorado River	M	160 mm
326109(paratype) (previously 11810)	H. B. Mollhausen**	Colorado River	M	95 mm
12264 (paratype)	H. B. Mollhausen**	Yampai Valley, AZ	M	185 mm

* United States and Mexican Boundary Survey (Gadsden Survey; 1854–1855).
** Lieutenant J. C. Ives' Exploring Expedition of the Colorado River (1857–1858).

In neither of Baird's publications is the term "type locality" explicitly used, perhaps because the standards of the time did not require it. In Baird (1858), the word 'habitat,' abbreviated as "Hab.," precedes locality or distribution statements for each species, but it is omitted under the description of *Euphryne obesus*. Multiple localities are listed for some species, while only one is the source of the designated type specimen. Therefore, Baird's statements were apparently not intended as type localities in the modern, strict sense.

Baird's brief, incomplete and contradictory reporting was not without consequences. For example, Stejneger (1891) listed Thomas as the collector of USNM 4172, as did Smith and Taylor (1950), who appended a question mark after his name. Cochran (1961:113) listed both A. Schott and G. G. [*sic*] Thomas as the collectors of USNM 4172 which she designated as a "cotype". Cochran's cotype designation apparently stems from Baird's use of multiple specimens in the original description, although the type specimen is listed. No authors have followed Cochran.

Baird's (1859) listing of USNM 2774 as a chuckwalla is erroneous. W. R. Heyer (pers. comm.) of the USNM informs me that this number is assigned to a specimen of *Holbrookia*. Other permutations of this number were explored, including the most likely, a transposition of the 4 and 2, i.e. USNM 4772. But this museum number is assigned to a *Coluber constrictor*, and no other permutations involve specimens of chuckwallas (R. Crombie, pers. comm.). Cope (1900:267) published a table of chuckwalla specimens examined by Stejneger that includes USNM 4172 as well as others collected by H. B. Mollhausen. On page 268, Cope repeated these numbers, except he listed USNM 4772 as a specimen from Fort Yuma, but since USNM 4172 does not appear in Cope's list, he was probably referring to the type specimen, and 4772 is simply a misprint (it should be noted that, in the old style cursive script, ones and sevens were often very similar). The same misprint had been given earlier by Yarrow (1882), and no other specimen was listed from Fort Yuma (also see De Queiroz 1995:35). Cope may have simply perpetuated Yarrow's mistake. It is possible that a paratopotype collected by G. H. Thomas never existed, otherwise Yarrow (1882) and Stejneger (1891) would likely have listed it. In writing his manuscript on the *Reptiles of the Boundary*, Baird may have listed the Fort Yuma specimen twice: as 4772 collected by Thomas, and as 4172 collected by A. Schott. In preparing the manuscript for publication, the type setter may have then transposed the 2 and 4 in 4772, a possible error, especially because the 2 and 4 flank two identical numbers (i.e. 77). Although speculative, this explanation of how USNM 2774 appeared in Baird's work is supported by the following facts: 1) the names of Arthur Schott and G. H. Thomas are both associated with USNM 4172 in the original ledger, and Thomas' name is linked with 2774 in the 1859 publication; 2) USNM 4172 was misprinted as 4772 in two other papers; 3) the misprinted number 4772 and 2774 have the same integers; and 4) both numbers are associated with the same locality (Fort Yuma).

The chuckwalla specimens that I believe were used by Baird (1858) for the original description are listed in Table 1. These specimens were extracted from the lists of Yarrow (1882), Stejneger (1891), and Cope (1900). No additional specimens catalogued prior to Baird's 1858 paper could be retrieved from the Smithsonian's electronic database, although I did not peruse the original ledger for additional records.

Baird's (1858:253) mention of Major Thomas seemingly ties his name with the United States and Mexican Boundary Survey and also perhaps with Lieutenant Joseph C. Ives' expedition, but apparently this was not his intent. Baird was simply listing the several sources of the preserved material he used for the generic and species descriptions of *Euphryne obesus*. Unfortunately, as constructed, the statement was misconstrued by Yarrow (1875:559) who erroneously associated Thomas with the Boundary Survey. Hollingsworth (1998:40), also linked Thomas with the Boundary Survey, if not also with the exploration of the Colorado River, and credited him with collecting the series of specimens used by Baird. It is clear from historical records, however, that Thomas played no role in either of these expeditions. The career of General George Henry Thomas in the United States Army and his significant contribution to the Union victory in the Civil War are well known (McKinney 1961; Thomas 1964). Drawing upon these two sources, the following relevant information is provided.

In 1854, as a captain, Thomas was reassigned from his duties as an artillery instructor at the United States Military Academy at West Point to take charge of a battalion with the Third Artillery Regiment. He proceeded to Benicia Barracks, near San Francisco, before receiving orders to take command of Fort Yuma, a 333-km overland march from San Diego. Thomas arrived by ship in San Diego and led two companies across the Colorado Desert in the midsummer (July) of 1854, reaching the post with his command in near exhaustion.

Thomas' stay at Fort Yuma was short, barely over a year. In accordance with War Department orders, he and his assistants made

important zoological and botanical collections (McKinney 1961). Thomas was credited as being the first to collect the leaf-nosed bat in U.S. territory, and in other ways adding substantially to the zoological knowledge of the region. While at Fort Yuma, Thomas presumably received the holotype along with other specimens from Schott, and had them shipped to Washington, D. C. Thomas was promoted to the rank of major on May 12, 1855, and ordered to duty with the Second Cavalry Regiment at Jefferson Barracks, Missouri. He left Fort Yuma on July 23, 1855.

Lieutenant Joseph C. Ives led the exploration of the Colorado River that began at the river's mouth on November 28, 1857, more than two years after Thomas left his command at Fort Yuma. Mr. H. B. Mollhausen was a member of the Colorado River expedition and made the zoological collections (Ives 1861). During the exploration of the Colorado River (1857–1858), Major Thomas was in Texas, engaged in military campaigns against the Comanches (McKinney 1961).



FIG. 2. Fort Yuma (note arrow), Imperial Co., California, a view from the Arizona side of the Colorado River showing the scarcity of suitable habitat for chuckwallas. Photo by Carelton Watkins, *circa* April, 1880. Courtesy: Arizona Historical Society, Tucson, Arizona.

William H. Emory, major First Cavalry, was Chief Astronomer for the running of the boundary between United States and Mexico from 1848 to 1853. He was appointed both United States Commissioner and Chief Astronomer in 1854, with full powers, under the Gadsden Treaty, and officially completed the survey in 1857 (Thrapp 1990).

Arthur Schott served as one of the Army surveyors for the Boundary Commission; the following pertinent information is taken from Fox (1977) and Goetzmann (1979). Arthur Carl Victor Schott, born in Germany, emigrated to the United States in 1850, and subsequently befriended Princeton University botanist John Torrey. In 1851, Torrey persuaded Emory to hire Schott as a surveyor and scientific collector. The new Commission to survey the Gadsden Boundary was divided into two parties: one under Emory that was to work its way west from the Rio Grande, and one under Lieutenant Nathaniel Michler that was to proceed via San Diego to the Colorado River, and thence eastward to the 111th meridian. Michler completed the western half of the survey on 14 October 1855. Schott was attached to Michler's party as a surveyor and scientific collector. He collected plants, minerals, and fossils with botanist-geologist Charles Parry, as well as insects and vertebrate specimens, including amphibians and reptiles, that ultimately would be shipped back to the Smithsonian Institution. Schott was also a talented artist and prepared many color illustrations of the region's topography, vegetation, and indigenous peoples. Schott is honored in the botanical and herpetological literature, e.g., *Yucca schottii*, *Lophocereus schottii*, *Masticophis schotti*, and *Urosaurus ornatus schotti*.

The actual location of Fort Yuma (neither indicated in the original ledger nor specified by Baird [1859:6]) has also been a source of confusion for some herpetologists. Among subsequent workers who listed the type locality for *S. obesus*, Stejneger (1891), Schmidt (1922, 1953), Stejneger and Barbour (1923, 1933, 1939, 1943), Smith (1946), and Hollingsworth (1998:40) mistakenly stated that it is in Arizona, undoubtedly associating it with the town of Yuma. Van Denburgh (1922) correctly indicated its location in California, as did Shaw (1945).

The town site on the Arizona shore of the river was surveyed in 1854, and originally named Colorado City, and later, Arizona City. It was renamed Yuma in 1873 (Lamar 1977). On the other hand, Fort Yuma was established in 1852 on the California side of the river south of the Cargo Muchacho and Chocolate mountains, on a hill that originally was the site of a Spanish mission; the site intermittently became an island during floodwaters. Its purpose was to protect the ferry across the Colorado River, an important link in the livestock trails from New Mexico and Sonora to California (McKinney 1961; Wharfield 1968). Today, the renovated fort lies within the Yuma (Quechan) Indian Reservation in Imperial County.

No chuckwallas, or their scat, were observed during a recent visit to Fort Yuma. The immediate vicinity has had a history of substantial habitat disturbance; the Southern Pacific railroad cuts along the southern slope of the hill and Interstate Highway 8 passes close by. Whether chuckwallas actually occurred at Fort Yuma may never be known. Early photographs of the site (Fig. 2) suggest a paucity of suitable habitat, although these lizards occasionally occupy earthen hills and banks of large washes, using holes and crevices for shelter (Feldner and Feldner 1991; Montanucci, pers. observ.). There is one additional chuckwalla recorded from Fort Yuma; the specimen (CAS 130) was collected by F. P. McLean (date unknown), but later lost in the San Francisco earthquake and fire of 1906 (Jens V. Vindum, pers. comm.).

If one assumes that the type specimen was collected near Fort Yuma, the nearest suitable habitat exists at Pilot Knob. Therefore, an alternative explanation to be considered is that the chuckwallas procured by Arthur Schott and by F. P. McLean were actually collected at Pilot Knob, but labeled "Fort Yuma" as a consequence of the early common practice of designating the shipping point as the collection locality. Fort Yuma is known to have been an important mail post (Wharfield 1968). Pilot Knob, which has substantial rocky habitat and supports a population of chuckwallas, lies about 11.4 km west of Fort Yuma, and only 1.4 km north of the survey route traveled by Arthur Schott. The holotype, which is a female, compares favorably with living specimens photographed at Pilot Knob, but this evidence is inconclusive because females from different areas generally lack diagnostic pattern features.

The precise location of Fort Yuma may have added importance in the context of the subspecific taxonomy of these lizards. I have

noted differences in the color pattern of male chuckwallas from opposite sides of the Colorado River near Yuma. The head, neck, chest, forelimbs, hindlimbs and rump are jet black in males from both sides of the river. But in those from Pilot Knob, the Cargo Muchacho and Chocolate mountains (N = 10: 3 alcoholics, 7 voucher photos) the dorsal mid-body is cream to pale tan with dense reticulations of red. Males from the Gila Mountains (Telegraph Pass, type locality of *S. o. tumidus*), and mountains further east (N = 28: 7 alcoholics, 21 voucher photos), have a uniform red dorsal mid-body, with or without black reticulations, black spots, and white spots. These color pattern differences are obvious in living specimens, but eventually disappear in preserved material. Hollingsworth (1998) did not recognize any subspecies in the common chuckwalla, but pending further study, subspecific designations may be warranted.

In summary, Baird's (1858) description of *Euphryne obesus* is brief and incomplete; his statement "abundant in the canons of the Colorado, of California" should be interpreted as a habitat description, not as the type locality. Only by consulting both of Baird's works (1858 and 1859) can it be ascertained that Fort Yuma is the type locality and the collector of the holotype was Arthur Schott, not Major G. H. Thomas. A paratopotype listed in the 1859 work as USNM 2774 does not exist, and the museum number is erroneous. Historical records clearly show that G. H. Thomas had no involvement with the United States and Mexican Boundary Survey, or with Lt. Ives' exploration of the Colorado River. Fort Yuma is situated in California, not Arizona, and its precise location may have importance in the subspecific taxonomy of chuckwallas, as distinct populations occur on either side of the Colorado River near Yuma. The ambiguities in Baird's work have contributed to errors in the chuckwalla literature, including the most recent papers.

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Estimating Terrestrial Salamander Abundance in Different Habitats: Efficiency of Temporary Removal Methods

SEBASTIANO SALVIDIO

DIP.TE.RIS – Dipartimento per lo studio del Territorio e delle sue Risorse
Università di Genova, Via Balbi 5, I-16126 Genova, Italy
e-mail: salvidio@dipteris.unige.it
and
Gruppo Speleologico Ligure "Arturo Issel"
Villa Comunale ex Borzino, CP 21, I-16100 Busalla, Italy

Temporary removal methods may be used in the investigation of terrestrial salamander population dynamics (Bruce 1995; Salvidio 1998), as well as amphibian long-term population changes (Hayek 1994). In these studies, all animals captured are physically removed from the population, kept in a holding area, and relocated when the study is completed. Removal experiments usually require short sampling intervals, reduced field personnel, and are less expensive than mark-recapture studies (Hayek 1994). When basic assumptions are met (e.g., population closure, equal sampling effort, equal catchability, and effective reduction of the population after each search), the statistics calculated from removal data seem reliable. There are relatively few ecological studies on amphibian populations that use this technique and there are no comparative analyses on the efficiency of removal experiments upon conspecific populations living in different habitat types.

In this study, temporary removal data were analyzed from two populations of the European terrestrial plethodontid salamander *Speleomantes strinatii* (Aellen 1958) living in different environmental conditions: a cave environment (i.e., an artificial tunnel excavated during World War II to serve as an air-raid shelter) and a subsurface habitat (i.e., a humid rock-face). These environments constitute ends of a continuum (Culver 1986; Juberthie et al. 1980) relative to their ecological conditions. Caves are relatively simple in structure because cave walls are lacking overgrowing vegetation and salamanders are active on a completely bare surface. Also, the artificial cave has relatively constant environmental conditions: mean annual temperature is 9°C (range 5–12°C), and air relative humidity is >90% (Salvidio et al. 1994). In contrast, the rock face is structurally more complex because creepers (e.g., the English ivy *Hedera helix*), litter accumulation, and rock debris are present, providing refugia for salamanders. The rock-face is exposed to circadian and seasonal variations in solar radiation, temperature, air humidity, and rainfall. In this area, the mean annual temperature is about 12°C, ranging from 5°C in January to 21°C in July. Annual rainfall averages 1600 mm, with monthly values ranging from 40 mm in July to 200 mm in November (Brancucci 1994). Climatic events (see Salvidio 1998), vegetation growth, litter accumulation, and rock-face erosion produce small year-to-year microhabitat changes that increase habitat variability. The two sites are predicted to differentially affect resident salamander activity patterns, and hence the effectiveness of temporary removal methods.

The aim of this study was to examine the efficiency of temporary removal methods in these different environments. We predicted that removal methods would be more efficient in simple-structured and constant habitats (i.e., caves) in comparison to relatively complex and variable ones (i.e., rock faces). In particular, we hypothesized that 1) average capture probabilities would be higher in the cave environment; and 2) capture probabilities would be more variable in the rock face site.

The two study sites are located in NW Italy near Genova and are separated by a linear distance of about 10 km. The rock face habitat is located along a small stream, surrounded by mixed deciduous forest (*Castanea sativa*, *Alnus glutinosa*, *Ostrya carpinifolia*, *Fraxinus ornus*) that produces a thick vegetative cover. In both habitats, three temporary removal samples were taken each year from 1996 to 1999 by the same collector, usually every other day during the peak activity period of *Speleomantes strinatii* populations, which are in July–August and in October–November in cave and rock face habitat, respectively. The total sampled surface area was 120 m^2 in the cave and 190 m^2 in the rock face environment. Animals were located with the aid of a headlamp and collected by hand. All salamanders captured were removed, measured (snout–vent length, SVL) and housed in plastic boxes lined with wet paper towels at about 5°C. During this study, no direct mortality of the removed salamanders occurred, and at the end of the third removal sampling, all salamanders were released at their capture sites.

The SVL measurements generated polymodal frequency distribution histograms that were analyzed with the FAO-ICLARM Stock Assessment Tools (FiSAT) computer program (Gayanilo et al. 1996). This program enabled the decomposition of mixed length-frequency distributions into their Gaussian components by means of Bhattacharya's (1967) log-differences method. In all samples, three SVL groups were separated: the two smallest ones corresponding to immatures, and the largest comprising adults plus subadults (ranges of annual mean SVL in the rock face and cave populations, respectively, were: first group, 29.2–32.3 and 24.1–26.0 mm; second group, 43.2–44.3 and 33.2–37.7 mm; largest group, 58.8–62.6 and 56.2–61.9 mm).

Population abundance was estimated by means of the program CAPTURE routine M_{bh} (White et al. 1982). This routine gives the population estimate N_i, its standard error s_x, and, if at least three removal samplings are used, it allows a test for homogeneity of capture probabilities with a χ^2 goodness of fit test (White et al. 1982). In this model, capture probability (CP) is the average probability of capture of an animal, and every individual has an equal and constant CP on all removal occasions (White et al. 1982). Salamander observability (CP in this case) could be related to habitat differences and microclimatic variations in the two study sites (Conroy and Nichols 1996). Population size was estimated for the entire population (i.e., all individuals pooled) and for juvenile (i.e., the two smallest SVL cohorts) and adult components separated according to FiSAT analysis. This procedure was important, because the two salamander populations were sampled in different seasons and displayed different boundaries between adjacent SVL components.

Individuals may have been recaptured among years because *S. strinatii* are long-lived (Salvidio 1993). For this reason, successive CP values were not independent. Thus, to compare CP within

TABLE 1. Population estimates, calculated from removal data using CAPTURE routine M_{bh}, of two populations of *Speleomantes strinatii* living in different habitats. N_i = number of salamanders estimated, s_x = standard error, and χ^2 = test for homogeneity of capture probabilities among the three successive removal samples.

Habitat	Sampling year	Age class	N_i	s_x	Capture probability	χ^2	P
Rock face	1996	juveniles	72.78	23.4	0.290	0.24	0.62
		adults	31.03	5.8	0.440	0.20	0.65
		all ages	105.38	22.3	0.323	0.18	0.67
	1997	juveniles	29.66	2.5	0.584	0.65	0.42
		adults	72.87	39.3	0.223	1.07	0.30
		all ages	89.81	15.8	0.363	0.53	0.40
	1998	juveniles	59.52	13.5	0.356	0.22	0.64
		adults	74.87	48.5	0.202	0.29	0.59
		all ages	133.15	37.4	0.267	0.05	0.82
	1999	juveniles	50.56	14.3	0.334	2.81	0.94
		adults	40.64	6.6	0.431	1.70	0.19
		all ages	93.55	15.9	0.365	3.54	0.06
Artificial Cave	1996	juveniles	56.38	4.62	0.530	0.41	0.52
		adults	28.00	0.90	0.737	2.62	0.11
		all ages	84.40	4.02	0.589	1.45	0.23
	1997	juveniles	51.31	2.59	0.621	0.62	0.43
		adults	46.00	0.65	0.807	2.90	0.09
		all ages	97.04	2.11	0.703	2.52	0.11
	1998	juveniles	51.67	5.79	0.484	1.54	0.21
		adults	69.00	0.77	0.812	7.07	0.01
		all ages	117.47	2.76	0.677	7.89	0.01
	1999	juveniles	50.91	2.31	0.639	2.20	0.14
		adults	81.98	4.38	0.572	4.99	0.03
		all ages	133.94	5.11	0.587	0.92	0.34

and between populations, the Friedman two-way analysis of variance by ranks was used. The null hypothesis of this test was that the k repeated measures or matched groups compared came from the same population or populations with the same median (Siegel and Castellan 1988). To compare the variability of CP between populations, the coefficient of variation (CV = standard deviation/mean) was tested by a two-way ANOVA, using habitat and age class as factors.

During this study, 704 salamanders were captured, measured, and released at the two study sites. In all samples, CP values were higher than 0.20 (Table 1), a value considered adequate for estimating population abundance in removal experiments (White et al. 1982). Moreover at the end of the third removal occasion, substantial proportions of *S. strinatii* populations were removed; about 90% and 60% in the cave and rock face habitats, respectively.

Capture probabilities were not different from homogeneity in the rock face habitat ($0.06 < P < 0.82$, Table 1). In the cave, there were differences from homogeneity in three cases: in the adult subpopulations, both in 1998 and 1999 ($P = 0.01$, and $P = 0.03$), and in the 1998 total sample ($P = 0.03$). However, the analysis of capture data showed that adult salamanders were extremely catchable during the first sampling occasion, because more than 80% of the entire population was removed after the first sampling. Thus, the linearity of CP should not be of concern (Lancia and Bishir 1996). For these reasons, it was assumed that sampling protocols were adequate in yielding repeatable statistics in both habitat types. Within each population, there were no differences between adult and juvenile CP (Friedman two-way analysis of variance by age blocked by year: cave, $F_r = 1.00$, DF = 1, $P = 0.317$; and rock-face, $F_r = 0.00$, DF = 1, $P = 1.000$) allowing CP of the entire samples to be used when comparing different habitats. On average, cave population CP values were about twice those estimated in the rock face habitat (Table 2), and when the two populations were compared, CP values differed ($F_r = 4.00$, DF = 1, $P = 0.046$). In addition, salamanders living in the two habitats displayed different patterns of observability and thus of catchability.

TABLE 2. Mean capture probabilities of two *Speleomantes strinatii* populations living in different habitat types. CP = capture probability; CV = coefficient of variation; N = number of sampling years; SD = standard deviation of the mean.

Age class	N	Mean CP	SD	Range of variation	CV
Rock face population					
Juveniles	4	0.393	0.130	0.290–0.584	0.331
Adults	4	0.324	0.129	0.202–0.440	0.399
All ages	4	0.330	0.046	0.267–0.365	0.139
Cave population					
Juveniles	4	0.569	0.074	0.484–0.639	0.130
Adults	4	0.732	0.112	0.572–0.812	0.153
All ages	4	0.639	0.060	0.587–0.703	0.094

In the cave habitat, 66% of the entire population estimated was captured during the first search, in comparison to only 32% of the rock-face population. The year-to-year CP variability, expressed as the coefficient of variation, was more than two times lower in the cave than in the rock-face habitat (Table 2). However, this difference was not statistically significant (two-way ANOVA $F = 109.17$, $DF = 3$, $P = 0.062$).

In this study, the efficiency of removal methods was tested on two conspecific populations of the European plethodontid salamander *Speleomantes strinatii* living in different habitat types. The analysis of capture data showed that removal protocols were adequate in both cases. The first hypothesis (i.e., higher CP values in the more constant habitat) was supported, while the second (i.e., lower variability of CP in the more constant habitat) was not, probably because of the relative small number of years (N = 4) in which CP were calculated. Indeed, removal efficiency, expressed as the probability of observing salamanders, was enhanced in the more constant and simple-structured habitat, where a higher proportion of the salamander population was active and exposed to capture.

Temporary removal techniques have proved adequate in estimating population abundance of terrestrial salamanders (Bruce 1995; Salvidio 1998). However they are seldom, if at all, used in long-term monitoring studies, because count data that require less time and effort are usually preferred (North American Amphibian Monitoring Program 1996). Count programs appear relatively inexpensive but produce data on the surface activity pattern of salamanders rather than on their population size or abundance. However, as this study has suggested, different percentages of salamander populations may be active on the surface in different ecological conditions, and thus caution should be used when comparing salamander populations living in different environments on the basis of simple count data. In these cases, the only way to deal with unknown sources of variation in observability is to estimate the observation probabilities (i.e., capture probabilities) for the samples being compared (Conroy and Nichols 1996).

In the case of temporary removal monitoring, the field effort could be maintained similar to count programs in which successive searches are planned. The main difference probably would be a much shorter time period between successive removals to prevent immigration from adjacent plots. In addition, laboratory facilities and collecting and transport permits might be needed to displace salamanders and maintain them in captivity. In any case, population size estimates resulting from removal methods appear to be a fine method to document long-term trends and should be taken into serious consideration when planning studies monitoring amphibian population fluctuations over time, at least in temperate climates, as the efficiency of removal methods in extremely complex (i.e., tropical rainforests) and freshwater habitats remains to be tested.

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A High Validity Census Technique for Herpetofaunal Assemblages

GORDON H. RODDA
US Geological Survey, Midcontinent Ecological Science Center
4512 McMurry Avenue, Fort Collins, Colorado 80525, USA
e-mail: Gordon_Rodda@usgs.gov

EARL W. CAMPBELL, III*
Ohio Cooperative Fish and Wildlife Research Unit, Ohio State University
Columbus, Ohio 43210, USA

and

THOMAS H. FRITTS
US Geological Survey, Midcontinent Ecological Science Center
4512 McMurry Avenue, Fort Collins, Colorado 80525, USA
e-mail: tfritts@compuserve.com

**Present address: National Wildlife Research Center, Hilo Field Station*
P.O. Box 10880, Hilo, Hawaii 96721, USA
e-mail: 76130.312@compuserve.com

In 1994 we were attempting to quantify the abundance of small lizards on Guam as a means of appraising the predatory impact of the brown treesnake (*Boiga irregularis*). Our mark-recapture effort had failed, due to an unknown combination of loss of marks and low recapture probability. We had identified several indices of lizard abundance (sightings per hour, trap captures per hour), but we were concerned that the ecological "signal" from these indices might be obscured by extraneous factors such as interobserver inconsistency, behavioral response of the lizards to detection or removal, etc. To test our indices, we elected to compare them to high validity absolute population density estimates that we obtained by an unprecedented method that we call a total removal plot: we physically isolated small patches of forest and counted the lizards encountered while we disassembled the forest leaf by leaf.

The technique worked much better than expected; we were able not only to obtain a complete count (a census) for a precisely defined area, but we also discovered an unexpectedly large number of animals. From the twenty total removal plots we have sampled on the islands of Guam, Saipan (both Mariana Islands of western Pacific), and Guana (British Virgin Islands, West Indies) to date (1995–1999), we have obtained an average of 160.5 reptile individuals per 100 m^2 plot (range 16–711). Documenting such high absolute densities has not only greatly enriched our understanding of reptile ecology, but it has also played a key role in interpreting the abundances of reputedly rare lizards to regulatory authorities hostile to scientific collecting. We are also able to quantify entire assemblages with total removal plots; previously we had to make the untenable assumption that our collecting technique worked equally well for all species of interest. The technique has also given us a tool for hard validation of myriad sampling methods. Most evaluations of sampling methods (Brown and Nichols 1993; Campbell and Christman 1982; Fitch 1992; Grant et al. 1992) are "soft" in the sense that they compare the number of specimens obtained, or the cost of the sampling tools, but they do not measure either precision or bias of the population estimate. The outcome of that omission is that one knows only the denominator (cost) of the technique's benefit-cost ratio, which promotes the use of low-cost methods that are erroneous to an unknown degree. Another soft validation approach has been to estimate the amount of bias and precision by contrasting two techniques, both of which are of unknown validity (e.g., Rotella and Ratti 1986), an approach that has drawn criticism but no practical solution (White 1992). In forthcoming papers we will report our measurements of the precision and bias of various techniques by comparing each technique to the complete census provided by total removal plots. In this work we describe our total removal method.

METHODS

The four major components of our method are: 1) plot selection, 2) plot characterization by non-destructive methods, 3) physical isolation of the plot, and 4) total disassembly and removal of all aboveground organic matter to census the inhabitants. Our method differs from traditional tropical forest litter plots (Inger 1980; Lloyd et al. 1968; Scott 1976) in that we physically isolate the plots prior to sampling them, and we remove all aboveground vegetation.

Selection of the plot site.—We sampled plots of 100 m^2 (= 0.01 ha). Larger plots are desirable from the standpoint of minimizing boundary effects, but they require substantially more work without a concomitant increase in the geographic representation of the sample. All things being equal, numerous smaller plots spread throughout a study area are more likely to reflect average conditions than are a few large ones, but small plot results may be grossly distorted by the habitat and human disturbance associated with boundary clearing. The tradeoff between minimizing boundary effects and maximizing geographic representation will have a different optimum in different habitats. Because the forest canopy

was relatively low (usually about 10 m high) in the areas in which we have worked, plots of 100 m^2 were judged to be of minimum size to permit the felling of canopy trees within the enclosed area. Larger plots would be desirable for taller canopy forest. Smaller plots might be optimal in shrubland.

We selected sites, without knowledge of reptile density, on the basis of habitat type, vegetation structure, and substrate. Habitat type (e.g., *Leucaena leucocephala* forest) was chosen on the basis of our sampling objective. Plot location was selected qualitatively to represent the average vegetative structure of the target habitat. For example, if the target habitat typically had a canopy height of 11 m and canopy coverage of about 75%, we selected a sample plot that would conform to those averages. Additionally, it was impractical to physically isolate plots that had a fissured or rocky substrate. Therefore, we positioned plots to have a sandy or earthen substrate, with minimal rock outcrops or at least rock outcrops that could be isolated. Our plots were usually 10 x 10 m, but the shape was occasionally modified to 8 x 12.5 m or a similar rectangle of 100 m^2. The actual boundary line sometimes deviated slightly from a straight line to avoid troublesome substrate or large leaning trees. Any subtractions made by deviating to the inside of the nominal boundary were balanced elsewhere by equivalent additions.

Plot characterization.—Prior to isolating each plot we sampled the reptile populations with a variety of nondestructive relative and absolute population abundance measures, and we always quantified the structure and composition of the plot's vegetation before disturbing it. At the time of vegetation removal, we weighed the fresh mass of all vegetation removed. The large quantity of wood made it impractical to obtain dry mass measurements. Careful analysis of tropical forest biomass by others (Art and Marks 1971; Lieberman and Lieberman 1994; Odum et al. 1970; Rodin and Basilevic 1968) indicates that dry forest biomass is about 50% of the fresh biomass. Fittkau and Klinge (1973) weighed each component of an Amazonian forest separately and found that only 2.2% of the fresh mass was leaves (84% stems and trunks, 7.5% litter, and the remainder vines and lianas). Thus we presume that our biomass measurements reflect primarily the amount of wood in a study plot.

Isolation of the forest plot.—The first step was to remove enough low-lying vegetation to insure that animals could not use the vegetation as a bridge across the ground level barrier that we would later put in place. The ground-level barrier we used was constructed with 508 mm wide (sold as "20 inch wide") aluminum flashing buried 50–100 mm into the ground. In other localities the height of the fence may need to be adjusted for the scansorial skills of the target species. To effect an unequivocal separation, we cleared a swath about 1.5 m wide to a height of about 2 m along the course in which the flashing fence was later placed, and excavated a furrow into which the flashing was to be inserted. Furrow excavation always revealed root obstacles, which were severed to allow the later burial of the bottom of the flashing. In addition, if the soil was shallow we placed rebar supports at places where the flashing had to bend sharply, such as the corners of the enclosure, and at especially high and low places. Generally we used 3 or 4 supports per 10 m side. Additional rebar supports were later positioned where a roll of flashing ended or began. We used rebar for the supports, but any sharpened metal post would do. The preferred length of the bar depends on the hardness of the soil or substrate. We used rebar pieces about 0.9 m long pounded vertically into the ground at the bottom of the trench such that the top of a bar was level or below the height of the flashing whenever possible. In the sandy soils present in our British Virgin Island sites we did not find it necessary to use rebar supports.

Five rules were followed to minimize the influence of this trenching/clearing activity on herpetofauna: 1) activity occurred during the day to minimize disturbance of nocturnal geckos; 2) no motorized tools were used (in our experience, chainsaws in particular induce flight in lizards); 3) brush removed at this stage was dispersed rather than being piled, so that animals would not be attracted to potential brushpile refugia; 4) half of the removed vegetation was placed within the plot and the other half was placed outside, to limit any bias this vegetation might have on lizard movements; and 5) this activity was scheduled to occur 24 h prior to initiation of vegetation removal, so that any terrestrial species disturbed by the activity would have plenty of time to regain their normal home range prior to isolation. Because heliophilic lizards were attracted to the light gap created by vegetation removal, it was deemed desirable to otherwise minimize the interval during which heliophils might colonize the light gap.

Canopy separation.—Canopy separation inevitably had an adverse effect on arboreal species. Most arboreal species in the Mariana Islands are also nocturnal. Unless physically displaced, nocturnal species did not attempt to move away from an area of daytime disturbance until the following nightfall. However, the diurnal species disturbed by daytime canopy separation moved away immediately, but returned to their home ranges if given sufficient daylight hours without a disturbance. Therefore, in areas where the arboreal species are mostly diurnal (Virgin Islands) we separated the canopy at night (at the same time we emplaced the ground-level barrier). In areas where the arboreal species are mostly nocturnal (Mariana Islands) we separated the canopy as early as possible in the day on which the barrier would be placed after nightfall. In this way, nocturnal species would have no opportunity to vacate the plot if they were disturbed by canopy separation, and diurnal species would have at least half a day to return to their terrestrial haunts after we had left the area, before we returned to construct the barrier.

Canopy separation was straightforward in principle; a gap of at least 1.5 m was created between the aboveground vegetation inside the removal plot and the vegetation outside of the plot. The gap distance had to be maintained despite wind-induced tree movements, and the distance criterion was chosen to accommodate the jumping ability of the reptile species to be isolated. Where possible, we created the gap in the foliage directly over the line on which the ground level barrier was later placed, and in forests composed of trees with vertical trunks this could be achieved. However, our sites often had trees that had partially fallen as a result of hurricanes. We attempted to minimize inclusion of leaning trees when choosing a site, but could not always avoid them. The temptation was to cut all trunks, limbs, and branches that extended over the plot boundary. However, if all stems that crossed the perimeter line were cut, the total amount of aboveground vegetation formerly within the plot would have been reduced by the amount of leaning vegetation that entered the plot's "airspace" from trunks rooted outside of the plot. Furthermore, strict bound-

ary cutting creates excessively large light gaps (altering habitat for heliophilic species). The solution we chose was to generally leave intact all stems that arose from trees rooted within the plot, regardless of whether they passed to the outside of the barrier above ground level. This insured that the amount of aboveground vegetation sampled was the same as that which would have been found in the airspace of an average 10 x 10 m column of forest. We used extended pole clippers and arborist methods (Dial and Tobin 1994) to create the canopy separation.

Installation of barrier.—We installed the aluminum flashing barriers in the first hours of darkness on the night immediately preceding vegetation removal. This insured that nocturnal species would be trapped within the sampled plot (because they are loath to crawl into the open while humans are disturbing the area). The diurnal species were also trapped because they had already cloistered themselves in their nighttime refugia by the time we began barrier installation. Because the trench to receive the barrier had already been prepared, it took only 1–2 h for a crew of four to install the fence.

Barrier installation involved eight steps in the following order: 1) flashing inserted in ground; 2) rebar supports emplaced; 3) earth tamped to hold bottom of flashing; 4) rebar tied to flashing; 5) all seams and rugosities taped; 6) lithium grease sprayed on completed fence; 7) soil at base of fence wetted and retamped for better seal; and 8) protective glueboards placed.

The aluminum flashing was rolled out by one or two persons while one or two more forced it into the trench and backfilled soil. We found that it was vastly preferable to have the fence follow a subtly sinuous path rather than run in a straight line. Sinuosity in the fence line enabled it to conform to the inevitable irregularities in the ground's height, without the necessity for seaming the flashing or creating sharp curves that lizards could climb. Sinuousity also increased the barrier's vertical stability.

Soil tamping was only partially effective if the soil was dry. We found that wetting the soil helped, but it was important to avoid wetting the soil on the first tamping, because it was very difficult to wet the soil right next to the flashing without getting the flashing wet, and wet flashing could not be greased. Also, we found that tamping had more enduring benefits if completed only after the fence was in its final position.

To tie the flashing to the rebar it was necessary to punch two small holes (about 2 cm apart, pushing from the inside to the outside of the enclosure), one on either side of the rebar. Holes punched from the outside to the inside of the enclosure tended to create a rough spot on the inside, potentially enabling a climbing lizard to gain purchase and escape; therefore, this was avoided. One pair of holes was punched 5–10 cm below the top of the rebar, the other at the base of the flashing. A 20 cm long piece of tie wire was doubled into a U-shape and pushed through the flashing from the inside. After twisting the two ends tightly together around the post, the excess was cut off, and the protruding remainder folded down flush against the rebar.

After smoothing the tie wire against the inside, a 5 x 5 cm patch of aluminum tape (such as is sold at hardware stores for patching car bodies or mufflers) was placed over the inside ties. When carefully rubbed down, this tape presented an extremely smooth surface. Aluminum tape was also used to close the seam at the ends of flashing pieces. However, aluminum tape is expensive and it does not accommodate irregular surfaces. Therefore, for the outside surfaces of the barrier we used duct tape, which covered the irregular ties, rebar, and ends of flashing rolls.

We sprayed white lithium grease on all tape and rough surfaces, as well as the top 20 cm of the fence (both inside and out).

To minimize immigration/emigration by jumping lizards, we stapled paper glueboards (Rodda et al. 1993) on all elevated surfaces near enough to the barrier (inside and out) to tempt a leaping animal.

General removal strategy and inspection notes.— Live animals are extremely easy to detect; dead ones are easily lost in the debris. Therefore, it was our first priority to keep all the animals in the plot alive. As the barrier was secure for the target species, there was little opportunity for an escape, and therefore, it was not necessary to catch each animal on first sighting. Instead, we inspected the vegetation systematically and captured the animals when it was made easy by their being "trapped" against the fence or out in the open. We found it most productive to focus our efforts on minimizing the amount of vegetation that had been cut down but not yet inspected. Inspected vegetation was placed in trash cans greased on the outside to repel climbing lizards. We found it desirable to avoid using trash cans with wheels, as it was difficult to confirm that lizards were not clinging to the inside of wheels as the filled trashcan was being taken out of the plot for weighing.

The general strategy was to work from the outside in, first by pivoting into the plot any trees that leaned out over the fence. Usually, such leaners were pulled to the inside by ropes as they were being dropped. Although lizards jumping from trees have been very rare in our experience, almost all jumping occurred at the moment when tree tops were felled. Therefore, for such moments we assigned one person to do nothing other than watch for possible escapes. Fewer than five such attempts were detected, and most of these lizards were captured on the ground. The others were visually identifiable, allowing inclusion in the population estimate.

Lizards hid in remarkably small cavities. Gaps in wood grain as narrow as 3 mm concealed small geckos. Therefore, it was necessary to inspect every surface with great care. All vegetation was cut into modest-sized pieces before being inspected. Solid woody items were generally reduced to pieces less than 1 m long; wood with crevices was chopped apart completely. Leafy branches were harder to inspect and often needed to be chopped into hand-sized pieces. We found that lizards were often concealed: within dead or live leaves that had curled, within holes in rocks (all porous surface rocks were broken apart), under rocks and roots (all were excavated to solid undisturbed soil), within tree cavities (all were split open), and under bark (all loose bark was removed). As we carried out our search, animals were eventually exposed, causing them to flee and become extremely conspicuous. In a few cases, however, small unseen lizards were unintentionally trod under foot. We believe that most of these were found, either by visual detection of the carcass, or by paying attention to aggregations of flies or ants, which generally indicated the presence of a dead animal. We found that the most effective tactic was to keep the ground clear, so that animals were not lost by being inadvertently killed while hidden under debris. We found that raking tended to bury frogs and lizards rather than reveal them, so we avoided raking.

We found that some animals reacted with extreme distress to the sound of a chain saw. Therefore, we attempted to cut all trees leaning to the outside of the barrier with a hand saw (to minimize jumpers), and we avoided using a chainsaw until all upright vegetation was well within the perimeter of the plot. In the Marianas, we also maintained glueboards against the fence, to capture fleeing lizards that might not otherwise have been seen. Glueboards were not used in the Virgin Islands, where there were saurophagous birds (Pearly-eyed Thrashers, *Margarops fuscatus*) that would dart in among the researchers to consume lizards trapped on glueboards. It was necessary to closely monitor any glueboards left in sunny places, as the solar-heated glue became excessively hot, and rapidly induced hyperthermia in immobilized lizards.

We found that the sawdust created by the chainsaw could cover the grease on the flashing and make it possible for lizards to scale the flashing. Therefore, we faced towards the flashing when using the chainsaw, directing the resultant debris spray towards the center of the enclosure. Care was exercised to keep the barrier free of scattered soil and plant debris.

After the plot was cleaned down to mineral soil, we set a new array of glueboards within the plot and left the area. These traps were checked periodically until the following morning. Occasionally, a lizard was buried during vegetation clearing and undetectable in the duff until we left the area or night fell and the lizard ventured forth, only to be snared by the traps.

Evaluation

Validation of barrier adequacy.—We created three 3 x 3 m enclosures on Guam, removed all resident lizards, stocked the enclosures with at least five skinks and five geckos, left them for 24 h to give them opportunities to escape, and then recaptured all lizards within the enclosure to assess its permeability to lizards. The lizards were not marked. Thus if a lizard of the same species and general size had intruded and replaced one that had escaped, such a turnover might have gone undetected, though such a scenario was judged unlikely because the small size of the enclosures was expected to more highly motivate lizards to escape. The three enclosures were each coated with a different type of grease: spray automotive lithium grease, a spray cooking lubricant, and hand applied automotive grease. We found that the spray cooking lubricant lost its grip on the aluminum when sunlight hit the metal, and the hand applied grease was more difficult to apply than was the spray lithium grease. Within both greased test enclosures we detected no escapes, although we prefer to use the spray grease for its ease of application and more consistent coverage.

Applicability.—As indicated above, the total removal technique is limited to sites with suitable substrate. Fissured rock and streams preclude barrier effectiveness. The technique would be difficult but not impossible to apply to tall canopy forest, for which larger plot sizes would be recommended. The technique is suitable for all terrestrial and non-volant arboreal species (both vertebrates and invertebrates, though we have not endeavored to sample the vast number of invertebrates trapped in an enclosure). The technique is of particular value to herpetologists because it provides a total count for most of the smaller species: small frogs, salamanders, lizards, turtles, small crocodilians, snakes, mammals, and all non-volant non-fossorial invertebrates. The fence would need to be increased in height or durability to restrain large or arboreal snakes, crocodilians, mammals, or high-leaping frogs. It is probably not suitable for any gliding or flying species (e.g., *Chrysopelea, Ptychozoon, Draco*, birds, and bats). Surprisingly, brown treesnakes are caught in total removal enclosures about as often as one would expect from their density (estimated by mark-recapture: Rodda and Fritts 1992), though this arboreal species is certainly capable of scaling the fence.

We were surprised by the large number of individual lizards collected by this technique (range 16–709 per 100 m^2 plot). Individual lizard species densities ranged from 1 to 676 per 100 m^2 plot (100–67,600/ha). Species that occur at densities less than about 100/ha present special difficulties in sampling. On average, one individual of such species will be found per 100 m^2 total removal plot, requiring a very large number of plots for adequate sampling. However, such species often defy enumeration by visual surveys, mark-recapture and many other collection techniques as well. It is notable that a single 100 m^2 removal plot in Amazonia revealed the presence of five individuals of one anuran that was not otherwise detected by an expedition that collected over 500 specimens (Reynolds et al. 1997); thus total removal methodology may indicate that apparently rare species are in actuality well above the low-density threshold of about 100/ha.

We have not attempted to use the technique for censusing specialized fossorial species, such as the sand skink *Neoseps reynoldsi*. The problem of fossorial species burrowing under the barrier is apparently not as limiting as one might suppose, as Mushinsky et al. (1997; Mushinsky and McCoy 1999; Sutton et al. 1999) have efficiently used similar barriers with pitfalls to census *Neoseps*.

Costs.— The materials cost for total removal sampling was minimal, as all materials except tape and grease were reused. Aluminum flashing was cleaned and patched (when necessary) with aluminum tape, but reused flashing eventually needed replacement (1999 cost about US $2/m). The much greater cost was that of labor involved in clearing the vegetation. Discovering the many animals in a rich area is very enjoyable work, and we had considerable success obtaining the services of volunteers. Our labor needs averaged 0.83 person-hours/m^2 (range 0.45–1.56). To provide a comparison with other collecting methods, we used an average of 0.97 person-hours per specimen obtained (range 0.09–1.56). However, the labor costs were not dependent on the area cleared or the specimens obtained, but on the amount of vegetation to be checked. The relationship between fresh vegetation biomass and person-hours required for complete inspection was fairly strong ($r^2 = 0.70$), yielding the equation: Predicted PersHrs = 34.85 + 0.018*(kg of fresh vegetation). In our plots, the median mass of fresh vegetation was 1529 kg, corresponding to 63 person hours of labor.

There are innumerable opportunities for conducting total removal plot sampling in areas already destined for deforestation. These provide an excellent opportunity to extract valuable information from animals that are doomed along with their habitat. However, in some cases sampling objectives may dictate population enumeration in areas not otherwise due for clearing. Because the patch size is small in relation to regenerative processes in most areas, regrowth is rapid. However, development of weeds and light gap species was encouraged by the clearing created during total removal sampling.

Comparison to alternate sampling techniques.—The method described herein has greater face validity that almost all other tech-

TABLE 1. Primary differences between total removal plots and other techniques for quantifying population attributes of herpetofauna.

Detection technique	Analytical tool	Key advantages in comparison to total removal	Key disadvantages in comparison to total removal
general collecting	species list	efficient tool for obtaining species list; provides microhabitat data	can overlook cryptic species; may have strong detection biases
general collecting	species accumulation curve	good geographic dispersion of samples	irregular and poorly defined increments of effort; may have strong observer biases
road cruising	catch per unit effort (CPUE)	less strenuous	geographic coverage, selectivity, and abundance unknown; little control over placement of samples
pitfall/drift fence array	CPUE	high specimen yield per man-h for arrays already in place	unknown detectability differences among species, among arrays, and among sample times
trap or coverboard survey	CPUE	easy to disperse traps for broad and representative geographic coverage	must make untenable assumptions about equivalence or constancy of capture probabilities
breeding pond or hibernaculum survey	count as index	many animals sampled quickly and easily	ecological density unknown and usually unknowable
visual encounter survey	CPUE	usually easy to disperse transects for broad and representative geographic coverage	unknown detectability differences among species, transects, observers, and sample times
visual encounter survey	DISTANCE analysis (estimate distance from animal to transect centerline)	usually easy to disperse transects for representative coverage	requries difficult assumption that all animals detected, and detected before movement from centerline; observer bias likely in distance estimation
trapping webs	DISTANCE analysis (traps placed in precise radial array)	quick and flexible in placement of web	requires difficult assumptions about uniformity of habitat and total capture success at center
trap or hand capture	"removal methods" (extrapolation of capture rate decline under constant effort)	estimate obtained quickly (in some cases) with relatively minimal equipment	requires sensitive assumption about constancy of capture probability
trap or hand capture	mark-recapture	may be more efficient for species at low density	requires a reliable marking technique; limited sample may force assumptions about capture probability equivalence
traditional litter plots	count	easier to obtain good ecological and geographic dispersion of sample points	requires questionable assumptions about complete capture probability; not suitable for species that hide in trees
1 m^2 sampling frames or other small transects	count	easy to obtain good ecological and geographic disperson of sample points	cannot use on large species or species that flee from investigator, use uneven substrate (sampling frame), or refuge in trees

niques, but it requires more effort. Therefore, any comparison among methods should specify greater validity and often greater cost when comparing total removal sampling to any other method. Those differences are constant from method to method and therefore have been omitted from Table 1. The greater cost of total removal sampling does not apply in all circumstances; in some soils, installation of a long drift fence with pitfalls would require more effort than that needed for a total removal plot. Other techniques (e.g., litter plots) are less work, but have so much lower success that the yield per unit effort is lower (in addition to being of poorer quality).

The use of litter plots is the sampling technique most similar to total removal plots, and some discussion is warranted to justify the additional expense of bounding a plot and removing the trees. We initially chose to remove the trees because we were interested in the relative densities of arboreal species, which are not sampled

by traditional unbound litter plots. In the process of disassembling trees we have become sensitized to the variety of ways in which traditional unbound litter plots may be undercounts of terrestrial species. For example, in our experience a surprisingly large fraction of the terrestrial individuals take refuge inside tree bases or tree cavities, or by ascending trees. These would be overlooked by traditional litter plot methods. An example of this was inadvertently provided by the clever series of litter plots conducted by Slowinski et al. (1987); they found much higher numbers of individuals of diurnal terrestrial species when they cleared the plots at night. They interpreted the difference between day and nighttime capture rates as reflecting diel arboreal movements of the target species, but another interpretation is that the sleeping animals were captured before they had an opportunity to flee into the trees (as they did during the day). We have not attempted to test this hypothesis by ringing trees with adhesive traps; such an approach would presume the absence of cavities that would allow small lizards to bypass the glue barrier by passing inside tree hollows or under glueboards. In the forests in which we have worked, it would be very difficult to have that assurance. To determine if forest removal was necessary, we attempted to collect all of the lizards from one plot using hundreds of glueboards for a week prior to disturbing the vegetation. One non-climbing skink, *Carlia fusca*, was adequately sampled by this approach, but the remaining terrestrial and arboreal species were undercounted.

Traditional litter plots are also vulnerable to the stealthy or undetected escape of individuals through the litter. For example, in the Virgin Islands we found that *Sphaerodactylus macrolepis* geckos are adept at responding to footsteps and fleeing through the litter ahead of an approaching searcher. In the absence of a barrier these diminutive lizards might exit the plot undetected. In this regard it is notable that a pioneering series of litter plots by Heatwole and Sexton (1966; Sexton et al. 1964) used a partial barrier (cheesecloth) at the perimeter of their plots, and obtained notably higher counts than have been obtained by subsequent researchers in lower Central America using unbound litter plots (Fauth et al. 1989; Heinen 1992; Lieberman 1986; Scott 1976; Slowinski et al. 1987). The most direct evidence of the difference between bound and unbound litter plots was provided by a single comparison in Amazonia by Reynolds et al. (1997). They sampled one unbound 100 m^2 litter plot and obtained three anurans, a value comparable to other litter plot samples from the Amazon (Allmon 1991; Gascon 1996; Rodríguez 1992,). However, in an equivalent-but-bound total removal plot nearby they obtained 29 anurans and one snake. Until this matter is clarified further, it seems prudent to conclude that traditional litter plot methods may be significantly undercounting stealthy species.

Animal density estimation is the dual challenge of estimating the number of animals and determining the area that such a population of animals is using. In the case of total removal plots, we obtain a census of animals from a sharply defined area. In comparison to all other methods (Table 1), total removal plots have higher face validity, though at a cost in labor and therefore geographic dispersion of samples. We think that the technique is most valuable not as an operational sampling technique for single species, but as a means of measuring the bias and precision of less expensive alternate techniques. None of the alternative techniques provide a validated means of comparing the abundances of different species, however. For operationally quantifying herpetofaunal assemblages, a total removal methodology may be preferred.

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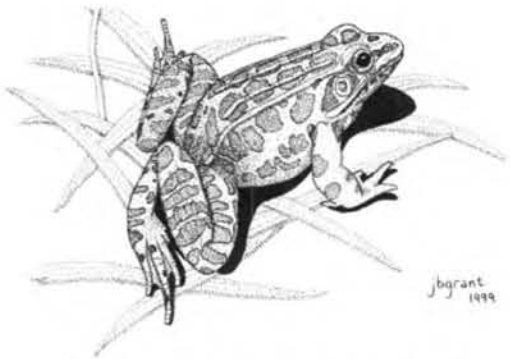
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Rana palustris. Illustration by J. B. Grant.

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Technique for Temporarily Marking Lizards That Does Not Require Capture

KELLY M. PASSEK
Department of Biology, Virginia Tech
Blacksburg, Virginia 24061-0406, USA
e-mail: kpassek@vt.edu

and

MICHAEL E. COLLVER
609 South Main Street, Blacksburg, Virginia 24060, USA
e-mail: mcollver@mail.mcps.org

Often, researchers need to track individual animals over the course of consecutive days to measure parameters such as territory size or home range size or to determine the status of a given individual (e.g., territory holder, floater). Because multiple animals may be present within the given study area, it is obviously important to assure that the same animal is followed from day to day.

One way to keep track of individual animals is to mark them. Reptiles are commonly marked using techniques such as scale clips, toe clips, unique paint patterns and tail beads. These marking techniques all require that the animal be initially captured in order to apply the unique mark. However, it is more difficult to capture animals after they have had the experience of being captured (Marcellini and Jenssen 1991), and often, capture is needed to complete the data collection for a study. Researchers may spend excessive time at the end of a study attempting to capture animals in order to take final measurements, blood samples, etc. If these animals cannot be captured, data will be lost. Thus a technique that allows animals to be marked without the need to capture them may save time and prevent frustration in the field by allowing animals to remain naïve with respect to capture, and thus easier to catch at the end of the study than those otherwise caught at the beginning of the study simply for the purpose of marking them. Also, because of the reduced handling time, there is less opportunity for damage (e.g., tail breaks) to occur to the animal. Finally, capturing an animal prior to data collection may result in the animal becoming wary of the observer and therefore exhibiting abnormal behavior during data collection due to observer presence. We have developed a technique for temporarily marking *Anolis carolinensis* without the need for initial capture that may be applicable to other lizard species.

A rubber squeeze bulb (we used an ear bulb syringe) was placed into the widest diameter end of a fully extended (1.6 m) telescoping fishing pole (with the terminal metal eyelet removed) so that the elongated tip of the squeeze bulb was completely inside the pole with only the bulb remaining on the outside. The junction between the bulb and the pole was sealed with duct tape (Fig. 1). Once the lizard of interest was in view and relatively close (within 4 m) to the observer, a small amount of model airplane paint (Testors® gloss enamel) was drawn up into the tip of the pole opposite the squeeze bulb. Model airplane paint (with propanol as the solvent) has been shown to have no adverse affects on lizard survivorship (Jones and Ferguson 1980) as opposed to other types of paints such as those using xylene as a carrier (Boone and Larue

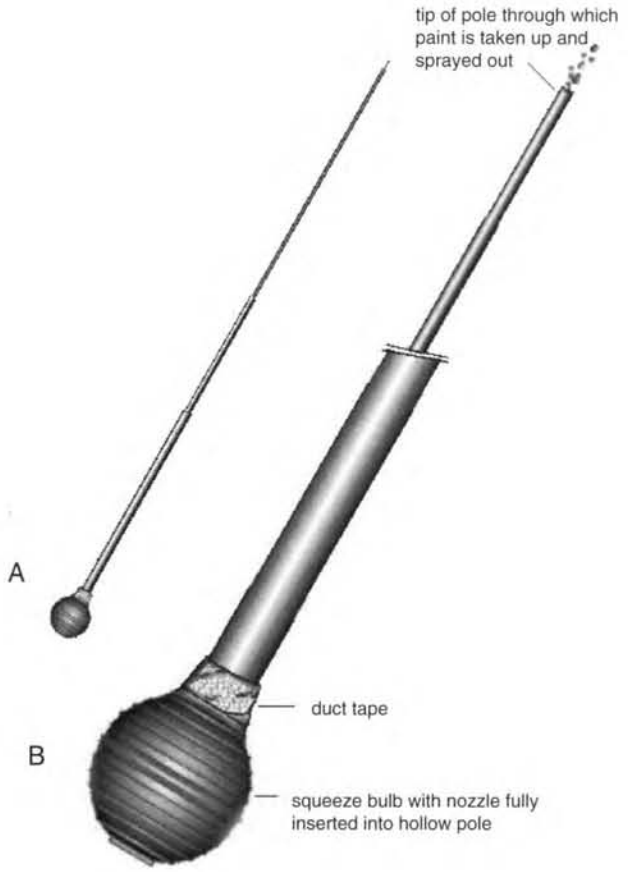


FIG. 1. Paint spraying device for temporarily marking lizards. A. Telescoping fishing pole in its fully extended (1.6 m) position. B. Enlarged view of both ends of paint spraying device.

1999). Within 60 sec of taking paint up into the pole, the tip of the pole was placed within one meter of the lizard and the bulb was quickly squeezed to release a light mist of paint. This resulted in the dorsal surface lizard becoming patterned with a number of small (<1 mm diameter) paint dots. Usually, the paint dots were not visible on the lizard unless the lizard was viewed with binoculars. The paint spray was not powerful enough to knock the lizard off of its perch, nor did the lizard move very far once sprayed (<0.5 m). Although we are not certain how long the paint took to fully dry on the lizard, we never found an animal to have smeared paint dots once it was captured at the end of the observation period.

Different animals in the same area were marked in either of two ways. In some cases, we used different paint colors for different animals. In other cases where we used the same paint color for animals in close proximity to each other, we noted the unique pattern of dots produced by the sprayed paint and used that as a means of identification once the lizards were captured.

Field studies investigating the effects of paint-marking on lizard survivorship have shown that lizards with conspicuous (brightly colored to the human eye) marks do not appear to have a reduction in survival when compared to inconspicuously marked lizards (as measured by recapture rates) (Jones and Ferguson 1980; Simon and Bissinger 1983). This lack of a survival difference has been attributed to a lack of detection by visually oriented predators (Jones and Ferguson 1980). However, we also need to consider the context in which marks will be perceived by conspecifics. Colors are recognized as indicators of status and physiological state in many animals (see Cooper and Greenberg 1992), so artificially adding color could interfere with a natural signaling system and thus affect the outcome of our studies (e.g., Burley et al. 1982). It is therefore beneficial that the marks produced by this technique are relatively inconspicuous and that multiple paints can be blended to achieve a full range of colors.

Perhaps the only caution to using this marking technique is that within 2 to 3 min of spraying the tip of the pole must be cleaned to prevent clogging. (After 60 sec with the paint at the tip of the pole, the paint would dry just enough to prevent it from being sprayed out in a fine mist at the lizard). We cleaned the pole by repeatedly (4 to 5 times) taking up thinner and spraying it back into the jar. We were able to use each 7.5 ml jar of Testors® enamel thinner to clean the pole approximately ten times.

Any marking technique that does not initially require capture of the study animals is likely to be an improvement over techniques requiring capture. Our technique is not toxic to the animal and relatively inconspicuous. It is also simple and quick to employ, requiring very little extra equipment to be carried in the field.

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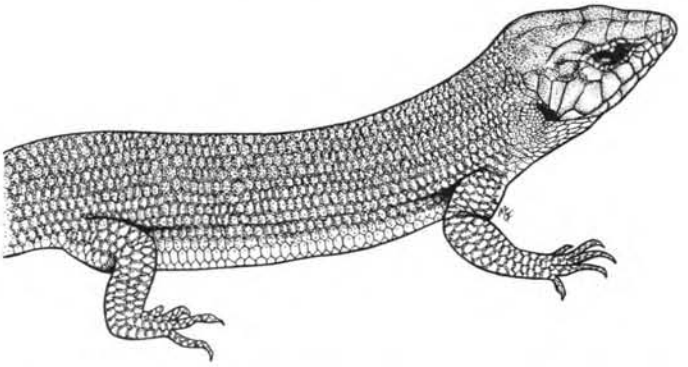
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Eumeces laticeps (Broad-headed Skink). Illustration by Michael G. Frick.



FIG. 1. Transmitter in PVC sleeve bolted directly to the carapacial margin. Note the reasonably tight fit of this unit to the shell.

than the transmitter). Next, a portion of each end of this tube was cut away to leave a flat tab extension. The tabs were drilled to accept stainless steel bolts, for attachment to holes drilled in the marginals of the turtle being tagged. The transmitter was next coated (except for the ends) with multipurpose cement (TITESEAL all purpose, T62-04) and inserted slowly into the PVC tube. After a curing period of 24 h these assembled units were engraved with a rotary tool on the upper side to identify the signal that would be given by the transmitter inside, e.g. 258. The tubing was similarly marked with bold indelible black ink to make a very visible number (Fig. 1). The completed units, which weighed about 35 g, were then bolted to the carapace through two holes drilled in the marginal scutes to the left of midline (Fig. 1) to reduce interference with mating behavior. What resulted was a very durable bond between transmitter and tubing and a solid attachment to the shell. Of seven transmitters attached in this fashion, six were found intact after one year, while only one of eight affixed with monofilament line was located.

Our attachment method could be modified to accommodate data loggers, radiotransmitters, or other small pieces of equipment. Finally, we do not endorse the use of ultrasonic tracking equipment in all situations. It is highly useful in marine habitats and some freshwater situations, but signal attentuation by vegetation, trees, brush, or other debris in seasonally inundated woodlands adjacent to rivers can make it extremely difficult, if not impossible, to locate tagged animals that move into those settings.

Acknowledgments.—We thank Carlos Crocker for help with the initial fastening of transmitters with monofilament line, and Marlin Gregor of Sonotronics for discussion which led to the more effective means of attachment reported here.

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 31, Number 1 (March 2000). Submissions should be directed to one of the section editors (contact information located on inside front cover of this issue), as follows: amphibians (Painter); lizards, amphisbaenians, crocodilians, *Sphenodon* (Hauge); snakes and turtles (Butterfield).

CAUDATA

AMBYSTOMA BARBOURI (Streamside Salamander). **REPRODUCTION.** Geographically isolated populations of *Ambystoma barbouri* have recently been verified from middle Tennessee (Scott et al. 1997. Herpetol. Rev. 28:155). Information on the natural history of these populations is limited to a report by Ashton (1966. J. Tennessee Acad. Sci. 41:106–111), who commented on the unusual, stream-breeding habits of *A. texanum* in Davidson County, Tennessee. The Davidson County population discussed by Ashton is thought to be *A. barbouri* rather than *A. texanum* (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington. 587 pp.). Here, we report a second breeding stream in the Central Basin of Tennessee and provide information on the timing of reproduction, egg mass size, and hatchling size.

Egg masses and hatchlings were discovered in the southernmost section of Puckett's Creek (35°49'N, 86°28'30"W), in Rutherford County, on 10 March 2000. Puckett's Creek is a first-order stream bordered by a narrow (5–30 m) strip of forest and ca. 1.0 km of field extending either to state roadways or residential housing. The eggs were found attached in a monolayer to the underside of flat rocks located in intermittent pools within the stream course. A single egg mass was collected and transported to the laboratory for rearing and confirmation. Within three days all of these eggs hatched and all hatchlings were measured (N = 51; mean TL ± 1SD = 15.6 ± 1.2 mm). Seventeen additional egg masses were located on 14 March 2000, but several were deteriorating following hatching or dehydration. Clutch sizes were estimated from ten intact masses (eggs per mass: 65, 61, 52, 16, 15, 15, 14, 8, 7, 5). Based on time of hatching and assuming a 29–82 day incubation period (Petranka, *op. cit.*), we estimate that oviposition occurred between late December and mid-February. The Middle Tennessee region is rapidly expanding. Residential construction is currently underway at the north end of Puckett's Creek, approximately 3.0 km from this unstudied population.

Submitted by **KURT J. REGESTER** and **BRIAN T. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

PLETHODON CADDOENSIS (Caddo Mountain Salamander) and ***PLETHODON SERRATUS*** (Southern Redback Salamander). **NOCTURNAL CLIMBING ACTIVITY.** Nocturnal surface activity in the plethodontid salamander genus *Plethodon* has been well documented for a variety of species (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.; Spotila 1972. Ecology 42:95–125). Observations on the nocturnal climbing abilities of some members within this genus as well as in other plethodontids, however, have appeared less frequently in the literature (Cliburn and Porter 1986.

J. Mississippi Acad. Sci. 31:91–96; Jaeger 1978. Copeia 1978:686–691). Herein, we report on nocturnal and climbing activity in two plethodontid species taken from the same study site.

On the evening of 14 April 2000 between 2030 and 2130 h, a group of 14 observers visited an historical collection site known to harbor large numbers of both *P. caddoensis* and *P. serratus*. The locality is in the Ouachita National Forest along Forest Rd 73 (ca. 0.8 km S St Hwy 8), Montgomery County, southwestern Arkansas, USA (Trauth and Wilhide 1999. J. Arkansas Acad. Sci. 53:125–137). The sky was clear, the air temperature was ca. 17.0°C, and the ground surface litter was dry. This region of the National Forest had received moderate rainfall two days prior to our arrival. The oak/hickory forest habitat is an east-facing, moderately-sloping embankment of small, loose talus; the bank steepens sharply along an intermittent stream. Initially, we utilized an established collection technique involving the removal of surface rock in swaths to reveal salamanders hidden within the interstitial spaces of the top 20–30 cm of rock talus in the riparian zone. Although this method was successful, collectors began noticing both species of salamanders on the exposed surfaces of small-to-intermediate sized boulders. Moreover, 11 of 52 (21%) *P. caddoensis* were taken from the trunks of trees up to a height of 50 cm. In more than one instance, individuals of both species were found together on the tops of boulders. In addition to the 52 *P. caddoensis*, 45 *P. serratus* and 3 *Eurycea m. multiplicata* were found at this streamside habitat.

Jaeger (1978. Copeia 1978:686–691) noted that terrestrial salamanders (e.g., *P. cinereus*) that climb plants at night consume a significantly larger volume of food than do non-climbing conspecifics. An apparent lack of aggressive behavior between *P. caddoensis*, a larger species (in our sample, average SVL 37.33 ± 10.6 mm; range 16–52) as compared to *P. serratus* (28.16 ± 8.75; range 18–45), presumably allows each species to coexist syntopically both above and below the ground surface.

We thank the Department of Biological Sciences, Arkansas State University, for providing financial support for this field study.

Submitted by **STANLEY E. TRAUTH, MALCOLM L. McCALLUM*, BEN J. BALL**, and **VERNON E. HOFFMAN**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467-0599, USA; *Address of MLM: Environmental Science Ph.D. Program, P.O. Box 847, Arkansas State University, State University, Arkansas 72467, USA; e-mail (SET): strauth@navajo.astate.edu.

TRITURUS MARMORATUS (Marbled Newt). **PREDATION.** Adult European newts typically feed on earthworms, insects, and other invertebrates (Griffiths 1996. Newts and Salamanders of Europe. T & A.D. Poyser. London). Additionally, some studies have reported intra- and interspecific predation by adults on larvae, as well as predation by larvae on larvae. However, predation by adults on adults seems exceptional (Crump 1992. *In* Elgard and Crespi [eds.], Cannibalism: Ecology and Evolution Among Diverse Taxa, pp. 256–276. Oxford University Press. New York).

During a newt survey in June 1999, we netted a bulky adult female *Triturus marmoratus* (SVL ca. 80 mm), in Veneros Lake (Asturias, Northern Spain, 43°10'N, 5°54'W; elev. 1300 m). After a few minutes, the female regurgitated a gravid female *T. alpestris* (Alpine newt), SVL ca. 55 mm, with the anterior body, including the head and forelegs, in an early stage of digestion (prey:predator SVL ratio 0.68).

Submitted by **GERMÁN ORIZAOLA** and **CARLOS RODRÍGUEZ DEL VALLE**, Departamento de Biología de Organismos y Sistemas (Unidad de Zoología), Universidad de Oviedo, c/ Catedrático Rodrigo Uría s/n, 33071 Oviedo, Spain; e-mail (GO): orizaola@correo.uniovi.es.

ANURA

BUFO BOREAS (Western Toad). **PREDATION.** In Oregon and throughout much of its range in the northwestern United States and western Canada, the Columbia spotted frog (*Rana luteiventris*) commonly shares breeding sites with the western toad (*Bufo boreas*) (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. University of Idaho Press. Moscow. 353 pp.; Green and Campbell 1984. The Amphibians of British Columbia. British Columbia Provincial Museum. Handbook No. 45. 101 pp.). Previous diet analyses of *R. luteiventris* have not reported western toads among items consumed, and suggest they rarely consume vertebrate prey. Here I report *R. luteiventris* predation on metamorphic and late-larval *B. boreas* at a site near Anthony Lake (elev. 2160 m; Baker County) in northeastern Oregon, USA. On 8 August 1998, I observed four adult *R. luteiventris* in hydrophytic vegetation adjacent to an aggregation of metamorphic *B. boreas*. More than 150 *B. boreas* (14–17 mm SVL; Gosner stage 43–45) were densely packed into ca. 1.5 m^2 along the marsh shoreline. One adult female *R. luteiventris* (85 mm SVL) ingested two toadlets from this aggregation during about 15 minutes. I disturbed a second adult female *R. luteiventris* (83 mm SVL), who swam from her position near the *B. boreas* aggregation to a refuge in submerged vegetation. After remaining motionless underwater for about 20 seconds, the frog ingested a *B. boreas* tadpole (Gosner stage 40–41) that swam directly in front of her. Neither spotted frog regurgitated the *B. boreas* before, during, or immediately after the 5 minutes associated with capture and measurement.

With the exception of one observation of cannibalism (Pilliod 1999. Herpetol. Rev. 30:93) and one report of an 'unidentified anuran' among stomach contents (Whitaker et al. 1983. Northwest. Sci. 57:147–154), vertebrates have not been documented as prey of *R. luteiventris* (Miller 1978. Northwest. Sci. 52:243–249; Turner 1959. Amer. Midl. Nat. 61:403–413; Moore and Strickland 1955. Amer. Midl. Nat. 54: 253–256). Many *Bufo* species are known to possess dermal compounds that make them unpalatable to certain predators, and deterrence effectiveness can vary with *Bufo* phenology and feeding mode of the predator (Brodie et al. 1978. Herpetologica 34:302–306; Licht and Low 1968. Copeia 1968:547–551; Wassersug 1971. Amer. Midl. Nat. 86:101–109). These observations suggest that adult *R. luteiventris* at this site are not deterred by unpalatable skin compounds in larval and metamorphic stages of *B. boreas*, and that this predator may seek young toads during the short temporal window when they are available at montane sites.

I thank Allison Kuehl for her support and help with fieldwork, and Erik Jules and R. Bruce Bury for constructive comments. Funding for this work was provided by the U.S. Forest Service.

Submitted by **CHRISTOPHER A. PEARL**, USGS, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, Oregon 97331, USA.

BUFO MARINUS (Marine Toad). **FEEDING BEHAVIOR.** *Bufo marinus* is reported to feed on a large variety of prey items throughout its range (Alexander 1964. Herpetologica 20:255–259; Campbell 1998. Amphibians and Reptiles of Northern Guatemala, the Yucatan, and Belize. University of Oklahoma Press Norman, pp. 68–69; Jaeger 1976. Copeia 1976:833–834). Herein we report an unusual instance of *B. marinus* preying upon a large column of army ants (*Eciton* sp.).

On 11 May 2000 at ca. 1900 h we observed a single *B. marinus* consuming army ants as the ants traveled along the bank of Lake Shimigay, Departamento Loreto, Peru. The lake is located on the southern bank of the Rio Napo ca. 1 km southeast of the village of LLChanga.

After the toad fed upon the ants for several minutes, the ants began attacking the toad. The attacking ants prompted the toad to leap ca. 1 m into the shallow water along the edge of the lake, where it began using its forelimbs to brush the attacking ants off of its body. A few minutes later the toad returned to the army ant column and resumed feeding.

Submitted by **WINSTON CARD** and **BRIAN AUCONE**, Dallas Zoo, Department of Herpetology, 650 R.L. Thornton Freeway Dallas, Texas 75203, USA; e-mail: reptiles@airmail.net.

HYLA CADAVERINA (California Treefrog). **PREDATION.** On 14 March 2000, a 30 cm green sunfish (*Lepomis cyanellus*), a non-native predatory fish, was observed in a pool with a light colored object protruding from its mouth. The pool (2.5 m L x 1.5 m W x 30 cm deep) is located in Cedar Creek in the Cleveland National Forest (T13S R3E NE1/4 Sec 31), San Diego County, California, USA. Upon capture it was noted the right rear foot of an adult *H. cadaverina* was extended from the mouth of the sunfish. The fish was photographed, and the partially digested treefrog remains were removed and preserved in 70% ethanol. The right rear foot that had not been ingested showed no sign of digestion, suggesting the treefrog was captured while still alive. *Taricha torosa*, *Bufo boreas*, and *Hyla regilla*, other native aquatic-breeding amphibians, also occur at this site. A slide of the *L. cyanellus* (with the *H. cadaverina* foot extending from its mouth) and the *H. cadaverina* remains were deposited in the California Academy of Science as vouchers (CAS 211867).

Submitted by **EDWARD L. ERVIN** and **ROBERT N. FISHER**, U.S. Geological Survey, Department of Biology, San Diego State University, San Diego, California 92182-4614, USA, and **KYLE MADDEN**, NSW National Parks and Wildlife Service, P.O. Box 1967, Hurstville, Australia.

LYSAPSUS LIMELLUS (NCN). **REPRODUCTIVE TRAITS.** *Lysapsus limellus* is restricted to areas along the Paraguay and Paraná Rivers, from Rondonia and Matto Grosso (Brazil) to central Argentina. Within Argentina, *L. limellus* occurrs in the provinces of Chaco, Formosa, Corrientes, and Santa Fé, and north of Buenos Aires (Cei 1980. Amphibians of Argentina. Monit. Zool. Ital. (NS) Monog. 2: 609 pp.). *Lysapsus limellus* is very aquatic, occurring in semi-permanent and permanent ponds (Hamann and Kehr 1997. Herpetol. Rev. 28:85; Kehr and Basso 1990. Copeia 1990:573–575.). Herein we report the first reproductive traits of the species.

Between February 1995 and November 1997, in seven samples, we collected 91 specimens (43 males and 48 females). Fifteen gravid females were collected on the following dates: 17 Feb 95 (N = 5), 28 Nov 95 (N = 3), 24 Feb 97 (N = 2), 10 Mar 97 (N = 1), 9 Apr 97 (N = 1), 4 Nov 97 (N = 2), and 13 Nov 97 (N = 1). The samples were taken in four permanent and one semipermanent ponds located ca. 15 km from Corrientes city (27°30'S, 58°45'W), province of Corrientes, Argentina. Frogs were captured by hand between 2000 and 2200 h, preserved in 10% formalin, and deposited in the CECOAL (Centro de Ecología Aplicada del Litoral) collection (frogs captured 1995 in lot #026; 1997 in lot #544). Gravid females were 17.8–29.2 mm SVL (mean 20.2 mm; SD 2.7 mm), body mass was 0.34–1.67 g (mean 1.09 g; SD 0.37 g), mature ova count range was 35–131 (mean 76.3; SD 28.6), and ma-

TABLE 1. Length, weight, and fecundity data for 15 gravid female and 43 male *Lysapsus limellus*. Date = date of capture and pond type; Sex = sex of specimens; SVL = mean snout-vent length ± one standard deviation; WT = mean body weight ± one standard deviation; Ova Number = mean mature ova number ± 1 SD; Diameter Ovum = mean diameter mature ovum ± 1 SD.

Date	Sex	SVL (mm)	WT (g)	Ova Number	Diameter Ovum (mm)
02/17/95	Female (N = 5)	19.5 ± 1.4	0.94 ± 0.11	74.2 ± 27.3	0.583 ± 0.05
Permanent	Male (N = 9)	16.3 ± 1.9	0.58 ± 0.15	—	—
11/28/95	Female (N = 3)	20.5 ± 0.8	1.46 ± 0.17	61.33 ± 17.5	0.632 ± 0.03
Permanent	Male (N = 0)	—	—	—	—
02/24/97 and 03/10/97	Female (N = 3)	20.0 ± 1.3	1.4 ± 0.60	106.3 ± 39.3	0.610 ± 0.03
Permanent	Male (N = 6)	15.3 ± 0.8	0.784 ± 0.24	—	—
04/09/97	Female (N = 1)	29.2	1.67	46	0.736
Semipermanent	Male (N = 19)	17.4 ± 1.0	1.34 ± 0.18	—	—
11/04/97 and 11/13/97	Female (N = 3)	18.4 ± 0.8	0.863 ± 0.18	75 ± 14.4	0.553 ± 0.03
Permanent	Male (N = 9)	17.6 ± 1.2	1.12 ± 0.16	—	—

ture ovum diameter range was 0.52–0.73 mm (mean 0.6 mm; SD 0.06 mm). Male SVL (N = 43) range was 13.8–19.5 mm (mean 16.99 mm; SD 1.44 mm) and body mass range was 0.43–1.5 g (mean 1.07 g; SD 0.35 g). There was significant difference in SVL between gravid and non-gravid females (t-test 5.3, df 46, $p < 0.001$), but no significant difference between body mass (t-test 0.88; df 46, $p > 0.05$). The difference in SVL between males and gravid females was significant, with females larger (t-test -5.84; df 56, $p < 0.01$), while the difference between these groups in body mass was not significant (t-test -0.25; df 56, $p > 0.79$). Furthermore, no significant difference was observed in SVL or body mass between males and non-gravid females (SVL [t-test 1.65; df 74, $p > 0.05$]; body weight [t-test 0.93; df 74, $p > 0.05$]). Finally, *L. limellus* has a reproductive mode that is characterized by eggs deposited freely in lentic water (Duellman and Trueb 1986. Biology of the Amphibians. McGraw Hill Book Co., 670 pp.). Table 1 summarizes the number and morphometric features of gravid females and males captured by each sampling date and pond type.

We thank Marta I. Duré and Monika I. Hamann for helping with laboratory and fieldwork.

Submitted by **FEDERICO MARANGONI** and **ARTURO I. KEHR**, CECOAL-CONICET, C.C. 140, (3400) Corrientes, Argentina; e-mail: kehr@arnet.com.ar.

PELOBATES CULTRIPES (Iberian Spadefoot Toad). **PREDATION**. Data on predation of amphibian eggs by other amphibians are scarce. Reports documents newts and salamanders as well as large anuran tadpoles feeding on amphibian eggs (Walters 1975. J. Herpetol. 9:267–279; Crump 1983. Am. Nat. 121:281–287; Denton and Beebee 1991. Amph. Rept. 12:111–112).

On 2 April 2000, at 2130 h, in a large (ca. 75 m x 30 m) ephemeral pool near Valdemanco (Madrid Province, Spain, UTM 30TVL4623), which is used for reproduction by at least six species of amphibians (*Pleurodeles waltl*, *Triturus m. marmoratus*, *Bufo calamita*, *Hyla arborea*, *Pelobates cultripes*, and *Rana perezi*), I observed one male and two female *T. marmoratus* feeding on an egg clutch of *P. cultripes*. The clutch had not been recently laid, so the gelatin that protects the eggs was disintegrating, thus facilitating the attack on the eggs.

Other adult *T. marmoratus* were observed in the same pool in the vicinity of *Pelobates* clutches, although direct feeding behavior was observed in only one case. In the same pool there were several clutches of *B. calamita*. No adult *T. marmoratus* were observed near them, although it has been reported that *T. marmoratus pygmaeus* occasionally feeds on *B. calamita* eggs (Díaz-Paniagua *in* Tejedo 1991 Herpetologica 47:322–327).

No data are available on the occasional predators of *Pelobates* eggs, nor on *T. marmoratus* feeding on other amphibian eggs. Predation by other amphibians may be common in temporary ponds, where competition for resources is expected to play a major role in survival. In this context, strategies reducing the risk of predation on eggs and embryos would be highly advantageous. This strategy has been adopted by *B. bufo* and *B. calamita*, whose eggs are unpalatable for some *Triturus* species (Denton and Beebee, *op. cit.*). Data on relative unpalatability of *Pelobates* eggs are not available.

I thank B. Lorente and I. Urbán for field assistance. This work was supported by a Comunidad de Madrid-Museo Nacional de Ciencias Naturales predoctoral fellowship in the project PB97-1231.

Submitted by **IÑIGO MARTINEZ-SOLANO,** Museo Nacional de Ciencias Naturales, CSIC c/ José Gutiérrez Abascal, 2 28006 Madrid, Spain; e-mail: imartinez@mncn.csic.es.

PSEUDACRIS TRISERIATA (Western Chorus Frog). **CALLING SITES AFTER DROUGHT**. Illinois experienced severe drought during the last half of 1999. Low precipitation during fall and winter can affect late-winter and early-spring breeding amphibians. In Illinois, *Pseudacris triseriata* breeds from mid-February into May (Phillips et al. 1999. A Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8. 300 pp.). Males typically call from the water of shallow, vegetated temporary pools, but also may call from human-made ponds and lakes (Pope 1964. Amphibians and Reptiles of the Chicago Area. Chicago Nat. Hist. Mus., Chicago. 275 pp.; Smith 1961. Bull. Illinois Nat. Hist. Surv. 28:1–298; Whitaker 1971. J. Herpetol. 5:127–150).

During the night of 26 March 2000, we made observations on two choruses of *P. triseriata* on the northwest side of Dawson Lake in Moraine View State Park, McLean County, Illinois, USA (T23N R4E Sec 26). The first chorus was in a human-made pond adjacent to the lake. Due to below average precipitation in early spring and drought conditions the preceding fall and winter, the water had receded from the vegetated shore and left large areas of barren ground. There was no emergent or submerged vegetation in the water, only sparsely scattered debris. Some males called from the water, often while located near debris floating near shore. However, most called from atypical terrestrial sites. Males called from vegetation ca. 4 m from water, from above-ground positions on the barren bank, and from a few cm below ground in cracks in the mud. We believe this to be the first report of subterranean calling by *P. triseriata*.

The second chorus was in a wooded area adjacent to a flooded stream ca. 1 km to the west of the first chorus. At this location, males called from quiet, shallow water with abundant emergent and submerged vegetation. The calling sites in this temporary breeding pool were more characteristic of *P. triseriata*, and there appeared to be no shortage of oviposition sites.

Our observations suggest that early breeding amphibians are more susceptible to the effects of fall and winter drought in man-made impoundments than in more natural habitats. During drought periods, water levels decrease and water recedes . Temporary pools form quickly during rains whereas ponds and lakes can take long periods to refill or develop new vegetation. *Pseudacris triseriata*, like many other amphibians, requires submerged vegetation or stems to oviposit (Gosner and Rossman 1959. Copeia 1959:263–266). Further, since the egg complement of *P. triseriata* is deposited as several small egg masses (Wright and Wright 1949. Handbook of Frogs and Toads of the United States and Canada. 3rd ed. Comstock, Ithaca, New York. 640 pp.), the availability of oviposition sites may be a critical factor in determining reproductive success in an area. Without the necessary conditions for oviposition, the area becomes undesirable for breeding. Individuals that breed in temporary pools may not be as strongly affected by fall and winter drought as those that breed in ponds and lakes.

Submitted by **DONALD B. SHEPARD** and **ANDREW R. KUHNS**, Department of Biological Sciences, Illinois State University, Normal, Illinois 61790-4120, USA.

RANA CATESBEIANA (Bullfrog). **TADPOLE DEPTH RECORD**. On 20 Nov 1999, while SCUBA diving at 35 m, one of us (DW) noted tadpoles associated with sunken tree stumps and lying on the bottom of Wolf Lake (elev. ca. 1006 m) ca. 12.4 km (air) east of Tuckasegee, Jackson Co., North Carolina, USA. Returning on 12 Dec 1999, DW collected two tadpoles in the southwest corner of the lake (ca. 35°13'23"N 82°59'49"W) at a depth of 32.6 m where the water temperature was ca. 7.8°C. At that depth, the tadpoles would have been subjected to a pressure of 3.2 atm. These tadpoles were catalogued in the North Carolina Museum of Natural Sciences (NCSM 60268).

The maximum depth selected by the tadpoles of any species is surely an indication of that species' overall physiological plasticity, yet there are few data recorded for this parameter. Richmond et al. (1999. Herpetol. Rev. 30:90–91) recorded *Bufo americanus* at a depth of 8 m.

Submitted by **DAVID WALKER**, 4230 Lake Logan Road, Canton, North Carolina 28716, USA (e-mail: davidw@primeline.com) and **STEPHEN D. BUSACK**, North Carolina Museum of Natural Sciences, 11 West Jones Street, Raleigh, North Carolina 27601-1029, USA (e-mail: steve.busack@ncmail.net).

RANA CATESBEIANA (Bullfrog). **FEMALE VOCALIZATION**. Female reciprocal calls have been described for 14 anuran species (Schlaepfer and Figeroa-Sandí 1998. Copeia 1998:1076–1080 and references therein). Vocalizations by female bullfrogs (*Rana catesbeiana*) have been reported, but only in the laboratory (Capranica 1968. Behaviour 31:302–325). Since 1985, we have been conducting a long-term study of population dynamics and reproductive behavior in a population of bullfrogs at Lake Sasajewun (45°35'N, 78°30'W) in Algonquin Provincial Park, Ontario, Canada. To study reproductive behavior, the breeding population of bullfrogs is censused nightly during the chorusing season. Here we describe observations and circumstances of calling by a female in this population.

On 27 June 1999, between ca. 0400 and 0430 h, we observed a female bullfrog produce vocalizations resembling the male bullfrog advertisement call while she was located within an active chorus of male bullfrogs. The female's call was qualitatively similar to the stereotypical male bullfrog advertisement call, although it was weaker in intensity, higher in pitch, and consisted of only one croak. We have occasionally heard female bullfrogs make similar-sounding vocalizations in the lab. While vocalizing, the female maintained the characteristic "low" posture that female bullfrogs use when moving within an active male chorus (Emlen 1976. Behav. Ecol. Sociobiol. 1:283–313). She also expanded her throat, although not to the same degree as males do when producing an advertisement call.

The female had been captured earlier in the night (26 June 1999 at ca. 2315 h) when we were conducting a nightly census of the population of chorusing male bullfrogs. Although it had not been possible to measure her snout-urostyle length (SUL), her mass was 300 g, the heaviest mass recorded for a bullfrog from this population during our 15-year study (R. J. Brooks, unpubl. data). The female was in the midst of a local chorus of 5 males and was nearest to a male with whom she later mated. This territorial male (identified by the unique ventral alphanumeric tattoo, C12) was the largest (SUL 119 mm, mass 155 g) of the 88 males that participated in chorus activity on Lake Sasajewun that night, and was 13 mm longer and 58 g heavier than the next largest male within the local chorus of 5 males.

Males in this local chorus responded to the female's vocalizations immediately, although none of the other 83 males present reacted. On each of the three occasions that the female was seen calling, at least two of the five nearby males (but never the large territory holder, C12) rapidly approached to within ca. 1 m of the female's position and began to produce advertisement calls. C12, seemingly alerted to their intrusion into his territory by their calls, then chased these males away with either territorial calls or bouts of wrestling. During each of these moments of male–male aggression, the female moved away from the group of males. After the last call by the female, C12 wrestled with two of the males present and then moved ca. 5 m away from the group of males and the female, repeatedly making advertisement calls. After ca. 2–4 min, the female swam toward C12 until she was roughly halfway between him and the other males, who were still wrestling. Then C12 approached to within 10 cm of her, made one advertisement call and attempted, unsuccessfully, to amplex her. The female dived and surfaced ca. 1 m away from C12. The male then repeated the approach, call and grasp behaviors, this time successfully. This sequence of behaviors is unusual in that it is typically the female bullfrog that initiates amplexus (Emlen, *op. cit.*). Within 5 min, the amplexed pair had started to lay an egg mass (ca. 0435 h). After they had finished, the female was recaptured and weighed at 220 g, demonstrating that she had lost approximately 80 g during egg-laying, 27% of her pre-amplexus body mass. This is the largest investment in reproduction ever recorded for a female from this population (R. J. Brooks, unpubl. data).

In other anurans, female reciprocal calls often elicited increased vocal activity in neighboring males (e.g., Roy et al. 1995. Curr. Sci. 69:265–270), although it is unclear whether there was an accompanying increase in male–male physical aggression. There was no indication from our observations that the female bullfrog and her eventual mate exchanged calls as a precursor to amplexus as is the case in *R. virgatipes* (Given 1993. Anim. Behav. 46:1139–1149). Our observations suggest that the female bullfrog's vocalizations incited high levels of aggressive, physical male–male competition. This advertisement vocalization is probably rare among female bullfrogs as it was not reported by previous detailed field studies of bullfrog reproductive behavior (e.g., Emlen, *op. cit*; Howard 1978. Evol. 32:850–871; Ryan 1980. Copeia 1980:108–114). However, such vocalizations may be more common among very large and old females because they have a large investment in current reproduction and a low probability of surviving the next winter. In such cases, failing to mate with a high quality male may incur significant fitness costs (e.g., high predation of eggs by the leech, *Macrobdella decora*; see Howard 1978. Ecol. 59:789–798). It is also possible that we will more frequently observe female vocalization now that this behavior has been documented.

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Submitted by **KEVIN A. JUDGE** (e-mail: kevinjudge@yahoo.com), **SARAH J. SWANSON** (e-mail: sswanson@uoguelph.ca), and **RONALD J. BROOKS** (e-mail: rjbrooks@uoguelph.ca), Department of Zoology, University of Guelph, Ontario N1G 2W1, Canada.

CROCODYLIA

CROCODYLUS MORELETII (Morelet's Crocodile). **BEHAVIOR**. On 2 September 1998 at ca. 2345 h, we found a pod of hatchling Morelet's crocodiles concealed in dense aquatic vegetation (primarily *Typha* spp.) ca. 3 m from a recently excavated nest at Gold Button Lagoon (17°55'N, 88°45'W), Orange Walk District, Belize. Sixteen hatchlings were collected for mark-recapture purposes. Upon capture each hatchling vocalized, and vocalizations continued several minutes after animals were placed in a holding bag. Shortly after vocalizations began, a large crocodile (eyes and snout visible only) ca. 50 m from the bank began swimming slowly toward our canoe. The crocodile approached to within 20 m, stopped, and remained there until we left the area (30 minutes later).

On 9 September at ca. 0130 h, we returned to the same area and spotted two hatchlings ca. 20 m from the nest site. A large crocodile (eyes and snout visible only), presumably the same animal observed previously, was observed in close proximity (< 1 m) to the hatchlings. As our canoe approached, the large crocodile submerged and we captured the hatchlings, which vocalized during and after capture. As we then paddled to the nest site to search for more hatchlings, the large crocodile surfaced < 1 m from the canoe. We noticed a white, linear scar on the crocodile's left premaxillary region. The crocodile made no attempt to approach closer, and we slowly left the nest site. The crocodile then followed us for ca. 75 m into a small cove and finally stopped as we moved into shallow (< 0.5 m) water. In this cove, we collected more hatchlings, which also vocalized. After ca. 30 min, we began paddling out of the cove, and the large crocodile resurfaced < 1 m from the canoe. As we slowly passed by, the crocodile lunged and bit the side of the canoe. We continued paddling out of the cove, and the crocodile followed for ca. 75 m, until we had passed the first nest site.

On 23 and 24 September at ca. 2330 h, we returned to the nest site in a fiberglass boat powered by a 12-volt trolling motor. On both nights, the large crocodile (identified by the scar) quickly approached to within 1 m and followed for ca. 50 m as we moved through the area. On more than one occasion, the crocodile was nudged with a paddle and did not respond. At one point on 24 September, the crocodile surfaced (head only) directly in front of the boat and did not submerge as the boat passed directly over it.

On 25 September at ca. 2230 h, we returned to the nest site. The same crocodile approached the boat and was captured with a breakaway cable snare. During capture, the crocodile bit a hole in the hull of the boat. Cloacal examination revealed the crocodile (148.5 cm SVL, 290.0 cm TL) to be a male. The animal was marked and released at the site of capture.

On 6 October at ca. 2300 h, we returned to the nest site. As we approached to within ca. 75 m, we observed a large crocodile (head visible only) rapidly swimming away and submerging. Although we were unable to move close enough to positively identify it, we speculate that this was the same animal seen on previous nights, as no other large crocodiles had been observed in the area. During a 30 min search of the area, we saw no sign of the crocodile.

Female Morelet's crocodiles will defend both nests and young (Alvarez del Toro 1974. Inst. Mexico Rec. Nat. Renov. 70 pp.; Hunt 1975. Copeia 1975:763–764; Perez-Higareda 1980. Bull. Maryland Herpetol. Soc. 16:52–53; Platt 1996. The Ecology and Status of Morelet's Crocodile in Belize. Unpubl. Ph.D. dissertation. Clemson University), but to our knowledge parental care by males of this species has not been reported. Parental care by other male crocodilians has been previously observed (Garrick and Lang 1977. Amer. Zool. 17:225–239; Lang et al. 1986. Nat. Geog. Res. 2:519–525; Rom Whitaker, pers. comm.) but this behavior is not believed to be widespread among all species. We suspect the crocodile observed here was the male parent of the hatchlings we collected, and the aggressive behavior displayed was in response to the distress vocalizations of its young. Also of note was the absence of the crocodile at the site following its capture. Capture may induce wariness in crocodilians (Webb and Messel 1979. Aust. Wildl. Res. 6:227–234; Santiago et al. 1998. J. Herpetol. 32:320–324), and we suspect this to be the case here.

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Submitted by **THOMAS R. RAINWATER** and **SCOTT T. McMURRY**, The Institute of Environmental and Human Health, Department of Biological Sciences, Texas Tech University, 1207 Gilbert Drive, Lubbock, Texas 79416, USA, and **STEVEN G. PLATT**, Wildlife Conservation Society, Lamanai Field Research Center, P.O. Box 63, Orange Walk, Belize.

TESTUDINES

CARETTOCHELYS INSCULPTA (Pig-nosed Turtle). **ECTOPARASITES**. On 26 October 1996, two leeches were collected from two adult female *Carettochelys insculpta* captured in the Daly River at Oolloo crossing, Northern Territory, Australia. The river at this site is characterized by clear, shallow water during the dry season (when the leeches were collected) and deep turbid water during the wet season. The Daly possesses sandy and rocky substrates, is ca. 70 m wide, and averages 1.5 m deep during the dry season. Aquatic vegetation is mostly *Vallisneria* sp., which is extensively grazed upon by the omnivorous *C. insculpta* (Welsh 1999. Resource Partitioning among the Freshwater Turtles of the Daly River, Northern Territory. Ph.D. dissertation, University of Canberra, Canberra, Australia. 101 pp.). The first leech was found affixed to the neck of one turtle, whereas the second leech was attached to the forelimb of the other. The leeches were placed in 95% ethyl alcohol, and were subsequently identified as *Placobdelloides bancrofti*. According to Sawyer (1986. Leech

Biology and Behaviour, Vol. 2, Feeding, Biology, Ecology, and Systematics. Oxford University Press, New York, New York. 754 pp.), this leech species has not been collected since the original description from the host turtle *Emudura krefftii* in the Burnett River, Queensland, Australia. Thus, we document a new host record and range extension for *Placobdelloides bancrofti*, and the first hirudinean parasite for *Carettochelys insculpta*. Leeches were deposited in the reference collection of R. W. Davies at Monash University, Melbourne, Australia.

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Submitted by **RAYMOND A. SAUMURE**, Department of Natural Resource Sciences, McGill University, 21111 Lakeshore Road, Ste-Anne-de-Bellevue, Québec, H9X 3V9, Canada and **J. SEAN DOODY**, Applied Ecology Research Group, University of Canberra, Belconnen, ACT 2601, Australia (e-mail: doody@aerg.canberra.edu.au). Present address (RAS): Shark Reef at Mandalay Bay, 3950 South Las Vegas Boulevard, Las Vegas, Nevada 89119, USA; e-mail: insculpta@hotmail.com.

CHELYDRA SERPENTINA (Common Snapping Turtle). **DENSITY and BIOMASS**. Snapping turtle densities have previously been estimated to be 0.17/ha (Pearse 1923. Ecology 9:24–28), 1.2/ha in South Dakota (Hammer 1969. J. Wildl. Mgmt. 33:995–1005; standing crop biomass, 9.1 kg/ha, calculated by Iverson 1982. Oecologia 55:69–76), 7.3–8.0/ha in Michigan (20.6–21.6 kg/ha; Congdon et al. 1986. Amer. Midl. Nat. 115:165–173), 6.8–13.3/ha in South Carolina (15.9–33.9 kg/ha; Congdon et al. 1986, *op. cit.*), and at least 59/ha in Tennessee (Froese and Burghardt 1975. Herpetologica 31:204–208; 181 kg/ha estimated by Iverson 1982, *op. cit.*). While trapping for turtles for reproductive studies in a 0.71 ha pond in the Blue Creek drainage, 16.9 km NNE of Oshkosh, Garden Co., Nebraska, USA, we discovered a population of snapping turtles so dense as to interfere with efficient trapping of other turtles. We therefore removed all trapped snapping turtles and held them for subsequent live release. Between 31 May and 5 July 1999, we removed and measured 36 snappers (15 male, 14 female, 7 uncertain sex; 15.6–40.4 cm maximum carapace length), estimated to weigh 171.3 kg. Because of the large mesh size on our traps (50 mm), these data certainly represent minimum numbers present. Thus, the minimum density of snapping turtles in this pond was 50.7/ha, similar to the estimate from Tennessee (Froese and Burghardt 1975, *op. cit.*). However, because of the larger body size of Nebraska turtles, standing crop biomass was considerably higher, at nearly 242 kg/ha. This value is substantially higher than the mean biomass of 102.1 kg/ha (maximum, 586 kg/ha) for 49 populations of 33 species of turtles reviewed by Iverson (1982, *op. cit.*).

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Submitted by **JOHN B. IVERSON, DAMON HEARNE, JESSA WATTERS**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA (e-mail: JohnI@Earlham.edu), **DEAN CROSHAW**, Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA, and **JASON LARSON**, Department of Zoology, Miami University, Oxford, Ohio 45056, USA.

STERNOTHERUS ODORATUS (Common Musk Turtle). **AERIAL BASKING.** Carr (1952. Handbook of Turtles. Cornell Univ. Press, Ithaca, New York. 542 pp.) characterizes *Sternotherus odoratus* as "a highly aquatic species, being one of the few turtles that apparently never bask in the sunshine." Ernst et al. (1994. Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 578 pp.) state that the *S. odoratus* basking habit is poorly developed and that they are rarely found out of water. During an 18-year study (1965–1983) of *S. odoratus* in Pennsylvania there were only 16 observations of aerial basking (Ernst 1986. J. Herpetol. 20:341–352; Ernst, pers. comm.), all of which occurred in the AM and were concentrated in April and May, when air temperatures ranged from 19.8 to 22.2°C. Typical aquatic basking, with the turtle floating at or just under the surface or clinging to near-surface aquatic vegetation, was more prevalent from June through August (112 observations), with water temperatures ranging from 18.5 to 24°C.

Here, I report more frequent aerial basking in *S. odoratus*. During intensive summer stream surveys that incorporated use of skin-diving gear, 15 *S. odoratus* were observed aerially basking within a 2500 m section of the North Fork of White River, Ozark Co., Missouri, USA. All observations were made between 26 June and 11 October 1969, and also between 12 June and 24 July 1970. Most basking sites were on the eastern stream margins, which benefited from increased PM insolation. All observations occurred between 1150 and 1620 h. Typical aquatic basking by *S. odoratus* was only observed on three occasions, although numerous yearling *Graptemys geographica* were observed basking in this manner. Eight *S. odoratus* basked on logs at or near water level. Seven were basking on limbs of small woody saplings or bushes, located at positions from bank-level to heights of more than 1 m. Several turtles basked in sun/shade mosaics created by tree canopy cover. Startled turtles typically plunged from these basking perches into the water below. I was unable to obtain equivalent data for all turtles. However, both genders (N = 7; 3 M, 4 F), and turtles of a wide size range (N = 13; 2.5–7.8 cm PL, 9.4–201 g) basked aerially. All basked alone except one male (8.7 cm CL, 6.6 cm PL, 122 g), which basked with a *Graptemys geographica* and a small *Pseudemys concinna* on a drift log. All *S. odoratus* were near the streams margins and in still pools where the stream bottom was silty mud or silty sand, often with rooted aquatic vegetation. None was observed in areas of stream-swept chert, dolomite, or limestone bottoms. I have no April or May data, and the pools where *Sternotherus* were observed are distant from survey access points and often were not reached in the AM. Also, comparing the Pennsylvania aquatic habitats to those of the North Fork of White River is difficult.

The North Fork of White River is a heavily spring-fed stream of renowned clarity, which flows through a narrow, forested valley. Water temperature data from North Fork collecting sites recorded maximum monthly temperatures of 20°C in June, 22.5°C in July, 22°C in August, 21°C in September and 16°C in October. Corresponding monthly air temperature maximums, measured ca. 0.5 m from the water, were 28°C in June, 28.5°C in July, 29.8°C in August, 29.5°C in September and 21°C in October (Nickerson and Mays 1973. The Hellbenders: North American "Giant Salamanders." Milwaukee Public Museum Publ. Biol. Geol. No. 1. 106 pp.). The mean preferred temperature of *S. odoratus* is 21–

26°C (Hutchison 1979. *In* Harless and Morlock [eds.], Turtles: Perspectives and Research, pp. 207–228. Wiley, New York). Thus, water temperatures in the study area seldom reached the preferred temperatures of this species. These observations would support the hypothesis that the unusual aerial basking activity of this *S. odoratus* population is in response to marginal or non-optimal aquatic temperatures, even during the warmest portion of the annual cycle. However, Manning and Grigg (Copeia 1997. 1997:579–584) showed that basking was not of thermoregulatory significance in *Emydura signata*. One alternative hypothesis would be that the *S. odoratus* in this study are adjusting their basking behavior in response to a low dietary intake of vitamin D3.

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Submitted by **MAX A. NICKERSON.** Florida Museum of Natural History, University of Florida, P.O. Box 117800, Gainesville, Florida 32611-7800, USA; e-mail: maxn@flmnh.ufl.edu).

LACERTILIA

ANOLIS CAROLINENSIS (Green Anole). **NECTIVORY and FLOWER POLLINATION.** Anoles forage mainly on arthropods, but they are also known to take fruit (Lazell 1972. Bull. Mus. Comp. Zool. 143:22–74) and even lap nectar from flowers (Bartlett 1995. Reptiles 2:48–65). While nectivory is relatively rare among lizards, green anoles (*Anolis carolinensis*) have been observed obtaining nectar from hummingbird feeders (Liner 1996. Herpetol. Rev. 27:78), *A. stratulus* was observed lapping nectar from flowers of a euphorb in the British Virgin Islands (Perry and Lazell 1997. Herpetol. Rev. 28:150–151), and *A. conspersus* was observed lapping nectar from orchids on Grand Cayman Island (Echternacht et al. 2000. Herpetol. Rev. 31:173). As a result of nectar foraging, some lizards are also effective plant pollinators (Traveset and Sàez 1997. Oecologia 111:241–248, and references therein). We have regularly observed both male and female green anoles lapping nectar from the flowers of both saw palmettos (*Serenoa repens*) and cabbage palmettos (*Sabal palmetto*). These observations were made during a field study conducted on dredge spoil islands created by the U.S. Army Corps of Engineers along the intracoastal waterway in Mosquito Lagoon, within the boundaries of Canaveral National Seashore (CANA) and Merritt Island National Wildlife Refuge (MINWR), Volusia and Brevard Counties, Florida.

Foraging observations were made during capture-mark-recapture surveys conducted in the summers of 1995 through 1998. Large numbers of insects (mostly Hymenoptera, Diptera, and Coleoptera) congregate on the flower heads of these and other plant species to consume nectar, and green anoles were occasionally observed slowly moving about flower heads foraging for arthropods. In these cases, we documented foraging behaviors for a few minutes before the lizards were captured. During May and June of each year of the study, we observed green anoles consuming nectar (27 observations total), and pollen was found on the rostrum of most of these individuals. Brown anoles (*A. sagrei*) were never observed consuming nectar, a finding consistent with their sit-and-wait foraging strategy.

At this latitude, *Serenoa repens* and *Sabal palmetto* produce flowers throughout spring and summer, and the flowers of *S. repens* are suitable for making honey (Taylor 1992. Florida Wildflowers. Taylor Publ. Co., Dallas, Texas). Furthermore, these two species of plants often make up significant portions of the vegetation of many habitat types in Florida (Myers and Ewel 1990. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida), and the flowering heads are very large, containing thousands of flowers. Nectar could be an important food source, however its relative energetic contribution to a lizard's diet must ultimately depend on season and plant species present. Nectivory was relatively rare in this study, which was conducted over a tiny portion of the geographic range of the green anole. However, these observations further demonstrate that nectivory is a more important anole foraging strategy than previously thought, and that green anoles may play at least a minor role in plant pollination.

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Submitted by **TODD CAMPBELL**, Department of Ecology and Evolutionary Biology, 569 Dabney Hall, University of Tennessee, Knoxville, Tennessee 37996, USA (e-mail: lizardman@utk.edu), and **CATHERINE BLEAZY**, Division of Natural Sciences, Maryville College, Maryville, Tennessee 37804, USA.

ANOLIS* SP.** and ***GONATODES ALBOGULARIS (Yellow-headed Gecko). **PREDATION.** During a trip to Cuba in the summer of 1999, I witnessed two instances of predation on small lizards by the introduced house sparrow, *Passer domesticus*. In most human inhabited areas, particularly in and around La Habana, I noticed the introduced house sparrow to be very common. These weaver finches eat fruits and insects (Ehrlich et al. 1988. The Birder's Handbook. Simon and Schuster/Fireside Books. New York. 667 pp.) as well as discarded human food. Here I report on lizards as a food item for Cuban house sparrows. On 9 July 1999 in La Lisa, Habana, I observed an adult house sparrow attack a hatchling *Anolis* sp. perching on the side of a fence post. The lizard was very likely *A. porcatus,* as there was a resident adult pair in the vicinity. The lizard was close to ground level, and as the bird approached it tried to escape by climbing up and around the post. After an unsuccessful aerial attack, the bird landed and quickly hopped around the post, jumped, and grabbed the lizard by the head. The lizard was pecked twice and then swiftly swallowed. Three days later (12 July 1999) in a nearby yard, I observed another house sparrow capture and eat a *Gonatodes albogularis*. The bird swooped down and grabbed the lizard from its perch on a cinder block. Once again the bird pecked the lizard before swallowing it. Lizards, particularly anoles and geckos, are commonly encountered in high numbers in and around residential areas throughout the Caribbean. Many of these species or their young are small enough to be preyed upon by opportunistic house sparrows. At the high population densities observed, the house sparrow may be an important factor in Cuban urban lizard ecology.

Submitted by **ROBERTO E. BELLO**, Museum of Vertebrate

Zoology, University of California, Berkeley, California 94720-3160, USA; e-mail: culebron@socrates.berkeley.edu.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). **ENDOPARASITES**. The Mediterranean gecko, *Hemidactylus turcicus,* is native to the Old World (North Africa, Middle East, southern Europe, etc.) and has been established at many localities in the West Indies, Panama, Mexico, and the southern United States, including southern Arizona, southern California, and southern Nevada (Conant and Collins 1998. A Field Guide to Reptiles and Amphibians: Eastern and Central North America, Houghton Mifflin Company, Boston, Massachusetts. 616 pp.; Saethre and Medica 1993. Herpetol. Rev. 24:154–155). It was first collected in southern Arizona from Tucson in 1970 (Robinson and Romack 1973. J. Herpetol. 7:311–312). There are three reports of helminths from *H. turcicus* from the United States, all from Texas (Pence and Selcer 1988. Copeia 1988:565–572; Riley et al. 1988 J. Parasitol. 74:481–486; McAllister et al. 1993. J. Helm. Soc. Washington 60:280–282). The purpose of this note is to report helminths of *H. turcicus* from Tucson, Arizona.

Thirty-six *Hemidactylus turcicus* (mean SVL = 46.4 mm ± 8.5 SD, range = 26–56 mm) were collected during May and August 1999 at apartment complexes in northwest Tucson (32°16'N, 110°58'W), Pima County, Arizona, USA. Lizards were sacrificed within 24 h of capture. The abdominal cavity was opened and the body cavity, liver, esophagus, stomach, small and large intestines, and lungs were examined for helminths under a dissecting microscope. Helminths were removed and placed in a vial of 70% ethanol for a minimum of 48 h. Nematodes were cleared on a glass slide in undiluted glycerol for examination. Selected cestodes were stained with hematoxylin and mounted on glass slides in balsam for identification. Two species of helminths were found; cysts within lizard peritonea contained larvae of the spirurid nematode *Ascarops strongylina,* and lizard small intestines contained gravid individuals of the cyclophyllidean cestode *Oochoristica macallisteri*. Voucher helminths were deposited in the United States National Parasite Collection: *O. macallisteri,* slide, USNPC 89267; *A. strongylina* (larvae), vial, USNPC 89266. Geckos were deposited in the herpetology collection of the Natural History Museum of Los Angeles County (LACM 145481–145510; 145514–145518; 145751). Twelve geckos (33%) harbored *O. macallisteri*, and 19 (53%) harbored larvae of *A. strongylina*. Mean intensity (total number of individuals of the parasite species divided by number of infected hosts) was 5.2 ± 8.3 SD for *O. macallisteri* and 5.6 ± 5.7 SD for *A. strongylina*. Mean abundance (total number of individuals of a parasite species in a sample of a host divided by the number of hosts examined) was 2.9 ± 5.0 SD for *O. macallisteri* and 1.7 ± 5.3 SD for *A. strongylina*.

Larvae of *A. strongylina* in cysts were previously reported in *H. turcicus* from Texas (McAllister et al., *op. cit.*). They also were found in *Sceloporus occidentalis* and *Sceloporus vandenburgianus* from California (Goldberg and Bursey 1988. J. Wild. Dis. 24:568–571; Goldberg and Bursey 1989. J. Wild. Dis. 25:630–633). *Ascarops strongylina* is a common stomach parasite of pigs (Suidae) and requires an insect intermediate host for development (Anderson 1992. Nematode Parasites of Vertebrates: Their Development and Transmission. C.A.B. International, Oxon, U.K., 578 pp.). *Hemidactylus turcicus* may serve as a paratenic (transport) host for this helminth, but infection of this gecko appears to be incidental (a by-product of diet) because development of the parasite to adult does not occur. *Oochoristica macallisteri* was described from *Uta stansburiana* collected in Los Angeles County, California (Bursey and Goldberg 1996. Folia Parasitol. 43:293–296). *Hemidactylus turcicus* represents a new host record and Arizona a new locality record for *O. macallisteri*. This is the first record of *A. strongylina* larvae in lizards from Arizona.

Hemidactylus turcicus were collected under permits issued by the Arizona Department of Game and Fish.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, **ROBERT L. BEZY**, Section of Herpetology, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA, and **CHERYL WONG**, Department of Biology, Whittier College, Whittier, California 90608, USA.

MABUYA GUAPORICOLA (Calango-Liso). **NATURAL HISTORY**. *Mabuya guaporicola* occurs in the Cerrado and Pantanal biomes and is known from very few specimens from Rio Guaporé, Mato Grosso state, Brazil (Dunn 1936. Proc. Acad. Nat. Sci. Philadelphia 87:533–557), Barra do Bugres, Mato Grosso state, Brazil (Nascimento et al. 1988. Bol. Mus. Para. Emílio Goeldi, nova sér., Zool., Belém 4:21–66), Cachimbo, Pará state, Brazil (Ávila-Pires 1995. Lizards of Brazilian Amazonia, Zool. Verh. Leiden. 706 pp.), and Departamento Santa Cruz and Departamento Beni, Bolivia (Fugler 1989. Ecología en Bolivia 13:57–75). Virtually nothing is known of the ecology of this species. Herein we provide new locality records and new data on habitat, time of activity, body and environmental temperatures, behavior, reproduction, and diet, and also a description of the color in life of *M. guaporicola* from the Brazilian Cerrado.

Lizards were collected at Ilha do Bananal, Santa Terezinha, Mato Grosso state, (10°26'S, 50°35'W) (7 individuals, April 1999), Cachimbo, Pará state (3 individuals, March 1995), and Brasília, Distrito Federal (15°47'S, 47°55'W) (1 individual, September

TABLE 1. Diet of *Mabuya guaporicola* (N = 10; f = number of stomachs, n = number of items).

Prey Item	f	f%	n	n%
Araneae	1	10	1	10
Coleoptera	5	50	5	50
Diptera	1	10	1	10
Formicidae	1	10	1	10
Grillidae	1	10	1	10
Hemiptera	3	30	3	30
Unidentified insects	1	10	1	10
Orthoptera	5	50	5	50
Termitidae	2	20	4	40

1991). At Ilha do Bananal specimens were collected in "campo de murunduns," a seasonally flooded grassland with sparse mounds covered with small trees, and in "campo sujo," a grassland with very sparse schrubs. At Cachimbo, lizards were collected in "campo sujo" over sandy soils. No habitat data are available for the Brasília specimen. Overall, it seems that *M. guaporicola* prefers more open physiognomies of Cerrado.

Lizards at Ilha do Bananal (4) and Cachimbo (3) were collected (1100 to 1200 h) while basking. Three individuals at Ilha do Bananal were collected in pitfall traps; all the others were collected by hand. Cloacal temperatures (N = 4) averaged 35.05°C ± 0.85. Mean environmental temperatures were as follows: substrate 32.25°C ± 0.85, air at 5 cm above the substrate 30.75°C ± 1.14, and air at chest height 29.80°C ± 0.98. Therefore, *M. guaporicola* is apparently a heliophyllic species. After being approached, lizards moved quickly amidst grasses by rapid lateral undulation of the body and tail, seeking refuge in the leaf litter beneath shrubs. Limbs are apparently adpressed against the body during rapid locomotion.

With the exception of a male from Cachimbo (SVL = 37 mm), all individuals were reproductive. Clutch size (N = 4) averaged 4.25 ± 0.50, range 4 to 5. The smallest reproductive male measured 63 mm SVL, whereas the smallest reproductive female measured 43 mm SVL. The largest male measured 70 mm SVL and the largest female measured 82 mm SVL. Hence, *M. guaporicola* is apparently sexually dimorphic, with females attaining a larger body size than males, and females apparently attain sexual maturity at an early age, as seems to characterize several neotropical congeneric species (Vrcibradic and Rocha 1998. Copeia 1998:612–619; Vitt and Blackburn 1991. Copeia 1991:916–927).

Mabuya guaporicola has a relatively diverse diet, the most important prey items being coleopterans, orthopterans, hemipterans, and termites (Table 1). Color in fixative was described by Ávila-Pires (*op. cit.*). In life, the dorsum is light brown with three narrow, dark brown longitudinal stripes (sometimes interrupted) from the nape to the tip of the tail. The flanks are marked with two longitudinal dark-brown stripes separated by a light stripe; upper one broader, from the snout to the tip of the tail; lower one from the commissure of the mouth to the tip of the tail. Limbs are light-brown from above, with irregular dark spots. Gular region, chest, belly, and ventral part of limbs are immaculate.

Submitted by **DANIEL O. MESQUITA, AYRTON K. PÉRES, JR., GUSTAVO H. C. VIEIRA**, and **GUARINO R. COLLI**, Departamento de Zoologia, Universidade de Brasília, 70910-900 Brasília-DF, Brazil; e-mail (DOM): danmesq@unb.br.

MICRABLEPHARUS ATTICOLUS (NCN). **NATURAL HISTORY.** *Micrablepharus atticolus* is an endemic of the Cerrado biome in South America and was named for observations suggesting an association with nests of leaf-cutter ants, genus *Atta*, in which the lizards seek refuge (Vitt 1991. J. Herpetol. 25:79–90; Rodrigues 1996. Herpetologica 52:535–541). These observations led Rodrigues (*op. cit.*) to hypothesize that the advanced eyelid condition in *M. atticolus* (complete suture between upper and lower eyelids, compared to presence of eyelid in *M. maximiliani*) could be related to the habit of burrowing in sand at the base of ant nests. Natural history data on the species, based on few specimens from Alto Araguaia, Mato Grosso, were provided by Vitt (*op. cit.*). Herein we present data on microhabitat, body and environmental temperatures, reproduction, and diet of *M. atticolus* from two Cerrado localities. We collected 16 individuals at Chapada dos Guimarães, Mato Grosso state, Brazil (15°26'S, 55°45'W), during September and October 1988. In April 1999 we further collected, by manual capture and using pitfall traps, 24 individuals of *M. atticolus* at Parque Nacional do Araguaia, Ilha do Bananal, Santa Terezinha, Tocantins state, Brazil (10°26'S, 50°35'W).

TABLE 1. Diet composition of 15 *Micrablepharus atticolus* (N = number of stomachs, n = number of prey, v = volume of prey in mm^3).

Prey Item	N	f%	n	n%	v	v%
Araneae	2	13.33	2	8	18.83	7.69
Insect larvae	1	6.67	1	4	69.33	28.32
Homoptera	5	33.33	5	20	64.14	26.20
Lepidoptera	1	6.67	1	4	27.82	11.36
Unidentified insects	5	33.33	9	36		
Orthoptera	5	33.33	7	28	64.72	26.43

At Chapada dos Guimarães lizards were collected in low cerrado over sandy soils. At Ilha do Bananal specimens were collected in "campo de murunduns," a seasonally flooded grassland with sparse mounds covered with small trees, and in "campo sujo," a grassland with sparse shrubs. None of the lizards were associated with nests of *Atta*, which were not common at the study sites. Hence, it seems that *M. atticolus* prefers open physiognomies of Cerrado and uses nests of *Atta* opportunistically. Temperature data of two individuals were as follows: cloacal temperatures = 35.0°C and 34.2°C; substrate = 34.0°C and 31.2°C; air at 5 cm above the substrate = 30.4°C and 30.8°C, and air at chest height = 29.6°C and 29.8°C, suggesting that *M. atticolus* is a heliophyllic species.

With the exception of one female and three males, all individuals were reproductive. Clutch size (N = 13), based on counts of vitellogenic follicles or oviductal eggs, averaged 1.9 ± 0.3 (range 1–2; one female presented a single vitellogenic follicle). Three females presented vitellogenic follicles and oviductal eggs, indicating multiple clutches during the reproductive season. The smallest reproductive male, based on the presence of enlarged testes and epididimydes, measured 34 mm SVL, whereas the smallest reproductive female measured 26 mm SVL. No difference was observed in mean SVL between the sexes (adult individuals only; males: 37.3 ± 1.9, N = 27; females: 38.8 ± 4.6, N = 13; $F = 2.07$, $p = 0.16$). The largest male measured 41 mm SVL and the largest female measured 43 mm SVL. Hence, there is no sexual dimorphism in SVL in *M. atticolus* and females seemingly attain sexual maturity at an early age.

Micrablepharus atticolus has a relatively diverse diet (Table 1). Most lizards ingested homopterans, orthopterans, and unidentified insects. Numerically, unidentified insects, orthopterans, and homopterans prevailed, while volumetrically, insect larvae, orthopterans, and homopterans were most important.

Submmited by **GUSTAVO H. C. VIEIRA**, Departamento de Biologia Celular, Universidade de 70910-900 Brasília-DF, Brazil

(e-mail: ghcv@unb.br), **DANIEL O. MESQUITA**, Departamento de Ecologia, Universidade de Brasília, 70910-900 Brasília-DF, Brazil (e-mail: danmesq@unb.br), **AYRTON K. PÉRES JR.**, Departamento de Zoologia, Universidade de Brasília, 70910-900 Brasília-DF, Brazil (e-mail: chemin@uol.com.br), **KINITI KITAYAMA**, Departamento de Zoologia, Universidade de Brasília, Brasília-DF, Brazil (e-mail: kiniti@tba.com.br), and **GUARINO R. COLLI**, Departamento de Zoologia, Universidade de Brasília, Brasília-DF, Brazil (e-mail: grcolli@unb.br).

PHRYNOSOMA DITMARSI (Rock Horned Lizard). **ENDOPARASITES.** The rock horned lizard, *Phrynosoma ditmarsi*, is endemic to Sonora, Mexico (Hodges 1995. Cat. Amer. Amph. Rept. 614.1–614.3). It has been reported to harbor the nematode *Skrjabinoptera phrynosoma* (Roth 1971. J. Arizona Acad. Sci. 6:278–281). The purpose of this note is to report *P. ditmarsi* as a host of the cestode *Oochoristica scelopori*. Three adult *P. ditmarsi* from the herpetology collection of the University of Arizona, Tucson, (UAZ) were examined (UAZ 32340 collected September 1970, 2 km NE Mina Alecrán; UAZ 32357, September 1970, Rancho Alecrán; UAZ 39540, July 1974, Cerro de la Palma). The body cavity was opened and the esophagus, stomach, small intestine, large intestine, coelom, and liver were searched for helminths using a dissecting microscope. One cestode was present in the small intestine of UAZ 39540. It was dehydrated, cleared, stained in hematoxylin, mounted in balsam, examined under a compound microscope and identified as an immature *O. scelopori*. No endoparasites were found in UAZ 32357. Among the ingesta in the stomach of UAZ 32340 were eleven third-stage nematode larvae and one acanthocephalan larva. These specimens were placed on a glass slide in a drop of glycerol, allowed to clear, and identified with the aid of a compound microscope. The nematode larvae were assigned to the genus *Physaloptera* and the larval acanthocephalan was assigned to the family Oligacanthorhynchidae. All specimens were deposited in the United States National Parasite Collection: *Oochoristica scelopori* USNPC 89270; physalopteran larvae USNPC 89268; oligacanthorhynchid larva USNPC 89269.

Phrynosoma ditmarsi represents a new host record for *O. scelopori*. This is the first record of *O. scelopori* from the genus *Phrynosoma*. Other horned lizards, namely, *Phrynosoma braconnieri, P. cornutum, P. solare*, and *P. taurus* have been reported to harbor a different cestode, *Diochetos phrynosomatis* (Goldberg and Bursey 1991. Southwest. Nat. 36:365–368; Goldberg et al. 1993. J. Helm. Soc. Washington 60:234–238). *Oochoristica scelopori* has been reported from 15 species of North American lizards, primarily sceloporines (Goldberg et al. 1996. Great Basin Nat. 56:180–182).

Species of *Physaloptera*, as well as species of the Acanthocephala require an insect intermediate host (Cheng 1986. General Parasitology. 2nd Ed., Academic Press, Orlando, Florida. 827 pp.). Any insectivore could be expected to have representatives of these species in the ingesta. Larval physalopterans (and absence of adults) have been reported from the digestive tracts of 22 species of anurans and 15 species of lizards (Goldberg et al. 1993. Bull. S. California Acad. Sci. 92:43–51). Encysted cystacanths have been found in spceies of *Cnemidophorus* and *Sceloporus* (Goldberg et al. 1995. J. Helm. Soc. Washington 62:188–196). This report of physalopteran larvae and the acanthocephalan cystacanth must be considered an incidental occurrence, a byproduct of diet, until adult individuals of a species of *Physaloptera* and encysted or mature acanthocephalans are reported from *P. ditmarsi*.

We thank Charles H. Lowe (The University of Arizona) for permission to examine *P. ditmarsi*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, and **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA.

PHRYNOSOMA MODESTUM (Roundtailed Horned Lizard). **NOCTURNAL NEST-DIGGING and OVIPOSITION.** On 20 July 1997 a gravid female (mass 13.4 g; SVL 59 mm) *Phrynosoma modestum* was collected 0.5 km north of Cave Creek (Foothills Road to San Simon) near Portal (elevation 1400 m), San Simon Valley, Cochise County, Arizona, USA. The lizard was fitted with a Holohil BD-2A radiotransmitter (0.62 g; 148 KHz; pulse 0.6; whip antenna 15.5 cm) and released 22 July (1400 h) at a study site 4.4 km to the southeast. The lizard was relocated once or, usually, twice daily for the next eight days (15 times, day and night). After dark (2150 h) on 22 July it was observed to be digging, its body just inside a slanting tunnel, in moist sandy soil (rain had fallen on the site 20 and 21 July) at a vegetation-free location, air temperature (AT) 24°C. The following morning, 23 July at 0530 h, the lizard was located sleeping (eyes closed) on the dig site, AT 20°C. The excavated hole had been filled in and the area surrounding the hole was clearly disturbed (scratched). Fifteen minutes later the lizard had shifted to a new position, eyes were closed. The sun had risen above the horizon but was not shining on the lizard. Later that day, 1400 h (AT 35°C), the lizard had moved 49 m away and never returned to the site. The scraped area around the nest was larger than it had been in the morning and the hole was completely filled in. That evening, 2115 h, the nest was dug up and 12 eggs (average clutch size for *P. modestum* is 11.2 ± 9.7, range 7–18: Howard 1974. J. Arizona Acad. Sci. 9:108–116) located at 7–8 cm depth were removed. The female was found dead on 30 July, 1440 h, near an active ant nest. These observations suggest that nest digging began late in the day or early in the evening and continued well into the evening, that the egg clutch was laid at night and was mostly covered by morning, and that the finishing of nest-hiding soil arrangement was completed the following morning before the site was abandoned.

Three female *P. solare* have been seen digging at deep nests (35 cm) during the early morning, 0730–0800 h, (suggesting excavation the night before), with oviposition and nest completion by two lizards occurring during the subsequent day or night (Van Devender and Howard 1973. Herpetologica 29:238–239). A captive *P. cornutum* female (mass 82.0 g; SVL 98 mm) captured 23 June 1991 and maintained in an outdoor enclosure at the Southwestern Research Station was seen excavating a nest in the evening on 1 July 1991 (pers. obs.) after 2.3 cm rain fell on 30 June. At 0430 h the following morning, she was observed in the entry hole facing outward, apparently laying her clutch of eggs, and by 1100 h the nest with eggs was completely covered. She remained near

the nest site until at least 1500 h. Both diurnal (N = 3: Hewett 1937. Copeia 1937:234; Ramsey 1956. Herpetologica 12:239–240) and nocturnal (crepuscularly initiated) nestings (N = 6: Edwards 1896. Zool. Anz. 19:108–111; Cahn 1926. Am. Nat. 60:546–551) have been recorded for *P. cornutum* under varied conditions. Nocturnal, summer nesting at the onset of the monsoonal rainy season may allow females of some species of horned lizards to 1) avoid attracting diurnal predators with their digging activities at exposed sites, 2) avoid possible high daytime surface temperatures that might cause them to suspend activity before completion of nesting, 3) dig more easily in moistened soil with fewer roots, and 4) provide their eggs with an incubation site that has initial high moisture and that will receive maximal solar radiation due to the lack of vegetative shading.

Submitted by **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA; e-mail: wcs@amnh.org.

SCELOPORUS JARROVII (Yarrow's Spiny Lizard). **OCULAR SINUS BLEEDING.** On 28 August 1999 an adult male (mass 20.8 g; SVL 85 mm) *Sceloporus jarrovii* was noosed at 1035 h from a rock along East Turkey Creek, Chiricahua Mountains, elevation 1830 m, 2.5 km upstream from Paradise, Cochise County, Arizona, USA. While the noose-string was being removed, taking ca. 1 min, a large drop of bright-red fluid was noted, split on the supraocular scales above the right eye and on the mid-edge of the open upper eyelid. Examination of the eye with a 10x hand lens revealed a reddish tinge, which was no longer apparent two hours later. Apparently the fluid was the lizard's blood, expelled from the vascular system due to increased pressure in the sinus orbitalis and rupture(s) of one or more capillaries. The position of the blood above the eye suggests possible upward ejection, perhaps through the tear duct as postulated in the blood-squirting species of horned lizards (*Phrynosoma coronatum*, Burleson 1942. Copeia 1942:246–248; and *P. cornutum*, Middendorf and Sherbrooke 1992. Copeia 1992:519–527). Although autohemorrahaging is apparently rare in reptiles (Smith et al. 1993. Herpetol. Rev. 24:130–131; Greene 1988. *In* C. Gans and R. B. Huey [eds.], Biology of the Reptilia, vol. 16, pp. 1–152), observations of ocular-sinus autohemorrahaging have been made in snakes (Smith et al., *loc. cit.*) and in another species of iguanid lizard, *Urosaurus ornatus* (Mahrt 1996. Herpetol. Rev. 27:21–22).

An antipredator defensive role has been suggested for ocular blood squirting by some horned lizards (Middendorf and Sherbrooke, *loc. cit.*). Delivery of distasteful compounds circulating in the blood of these lizards onto the oral or other membranes of a predator apparently is a more effective defense than their release as a result of predator inflicted wounds. The rare occurrence of ocular-sinus bleeding by lizards outside the *Phrynosoma* clade suggests a precursor character, ability to exhibit occular-sinus bleeding during tactile trauma, that could have undergone positive natural selection once horned lizards incorporated chemicals into their blood that were distasteful to some predators.

Submitted by **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA; e-mail: wcs@amnh.org.

TARENTOLA (=MAKARIOGECKO) DELALANDII (Delalande's Gecko). **MAXIMUM SIZE.** *Tarentola delalandii* Dumeril and Bibron 1836 is endemic to the Canary Islands (Spain), where it is known only from the islands of La Palma and Tenerife, and from the Roques of Anaga and Garachico, near Tenerife Island. At present, most of the details concerning its biology remain unknown and few studies have addressed its morphology (Joger 1984. Cour. Forsh. Inst. Senckenberg 71:91–111; Joger and Bischoff 1983. Bonn. Zool. Beitr. 34:459–468). This species has previously been considered a small- to medium-sized gecko, reaching a maximum SVL of 70 mm (Salvador 1985. Guía de Campo de los Anfibios y Reptiles de la Península Ibérica, Islas Baleares y Canarias. S. García, León. 212+XLIII pp; Barbadillo 1987. La Guía de Incafo de los Anfibios y Reptiles de la Península Ibérica, Islas Baleares y Canarias. Incafo, Madrid. 694 pp.), thus being much smaller than the congeneric *T. mauritanica*. On 23 February 1998, on the island of Tenerife, we captured, measured, and photographed a male *T. delalandii* that measured 84 mm SVL (mass = 18.5 g). The specimen was then released. This size greatly exceeds the maximum known SVL for this species and is comparable to the maximum SVL reached by *T. mauritanica* (86 mm, Martínez-Rica 1974. Publ. Cent. Piren. Biol. Exp. 5:1–291). This observation indicates that the two species can actually reach similar sizes.

Submitted by **L. J. BARBADILLO** and **I. MARTÍNEZ-SOLANO**, Unidad de Paleontología, Departmento de Biología, Facultad de Ciencias, Universidad Autónoma, 28049 Cantoblanco, Madrid, Spain.

VARANUS SALVATOR (Water Monitor). **NESTING BEHAVIOR**. During a study of the nesting behavior of the Nicobar Megapode (*Megapodius nicobariensis*) on Great Nicobar Island (6°45'–7°15'N, 93°38'–93°55'E), I observed nesting of the water monitor, *Varanus salvator*. Unlike most birds, megapodes do not brood their eggs, but instead bury them in large mounds of sand, soil, and organic matter. The eggs are warmed by the decomposition of organic matter and the adult bird attends the mound, adding or removing sand to maintain the proper incubation temperature (Sankaran and Sivakumar 1999. Zoologische Verhandelingen 327:75–90). This study occurred from December 1995 to May 1998. During the peak megapode nesting period (February through May) water monitors were frequently seen at nest mounds, often while adult megapodes were present. These monitors are the primary predators of megapode eggs on Great Nicobar Island but are not known to prey on adult megapodes.

While the main breeding season of *V. salvator* occurs in October and November, breeding has been known to occur throughout the year (Horn and Visser 1989. Int. Zool Ybk. 12:140–150). On four occasions, *V. salvator* were observed nesting in the nest mound of the Nicobar megapode. One of these clutches (11 eggs) was immediately unearthed and reburied with a thermal sensing probe in the ground near the nest (this clutch became our control). The other three (9, 10, and 11 eggs) were left within the megapode nest mounds. Maximum temperature of the control clutch was 28°C, while the megapode nest mounds averaged 32.5°C. All clutches hatched successfully. The control clutch hatched in 305 days, while the nest mound clutches hatched after an average of

265 days. Previous studies of incubation period of *V. salvator* reported periods varying from 222 to 327 days (Andrews and Gaulke 1990. Hamadryad 15:1–5; Horn and Visser, *loc.cit.*). The shorter incubation period for the nest mound clutches when compared to the control clutch was presumably due to the increased temperature within the mounds.

Submitted by **K. SIVAKUMAR**, Wildlife Institute of India, P.O. Box No. 18, Chandrabani, Dehra Dun, India; e-mail: ksivakumar@wii.gov.in.

SERPENTES

AGKISTRODON PISCIVORUS (Cottonmouth). **DIET**. On 26 March 1984 we found an adult female *Agkistrodon piscivorus* (124 cm total length) consuming a litter of swamp rabbits (*Sylvilagus aquaticus*). The young rabbits were in a nest among dense vegetation along Bayou Fountain, ca. 2.5 km SE of the intersection of Siegen Lane and Highland Road, East Baton Rouge Parish, Louisiana, USA. The cottonmouth was collected and later deposited in the Campbell Museum, Clemson University, Clemson, South Carolina (CUSC 1825). The snake was ingesting one rabbit, and a second rabbit was found dead in the nest. The latter probably had been envenomated a short while earlier. We dissected the snake and recovered a third rabbit from the stomach. The rabbits were estimated to be about two weeks old and each was ca. 15 cm long. Cottonmouths are generalist predators known to consume a variety of mammalian prey, but our observation constitutes the first record of swamp rabbit predation (Ernst 1992. Venomous Reptiles of North America. Smithsonian Institution Press, Washington, D.C. 236 pp.).

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Submitted by **STEVEN G. PLATT**, Wildlife Conservation Society, P.O. Box 1620, Phnom Penh, Cambodia, and **THOMAS R. RAINWATER**, The Institute of Environmental and Human Health, Box 41163, Texas Tech University, Lubbock, Texas 79409-1163, USA (e-mail: trainwater@ttu.edu).

ALSOPHIS VUDII (Bahamian Brown Racer). **OVERWATER DISPERSAL**. Anecdotal accounts exist of snakes being encountered in the marine waters of the Bahamas. Some of these accounts probably stem from the morphological similarities of eels in the genus *Myrichthys* to colubrid snakes. Another possible explanation may be overwater movements of *Alsophis*, *Epicrates*, or *Tropidophis* throughout the shallow Bahamian seas of the Great Bahama Bank. On 8 March 1998, I witnessed an *Alsophis vudii* emerging from the surf onto the eastern beach of Alligator Cay, Exuma Cays Land and Sea Park, Bahamas (24°23'N, 76°38'W). The snake exited the sea at 1535 h and remained basking on the beach rock for 20 min before retreating to the karst limestone ridge adjacent to the beach. This species has not been reported from this cay (Franz et al. 1993. Carib. J. Sci. 29:165–173) and is most likely a random migrant. The closest neighboring cay is 100 m to the north and separated by a channel of flowing water that coincides with the tides. *Alsophis* inhabits beaches and coastal mangroves (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies. Univ. Florida Press, Gainesville, Florida. 720 pp.); however, this is the first documented account of this species taking to the sea and colonizing an island. This event has biogeographic implications and may offer insight to historical and present reptile distributions in the Bahamas.

Submitted by **CHARLES KNAPP,** Department of Conservation, John G. Shedd Aquarium, Chicago, Illinois 60605, USA, and Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32601, USA; e-mail: cknapp@ufl.edu.

BOA CONSTRICTOR (Boa Constrictor). **DIET**. *Boa constrictor* diets include a variety of lizards, birds, and mammals (Greene 1983. *In* Janzen [ed.], Costa Rican Natural History, pp. 380–383. University of Chicago Press, Chicago, Illinois). Previous accounts of avian prey items from stomachs of individual *B. constrictor* include an antbird (Formicariidae), a blue-gray tanager (*Thraupis episcopus*, Thraupidae), and an orange-billed sparrow (*Arremon aurantiirostris*, Emberizidae) (Beebe 1946. Zoologica. 31:11–52; Greene 1983, *op. cit.*; Guyer and Donnelly, unpubl.). Here we report an additional avian prey item; a bright-rumped attila (*Attila spadiceus*, Tyrannidae; 39.5 g), palped from a immature female *B. constrictor* (SVL 76 cm, 240 g without prey) on 14 July 1999 at 2100 h at the La Selva Biological Station, Heredia Province, Costa Rica (Fig. 1). This snake was collected about 10 m above ground in a *Pentaclethra macroloba* adjacent to the main suspension bridge over the Rio Puerto Viejo. The snake was released at the point of capture after data were collected.

The birds that have so far been recorded in the diet of *Boa constrictor* occupy diverse strata in the forest, ranging from the ground to the canopy (Stiles and Skutch. 1989. A Guide to the Birds of Costa Rica. Cornell Univ. Press, Ithaca, New York. 511 pp.). This suggests that adult and juvenile *B. constrictor* feed on avian prey throughout the arboreal strata. These snakes may affect important forest processes by consuming key predators of arthropods and dispersers of seeds.

We thank the Organization for Tropical Studies for the opportunity to collect these data.



FIG. 1. Immature female *Boa constrictor* and its prey, a bright-rumped attila (*Attila spadiceus*), La Selva Biological Station, Costa Rica.

Submitted by **SCOTT M. BOBACK**, Department of Biological Sciences, Auburn University, Auburn, Alabama 36849, USA (e-mail: bobacsm@auburn.edu), **ELIZABETH BURROUGHS**, Forestry Department, Duke University, Durham, North Carolina 27708, USA, **CRISTINA UGARTE** and **JAMES WATLING**, Department of Biological Sciences, Florida International University, Miami, Florida 33199, USA.

BOIGA IRREGULARIS (Brown Tree Snake). **PREDATION**. *Boiga irregularis* is an arboreal snake native to Australia and Papua New Guinea with introduced populations on Guam, Saipan, and other islands of the mid-Pacific region. We are unaware of any reports of predators on *B. irregularis* in its native range. We present three instances of predation on *B. irregularis* by the red-bellied black snake (*Pseudechis porphyriacus*) and the cane toad (*Bufo marinus*).

In April 1992, we were feeding chickens in Babinda, Queensland (17°20.50'S, 145°55.54'E), and discovered a 1.6 m total length (TL) red-bellied black snake attempting to capture a similarly-sized brown tree snake in the rafters of the aviary. The red-bellied black snake climbed into the rafters, caught the brown tree snake, and consumed it in ca. three hours. Photographs of the event were taken.

On 3 March 1999 at 1745 h, we examined the stomach contents of a road-killed red-bellied black snake (ca. 1.5 m TL) on a paved highway on the outskirts of Babinda. The snake contained a brown tree snake (ca. 0.8 m TL). No other food items were discovered in the snake's digestive tract.

We also observed a cane toad (*Bufo marinus*) catch and consume a neonate (ca. 50 cm TL) brown tree snake. On 25 May 1998 at 1130 h in a banana plantation outside Babinda, Queensland (17°27.45'S, 145°52.16'E), a brown tree snake fell out of a bunch of bananas during harvest. Brown tree snakes are commonly found in banana bunches by plantation workers in this area. Seconds after the snake fell to the ground, a large *B. marinus* came from under a banana leaf and swallowed the neonate. No specimens were collected from any of the events.

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Submitted by **JOE N. CAUDELL**, Jack Berryman Institute, Department of Fisheries and Wildlife, Utah State University, Logan, Utah, 84322-5210, USA (e-mail: jcaudell@cc.usu.edu), **BRIAN JAMES**, P.O. Box 157, Babinda, Queensland 4861, Australia, and **PAULINE LAWIE**, Babina, Queensland 4861, Australia.

CROTALUS LEPIDUS KLAUBERI (Banded Rock Rattlesnake). **CAUDAL LURING**. Caudal luring has been reported for a wide variety of crotalines, a handful of viperines, three boids, and one elapid (Strimple 1992. Greater Cincinnati Herpetol. Soc. Contrib. Herpetol. 49–54), and more recently in several colubrids (Sazima 1993. Copeia 1993:222–226; Leal and Thomas 1994. J. Herpetol. 28:126–128; Tiebout 1997. J. Herpetol. 31:290–292). However, the vast majority of observations have been made on captives and observations of luring in the wild are limited to three species (Strimple 1992, *op. cit.*). While caudal luring has been described in captive *Crotalus lepidus* (Kauffeld 1943. Am. Midl. Nat. 29:607–614), we report the first observation of this behavior in the field. Caudal luring has been defined as "the waving or wriggling of a conspicuous tail by an otherwise cryptically colored snake, thereby attracting small animals which attempt to feed on the worm-like or caterpillar-like tail but themselves become prey when they come within striking distance of the snake" (Heatwole and Davison 1976. Herpetologica 32:332–336). This definition requires that prey are attracted to the wriggling tail, a distinction supported by Strimple (1992, *op. cit.*) who suggests the term "caudal-luring–like behavior" be used for observations of tail wriggling in the absence of prey or prey attraction.

On 10 September 1999 at ca. 1013 h one of us (BLS) discovered a neonatal *C. l. klauberi* loosely coiled atop a large (1 x 0.75 m) rock near the upper edge of a steep (35°) talus slide in the Chiricahua Mountains, Cochise Co., Arizona, USA. We assume this specimen was probably less than eight weeks old based on the snake's size, the fact that it possessed only a button, and the phenology of parturition in this species. The snake did not visibly react to the observer's presence 3 m behind it. After sitting motionless for 5 min while being silently observed, the snake raised its tail ca. 1 cm above the dorsum and began undulating it in continuous waves at a frequency of 60–80 cycles per minute. The neon yellow tail was fully exposed ca. 1 cm behind and to the side of the head. The behavior continued uninterrupted for at least 5 min. Cessation of the behavior was concurrent with the appearance of full sun from behind clouds. About 15 sec later the snake slowly crawled to cover.

In the Madrean Archipelago, *C. l. klauberi* diet consists chiefly of *Sceloporus jarrovii* (Holycross, unpubl. data), a diurnal lizard that is especially abundant in talus. Although *S. jarrovii* were not observed in the immediate vicinity (3 m) of the neonatal rattlesnake, numerous individuals were observed throughout the talus prior to and after the observation. The observer did not consciously look for lizards while he watched the snake lure, so it is possible that the snake was luring a specific prey item that the observer did not notice. Alternatively, as suggested by Chiszar et al. (1990. J. Herpetol. 24:253–260), the snake may have been using its tail as a "probe" to lure undetected prey in a microenvironment where prey are reasonably abundant. Since we cannot document attraction of prey to the tail, strict application of the definitions cited above would prohibit interpreting the observed behavior as caudal luring. Nevertheless, we find that the context of this observation strongly suggests the snake was using its tail as a lure to attract prey. If the behavior is an adaptation for misdirecting strikes by potential predators, the placement of the tail over the body seems counterproductive. If it is displacement behavior, it is probably maladaptive in this context where it might attract the attention of a potential predator.

Submitted by **BRYAN L. STARRETT**, Herpetology Section, South Carolina Aquarium, 57 Hasell Street, Charleston, South Carolina 29401, USA (e-mail: bvipers@aol.com), and **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu).

CROTALUS WILLARDI OBSCURUS (New Mexico Ridgenose Rattlesnake). **CAUDAL DICHROMATISM.** *Crotalus willardi willardi* exhibit black, gray striped, and, rarely, yellow tails at birth. Martin (1975. Bull. Maryland Herpetol. Soc. 11:64–65) noted that seven neonates born to a female collected from the Santa Rita Mountains of Arizona all had yellow tails. Martin (1975. Bull. Maryland Herpetol. Soc. 11:187–189) later described another litter from Santa Rita parents; two of these had yellow tails while four had gray striped tails. However, eight *C. w. willardi* (two unrelated litters) born to parents from the Huachuca Mountains (Arizona) did not demonstrate yellow tails at birth, but instead had "dark tails" (Quinn 1977. Bull. Maryland Herpetol. Soc. 13:11; Tryon 1978. Bull. Maryland Herpetol. Soc. 14:83–88). Likewise, yellow tails were absent in three complete litters (17 neonates) and an additional 10 neonates observed by Fred Wilson (pers. comm.) in the Huachuca Mountains. Wilson described these tails as darkly striped. Finally, Martin (1976. Bull. Maryland Herpetol. Soc. 12:126–128) reported a litter of nine Animas Mountain (New Mexico) *C. w. obscurus* that had "mostly black colored tails" but had yellow pigment on the upper and lower labials, rostral, and mental scales.

Herein I report the occurrence of both yellow and black tails in a single litter of *C. w. obscurus*. On 2 August 1998 a 489 mm SVL *C. w. obscurus* was captured in the Peloncillo Mountains, New Mexico. Palpation revealed eight embryos. On 13 August 1998 at 0800 h her mass was 138 g. At 1551 h eight neonates were discovered in the container housing the female; three still partially encased in embryonic sacs. Parturition was complete by 1730 h. The female's mass was 78 g at 1905 h. Litter mass represented 54.5% of the female's postpartum mass. Litter mass and mass of expelled fluids/tissues combined represented 76.9% of the female's postpartum mass. Neonate morphometrics are within previously reported ranges (mean ± SD: 158.9 ± 2.2 mm SVL, 5.3 ± 0.3 g). At birth, six of the neonates had yellow tails, while the remaining two had dark tails. After shedding, the tails of the former were brighter yellow while the latter two had nearly solid black tails. All specimens had very faintly striped tails. All of these neonates had yellowish facial markings as described by Martin (1976, *op. cit.*). All eight offspring and the mother were released at point of capture.

Although caudal luring has not been formally reported in *C. willardi*, Schuett et al. (1984. Anim. Behav. 32:624–629), Greene (1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 107–118. Selva, Tyler, Texas), and Strimple (1992. Greater Cincinnati Herpetol. Soc. Contrib. Herpetol., pp. 49–54) all cite an unpublished observation by Bern Tryon as a personal communication. Most juvenile vipers with brightly colored tails use the tail to lure prey (Strimple, *op. cit.*). Those that have not yet been observed luring, are expected to do so, or be descendants of snakes that did so (Greene, *op. cit.*). It is generally assumed that bright coloration is an adaptation that renders the tail more attractive to prey such as diurnal lizards that have excellent color vision (e.g., Fleishman et al. 1997. J. Comp. Phys. A 181:446–460). In this context it seems probable that juvenile *C. w. obscurus* caudal lure with their sometimes brightly colored tails for *Sceloporus jarrovii*, their primary prey (Holycross, unpubl. data). Interestingly, while vicariance has led to the evolution of manifest differences in ground color and facial pattern between *C. w. obscurus* and *C. w. willardi*, yellow tails have been preserved in both at low frequency, despite small population sizes and potential for bottlenecks in some isolates. *Crotalus willardi* or other species with polymorphic tail coloration (e.g., some *Bothrops* spp. where the trait is sex-linked) may be ideal species for addressing questions related to the function and microevolution of brightly colored tails in juvenile pitvipers. On a broader scale, it is unclear whether bright tail coloration is homoplasious or homologous within pitvipers. Caudal luring is widespread among pitvipers and may be a homology (or "latent homology") preserved by the clade's widespread dependence on "sit and wait" foraging strategies (Greene, *op. cit.*). Caudal luring may then provide a context for repeated independent evolution of brightly colored tails within Crotalinae.

Submitted by **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu).

HAPSIDOPHRYS SMARAGDINUS (Emerald Snake), ***PHILOTHAMNUS IRREGULARIS*** (NCN), ***PHILOTHAMNUS HETERODERMUS*** (NCN), ***DASYPELTIS* SP.** (Egg-Eating Snake), ***AFRONATRIX ANOSCOPUS*** (Brown Water Snake), ***GRAYIA SMYTHII*** (Smyth's Water Snake), ***NATRICITERES VARIEGATUS*** (NCN), ***BOAEDON LINEATUS*** (House Snake), and ***APARALLACTUS NIGER*** (Centipede-Eater). **CAUDAL PREHENSION.** Between January 1986 and June 1989, I collected several live colubrid snakes in Liberia, western Africa. These included five *Hapsidophrys smaragdinus* (total lengths = 38 cm, 73 cm, 84 cm, 87 cm, 98 cm), five *Philothamnus irregularis* (TL = 56 cm, 66 cm, 76 cm, 90 cm, 91 cm), one *Philothamnus heterodermus* (TL = 58 cm), one *Dasypeltis* sp. (TL = 61 cm), ten *Afronatrix anoscopus* (TL = 23 cm, 23 cm, 24 cm, 25 cm, 28 cm, 40.5 cm, 42 cm, 52 cm, 53 cm, 54 cm), two *Grayia smythii* (TL = 112 cm, 130 cm), one *Natriciteres variegatus* (TL = 35 cm), four *Boaedon lineatus* (TL = 35 cm, 65 cm, and two adults of unrecorded length), and three *Aparallactus niger* (TL = 44 cm, 48 cm, 57 cm). In these snakes, I tested for caudal prehensile ability by running a finger along the tail. If the snake's tail responded to this by seizing the finger, I concluded that the tail was prehensile. If the tail did not seize the finger after four trials, I concluded that the tail was not prehensile. All specimens were handled repeatedly, and in no case did subsequent handling falsify these conclusions.

Strong prehensile ability (ability to grip tightly) was found in *H. smaragdinus*, *P. heterodermus*, *P. irregularis*, *A. anoscopus*, *G. smythii*, *Dasypeltis* sp., *A. anoscopus*, and *G. smythii*. Weak prehensile ability (ability to grip, but not tightly) was found in *N. variegatus*. In all specimens of all nine species, the finger was seized on the first trial. A review of the literature (Schmidt 1923. Bull. Am. Mus. Nat. Hist. 49:1–145; Villiers 1950. IFAN Initiations Africaines 2:1–148; Broadley 1957. Afr. Wild Life 11:53–55; Doucet 1963. Acta Tropica 20:201–340; Cansdale 1971. West African Snakes. Longman Group Ltd, Essex, United Kingdom, 74 pp.; Dunger 1971. The Nigerian Field 36:21–38; Dunger 1973. The Nigerian Field 38:158–180; Pitman 1974. A Guide to the Snakes of Uganda, Revised Edition, Wheldon and Wesley, Ltd, Codicote, England, 290 pp.; Marais 1992. A Complete Guide to the Snakes of Southern Africa, Krieger Publishing Company,

Malabar, Florida, 208 pp.; Branch 1998. Field Guide to the Snakes and other Reptiles of Southern Africa, Ralph Curtis Books, Sanibel Island, Florida, 399 pp.) revealed that caudal prehension in members of all the genera examined here is heretofore unreported. The only exception to this is a statement by Pitman (*op. cit.*, p. 96) that the tail of *P. semivariegatus* is "highly prehensile."

The discovery of prehensile tails in arboreal species (*H. smaragdinus*, *P. heterodermus*, *P. irregularis*, *Dasypeltis* sp.) is not surprising. These snakes use their tails to grip branches during climbing, thereby gaining more stability (pers. obs.).

Afronatrix anoscopus is an aquatic species that uses caudal prehension to anchor itself during underwater ambush foraging (pers. obs.). *Afronatrix anoscopus* grips a submerged rock or stick with its tail while awaiting its prey. When a fish, frog, or tadpole comes within striking range, the snake shoots its head toward the prey item, seizes it with its mouth, and commences to swallow, all the while maintaining a caudal grip upon its anchor. If the snake's strike misses, the snake often remains anchored to the same object and awaits the next prey item.

Of all the species examined here, the strongest caudal grip (as measured by the feeling of pressure upon the researcher's fingers and arms) is exhibited by *Grayia smythii*. I once wrapped the tail of a 1.3-m individual around a tree branch, and let the snake hang with no other support. The snake tried repeatedly to pull the rest of its body up onto the branch, but was unable to do so, although it maintained its caudal grip with apparent ease. *Grayia smythii* is aquatic, and eats fish, frogs, and tadpoles (Dunger 1971, *op. cit.*; Pitman, *op.cit.*). It might therefore use its tail for anchoring during prey capture, as in *A. anoscopus*. However, prey capture behavior in *G. smythii* is unknown (Cansdale, *op.cit.*; Dunger 1971, *op. cit.*; Pitman, *op. cit.*).

The function of the weak prehension in the tail of *Natriciteres variegatus*, a terrestrial denizen of damp places (Dunger 1971, *op. cit.*; Pitman, *op. cit.*), is enigmatic.

The tails of the terrestrial species *Boaedon lineatus* and the fossorial species *Aparallactus niger* lacked prehensile ability. This is not surprising, as stability is not a problem for a snake which tends not to occur high above the ground. However, I observed that the hind end of the trunk (immediately anterior to the tail) in both species is capable of exerting a powerful grip on a finger. The function of this hind grip in both species is enigmatic.

I thank Jim and Jane Park, John and Marie Taylor, and George and Libby Senter for allowing me to keep cages of snakes under their garage or porch roofs. I thank Alfred, Mary, and Torseh Yeanay, Earl and Ken Williams, Sam Wiah, and several individuals of unknown identity, for locating some of the snakes used in this study.

Submitted by **PHIL SENTER**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA.

LIOPHIS PORTORICENCIS ANEGADAE (NCN). **NIGHT-LIGHT NICHE**. Geckos have for years been known to associate with human dwellings, foraging around lights at night. More recently, diurnal lizard species have developed this behavior, termed "night-light niche" by Schwartz and Henderson (1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. University of Florida Press, Gainesville, Florida. 720 pp.). McCoid and Hensley (1993. Herpetol. Rev. 23:87–88) listed seven species of *Anolis* and a skink (*Cryptoplepharus poecilioplеurus*), and Perry and Buden (1999. Micronesica 31:263–273) added another skink, *Lamprolepsis smaragdina*, to the list of reptiles that employ this behavior. On Guana Island, British Virgin Islands, the crested anole *Anolis cristatellus* has for years been known to occupy this niche (Lazell, unpubl.). In October 1999, the diurnal gecko *Sphaerodactylus macrolepis* was first seen in the night-light niche, with individuals seen foraging on path lights between 2030 and 2100 h (Perry, unpubl.). In the last three years, however, a diurnal colubrid snake has also joined the growing list of species foraging at lights in the night. Starting in 1997, we have observed several individuals of *Liophis portoricensis anegadae* apparently ambushing lizards at these lights. On 2 October 1999, one was observed consuming an *Anolis*, itself using the light to ambush prey. To our knowledge, this is the first record of a snake occupying the night-light niche. With this development, a chain that started with insects being attracted to lights, and then extended to insect predators, now has its first secondary predator.

We are indebted to Barry and Buena Valentine for recording the *Anolis* consumption.

Submitted by **GAD PERRY**, Department of Zoology, University of Wisconsin, 430 Lincoln Drive, Madison, Wisconsin 53706-1381, USA (e-mail: GPerry@facstaff.wisc.edu), and **JAMES LAZELL**, The Conservation Agency, 6 Swinburne St., Jamestown, Rhode Island 02835, USA.

MASTICOPHIS FLAGELLUM (Western Coachwhip). **SECONDARY INGESTION**. On 19 April 1999, at 1930 h, an adult female *Masticophis flagellum* was captured under a four-foot piece of aluminum siding at Cedar Hill State Park, Dallas Co., Texas, USA. The snake (142.0 cm total length), which appeared to have recently fed, was palped. An *Opheodrys aestivus* (rough green snake), attached to a 15.0 cm elm stem (*Ulmus crassifolia*) containing 17 leaves was regurgitated. The *O. aestivus* (ca. 50 cm total length) had wrapped its posterior half including its tail tightly around the vegetation. This suggests that the *Opheodrys* was attempting to evade predation by clinging to the elm. The *Opheodrys aestivus*, still attached to the vegetation, was preserved and placed in the University of Texas at Arlington Collection of Vertebrates (UTA-R46045). The *Masticophis* was released.

We thank Ardell Mitchell for reviewing this manuscript, and the staff of the Dallas Zoo Department of Herpetology for their support. We also thank the Texas Parks and Wildlife Department (Permit # 51-98), and the staff of Cedar Hill State Park.

Submitted by **RICHARD D. REAMS** and **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, Dallas, Texas 75203 USA, and **JOHN M. DAVIS**, Texas Parks and Wildlife, P.O. Box 941 Cedar Hill, Texas 75106 USA; e-mail (RDR): Hylareams@aol.com.

OXYRHOPUS PETOLA DIGITALIS (NCN). **PREY**. Neotropical colubrid snakes of the genus *Oxyrhopus* are known to feed on lizards and rodents (Duellman 1990. *In* Gentry (ed.), Four Neo-

tropical Rainforests, pp. 455–505. Yale Univ. Press, New Haven, Connecticut; Sazima and Abe 1991. Studies on Neotropical Fauna and Environment 26:159–164; Strussmann and Sazima 1993. Studies on Neotropical Fauna and Environment 28:157–168; Andrade and Silvano 1996. Revta Bras. Zool. 13:143–150). Birds have also been reported as prey of *O. guibei* (Sazima and Abe, *op. cit.*). Here we report the stomach contents of one *O. petola digitalis* (1287 mm total length), captured in the Municipality of Ibiporã, Paraná, Brazil. One unidentified rodent (ca. 70 mm SVL) and one bird, *Columbina talpacoti* (Aves: Columbiformes, 110 mm bill to uropygial gland length), were found in the snake's stomach. The two specimens were ingested head first. This is the first record of *O. p. digitalis* eating a bird. The snake was deposited in the herpetological collection of the Universidade Estadual de Londrina (MZUEL 150), Londrina, Brazil.

Submitted by **PAULO SÉRGIO BERNARDE** and **REGINALDO ASSÊNCIO MACHADO**, Curso de Pós-Graduação em Zoologia, Depto. de Zoologia, Universidade Federal do Paraná, CP 19020, Curitiba-PR, 81531-990, Brazil (e-mail: rmachado@garoupa.bio.ufpr.br).

SISTRURUS CATENATUS (Massasauga). **LITTER SIZE**. Female body size is known to affect litter size in snakes (Seigel and Ford 1987. *In* Seigel et al. (eds.), Snakes: Ecology and Evolutionary Biology, pp. 239–240. MacMillan Publishing Co., New York, New York). Data exist on litter size for *Sistrurus catenatus* across the species' range in North America (Fitch 1985. Univ. Kansas Mus. Nat. Hist. Misc. Pub. 76:1–76). Litter size in Illinois *S. catenatus* was 5–14 (mean = 9.5) in six litters examined (Wright 1941. Am. Midl. Nat. 25:659-672). In other states, mean litter size for this viperid ranged from 3 to 19 (Seigel 1986. Biol. Cons. 35:333–346).

On 21 July 1999 a gravid female *S. catenatus* was collected in Cook Co., Illinois, USA. The snake was retained for reproductive data as part of ongoing studies of *Sistrurus catenatus* populations in northeastern Illinois. The snake was maintained alone in an enclosure (23–28°C). The female (660 mm SVL, 520 g on 1 August 1999) gave birth to 20 neonates between 0800–1130 h on 11 August 1999. Total litter mass (taken within 1 h of parturition) was 210 g; afterbirth weight was 80 g. This yielded 290 g of total expended reproductive mass. Female post-parturition weight was 230 g. Relative reproductive effort (Lemen and Voris 1981. J. Anim. Ecol. 50:89–101), obtained by dividing total litter mass by female pre-parturition mass, was calculated to be 40.3% for this female. However, when the female's total expended reproductive mass (290 g) is divided by female pre-parturition mass, total reproductive effort was 55.7%, with 40.3% being effort invested only in neonates.

Neonates were sexed by probing, weighed on an Acculab Pocket Pro digital gram balance, and measured to the nearest 5 mm. The 20 (17 female, 3 male) neonates ranged from 200–220 mm SVL (mean ± SD = 212.3 ± 4.88 mm). Body weight ranged from 10.6–12 g. (11.51 ± 0.589 g). Neonates were individually identified by dorsal-pattern description and photographs, and were released with the female at the capture site. This litter currently represents the largest number of young known for *Sistrurus catenatus* in North America.

This study was funded by the Illinois Department of Transportation. The Illinois Department of Natural Resources, Endangered Species Protection Board (G. Kruse) provided permits to retain the gravid female *S. catenatus*. The author thanks Harold K. Voris for comments on the manuscript.

Submitted by **THOMAS G. ANTON**, Department of Zoology, Division of Amphibians and Reptiles, Field Museum of Natural History, Roosevelt Road at Lakeshore Drive, Chicago, Illinois 60605, USA (e-mail: TAnton2963@aol.com).

THAMNOPHIS SIRTALIS FITCHI (Valley Garter Snake). **DIET**. Several snakes of the genus *Thamnophis* are recognized scavengers. For example, *T. elegans*, *T. radix* and *T. proximus* are all reported as occasional carrion eaters (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.). Recently, the most wide ranging garter snake, *T. sirtalis*, has been implicated as a scavenger (Sajdak and Sajdak 1999. Herpetol. Rev. 30:229). Here, we report another instance of scavenging in *T. sirtalis*.

On 9 August 1999, at Furnace Flat in the Tahoe National Forest, Nevada Co., California, USA (39°21'20.5"N, 120°30'13.6"W) we encountered a male *T. sirtalis fitchi* (SVL 486 mm, tail length 130 mm, 46.68 g, deposited in the California Academy of Sciences, CAS 209985) attempting to swallow the anterior portion of a headless fledgling fox sparrow, *Passerella illiaca* (tarsus length 160 mm, 2.46 g, held with CAS 209985). Upon our approach, the snake disengaged its jaws and fled. It was caught and palped for stomach contents but contained none. Although *T. sirtalis* are known to prey on birds (Gregory 1978. Can. J. Zool. 56:167–174), the sparrow remains were in an advanced stage of decomposition and showed no signs of being previously swallowed and regurgitated by the snake. These observations support the widely held view that *T. sirtalis* is a generalist predator eating a wide variety of prey (Fitch 1965. Univ. Kansas Publ. Mus. Nat. Hist. 15:493–564).

We thank Doug Long for help identifying the fox sparrow and Jens Vindum and Marylin Tierney for their supervision during this fieldwork. Fieldwork was funded by a Challenge Cost-Sharing Agreement between the CAS and the U.S. Department of Agriculture, Forest Service Region 5 (CCS-5-99-20-069).

Submitted by **CHRIS R. FELDMAN**, Department of Biology, San Francisco State University, San Francisco, California 94132, USA, and **JEFFERY A. WILKINSON**, Department of Herpetology, California Academy of Sciences, San Francisco, California 94118, USA (e-mail: jwilkinson@harveyecology.com).

THAMNOPHIS SUMICHRASTI (Sumichrast's Garter Snake). **PREY**. *Thamnophis sumichrasti* is a poorly known garter snake that occurs in eastern México. Data on the diet of this species is lacking. However, data on 20 species of garter snakes show that fish and amphibians are the main dietary items (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. University of Oklahoma Press, Norman, Oklahoma. 332 pp.). On 5 August 1995 we collected a young female *T. sumichrasti* (blotched morph, 117 mm SVL), at the vicinity of Carpinteros, Hidalgo, México. It was basking on the ground of a pine-oak forest. During handling the

snake regurgitated a partially digested adult *Pseudoeurycea leprosa* (Plethodontidae), that was ca. 53 mm SVL. To our knowledge this is the first record of *T. sumichrasti* preying on *P. leprosa*. The preserved snake (JLE0850) is deposited in the herpetological collection of Unidad de Biología, Tecnología y Prototipos (UBIPRO-Iztacala, UNAM).

Submitted by **JULIO A. LEMOS ESPINAL** (e-mail: lemos@servidor.unam.mx), **AURELIO RAMÍREZ BAUTISTA**, **GUILLERMO WOOLRICH PIÑA**, and **JORGE E. GONZÁLEZ ESPINOZA**, Laboratorio de Ecología, UBIPRO, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México, Apartado Postal 314, Tlalnepantla, México.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 31, Number 1 (March, 2000).

CAUDATA

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: NORTH CAROLINA: Avery Co: Pineola Bog, 0.8 km W jct. U.S. Rt. 221 and St. Rd. 181 (36°01'42"N, 81°54'00"W). 16 April 2000. Christopher R. Wilson. North Carolina State Museum of Natural Sciences Color Photograph 10164. Verified by Alvin Braswell. Eight females were found brooding seven clutches. One female and clutch were photographed and released. New county record; first record for the northern Blue Ridge Mountains of North Carolina (Harry LeGrande, North Carolina State Natural Heritage Program, pers. comm.).

Submitted by **CHRISTOPHER R. WILSON**, Department of Biology, Appalachian State University, Boone, North Carolina 28608, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: WISCONSIN: Door Co: Toft Point (45°04'23.5"N, 87°05'48.8"W). 4 September 2000. Steven J. Price and Russell D. Japundich. Richter Museum of Natural History (513-R). Verified by T. C. Erdman. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus., Milwaukee, Wisconsin. 87 pp.).

Submitted by **STEVEN J. PRICE**, Department of Natural and Applied Sciences, University of Wisconsin, Green Bay, Green Bay, Wisconsin 54311, USA (e-mail: pricsj07@uwgb.edu).

NOTOPHTHALMUS PERSTRIATUS (Striped Newt). USA: FLORIDA: Sumter Co: Lake Panasoffkee, Half Moon Wildlife Management Area, 28°53'84"N, 82°14'41"W. 19 August 1998. Nancy Dwyer. Florida Museum of Natural History (UF Color Slide 121139). Verified by F. Wayne King. Eft caught at a drift fence located in mesic flatwoods. Another eft was caught at a nearby drift fence (28°52'28"N, 82°14'47"W) on 5 August 1998. New county record (Franz and Smith 1999, Florida Fish and Wildl. Conserv. Comm. Final Rep. vi+46 pp. Tallahassee, Florida).

Submitted by **STEVE A. JOHNSON**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (e-mail: tadpole@ufl.edu), and **NANCY DWYER**, Florida Fish and Wildlife Conservation Commission, Half Moon Field Office, 8864 CR 247, Lake Panasoffkee, Florida 33538, USA (e-mail: dwyern@fwc.state.fl.us).

ANURA

ACRIS CREPITANS (Northern Cricket Frog). USA: TENNESSEE: Williamson Co: Harpeth River near bridge on McDaniel Road (35°49'59"N, 86°41'53"W). 25 September 1994. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3321). Verified by A. Floyd Scott. One specimen on sandbar along river. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

ALSODES AUSTRALIS. ARGENTINA: CHUBUT: Departamento Tehuelches: S shore Lake Vintter, 43°58'S, 71°33'45"W, ca. 990 m elev. 2 February 2000. Carmen Úbeda. Museo de La Plata, La Plata, Argentina (MLP A 1788). Verified by Néstor G. Basso. Adult male (SVL 53.43 mm) showing secondary sex characters (distinct thorny structures in the fingers and round bilateral spiny patches on the chest). Specimen was found under a rock near a cold, crystalline mountain stream where large numbers of *A. australis* tadpoles (of varying size) were also found; recently metamorphosed juveniles were also found in adjacent streams. The environment is temperate humid deciduous austral beech forest of lenga (*Nothofagus pumilio*). *Alsodes australis* is known to inhabit austral forests of Chile and Argentina. Only three previous records exist for the species: in Chile at Puente Traihuanca (46°25'S, 72°04'W), and in Argentina at Paso Pérez Rosales (41°04'S, 71°48'W) and Arroyo Zanjón Hondo (42°42'S, 71°41'W) (Formas et al. 1997, Stud. Neotrop. Fauna & Environm. 32: 200–211). Specimen extends known distribution to the eastern slopes of the Andes 145 km air line S from the southernmost previously known locality (Arroyo Zanjón Hondo) and decreases distributional hiatus between the southernmost locality in Argentina and the only one known for Chile.

Submitted by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Provincia de Río Negro, Argentina.

BUFO AMERICANUS (American Toad). USA: TENNESSEE: Scott Co: Big South Fork National River and Recreation Area Visitor Center, Bandy Creek Campground (36°32'27"N, 84°37'40"W). 9 April 1995. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3315). Verified by A. Floyd Scott. Numerous males calling at pond edge. Twice observed bat dive at and make contact with one toad. Bat flew away leaving the toad inflated in defense posture. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center Field Biol. Misc. Publ. 12:1–94). Coffee Co: Arnold Engineering and Development Center (35°26'12"N, 86°03'12"W). 17

March 1995. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3317). Verified by A. Floyd Scott. Many pairs in amplexus in dirt road puddle. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

ELEUTHERODACTYLUS UNO (Savage's Robber Frog). MEXICO: OAXACA: Santa Rosa Lachao, municipio Juquila. July 1972. Thomas MacDougall. UCM 52603. Verified by John D. Lynch. Second known specimen, and first from the state of Oaxaca, extending the known range (Savage 1984, Amphibia-Reptilia 5:253–260) about 250 km from south-central Guerrero (12.9 km SW Puerto del Gallo), although in the same biotic province.

Submitted by **HOBART SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

EPIPEDOBATES HAHNELI (Hahnel's Poison Frog). PERU: UCAYALI: Provincia Atalaya: Bolognesi (10°02'S, 73°57'W), 200 m elev. 31 January 1999. E. Lehr. Museo de Historia Natural de San Marcos (MHNSM 20296). Verified by Javier Icochea. First state record (Rodríguez et al. 1993, Publ. Mus. Hist. Nat. UNMSM [A] 45:1–22; Haddad and Martins 1994, Herpetologica 50:282–295).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany, (e-mail: elehr@sng.uni-frankfurt.de) and **CESAR AGUILAR**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

GASTROPHRYNE CAROLINENSIS (Eastern Narrowmouth Toad). USA: TENNESSEE: Williamson Co: Directly across Little Harpeth River from Deerwood Arboretum and Natural Area at end of Deerwood Lane off Johnson Chapel Road (36°01'59"N, 86°50'35"W). 21 August 1994. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3320). Verified by A. Floyd Scott. Five males calling in flooded lowland behind River Oaks subdivision; water depth 1.3 cm. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

HETERIXALUS LUTEOSTRIATUS (Yellowstripe Reed Frog). MADAGASCAR: MAJUNGA PROVINCE: Antsohihy Fivondronana: Ambolobozo Firaisana, Sahamalaza Peninsula, Betsimpoaka Village (14°19'79"S, 47°57'76"E). 11 February 2000. F. Andreone and J. E. Randrianirina. Museo Regionale di Scienze Naturali di Torino (MRSN-FAZC 10479, 10482, 10508); DIEGO-SUAREZ PROVINCE: Ambanja Fivondronana: Ambanja Firaisana, Ambanja Town (13°40'72"S, 48°28'37"E). 24 February 2000. F. Andreone, J. E. Randrianirina, and M. Vences, Zoologische Staatssammlung München (ZSM 426/2000). Both verified by F. Glaw. Until now, *Heterixalus luteostriatus* has been known only from localities in the southernmost part of Madagascar (i.e., Ranohira, Kirindy, Ampijoroa-Ankarafantika, Ambalabongo, Kandany, Andranolava and Mahajanga; Glaw and Vences 1994, A Fieldguide to the Amphibians and Reptiles of Madagascar. Vences und Glaw Verlag, Cologne. 480 pp). Betsimpoaka Village is 250 air km from the northernmost published record at Mahajanga. In addition, the record from Ambanja Town is located 75 km north of Betsimpoaka Village and extends the distribution 325 km north into the region of Antsiranana. At Betsimpoaka Village, the specimens were observed overnight in the vicinity of ricefields. At Ambanja Town, the specimen collected was found calling at night in a temporary swamp, in syntopy with *Heterixalus variabilis* (much more abundant), *Hoplobatrachus tigerinus*, *Boophis tephraeomystax*, *Mantidactylus wittei*, *Laliostoma labrosum*, and *Ptychadena mascareniensis*.



FIG. 1. *Heterixalus luteostriatus*. Photographed by Franco Andreone at Betsimpoaka Village, Sahamalaza Peninsula, northwestern Madagascar.

Submitted by **FRANCO ANDREONE**, Laboratory of Vertebrate Taxonomy and Ecology, Museo Regionale di Scienze Naturali di Torino, Via G. Giolitti, 36, I-10123 Torino, Italy (e-mail: frand@tin.it), **MIGUEL VENCES**, Laboratoire des Reptiles et Amphibiens, Muséum national d'Histoire naturelle, 25 rue Cuvier, 75005 Paris, France (e-mail: m.vences@t-online.de), and **JASMIN E. RANDRIANIRINA**, Département Faune, Parc Botanique et Zoologique de Tsimbazaza, BP 4096, Antananarivo (101), Madagascar (e-mail: pbzt@dts.mg).

HYLA ALEMANI. VENEZUELA: ESTADO COJEDES: Municipio Pao de San Juan Bautista: Galeras del Pao, Hato San Ignacio, 190 m elev. 31 August 1995. Ramón Rivero. Museo de la Estación Biológica de Rancho Grande, Maracay (EBRG 3216). ESTADO FALCÓN: Municipio Bolívar, near San Luis, on road from Cabure. Alberto Arends, Alexis Arends and Abraham Mijares-Urrutia. 15 November 1997. Centro de Investigaciones Ecológicas en Zonas Áridas, Universidad Francisco de Miranda, Coro (CIEZA 1003). Both specimens verified by Ramón Rivero. First records for the states of Cojedes and Falcón; fills gap between previously known records from states of Aragua and Zulia (La Marca 1992, Catálogo Taxonómico, Biogeográfico y Bibliográfico de las Ranas de Venezuela).

Submitted by **JESÚS MANZANILLA**, Museo del Instituto de

Zoología Agrícola, Universidad Central de Venezuela, Maracay, Venezuela (e-mail: jmanzanil@cantv.net), **ENRIQUE LA MARCA**, Laboratorio de Biogeografía, Escuela de Geografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Mérida 5101, Venezuela (e-mail: lamarca57@cantv.net), and **ABRAHAM MIJARES-URRUTIA**, Universidad Francisco de Miranda, Centro de Investigaciones Ecológicas en Zonas Áridas (CIEZA), Coro, Venezuela (e-mail: amijares@funflc.org.ve).

HYLA AVIVOCA (Bird-Voiced Treefrog) USA: LOUISIANA: OUACHITA PARISH: ca. 11.43 mi SW West Monroe in small slough (Bayou Lapine) adjacent to Charlie Griggs Road, ca. 0.86 mi S of Lapine Road. 15 June 2000. Eli Greenbaum. KU 289591–598. Verified by J. L. Carr. New county record for northeast Louisiana. Closest localities are in Evangeline parish to the south (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge. pp. 87–88), Webster Parish to the west [Himes 1999, New parish records of amphibians and reptiles from Louisiana. Herpetol. Rev. 30(3):175], and Union Parish to the north (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. expanded. 616 pp.).

Submitted by **ELI GREENBAUM**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045, USA.

HYLA AVIVOCA (Bird-voiced Treefrog). USA: TENNESSEE: MCNAIRY CO: Big Hill Pond State Park in pond along Cypress Tank Road (35°02'27"N, 88°26'10"W). 17 April 1995. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slides 3318, front and back view). Verified by A. Floyd Scott. Male calling from branch of *Alnus sp.* ca. 1 m above water. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

HYLA CINEREA (Green Treefrog). USA: TENNESSEE: HARDEMAN CO: Wetlands of Clover Creek along Hillhouse Road (35°23'17"N, 88°59'10"W). 3 June 1995. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3319). Verified by A. Floyd Scott. Calling male. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

HYLODES HEYERI. BRAZIL: PARANÁ: Municipality of Morretes (25°23'S, 48°52'W). Between March 1999 and March 2000. Collector not listed. Museu de História Natural Capão da Imbuia, Curitiba (MHNCI 3575–77, 3584, 3598, 3686–87, 3766, 3770, 3774). Verified by Célio F. B. Haddad through sonogram analysis. New record for the state of Paraná; extends range ca. 100 km from the type locality, Municipality of Eldorado, state of São Paulo, Brazil (Haddad et al.1996, Copeia 1996:965–969).

Submitted by **RODRIGO LINGNAU**, Universidade Federal do Paraná, Curitiba, Paraná, Brazil and Laboratório de Herpetologia, Museu de História Natural Capão da Imbuia, Departamento de Zoológico, (SMMA/PMC), Rua Prof. Benedito Conceição, 407, CEP 82810-080, Curitiba, Paraná, Brazil.

PHASMAHYLA JANDAIA (Jandaia Leaf Frog). BRAZIL: MINAS GERAIS: Reserva Biológica de Acauã, Municipality of Turmalina (17°17'S, 42°43'W, 718 m elev.). 1 March 1989. Renato N. Feio. Museu Nacional, Rio de Janeiro (MNRJ 23629–30). Verified by José P. Pombal, Jr. Known only from Serra do Cipó in the municipalities of Conceição do Mato Dentro and Jaboticatubas, state of Minas Gerais, Brazil. Listed as "vulnerable" by virtue of habitat destruction and restricted distribution (Nascimento 1998, *In* Machado et al. [eds.], Livro Vermelho das Espécies Ameaçadas de Extinção da Fauna de Minas Gerais, pp. 456–457. Fundação Biodiversitas, Belo Horizonte, MG, Brazil). Extends range 210 km northward from known distribution, and represents the northernmost record for the species and for the genus *Phasmahyla*.

Submitted by **ULISSES CARAMASCHI**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Rio de Janeiro, Brazil, **CARLOS ALBERTO GONÇALVES DA CRUZ**, Departamento de Biologia Animal, Universidade Federal Rural do Rio de Janeiro, 23851-970 Seropédica, Rio de Janeiro, Brazil, and **RENATO NEVES FEIO**, Departamento de Biologia Animal, Universidade Federal de Viçosa, 36571-000 Viçosa, Minas Gerais, Brazil.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: WISCONSIN: KENOSHA CO: Town of Salem, marsh bordering Hooker Lake, N1/2, SE1/4, Sec 11, T1N, R20E. 4 May 1998. R. Hendricks III. MPM Audio Recording Catalog No. A1. Verified by G. S. Casper. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus., 87 pp.).

Submitted by **RUSSELL HENDRICKS III**, Lake County Forest Preserve District, 2000 North Milwaukee Avenue, Libertyville, Illinois 60048, USA.

PSEUDACRIS FERIARUM (Upland Chorus Frog). USA: TENNESSEE: WILLIAMSON CO: Flooded fields at south end of Roberts Road (35°51'17"N, 86°42'53"W). 4 December 1994. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3322). Verified by A. Floyd Scott. Large breeding chorus. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12: 1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

PTERNOHYLA FODIENS (Lowland Burrowing Treefrog). USA: ARIZONA: MARICOPA CO: Vekol Valley, 11 km (airline) SW Table Top Mountain (32°41.51'N, 112°13.45'W), 600 m elev. 14 August 2000. Erik F. Enderson and Robert L. Bezy. UAZ 52026-PSV. Verified by Cecil R. Schwalbe. First record for Maricopa County; extends range 37 km (airline) NW from Santa Rosa Wash near Gu Komelik, Pinal County, Arizona (Jones and Timmons *in* Sullivan et al. 1996, Great Basin Nat. 56:38–47).

Submitted by **ERIK F. ENDERSON**, School of Renewable Resources, University of Arizona, Tucson, Arizona 85721, USA, and **ROBERT L. BEZY**, Department of Herpetology, Natural

History Museum of Los Angeles County, Los Angeles, California 90007, USA.

RANA CATESBEIANA (Bullfrog). USA: NEBRASKA: GARDEN CO: Blue Creek, 16.9 km NNE Oshkosh (41°32'N, 102°16'W). 14 June 1999. Dean A. Croshaw. Florida Museum of Natural History (UF 119756). Verified by John B. Iverson. Extends range ca. 20 km N in Garden County from the North Platte River (Lynch 1985, Trans. Nebraska Acad. Sci. 13:33–57).

Submitted by **DEAN A. CROSHAW**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA (e-mail: croshaw@ou.edu).

RANA CLAMITANS (Green Frog). USA: TENNESSEE: WILLIAMSON CO: Pig wallow along Seaboard Railroad tracks near Les Waggoner Road (35°52'06"N, 86°43'37"W). 22 June 1994. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3323). Verified by A. Floyd Scott. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

RANA PALUSTRIS (Pickerel Frog). USA: TENNESSEE: SCOTT CO: Big South Fork National River and Recreation Area Visitor Center, Bandy Creek Campground. (36°32'27"N, 84°37'40"W). 25 March 1995. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3316). Verified by A. Floyd Scott. Ten to fifteen calling males at pond. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94).

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

RANA PALUSTRIS (Pickerel Frog). USA: WISCONSIN: CRAWFORD CO: Lynxville, Sec. 23, T9N, R6W. 11 August 2000. Jordan Walley. HDW-NIU 1682–3. Verified by Harlan D. Walley. Casper (1996, Geographic Distribution of the Amphibians and Reptiles of Wisconsin. Interim Report of the Wisconsin Herpetological Atlas Project. Publ. Milwaukee Public Mus., Wisconsin. 87 pp.), cited this species from adjacent Grant and Vernon counties. Record reported herein represents the first specimens from the county.

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA.

SCAPHIOPUS COUCHII (Couch's Spadefoot). MEXICO: VERACRUZ: 21.6 km NNW Cardel. 26 July 1972. R. Earl Olson. UCM 49961; 24.5 km NNW Cardel. 26 July 1972. R. Earl Olson. UCM 49962. Both verified by Richard L. Holland. First precise records for the state of Veracruz, and a range extension of ca. 300 km from southern Tamaulipas to central Veracruz (Wasserman 1970, Cat. Amer. Amph. Rept. 85).

Submitted by **HOBART SMITH**, **DAVID CHISZAR**, and **ROSANNE HUMPHREY**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

SCAPHIOPUS HOLBROOKII (Eastern Spadefoot). USA: TENNESSEE: BEDFORD CO: On Pressgrove Road 0.5 km S of Kingdom Road (35°40'07"N, 86°32'38"W). 14 May 1995. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3324). One specimen on road following widespread tornadoes and heavy rainfall. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1-94). On 8 August 1995 following a 7.6 cm rainfall ca. 50 calling males were recorded in a flooded field at this location. FRANKLIN CO: Old CCC Road off Highway 156 (35°15'54"N, 85°53'30"W). 7 July 1997. Robert and Andrea English. Austin Peay State University Museum of Zoology (APSU Color Slide 3314). Captured newly metamorphosed specimen in borrow pit along logging road. New county record (Redmond and Scott 1996, Austin Peay State Univ. Center Field Biol. Misc. Publ. 12:1–94). Both verified by A. Floyd Scott.

Submitted by **ROBERT** and **ANDREA ENGLISH**, 6228 Les Waggoner Road, Franklin, Tennessee 37067, USA.

THOROPA MILIARIS (Rock Frog). BRAZIL: BAHIA: Municipality of Elísio Medrado: Serra da Jibóia (12°56'S, 39°31'W). September 1995. E. M. Neto. Laboratório de Animais Peçonhentos e Herpetologia da Universidade Estadual de Feira de Santana (LAPH-UEFS 030). Verified by J. P. Pombal-Jr. and C. A. G. da Cruz. Published distribution of the species is the Atlantic Forest and derivative vegetation in the states of Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo in southeastern Brazil; two localities are cited for Bahia, but Itaeté may well be in error, and the Itagimirim specimens were not confirmed as *T. miliaris* (Cocroft and Heyer 1988, Proc. Biol. Soc. Washington 101[1]:209–220). This Bahian record represents the northernmost for the species and for the genus *Thoropa* in Brazil.

Submitted by **RENATO NEVES FEIO**, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, 36571-000 Viçosa, Minas Gerais, Brazil, **FLORA ACUÑA JUNCÁ**, Universidade Estadual de Feira de Santana, 44031-460 Feira de Santana, Bahia, Brazil, and **ULISSES CARAMASCHI**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040, Rio de Janeiro, Rio de Janeiro, Brazil.

TESTUDINES

APALONE SPINIFERA (Spiny Softshell). USA: KANSAS: BROWN CO: 1.5 mi S and 3 mi E Robinson, Sec. 14, T3S, R18E, 22 June 1994. Chris Vitt. KU Color Slide 11778. Verified by David Edds. New county record (Collins 1993, Amphibians and Reptiles in Kansas. Third Edition. Univ. Press of Kansas, Lawrence. xx + 397 pp.).

Submitted by **CHRIS VITT**, Department of Biological Sciences, Emporia State University, Emporia, Kansas 66801-5087, USA.

CHRYSEMYS PICTA (Painted Turtle). USA: KANSAS: BROWN CO: Hiawatha Country Club, Sec. 32, T2S, R17E. 5 July 1994. Chris Vitt. KU Color Slide 11777. Verified by David Edds. New county record (Collins 1993, Amphibians and Reptiles in Kansas. Third Edition. Univ. Press of Kansas, Lawrence. xx + 397 pp.).

Submitted by **CHRIS VITT**, Department of Biological Sciences, Emporia State University, Emporia, Kansas 66801-5087, USA.

GRAPTEMYS PULCHRA (Alabama Map Turtle). USA: ALABAMA: Bibb Co: Cahaba River at County Road 26 crossing. 22 April 2000. Peter V. Lindeman. Verified by Joseph T. Collins. KU Color Slide 117881. Hatchling (PL 33 mm) captured in a fyke net. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **PETER V. LINDEMAN**, Department of Biology and Health Services, 150 Cooper Hall, Edinboro University of Pennsylvania, Edinboro, Pennsylvania 16444, USA (e-mail: plindeman@edinboro.edu).

PODOCNEMIS ERYTHROCEPHALA (Redhead River Turtle). BRAZIL: PARÁ: Santarém. 1999. Collector unknown. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 639–40, LPHA 992, LPHA 1201). Verified by Marcelo E. B. Dezincourt. Pritchard and Trebbau (1984, The Turtles of Venezuela. SSAR Contrib. Herpetol. 2:1-403 + 47 color plates + 16 maps) cite old museum specimens (e.g., MCZ 3414 collected in 1886) that suggested the occurrence of the species in or near Tefé and Santarém. However, they do not affirm that the species occurs at those localities. Mittermeier and Wilson (1974): "were unable you find specimens in either of these towns in 1973, and local inhabitants were unfamiliar with the species." These specimens confirm the occurrence of the species at Santarém, at the confluence of the Amazonas and Tapajós rivers (Pritchard and Trebbau 1984, *op. cit.*; Mittermeier and Wilson 1974, Papéis Avulsos Zool. 28[8]:147–162).

Submitted by **ANA CLÁUDIA BASTOS NEVES** and **RUBENS NOBUO YUKI**, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP 68.010-200 (e-mail: acbneves@zipmail.com.br and yuki@fit.br).

PODOCNEMIS SEXTUBERCULATA (Six-tubercled River Turtle). PERU: UCAYALI: Provincia Atalaya: Bolognesi (10°02'13"S, 73°57'48"W), 175 m elev. 27 June 1998. E. Lehr. Museo de Historia Natural de San Marcos (MHNSM 20022). Verified by Uwe Fritz. First state record and southernmost record in Peru (Iverson 1994, A Revised Checklist with Distribution Maps of the Turtles of the World. Privately Published, Richmond, Indiana; Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49:1–27). Specimen was obtained from a local market in Bolognesi. Dealer claimed to have caught it in the nearby Río Ucayali.

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de).

TRACHEMYS SCRIPTA (Slider). USA: NEW MEXICO: Union Co: Clayton Lake State Park, NW shore Clayton Lake, ca. 11.7 air mi NW Clayton, UTM Zone 13 N4049484, E651324. 13 August 2000. Charles W. Painter and Bruce L. Christman. University of New Mexico Museum of Southwestern Biology (MSB 61989). Verified by William G. Degenhardt. New county record; extends range ca. 79 km NE of nearest record from Ute Creek in Harding County (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.)

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA.

AMPHISBAENIA

AMPHISBAENA FULIGINOSA VARIA. BRAZIL: PARÁ: Santarém (2°26'S, 54°42'W), village of Santa Rosa on highway Santarém–Curuá-Una (PA-370). 3 April 2000. André L. C. Canto. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1228). Verified by Rubens Nobuo Yuki. First record for state; most oriental record for the subspecies and extends the distribution at least 1600 km (Vanzolini 1951, Bull. Mus. Comp. Zool. Zool. Harvard Cambridge 106:1–65).

Submitted by **HIPÓCRATES DE MENEZES CHALKIDIS**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200 (e-mail: chalkidis@ bol.com.br).

LACERTILIA

ANISOLEPIS GRILLI. ARGENTINA: MISIONES: Departamento Iguazú, Parque Nacional Iguazú, Sendero Macuco (25°40'S, 54°30'W). 9 May 1997. J. Herrera. Colección Herpetológica de la Universidad Nacional del Nordeste, Corrientes (UNNEC 7157). Verified by Gustavo Carrizo. Adult specimen founded under rubbish of Paranaense rainforest. Third record for province; species was previously recorded in Dos de Mayo, Cainguas Department, and mouth of Rio Victoria, Guaraní Department. This record extends geographic range in Argentina 150 km northward from center of Misiones Province (Etheridge and Williams 1991, Bull. Mus. Comp. Zool. 152[5]:317–361)

Submitted by **BLANCA B. ALVAREZ,** Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400, Corrientes, Argentina.

CYCLURA CARINATA CARINATA (Turks and Caicos Rock Iguana). TURKS AND CAICOS ISLANDS: J. A. G. S. McCartney Cay. 21 January 1999. Numi C. Mitchell. Photographed only. Museum of Comparative Zoology (MCZ Color Print 10247). Verified by David Clare. Given the high specimen density we observed in regions of the island visited, and the size of the island (4.5 km x 0.25 km), J. A. G. S. McCartney Cay may support several thousand iguanas and would therefore represent an important sub-population. Extends known range ca. 16 km SE of Joe Grant's Cay and ca. 200 m N of Middle Creek Cay, Caicos Islands (Coastal Systems International, Inc. 1998. Strategic environmental assessment for Big Ambergris Cay, Turks and Caicos Islands, British West Indies. Report to the Physical Planning Department, Ministry of Natural Resources, Turks and Caicos Islands, British West Indies; Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions and Natural History. Univ. Florida Press, Gainesville. 720 pp.).

Submitted by **NUMI C. MITCHELL**, The Conservation Agency Branch Office, 67 Howland Avenue, Jamestown, Rhode Island 02835, USA, **RICK HAEFFNER**, Denver Zoological Foundation, 2300 Steele Street, Denver, Colorado 80205, USA, **MICHELLE FULFORD**, Department of Environment and Coastal Resources, Turks and Caicos Islands, British West Indies, and **WESLEY CLERVEAUX**, Department of Environment and Coastal Resources, Turks and Caicos Islands, British West Indies.

CYRTOPODION SCABRUM (Roughtail Gecko). EGYPT: Siwa Oasis (29°12'N, 25°31'E) under carpet in hotel room. 16 May 2000. Mindy Baha El Din. Field Museum of Natural History (FMNH 258501). Verified by Alan Resetar. First record from Western Desert of Egypt, 550 km west of nearest records from Cairo area (Saleh 1997, Amphibians and Reptiles of Egypt. Natl. Biodivers. Unit Publ. No. 6., Egyptian Environmental Affairs Agency, Cairo. 243 pp.). Probably recently introduced to the locality.

Submitted by **SHERIF BAHA EL DIN**, 3 Abdalla El Katib Street, Dokki, Cairo, Egypt (e-mail: baha@internetegypt.com).

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). MÉXICO: BAJA CALIFORNIA: Ensenada. 4 September–15 November 1999. Julio Arpiza-Nuñez. Herpetological collection of the Facultad de Ciencias, Universidad Autónoma de Baja California (LVFCUABC-0126). Verified by Robert L. Bezy. First record from the state of Baja California; extends the range 120 km SW from Ocotillo, Imperial County, California (Porter 1988, San Diego Herpetol. Soc. Newsl. 10:5) and 150 km SW from El Centro, Imperial County, California (Laudenslayer in Saethre et al. 1993, Herpetol. Rev. 24:155). Four specimens (18–60 mm SVL) were collected at night at a hospital in the city of Ensenada (Secretaría de Salubridad y Asistencia).

Submitted by **REYNALDO MARTÍNEZ-ISAC** and **JORGE H. VALDÉS-VILLAVICENCIO**, Facultad de Ciencias, Universidad Autónoma de Baja California, Apartado Postal 1653, Ensenada, Baja California, 22800, México.

MABUYA ALBILABRIS. AFRICA: UGANDA: Mt. Ruwenzori, Semliki National Park, Mungilo Falls. 25 August 1996. David Modry and Petr Necas. ZFMK 63296. Verified by Wolfgang Böhme. Specimen was caught in a forest clearing near a small waterfall, just at the outermost margin of the Congo basin forests at the foot of W slopes of Ruwenzori Mts. Previously only known from Guinée, Ivory Coast, Ghana, Cameroon, Guinea Ecuatorial and Gaboon (type locality) (Hoogmoed 1974, Zool. Verh. 38:3–61). Represents the first record for Uganda and is the easternmost known locality of this species.

Submitted by **PATRICK MAUSFELD** and **ANDREAS SCHMITZ**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Herpetological Section, Adenaueralle 60, 53113 Bonn, Germany.

SERPENTES

ATRACTUS POTSCHI. BRAZIL: BAHIA: Feira de Santana (12°16'S, 38°58'W). 28 June 1993. José Silvestri. Laboratório de Animais Peçonhentos e Herpetologia da Universidade Estadual de Feira de Santana (LAPH-UEFS 454). Verified by M. T. Rodrigues. Previously known distribution was Sergipe and Alagoas, Brazil (Fernandes 1995, J. Herpetol. 29:416–419). First state record; extends distribution ca. 480 km southwest.

Submitted by **FLÁVIA MARIA PIRES LIMA**, **ILKA BIONDI DE QUEIROZ** and **FLORA ACUÑA JUNCÁ**, Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana, BA, 44031-460, Bahia, Brazil (e-mail: fjunca@uefs.br).

ATRACTUS SNETHLAGEAE. BRAZIL: PARÁ: Itaituba (4°17'S, 55°59'W) along shore Tapajós River at Fazenda Tambaú. January 1999. L. S. Rodrigues. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 855). Verified by Rubens N. Yuki. Species was known from Suriname and the states of Amapá, Rondônia, Amazônas (Manaus) and extreme eastern Pará in Brazil. First record for western Pará; fills distributional gap between the previously known localities. Specimen was collected 440 km airline from Manaus, the nearest previous record (Cunha and Nascimento 1983, Bol. Mus. Para. Emílio Goeldi Nova Sér. Zool. 122:1–42; Vanzolini 1986, Levantamento herpetológico da área do estado de Rondônia sob a influência da rodovia BR 364, Brasília, CNPq. 1-50; Cunha and Nascimento 1983, Bol. Mus. Para. Emílio Goeldi Nova Sér. Zool. 9(1):1–191; Martins and Oliveira 1993, Zoologische Mededelingen 67:21–40; Silva-Jr. 1993, Herpetol. Nat. Hist. 1:47–86).

Submitted by **JOSSEHAN GALÚCIO DA FROTA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200 (e-mail: jgfrota@mailbr.com.br).

BOTHROPS NEUWIEDI DIPORUS (Lancehead). ARGENTINA: RIO NEGRO: Departamento General Roca: 2 km N General Enrique Godoy (39°05'S, 67°09'W). 29 April 2000. Eduardo Mendoza. Herpetological collection, Fundación Miguel Lillo, Tucumán, Argentina (FML 09439). Verified by G. Scrocchi. First record for the province of Rio Negro and southwesternmost record for the species (Cei 1986, Mon. IV Mus. Reg. Sci. Nat. Torino. 527 pp.). Nearest record for *Bothrops neuwiedi diporus* is Casa de Piedra, Department Puelen, La Pampa Province, ca. 100 km airline to the north (Tiranti and Avila 1997, Bull. Maryland Herpetol. Soc. 33[3]:97–117).

Submitted by **DANIEL ROBERTO PEREZ** and **LUCIANO JAVIER AVILA**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, Caixa Postal 5301, Anillaco (La Rioja), Argentina.

CROTALUS MOLOSSUS (Blacktail Rattlesnake). USA: ARIZONA: Mohave Co: Arizona Strip District, Mule Point, N of Colorado River, N36.172886, W113.202076. 28 April 2000. Jeremiah L. La Grone and Hans F. Koenig. ASU 32960. Verified by Gordon W. Schuett. Adult male (100 cm SVL) collected at 0900 h (MST) in a rocky drainage at ca. 1630 m elev. Habitat was blackbrush plant community; an adult *Crotalus viridis lutosus* was collected <100 m from this specimen. Another adult specimen was collected from Toroweap (Tuweep) on the North Rim of the Grand Canyon National Park at N36.17967, W113.034717, 1435 m on 16 July 1995 by Ed Cummins (KU Color Slides 11779–80). Verified by Joseph T. Collins. The previous record of *Crotalus molossus* north of the Colorado River was from Trail Canyon (a tributary of

Parashant Canyon) on 19 May 1979 (LACM 136193). The spatial distance from this record to the Mule Point locality is <2 km and ca. 25 km from the Toroweap locality.

Submitted by **HANS F. KOENIG**, Arizona Game and Fish Department, P.O. Box 1269, St. George, Utah 84771, USA, and **JEREMIAH L. LA GRONE**, 2832 Bloomington Hills Drive East, St. George, Utah 84790, USA.

CROTALUS VIRIDIS CERBERUS (Arizona Black Rattlesnake). USA: NEW MEXICO: GRANT CO: 19.5 air mi W Cliff along Apache Creek at "Sid's Place," 6100 ft (1859 m) elev. NW1/4 Sec12, T16S, R21W. 7 July 2000. Bruce L. Christman and Charles W. Painter. University of New Mexico Museum of Southwestern Biology (MSB 61988). Verified by William G. Degenhardt. First verified county record (Mello 1978, Herpetol. Rev. 9:22; see discussion of this Grant County specimen in Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press. xix + 431 pp); extends range ca. 87 km south of nearest record in Catron County (Degenhardt et al., *op. cit.*).

Submitted by **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA, **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, **RANDY D. JENNINGS**, Department of Natural Sciences, Western New Mexico University, Silver City, New Mexico 88062, USA, and **AARON W. LAMB**, 4 Altura Road, Santa Fe, New Mexico 87505, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: NEW MEXICO: GUADALUPE CO: 48 km NW Santa Rosa, Anton Chico. 1 April 1952. R. G. Lindeborg. University of New Mexico Museum of Southwestern Biology (MSB 40970). Verified by C. W. Painter. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **JAMES N. STUART**, New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico 87504-5112, USA.

DRYMARCHON CORAIS (Western Indigo Snake). HONDURAS: ISLAS DE LA BAHIA: ISLA DE UTILA: Jerico, near Iguana Research and Breeding Station, 30 m elev. (16°6.19'N, 86°53.93'W). 4 March 2000. A. Gutsche. Forschungsinstitut und Naturmuseum Senckenberg (SMF 79719; skinned specimen without head). Verified by K. Klemmer. First record for Isla de Utila (Wilson and Meyer 1985, The Snakes of Honduras. Second Ed. Publ. Milwaukee Public Mus., Wisconsin. 150 pp.; Köhler 1998, Senckenbergiana Biol. 77:139–145).

Submitted by **GUNTHER KÖHLER** and **ALEXANDER GUTSCHE**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany.

EPICRATES CHRYSOGASTER CHRYSOGASTER (Turks Island Boa). TURKS AND CAICOS ISLANDS: JOE GRANT'S CAY: SE end of island, ca. 150 m W Jacksonville, East Caicos. 21 January 1999. Numi C. Mitchell. Photographed and released at capture locality. Museum of Comparative Zoology (MCZ Color Print 10246). Verified by Rick Haeffner. Extends known range ca. 13 km E of Middle Caicos and ca. 30 km NNW of Long Cay, Caicos Islands (Tolson and Henderson 1993, The Natural History of West Indian Boas. R & A Publishing Ltd., Somerset, England).

Submitted by **NUMI C. MITCHELL**, The Conservation Agency Branch Office, 67 Howland Avenue, Jamestown, Rhode Island 02835, USA.

EUNECTES DESCHAUENSEEI (Dark-spotted Anaconda). BRAZIL: PARÁ: Santarém (2°26'S, 54°42'W). Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1227). 29 March 1999. Alexandre Chaves; LPHA 1233. April 1999. Collector unknown. Both verified by Rubens N. Yuki. According to Chippaux (1986, Collection Faune Tropicale XXVII. 165 pp.) and Peters and Orejas-Miranda (1970, Bull. U.S. Nat. Mus. 297:1–347), species occurs only in the Ilha do Marajó (type locality) of Pará, Brazil. This record expands the distribution 470 km west.

Submitted by **ANDRÉ LUIZ COLARES CANTO**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil. CEP: 68.010-200; e-mail: belaco@biologo.mailbr. com.br.

HETERODON NASICUS (Western Hognose Snake). USA: NEW MEXICO: MORA CO: 17.7 km N Wagon Mound, DOR. 26 August 1993. J. P Hubbard (to J. N. Stuart). University of New Mexico Museum of Southwestern Biology (MSB 56215). Verified by C. W. Painter. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **JAMES N. STUART**, New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico 87504-5112, USA.

MICRURUS FRONTIFASCIATUS (Bolivian Coral Snake). BRAZIL: PARÁ: Almeirim (1°32'S, 52°34'W). 1999. Collector unknown. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, (LPHA 1216). Verified by Rubens N. Yuki. The specimen represents the first country record; extends known distribution ca. 1600 km airline (Peters and Orejas-Miranda 1970, Bull. U. S. Nat. Mus. 297:1–347; Roze 1983, Mem. Inst. Butantan 46:305–358).

Submitted by **ANDREI GUIMARÃES GUEDES**, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200; e-mail: andguedes@biologo.mailbr.com.br).

OXYRHOPUS MELANOGENYS MELANOGENYS. BRAZIL: PARÁ: ITAITUBA (4°17'S, 55°59'W) along shore Tapajós River. 1999. N. O. Serrano. Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós (LPHA 1319). Verified by Rubens N. Yuki. In Brazil, subspecies is known from the states of Rondônia and Amazônas (Occidental Amazonia), up to the Manaus meridian on the eastern edge of its distribution. Specimen represents first state record and extends distribution ca. 440 km (Vanzolini 1986, Levantamento herpetológico da área do estado de Rondônia sob a influência da rodovia BR 364, Brasília, CNPq, 50 pp.; Silva-Jr. 1993, Herpetol. Nat. Hist. 1:47–86).

Submitted by **JOSSEHAN GALÚCIO DA FROTA**, Linha de Pesquisa em Herpetologia da Amazônia, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Santarém, Pará, Brazil, CEP: 68.010-200 (e-mail: jgfrota@mailbr.com.br).

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). USA: FLORIDA: Broward Co: Davie, Wolf Lake Park. 14 July 2000. K. L. Krysko, J. N. Decker, and A. T. Reppas. Florida Museum of Natural History, University of Florida (UF 120906). Verified by F. Wayne King. New county record.

Submitted by **KENNETH L. KRYSKO**, Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA (e-mail: kenneyk@flmnh.ufl.edu), **JOHN N. DECKER**, 5926 Thomas Street No. 18, Hollywood, Florida 33021, USA, and **ANTHONY T. REPPAS**, Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). USA: FLORIDA: Orange Co: Winter Park (28°36'N, 81°21'W), backyard at 1607 Alamo Avenue. Five individuals, all found by C. W. Brown. The first, TL ca. 10 cm, was discovered on 6 February 2000 in a pile of leaves, but escaped while being photographed. Three additional specimens, also alive and 9.1 cm, 9.2 cm and 12.6 cm respectively, were found under the same small piece of debris on 27 March 2000 and were released. The fifth specimen, with a TL of 9.1, was found dead in a pile of vegetation on 19 April 2000 and was preserved (USNM 538080). Verified by Addison H. Wynn. Northernmost and second inland record for peninsular Florida. The other inland county record is from Lake Placid, Highlands County, northwest of Lake Okeechobee (Meshaka 1994, Herpetol. Rev. 25:34). Since its discovery in Dade County (Wilson and Porras 1983, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9:1–89; Wynn et. al. 1987, American Mus. Novit. 2808:1–7), the range of *R. braminus* has been extended by discoveries in Palm Beach County (Delorey and Mushinsky 1987, Herpetol. Rev. 18: 56), and Brevard County (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton-Mifflin, Boston, Massachusetts, 450 pp.) along the Atlantic Coast; Monroe County and the Keys in the south (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part 1. The Snakes. Windward Publ., Miami; Ehrig 1990, Herpetol. Rev. 21:41; Watkins-Colwell and Watkins-Colwell 1995, Herpetol. Rev. 26:210), and Lee (Conant and Collins 1991, *op. cit.*) and Pinellas (Crawford and Somma 1993, Herpetol. Rev. 24: 68) counties along the Gulf Coast. It can be expected in all Florida localities where imported plants have been introduced.

Submitted by **CARL H. ERNST**, Department of Biology, George Mason University, Fairfax, Virginia 22030-4444 (e-mail: cernst@gmu.edu), and **CHRISTOPHER W. BROWN**, Veterinary Emergency Clinic of Central Florida, 882 Jackson Avenue, Winter Park, Florida 32729, USA (e-mail: chris@itgoesboing.com).

TANTILLA RELICTA NEILLI (Central Florida Crowned Snake). USA: GEORGIA: Lowndes Co: Valdosta. 24 May 1976. J. P. Whitney. GMNH 22851. Verified by John B. Jensen. New state record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712). Extends range ca. 29 km NNE of previous northernmost known site (UF 118236, 1 mi S Pinetta).

Submitted by **MATTHEW J. ELLIOTT**, Georgia Gap Analysis Program, Institute of Ecology, University of Georgia, Athens, Georgia 30602, USA, and **M. ELIZABETH McGHEE**, Georgia Museum of Natural History, University of Georgia, Athens, Georgia 30602, USA.

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A Herpetological Collection from Bhutan, with New Country Records

INDRANEIL DAS
Institute of Biodiversity and Environmental Conservation
Universiti Malaysia Sarawak, 94300, Kota Samarahan
Sarawak, Malaysia
e-mail: idas@mailhost.unimas.my

and
JIGME PALDEN
Office of the Park Manager, Royal Manas National Park
Gelephu, Bhutan

The mountainous country of Bhutan (from the Sanskrit, meaning "highland"), which lies landlocked in the southern slopes of the Himalayas, remains biologically poorly explored. Although vast tracts of land of this relatively small country (area: 46,500 square km) are under forest cover (Das 1998; Mahat 1985), there have been few reports of its herpetofauna, the last one (Bauer and Günther 1992) being based on an old (1972) collection. Among the other published works on the country's herpetofauna are reports on crocodilians by Bustard (1979; 1980a, b) and a more general note by Biswas (1976) on a small collection from Bhutan, made incidental to an expedition in search of the Yeti (or Abominable Snowman), which supposedly haunts the higher reaches of the Himalayas.

Between 13–18 June 1999, we conducted Bhutan's first workshop on herpetological techniques for the personnel of the country's National Parks at Gelephu, southern Bhutan. During the associated field work, seven species of amphibians and twelve species of reptiles were collected.

We worked primarily in the southern region of Bhutan, in areas classified as having subtropical broad-leaved forests, at altitudes around 270 m above msl (except *Sibynophis sagittarius*, which was taken from the road between Surey and Gelephu, at an elevation of about 850 m above msl). Techniques utilized include opportunistic collecting, pitfall trapping in association with drift fences, 8 m x 8 m plot sampling, and road cruising. All specimens collected have been retained in the museum of the Royal Manas National Park (RMNP), Gelephu, Bhutan; numbers cited refer to the RMNP accession numbers ; SVL = snout–vent length. For each specimen, we provide locality and microhabitat data, date and time of capture, and measurements. Additionally, for most snakes, we provide data on pholidosis. Where relevant, species accounts have been annotated with remarks on occurrence in Bhutan, range ex-

tension, etc. Measurements were taken with Mitutoyo dial vernier calipers to the nearest 0.1 mm (for lengths up to 200 mm), or with a steel tape measure to the nearest 1 mm (for lengths >200 mm).

Most of the species being reported are characteristic of a lowland Indian fauna, although Indo-Chinese elements in the collection are also present—*Amolops marmoratus*, *Megophrys parva*, among amphibians, and *Cyrtodactylus khasiensis*, *Hemidactylus garnotii* and *Psammodynastes pulverulentus*, among reptiles. Seven species of amphibians and eight species of reptiles are added to the herpetofaunal list for Bhutan.

SPECIES LIST

AMPHIBIA

Family Megophryidae

Megophrys parva. RMNP 22. Sershong, Sarpang District. 18 June 1999. 1910 h. On trail within a secondary forest, ca. 15 m from a hill stream. Measurements: SVL 58.2 mm; tibia length 31.1 mm. Remarks: New record for Bhutan. According to Chanda (1994) and Zhao and Adler (1993), the species is distributed in India over Sikkim, (northern) West Bengal, east to Meghalaya, Bangladesh, South China, and Southeast Asia.

Family Bufonidae

Bufo melanostictus. RMNP 07. Maukhola, Sarpang District. 15 June 1999. 1130 h. Under stones, at the edge of river; RMNP 12. Maukhola, Sarpang District. 16 June 1999. 0950 h. In a pitfall trap, set at the edge of river. *Measurements:* RMNP 07. SVL 61.2 mm; tibia length 25.6 mm; RMNP 12. SVL 61.9 mm; tibia length 23.0 mm. *Remarks:* New record for Bhutan. A widespread species in South and Southeast Asia.

Family Ranidae

Amolops marmoratus. RMNP 14. Sershong, Sarpang District. 16 June 1999. 1910 h. From a boulder, in the middle of a hill stream; RMNP 15. Same data, 1915 h. *Measurements:* RMNP 14. SVL 46.5 mm; tibia length 30.4 mm; RMNP 15. SVL 37.4 mm; tibia length 23.2 mm. *Remarks:* New record for Bhutan. Dubois (1992) showed that *Amolops marmoratus* (Blyth 1854) has priority over *A. afghanus* (Günther 1858). Chanda (1994) and Zhao and Adler (1993) included Nepal, Northeast India, South China, and Southeast Asia in the distribution of the species.

Euphlyctis cyanophlyctis. RMNP 13. Sarpang, Sarpang Distict. 16 June 1999. 1105 h. Under a stone, within the town. *Measurements:* SVL 51.0 mm; tibia length 24.7 mm. *Remarks:* New record for Bhutan. Widespread in South Asia.

Hoplobatrachus tigerinus. RMNP 09. Maukhola, Sarpang District. 15 June 1999. 1510 h. Under shrubs, at the edge of a river. *Measurements:* SVL 121.4 mm; tibia length 64.7 mm. *Remarks:* New record for Bhutan. Widespread in South Asia.

Fejervarya cf. limnocharis. RMNP 08. Maukhola, Sarpang District. 15 June 1999. 1130 h. Under stones, at the edge of a river. *Measurements:* SVL 58.8 mm; tibia length 27.3 mm. *Remarks:* New record for Bhutan. Widespread in South, Southeast, and East Asia.

Rana (*Sylvirana*) sp. RMNP 10. Maukhola, Sarpang District. 15 June 1999. 1510 h. Under shrubs at the edge of a river. *Measurements:* SVL 61.2 mm; tibia length 33.9 mm. *Remarks:* New record for Bhutan. Probably a new species allied to *Rana danieli* and *R. chitwanensis*.

REPTILIA

Family Gekkonidae

Cyrtodactylus khasiensis. RMNP 06. Sershong, Sarpang District. 14 June 1999. 1535 h. Inside rotting tree trunk. *Measurements:* SVL 68.2 mm; tail length 66.5 mm. *Remarks:* New record for Bhutan. The species is known from the Darjeeling region of northern West Bengal, east to North Myanmar and the Abor region of Arunachal Pradesh, Northeast India (Smith 1935).

Hemidactylus brookii. RMNP 16. Road between Sershong and Gelephu Town, Sarpang District. 16 June 1999. 2040 h. From above a culvert, at the edge of the road. *Measurements:* SVL 48.4 mm; tail length 52.3 mm. *Remarks:* The only other known locality for the species in Bhutan is Samchi (Bauer and Günther 1992).

Hemidactylus garnotii. RMNP 02. Gelephu Town. 13 June 1999. 0800 h. From wall of a room in a house. *Measurements:* SVL 51.1 mm; tail length 60.7 mm. *Remarks:* New record for Bhutan. According to Zhao and Adler (1993) and Smith (1935), the species is distributed over Sikkim, Darjeeling (in northern West Bengal), east to Southeast Asia, and Oceania.

Family Agamidae

Calotes versicolor. RMNP 18. Gelephu Town, Sarpang Distict. 17 June 1999. 0900 h. From a rock wall. *Measurements:* SVL 95.7 mm; tail length 24.9 mm. *Remarks:* Previous records of the species from Bhutan were from Phuntsholing, Balu Jhura, and Wangdi Phodrang (Bauer and Günther 1992).

Family Scincidae

Mabuya macularia. RMNP 11. Gelephu Town. 15 June 1999. 1610 h. Under bush in a plantation. *Measurements:* SVL 65.0 mm; (regenerated) tail length 50.5 mm. *Remarks:* New record for Bhutan. The specimen matches Smith's (1935) form 4 of the species in squamation and coloration. A species complex, members of which range from India and Sri Lanka, east to Southeast Asia (Smith 1935:265–266).

Sphenomorphus indicus. RMNP 05. Sershong, Sarpang District. 14 June 1999. 1530 h. Inside rotting tree trunk. *Measurements:* SVL 69.8 mm; tail length 118.4 mm. *Remarks:* The only previous record of the species from Bhutan was from 87 km N of Phuntsholing (Bauer and Günther 1992).

Family Typhlopidae

Typhlops jerdoni. RMNP 03–04. Sershong, Sarpang District. 14 June 1999. 1430 h. Under rocks in riparian (RMNP 03) and plantation (RMNP 04) forests. *Measurements:* RMNP 04. SVL 127.2 mm; tail length 2.5 mm; RMNP 03. SVL 68.1 mm; tail length 2.4 mm. *Pholidosis:* Midbody scale rows 22. *Remarks:* Previous records of the species from Bhutan were from Samchi and Phuntsholing (Bauer and Günther 1992).

Family Colubridae

Oligodon dorsalis. RMNP 01. Sershong, Sarpang District. 13 June 1999. 1445 h. From the edge of a forest path, besides moss-covered boulder, in shade. *Measurements:* SVL 335.0 mm; tail length 54.0 mm. *Pholidosis:* Ventrals 180; subcaudals 36; midbody scale rows 15; anals 2. *Remarks:* New record for Bhutan. The species was previously reported from the Garo and Khasi Hills of Meghalaya, the Naga Hills of Nagaland (both in northeastern India), Chittagong Hill Tracts of Bangladesh, south to northern Myanmar (Smith 1943), and this is therefore an extension of range by ca. 80 km to the north bank of the River Brahmaputra.

Psammodynastes pulverulentus. RMNP 21. Sershong, Sarpang District. 18 June 1999. 1130 h. Edge of a secondary forest, ca. 15 m from a hill stream. *Measurements:* SVL 383.0 mm; tail length 80.9 mm. *Pholidosis:* Ventrals 167; subcaudals 51; midbody scale rows 17; anal 1. *Remarks:* New record for Bhutan. The species was previously reported from Nepal (Swan and Leviton 1962), east through northern Orissa (Bhowmik and Sur 1988) to northeast India, South China and Southeast Asia (Smith 1943; Zhao and Adler 1993). The Bhutanese specimen contained three neonates measuring (SVL) 128.0–136 mm. Wall (1907) had earlier reported viviparity in the species.

Sibynophis sagittarius. RMNP 19. On road between Surey and Gelephu, ca. 2 km from Surey. 17 June 1999. Mortally injured on the verge of the road. *Measurements:* SVL 459.0 mm; tail length 139.0 mm. *Pholidosis:* Ventrals 167; subcaudals 61; midbody scale rows 15; anal 1. *Remarks:* New record for Bhutan. Known to be widely distributed in South Asia (Smith 1943), including the western Himalayas, although this appears to be the first record from the eastern Himalayas.

Family Elapidae

Bungarus fasciatus. RMNP 23. Road between Sershong and Gelephu Town, Sarpang District. 18 June 1999. 2015 h. From a tarred road, entering the grassy margin. *Measurements:* SVL 1169 mm; tail tip missing. *Pholidosis:* Ventrals 221; subcaudals 8+ (tail almost entirely missing); midbody scale rows 15; anal 1. *Remarks:* New record for Bhutan. The species is widespread, from Central India, east to Southeast Asia and South China (Smith 1943; Zhao and Adler 1993), and the present record helps fill what had been a distributional gap in its known range in the eastern Himalayas.

Naja naja. Material: RMNP 17. Gelephu Town. 17 June 1999. 0900 h. Dead on road. *Measurements:* SVL 912.0 mm; tail length 189.0 mm. *Pholidosis:* Ventrals 186; subcaudals 60; midbody scale rows 23; anal 1. *Remarks:* Reported from Bhutan, without further data, by Mahendra (1984). The record may well be the easternmost for the species (see Wüster 1998; Wüster and Thorpe 1992).

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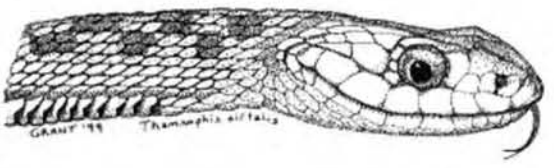
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Thamnophis sirtalis (Common Garter Snake). Illustration by J. B. Grant.

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New Records and Range Extensions for Amphibians and Reptiles from Puebla, México

LUIS CANSECO-MARQUEZ
Museo de Zoología, Facultad de Ciencias
Universidad Nacional Autónoma de México
A.P. 70-399, México, D.F. 04510, México
e-mail: lcm@minervaux2.fciencias.unam.mx

GUADALUPE GUTIERREZ-MAYEN
Laboratorio de Herpetología, Escuela de Biología
Benemérita Universidad Autónoma de Puebla, C.P. 72570, Puebla, México
e-mail: mggitier@siu.buap.mx

and

JORGE SALAZAR-ARENAS
Laboratorio de Herpetología, Escuela de Biología
Benemérita Universidad Autónoma de Puebla, C.P. 72570, Puebla, México

The herpetofauna of the Mexican state of Puebla is poorly known (Flores and Gerez 1994); the only account for the state is that of Fugler and Webb (1956). Between 1996 and 2000 we conducted inventories of the herpetofauna of several municipalities in the state (Fig. 1). Our surveys were concentrated in the following areas and habitats: coffee plantations and cloud forest in the Sierra Norte; oak woodland, pine woodland, and cloud forest in the Sierra Negra Oriente; and arid scrub, semiarid deciduous forest, and tropical deciduous forest in the southern and central areas of Puebla.

Our surveys produced 22 new species records for the state and documented range extensions for eight others. All specimens were deposited in the herpetological collections of the Escuela de Biología de la Benemérita Universidad Autónoma de Puebla, México (EBUAP), and Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC). Identifications of all specimens were verified by Edmundo Pérez Ramos.

STATE RECORDS

ANURA

Agalychnis moreletii (Morelet's Leaf Frog). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 0.7 km SW Yohualichan, 704 m elev. (20°03'N, 97°30'W). 31 August 1998. EBUAP 1041. Found on a branch of a bush near a pond, on which three tadpoles (Stages 27, 36, 37; Gosner 1960) of this species were found. Represents a range extension of about 140 km NW of previous localities in central Veracruz (Duellman 1970).

Eleutherodactylus spatulatus (Spatulate Robber Frog). Sierra Negra Oriente de Puebla: Municipality of San Pablo Zoquitlán: 2 km E Zoquitlán, 2155 m elev. (18°19'N, 97°00'W). 15 March 1997. EBUAP 1040. This specimen, a male, was found calling from a rock crevice. Previously recorded only from the states of Veracruz and Oaxaca (Campbell et al. 1989).

Eleutherodactylus verrucipes (Bigear Chirping Frog). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: Las Hamacas, 425–530 m elev. (20°02'N, 97°27'W). 26 November 1997. EBUAP 1047–48; 0.15 km SE Santiago Yancuictlalpan, 545–565 m elev. (20°03'N, 97°28'W). 27 January 1998. EBUAP 1049–51; 1.5 km NE Santiogpan, 500 m elev. (20°04'N, 97°29'W). 28 February 1998. EBUAP 1052; Tatahuitaltipan, 3 km SW of Yohualichan, 575 m elev. (20°04'N, 97°30'W). 1 March 1998. EBUAP 1053; 1.3 km ruins of Yohualichan, 675 m elev. (20°03'N, 97°30'W). 2 March 1998. EBUAP 1054–55; Reyezogpan de Hidalgo, 605 m elev. (20°04'N, 97°29'W). 2 March 1998. EBUAP 1056; 1 km S San Miguel Tzinacapan, 840–860 m elev. (20°01'N, 97°32'W). 25 April 1998. EBUAP 1110–11; Atepolihui, 790 m elev. (20°01'N, 97°32'W). 25 April 1998. EBUAP 1109. Municipality of Zapotitlán de Méndez: 2.5 km NW Zapotitlán de Méndez, 905 m elev. 15 February 1998. EBUAP 1234. Municipality of Hutzilan de Serdán: 2 km SE Huitzilan de Serdán, 870 m elev. 30 November 1998. EBUAP 1236–37. Municipality of San Pedro Camocuautla, 1350 m elev. 21 December 1998. EBUAP 1238. Found under logs or rocks in the leaf litter on coffee plantations. Previously recorded only in the states of San Luis Potosí, Querétaro, and Hidalgo (Lynch 1970).

CAUDATA

Bolitoglossa platydactyla (Broadfoot Mushroomtongue Salamander). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 1 km SE Cuetzalan, 1020 m elev. (20°01'N, 97°31'W). 25 November 1997. EBUAP 1058; Cuahutapanaloyan: 3 km SW Santiago Yancuictlalpan, 460 m elev. (20°04'N, 97°27'W). 26 January 1998. EBUAP 1059; near Río Apulco, 275 m elev. (20°04'N, 97°26'W). 26 January 1998. EBUAP 1060; 1 km S Xocoyolo, 1350 m elev. (19°58'N, 97°32'W). 25 March 1998. EBUAP 1061; near border with Equimita, 1350 m elev. (19°57'N, 97°33'W). 25 March 1998. EBUAP 1062; El Rosario, 735 m elev. (20°00'N, 97°28'W). 26 May 1998. EBUAP 1063–65. Municipality of Zapotitlán de Méndez: 0.5 km W Zapotitlán de Méndez, near Zempoala bridge, 680 m elev. (20°00'N, 97°43'W). 15 May 1998. EBUAP 1143. Municipality of Huitzilan de Serdán: 3 km NW Huitzilan de Serdán, 935 m elev. (19°59'N, 97°42'W). 4 November 1998. EBUAP 1142. Found on a cattle ranch and coffee plantations in several microhabitats: under rocks and logs, in bromeliads, and inside leaf axils of plants. Records fill gaps in the known distribution of the species (Wake and Lynch 1976).

Lineatriton lineola (Veracruz Worm Salamander). Sierra Negra Oriente de Puebla: Municipality of San Pablo Zoquitlán: 2 km southeast of Zoquitlán, 1865 m elev. (18°19'N, 97°06'W). 17 March 1997. EBUAP 718. Found dead in a cloud forest. Although *Lineatriton* presently is monotypic, work in progress (D. B. Wake and colleagues) will alter the composition of this genus, and it is likely that our specimen represents an undescribed species (D. B. Wake, pers. comm.). Thus, its referral to *L. lineola* must be considered tentative. Previously known only from the state of Veracruz (Wake and Lynch 1976).

LACERTILIA

Diploglossus enneagrammus (Huaxteca Lesser Galliwasp). Sierra Negra Oriente de Puebla: Municipality of Eloxochitlán: El Mirador, 1500 m elev. (18°29'N, 96°57'W). 17 December 1998. Male, EBUAP 1120. Found under a rock in a pine forest. Recorded previously only from localities in central Veracruz and northern Oaxaca (Campbell and Camarillo 1994).

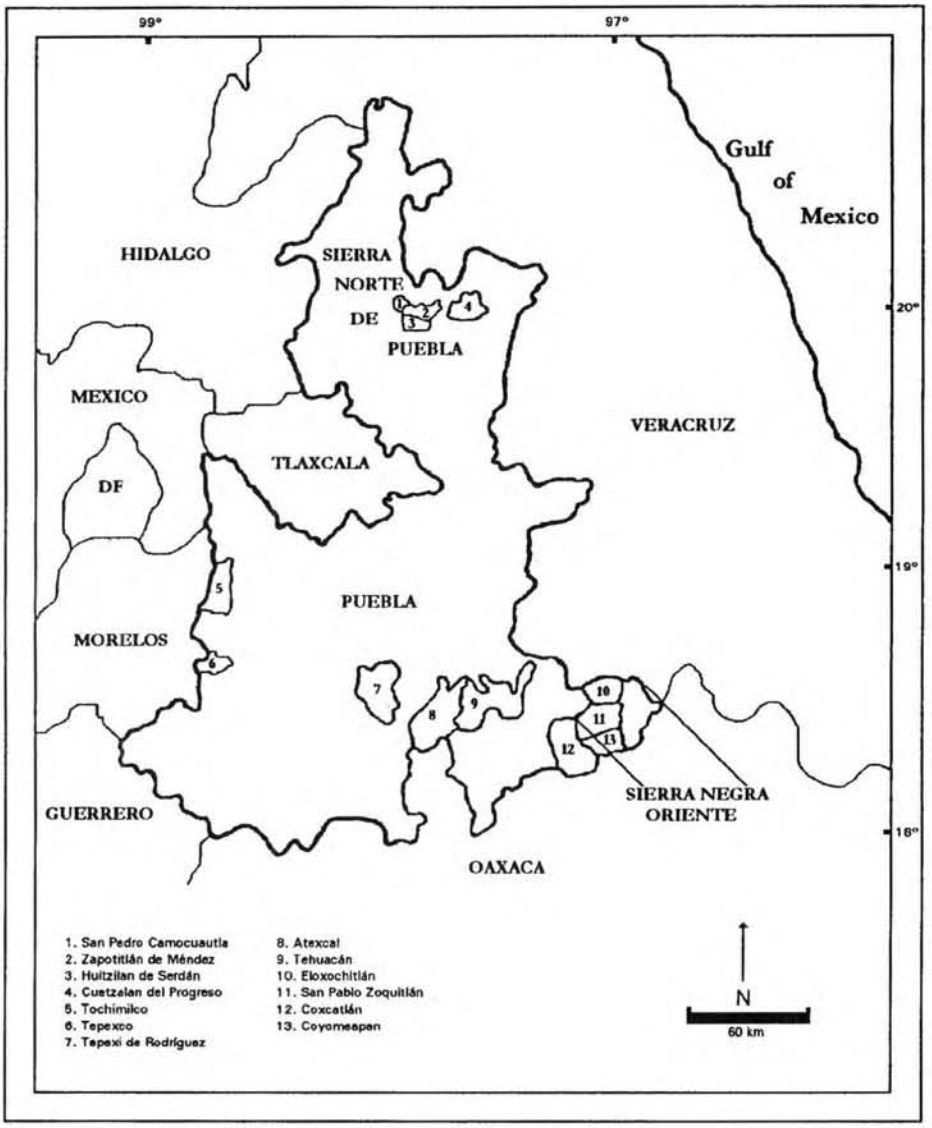


FIG. 1. A general map of the state of Puebla, México, showing the location of the municipalities mentioned in text.

Basiliscus vittatus (Brown Basilisk). Municipality of Coxcatlán: 0.05 km E of train station of Venta Salada, 1035 m elev. (18°14'N, 97°11'W). 28 June 1996. Female, EBUAP 760. Found in reeds near a water channel. Fills a gap in its previously known distribution (Lang 1989).

Corytophanes hernandezi (Hernandez's Helmeted Basilisk). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 2 km NE Zacatipan, 505 m elev. (20°02'N, 97°26'W). 14 July 1998. EBUAP 1106. Found in leaf litter on a coffee plantation. Fills a gap in its previously known distribution (Lang 1989).

Anolis laeviventris (White Anole). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 1 km SE Cuetzalan, 1065 m elev. (20°01'N, 97°32'W). 22 October 1997. EBUAP 1072; El Rosario, 875 m elev. (20°00´N, 97°32´W). 20 December 1997. Male, EBUAP 1073; Octimaxal Sur: Entrance to the cave, 1310 m elev. (20°00'N, 97°32'W). 21 December 1998. Male, EBUAP 1074; 1 km S San Miguel Tzinacapan, 840 m elev. (20°01'N, 97°32'W). 25 April 1998. Female, EBUAP 1075. Municipality of Zapotitlán de Méndez: El Puhuac: 1.5 km NW Zapotitlán de Méndez, 850 m elev. (20°47'N, 97°43'W). 9 February 1998. EBUAP 1140; 0.5 km SW Zapotitlán de Méndez, 705 m elev. 14 February 1998. EBUAP 1141. Records fill gaps between previously known localities in central Veracruz and Hidalgo (Mendoza-Quijano and Nieto-Montes de Oca 1995).

Anolis sericeus (Silky Anole). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 1 km S San Miguel Tzinacapan, 845 m elev. (20°01'N, 97°32'W). 25 April 1998. Female, EBUAP 1076; Octimaxal Norte, 805 m elev. (20°02'N, 97°30'W). 5 March 2000. EBUAP 2024. Found on a tree in a cultivated area. Records fill gaps in its previously known distribution (Lee 1980).

SERPENTES

Adelphicos quadrivirgatus (Middle American Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: Zacatipan, 600 m elev. (20°02'N, 97°26'W). 27 November 1997. EBUAP 1094; Xalpanat, 885 m elev. (20°00'N, 97°28'W). 18 December 1997. EBUAP 1112; Finca San José: 4 km ENE Santiago Yancuictlalpan, 360 m elev. (20°03'N, 97°26'W). 29 January 1998. Female, EBUAP 1095; 1 km SW Yancuictlalpan, 665 m elev. (20°03'N, 97°28'W). 30 January 1998. Female, EBUAP 1096; 1.5 km E Yohualichan, 725 m elev. (20°03'N, 97°30'W). 1 March 1998. Female, EBUAP 1097; Tatahuitaltipan: 3 km SW Yohualichan, 550 m elev. (20°04'N, 97°30'W). March 1998. Female, EBUAP 1098; Octimaxal Norte, 930 m elev. (20°02'N, 97°30'W). EBUAP 1099. Municipality of Huitzilan de Serdán: 1 km N El Paraiso, 720 m elev. 4 July 1999. EBUAP 1338. Found under logs on a coffee plantation and on a cattle ranch. The nearest records are from the foothills of the Sierra Madre Oriental, above the coastal plain, in central Veracruz (Campbell and Ford 1982).

Coniophanes fissidens (Yellowbelly Snake). Sierra Norte de Puebla: Municipality of Huitzilan de Serdán: Between Totutla and Taltzintan, 1110 m elev. (20°00'N, 97°44'W). 5 September 1998. EBUAP 1136. Found near a stream on a coffee plantation. Municipality of Cuetzalan del Progreso: 1 km SE San Andrés Tzicuilan, 1000 m elev. (20°00'N, 97°30'W). 4 May 1999. EBUAP 1146. The nearest locality records for this species are from central Veracruz (Bailey 1939).

Dryadophis melanolomus (Lizard Eater). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: Las Hamacas, 350 m elev. (20°02´N, 97°27´W). 26 November 1997. Male, EBUAP 1100;

San Miguel Tzinacapan, 805 m elev. (20°01'N, 97°32'W). 25 April 1998. EBUAP 1101; Zacatipan, 600 m elev. (20°02'N, 97°26'W). 11 July 1998. Female, EBUAP 1102; Zoquiapan: 1 km SE Cuetzalan (20°01'N, 97°30'W). 13 July 98. EBUAP 1103; Tacopixacta, 1045 m elev. (19°58'N, 97°30'W). 4 August 1998. EBUAP 1104; 2 km E Tzicuilan, 970 m elev. (20°00'N, 97°30'W). 18 September 1998. Male, EBUAP 1105. Municipality of San Pedro Camocuautla: between Tapayula and El Pasamanos, 1285 m elev. (20°01'N, 97°43'W). 15 August 1998. EBUAP 1138; 2.5 km S San Pedro Camocuautla, 940 m elev. 14 February 1998. EBUAP 1139. These specimens were found in coffee plantations, cloud or in pine-oak forests. Records fill gaps between previously known records (Stuart 1941).

Elaphe flavirufa (Tropical Rat Snake). Sierra Norte de Puebla: Municipality of Zapotitlán de Méndez: Near town of Zapotitlán, 640 m elev. (20°00'N, 97°42'W). 18 May 1998. EBUAP 1135. Nearest records for this species are from central Veracruz (Pérez-Higareda and Smith 1991).

Ficimia streckeri (Mexican Hooknose Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Preogreso: Santiago Yancuictlalpan, 600 m elev. (20°03'N, 97°28'W). 27 January 1998. EBUAP 1030; Octimaxal Norte, 880 m elev. (20°02'N, 97°30'W). 4 March 1998. Female, EBUAP 1029. Found under a rock on a coffee plantation. Southernmost record of the species, extending range about 79 km south from Castillo de Teayo, in northern Veracruz, and 138 km southeast from Zacualtipan, in northern Hidalgo (Hardy 1975).

Geophis semidoliatus (Coral Earth Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: Octimaxal Norte, 880–930 m elev. (20°02'N, 97°30'W). 4 March 1998. EBUAP 1032–35; Xalpanat, 820 m elev. (20°02'N, 97°28'W). 29 May 1998. EBUAP 1036–1037. Found in cloud forest and on coffee plantations. The nearest locality records for this species are from central Veracruz (Downs 1967).

Imantodes gemmistratus (Central American Tree Snake). Municipality of Tepexco: Calmeca, 1300 m elev. (18°38'N, 98°37'W). 3 April 1999. EBUAP 1134. The nearest locality record for this species is about 82 km at Huajintlán, Hidalgo (Zweifel 1959).

Leptophis diplotropis (Pacific Coast Snake). Municipality of Tochimilco: San Francisco Huilango, 1870 m elev. (18°50'N, 98°34'W). 20 November 1997. EBUAP 1107. Pérez-Higareda and Smith (1989) speculated that this species could occur in Puebla.

Rhadinaea hesperia (Western Graceful Brown Snake). Municipality of San Antonio Cañada: near the town of San Antonio Cañada, 1835 m elev. (18°31'N, 97°17'W). 27 May 1997. EBUAP 707. Municipality of Tepexi de Rodríguez: near the town of Tepexi de Rodríguez, 1700 m elev. (18°34'N, 97°55'W). 20 November 1997. Male, EBUAP 708. Found in arid scrub habitat. The nearest locality previously known for this species is in the state of Morelos (Myers 1974).

Rhadinaea marcellae (Marcella´s Graceful Brown Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: Xalpanat, 820 m elev. (20°00'N, 97°28'W). 29 May 1998. Male, EBUAP 1133,). Found near a waterfall in primary cloud forest. A specimen from near Tepango de Rodríguez, Puebla, was tentatively referred to *R. marcellae* by Nieto-Montes de Oca and Mendelson (1997) because it had some characteristics of *R. marcellae* and some of *R. forbesi.* Our specimen is entirely consistent with the diagnostic characters of *R. marcellae* (Myers 1974; Nieto-Montes de Oca and Mendelson 1997), thus confirming the presence of this species in Puebla.

Scaphiodontophis annulatus (Guatemalan Neckband Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 2 km SE San Andrés Tzicuilan, 1000 m elev. (20°00'N, 97°30'W). 25 April 1999. Male, EBUAP 1137; 3.5 km SE San Andrés Tzicuilan, 1000 m elev. (20°00'N, 97°30'W). 4 May 1999. Female, EBUAP 1144; 1 km SE of San Andres Tzicuilan, 985 m elev. 7 May 1999. EBUAP 1145. Found in leaf litter on coffee plantations. The nearest locality records are from central Veracruz (Pérez-Higareda and Smith 1991).

Ophryacus undulatus (Mexican Horned Pitviper). Sierra Negra Oriente de Puebla: Municipality of Coyomeapan: Coyomeapan, 2200 m elev. (18°16'N, 96°59'W). 13 May 1997. Female. EBUAP 722. Municipality of San Pablo Zoquitlán: 2 km southeast of Zoquitlán, 1825 m elev. (18°19'N, 97°06'W). 17 May 2000. EBUAP 2005–07. Found in an oak or pine-oak forest. Previously recorded only from the states of Hidalgo, Guerrero, Oaxaca, and Veracruz (Flores-Villela et al. 1992).

RANGE EXTENSIONS

Eleutherodactylus decoratus (Adorned Robber Frog). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 5 km S San Miguel Tzinacapan, near the grotto of Atepolihui, 880 m elev. (20°00'N, 97°32'W). 28 April 1998. EBUAP 1042–44. These males were calling in the rain at night in a cloud forest near Río Atepolihui. Previously known in Puebla from Tepango de Rodríguez, about 20 km to the East (Camarillo and Aguilar 1995).

Diploglossus legnotus. Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 0.1 km SW Xocoyolo, at entrance to a cave, 1450 m elev. (19°58'N, 97°32'W). 20 March 1998. EBUAP 1067; 2 km NE Xocoyolo, near Vista Hermosa, 1345 m elev. 22 March 1998. Male, EBUAP 1068; 3.5 km W Xocoyolo, 1210–1225 m elev. (19°59'N, 97°33'W). 24 March 1998. EBUAP 1069–70. Found inside fallen trunks of tree ferns or under logs and rocks on a cattle ranch surrounded by cloud forest. This recently described species was previously recorded only from its type locality of Tepango de Rodríguez (Campbell and Camarillo 1994). The current records extend the known range 27 km southeast of type locality.

Anolis naufragus (Hidalgo Anole). Sierra Negra Oriente de Puebla: Municipality of San Pablo Zoquitlan: Sección segunda de Zoquitlán, 2150 m elev. (18°19'N, 97°00'W). 23 June 1996. EBUAP 710; 2 km E Zoquitlán, 2155 m elev. (18°19´N, 97°00´W). 15 March 1997. MZFC 10478; 2 km SE Zoquitlán, 1870–2135 m elev. (18°17'N, 97°04'W). 16 March 1997. EBUAP 711–14, MZFC 10477. Found in rock crevices or on branches of bushes in cloud forest. Represent a range extension about 190 km southeast of the previous record for the state at Tepango de Rodríguez (Nieto-Montes de Oca 1994).

Scincella gemmingeri (Forest Ground Skink). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 5 km SE

Xocoyolo, near of Río Apulco, 920 m elev. (19°57'N, 97°32'W). 23 March 1998. EBUAP 1077; 3.5 km W Xocoyolo, 1225 m elev. (19°59'N, 97°33'W). 24 March 1998. Female, EBUAP 1078; El Rosario, 735 m elev. (20°00'N, 97°28'W). 26 May 1998. Female, EBUAP 1079; Xalpanat: Road to San Carlos, 870 m elev. (20°00'N, 97°28'W). 27 May 1998. Female, EBUAP 1080; border between Xalpanat and El Rosario, 805 m elev. (20°00'N, 97°28'W). 29 May 1998. Male, EBUAP 1081. Found in leaf litter and under logs. Previously known in Puebla only from Tepango de Rodríguez (Camarillo 1995), about 25 km west of our localities.

Lepidophyma sylvaticum (Madrean Tropical Night Lizard). Sierra Norte de Puebla: Municipality of Cuetzalan del Progeso: Las Hamacas, 325–420 m elev. (20°02'N, 97°27'W). 26 November 1997. Females, EBUAP 1082–84; Barranca Tzitzicapan, 0.1 km SE of Santiago Yancuictlalpan, 565 m elev. (20°03'N, 97°28'W). 27 January 1998. Female, EBUAP 1085; Between Tacoapan and Coapan, 400 m elev. (20°04'N, 97°28'W). 28 January 1998. Female, EBUAP 1086; Texochico: 2 km ENE Santiago Yancuictlalpan, 495 m elev. (20°03'N, 97°27'W). 29 January 1998. Female, EBUAP 1087; 0.2 km NE Santiogpan, 600 m elev. (20°04'N, 97°29'W). 28 February 1998. Female, EBUAP 1088; Tzonchomala, 540 m elev. (20°04'N, 97°30'W). 2 March 1998. Male, EBUAP 1089; 0.5 km SW San Miguel Tzinacapan, 850 m elev. (20°01'N, 97°32'W). 25 April 1998. Female, EBUAP 1090; 5 km SW San Miguel Tzinacapan, Montaña Alaxapota, 1100 m elev. (20°00'N, 97°33'W). 27 April 1998. Female, EBUAP 1091; Ayoapan, 860 m elev. (20°02'N, 97°31'W). 29 April 1998. Male, EBUAP 1092; Xalpanat, 670 m elev. (20°01'N, 97°28'W). 28 May 1998. Female, EBUAP 1114; border between El Rosario and Tenango, Río Cuitchat, 695 m elev. (20°01'N, 97°29'W). 29 May 1998. Female, EBUAP 1113; Zacatipan, 600 m elev. (20°02'N, 97°26'W). 10 July 1998. EBUAP 1093. Found under logs and in rock crevices on coffee plantations and in cloud forest. Previously known in Puebla only from Tepango de Rodríguez (Camarillo 1995), about 25 km west of our localities.

Xenosaurus rectocollaris (Pallid Knob-Scaled Lizard). Municipality of Tehuacán: 1 km NE Santa Ana Teloxtoc, 2170–2205 m elev. (18°23'N, 97°34'W). 1 October 1996. EBUAP 734–35. Municipality of San Martín Atexcal: Cerro Gordo in San Lucas Teteletitlán, 2502 m elev. (18°21'N, 97°38'W). 24 October 1996. EBUAP 736–37. Found in rock crevices in semiarid habitat. Previously known in Puebla only from a record near Chapulco (Smith and Iverson 1993), about 59 km northeast of our localities.

Coniophanes imperialis (Black-Striped Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: 1.5 km E Yohualichan, 725 m elev. (20°03'N, 97°30'W). 1 March 1998. EBUAP 1038; Zacatipan, 600 m elev. (20°02'N, 97°26'W). 11 July 1998. EBUAP 1039. The first specimen was found under a rock on a coffee plantation, the second was in the town proper. Previously known in Puebla only from Tuzamapan de Galeana (Mejenes-López et al. 1999), about 9 km northwest of our localities.

Tantilla morgani (Morgan's Black-headed Snake). Sierra Norte de Puebla: Municipality of Cuetzalan del Progreso: Octimaxal Norte, 930 m elev. (20°02'N, 97°30'W). 4 March 1998. EBUAP 1031. Known previously only from the holotype (Hartweg 1944) from Necaxa, about 57 km northwest of Octimaxal Norte. Second specimen of this rare endemic species from Puebla. In the original description, the snout–vent length was not mentioned. The specimen reported herein has a snout–vent length of 440 mm, tail length of 30 mm (tail incomplete), and 151 ventrals (vs. 149 for the holotype).

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Vacancy in Herpetology

The National Museum of Natural History, Leiden, The Netherlands has a vacancy for the position of

Deputy Curator of Reptiles and Amphibians

(male/female)
(32 hours per week)

Because the present Head of the Department of Vertebrates and Curator of Amphibians and Reptiles has become involved in international nature conservation matters, a task consuming a large part of his time, and necessitating considerable travel abroad, as of January 1, 2001 a temporary position has been opened for two years for a herpetologist to look after most aspects of the work of the Curator of Reptiles and Amphibians.

Depending on acquired skills and published results a salary of Dfl. 65.000 – 90.000 per year (including vacation allowance and incorporation into the Pensionfund) can be offered.

For further information about the function (requirements and tasks) see the internet page of the museum (www.naturalis.nl) for a full advertisement text (click on "Algemeen" and "Vacatures") or contact Dr. M.S. Hoogmoed, tel. +31 71 5687618, e-mail: hoogmoed@nnm.nl.

BOOK REVIEWS

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Patterns of Distribution of Amphibians–A Global Perspective, edited by William E. Duellman. 1999. The Johns Hopkins University Press, Baltimore and London. viii + 633 pp. Hardcover. US$ 69.95. ISBN 0-8018-6115-2.

BARRY CLARKE
Department of Zoology, The Natural History Museum
Cromwell Road, London SW7 5BD, England
e-mail: btc@nhm.ac.uk

The status of amphibian research has been greatly enhanced as a result of a series of landmark publications. The Vial-edited volume *Evolutionary Biology of the Anurans* (1973), Frost's *Amphibian Species of the World* (1985), Duellman and Trueb's comprehensive textbook, *Biology of Amphibians*, the ongoing series *Amphibian Biology* edited by Hal Heatwole (providing a parallel with the respected *Biology of the Reptilia*), and more recently (1999), McDiarmid and Altig's *Tadpoles–The Biology of Anuran Larvae*, have all helped to raise the profile of amphibians as a major interest group. At long last, amphibian biology seems to have come of age and is gradually taking its place alongside bird and mammal research. This change originated in the US, and has motivated the efforts of researchers around the world. There can be no doubt that *Patterns of Distribution of Amphibians* is destined to become the standard reference on amphibian zoogeography. It is an impressive book containing a breathtaking wealth of detail, while at the same time encompassing an extraordinarily broad subject area. Bill Duellman has assembled, managed and, it appears, cajoled a team of eight eminent amphibian workers from across the world to produce a remarkable reference volume. Much of the material included in the book was originally prepared for a symposium on amphibian distributions held at the Second World Congress in Adelaide in December 1993. That the volume was completed with no little pain to both its editor and the contributors is evident from a typically dry Bill Duellman comment in the Preface: "This project has evolved since the World Congress, as have the amphibians of the world and, indeed, even the position of the major tectonic plates"(!). The production of specialist scientific works like *Patterns* represent a considerable act of faith and goodwill on the part of editors, contributors, and publishers around the world; long may such efforts continue.

The inclusion of such an enormous mass of detailed information makes the book a daunting proposition for both reviewer and newcomer alike. Tables, charts, complex diagrams, and maps abound, together with comprehensive lists and appendices summarizing the geographical and altitudinal ranges of not merely hundreds but thousands of species across the world. The advice to the reader, particularly a final-year undergraduate or new postgraduate reader is, 'Take a deep breath—and plunge in.' For the specialist, biased in respect of a particular geographical area, there is much to be gained from a well-written account of his/her chosen region and still more from reading about other areas. For the novice, the detail may be more than is wanted or needed; selective

reading and culling of information from abstracts, maps, and headings to identify the most relevant sections are the order of the day. The book is arranged into ten chapters following a logical, geographical sequence.

Chapter 1 is the key chapter in the book. It provides an insight into some of the major difficulties encountered when synthesizing information into a book-length treatment. *Contra* Duellman's Preface remark, it is hardly surprising that "no modern synthesis of amphibian distributions exists." The scope of the subject is immense and the available information, detailed for some species, is almost non-existent for many/most others. Worse is the lack of a robust phylogenetic framework for a vertebrate group whose importance as an indicator of the state of the environment is becoming increasingly acknowledged. Progress in zoogeography is severely hampered by deficiencies in our knowledge of phylogeny at low, medium, and high levels.

In Chapter 1, Duellman sensibly used input from the other eight authors as well as Frost (1985) and his own (1993) additions and corrections to Frost's *Amphibian Species of the World*, to derive statistics relating to geographical distributions. The lack of a sound systematic arrangement of the Anura is immediately evident (see p. 2). It is ironic that the most stable scheme—that for the caecilians—is the one that has received least attention. Duellman comments that the classification he follows does "not necessarily reflect the phylogenetic relationships of many family-groups of amphibians," and that this is "especially evident" in the case of neobatrachian families, citing Ford and Cannatella (1993) as his reference. Duellman's Table 1:1 does not follow Frost (1985) or Duellman (1993) in at least one respect; in those references *Ascaphus* was placed in the Leiopelmatidae. Can Ascaphidae have come from Ford and Cannatella (1993)? No, it does not appear (as such) in that paper where the authors solemnly inform their readers that *Ascaphus truei* is one of the two anuran clades, *Ascaphus* being monotypic, the name *Ascaphus* being redundant with the taxon *truei* (!). Duellman's Table 1:1 also retains the Discoglossidae in the sense of including three Palaearctic genera—namely *Alytes*, *Bombina*, and *Discoglossus*; Ford/Cannatella split Bombinatoridae off from the Discoglossidae, separating *Bombina* from *Alytes* and *Discoglossus*. Can the listing of families have derived from Duellman (1975)? No, because it includes the Mantellidae, not recognized in that paper. Small wonder then, that "present familial classification does not reflect the phylogenetic relationships of many family-groups of amphibians;" one is tempted to ask "Which familial classification?" How easily new classifications/rearrangements of amphibian families arise with no justification for changes given! In a different vein, the criticism of celebrities and politicians who support the conservation of so-called 'fashionable' groups like birds and mammals is regrettable. It should be possible to argue for amphibian conservation without deriding the claims of other groups and their supporters. The section on "Threats to Amphibian Diversity" is excellent—at first; a pattern which is also followed in the sections on 'Declining Amphibian Populations' and 'Future Challenges.' The argument that scientific collecting accounts for "less than 1% of the annual regulated take of amphibians and reptiles" ('Harvesting and Collecting' p. 18) leaves itself open to the criticism that without it there would be a 1% reduction in the pressure on natural populations. If the conservationist is sincere in his/her aim to conserve, he/she should do all they can to pose no additional threat. How many field workers have *really* tried to explore alternatives to collecting? The conservationist lobby might reasonably pose the question: "Which has primacy—amphibian conservation or the right of the individual to do research on amphibians?" The comment "Because of the burgeoning amount of international, national, and state regulations, biologists and conservationists are frustrated in their efforts to obtain the kinds of documentation necessary for their research." ('Declining Amphibian Populations' p. 19) sounds like special pleading. Comments in the same vein are to be found under 'Future Challenges' ('Legislation') where the author recommends that scientific collection be separated from commercial regulation "with the implementation of scientific procedures placed in the hands of scientists." Surely even "informed biologists" do not actually *make* laws (p. 25), nor can they be presumed to be any less disinterested in the outcome of legislation which may affect their professional activities than those who are "unduly influenced by commercial considerations." If research funding is to be provided by outside agencies ("private foundations," "national and multinational corporations"), the actions of the researchers they fund will reflect upon the image of the companies concerned, and companies will legitimately demand to be consulted on research procedures and ethics.

Chaper 2—Duellman and Sweet on amphibians of Nearctic North America—was especially well written. The maps and the information in this chapter will be welcomed by undergraduate and graduate students. Information comes thick and fast making this, like most of the other chapters in the book, a valuable reference work. The section on 'Natural Regions of North America' was very useful but I found the use of specialist terminology a little intrusive—what is a 'craton,' an 'exotic terrane,' when were the Ordovician, the Taconian, Acadian, and Appalachian episodes, where was the Iapetus Ocean, and what is 'an orogenic episode'? All these terms appeared in less than 10 lines of text; a glossary would have been welcome. The volume of fascinating information on the plethodontid salamanders made me realize—yet again—what a superb group they are for an aspiring researcher. Just the 'right' number of species, occupying a well defined geographical region with a wonderful balance between what is known and what is open to future discovery, accompanied by a good supporting literature. Graduate students seeking a research topic, take note. The section on Historical Biogeography was particularly interesting, likewise that on Phylogeny and Patterns of Distribution. The statement that the only Mesozoic anuran definitely assigned to a family is *Paradiscoglossus americanus* ignores the claim of *Scotiophryne* from Montana and Wyoming described by Estes (1969), which provides additional evidence for the presence of the *predominantly* (though not exclusively) European family Discoglossidae in North America. I suspect there are others.

Jonathan Campbell's contribution on Middle American amphibians (Chapter 3) was a particularly enjoyable read; his interest and expertise in the subject is evident. Jargon still presents an occasional problem for the uninitiated: "...elevation and resulting adiabatic lapse rates..." and "...the complexity of edaphic conditions..." No explanation is offered for these terms but I did learn that terranes are "regions of distinctive geology, bounded by faults." Maps and tables are plentiful but not overdone. Campbell's chapter is characteristically well written and well thought out; gradu-

ate students intending to carry out fieldwork in Middle America will greatly appreciate his note on areas most in need of study (p. 114). In fact, for the newcomer to research on the amphibians of this region, the text is full of useful items of information, from data on rainy seasons, dry periods, and vegetation zones.

Hedges had the benefit of writing on a fascinating zoogeographical region—the West Indies (Chapter 4). His is a well-balanced contribution, which is unfortunately marred by poor quality diagrams and proof reading. The inclusion of dendrograms of the biogeographic regions based on estimates of amphibian faunal similarity was a good idea. Unfortunately, all but one of these dendrograms are out of synch with their text—a fault that could, and should, have been corrected at proof stage. The dendrogram for Cuba appears within the text for Jamaica, that for Jamaica under Hispaniola. The one for Hispaniola is in its proper place, while those for the Puerto Rican Bank and the Lesser Antilles are to be found under the Lesser Antilles and Bahamas Bank respectively, while the Bahamas Bank having only two species, *Osteopilus septentrionalis* and *Eleutherodactylus planirostris*, does not qualify for a dendrogram of its own. The quality of the maps was variable throughout the book, but they were poor in this chapter and, personally, I found the unaligned maps of Jamaica and Hispaniola particularly irritating. The amphibian density maps for Cuba (Fig.4:8) and Hispaniola were the worst, spoiled by converging contour lines. Fig. 4:17 conveys little and the arrows indicating the total area of each island are missing. I would also like to know how, in respect of *Eleutherodactylus pezopetrus*, a single locality "encompasses a range in elevation." One oddity I did pick up; Hedges referred to an important and "relatively small radiation of bufonids" as the *Bufo peltocephalus* group. In doing so, he either ignores the existence of the genus *Peltophryne* Fitzinger, 1843, which is endemic to the Greater Antilles, or else fails to provide comment or reasons for preferring their inclusion in an already unwieldy and speciose *Bufo*. No mention of *Peltophryne* is made in the paragraph on endemism in the West Indian amphibian fauna spanning pages 227–228.

Duellman obviously did the lion's share of the work on this volume, not only acting as Editor but also writing two chapters as sole author and co-authoring a third (reviewed above) with Samuel Sweet. One of these chapters (Chapter 5) covers South America—a region with the highest species density (more than 1700 species)—the Neotropics. Duellman's comments about the amphibian fauna being the richest in the world—1742 species in 140 genera and 16 families—echo Darwin's comments about stepping out into a tropical forest for the first time. For once, presenting the information in hard figures provided a fascinating perspective on the origins and diversity of the South American fauna. 94.4% of the amphibians in South America are anurans, and the remaining 5.6% are still significant in that approximately one-half of the world's caecilian species are to be found here. The region supports 64.8% of the world's species of *Hyla*, only 22% of *Bufo* and a minute 1.3% of all *Rana* spp. (only three species). This chapter was a massive undertaking and Bill Duellman fully accomplished his task. To complain about the quality of the maps sounds paltry but I hope that it might be possible to improve their quality in subsequent editions.

Borkin (Chapter 6) may have had only some 10% of the species that Duellman had to contend with, but the land surface area, topology, and climatic range of his region—North Africa, Europe, Western Asia, and the old Soviet Union—coupled with a literature in a diversity of languages made his task far from 90% easier! As Duellman says in the Preface, Borkin has provided a great service to western herpetologists in opening up the eastern European and Russian literature. Eurasia spans from the Atlantic to the Pacific an area with an enormous diversity in landscape and climatic conditions (from below sea level to the Himalayan chain of mountains, from arctic temperatures to hot deserts). There has been a significant growth in systematic studies and, not mentioned by Borkin, a growth in phylogenetic interpretation of taxa. This trend has the possibly unfortunate effect of proliferating species. But perhaps the most significant barrier to progress has been the "lack of a tradition in herpetology to analyze the distribution of amphibians throughout the Palearctic as a whole." This understates a situation which Borkin attempts to, and succeeds in, putting right. Borkin's case for regarding the Arabian Peninsula as part of the Afrotropical Realm is unconvincing; it is not proven or even well substantiated. His argument hinges chiefly on an interpretation of relationships of members of the genus *Bufo*, which I personally regard as incorrect. The evidence, such as it is, suggests the Arabian Peninsula is part of the Palearctic as is Iran, areas best considered as transition zones with a primarily Palearctic fauna—a status even more appropriate in the case of Afghanistan, Pakistan, and northwestern Nepal. Not so northwestern India, the amphibian fauna of which is best described in Borkin's own words: "Some Palearctic species have infiltrated into northwestern India." Dubois' description of the Himalayas as part of the Tibetan zoogeographical region is appropriate, since it comprises (as Borkin neatly says) "two secondary centres of independent faunal differentiation." I liked the section on the southeastern boundary of the Palearctic; a real problem zone but an area of intense biogeographical interest. The maps in this chapter are excellent, the best in the book; perhaps Duellman should have put Borkin as OC in charge of maps!

The chapter by Zhao on the amphibians of temperate eastern Asia is one of the shortest in the book, just 22 pages (Chapter 7), the same length as Tyler's on the Australo-Papuan area (Chapter 10). In both cases this is a surprise given the number of species in each of the two areas. Like Borkin, Zhao has been instrumental in opening up a fauna of an area and its associated literature to western audiences. The area of this region he had to deal with is half as large again as Australo-Papua, and two-thirds the size of South America, yet it is the least well explored. Zhao comments with a refreshing honesty that he has little or no personal knowledge of the landscapes and environments in much of this part of the world (hardly surprising in an area approaching 12 million square kilometers), and that the survey he presents must be regarded as preliminary, providing only a rough picture of amphibian distribution patterns in the region. As Zhao comments, some species are conspecific with others, others are cryptic species within a complex and there are many new taxa awaiting description. Zhao's contribution must have been one of the most difficult to write because of the paucity of information. I expect it will provide a fresh impetus for renewed interest in this important yet enigmatic region.

Inger provides a useful treatment of the distribution of southern Asian amphibians (Chapter 8). His comments echo the problems arising from the lack of stable phylogeny at almost any taxonomic

level, which provides an impediment to further progress on interpreting amphibian distribution patterns. Inger follows Ford and Cannatella (1993) without really explaining why (except for noting that little else is available). There is an element of opinion unsupported by evidence in this chapter—Ford and Cannatella (1993) is adopted; Frost (1985) is followed; Dubois' (1992) arrangement of the Ranidae is disliked but partially followed nonetheless—an action which he explains "does not signify thoughtful agreement with Dubois's (sic) decisions." This comment is followed immediately with "On the other hand, parts of Dubois's classification probably will be supported by future phylogenetic studies." These comments, and the attitudes expressed by Duellman in his introductory chapter, Frost (1985), Ford and Cannatella (1993), and Dubois (1992) in their papers, go some way towards providing an explanation for the currently perceived state of taxonomic chaos. There is a tendancy for authors to bemoan the literature on anuran taxonomy and to express a critical opinion based on gut-feeling. This practice pervades the literature either on, or citing the results of, anuran systematics. Inger provides examples of this practice in action. "I also use *Limnonectes* as defined in Dubois (1987), except for those moved to *Hoplobatrachus* by Dubois (1992), although the phylogenetic basis for this taxon is dubious; *further study almost certainly will establish the paraphyly of this group*." (my italics). Nonetheless, Inger's chapter provides a useful review of the current literature on southern Asia.

John Poynton's chapter on amphibian distributions in sub-Saharan Africa, Madagascar, and the Seychelles provides an excellent synthesis of the available data on a difficult region (Chapter 9). If the comment: "The preliminary nature of this treatment needs to be emphasized at the outset" was justified at the beginning of the chapter, it is scarcely so by the end. I understand the sentiment that much about the amphibian fauna remains unknown to us, but I do not believe that it follows that we are in the state of ignorance about the African fauna that Poynton seems to suggest. Africa is a continent of contrasts; climate and topology interact to create many different regions and ecological niches. While the land surface area to the north of the equator exceeds that of the south, there is a greater area above 1000 meters in the south. Add to this extensive climatic and vegetation changes (even over historical time) and the scenario is one of extremely complex faunal zonation. Links with South America to the west—Madagascar and India to the east and (less frequently mentioned), with Antarctica and Australia to the south and southeast, when Africa formed a central part of the southern supercontinent Gondwanaland—demonstrate the significance of Africa in any understanding of global distributions of both fauna and flora. I enjoyed Poynton's description of the biogeographical regions and provinces, and his advocacy of an Afrotemperate fauna—the latter is a significant contribution to the understanding of African amphibian zoogeography.

Tyler's chapter on the distributions of Australo-Papuan frogs was disappointing. It is hard to believe that the amphibian fauna of the "entire region" really is as poorly known as is claimed. Revised estimates of species numbers and a rapid increase in species descriptions are a global phenomenon—in some parts of the world at a faster rate than in Australia. It would have been interesting to have had an objective basis for the comments that "Perhaps only 50% of the fauna has been described" (Abstract) and "I suspect that the total fauna of New Guinea includes about 400 species, about twice the number known today." A diagram to show discovery rates of amphibians against time as included by other authors e.g., Duellman and Sweet (N. America), Hedges (West Indies), Duellman (South America), Borkin (Eurasia and N. Africa)—the last two surely more arduous to produce than the equivalent for Australia—would have gone some way towards providing some justification for these claims. The 'Material and Methods' section is really 'Description of the Regions,' with the last paragraph referring to sources of data for the species lists in separate appendices for Australia and New Guinea and Australo-Papuan archipelagos and islands. The best sections are the 'Physical Components' section and the very brief 'Patterns of Amphibian Distribution' but even these read more like an expanded abstract than sections in a major contribution. Tyler mentions having to write this chapter while suffering a prolonged period of ill health; the assistance of a co-author would have been invaluable.

This is an excellent book, and it was a genuine pleasure to review. It will be an important addition to libraries in natural history museums and university biology departments. Unquestionably one of the most important books on amphibians to appear in the last decade or so, it should be drawn to the attention of, and read by biogeographers working on other groups. Amphibian systematists and zoogeographers will undoubtedly want to have their own copy.

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Plethodon variolatus (South Carolina Slimy Salamander). Illustration by Michael G. Frick.

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General Zoology or Systematic Natural History. Volume III. Amphibia, by George Shaw. 1802. With an introduction, George Shaw and the Herpetology Volume in His Series, General Zoology, by Hobart M. Smith and Patrick David. Facsimile Reprint by Society for the Study of Amphibians and Reptiles. 96 + vi + [2] + 312 + vi + [1] + 303 pp. Hardcover. US $75.00 plus shipping. ISBN 0-916984-48-6.

GLENN M. SHEA
Department of Veterinary Anatomy and Pathology
University of Sydney, New South Wales 2006, Australia
e-mail: gshea@mail.usyd.edu.au

In a herpetological world which is now dominated by the English language and with systematics codified by an International Code of Zoological Nomenclature, it is difficult to imagine herpetology at the beginning of the nineteenth century. Less than a half-century since Linnaeus published the final edition of his Systema Naturae, the vast majority of taxonomic publications since then had been in Latin, German, French, or Dutch. Many of the new names were based on earlier scanty, often fanciful descriptions by travellers unfamiliar with biology and willing to uncritically accept and publish the tales of fellow travellers. Access to the literature was difficult, with researchers mostly working in isolation and with limited resources, and in most cases, without any field experience with their subjects.

Working with all these constraints, George Shaw, Keeper of Natural History at the British Museum, produced four works in English that have had a major impact on herpetology, although none was conceived as predominantly herpetological in nature. In 1790, he named five lizards and one frog and provided descriptions and illustrations of several additional snakes and lizards in the natural history Appendix to John White's "Journal of a Voyage to new South Wales" (reprinted 1962 by Angus and Robertson, Sydney, with a facsimile reprint published 1971 by Arno Press, New York; see also Nelson 1998, and Bauer 1999). In 1794, he produced a more specifically zoological publication, "The Zoology of New Holland" (facsimile reprint 1998 by the Friends of the State Library of South Australia, Adelaide), which named another two new Australian reptiles, including the first turtle. These two publications introduced the herpetofauna of Australia to the rest of the world.

In 1789, in collaboration with Frederick Nodder (later replaced by Elizabeth and then Richard Nodder), he began a multivolume series, "The Naturalist's Miscellany," which was to continue publication until his death in 1813, after which it was continued until 1817 by his successor, William Leach, under the title "The Zoological Miscellany." Herpetological accounts covering a variety of species appeared in these volumes.

Finally, in 1800, he began the series "General Zoology," which appeared in 14 volumes, bound as 28 parts. As with "The Naturalist's Miscellany," the series was incomplete on his death, and was later completed by J. F. Stevens, with the last volume appearing in 1826. Volume Three, covering "Amphibia" in two separately bound parts (Testudines, Ranae, Lacertae in one, Serpentes in the other), appeared in 1802. Shaw, like Linnaeus, included reptiles in the Class Amphibia, although recognizing an Order Reptilia within it to include chelonians, anurans, urodeles, crocodilians, and lizards, the latter three under the classification Lacertae. Serpentes, on the other hand, included anything limbless or almost so, and so covered amphisbaenians, caecilians, and several serpentiform lizards and urodeles.

These two volumes were not only the first post-Linnean herpetological publication of world-wide scope in English, but were also specifically written for a popular audience. They drew together the earlier accounts of a diverse range of authors and combined them with Shaw's own observations on collections in England, providing a starting point for herpetology in England and at the British Museum and leading directly to the nineteenth century dominance of Gray, Günther, and Boulenger in herpetology. As a popular work, they are profusely illustrated, with 140 black and white plates plus a frontispiece for each part. Although Shaw stated that these were "engraved principally by Mr. Heath," who signed 86 plates, 16 other artists are also indicated (Hill the next most frequent [37 plates], the others being Arnoldi, Barnfield, Bateman, Beale, Blakemore, Brown, Coates, Dixon, Grant, Harwood, Reading, Russell, Stalker, Strafford, and Wilson, none of whom contributed more than two plates). Additionally, many of the illustrations presented are copied from earlier works, only some of which are indicated (as a contribution to tracing the source of these illustrations, I note that the plates of Australian reptiles, plates 16, 65, 81, 110 and frontispiece to Part II, are redrawn from illustrations first appearing in White's "Journal of a Voyage to new South Wales," and Shaw's "Zoology of New Holland," with the illustrations of the Muricated Lizard (plate 65) and the two snakes (frontispiece and Plate 110) being reproduced in reverse, and with an extra terminal coil added to the Crimson-sided Snake). The quality of the illustrations therefore varies markedly, from accurate and beautiful representations to the bizarre (e.g., the two illustrations of the Horned Toad on plates 48 and 49, while many of the snake plates are sufficiently horrific to turn a sensitive child off herpetology for life!). As a popular work, it is also not exclusively taxonomic in nature, Shaw having incorporated as much natural history information as he could glean from his sources, together with tales of the potency of various snake venoms and even some quotes from Latin classics and poetry (e.g., pp. 368–369). The result is far from the dry taxonomic literature that was to dominate for the next century.

This facsimile reprint of Volume Three of the General Zoology by the SSAR combines both sections under a single set of covers, and prefaces them with an extensive (96-page) introduction by Hobart Smith and Patrick David. The facsimile is of the usual high SSAR standards of printing and binding. In comparison with an original copy I examined in the University of Sydney library (a copy which is stamped Museum Zoologicum Universitatis Frid. Guil. Berolin., and which was obtained by the University of Sydney from the family of herpetologist Dene B. Fry—it carries Fry's signature and the date 26.iii.1914), the plates in the facsimile are a little darker. This has led to loss of detail on darker parts of some plates.

The Introduction begins with a brief documentation of the little that is known of Shaw's life. Initially trained in religion, he served as a parish deacon for several years, before beginning medical training. After a few years in medical practice, he was employed

by the British Museum from 1791 until his death, first as Assistant Keeper then Keeper of the Natural History collections (see also Hankel 1998). Shaw's publications were predominantly synthetic and popularist. In addition to his General Zoology and Naturalist's Miscellany series, his two other major publications were multivolume bibliographic reviews of natural history literature (Philosophical Transactions Abridged, 1809) and compilations of his public lectures (Zoological Lectures, delivered at the Royal Institution, 1809). With his attention drawn towards public education, his museum duties suffered, and opinion of his activities in the latter direction is largely negative.

The majority of Smith and David's Introduction is a thorough exploration of the identity of the more than 400 species listed by Shaw and identification of his sources of information for each taxon. Possibly reflecting time constraints in preparation, Shaw's species accounts are inconsistent in style and quality. His acknowledged sources are often abbreviated, which may not have been a problem for the contemporary reader, but creates difficulties for the modern reader. In addition to simply summarizing previous descriptions, Shaw also introduced a number of new names, both new names for previously described taxa and new species descriptions.

Because he drew extensively on an earlier literature for his new species, a literature that was also available to other herpetologists, many of his new species are junior synonyms. However, he also made use of his access to English collections unavailable to continental workers (predominantly the British Museum and Leverian Museum), and the new species he described from specimens at hand are often still recognized. Of 108 new species described by Shaw, 26 are considered to be valid by Smith and David. A few additional names (e.g., *Boa palpebrosa*, *Coluber crucifer*, *Coluber sagittatus*) are overlooked and unused senior synonyms of names in wide current use, and about 20 additional names, particularly of snakes, are not assignable to a specific taxon. A few additional species mentioned by Shaw were presented by common names only, and would not be formally named until much later. Among the 26 valid species are such well-known names as *Rana catesbeiana*, *Ambystoma* (as *Lacerta*) *maculatum*, *Geochelone* (as *Testudo*) *radiata*, *Python regius*, *Chrysopelea* (as *Coluber*) *ornatus* and *Bitis nasicornis*, and a geographic coverage of North, Central and South America (9 species), Asia (14 species) and Africa (3 species).

Smith and David's assessments are not confined to Shaw's new names. In considering the status of all names appearing in the General Zoology, they also consider the status of a number of names proposed by Linnaeus, Laurenti, Molina, and Schneider, among others.

The bibliography, presenting full citations for the identifiable literature cited by Shaw, is a tool of tremendous value, an introduction to a literature that is now difficult to trace. In SSAR tradition, it includes numerous notes on authorship, publication dates, and editions that will assist the bibliographer.

My only significant criticism is that on a number of occasions, Smith and David apply Article 23(9) of the new (1999) edition of the Code of Zoological Nomenclature to reject unused senior synonyms (not all of them Shaw's) of names in current usage. However, they do not fully abide by the requirements of this Article and its related articles. The new Article, aimed at maintaining stability of nomenclature, allows rejection of an unused senior synonym (which becomes a *nomen oblitum*) and retention of the junior synonym in use (which becomes a *nomen protectum*) without recourse to the ICZN in certain circumstances. The senior synonym must not have been used as the valid name since 1899, and the junior synonym must have been used in more than 25 works by a minimum of ten authors during the past 50 years. In invoking Article 23(9), Smith and David do not demonstrate the latter in any instance, nor do they explicitly state that the former applies. Hence their actions are not valid. This Article will undoubtedly prove a headache for editors wishing to minimize the length of papers, but these requirements must be followed in order for Article 23(9) to be applied.

This criticism apart, the SSAR edition of Shaw's General Zoology will appeal to a wide readership, from the non-specialist interested in temporarily experiencing a past world or seeking unusual illustrations, to systematists, historians, and bibliographers from a wide range of backgrounds.

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Herpetofauna of West Africa vol. I: Ampibians of the West African Savanna, by Mark-Oliver Rödel. 2000. Edition Chimaira, Frankfurt am Main. 332 pp. Softcover, plus audio CD. DM.– 88 (approx. US$ 43). ISBN 3-930612-16-X.

ARNE SCHIØTZ
Humlehaven 2, DK 4571 Grevinge, Denmark
e-mail: SCHIOETZ@worldonline.dk

This book covers the fauna of frogs and toads in the savanna belt of the entire West Africa, from Cameroun and Chad westwards. It gives a careful and detailed treatment of all the species known from this area, with strong emphasis on their biology. The book is the result of the author's work in Comoé National Park, northeastern Côte d'Ivoire, where he has spent 19 months over a four year period studying tadpole ecology.

Strictly speaking the book does not cover the Amphibia, but only the Anura. Like many people, the author presumably regards the gymnophiones merely as advanced earthworms, not deserving the attention of real herpetologists!

The book is an English version of his *Amphibien der Westafrikanischen Savanna* originally published in 1996 (reviewed in Herpetological Review 28:218). Compared to the German version the text has been extended somewhat, the literature citations have been brought up to date, the quality of the black and white photos of biotopes has been improved considerably, the number

of color photos has been increased, and a CD with the voices of some frogs has been added.

The West African Amphibia fall into three distinct faunas or guilds: one connected with moist evergreen forests, another associated with savannas, and a third found in dry gallery-forests and patches of dry forest and farmbush within the savanna belt. This book deals with the two latter faunas. Somewhat confusingly, the author, in his very brief general chapter on the West African savanna belt, uses the term forest for what is conventionally called Guinea savanna. This vegetation zone is characterized by scattered trees in an otherwise grassy habitat, is subject to frequent burning, and harbors a typical savanna frog fauna.

The author mentions that this book originally was planned as a monograph of the frogs of Comoé National Park, but that the lack of accessible literature for many of the genera caused him to expand its scope. Such an extension has its advantages and disadvantages. One advantage is that a book covering the entire area is obviously far more useful than one about Comoé alone. A disadvantage is that the author's familiarity with the species necessarily must be very uneven (although fortunately, most West African savanna and farmbush species are so widespread that the majority of the forms occur in Comoé). Despite the broader scope of the book as a whole, however, the author's original plan is still evident. For example, in the introductory chapter describing the environment 12 pages are devoted to a detailed description of Comoé National Park, while West Africa as a region is given a mostly cursory description on a single page.

Rödel has used the literature exhaustively, but has used museum collections only to a very limited degree. The book is an exercise in literature extraction, to a degree that reminds one of the proverbial German thoroughness in scientific publications. Every bit of information throughout the book is followed by meticulous literature references. This makes the book very useful, but it also makes reading very bumpy and sometimes tedious. For example, the paragraph on the distribution of *Hoplobatrachus occipitalis* includes a list of the countries where the species occurs, followed by 83 references which occupy half a page! In spite of its length, such a list of references is of limited use since there is no direct link between particular countries and specific references, so if one needed to check who has recorded the species for Sudan, all of the references would need to be searched.

The sections on geographic ranges thereby are not only long and difficult to work with, but suffer greatly from the total lack of distribution maps. Such maps would have been most useful, not only to illustrate the distributions at a glance, but to provide more precision than a mere listing of countries allows.

An example of the coarseness of presenting only country records and of the danger of relying on literature without checking the actual specimens is seen in the distribution of *Afrixalus dorsalis*. According to the text, it is widely distributed not only in West Africa but also in the greater part of Central Africa, namely Gabon, Congo, R.D. Congo, Angola, and the Central African Republic. In fact the species is only found outside of West Africa in a narrow belt along the Atlantic coast from Cameroun to Angola. A map would have also shown that the record from the Central African Republic is suspiciously outside the species' range (in fact the record represents *A. vittiger*, the confusion stemming from the name *leptosomus* being variously associated with both species). Rödel does, in a note, mention the correct range of the species, but almost as an afterthought.

This raises the question of how selective one should be with distribution data, especially data from older papers for which identifications have not recently been verified. Rödel tends to accept all records, including older ones, at face value, although for some species he does use a question mark for such doubtful records. In my opinion he nevertheless includes too many records that are unchecked and therefore suspect. Museums and older publications are full of misidentified specimens. I believe that one should, especially in a non-technical book such as this, restrict rather than expand distributional data. In the Copenhagen database of distribution of African Amphibia it has thus been the policy to omit doubtful, unchecked old records, especially those on the periphery or outside of the known range.

Voices are of paramount importance for anuran taxonomy, since they are the primary species-specific characters in many groups. Sonograms and oscillograms are presented for the species Rödel has encountered in Comoé. Quite apart from the question whether oscillograms provide information not contained in the sonograms, both types of representations are reproduced so poorly that they are of very little use. This is a pity, and difficult to understand since much better sonograms of almost all the species have been published elsewhere. A CD is included with the voices of 24 out of the 51 species covered in the book, plus some "soundscapes" of Comoé N.P., compiled by Ulmar Grafe. The quality is high, but again one would have preferred that the many voices available from other workers be included. Only then would the voices have been really useful for the field worker, especially in difficult genera, such as *Ptychadena* and *Phrynobatrachus,* where species are easier to identify by voice than by appearance.

It is likewise a rather annoying peculiarity that, while the author is most keen to use all available literature, with very few exceptions he uses only his own illustrations, even when much better illustrations have been published elsewhere or in cases in which figures borrowed from other works would have made valuable additions (e.g., species not encountered by the author in the field). Had he been more willing to utilize such published illustrations Rödel could have presented sonograms of almost all species (instead of only those from Comoé) and could have provided better drawings of male throats (e.g., *Phrynobatrachus*, *Kassina,* and *Hyperolius*).

The meticulous descriptions of tadpoles, including possible differences between species in the same genera, are a valuable contribution. These descriptions include electron micrographs of mouthparts of most species as well as many observations on tadpole ecology (the subject of a separate book by the same author).

The book ends with a very informative general chapter on the biology of the anuran communities in the savanna and gallery forests in Comoé National Park and with an extensive list of literature.

In spite of criticisms expressed here of many details, Mark-Oliver Rödel's book is a very thorough and valuable contribution to the systematics and biology of the little known anuran fauna in the savanna and dry gallery-forests of West Africa. It combines a most impressive literature extraction with many original field observations from Comoé National Park.

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Maine Amphibians and Reptiles, edited by Malcolm L. Hunter Jr., Aram J. K. Calhoun, and Mark McCollough. 1999. University of Maine Press, Orono, Maine. 252 pp. Softcover. US $19.95. ISBN 0-89101-096-3.

NATHAN J. KLEY
Organismic & Evolutionary Biology Program, University of Massachusetts Amherst, Massachusetts 01003-5810, USA
e-mail: kley@bio.umass.edu

This book represents an updated and expanded edition of *The Reptiles and Amphibians of Maine* (Hunter et al. 1992). Like its predecessor, *Maine Amphibians and Reptiles* provides a general introduction to the herpetofauna of Maine that is directed primarily toward the amateur naturalist. While the core of the book has changed little since the first edition, several new features have been added that significantly increase the book's utility for non-specialists. Regrettably, however, several aspects of the original edition that limited the book's usefulness among herpetologists remain unchanged in the new edition.

The book opens with a brief preface, followed by several short introductory chapters. The first and second chapters provide cursory overviews of the evolution, natural history, and physiology of amphibians and reptiles, respectively. Both of these chapters are rather brief (two pages each), and focus only on the most fundamental aspects of amphibian and reptile biology. The following chapter is a brief synopsis of the physical geography of Maine and its influence on the distribution of amphibians and reptiles within the state. While this chapter may be potentially useful for interpreting biogeographical patterns, I believe its utility in this capacity would be greatly enhanced with the inclusion of a topographical map of the region. The fourth chapter, dealing with conservation, details the most serious threats facing the state's herpetofauna and the steps that are being taken to counter these threats. Included in this chapter is a useful table that gives the current status of all amphibian and reptile species listed as endangered, threatened, vulnerable, or of special concern in the six New England states and five provinces of Atlantic Canada. Finally, the introductory section of the book concludes with a short chapter on finding and enjoying amphibians and reptiles, as well as a brief overview of the regional range maps that were incorporated into the new edition.

The introductory chapters are followed by a checklist of Maine amphibians and reptiles and a 16-page gallery of color photographs. In the checklist, subspecific names are given only for those species that are represented in the state by multiple subspecies. While this was presumably done to make the checklist less daunting to the non-specialist, I found this convention to be awkward and unbalanced. The color photographs represent a new and valuable addition to the book. Although the quality of the photos is somewhat variable and one (of *Nerodia sipedon*) is printed upside-down, nearly all provide a greater level of detail than that which is found in the line drawings that accompany each species account. As a result, the book is now more likely to be useful for purposes of identification.

The remainder of the book's text is devoted almost entirely to accounts of the 38 species of amphibians and reptiles that occur (or have occurred historically) in Maine, including both the introduced mudpuppy (*Necturus maculosus*) and the extirpated timber rattlesnake (*Crotalus horridus*). These accounts were contributed by 27 different authors, ranging from amateur naturalists to professional field biologists. As a result of the number of authors and their diverse backgrounds, the species accounts vary somewhat in coverage, use of references, and overall quality. This potentially distracting heterogeneity is limited to some degree, however, by the consistent format adhered to by the authors. Each account consists of six to eight sections: Description; Voice (for anurans only); Taxonomic Status (for species having multiple subspecies); Distribution and Status; Habitat; Reproduction; Diet; and Interactions with People and Other Animals. In general, the species accounts have changed little since the first edition. Most have been revised minimally to incorporate information from recent studies published between 1991 and 1998. However, the accounts of the spotted turtle (*Clemmys guttata*) and wood turtle (*Clemmys insculpta*) were contributed by new authors and have been entirely rewritten. Also new to this edition are line drawings illustrating some of the diagnostic characters useful for identification purposes for each of the four orders of amphibians and reptiles that occur in the state. While these figures are useful additions, they do not include all of the characters that are referred to in the text. For instance, the number of dorsal scale rows is given as a diagnostic character to distinguish *Storeria dekayi* from *Storeria occipitomaculata*, but the figure summarizing the external morphology of snakes neither labels the dorsal scale rows nor illustrates how to count them accurately.

In general, the species accounts provide accurate information and sufficient detail for the intended audience. However, I did notice two errors in terminology in these accounts. First, in both the description of *Bufo americanus* (p. 73) and the figure illustrating the external morphology of anurans (p. 71), the parotoid glands are referred to as 'parotid glands.' Second, in the account of *Terrapene carolina* (pp. 148–149), the upper jaws are referred to as the 'upper mandible.'

Following the species accounts is a short chapter dealing with "hypotheticals" (species that are known from nearby states or provinces but have not been documented in Maine), "accidentals" (vagrants that occur only sporadically in Maine, e.g., sea turtles), and "other oddities" (exotic species that have been found in the state but have not become established). This is then followed by a key to Maine's amphibian eggs. This key is one of the most valuable of the new additions to this book. In fact, its utility and simplicity prompted me to wonder why no key was included for adults.

The final section of the book is devoted to the geographical distributions of individual species within the State of Maine. Separate maps are provided for each species, documenting their known distributions by township according to records derived from the Maine Amphibian and Reptile Atlas Project (MARAP). Species occurrences are plotted onto the maps according to 3 or 4 different levels of verification: 1) a specimen was collected or photographed; 2) a specimen was handled, then released; 3) a specimen was seen, but not captured; and 4) a specimen was heard, but not captured (applicable to anurans only). I was pleased to see the increased size of the range maps in this new edition, which makes them much easier to read than those in the original edition. However, I was disappointed to see that many conspicuous gaps still

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exist in these range maps, despite the incorporation of approximately 1200 new MARAP records. This undoubtedly results both from the natural tendency to focus search efforts on rare species (often having highly restricted ranges) and from Maine's relatively low population density (the lowest of any state east of the Mississippi River). I also thought that it was unfortunate that no effort was made to incorporate distributional data from museum specimens. Despite these criticisms, however, these maps serve as useful preliminary approximations of species distributions and will hopefully motivate both amateur naturalists and professional field biologists to intensify their searches for amphibians and reptiles in Maine's less populated areas (such as central and western Aroostook County).

Given its reasonable price, I can recommend this book to nonspecialists with few reservations. New additions such as the color photographs, the key to amphibian eggs, and the included compact disc with recordings of anuran vocalizations have substantially increased the book's overall utility. While the book was not written for herpetologists, it nevertheless stands as one of the most comprehensive modern accounts of the herpetofauna of any New England state. Although herpetologists will likely find Klemens (1993) to be a more useful resource for a general account of New England's amphibians and reptiles, anyone having a specific interest in the herpetofauna of Maine should buy this book.

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HUNTER, M. L., J. ALBRIGHT, AND J. ARBUCKLE (EDS.). 1992. The Amphibians and Reptiles of Maine. Maine Agricultural Experiment Station Bulletin 838. 188 pp.

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Erratum

In the March 2000 issue (vol. 31, no. 2, page 108), the range extension note for *Aulura anomala* by Borges-Nojosa and Caramaschi was listed under Gymnophiona, when it should have appeared under Amphisbaenia.



Bufo americanus (American Toad). USA: New York: Tompkins County. Illustration by J. B. Grant.

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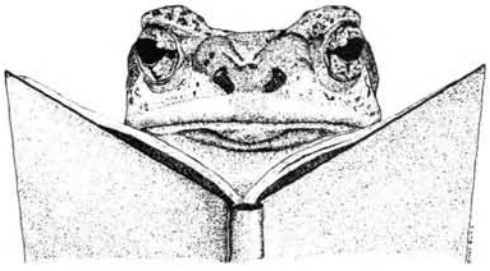
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Department of Biology
Saint Louis University
3507 Laclede Avenue
St. Louis, Missouri 63103-2010, USA
e-mail: ssar@slu.edu

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Missoula, Montana 59807, USA

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
University of Florida
bowen@gnv.ifas.ufl.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

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Hanover College
karns@hanover.edu

MICHAEL E. DORCAS
Davidson College
midorcas@davidson.edu

SHARYN B. MARKS
Humboldt State University
sbm1@axe.humboldt.edu

PAUL A. STONE
University of Central Oklahoma
pstone@ucok.edu

DEANNA H. OLSON
USDA Forestry Science Lab
dede.olson@orst.edu

GUNTHER KÖHLER
Forschungsinstitut und
Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

Current Research
JENNIFER M. GARRISON
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
jmg1@ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey–Foley Hall
The University of Kansas
2021 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jjohnson@utep.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Legislation & Conservation
TRAVIS J. RYAN
Department of Biology
Furman University
Greenville, North Carolina 29613, USA
travis.ryan@furman.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

Copy Editors: *Anna Clarke, Eli Greenbaum, Jeff Parmelee, Jenny Pramuk*

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All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

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Future Annual Meetings

2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 26–30 July 2001

About Our Cover: *Atheris ceratophora*



Horned or Eyelash Bush Vipers, *Atheris ceratophora*, are small (up to 54 cm in total length), semi-arboreal snakes with highly variable coloration. Plain green, black, and yellow specimens are known. More recently, individuals exhibiting a mottled pattern of irregular black blotches or bands over yellowish ground colors have been arriving in shipments from Tanzania and Kenya.

Atheris ceratophora is known to occur only in high elevation (~1400 m) forests with abundant moisture. They are restricted to several montane "islands" of habitat in eastern Tanzania in the Usumbara and Udzungwa (=Uzungwe) mountain ranges, and possibly also those of the Uluguru Mountains (Rasmussen and Howell 1982. Amphibia-Reptilia 3:269–277). Specimens have been encountered on the ground, on low stumps, and in short bushes and tussocks of grass. Irascible when approached, they don't hesitate to strike defensively.

Their wild diet includes frogs, although imported specimens have also accepted geckos, baby birds, and small rodents readily in captivity. Captive specimens are crepuscular and nocturnal, and prefer cooler temperatures than other *Atheris* species. A temperature from 55°F (~13°C) at night and up to 75–80°F (~24–27°C) by day has proven successful for maintenance (Michael Jacobi, The World of Atheris, http://www.worldofatheris.net). Captive reproduction is unknown.

The bush vipers comprise a group of mostly small snakes endemic to Africa. Most species have narrow distributions, their ranges associated with montane islands or other disjunct habitats that have favored isolation. Fourteen species are currently recognized within the Tribe Atherini (Broadley. 1996 J. Herpetol. Assoc. Africa 45(2):40–48): 11 species of *Atheris*, and one each in the genera *Adenorhinos*, *Montatheris*, and *Proatheris*. A tuft of one to three raised supraocular scales gives *A. ceratophora* a distinct appearance, readily differentiating it from other bush vipers. While most species of *Atheris* are principally arboreal, those of the monotypic genera are typically terrestrial. Recent works by Broadley (1998. Herpetol. J. 8:117–135) and Lawson (1999. Proc. Biol. Soc. Washington. 112[4]:793–803) have added to the list of known species.

Bill Love (Blue Chameleon Ventures) used Fujichrome Velvia (ASA 50) film to capture this cover image of one of the very first 'tiger phase' specimens imported into the USA in the late 1990s. The snake was a female, part of a shipment imported from Joe Beraducci of Mountain Bird Company in Arusha, Tanzania, by Rob MacInnes of Glades Herp, Inc. of Fort Myers, Florida.



Separation and imaging of Love's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

Sherman A. Minton Student Travel Awards Call for Applications

Awards of US $200 each are available for travel to the SSAR/HL Annual Meeting, Indianapolis, Indiana, 26–30 July, 2001. An applicant for a travel award must be a student and must be first author (or co-author, see below) of a paper or poster to be presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that states: he/she is not completely funded for travel from another source; 2) an official copy of the paper or poster abstract to be presented; and 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site are excluded from applying for a travel award.

Applications must be postmarked by 15 May 2001. Award recipients will be notified by 1 June 2001 and award checks will be disbursed at the meeting. Direct requests for information and submit applications to: *Stephen C. Richter, Department of Zoology, The University of Oklahoma, Norman, Oklahoma 73019-0235, USA. Tel: (405) 325-7671; fax: (405) 325-6202; e-mail: richter@ou.edu.*

Seibert Award Winners for 2000 Announced

The ninth annual Seibert Awards were presented at the 43rd Annual Meeting of the SSAR in La Paz. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). The awards are given in recognition of outstanding student presentations at the annual meetings. Awardees received a check for US $200 and a book from Academic Press. The winners:

Conservation: **P. M. Richards**, University of Miami, Coral Gables, "Population modeling of the American crocodile, *Crocodylus acutus*, for conservation and management in South Florida."

Systematics: **C. R. Feldman**, Department of Biology, San Francisco State University, "Molecular phylogeny of emydine turtles." (Co-author J.F. Parham).

Physiology/Morphology: **N. I. Filoramo**, Department of Ecology and Evolutionary Biology, University of Connecticut, "Ultrastructure of the lingual surface in anguimorph lizards and snakes: evolutionary and functional implications." (Co-author K. Schwenk).

Ecology/Evolution: **P. R. Stephens**, Carnegie Museum of Natural History, "The effects of phylogenetic history on patterns of emydid species richness at different spatial scales." (Co-author J J. Wiens.)

The judges were Bob Brodman, Stanley Fox, Randy Jennings, Hinrich Kaiser, Todd Reeder, Steve Secor, Lynnette Seivert, and Kelly McCoy (Chair).

Kennedy Student Award Committee Annual Report—2000

The Kennedy Award Committee has completed its work for Volume 33 of the *Journal of Herpetology*. The Committee has selected "Lizard assemblage response to a forest ecotone in northeastern Australia: a synecological approach" by **Simon D. S. Conroy** (Vol. 33:409–419). The Kennedy Award carries with it a cash prize of US $200 or the winner's selection of any SSAR publications valued at twice that amount.

The Committee encourages each student member of the Society to submit their work to the *Journal*, and encourages each regular member who supervises the work of students to encourage his/her students to submit their work to *JH*.

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APPLICATIONS MUST BE POSTMARKED BY 15 MAY 2001. Award recipients will be notified by 1 June 2001 and award checks will be disbursed at the meeting. Direct requests for information to: *Scott Boback, 331 Funchess Hall, Department of Biological Sciences, Auburn University, Auburn, Alabama 36849-5414, USA; e-mail: bobacsm@auburn.edu.*

SSAR Student Awards Fund-raiser: 2000 Results and Call For 2001 Donations

Thanks to the many generous donations from several individuals to the 2000 silent auction at La Paz, the SSAR Student Travel Awards Committee (SSAR STAC) awarded seven US $200 travel grants to the following individuals: Scott Boback, Felipe Rodriguez, Nicole Gerlanc, Norma Manriquez, Michael Shapiro, Patrick Stephens, and Omar Torres-Carbajal. The SSAR STAC wishes to thank all who donated items to the 2000 silent auction at La Paz: United Design, David Hardy, Julian Lee, Rainforestimages.com, AVM/Barbara Kermeen, William Montgomery, Breck Bartholomew, Scott Boback, Roy McDiarmid, Hobart Smith, Roger Birkhead, Jackie Grant, Chris Scott, Henry Mushinsky, Biomark, Norm Scott, Al Savitzky, Smithsonian Institution Press/Vincent Burke, Dick Vogt, Rudy Ruibal, Wade Sherbrooke, Ken Dodd, Laurie Vitt, Jan Caldwell, and Peter Uetz. The sixth annual Frameable Art Silent Auction raised over US $2065 for future student travel awards. On behalf of the SSAR, thanks to all who helped, including Lynda Richter, Mark Walvoord, Cari Deen, and the La Paz meeting organizers. Special thanks for a job well done to the SSAR STAC Chairman, Stephen Richter.

The SSAR STAC announces the Seventh Annual Frameable Art Silent Auction to be held at the 2001 SSAR meeting at Indianapolis. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *Scott Boback, 331 Funchess Hall, Department of Biological Sciences, Auburn University, Auburn, Alabama 36849-5414, USA; e-mail: bobacsm@auburn.edu.*

Amphibian Population Declines Symposium

Since the problem of amphibian population declines became known just over ten years ago, an enormous and productive international research effort has ensued, mobilized to a considerable extent around the world by the Declining Amphibian Populations Task Force. From a worrisome notion ten years ago, it is now abundantly recognized that amphibian populations are in worldwide decline and that there are numerous causes, some hitherto unsuspected, for both the decline of numbers of individuals and the losses of populations. The imminent loss of the species they work on is the single greatest problem for amphibian biologists today.

In view of the great amount of research work that lately has been focused upon amphibian populations, now is the right time to hold an international symposium to bring together what we have learned, to discuss that new knowledge, and use it as a springboard to further understanding. With this in mind, the DAPTF last year decided to mark the end of its IUCN mandate with a major symposium on global amphibian declines.

The symposium will be held at the joint SSAR/HL herpetology meetings in Indianapolis in July 2001, with the support of both societies and DAPTF. David M. Green and Karen Lips are the organizers. The symposium will be a singular and seminal event. It will be a significant synthesis of information on declining amphibian populations, with implications for the conservation biology of herpetofauna in general.

The symposium tackles a global issue and speakers will be coming from distant corners of the world, including countries where a plane ticket to Indianapolis is beyond their means. To make this event a success, we ask for your help. The DAPTF, in conjunction with HL and SSAR are doing everything they can to be able to provide these eminent researchers with the funding to attend and speak. US $1500 will sponsor one overseas speaker. SSAR will accept your tax-deductible (for US residents) contributions in support of the symposium. Donations should be directed to: *Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103-2010, USA; e-mail: ssar@slu.edu.*

2000 Annual Meeting: La Paz

The 43rd annual meeting of SSAR took place from 14 to 21 June 2000 in La Paz, Baja California Sur, Mexico. This year's meeting was held jointly with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists and was hosted by the Universidad Autónoma de Baja California Sur. Herpetological presentations were conducted at the Hotel Araiza Inn Palmira, a very pleasant location. In being marginalized by the ichthyologists on the planning committee, SSAR members were ensured cultural opportunities not experienced by our fin-bearing brethren; casual sea-side walks, stimulating conversation with local taxi drivers, and herpetological excursions among the hills were all potential benefits at the Hotel Araiza. Carlos Villavicencio Garayzar served as the local chair for the meeting that saw the scheduled presentation of 968 talks and posters. Armed guards at the airport and lost luggage aside, the meeting was a terrific success.

Social Programs

Numerous social events served as diversions from the lively discussions of the daily scientific sessions. On Wednesday, 14 June 2000, an informal "no-host" social saw many herpetologists and ichthyologists rubbing elbows at Carlos and Charlie's, a watering hole and eatery in downtown La Paz. The Opening Plenary Session, on the surprisingly rainy morning of 15 June, kicked off with an introduction by Local Committee Chair Carlos J. Villavicencio Garayzar. Joint Meeting attendees were given a warm welcome by C. Leonel Cota Montaño, the Governor of Baja California Sur. The Governor stated that attendees were always welcome to return to La Paz if we brought significant precipitation, the first the region had seen in over two years. The Herpetologists' League Distinguished Lecture was given by Linda Trueb, who spoke on "Frogs, fossils and phylogeny: a perspective on the last 140 million years and prospectus for the future." José Luis Castro Aguirre gave an historical ichthyological presentation that focused on the contributions of Mexican scientists to the field. Herpetologists and ichthyologists, alike, were able to appreciate the humor and insight of ASIH Past President Robert Cashner's address, one that had attendees rolling in the aisles of the Teatro de la Ciudad. Scientific sessions commenced after a lunch break that followed the obligatory photographs of meeting attendees.

The Muelle Turístico served as the venue for the Joint Meeting Reception on the evening of 15 June 2000. Attendees were greeted by smiling representatives of the Cervecería Tecate, who supplied ample quantities of their products for consumption. Many of the resort hotels sponsored tents that provided a generous mix of local cuisine offerings. Music and spirits filled the air as the sun set over the Sea of Cortez and social adventures continued into the night. The Graduate Student Reception on 16 June was held at El Kiosko in downtown La Paz. Certainly, the highlight of the social events for the Joint Meeting was the Beach Picnic at Playa El Caimancito, the Governor House, on Saturday, 17 June. A great variety of delicious seafood and beverages were consumed as the waves splashed at the heals (and other body parts) of attendees. Live music provided a poolside alternative to those not exploring the sea life of the breakwater.

The SSAR Auction was held on the evening of 18 June in the Loreto Meeting Room of the Hotel Araiza Inn Palmira and was conducted by David Morafka. A cash bar, supplemented by free drinks tickets handed out by President Lee, helped to stimulate aggressive bidding for a number of exceptional auction items. An item of particular note was an antique African beadwork hanging loaded with herpetological iconography and symbolism that saw hefty bidding action. The evening of Monday, 19 June, saw numerous guests taking part in a dinner and "roast" to honor Jay Savage and his contributions to herpetology. The social events of the Joint Meeting closed on 20 June with the reception and banquet sponsored by the attending societies. This event was hosted at the Crowne Plaza, a lovely facility that overlooked the Sea of Cortez. Finally, many post-meeting field trips offered the possibility for natural history excursions and explorations including trips to nearby islands to view endemic herpetofauna and snorkeling with schools of hammerhead sharks. Even the hillside above the meeting location held a unique assemblage of organisms for those adventuresome souls who chose to explore the xeric habitats of La Paz.

Business Meeting

Society President Lee called the Annual SSAR Business Meeting to order at 1611 h in the Pescador Room of the Marina Hotel on 17 June 2000. Approximately 20 Society members were in attendance, most of these being members of the Board or holding other Society positions.

Julian Lee summarized the Presidential Report to Board of Directors by focusing on two key issues: 1) recruitment of new members to the Society, and 2) the appointing or resignation of Board Members and publications editorial staff. Membership continues to remain stable, but could draw from additional areas within the herpetological community (i.e., zoological park and state/federal agency personnel). During his term, President Lee appointed (with Board approval) the following individuals to positions within the Society. A) Michael V. Plummer – Chair of the Conservation Committee. Plummer will head an eight-member committee that in-



Meeting attendees enjoyed a beach picnic at Playa El Caimancito, the Governor's House.

cludes Kurt Buhlmann, Ken Dodd, Mike Dorcas, Lee Fitzgerald, John Jensen, Andy Price, Steve Sheffield, and Mike Sredl. President Lee praised Plummer for his aggressive coordination of the committee and energetic revitalization of the Conservation Committee. B) Aaron Bauer – Editor of *Facsimile Reprints in Herpetology* beginning January 2002 (to replace Kraig Adler). C) Brian K. Sullivan – Editor of the *Journal of Herpetology* beginning January 2001 (to replace Richard Seigel). D) Ms. Jean Bann – hired as copy editor for the *Journal of Herpetology*. Additionally, President Lee has accepted the resignation of Harold Dundee as Caudata Editor for the *Catalogue of American Amphibians and Reptiles*. All outgoing editors and officers are thanked for their thoughtful service to the Society.

President Lee announced the establishment of a one-time, multiple person award in memory of the late Sherman A. Minton, M.D. that would serve to recognize his many contributions to herpetology, toxicology, and medicine. The Sherman A. Minton Student Travel Awards (SM-STA) will be made to approximately ten students and will serve to defray the costs of attending the annual meeting in Indianapolis in July 2001. A minimum goal of US $2000 is expected to be raised and will be allotted to students in the range of US $200–$400 to individuals presenting at the meeting. David Hardy will chair the SM-STA committee and Stephen Richter will help to implement the selection process.

Society Treasurer Robert Aldridge reported that SSAR remains financially viable with total assets of $219,000 in restricted accounts. Aldridge reported that the sale of Joseph Bailey's library collection grossed $20,620 for the Society. Lee thanked Kraig Adler and Steve Busack for their roles in the sale of the Bailey library. Bob Aldridge changed hats and reported, as the Publications Secretary, that the Society has a collection of publications valued at $500,000. He stressed the importance of decreasing the current holdings as they represent potential revenues for the Society. President Lee announced that Aldridge has tendered his resignation as Treasurer (to take effect at the end of 2001), but will remain as Publications Secretary. Bob Aldridge and wife, Linda, were praised for the job they have done for the Society and President Lee stressed the need for a replacement for this important position.



Herpetologists enjoyed a unique dining experience at Playa El Caimancito.



Jay Savage was this year's recipient of the Henry Fitch Award, presented by Harry Greene. The Fitch Award was initiated by ASIH in 1998 to recognize excellence in the field of herpetology. A "Savage Symposium," featuring talks in tropical ecology and evolution, spanned two days of the meetings, and Savage was also honored at an evening dinner and roast.

Outgoing *Journal of Herpetology* Editor, Rich Seigel (*in absentia*), submitted a report indicating a number of personnel changes. Brian Sullivan has assumed the duties of Editor as of August 2000. Additional changes in the editorial staff include John Fauth (Associate Editor), Brent Graves (Associate Editor), and Dawn Wilson (Editorial Board). Rich reported that submissions to the *Journal* were down slightly in 1999 from the previous year, but still remained solid at 235. Submissions as of May 2000 were running higher than a comparable date in recent years, and could reach record levels. To this point, the *Journal* has been able to maintain a backlog time of no more than 12 months thanks, in part, to an increase in the publication budget for 1999, a lower submission rate for the same period, and reduced publication costs from Allen Press. Seigel cautions that the backlog time for accepted submissions could increase as the average submission increases in length (from 5.5 pages/title in 1997 to 6.3 in 1999) and the need for additional funds for publication charges persists. Lastly, Seigel noted that the addition of a Copy Editor for the *Journal* will aid in journal production, but will incur a cost to the Society.

Herpetological Review Editor, Robert Hansen, reports personnel changes including new Associate Editors Gunther Köhler, Brad Hollingsworth, Adam Summers, and Michael Dorcas. New Section Editors include Winston Card (Herpetological Husbandry), Travis Ryan (Legislation and Conservation), and Jennifer Garrison (Current Research). *Herp Review* seems to be able to maintain its current, expanded production size – 256 pages in four issues for Volume 30. Bob reports that the publication will be produced on glossy paper stock beginning with Volume 31. He also announced the addition of a new section within *HR*, Herpetological History.

Robert Powell (*in absentia*), Editor of the *Catalogue of American Amphibians and Reptiles* (*CAAR*), submitted a report on the status of this important publication effort. Bob reports that the

1999 contributions to *CAAR* consisted of 20 accounts (Nos. 681–700; 8 salamander, 1 frog, 2 turtle, 6 lizard, 2 snake, and 1 crocodilian accounts)—for a total of 97 printed pages. Color plates were included in 16 of the accounts. Bob expects the completion of 20 accounts for 2000, has plans for another 20 accounts for 2001, and would like to see this number maintained annually, as long as sufficient number of individuals submit species accounts. Digital technology is being used to archive *CAAR* accounts on CD-ROM.

Kraig Adler, Editor (*in absentia*), submitted reports on the activities of two Society publication series, *Contributions to Herpetology* and *Facsimile Reprints in Herpetology*. Recent publications include "Lizards of Iran," by Steven Anderson (1999) and "General Zoology: Volume 3 Amphibia," by George Shaw (1999). Upcoming and newly completed offerings include several significant publications. "Herpetological Illustrations from the Spencer Research Library, University of Kansas," compiled by Sally Haines is scheduled for fall 2000 and will feature the development of herpetological illustration from 1550 to 1950. "Herpetofauna of New Caledonia and Surrounding Islands," by Aaron Bauer and Ross Sadlier is expected in late 2000. William Duellman has updated his classic 1970 publication, "Hylid Frogs of Middle America," and this should be available in late 2000. Inclusion of newly described species and original artwork by David Dennis is certain to make this a big seller. "Amphibians of Honduras," by James R. McCranie and Larry David Wilson should be published in early 2001. Also expected in 2001, is a reprinting of "Anatomy of the Salamander," by Eric T. B. Francis. Originally published in 1934, this work will have a new introduction by James Hanken. Adler reports that three additional projects are in the works and should see publication in the next year or two. These include "Field Guide to Amphibians and Reptiles of the West Indies," by S. Blair Hedges, "Lizards of Southern Africa," by William Branch and Aaron Bauer, and "Biology of the Reptilia, Volume 20 (Morphology)," edited by Carl Gans and Abbot Gaunt.

Herpetological Circulars Editor, John Moriarty (*in absentia*), submitted a report on the status of three publications in that series. *Herpetological Circular No. 27* – "Lineages and Histories of Zoo Herpetologists in the United States," by Winston Card and James B. Murphy was published in February 2000. *HC No. 28* – "State and Provincial Amphibian and Reptile Publications for the United States and Canada," by John Moriarty and Aaron Bauer is currently available. "Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding," (*HC No. 29*) by Brian Crother et al., is anticipated shortly and should be larger than previous versions of this publication.

Stephen Corn, Editor of *Herpetological Conservation* reported that progress on Volume 2, "Ecotoxicology of Amphibians and Reptiles," had been slowed, but he still anticipates its completion by the end of 2000. A proposed Volume 3, "Conservation and Status of Reptiles in Canada," has received solid backing by The Canadian Amphibian and Reptile Conservation Network. This volume will be edited by Carolyn Seburn and Christine Bishop and feature 15 chapters authored by numerous prominent Canadian herpetologists. Other projects are in the planning phase, but will require the direction of another editor as Steve Corn has requested a replacement be identified for *Herpetological Conservation*.

Several outstanding student projects received recognition during the past year. Robert Gatten reported that the Kennedy Award Committee selected the best student paper for publication in volume 33 of the *Journal of Herpetology* for 1999. The committee selected a paper authored by Simon D.S. Conroy titled, "Lizard assemblage response to a forest ecotone in northeastern Australia: a synecological approach." The ninth annual Seibert Awards were selected from student presentations made at the 43rd Annual Meeting of the SSAR in La Paz. Committee Chair C. Kelly McCoy announced the following Seibert Award winners for 2000: C. R. Feldman (San Francisco State University) – Systematics, "Molecular phylogeny of Emydine turtles," I. F. Nirvana (University of Connecticut) – Physiology/Morphology, "Ultrastructure of the lingual surface in anguimorph lizards and snakes: evolutionary and functional implications," P. M. Richards (University of Miami) – Conservation, "Population modeling of the American crocodile *Crocodylus acutus* for conservation and management in South Florida," P. R. Stephens (Carnegie Musuem of Natural History) – Ecology, "The effects of phylogenetic history on patterns of emydid species richness at different spatial scales."

Henry Mushinsky clarified many aspects of the 2001 Annual Meeting that will see SSAR meeting jointly with The Herpetologists' League at the Double Tree conference center in Indianapolis, Indiana. The meeting is scheduled for 26–30 July 2001 and will be jointly hosted by Purdue University and Indiana University. Many aspects of the 2001 meetings will serve to honor the late Sherman A. Minton, M.D., for his years of dedication to the Society and contributions to the field of herpetology. A symposium titled "Herpetological Research in Zoos: The Academic Connection" is being organized by John Groves and Hugh Quinn, and will be dedicated to Sherman Minton. David Green and Karen Lips are organizing another symposium on amphibian population declines. Other activities planned for the 2001 meeting include the beautiful herpetological imagery of David Dennis and Eric Juterbock. President Lee announced that he and Marty Crump would reinstate the Herpetology Quiz. Mushinsky stressed the need for organizational help with the meeting, especially the Society Auction—any interested individuals should contact Henry. Mushinsky also emphasized the need for graduate student projectionists for the scientific sessions, as the cost to the Society for "professional" projectionists will be excessive. When asked about the possibility of inexpensive housing (=university dormitories), Mushinsky stated that there was none available in association with the meeting site. Henry went on to say that there were few "hidden" costs connected with next year's event—registration fees will cover most of the associated social events. Mushinsky outlined possible future meeting locations including Kansas City (2002 – joint meeting with ASIH), San Diego (2003), Oklahoma (2004 – to commemorate the 20th anniversary of the joint meeting hosted by Past President Vic Hutchison at the University of Oklahoma), Tampa (2005 – to be hosted by Henry Mushinsky), and Victoria, B.C. (2006 – to be hosted by Pat Gregory).

Akira Mori summarized the results of an opinion survey he conducted of non-US members as to their satisfaction with the activities of SSAR. Mori pointed out that, at 446 individuals, non-US members account for nearly 30% of the Society's membership. He received responses from only 34 non-US members, but concluded that most comments were generally favorable. Many con-

structive comments centered on aspects of increasing international involvement and decreasing the cost to members from developing countries. The language barrier contributes to aspects of dissatisfaction from non-US members, both in terms of publication issues and communication of Society activities. Related to increasing international activities, President Lee commented on the Society's role in sponsoring a Cuban herpetologist. Associated with increased international outreach, Lee accepted an offer from Karen Lips to serve as the new Chair of the Society's International Cooperation Program (a position previously filled by Martha Crump).

On behalf of George Pisani (*in absentia*), President Lee addressed aspects of the Society webpage and electronic publishing. Pisani reported that the Society website continues to experience active visitation and is linked to many resource locations. The SSAR website was relocated from Pisani's personal directory to a dedicated location on the University of Kansas computing network. At the present time, the Society has chosen not to go "online" in terms of journal publishing. Questions of web-based membership renewal have also been explored, but deferred to a later date until aspects of security can be ensured. Pisani reports that time needed to compile corrections to the *Directory of Herpetologists* has eclipsed the abilities of the editors of that effort—Pisani, Harold Dundee, and Robert Aldridge. Members of the SSAR Board agreed that, while valuable, changes to the *Directory* would not be implemented by the Society.

Bill Cooper (*in absentia*) reported as Chair of the Publications Task Force. Of recent concern to the Task Force are issues associated with the Society's policy on institutional approval connected to the use of live animals in research. Several editorial policies address issues of the humane and ethical treatment of animals in association with field and laboratory studies. Cooper noted that Society publications require a cover letter indicating that authors have complied with all applicable institutional animal care guidelines, and that all required permits for research, collection of specimens, import, and export have been obtained in the appropriate countries. While the Task Force feels it is important for all scientists engaged in animal research to acquire appropriate permits, it is not necessary for authors submitting manuscripts to supply permit documentation. Use of museum accession numbers for voucher specimens is recommended only for those studies that are systematic in nature. Lastly, in keeping with the need for manuscript uniformity and editorial continuity, the Task Force recommends the hiring of a Copy Editor for the *Journal of Herpetology* (a recommendation that has been implemented by the Board).

Finally, in a ceremony shrouded in honor and mysticism, President Lee passed the totem of presidential office to President-Elect David Green. Green accepted the post and its scepter, laden with herpetological iconography, graciously, before the meeting was adjourned. The coming year holds much potential for the Society, as David Green becomes the first president to face a two-year term of office.

—Respectfully submitted by John M. Matter, Secretary

2000 Resolutions

Honoring Outgoing SSAR Officers, Editors, and Others

WHEREAS, the following individuals have given freely of their time, skills, and knowledge to the Society for the Study of Amphibians and Reptiles this past year; and,

WHEREAS, they have therefore been instrumental in advancing the Society's goals and furthering its growth as an international scientific society; and,

WHEREAS, SSAR is dependent upon the generosity of these persons and those who have gone before them, and is greatly indebted to them for their fine efforts in its behalf; therefore,

BE IT RESOLVED that the Society for the Study of Amphibians and Reptiles offers its sincere gratitude to the following persons who have served in these capacities:

ROGER A. ANDERSON — Associate Editor, *Journal of Herpetology*
DANIEL D. BECK — Associate Editor, *Herpetological Review*
JERRERY P. DEMUTH — Section Editor, *Herpetological Review*
R. WAYNE VAN DEVENDER — Director
MAUREEN DONNELLY — Liaison for 2000 Local Committee
HAROLD A. DUNDEE — Editor - *Combined Directory of Herpetologists*; Section Editor — Caudata, *Catalogue of American Amphibians and Reptiles*
RENEE FERACHI-SIMS — Editorial Assistant, *Journal of Herpetology*
STANLEY FOX — Liaison for 2000 Local Committee
VICTOR H. HUTCHISON — President
MICHAEL W. KLEMENS — Conservation Committee
ANNE M. MAGLIA — Section Editor, *Herpetological Review*
LANCE McBRAYER — Student Travel Awards
LYNDON A. MITCHELL — Section Editor, *Herpetological Review*
HENRY R. MUSHINSKY — Long Range Planning, Nominating Committee
CHARLES W. PAINTER — Director
GEORGE PISANI — *Catalogue of American Amphibians and Reptiles; Combined Directory of Herpetologists*
JAY STAUFFER — 1999 Local Committee
RICHARD VOGT — Liaison for 2000 Local Committee

BE IT FURTHER RESOLVED that the SSAR urges these persons not to become consumed by other more pressing but perhaps more interesting responsibilities, but to be available in the future as resources for those who follow in their service to the Society.

Adopted by the Society for the Study of Amphibians and Reptiles, 17 June 2000, at its Annual Business Meeting.

Resolution Thanking Ellen J. Censky

WHEREAS, Ellen J. Censky has been one of the most hard-working members of SSAR for many years; and,

WHEREAS, Ellen answered the call to assist the Society by as-

suming the demanding role of Secretary, and has most capably filled this role these several years; and,

WHEREAS, the role of Secretary encompasses not only myriad tasks associated with the functioning of the Annual Meeting, but also involves guiding the President and Directors through many issues that span more than a single year; and,

WHEREAS, the Secretary thus provides needed continuity through the terms of other officers; therefore

BE IT RESOLVED that the Society for the Study of Amphibians and Reptiles here expresses its most sincere thanks to Ellen J. Censky for her dedication and service as Secretary; and be it further

RESOLVED that the Society wishes her all the best in her new professional challenges.

Adopted by the Society for the Study of Amphibians and Reptiles at its Annual Business Meeting, 17 June 2000.

NEWSNOTES

Greene and Shine Named Wilson Award Winners

Herpetologists Harry Greene (Cornell University) and Richard Shine (University of Sydney) were this year's recipients of the E. O. Wilson Naturalist Award. This prestigious award was presented at the American Society of Naturalists annual meeting in Bloomington, Indiana in June. In recognition of the lifetime of outstanding contributions of Professor E. O. Wilson in the areas of ecology and evolutionary biology, the award was established in the year of Professor Wilson's retirement from Harvard University. The Wilson Award is given to an active investigator in mid-career who has made significant contributions to the knowledge of a particular ecosystem or group of organisms. Congratulations to Harry and Rick for this outstanding recognition.

Field Museum Herpetological Collection Online

The website for the retrieval of information on the approximately 265,000 specimens in the collection of the Division of Amphibians and Reptiles at the Field Museum can be queried at http://www.fmnh.org/herps/. This new service was implemeneted as aprt of a grant from the National Science Foundation.

The Field Museum's amphibian and reptile collection is global in origin and almost equally divided between the New World and Old World. The approximate breakdown of collection holdings by major geographic area is: North America (32.9% of catalog entries), Indo-Australia (20.9%), Asia (15.4%), South American (10.4%), Africa (9.0%), Central America (4.7%), Australia (2.7%), Caribbean (1.2%), Pacific (0.9%), Europe (0.6%), Madagascar (0.5%), Atlantic Ocean (0.3%), and Indian Ocean (0.1%).

The total number of catalog entries from the United States is approximately 50,500. States representing from five to ten percent of this total include (ranked highest to lowest): Illinois, New York, Texas, North Carolina, Mississippi, and Indiana.

The collection contains over 6,000 species and 1,180 genera. The approximate breakdown of collection holdings by order or suborder is: frogs (42.6% of catalog entries), salamanders (12.4%), caecilians (0.25%), turtles (1.97%), rhynchocephalians (0.006%), lizards (26.4%), snakes (16.0%), amphisbaenians (0.16%), and crocodilians (0.26%).

Please direct any comments, suggestions, or problems to Harold Voris (e-mail: hvoris@fmnh.org) or Alan Resetar (e-mail: aresetar@fmnh.org), Division of Amphibians and Reptiles, Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, Illinois 60605-2496, USA.

Southwestern Research Station Positions And Grants For 2001

VOLUNTEERS—Approximately 30 volunteer positions are open in 2001 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024-5192, USA; http://research.amnh.org/grants/index.html; e-mail: rnavarro@amnh.org. Application due date: February 15, 2001. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632, USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reserva-

tions, answering phones, greeting guests, supervising volunteers, etc. Begin March 15, 2001, through September 2001 (end date flexible). Five-day week; salary $245/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

MEETINGS

IHS Announces Grants Program and Call for Papers

A herpetocultural/herpetological Grants Program has been established by the International Herpetological Symposium and was announced at the 24th Annual Meeting held in New Orleans, Louisiana, 19–22 July 2000. The goal of the program is to award funds to a wide variety of applicants whose projects represent a significant contribution to herpetoculture in one of the following categories: Herpetological Natural History, Herpetological Conservation Biology, Captive Propagation, and Herpetological Education. Enthusiastic amateurs will receive the same level of consideration as professional herpetologists and graduate students. For more information about the program, write to: International Herpetological Symposium, Grants Program, P.O. Box 16444, Salt Lake City, Utah 84116-0444, USA.

The 25th Annual IHS Meeting will be hosted by the Detroit Zoological Institute in Detroit, Michigan, USA, 14–17 July 2001. Individuals wishing to present their papers on herpetological natural history, conservation biology, veterinary medicine, or captive husbandry topics may submit them to Donal Boyer, Curator of Herpetology, Zoological Society of San Diego, P.O. Box 120551, San Diego, California 92112, USA.

Detailed information about the Grants Program and the 25th Annual Meeting can be found online at http://www.kingsnake.com/ihs.

Meetings Calendar

22 February 2001—Declining Amphibian Populations in California and Nevada: Causes and Solutions. Radisson Hotel, Sacramento, California, USA. This workshop will be held in conjunction with the annual meeting of The Wildlife Society, Western Section (www.tws-west.org), and is sponsored by the California-Nevada Working Group of the Declining Amphibian Task Force (DAPTF), Species Survival Commission, World Conservation Union (IUCN). For information contact: David F. Bradford, US Environmental Protection Agency, National Exposure Research Laboratory, 944 East Harmon, Las Vegas, Nevada 89119, USA; Tel: 702-798-2681, FAX: 702-798-2692, e-mail: bradford.david@epa.gov.

24–28 February 2001—21st Annual Symposium on Sea Turtle Biology and Conservation, Philadelphia, Pennsylvania, USA. Information at www.seaturtle.org.

16–19 March 2001—Desert Tortoise Council 26th Annual Meeting and Symposium, InnSuites Hotel and Resort, Tucson, Arizona, USA. Information at www.deserttortoise.org.

14–17 July 2001—International Herpetological Symposium 25th Annual Meeting, Detroit Zoological Institute in Detroit, Michigan, USA. *Refer to meeting announcement above for details.*

16–20 July 2001—Societas Europaea Herpetologica 11th General Meeting, Slovenia. Details from: DPPVN/DAPTF Slovenia, Ptujska c. 91, SI-2327 Race, Slovenia; fax: +386 (0)2 788 30 51; e-mail: milan.vogrin@guest.arnes.si.

26–30 July 2001—44th Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League (http://www.inhs.uiuc.edu/cbd/HL/HL.html). Indiana University/Purdue University, Indianopolis, Indiana, USA. Details available in March 2001 issue of HR and on the SSAR web site: www.ukans.edu/~ssar/an-mtng.html.

19–23 September 2001—Association of Reptilian and Amphibian Veterinarians, Eighth Annual Conference, Orlando, Florida, USA. Details from: Charles J. Innis, VMD, VCA Westboro Animal Hospital, 155 Turnpike Road, Westboro, Massachusetts 01581, USA; tel. 508-366-1444; fax 508-634-6997; e-mail: clemmys@aol.com.

2–9 December 2001 (note change of dates)—Fourth World Congress of Herpetology, Colombo, Sri Lanka. Details from: 4WCH Promotions Office, 95 Cotta Road, Colomba 8, Sri L*anka; e-mail: admin@4wch.com; http://www.4wch.com.

LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles. This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. We are in need of information at local, state, national, and international levels. Please direct all communications to the section editor, Travis Ryan (postal and e-mail addresses on inside front cover).

USA: Department of the Interior: On 4 November 1997, the northern population of the bog turtle (*Clemmys muhlenbergii*) was listed as a threatened species under the 1973 Endangered Species Act (ESA). The northern population is distributed among Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania. The ESA requires that a recovery plan be established for each listed species. A draft of the bog turtle recovery plan has been produced by the Fish and Wildlife Service and is available for the public review.

Bog turtles require a diversity of microhabitats, including wetlands and associated open canopy upland areas. The thrust of the draft recovery plan is to preserve approximately half of the current extant populations in the long-term by understanding population dynamics as well as eliminating habitat fragmentation and illegal trade.

A copy of the draft recovery plan can be obtained at the addresses below. For further information, contact: Carole Copeyon, US Fish and Wildlife Service, Pennsylvania Field Office, 315 South Office Street, Suite 322, State College, Pennsylvania 16801, USA. Also, contact Herp Digest (attn: Allen Salzberg) via e-mail at x5245@erols.com.

USA: Department of the Interior: The US Fish and Wildlife Service has proposed designating more than 2,175,000 acres of land distributed among 24 counties in central California as critical habitat for the California Red-legged Frog (*Rana aurora draytonii*). This action is designed to maintain connectivity of breeding ponds and surrounding upland habitats in an effort to stave off further fragmentation of the landscape. If the action receives final approval, land within the critical habitat cannot be adversely modified or destroyed by any activities funded or authorized by any federal agencies or persons. The call for comments ended 11 October 2000. For further information, contact: Curt McCasland or Brian Twedt, US Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, W-2605, Sacramento, California 95825-1864, USA.

USA: Department of the Interior: On 21 September 2000, the US Fish and Wildlife Service listed the Santa Barbara County Distinct Vertebrate Population Segment (DPS) of the California Tiger Salamander (*Ambystoma californiense*) as endangered under the 1973 Endangered Species Act. In order to be considered for protection as a DPS the candidate population must be found to be a discrete population segment (relative to the rest of the species distribution) comprising a significant portion of the population. Genetic analyses suggest that there are low levels of interchange among the Santa Barbara County DPS and the rest of *A. californiense*. Five of six habitat complexes within the range of the DPS have undergone serious degradation (conversion to vineyards, grazing land) in the last several years, with plans for more habitat conversion pending at the time of listing.

The listing completes a long series of federal conservation actions. *Ambystoma californiense* was first listed as a candidate species (category 2) in 1985. In 1992 the Fish and Wildlife Service was petitioned to list the species, but this did not result in federal protection. The current ruling is the result of an emergency rule published 19 January 2000. See *Herpetological Review* 31:68 for further details. For further information, contact: Grace McLaughlin, Ventura Fish and Wildlife Office, 2394 Portola Road, Suite B, Ventura, California 93003, USA.

USA: Department of the Interior: The US Fish and Wildlife Service has designated more than 400,000 acres as critical habitat for the Alameda Whipsnake (*Masticophis lateralis euryxanthus*). The habitat designation makes it illegal for Federal agencies and their charges to destroy or damage the critical habitat that is distributed among several California counties (Contra Costa, Alameda, San Joaquin, and Santa Clara). See *Herpetological Review* 31:67 for further details or contact Jason Davis or Heather Bell, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Suite W-2605, Sacramento, California 95825, USA.

International: World Conservation Union-International Union for Conservation of Nature and Natural Resource (IUCN). The recently released 2000 Red List of Threatened Species shows an increase the number of reptiles listed since the 1996 of the list. The current edition lists 291 species as Critically Endangered, Endangered, or Vulnerable, up from 253 four years ago. The 2000 list includes 24 Critically Endangered and 47 Endangered species. The crisis over freshwater turtles in Southeast Asia (see *Herpetological Review* 30:68–69) is largely responsible for the increase. The IUCN lists habitat loss/degradation, unsustainable use (exploitation), and invasive species as the major causes of the worldwide loss of biodiversity. For more information, contact: IUCN Red List Programme Office; e-mail: craig.hilton-taylor@ssc-uk.org, website: www.iucn.org.

USA: New York: On 23 August 2000, New York governor George Pataki signed into law a bill that requires posted signs warning of the risk of salmonellosis that is associated with handling reptiles. The signs are to be posted in all pet stores and other retailers trading in reptiles within the state. Failure to comply carries a maximum fine of US $500. The law is due to take effect in February 2001. For more information, contact: Herp Digest (attn: Allen Salzberg) via e-mail at x5245@erols.com.

USA: US Senate: On 20 September 2000, the United States Senate ratified the Inter-American Convention for the Protection and Conservation of Sea Turtles. The US is one of eight countries in the Americas entering into the treaty that will require 1) the use of turtle excluder devices in trawl nets used in shrimping, 2) protection of nesting beaches and other sea turtle habitats, and 3) prohibit the international trade of sea turtles and sea turtle products. The treaty further supports research efforts into sea turtle biology and conservation. For more information, contact: Amanda Johnson, National Wildlife Federation; telephone: (202) 797-6801.

CURRENT RESEARCH

Please refer to Volume 31, Number 1 for information concerning submissions to this section. Section editor contact information is located on the inside front cover of this issue.

The current contents of various herpetological journals and other publications can now be found at: http://www.herplit.com/contents.

Blindness Not Detrimental to Island Snakes

Researchers working on Carnac Island, Australia, found many adult tiger snakes in the study population to have suffered from injuries which resulted in the snakes' partial or total blindness. Behavioral and mark-recapture data were utilized to determine the effects of these injuries on survival and fitness of the snakes in relation to their uninjured counterparts. While it is often assumed that all organ systems must be functioning in a study organism for optimal survival, the researchers recorded some counterintuitive observations. The survival (as measured by recapture rate) of blind snakes was higher than in uninjured snakes, while body mass increase, growth rate (SVL), and body condition (ratio of mass to SVL) were unaffected by blindness. In addition, two blind male snakes were observed trailing and subsequently mating with female snakes. The plasticity of visual systems in snakes along with

these observations begs the question, "What factors may permit the loss of sight without negative effect?" The authors suggest that the low predation pressure imposed on this introduced population along with a rich food source (a gull rookery) are contributing factors. In addition, their findings lend support to the hypothesis of "momentarily excessive construction" presented by Gans. According to this theory, organisms may posses complex sets of features not required for survival and reproduction. In essence, organisms may be "overdesigned."

BONNET, X., D. BRADSHAW, R. SHINE, AND D. PEARSON. 1999. Why do snakes have eyes? The (non-)effect of blindness in island tiger snakes (*Notechis scutatus*). Behavioral Ecology and Sociobiology 46:267–272.

Correspondence to: X. Bonnet, Centre d'Etudes Biologiques de Chizé, CNRS, F-79360 Villiers en Bois, France; e-mail: bonnet@cebc.cnrs.fr.

Historical Biogeography of *Crotalus viridis*

The authors examined approximately 1350 base pairs from the cytochrome b and NADH mitochondrial genes, to study the phylogeography of the Western Rattlesnake (*Crotalus viridis*). Specimens were sampled from throughout the range of this species, and represented all currently recognized subspecies. Parsimony and likelihood methods of phylogenetic inference were employed, and results of these analyses reveal two clades of populations. The first clade recognizes those populations east and south of the Rocky Mountains (*C. v. viridis* and *C. v. nuntius*), whereas the second clade includes those populations west of the Rocky Mountains. According to the authors, the conventionally recognized subsepecific diversity is not consistent with the phylogenetic pattern; therefore, a review of the systematic status of these subspecies is required. Results of this study also suggest that relatively small body size has evolved twice within this species, and that lethal toxins related to Mojave toxin arose within the complex including *C. v. concolor.*

POOK, C. E., W. WÜSTER, AND R. S. THORPE. 2000. Historical biogeography of the western rattlesnake (Serpentes: Viperidae: *Crotalus viridis*), inferred from mitochondrial DNA sequence information. Molecular Phylogenetics and Evolution 15(2):269–282.

Correspondence to: Catherine Pook, School of Biological Sciences, University of Wales, Bangor, Gwynedd LL57 2UW, Wales, United Kingdom.

Ontogenetic Plasticity in a Mexican Iguanid Lizard

An ontogenetic shift from insect consumption in juveniles to plant consumption in adults is relatively rare among herbivorous iguanids. This study of *Ctenosaura pectinata* documents an ontogenetic shift in the diet and anatomy of the digestive system in this species. Though *C. pectinata* was found to consume a variety of plant parts (foliage and flowers) in all age classes, non-adult lizards were found to utilize the broadest diversity of food items. Arthropods were found to covary seasonally with a decline in arthropod abundance for juvenile and immature lizards. The author rejects the hypothesis that the arthropod diet of juveniles is incidental to consumption of plant material because the size-adjusted morphology of the digestive system and its capacity was similar in all age classes, and because the arthropod density of all food plants surveyed did not have enough insect diversity to explain the proportions of plant/insects seen in juvenile lizards. The author supports the hypothesis that though juvenile *Ctenosaurus* can eat plants, they don't because insects offer a higher nutritional value. Finally, the author discusses the possibility that the broad diet of juveniles and immature lizards may offer benefits for these lizards by reducing searching costs, improving nutritional and energetic consideration, and increasing new food exposure of individuals in high-predation-risk periods of growth.

DURTSCHE, R. D. 2000. Ontogenetic plasticity of food habits in the Mexican spiny-tailed iguana, *Ctenosaura pectinata*. Oecologia 124:185–195.

Correspondence to: Richard D. Durtsche, Department of Zoology, University of Oklahoma, Norman, Oklahoma, 73019, USA; e-mail: durtsche@nku.edu.

Phylogenetic Position of Caecilians

Zardoya and Meyer sequenced the complete mitochondrial genome (over 17,000 base pairs) of the caecilian *Typhlonectes natans*. These sequence data were combined with sequence data for other lissamphibians and tetrapods, and used to evaluate the phylogenetic position of caecilians and the origin of amphibians. Two data sets were analyzed (one examining protein coding genes, the other examining combined tRNA genes), and both supported the monophyly of a caecilian + frog clade. The results of this research could not resolve relationships among the coelacanth, lungfishes, and tetrapods, and the authors suggest that there is relatively strong support for a diapsid affinity of turtles. In a final phylogenetic analysis, the authors examined a mitochondrial rRNA data set for an expanded list of salamanders, frogs, and caecilians; results of this analysis support a frog + salamander clade. Rate heterogeneity in the rRNA data set is discussed.

ZARDOYA, R., AND A. MEYER. 2000. Mitochondrial evidence on the phylogenetic position of caecilians (Amphibia: Gymnophiona). Genetics 155:765–775.

Correspondence to: Rafael Zardoya, Museo Nacional de Ciencias Naturales, José Gutierrez Abascal, 2, 28006 Madrid, Spain; e-mail: mcnr154@pinar2.csic.es.

Herpetofaunal Communities in Ghana

This article provides a summary of the herpetofaunal diversity surveyed at the Muni Lagoon during the primary rainy season. Of the 13 species of amphibians and 19 species of reptiles recorded at this site, none are endemic to Ghana, and only three species are first records for coastal habitats. Grassland thickets and freshwater ponds offered the most diverse herpetofaunal communities, and the authors suggest that conservation efforts in this region of Ghana should focus on protecting these two habitat types. Finally, the authors suggest that *Hyperolius, Python,* and *Varanus* may offer the greatest potential for undertaking long-term monitoring within these habitat types, as they are easily surveyed, and may be sensitive to a diversity of environmental stressors.

RAXWORTHY, C. J., AND D. K. ATTUQUAYEFIO. 2000. Herpetofaunal communities at Muni Lagoon in Ghana. Biodivesity and Conservation 9:501–510.

Correspondence to: Christopher J. Raxworthy, The American Museum of Natural History, Central Park West at 79th Street, New York, New York, 10024-5192, USA; e-mail: rax@amnh.org.

Directional Asymmetry of Two Families of Lizards

The author compares the ecology and evolution of directional asymmetry through ontogeny with that of its product, morphological directional asymmetry. Representatives of Lacertidae (*Acanthodactylus, Aldolfus, Eremias, Heliobolus, Ichnotropsis, Lacerta, Meroles, Mesalina, Ophisops, Pedioplanis, Podarcis* and *Takydromus*) and Agamidae (*Agama*)were included in this study. According to the author, variation in the morphological directional asymmetry reflects reversible adaptaions to the environment of these species, whereas variation in the developmental trajectory that produces the morphological directional asymmetry is independent from the immediate environment, but is determined by some evolutionary processes. Essentially, the environment was found to define the results of the processes of development of morphological developmental asymmetry, but not to affect the mechanisms of the process that produces this asymmetry.

SELIGMANN, H. 2000. Evolution and ecology of developmental processes and of the resulting morphology: directional asymmetry in hindlimbs of Agamidae and Lacertidae (Reptilia: Lacertilia). Biological Journal of the Linnean Society 69:461–481.

Correspondence to: Hervé Seligmann, Department of Evolution, Systematics and Ecology, The Hebrew University of Jerusalem, 91904 Jerusalem, Israel; e-mail: Herves@vms.huji.ac.il.

Ecology of the Checkered Garter Snake

The authors studied the reproductive biology and ecology of *Thamnophis marcianus* in southeastern Arizona. Checkered garter snakes were found to be active at night and during the day; however, this activity was restricted to aquatic areas or adjacent habitats. The authors found this species to give birth to single clutches of young during late May or early June, significantly earlier than other populations of this species and nearly all other North American livebearing snakes. A discussion of the implications of early timing of birth, as well as geographic variation in reproduction is provided. In the case of *T. marcianus*, the authors regard phenotypic plasiticity in some traits of this species as the result of proximate environmental factors such as food availability and precipitation, and that offspring size has been canalized relative to food availability; therefore, this trait is relatively more amenable to geographic variation.

SEIGEL, R. A., N. B. FORD, AND L. A. MAHRT. 2000. Ecology of an aquatic snake (*Thamnophis marcianus*) in a desert environment: implications of early timing of birth and geographic variation in reproduction. American Midland Naturalist 143:453–462.

Correspondence to: Richard A. Seigel, Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana, 70402, USA.; e-mail: rseigel@selu.edu.

Distribution and Ecology of Leptodactyid Frogs in the British Virgin Islands

Between October 1993 and October 1997, the authors visited 17 islands, confirming all but three previous records of leptodactylid frogs, and finding 10 previously unreported populations. The four species occurring in the British Virgin Islands (BVI) are *Leptodactylus albilabris, Eleutherodactylus antillensis, E. schwartzi, and E. cochranae*. The biphasic life cycle and aquatic dependence of *Leptodactylus albilabris* contrasts with the direct development and terrestrial habitat use found in all of the species of *Eleutherodactylus*. Investigators used visual encounter surveys, auditory transect surveys and night driving methods to locate individual frogs. During one survey year (1996), recorded advertisement calls were played to induce calling. Data were recorded for both frog species (including SVL, weight, microhabitat use and perch height) and habitat variables (including presence/absence of bromeliads, amount of leaf litter, and vegetation height). Multiple regression analysis and one-way ANOVA were used to examine island factors versus number of species present, and body size of males versus years and islands, respectively. Area and elevation explained most of the variance in the number of species found on each island, with elevation as the far more important factor. While males did show a difference in size among islands, they did not among years. The number of calling males was weakly correlated with recorded habitat variables.

OVASKA, K., J. CALDBECK, AND J. LAZELL, JR. 2000. New records and distributional and ecological notes of leptodactylid frogs, *Leptodactylus* and *Eleutherodactylus,* from the British Virgin Islands. Breviora (508):1–25.

Correspondence to: K. Ovaska, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4; e-mail: kovaska@jdmicro.com.

Description of Oogenesis and the Ovarian Histology of the American Alligator

This paper provides the first thorough description of the histological features of an adult ovary and associated oogenesis of a crocodilian. Phylogenetic relationships between crocodilians and birds suggests that there should be similarities in reproductive functional morphology between the two groups if these structures are conserved. Researchers surgically removed and studied the ovaries of 13 adult *Alligator mississipppiensis* from three lakes in Florida. Each ovary was histologically sectioned and placed into one of 10 folliculogenic stages (which are discussed individually in the article). The reproductive cycle was determined to begin in autumn with an increase in hormone concentration and subsequent vitellogenesis. Ovulation and gravidity occur during the following May/June. The authors found several features in common between *A. mississippiensis* and other reptiles, and other characteristics that were similar to those described for birds. Among those features uniting *A. mississippiensis* to other reptiles are follicular characteristics of the ovary in early follicular development. Bird/crocodilian shared characteristics include morphology of yolk platelets and the presence of an ovarian system of lacunae and

thick and smooth muscle bundles around follicles. The researchers observed several aspects of crocodilian folliculogenesis that lend support to the current theory of archosaurian evolution.

URIBE, M. AND L. GUILLETTE, JR. 2000. Oogenesis and ovarian histology of the American alligator *Alligator mississippiensis*. Journal of Morphology 245:225–240.

Correspondence to: Louis Guillette, Jr., Department of Zoology, 223 Bartram Hall, P.O. Box 118525, University of Florida, USA; e-mail: ljg@zoo.ufl.edu.

Molecular Phylogeny of Xenodontine Snakes

Xenodontinae is one of the largest subfamilies within Colubridae, and is comprised of nearly 90 genera, and over 500 species. Xenodontinae is believed to be restricted to the New World, the majority of species from Central and South America, as well as the West Indies. The authors have inferred the phylogeny of xenodontine snakes by examining portions of the 12S and 16S ribosomal RNA genes from 85 species. Results of this analysis support a monophyletic Xenodontinae and the basal position of a North American clade of xenodontines. The authors suggest that the inferred phylogeny and pattern of distribution supports an Asian–North American origin of the xenodontines. The West Indian xenodontines appear to form a monophyletic group that diverged from the South American xenodontines that originated by dispersal in the mid-Cenozoic. Finally, their results suggest that several morphological and ecological traits have evolved multiple times during the evolution of these snakes.

VIDAL, N., S. G. KINDL, A. WONG, AND S. B. HEDGES. 2000. Phylogenetic relationships of xenodontine snakes inferred from 12S and 16S Ribosomal RNA sequences. Molecular Phylogenetics and Evolution 14(3):389–402.

Correspondence to: Nicolas Vidal, Service de Systématique Moléculaire, Institut de Systématique (CNRS FR 1541), Muséum National d'Histoire Naturelle, 43 ru Cuvier, 75231 Paris Cedex 05, France.

The Effects of Logging Roads on Amphibian Movement

The dominance of logging as a land use in areas like northern New England, makes requisite the understanding of impacts of logging practices on wildlife. This study looks at secondary forest road development and its role as a disturbance factor to amphibian species. Direct mortality from such roads is limited, as the frequency of vehicular traffic is generally light. However, the impact of these roads as a barrier to amphibian dispersal (natal, migratory and home range movement) is little understood. The authors used 6 pairs of drift fences with pitfall traps along each of two study sites: one wide (12 m) and one narrow (5 m) road, both in a logged area of Penobscott County, Maine. Fencing was placed near the road and within the forest as a control. The narrow and wide roads were each sampled for more than 12,000 trap nights, however sampling was completed during different years (1992 for the narrow road site, 1993 for the wide road site). Data was analyzed for eight amphibian species (four salamanders, four anurans). Recaptured animals and treefrogs were excluded from the data analysis. No significant difference in capture rates for anurans was found between forest and road traps at either site. However, salamander species were found preferentially in continuous forest habitat compared with traps near the larger road.

Different life history movement types (juvenile dispersal, adult migrations and home-range movement) were differently affected by the road barrier. Juvenile amphibians showed the highest crossing rate, while adult home-range movement was most restricted by the barrier. It was also demonstrated that forest surface activity of amphibians was positively correlated with the amount of rainfall during the trapping period. The effect was more profound in salamanders than anurans, and greater in control (forest) locations than traps nearest the roadways. In general, effects of secondary roads on amphibian species were found to be taxon and life history stage dependent.

P. DEMAYNADIER, AND M. HUNTER, JR. 2000. Road effects on amphibian movements in a forested landscape. Natural Areas Journal 20:56–65.

Correspondence to: P. deMaynadier, Endangered Species Group, Maine Department of Inland Fisheries and Wildlife, 650 State Street, Bangor, Maine 04401, USA; e-mail: phillip. demaynadier@state.me.us.

Parental Investment and Resulting Potential Reproductive Rates of a Dart Frog

The investigators studied the gender-specific parental investment (time) of strawberry dart frogs (*Dendrobates pumilio*) and the resulting potential reproductive rates (PRR) of both males and females. Observations were recorded over a six-month period in Costa Rica, resulting in a description of the mating system of *D. pumilio* as a "sequential polygamy." This system is based on a sequential and simultaneous combination of polygyny and polyandry. Females are able to produce clutches continuously throughout the prolonged breeding season, and both sexes contribute to the parental care responsibilities. Females were observed to be more selective in their choice of mates than were males, and male mating success was found to be highly variable. Time required to rear one offspring was calculated to be 5 h total for males and 73.2 h total for females. Because females' parental investment is greater than that of males, females have a lower PRR, and are therefore the limiting gender as mates. Researchers also believe that because of the lower PRR of females, they are more selective in mate choice and therefore contribute to variable male mating success.

PRÖHL, H., AND W. HÖDL. 1999. Parental investment, potential reproductive rates and mating system in the strawberry dart-poison frog, *Dendrobates pumilio*. Behavioral Ecology and Sociobiology 46:215–220.

Correspondence to: H. Pröhl, Institut für Zoologie, Tierärzliche Hochschule Hannover, Bünteweg 17, D-30559 Hannover, Germany; e-mail: hproehl@stud.tiho-hannover.de.

OBITUARIES

Herpetological Review, 2000, 31(4), 213–214.
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Mary L. Anderson (1918–1999)

ROGER CONANT
Department of Biology, University of New Mexico
Albuquerque, New Mexico 87131, USA



Few persons knew Mary Anderson, who was the baby turtles' best friend. She worked alone and even her family, who was well aware of her humane objectives, usually didn't know just what she was up to. When she needed help she called on me and other herpetologists for advice. She kept at it for 40 years and was instrumental in obtaining a ban on the sale in the U.S. of turtles with carapaces less than four inches in length.

To Mrs. Anderson the trade in baby turtles was a loathsome racket. The average vendor handled his living merchandise like cans of beans, with little or no thought for their welfare and comfort. Robert G. Hudson, an able agent for the Pennsylvania SPCA, reported finding a large aquarium in a pet store containing little turtles seven deep. Those on top were alive. All others were dead; those on the bottom were rotten from decay.

The vendors, to augment their income, raided turtle nests, dug up the eggs, and incubated them until they hatched.

Norman E. Hartweg, the University of Michigan's famous cheloniologist, often visited Reelfoot Lake in western Tennessee to study the huge populations of turtles of many species that the lake supported. On a trip during the early 1930s he found several large adult female red-eared turtles, *Trachemys scripta elegans*, that had been chopped open with a hatchet. The eggs had been removed and the mothers left to die. The eggs were doubtless added to others being incubated.

Mary Anderson was severely vexed by such atrocities, but she worried most about the more subtle problem that an enormous percentage of the baby turtles failed to survive when they reached their final owners. The vendors sold small parcels of dried ant pupae under the guise of being turtle food. How well I remember the hundreds of the little orphan reptiles donated to the Philadelphia Zoo over a period of many years. Virtually all were in an advanced state of malnutrition. Their eyes were swollen shut and their shells were soft from lack of calcium. We had to explain to the donors, often parents whose children were already weeping about giving up their pets, that there was nothing we could do except to put them painlessly out of their misery.

The sales of infant turtles were often the result of impulse buying. They were cute and colorful, and the vendors said they made wonderful pets for children. This sad scenario inspired Mrs. Anderson's first efforts on behalf of the turtles being sold as pets. She "rescued" many from horrible conditions in stores, took in others much like the ones we encountered in Philadelphia, and quickly realized that the care of these creatures was far more complex than suggested by those who sold them. At first she tried to address the problem of the totally useless commercial food, but soon realized that the only real way to end the cycle of abuse and cruelty was to prohibit the sale of turtles as pets altogether. The accomplishment of this basic humane goal was the driving force for all of the endeavors that followed.

Mary Anderson was an extremely shy person and scarcely anyone other than a few trusted friends and her family knew of her dedication to the hatchling turtles. She would not allow her name to be used. She preferred to work alone and to remain unknown. In the mid-1990s, as I was preparing the text for my memoirs ("A Field Guide to the Life and Times of Roger Conant," published by Selva and sponsored by the Toledo Zoo), I finally convinced her that the extraordinary work she had done should be recorded for posterity. She was not well and was suffering from severe osteoporosis. She finally gave me permission to use the following paragraphs from my book, which I am able to reproduce herewith through the kindness of William V. A. Dennler, executive director of the Toledo Zoological Gardens.

"In 1965 medical research documented the frequent occurrence of *Salmonella* bacteria in hatchling turtles sold as pets. During that year Mary L. Anderson, a dedicated and public-spirited person who was appalled by the health risk to children and the carnage among the little turtles, became deeply interested in the problem. She went to Washington and discovered that federal agencies knew little or nothing about the situation. After being advised to get in touch with the Centers for Disease Control, she learned that the CDC was trying unsuccessfully to solve the problem by using various chemicals in the turtle breeding ponds, and was conducting extensive research on the subject. Meantime, sales were increasing, reaching 15 million turtles annually and causing 280,000 cases of illness a year, mostly among children.

"In 1971 Mrs. Anderson successfully influenced her Congresswoman, Leonor Sullivan of Missouri, to introduce a bill calling for federal regulation of the turtle trade. Similar bills were offered by two other members of Congress, but they languished in committee. Senator Edward M. Kennedy then introduced a resolution calling for action by the Health, Education, and Welfare Department within 30 days. It was successful in requiring the issuance of a document certifying an absence of *Salmonella* bacteria before turtles could be shipped. In most cases, however, by the time the turtles arrived at pet stores the bacteria were present.

"The turtle vendors then came up with the asinine scheme of selling individual turtles in covered sterile bowls, but with the recommendation that the little reptiles be placed in water for a short time each day. Meantime, Mrs. Anderson kept the Animal Welfare Institute, the Consumers' Union, and the Humane Society of the United States aware of what was happening. The three organizations were finally successful in getting the Food and Drug Administration to issue a total ban on the sale of turtles with shells less than four inches long. The ban is still in effect as this is written.

"With their domestic market cut off, the vendors began selling red-eared baby turtles overseas. In 1984, when Kathryn [my wife] and I were in Hong Kong, I visited two snake shops in the futile

hope of finding a live member of the venomous *Agkistrodon* snake complex to photograph. In front of one shop was an aquarium with several baby red-ears swimming listlessly about in the water. Since then, the foreign market has grown to seven million turtles shipped in 1994 to 39 different countries."

I am lost in admiration for all Mary Anderson accomplished. She was a quiet, unassuming lady, but her constant prodding in the right places kept things moving for many years. Her extensive files have been given to Peter Pritchard and Anders Rhodin of the Chelonian Research Institute, who have agreed to make them available to interested researchers.

ARTICLES

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Notes on the Island Populations of the Western Rattlesnake, *Crotalus viridis*

KYLE G. ASHTON
Department of E. P. O. Biology, Campus Box 334
University of Colorado, Boulder, Colorado 80309, USA
e-mail: ashtonk@colorado.edu

Islands tend to be less complex than mainland environments and have been used to study patterns and mechanisms in ecology and evolution (e.g., Grant 1998; MacArthur and Wilson 1967). In addition, island populations of animals often show unique characteristics (e.g., rattleless rattlesnakes, Cliff 1954; Radcliffe and Maslin 1975). Yet, island populations of animals in general, and snakes in particular, are especially vulnerable to extinction (e.g., Dodd 1987, 1993). Accordingly, it is important to gather information on the status of island populations.

Klauber (1972) reported that the western rattlesnake, *Crotalus viridis*, occurred on five islands throughout its range, and to my knowledge this species has not been collected on any additional islands. The current status of the island populations of *C. viridis* is uncertain because there are no published records of specimens from four of the islands subsequent to those examined by Klauber (1972)—all of which were taken prior to 1956. Here I briefly review the historical records of *C. viridis* on each of the islands, the general history of each island, and present results of recent trips to three of the islands.

Klauber (1972) reported that *Crotalus viridis lutosus*, the Great Basin rattlesnake, occurred on Anaho Island, Pyramid Lake, Washoe Co., Nevada. Pyramid Lake is roughly 40 km long with an approximate surface area of 275 km^2 (Wheeler 1987; Woodbury 1966). Anaho Island is about 3 km^2 (Woodbury 1966) and approximately 0.8 km away from the mainland. In 1913 Anaho Island was declared a National Wildlife Refuge because in the summer it supports one of the largest breeding populations of white pelicans (Woodbury 1966). At one point sheep and pigs were probably introduced to the island (Woodbury 1966), but they have not been there for many years. There are no native terrestrial predators of *C. v. lutosus* on the island (Woodbury 1966), none have been introduced, and because there are no human inhabitants and human visitors are rare, the only predation is probably from birds.

The first *Crotalus viridis lutosus* specimen from Anaho Island of record was collected in July 1917 (CAS 43578). Forty-four additional museum specimens were collected between 1924 and 1961 (see material examined). Woodbury (1966) mentioned seeing several snakes on the island and suggested that there was a large population. From 16–19 August 1999, I visited Anaho Island and found eight individual *C. v. lutosus*, which included two reproductively active males and two pregnant females. Snakes on the island are substantially smaller than those on the nearby mainland (Ashton, unpubl. data), despite the relatively short distance separating them. It is possible that a large population of *C. v. lutosus* occurs on Anaho Island and the future prospects for this population are promising as long as the site continues to be protected and remains an island (the lake level dropped steadily between 1867 and 1982, but was never connected with the mainland; Wheeler 1987).

The northern Pacific rattlesnake, *Crotalus viridis oreganus*, has been captured on Rattlesnake Island in Clear Lake, Lake County, California. Clear Lake is about 30 km long and 13 km wide (Goldman and Wetzel 1963). Rattlesnake Island is the largest island in Clear Lake with a total area of about 0.15 km^2 (Mauldin 1968). At one point the island supported one of the largest Indian villages (Elem Indians) in Lake County (Mauldin 1968), but is currently privately owned. Mauldin (1968) reported that rattlesnakes were collected on the island and sold as part of an antibiotic to local mine workers, indicating that at one time there were many rattlesnakes on the island. Hogs were introduced to the island around 1960 and within a few years the rattlesnakes were apparently exterminated (Mauldin 1968). It is suggested that the hogs ate the rattlesnakes (Mauldin 1968), but their impact may have been more through decimating the snakes' prey and destroying habitat.

Only one museum specimen, a juvenile male, has been recorded from Rattlesnake Island (MVZ 34526). This specimen was collected on 21 June 1940. I planned on visiting the island in 1999 but was unable to gain access from the owner. The island is about 100 m from the mainland and it would be interesting to know if the island population is or was genetically differentiated from mainland individuals. Rattlesnakes are known to swim (Klauber 1972), so there may have been regular gene flow between the island and the mainland.

Another island population mentioned by Klauber (1972) is *Crotalus viridis oreganus* on Morro Rock, San Luis Obispo County, California. Morro Rock is one of the nine exposed San Luis Peaks, which originated 20–25 million years ago from volcanic activity (Dickerson 1990). Morro Rock rises 177 m and has an area of about 0.15 km^2 (Dickens 1983). From at least the Pleistocene until 1936, Morro Rock was an island (Dickerson 1990), separated from the mainland by 300 m of ocean water (Gerdes et al. 1974). In 1936 a causeway from the mainland was built, using stone from Morro Rock, to facilitate quarrying that had been going on since 1891 (Dickerson 1990). In 1963, quarrying ceased and in 1973 Morro Rock was declared an ecological preserve, primarily to minimize impact on nesting peregrine falcons (Dickerson 1990).

There are four museum specimens documenting the presence of *Crotalus viridis oreganus* on Morro Rock. The first was collected

in 1930 (SDNHM 2696), which was prior to the connection of Morro Rock to the mainland. I have been unable to find any information on whether there was an established rattlesnake population on Morro Rock before the causeway was built—the first published study of the fauna of Morro Rock was in 1957 (Munro 1957). The last rattlesnake observed on Morro Rock was collected in June of 1975 (CPSU H-3523). I visited Morro Rock on 8 August 1999 and again on 12 August 1999, but found no rattlesnakes on either day. I saw many *Sceloporus occidentalis* (25 different individuals in a single hour) and two *Elgaria multicarinata*. The snakes on Morro Rock may have been dwarfed, based on Klauber's (1972) report of a pregnant female that was only 467 mm SVL, and smaller *C. viridis* typically feed on lizards (Mackessy 1988; Ashton, unpubl. data). Hence, there is currently sufficient prey for *C. viridis* on Morro Rock. Additionally, small mammals were captured at the base and top of Morro Rock in 1980–1981 (Dickens 1983).

Feral cats have been a problem on Morro Rock, especially during the 1970s and 1980s (A. Roest, pers. comm.). In 1981, 12 individual feral cats lived on Morro Rock (Dickens 1983); by 1986 this number had increased to 21 (S. J. Marek, unpubl. data). The California State Parks and Recreation Department has been trapping and removing feral cats in the 1990s; there are currently no feral cats on Morro Rock (V. Cicero, pers. comm.). Feral cats may have affected rattlesnakes on Morro Rock by reducing their prey population and possibly killing rattlesnakes. It is possible that the lizard population on Morro Rock decreased during 1970–1990, because of feral cats, and the abundance of lizards during my visit was a recent phenomenon that has occurred as a result of the extermination of feral cats. Unfortunately, Dickens (1983) did not present any measure of abundance of lizards that could be compared with my recent observations.

Dickens (1983) spent one year surveying vertebrates on Morro Rock and failed to find any rattlesnakes. Falconers have been visiting the Rock for many years to study the nesting peregrine falcons and have never seen a rattlesnake (V. Cicero, pers. comm.). These observations, along with my recent visit, suggest that *Crotalus viridis oreganus* no longer occurs on Morro Rock.

The southern Pacific rattlesnake, *Crotalus viridis helleri*, occurs on one Channel Island— Santa Catalina Island, Los Angeles County, California. Santa Catalina Island is a continental island that is located 32 km from the mainland, with an area of 194 km^2 (Schoenherr 1992). This island has a long history of private ownership. In 1972, the Wrigley family created the Santa Catalina Island Conservancy and in 1975 they donated 86% of the island to the Santa Catalina Island Conservancy (Mallan 1992). The island also has a long history of impact from introduced species. In 1827, goats were introduced to the island and still remain (Schoenherr 1992). Pigs, deer, cattle, horses, and bison have also been introduced, although today only pigs, goats and bison remain in large numbers (Mallan 1992; Schoenherr 1992). The bison population is maintained at 200–400 individuals and the Santa Catalina Island Conservancy has been working, successfully, for many years to eradicate goats and pigs from the island. Nonetheless, these animals have been numerous and have caused substantial damage across the entire island (Schoenherr 1992). Unfortunately, there are no data on abundance or distribution of rattlesnakes prior to the introduction of these species so it is impossible to directly assess the impact of these introductions on rattlesnakes. However, several longtime human residents of the island suggest that rattlesnakes are less common today, especially since the introduction of pigs.

Crotalus viridis helleri have been collected on Santa Catalina Island since 1910. The most recent museum specimen was captured in 1967 (MVZ 81740). During the first week of August 1999, I visited the island and found five individuals at four separate localities. Additionally, many locals reported seeing snakes during the duration of my trip. Based on these reports, the specimens I captured, and museum specimens, it appears that *C. v. helleri* is relatively common and widely distributed on the island. The future of *C. v. helleri* on Santa Catalina Island is promising because most of the island is protected, which minimizes direct human destruction, and introduced species are being eradicated.

Probably the best known island population is on South Coronado Island. This island is the largest of the four Coronado islands and is located just south of the U.S.–Mexico border, 12 km west of mainland Baja California Norte, Mexico (Ellsberg 1970; Zweifel 1952). The island is about 3 km^2 in total area (Zweifel 1952), yet rattlesnakes on the island may be primarily limited to about 1.5 km^2 of habitat because of the steep sides of the island (Rubio 1998). Rattlesnakes have been captured on South Coronado Island for many years; museum specimens range from 1898 to 1976 (no specimens have been collected on any of the other Coronado Islands). They appear to be either abundant or very easy to find. For example, Zweifel (1952) recounted a brief trip during which he captured eight snakes. I planned on visiting this island in the summer of 1999, but was unable to obtain all the necessary permits in time.

There have been relatively few human occupants of the Coronado Islands, at least in part because of a lack of fresh water. From 1870–1880 the islands were used for fishing, quarried for rock, and mined for copper (Ellsberg 1970). In the 1930's a resort hotel was built on South Coronado Island, but it was a failure (Ellsberg 1970). Since that time the Mexican military has maintained a base on the island (Ellsberg 1970). Even though there have been few inhabitants of the islands, direct and indirect effects of humans have still resulted in local extinctions (Oberbauer 1978). At one time goats were introduced to the island, but were gone by the 1950's (Ellsberg 1970). However, on a recent trip to South Coronado Island, Rubio (1998) reported that goats and mules had been reintroduced. The island is mainly covered by low grasses; thus, it may not take long before the snakes have virtually no vegetative cover (Rubio 1998). This could lead to increased avian predation on lizards, the primary prey of the snakes (Klauber 1972), and on the snakes themselves. It is essential that monitoring begin soon to evaluate the impact of goats and mules on the abundance and distribution of rattlesnakes on the island.

This population was described as a separate subspecies, *Crotalus viridis caliginis*, by Klauber (1949), but this designation has not always been followed (e.g., Stebbins 1985). The main difference between *C. viridis* on the island and those on the adjacent mainland (ssp. *helleri*) is body size (snakes on the island are much smaller than those on the adjacent mainland). Genetic studies are underway to assess the relationships of this island population to those from the nearby mainland (Ashton, unpubl. data).

It is striking that *Crotalus viridis* is dwarfed on all four of the islands for which data are available (Klauber 1972; Ashton, unpubl. data). Case (1978) suggested that in general snakes are dwarfed on islands, but he did not present data on the strength of this trend. Certainly there are well known exceptions (e.g., Schwaner 1985; Schwaner and Sarre 1988). What determines body size of snakes on islands? Prey size seems to be the best correlate; larger prey means larger snakes (Forsman 1991; Schwaner 1985; Schwaner and Sarre 1988). On the islands with the smallest body sizes, Anaho Island and South Coronado Island, the only available mammalian prey is a single species of *Peromyscus* (Oberbauer 1978; Woodbury 1966). The snakes on Santa Catalina Island are dwarfed compared to the mainland, but are larger than on the other islands (Ashton, unpubl. data). The largest potential mammalian prey species on Santa Catalina Island is a ground squirrel (*Spermophilus beecheyi*; Mallan 1992). Thus, body sizes of *C. viridis* on islands appear to be consistent with the idea that snake size is positively correlated with prey size. Shine (1987) points out that island size differences may be a direct result of food availability as opposed to responses to selection. The genetic basis of body size variation among island and mainland populations of *C. viridis* deserves study.

In summary, there are three islands that currently support populations of *Crotalus viridis*. One island that no longer appears to have a population of rattlesnakes, but did so historically, is Rattlesnake Island in Clear Lake. Morro Rock used to be an island, but it is unknown whether a distinct population ever occurred there prior to its connection to the mainland about 60 years ago (only one individual of record was captured when Morro Rock was an island). It now appears that there are few, if any, rattlesnakes on Morro Rock; none have been collected for about 20 years. The population on Anaho Island appears to have been the least impacted by humans, and probably contains a large population of snakes. Introduced animals certainly have affected *C. viridis* on Santa Catalina Island, but the snakes seem to be fairly common and may increase in abundance as pigs and goats are eradicated. The future of the population on South Coronado Island is uncertain. *Crotalus viridis* is dwarfed on four of these islands (no data exist for one of the islands). Studies on the distribution, natural history, life history, and genetic relationships of *C. viridis* on Anaho Island and Santa Catalina Island are currently underway (Ashton, unpubl. data).

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APPENDIX

Material examined (museum acronyms follow Leviton et al. 1985).—USA: Nevada: Washoe Co.: Pyramid Lake: Anaho Island CAS 21622–21646, 43578; KU 69599–69601; MVZ 33702, 33703; SDNHM 38374, 38376, 39269–39273; UNR 852, 876, 987, 2073, 3539; USNM 310846, 310847. California: Lake Co.: Clear Lake: Rattlesnake Island MVZ 34526; San Luis Obispo Co.: Morro Rock CPSU H-3523; MVZ 36323; SDNHM 2696, 25442; Los Angeles Co.: Santa Catalina Island LACM 3057–3073, 20138; MVZ 4323, 5617, 81740; SDNHM 17176, 26934, 26935, 39651; Mexico: Baja California Norte: South Coronado Island CAS 13476, 13583–13587, 13603, 63734, 192684, 192686; LACM 20139–20145, 74065; MVZ 5404; SDNHM 2800–2804, 4924–4926, 7538–7540, 11177, 11178, 13711–13715, 20077, 20078, 40751, 41198, UTA 6945, 35038, 35046

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Reproductive Behavior and Larval Development of *Leptodactylus fallax* in Dominica, West Indies

SHIRLEY L. DAVIS
Onward Program, University of Maine, Orono, Maine 04469, USA
e-mail: shirley_davis@umit.maine.edu

RONALD B. DAVIS
Department of Biological Sciences, University of Maine
Orono, Maine 04469, USA

ARLINGTON JAMES
Forestry and Wildlife Division, Ministry of Agriculture
Roseau, Dominica, West Indies

and

BECKY C. PREGGER TALYN
Department of Biological Sciences, University of Maine
Orono, Maine 04469, USA

Little is known about the reproduction and larval development of the large (up to 16.7 cm SVL, Heyer 1979; Kaiser 1994) terrestrial frog, *Leptodactylus fallax*, because of its cryptic nesting behavior and currently restricted distribution only on parts of two Caribbean islands, Dominica and Montserrat. Breeding of *L. fallax* is thought to be initiated by rainfall, with male calling concentrated from mid-February to September in Dominica. As prolonged breeders (Stebbins and Cohen 1995; Wells 1977), females breed asynchronously, and males have stationary calling sites and antiphonal calling. Eggs are deposited in foam nests in cavities under rocks, logs, or in stumps (Brooks 1968) where larvae complete their development (Lescure 1979). Lescure and Letellier (1983) reported that the larvae live and grow in the foam nest only on their vitelline reserves until metamorphosis. The nests are extremely difficult to locate due to asynchrony of breeding and to concealed nest cavity entrances. Brooks (1968) and Lescure (1979) indicate that the female remains with the eggs and larvae in the cavity until the froglets emerge.

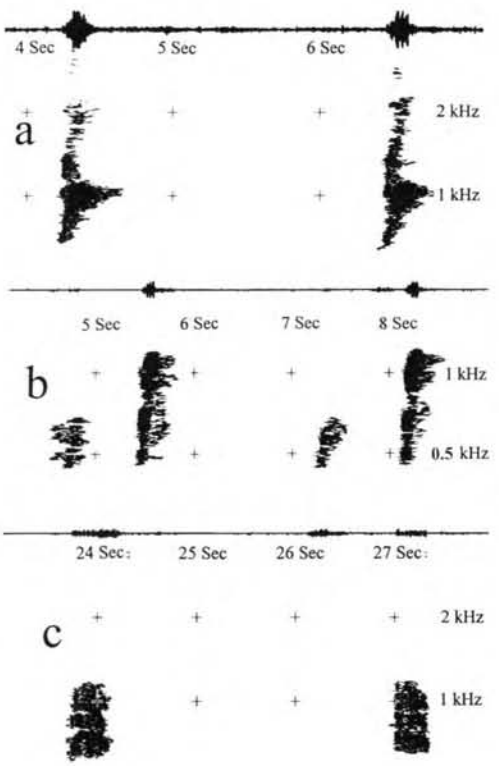


FIG. 1. Calls of *Leptodactylus fallax*. a) male advertisement call, with harmonics, oscillograph (top), sonograph (bottom); b) duo of type 1 female call (first) and male call (second); c) type 2 female call.

Our research had three aspects: 1) study of a captive, caged pair of frogs, 2) observations of adult calling in nature, and 3) study of larval development in a nest cavity. Prior to our study, no one had followed the development of *L fallax* larvae in a nest in the field.

Our study was carried out from February to June, 1996, at the Springfield Estate at 290–390 m elev., 5.5 km NNE of the Dominica (W.I.) capital, Roseau (15°20'N, 61°23'W). The property occupies mountainous terrain largely covered by abandoned tree crops and gardens in various stages of succession to forest, and second growth moist evergreen forest with a few deciduous species. All observations were centered around and within 500 m of a small cluster of buildings.

An adult male and female *L. fallax* were placed in a wire mesh cage (1.4 x 2 m) at Springfield on 11 February. These were provisioned with natural objects for shelter, and daily with water and small invertebrates as food. We observed the frogs 1–2 h each day just before dawn and just after dusk until 29 April. Over four months, behavior and calls of the captive frogs were noted and tape recorded.

From the cage we also could readily hear five wild *L. fallax* males, spaced ~20–100 m apart. Site specificity of these different individuals was confirmed by reconnaissance. Each wild male maintained the same calling site night after night throughout the

study period. The calls of both males and females were digitized and analyzed using Spectrogram version 4.2.2a (Horne 1994) software. Considerable effort was made to locate nests, including advertisement of a cash award for anyone who could point one out to the researchers. None was reported.

Starting 2 March, we directed our attention to a male that called from a cavity under a patio at Springfield. Mating and foam nest production took place in the cavity six weeks later, and subsequently we followed the development of the larvae in the nest. We observed the nest with a small angled mirror on the end of a 0.7 m rod. A beam from a fiber-optics light enabled us to clearly observe the interior of the cavity including the foam nest. We made almost daily observations of the larvae until 15 May, followed by 11 observations, irregularly spaced between 16 May and 17 June. Video footage of the larvae in the nest and froglets in the cavity out of the nest was obtained on several occasions in late May and early June. On 8 May, we collected two larvae and a small amount of foam for microscopic study, and subsequently sent these to W. R. Heyer for deposit in the National Museum of Natural History, Smithsonian Institution collection (accession USNM 510211).

Starting in late February, males began advertisement calling at night (Fig. 1a). At dawn, some males and females gave a brief bout of low intensity calls. On rare occasions males called briefly during the day. Each call increased in frequency from beginning to end, and had up to three high frequency harmonics (Fig. 1a). Average wild male call duration at night was 0.248 sec (N = 166 calls, CV = 17.6%), dominant frequency 1170 Hz (CV = 15.1%), and inter-call interval 1.887 sec (CV = 104.8%). However, these results incorporate at least three sources of variance: different individuals (3 identified males; 7 unknown males), different bouts of the same individual, and different calls within a bout. No differences were found between call duration and interval of the same male, but the two males with multiple bout records differed in frequency between bouts (t-tests p = 0.003 and 0.0004, respectively). These two males were marginally different from each other in call duration (t-test, 2 bouts per male, p = 0.028), suggesting that duration may be important for recognition of individuals. Further study of reproductive behavior of this species should include a more thorough analysis of call components as they relate to mate selection by females.

The captive female frog calls were always much quieter and different in quality (Figs. 1b and 1c) from male advertisement calls. Concealed wild frogs were identified as female on the basis of these distinctive calls. Females sometimes initiated calls and sometimes responded to male calls. Two types of calls were recorded from the captive female. One type (Fig. 1b; N = 12 calls) increases in frequency from beginning to end, and has an average duration of 0.127 sec (CV 15.3%), dominant frequency 538 Hz (CV 16.2%), and inter-call interval 1.828 sec (CV 11.3%). The other type (Fig. 1c; N = 14 calls) maintained a constant frequency range with no dominant frequency, but with three bands of spectral power. The average duration was 0.322 sec (CV 11.3%), with recorded frequency of 370 to 1300 Hz, and inter-call interval 3.049 sec (CV 34.3%).

Advertisement calls of different males did not overlap. When one male called loudly all night, others within our hearing range remained quiet. All-night callers took turns on different nights. On some nights, shorter-term callers made a duet, or a trio, with each male's call alternating (antiphonally) with the other(s). The duration of trios was shorter than that of duets. Males typically

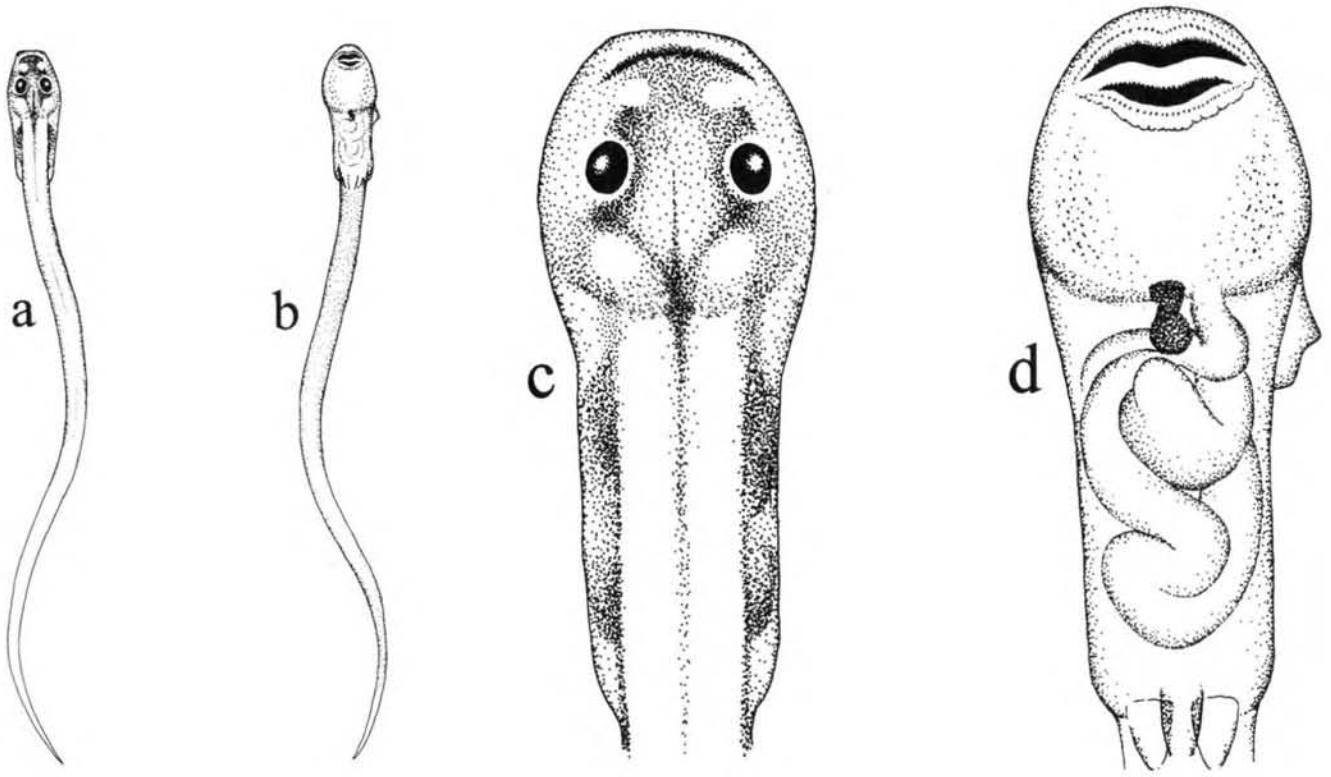


FIG. 2. *Leptodactylus fallax* larva, 24 days old. Total length 6.0 cm, tail 4.9 cm, body 1.1 cm, body max. width 0.45 cm. a) whole larva, dorsal; b) whole larva, ventral; c) body, dorsal; d) body, ventral (denticle rows sketched—not an accurate count).

called very little during dry series of nights.

Our observations confirm that mating can occur as early as mid-April, and is preceded by mostly dry weeks, as reported by Lescure (1979). In 1996, a dry period ran from mid-March to mid-April. It started to rain on 13 April. At 2300 h on the rainy 14th of April, a male *L. fallax* began rapid-fire calling from his cavity. A frog sped away when we moved some rocks to facilitate observation of the cavity entrance. A few minutes later that frog, undoubtedly the female, returned and entered the cavity where the male frog was calling at ~120 times/min. The female joined his calls every fourth note in a synchronous manner. After a few minutes, all was quiet until 0130 h when the male resumed rapid-fire calling for approximately 15 min.

The first time (22 April) that we looked into the cavity, we saw an adult frog (sex not determined) in front of a foam nest. On the nights of 16 April and 15 May, a male called from in or adjacent to the cavity, but between these dates the closest male calls (the same male?) were a few meters away. After 22 April, we saw no adult frogs in the cavity, despite reports that the female remains with the larvae during development. However, she could have been out of view in an obscure chamber of the cavity.

The cavity entrance was at the bottom of the cement foundation wall of a raised patio, in a position that was difficult to access, not frequented by humans, and obscured by thick weedy vegetation and a jumble of rocks. The entrance, a gap in the base of the wall, was ~20 cm wide and highest (~10 cm) in the middle. The interior (main chamber) was 20–25 cm wide, 10–15 cm high, and ~50 cm deep, with a near-horizontal floor of hard, moist soil. The foam nest occupied a shallow depression in the floor near the inner end of the main chamber. The nest was ovoid, 14 x 11 cm, and 2–4 cm deep in the middle, but these dimensions diminished between times of foam replenishment. The temperature in the cavity remained at 23°C.

On 25 April, we made our first observations of larvae in the foam. It was difficult to determine the size of the brown and translucent larvae, and difficult to count them because they thrashed about in a wet mass, but on 28 April and subsequent dates we were able to determine that 15–20 were present. The larvae were totally submerged during some observation periods, when we could see only the motionless or churning foam; at other times they were active at the surface where we often saw many opening and closing mouths rising out of the foam. As the larvae grew larger, they rose more frequently above the foam surface. In a typical activity period, 5–10 sec in duration, most or all of the larvae moved simultaneously and energetically, their long tails in a writhing tangle. Of the three larvae spooned up on 8 May, one was 6.0 cm and the other two 3.0 cm long (two were preserved; one small one returned to the nest). Two- to three-factor differences in linear dimensions of larvae persisted throughout the period of observation.

No yolk sac was present on the large and small 24-day old larvae collected on 8 May (Fig. 2), nor were yolk sacs observed later on larvae in the foam. Therefore, the claim of Lescure and Letellier (1983) that *L. fallax* larvae are nourished only by their vitelline reserves until metamorphosis is not supported by our observations. By late May, hind legs were present on some larvae, and on 7 June, six froglets were observed out of the nest but inside the cavity. Their lubricated bodies were ~3 cm long, and only a vestige (rounded stump) of the tail remained. Froglets jumped back into the nest, suggesting that "fledging" is a gradual process. On 7 and 10 June, only a small number of larvae remained in the foam. By 12 June, only two "mature" larvae (not quite froglets) were in the foam, and we saw one froglet in the cavity outside the foam. On 17 June, no foam or larvae remained, nor did we see froglets in the cavity. On 28 June we saw one froglet in the cavity, indicating continued use of the cavity after the nesting period.

The collected larvae had light brown bodies, and translucent, worm-like tails (Fig. 2). Major dimensions of the 6.0 cm specimen were: body length 1.1 cm, max. body width 0.45 cm, tail 4.9 cm (Fig. 2). The smaller larvae (3.0 cm) were less pigmented than the large one, but superficially similar. The jaws had serrated horny beaks and one row of anterior labial denticles. The posterior labium had a discontinuous row of denticles (Fig. 2c and d). Larvae in the nest in late May and early June continued to vary in pigmentation.

The foam from the nest contained numerous round cells, each ~30 µm, too small to be *L. fallax* ova (as reported for other nests by Lescure and Letellier 1983). On 5 May, the foam contained red streaks and tissue debris. On 8 May, dividing "embryonic" cells and at least two sets of black spine-like structures resembling *L. fallax* beak serrations were in the foam. On 13 May, ciliated protozoa and a nematode were observed in a drop of foam. On 10 May, fresh crab legs were present inside the entrance of the cavity.

The foam was periodically replenished, making the nest higher and whiter. Recently replenished foam was observed on 2, 9, 12, and 23 May, and on 7 June. Between replenishments the foam diminished, on occasion barely covering the developing larvae in a small area of the soil depression.

The type of nest cavity used by *L. fallax* is quite variable, apparently depending on availability. Our captive frogs, caged on hard grass-covered soil, did not attempt to burrow or dig out of the cage. This species does not appear to have the anatomy to do so. However, a captive individual dug a nest cavity in peat at Lescure and Letellier's (1983) laboratory. The nest cavity we studied and another observed by one of us (A.J.) in Dominica were both associated with human buildings. Other reported *L. fallax* nest cavities in Dominica have been in agricultural (e.g., base of a banana tree) or natural vegetated environments (Lescure 1979). On Dominica, numerous burrows are dug by land crabs and rats. The cavity we studied had human debris in it, including a toothpaste tube, suggesting that it may have been dug and/or occupied by rats, which are numerous in the vicinity.

An unresolved question is: do the larvae feed, and if so, how? Lescure (1979) and Lescure and Letellier (1983) maintained that *L. fallax* larvae do not feed, but live off their yolk. However, we found no yolk in larvae three weeks old, with six more weeks of growth ahead. Our observations lead to three hypotheses on larval nutrition; they need not be exclusive: 1) the female replenishes the nest with nutritious secretions from her body, perhaps containing oocytes or other cells; 2) one or both parents provision the young with prey; and 3) larval cannibalism occurs, most likely the large larvae consuming the small ones.

The repeated replenishment of foam is consistent with the first hypothesis. In addition to maintenance of a quasi-aquatic environment for the larvae, the replenishment could renew the food supply. The secretions for the foam may be composed of muco-

polysaccharides and mucoproteins, as are the gelatinous egg capsules (Stebbins and Cohen 1995), although we have found no published analyses of foam chemistry. *Leptodactylus pentadactylus* and *L. labyrinthicus* larvae eat the foam before moving to a nearby water body (Lescure and Letellier 1983). The small cells we observed in the foam may have come from an attendant parent. Several cases of females returning to oviposition sites to lay unfertilized eggs as food for their offspring have been reported for other species (e.g., Lannoo et al. 1987). Lescure and Letellier (1983) noted about 150 eggs together with the *L. fallax* larvae in a foam nest at their laboratory. The microinvertebrates we observed suggest that the foam supports a culture of organisms that also could serve as nutrition for the larvae.

Females must accumulate sufficient fat reserves before seeking males for mating. If females must also repeatedly replenish the foam and, possibly, add unfertilized eggs to it and/or provision the larvae with prey, it is necessary for them to draw on reserves to fulfill these functions. The mother is said to refuse food during the period when the larvae are developing, at least in captivity (Lescure and Letellier 1983; R. Johnson, pers. comm.). We question whether it would be possible for wild *L. fallax* females to nourish the larvae in any of the above modes without feeding during the nesting period of two months.

The second hypothesis is supported by the presence of prey remains, namely the fresh crab legs inside the cavity entrance. The red streaks and multiple flesh bits in the foam could have come from prey, or could be the remains of larvae—supporting the third (cannibalism) hypothesis. The black beak-serrations in the foam also support the third hypothesis. However, small as well as large larvae survived throughout larval development, and the total number of larvae did not noticeably diminish during the two months of observation.

Leptodactylus fallax nests are extremely difficult to find; nevertheless, the lack of observation of more than one nest is an obvious weakness in our study. It may be possible to radio-tag potential parents and follow them to find more nests. One also might try setting up artificial nesting cavities with removable lids in likely nest areas and monitor them periodically. If a nest were found, one could install a recording device such as an infrared camera to record parental and larval behavior. In addition, it may be possible to implant small radio transmitters under the skin of adult frogs to track their movements relative to the nest cavity and, in combination with recording devices in nest cavities, learn whether and how they provision the larvae.

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TECHNIQUES

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A Novel Technique for Gathering Turtle Nesting and Emergence Phenology Data

J. SEAN DOODY*
and
ARTHUR GEORGES
Applied Ecology Research Group, University of Canberra
Belconnen, ACT 2601, Australia
e-mail (JSD): doody@aerg.canberra.edu.au
and
Cooperative Centre for Freshwater Ecology, University of Canberra
Belconnen, ACT 2601, Australia

** Author to whom correspondence should be directed.*

Logistical problems often serve as roadblocks, preventing researchers from answering potentially important questions about a species' biology. However, these roadblocks often crumble under the mighty hand of technology. For example, discovering how many fathers sire a brood by direct observation was virtually impossible for most animal species until the development of DNA microsatellite techniques made achievable that seemingly unreachable goal. Similarly, nesting and emergence phenology has been little-studied in turtles because of the logistical problems presented. Until recently, obtaining data on hatchling turtle emergence has required up to hundreds of person-hours monitoring several nests continuously (e.g., Gyuris 1993) during the period in which turtles would be expected to emerge. Such logistical challenges are often not met, particularly when the outcome is not of general interest or relevance to management. For example, the question "What time of night/day do turtles nest?" is descriptive and may seem inherently trivial when viewed from an evolutionary or management perspective. However, when placed in the context of whether turtles can predict and manipulate offspring sex, for example, the



FIG. 1. Photograph, taken by Trailmaster® camera setup, showing tagged gravid *Carettochelys insculpta* emerging to search for a nest site.

question becomes more important.

During a three-year study of ecology and sex determination of pig-nosed turtles (*Carettochelys insculpta*) in northern Australia, we discovered an efficient remote data-collection technique for 1) determining nesting times of mothers, 2) determining emergence times of hatchlings, and 3) linking mothers to nests. Nesting times help us answer the question of whether or not mothers could control offspring sex, and linking mothers to nests can be used to test this idea. Emergence data can be used to address the idea that synchronous emergence is adaptive in turtles.

The technique is simply a modified use of the TRAILMASTER® infra-red remote trail monitoring system. Originally designed for tracking mammals (e.g., Tarpy 1997; Tuberville and Burke 1994), the TRAILMASTER® (TM1500) can be attached to a 35 mm automatic camera (TM35-1) which photographs animals when the infra-red beam is broken. A transmitter (12 cm L x 8.5 cm W x 5 cm D) sends the beam to a receiver (19 cm L x 8.5 cm W x 5.5 cm D), which has a digital display and memory. The receiver records the date and time of each event (can store up to 1000 events), and whether a photograph was taken. Both the receiver and transmitter run on 'C' cell batteries. Costs are US $260 for the TM1500 and US $290 for the automatic 35 mm camera kit (Olympus® TM 35-1). The camera kit includes an interface cable and mounting apparatus. Although the systems can be used without a camera, without confirmatory photographs the researcher cannot be sure that the animal crossing the beam was the target species.

To record nesting, we placed the transmitter box on one end of a nesting beach and the receiver box on the other, in a line near and parallel to the water's edge (boxes were less than one meter above water). The boxes can be placed as far as 30 m apart. The camera, attached by a cable to the receiver box, comes with a mounting apparatus, which we attached to a metal post driven into the sand in shallow water, a few meters from the beach. Larger beaches can be accommodated by moving the camera setup farther from the beach. However, because we were also interested in identifying mothers, cameras were placed close enough to the beach to ensure that identification (cattle ear) tags could be read in photographs (Fig. 1). To record emergence, the boxes were placed 0.3 m apart, just to the river side of previously discovered nests, near the time they were expected to hatch (Fig. 2). The camera setup was similar to that used to record nesting, but placed directly above the nest. To link mothers to nests we surveyed beaches daily for nests. When a fresh nest was found we recorded the date and time stored by the receiver, and compared it to the date and time superimposed on the developed photographs. Matching photographs were then examined for readable identification tags (cattle ear tags mounted on the rear carapacial edge) for individual identification.

The technique was highly successful at efficiently providing data to answer the following questions for *C. insculpta*: (1) When do turtles nest, by day or at night? What time? Do sand temperatures during nesting correlate with nest temperatures during the sex-determining period of offspring? When do hatchlings emerge, by day or at night? Exactly when? Do they emerge singly, in groups, or all at once? Are they more likely to emerge during/after rainfall? For example, *C. insculpta* hatchlings emerged around midnight (mean = 2348 h ± 147.4 min SD; N = 67; range = 1756–0456 h) at an average nest temperature of 33.0 ± 2.2°C (N = 64, range = 28.8–35.0), and hatchlings emerged at a greater frequency on nights after rainfall (0.92) than expected (0.60) on nights when no rainfall occurred. Our data are being published elsewhere (Doody et al., in prep.).

We used 15 infra-red setups to obtain these data, but the staggering of nesting and emergence in most turtles means that setups



FIG. 2. Hatchling *Carettochelys insculpta* emerging from the nest. Emanating from the nest are datalogger probes.

could be employed on more than one nest in a season, and so fewer setups could be used to collect an adequate amount of data. Maintenance included changing batteries periodically (ca. every 2–3 weeks) in both the boxes and in the camera ('AA' cells), changing film, and keeping the beam free of debris and new vegetation. Although the setup is weatherproof, we placed cardboard over the boxes to protect them from heat due to intense solar irradiation. Care should be taken when systems are used in flood-prone areas.

Limitations to the technique are mainly those associated with its use to link mothers to nests. For example, if the nesting beach or area is too wide along the water's edge (i.e., > 20 m), then the field of view of the camera may not cover the entire area where turtles will emerge from the water (moving the camera too far back will result in photographs with images too small for individual identification). The technique may not be useful for species in which discrete nesting areas cannot be identified. We also noted that birds were fond of perching atop the camera systems, often resulting in cameras being off-center. Care must be taken to ensure that batteries are viable and that a sufficient number of pictures remain. These problems can be eliminated by frequent monitoring of the system.

It is our hope that this system will be adopted by researchers to help fill in the gaps of our knowledge of nesting and emergence phenology in turtles. Indeed, the system can be used for other questions associated with nests, such as predator identification (R. Shine, pers. comm.). Behavioral studies with robust funding may wish to use video cameras in place of still cameras. This can be accomplished with the TRAILMASTER® TM700v kit (US $595), which can be attached to any video camera. Detailed information can be obtained from the TRAILMASTER® web site (http://www.camera-trap.com).

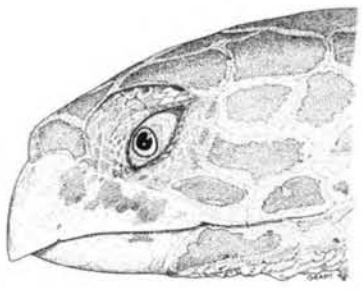
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Eretmochelys imbricata (Hawksbill Seaturtle). Illustration by J. B. Grant.

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Color of Pitfall Affects Trapping Success for Anurans and Shrews

ERIC CRAWFORD*
and
ALLEN KURTA**
Department of Biology, Eastern Michigan University
Ypsilanti, Michigan 48197, USA

**Present address: Great Lakes Science Center, United States Geological Survey, Biological Resources Division, 1451 Green Road, Ann Arbor, Michigan 48105, USA*

***Corresponding author: e-mail: bio_kurta@online.emich.edu*

Monitoring amphibian populations often is done by call surveys, use of cover boards, or trapping programs (Heyer et al. 1994). A common type of trap for terrestrial surveys is a pitfall, which usually is made from metal cans or large plastic containers, such as those used to package ice cream or cottage cheese for restaurants (Corn 1994; Vogt and Hine 1982; Yunger et al. 1992). Although metal cans are inexpensive, there are drawbacks to their use. Cans only come in specific sizes, and changing the length (depth) of the pitfall requires cutting the metal or joining multiple cans together, often with tape (Corn 1994; Vogt and Hine 1982). In addition, cans and tape deteriorate, especially when placed in moist soils, and consequently, traps must be replaced during multiyear projects.

Although plastic containers will not deteriorate, they also may need to be joined to achieve adequate depth, and another potential drawback is that they typically are white in color (e.g., Yunger et al. 1992). Although color of trap influences capture success for insects and small mammals (Leong and Thorp 1999; Suplinskas 1987), this phenomenon has not been examined in amphibians. In this study, we introduce polyvinylchloride (PVC) sewer pipe as a long-lasting material for making pitfalls, and we also investigate the effect of color of trap (black or white) on capture success.

Pitfalls were made from smooth-walled PVC pipe (Schedule 40, Bristolpipe Corporation, Bristol, Indiana, USA) that is readily available at plumbing supply stores. Such pipe is either black or white on the inside and made in a variety of sizes (diameters). We used pipe that is 15 cm wide (cost: US $12 per 3-m length), because it approximates the size of metal cans (#10) that often are used to make pitfalls (Corn 1994). Using a hand saw, we cut each pipe into seven pieces that were about 44 cm long.

In the field, pitfalls and drift fences were placed in Y-shaped arrays (Corn 1994). In the center of each array was a single large pitfall (a 20-liter bucket). Extending from the central pitfall and separated by 120° were three drift fences (5 m long by 25 cm high) made from aluminum flashing. At the outer ends of each fence, two experimental pitfalls were placed—a black trap on one side of the fence and a white trap on the opposite side. We placed a metal screen in the bottom of each pipe to prevent animals from burrowing, and leaf litter was placed in all traps for insulation against cold and to prevent desiccation of captured animals. When not in use, traps were closed using prefabricated drain caps (cost: US $2) that fit snugly into each trap.

The study site was Crosswinds Marsh, a manmade wetland in Wayne Co., Michigan, USA, where we were conducting a post-construction survey of anuran populations. Five arrays, for a total of 15 black and 15 white traps, were placed in various habitats; two arrays were located in wet meadows, two in forested wetlands, and one in an upland woodlot. Pitfalls were checked each morning after 86 trap-nights, between 1 April and 1 June 1997 and 1998. Captured animals were identified to species and immediately released 10 m from the array. Animals were not marked, because a pilot study in 1996 indicated that only 0.3% of marked individuals (N = 896) were recaptured.

TABLE 1. Captures of amphibians and mammals in black vs. white pitfall traps.

Taxon	Number Captured in Black Traps	Number Captured in White Traps	χ^2	P
Anurans				
Bufo americanus	111	45	27.92	<0.001
Rana sylvatica	91	59	7.75	<0.004
Pseudacris spp.[1]	15	6	3.86	<0.05
Other *Rana*[2]	14	26	3.60	>0.05
Mammals				
Sorex cinereus	24	6	10.8	<0.001
Other mammals[3]	13	17	0.53	>0.10

[1]*Pseudacris crucifer* and *P. triseriata*
[2]*Rana catesbeiana, R. clamitans*, and *R. pipiens*
[3]*Blarina brevicauda, Microtus pennsylvanicus, Peromyscus leucopus*, and *Zapus hudsonius*.

We used chi-squared tests to examine the null hypothesis that captures were equally distributed between black and white traps (Leong and Thorp 1999; Yunger et al. 1992). To examine potential differences within species, those with a relatively large number of captures (30) were tested separately . Species with fewer captures were lumped with similar taxa before analysis (Dixon and Massey 1983).

Overall, 135 anurans were trapped in white pitfalls, and 231 were captured in black pitfalls ($\chi^2 = 25.18$; d.f. =1; $P < 0.001$). Only wood frogs (*Rana sylvatica*) and American toads (*Bufo americanus*) were caught in sufficient numbers to allow individual analyses. Black traps captured 54% more wood frogs and 146% more American toads than white traps (Table 1). Low number of captures required lumping two species of *Pseudacris* (spring peeper, *P. crucifer*, and striped chorus frog, *P. triseriata*) together and three large ranids (bullfrog, *Rana catesbeiana*; green frog, *R. clamitans*; and leopard frog, *R. pipiens*). Black traps caught significantly more *Pseudacris* spp., but there was no significant difference in number of captures between black and white traps for the lumped ranids.

The masked shrew (*Sorex cinereus*) was the only mammalian species with a sample large enough to analyze separately (Table 1), and it too was caught significantly more often in black traps. The other four species of mammals were the short-tailed shrew (*Blarina brevicauda*), meadow vole (*Microtus pennsylvanicus*), white-footed mouse (*Peromyscus leucopus*), and meadow jumping mouse (*Zapus hudsonius*). Each was caught in small numbers, and as a group, they showed no difference in capture success between white and black traps.

Although flower-visiting insects appear genetically programmed to prefer certain colors and some mice are attracted to shiny objects (Leong and Thorp 1999; Suplinskas 1987), anurans simply may perceive light-colored traps as different from the substrate and avoid them, or perceive dark traps as potential refugia and enter them. The masked shrews, with their extremely poor vision (Branis and Burda 1994) may be similarly affected, although it is possible that shrews were attracted to the greater number of potential prey (amphibians) in the dark traps. Only the lumped categories of "other *Rana*" and "other mammals" indicated no significant difference between black and white traps (Table 1). However, the other mammals are larger (15–60 g) than the masked shrew (3–5 g; Kurta 1995), and the other ranids are typically larger and/or more agile than the wood frog or American toad (Harding 1997). Vogt and Hine (1982) noted that large anurans are less frequently caught in pitfalls, and the lack of an effect of color on larger mammals and anurans in our study simply may reflect the ability of larger animals to avoid capture.

A variety of ecological studies require the capture of animals. Our study shows that some anurans and shrews are captured significantly more often in pitfalls with a black interior than those with a white interior. Biologists who wish to maximize the number of individuals that are captured during a monitoring study should consider this bias when selecting their trapping protocol.

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Testing Skeletochronology in Black Tegu Lizards (*Tupinambis merianae*) of Known Ages

CHRISTIAN F. DUARTE VARELA[1]
and
MARIO R. CABRERA[2]
Cátedra de Anatomía Comparada, Universidad Nacional de Córdoba
Vélez Sarsfield 299, (5000) Córdoba, Argentina

[1] *e–mail: chrislio@arnet.com.ar*
[2] *CONICET Researcher. Author to whom correspondence should be addressed; e–mail: mcabrera@com.uncor.edu*

The relevance of age determination resides not only in the need to know how long an organism lives, but also the age of important life events, such as sexual maturity. The reproductive periodicity or the time interval between the production of offspring also is related to age (Zug 1993).

The technique of skeletochronology allows research on maturation by scoring the periods of active growth with alternate periods when the growth process is very slow (Castanet 1978). This seasonal characteristic, evident in the bone tissue, is observed as concentric rings called LAGs (Lines of Arrested Growth) .

One of the first applications of skeletochronology in lizards (scincids and varanids) was accomplished by Peabody (1961). In the green iguana (*Iguana iguana*), Zug and Rand (1987) reported three basic assumptions: 1) there is a period of active growth, followed by a period of arrested growth, leaving distinctive cyclic marks in the bone; 2) each one of these marks indicates one year's growth; 3) where these marks have been lost due to bone remodeling, the number of lost rings can be estimated from the quantity and dimension of the remaining marks (Zug and Rand 1987).

The purpose of this research was to verify the effectiveness of skeletochronology with the black tegu *Tupinambis merianae* [populations formerly assigned to *T. teguixin*, see Avila Pires (1995)], by comparing ring counts to known ages of individuals.

Materials and Methods.—The samples comprised of *Tupinambis merianae* from a commercial breeding facility. They were captive raised under a semi–controlled environment, with natural photoperiod and temperate seasonal conditions. The lizards underwent hibernation from April to mid–September, each year. A balanced diet, mimicked from those in the wild, was provided. Known–age specimens were used, ranging from one to twelve years. Humeri from the right forelimb were removed from sacrificed individuals. In live specimens, the second and third phalanges from the fourth toe of the right hind foot were surgically removed. Afterwards, wounds were treated with iodine–90% ethanol, and animals were immediately returned to their respective stockyards.

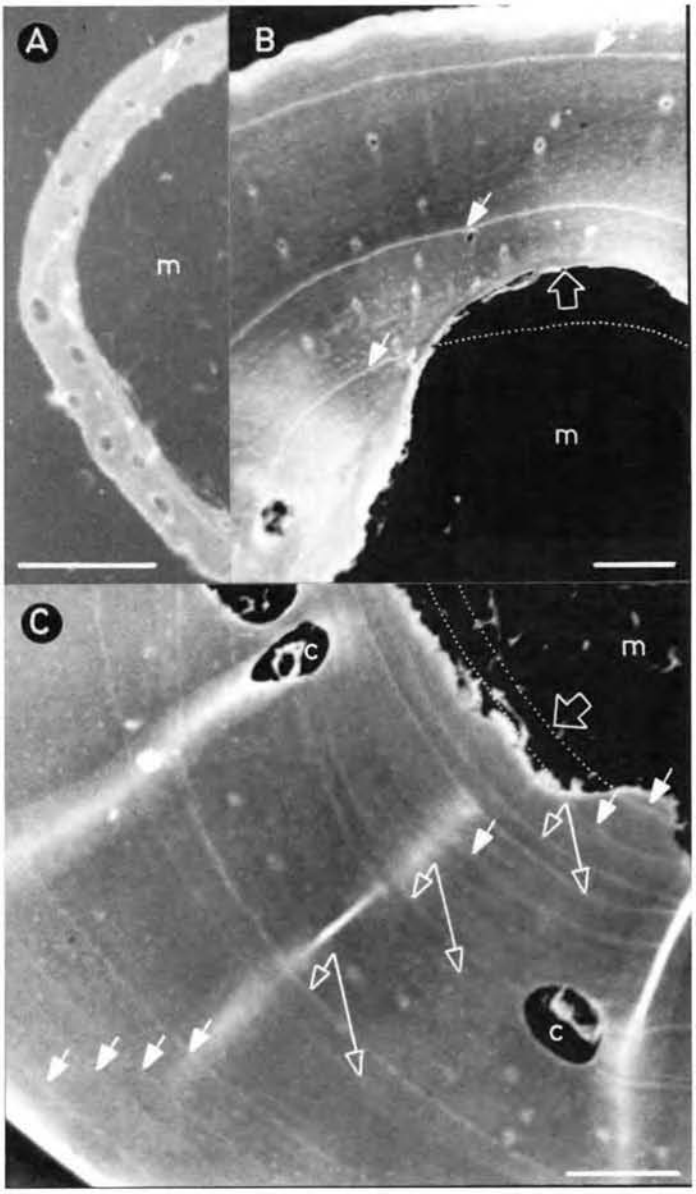


FIG. 1. Cross–section through diaphyseal level of phalanx (A), and humerus (B and C) of *Tupinambis merianae*. (A) One year old specimen; (B) three years old specimen. A marked bone resorption is indicated by the white arrow. The first LAG trait was restored by following the fragment of LAG near the marrow cavity; (C) ten years old individual. First two LAGs restored. Each black arrow indicates a LAG; little white arrows indicate doubled LAGs; big white arrow points to resorption zone; c = canal; m = marrow cavity. Scale bar = 0.2 mm.

A total of 17 humeri and 30 phalanges from randomly captured animals were obtained. The study material was fixed in a 10% buffered formalin solution, decalcified in 5–10% nitric acid, and embedded in paraffin wax. In order to count bone rings, 10 µm serial permanent sections were mounted on glass slides and stained with Ehrlich´s hematoxylin and eosin.

LAGs were counted using a microscope at 5x, 10x, and 40x magnification, several sections of each bone were examined. The microscopic interpretation was performed by two independent readers who, in all cases, did not known the actual age and sex of

TABLE 1. Analyses of humeri and phalanges of *Tupinambis merianae* individuals. Known age (in years) and estimated age (in number of LAGs counted), sex (M = male, F = female) and snout-vent length (SVL) in cm, C.N. = collection number.

Humeri					Phalanges				
Known age	Estimated age	Sex	SVL	C.N.	Known age	Estimated age	Sex	SVL	C.N.
1	2	F	37.1	8	1	1	M	26.8	18
3	3	F	35.1	1	1	1	M	22.5	19
3	4	M	33.9	3	1	1	M	27.8	20
3	3	F	36.0	4	1	1	M	25.5	21
4	4	F	33.0	2	1	1	F	28.2	22
4	4	M	34.1	10	1	1	F	26.4	23
4	3	M	34.8	11	1	1	F	32.0	24
4	4	F	34.1	14	1	1	M	28.0	25
5	5	F	35.9	5	1	1	M	24.7	26
5	5	F	35.2	7	1	1	F	34.0	39
5	5	M	37.1	9	1	2	F	41.0	28
5	5	F	40.2	15	1	2	F	39.2	32
6	6	F	41.7	6	4	3	F	35.7	31
6	6	F	38.4	16	4	4	F	34.5	33
9	7	M	40.5	12	4	4	F	40.8	37
8	8	F	43.7	13	4	4	M	47.5	41
10	10	F	36.1	17	4	4	F	39.6	42
					4	4	M	38.6	47
					5	4	M	47.2	27
					5	5	F	38.2	29
					5	5	F	38.4	30
					5	5	F	33.0	36
					5	5	M	49.2	38
					5	5	F	38.4	44
					6	6	M	47.7	40
					6	6	M	40.9	46
					7	7	F	36.2	34
					7	7	F	41.5	35
					11	11	M	50.1	45
					12	12	M	43.6	43

the individuals under study. The known–age data and counted LAGs (the estimated age), were compared.

Results and Discussion.—The LAGs are seen as haematoxylinophilic, concentric, regular lines. In every one–year–old specimen, a single thin LAG was present. Tegu lizards hatch from mid–January to late March at this latitude. Our youngest specimens were 13 months old, and thus had undergone one winter season. In these individuals, evidence of a LAG formed at hatching was not observed (Fig. 1A). Smirina (1974) described two LAGs in one–year–old individuals of *Lacerta agilis*, one formed at during their summer hatching, and another representing their first winter latency.

Stained and distinct LAGs were counted, although some were not necessarily complete (Fig. 1B). The presence of double LAGs in *T. merianae* was interpreted as a temporary interruption of the hibernation period. Growth is arrested again when latency conditions return, thus forming two consecutive LAGs. The gap between them is narrow but they can be easily distinguished from single LAGs (Fig. 1C). According to Zug and Rand (1987), difficulty in LAG counting is caused not only by loss of early LAGs, but also by the presence of supernumerary lines. Castanet (1978) explained the presence of double and triple LAGs in terms of "arrêt – reprise – arrêt" (arrest – resumption – arrest) during the same winter season. Supernumerary lines have been described by Zug and Rand (1987), but did not occur in our study.

Resorption of tissue at the perimeter of the marrow cavity was seen in almost all of the bone sections. This endosteal resorption partly masked the interpretation of LAGs. In such cases, age was estimated upon identifiable remaining LAG fragments (Fig. 1 B, C). Comparison of LAG counts between the two observers resulted in 28 matching interpretations and 19 differences. After adjustment with actual age, we reduced the discrepancies to eight misinterpretations. The coincidence between known–age data and estimated–age data was 83% (Table 1). Known–age and estimated–age data linear regression analyses showed a significant relationship for both humeri and phalanges (Fig. 2).

LAG identification was somewhat easier in humeri than in phalanges. In the latter however, which accounted for 63.8% of the samples, the interpretation of LAGs was always possible. The use of phalanges is highly recommended because it prevents sacrificing animals, and allows monitoring of the individual's growth in subsequent years.

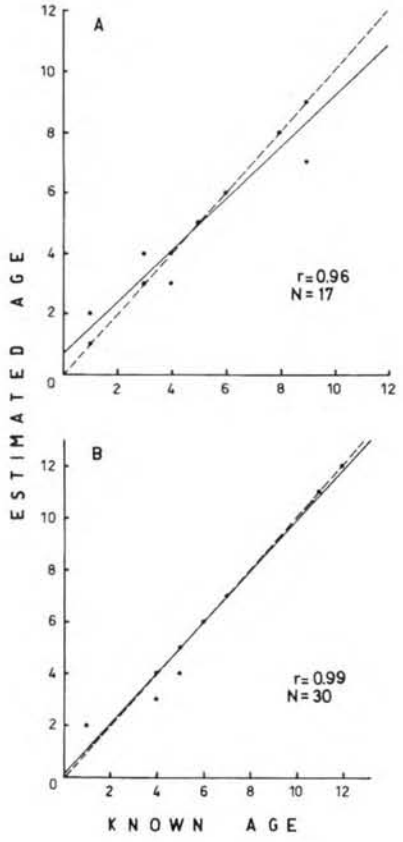


FIG. 2. Linear regression analyses for humeri (A), and phalanges (B), of *Tupinambis merianae*, known age vs. estimated age based upon LAG counts. The dashed line indicates the one–to–one relationship expected if the age estimators are valid, and the continuous line the adjustment between the two variables.

Castanet and Roche (1981) noted that in every skeletochronological study it is critical to work on diaphyseal sections because in metaphyseal zones the bones tend to ovalate. Important remodeling processes occur during growth, resulting in a "drift" of the bone and marrow cavity (Enlow 1969). Furthermore, Castanet and Roche (1981) pointed out that early LAGs never disappear at diaphyseal zones. Our results concur with these authors; LAG counts in *T. merianae* at the metaphyseal level were obscure due to internal structure, but at the diaphyseal level LAGs could easily be interpreted.

The power of skeletochronology to estimate age of animals with cyclic growth has been proven repeatedly (e.g., Castanet et al. 1988; Francillon–Vieillot et al. 1990; Patón et al. 1991; Sagor et al. 1998; Zug and Parham 1996). However, it is probable that the skeletochronological technique diminishes in efficacy when determining age in older specimens, due to the osseous remodeling process (Castanet 1978). In our samples the individual LAG counts and age determination was possible for all specimens. Therefore, we find the technique accurate for specimens up to twelve years old. These results also are encouraging for future research with older individuals.

In conclusion, we confirm the utility of skeletochronology to determine age in *Tupinambis merianae*. LAGs represent an accurate record of the individual's growth process, allowing estimation of age, as well as of interruptions of hibernation during growth. Likewise, skeletochronology is a suitable tool to help monitor tegu lizards that are hunted, as it allows verification of age of trapped animals, and design of capture–mark–recapture and population dynamics projects.

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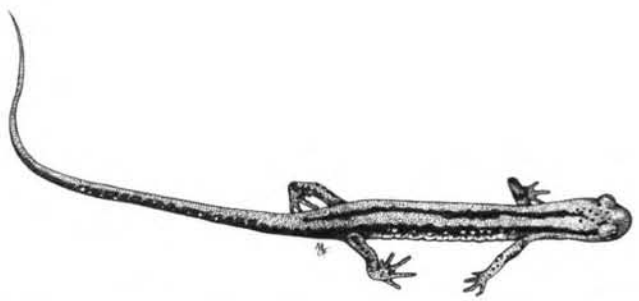
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Eurycea guttolineata (Three-lined Salamander). Illustration by Michael Frick.

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Keys to Partial Mammals: A Method for Identifying Prey Items from Snakes

JOSHUA RYAN WHORLEY*
Museum of Vertebrate Zoology and Department of Integrative Biology
University of California at Berkeley
Berkeley, California 94720-3160, USA

**Present address:*
Burke Museum of Natural History, University of Washington, Box 353010,
Seattle, Washington 98195, USA
e-mail: jwhorley@u.washington.edu

Researchers study the diet of snakes to address a wide range of topics, including optimal foraging (e.g., Arnold 1993; Shine 1991), the evolution of body size and morphology (e.g., Greene 1983; Pough and Groves 1983), interspecific niche partitioning (e.g., Reynolds and Scott 1982; Rodriguez-Roblez et. al. 1999), and intraspecific resource partitioning (e.g., Macartney 1989; Shine 1986). The usefulness of such studies depends upon precise prey identification, which may be challenging if the snake species under study has eclectic food habits and/or consumes prey from multiple orders or classes (see Greene 1997 for an overview of diet breadth).

Identifying half-digested mammals remains a problem for many researchers interested in the feeding ecology of snakes. Because snakes usually ingest prey headfirst (Greene 1989; Seib 1984), the diagnostic skulls and teeth of mammalian prey are digested first, making identification difficult. Occasionally teeth may remain in the stomach—still rooted in the mandible or dentary—and in rare cases, salvaged prey items may even be largely undigested. However, stomach contents collected from museum specimens often consist of no more than a set of hind feet and a tail. Not surprisingly, researchers often list these disintegrating contents only as "unidentified mammal" or "rodent." Though this provides some information, prey identification to the class, ordinal, or even familial level may be too imprecise to address the question being asked. If one is testing specific hypotheses of foraging theory or prey choice, for example, identification to at least generic level is necessary to avoid overestimates of diet breadth or incorrect conclusions about predator behavior or community dynamics (Greene and Jaksic 1983).

To solve the problem of accurate prey identification, some workers have relied on keys detailing the length, width, and microstructure of dorsal guard hairs. However, this method is time consuming and sometimes inconclusive. Hair analysis demands that one find, cross-section, and mount guard hairs retrieved from each prey item needing identification. It also requires a published key or collection of pre-mounted guard hairs covering the geographic area of interest. Few such keys exist, and rather than focusing on all mammal species inhabiting a particular life-zone or biome, they are often state or region specific (e.g., Mathiak 1938; Mayer 1952; Williams 1938). Consequently, unless the range of a particular snake species is extremely limited, or the diet study focuses only on a selected population (e.g., Macartney 1989; Wallace and Diller 1990), one key may not provide all the hair sample material necessary for comparisons. In addition, finding a dorsal guard hair within the recovered prey remains is often impossible—especially if all that remain are hind feet and tail. If stomach contents do not include teeth or soft tissue, one must use hair structure to identify mammalian prey. But for samples that do include soft tissue, a more efficient, precise, and reliable method is available.

Hindquarters of prey are often present in snake stomachs, and are easier to find and manipulate than individual hairs. Because they are highly variable among genera, hind feet and tails provide excellent characters upon which to base a dichotomous key. The plantar tubercles (foot pads) of rodent hind feet often vary in number, degree of development, and arrangement on the foot (Fig. 1A, 1D). Hind feet may also vary in length or number of toes, and in density and color of fur covering their ventral surface (Fig. 1B). Tails differ in a number of categories including color pattern, dorsal and/or ventral striping, pelage thickness, and expansion at the tip (Fig. 1C). Because hindquarters are the last portions attacked by digestive enzymes, these variant traits are dependably intact.

To build a key, first compile a list of the small mammal families occurring within the geographic and elevational range of the snake species under study. Use an encyclopedic mammal reference (e.g., Hall 1981; Lawlor 1979; Nowak 1991) to quickly identify all the possibilities. Use one that provides concise accounts of the general features that characterize each mammal family. Lawlor's (1979) *Handbook to the Orders and Families of Living Mammals* is optimal because it covers morphological features, and general habits and habitat preferences, and also identifies which biomes particular mammal families occupy.

After using Lawlor or a similar text, refine the mammal list to genus and species by consulting a regional checklist or field guide detailing mammal life-histories, appearance, and ranges. Dozens of field guides exist for North American mammals. Each has advantages and disadvantages, and one should use two or three in concert to gather a complete set of information. In contrast to North America, other continents or regions may completely lack field guides or checklists of local mammal fauna. This may not be problematic though, as many museums are now placing their specimen databases on the World Wide Web (e.g., Museum of Vertebrate Zoology (MVZ); California Academy of Sciences (CAS); United States National Museum (USNM), Australian Museum, Peabody Museum). Most online catalogues are accessible and easy to navigate, and provide a variety of searchable fields (e.g., MVZ, Peabody Museum, USNM) including county, state/province, and geographic area. If a museum has collected mammal specimens from the geographic region of interest, generating a list of probable prey items from their online museum records should be fast and inexpensive. Such records may also have links to collectors' notes (e.g., MVZ), which may include valuable information on relative abundance and habitat requirements.

Next, collect mammal field guides or checklists with drawings of teeth. Use teeth to identify prey items whenever they can be found in mammal remains. (One can immediately identify a prey item to genus using tooth morphology, and usually to species with the additional aid of a range map.) Teeth may be loose in the snake's stomach, still rooted in the mandible or dentary, or encased in a clump of fur (Rodriguez-Robles et al. 1999). If no drawings exist, sketch your own to complement your dichotomous key (see below).

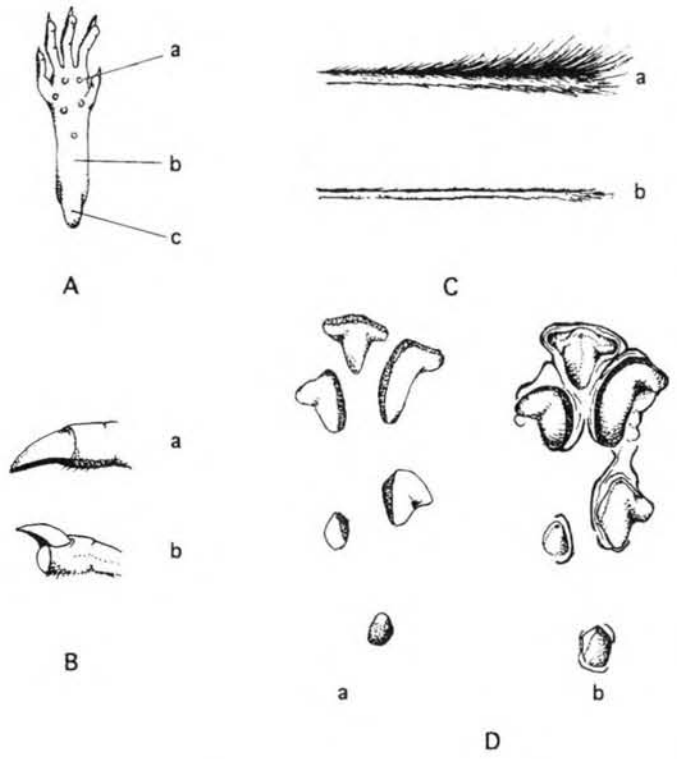


FIG. 1. Variable traits of mammalian hind feet and tails. A) Rodent foot anatomy: (a) tubercles, (b) sole, (c) heel. B) Toe anatomy of rodent species: (a) *Thomomys* species, (b) other species. C) Tail anatomy of rodents: (a) crested, (b) penicillate. D) Plantar tubercle anatomy: (a) pointy and wedge-shaped, (b) bulbous and layered.

The final step is to construct a dichotomous key by referring to alcohol-preserved mammal specimens. Gather representative specimens from each potential prey species on your list, then separate them by identifying unique hind foot and tail characteristics. Some species of the same genus are indistinguishable based on hind foot anatomy and dimensions alone. In such cases, you'll have to rely on a combination of range maps and snake specimen capture/locality data to determine probable prey species.

After completing an inclusive key, briefly study the morphology of those small mammals that share habit and habitat with the snake under study. Familiarity with morphology will facilitate rapid identification of rodents that commonly appear in snake stomachs, and preclude consistent reliance on a key. Just knowing the substrate (e.g., sand dunes, hardpan and gravel, or rock and boulder outcrops) and vegetation types present—both in terms of physical structure/cover, and as a potential food source for rodents—will provide insight into the small mammal fauna of the area. For example, to study the diet of the Mojave rattlesnake, *Crotalus scutulatus*, you would determine from Lawlor that heteromyids (kangaroo rats, kangaroo mice, and silky and spiny pocket-mice) are the most common nocturnal rodents inhabiting desert creosote/sagebrush flats and sand dunes, the usual habitat of those snakes. However, to study the food habits of the speckled rattlesnake, *Crotalus mitchellii*—from the same desert—would require close examination of the cricetine rodents (wood rats, white-footed mice, and harvest mice), as they prefer the higher elevation rocky canyons and outcrops where *C. mitchellii* is usually found.

Below is a sample key based on hind foot and tail characteristics of the potential prey items of the Mojave rattlesnake (*Crotalus scutulatus*). Because the key includes all rodents and rabbits within the rattlesnake's range, it avoids artificial boundaries and is really a key to the small mammals of that region. By using hind foot and tail characteristics to identify the genus of each prey item, and then consulting field guide range maps to determine which species it could belong to, I unambiguously identified 62 of 73 items from Mojave rattlesnake stomachs (Whorley, unpubl.).

Key to Potential Mammalian Prey of the Mojave Rattlesnake (*Crotalus scutulatus*)

1. Ventral side of hind feet woolly. Foot pads (plantar tubercles) hidden by fur ..... See 2
1a. Hind feet lightly furred or naked ventrally. Plantar tubercles naked. ..... See 5
2. Tail short and puffball. Hind feet stocky; no dusky stripe ..... See 3
2a. Tail long and tufted. Hind feet slender; distinct dusky stripe on ventral side ..... See 4
3. Hind foot < 100 mm in length ..... ***Sylvilagus audubonii***
3a. Hind foot > 112 mm in length ..... ***Lepus californicus***
4. Hind foot with 4 large toes. Fifth toe is vestigial and located halfway up inside of hind foot; usually just the claw is visible. ..... ***Dipodomys*** species
4a. Hind foot with 4 large toes, no vestigial fifth toe. ..... ***Dipodomys merriami***
5. Four plantar tubercles arranged symmetrically about long axis of hind foot. Sole of hind foot densely furred from heel to tubercles. ..... See 6
5a. More than four plantar tubercles arranged asymmetrically about long axis of foot. Sole of feet sparsely furred or naked from heel to tubercles ..... See 8
6. Fur on tail and hind feet thick, coarse, and long. Hind feet longer than 28 mm; tail longer than 54 mm ..... See 7
6a. Fur on tail and hind feet fine; short and sparse on tail. Hind foot length less than 25 mm. Tail stout and less than 54 mm; proximal dorsal 1/3 reddish-brown; distal 2/3 and entire ventral side pale. ..... ***Onychomys*** species
7. Dark brown, gray, or black fur on underside of feet; dark skin. Tail bushy, flattened distally, and sometimes striped. ..... ***Ammospermophilus*** species
7a. Pale tan, or brown fur on underside of feet; pale skin. Tail somewhat expanded distally, rounded, not flattened. ..... ***Spermophilus*** species
8. Claws thick, protruding from front of toes (Fig. 1B). ..... ***Thomomys*** species
8a. Claws thin, arching from top of toe (Fig. 1B) ..... See 9
9. Six or fewer poorly developed, hard, circular plantar tubercles. ..... See 10
9a. Six well developed, protruding, sometimes bulbous or wedge-shaped plantar tubercles ..... See 12
10. Tail with no distal penicillation or crest. First (outermost) and fifth (innermost) digit of right hind foot (RHF) about same length and barely reaching the base of digits 2 and 4. ..... ***Sigmodon*** species
10a. Tail with distal penicillation or crest. Fifth digit of RHF noticeably longer than first digit, and reaching well past the base of fourth digit ..... See 11
11. Tail crested (Fig. 1C); sole and heel of hind feet naked. ..... ***Chaetodipus*** species

11a. Tail penicillate (Fig. 1C); fur encroaching onto heel of hind feet. ..... ***Perognathus*** species

11b. Tail penicillate; sole and heel of hind feet naked. ..... ***Peromyscus eremicus***

12. Tubercles pointy and wedge-shaped (Fig. 1D) ..... See 13

12a. Tubercles bulbous and stacked (Fig. 1D) ..... See 14

13. Hind feet < or = 15 mm. tail 34–53 mm ..... ***Baiomys tailori***

13a. Hind feet longer than 15 mm. tail 55–96 mm. ..... ***Reithrodontomys megalotis***

14. Tail bicolored with distinct dorsal stripe; darker above than below. ..... ***Peromyscus*** species

14a. Tail unicolored ..... ***Neotoma*** species

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Spawning *Bufo bufo* (Common Toad). Illustration by P. A. Benson.

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Use of Fluorescent Powder to Track Horned Lizards

RICHARD C. STARK
Department of Zoology and
Oklahoma Cooperative Fish and Wildlife Research Unit
Oklahoma State University, Stillwater, Oklahoma 74078, USA
e-mail: StarkkRV@prodigy.net

and
STANLEY F. FOX
Department of Zoology, Oklahoma State University
Stillwater, Oklahoma 74078, USA
e-mail: foxstan@okstate.edu

Researchers have successfully used fluorescent powder to track small mammals (Lemen and Freeman 1985) and tortoises (Blankenship et al. 1990; Butler and Graham 1993; Keller 1993). Fellers and Drost (1989) used the method to track island night lizards, *Xantusia riversiana*, and suggested that the powder may work better on lizards with keeled scales. Here, we report the successful use of fluorescent powder to track Texas horned lizards, *Phrynosoma cornutum*. We hope that this method can be used on other reptiles with spiny integuments.

Over the past several decades, Texas horned lizards have decreased in both range and abundance in Oklahoma (Carpenter et al. 1993), as in Texas (Donaldson et al. 1994), and scientific research on this species in Oklahoma has been limited. In fact, the only study conducted on this species in Oklahoma was a population census (Carpenter et al. 1993). Future investigations into the ecology of Texas horned lizards in Oklahoma may be necessary to help conserve this species.

We used fluorescent powder to track Texas horned lizards on two study sites in north-central Oklahoma that we named Antique Field (AF) and South Field (SF). The fluorescent powder method was used to obtain area and habitat use data because it allowed us to obtain exact information about the movements of the lizards.

We located horned lizards by visual searches and toe clipped captured individuals for future identification. Following the methods of Fellers and Drost (1989), captured lizards were then dipped into a plastic bag containing the fluorescent powder. The lizards were held by the head while being dipped so that the powder did not get into their eyes, nares, and ear openings. Additionally, we gently rubbed the powder on each lizard to make certain the powder adhered well, and that the lizard was well covered.

Dipped lizards were released at the place of capture, and that spot was marked with a survey flag. That night, with the aid of a portable ultraviolet lamp, we traced the trail of powder left by the lizard—all the way to the current position of the lizard if possible. We placed survey flags in the ground at approximately every five meters on the trail and also at the end of the trail where lizards were relocated. The flags were used to estimate total daily distance moved (Tables 1 and 2), as markers to take microhabitat measurements, and to determine the x-y coordinates of lizard locations (grid systems were set up at each study site using survey equipment).

We purchased powder in 1998 from Radiant Color (2800 Radiant Avenue, Richmond, California 94804, USA) for US $12 per one-pound can. The colors we used were pink, chartreuse, orange, green, and blue. Lizards dipped in chartreuse, pink, and green left bright, distinctive trails. Pink and orange looked very similar under ultraviolet light, as did green and chartreuse. The blue powder was difficult to find after about 15 m, and is therefore not recommended.

Our lamp was a portable, rechargeable, longwave ultraviolet lamp. Each charge lasted for about five hours, and the lamp could be recharged 500 times. We purchased the lamp from Fisher Scientific (http://www.fisher1.com) in 1998 for US $215.

The fluorescent powder method was used in two field seasons, 1998 and 1999. Success with the method improved with practice, and here we briefly report results gathered only in the second season. At both sites, we dipped and released lizards at various times of day. Contrary to our expectations, distances traveled (standardized as $(x_i - \bar{x})/SD$, where x_i is distance traveled by an individual, and $\bar{x}$ and SD are the mean and standard deviation of the age/sex/site class to which that individual belongs) did not vary with the time of day when the lizard was dipped and released ($r = 0.02$, $df = 72$, $p > 0.50$). In other words, lizards marked and released early in the day did not travel further than those marked and released later in the day, despite having more time to do so.

At SF, 15 lizards (7 males, 6 females, 2 juveniles) made 28 tracks between 28 May and 25 July, 1999. We successfully tracked a lizards to where they slept (end of the day's trail) 93% of the time. Unsuccessful attempts to track a lizard to its sleep spot were usually not due to the length of a trail, but rather to confusion caused by trails of the same color overlapping several times. Daily (untransformed) distance traveled was not significantly different for males, females, and juveniles (Kruskal-Wallis Test, $H = 3.7$, $df = 2$, $p > 0.10$). Maximum daily distance traveled was 55 m (Table 1).

At AF, 25 lizards (7 males, 10 females, 8 juveniles) made 46 tracks between 8 May and 25 July, 1999. Lizards were successfully tracked to their sleep spots 81% of the time. To better compare distances traveled by the age/sex classes at the two sites, we divided tracks at AF into those made on or before 28 May and those made after 28 May. Before 28 May, daily distance traveled was significantly different among males, females, and juveniles (Kruskal-Wallis Test, $H = 11.66$, $df = 2$, $p < 0.003$), with males

TABLE 1. Daily distance (m) traveled by Texas horned lizards at SF and AF after May 28.

Site	Class	N	Range	Mean	SD
SF					
	Female	14	15–50	29.3	12.2
	Male	10	10–55	27.0	14.2
	Juvenile	4	5–35	16.3	13.1
AF					
	Female	17	5–95	29.3	32.8
	Male	6	10–95	40.8	28.9
	Juvenile	7	5–35	13.6	10.3

TABLE 2. Daily distance (m) traveled by Texas horned lizards at AF prior to May 28.

Class	N	Range	Mean	SD
Female	7	10–55	31.4	15.7
Male	7	55–225	111.4	67.5
Juvenile	2	5	5.0	0

moving much greater daily distances than females and juveniles (Table 2) even though they were tracked less frequently to their sleep spots during this time (although not significantly less frequently than the other age/sex classes: $\chi^2 = 2.82$, df = 2, $p > 0.20$). Even though time of day when lizards were dipped and released did not influence distance traveled, time of day dipped was not significantly different among age/sex classes (Kruskal-Wallis Test, $H = 0.62$, df = 2, $p > 0.50$). Males also moved greater daily distances than females and juveniles after May 28 (Table 1), but not significantly so (Kruskal-Wallis Test, $H = 4.603$, $p > 0.05$). Maximum daily distance traveled at this site was 225 m, performed by a male lizard prior to May 28 (Table 2).

The large difference in maximum daily distances traveled at the two sites and the fact that daily distance traveled was significantly different among age/sex classes only at AF before May 28 can be explained by the observation that all tracking instances over 100 m at AF were by males in early to mid-May, and occurred before tracking began at SF. Texas horned lizards emerge from brumation in mid-April or early May, and adult males may travel greater daily distances soon after to find mates. After that time, distances moved per day appear to be shorter.

Although this method allows a researcher to obtain information about the exact movements of an animal, and we were often able to record the entire daily movements of a lizard, certain limitations exist. Lizards that tend to stay in the same area can be tracked a limited number of consecutive days because current and recent trails are often difficult to distinguish and may overlap considerably. Thus, it is difficult to track individuals in a small area over an extended period of time unless there is rainfall during that period to help fade old trails. Using a different color of powder each day for one lizard helps to alleviate this problem, but there are a limited number of colors available. Also, only a few animals can be tracked in a small area at one time, or else the trails of lizards dipped in the same color may cross several times, leading to confusion. Perhaps old trails could be "erased" using a small leaf blower or portable water sprayer, although the regular use of these items might alter habitat (food, vegetation, etc.). Finally, the powder can blow off lizards that spend much time in the open on windy days, leading to scattered deposits. Trails show up best in areas of grassy and herbaceous vegetation.

Acknowledgments.—This work was part of a study on the space and habitat use of Texas horned lizards in Oklahoma. Financial support was provided by the Wildlife Diversity Program of the Oklahoma Department of Wildlife Conservation, the Department of Zoology at Oklahoma State University, and the Oklahoma Cooperative Fish and Wildlife Research Unit (Oklahoma State University, Oklahoma Department of Wildlife Conservation, USGS Biological Resources Division, and Wildlife Management Institute, cooperating). We thank ARC Communities and Lambert Construction for allowing us to conduct the study on their properties. We also thank David M. Leslie, Jr., for his useful comments and suggestions, reviewer Gary Fellers for his suggestion about "erasing" old trails, and John Dyer, Matt Sivils, and Joe Hackler for their valuable help in the field.

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PVC Sleeves for Attaching Ultrasonic Transmitters to Turtles

TERRY E. GRAHAM
and
CYNTHIA B. GRAHAM
Department of Biology, Worcester State College
Worcester, Massachusetts 01602, USA
e-mail: tgraham@worcester.edu

During the initial phase of field study of winter behavior and physiology in the common map turtle, *Graptemys geographica*, in northern Vermont, USA, we attached ultrasonic transmitters (Sonotronics model CT82-2) to the carapaces of adult females. We used monofilament fishing line tied to two small stainless steel screweyes screwed into the dorsal surface of the marginals. These plastic-encased cylindrical transmitters measured 16 x 64 mm, weighed 8 g, and had a small hole at each end for attaching them with wire or fishing line. We found that the tags tied on with fishing line were not held tightly against the carapace, and thus risked being caught on submerged snags. In addition, we thought that the monofilament line might break or deteriorate causing costly loss of equipment and time. For these reasons we decided to modify the means of transmitter attachment.

Rather than change to stainless steel wire, which might eliminate the risk of breakage (but not the risk of snagging) we sought an alternative means of transmitter attachment. We decided to glue the transmitters inside plastic pipe of about the same diameter. Inexpensive 3/4-inch (1.9 cm) white PVC pressure pipe, which has an inside diameter (17 mm) slightly greater than the outside diameter of the transmitters, was first cut to length (ca. 5 cm longer



FIG. 1. Transmitter in PVC sleeve bolted directly to the carapacial margin. Note the reasonably tight fit of this unit to the shell.

than the transmitter). Next, a portion of each end of this tube was cut away to leave a flat tab extension. The tabs were drilled to accept stainless steel bolts, for attachment to holes drilled in the marginals of the turtle being tagged. The transmitter was next coated (except for the ends) with multipurpose cement (TITESEAL all purpose, T62-04) and inserted slowly into the PVC tube. After a curing period of 24 h these assembled units were engraved with a rotary tool on the upper side to identify the signal that would be given by the transmitter inside, e.g. 258. The tubing was similarly marked with bold indelible black ink to make a very visible number (Fig. 1). The completed units, which weighed about 35 g, were then bolted to the carapace through two holes drilled in the marginal scutes to the left of midline (Fig. 1) to reduce interference with mating behavior. What resulted was a very durable bond between transmitter and tubing and a solid attachment to the shell. Of seven transmitters attached in this fashion, six were found intact after one year, while only one of eight affixed with monofilament line was located.

Our attachment method could be modified to accommodate data loggers, radiotransmitters, or other small pieces of equipment. Finally, we do not endorse the use of ultrasonic tracking equipment in all situations. It is highly useful in marine habitats and some freshwater situations, but signal attentuation by vegetation, trees, brush, or other debris in seasonally inundated woodlands adjacent to rivers can make it extremely difficult, if not impossible, to locate tagged animals that move into those settings.

Acknowledgments.—We thank Carlos Crocker for help with the initial fastening of transmitters with monofilament line, and Marlin Gregor of Sonotronics for discussion which led to the more effective means of attachment reported here.

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 31, Number 1 (March 2000). Submissions should be directed to one of the section editors (contact information located on inside front cover of this issue), as follows: amphibians (Painter); lizards, amphisbaenians, crocodilians, *Sphenodon* (Hauge); snakes and turtles (Butterfield).

CAUDATA

AMBYSTOMA BARBOURI (Streamside Salamander). **REPRODUCTION.** Geographically isolated populations of *Ambystoma barbouri* have recently been verified from middle Tennessee (Scott et al. 1997. Herpetol. Rev. 28:155). Information on the natural history of these populations is limited to a report by Ashton (1966. J. Tennessee Acad. Sci. 41:106–111), who commented on the unusual, stream-breeding habits of *A. texanum* in Davidson County, Tennessee. The Davidson County population discussed by Ashton is thought to be *A. barbouri* rather than *A. texanum* (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington. 587 pp.). Here, we report a second breeding stream in the Central Basin of Tennessee and provide information on the timing of reproduction, egg mass size, and hatchling size.

Egg masses and hatchlings were discovered in the southernmost section of Puckett's Creek (35°49'N, 86°28'30"W), in Rutherford County, on 10 March 2000. Puckett's Creek is a first-order stream bordered by a narrow (5–30 m) strip of forest and ca. 1.0 km of field extending either to state roadways or residential housing. The eggs were found attached in a monolayer to the underside of flat rocks located in intermittent pools within the stream course. A single egg mass was collected and transported to the laboratory for rearing and confirmation. Within three days all of these eggs hatched and all hatchlings were measured (N = 51; mean TL ± 1SD = 15.6 ± 1.2 mm). Seventeen additional egg masses were located on 14 March 2000, but several were deteriorating following hatching or dehydration. Clutch sizes were estimated from ten intact masses (eggs per mass: 65, 61, 52, 16, 15, 15, 14, 8, 7, 5). Based on time of hatching and assuming a 29–82 day incubation period (Petranka, *op. cit.*), we estimate that oviposition occurred between late December and mid-February. The Middle Tennessee region is rapidly expanding. Residential construction is currently underway at the north end of Puckett's Creek, approximately 3.0 km from this unstudied population.

Submitted by **KURT J. REGESTER** and **BRIAN T. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

PLETHODON CADDOENSIS (Caddo Mountain Salamander) and ***PLETHODON SERRATUS*** (Southern Redback Salamander). **NOCTURNAL CLIMBING ACTIVITY.** Nocturnal surface activity in the plethodontid salamander genus *Plethodon* has been well documented for a variety of species (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 587 pp.; Spotila 1972. Ecology 42:95–125). Observations on the nocturnal climbing abilities of some members within this genus as well as in other plethodontids, however, have appeared less frequently in the literature (Cliburn and Porter 1986.

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CAUDATA

AMBYSTOMA TALPOIDEUM (Mole Salamander). **TIMING OF BREEDING**. Paedomorphosis occurs when adult salamanders retain a larval morphology. *Ambystoma talpoideum* is a facultatively paedomorphic species found throughout the southeastern United States. In South Carolina populations, paedomorphic *A. talpoideum* breed primarily in October and November, ca. 6 weeks earlier than metamorphic individuals (Scott 1992. Am. Midl. Nat. 129:397–402; Krenz and Sever 1995. Herpetologica 51:387–393). Paedomorphic breeding wanes in January, while metamorphic courtship may continue until early March (Whiteman, unpubl. data). Here I describe evidence of breeding occurring in both morphs of *A. talpoideum* in mid-March, much later than has presently been recorded.

During 14 March–19 April 1999, I captured 13 paedomorphic (7 male; 6 female) and 3 metamorphic (2 male; 1 female) *A. talpoideum* in a wooded, permanent cattle pond on the Ridley Farm property in western Calloway County in western Kentucky. Within the first week (14–21 March), two paedomorphic (SVL 58 mm female; 60 mm male) and two metamorphic (SVL 60 mm male; 50 mm male) individuals were breeding. Salamanders captured after this time were no longer breeding, as cloacal swellings had receded. Using the Lincoln-Peterson mark-recapture equation (Pollock et al. 1990. Wildl. Monogr. 107:1–97), I estimated the paedomorphic population to be ca. 20 individuals.

Finding two large, actively-breeding paedomorphic *A. talpoideum* during March is unusual. In a study of South Carolina *A. talpoideum*, Whiteman (unpubl. data) found that large paedomorphs bred in December and early January, but only small, recently mature individuals bred into early February. Thus, either this Kentucky population represents an extension of the normal breeding time of paedomorphic *A. talpoideum*, or the individuals I captured had only recently matured, although at an enlarged size.

In support of the first hypothesis, terrestrial *A. talpoideum* breed until mid-February in southern Louisiana (Shoop 1960. Tulane Stud. Zool. 8:65–82), and through March in northern Louisiana (Hardy and Raymond 1980. J. Herpetol. 14:327–335), suggesting that further increases in latitude may prolong paedomorphic breeding as well. Although *A. talpoideum* can mature at 30 mm SVL, they sometimes delay maturity until larger size is reached (Semlitsch 1985, Oecologia 65:305–313), providing support for the second hypothesis. Only further study will allow proper testing of these alternatives.

I thank Dr. Ridley for access to his ponds, R. Cates and M. Dotson for field assistance, and H. Whiteman for manuscript revision.

Submitted by **KRISTI G. LANE**, Department of Biological Sciences, Murray State University, Murray, Kentucky 42071-0009, USA.

DESMOGNATHUS OCOEE (Ocoee Salamander). **REPRODUCTIVE FAILURE**. Beginning in 1994, I have monitored oviposition by female *Desmognathus ocoee* in crevices in wet cliffs associated with small streams in Banks County, Georgia, USA. A pair of small cliffs (combined area ca. 1.5 m^2 of wet cliff face) marks the headwaters of a first-order stream and is normally kept wet by a thin, flowing sheet of water. In every year of this study prior to 1999, females successfully oviposited in narrow, wet crevices at this site. Typical of this species' nesting behavior (Forester 1981. J. Herpetol. 15:29–34), each female established residency at a nesting site prior to oviposition, and then remained there until her eggs hatched. Hatching occurred an average of 36.1 (range = 32–39 for 7 clutches) days following egg-deposition. Larvae escaped into the stream by swimming across the thin sheet of water across the cliff face. Oviposition began every year by the second week of August, with the earliest new clutch laid 13 July 1996 and the latest new clutch 15 August 1995. As many as eight different females and their associated clutches have been observed on these cliffs at one time.

This area experienced drought in 1999 and the cliffs were completely dry by late July. During this time, the stream surfaced 88 m downstream of its normal point of origin. I visited the site regularly (at maximum intervals of every four days) from 10 August to 2 October 1999. Four gravid females, whose eggs could be seen through their venters, were initially observed occupying crevices. The first measurable rain (>2 cm) of August fell 20–24 August and kept the cliffs wet for several days. On 29 August one of the females had laid 6 eggs. Ova could still be seen through her venter, indicating that she laid only part of her complement of eggs . By 2 September the cliffs were again dry, and the eggs were gone. The female remained in the crevice and was last seen on 26 September. By 30 September she had abandoned the site. None of the other females laid clutches, and by 2 October all but one had abandoned their nesting sites. On 2 October the last remaining female was collected, preserved, and subsequently dissected. She measured 43.5 mm SVL and contained 12 enlarged ova. This specimen has been deposited in the University of Georgia Museum of Natural History (UGMNH 44321).

Indications are that the subpopulation associated with this set of small cliffs suffered total reproductive failure. Because females breed annually (Petranka 1998. Salamanders of the United States and Canada, Smithsonian Inst. Press, Washington, D.C.), the loss of a year's reproductive effort probably has a significant negative effect on fitness. Appalachian streams are generally thought to represent stable environments (Bruce 1985. Copeia 1985:847–854). However, fluctuation in levels of available moisture, particularly in headwater areas, may provide a previously unconsidered source of environmental instability. Relative instability of these areas in turn may influence the evolution of life-history traits in a way to minimize fitness loss (Stearns 1992. The Evolution of Life Histories, Oxford Univ. Press, New York).

Submitted by **CARLOS D. CAMP**, Department of Biology, Piedmont College, Demorest, Georgia 30535, USA.

EURYCEA CIRRIGERA (Southern Two-lined Salamander). **LARVAL PERIOD/ SIZE-CLASS DETERMINATION**. Little has been documented regarding the life history of *Eurycea*

cirrigera, a sibling species of *E. bislineata*. This species was first recognized in West Virginia by Jacobs (1987. Herpetologica 113:202–204). During a four-month period from July–October 1992, data were collected in Keeney Creek, Fayette County, West Virginia, USA, that indicated there are three distinct larval periods, or year classes, in *E. cirrigera*. The size groups observed were 6–11.5 mm, 13.2–16 mm, and 20–27.2 mm SVL. The first size-class represents newly hatched individuals, the second, 2nd year larvae, and the third, 3rd year larvae (juveniles). These data coincide with the size-class means observed for *E. bislineata* of 9.18, 20.04, and 25.25 mm SVL reported by Duellman and Wood (1954. Copeia 19542:92–98). In contrast to its sibling species in southern populations that have a 12–14 month larval period (Bruce 1986. Herpetologica 42:149–155), *E. cirrigera* has a much longer larval period of ca. 3 years in West Virginia. Similar to *E. bislineata*, *E. cirrigera* also experienced downstream drift and were found to have low surface density when surface density of *Desmognathus quadramaculatus* was high. Adults and juvenile *E. cirrigera* were abundant from the study area during summer and early fall, as was true of *E. bislineata* in previous studies (Kleeberger 1984. Ecology 65:1849–1856). The surface density of larvae began to increase with the return of adult individuals at the end of the study period (mid-October) as water temperature decreased. In summary, the observations reported herein support the hypothesis that *E. cirrigera* has a similar, if not identical, life history as that of its sibling species, *E. bislineata*.

Submitted by **CAROL A. POLLIO**, 1105 Wythe Court, Fredericksburg, Virginia 22405, USA; e-mail carol_pollio@nps.gov.

PLETHODON CINEREUS (Red-backed Salamander). **INTRASPECIFIC AGGREGATION.** The red-backed salamander, *Plethodon cinereus*, is a terrestrial species found in late-successional deciduous forests from Ontario and Newfoundland in the north, to Indiana and North Carolina in the south (Behler and King 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York. 743 pp.). Several studies have shown that this species is territorial and solitary in its southernmost range. Research carried out in both a laboratory setting and natural habitats has demonstrated that both males and females actively defend areas against intruding conspecifics and usually expel such intruders aggressively (Jaeger 1981. Am. Nat. 117:962–974; Mathis 1990. Anim. Behav. 40:953–962). Anthony et al. (1997. Behaviour 134:71–88) believe that aggressive behavior among plethodontid salamanders is a crucial component of their social interactions. Conversely, a recent study suggests that red-back salamanders in the northern part of their range do prefer to aggregate in both natural and laboratory settings (Quinn and Graves, *in press*. Ethology 105). With the exception of this recent study, research and observations concerning geographic variation in *P. cinereus* social behavior is lacking.

On 25 September 1999, five *Plethodon cinereus* were found aggregated within the same fallen log in a late-successional deciduous forest at Big Bay, Marquette County, Michigan, USA. The largest aggregations observed in natural habitats rarely exceed two animals (Quinn and Graves, *op. cit.*) and groups of five have never been reported. All salamanders were within 1-3 cm of all the other salamanders in the group. The log was ca. 1.2 meters in length and 15 cm wide. Fallen logs of equal size were abundant at the site, however all cover objects turned within a $10m^2$ area appeared to be unoccupied by conspecifics. Following their discovery, salamanders either attempted to escape or remained stationary. Escape behaviors consisted of crawling further into the log or moving towards the forest floor away from the log. Mating activity is believed to occur in the fall (October through December), where males actively seek females (Harding 1997. Amphibians and Reptiles of the Great Lakes Region. The University of Michigan Press, Ann Arbor. 378 pp.). Breeding aggregations of this size have not been reported, and aggregations of more than two red-backed salamanders in any other context are rarely encountered. A sufficient explanation for this aggregation cannot be speculated given the readily available cover objects, moisture, and prey items. This observation leads us to believe that geographic variation in territorial behavior may occur in plethodontid salamanders.

Submitted by **JOHN S. PLACYK JR.**, **LUIGI TORRETTI**, and **BRENT M. GRAVES**, Biology Department, Northern Michigan University, Marquette, Michigan 49855, USA.

ANURA

BUFO BAXTERI (Wyoming Toad). **PREDATION.** Endangered species are often characterized by small, isolated populations with a high risk of extinction from stochastic events (i.e., unfavorable weather, habitat destruction, increased depredation). Local and even broad scale population declines or extinctions due to increased depredation are often attributed to introduced predators. It is not often that a naturally occurring predator-prey relationship results in the extinction or extirpation of a prey population

The Wyoming toad, *Bufo baxteri*, thought to be a glacial relict of the Canadian toad, *Bufo hemiophrys*, historically existed only in the Laramie River Basin of Albany County, Wyoming, USA. In the mid-1970s, the entire population experienced drastic declines in abundance for unknown reasons and was listed as federally endangered, after it was thought to be extinct, in 1984. Later, a wild population was found at a single, small, aquifer- and irrigation-fed seepage lake (Mortenson Lake) in the basin. The population was estimated to be fewer than 50 adults during a fall 1999 survey by the U.S. Fish and Wildlife Service.

A widespread captive-breeding program has been important in the management of this population and involves 12 zoos across the nation and two U.S. Fish and Wildlife Service facilities. For almost 8 years, the captive-breeding program has allowed reintroduction of tadpoles and toadlets to Mortenson Lake to help maintain the population because there was no natural reproduction between 1991 and 1998. During the 1998 and 1999 breeding seasons, there were at least six fertile egg masses produced in the wild.

During the summer of 1998, we implanted radio transmitters in nine Wyoming toads captured at Mortenson Lake. The toads were followed from 1 August until 7 October. By the second week of September, six remaining toads with active transmitters and an unknown number of unmarked toads congregated at a very small area where suitable hibernacula were suspected to exist. The area

was a ditch adjacent to the shore of the lake. A small berm bordered the north side of the ditch and the slope of a hill bordered the south side of the ditch to form raised topography suitable for hibernacula. Congregation at hibernacula is typical of the species, as well as the closely related *Bufo hemiophrys*, and usually does not last long before freezing temperatures force them underground for the winter. During this fall congregation period, predators killed the six toads with active transmitters the last week of September. Of the other three that had transmitters, one was killed by a predator during the last week of August, a second died of a fungal infection (*Basidiobolus ranarum*) as diagnosed by the state veterinary laboratory, and the third was lost due to transmitter failure (the toad was visually identified, though no signal was being transmitted).

Since management of the Wyoming toad began, it was thought that the only significant cause of mortality threatening the population was *Basidiobolus ranarum* and *Aeromonas hydrophila*, a saprophytic fungus and bacterium, which causes micotic dermatitis and "red leg." Evidence at the kill sites of each toad suggests mustelids as the primary predators. The transmitters were left behind with tooth-marks in them as well as footprints at the sites. Indicative of mustelids was the fact that the entire carcass was consumed in each case. Other mammalian and avian predators are known to "peal" the skin off of toads, or at least leave the toxic parotoid glands behind. Many mustelids are tolerant of amphibian toxins. *Mephitis mephitis, Mustela vison, Mustela frenata,* and *Taxidea taxus* are common throughout the Laramie River Basin.

The observed mortality from depredation suggests that more than 20% of the adult population of this endangered toad was lost in a single event, but this estimate is based only on observed depredation of the marked animals. We have no idea how many unmarked toads may have been lost as there would be no trace of the kills. The vulnerability of this population prior to hibernation due to their aggregative behavior indicates that predator control may become an important tool in their management, at least until their numbers increase sufficiently to sustain such losses.

Submitted by **JOSH PARKER** (e-mail: jmparker@uwyo.edu), **STANLEY H. ANDERSON** (e-mail: anderson@uwyo.edu), and **FREDRICK J. LINDZEY** (e-mail: flindzey@uwyo.edu), Department of Zoology and Physiology, University of Wyoming, Wyoming Cooperative Fish and Wildlife Research Unit, P.O. Box 3166, Laramie, Wyoming 82071, USA.

BUFO MICROSCAPHUS (Arizona Toad). **REPRODUCTION**. Krupa (1988. Copeia 1988:800–802) provided the clearest evidence that the basket method employed by *Bufo cognatus* maximizes fertilization efficiency in toads. Both Krupa and Miller (for *B. americanus*) described the basket as a space formed when the clasping male "...hooks his feet between the female's hind limbs, thus forming a basket between the feet and the legs of the male and the legs and body of the female" (Miller 1909. Amer. Nat. 43:641–668). However, they did not mention the importance of the male's feet in catching and holding the eggs, as for example in *Litoria verreauxi* (Antis 1976. Trans. Royal Soc. S. Australia 100:193–202) where the male "lowered his vent towards the eggs and cupped his feet around, so holding them....the sides of the male then undulated and his feet moved up and down in a brief fanning motion over the eggs." We observed and videotaped breeding in *B. microscaphus* (Gergus 1988. Herpetologica 54:317–325) along the Beaver Dam Wash at Lytle Preserve in southwestern Utah, USA, 2024 h on 16 March 1999. Ambient air temperature was 9°C and water temperature was 12°C. Clasping male *B. microscaphus* not only assumed a basket position but also used the tops of their feet to cradle the emerging eggs, pulling them up against the vent while fertilizing them. Undulations near the males' cloacas also occurred at this time. Fertilization behavior is stereotyped, each episode involving a few hundred eggs extruded by the female. The behavior can be subdivided into: 1) female ventroflexing—the clasped female extends her legs backwards while forming a concavity with her back; 2) feet-dipping—the clasping male moves his feet from the top of the female's thighs to between her extended legs just below her cloaca; 3) egg extrusion—the male catches the extruding eggs with the tops of this feet and toes and pulls them up towards his cloaca; rhythmic contractions of the muscles surrounding the male's coccyx occur at this time; 4) foot sagging—the male's feet and toes relax and hang slightly away from the female's cloaca; 5) female resumes preventroflexing posture—the female arches her back and flexes her legs into the normal z-shaped amplexus position; and 6) male drops eggs and places his feet on the tops of the female's thighs. From the time the female ventroflexed to alert the male that she was about to extrude eggs to the time when she resumed a normal posture and he placed his feet back on top of her thighs, three episodes of fertilization took 42 sec, 75 sec, and 52 sec. A single female produces an average of 4500 eggs per clutch (Blair 1955. Amer. Mus. Novitates 1722:1–38). Thus, a minimum time for the female to extrude all of her eggs (e.g., 300 per 42 sec fertilization episode) is about 10.5 h, if no delays or pauses occur between these episodes. However, delays between episodes of fertilization do occur and the pair may remain clasped for many more hours.

An annotated videotape of the basket posture for amplexing *B. microscaphus* can be seen at www.li.suu.edu/basket/. A copy of the tape has been deposited with Dr. Jack Sites in the herpetology collections of the Monte Bean Natural History Museum, Brigham Young University. We thank the Monte Bean Museum of Natural History and the Utah Division of Wildlife Resources for permission to study toads at Lytle Preserve.

Submitted by **ANNA BROWN, BROOKE CHRISTENSEN**, and **TERRY D. SCHWANER**, Department of Biology, College of Science, Southern Utah University, Cedar City, Utah 84720, USA, and **MATT NICKERSON**, Library Department, College of Education, Southern Utah University, Cedar City, Utah 84720, USA.

BUFO PUNCTATUS (Red-spotted Toad). **PREDATION**. Because of their short duration, temporary pools usually contain few predators of larval anurans compared to more permanent habitats (Woodward 1983. Ecology 64:1549–1555). However, water scavenger beetles (Hydrophilidae) typically have an aquatic larval phase of rather brief duration (Archangelsky 1997. Bull. Ohio Biol. Surv., New Ser. 12[1]:1–207), giving this group of predators the opportunity to exploit larval anurans in temporary pools. On 24 June 1999, pools along the intermittent stream in No Thoroughfare Canyon, Colorado National Monument, Colorado, USA, contained

various combinations of *Bufo punctatus*, *Hyla arenicolor*, and *Spea intermontana* tadpoles. No arthropods have been reported as preying on tadpoles of these species (e.g., Hammerson 1999. Amphibians and Reptiles in Colorado. 2nd ed. University Press of Colorado). Most of the pools with tadpoles also contained water scavenger beetle larvae, *Hydrochara lineata* (LeConte). The *S. intermontana* tadpoles had grown to sufficiently large sizes (50–70 mm total length) that they were unlikely to be subject to predation by the insect larvae. However, most tadpoles of other species were much smaller (total length 28 mm). One very small, shallow pool (ca. 0.3 x 0.6 m) contained six *Hydrochara* larvae and three *H. arenicolor* tadpoles sufficiently small to be at risk. At a larger pool, one of the larval insects had captured a *B. punctatus* tadpole and was consuming it by the shoreline.

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Submitted by **LAUREN J. LIVO**, Colorado Division of Wildlife, 317 West Prospect Road, Ft. Collins, Colorado 80526, USA and EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA, and **BORIS C. KONDRATIEFF**, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, Colorado 80523-1177, USA.

BUFO TERRESTRIS (Southern Toad). **MAXIMUM SIZE**. The maximum body size reported for *Bufo terrestris* is 113 mm SVL (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America, 3rd ed., Houghton Mifflin Co. Boston, Massachusetts, 450 pp.). Here, I report on the measurements of a larger individual. A female was captured on the rainy night of 9 December 1999 in Florida, Miami-Dade County, Everglades National Park (ENP), Royal Palm Hammock Road, immediately north of Royal Palm Hammock. The female (Everglades National Park EVER 308341), frozen then thawed, measured 123.8 mm SVL. Her gape measured 49.6 mm, and she weighed 134.4 g without her digestive tract. Her stomach contained the remains of a freshly eaten millipede of 90 mm. After one week in formalin, she measured 121.9 mm SVL. As noted by Duellman and Schwartz (1958. Bull. Florida State Mus., Biol. Sci. 3:181–324), large females of *B. terrestris* exceeding 100 mm SVL are not rare in southern Florida. In that regard, from a series of 129 females I collected from ENP during 1995–1999, 16.3% exceeded 100 mm SVL and 54.3% exceeded the 41–75 mm SVL reported for this species (Conant and Collins *op. cit.*). The possibility of regional distinction in female body size of *B. terrestris* is an interesting problem in an otherwise poorly studied species.

Submitted by **WALTER E. MESHAKA, JR.**, Everglades Regional Collection Center, Everglades National Park, 40001 SR-9336, Homestead, Florida 33034-6733, USA.

DENDROBATES AURATUS (Green Poison Frog). **REFUGE USE**. Amphibians that experience dry conditions have developed many desiccation avoidance strategies, including seasonal dormancy and cocoon building (Pough et al. 1998. Herpetology. Prentice-Hall, Inc. New Jersey). In areas with shorter, less predictable dry periods, behavioral modifications may be sufficient for survival. For example, on days without rain, Panamanian *Dendrobates auratus* restrict activity to the cooler hours of the day. The question of how these frogs survive exceptionally long periods of extreme dryness will be addressed here based on observations made on Taboga Island, Republic of Panama. The El Niño of 1997–98 resulted in a short wet season followed by a longer and more severe dry season than usual (Meteorological and Hydrological Branch of the Panama Canal Commission). On 23 April 1998, work began on a population of *Dendrobates auratus* that was abundant in 1996. The forest was extremely dry and there was a pungent smell of smoke from fires that had burned through the leaf litter. There was no dendrobatid activity at sites where there had previously been many frogs. Eventually six *D. auratus* were observed in a boulder crevice in the dry streambed of the Quebrada del Pueblo. Approaching these frogs, one of us (HMG) stepped into a deep depression full of leaf litter directly in front of the crevice. Suddenly frogs started coming out of the leaf litter and hopping away. Seventeen adult and one juvenile *D. auratus* were caught, as well as two *Physalaemus pustulosus* adults. Many of the frogs that went far into nearby rock crevices were not caught, but about 40 frogs are estimated to have been in the 85-cm-wide depression, beneath 55 cm of leaf litter. The soil under the leaf litter was damp to the touch and the leaves directly above the soil moist. Subsequent observations showed that this was one of the places where the mostly subterranean stream would come above ground and form a pool after heavy rainfall. Territorial behavior appeared to have been suspended so these frogs could aggregate in the only area where any moisture could be found. On 27 April, the frogs had dispersed and were moving about the forest. Calling intensity was high as well as aggressive interactions. With the onset of the wet season, territories were being reestablished and defended. One of the frogs caught in the streambed refuge was recaptured a year later 75 m away, indicating that animals may have to travel some distance to escape desiccation. The effect of the long dry season on the population size is unknown, as censusing was not done prior to 1998 in this area. There was mortality probably attributable to desiccation as two *D. auratus* carcasses were found in the leaf litter of the refuge on 27 April. One animal was in advanced decomposition, so may have died before the disturbance of the refuge, while the other animal was fresher but was not one of the animals captured on 23 April. As *D. auratus* is a small frog (SVL <33 mm), carcasses in the leaf litter may have been missed. The largest amphibian in the area, *Bufo marinus*, is harder to miss. Fourteen *B. marinus* skeletons were found in a 6-m stretch of streambed 100 m above the refuge. Another five skeletons were found in <1 m of trail next to this part of the streambed. Pelvic girdles were counted as the skeletons of many individuals were mixed together. The bones were picked clean except for the parotoid glands that were left intact. It is not uncommon in the dry season to find a few *Bufo marinus* skeletons (K. Summers, pers. comm.), but the high number indicates that toad mortality was substantial and this may have also been the case for the *D. auratus*. The populations of *D. auratus* and *B. marinus* appeared to be thriving in 1999. A large protected forest reserve such as that on Taboga may have the necessary microhabitats and large amphibian population sizes necessary to buffer against unusual climatic conditions such as those experienced during El Niño events.

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cal data, and the Smithsonian Tropical Research Institute for assistance and logistic support.

Submitted by **HEATHER M. GRAY** and **DAVID M. GREEN**, Redpath Museum, McGill University, 859 Sherbrooke Street West, Montreal, Quebec H3A 2K6, Canada.

HYLA BOANS (Rusty Tree Frog). **DIET**. *Hyla boans* is a large tree frog widely distributed across northern South America. On 18 February 1999 at 0900 h we observed a *Hyla boans* (120 mm SVL) eating a bat (Order Chiroptera) in Parque Nacional Cinaruco-Capanaparo, Rio Cinaruco, Estado Apure, Venezuela (6°33'09"N, 67°24'29"W). The bat was only partially ingested, with the wrists (distal ends of both radiae) protruding out of the mouth of the frog. We did not identify the consumed bat. We are unsure if the frog captured the bat while the bat was flying or roosting, nor are we certain the bat was alive when the frog consumed it. This represents, to our knowledge, the first observation of predation on bats by a tree frog of the genus *Hyla*.

Lee Fitzgerald verified the *Hyla* identification.

Submitted by **D. ALBREY ARRINGTON** and **JENNIFER L. ARRINGTON**, Department of Wildlife & Fisheries Sciences, Texas A&M University, 210 Nagle Hall, College Station, Texas 77843-2258, USA.

LIMNONECTES ANDAMANENSIS (Andaman Paddyfield Frog) x ***L. LIMNOCHARIS*** (Cricket Frog). **WILD HYBRIDS**. *Limnonectes andamanensis* and *L. limnocharis* are distinguished on the basis of a rich reddish-brown patch on the dorsum, presence of dorsolateral dermal folds, and a shagreened (vs. elongated warts) dorsum in *L. andamanensis*, which are lacking in *L. limnocharis* (fide Boulenger 1920. Rec. Indian Mus. 20:1–226; Sarkar 1990. Rec. Zool. Surv. India 86:103–117). Three *Limnonectes* sp. collected from Wandoor (11°36'N and 92°40'E), South Andaman Island, Bay of Bengal, India, show the following characteristics: reddish-orange (in life) or orangish-brown (in ethanol) patch in the sagittal region and two paired blotches of the same color on each side of midbody, no dorsolateral folds; dorsum shagreened (two examples) or warty (one example). An adult male (SVL 36.3 mm; field number MCBT 140087) with paired internal vocal sacs and darkened throat, and two adult females (SVL 43.4 and 38.6 mm, field numbers ID/AN 02 01 and 02 02; all specimens now in the Zoological Survey of India [ZSI, registration numbers pending]) are considered wild hybrids between *L. andamanensis* and *L. limnocharis*. They were collected on 16 August 1997 at the edge of a marsh at the ecotone of a rainforest and mangroves, where much of the natural vegetation had been lost to paddy cultivation and settlement. Active, breeding adults of *L. andamanensis* and *L. limnocharis* were also collected from the site. Hybrids between these two species were previously unreported.

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Submitted by **INDRANEIL DAS**, Andaman and Nicobar Islands Environmental Team, Centre for Herpetology, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India. Present address: Institute of Biodiversity and Environmental Conservation, University Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia; e-mail: idas@mailhost.unimas.my.

RANA MUSCOSA (Mountain Yellow-legged Frog). **EGG PREDATION**. Tadpoles of *Rana muscosa* were seen feeding on conspecific egg masses in Kings Canyon National Park, Fresno County, California, USA (36°49'30"N 118°25'45"W; 3360 m elev.). Between 24–30 June 1999, a small pond (20 m x 20 m; 1.5 m deep) and outlet stream were checked daily for egg masses. During that period, 136 egg masses were laid, marked with small PVC tubes, and examined daily until hatching. One hundred and one egg masses were laid in the pond and 35 were laid in the outlet stream. *Rana muscosa* tadpoles can take 2–4 years to metamorphose (Zweifel 1955. Univ. California Publ. Zool. 54:207–292), and this pond contained 400–800 second-year tadpoles (28–32 mm body length). Soon after egg laying was completed (1 July 1999), the adult frogs left the immediate breeding area. Over the next four days, tadpoles were concentrated among the egg masses laid in the pond and were seen feeding on eggs (Fig. 1). The tadpoles completely consumed 100 of 101 egg masses laid in the pond. In the outlet stream, 33 egg masses survived to hatching and two became exposed and desiccated. In 1998, tadpoles consumed 63 of 110 egg masses laid in the same pond. In 1999, the single surviving egg mass was 4.5 m east of the outlet and 3.45 m (shoreline length) from the nearest egg mass. We searched the pond thoroughly for newly hatched tadpoles (5–9 July 1999) and never counted more than 25 individuals of this size class (2–4 mm body length). Second-year tadpoles were photographed swallowing eggs with viable embryos. Five second-year tadpoles were collected on 5 July 1999 and preserved in formalin. All five



FIG. 1. Second-year *Rana muscosa* tadpole feeding on conspecific egg

tadpoles contained eggs in their intestinal tracts. I conclude that second-year *R. muscosa* tadpoles are significant predators on conspecific eggs in certain habitats.

I thank the Museum of Vertebrate Zoology, the Department of Integrative Biology (UC Berkeley), the Gompertz Fund (UC Berkeley), the American Museum of Natural History, and USGS Biological Resources Division for financial support.

Submitted by **VANCE VREDENBURG**, Museum of Vertebrate Zoology, Department of Integrative Biology, University of California, Berkeley, California 94720, USA; e-mail vancev@socrates.berkeley.edu

RANA UTRICULARIA (Southern Leopard Frog). **PREDATION**. On 11 September 1999 at 0130 h, a barn owl, (*Tyto alba*) was observed foraging on *Rana utricularia* on Country Rd. 84 ca. 6.4 km northwest of Fayetteville, Arkansas, USA (T17N, R31W, NW1/4 Sec 36). The owl was observed to fly down to the paved road and pick up a frog, and then fly away and alight on the top of a nearby telephone pole. After ca. 10 min, the barn owl again landed on the road but was flushed by a car. The owl may have been trying to feed on frogs as there were 3–4 DOR *R. utricularia* on this section of the road. It is known that some species of owls feed on amphibians (Cook 1992. Kingbird 42:84) but most of these observations were reported from pellet analysis (Marti 1991. Barn Owl. *In* Birds of North America No. 1; Jedrzejewski 1994. J. Avian Biol. 25:308–318). To my knowledge, this is the first observation of a barn owl feeding on amphibians and the first report of *R. utricularia* as a prey item. Nero (1986. Blue Jay 44:189–190) provided evidence that great gray owls (*Strix nebulosa*) utilize roads as feeding sites in Manitoba's Interlake Region. Therefore, the use of roads as foraging sites for owls may be a frequent occurrence, but due to the nocturnal behavior of owls and amphibians it is rarely observed.

Submitted by **JEFFERY T. BRIGGLER**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

SCINAX FUSCOMARGINATUS (NCN). **PREDATION**. The attack on amphibians by blood-sucking leeches is common, mainly on aquatic species or those that enter the water to breed (Duellman and Trueb 1986. Biology of Amphibians. McGraw Hill. New York 670 pp.), like *Bufo paracnemis* and *Leptodactylus ocellatus* (A. Sebben, pers. comm.). In most cases however, these attacks are temporary and likely do not drastically interfere with the fitness of the individual (Duellman and Trueb 1986, *op. cit.*).

Here we present an observation of amphibian death caused by the attack of the blood-sucking leech *Oxyptychus brasiliensis* on an adult male *Scinax fuscomarginatus*, an abundant treefrog in wet grasslands in the Cerrado. On 22 December 1998, several adult male *S. fuscomarginatus* were seen calling on an aquatic Cyperaceae, in a little dam in Pirenópolis, Goiás state, Brazil (15°50'S, 48°58'W). At 0100 h we found an adult male *S. fuscomarginatus* (SVL 21.3 mm; Laboratory of Animal Physiology, Universidade de Brasília, UnB 2117) on a leaf tip, 15 cm above the water, with a blood-sucking leech attached on its left flank, close to the arm. When disturbed, the leech released the treefrog with lateral movements and fell into the water, where it was captured. The treefrog showed a circular skin injury 1.77 mm in diameter. An autopsy revealed a deep injury, and consumption of tissues of the left lung. Measurements of the leech (retracted): 12.0 mm total length; 5.38 mm total width; 2.7 mm oral sucker width.

We are grateful to Guarino Colli and Edson Zerbini for critical reading, Antonio Sebben for helpful comments, and Mark Siddal for the identification of leeches. We also thank Bárbara Fonseca and Vívian Braz, who gave their blood for this work.

Submitted by **REUBER ALBUQUERQUE BRANDÃO**, Departamento de Ecologia, Universidade de Brasília, Brasília, Distrito Federal, Brazil. CEP 70.910-900 (e-mail: reuber@unb.br), and **ADRIAN ANTONIO GARDA**, Laboratório de Fisiologia Animal-CFS-IB, Universidade de Brasília, Brasília, Distrito Federal, Brazil. CEP 70.910-900 (e-mail: adriangarda@hotmail.com).

SCINAX NASICUS (NCN). **HABITAT**. A population of *Scinax nasicus* was studied in Sauce Viejo, Santa Fe town suburban area (Santa Fe, Argentina), from 10 February to 4 April 1996. Six hundred and ninety-seven observations of *S. nasicus* activity were recorded in houses and surrounding habitats.

Individual counts in three windows (1.2 x 1.6 m) with different light intensity (A:5O Ev [lux], B: 83.33 Ev and C: 166.66 Ev) were conducted each day (22–24 h). Climatic data were obtained from EEA-INTA Paraná Meteorological Station.

The proportions of frogs from each different light intensity were tested with the Multiple Proportions Test (Zar 1996. Biostatistical Analysis. Prentice Hall, New Jersey, 662 pp.). The temporal distribution of the number of frogs in different windows was tested with the G test (Sokal and Rohlf 1979. Biometría. Blumé, Madrid, 830 pp.). *Scinax nasicus* activity relative to environmental variables was analyzed through the Conformity rate (h^2). During the day, frogs were found in wet shelters near water sources (reservoirs, fountains tanks, bathrooms, closets, cocks, pipes, drains). At night, the frogs left these refuges and congregated at the windows where arthropods were attracted by the light.

The numbers of frogs at the windows with the greatest light intensity was significant ($c^2 = 46.2$; $p < 0.05$). Temporal distribution of frogs showed significant differences between windows A and B (G: 0.89; $p < 0.05$), A and C (G: 0.88; $p < 0.05$), and B and C (G: 0.77; $p < 0.05$). Frog activity increased when the temperature (h^2: 0.87; $p < 0.05$), relative humidity (h^2: 0.71; $p < 0.05$), and rainfall (h^2: 0.60; $p < 0.05$) increased. A clear trend to use the windows with the greatest intensity was observed. The waste-water drainage systems and the local distribution of human dwellings likely provides refuges for *S. nasicus* during periods of dry conditions. These observations may help explain the propensity of *S. nasicus* to colonize urban areas, as *S. nasicus* is one of the few frogs that cohabit with man in large neotropical areas.

Submitted by **MARIANO ORDANO**, **PABLO COLLINS**, and **RAFAEL LAJMANOVICH**, Instituto Nacional de Limnología (INALI-CONICET), José Maciá 1933, 3016 Santa Tomé, Santa Fe, Argentina.

TESTUDINES

CHELYDRA SERPENTINA OSCEOLA (Florida Snapping Turtle) **REPRODUCTION**. The production of two or more clutches per season remains undocumented in *Chelydra* (Iverson et al. 1997. Herpetologica 53:96–117) and clearly is not supported in one population examined by dissection of female reproductive tracts (White and Murphy 1973. Herpetologica 29:240–246). Here, I present data from the dissection of reproductive tracts and from records of nesting in captivity in *Chelydra s. osceola*. These data support the possibilities, suggested more than 20 years ago, that *C. s. osceola* lays multiple clutches per season and has early annual onset of the nesting season (see Ewert 1976. Herpetologica 32:150–156; Moll 1979. *In* Harless and Morlock [eds.], Turtles: Perspectives and Research, pp. 305–331. Wiley, New York, New York).

TABLE 1. Attributes of the reproductive tracts of eight female *Chelydra serpentina osceola* collected in southern Dade Co., Florida.

Date of Capture	Date of Dissection	Sets of Ovarian Corpora Lutea[1]	Oviductal Eggs	Enlarged Ovarian Follicles[2]
3 March 1973	19 March	11	0	8
3 March 1973	24 March	11	11	15
4 March 1973	26 March	18	18	12
10 March 1973	27 March	13, 13	13	5
10 March 1973	30 March	10, 13	13	13
11 March 1973	20 April	10, 7	7	8
21 March 1979	28 March	9, 10, 8	8	0
21 March 1979	29 March	8, 8, 11	11	3

[1] Counts list the oldest set first (measuring 2.0–2.8 mm diam, if oldest of 3 sets), then the next oldest set (4.3–5.7 mm diam, if penultimate set), then the most recent set (6.5–10.5 mm diam).
[2] Only preovulatory sets (18–23 mm diam) are listed. (Occasionally also present: follicles at 15–17.5 mm diam).

Table 1 itemizes elements of the reproductive tracts of eight females collected in southern Dade Co., Florida, USA (2–4 km S to SW of Florida City; 25°25'N, 80°30'W). I palpated each female on the day of capture and felt shelled eggs in five of the six females collected in 1973 and in both females from 1979. The number of most recent corpora lutea equalled the numbers of eggs in both oviducts in the seven individuals with eggs. Two females had three sets of corpora lutea, and three females had just one set. Six females contained enlarged ovarian follicles. One female (collected on 11 March 1973) had two sets of enlarged follicles and could have ovulated two more clutches (8 eggs from pre-ovulatory follicles shown in Table 1 and 7 eggs from enlarged follicles, 15–17 mm diameter, not shown in in Table 1). Combining the counts of sets of corpora lutea and the counts of sets of enlarged follicles (for justification see Moll *op. cit.*) indicates the production of two clutches by three females, three clutches by four females, and possibly, four clutches by two females (10, 7, 8, and 7 eggs from the female collected on 11 March 1973; and 8, 8, 11, and 3 eggs from the female collected on 21 March 1979). Given an estimate of maximum productivity of three clutches per season, these eight females could have produced an average of 27.6 (range 19–36) eggs per female per year.

Two females provided data on production of multiple clutches in captivity. These females were housed in plastic trash containers and fed a highly fortified ground beef and commercial fish diet. A nesting substrate of damp riverine sand was provided in an additional trash bin. When the females were gravid, they were rotated ca. daily between the sand environment and their home container until they had nested. One female, collected as an adult from Dade Co., Florida, mated with a male from Highlands Co., Florida and produced a clutch of five normal eggs on 17 February 1998, and another clutch of seven normal eggs 74 days later on 22 May 1998. Another female, hatched from one of the eggs collected in 1973, matured in captivity and also mated with the male from Highlands Co. Her dates of laying (and egg counts) were 5 August 1990 (8 eggs), 9 September 1990 (11); then, 16 January 1992 (8), 25 February 1992 (10); and then, 23 October 1997 (9), 8 January 1998 (8), and 16 February 1998 (12). None of these clutches contained overmature eggs, an indicator of overlong egg retention that could implicate the conditions in captivity as too abnormal to allow inference on natural history. Additionally, most or all of the eggs in each clutch were fertile and were allowed to hatch. The three shortest internesting intervals estimated from these data are 35, 39, and 40 days. If these intervals are assumed to approximate the shortest ones occurring in the wild, the two gravid females containing their second clutches when collected on 10 March 1973 (Table 1) should have laid their first clutches of the 1972–1973 season during early February, if not before.

I was staying at the Archbold Biological Station (James N. Layne, Director) when I collected the turtles during 1973. Barb Henderson helped rear the one female from hatchling to adult. I thank Craig E. Nelson for helping in many ways. Portions of the dissected females have been deposited at the Carnegie Museum of Natural History, Pittsburgh (CM 86948, 86980–84, 87215–16).

Submitted by **MICHAEL A. EWERT**, Department of Biology, Indiana University, Bloomington, Indiana 47405-6801, USA; email: mewert@bio.indiana.edu.

LACERTILIA

AMEIVA BIFRONTATA (Visure Verde, Guaripete). **CANNIBALISM.** The stomach of an adult specimen of *Ameiva bifrontata* (90.4 mm SVL) collected from western Paraguaná Peninsula, State of Falcón, Venezuela, was found to contain the almost intact body of a conspecific juvenile (42.0 mm SVL). Traces of digestion were visible only in the distal portion of the tail. No previous report of cannibalism has been reported in this species (Roze 1964. Mem. Soc. Cienc. Nat. La Salle 24:209–210). The adult and juvenile specimens were catalogued in the Colección Herpetológica Paraguaná Regional del Centro de Investigaciones en Ecología y Zonas Áridas, Universidad Francisco de Miranda, as CIEZAH 989 and CIEZAH 990 respectively.

Submitted by **ABRAHAM MIJARES-URRUTIA**, Centro de Investigaciones en Ecología y Zonas Áridas (CIEZA), Universidad Francisco de Miranda, Apartado 7559, Santa Ana de Coro 4101-A, Venezuela (email: amijares@funflc.org.ve), **LILIMAR OSPINO, ALIXA PARTIDA, EVELÍN PEÑA,** and **YELITZA VALBUENA**, Centro de Ciencias, Unidad Educativa Mariano de Talavera, Punto Fijo, Venezuela.

ANOLIS CONSPERSUS (Grand Cayman Blue-Throated Anole). **NECTIVORY.** Nectivory or possible nectivory has been reported in *Anolis carolinensis* (Himes 1998. Herpetol. Rev. 29:236; Liner 1996. Herpetol. Rev. 27:78; T. S. Campbell and C. Bleazy, pers. comm.) and in *A. stratulus* (Perry and Lazell 1997. Herpetol. Rev. 28:150–151). On 31 May 1990, two of us (ACE and GPG) observed (and photographed) a single adult male *A. conspersus lewisi* (Eastern Grand Cayman Blue-Throated Anole) lapping fluid from the flowers of a wild banana orchid, *Schomburgkia thomsoniana* var. *thomsoniana* (Orchidaceae). The orchid was epiphytic on the trunk of a small tree (trunk diam < 10 cm) ca. 1.5 m above the ground under a relatively open canopy along a trail ca. 50 m north of Farm Road near its junction with Quarry Road on the eastern end of the island of Grand Cayman, British West Indies. The lizard moved out the long peduncles to reach the flowers and, often hanging head-down, inserted its head into the flowers and/or lapped the tips of the petals. It was also observed licking the sepals. The lizard was observed to tongue-wipe its lips after visiting a flower. Other species of *Schomburgkia* are known to have extrafloral nectaries associated with the sepals, but it is not known whether they are present in *S. thomsoniana* (Robert L. Dressler, pers. comm.). Extrafloral nectaries are known to attract ants, but we noted no insects on the flowers and sepals of flowers visited by the lizard, and we saw no insects on other flowers in the inflorecence, nor on their sepals. The flowers of this species of orchid open downward and do not, therefore, hold rainwater. Although it is possible that the lizard was lapping water made available by condensation, our observations were made on the afternoon of a sunny, hot (ca. 32°C), and dry day, and it is probable that it was lapping nectar. One of us (FJB) has observed and photographed similar behavior by *A. c. conspersus* (Western Grand Cayman Blue-Throated Anole) in an undisturbed dry thicket of native trees and shrubs among mangroves, 0.5 km NW of Little Salt Creek, West Bay.

The climate on Grand Cayman is classed as semiarid (Dec–Feb), arid (Mar–Apr), or subhumid (May) for six months of the year (Burton 1994. *In* Brunt and Davies [eds.], The Cayman Islands: Natural History and Biogeography, pp. 51–60. Kluwer Academic Publishers, Dordrecht, Netherlands). At least seasonally, in this environment of highly seasonal and episodic precipitation, the water gained by lapping nectar may be more important to the lizards than any energy gained. We have no explanation for our observation of the lizard licking the sepals.

We thank G. Ebanks-Petrie and J. E. Davies, then of the Cayman Islands Mosquito Research and Control Unit, for logistic support and other assistance, and Todd S. Campbell for comments on the manuscript.

Submitted by **A. C. ECHTERNACHT** and **GLENN P. GERBER**, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee 37996-1610, USA (e-mail: echterna@utk.edu and ggerber@ix.netcom.com.), and **F. J. BURTON**, National Trust for the Cayman Islands, P.O. Box 31116 SMB, Grand Cayman, Cayman Islands, B.W.I. (e-mail: fjburton@candw.ky).

ANOLIS SAGREI (Brown Anole). **CANNIBALISM.** Intraspecific killing and cannibalism have been reported for many organisms, including reptile species (Fox 1975. Ann. Rev. Ecol. Syst. 6:87–106; Hausfater and Hrdy [eds.] 1984. Infanticide: Comparative and Evolutionary Perspectives. Aldine. New York. 598 pp; Polis. 1981. Ann. Rev. Ecol. Syst. 12:225–251; Polis et al. 1984. Mamm. Rev. 14:187–198). Anoles are not known for cannibalistic tendencies. A commonly-studied species, *Anolis carolinensis*, is not known to engage in infanticide. Only one instance of cannibalism has been reported in *A. carolinensis* (Jenssen 1993. Herpetol. Rev. 24:58–59) and is believed to be an example of social pathology rather than typical behavior (Jenssen et al. 1998. Copeia 1998:774–779). We are not aware of any other published accounts of *Anolis* cannibalism.

We have observed two instances of adult *Anolis sagrei* consuming conspecifics, a hatchling and a juvenile. During a morning in September 1997, KEN and PMR observed an adult *A. sagrei* male (Fig.1) consume a hatchling-sized individual in a suburban setting. The adult moved quickly down a stick towards the ground, captured a prey item and then climbed back up the perch to consume its catch. Upon closer inspection, the prey item was a hatchling *A. sagrei*. On a second occasion (26 February 1998), KEN and AVP observed an adult male *A. sagrei* consume a juvenile male conspecific (SVL 32 mm). In this case, KEN and AVP were capturing, measuring, and releasing *A. sagrei* as part of another study. AVP released a captured individual that was promptly consumed by a larger conspecific.



FIG. 1. Adult male *Anolis sagrei* consuming a hatchling conspecific.

The consumption of young anoles by *A. sagrei* is of particular interest because *A. sagrei* is an introduced species that interacts with the native species *A. carolinensis* in the southeastern United States (Campbell 1996. Herpetol. Rev. 27:155). If *A. sagrei* consume conspecifics, they may also consume juvenile and subadult *A. carolinensis* and influence survivorship in the latter species.

It is unknown whether cannibalism among *A. sagrei* is common. However, our observations suggest that cannibalism may have implications for studies of territoriality and social behavior in this and other species of *Anolis*.

Submitted by **KIRSTEN E. NICHOLSON, ANN V. PATERSON**, and **PAUL M. RICHARDS**, Department of Biology, University of Miami, Coral Gables, Florida 33124, USA.

GEKKO GECKO (Tokay Gecko). **PREDATION**. Introduced species may impact native species by directly preying upon them in addition to indirectly competing with them for local resources. This note documents a case of an introduced lizard capturing and ingesting a juvenile indigenous snake. An adult *Gekko gecko* (ca. 26 cm total length) regularly prowls the wall of a building near my home in Alva, Lee County, Florida, USA. While walking past that wall during November 1998, two hours after sunset, I noticed the gecko in its favorite hunting position near an office window. A pass of my flashlight on that evening revealed the gecko clinging above the window, its head aimed downward with something long and slender, about the same length as the gecko's entire body, dangling straight down from its mouth. I couldn't discern what the item was, and I chose to get my camera from the car to record the curious phenomenon, whatever it was, rather than risking frightening the gecko into flight by approaching more closely. I was able to get a shot from a distance of about 4 m away by using a 200mm macro lens before it scurried for cover taking with it the mystery object. The identity of this item was unknown until the film was developed. The resulting photograph (Fig.1) showed that the object was a juvenile corn snake (*Elaphe g. guttata*) of ca. 30 cm total length, its head held firmly in the gecko's jaws. Its limp body suggests that the snake was already dead when I first encountered the situation.

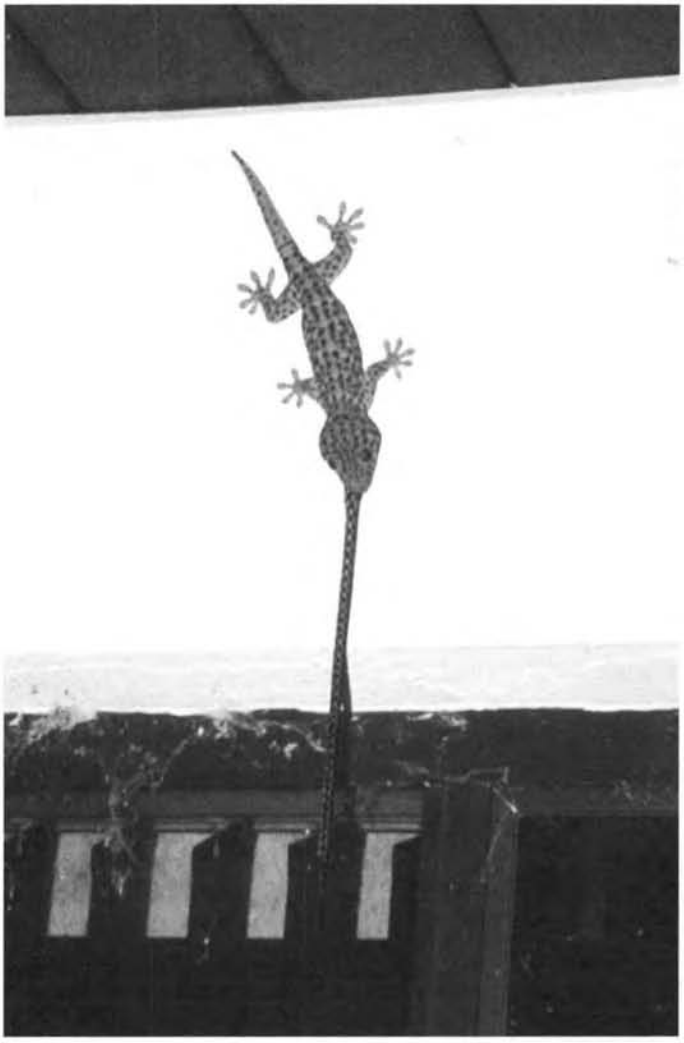


Fig. 1. Adult *Gekko gecko* with juvenile *Elaphe g. guttata* in its jaws.

Submitted by **BILL LOVE**, P.O. Box 643, Alva, Florida 33920, USA.

LIOLAEMUS KOSLOWSKY (NCN). **SAUROPHAGY**. *Liolaemus koslowsky* is a tropidurid lizard found in the intermontane valleys of La Rioja and Catamarca Provinces, northwestern Argentina. The diet of this species has been recently described and is known to include insects and spiders (Aun and Martori 1998. Cuad. Herp. 12[1]:1–9). Here we report an observation of interspecific saurophagy by an adult male *L. koslowsky* on a hatchling *L. pseudoanomalus*. On 29 January 1999, during the course of an ecological study of lizard communities carried out 6 km E Anillaco town (28°49'S, 66°57'W), Castro Barros Department, La Rioja Province, we collected in a bush land site, an adult male *L. koslowsky* (FML 08188, SVL 62 mm, TL 85 mm [tail broken], weight 7.96 g) using a rubber band. We hand-grabbed the lizard and as we squeezed it for a more secure grasp, the tail of another lizard protruded from its mouth. We grabbed the tail and pulled out a complete and dead hatchling of *Liolaemus pseudoanomalus* (FML 08189, SVL 32 mm, TL 43 mm, weight 0.96 g). The stomach contents of the *L. koslowsky* were subsequently examined and found to contain Coleoptera and Orthoptera. Saurophagy has not been previously documented under natural conditions for *Liolaemus* in Argentina.

These two lizard species are common and widespread in this part of the Monte biogeographic region and share similar microhabitats. Thus, predation on hatchlings of *L. pseudanomalus* by adult *L. koslowsky* may be a frequent occurence. Lizard identifications were verified by Fernando Lobo and specimens were deposited in the Herpetological Collection of the Instituto de Herpetología, Fundación Miguel Lillo, San Miguel de Tucumán, Tucumán, República Argentina (FML).

Submitted by **LUCIANO JAVIER AVILA** and **LUCIANA BELVER,** CRILAR-CONICET, Mendoza y Entre Ríos s/n, C.P. 5301. Anillaco (La Rioja), Argentina (e-mail: lavila@crilar.com.ar).

MABUYA MACRORHYNCHA (NCN). **ECTOPARASITES**. During a study of the skink *Mabuya macrorhyncha* at the island of Queimada Grande (24°30'S; 43°42'W), located ca. 33 km off the coast of São Paulo state in southeast Brazil, DV collected eight specimens on 21–22 November 1997 (wet season) and eleven specimens on 30–31 July 1998 (dry season). Three specimens in each year were damaged during collection and will not be considered here. The remaining 13 individuals (five males and eight females) ranged from 57.5 to 77.5 mm SVL. Subsequent examination of the lizards revealed the presence of acarine ectoparasites: all specimens (100%) bore larvae of the trombiculid mite *Eutrombicula* cf. *alfreddugesi* and four of them (30.8%) also

bore larvae of the ixodid tick *Amblyomma rotundatum*. Voucher specimens of *A. rotundatum* were deposited at the collections of the Instituto Butantan (IB 7016–17) and of the Instituto Oswaldo Cruz (IOC 0408 / IXA). The lizards were deposited at the Museu Nacional do Rio de Janeiro (MNRJ 7286–7304).

Chigger mites (larval *E.* cf. *alfreddugesi*) were found associated with the anterior axilllae of all lizards (one individual also bore three mites on the left groin), where scales are small and granular, while ticks were always found attached to the skin between two large scales of the torso. Mean parasite intensity (*sensu* Bush et al. 1997. J. Parasitol. 83:575–583) of *E.* cf. *alfreddugesi* was 26.8 ± 22.5 mites per lizard (range 3–68), and mean intensity per axilla was 15.0 ± 12.0 (range 1–47). All lizards had chigger mites on the left axilla and ten (76.9%) also bore them on the right axilla. Using one-way analyses of variance (ANOVA), we did not find any significant difference in mean intensity of chigger mite infestation between months ($F_{1,11} = 0.15$; $P = 0.71$) nor between sexes of hosts ($F_{1,11} = 0.34$; $P = 0.57$). Chigger mite intensity was not correlated with host SVL ($r = 0.13$; $F_{1,11} = 1.60$; $P = 0.23$). The mean parasite intensity of *A. rotundatum* was 1.25 ± 0.50 (range 1–2), with three lizards bearing a single tick and one bearing two. Ticks were found in the ventral region of all parasitized hosts, with one of them also bearing a tick on the dorsolateral region, near the right groin.

Intensity of infestation of *E.* cf. *alfreddugesi* in the *M. macrorhyncha* population of Queimada Grande was lower than that reported for a mainland coastal population of conspecifics inhabiting a sand-dune habitat in Rio de Janeiro State (mean = 42.6 mites/lizard; Cunha-Barros and Rocha 1995. Oecologia Bras. 1:307–316), perhaps due to a possible lower density of mites on the island than on the mainland. In that population, as in the insular one treated here, ectoparasite intensity does not seem to be correlated with host sex or size (Cunha-Barros and Rocha, *op. cit.*). Unlike our observations in the insular skink population, *E.* cf. *alfreddugesi* infest mainland skinks on various parts of their bodies, though most intensely in the axillary region (Cunha-Barros and Rocha, *op. cit.*). This fact may also be indicative of a lower density of mites on the island.

Amblyomma rotundatum is a common parasite of neotropical snakes, anurans, and tortoises (Amorim and Serra-Freire 1995. Parasitol. al Dia 19:9–19; Aragão 1936. Mem. Inst. Oswaldo Cruz 31:759–843), and has also been recovered from teiid and tropidurid lizards (Amorim and Serra-Freire, *op. cit.*; D. M. Barros-Battesti, pers. comm.). Adults of *A. rotundatum* are known to parasitize the endemic pitviper *Bothrops insularis* at Queimada Grande (Aragão 1936. *op. cit.*; Duarte et al. 1995. Stud. Neotrop. Fauna Environ. 30:1–23). *Mabuya macrorhyncha* represents a new host record for *A. rotundatum*.

We thank D. M. Barros Battesti and M. Amorim for confirming the identification of the ticks, and the researchers of the "*Bothrops insularis* Project" of the Instituto Butantan for allowing DV to participate on field excursions to Queimada Grande. The authors benefited from grants from the Conselho Nacional do Desenvolvimento Cientifico e Tecnológico - CNPQ. DV and CFDR also received financial support from the Fundação do Amparo à Pesquisa do Estado do Rio de Janeiro - FAPERJ (Process E-26/ 170.385/97 - APQ1).

Submitted by **DAVOR VRCIBRADIC**, **MÔNICA CUNHA-BARROS**, and **CARLOS FREDERICO D. ROCHA**, Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-011, Rio de Janeiro, RJ, Brazil; e-mail (DV): dvrcibradic@hotmail.com.

***OLIGOSOMA* SPP.** (New Zealand Skinks). **PREDATION.** On 23 November 1998, I observed an adult European starling, *Sturnus vulgaris*, attempting to feed its young on Stephens Island, a reserve in Cook Strait, New Zealand. While seated in the pasture about 40 m from a shearing shed, I observed a starling flying in circles and landing in a nearby shrub, *Coprosma repens*. The starling's nest was in the roof of the shearing shed, but the bird was reluctant to enter while my colleagues and I were nearby. The repeated attempts by the starling to enter the nest enabled me to identify, with the use of binoculars, that it was carrying a tailless speckled skink, *Oligosoma infrapunctatum*. *O. infrapunctatum* is the largest skink on Stephens Island, reaching a SVL of up to 106 mm (Gill and Whitaker 1996. New Zealand Frogs and Reptiles. Bateman Field Guides, David Bateman Ltd., Auckland, New Zealand. 112 pp.). After repeated aborted efforts to access the nest, the bird ate the skink. Within 20 minutes the bird returned with a large mygalomorph spider, repeating the whole performance. During the next hour, it returned with two skinks, both adult *O. lineoocellatum*. Both skinks had lost their tails. As for these last two prey items, the bird ate the first, and eventually entered the nest with the second.

I know of no other report of starlings eating reptiles in New Zealand. When one bird can capture three large skinks within the period of 1.5 h, the species has the potential to be a major predator of lizards in New Zealand. Interestingly, the starling returned on three consecutive occasions with tailless bodies of skinks. Presumably, the tails were lost during capture, but the bird still captured the skink. Whether the bird had consumed the tails is not known.

The most notable feature of Stephens Island is that it contains the largest and most secure population of tuatara, *Sphenodon punctatus*, in New Zealand. Adult tuatara emerge throughout the day under the cover of forest on Stephens Island, but rarely in the pasture where predation by harriers, *Circus aeruginosus*, is likely (unpubl. observation). Given that starlings may forage in the forest, as well as in the pasture, and given that juvenile tuatara are considerably smaller than the skinks that I observed to be taken, there is a high likelihood that starlings may be an introduced predator of juvenile tuatara also.

Submitted by **MICHAEL B. THOMPSON**, School of Biological Sciences and Wildlife Research Institute, University of Sydney, NSW 2006, Australia.

PHRYNOSOMA ORBICULARE ORBICULARE (Mexican Plateau Horned Lizard). **REPRODUCTION.** At present, few data exist on reproductive characteristics of *Phrynosoma orbiculare orbiculare* (Fitch 1970. Univ. Kansas Mus. Nat. Hist. 52:1–247). Here we report reproductive data for two female specimens of *P. o. orbiculare*. On 27 May 1996 we collected a juvenile female (XR 0149: 73.1 mm SVL, 35.3 mm tail length, 35.0 g) at Las Comadres (elevation 2240 m; oak forest), municipality of Guadalcázar, San Luis Potosí, México. On 15 March 1997 we

collected a gravid female (XR 0538: 110.5 mm SVL, 53.7 mm tail length, 95.0 g) at San José de las Flores (22°40'46"N, 100°24'52"W; elevation 1890 m; xerophilic brushland). The juvenile female had 22 non-vitellogenic follicles (2.4 mm length, 2.0 mm width). The gravid female had 17 embryos with a mean mass of 1.165 ± 0.039 g (0.773–1.353), length 11.259 ± 0.262 mm (9.7–13.7), width 9.082 ± 0.273 mm (7.0–10.9), and volume 525.51 ± 38.9 mm^3 (300.7–867.9). The relative clutch mass (Vitt and Price 1982. Herpetologica 38:237–255) at the time of collection was 0.255. *Phyrnosoma o. orbiculare* and other closely related species such as *P. douglasi* (Ashton and Ashton 1998. Herpetol. Rev. 29:168–169) are viviparous.

We thank H. M. Smith and H. Hernández for their help and advice during the field work, and M. Espinoza and the local authorities for their logistic help. This study was supported by CONABIO project R045/98 and CONACYT project # 27618-N.

Submitted by **XÓCHITL HERNÁNDEZ-IBARRA**, **AURELIO RAMIREZ-BAUTISTA**, and **RICARDO TORRES-CERVANTES**, Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos (UNIPRO), Escuela Nacional de Estudios Profesionales-Iztacala, UNAM, Av. de los Barrios s/n. Los Reyes Iztacala, Tlalnepantla, Edo. de México. C.P. 54090, A.P. 314, México (e-mail [XHI]: xrgjthic@servidor.unam.mx; [ARB]: raurelio@servidor.unam.mx, and [RTC]: rjtcxh@servidor.unam.mx.

SCELOPORUS OLIVACEUS (Texas Spiny Lizard). **PREDATION.** Clark (1949. J. Tennessee Acad. Sci. 24:244–261) found 78 mammals and 17 birds in stomachs of 100 *Elaphe obsoleta* in Louisiana. Barbour (1950. Copeia 1950:100–107) found that 47% of the prey eaten by *E. obsoleta* were mammalian and 53% were avian. Kennedy (1964. Texas J. Sci. 16:210–215) reported an *Anolis carolinensis* from a juvenile *E. obsoleta*. Here we report predation on *Sceloporus olivaceus* by *E. o. lindheimeri* in Texas.

On 29 October 1998, an *E. o. lindheimeri* was captured crossing a park road in Cedar Hill State Park, Dallas Co., Texas, USA, during a herpetological survey (Permit #51-98). The stomach of the snake was fully distended. During measurement of the snake (55.0 cm SVL; 11.3 cm tail length) it regurgitated a *S. olivaceus*. The lizard was partially digested and was missing the anterior half of its body. The remains of the lizard, measuring 148.4 mm TL, were placed in the University of Texas at Arlington Collection of Vertebrates (UTA R-45193).

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Submitted by **RICHARD D. REAMS** and **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, Dallas, Texas 75203, USA, and **JOHN M. DAVIS**, Texas Parks and Wildlife, P.O. Box 941, Cedar Hill, Texas 75106, USA; e-mail (RDR): Hylareams@aol.com.

SCINCELLA LATERALIS (Ground Skink). **HATCHLING MORPHOMETRICS**. On 14 June 1999, two adult female *Scincella lateralis* were collected outside of the Dallas Zoo's Bird and Reptile Building, Dallas, Texas, USA. Female number 1 measured 40.6 mm SV, 5.2 mm tail length, and weighed 0.90 g (post oviposition). Female number 2 measured 43.8 mm SVL, 49.9 mm tail length, and weighed 1.2 g (post oviposition). On 15 June 1999, female number 1 deposited two eggs with a mean length of 9.37 mm (± 0.01), mean diameter of 5.26 mm (± 0.03), and mean weight of 0.14g (SD < 0.01). The next day female number 2 deposited four eggs with a mean length of 8.38 mm (± 0.05), mean diameter of 5.62 mm (± 1.57), and mean weight of 0.16 g (± 0.02). All eggs were placed in a 1:1 vermiculite:water mixture and artificially incubated at 28°C. During incubation one egg, containing a dead embryo, was removed. On 20 July 1999, the remaining five eggs hatched. Mean measurements of hatchling skinks were as follows: SVL of 18.9 mm (± 1.11), tail length of 27.6 mm (± 1.36), and weight of 0.14 g (± 0.01).

Submitted by **RUSTON HARTDEGEN**, Dallas Zoo Department of Herpetology, 650 South R.L. Thornton Freeway (I35-E), Dallas, Texas 75203, USA (e-mail: rustonh@sprintmail.com).

TROPIDURUS NANUZAE (NCN). **ENDOPARASITE.** Helminths are common gut parasites of amphibians and reptiles (Aho 1991. Parasite Communities: Patterns and Processes. Chapman and Hall, New York, 429 pp.). *Tropidurus nanuzae* (Tropiduridae) is an endemic lizard from the Espinhaço mountain chain, southeastern Brazil, occurring at sites above 1000 m. Ecological data for this species are scant. In a population from an area of rupiculous vegetation at Serra do Cipó (19°12'S, 43°30'W), Minas Gerais state, we found nematodes of an undescribed species of the genus *Subulura* Moulin, 1860 (Subuluridae) parasitizing the intestine of *T. nanuzae*. Nematode voucher specimens are deposited at the Coleção Helmintológica of the Instituto Oswaldo Cruz (CHIOC 34196 and 34197). In our sample (N = 55 lizards examined) this nematode's prevalence was 65.5% (36/55) and the mean intensity of infection was 20.2 ± 27.2 nematodes/lizard. The high prevalence suggests that this species is an effective gut parasite of *T. nanuzae*. Nematodes of the genus *Subulura* are common parasites of avian and mammalian hosts but were not known to parasitize reptiles (Vicente et al. 1993. Rev. Bras. Zool. 10[1]:19–168; Vicente et al. 1995. Rev. Bras. Zool. [Supl. 1]:1–273; Vicente et al. 1997. Rev. Bras. Zool. [Supl. 1]:1–452). This is the first record of lizard infection by nematodes of the genus *Subulura*.

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Submitted by **MONIQUE VAN SLUYS** and **ANGÉLICA F. FONTES**, Setor de Ecologia, DBAV, IBRAG, Universidade do Estado do Rio de Janeiro, R. São Francisco Xavier 524, Maracanã, 20550-013, Rio de Janeiro, RJ, Brazil, **MARA CÍNTIA KIEFER**, Pós-Graduação em Ecologia, IB, UNICAMP, 13083-970, Campinas, SP, Brazil and **JOAQUIM J. VICENTE** and **ROBERTO MAGALHÃES PINTO**, LHPV, Departamento de Helmintologia, Fiocruz, Brazil. (e-mail [MVS]: vansluys@uerj.br).

VARANUS PANOPTES (Northern Sand Goanna). **DIET.** *Varanus panoptes* is the largest goanna of tropical northern Australia, attaining a total length of up to 1.5 m (Storr et al. 1983. Lizards of Western Australia II: Dragons and Monitors. W.A. Museum Press, Perth. 113 pp.). Hatchlings are ca. 30 cm in length and weigh ca. 30 g (Bennett 1998. Monitor Lizards: Natural History, Biology and Husbandry. Edition Chimaira, Frankfurt. 352 pp.). Many large monitor lizards (*Varanus* spp.) are described as being insectivorous when young and progressing to a more carnivorous diet upon maturity (Auffenberg 1981. The Behavioral Ecology of the Komodo Monitor. University of Florida Press, Gainesville, Florida. 406 pp; Green et al. 1986. Aust. Wildl. Res. 13:585–595). Documentation of the dietary habits of many varanid hatchlings, however, is sparse.

In January 1998, a hatchling *V. panoptes* was captured in a drain within the grounds of the Northern Territory University, Casuarina Campus. The hatchling was placed in a cloth bag and taken to the laboratory where it was measured and weighed. A scat was deposited in the bag and this was soaked in alcohol and later rinsed, sieved (Sieve Type 1507, Endicotts, London), and dried in an oven (105°C) for seven days.

The lizard's total length was 28.4 cm and it weighed 100 g. One grasshopper, two skink tails, and the remains of a bird were recovered from the scat material. These represented 29%, 28%, and 43% of the dry weight, respectively. This is the first documentation of a carnivorous diet in a hatchling varanid and it may explain the larger than expected mass of this specimen. The prey items were probably opportunistically encountered but it appears that varanid hatchlings will exploit vertebrate prey if available.

Submitted by **SEAN J. BLAMIRES**, Faculty of Science, Northern Territory University, Darwin Northern Territory 0909, Australia (e-mail: s_blamires@hotmail.com). Present address: The Morning Bell Language School, 671-3 Juk-Do2 Dong, Buk-Gu, Pohang City, Gyeong-Buk, 791-052, South Korea.

SERPENTES

AFRONATRIX ANOSCOPUS (Brown Water Snake). **COLORATION**. Previous authors have noted dorsal pattern variation in *Afronatrix anoscopus*, but this has not been quantified (Cansdale 1970. West African Snakes. Longmans, London. 74 pp.; Rossman 1976. Herpetologica 32:256–257; Villiers 1950. Les Serpents de L'Ouest Africain. Institut Francais d'Afrique Noir, Dakar. 148 pp.).

From June 1984 to July 1987, I collected 12 *A. anoscopus* from the same 30-acre area in the town of Yekepa, Nimba County, Liberia. Two specimens were dead when collected. Of the rest, two died in captivity, seven were returned to the wild (at various locations in the 30-acre area), and one was donated to Steiner Zoo, Monrovia, Liberia. Specimen sizes, color patterns, and scalation data ensured that none of the released specimens was counted twice in this study.

The dorsum of *A. anoscopus* is brown, with or without black markings. Of the 12 specimens collected, markings were absent in two specimens (17%). Markings consisted of two staggered rows of black spots the size of a scale or less, in one specimen (8%). Markings consisted of two staggered rows of black spots the size of three to five scales, in two specimens (17%). Markings consisted of bold, black, transverse bars—some broken at the midline, some continuous—in seven specimens (58%).

Mr. Alfred Yeanay, who farmed rice in Yekepa, found seven of the *A. anoscopus* used in this study. His son, Torseh Yeanay, found one specimen. I thank the Yeanays for their help.

Submitted by **PHIL SENTER**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

CHARINA BOTTAE (Rubber Boa). **ANTIPREDATOR BEHAVIOR**. In September 1998, a birdwatcher (name withheld by request) witnessed an immature red-tailed hawk (*Buteo jamaicensis*) feeding on a rubber boa (*Charina bottae*). The hawk was perched in a tree on the southeast shore of Washoe Lake, Washoe Lake State Park, Washoe Co., Nevada, USA (39°15'N, 119°46'W, ca 1650 m elevation). The bird suddenly fell from the tree into the shallow water below, then walked out onto the lakeshore whereupon it dropped dead. Upon inspection, the remains of a partially eaten rubber boa were found in the hawk's mouth and the middle third of the snake was tightly coiled around the bird's neck. Apparently the hawk had captured the rubber boa, and in the process of subduing and consuming the snake, the dying boa managed to place a few coils around the hawk's neck and strangle it. Presumably the snake was already dead when the hawk succumbed because the snake's carcass was both headless and tailless (the remaining body section measuring 16.5 cm). Remnants of down feathers were attached to the snake's body. Although red-tailed hawks are known to eat snakes (Farrand [ed.] 1983. The Audubon Society Master Guide to Birding, Vol. 1. Alfred A. Knopf, New York, New York. 447 pp.), to our knowledge this is the first record of a rubber boa strangling a hawk during a predatory encounter. This is the second recent record of a snake killing a red-tailed hawk during a predatory encounter in which the snake was the intended prey (Vandermast 1999. Herpetol. Rev. 30:169).

R. E. Espinoza confirmed the identity of the snake. The boa's carcass has been deposited in the Herpetological Collection of the University of Nevada, Reno (UNR 7048). We thank A. Gubanich for identifying the hawk.

Submitted by **RONALD W. VAN HEEST** and **JESSICA A. HAY**, Biological Resources Research Center, MS 314, University of Nevada, Reno, Nevada 89557, USA (e-mail: Rronster@aol.com).

CROTALUS ATROX (Western Diamondback Rattlesnake). **MORPHOLOGY**. Painter et al. (1999. Herpetol. Rev. 30:44) reported congenital absence of the rattle in two specimens of *Crotalus atrox* from Eddy Co., New Mexico. Herein, I report two additional rattleless adult *C. atrox* collected from the San Simon Valley, Cochise Co., Arizona, USA, and deposited in the vertebrate collections at Arizona State University. One specimen (ASU 31401) lacks any evidence of a rattle, and has a short, abruptly tapered tail with no evidence of scarring or injury. The second specimen (ASU 31410) possesses a small, short, tapered segment ca. 2–3 mm in length. The segment is conical in shape, thus preventing formation

of an interlocking rattle string. These specimens were collected on 24 May 1997 (ASU 31401) and 27 July 1995 (ASU 31410) within 6 km of the intersection of Price Canyon Road and Arizona Hwy 80. Between 1993 and 1997 I observed 133 *C. atrox*, 343 *C. scutulatus*, and 123 *Sistrurus catenatus* near this site and these were the only rattleless individuals.

Submitted by **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu).

CROTALUS VIRIDIS VIRIDIS (Prairie Rattlesnake). **MORPHOLOGY**. Painter et al. (1999. Herpetol. Rev. 30:44) report a rattleless female *Crotalus viridis viridis* that gave birth to a litter that included a rattleless neonate. Herein I report a rattleless female *C. v. viridis* with an abruptly tapered tail collected 20 September 1991 from a black-tailed prairie dog (*Cynomys ludovicianus*) town in south-central (T26N, R33W, S24) Cherry Co., Nebraska. Since there was no evidence of scarring or injury I concluded the condition was congenital. A photograph of the tail is provided in Holycross (1993. Movements and Natural History of the Prairie Rattlesnake, *Crotalus viridis viridis*, in the Sand Hills of Nebraska. Master's Thesis. Univ. of Nebraska, Lincoln. 88 pp.). I observed 157 *C. viridis* from this population during 1991 and this was the only rattleless individual.

Submitted by **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu).

ECHINANTHERA AFFINIS (NCN). **DIET**. A young specimen of a neotropical colubrid snake, *Echinanthera affinis* (305 mm SVL, 105 mm tail length), was collected in a pitfall trap at the Parque Estadual do Ibitipoca (21°4'S, 43°52'W, ca. 1100 m elev), Municipality of Lima Duarte, State of Minas Gerais, Brazil, on 3 July 1997. We observed a tail tip in the snakes's mouth, and subsequently removed a young lizard, *Heterodactylus imbricatus* (44 mm SVL, 92 mm TL). Both specimens are deposited in the Museu Nacional-Rio de Janeiro collection (snake MNRJ 7306, lizard MNRJ 7307, verified by Ulisses Caramaschi).

In the intestines of the snake we also found some scales of *H. imbricatus*. The fact that this snake had already ingested another specimen of the same lizard species, at a different time, suggests that juvenile *E. affinis* commonly eat small lizards.

Submitted by **BERNADETE MARIA DE SOUSA**, Departamento de Zoologia, Instituto de Biociências, Universidade Federal de Juiz de Fora, Campus Universitário, Martelos, 36036-330 Juiz de Fora, MG, Brazil, and **CARLOS ALBERTO GONÇALVES DA CRUZ**, Departamento de Biologia Animal, Instituto de Biologia, UFRRJ, 23851-970 Seropédica, RJ, and Departamento de Vertebrados, Museu Nacional, Quinta da Boa Vista, 20940-040 Rio de Janeiro, RJ, Brazil (e-mail: cagcruz@uol.com.br).

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). **DIET**. *Elaphe guttata* is known to eat mammals, birds, lizards, and frogs (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Miffin Co., Boston, Massachusetts. 336 pp.; Degenhardt et al. 1996. Amphibians & Reptiles of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 430 pp.). On 19 March 1997 (0700–0720 h) we collected two male *Elaphe guttata emoryi* (768 and 704 mm SVL, 123.3 and 143 mm tail length (TL), 165.0 and 137.0 g, respectively) on the ground under logs of *Yucca* spp. at Las Norias del Refugio (22°55'26.1"N, 100°24'9"W; 1322 m elevation; xerophilic brushland), San Luis Potosí, México. Each snake had a *Sceloporus jarrovi minor* in its stomach. The lizard in the first snake measured 74.8 mm SVL, 50.5 mm TL, 9.0 g, and the lizard in the second snake measured 75.2 mm SVL, 48.3 mm TL, 8.0 g. Both lizards were female. The snakes and lizards are deposited in Colección Nacional de Anfibios y Reptiles del Instituto de Biología (IBH 12455-56), Universidad Nacional Autónoma de México.

We thank Héctor Hernández for his support, and Armando Borgonio for his logistic help. This study was supported by CONABIO Project No. R045/98.

Submitted by **AURELIO RAMÍREZ-BAUTISTA**, **XÓCHITL HERNÁNDEZ-IBARRA**, and **RICARDO TORRES-CERVANTES**, Laboratorio de Ecología, Unidad de Biología, Tecnología, y Prototipos (UBIPRO), Universidad Nacional Autónoma de México. Av. de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de Méx. C.P. 54090, A.P. 314, México; email (ARB): raurelio@servidor.unam.mx.

FICIMIA HARDYI (Hooknose Snake). **REPRODUCTION**. Nothing is known about reproduction in *Ficimia hardyi*, a recently described snake from northern Hidalgo state, México (Mendoza-Quijano and Smith 1993. J. Herpetol. 27:406–410). On 15 March 1997, Carlos Gómez collected a gravid female *F. hardyi* that was deposited in Colección Nacional de Anfibios y Reptiles del Instituto de Biología, Universidad Nacional Autónoma de México (IBH-12454). The snake was caught in chaparral (1850 m elevation) at the San José de las Flores Ranch, ca. 17.5 km N of Guadalcázar, San Luis Potosí, México (22°44'17"N, 100°23'24"W). The female (276.0 mm SVL, 19.0 g) contained four eggs, which measured (mean ± SE): 14.2 ± 0.37 mm length; 6.1 ± 0.09 mm width; 0.31 ± 0.014 g. Relative clutch mass was 0.070 (Vitt and Price 1982. Herpetologica 38:237–255). This is the first record of reproduction in this species.

We thank Héctor Hernández for his support of this study, Hobart Smith for sending us literature, Armando Borgonio, Marcelino Espinosa, José Avila, and the authorities of the region for their logistic help, and Carlos Gómez and Rolando Bárcenas for their support in the field. Funding for this study was provided by CONABIO project # R045/98.

Submitted by **XÓCHITL HERNÁNDEZ-IBARRA**, **AURELIO RAMÍREZ-BAUTISTA**, and **RICARDO TORRES-CERVANTES**, Laboratorio de Ecología, Unidad de Biología, Tecnología, y Prototipos (UBIPRO), Universidad Nacional Autónoma de México. Av. de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, C.P. 54090, A.P. 314, México; email (XH): xrgjthic@servidor.unam.mx.

HAPSIDOPHRYS SMARAGDINUS (Emerald Snake). **EGGS.** Until now, there have been only two published accounts of egg-related data for *Hapsidophrys smaragdinus*. Schmidt (1923. Bull. Am. Mus. Nat. Hist. 49:1–146) records that a female *H. smaragdinus* collected in April 1914 in "Belgian Congo" contained three elongate eggs, 56 x 12 mm. Pitman (1974. A Guide to the Snakes of Uganda. Wheldon & Wesley, London. 294 pp.) records that a Ugandan specimen contained eggs 30 x 7 mm, but does not record their number or the time of year. Here, I report the number of eggs found in a third *H. smaragdinus*.

On 28 April 1986, a female *H. smaragdinus* was killed inside a house on the Southern Baptist Mission compound in Congotown, an area in the city of Monrovia, Liberia. The specimen, 87.5 cm total length, was brought to me. Dissection revealed that it was gravid with two eggs. I did not record their dimensions, but photographs of the specimen show that the eggs were about four times as long as wide, as in the previous reports of this species.

I thank Bob and Joan Juday for providing the specimen.

Submitted by **PHIL SENTER**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

PHILOTHAMNUS HETERODERMUS (NCN). **DEFENSE.** Several species of the colubrid snake genus *Philothamnus* are known to inflate the neck when harassed (Marais 1992. A Complete Guide to the Snakes of Southern Africa. Krieger Publishing Company, Malabar, Florida. 208 pp.). Here, I record this behavior for the first time in *Philothamnus heterodermus*.

On 16 April 1987, I collected a live *P. heterodermus*, 58 cm total length, from a brush pile on the edge of a swamp behind House 4 of Area J, Yekepa, Nimba Co., Liberia. The snake was kept in a wood and screen cage for 44 days, after which it escaped. When first approached, the snake would cease motion. If further disturbed, it would inflate its throat, exposing black interstitial skin and a bright yellow spot on each dorsal scale. Each dorsal scale was green except for the yellow dot, which was covered by the adjacent scale when the neck was not inflated. Neck inflation thus transformed a solid green snake into a three-colored snake, as in *P. irregularis* and the closely-related *Hapsidophrys smaragdinus* (Senter 1999. Herpetol. Rev. 30:142). When handled, the snake bit. Dunger (1973. The Nigerian Field 38:158–180) records that the dorsal scale spots of *P. heterodermus* may be yellow in some specimens, but sky-blue or greenish blue in others.

Submitted by **PHIL SENTER**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

PYTHON SEBAE (African Rock Python). **CAUDAL DISPLAYS.** Previous authors have recorded that *Python sebae* employs a defensive display which involves coiling the tail into a flat disk (Starin and Burghardt 1992. The Snake 24:50–62; Stemmler 1970. Salamandra 7:137–142). I have observed juvenile *P. sebae* exhibiting two different tail displays. These observations were made in the town of Yekepa, Nimba County, Liberia.

The first observation involved a captive snake that was crawling rectilinearly on a concrete porch when approached by a pet cat. The cat patted the snake's tail with a forepaw, and, in response, the python gathered its body together, drew its neck into an S-coil, ballooned its body to about twice its normal girth, and vibrated its tail violently in front of its face in the manner of a rattlesnake. Twice, the cat batted the python's vibrating tail with a forepaw. In response to each tail-batting, the python struck at the cat, though the cat jumped back too quickly to be bitten. After the second strike, the owner seized the snake and put it in its cage.

The snake was 66 cm in total length, just 5 cm longer than the average hatchling length given by Pitman (1974. A Guide to the Snakes of Uganda. Wheldon & Wesley, London. 290 pp.). The young age implied by the size of the snake suggests that its tail display behavior was innate, not learned, a suggestion that is supported by the owner's assertion that this was the snake's first contact with this cat. It is possible the captive snake was exhibiting behavior that a wild *P. sebae* might not exhibit. However, the snake had not been in captivity very long; according to the owner, it had been found in the bush in Montserrado Co., Liberia, only a few days before the incident.

Rapid tail vibration as an anti-predator device is widespread among caenophidians, especially colubrids and crotalines (Greene 1988. *In* Gans and Huey [eds.], Biology of the Reptilia Vol. 16, Ecology B, Defense and Life History, pp. 1–152. Alan R. Liss, New York, New York). Often, the tail is vibrated against some substrate, in order to produce a buzzing noise. This behavior has been interpreted as a means of avoiding being trampled by ungulates, or as a means of distracting a predator's attention from the snake's head (Greene, *op. cit.*). The scene which I report above suggests the latter interpretation for this behavior in *P. sebae*.

The second behavior was observed in two sibling *P. sebae* hatched in captivity at Steiner Zoo, Monrovia, Liberia. On several occasions during 1986–1988, I observed these two snakes wagging their tails as they crawled rectilinearly on the same porch. A stimulus for the tail-wagging was not apparent. The tail-wagging of these two pythons was slow and sinuous, as in the prey-luring tail-wag of *Chondropython viridis* (Murphy et al. 1978. J. Herpetol. 12:117–119). However, the *P. sebae* were not stationary, and it is therefore doubtful that they were attempting to lure prey.

The tails of snakes which caudally lure prey tend to have a color which differs from that of the rest of the body (Murphy et al., *op. cit*; Neill 1960. Quart. J. Florida Acad. Sci. 23:173–200). This contrast apparently helps to draw attention to the tail when the tail is moving. In *P. sebae*, the tail exhibits the same colors as the rest of the body, but its pattern is different. The tail of *P. sebae* exhibits a bold golden-yellow stripe which is set off by a dark brown border, while the snake's back exhibits a cryptic chain of dark brown blotches on a tan background. Though caudal luring has not been reported in this species, the boldness of the striped tail pattern and its contrast with the pattern on the rest of the body may function to fix a predator's attention on the tail. Such diversionary tail displays are recorded for members of most snake families (Greene, *op. cit.*).

I thank the owner of the pythons for access to them for observation.

Submitted by **PHIL SENTER**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: beccafaye@worldnet.att.net).

SALVADORA GRAHAMAE LINEATA (Texas Patchnose Snake). **DIET**. Nothing is known about the food habits of *Salvadora grahamae lineata* in the wild. On 25 March 1997, we collected an adult male (Colección Nacional de Anfibios y Reptiles del Instituto de Biología, Universidad Nacional Autónoma de México, IBH-12453) *Salvadora grahamae lineata* (573 mm SVL, 129.5 mm tail length, 31.0 g) under a rock in grassland habitat on the road between Las Lagunas and La Noria de las Flores (22°40'46"N, 100°24'52"W, 2200 m elevation), San Luis Potosí, México. Dissection of the stomach revealed an adult *Sceloporus scalaris scalaris* (ca. 45 mm SVL, 5 g). The lizard was almost incomplete because of digestion. This is the first record of *Salvadora grahamae lineata* feeding on *Sceloporus scalaris scalaris* .

We thank the people of the region for their tremendous help during the field work. This study was supported by CONABIO Project No. R045/98.

Submitted by **AURELIO RAMÍREZ-BAUTISTA**, **XÓCHITL HERNÁNDEZ-IBARRA**, and **RICARDO TORRES-CERVANTES**, Laboratorio de Ecología, Unidad de Biología, Tecnología, y Prototipos (UBIPRO), Universidad Nacional Autónoma de México. Av. de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, C.P. 54090, A.P. 314, México; e-mail [ARB]: raurelio@servidor.unam.mx.

THAMNOPHIS CYRTOPSIS CYRTOPSIS (Western Blackneck Garter Snake). **BROOD SIZE**. Up to now nothing is known on reproduction of *Thamnophis cyrtopsis cyrtopsis* from México (Fitch 1970. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 52:1–214; Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman, Oklahoma. 332 pp.). However, in *Thamnophis* from Texas, Arizona, and New Mexico brood sizes range from 3–22 young (Fitch, *op. cit.*; Rossman, *op. cit.*; Degenhardt et al. 1996. Amphibians & Reptiles of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 430 pp.). On 29 May 1999 at El Oro, Muncipality of Guadalcázar, San Luis Potosí, México, we captured a pregnant female *T. c. cyrtopsis* among rocks in chaparral-grassland (1800 m elevation). The snake was deposited in Colección Nacional de Anfibios y Reptiles del Instituto de Biología, Universidad Nacional Autónoma de México (IBH-12457). The snake (542 mm SVL, 207.7 mm tail length, 138.0 g) contained 9 well-developed embryos and 5 atretic follicles. Measurements of the embryos (mean ± SE, range) are as follows: mass 2.531 ± 0.138 g, 2.022–3.264, total length 19.6 ± 1.035 mm, 15.6–25.3. The relative litter mass (Vitt and Price. 1982. Herpetologica 38:237–255) was 0.1977.

We thank Hobart M. Smith for his tremendous help on this note, and Armando Borgonio, Marcelino Espinosa, and the authorities of the region for their logistic help. Funding for this study was provited by CONABIO Project No. R045/98.

Submitted by **AURELIO RAMÍREZ-BAUTISTA**, **XÓCHITL HERNÁNDEZ-IBARRA**, **RICARDO TORRES-CERVANTES**, Laboratorio de Ecología, Unidad de Biología, Tecnología, y Prototipos (UBIPRO), Universidad Nacional Autónoma de México. Av. de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Estado de México, C.P. 54090, A.P. 314, México, and **HÉCTOR HERNÁNDEZ-MACÍAS**, Instituto de Biología, Universidad Nacional Autónoma de México, A.P. 70-153 C.U., C.P. 04510, México 20, Distrito Federal, México; email (ARB): raurelio@servidor.unam.mx.

TYPHLOPS DECORSEI (Decorse's Blind Snake). **MAXIMUM LENGTH**. Mocquard (1901. Bull. Mus. Natl. Hist. Nat. 7:251–255) reported a length of 455 mm for the holotype of *Typhlops decorsei*. Guibé (1958. Mém. Inst. Sci. Madagascar 12A:189–260) and Glaw and Vences (1994. A Field Guide to the Amphibians and Reptiles of Madagascar, 2nd ed. Privately Published. 350 pp.) list 455 mm as the maximum length. In January 1995, Frank Glaw collected and identified a *T. decorsei* at Kirindy (20°57'S, 44°13'E, 229 m), N Toliara Prov., W Madagascar that measures 600 mm in total length (preserved). This is a record size *T. decorsei* and the longest typhlopid known from Madagascar. The specimen is deposited in the Museum Alexander Koenig, Bonn, Germany (ZFMK 59793); identification was confirmed by Wolfgang Böhme.

Submitted by **VAN WALLACH**, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138, USA; e-mail: vwallach@oeb.harvard.edu.

TYPHLOPS TASYMICRIS (Grenada Blind Snake). **MAXIMUM LENGTH** and **SECOND KNOWN SPECIMEN**. *Typhlops tasymicris* (Thomas 1974. Occ. Pap. Mus. Zool. Louisiana St. Univ. 46:1–5) has been known solely from the female holotype (Florida Museum of Natural History, Gainesville, UF/FSM 21547). A second and larger specimen (Museum of Vertebrate Zoology, Berkeley, MVZ 84060) from Pearl's Airport, St. Andrew Parish, Grenada (12°08'N, 61°37'W, elevation < 8 m), collected by J. F. Lynch (Field no. Y-25369) on 22 July 1968, was recently identified. It represents a range extension of 12 km NNW from the type locality. It agrees in most respects with the type specimen (20-20-20 scale rows, nasal divided, inferior suture contacting second supralabial, lacking postnasal concavity, one postocular, T-III supralabial imbrication pattern, parietals and occipitals transversely enlarged, 13 middorsal rows pigmented). Relevant data differing from the type are as follows (that of holotype given parenthetically): total length 196 (181) mm, tail length 2.5 (2.6) mm, tail/total length ratio 1.3% (1.4%), subcaudals 7 (5), total length/midbody diameter ratio 43.6 (47.6), and rostral/head width 0.5 (0.4). The specimen has only two teeth evident on each maxilla (possibly a third tooth has been shed on each side) and 3/5 undeveloped follicles are present in the left/right ovary.

I thank Emily N. Taylor and J. A. Rodríguez-Robles for loan of the specimen and permission to examine its viscera.

Submitted by **VAN WALLACH**, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138, USA; e-mail: vwallach@oeb.harvard.edu.

UROMACERINA RICARDINII (Vine Snake). **PREDATION AND PREY**. Vine snakes display morphological features related to arboreal habits, including a very slender body and long tail (Henderson and Bider 1980. Milwaukee Publ. Mus. Contr. Biol.

(Henderson and Bider 1980. Milwaukee Publ. Mus. Contr. Biol. Geol. 37:1–38). All vine snakes are primarily arboreal and feed mainly on lizards (Henderson and Bider, *op. cit.*). *Uromacerina ricardinii* is a cryptically colored vine snake that occurs mainly in the Atlantic Forest in southeastern Brazil (Cunha and Nascimento 1982. Bol. Mus. Par. Emilio Goeldi, n.s. Zool. 113:1–9). Amaral (1978. Serpentes do Brasil. Melhoramentos/Univ. São Paulo, Brazil, 246 pp.) mentions that *U. ricardinii* is arboreal and preys on lizards. Here, I report the gut contents of the three specimens housed in the collection of the Instituto Butantan (IB), and an observation of predation on this snake.

An adult female (IB 42061, 40.5 mm SVL, 33 mm tail length) contained one semi-digested treefrog (*Hyla* sp.). Another female (IB 34412, 435 mm SVL, 360 mm tail length) contained the legs of a hylid treefrog. A third snake (IB 45178, 315 mm SVL, 305 mm tail length) had insect remains in its hindgut, possible due to secondary ingestion. One adult male (IB 25120, 420 mm SVL, 325 mm tail length) collected by W. Grantsau was found in the stomach of a mantled hawk (*Leucopternis polionota*). This forest hawk is reported to feed on arthropods and small snakes (Sick 1984. Ornitologia Brasileira, vol I, Editora UNB, Brasil, 481 pp.). The data here do not support the assertion of Amaral (*op. cit.*) that this snake is a lizard specialist. At the very least, *U. ricardinii* also regularly preys on hylids. Additionally, despite its camouflage, *U. ricardinii* at least occasionally falls prey to forest hawks.

I thank I. Sazima for reviewing the manuscript.

Submitted by **OTAVIO A. V. MARQUES**, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brazil, 1500, CEP 05503-900, São Paulo, SP, Brazil (e-mail: otaviomarques@originet.com.br).

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 31, Number 1 (March, 2000).

GYMNOPHIONA

CAECILIA TENTACULATA (Linnaeus' Caecilian). PERU: UCAYALI: Provincia Atalaya: Bolognesi (10°06'S, 73°49'W, 230 m elev.). 29 January 1999. E. Lehr. Museo de Historia Natural de San Marcos (MHNSM 20462). Verified by Javier Icochea. First record for state of Ucayali (Rodríguez et al. 1993, Publ. Mus. Hist. Nat. UNMSM [A] 45:1–22).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany (e-mail: elehr@sng.uni-frankfurt.de).

CAUDATA

AMPHIUMA TRIDACTYLUM (Three-toed Amphiuma). USA: LOUISIANA: Vernon Parish: Fort Polk Military Reservation area; 2.5 mi NE jct Lookout Road and Fullerton Road. 8 May 2000. Beau B. Gregory and Jim Johnson. Seale Museum of Louisiana, McNeese State University (SML 9323). Verified by Steve Shively. First parish record; fills gap between Beauregard and Natchitoches Parishes as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **BEAU B. GREGORY**, Environmental and Natural Resource Management Division, Directorate of Public Works, Fort Polk, Louisiana, 71459, USA.

ANURA

ACRIS CREPITANS BLANCHARDI (Blanchard's Cricket Frog). USA: INDIANA: Fayette Co: Mary Gray Bird Sanctuary (39°35'03"N, 85°13'44"W). 22 October 1999. Laura Leininger. FMNH 257846–847. Verified by M. J. Lannoo. Two males captured on mudbank of a semipermanent wetland. New county record. (Minton 2000, Amphibians and Reptiles of Indiana. Second Ed., in press).

Submitted by **LAURA LEININGER** and **PRIYA NANJAPPA**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

ACRIS CREPITANS BLANCHARDI (Blanchard's Cricket Frog). USA: INDIANA: Grant Co: privately owned, humanmade wetland (40°29'29"N, 85°28'03"W). 20 October 1999. Priya Nanjappa. FMNH 257848–849). Verified by M. J. Lannoo. A male and a female captured near edge of wetland. New county record (Minton 2000, Amphibians and Reptiles of Indiana. Second Ed., in press).

Submitted by **PRIYA NANJAPPA** and **LAURA LEININGER**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

ALSODES GARGOLA. ARGENTINA: CHUBUT: Departamento Cushamen: La Hoya, Cordón de Esquel (42°50'42"S, 71°15' 5"W), ca. 1420 m elev. 29 January 2000. Carmen Úbeda. Facultad de Ciencias Naturales y Museo de La Plata, Buenos Aires, Argentina (MLP A. 1691). Verified by Néstor G. Basso. Juvenile male (SVL 35.7 mm). Found under a rock, at the edge of a cold, crystalline mountain stream where *A. gargola* tadpoles of different sizes were common. Species is endemic to northwestern Argentinian Patagonia, and has been recorded from a few localities between the volcanic tablelands of Lonco Luan, province of Neuquén (38°52'S, 70°34'W) and Cerro Catedral, province of Río Negro (41°12'S, 71°29'W) (Cei, 1980, Amphibians of Argentina. Monit. Zool. Ital. [N.S.], Monogr. 2:1–609). Specimen represents the first province record; extends known range ca. 182 km air line S from previously southernmost vouchered record at Cerro Catedral (Gallardo 1970, Neotropica 16[50]:73–85).

Submitted by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Provincia de Río Negro, Argentina.

EUSPONDYLUS GOELETI. VENEZUELA: AMAZONAS: Cumbre del Cerro Autana (04°51'40"N, 67°27'06"W), 1350 m elev. 14 April 2000. Mark Moffet and Oswaldo Fuentes. Museo de Biología, Universidad Central de Venezuela (MBUCV 7114).

Verified by César Molina. Second known specimen for this recently described species, previously recorded only from the type locality on Cerro Yavi, Amazonas, Venezuela (Myers and Donnelly 1996, Am. Mus. Novitates 3172:1–56). Collected between the 1100–1200 h within a terrestrial plant (*Brocchinia tate*); extends distribution 190 km SW from the type locality.

Submitted by **OSWALDO FUENTES**, Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041-A, Venezuela (e-mail: ofuentes@tyto.ciens.ucv.ve) and **GILSON RIVAS FUENMAYOR**, Fundacion La Salle de Ciencias Naturales, Estacion de Investigaciones Agrope-cuarias, Avenida Bolívar 20-1219, San Carlos 2201, Estado Cojedes, Venezuela (e-mail: gilsonrivas@mixmail.com).

HYLA VERSICOLOR (Eastern Gray Treefrog). USA: WISCONSIN: Crawford Co: Lynxville, from under bark of a Honey Locust Tree (*Gleditsia triacanthos*), Sec. 23, T9N, R6W. 3 June 2000. Harlan D. Walley. HDW-NIU 1678–9. Verified by Kristin Stanford. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Interim Report Wisconsin Herpetological Atlas Project, Milwaukee Public Museum. 87 pp.).

Submitted by **HARLAN D. WALLEY** and **JODI SCALLETA**, Deparmtent of Biology, Northern Illinois, Dekalb, Illinois 60115, USA.

LALIOSTOMA LABROSUM. MADAGASCAR: ANTSIRANANA: Montagne des Français, 20 m elev. (12°18'44" S, 49°20'17" E). 13–16 March 2000. M. Vences, F. Glaw, and K. Schmidt. Zoologische Staatssammlung München (ZSM 500/2000 and 501/2000) and Université d'Antananarivo, Département de Biologie Animale (UADBA, four specimens). Verified by Wolfgang Böhme. First record in the biogeographic region of northern Madagascar. Extends range 185 km northwards (Glaw and Vences 1992, A Fieldguide to the Amphibians and Reptiles of Madagascar. Köln. 331 pp.). Confirms earlier, questionable records (Mocquard 1895, Bull. Soc. Philom. Paris Ser. 8, 7:112–136; Guibé 1978, Bonn. Zool. Monogr. 11) which were not accepted by Blommers-Schlösser and Blanc (1991, Faune de Madagascar 75:1–379) and subsequent authors.

Submitted by **MIGUEL VENCES**, Muséum National d'Histoire Naturelle, Laboratoire des Reptiles et Amphibiens, 25 Rue Cuvier, F-75005 Paris, France, and **FRANK GLAW**, Zoologische Staatssammlung, Münchhausenstrasse 21, D-81247 München, Germany.

LIMNONECTES HASCHEANUS (Hill-forest Frog). MALAYSIA: PENINSULAR MALAYSIA: Pahang: Pulau Tioman (02°35'N, 104°15'E). 27 June 1985. J. Counsilman. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.3008, SVL 19.4 mm; ZRC.1.3009, SVL 26.1 mm); 22 June 1999. Peter K. L. Ng. (ZRC.1.4078, SVL 25.3 mm). All verified by Kelvin K. P. Lim. New island record; increases the amphibian checklist of Pulau Tioman to 21 species, instead of 20 as previously reported (Lim and Lim 1999, Raffles Bull. Zool. Suppl. No. 6:131–155).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

LIMNONECTES PARAMACRODON (Masked Swamp Frog). MALAYSIA: PENINSULAR MALAYSIA: Johor: swamp forest at foothills of Gunong Panti (01°51'N, 103°56'E). 20 September 1990. Peter K. L. Ng, K. S. Boon, and Kelvin K. P. Lim. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.2901, SVL 37.1 mm; ZRC.1.2902, SVL 42.8 mm, ZRC.1.2903, SVL 52.2 mm; ZRC.1.2904, SVL 42.9 mm). All verified by Kelvin K. P. Lim. New state record (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.), and southward extension of range into the peninsula.

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

LEPTOBRACHIUM NIGROPS (Black-eyed Leaflitter Frog). INDONESIA: SOUTH KALIMANTAN: Banjarmasin: stream 55 km from Martapura on Rantau-Martapura road (03°08'S, 115°11'E). 6 June 1996. Heok Hee Ng & Oliver K. S. Chia. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.1.4617–22, 6 larvae, Gosner stages 37–43, total lengths 39.4-51.1 mm). Verified by Kelvin K. P. Lim. New country record; eastward extension of distribution in Borneo, apart from Sarawak (Inger and Stuebing 1997, A Field Guide to the Frogs of Borneo. Natural History Publications, Kota Kinabalu, Sabah, Malaysia. ix + 205 pp.). Outside of Borneo, the species is also found in Peninsular Malaysia and Singapore (Berry and Hendrickson 1963, Copeia 1963:643–648).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

LEPTOTYPHLOPS UNGUIROSTRIS. ARGENTINA: FORMOSA: Departamento Ramón Lista, Lote 8 (22°50'25"S, 62°16'30"W). 12 January 2000. L. Lanari and A. López. Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina (MACN 37084). Verified by Gustavo Couturier. First province record and northernmost locality for the species; extends range 170 km NE of nearest previous record (Kretzschmar 1996, Acta Zool. lilloana 43[2]:275–279).

Submitted by **LAURA LANARI**, Museo Argentino de Ciencias Naturales, Sección de Herpetología, Avenida Angel Gallardo 470 (1405), Buenos Aires, Argentina (e-mail: tandra@ciudad.com.ar) and **ARIEL LOPEZ**, García Lorca 434 1° "A" (1405), Buenos Aires, Argentina (e-mail: wichiku@hotmail.com).

OSTEOCEPHALUS AYARZAGUENAI: VENEZUELA: ESTADO AMAZONAS: Makrapiwei, Upper Orinoco (2°10'N, 65°10'W). 130 m elev. March 1989. H. Magdefrau. Museo de Biología, Universidad Central de Venezuela, Caracas (MBUCV 6632). Verified by Gilson Rivas. First state record and second known specimen of the taxon. Extends distribution from type locality (Valle del Río Karuay, Estado Bolívar, 5°20'N, 61°54'W; Gorzula and Señaris 1996, Acta Biol. Venezuela 16[4]:19–22) 470 km to the SW.

Submitted by **CÉSAR LUIS BARRIO**, Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com) and **OSWALDO FUENTES**, Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041, Venezuela (e-mail: ofuentes@tyto.ciens.ucv. ve).

PHRYNOGLOSSUS MARTENSII (Paddyfield Puddle Frog). MALAYSIA: PENINSULAR MALAYSIA: KEDAH: stream ca. 3 km from Universiti Utusan Malaysia on Sintok Padang Senai road (06°27'N, 100°32'E). 19 February 1997. Heok Hee Ng. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.4165, SVL 18.9 mm); PULAU LANGKAWI: Sungei Tarom, (06°22'N, 99°46'E). 4 December 1960. Collector unknown. ZRC.1.4366, SVL 27.8 mm. Both verified by Kelvin K. P. Lim. Previously unrecorded from Peninsular Malaysia (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.); southward extension of distribution. Verifies occurrence of species in the country (Kiew 1984, Malaysia Nat. J. 37[4]:6–10.). New island record for Langkawi.

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

PHYLLOMEDUSA BICOLOR (Giant Monkey Frog). PERU: UCAYALI: PROVINCIA ATALAYA: Bolognesi (10°06'S, 73°49'W, 230 m elev.). 22 January 1999. E. Lehr. Natur-Museum und Forschungs-Institut Senckenberg (SMF 80369). Verified by Gunther Köhler. First record for state of Ucayali (Rodríguez et al. 1993, Publ. Mus. Hist. Nat. UNMSM [A] 45:1–22).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany, (e-mail: elehr@sng.uni-frankfurt.de) and **CESAR AGUILAR**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

PIPA PARVA. VENEZUELA: ESTADO TACHIRA: 8 km from La Grita. 28 August 1969. L. Duque and R. Ampueda. Museo de Biología, Universidad Central de Venezuela, Caracas (MBUCV 6634). Verified by Gilson Rivas. First state record and southernmost for the country; fills distribution gap between the other known localities in Venezuela (Barrio 1998: Acta Biol. Venezuela 18[2]:59) in the north and northeast, and known localities in Colombia (Cochran and Goin 1970, U.S. Natl. Mus. Bull. 288:9).

Submitted by **CÉSAR LUIS BARRIO**, Fundación AndígenA, Apartado Postal 210, Mérida 5101-A, Venezuela (e-mail: cesarlba@yahoo.com), and **OSWALDO FUENTES**, Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041, Venezuela (e-mail: ofuentes@tyto.ciens. ucv.ve).

POLYPEDATES MACROTIS (Dark-eared Treefrog). INDONESIA: MENTAWEI ISLANDS: Siberut Island (01°30'S, 99°5'E). September 1924. Collector unknown. Raffles Museum of Biodiversity Research: Zoological Reference Collection (ZRC.1.1014, SVL 44.5 mm). Verified by Kelvin K. P. Lim. Previously misidentified as *Rhacophorus* or *Polydedates leucomystax*. New island record and westward extension of distribution. Elsewhere, species occurs in Borneo, Philippine Islands, Natuna Islands, Sumatra, and Peninsular Malaysia (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.; Inger and Tan 1996, Raffles Bull. Zool. 44[2]:551–574).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: ILLINOIS: DEKALB CO: Mayfield Twp. (Sec. 21, T41N, R4E). 21 April 2000. Wilkinson-Renwick marsh edge observation by KS on 20 June 2000, and voucher specimen collected by HDW. HDW-NIU 1678. Verified by Dale Saar. New county record; range extension from the closest localities in Ogle County and an earlier observation in Winnebago County (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298; Phillips et al. 1999, Illinois Nat. Hist. Surv. Manual 8:1–282.

Submitted by **HARLAND D. WALLEY** and **KRISTIN STANFORD**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

RANA MIOPUS (Three-striped Frog). MALAYSIA: PENINSULAR MALAYSIA: TERENGGANU: Sekayu Waterfalls (04°58'N, 102°58'E). 18 March 1992. Peter K. L. Ng et al. Raffles Museum of Biodiversity Research, Zoological Reference Collection (ZRC.1.3063, SVL 41.7 mm). Verified by Kelvin K. P. Lim. New state record (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

SCAPHIOPUS HOLBROOKII HURTERII (Hurter's Spadefoot). USA: LOUISIANA: Vernon Parish: Fort Polk Military Reservation area, 0.5 mi W jct. Artillery Road and Cole Road. 3 April 2000. Dave E. Plair and Ken Moore. Seale Museum of Louisiana, McNeese State University (SML 9322). Verified by Jeff Boundy. First parish record; extends distribution south from Sabine and Natchitoches Parishes and west from Rapides Parish as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **BEAU B. GREGORY**, Environmental and Natural Resource Management Division, Directorate of Public Works, Fort Polk, Louisiana 71459, USA.

TELMATOBIUS CARRILLAE (Ancash Water Frog). PERU: HUANUCO: PROVINCIA DOS DE MAYO: Baños, Caserio de Rio Blanco (10°05'S, 76°46'W, 4000 m elev.). 14 October 1998. E. Lehr. Natur-Museum und Forschungs-Institut Senckenberg (SMF 80531–38). Verified by Javier Icochea. First record for state of Huanuco and southernmost for Peru (Morales 1988, Revta Bras. Zool. 5:603–608; Rodríguez et al. 1993, Publ. Mus. Hist. Nat. UNMSM [A] 45:1–22).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de) and **EMILIO FUENTES**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

TESTUDINES

APALONE SPINIFERA SPINIFERA (Eastern Spiny Softshell). USA: NORTH CAROLINA: ROCKINGHAM CO: 4 km SW Stoneville

near Mayo River. 8 September 1998. F. Gann and T. Martin. North Carolina State Museum of Natural Sciences (NCSM 60382). Verified by William M. Palmer. New county record. First record for Roanoke (Dan) River drainage (Palmer and Braswell 1995, Reptiles of North Carolina. Univ. North Carolina Press, Chapel Hill. xiii + 412 pp.). May represent an introduction; survey work should be undertaken to verify the presence of a native population in this drainage. The specimen, an adult male, is apparently also of record size, measuring 310 mm CL. Conant and Collins (1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Exp. Houghton Mifflin Co., Boston, Massachusetts. xviii + 616 pp.) reported a maximum size of 235 mm.

Submitted by **ANN B. SOMERS**, Department of Biology, P.O. Box 26174, University of North Carolina at Greensboro, Greensboro, North Carolina 27402-6174, USA, **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, Research Laboratory, 4301 Reedy Creek Road, Raleigh, North Carolina 27607, USA and **DENNIS W. HERMAN**, North Carolina State Museum of Natural Sciences, 11 West Jones Street, Raleigh, North Carolina 27601, USA.

CHELYDRA SERPENTINA (Common Snapping Turtle). USA: FLORIDA: Franklin Co: St. George Island, St. George Island State Park. 7 January 2000. L. K. Irwin and K. J. Irwin. Verified by Joseph T. Collins. KU Color Slide 11774. Adult photographed while basking in fresh water pond, directly adjacent to bay side of coastal dunes. First record for St. George Island and Apalachicola Bay Barrier Islands (Blaney 1971, Herpetologica 27:406–430; Means 1974, *In* Livingston et al. [eds.], St. George Island: Biota, Ecology, and Management Program for Controlled Development. Rept. Develop. Regional Impact Franklin County Commission).

Submitted by **LISA K. IRWIN**, Clemson Institute of Environmental Toxicology, 509 Westinghouse Road, Pendleton, South Carolina 29670, USA, and **KELLY J. IRWIN**, Arkansas Game & Fish Commission, Nongame Aquatics Program, 915 East Sevier Street, Benton, Arkansas 72015, USA (e-mail: kirwin@agfc.state.ar.us).

CHELYDRA SERPENTINA (Common Snapping Turtle). USA: WISCONSIN: Green Co: Brodhead, Route 11 at jct. with Sugar River, Decatur Twp., Sec 11 T1N, R10E. 4 June 2000. Harlan D. Walley. HDW-NIU 1680. Verified by Dayle Saar. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Interim Report Wisconsin Herpetological Atlas Project, Milwaukee Public Museum. 87 pp.).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois, Dekalb, Illinois 60115, USA.

GRAPTEMYS GEOGRAPHICA (Common Map Turtle). USA: WISCONSIN: Crawford Co: Spring Lake, Ambrough Slough. Sec. 36, T96N, R3W. 21 June 2000. Harlan D. Walley and William Peterson. HDW-NIU 1681. Verified by Joseph T. Collins. Gravid female, DOR. Casper (1997, Herpetol. Rev. 28:216) cited a USNM specimen collected from Crawford County, Prairie du Chien, in August 1927. The specimen reported herein represents the first record from the county since the 1927 record, and verifies its presence there.

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

PHRYNOPS VANDERHAEGEI (Vanderhaege´s Toadhead Turtle). ARGENTINA: MISIONES: Departamento Capital: Villa Lanus, Posadas (27°27'S, 55°53'W). 15 September 1992. D. Baldo. Herpetological collection of Fundación Miguel Lillo, Tucumán, Argentina (FML 09381). Verified by E. Richard. First voucher specimen with precise locality for Misiones province and second record from Argentina, where its presence was previously reported by Iverson 1986 (A Checklist with Distribution Maps of the Turtles of the World. Privately printed. Richmond, Indiana. 229 pp.) and Waller and Chébez (1987, Hist. Nat. 7:56).

Submitted by **DIEGO BALDO** and **ERNESTO KRAUCZUK**, Laboratorio de Citogenética General, Departamento de Genética, Facultad de Ciencias Exactas Químicas y Naturales, Universidad Nacional de Misiones, Félix de Azara 1552, 3300 Posadas, Misones, Argentina (e-mail: diegobaldo@hotmail.com).

PSEUDEMYS CONCINNA (Eastern River Cooter). USA: KENTUCKY: Muhlenberg Co: adult male alive on county road ca. 6.4 km ENE Central City, 0.4 km W Nelson and 1.5 km W Green River. 11 October 1999. Michael J. Lodato. CMNH Photo Voucher Accession 36628). Verified by John McGregor. New county record; confirms presence of this turtle in middle/lower reaches of Green River (John McGregor, pers. comm.).

Submitted by **MICHAEL J. LODATO** and **PATRICIA J. LODATO**, 925 Park Plaza Drive, Evansville, Indiana 47715, USA.

STERNOTHERUS ODORATUS (Common Musk Turtle). USA: KANSAS: Leavenworth Co: backwater 0.5 mi NE railroad crossing on Leavenworth County Road 1, N of Eudora, N38.9775, W95.0874. 12 June 2000. John Tollefson, David Edds and Kyle Edds. KU Color Slides 11775-776 (photographed by Suzanne L. Collins). Verified by Joseph T. Collins. First record for county (Collins 1993, Amphibians and Reptiles in Kansas. Third Edition. Univ. Press Kansas, Lawrence. xx + 397 pp.).

Submitted by **JOHN TOLLEFSON**, Department of Biological Sciences, Emporia State University, Emporia, Kansas 66801, USA.

LACERTILIA

CNEMIDOPHORUS SACKII (Sack's Spotted Whiptail). MEXICO: MEXICO: Municipality of Malinalco (18°52'N, 99°27'W), 1600 m. 6 July 1996. Rodolfo García Collazo, Claudia Valdespino Torres, Isabel Mercado, and Arturo Morales Gutiérrez. Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México. (IBH 12301–302). Verified by Aurelio Ramírez-Baustista. First record for the state of México: extends range 14 km S from the closest known locality in Coatlán del Río, Morelos (Castro y Aranda 1984, Estudio Preliminar sobre la Ecología de los Reptiles del Estado de Morelos. Tesis Licenciature, Escuela de Ciencias Biológicas, UAEM: 61).

Submitted by **CLAUDIA S. VALDESPINO** and **RODOLFO GARCÍA-COLLAZO**, Laboratorio de Zoología, Escuela Nacional de Estudios Profesionales Campus Iztacala, Universidad Nacional Autónoma de México, Avenida de los Barrios s/n, Los

Reyes Iztacala, Tlanepantla, Estado de México, Caixa Postal 54090, Apartado Postal 314, México.

HEMIDACTYLUS FLAVIVIRIDIS (Indian Leaf-toed Gecko). EGYPT: ISMAILIA PROVINCE: Ismailia City, Area No. 6 (30°35'41"N, 32°18'26"E). 8 July 1999. Adel A. Ibrahim. Museum National d'Histoire Naturelle, Paris (MNHN 2000.2509). Verified by Ivan Ineich. A subadult female (56 mm SVL) captured at 2130 h on the fence of the Suez Canal Authority Hospital, immediately adjacent to the Suez Canal. First record for Ismailia Province (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. 11:1–234). In Egypt, this species has been previously recorded from the city of Suez, the southern terminus of the Suez Canal, and Qusair on the Red Sea (Anderson 1898, Zoology of Egypt. Reptilia and Batrachia. Quaritch, London. Vol. I. 370 pp.).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt (e-mail: aibrahim@ismailia.ie-eg.com).

LIOLAEMUS FITZGERALDI. ARGENTINA: SAN JUAN: Calingasta Department: 130 km from city of San Juan on Quebrada de las Cortaderas, Río Castaño (30°57'S, 69°32'W). March 1999. J. C. Acosta, G. Ortiz, and F. Murúa. Herpetological Collection, Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 399–400). Verified by Luciano Avila. Extends the known range (Avila et al. 1998, Cuad. Herpetol. 12[1]:11–29) ca. 120 km NE of nearest locality (El Pachón, Calingasta Department, San Juan Province).

Submitted by **JUAN CARLOS ACOSTA**, **GRISEL ORTIZ**, and **FERNANDO MURÚA**, Departamento de Geofísica y Astronomía e Instituto y Museo de Ciencias Naturales, F. C. E. F. y N., Universidad Nacional de San Juan, Avenida España 400 (N), Caixa Postal 5400, San Juan, Argentina (e-mail [JCA]: jcacosta@impsat1.com.ar).

SCELOPORUS GADOVAE (Gadow's Spiny Lizard). MEXICO: MEXICO: Municipality of Malinalco (18°52'N, 99°26'W), 1580 m. 6 July 1996. Rodolfo García Collazo. Coleccíon Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México (IBH 12303–04); Municipality of Zumpahuacan (18°50'N, 99°33'W), 1850 m. 16 May 1997. Rodolfo García Collazo and Claudia S. Valdespino Torres. IBH 12305. Both verified by Aurelio Ramírez Bautista. First records for the state of México; extends range at least 15.5 km SW from the closest known locality in Coatlán del Río, Morelos (Castro y Arando 1984, Estudio Preliminar sobre la Ecología de los Reptiles del Estado de Morelos. Tesis Licenciatura, Escuela de Ciencias Biológicas, UAEM: 118).

Submitted by **CLAUDIA S. VALDESPINO** and **RODOLFO GARCÍA-COLLAZO**, Laboratorio de Zoología, Escuela Nacional de Estudios Profesionales Campus Iztacala, Universidad Nacional Autónoma de México, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlanepantla, Estado de México, Caixa Postal 54090, Apartado Postal 314, México.

STENODACTYLUS STHENODACTYLUS STHENODACTYLUS (Elegant Gecko). EGYPT: ISMAILIA PROVINCE: ca. 15 km SE Ismailia City (vicinity of Tosson), Ismailia-Suez Canal Highway, 30°29'38"N, 32°20'20"E. 1 May 2000. Adel A. Ibrahim. Museum National d'Histoire Naturelle, Paris (MNHN 2000.2511). Verified by Ivan Ineich. AOR adult female (53 mm SVL) collected at 2200 h. First record for Ismailia Province and the Suez Canal Zone (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. 11:1–234). Species is widely distributed in the eastern and western deserts of Egypt, desert margins of the Nile River, and the western coasts of the Gulf of Suez and the Gulf of Aqaba (Flower 1933, Proc. Zool. Soc. London 1[4]:735–851).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt (e-mail: aibrahim@ismailia.ie-eg.com).

TARENTOLA ANNULARIS ANNULARIS (Ringed Wall Gecko). EGYPT: ISMAILIA PROVINCE: ca. 1.5 km N Ismailia City, Suez Canal University Old Campus (30°36'19"N, 32°18'22"E). 16 July 1999. Adel A. Ibrahim. Museum National d'Histoire Naturelle, Paris (MNHN 2000.2510). Verified by Ivan Ineich. Adult female (85 mm SVL) captured from a building on campus at 2045 h. Species was subsequently found to inhabit all buildings of the Suez Canal University Old Campus. First province record (Saleh 1997, Amphibians and Reptiles of Egypt. Publ. National Biodiversity Unit. No. 11:1–234).

Submitted by **ADEL A. IBRAHIM**, Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, Suez Canal University, North Sinai, Egypt (e-mail: aibrahim@ismailia.ie-eg.com).

TUPINAMBIS RUFESCENS (Red Tegu). ARGENTINA: SAN JUAN: Caucete Department: 42 km from city of San Juan on Puesto de Narváez, Km 202, Ruta Nacional 141 (31°11'S, 68°10'W). December 1999. F. Gallego, P. F. Gomez, J. C. Acosta, and R. Martori. Herpetological Collection, Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 456, juv.). Verified by Ricardo Martori. Extends known range (Cei 1993, Mon. XIV Mus. Reg. Sci. Nat. Torino. 949 pp.) ca. 93 km W of nearest known locality (Marayes, Caucete Department, San Juan Province).

Submitted by **JUAN CARLOS ACOSTA** and **PABLO GOMEZ**, Departamento de Geofísica y Astronomía e Instituto y Museo de Ciencias Naturales, F. C. E. F. y N., Universidad Nacional de San Juan, Avenida España 400 (N), Caixa Postal 5400, San Juan, Argentina (e-mail [JCA]: jcacosta@impsat1. com.ar).

SERPENTES

GEOPHIS CHALYBEUS (Veracruz Earth Snake). MEXICO: VERACRUZ: Cerro Aquila, Municipality of Aquila (18°47'39"N, 97°18'27"W), 1800 m elev. Oak forest. 23 October 1998. Collected by Miguel Angel de la Torre Loranca. Estacion de Biología Tropical Los Tuxtlas (UNAM-LT 3337). Verified by Gonzalo Pérez-Higareda. First record with precise locality for the state of Veracruz; previous records were not accurate (Pelcastre-Villafuerte and Flores-Villela 1992, UNAM Publ. Esp. Mus. Zool. 4:25–96). This record is 90 km (airline) NNE (20°) from locality "Xalapa"

(Pérez-Higareda and Smith 1991, Ofidiofauna de Veracruz. Instituto de Biología, Universidad Nacional de México, Publicaciones Especiales 7:1–122).

Submitted by **MIGUEL A. DE LA TORRE-LORANCA** and **MARCO ANTONIO LÓPEZ-LUNA**, Centro de Investigaciones Herpetologicas de Veracruz A. C. Apartado Postal 473, Caixa Postal 95500, Cordoba, Veracruz, Mexico (e-mail: cihvac@correoweb.com), and **RICHARD C. VOGT**, Estacíon de Biología Tropical Los Tuxtlas, Apartado Postal 91, Caixa Postal 95700 San Andres Tuxtla, Veracruz, México (e-mail: dickturtle@aol.com).

HYDROPS TRIANGULARIS (Triangle Water Snake). VENEZUELA: COJEDES: Municipio Rómulo Gallegos: Asentamiento La Blanca, sector Rincón Moreno, SW San Carlos City (09°34'18"N, 68°37'14"W), 140–150 m elev. 1996 (date not recorded). Numa Hurtado. Museo de Biología, Universidad Central de Venezuela (MBUCV) 7117. Verified by César R. Molina. First state record and northernmost locality for the species. Widely distributed in South America, in northern cis-Andean regions of Colombia, Venezuela, Guyanas, Brazil, Bolivia, Peru, Paraguay, Ecuador, and the island of Trinidad (Kornacker 1999, Checklist and Key to the Snakes of Venezuela. PaKo-Verlag. 270 pp.). Only one subspecies (*H. t. venezuelensis)* has been described for Venezuela (Roze 1957, Acta Biol. Venezuela 2[8]:51–95). Specimen differs from this subspecies in having a higher subcaudal scale count (69 as compared to 37 in *H. t. venezuelensis*). In this respect, it is closer to *H. t. neglectus* from Trinidad and Guyana. Conversely, the presence of 46 black dorsal bands and 11 black caudal bands is similar to counts for *H. t. fasciatus* and *H. t. triangularis*. Due to this uncertainty of subspecific allocation, we prefer to use only the binomial, pending future detailed studies. Similar uncertainties in the recognition of subspecies in *Hydrops triangularis* based on current recognized characters have also been noted by other authors (e.g., Chippaux 1986, Les Serpents de la Guyane Française. Edition de l'ORSTOM. 165 pp.; Rufino 1999, Analisis Comparativa de *Hydrops triangularis triangularis* [Wagler, 1824] e *Hydrops triangularis fasciatus* [Gray, 1824]. V Congreso Latinoamericano de Herpetologia. Publ. Extra Mus. Nac. Hist. Nat. Montevideo- Uruguay 50:104).

Submitted by **GILSON RIVAS FUENMAYOR**, Fundación La Salle de Ciencias Naturales, Estación de Investigaciones Agropecuarias, Avenida Bolívar 20-1219, San Carlos 2201, Estado Cojedes, Venezuela (e-mail: gilsonrivas@mixmail.com), and **OSWALDO FUENTES**, Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041, Venezuela (e-mail: ofuentes@tyto.ciens.ucv.ve).

LAMPROPELTIS TRIANGULUM MULTISTRIATA (Pale Milk Snake). USA: NEBRASKA: Garden Co: 28.7 km N of Rt. 26 (by Road 181 from Oshkosh), 200 m W Road 181 (41°39'N, 102°21'W, elev. 1143 m) on rocky outcrops near Blue Creek. 30 July 1998. S. J. Converse. Florida Museum of Natural History (UF 120808). Verified by J. B. Iverson; 1.6 km SE of Windlass Hill, Ash Hollow State Park (two specimens). 16 May 1976. J. B. Iverson. UF 116210–211. Verified by K. L. Krysko. New county record (Lynch 1985, Tran. Nebraska Acad. Sci. 13:33–57).

Submitted by **SARAH J. CONVERSE**, Department of Fishery and Wildlife Biology, Colorado State University, Ft. Collins, Colorado, 80523-1474, USA, and **DEBRA S. BAKER**, Natural History Museum and Biodiversity Center, University of Kansas, Lawrence, Kansas 66045-2454, USA.

LEPTOTYPHLOPS ALBIFRONS (Wagler's Blind Snake). PERU: PASCO: Provincia Oxapampa: Pozuzo (10°04'S, 75°33'W, 770 m elev.). 30 April 1995. R. Cielos. Collection of the Centro de Salud San Camilo Pozuzo (PE 1169–71) and photograph vouchers Natur-Museum und Forschungs-Institut Senckenberg (SMF-F 220–22). Verified by Nelly Carrillo de Espinoza. First record for state of Pasco (Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49:1–27).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany (e-mail: elehr@sng.uni-frankfurt.de).

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). MEXICO: MEXICO: Municipality of Tenancingo (18°56'28"N, 99°36'W), 2000 m. 15 May 1997. Claudia S. Valdespino Torres. Coleccíon Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México. (IBH 11307). Verified by Aurelio Ramírez-Bautista. First record for the state of México. Specimen was found in recently turned earth near a flower market. Previously, Mexican records were based on specimens from introduced populations in Baja California Sur (Murphy and Ottley 1979, Herpetol. Rev. 104:119), Sinaloa, Michoacán, and Guerrero on the Pacific Coast, and inland from Querétaro and Morelos (Dixon and Hendricks 1979, Zool. Verhandelingen 173:1–39), Jalisco (Dundee and Flores-Villela 1991, Herpetol. Rev. 22:26), Veracruz (Mendoza et al. 1993, Herpetol. Rev. 24:110), Oaxaca (Mendoza and Rendón 1994, Herpetol. Rev. 25:34), Puebla (Eliosa et al. 1995, Herpetol. Rev. 26:110), Nuevo León (Alvarez and Lurillo 1996, Vert. Mexicana 2:1–2).

Submitted by **CLAUDIA S. VALDESPINO** and **RODOLFO GARCÍA-COLLAZO**, Laboratorio de Zoología, Escuela Nacional de Estudios Profesionales Campus Iztacala, Universidad Nacional Autónoma de México, Avenida de los Barrios s/n, Los Reyes Iztacala, Tlanepantla, Estado de México, Caixa Postal 54090, Apartado Postal 314, México.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). MEXICO: VERACRUZ: Municipality of San Andres Tuxtla (18°26'8"N, 95°12'58"W), 300 m elev. 15 November 1998. Collected by Miguel Angel de la Torre Loranca. Estacíon de Biología Tropical Los Tuxtlas (UNAM-LT 3338). Verified by Gonzalo Pérez-Higareda. Second record for the state and range extension of 128 km (airline) NW (307°) from Playa Mocambo (Mendoza-Quijano et al. 1993, Herpetol. Rev. 24:110).

Submitted by **MIGUEL A. DE LA TORRE-LORANCA** and **MARCO A. LÓPEZ-LUNA**, Centro de Investigaciones Herpetologicas de Veracruz A. C. Apartado Postal 473, Caixa Postal 95500, Cordoba, Veracruz, Mexico (e-mail cihvac@correoweb.com), and **RICHARD C. VOGT**, Estacíon de Biología Tropical Los Tuxtlas, Apartado Postal 91, Caixa Postal 95700 San Andres Tuxtla, Veracruz, México (e-mail: dickturtle@aol.com).

REGINA RIGIDA (Glossy Crayfish Snake). USA: FLORIDA: FRANKLIN Co: St. Vincent Island National Wildlife Refuge at jct. Roads D & 4. 14 January 2000. Thomas E. Lewis. Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas (MHP 6733). Verified by Travis W. Taggart. First record for island [Blaney 1971, Herpetologica 27:406–430].

Submitted by **THOMAS E. LEWIS**, St. Vincent National Wildlife Refuge, P.O. Box 447, Apalachicola, Florida 32329, USA, and **JOSEPH T. COLLINS**, The Center for North American Amphibians and Reptiles, 1502 Medinah Circle, Lawrence, Kansas 66047, USA.

TACHYMENIS PERUVIANA (Peru Slender Snake). PERU: HUANUCO: PROVINCIA PACHITEA: Chaglla (09°50'S, 75°54'W, 2980 m elev.). 18 August 1998. E. Lehr. Museo de Historia Natural de San Marcos (MHNSM 20062). Verified by Nelly Carrillo de Espinoza. First record for state of Huanuco (Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49: 1–27).

Submitted by **EDGAR LEHR** and **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail [EL]: elehr@sng.uni-frankfurt.de).

TAENIOPHALLUS AFFINIS (NCN). BRAZIL: ALAGOAS: Murici Forest, Fazenda Bananeiras (09°14'S, 35°48'W). 27 May 1995. Museu de História Natural, Universidade Federal de Alagoas (MUFAL 1663); Salva Forest, Rio Largo (09°30'S, 35°50'W) in small patches of Atlantic Forest. 5 May 1995. MUFAL 1664. Eliza M. X. Freire, Selma T. Silva, and Jorge L. Lopes. PARAÍBA: Mamanguape, Guaribas Reserve (06°45'S, 35°07'W). 25 November 1999. Universidade Federal da Paraíba (UFPB 2384); 10 December 1999. UFPB 2385. Selma T. Silva. All verified by Marcos Di-Bernardo. First records for the north Atlantic Forest; extend the known range ca. 1350 km N of Espirito Santo, Brazil (Di-Bernardo 1992, Comunic. Mus. Ciênc. PUCRS 5[13]:225–256) and 920 km NE from Vitória da Conquista, Bahia, Brazil (Argôlo 1998, Herpetol. Rev. 29:176).

Submitted by **ELIZA MARIA XAVIER FREIRE** and **SELMA TORQUATO DA SILVA**, Departamento de Zoologia and Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade, 452, Farol, Maceió, Alagoas, 57021-090, Brazil.

TANTILLA YAQUIA (Yaqui Blackhead Snake). USA: NEW MEXICO: Hidalgo Co: along New Mexico Rt. 9, 8 km E jct. with I-80. 25 September 1999. 1857 h. Michael D. Wilcox and Denise A. Wilcox. MSB 61412 and LACM Color Slide PC-1335. Verified by D. A. Kizirian. Extends known range in New Mexico ca. 43.5 km N and 8.1 km E of previous known records (McDiarmid 1977, Cat. Am. Amph. Rept. 198:1–2; Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 430 pp.). Occurs sympatrically with *T. hobartsmithi and T. nigriceps* in this area.

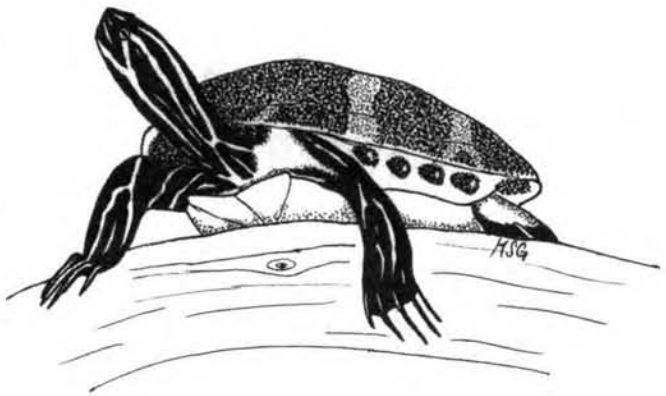
Submitted by **MICHAEL D. WILCOX**, Ogden Environmental and Energy Services, 3120 Chicago Avenue, Suite 180, Riverside, California 92507, USA, **DENISE A. WILCOX**, Western University of Health Sciences, 309 East Second Street, College Plaza, Pomona, California 91766, USA, **KENT R. BEAMAN**, Section of Herpetology, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

TANTILLITA LINTONI ROZELLAE (Rozella's Dwarf Shorttailed Snake). MEXICO: VERACRUZ: Municipality of Tezonapa, G. Vázquez-Vela Ejido (18°39'04"N, 96°47'20"W), elev. 550 m, and Loma Buena Vista Ejido (18°39'10"N, 96°47'29"W), elev. 500 m. 21 July 1997. Collected by Roberto Mora Gallardo. Estación de Biología Tropical "Los Tuxtlas", Instituto de Biologia, Universidad Nacional Autonoma de México (UNAM-LT 3350, UNAM-LT 3335 respectively). Verified by Gonzalo Pérez-Higareda. Characters are the same as those described in Pérez-Higareda G. (1985, Bull. Maryland Herpetol. Soc. 21:38–40). Range extension of 180 km NW from the only previously known locality in Sierra de Los Tuxtlas (Pérez-Higareda and Smith 1991, Ofidiofauna de Veracruz. Instituto de Biología, Universidad Nacional de México, Publicaciones Especiales 7:1–122).

Submitted by **MARCO ANTONIO LÓPEZ-LUNA** and **MIGUEL ANGEL DE LA TORRE-LORANCA**, Centro de Investigaciones Herpetologicas de Verzcruz A. C. Apartado Postal 473, Caixa Postal 95500, Cordoba, Veracruz, Mexico (e-mail: cihvac@correoweb.com), and **RICHARD C. VOGT**, Estacíon de Biología Tropical Los Tuxtlas, Apartado Postal 91, Caixa Postal 95700 San Andres Tuxtla, Veracruz, México (e-mail: dickturtle@aol.com).

TRIPANURGOS COMPRESSUS (Tropical Flat Snake). PERU: UCAYALI: PROVINCIA ATALAYA: Bolognesi (10°06'S, 73°49'W, 230 m elev.). 13 June 1998. E. Lehr. Natur-Museum und Forschungs-Institut Senckenberg (SMF 80062). Verified by Nelly Carrillo de Espinoza. First record for state of Ucayali (Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49:1–27).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany (e-mail: elehr@sng.uni-frankfurt.de), and **ROSARIO FERNANDEZ**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.



Pseudemys rubriventris (Northern Red-bellied Cooter). Illustration by Margaret Gunzburger.

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New Herpetological Records for the Tambopata Province, Department of Madre de Dios, Perú

TIFFANY M. DOAN
and
WILFREDO ARIZABAL ARRIAGA
TReeS-RAMOS, Casilla 28
Puerto Maldonado, Madre de Dios, Perú

Current Addresses:
(TMD) Department of Biology, University of Texas at Arlington
P.O. Box 19498, Arlington, Texas 76019-0498, USA
e-mail: tiffperu@yahoo.com

(WAA) Museo de Historia Natural
Universidad Nacional de San Antonio Abad del Cusco
Urb. Los Angeles E-1, Cusco, Perú
e-mail: wilari@yahoo.com

The herpetofauna of the southeastern Peruvian rainforest is still relatively unknown; a small number of short-term studies have produced preliminary inventories of some sites but, until recently, no long-term censuses had been conducted. Previous inventory lists for four sites in the Tambopata Province have been written: Cusco Amazónico (Duellman and Salas 1991), Explorer's Inn (McDiarmid and Cocroft 1995), Sachavacayoc Centre (Sehgelmeble 1997), and Tambopata Research Center (Salas 1995). Recently, we have completed an intensive study that took place from January 1997 to November 1998 at six localities within the Tambopata Province, Department of Madre de Dios. This study revealed seven species not previously recorded in the Tambopata Province and many other species that had not been recorded for the sampled localities. Voucher specimens are deposited in the Museo de Historia Natural, Universidad de San Antonio Abad del Cusco, Perú (MHNUNSAAC; specimens of that Museum retain original field codes, therefore all specimens collected by us bear the code PT). All specimens were verified by Oscar Ochoa Mendieta.

Hyla triangulum (Triangle Treefrog). TAMBOPATA PROVINCE: EcoAmazonía, 35.2 km ENE Puerto Maldonado (12°31'44"S, 68°55'58"W). 6 June 1997. Margaret Bartee. MHNUNSAAC PT 232. An adult male specimen was found at night perched on a leaf at 40 cm off the ground. First record for Provincia Tambopata. Previously recorded in Estación Biológica de Cocha Cashu, Provincia Manu, Departamento de Madre de Dios, 297 km to the WNW (Rodríguez and Cadle 1990).

Amphisbaena fuliginosa (Mottled Amphisbaena). TAMBOPATA PROVINCE: Explorer's Inn, 30 km SSW Puerto Maldonado (12°50'18"S, 69°17'45"W). March 1997. Tiffany M. Doan. MHNUNSAAC PT 514. Specimen was found crawling along a trail during the morning. First record for Departamento de Madre de Dios. Previously recorded from the departments of Amazonas, Cusco, Loreto, and Ucayali, a minimum extension of 318 km to the WSW (Cusco) (Carrillo and Icochea 1995).

Anolis nitens (Matinga Anole). TAMBOPATA PROVINCE: EcoAmazonía, 35.2 km ENE Puerto Maldonado (12°31'44"S, 68°55'58"W). 6 June 1997. Wilfredo Arizábal Arriaga. MHNUNSAAC PT 234. One of four species of *Anolis* in Provincia Tambopata, this lizard is very uncommon and most easily captured at night while it sleeps on green leaves ca. 1 m above the forest floor. First record for Provincia Tambopata. Previously reported from Estación Biológica de Cocha Cashu, Provincia Manu, Departamento de Madre de Dios, ca. 290 km to the WNW (Rodríguez and Cadle 1990).

Atractus badius (Earthsnake). TAMBOPATA PROVINCE: Cusco Amazónico, 15 km ENE Puerto Maldonado (12°32'28"S, 69°03'36"W). April 1997. Wilfredo Arizábal Arriaga. MHNUNSAAC PT 182; Sachavacayoc Centre, 35 km SSW Puerto Maldonado (12°51'10"S, 69°21'57"W). 23 November 1997. Tiffany M. Doan. MHNUNSAAC PT 377; EcoAmazonía, 35.2 km ENE Puerto Maldonado (12°31'44"S, 68°55'58"W). 18 March 1998. Wilfredo Arizábal Arriaga. MHNUNSAAC PT 222; Tambopata Research Center, 86.5 km SSW Puerto Maldonado (13°08'53"S, 69°37'02"W). 15 February 1998. José Antonio Ochoa Cámara. MHNUNSAAC PT 422. All individuals were captured on the forest floor at night. First records for Departamento de Madre de Dios. Previously recorded in the department of Loreto, 1099 km to the north (Carrillo and Icochea 1995).

Ninia hudsoni (Amazon Coffee Snake). TAMBOPATA PROVINCE: Tambopata Research Center, 86.5 km SSW Puerto Maldonado (13°08'53"S, 69°37'02"W). 30 November 1997. Tiffany M. Doan and Wilfredo Arizábal Arriaga. MHNUNSAAC PT 393. Found in leaf litter at night. Another individual was caught at the same locality on 31 August 1997, but escaped. First record for Perú. Previously recorded in the countries of Brazil, Guyana (Peters and Orejas-Miranda 1970) and Ecuador (Duellman 1990). Also listed as a "probable" species for Perú (Lamar 1997).

Oxybelis argenteus (Vine Snake). TAMBOPATA PROVINCE: Cusco Amazónico, 15 km ENE Puerto Maldonado (12°32'28"S, 69°03'36"W). April 1997. Arturo Cornejo Farfán. MHNUNSAAC PT 184; EcoAmazonía, 35.2 km ENE Puerto Maldonado (12°31'44"S, 68°55'58"W). 8 October 1997. Wilfredo Arizábal Arriaga. MHNUNSAAC PT 351. Found sleeping on branches of shrubs ca. 1 m above the ground. First records for Provincia Tambopata. Previously recorded from Estación Biológica de Cocha Cashu, Provincia Manu, Departamento de Madre de Dios, ca. 290 km to the WNW (Rodríguez and Cadle 1990).

Rhinobothryum lentiginosum (Amazon Ringed Snake). TAMBOPATA PROVINCE: EcoAmazonía: 35.2 km ENE Puerto Maldonado (12°31'44"S, 68°55'58"W). 23 January 1997. Wilfredo Arizábal Arriaga. MHNUNSAAC PT 102; Cusco Amazónico, 15 km ENE Puerto Maldonado (12°32'28"S, 69°03'36"W). 19 February 1997. Wilfredo Arizábal Arriaga. MHNUNSAAC PT 007. Found at night on the forest floor near small pools of water. First records for Provincia Tambopata. Previously recorded in Estación Biológica de Cocha Cashu, Provincia Manu, Departamento de Madre de Dios, ca. 290 km to the WNW (Rodríguez and Cadle 1990).

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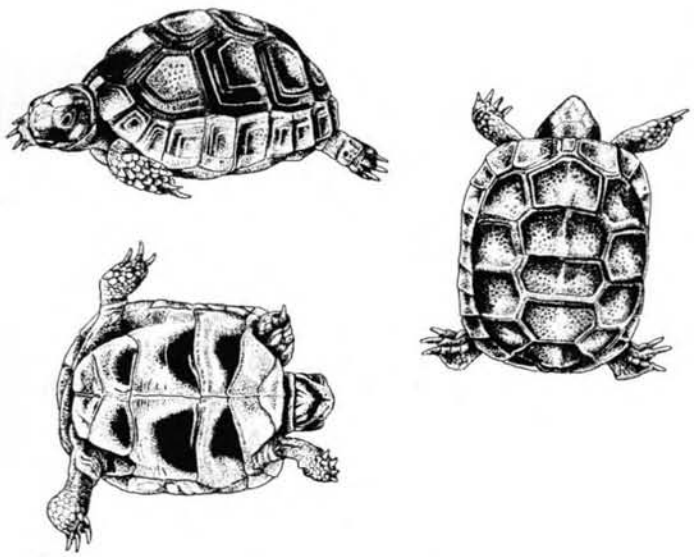
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Testudo marginata (Marginated Tortoise) hatchling. Illustration by P. A. Benson.

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New Amphibian and Reptile County Records in Illinois

JOHN E. PETZING
MICHAEL J. DRESLIK
CHRISTOPHER A. PHILLIPS
Illinois Natural History Survey, Center for Biodiversity
607 East Peabody Drive, Champaign, Illinois 61820, USA
e-mail (JEP): jpetzing@mail.inhs.uiuc.edu

COLLIN D. SMITH
Department of Zoology, Eastern Illinois University
Charleston, Illinois 61920, USA

ANDREW R. KUHNS
DONALD B. SHEPARD
Department of Biological Sciences, Illinois State University
Normal, Illinois 61790-4120, USA

JOHN G. PALIS
P.O. Box 387, Jonesboro, Illinois 62952, USA

EDWARD O. MOLL
School of Renewable Natural Resources
University of Arizona, Tucson, Arizona 85721-0043

DANIEL J. OLSON
Department of Natural Resources and Environmental Sciences
University of Illinois
Urbana, Illinois 61801, USA

THOMAS G. ANTON
800 Oak Street, Winnetka, Illinois 60093, USA

DAVID MAUGER
Forest Preserve District of Will County
22606 South Cherry Hill Road, Joliet, Illinois 60433, USA

and

BRUCE KINGSBURY
Center for Reptile and Amphibian Conservation and Management
Indiana–Purdue University, Fort Wayne, Indiana 46805-1499, USA

This article represents a continuation of recent contributions focusing on new county records of amphibians and reptiles in Illinois. Recent articles published in *Herpetological Review* include Tucker (1994, Herpetol. Rev. 25:79–80), Redmer and Ballard (1995, Herpetol. Rev. 26:49–53), Petzing et al. (1998, Herpetol. Rev. 29:179–182) and Wilson (1999, Herpetol. Rev. 30:118–120). Specimens reported herein are housed in the Illinois Natural History Survey (INHS) and Southern Illinois University at Carbondale (SIUC) herpetological collections. County records were verified by checking the Illinois Herpetological Database, located at the Illinois Natural History Survey, which contains data on Illinois amphibians and reptiles from thirty museum and private collections and unvouchered records from herpetologists and other reliable biologists. Using information from the database, a web page was developed to provide county-level distribution data for amphibians and reptiles in Illinois. This web site can be accessed via the following URL:

http://www.inhs.uicc.edu/cbd/herpdist/herp.html

The database can be searched by either species or county. Distribution maps or county species lists may be printed out for field reference or other relevant uses.

CAUDATA

Ambystoma maculatum (Spotted Salamander). EDWARDS Co: 4.75 km N Albion; 0.9 km E Illinois Rt. 130 (SW 1/4 SE 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4253930m, E408660m). 28 February 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14034. New county record; WHITE Co: 2 km E Burnt Prairie and just N I-64 (NE 1/4 Sec. 20, T3S, R9E; UTM Zone 16: N4234440m, E392440m). 27 February 1998. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14087. New county record. Metamorph.

Ambystoma opacum (Marbled Salamander). CLAY Co: 4.8 km NE Xenia (SW 1/4 Sec. 25, T3N, R5E). 2 May 1998. K. M. Weidner. Verified by C. A. Phillips. INHS 13952. New county record; EDWARDS Co: 4.75 km N Albion; 0.9 km E Illinois Rt. 130 (SW 1/4 SE 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4253930m, E408660m). 24 January 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14035. New county record.

Ambystoma texanum (Smallmouth Salamander). KNOX Co: 1.8 km WNW De Long (NW 1/4 SW 1/4 Sec. 30, T10N, R2E; Lat/Long: 40°49.283'N, 90°19.551'W). 27 May 1999. T. G. Anton and D. Mauger. Verified by C. A. Phillips. INHS 15005. New county record. Larva dipnetted from ditch.

Plethodon cinereus (Redback Salamander). COLES Co: 2 km N Hutton at Frank Hedges' farm (NE 1/4 NW 1/4 Sec. 3, T11N, R10E). 24 April 1989. F. Hedges. Verified by C. A. Phillips. INHS 14701. New county record; LAWRENCE Co: S side Indian Creek, Lawrenceville (NE 1/4 SW 1/4 Sec. 18, T3N, R11W). 1 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC H-5726. New county record. Ten specimens were collected in a rich, mesic hardwood forest on a north-facing slope. A total of 24 animals were observed, 22 of which were lead phase.

Plethodon glutinosus (Slimy Salamander). JASPER Co: Prairie Ridge State Natural Area (SW 1/4 Sec. 30, T6N, R9E). 30 April 1999. D. J. Olson. Verified by C. A. Phillips. INHS Herpetological Slide 1999-16. New county record. Specimen not collected because it was found on state protected land; LAWRENCE Co: S side Indian Creek, Lawrenceville (NE 1/4 SW 1/4 Sec. 18, T3N, R11W). 1 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC H-5727. New county record. Adult collected in rich, mesic hardwood forest on a north-facing slope; PERRY Co: 5.7 km SW Pinckneyville, Arch Minerals woodlot (NW 1/4 Sec. 4, T6S, R3W; UTM Zone 16: N4212430m, E285670m). 14 April 1998. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 13904. New county record.

Necturus maculosus (Common Mudpuppy). MCLEAN Co: Mackinaw River, E Gridley Blacktop Road bridge (NE 1/4 NW 1/4 Sec. 5, T25N, R3E). October 1998. R. C. Dobbs and D. B. Shepard. Verified by C. A. Phillips. INHS 14796. New county record.

Notophthalmus viridescens louisianensis (Central Newt). WILL Co: 0.8 km SE of Braidwood, Braidwood Dunes and Savanna Nature Preserve (SW 1/4 Sec. 16, T32N, R9E). 12 May 1991. D. O'Connell. Verified by C. A. Phillips. INHS 14700. New county record.

Siren intermedia (Western Lesser Siren). COLES Co: 4 km SE Charleston, backwater of Embarras River. 27 February 1986. E. O. Moll. Verified by C. A. Phillips. INHS 14702. New county record. Specimen found dead in ice.

ANURA

Bufo americanus (American Toad). MOULTRIE Co: 4 km WSW Allenville near Illinois Natural History Survey Kaskaskia Biological Station on Co. Rd. 1000N (NW 1/4 NW 1/4 NE 1/4 Sec. 30, T13N, R6E; UTM Zone 16: N4378750m, E364770m). 3 August 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14188. New county record; PERRY Co: 6.4 km SW Pinckneyville (SW 1/4 Sec. 4, T6S, R3W; UTM Zone 16: N4211705m, E285495m). 14 April 1998. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 13909. New county record.

Bufo fowleri (Fowler's Toad). EDWARDS Co: 4.5 km N Albion; 0.3 km E Illinois Rt. 130 (SW 1/4 SW 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4253810m, E408000m). 7 July 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14189. New county record; MOULTRIE Co: 4 km WSW Allenville near Illinois Natural History Survey Kaskaskia Biological Station on Co. Rd. 1000N (NW 1/4 NW 1/4 NE 1/4 Sec. 30, T13N, R6E; UTM Zone 16: N4378750m, E364770m). 17 July 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14186. New county record.

Acris crepitans (Northern Cricket Frog). MERCER Co: 5.75 km NNE Alexis, North Henderson Creek at Co. Rd. 2900E (SW 1/4 SW 1/4 NW 1/4 Sec. 17, T13N, R1W; UTM Zone 15: N4554320m, E707180m). 22 September 1998. J. E. Petzing and C. A. Phillips. Verified by M. J. Dreslik. INHS 14207. New county record; STARK Co: 1.25 km W Wyoming, Spoon River at Illinois Rt. 17/Illinois Rt. 91 (SE 1/4 Sec. 34, T13N, R6E; UTM Zone 16: N4549335m, E265095). 21 May 1998. J. E. Petzing. Verified by C. A. Phillips. INHS 13979. New county record.

Hyla chrysoscelis/Hyla versicolor (Gray Treefrog Complex). BUREAU Co: 12 km N Mineral, Fairfield Union Special Ditch at Co. Rd. 2400N (SW 1/4 Sec. 33, T18N, R6E; UTM Zone 16: N4597520m, E265140m). 15 July 1999. M. E. Retzer and T. J. Near. Verified by C. A. Phillips. INHS 15007. New county record; GALLATIN Co: 3 km NNE Old Shawneetown on Round Pond Road (NE 1/4 Sec. 20, T9S, R10E; UTM Zone 16: N4176160m, E401030m). 25 May 1998. M. J. Dreslik and A. R. Kuhns. Verified by C. A. Phillips. INHS 14006. New county record; MARSHALL Co: SE of jct. Illinois Rt. 26 and Atchison, Topeka and Santa Fe RR tracks (SW 1/4 NW 1/4 Sec. 35, T29N, R3W). 18 May 1999. A. R. Kuhns and D. B. Shepard. Verified by C. A. Phillips. INHS 14808. New county record; TAZEWELL Co: 3.2 km N Mackinaw on the Dee-Mac Road (NE 1/4 Sec. 6, T24N, R2W). 12 April 1998. R. J. Whitlatch. Verified by C. A. Phillips. INHS 13953. New county record; WHITESIDE Co: Sterling, lot bordered by E 9th Street to the N, E 8th Street to the W, E 7th Street to the S and 4th Avenue to the E (SE 1/4 Sec. 21, T21N, R7E; UTM Zone 16: N4630150m, E276200m). 12 August 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14187. New county record.

Pseudacris crucifer (Spring Peeper). MARSHALL Co: 0.6 km E Illinois Rt. 26 on Atchison, Topeka and Santa Fe RR (SE 1/4 NW 1/4 Sec. 35, T29N, R3W). 6 April 1999. D. B. Shepard and A. R.

Kuhns. Verified by C. A. Phillips. INHS 14797. New county record; SALINE CO: 0.8 km E Williamson-Saline Co. line and just N of new Illinois Rt. 13 alignment; 6.8 km NW Carrier Mills (SW 1/4 Sec. 18, T9S, R5E). 12 May 1999. J. E. Petzing. Verified by C. A. Phillips. INHS 15038. New county record. Series of five metamorphs. Collected as tadpoles and raised in the lab through metamorphosis; WOODFORD CO: NW Metamora, jct. Co. Rd. 825E and Co. Rd. 1650N (SW 1/4 NW 1/4 Sec. 6, T26N, R2W; UTM Zone 16). 6 April 1999. A. R. Kuhns and D. B. Shepard. Verified by C. A. Phillips. INHS 14802. New county record.

Pseudacris triseriata (Western Chorus Frog). EDWARDS CO: 4.6 km N Albion; 0.4 km E Illinois Rt. 130 (NW 1/4 Sec. 24, T1S, R10E; UTM Zone 16: N4253735m, E408170m). 20 March 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14032. New county record; MARSHALL CO: NE jct. Illinois Rt. 26 and Atchison, Topeka and Santa Fe RR tracks (SW 1/4 NW 1/4 Sec. 35, T29N, R3W). 18 May 1999. D. B. Shepard and A. R. Kuhns. Verified by C. A. Phillips. INHS 14806. New county record.

Rana blairi (Plains Leopard Frog). FAYETTE CO: 8.5 km SE Herrick, Kaskaskia River at Lorton Bridge (SW 1/4 Sec. 32, T9N, R3E; UTM Zone 16: N4338055m, E336370m). 12 July 1998. J. E. Petzing and J. W. Petzing. Verified by C. A. Phillips. INHS 14063. New county record; FORD CO: 4 km SW Paxton, Big Four Ditch at Co. Rd. 1600E (SE 1/4 SE 1/4 Sec. 15, T23N, R9E; UTM Zone 16: N4477570m, E401890m). 17 September 1999. J. E. Petzing and C. A. Phillips. Verified by M. J. Dreslik. INHS 15019. New county record; MERCER CO: 4.75 km NNE Alexis, North Henderson Creek at Co. Rd. 2835E (SW 1/4 SE 1/4 Sec. 18, T13N, R1W; UTM Zone 15: N4553700m, E706400m). 22 September 1998. C. A. Phillips and J. E. Petzing. Verified by M. J. Dreslik. INHS 14210. New county record.

Rana catesbeiana (Bullfrog). BUREAU CO: 2.8 km W La Moille, Big Bureau Creek at Co. Rd. 2600N (SE 1/4 SE 1/4 SW 1/4 Sec. 22, T18N, R10E; UTM Zone 16: N4599400m, E306000m). 20 August 1998. J. D. Evans and L. M. Page. Verified by C. A. Phillips. INHS 14185. New county record; CARROLL CO: 5.5 km NNW Savanna, slough along the Mississippi River; 0.4 km NW Mississippi Palisades State Park office (SE 1/4 SE 1/4 Sec. 20, T25N, R3E). 1 April 1999. C. D. Smith. Verified by C. A. Phillips. INHS 15046. New county record; CRAWFORD CO: 2 km SSE West York at Raccoon Creek (SW 1/4 Sec. 8, T8N, R11W). 17 May 1999. L. M. Page, M. Hardman, S. Herrington and J. D. Evans. Verified by C. A. Phillips. INHS 15075. New county record; DOUGLAS CO: 2.9 km W Camargo at Spring Lake (NE 1/4 SW 1/4 Sec. 33, T16N, R9E; UTM Zone 16: N4405600m, E397900m). 13 September 1999. C. A. Phillips. Verified by J. E. Petzing. INHS 15065. New county record; EDWARDS CO: 4.7 km N Albion; 0.6 km E Illinois Rt. 130 (SE 1/4 SW 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4253820m, E408320m). 5 August 1997. C. D. Smith. Verified by C. A. Phillips. INHS 14190. New county record; FORD CO: 4 km SW Paxton, Big Four Ditch at Co. Rd. 1600E (SE 1/4 SE 1/4 Sec. 15, T23N, R9E; UTM Zone 16: N4477570m, E401890m). 17 September 1999. J. E. Petzing and C. A. Phillips. Verified by M. J. Dreslik. INHS 15620. New county record. Two tadpoles; GRUNDY CO: 1.4 km S Morris (SE 1/4 Sec. 10, T33N, R7E; UTM Zone 16: N4578150m, E382670m). 27 May 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14749. New county record; KENDALL CO: 12.5 km W Shorewood, West Aux Sable Creek at Brisbin Road (NW 1/4 Sec. 7, T35N, R8E; UTM Zone 16: N4598040m, E386040m). 22 September 1999. B. Rung. Verified by C. A. Phillips. INHS 14703. New county record; LAWRENCE CO: "The Slough," 3.2 km ESE Chauncey; W side Co. Rd. 400E, 0.6 km S Co. Rd. 1750N (SE 1/4 SE 1/4 Sec. 34, T5N, R13W). 11 September 1998. J. G. Palis. Verified by R. A. Brandon. SIUC H-6395. New county record. Juvenile; LIVINGSTON CO: S side Forrest, South Fork Vermilion River to E of Illinois Rt. 47 in Forrest Park (NW 1/4 Sec. 10, T26N, R7E; UTM Zone 16: N4510990m, E380970m). 8 September 1999. J. E. Petzing. Verified by C. A. Phillips. INHS 14997. New county record; MERCER CO: 4.75 km NNE Alexis, North Henderson Creek at Co. Rd. 2835E (SW 1/4 SE 1/4 Sec. 18, T13N, R1W; UTM Zone 15: N4553700m, E706400m). 22 September 1998. C. A. Phillips and J. E. Petzing. Verified by M. J. Dreslik. INHS 14211. New county record; PIATT CO: 6.75 km SW Monticello, tributary Sangamon River in Robert Allerton Park (SE 1/4 Sec. 20, T18N, R05E; UTM Zone 16: N4428650m, E358620m). 6 August 1998. J. R. Johnson, C. A. Phillips and J. E. Petzing. Verified by M. J. Dreslik. INHS 14097. New county record; WARREN CO: 1.7 km N Utah at unnamed stream (SE 1/4 Sec. 27, T12N, R1W; UTM Zone 15: N4541610m, E711375m). 22 September 1998. C. A. Phillips and J. E. Petzing. Verified by M. J. Dreslik. INHS 14203. New county record; WHITE CO: 2 km E Burnt Prairie and just N I-64 (NE 1/4 Sec. 20, T3S, R9E; UTM Zone 16: N4234440m, E392440m). 27 February 1998. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 13873. New county record.

Rana clamitans (Green Frog). EDWARDS CO: 4.75 km N Albion; 0.9 km E Illinois Rt. 130 (SW 1/4 SE 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4253930m, E408660m). 12 April 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14033. New county record; WOODFORD CO: 5.07 km W Washburn; 1.1 km W Co. Rd. 1035E on Co. Rd. 2250N (SW 1/4 SW 1/4 Sec. 05, T28N, R2W). 9 July 1998. D. B. Shepard and A. R. Kuhns. Verified by C. A. Phillips. INHS 14810. New county record.

Rana pipiens (Northern Leopard Frog). WHITESIDE CO: 3.25 km N Sterling, Sugar Creek at Freeport Road (NE 1/4 NE 1/4 SE 1/4 Sec. 03, T21N, R07E; UTM Zone 16: N4634970m, E278310m). 18 September 1998. J. E. Petzing. Verified by C. A. Phillips. INHS 14184. New county record.

Rana sphenocephala (Southern Leopard Frog). CLAY CO: 6.75 km SE Clay City, just W of Little Wabash River on N side of Co. Rd. 250N (Wilcox Bridge Lane) (SE 1/4 Sec. 3, T2N, R8E; UTM Zone 16: N4276820m, E387040m). 23 April 1998. J. E. Petzing, M. J. Dreslik and W. C. Handel. Verified by C. A. Phillips. INHS 13925. New county record; FORD CO: 4 km SW Paxton, Big Four Ditch at Co. Rd. 1600E (SE 1/4 SE 1/4 Sec. 15, T23N, R9E; UTM Zone 16: N4477570m, E401890m). 17 September 1999. J. E. Petzing and C. A. Phillips. Verified by M. Redmer. INHS 15020. New county record. Possible hybrid between *Rana sphenocephala* and *Rana blairi* but characters predominantly *sphenocephala*-like.

TESTUDINES

Chelydra serpentina (Common Snapping Turtle). MADISON CO: 3.5 km NNW Highland at Highland Silver Lake (SE 1/4 Sec. 19,

T4N, R5W; UTM Zone 16: N4294720m, E265920m). 7 October 1998. J. E. Petzing. Verified by C. A. Phillips. INHS 14252. New county record. Skull of dead individual; MARION CO: Prairie Ridge State Natural Area, INHS Tract (SE 1/4 SW 1/4 SE 1/4 Sec. 35, T4N, R3E). 9 October 1998. D. J. Olson and S. R. Bilyeu. Verified by C. A. Phillips. INHS Herpetological Slide 1999-20. New county record. Slide is of dorsal aspect. Specimen not collected because it was found on protected land; MARSHALL CO: S of jct. Illinois Rt. 26 and Atchison, Topeka and Santa Fe RR (SW 1/4 NW 1/4 Sec. 35, T29N, R3W). 20 May 1999. D. B. Shepard. Verified by C. A. Phillips. INHS 14811. New county record. DOR.

Chrysemys picta (Painted Turtle). CLAY CO: 5.5 km E Bible Grove; 0.3 km N jct. Co. Rd. 1825N and Co. Rd. 1700E (Clay City-Dietrich Blacktop) on Co. Rd. 1700E (SE 1/4 Sec. 14, T5N, R7E; UTM Zone 16: N4303530m, E380270m). 30 May 1998. M. J. Dreslik and A. R. Kuhns. Verified by C. A. Phillips. INHS 14041. New county record; MARION CO: 4.5 km SW Farina exit on northbound I-57; 3 km SE Marion-Fayette Co. line (NW 1/4 NW 1/4 Sec. 12, T4N, R3E; UTM Zone 16: N4296925m, E341575m). 15 April 1998. M. J. Dreslik and J. E. Petzing. Verified by C. A. Phillips. INHS 13917. New county record. DOR adult; WHITESIDE CO: 5.4 km NE Fulton, Mississippi River slough (SW 1/4 NE 1/4 Sec. 2, T22N, R3E). 15 July 1999. C. D. Smith. Verified by C. A. Phillips. INHS 15057. New county record.

Graptemys geographica (Common Map Turtle). CARROLL CO: Thomson, Illinois Rt. 84 at entrance to Thomson causeway. 30 May 1990. F. Janzen. Verified by C. A. Phillips. INHS 13853. New county record.

Graptemys ouachitensis (Ouachita Map Turtle). GALLATIN CO: Ohio River (River Mile 855), near Bell Island on the Illinois–Kentucky border (SW 1/4 Sec. 22, T9S, R10E). 19 July–9 August 1993. E. O. Moll. Verified by C. A. Phillips. INHS 15121. New county record. Specimen originally in E. O. Moll's private collection; JO DAVIESS CO: 8 km SSW Hanover, Mississippi River at the Savanna Army Depot (SE 1/4 Sec. 31, T26N, R2E). 27 May 1998. L. M. Page, M. Hardman and J. D. Evans. Verified by E. O. Moll. INHS 14026. New county record.

Pseudemys concinna (River Cooter). MASSAC CO: 1 km E Metropolis, Ohio River at Fort Massac State Park (Sec. 7, T16S, R5E; UTM Zone 16: N4111910m, E348420m). 29 August 1998. L. M. Page, T. J. Near, M. E. Retzer, J. D. Evans, M. Hardman and R. S. Steinberg. Verified by C. A. Phillips. INHS 14225. New county record.

Terrapene carolina (Eastern Box Turtle). EDWARDS CO: 0.3 km W Albion on Illinois Rt. 15 (SW 1/4 Sec. 2, T2S, R10E; UTM Zone 16: N4248040m, E406550m). 16 May 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14019. New county record. DOR; LA SALLE CO: 0.3 km W Blackball Mine. 3 September 1994. T. G. Anton. Verified by C. A. Phillips. INHS Herpetological Slide 2000-1. Adult male. Specimen not collected because it was found in a nature preserve.

Trachemys scripta (Slider). EDWARDS CO: 5.75 km N Albion, adjacent to acre pond E of Illinois Rt. 130 (NW 1/4 NW 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4255110m, E407770m). 12 April 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14027. New county record; EFFINGHAM CO: 5.25 km S Dietrich; 0.8 km S jct. Co Rd. 2300E and Co Rd. 700N on Co. Rd. 2300E (SE 1/4 SE 1/4 NE 1/4 Sec. 35, T7N, R7E; UTM Zone 16: N4318420m, E380400m). 8 June 1998. M. J. Dreslik. Verified by C. A. Phillips. INHS 14089. New county record; JASPER CO: 8.25 km SSW Newton, 40 m E jct. Co. Rd. 400N and Co. Rd. 900E on Co. Rd. 400N (or 2.75 km NW of Shamrock) (NW 1/4 NW 1/4 Sec. 3, T5N, R9E; UTM Zone 16: N4306840m, E395400m). 21 June 1998. D. J. Olson. Verified by C. A. Phillips. INHS Herpetological Slide 1999-18. New county record. Specimen not collected because it was a gravid female; JEFFERSON CO: 4.4 km N Waltonville, Rayse Creek at Co. Rd. 600E (NE 1/4 Sec. 24, T3S, R1E; UTM Zone 16: N4235780m, E321480m). 6 May 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14698. New county record. AOR juvenile; RICHLAND CO: 1.5 km N Olney on Illinois Rt. 130; 1.1 km W East Fork Lake (SW 1/4 Sec. 22, T4N, R10E; UTM Zone 16: N4290740m, E404910m). 7 June 1999. D. J. Olson. Verified by C. A. Phillips. INHS 15120. New county record. DOR adult; WAYNE CO: 4 km S Fairfield; 0.6 km S Co. Rd. 600N on U. S. Rt. 45 (SE 1/4 SE 1/4 NW 1/4 Sec. 19, T2S, R8E; UTM Zone 16: N4243840m, E381120m). 28 May 1998. M. J. Dreslik and A. R. Kuhns. Verified by C. A. Phillips. INHS 14010. New county record.

Kinosternon flavescens (Yellow Mud Turtle). LEE CO: Ernot Farm, 9.6 km N Ohio (NE 1/4 NE 1/4 Sec. 16, T19N, R9E). 17 July 1972. M. Johnson. Verified by C. A. Phillips. INHS 13856. New county record. This specimen was formerly in the collection of E. O. Moll (EOM 1854).

Sternotherus odoratus (Common Musk Turtle). JEFFERSON CO: 3 km SW Scheller at Scheller Lake West (NW 1/4 SW 1/4 Sec. 17, T4S, R1E; UTM Zone 16: N4227100m, E313510m). 6 May 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14693. New county record. Shell of dead individual.

Apalone mutica (Smooth Softshell). GALLATIN CO: Ohio River (River Mile 855) near Bell Island on the Illinois–Kentucky border (SW 1/4 Sec. 22, T9S, R10E). 19 July–9 August 1993. E. O. Moll. Verified by C. A. Phillips. INHS 15130. New county record.

Apalone spinifera (Spiny Softshell). HENDERSON CO: 3.2 km E Oquawka, Jinks Creek at mouth of Smith Creek (SE 1/4 Sec. 24, T11N, R5W; UTM Zone 15: N4532840m, E676005m). 28 May 1998. L. M. Page, M. Hardman and J. D. Evans. Verified by C. A. Phillips. INHS 14025. New county record.

LACERTILIA

Sceloporus undulatus (Fence Lizard). JASPER CO: Prairie Ridge State Natural Area (SW 1/4 Sec. 30, T6N, R9E). 30 April 1999. D. J. Olson, E. L. Kershner and J. Walk. Verified by C. A. Phillips. INHS Herpetological Slide 1999-17. New county record. Specimen not collected because it was found on protected land.

Eumeces fasciatus (Five-Lined Skink). EDWARDS CO: 4.7 km N Albion; 0.6 km E Illinois Rt. 130 (SE 1/4 SW 1/4 Sec. 13, T1S, R10E; UTM Zone 16: N4253820m, E408320m). 5 August 1997. C. D. Smith. Verified by C. A. Phillips. INHS 14038. New county record.

Scincella lateralis (Ground Skink). CLAY CO: 3.5 km SW Edgewood, S side Illinois Rt. 37 in RR right-of-way (NW 1/4 Sec.

7, T5N, R5E; UTM Zone 16: N4306490m, E353140m). 23 April 1998. J. E. Petzing, M. J. Dreslik and W. C. Handel. Verified by C. A. Phillips. INHS 13920. New county record.

SERPENTES

Coluber constrictor (Eastern Racer). CLAY CO: Co. Rd. 2075E (labeled Co. Rd. 2100E in the Illinois Atlas), 0.24 km N U. S. Rt. 50 (SE 1/4 Sec. 16, T3N, R8E). 9 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC R-3163. New county record. DOR adult.

Elaphe obsoleta (Eastern Rat Snake). CLAY CO: 1.75 km N Clay City, Little Wabash River at Co. Rd. 1860E (SE 1/4 Sec. 7, T3N, R8E; UTM Zone 16: N4285140m, E382290m). 28 May 1998. M. J. Dreslik and A. R. Kuhns. Verified by C. A. Phillips. INHS 14011. New county record; MARION CO: 1.4 km SSW Alma on Illinois Rt. 37 (NW 1/4 NW 1/4 NE 1/4 Sec. 13, T3N, R2E). 1 June 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14765. New county record. DOR adult; MOULTRIE CO: 6 km W Illinois Rt. 121 on Bruce-Findlay Road (Co. Rd. 800N) (SW 1/4 SW 1/4 Sec. 33, T13N, R6E; UTM Zone 16: N4375460m, E367600m). 17 June 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14191. New county record; WHITE CO: 1.2 km S Mill Shoals on U. S. Rt. 45 (SE 1/4 NW 1/4 Sec. 29, T3S, R8E; UTM Zone 16: N4232610m, E381190m). 24 May 1998. M. J. Dreslik and A. R. Kuhns. Verified by C. A. Phillips. INHS 14015. New county record.

Elaphe vulpina (Western Fox Snake). IROQUOIS CO: 2.6 km NNE Cissna Park on E shoulder of Illinois Rt. 49; 0.3 km S Co. Rd. 770N or 1 km S Kellart Lake (SW 1/4 NW 1/4 Sec. 30, T25N, R13W; UTM Zone 16: N4493895m, E425320m). 16 September 1998. J. E. Petzing. Verified by C. A. Phillips. INHS 14181. New county record. DOR juvenile; MERCER CO: 2.5 km WNW Alexis on U.S. Rt. 67, 1.2 km N jct. with Illinois Rt. 135 (NE 1/4 Sec. 34, T13N, R2W; UTM Zone 15: N4550000m, E702500m). 22 September 1998. C. A. Phillips and J. E. Petzing. Verified by M. J. Dreslik. INHS 14213. New county record. DOR adult.

Heterodon platirhinos (Eastern Hognose Snake). SCOTT CO: 3.8 km S Alsey, S of Little Sandy Creek at Illinois Rt. 106 (SE 1/4 SW 1/4 Sec. 34, T13N, R12W; UTM Zone 15: N4377750m, E721340m). 8 September 1998. P. Tessene. Verified by C. A. Phillips. INHS 14179. New county record.

Lampropeltis calligaster (Prairie Kingsnake). CRAWFORD CO: Heathsville, Co. Rd. 290N just E jct. with Illinois Rt. 33 (Sec. 7, T5N, R10W; UTM Zone 16: N4305030m, E450870m). 30 October 1999. L. M. Page and M. H. Sabaj. Verified by C. A. Phillips. INHS 15131. New county record. DOR adult; EDWARDS CO: 0.7 km W Albion, S Illinois Rt. 15 (NE 1/4 SE 1/4 Sec. 3, T2S, R10E; UTM Zone 16: N4248020m, E405710m). 12 April 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14028. New county record.

Lampropeltis getula nigra (Black Kingsnake). GALLATIN CO: 1 km E Ridgway, jct. Ridgway-New Haven Road (Co. Rd. 15500N) and Farmer Rd. (Co. Rd. 7500E) on Ridgway-New Haven Road (Center Sec. 29, T8S, R9E; UTM Zone 16: N4184030m, E390960m). 25 June 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14793. New county record. DOR.

Nerodia erythrogaster (Plainbelly Water Snake). CLAY CO: Ditch on E side of Co. Rd. 2075E (AKA Co. Rd. 2100E), 20 m S Co. Rd. 800N (E of Flag Pond) (NW 1/4, NW 1/4, NW 1/4, NW 1/4 Sec. 10, T3N, R8E). 9 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC R-3164. New county record. Neonate; LAWRENCE CO: N Lawrenceville; Illinois Rt. 1, 1.3 km N U. S. Rt. 50 (NW 1/4 SW 1/4 Sec. 30, T4N, R11W). 1 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC R-3165. New county record. DOR adult.

Nerodia rhombifer (Diamondback Water Snake). JEFFERSON CO: 4.6 km W Mt. Vernon; 0.2 km E Big Muddy River on Illinois Rt. 15 (SW 1/4 NE 1/4 Sec. 33, T2S, R2E; UTM Zone 16: N4241830m, E326370m). 6 May 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14686. New county record. DOR juvenile; MARSHALL CO: 0.2 km S jct. Illinois Rt. 26 and Atchison, Topeka and Santa Fe RR (SW 1/4 NW 1/4 Sec. 35, T29N, R3W). 18 July 1999. D. B. Shepard. Verified by C. A. Phillips. INHS 14851. New county record. Juvenile.

Nerodia sipedon (Northern Water Snake). CLAY CO: 6.75 km SE Clay City, Little Wabash River at Co. Rd. 250N (Wilcox Bridge) (Sec. 3, T2N, R8E; UTM Zone 16: N4277000m, E387093m). 8 September 1998. C. A. Phillips, K. S. Cummings and W. C. Handel. Verified by J. E. Petzing. INHS 14178. New county record. Collected near the county line; Ditch on W side of Co. Rd. 2075E (aka Co. Rd. 2100E), 1.3 km N U. S. Rt. 50 (NE 1/4 Sec. 16, T3N, R8E). 9 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC R-3162. This record included because the locality is further within the county than the previous record; EDWARDS CO: 5.4 km N Albion, N side Moose Lake (NE 1/4 Sec. 14, T2S, R10E; UTM Zone 16: N4254550m, E407430m). 12 April 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14029. New county record; MOULTRIE CO: 4 km WSW Allenville near Illinois Natural History Survey Kaskaskia Biological Station (NW 1/4 NW 1/4 NE 1/4 Sec. 30, T13N, R6E; UTM Zone 16: N4378750m, E364770m). 8 September 1998. C. D. Smith. Verified by C. A. Phillips. INHS 14194. New county record.

Regina septemvittata (Queen Snake). MARSHALL CO: 0.6 km S Co. Rd. 115N on Illinois Rt. 26 (NE 1/4 NE 1/4 Sec. 34, T29N, R3W; UTM Zone 16: N4534070m, E295490m). 27 June 1999. D. B. Shepard. Verified by C. A. Phillips. INHS 14812. New county record. DOR adult.

Storeria dekayi (Brown Snake). PERRY CO: 5.7 km SW Pinckneyville, Co. Rd. 800E (NW 1/4 Sec. 4, T6S, R3W; UTM Zone 16: N4212470m, E285410m). 1 June 1999. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 14757. New county record. DOR juvenile.

Thamnophis radix (Plains Garter Snake). WHITESIDE CO: 1.26 km E Morrison on Bishop Rd. (SW 1/4 NW 1/4 Sec. 16, T21N, R5E). 13 April 1999. C. D. Smith. Verified by C. A. Phillips. INHS 15051. New county record. DOR.

Thamnophis sirtalis (Common Garter Snake). LAWRENCE CO: Lawrenceville, 15 m E former RR grade (W 1/2 NW 1/4 Sec. 18, T3N, R11W). 2 May 1999. J. G. Palis. Verified by R. A. Brandon. SIUC R-3166. New county record. Adult collected under trash; WHITE CO: U. S. Rt. 45, 4.2 km N Illinois Rt. 141 (Gallatin Co. line) (E 1/2 Sec. 5, T7S, R8E). 8 September 1998. J. G. Palis. Verified by R. A. Brandon. SIUC R-3438. New county record. DOR adult.

Crotalus horridus (Timber Rattlesnake). COLES CO: just E of Charleston. September 1917. Verified by C. A. Phillips. INHS 13857. New county record. Formerly in the Eastern Illinois University Teaching Collection.

Acknowledgments.—We would like to thank Fredric J. Janzen for permission to publish the Carroll County *Graptemys geographica* record and Kevin S. Cummings and Christopher A. Taylor for reviewing the manuscript. Field work by JEP, MJD and CAP was partially supported by a contract with the Illinois Department of Transportation and grants from the Wildlife Preservation Fund (Illinois Department of Natural Resources, Division of Natural Heritage) to JEP, and a grant from the Wildlife Preservation Fund, Illinois Endangered Species Protection Board, and the Linnaeus Fund of the Chelonian Research Foundation to MJD. Field work by JGP was partially funded by a grant awarded to BK from the U.S. Office of Surface Mining Regulation and Enforcement. JGP would like to thank Ronald Brandon and Karen Lips for expediting the process of assigning museum numbers to his specimens. Field work by DJO was partially funded by a grant from the Wildlife Preservation Fund (Illinois Department of Natural Resources, Division of Natural Heritage). DJO would also like to thank Scott Simpson (Prairie Ridge State Natural Area Supervisor), Terry Esker (IDNR District Heritage Biologist), Eric Kershner, and Jeff Walk.

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New County Records from Colusa, Glenn, Plumas, and Yuba Counties, Mendocino and Plumas National Forests, California, USA

RHONDA S. LUCAS
and
JENS V. VINDUM
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118-4599, USA
e-mail (RSL): rlucas@calacademy.org
e-mail (JVV): jvindum@calacademy.org

While conducting herpetological investigations for the Mendocino and Plumas National Forests, five new county records for two amphibian and two reptile species were noted from Colusa, Glenn, Plumas, and Yuba counties, California, from within the boundaries of the national forests.

Localities for these specimens were compared with the following references: Cook (1960), Nussbaum (1976), and Wake and Yanev (1986). Localities were also compared with records from the following institutions: AMNH, BYU, CAS, Chico State University, CM, FMNH, HSU, KU, LACM, MCZ, MVZ, OS, SDSNH, SSU, TNHC, UMMZ, University of Nevada (Las Vegas), UNR, USNM, and UTA (museum codes follow Leviton et al. 1985). All identifications were verified by R. C. Drewes.

Dicamptodon tenebrosus (Pacific Giant Salamander). COLUSA CO: Mendocino National Forest, unnamed tributary to the South Fork of Stony Creek at Davis Flat, SE 1/4 Sec. 32, T17N, R7W. 9 March 1991. M. R. Jennings and M. P. Hayes. CAS 180325. This is the first record of *Dicamptodon* from Colusa County, and we tentatively identify the specimen as *D. tenebrosus*. Nussbaum (1976) recognized morphological differences between populations of *D. ensatus* from south of Mendocino, Lake, and Glenn counties and the more northern populations. He found the southern populations had larger heads, higher numbers of maxillary, premaxillary, and vomerine teeth, and lack palatopterygoid teeth in the larvae. Nussbaum hypothesized that the "North Coast Divide" (from coastal southern Mendocino County east to southern Lake County and north to Glenn County) may provide a dispersal barrier. From allozyme variation, Good (1989) suggested that two cryptic species of *Dicamptodon* occur in northern California, with the contact zone occurring in southern Mendocino County. However, the contact zone was only analyzed for coastal populations, leaving the status of inland populations in question. Good (1989) mentioned that preliminary analysis of inland populations did not correspond to Nussbaum's "North Coast Divide," but he did not give any indication of the area of contact between the inland forms. Although Nussbaum included specimens from southern Glenn County in the southern form, we found this specimen from Colusa County (south of Glenn County) to have the characteristics of Nussbaum's northern populations, including the presence of palatopterygoid teeth.

The specimen was found in a creek draining the eastern slope of the North Coast Range in dry habitat dominated by mixed chaparral and Gray Pine (*Pinus sabiniana*).

Ensatina eschscholtzii (Ensatina). COLUSA CO: Mendocino National Forest, Dixie Glade Campground (39°20'09.5"N, 122°42'09.8"W), ca. 918 m elev. Under log. 29 March 1997. J. V. Vindum. CAS 202596; Mendocino National Forest, Forest Rd M10, 17.6 km W (by road) of Stonyford, N slope of Potato Hill, (39°20'40.0"N, 122°41'01.1"W), 841 m elev. N facing slope, under rocks. 18 January 1997. J. V. Vindum. CAS 202444-45; Mendocino National Forest, Forest Rd M10, 18.56 km W (by road) of Stonyford, N slope of Potato Hill, (39°20'31.5"N, 122°41'41.4"W), 866 m elev. N facing slope, under rocks and wood. 19 January 1997. J. V. Vindum. CAS 202451; PLUMAS CO: Plumas National Forest, French Creek, NE 1/4 of SW 1/4 Sec. 23, T26N, R7E (40°05'33.0"N, 121°09'49.33"W), 1244 m elev. In log next to stream. 24 August 1999. J. A. Wilkinson and J. V. Vindum. CAS 209431.

Contia tenuis (Sharptail Snake). GLENN CO: Mendocino National Forest, Brittan Ranch (39°23'20.6"N, 122°39'42.0"W), 708 m elev. 24 February 1997. J. V. Vindum. CAS 202582; Mendocino National Forest, Brittan Ranch (39°23'34.9"N, 122°39'41.0"W), 708 masl. 24 February 1997. J. V. Vindum. CAS 202585.

Crotalus viridis (Western Rattlesnake). YUBA CO: Plumas National Forest, Scales Road (Forest Road 04), ca. 1.1 km S (by road) of Quincy La Porte Hwy, NW 1/4 of SW 1/4 Sec. 22, T20N, R8E (39°34'39.6"N, 121°04'31.18"W), 1242 m elev. Alive on road. 9 August 1999. R. S. Lucas and K. D. Wiseman. CAS 209705.

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BOOK REVIEWS

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The Amphibians of Java and Bali, by Djoko T. Iskander. 1998. Research and Development Centre for Biology - LIPI Indonesia. xix + 117 pp. Softcover. US $25.00. ISBN 979-579-014-5.

MICHAEL J. TYLER
Department of Environmental Biology, University of Adelaide
SA 5005, Australia
e-mail: michael.tyler@adelaide.edu.au

As Bob Inger points out in the Preface, there has been no synthesis of the amphibians of Java and Bali since Van Kampen produced *The Amphibia of the Indo-Australian Archipelago* in 1923. It follows that this book by Djoko Iskander is a most welcome one, and a significant step in the documentation of the herpetofauna of the many major islands that comprise Indonesia.

The contents are presented in an orderly fashion with separate chapters on biology, classification, identification to families and identification of tadpoles, followed by species accounts of the single caecilian (*Ichthyophis hypocyaneus*) and 40 species of frogs grouped in seven families. Of those species three are introduced : *Rana catesbeiana*, *Xenopus laevis* and *Hymenochirus* sp. Given the known establishment of *Litoria infrafrenata* at Bogor, and the report by Iskander that *Ceratophrys* has been seen in Javanese pet shops, the proportion of exotic species in Java is substantial and the risk to the native species from colonizers is high.

The species accounts are concise but detailed with separate sections on etymology, type locality, description, size, skin texture, color, reproduction, habitat, chromosome number, known localities (supported by details of the museum catalogue numbers of the specimens on which those records are based), distribution outside Java, other known names, and related species.

The text contains numerous interesting facts that will appeal to the historian, such as that Kuhl and Van Hasselt (authors of *Megophrys* and *Rhacophorus*) died at the ages of 24 and 26, respectively, and share a tomb in the Bogor Botanical Gardens. There are fascinating notes on defense mechanisms and reference to a curious skin exudate of *Kalophrynus*: "If you held such a frog... firmly in your palm, it will be very difficult to open your fist again" (p. 6).

As is to be expected in any work of this kind, some of the nomenclatural actions will be debated. For example, the recognition of the Pelodryadidae and, particularly, the inclusion of *Hyla javana* Ahl as a *Litoria* species. Like *Rhacophorus depressus* Ahl, which Iskander excludes, this species is almost certainly based upon a specimen taken elsewhere in the world, and it should have been treated in a similar fashion.

Rarely have I enjoyed so much browsing through a field guide and I commend it highly. My only word of caution is to those attracted by the caption to the "shingle stream" in Plate 1 as "an ideal habitat for amphibians at night." Within my experience, the raging torrent and precipitous boulders indicate that it is not an ideal habitat for collectors at night.

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Los Anfibios del Monumento Natural Barro Colorado, Parque Nacional Soberania y Areas Adyacentes. The Amphibians of Barro Colorado Nature Monument, Soberania National Park and Adjacent Areas, by R. C. Ibañez, A. S. Rand, and C. A. Jaramillo. 1999. Editorial Mizrachi & Pujol S.A., Panama. (Order from: bookstore@tivoli.si.edu or Smithsonian Tropical Research Institute, Bookstore, Apartado 2072, Balboa, Rep. de Panama). 187 pp. Hardcover. US$ 20.00, accompanying CD $15.00 (+ shipping $ 5.00 to North America, $ 6.00 to South America, $10 to Europe, and $13 everywhere else). ISBN 9962811171.

RAFAEL O. DE SÁ
Department of Biology, University of Richmond
Richmond, Virginia 23173, USA
e-mail: rdesa@richmond.edu

This book focuses on the batrachofauna of Barro Colorado Nature Monument, Soberania National Park and adjacent areas. It complements other recent publications on Neotropical amphibians such as those by Rodríguez and Duellman (1994) on Peru, Achaval and Olmos (1995) on Uruguay, and Meyer and Foster (1996) on Belize. The goal of these books is to reach a wider audience than the more technical batrachofaunal summaries—e.g., *Frogs of Boracéia* (Heyer 1990), *Amphibians of Argentina* (Cei 1985), and *Frogs of the Genus Eleutherodactylus* in Western Ecuador (Lynch and Duellman 1997). These geographically focused guides are especially useful to students, amateur biologists, and to the increasingly omnipresent ecotourists roaming the Neotropics. However, they are also valuable tools for beginning biology graduate students who are looking for an "organism" to work on, as well as to the trained herpetologist visiting an area for the first time.

A distinctive and positive feature of this book is its completely bilingual format. This format is targeted toward students and professionals in Latin America and undoubtedly it will be well received there.

The authors provide an informative map of the region with key localities clearly identified and plotted. Good quality photographs are provided for each of the 62 amphibian species occurring in the area. In addition, sonograms are presented for 52 out of the 59 frog species considered.

Each of the species accounts includes an overall description of adults, with a few diagnostic characteristics noted in italics for quick identification, followed by brief descriptions of the calls

and notes on the natural history of the species. A CD complements the descriptions of calls. The sonograms will be of interest to the technical reader, whereas the actual CD sounds would help individuals in the field. The natural history notes include a bit of ecology of calling males and site of egg deposition. Parental care information and the presence of a free-swimming tadpole stage are noted where appropriate. The final component in each species account is a brief summary of key references. These references will point interested individuals toward information for additional studies and details on the biology of each species.

Incorporating tadpole illustrations and descriptions with the species accounts could have strengthened this book. These geographic guides tend to overlook the characteristics of the larval stage, missing the opportunity to produce complete summaries of the biology of the amphibians inhabiting any area. The second, and more important, shortfall is the absence of dichotomous keys for genera and species identification. The inclusion of such keys would have been extremely beneficial for all who would use this book, particularly while visiting the Barro Colorado area. Nonetheless, the authors have done a good job summarizing information for the amphibians of Barro Colorado and this guide will be of widespread use and interest to anyone visiting or working in Barro Colorado and surrounding areas.

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The Lizards of Iran, by Steven C. Anderson. 1999. Society for the Study of Amphibians and Reptiles, Oxford, Ohio. vii + 442 pp, 25 plates. Hard cover. US $65.00. ISBN 0-916984-49-4.

NASRULLAH RASTEGAR-POUYANI
Department of Biology, Faculty of Science, Razi University
Kermanshah, Iran

Herpetologically and biogeographically, Iran is one of the most complex countries in the Middle East and Southwest Asia. It serves as a crossroad between North Africa, Arabia, Central Asia, southeastern Europe and the Oriental region (southern Pakistan and northwest India). Iran covers an area of 1,648,000 km^2, situated between latitudes 25° and 39°N and longitudes 44° and 62°E (Davoudzadeh 1997). This large territory is very rich from the standpoint of its lizard fauna; to date 122–125 lizard taxa belonging to 34 genera and 8 families have been documented, and additional taxa may be expected from the remote and poorly investigated regions of the country.

For nearly half a century Steven Anderson has studied the lizard fauna of the Iranian Plateau and has made pioneering contributions to our knowledge of the saurology of the region (Rastegar-Pouyani 1999a). During extended field trips in 1958 and 1975 Anderson conducted field work in most parts of Iran, including the harsh lowland southwest of the country. He has observed most of the lizard species of the region and has published extensively on them (e.g., Anderson 1963, 1966a,b,c, 1968, 1974). Now, and after more than forty years of study and research, he has produced *The Lizards of Iran* as a definitive work based on museum material from collections throughout the world, an extensive review of relevant literature, and his own considerable field and laboratory experience.

The Lizards of Iran is nearly 450 pages long and is illustrated by 25 plates (including two black and white satellite photographs of Iran, 150 color photos of lizards [plates 1–19], and 38 color photos of their habitats [plates 20–25]), as well as 137 figures in the text. Furthermore, some 32 figures, mainly illustrating the identification keys, and 109 distribution maps are distributed throughout the text. The book represents an ambitious, well-written, and successful attempt to summarize almost all that is known about the lizards of Iran. As the first handbook on Iranian lizards it will undoubtedly serve as an invaluable reference for herpetologists carrying out further regional research.

The book is organized into two main parts: a general section (pp. 9–65) and a systematics section (pp. 66–299). A prelude by Eskandar Firouz (a former deputy to the prime minister of Iran and director, Department of Environment) precedes the introduction. The general, introductory part of the book is subdivided into several subheadings: an introduction, in which the author gives a short account of his two field trips in Iran in 1958 and 1975; a short, but impressive, history of herpetological investigations in the Iranian Plateau including a review of key workers and their publications, and an overview of biogeography and ecology of the lizards of Iran (pp. 42–65) which provides an excellent data-rich summary of these topics. Here, all the different physiographic regions and main drainages of Iran are succinctly reviewed and the composition of their lizard faunas are given, with emphasis on the endemic species. The role of physical and biological factors affecting lizard distribution and abundance (e.g., substrate type, temperature, moisture, vegetation, predation) is also discussed. Relationships of the Iranian Plateau lizard fauna to that of adjacent areas are documented, the number of taxa shared with each region is given, and the role of paleogeographic events (e.g., plate tectonics) on the evolution and present distribution of the lizard fauna of Iran is discussed.

Regarding this general part of the book, a few errors need to be mentioned: in one instance, at least, the names Zagros and Albors have been confused (p. 50); on page 58, the Masjid-e-Soleyman region in southwestern Iran is illustrated in plate 22A–C (rather than 21A–C); it does not appear that *Laudakia nupta, Trapelus ruderatus* (now *Trapelus lessonae*), *Eublepharis angramainyu, Asaccus griseonotus, Carinatogecko heteropholis, Cyrtopodion*

heterocercum, Lacerta cappadocica, L. media, and *L. princeps* occur in Kuwait (p. 60) unless we regard Iraq and Kuwait as a single entity!; *Laudakia microlepis* should be included to the list of the fauna of Pakistan and Afghanistan (p. 61); and the occurrence of *Ophisops elegans* in Turkmenistan (p. 61) is highly doubtful and contradicts the information in the species account for this taxon.

The systematic section, as the core of the book, covers the lizard fauna of the entire territory of Iran, which includes 8 families, 34 genera, and some 123 species (21 agamids, 2 anguids, 3 eublepharids, 40 gekkonids, 38 lacertids, 14 scincids, 3 uromasticids, and 2 varanids). It begins with a key to the lizard families of Iran, followed by family, generic, and species accounts in alphabetical order. A brief overview is provided for each family (except Varanidae) followed by a key to the relevant genera occurring in Iran. Each genus is treated under the subheadings "definition," "distribution," and "remarks." In the diagnosis of species and subspecies, external morphological characters (mostly scalation and color pattern) are employed almost exclusively, but for the definition of families and sometimes genera, osteological characters are frequently used. Keys are provided for all the species and subspecies (both documented and doubtful taxa). To the best of my knowledge, most keys are workable and clear.

Species accounts constitute the main part of the systematics section, covering all 123 (110 documented and 13 doubtful) lizard species. Descriptions are based on the author's own observations and field work as well as the literature. Each account provides almost all available relevant data. Information concerning the extralimital taxa are provided only if the data are lacking for the Iranian ones. Species accounts are relatively comprehensive, consisting of the name of the original describer, type(s) and type locality, a list of synonyms (if any) as well as scientific and English vernacular names, diagnosis, color pattern, size, habitat, distribution, and remarks. Accounts vary in their thoroughness depending in part on whether the information was derived chiefly from field study by the author, museum collections, or the literature. Individual accounts range from about half a page (e.g., *Carinatogecko heteropholois, Acanthodactylus nilsoni, Ophiomorus persicus*) to about five pages (*Trapelus agilis*).

Distribution spot maps for all taxa occurring in Iran are provided (except for *Lacerta media media*). The distribution of each taxon (species or subspecies) is shown as a series of solid or open symbols, the former identifying specimens examined by the author, the latter those reflecting literature records. These symbols are plotted onto a small, simple map of Iran without further information. The type localities, if applicable, are represented as rectangles. Most species as well as some relevant habitats are represented by high quality photographs grouped into a series of plates at the end of the systematic section. Further, line drawings or black and white photos frequently accompany the description of species in the text. The text figures are mainly taken from older literature sources and are, in some cases, of poor quality.

Different systems of classification are followed throughout the book including both traditional and modern approaches. For instance, the taxonomy of the Gekkota mostly follows Kluge (1987) and Grismer (1988), recognizing the Eublepharidae as a familially distinct monophyletic group, with all other Iranian taxa belonging to the family Gekkonidae (Kluge 1967, 1983, 1985; Szczerbak and Golubev 1986). The problematic inter- and intrageneric relationships of the arid Asian gekkonids (e.g., *Agamura, Bunopus, Carinatogecko, Cyrtopodion*) remain unresolved. In the taxonomy of the Agamidae, the author has followed the unpublished thesis of Moody (1980), separating *Uromastyx* from the other Iranian genera of agamids, placing it, along with the Southeast Asian *Leiolepis*, in the family Uromastycidae (although this grouping has subsequently been regarded by some authors as a subfamily within the Agamidae; Barsuk-Bialynicka and Moody 1984). The systematic status of *Trapelus agilis,* and the traditionally recognized *T. persicus* and *T. ruderatus* complexes, are not clarified and, although the nomenclature of this group has changed greatly in recent years, the book employs an older set of terminology. For example, *Trapelus agilis* now has four recognized subspecies, and the following names now refer to different biological entities than they did in the past: *T. ruderatus* (= the former *T. persicus*), *T. lessonae* (= the former *T. r. ruderatus*), and *T. megalonyx* (= the former *T. megalonyx* + *T. r. baluchianus*) (Rastegar-Pouyani 1998, 1999a,b,c, in press, unpubl. data). Further, it is not obvious whether Anderson accepts *Laudakia caucasia triannulata* as a distinct taxonomic entity. The validity of this trinomen has been rejected based on molecular as well as morphological studies (Macey et al. 1998; Rastegar-Pouyani and Nilson, unpubl. data).

The two main drawbacks of the book are the poor quality of some of the illustrations in the text and the complete lack of convenient, tabulated data in the main text. Most other problems reflect apparently inadvertent omissions and minor errors. Anderson claims (p. 100) that the holotypes of *Agama kirmanensis* and *A. kirmanensis* var. *brevicauda* are destroyed. However, I examined both of them in February 1996 during my visit to the Russian Academy of Sciences, St. Petersburg. The lack of a distribution map for *Lacerta media media* is surprising, as it is one of the best known lacertids in western and northwestern Iran. The distribution map of *Lacerta princeps princeps* and *L. p. kurdistanica* (p. 241) is problematic, being contradictory with the description in the text. It does not appear that the nominal subspecies (*L. p. princeps*) occurs in Kermanshah province. If it does occur there, then the relegation of these forms to subspecific status must be reconsidered. There are some minor misspellings of Persian terms throughout the book; however, as a native Persian (Farsi) speaker, I deeply appreciate the tremendous effort made by the author in translation and application of the Persian names.

Nearly one third of the book is devoted to literature citations, appendices, and an index. An impressive, accurate, and detailed bibliography (pp. 301–345), consisting of 929 references from 1758 to 1999, is one of the strongest points of *The Lizards of Iran.* It serves as a valuable resource for any aspect of the herpetology of the Iranian Plateau. Abbreviations for museums and author names are provided in Appendix I (pp. 347–349). All the material examined and their relevant Iranian localities in different Provinces (Ostans) are represented, in alphabetical order, in Appendix II (pp. 351–382). Here, the arrangement is based on Taxon / Province (Ostan). Appendix III (pp. 383–415) is a gazetteer providing almost all the Iranian reference localities (from the herpetological point of view) along with their relevant Province (Ostan) names. If available, latitude, longitude, and elevation are also given. In the second page of the gazetteer (p. 384) some Persian (Farsi) terms along with their correspondent English names are presented; unfortunately some of these have been inappropriately translated

(e.g., ab = water [not stream or well]; shekasteh = broken [not mountain]; jebal = mountains [not hills], shur = salty [not stream], etc.). An index to the authors, subjects, English and scientific names of the taxa (pp. 417–442) completes Anderson's book.

In short, *The Lizards of Iran* is an invaluable reference and a substantial contribution to the herpetology of a taxonomically and biogeographically key region. It represents the results of nearly half a century of study and research by the author in the field and laboratory. Steven Anderson deserves to be commended for producing such an important contribution to the knowledge of the herpetology of the Iranian Plateau. His book certainly serves as a standard for future regional monographic works, provoking constructive thoughts and encouraging further investigations of the lizard fauna of this herpetologically complex region. The book is for anyone interested in the saurology of the Iranian Plateau, Central Asia, or the Middle East. I strongly recommend that both professionals and amateurs add this important publication to their libraries.

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Field Guide to Amphibians and Reptiles of Illinois, by Christopher A. Phillips, Ronald A. Brandon, and Edward O. Moll. 1999. Illinois Natural History Survey Manual (8):xiii–xv + 282 pp., Champaign, Illinois. ISBN 1-882932-04-8 . Cloth. US $19.95.

HARLAN D. WALLEY
Department of Biology, Northern Illinois University
Dekalb, Illinois 60115, USA
e-mail: hdw@niu.edu

Not since Philip W. Smith published his monographic study in 1961 has a major work on the herpetofauna of Illinois appeared. The Smith monograph was the first state monograph to use both excellent illustrations and distribution maps, along with complete ecological, distributional, and historical information, and has served as a guideline for subsequent state monographs.

The present volume is the eighth publication in a general series on the flora and fauna of Illinois. Previous volumes covered Illinois wildflowers, shrubs, land snails, mammals, mussels, and long-horned beetles. Each volume in this series has been compacted into a pocket guide, which can easily be carried in the field.

Like the preceding volumes, this small book is an excellent practical guide for the general public to aid in the identification of the 102 species of amphibians and reptiles that live within the boundaries of Illinois. It is organized in a manner that makes it easy to use for one with little or no prior knowledge. Basic information is presented on the biology and life history of amphibians and reptiles, and a brief account is given of the species that are listed under the State's Endangered Species Protection Act. This is followed by a short discussion on regulations for collecting and keeping herptiles, along with remarks on mortality and habitat improvement. There is also a short section on the "Geologic and Climatic History of Illinois," in which the authors discuss how earth history has played an important role in the former distribution and abundance of species within the state (although this has changed drastically due to human activities). This is followed by a glossary of terms, and an illustrated key to amphibians and reptiles of Illinois, using only common names.

After the key, individual accounts cover the 102 species within the state. The accounts are condensed, containing brief sections on identification, similar species, subspecies recognized within the state, short description, habitat, natural history notes, and status. The serious reader might have desired additional information in these accounts but what is presented is concise and accurate, and well suited to the function of the book as a field guide.

Each species account is provided with an excellent color photograph (the majority of which were taken by Mike Redmer), along with a color distribution map, which shows the counties cited with voucher specimens, photographic records, verified sightings, and pre-1980 records.

The individual species accounts are followed by a short section discussing species of questionable occurrence in Illinois (*Ambystoma tremblayi, Terrapene carolina triunguis*, and *Cemophora coccinea*). A short section on additional literature is followed by an index to common and scientific names which completes the volume.

I noted no errors in the text, except that on pages 15–16 one sentence has been duplicated. This is an excellent book that admirably fulfills its purpose. The authors should be commended for their effort. I recommend this publication to both laymen and professionals.

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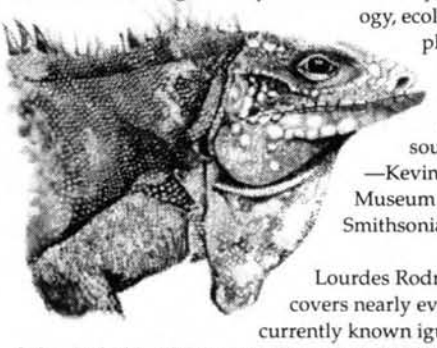
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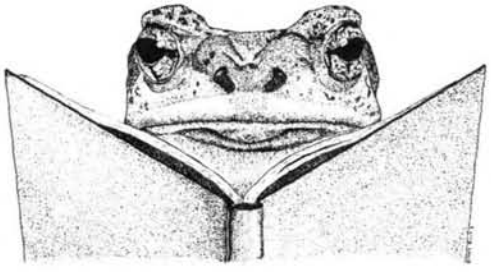
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HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
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BRADFORD HOLLINGSWORTH
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midorcas@davidson.edu

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sbm1@axe.humboldt.edu

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pstone@ucok.edu

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dede.olson@orst.edu

GUNTHER KÖHLER
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Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

Current Research
JENNIFER M. GARRISON
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
jmg1@ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey
2041 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968, USA
jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Legislation & Conservation
TRAVIS J. RYAN
Department of Biology
Furman University
Greenville, North Carolina 29613, USA
travis.ryan@furman.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

Copy Editors: *Anna Clarke, Eli Greenbaum, Jeff Parmelee, Jenny Pramuk*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

www.ukans.edu/~ssar



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

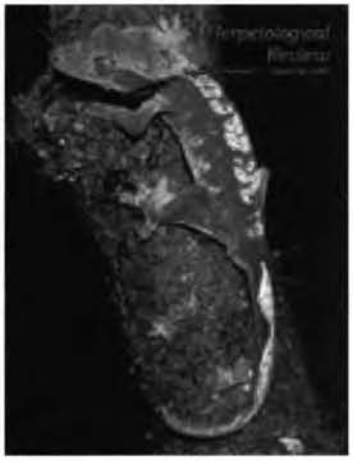
ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2000 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@slu.edu.

Future Annual Meetings

2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 26–30 July 2001

About Our Cover: *Rhacodactylus ciliatus*



Islands are fertile ground for the birth of species, thanks to their unique and complex mix of circumstances including isolation, small gene pools, and a limited number of predators. Reptiles endemic to islands sometimes evolve highly derived characteristics that would not normally be viable on a continental ecosystem. Gigantism is a case in point. Many reptile families can count island taxa among their largest extant members.

The French territory of New Caledonia is home to the richest herpetofauna of any non-archipelagic island group in the Pacific. It also harbors more endemic taxa, both in absolute numbers and as a percentage of its whole, than any other island in the Pacific except New Guinea (Bauer and Sadlier 1994. Pacific Science 48[4]:353–366). Among its suite of herpetological oddities are some of the world's largest geckos.

Giant geckos of the genus *Rhacodactylus* are endemic to New Caledonia. Six species are known to occur in the island's rainforests and *marquis*, the peculiar heath-like vegetation communities that thrive on the toxic, nickel-rich soils. The largest of these, with a snout-vent length of 245 mm or more, is *R. leachianus*, considered to be the world's largest living gekkonid. This great flabby gecko with its long, horse-like face and loose folds of skin is relatively common in humid forests throughout New Caledonia.

But perhaps the most enigmatic and spectacular is the crested gecko (*R. ciliatus*). This extraordinary lizard, with a snout-vent length of 'only' 130 mm, has an elaborate pair of spinose crests sweeping back from above each eye to form a parallel series on the nape. It also has extensive webbing at the rear of the hind limbs and a thin, cylindrical tail with a flattened, spatulate tip bearing adhesive lamellae.

Rhacodactylus ciliatus was described as *Correlophus ciliatus* by Guichenot in 1866. The type locality, given as simply *Nouvelle-Calédonie*, sheds no light on its provinence. A series of some 20 specimens collected in the latter part of the 1900's are labelled Ciu and Noumea but the latter is more likely a point of shipment than a collecting site for specimens (Bauer 1990. Bonn. Zool. Monogr. 30:1–220). No more were found for nearly a century and it was feared the lizard may have become extinct. In 1994 *Rhacodactylus ciliatus* was rediscovered on Ile des Pins (Isle of Pines), a small island about 50 kilometres off the southern tip of New Caledonia. Recently, more intensive field work has revealed crested geckos in at least three separate sites on the southern New Caledonian mainland.

Little has been documented on the crested gecko in the field. Bavay (1869. Mem. Soc. Linn. Normandie 15:1–37) considered it an inhabitant of montane forests that was seen only after rain, but field observations over the past several years revealed that it also occurs in warm, moist lowland forests. Fecal examinations reveal fruit to be a significant part of its diet although, not surprisingly, captive individuals thrive on a variety of insects. Original tails are uncommon on adults and they are said to be incapable of growing a new one, regenerating little more than a stump.

The large adult pictured, complete with original tail, was one of three specimens including two juveniles that were found foraging on saplings and tree limbs in dense forest in southern New Caledonia. In keeping with Bavay's observations of 130 years ago, they were active during and after torrential downpours. The endemic genera *Bavayia* and *Eurydactylodes*, along with another giant gecko, *R. auriculatus*, were found in the same forest. The gecko was photographed *in situ* by Australian herpetologist **Steve Wilson**, in May 1998. Steve used an Olympus OM4Ti, a 50mm f3.5 macro lens and a single hand-held manual flash. He prefers to use a single flash, with a small pen-light attached to help focus in the dark and indicate precisely where the shadows will lie.

Steve is a supervisor in the Inquiry Centre of the Queensland Museum in Brisbane. He also works freelance as a wildlife photograper and writer. Steve has been photographing reptiles, amphibians, insects, and spiders for more than 25 years. The two main focal points of his work are the comprehensive coverage of the Australian lizards and snakes, and the herpetology of tropical islands. With co-author Dave Knowles, he published *Australia's Reptiles—a Photographic Reference to the Terrestrial Reptiles of Australia* (Collins Australia, 1988). Their book, bringing together the combined talents of some of Australia's leading reptile photographers, features a near complete pictorial coverage of Australia's lizards and land snakes. Steve's photography and articles are widely published in books and magazines throughout Australia. His next project is the publication of a field guide to the reptiles in his home state of Queensland.



Separation and imaging of Wilson's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

New Editor at the *Journal of Herpetology*

Richard Seigel, long-time Editor of the *Journal of Herpetology*, is stepping down. The journal has flourished under Rich's expert guidance, with manuscript submissions increasing each year. Effective 1 December 2000, Dr. Brian Sullivan will assume the role of Editor. Please send all new submissions and editorial correspondence to him at the following address:

Brian Sullivan
Department of Life Sciences
PO Box 37100
Arizona State University-West
Phoenix, Arizona 85069, USA

Sherman A. Minton Student Travel Awards for 2001: Appeal for Contributions

The Board of Directors of SSAR have approved one time multiple travel awards to honor the memory of the late Sherman A. Minton, M.D., which would will also serve to recognize his many important contributions in herpetology, toxinology, and medicine.

Approximately ten awards will be made to students to help defray travel expenses to the SSAR/HL Annual Meeting in Indianapolis in July 2001. These awards would be in addition to the SSAR Student Travel Awards, and will have the same criteria. The winners will be recognized in *Herpetological Review*, December 2001 issue. Donors will be recognized in appropriate ways, unless they ask to remain anonymous. Many feel Dr. Minton has a special place in their memory and we hope they will express their feelings by making a significant contribution to these awards.

Southern Torrent Salamanders are limited to headwaters of streams, seeps, and springs within coniferous forests in northern California and southern Oregon. Larvae take up to 3.5 yr to reach metamorphosis and an additional 1–1.5 yr to achieve maturation. Adults are rarely found more than 50 m from lotic waters. Timber harvesting, particularly the impacts of road-building and clearcutting on streams, is perceived as the primary threat to population viability. Effects of timber harvesting on hydrological stability, microhabitat integrity (i.e., low siltation and a rocky substrate), and temperature profiles have been identified as concerns. However, the practice of clearcutting has been strongly curtailed in this region over the past decade, and there appears to be some evidence that *R. variegatus* persists in altered habitats. Currently there are inadequate data to conclusively demonstrate that the species has low genetic variability, although it is likely the most genetically distinct (isolated) of *Rhyacotriton* species.

The Southern Torrent Salamander is listed as a species of special concern in California and as a vulnerable and sensitive species in Oregon. However, the species distribution is limited on California and Oregon state lands (2% and 1%, respectively, of the total species range). Thus, *R. variegatus* has no protection throughout the vast majority of its distribution, which is overwhelmingly on private (60%) and federal (37%) lands.

For further information, contact: Ann Chrisney, US Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, W-2605, Sacramento, California 95825-1864, USA.

USA: Department of the Interior: The US Fish and Wildlife Service proposed to declare 193,600 ha spread over nine counties in central and southern California as critical habitat for the Arroyo Southwestern Toad (*Bufo microscaphus californicus*; now usually regarded as a distinct species, *B. californicus*). *Bufo microscaphus californicus* is a small toad native to the drainages of central (coastal) and southern (coastal and desert) California southward to Mexico's northern Baja California. The wetlands within these drainages are highly variable. Adult *B. microscaphus californicus* prefer to breed in shallow pools in low-gradient streams and are most often found near the breeding sites throughout the year (within 0.5 km). Females are quite fecund, with clutch sizes approaching 10,000. The larval period is relatively brief, lasting less than 3 mo. Males and females may reach maturity by 2 yr post-hatching, although some females may require an additional year.

Bufo microscaphus californicus is believed extirpated from more than 75% of historical localities. Habitat alteration is regarded as the key threat to continued survival. If the proposed rule is adopted, destruction and/or severe modification of the critical habitat by any federally-funded or -approved activity would be prohibited. However, less than half of the critical habitat is located on federally-owned lands.

The public comment period on the proposal ended 7 August 2000. For further information, contact: Grace McLaughlin, Ventura Fish and Wildlife Office, 2394 Portola Road, Suite B, Ventura, California 93003, USA.

USA: Department of the Interior: The US Fish and Wildlife service proposed to list the Chiricahua Leopard Frog (*Rana chiricahuensis*) as threatened under the Endangered Species Act. The Chiricahua Leopard Frog is found in central and southern Arizona and New Mexico and in the adjoining region of Mexico. The species breeds in mid- to high-elevation (between 1,000 and 2,700 m) isolated wetlands that are frequently surrounded by arid terrestrial habitats. Recent surveys for *R. chiricahuensis* have indicated that the species appears to be absent from up to 80% of historical localities in the US. Less than 80 populations are believed to remain in this country.

One threat to *R. chiricahuensis* is competition and predation from non-native vertebrates, especially centrarchid fishes, Bullfrogs, and Tiger Salamanders. In a recent study, *R. chiricahuensis* was absent from nearly all wetlands where non-native vertebrates were present, and it was present in habitats lacking the non-native vertebrates. In addition, chytrid fungus—which is believed responsible for amphibian population declines and local extinctions in Australia and Central America—has been discovered on the skin of dead Chiricahua Leopard Frogs.

Several federal agencies, Arizona Game and Fish Department, New Mexico Department of Game and Fish, private landowners, and local groups are working in consort to develop management and conservation plans for the Chiricahua Leopard Frog.

The public comment period on the proposal ended 12 September 2000. For further information, contact: Jim Rorabaugh, Arizona Ecological Services Field Office, US Fish and Wildlife Service, 2321 West Royal Palm Road, Suite 103, Phoenix, Arizona 85021-4951, USA.

International: Convention on International Trade in Endangered Species (CITES): The 11th Conference of CITES was held on 10–20 April 2000 in Kenya. The following resolutions were ACCEPTED by the delegates at the convention:

- Include Asian box turtles (*Cuora* spp.) in Appendix II.
- Transfer African Spurred Tortoise (*Geochelone sulcata*) from Appendix II to Appendix I.
- Delete Sonoran Green Toad (*Bufo retiformis*) from Appendix II.
- Include Mantella frogs (*Mantella* spp.) in Appendix II.

The following resolutions were REJECTED by the delegates at the convention:

- Include Spotted Turtle (*Clemmys guttata*) in Appendix II.
- Transfer Hawksbill Turtle (*Eretmochelyes imbricata*) from Appendix I to Appendix II.

Appendix I species are threatened with extinction and may be affected by trade. Appendix II species are not currently threatened but such status is likely unless trade is restricted.

For more information, contact: CITES Secretariat, 15 chemin des Anemones, 1219 Chatelaine-Geneva, Switzerland. telephone:(+4122) 917 8139/40, fax: (+4122) 797 3417, e-mail: cites@unep.ch.

USA: Michigan: On 24 June 2000, the Detroit Zoological Institution opened the National Amphibian Conservation Center (NACC). The NACC is a $6 million facility covering 12,000 square feet, with the goal of drawing attention to the perceived worldwide amphibian decline problem. While much of the space at NACC is devoted to exhibits featuring about 1,000 amphibians, about half of the facility is devoted to husbandry, reproduction,

A New Book from the Society for the Study of Amphibians and Reptiles

THE HERPETOFAUNA OF NEW CALEDONIA

by AARON M. BAUER *and* ROSS A. SADLIER

with French summaries by Ivan Ineich and 189 color photographs

NEW CALEDONIA, INCLUDING THE LOYALTY ISLANDS AND AN ASSOCIated group of smaller islands and reefs, is a French territory located in the tropical Southwest Pacific equidistant from New Guinea, New Zealand, and Australia. This ancient group of islands supports one of the most highly endemic and species-rich herpetofaunas in the Pacific region. Among the 71 species of terrestrial reptiles, 86% are endemics, and most belong to endemic genera. Despite being only 2.5% the size of New Guinea, New Caledonia has 36% as many lizard species. In addition, the New Caledonian barrier reef system, one of the largest and most diverse in the world, is inhabited by a dozen species of seasnakes. Because of the diversity of its flora and fauna and the fragility of its habitats, New Caledonia is regarded as a biodiversity "hot spot," one of the earth's biologically richest and most endangered terrestrial ecoregions.

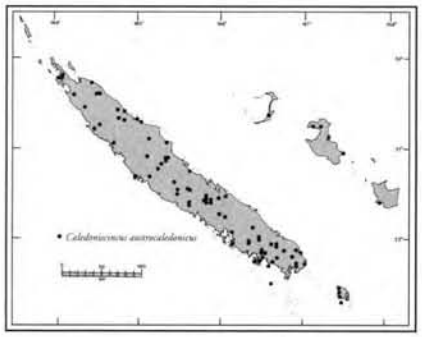
This book—at the same time a scientific monograph and a field guide—is the first modern review of the amphibians and reptiles of New Caledonia. It covers the frogs, family Hylidae (1 species), geckos of the families Diplodactylidae (20) and Gekkonidae (6), the Scincidae (42), snakes of the families Boidae (1), Elapidae (12, all marine), and Typhlopidae (2), and the sea turtles, Cheloniidae (3). Geckos and skinks, in fact, are the most numerous and dominant terrestrial vertebrates in New Caledonia. These two groups have undergone extensive generic and specific diversification, including the world's largest living geckos (*Rhacodactylus*) and more than a dozen genera of skinks including the giant skinks (*Phoboscincus*).

The authors, Aaron M. Bauer (USA) and Ross A. Sadlier (Australia) are both noted authorities on the Pacific herpetofauna. Their extensive field work in New Caledonia began more than 20 years ago. As a result of their research, numerous new genera and species of New Caledonian geckos and skinks have been described and named, but this book represents the first synthesis of their 20 years of study.

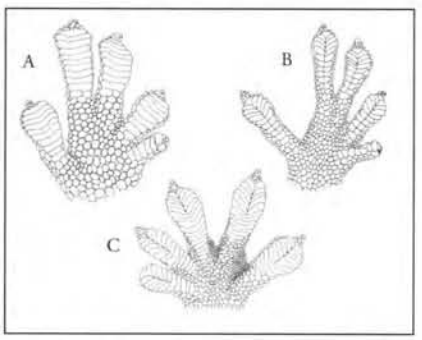
Organization of the Book

- Geography, Vegetation, Geological History, and Biogeography
- Ecological Patterns of Terrestrial and Marine Species
- Conservation
- Humans and the Herpetofauna, including a History of Scientific Studies
- Systematic Accounts of Genera and Species:
  Keys; Synonymies; Descriptions; Distribution (spot map for each species); Natural History; Conservation Status; Remarks and Status
- Incidental Taxa, Taxa of Questionable Occurrence, and Those Erroneously Recorded from New Caledonia
- Fossil and Subfossil Species
- Literature Cited and Bibliography of New Caledonian Herpetology (more than 1000 references)
- Gazetteer of Place Names; Index to Scientific Names

The 153 color photographs of animals depict nearly every species. There are also 36 photographs of New Caledonian habitats.







Specifications: 325 pages, 7 x 10 inches (18 x 22.5 cm), plus 189 color photographs of animals and habitats on 24 plates, 47 maps, 63 figures, and 4 tables. Clothbound. ISBN: 0–916984–55–9. To be published December 2000.

PRICES: Pre-publication to SSAR members US$50; Institutions and non-members US$60. ***SHIPPING:*** USA address, add US$3; non-USA, US$6

SEND ORDERS TO: Dr. Robert D. Aldridge, SSAR Publications Secretary, Department of Biology, Saint Louis University, 3507 Laclede Avenue, Saint Louis, Missouri 63103–2010, USA (*telephone:* area code 314, 977–3916 or –1710; *fax:* 314, 977–3658; *e-mail:* ssar@slu.edu). Please make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks or by International Money Order. Orders may also be charged to MasterCard or VISA (please provide the account number and card expiration date). SSAR membership information and a complete list of all Society publications can be obtained on request to Dr. Aldridge.

and research. The NACC is prepared to engage in collaborative projects with some of the leading conservation organizations, such as The Nature Conservancy and the IUCN's Declining Amphibian Populations Task Force.

For more information, contact: Andy Snider, Curator of Herpetology, Detroit Zoological Institute, 8450 West 10 Mile Road, P.O. Box 39, Royal Oak, Michigan 48068-0039, USA.

USA: US House of Representatives: On 11 May 2000, the House of Representatives passed the Conservation and Reinvestment Act (H. R. 701). The act would establish a Conservation and Reinvestment Act Fund, which would have a $2.825 billion annual budget. The Fund would support states' coastal conservation, development and implementation of endangered and threatened species recovery plans, federal and land restoration, among other programs. The bill was sent to the Senate where it was referred to the Committee on Energy and Natural Resources.

For more information, contact: Senator Frank Murkowski, Chairman, Energy & Natural Resources Committee, US Senate, Washington, DC 20510, USA; tel. (202) 224-6665; fax (202) 224-5301.

SSAR Grants-in-Herpetology

Proposals are now being accepted for the 2001 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include *in situ* behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

6. INTERNATIONAL. Proposals may address needs in any of the above five categories, but applicants must be from countries where herpetological research has historically been underfunded, and where alternative sources of financial support are scarce or nonexistent.

7. BIBLIOGRAPHIC RESEARCH. This special category continues for 2001 thanks to a donation from Itzchak and Carolyn Gilboa. Proposals should address a major need to consult library or other information resources. The project must focus on a herpetological topic. Proposals from individuals only, accompanied by a letter of support from someone knowledgeable about the applicant and about the importance of the project.

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be students AND members of the SSAR with the exception of those applying for support of regional herpetological society projects, or those applying in the international category. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 2000 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. Past recipients of an SSAR GIH award in any category are not eligible for future awards. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) TITLE PAGE giving the title of the project, the name, mailing address, office and home telephone numbers and, if possible, fax number and e-mail address of the applicant. The title page should include a statement indicating that applicants "will comply with all applicable permit regulations, and adhere to all appropriate animal care guidelines in the course of conducting funded projects." (B) BACKGROUND AND OBJECTIVES of the proposed project. (C) METHODS of carrying out the project. (D) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). Include an explicit explanation of how an SSAR award of $500 would be applied toward the objectives of the project, and provide a listing of all current and pending support for the project. (E) BRIEF RESUMÉ of the applicant or project coordinator. (F) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed 1200 words, excluding title page, literature cited, resumé, and budget. Applicants must indicate word count on their application.

Applicants must designate to which of the seven categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than **31 DECEMBER 2000** to be considered. Failure to meet these guidelines may result in elimination of a proposal from consideration. The awards will be announced on or around 1 April 2001. Successful applicants are encouraged to submit the results of their research for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Joseph R. Mendelson III, Chair, SSAR Grants-in-Herpetology, Department of Biology, Utah State University, Logan, Utah 84322-5305, USA. Tel. (435) 797-2097; Fax (435) 797-1575; e-mail: sapo@biology.usu.edu.*

A New Book from the Society for the Study of Amphibians and Reptiles

SLITHY LOVES

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by Sally Haines





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The bulk of this volume consists of full-color reproductions of illustrations from classic works together with extensive captions containing information about the authors, the artists, and the books. It is an iconography of herpetology and an essential part of the history of the field.

Organization of the Book

Myth versus Reality: the Challenge of Illustrating Amphibians and Reptiles, *by Kraig Adler*
Part I — Herpetology to 1758: The Pre-Linnaean Period
Part II — Herpetology after 1758: Beyond Linnaeus
Part III — West of Eden: New World Herps
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Chronological Index to Illustrated Herpetological Works in the Spencer Library

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POINTS OF VIEW

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"Coluber" Versus *"Ptyas"*: A Regrettable Tangle of Names

THEODORA PINOU
Department of Ecology and Evolution
Yale University, 165 Prospect Street
New Haven, Connecticut 06520-8104, USA
e-mail: theodora.pinou@yale.edu

and
HERNDON G. DOWLING
Rendalia Biologists, 1811 Rendalia Motorway
Talladega, Alabama 35160-4573, USA
e-mail: hdowling@coosavalley.net

Ptyas is a genus of large, terrestrial snakes that range from southern China and Afghanistan through the Malayan Peninsula and the Philippines to Sulawesi (Celebes) in the east (Fig. 1). This genus (*Ptyas* Fitzinger, 1843:26) has been recognized as valid at least since Stejneger (1907:345) who used this name in his "Herpetology of Japan." It was a surprise, therefore, to encounter recent zoogeographic studies (Das 1996, 1998) using the Linnaean genus *Coluber* for the species heretofore referred to *Ptyas*. As commonly recognized, *Coluber* is a North American genus, with its closest relative, *Masticophis* Baird & Girard (1853:98), also restricted to the Americas (Fig. 1).

The European racers formerly included in *Coluber* have been shown to belong to other genera (i.e., *Hemorrhois* F. Boie, 1826, and *Hierophis* Fitzinger, 1834) by various authors in the last several decades. Inger and Clark (1943) pointed out that they differed in dorsal scale row reduction patterns, Schatti (1986 et seq.) showed them to differ in skull, vertebral, and hemipenial morphology, and Lopez and Maxson (1995) showed them to differ in mitochondrial DNA sequences. Still, the weight of Boulenger's catalogues (1893–1896) lingers on, barring full acceptance of these data.

The confusion between *Ptyas* and *Coluber* apparently was initiated by Lazell (1998:134), who stated, "There is no morphological basis for recognition of a genus *'Ptyas'* as separate from *Coluber* sensu stricto." We will show here that not only is this statement erroneous, but that Lazell's method of "proof" was, itself, invalid.

The type species of *Coluber* is *C. constrictor* Linnaeus (1758), of North America. That of *Ptyas* is *P. mucosus* (Linnaeus 1758), of the tropics and subtropics of Asia. These two species (and the other species generally associated with each of them) differ in many features. We bring additional morphological information, as well as chromosomal, immunological, and genomic data to demonstrate the distinctness of these genera.

Morphology.—*Ptyas* and *Coluber*, along with 45 or more other genera, are members of the family Colubridae (*sensu stricto*). As such, they lack hypapophyses on their posterior body vertebrae, have the typical nine caenophidian crown scutes, and have the typical colubrid asymmetrical hemipenes (i.e., mirror-image basally, similar apically), with proximal spines, distal calyces, and a simple, dextrally trending *sulcus spermaticus*.

Although these genera are somewhat similar in general morphology, they differ in body size and proportions, scutellation,



FIG. 1. Approximate geographic distributions of the colubrid *(s.s.)* snake genera *Ptyas* and *Coluber*. Note that the genus *Ptyas* (b) is restricted to the Oriental region of Asia, whereas *Coluber* (a) is restricted to Nearctic North America. [The closely related genus *Masticophis* ranges from the southern United States to Colombia and Venezuela.] The arrow indicates the range (Sulawesi = Celebes) of *Ptyas dipsas*, the major subject of Lazell's studies.



FIG. 2. Head morphology of *Ptyas mucosus* (a) and *Coluber constrictor* (b). Note especially the larger eye and the presence of a "brow ridge" in *Ptyas*. ["a" from Smith (1943: Fig. 49; "b" original (HGD-HISS) from AMNH 99107.

dentition, vertebral proportions, and hemipenial structure (cf. Ortenburger 1928:178–181, pls. 27–30, and Smith 1943:158–166).

The species of *Ptyas* (including *P. mucosus*) are much larger snakes than *Coluber constrictor*, with record lengths of *P. mucosus* exceeding 358 cm (Smith 1943:160) versus the 185.4 cm record of *C. constrictor* (Conant 1975:178). The eye in *Ptyas* is proportionately larger and has an overhanging "brow ridge" not found in *Coluber* (Fig. 2). As shown by Clark and Inger (1942), the two genera also differ in the mode of dorsal scale reduction.

The maxillary teeth differ in number (20–25 in *Ptyas*; 13–16 in *Coluber*) and size, with the two posterior teeth of *Coluber* being distinctly larger than the others, and often set off by a diastema, whereas those of *Ptyas* are more uniform in length (Smith 1943: Fig. 48, p. 159).

The vertebrae differ in proportions (reflecting the larger size of mature *Ptyas)*, even when specimens similar in size are compared: those of *Ptyas* are more massive in structure and have distinctly higher neural spines than do those of *Coluber*.

The most definitive difference, however, is in the morphology of the everted hemipenis (Fig. 3). *Coluber* (and the closely related *Masticophis*) has a distinctly bilobed organ, covered distally with distinct, closely associated calyces. *Ptyas*, in contrast, has a most unusual hemipenis, lingulate (tongue-like) in shape, with flounces basal to an almost transparent region on which the broad calyces are only faintly inscribed. There are no lobes, and, in fact, the hemipenis differs greatly from that of any other genus of snake in which the everted organ has been described. The hemipenis of *Ptyas* shows no resemblance to that of *Coluber* except in those features typical of the Colubridae *(s.s.)*: basal spines, apical calyculi, and a simple, dextrally trending sulcus.

Chromosomes.—The chromosome number for *Ptyas mucosus* has been reported (Bhatnagar 1957) as 34, showing the loss of a pair of microchromosomes from the "standard" snake chromosome number of 36, which is characteristic of *Coluber constrictor* (Baker et al. 1972). The significance of this, however, is not clear.

Molecular data.—An immunological study (Dowling et al. 1983) showed *Ptyas mucosus* to be 24 AID (albumin immunological distances) from *Masticophis flagellum*, which was only 10 AID from *Coluber constrictor*. A later electrophoretic study (Dowling et al. 1996) showed *Ptyas mucosus* to differ from *Coluber constrictor* in one of four "slow evolving" protein loci: the same distance as shown between *C. constrictor* and the Nearctic greensnake, *Liochlorophis vernalis*.

The relationships suggested above were further supported by a genomic study (Lopez and Maxson 1995) that showed Oriental *Ptyas* to cluster closely with Oriental *Zaocys* (and distantly with Nearctic *Opheodrys*), in contrast to Nearctic *Coluber*, which clustered closely with Nearctic *Masticophis* and only distantly with the Oriental genus *Gonyosoma*.

Behavior.—*P. mucosus* inflates the throat when disturbed and is reported to "growl" at an attacker (Pope 1935:222). Neither of these behaviors is found in *Coluber*.

Discussion.—Lazell (1998) gave no description of the features of *Ptyas* and *Coluber* that served to support his action in synonymizing the former, but referred to a previous paper for details (Lazell et al. 1991). Inspection of this paper shows that he had been impressed with a "Black Racer" (*Ptyas dipsas*) on Sulawesi, commenting that *Coluber constrictor* was "probably its closest living relative." It should not be necessary to point out that black populations of *Ptyas* are known from elsewhere (Smith 1943:160), and that *C. constrictor* populations are black only in the eastern United States. Western populations may be gray, blue, or spotted. Neither are genera ordinarily identified by "eye-balling" their color patterns. As emphasized some years ago by Cope (1895), Dunn (1928), Bogert (1940), and Bourgeois (1969), it is necessary to consider other characters (often internal) in identifying the taxa and establishing the relationships of snakes.

Lazell (*in* Lazell et al. 1991) did examine a specimen of *P. dipsas* in the British Museum and gave an account of his observations, including some features of the (inverted) hemipenis. He also examined inverted hemipenes of *"Coluber korros* and *Coluber mucosus"* at the Museum of Comparative Zoology (MCZ), which "revealed conditions intermediate between these simple organs [of *P. dipsas*] and the strongly bilobate hemipenes of *Coluber constrictor, C. flagellum*, and other American members of the genus."

It is understandable that Lazell found it difficult to determine the shape of the hemipenis of *P. dipsas*, because he was examining a retracted organ that had been split and spread open. The same was true of the MCZ specimens. However, inasmuch as the hemipenis of *Ptyas* has flounces and no lobes, whereas the hemipenis of *Coluber* and *Masticophis* has no flounces and is bilobed (and the shape of the organ is difficult to see in the retracted state), it is difficult to place great reliance on these observations. Further, our hemipenis preparations (Fig. 3) show that the hemipenis of *Ptyas mucosus* is by no means "intermediate." Actu-

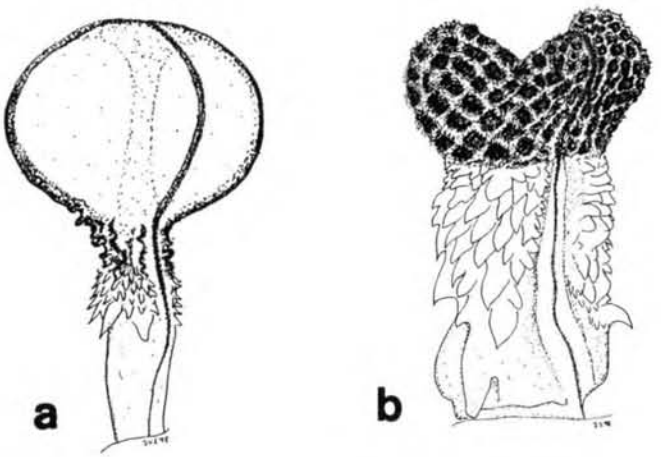


FIG. 3. Hemipenial morphology in *Ptyas mucosus* (a) and *Coluber constrictor* (b). Note especially the greatly expanded (and almost transparent) apical region of *Ptyas* in contrast to the bilobed, distinctly calyculate apical region in *Coluber*. The single *sulcus spermaticus* trends to the right (a colubrid *s.s.* feature) in both genera. [Sketch "a" from HGD Field Series #72726, and "b" from a photograph in Ortenberger (1929: Pl. 29.]

ally, it is much more different from that of *Coluber* than Lazell reported. His description of the inverted hemipenis of *P. dipsas* may be compared with Smith's (1943:160, 164) similar observations of the inverted hemipenes of *P. mucosus* and *Zaocys carinatus*. Excellent photographs of the everted hemipenes of *Coluber* (*sensu stricto*) and several species of *Masticophis* may be found in Ortenberger (1928).

Lazell's major error, however, was to choose *P. dipsas* to discriminate between the genera *Ptyas* and *Coluber*. If the data had so indicated, he might have been able to demonstrate that *P. dipsas* was actually a *Coluber*, but this would not have disturbed the status of the genus *Ptyas*. If a genus is to be synonymized, it must be done through comparisons of the type species of the genera. *Coluber constrictor* is the type of its genus, but *Ptyas dipsas* is not. *Ptyas mucrosus* is the type, and Lazell did not compare the two type species. Thus his referral of *Ptyas* to the synonymy of *Coluber* is both wrong and illegitimate. Our data clearly demonstrate that *Coluber* and *Ptyas* are not closely related to one another.

We suggest on the basis of the numerous and profound differences between the type species of these genera that *Ptyas* Fitzinger (1843) should be reinstated as a distinctive Oriental taxon, and that *Coluber* Linnaeus (1758) be restricted to the Nearctic racers, as it is commonly applied.

Acknowledgments.—We thank Janann Jenner for the sketches of the hemipenes. We also thank the two reviewers, Ted Papenfuss and Joe Slowinski (and the editor) for helping us to focus this paper on the more important elements of the review. The title is derived from that of Thomas Barbour (1917), written in reference to a somewhat similar situation.

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Comments on the Restriction of the Type Locality and Nomenclature of the Chuckwalla, *Sauromalus ater* Duméril, 1856

RICHARD R. MONTANUCCI
Department of Biological Sciences, Clemson University
Clemson, South Carolina 29634 -0326, USA
e-mail: rrmnt@clemson.edu

The holotype of *Sauromalus ater* (MHNP 813) was collected during a circumnavigational voyage of the French frigate, *La Danaide*, and presented by Lieutenant M. Jaurès, without locality data, to the Muséum National d'Histoire Naturelle in Paris (Brygoo 1989). The absence of a type locality for *S. ater* has remained ever since, an acknowledged problem for taxonomists working with *Sauromalus* (Hollingsworth 1998; Schmidt 1922; Shaw 1945).

Shaw (1945), unable to study the holotype due to political conditions in Europe, believed he had uncovered clues in the literature as to its origin. In a redescription by Duméril and Bocourt (1870) and remarks pertaining to color pattern by Mocquard (1899), some details seemed to suggest that the type had originated from

one of the islands off the coast of the southern part of the Baja California peninsula. Thus, for the type locality, Shaw (1945) stated: "Not definitely known but undoubtedly one of the several islands in the southern part of the Gulf of California where this species is known to occur." Subsequently, Smith and Taylor (1950) further restricted the type locality to Isla Espiritu Santo without justification. Their restriction apparently was not based on any specific information about the holotype (de Queiroz 1995), but they may have selected this island simply because it is the largest island close to the port settlement of La Paz.

In a comprehensive systematic revision of the genus *Sauromalus*, Hollingsworth (1998) relegated *S. obesus* (Baird) 1858, and *S. australis* Shaw 1945, to the synonymy of *S. ater*. Using principal components and discriminant function analyses of meristic characters, he demonstrated substantial overlap within multivariate space among the three taxa, including the subspecies previously assigned to *obesus* and *ater*. He also described a zone of color pattern transition between *obesus* and *australis* in Baja California, which suggested conspecificity between the two mainland forms. Furthermore, based on additional evidence, he restricted the type locality of *S. ater* to southern Sonora.

Hollingsworth (1998), in an effort to determine the probable type locality of *S. ater*, drew upon both univariate and multivariate statistical data as well as color pattern information. He examined 8 meristic and 3 proportional characters, comparing the holotype with various population samples (see his Tables 10–15). He considered, in this context, only coastal and insular locations and excluded any sample area as the possible type locality if the holotype's character state fell outside the sample limits.

Herein, I argue that Hollingsworth's (1998) analysis to determine the provenance of the type specimen is unconvincing because of limitations of his data, leading to ambiguous results and an unsubstantiated conclusion. My arguments are based on the examination of his original thesis (which contains raw meristic data and color photographs of the holotype of *S. ater*), as well as the published version of his work. I also suggest that the specific name, *Sauromalus obesus* (Baird) 1858, should be conserved because the name has been widely used in the literature and the type locality is known (Shaw 1945; Montanucci, *in press*).

Hollingsworth (p. 119) asserted that there is agreement between the holotype of *S. ater* and southern Sonoran samples in color pattern, but the similarities were not stated explicitly. Hence, the reader is left only with the implication that the holotype is more similar to the southern Sonoran samples than to the Baja California and gulf island chuckwallas. In fact, Hollingsworth classified Baja California Sur, southern gulf islands, and southern Sonoran populations in the same pattern class (see his Fig. 48), and gave no indication of differences between these populations on opposite sides of the Gulf of California. Hollingsworth (p. 116), discerned five indistinct dark brown transverse bands composed of strong to weak reticulations on the dorsum of the holotype. He referred to the most distinctive of these as a "pectoral" band which is confusing and incorrect; the appropriate adjective would be "scapular" or "interbrachial." The bands are not evident in his published photographs (see his Fig. 44C), nor in his unpublished thesis (see color photograph, Fig. 57A). I could not confirm the presence of five indistinct dorsal bands in the holotype when I recently examined it. Duméril's (1856) description of the holotype does not allude to the presence of faint dorsal cross bands, and Duméril and Bocourt's (1870) redescription simply mentions that the body is covered by small black spots. However, Mocquard compared a male specimen from Baja California with the type specimen and noted, apparently in both, a faint black, transverse band in the interbrachial area just posterior to the forelimb insertions. Hollingsworth's interpretation of the color pattern may be inaccurate, as the type specimen had been in preservative over 140 years when he examined it.

In his univariate analysis of meristic characters, Hollingsworth (p. 119) ruled out certain populations as the potential source of the holotype because the holotype's value fell outside the range limits of the sample. The sample sizes for the excluded populations range from N = 3 to N = 27. One could reasonably argue that some of these samples are too small to justify their exclusion with confidence. To determine whether or not Hollingsworth was justified in excluding these localities, prediction intervals (Hahn and Meeker 1991) were calculated using the formula: Mean $\pm t_{(1-\alpha/2, N-1)}[s^2(1 + 1/N)]^{1/2}$. On the basis of the sample size, mean, and variance, the formula yields the predicted range limits within which any future observation is likely to fall with 95 percent confidence. The method assumes the sample is drawn from a population with a normal distribution; in this case, the meristic characters were found to conform to, or closely approximate, normality. The predicted range limits were calculated and the values of the holotype were then considered "future" observations which either fell within, or outside, the calculated limits.

Table 1 summarizes the statistics of dispersion and calculated prediction intervals for sampled localities which Hollingsworth excluded as the potential type locality. On the basis of number of caudals, the holotype's value (27) falls well outside the predicted range limits for the MNLND-A sample. Thus, Hollingsworth may have been justified in excluding this area as the potential type locality. The holotype's value for dorsals (32) falls very close (within rounding error) to the predicted range limits for the Isla Espiritu Santo (IES) sample, and I would hesitate to exclude this locality on that basis. The remaining localities in Table 1 have predicted range limits that encompass the holotype's values, and therefore Hollingsworth was not justified in excluding them.

Additionally, several localities have character range limits that do not encompass the holotype's value, yet they were not excluded by Hollingsworth on that basis. These include: MNLND-A (N = 27) for ventrals (145–195; holotype 144), and for brachials (41–57; holotype 39); IDANZ (Isla Danzante) for ventrals (N = 3, 127–138; holotype 144), for caudals (N = 3, 28–29; holotype 27), for supralabials (N = 3, 25–30; holotype 24), for infralabials (N = 2, 27–29; holotype 26); ISD (Isla San Diego) for ventrals (N = 7, 126–141, holotype 144), for dorsals (N = 5, 27–31; holotype 32), and for supralabials (N = 7, 22–23; holotype 24). Prediction intervals with an a level of 0.05 were calculated for these samples as well, and in all cases, the holotype's value was encompassed by the predicted limits. Hence none could be excluded as the potential type locality.

The holotype has five rostral scales, a value encompassed by the samples from islas San Diego, Santa Cruz, Danzante, and Baja California Sur, and several continental samples (see Tables 13 and 15 in Hollingsworth). On the basis of rostral counts, Hollingsworth explicitly excluded only Isla Partida Sur (limits 3–4; N = 16) and

Isla Tiburon (limits 3–4; N = 10) as the potential type locality. Using his method, however, several additional localities could be excluded: Cape region (limits 3–4; N = 19); Isla San Jose (4; N = 5); Isla Espiritu Santo (limits 3–4; N = 22); Isla San Marcos (4; N = 14), and Isla San Francisco (limits 3–4; N = 21). The rostral count data do not conform to either a normal or Poisson distribution because the values in each sample are either a 3 or a 4. The calculation of prediction intervals therefore requires the use of a distribution-free method. Using that approach, the equation for the range limits having an a value of 0.05 requires a sample size of 39 or greater (Hahn and Meeker 1991). Hence, exclusion of any of the above-mentioned localities would be unjustified because the sample sizes are insufficient to render a decision with confidence.

Hollingsworth (p. 48), stated that the fragmented rostrals of *Sauromalus* are slightly larger as compared with supralabials (see his Fig. 7 B). His illustration depicts the ideal distinction between rostrals and adjacent supralabials. However, there is variation in the size of the rostral scales due to horizontal as well as vertical fragmentation. These scales can be larger, smaller, or the same size as scales comprising the supralabial series. Also, the lateral extent of the series of enlarged scales varies (depending on the size and number of scales) relative to the position of the external nares, thus raising questions about homology. Such variation in size and position presents difficulties in distinguishing rostrals from adjacent supralabials (Fig. 1). Hollingsworth did not use any other criterion, except size, to distinguish these scales. Without discrete reference points to begin and terminate the counts, there is potential ambiguity in counting rostral scales. Hence, the character is of doubtful utility in determining the origin of the holotype. Further support for my conclusion comes from Hollingsworth's data analyses. The rostral character was not used in the canonical variates and principal components analyses in his unpublished thesis. Yet, the inclusion of the rostral count data in the published analyses did not materially affect the position of the holotype relative to known samples when the unpublished and published plots are compared (see discussion below).

Hollingsworth stated that the holotype is missing the tip of its tail, and its actual tail length/total length ratio is 0.500. He (p. 119) estimated a hypothetical tail length/total length ratio of 0.519 (by arbitrarily adding 10 mm). On the basis of actual (uncorrected) and estimated ratios, he excluded the following localities: Cape region (limits 0.522–0.529, N = 2); Isla Danzante (0.551, N = 1); Isla Espiritu Santo (limits 0.514–0.552, N = 6); Isla San Diego (limits 0.523–0.534, N = 4), and Isla Santa Cruz (limits 0.524–0.554, N = 10). However, note that using the estimated ratio, the Isla Espiritu Santo sample was erroneously excluded.

According to Hollingsworth (p. 119) the Isla Danzante chuckwallas (based on a single male and two females), have relatively long tails; the male has a ratio of 0.551. If for the sake of argument, this is accepted as near the upper limit, then a lower limit difference of 0.032 or greater would easily encompass the estimated ratio for the holotype. Indeed this magnitude of difference and greater occurs among males from Isla Espiritu Santo (0.038), Isla Partida Sur (0.039), and from Isla San Francisco (0.052); see Hollingsworth's Table 10. The same argument can be made for Isla San Jose (limits 0.540–0.554, N = 2) which was not excluded by Hollingsworth on the basis of the tail length ratio.

The estimated tail length ratio in the holotype exceeds the lower limit ratios of Isla Santa Cruz and Isla San Diego samples by only 0.005 and 0.004 respectively. Assuming a comparison between the holotype and another specimen of identical total length, these ratio differences convert to an actual measurement difference of only 1.33 mm for the Isla Santa Cruz sample, and 1.07 mm for the Isla San Diego sample. These differences are exceedingly small, and errors of this magnitude can be expected in repeated measurements of these lizards using a metric ruler with 1 mm increments. Furthermore, a difference of 1 mm falls within the 90% confidence interval of Hollingsworth's estimate (he added 10 mm to the tail length). Hence, in all of these cases, the exclusions are unjustified because: 1) the holotype's tail length can only be estimated; 2) the holotype's ratio falls outside the limits of samples by a very small value that is within the range of experimental error; 3) the sample sizes are inadequate to calculate distribution-free prediction intervals with 95% confidence (N = 39 or greater would be required).

TABLE 1. Localities excluded as the source of the holotype of *S. ater* with data from Hollingsworth (1998). See text for calculation of prediction intervals. Localities are: Baja California Sur (MNLND-A); Cape region (CAPE); Isla Espiritu Santo (IES); Isla San Marcos (ISM); Isla San Francisco (ISF); Isla Santa Cruz (ISCRZ); Isla San Jose (ISJ).

Character	N	Mean	S^2	Observed Range	Holotype Value	Predicted Range
Caudals						
MNLND-A	27	37.44	3. 7249	31–38	27	30.40–38.48
CAPE	19*	31.53	5.1529	28–37	"	26.64–36.42
Dorsals						
IES	7	29.43	0.9604	28–31	32	26.87–31.99
ISM	3	29.33	2.3409	28–31	"	21.73–36.93
ISF	6	28.50	2.3104	27–31	"	24.28–32.72
Infralabials						
ISJ	5	28.40	2.3104	27–31	26	23.78–33.02
Femoral Pores						
ISCRZ	23	35.65	3.9601	33–40	32	31.43–39.87

* Table 14 in Hollingsworth gives N = 231 which is in error based on his unpublished thesis.

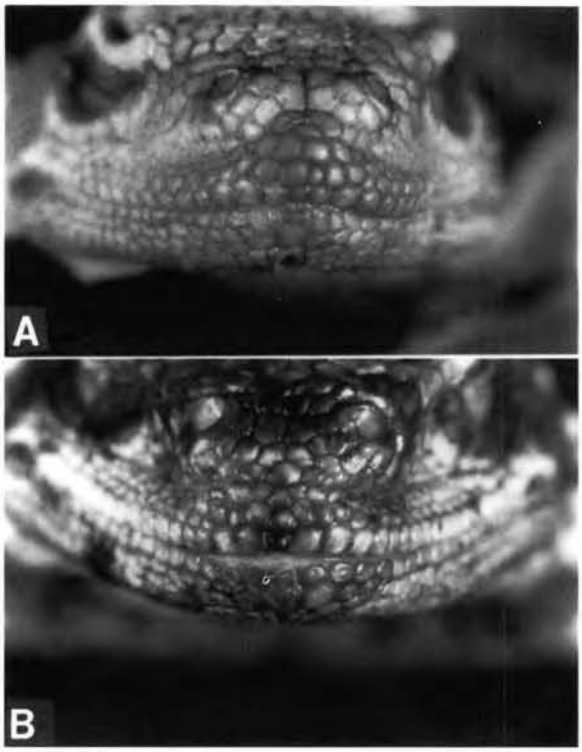


FIG. 1. Examples of the difficulty distinguishing rostral and supralabial scales in *Sauromalus obesus*. (A) Three small scales in the rostral area flanked by large scales of the same size as those in the supralabial area (RRM 2869). (B) Small, dark median "rostral" scale, flanked by larger scales showing little or no size diminution into the supralabial area. One slightly larger scale interrupts the size continuity on the anatomical left (RRM 2793). Photos by David H. Lewis.

Hollingsworth also linked the holotype with Sonora because it has four postrostrals, a number typical of Sonoran populations (limits 3–4), whereas Baja California Sur and the southern gulf island chuckwallas have 2–3 postrostrals. However, without information on sample sizes, the usefulness of this character is difficult to judge. Furthermore, it is unclear if Hollingsworth is suggesting a discrete character difference between these populations (which could be used to diagnose species), or a non-discrete statistical difference, which may have dubious value in determining the type locality.

My analysis of Hollingsworth's univariate statistical comparisons indicates that due to inadequate sample sizes most insular and southern coastal mainland sites cannot be ruled out as the source of the holotype. Furthermore, although Hollingsworth employed an objective method to exclude certain localities, the univariate approach has an intrinsic weakness. It is possible for a specimen from a given population to exceed the sample range limits for one character, while conforming to a series of others. Thus, to exclude an unknown individual from a population sample on the basis of a single character is inherently risky. On the other hand, a multivariate approach to determine the origin of the holotype is theoretically much more robust because it takes into consideration all the characters used in the analysis.

The multivariate classification analysis places the type specimen with the southern Sonoran sample (Hollingsworth, p. 119 and Appendix V). This assignment has a posterior probability of 0.51; in other words, the level of confidence that the holotype originated from southern Sonora is 51 percent. The next highest probability is 0.22 for Isla San Diego.

However, the result of this classification analysis is contradicted by the discriminant function analysis dispersion plot (Hollingsworth, p. 137, Fig. 51). In that plot, the holotype falls within the dispersion polygon for Isla San Francisco, lies adjacent to the boundary of Isla San Marcos, and slightly farther away from the boundary of the southern Sonora sample. The principal components analysis plot (Hollingsworth, p. 139, Fig. 52) also does not clearly support the classification analysis. Although there is considerable overlap among taxa, the type specimen appears to be positioned well within the cluster of points representing *Sauromalus ater ater*, but falls marginally relative to those points identified as *S. obesus townsendi* of Sonora along the first principal axis. In accepting the result of his classification analysis, Hollingsworth did not attempt to reconcile the apparent discrepancies between it and the discriminant functions (canonical variates) and principal components analyses, nor did he explain why he favored the former over the latter two.

Hollingsworth did not depict the position of the holotype relative to known samples in plots based on additional axes (e.g., third and fourth canonical and principal components axes). Presumably, if these plots had supported his hypothesis of a Sonoran origin for the holotype, he would have published them or provided some discussion. Plots for the first and third axes for the canonical variates and principal components analyses can be found in his unpublished thesis. However, the position of the holotype is not indicated in these plots. The axes beyond the first two explain progressively smaller percentages of the total variance in the data. Thus, even if the holotype were positioned within the dispersion polygon for Sonora using subsequent axes, this result would be less convincing than that based on the first two axes. Hypothetically, an exception would be conflicting results using PC I and PC II versus PC I and PC III, because in Hollingsworth's data the percentages for PC II and III are nearly identical (see his Appendix V).

Hollingsworth (p. 137) stated that only 60.8 percent of the males could be classified into their respective populations, and (p. 138) that the principal components analysis yielded no separation between taxa and no groups could be designated. In view of these statements, his decision to restrict the type locality to southern Sonora appears to be indefensible. In my opinion, no evidence has been presented by Hollingsworth that definitively supports the designation of southern Sonora as the type locality to the exclusion of the southern peninsula and adjacent gulf islands of Baja California. I acknowledge that southern Sonora must be given consideration. But without additional evidence, I believe the provenance of the holotype remains open to speculation and conjecture.

The name *Sauromalus ater* was proposed by A. Duméril in 1856, and therefore has priority over the name *S. obesus* (Baird) 1858. But, *S. ater* has been little used and is essentially restricted to papers published in technical journals, whereas the name *S. obesus* appears in numerous papers and books, ranging from technical to popular. Beaman et al. (1997) listed 626 titles of technical and popular articles pertaining to the genus *Sauromalus*, and several others have since been published. Out of this total, the name *S.*

ater is used in approximately 46 titles. Most of these (34) were published before 1950, and nearly all concern taxonomy or distributional records.

The literature for *S. obesus* is far more extensive by comparison, and the number of publications in which the name is used is conservatively estimated to be about 90 percent of the total, or over 550 works. Even in papers that deal with another species of *Sauromalus*, e.g. *S. varius* or *S. hispidus*, the name *S. obesus* often appears in reference to the common western chuckwalla. *Sauromalus obesus* is almost exclusively used in the literature dealing with physiological ecology of chuckwallas (about 133 papers), most of the ecological studies (about 71 papers), as well as morphological studies (about 92 papers).

Clearly, the name *S. obesus* has had a long history of usage to the present, and is deeply entrenched in both the scientific and popular literature. Replacing it with the name *S. ater*, which is barely known outside the field of lacertilian taxonomy, would result in permanent and serious havoc. Therefore, in the interest of nomenclatural stability in herpetology, I intend to petition the International Commission on Zoological Nomenclature to conserve the long used and well known specific name of *Sauromalus obesus*.

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ARTICLES

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Reproductive Biology of Green Turtles at Ras Baridi, Saudi Arabia

NICOLAS J. PILCHER*
and
MUSTAFA AL-MERGHANI
National Commission for Wildlife Conservation and Development
P.O. Box 61681, Riyadh, Saudi Arabia 11575

**Present address: Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*
e-mail: nick@tualang.unimas.my

Saudi Arabian waters are home to several green turtle (*Chelonia mydas*) populations in need of management and conservation. In the Arabian Gulf a large nesting population utilizes four small Saudi Arabian islands (Miller 1989), but the Red Sea has, until now, remained a poorly studied region in terms of sea turtle nesting and foraging populations. Frazier and Salas (1984) indicated diffuse populations along the Egyptian shoreline, but also highlighted some of the difficulties of working in the region. In 1982, a comprehensive survey of turtle population in the Arabian region highlighted even further the dearth of information in the Red Sea, linked to lack of response to questionnaires and lack of available data to report on by several governments (Ross and Barwani 1982). Along the 1800 km Saudi Arabian Red Sea mainland coast, green turtles nest almost entirely at Ras Baridi, a 6 km stretch of the shoreline on five isolated sandy beaches (Miller 1989; Pilcher et al. 1990). The nesting beaches' close proximity to a sizable cement factory and its associated environmental degradation prompted research and conservation efforts by the National Commission for Wildlife Conservation and Development (NCWCD). The effect of the cement dust on hatching success were described by Pilcher (1999). The area immediately south of the main Ras Baridi headland was also the only confirmed feeding and foraging range for green turtles in the Saudi Arabian portion of the Red Sea (Pilcher 1992), although the Farasan bank in the south was believed to support a similar foraging population.

The objectives of this project were to conduct seasonal surveys from 1989 to 1992, to detail for the first time the general reproductive biology, inter-seasonal migrations, reproductive output and status of green turtles at Ras Baridi, and to determine the morphometric characteristics of the nesting population, eggs, and hatchlings.

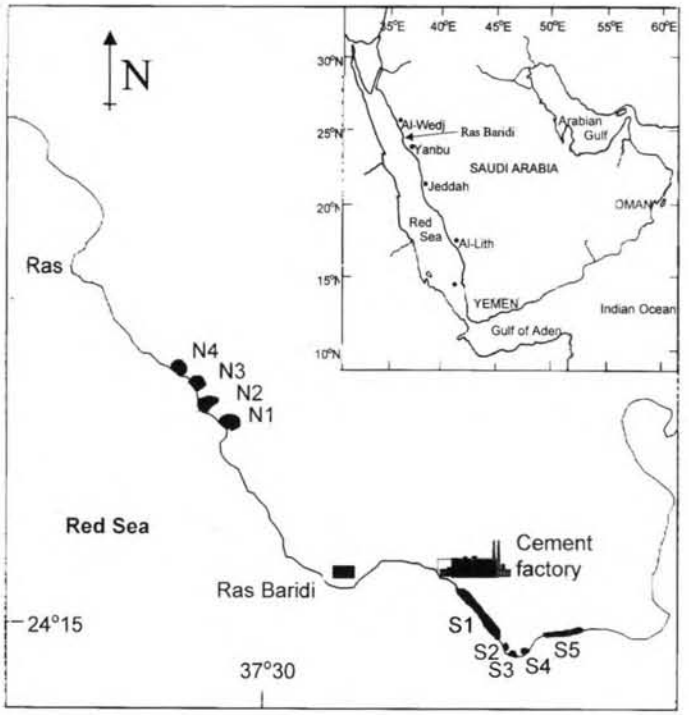


FIG. 1. The Ras Baridi rookery in Saudi Arabia. Nesting beaches N1 to N4 are north of the cement factory, S1 to S5 are the nesting beaches south of the factory and in the path of wind-blown cement dust.

METHODS AND MATERIALS

The Ras Baridi rookery is located 70 km north of Yanbu Al-Bahr and extends from 24°14'N, 37°45'E to 24°26'N, 37°25'E (Fig. 1). There are no villages and the area is only infrequently visited by local fishermen. The only industrial activity is a cement factory located south of the Ras Baridi headland. Four nesting beaches are located north of the cement factory on which a minor amount of nesting occurs (N1 to N4). South of the cement plant there are five nesting beaches on which the majority of nesting takes place (S1 to S5). An exposed fossil reef extends inland 500–1000 m and forms a flat ledge 2–3 m above sea level. Among this formation small sandy coves make up the nesting beaches, which range from 10 m to 1.2 km in length and 2–500 m in width with sand depths ranging from 0.5 to 2 m. The beach surface is littered with rocks, and vegetation is comprised of small halophytic plants that form a partial cover above the dune line. Hard, raised limestone reefs form the borders to all the beaches which effectively seal the sides, leaving only the rear open to occasional vehicle passage and turtle and hatchling movement. A fringing reef 20–200 m offshore forms a lagoon that ranges from 20 cm to 5 m in depth. The nesting beaches consist of fine to medium-coarse sands mixed with cement dust. Since the cement factory started operations in 1979, prevailing winds have blown the cement dust toward and over the main nesting beaches, and nesting activities by sea turtles have mixed the original sand with the fine (< 0.15 mm particle size) cement dust that now penetrates down to 1 m below the surface.

Surveys were carried out from June to December 1989 to 1992 to estimate the number of adult females, egg production and subsequent hatchling emergence, along with details of the nesting activity. Study periods spanned peak nesting, incubation and emergence. Data were collected on adult, egg, and hatchling morphometrics, nesting activity and frequency, and on the effects of cement dust from the nearby factory.

Turtles were tagged, measured, and weighed after oviposition. Adult females were tagged with two titanium tags (Stockbrands Pty. Ltd.) applied between the first and second proximal scales (in 1989), or through the first scale (in 1990–1992) on the trailing edge of the front flippers. On one of the tags the address was printed in Arabic and on the other it was in English. Turtles were weighed using a Salter hanging spring balance (± 0.5 kg). Measurements were made using a flexible fiberglass tape for curved carapace length and width, head width and tail length (± 0.5 cm) and with a large set of calipers for straight length and width (± 0.5 cm). Measurements followed Limpus et al. (1983) except tail length which was measured from the tip of the tail to the tail/carapace junction.

In 1989 ten nests were dug up to determine average sizes and weights of the eggs. Each egg was marked on the top of the shell as it was removed from the nest to reduce the chances of rotation through the vertical axis, as this movement is known to be a cause of egg mortality (Limpus et al. 1979). During the 1990–1992 monitoring periods, ten eggs were collected as the female continued to lay the balance of the clutch. These were weighed and measured and returned to the nest prior to the conclusion of egg-laying, to reduce the chances of movement-induced mortality and promote egg survival. After a customary 55–60 day incubation period, further surveys were carried out to determine incubation and emergence success. Hatchlings were collected on the beach and their tracks were traced back to the point of emergence, whereupon the nest was dug up to determine the total number of egg shells, number of infertile eggs and partially developed embryos. Eggs and hatchlings were weighed on a Sartorius electronic balance (± 0.1 g). The maximum egg diameter and hatchling Straight Carapace Length and Width were measured using dial-scale calipers (± 0.1 mm).

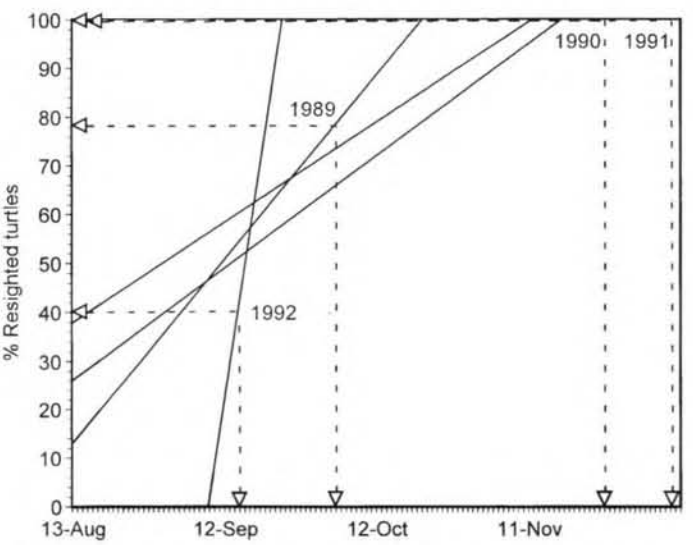


FIG. 2. Renesting trends during the four-year project. Solid lines represent linear trends (based on regression) in the percentage of recaptures with each season. The intersection of these trends with the end of each monitoring period (dashed lines) represent the estimated percent of turtles tagged during each season (see text for details).

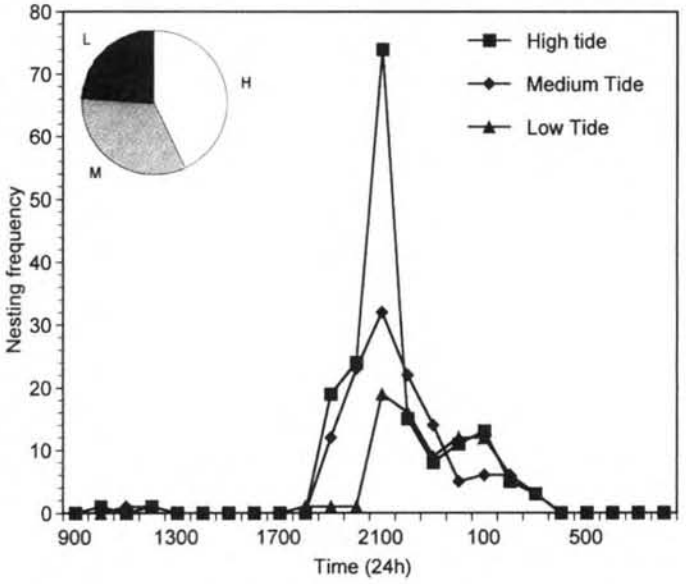


FIG. 3. Nesting distribution over 24 hours at different tide heights.

RESULTS

Remigration and Nesting Dynamics.—Fifteen out of the 194 turtles that were recorded on the beaches between 1989 and 1992 returned for second nesting seasons. Five of these had been previously tagged in 1987 by J. Miller. The maximum remigration interval (between nesting seasons) was four years, the minimum was 1 year (mean = 2.7, SD = 0.87, N = 6). Of the remigrants, four turtles returned to nest at the same beach they were originally tagged on, and five moved less than 50 m between S2 and S3 (Fig. 1).

The number of turtles nesting between 1989 and 1992 fluctuated between 14 and 99 individuals per year. Due to the length and variation of monitoring periods it was not possible to tag and count every nesting female, therefore, based on simple mark-recapture probabilities, straight line regressions of renesting trends were used to estimate annual nesting population size (Fig. 2).

It was estimated that a large portion of the turtles that would have nested each season were encountered during the surveys, based on simple mark-recapture probabilities. After turtles were tagged and allowed to return to the internesting habitat, they were assumed to mix evenly among non-tagged individuals. During subsequent nesting attempts, the ratio of tagged turtles to non-tagged turtles was used to estimate the percentage of that season's turtles that had been tagged up to that point in time.

In 1990 and 1991, it was estimated that 100% of the nesting turtles were tagged (horizontal dashed lines, Fig. 2) by the end of the monitoring period (dashed arrows, Fig. 2). In 1989, the percentage of tagged turtles at the end of the season was estimated to be 78% and in 1992 it was 40%. These estimates assume that the turtles that were not observed during the nesting periods behaved in a similar manner and renested at similar frequencies to those that were observed. Extrapolation from the number of turtles that were tagged in 1989 (59), suggests the total nesting population size may possibly have been 76. Similarly, the estimated total nesting population sizes for 1990, 1991, and 1992 were 14 (100% recaptured), 99 (100% recaptured), and 53 (40% recaptured) respectively.

Nesting occurred from July to November and peaked during September. Although beaches were frequently monitored during daytime, turtles were rarely encountered prior to 1700 h. Beaches were patrolled each morning to find signs of any nesting not recorded the night before. Late afternoon nesting was never recorded, although by early evening a slight amount of nesting took place. Most nesting (96.7%) took place between 1900 and 0200 h, with a large proportion (46%) emerging during high tide (Fig. 3).

No significant differences were found between renesting intervals among the years ($-1.73 < z < 1.03$, $P > 0.05$). Overall, recaptures indicated a renesting interval of 12.1 days (SD = 2.68, range 5–20, N = 147). These figures exclude turtles returning to the beach within five days as it is believed these attempts follow unsuccessful first nesting attempts (Mortimer and Portier 1989). They also exclude turtles nesting more than 20 days after first sighting as the turtles might have nested during this period but not been observed. Classified into 1st, 2nd, 3rd, and 4th renesting occurrences, the internesting intervals were 13.1 (SD = 2.47, N = 74), 10.6 (SD = 2.15, N = 45), 10.2 (SD = 1.58, N = 14), and 11.4 (SD = 1.14, N = 5) days, with a significant shortening of interval after the first renesting occurrence ($z_{0.05} = 5.899$, $P < 0.05$) (Fig. 4).

Turtles nested 1–5 times in a season (mean = 1.9, SD = 1.88, N = 118), but 32.5% were found to nest only once. In 1991 and 1992, only five nesting attempts were missed (determined by track counts during the day), virtually eliminating the possibility of recording error. Most nesting (70%) took place on the two larger beaches south of the cement factory, S1 and S5. Only 6 nesting attempts (1.04%) were documented on the beaches north of the cement factory during the four years, though the beaches are similar in shape, size, and sand type. The fixation for a single headland and its five beaches, and lack of movement to nearby beach clusters, suggest there may be no nesting by these females at any other location. Of 194 turtles, 77 (40%) returned to the same nesting beach on all nesting attempts, again mostly on beaches S1 and S5, although 16

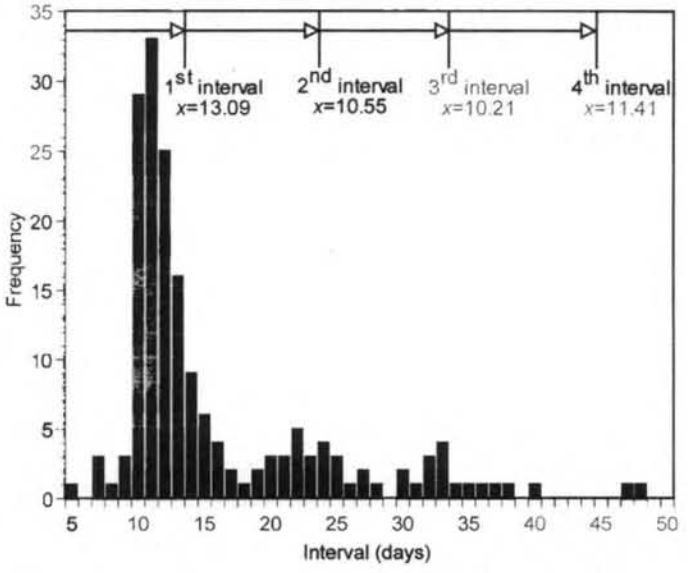


FIG. 4. Renesting intervals between successful nesting attempts for green turtles at Ras Baridi, 1989-1992. *x* represents the numerical mean of each recapture interval.

turtles also returned to within 30 m of their original nest location on the small beaches S2 and S3 (Fig. 1).

Adult Morphometrics and Growth.—Sizes and weights of turtles were pooled from the four annual data sets (Table I). No significant differences were detected for curved carapace length (CCL) (1.294 z -0.357) and weight (-0.778 z -0.203) over the four years which, in the absence of sufficient other long-term nesting data, suggests a degree of uniformity among nesting aggregations with a proportional number of recruits and seasoned nesters. Carapace sizes ranged from 88 cm to 115 cm (CCL) and were found to be normally distributed with a small number of recruits and older age/size classes (Fig. 5). Average female straight carapace length was 97.2 cm (SD = 5.75, N = 199) and average weight was 124.7 kg (SD = 16.28, N = 72). The smallest egg-laying female (smallest size at maturity for the site) measured 89.0 in CCL and 78.0 cm in SCL, and weighed 82.0 kg.

The relative shape of the carapace may be indicative of a predator avoidance strategy related to hydrodynamics. Because sizes alone may not completely reveal the character of the turtles' carapace, an index of carapace shape (domed vs. flat) was also calculated. A relative index of carapace curvature among 100 females (as per Balazs, 1980) yielded a ratio (curved to straight carapace length) of 1.08 (± 0.05, range 1.01–1.24). Predominant adult male and female coloration was dark brown/green with occasional highlights of olive green and yellow.

Egg and Hatchling Morphometrics and Clutch Viability.—Weights and diameters were measured for over 700 eggs, and clutch size was determined in 66 cases. No significant differences were noted between the four years (for weight and diameter: $z < 0.5$, $P < 0.01$). The average clutch size was 99.7 (SD = 29.06, range 7–158) and the number of small, yolkless eggs per clutch was 0.4 (SD = 1.82, range 0–19). Eggs averaged 51.3 mm maximum diameter (SD = 6.8, N = 717) and weighed 44.5 g (SD = 2.2, N = 717) (Table 1). Regression analysis found no significant relationship between total clutch size and number of small deformed eggs ($r = 0.255$, N = 43).

The mean incubation period was 59.7 days (SD = 2.9, range 50–82, N = 39 nests). Incubation success in 28 nests from which hatchlings emerged averaged 80% (SD = 16.0, range 32–98.9) inclusive of infertile eggs (which averaged 10.1 per clutch, SD = 8.1) but exclusive of small deformed yolkless eggs.

Samples of six to ten hatchlings were taken from 70 nests and hatchlings weighed an average of 24.6 g (SD = 3.8, N = 847). Mean SCL was 48.7 cm (SD = 2.5, N = 847) and mean SCW was 37.8 cm (SD = 3.0, N = 847) (Table 1). These fall within the narrow 2–3 mm and 4–5 g variation that is common to green turtle hatchlings (Hirth 1997).

Mortality.—Mortality of adults on nesting beaches was rare. Three turtles (1 on beach S2 and 2 on beach S3) were found dead after having wandered beyond the beach, across the fossil reef and then fallen off the edge to land inverted. Nesting females were subject to in-water predation as evidenced by numerous scars and several missing rear flippers and although the nearby waters were home to a number of species of sharks, no conclusive data exists that suggests they were actually responsible. No land-based predation was noted on adult turtles.

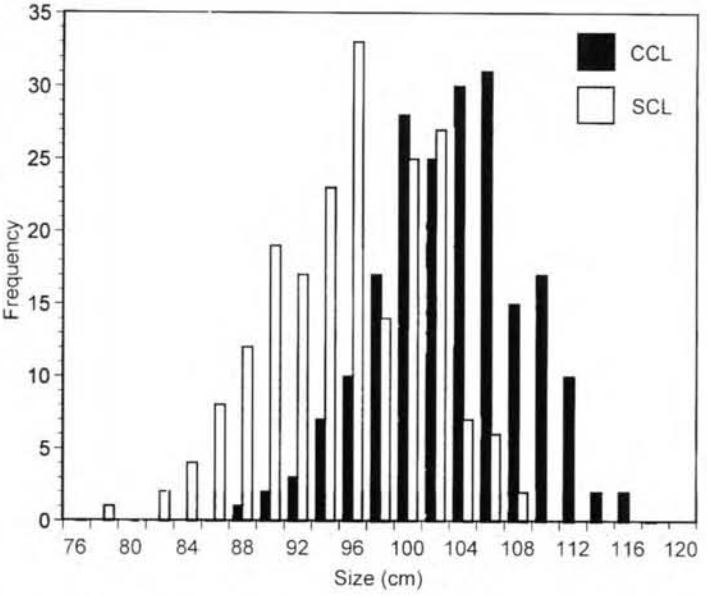


FIG. 5. Size class distribution of nesting females at Ras Baridi. CCL = Curved Carapace Length; SCL = Straight Carapace Length.

On one occasion a fisherman was found searching for eggs, but our presence during the nesting seasons probably dissuaded further egg collection. Only a small number of fishermen were active in the area, and they collected eggs infrequently. Due to religious customs, adult turtles are not eaten by Saudi nationals.

The beaches are frequently patrolled by falcon hunters during the nesting season as it coincides with the migration of peregrine falcons (*Falco peregrinus*), a highly prized catch in the Kingdom. Though not a direct threat to sea turtles, these falconers cross the beaches in 4x4 vehicles at day and at night following the birds. Several times dead hatchlings were found in the tire tracks of these vehicles, and adult turtles were disturbed by the moving lights on the nesting beaches (particularly on S1).

A frequent predator on the beaches was Rueppel's fox (*Vulpes rueppelli*). The foxes (estimated to number 5–10 in the area from personal observations) frequently dug up nests for eggs and hatchlings. Foxes waited for the hatchlings to emerge, and then decapitated as many hatchlings as possible before they reached the sea. The foxes then returned to consume those that they had

TABLE 1. Summary of morphometric data for adult female green turtles at Ras Baridi. SD = Standard Deviation: N = Sample size; CCL = Curved Carapace Length; CCW = Curved Carapace Width; SCL = Straight Carapace Length; SCW = Straight Carapace Width; PL = Plastron Length; PW = Plastron Width; TL = Tail Length; HW = Head Width, all in cm; WT = Weight (kg).

	CCL	CCW	SCL	SCW	PL	PW	TL	HW	WT
Mean	105.1	94.6	97.2	74.9	82.7	74.4	20.2	13.7	124.7
SD	8.15	5.30	5.75	4.80	3.95	6.28	3.45	1.26	16.28
Min	89.0	81.0	78.0	60.0	71.0	59.0	12.0	11.5	82.0
Max	193.0	110.0	110.0	92.0	91.5	87.0	26.0	19.0	156.0
N	200	199	199	200	77	76	84	187	72

killed. In this manner it was believed they were able to consume more hatchlings than if they had consumed one at a time after emergence. Ghost crabs (*Ocypode saratan*) were found to feed on hatchlings, but were never observed to actively chase seaward-bound hatchlings, nor were their burrows ever found infiltrating exhumed nests.

Discussion

Sea turtles share a similar life cycle and general reproductive biology with only slight variances among species. An extensive literature exists on the biology, reproductive techniques, egg development, hatchling behavior, and morphology for sea turtles (reviewed by Hirth 1997). One important aspect of sea turtles' natural history is that they must emerge onto dry land to lay their eggs. At this point they are vulnerable to a number of threats, including harvesting by man and habitat degradation. Because turtles are not generally known to change nesting sites in the course of their lifetime (Limpus et al. 1983b), the protection of the nesting habitat and the preservation of normal nesting behavior at that site are critical to ensuring the long-term survival of the nesting population. For this reason the protection of the only large mainland nesting aggregation along the Saudi Arabian Red Sea coastline is considered vital. Although not as numerous as the Oman and Arabian Gulf populations, the Ras Baridi turtles represent the only known major aggregation on the Saudi Red Sea.

Remigration and Nesting Dynamics.—The nesting process was found to be consistent with that generally reported for green turtles (reviewed by Hirth 1997). Turtles were not found to deviate from the normal pattern of nesting at night, although a few nesting incidences were recorded during daylight hours. In general turtles nested at, or just before, high tide. It is thought that this occurs because at high tides females have the most time to complete the nesting process and return to deep water before being stranded on the reef or in the shallow lagoon as the tide recedes. At low tides, the fringing reef that borders the beach is exposed and difficult to cross.

In general, turtles displayed a high degree of site fidelity over remigration intervals, comparable to that found on Ascension (Mortimer and Portier 1989) and in Australia (Limpus et al. 1992). Because the nesting site consists of only a few small beaches, and no nesting was recorded on similar beaches that exist nearby, it is believed that the nesting beaches at Ras Baridi are the only beaches upon which these turtles emerge to lay eggs.

Although migrations between foraging and nesting sites have been well documented for this species (Balazs 1976; Mortimer and Carr 1987), no movements of this type have been recorded in the Red Sea. Neither FAO (1973) or Hirth and Carr (1970) indicate any movements into the Red Sea from turtles tagged in the Gulf of Aden, Oman, and the eastern coast of Somalia in their reports on long-distance migrations for green turtles in this region. Similarly, no tags have been returned from these areas after tagging programs within the Red Sea. Ross and Barwani (1982) report on the only known instance where a tag originating in Masirah was returned from Ethiopia, though the turtle was probably caught off the Somali coast (P. Ross, pers. comm.). The cyclic ocean currents within the Red Sea (Edwards 1987) and the relatively narrow Straits of Bab Al Mandeb (29 km), are suggested as possible explanations for the lack of movement between the two water bodies. The only two sites known or thought to support significant numbers of foraging turtles in Saudi waters are at Sharm Al Khaur (next to Ras Baridi) and Farasan (south Red Sea) (pers. obs.). Miller (1989) suggests a more extensive distribution of foraging areas, but in aerial surveys of the region during the present study only the two mentioned above (also noted by J. Miller) had significant numbers of resident turtles.

Green turtles feed primarily on seagrass (Bjorndal 1985), and whereas along the Red Sea the seagrass distribution is near-continuous, pastures are sparse in the northern latitudes and only moderately dense from mid- to southern latitudes along the Saudi Arabian coastline, and the presence of turtles is rare (Price and Crossland 1988). Frazier and Salas (1984) indicate that foraging sites along the Egyptian Red Sea may also be rare. If this case proves true, the few areas that Red Sea-resident turtles do use will warrant strong and effective protection, particularly if turtles do not emigrate from the Red Sea to forage.

Adult Morphometrics.—The smallest egg-laying female (smallest size at maturity for the site) measured 89.0 cm in CCL and weighed 82.0 kg, comparable to that of the Arabian Gulf (CCL 89.5 cm; Miller 1989) but larger than that of Yemen (CCL 68.2 cm; Hirth and Carr 1970). The relative index of carapace curvature among Ras Baridi nesting females was similar to the Arabian Gulf turtles (1.07 ± 0.02, data extracted from Miller 1989), while in general turtles were larger than that reported for Oman (83.9 cm; Ross 1985) and Yemen (83.2 cm; FAO 1968), where turtles nest on beaches facing the Indian Ocean.

The larger size of the nesting females within the Red Sea may be explained by the fact that nesting populations on both coasts of the Red Sea are small in comparison to those nesting on the southern coast of the Arabian peninsula. These populations possibly exert smaller pressure on foraging grounds, eliminating food as a limiting factor to growth. It is also possible that little or no migration occurs from the Red Sea to the Gulf of Aden or vice versa, based on the lack of tag returns and that the energy formerly used for migration is invested in growth.

Reproductive Output.—Average clutch size was found to be low on a global scale, but similar to other Arabian region findings (Oman: 97–103, Ross and Barwani 1982; Arabian Gulf: 87–89, Miller 1989; Yemen: 88.1, Hirth and Carr 1970). However, the incubation period was consistent with that found at other rookeries (48–72 days: Hirth 1971), and the hatching success was high on a global scale.

It must be noted though, that the reproductive success calculations involved only nests from which hatchlings emerged, and the overall rate for the rookery was believed to be lower because up to 40 % of nests do not hatch at all. Egg and hatchling survival at the site was addressed through a separate series of trials.

Mortality.—A major cause of mortality was the cement dust and light from the cement factory. During investigations in 1992, hatchlings from beaches S1 and S2 were attracted to the light as they emerged and an average of 9.3 dead hatchlings were found each day along the factory perimeter fence for 28 days (260 hatchlings) (Pilcher 1999). During this study it was found that the partially-processed cement dust was carried by prevailing winds to the five southern nesting beaches, and had mixed with the sand over 17 years of turtle nesting to penetrate to depths over 1 m. The

cement dust in the sand, combined with ambient moisture, formed a domed ceiling above the nest, in effect creating an artificial pocket from which hatchlings were often unable to escape. It was believed that this accounted for up to 40% of hatchling and nest mortality (Pilcher 1999). The overall hatching success rate in 1989 (including nests from which no hatchlings emerged) was 39%. In 1990 and 1991, when concentrated efforts were made to assist nests that might not hatch due to cement dust clogging, overall hatching success rose to 71% and 81% respectively (Pilcher 1999).

A reduction in light emission would reduce the number of hatchlings disoriented in their journey to the sea, but a reduction in cement dust output would only partially solve the problem encountered by emerging hatchlings. The dust that has accumulated over 21 years is now mixed with the sand so that even if there was a complete reduction in cement dust output, the nests would still be subject to the same problem. A nest marking and assisted emergence program is one of the only practical solutions at this time.

The effect of artificial lights on hatchling orientation have been well documented (Lohmann et al. 1990; Salmon and Witherington 1995) and the brightness of the factory lights are similar to, if not brighter than, those from beach-front condominiums and other residential areas. It is suggested that a reduction in light output, by shielding the security floodlights and by eliminating many of the fluorescent lights at underutilized areas would greatly increase the numbers of hatchlings that reached the sea.

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Occurrences of Marine Turtles in Alaska Waters: 1960–1998

ROBERT PARKER HODGE
ME2, POB 1521, Gig Harbor, Washington 98335-1521, USA

and

BRUCE L. WING
Auke Bay Laboratory, 11305 Glacier Highway
Juneau, Alaska 99801-8626, USA
e-mail:bruce.wing@noaa.gov

Four species of marine turtles have been observed in Alaska waters (Bane 1992; Hodge 1979, 1981, 1992; Wing and Hodge 1998). Although occurrences of marine turtles in Alaska have been reported geographically, there is no published information on the frequency of occurrence and abundance of turtles in Alaska. In this paper we discuss the frequency and abundance of marine turtle occurrences in Alaska waters since 1960.

Reports of marine turtles were gathered from several sources. The senior author compiled records from museums, correspondence, interviews, and questionnaires distributed to fishermen, biologists, and school teachers in Alaska coastal communities. The junior author compiled records from field notes, correspondence, newspaper articles and reporters, biologists and records in the herpetological collection of the National Marine Fisheries Service Auke Bay Laboratory, Juneau, Alaska. The authority/source references for all occurrences are in the Auke Bay Laboratory herpetological collection records.

Mean August sea surface temperature records from Auke Bay, Alaska (Wing and Pella 1998) were used to characterize environmental conditions for years in which turtles occurred in Alaska. Mean sea surface temperatures within one standard deviation (1 SD) of the long-term mean were considered normal-water years. Years with mean sea surface temperatures 1 SD or higher above the long-term average were considered warm-water years; years with mean sea surface temperatures 1 SD or lower below the long-term mean were considered cool-water years. All Alaska marine turtle records were plotted in relation to warm-water year, normal-water year and cool-water year occurrences.

Alaska marine turtle occurrences since 1960 include 19 leatherbacks, *Dermochelys coriacea* (including one sighting of two turtles), 9 greens, *Chelonia mydas*, 2 Pacific Ridleys, *Lepidochelys olivacea*, 2 loggerheads, *Caretta caretta*, and 2 unidentified hard shell turtles (Table 1, Fig. 1). Marine turtles have been observed in Alaska waters 14 of the past 39 years (Fig. 2) during all months except February and April (Fig. 3). Stinson (1984) and Starbird et al. (1993) identify a 'turtle season' in the northeast Pacific Ocean as July, August and September. Our data identify a similar Alaska 'turtle season' as July through October with 75% of occurrences during this four-month period.

Historically, marine turtle occurrences in the high latitudes of the North Pacific Ocean have been associated with warm-water years (Eckert 1993). However, in Alaska *Dermochelys* occurrences do not reflect a warm-water year connection, with only 53% of occurrences in warm-water years. *Dermochelys* has occurred in 3 warm-water years (10 occurrences), in four normal-water years (9 occurrences) and none in cool-water years (Fig. 2). Likewise, hard shell turtle (*Chelonia, Caretta, Lepidochelys*) occurrences in Alaska do not reflect a warm-water year connection, with only 47% of occurrences in warm-water years. Hard shell turtles were recorded in two warm-water years (7 occurrences), in five normal-water years (8 occurrences) and none in cool-water years (Fig. 2).

The State of Alaska is 3840 km east (Hyder, 55°54.7'N, 130°01.3'W) to west (Attu Island, 52°55'N, 172°57'E) (Fig. 1). Hyder is in the northeastern Pacific Ocean; Attu Island is in the northwestern Pacific Ocean, west of the international date line. Amatignak Island (51°17'N, 179°08'W) in the Aleutian Islands is the southernmost point in Alaska. Alaska has 10,624 km of coastline and 54,246 km of shoreline (including islands). Because of low human population throughout most of the coastal area, chances for human-turtle contact are minimal. Much of the coastline, especially Southeast Alaska (south of 59°N and east of

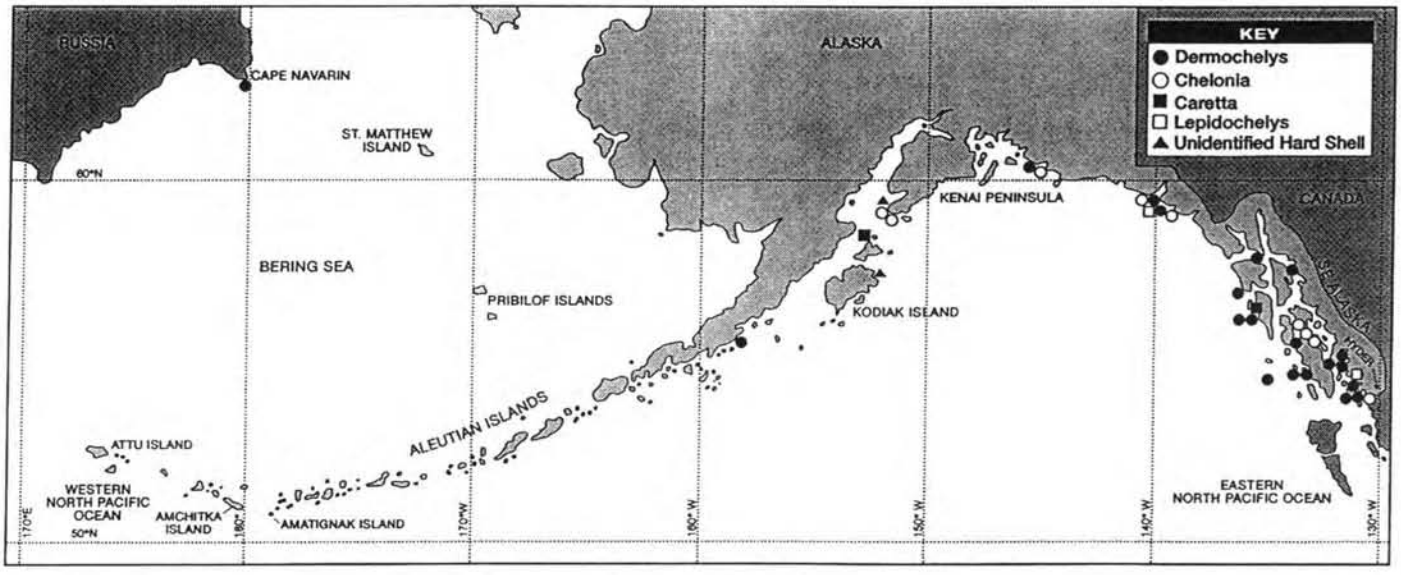


FIG. 1. Marine turtle occurrences in Alaska waters.

137'W) and the Aleutian Islands, is not readily accessible to beach combing. We suspect most cold-killed, grounded turtles are probably destroyed by wave action (pounding on rocks) and scavengers before anyone finds the evidence. Consequently, all reported Alaska marine turtle occurrences are in clusters near centers of human population; 21 in Southeast Alaska, 5 near Yakutat, 2 near Cordova, 3 near Homer on the lower Kenai Peninsula, 2 in the Kodiak Island group and 1 at Perryville on the Alaska Peninsula (Fig. 1).

Dermochelys was first recorded from British Columbia in August 1931 (MacAskie and Forrester 1962) but not recorded from Alaska until 1963. MacAskie and Forrester (1962) reported 10 observations of *Dermochelys* from British Columbia over a 31-year period (1931–1961) and were impressed the turtles were active at sea surface temperatures near 11.7°C. We have 19 Alaska *Dermochelys* occurrences for a 39-year period (1960–1998) and similarly low sea surface temperatures in September, which average 10.9°C, and range from 9.95°C to 12.28°C (Wing and Pella 1998). *Dermochelys* regularly occurs in cold temperate waters of high latitudes (Bleakney 1965; Pritchard 1980; Eckert et al. 1989). North of 60°N latitude in the northeastern Pacific Ocean, *Dermochelys* has been recorded from the Copper River flats (60°25'N, 145°00'W) near Cordova, Alaska (Hodge 1979). North of 60°N latitude in the Bering Sea *Dermochelys* has been recorded at Cape Navarin, Russia (62°17'N, 179°13'E) (Bannikov et al. 1971). Cape Navarin is 450 km northwest of Saint Matthew Island, Alaska and 1200 km due north of Amchitka Island (Aleutian Islands), Alaska. *Dermochelys* is a cold-tolerant turtle with recorded body temperatures well above ambient water temperatures, heat retention capabilities, and demonstrated endothermy (Ernst and Barbour 1989; Ernst et al. 1994). It is not surprising *Dermochelys* represents 58% of Alaska marine turtle occurrences.

The cold-tolerant *Dermochelys* may respond favorably to the Alaska environment. Late summer sea temperatures are frequently within or above the 15–16°C (Wing and Pella 1998) associated with *Dermochelys* off the California coast (Starbird et al. 1993). Atlantic Ocean *Dermochelys* maintain elevated body temperature (25.5°C) in much colder water (7.5°C) (Frair et al. 1972; Paladino et al. 1990). Estimated mean selected body temperature of *Dermochelys* ranges from 25.5–33°C (Mrosovsky 1980; Spotila and Standora 1985), easily attainable in late summer and early fall Alaska waters. Known or presumed foods of *Dermochelys* are often abundant in the Gulf of Alaska during late summer and fall and are concentrated in the deep scattering layer (e.g., siphonophores) and along thermal fronts (e.g., salps, scyphozan and hydrozoan medusae).

The hard shell turtles that occur in Alaska waters (*Chelonia, Caretta, Lepidochelys*) are considered tropical, subtropical, and warm temperate species that rarely stray into cold waters (Eckert 1993). Most hard shell turtles seek optimal sea water temperature near 18°C and are cold-stressed at sea water temperatures below 10°C (Mrosovsky 1980; Schwartz 1978). North of 60°N latitude in the northeastern Pacific Ocean, *Chelonia mydas* has been recorded from the Copper River flats near Cordova, Alaska (Table 1). This is the northernmost Pacific Ocean record to date. Although four *Chelonia* have been observed alive in Alaska as late as October, they probably could not survive to return to warmer waters. Two occurrences of live *Chelonia* (October–November 1976 and

TABLE 1. Marine turtle occurrences in Alaska waters, 1960–1998.

Date	Location	Lat. (N)	Long. (W)	Comments
Lepidochelys olivacea				
Jan-86	Cannon Beach	59.50	139.75	Carcass
Jun-91	S. of Ketchikan	55.33	131.63	Carcass
Caretta caretta				
Dec-91	Shuyak Island	58.52	152.50	Carcass
Jul-93	Cape Georgena	57.33	135.87	Sighting
Chelonia mydas				
Oct-76	Point Macartney	57.00	134.05	Sighting
Nov-76	Eliza Harbor	57.20	134.28	Carcass
Sep-81	Dundas Island, B.C.*	54.50	130.67	Repeated sightings
Oct-93	Seldovia	59.50	151.72	Sighting
Oct-93	Homer (Bishop Beach)	59.67	151.67	Carcass
Oct-96	Rocky Pass	56.65	133.72	Sighting
Oct-96	Copper River Flats	60.42	145.00	Live-sent to San Diego
May-98	Blacksand Spit	59.38	139.43	Carcass
Oct-98	Ocean Cape	59.53	139.85	Carcass
Unidentified Hard Shell				
Aug-74	Kachemak Bay	59.67	151.62	Sighting
Aug-79	Marmot Bay	58.00	152.10	Sighting
Dermochelys coriacea				
Aug-63	Stephens Passage	58.07	134.02	Sighting
Sep-63	Copper River Flats	60.42	145.00	Netted & killed
Jul-78	Eaton Point	55.93	132.07	Netted & released
Aug-78	Craig	55.47	133.05	Netted & killed
Aug-78	Craig	55.47	133.05	Netted & released
Aug-78	Gravina Island	55.45	131.85	Sighting
Aug-78	Myer's Chuck	55.72	132.27	Sighting
Aug-79	Union Bay	55.82	132.22	Netted & released
Aug-79	Metlakatla	55.13	131.58	Netted & killed
Mar-83	Perryville	55.97	159.47	Carcass
Jul-83	Yakutat	59.00	139.00	Sighting
Aug-83	Noyes Island vicinity	55.00	134.00	Sighting
Aug-83	Cape Cross	57.92	136.57	Sighting
Aug-83	Deer Hbr., Yakobi Is.	57.95	136.58	Sighting, 2 individuals
Aug-83	Glacier Bay entrance	58.33	136.00	Sighting
Aug-84	Cape Addington	56.43	133.83	Sighting
Jan-90	Yakutat	59.50	139.65	Carcass
Jul-93	Vitskari Straight	57.00	135.80	Sighting
Aug-93	Vitskari Rocks	57.00	135.55	Sighting

*Dundas Island, British Columbia is 11 km south of the international boundary.

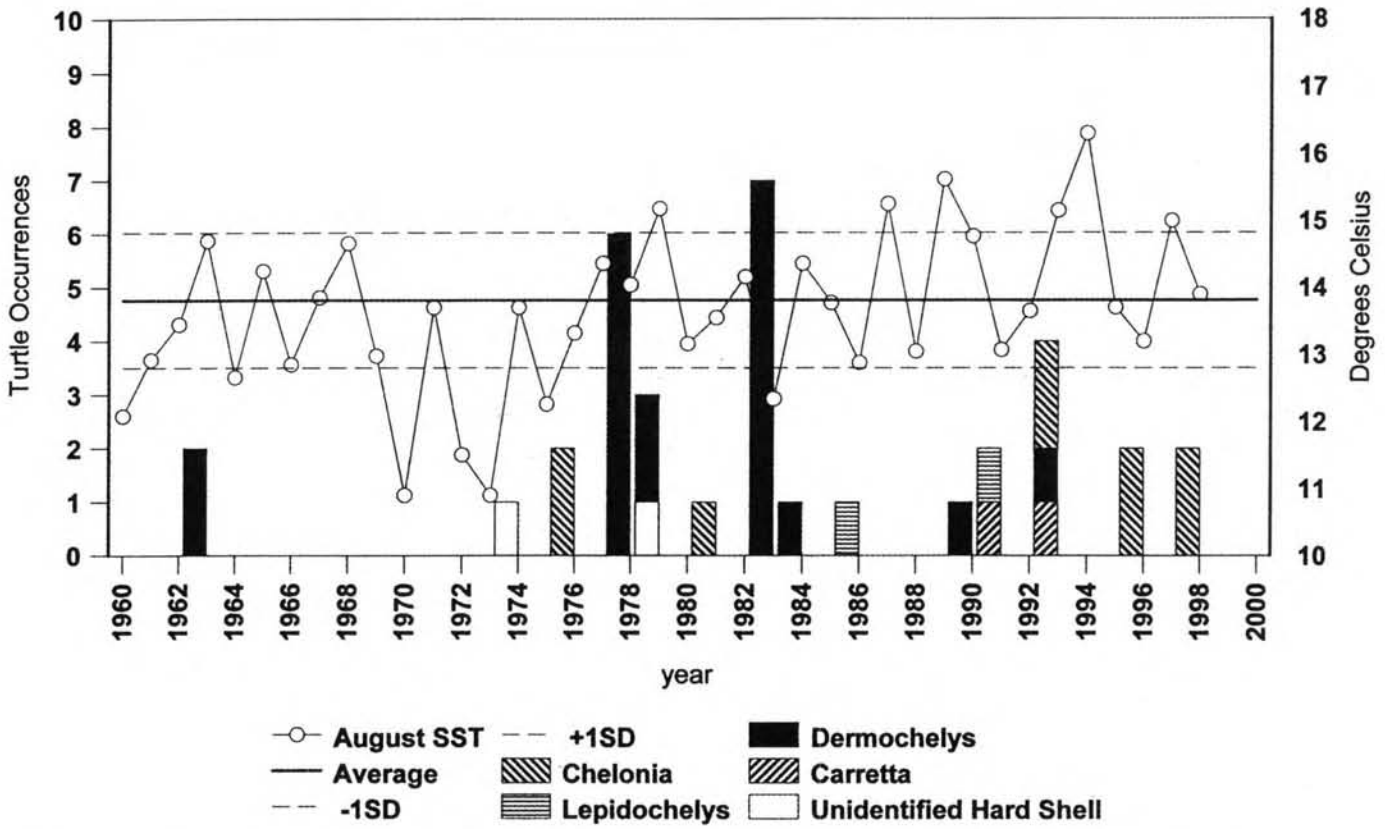


FIG. 2. Annual distribution of marine turtle occurrences in Alaska waters and annual variation of August sea surface temperatures at Auke Bay, Alaska.

October 1993) are believed to be individuals later found and reported as carcasses (Table 1). The *Chelonia* captured October 1996, near Cordova, Alaska, was obviously cold-stressed and transported to Sea World Aquarium, San Diego, California, for rehabilitation. This turtle did recover and subsequently was tagged and released off southern California (Hubbs-Sea World 1998).

Marine turtles are a natural part of the Alaska marine environment, although they are uncommon in the northeast Pacific Ocean north of Oregon (Stinson 1984). Marine turtles occur in Alaska waters too frequently to be considered 'accidental' as defined in ornithological literature. The occurrence terminology developed for Alaska birds by Isleib and Kessel (1973) and referenced by Armstrong (1990) appears to apply equally well to Alaska marine turtle occurrences and marine turtle occurrences generally. Using this terminology, *Dermochelys* are uncommon, *Chelonia* rare, and *Caretta* and *Lepidochelys* casual visitors to Alaska waters. The low frequency of occurrence of hard shell turtles in Alaska indicates they are straying beyond their tolerable range. The higher frequency of occurrence of *Dermochelys* suggests they are ranging into marginal habitat that may not be consistently used from year to year.

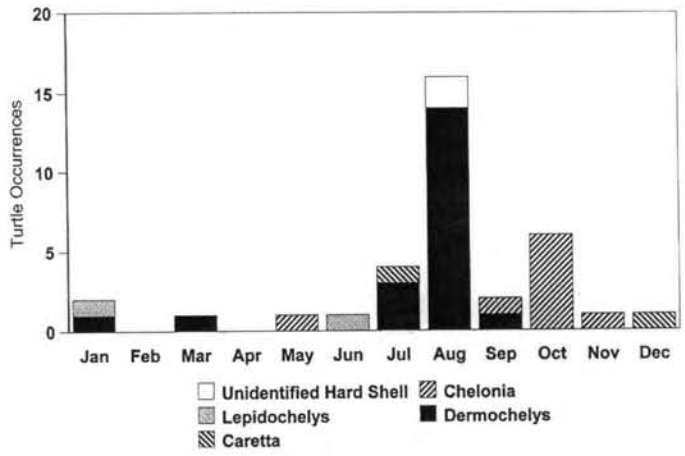


FIG. 3. Seasonal distribution of marine turtle occurrences in Alaska waters.

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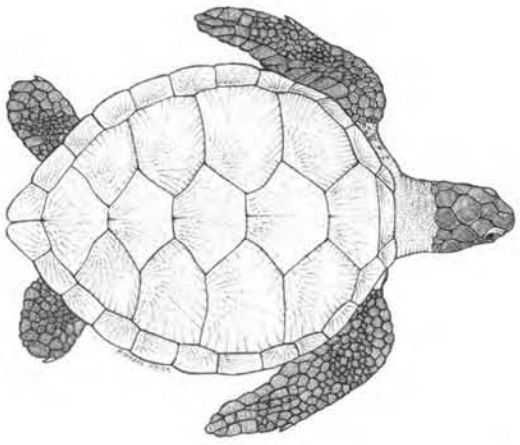
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Chelonia mydas (Green Turtle), subadult. Illustration by Michael G. Frick.

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Maternal Care and Infanticide in the Australian Skink, *Egernia stokesii*

ELVIRA J. LANHAM
and
C. MICHAEL BULL
Biological Sciences, Flinders University of South Australia
GPO Box 2100, Adelaide 5001, South Australia, Australia
e-mail (EJL): elvira.lanham@flinders.edu.au

Maternal care is often reported among mammal, bird, and crocodilian taxa. It also occurs less commonly among oviparous squamates, usually in the form of attendance of eggs by the female (Shine 1988). It is, however, rare among viviparous lizards (but see Niekisch 1975 and Halloy and Halloy 1997 for exceptions). Maternal care in viviparous species includes female defense of a home range that also contains neonates (Halloy and Halloy 1997), and increased female aggression to the approach of humans after the birth of her offspring (e.g., *Tiliqua nigrolutea*; A. Edwards, pers. comm).

Some species of mammals and birds exhibit both maternal care and, rarely, maternal infanticide. Many reptiles and amphibians exhibit a form of infanticide—oophagy—where a female consumes her own eggs for nutrition or to remove dead or decaying eggs and thus enhance survivorship of the remaining clutch (Mitchell and Groves 1993). However, most reports of consumption of live young involve adults devouring unrelated neonates. Maternal infanticide, where a female consumes her own live young, is still considered rare (Jenssen et al. 1989).

Maternal infanticide may be advantageous if it results in reduced competition for limited resources either for the adult or for its remaining offspring, if it provides otherwise unavailable energy resources, or if it improves inclusive fitness of parents by selective killing of deficient offspring (Huntingford and Turner 1987).

In this note we report maternal care and infanticide in the Australian skink, *Egernia stokesii*. This medium-sized lizard (average adult SVL = 19 cm) occupies crevices in rocky outcrops throughout central and southern Australia. It forms stable aggregations of up to seventeen individuals. One adult of each sex and their offspring share several crevices within highly overlapping home ranges. These groups remain together both between and within years. Other unrelated adults are also often found in some groups. Juveniles remain in their natal group for up to five years (G. Duffield, pers. comm).

Eleven gravid females, collected in January 1996 from several sites in South Australia, were held in glass tanks (35.5 x 30 x 60 cm) with shelter, water ad libitum, and food twice weekly. Live young were born in February and early March 1996. Births in two litters were video recorded on 25 February 1996 in tanks with shelters removed (but with the glass sides covered with paper to minimize disturbance and awareness of lizards in other tanks). Seven births, four from Female 1 and three from Female 2, were recorded over 6.5 h, beginning at 1340 h. Before parturition, contractions, shown by a lateral movement of the tail, lasted up to 40

min. Neonates were fully emerged and moving within 10 s of the appearance of the head.

Infanticide.—Female 1 produced one young at 1340 h, a second at 1600 h, and a third 2.5 min later. On the video playback, the third neonate appeared no different from the first two. It was moving 13 s after birth, similar to the first two neonates, and it seemed fully formed in all respects. The mother appeared to still be having contractions until she approached the newborn 100 s after birth, grasped it in her mouth, struggled with it for 75 seconds during which time it was still alive, and had consumed it completely within a further 32 s. In the next minute, the female approached one of her other neonates, "nosed" it, then lay still in the corner of the tank for 90 min before producing a fourth neonate. The mother showed no signs of aggression toward this juvenile, and produced four additional live young (unrecorded) in the next 20 h.

Without direct observation of each birth, it is difficult to estimate the frequency of maternal infanticide. Egg sacs are quickly consumed by neonates or their mother, removing any possible evidence of such occurrences. Unexplained disappearances of neonates have occurred, but normally these tanks have contained both parents, so even if infanticide is assumed it is impossible to determine which parent was involved. Anyway, these cases differ from the one just described, because they have occurred hours or even days after birth.

Maternal assistance.—The video playback showed that Female 2 produced two young in the period 1400–1800 h. The mother began further contractions at 1840 h and produced a third young at 1903 h. After 15 s the baby was still in the embryonic sac and had not moved. A minute after birth, the baby began to move, but seemed unable to free itself from the sac. The mother began to touch the baby with her snout after a further 30 s, and 10 s later she began to chew on the membrane. After another 20 s (and two minutes after parturition) the neonate was free from the sac and moving around. For two more minutes both mother and baby appeared to be eating the remains of the embryonic sac. The mother had nosed the area where the embryonic sacs had been for the first two births, but had not actively attempted to eat them while those young were still inside. These first two neonates emerged quickly (< 10 s) from their embryonic sacs and then ate the sacs themselves. Female 2 produced an additional three offspring (unrecorded) in the next 24 h.

Maternal infanticide may be advantageous if the offspring is unlikely to survive because it is deficient or deformed, and the mother can gain greater nutritional value from consuming it before it dies naturally (Huntingford and Turner 1987). In this case, the birth video record showed no obvious problem. Selective killing of some young to reduce competition for resources among survivors seems an unlikely explanation, because subsequent offspring were not killed. Stress due to captivity is another possible cause of the infanticide, although it is unclear why the female behaved aggressively to only one offspring.

This report suggests infanticide can occur in litters of *E. stokesii*. Since most births were unrecorded, we cannot comment on the frequency of infanticide among the other nine captive females, nor do we know if this behavior occurs in field populations.

Similarly, we cannot report on the frequency of mothers giving assistance to young in emerging from the embryonic sac, as observed in the second female. If the mother is only trying to derive nourishment, she would be expected to attempt to eat more embryonic sacs. It is more likely that the mother is providing assistance for those juveniles that cannot emerge from the sac without help.

Closely related species exhibit both similar and completely contrary behavior. *Egernia cunninghami* will bite through the umbilical cord if the neonate cannot free itself, but unlike *E. stokesii*, the female will wait for up to 15 min before intervening (Niekisch 1975). Conversely, *Tiliqua nigrolutea* will allow its offspring to die of exposure rather than assist them with removal of the embryonic sac (A. Edwards, pers. comm.).

Acknowledgments.—We thank the Flinders University Animal Care Unit for caring for the lizards in this study and Juergen Stein for additional information about births.

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Field Biologist Positions Available

Three paid positions and two volunteer positions for a herpetological survey of northeastern Colorado are available. There is also the possibility of conducting this work as part of a Master's program at UNC. One position is available immediately, two additional positions available 1 July 2001; all positions are contingent on continued funding. Survey is projected to run April-October, 2000-2002; schedule will be 10 days on/four off. Applicants must be able to conduct fieldwork in difficult arid conditions (shortgrass prairie) with minimal supervision. Previous experience with fieldwork and a familiarity with rattlesnakes are helpful and preferred, as are diplomatic communication skills. For further information and initial consideration, please contact Dr. Stephen P. Mackessy at spmacke@bentley.unco.edu. Applicants will be required to submit a letter of qualifications, intention and experience, and two letters of recommendation, to: *Dr. Stephen P. Mackessy, Department of Biological Sciences, University of Northern Colorado, CB 92, 501 20th Street, Greeley, Colorado 80639-0017, USA.*

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Observations on Neonate Size and Sex Ratio of the Crevice-dwelling Lizard *Xenosaurus platyceps*

JULIO A. LEMOS-ESPINAL
Laboratorio de Ecología, Unidad de Biología, Tecnología y Prototipos
Escuela Nacional de Estudios Profesionales Iztacala
Av. de los Barrios s/n, Los Reyes Iztacala
Estado de México, 54090 México
e-mail: lemos@servidor.unam.mx

and

ISAAC ROJAS GONZÁLEZ
Laboratorio de Herpetología - Vivario
Escuela Nacional de Estudios Profesionales Iztacala
Av. De los Barrios s/n, Los Reyes Iztacala
Estado de México, 54090 México

Xenosaurus platyceps is a poorly studied lizard found in the central part of the Mexican state of Tamaulipas. Recently there have been some reports about female reproduction (Ballinger et al., in press); prey chemical discrimination (Cooper et al. 1998); antipredatory behavior (Cooper et al., in press); and natural history (Lemos-Espinal et al. 1997) of this crevice-dwelling lizard. However, nothing is known about the size of neonates at birth, or the sex ratio of litters of this viviparous lizard. The purpose of this report is to document those characteristics in *X. platyceps*.

On 7 February 1998 we collected four adult female (106–120 mm SVL; 20.3–25.8 g BM), and two male (120 and 125 mm SVL; 19.6 and 28.0 g BM) *X. platyceps* at km 154.0 on Mexican highway 101 (Jaumave–Cd. Victoria), Municipio de Cd. Victoria (1210 m elevation). Lizards were transported to Laboratorio de Herpetologia - Vivario of Escuela Nacional de Estudios Profesionales Iztacala - UNAM, and housed individually in 51 x 26 x 26 cm glass terraria, each one containing a water bowl, peat moss substrate, and small rocks arranged to simulate rock crevices. Lizards were fed crickets, king meal worms, and wax worms every other day. Room temperature was maintained at 25°C, which is near the mean body temperature in nature (Lemos-Espinal et al. 1997). We also provided a light cycle of 12L:12D.

Three of the four captive females gave birth in June 1998 (average litter size = 2.6 ± 0.66; Table 1), the remaining female laid two large undeveloped eggs in the same month. All neonates were born with yolk sacs that were completely absorbed within 8.5 h of birth. Data on litter size presented here fall in the range reported by Ballinger et al. (in press) for *X. platyceps* (range = 2–4). In addition, all four females were gravid when captured, suggesting that *X. platyceps* from this population may reproduce every year, as reported by Ballinger et al. (in press). Parturition occurred in the same period as reported for populations of *Xenosaurus newmanorum* at Xilitla, San Luis Potosí, and *Xenosaurus grandis* at Cuautlapán, Veracruz. Mating should, therefore, occur in August–September as it does in these other *Xenosaurus* species (Ballinger et al., in press). Of the eight neonates, four were females and four were males, suggesting a sex ratio in nature of 1:1 although larger samples are needed to confirm this pattern. Neonates size varied from 46.0 to 55.0 mm SVL, similar to minimum sizes of individuals collected in the field (53.0 mm SVL, 31 March 1996; 50.0 mm SVL, 8 August 1996; Lemos-Espinal, pers. obs.).

Acknowledgments.—We thank Geoffrey R. Smith and Daniel D. Beck for their helpful comments on the manuscript.

TABLE 1. Comparison of parent-female and neonate data of three litters of *Xenosaurus platyceps* from km 154, Mex-Hwy 101 (Jaumave-Cd. Victoria), Tamaulipas.

Female SVL and BM, before and after parturition	Neonate SVL (Mean ± SE)	Neonate BM (Mean ± SE)	Parturition date
120.0 mm 32.2 g 24.14 g	50.5 ± 0.289 mm N = 4 (2M + 2F)	2.312 ± 0.037 g	15 June 1998
112.0 mm 25.9 g 21.1 g	47.5 ± 1.5 mm N = 2 (1M + 1F)	1.740 ± 0.560	22 June 1998
110.0 mm 30.5 g 25.9 g	54.5 ± 0.5 mm N = 2 (1M + 1F)	1.475 ± 0.325	26 June 1998

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TECHNIQUES

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Visible Implant Elastomers as a Method for Marking Adult Anurans

SANDRA NAUWELAERTS
Laboratory of Functional Morphology, University of Antwerp
Universiteitsplein 1, B-2610 Wilrijk, Belgium
e-mail: sandran@uia.ua.ac.be

JOHAN COECK
Institute of Nature Conservation, Kliniekstraat 25
B-1070 Brussels, Belgium

and
PETER AERTS
Laboratory of Functional Morphology, University of Antwerp
Universiteitsplein 1, B-2610 Wilrijk, Belgium

Marking techniques must be chosen carefully according to the main purpose of the study, the effectiveness of the technique, the ease of application, and the effect on behavior or survival of the animal (Donnelly et al. 1994). The most commonly used marking technique for adult anurans is toe-clipping. Yet, toe-clipping may result in decreased survival (Clark 1972; Golay and Durrer 1994; van Gelder and Strijbosch 1996) and might interfere with locomotor performance. Another disadvantage is the regeneration of toes, which makes this technique unsuitable for long term studies. Other marking techniques such as Panjet dye marking and Passive Integrated Transponder (PIT) tags had no detected effect on survival or growth, but Indian ink Panjet marks are known to fade within 20 days (Brown 1997), whereas PIT tags are expensive and are often lost (Schooley et al. 1993). The most promising method so far is a pressurized fluorescent marking technique, but it is still expensive, heavy to transport into the field, and the application is potentially harmful to small anurans (Schlaepfer 1998). No references for use in adult amphibians are available. Although other micro-tagging techniques have been successfully used in fishes, such as Coded Wire Tag (1.1 mm x 0.25 mm stainless steel wire; Mattson et al. 1990; McMahon et al. 1996), and Visible Implant Alphanumeric Tags (small, 1.0 x 2.5 mm biocompatible implants with an alphanumeric code; Buckley et al. 1994; Frenette and Bryant 1996; McMahon et al. 1996), references to their application in adult amphibians are lacking.

We report here on the use of Visible Implant Fluorescent Elastomer (VIE) tags to mark amphibians. These tags consist of a biocompatible elastomer (Northwest Marine Technology Inc., http://www.nmt-inc.com) which has been successfully used for marking fish (Bonneau et al. 1995; Emata and Marte 1992; Willis and Babcock 1998) and anuran tadpoles (Anholt et al. 1998). The tagging material consists of two components, a liquid elastomer material and a curing agent, which are mixed prior to injection. After injection, the mixture cures into a pliable solid within a few hours at room temperature. Once mixed, the elastomer can be stored as a liquid in the freezer for two to three weeks prior to injection.

We used this technique to mark 40 adult *Rana esculenta*. The animals were anesthetized using a solution of MS-222 (3-aminobenzoic acid ethyl ester) in a 0.5 g/L concentration (Bonath 1977; Green 1979). The fluorescent mixture was injected into the transparent skin between two toes using a 3/10cc insulin syringe. After marking, the animals were placed in fresh water for 20 minutes to allow recovery, after which they were released in their terrarium. The next day all markings were found to be clearly visible under UV-light (Fig. 1). After four months, retention of the marks was still 100%, although some of them decreased in size as much as 20%. At eight months post-injection, the marks had not changed any further.



FIG 1. The VIE tag becomes highly visible under ultraviolet light.

Effects on survival in the field have not been reported. Yet, Govindarajulu and Anholt (pers. comm.) marked 100 *Rana catesbeiana* metamorphs and adults without incident. They recaptured adults in subsequent years with no evidence of mark deterioration. Consequently, VIE tags may be an effective technique for marking anurans because of the low costs (US $240/4000 marks; UV-light $35), the ease and swiftness of application (it takes about one minute, after anesthesia), the high rate of retention, and the possibility of marking many individuals. Because each foot has five webbed toes, this gives a total of eight locations for tag placement. Because the tags are available in four fluorescent colors, a high number of individuals can potentially be marked. Theoretically, with 'no mark' used as part of the marking system, $5^8-1 = 390{,}624$ possible combinations can be made when all eight locations are used. If exactly two tags are put on each individual,

448 unique marks are obtained. In species with webbed front legs, an additional six marking places are available. Other promising advantages, especially for use in the field, are the visibility at night (after recapture and using a UV-source) and the low volume and weight of the equipment.

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Estimating the Number of *Varanus* Inhabiting an Australian Tropical Beach from Track Characteristics

SEAN J. BLAMIRES*
Faculty of Science, Northern Territory University
Darwin, Northern Territory, 0909, Australia
e-mail: s_blamires@hotmail.com

**Present address: The Morning Bell Language School, 671-3 Juk-Do2 Dong, Buk-Gu, Pohang City, Gyeong-Buk, 791-052, South Korea*

Estimating animal populations involves capturing and marking a large portion of the population and then releasing and recapturing a significant proportion of those marked (Nichols 1992). Populations of animals that are difficult to encounter often cannot be estimated (Nichols 1992). Few population estimates have ever been made for monitor lizards (*Varanus* spp.). This is probably because they are difficult to encounter owing to their large size and their wide-ranging, non-social, and secretive habits (Greer 1989; King and Green 1993; Stamps 1977).

Populations of wild cats have been estimated by identifying individuals from measuring track characteristics, such as paw length and width, and toe spread and angle, and clustering the like characteristics (Riordan 1998; Van Dyke et al. 1985). Monitor lizards leave distinctive tracks on sandy substrates when walking in their regular motion from which inferences about their biology can be made (King and Green 1993; Pianka 1994). These tracks are recognizable by a curving line, formed by the side to side motion of the tail imprinting in the sand, and foot prints, imprinted either side of the tail line (King and Green 1993). It may be possible to

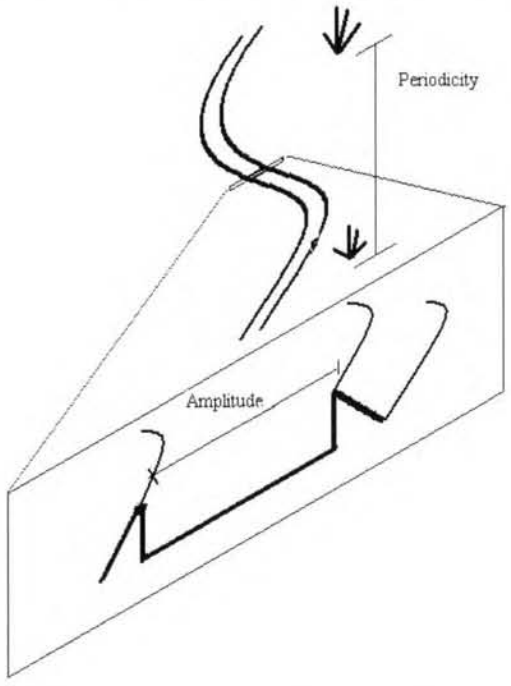


FIG. 1. Measurement taken to estimate the amplitude, periodicity, and foot length of monitor tracks encountered.

TABLE 1. Summary of likely beach inhabited, tail width, stride length and foot length of individual track characteristics derived from *k*-means cluster analysis.

Variable Track	Beach	Amplitude (cm)	Periodicity (cm)	Foot Length (cm)
1	2	1.9	37.5	8.7
2	2	1.8	38.9	9.8
3	3	1.3	37.9	9.2
4	3	2.6	39.3	10.6
5	4	1.7	35.7	9.2
6	2	1.4	35.6	8.9
7	2	1.5	33.9	9.8
8	3	3	35.2	9.8
9	2	4	38	10.5
10	4	4.7	37.8	9.2
11	4	2	38.5	7
12	3	2.5	35.4	7.4
13	4	3	40.2	9.7
14	2	2.3	34.2	8.6
15	3	3.3	33.5	13
16	4	1.9	40.6	12.4
17	3	3.5	37.6	12.4
18	4	2.5	33.3	8.3
19	2	4.3	33.8	8.5
20	2	2	30.8	8.8
21	2	2.2	42	8.5
22	3	2.1	41.7	9.4
23	4	2.3	32.7	10.5
24	2	4.2	41	9.8
25	2	5	42	11.3
26	2	1.9	44.7	7.6
27	4	2.2	43	11.7
28	2	2.3	43.8	10.8
29	3	2.1	43.2	9.5
30	2	1.8	31.9	6.3
31	2	4.5	44.7	9.7
32	1	5	46	11
33	3	2.3	46.2	11.2
34	3	1.9	28.8	7.3
35	2	3	28.5	10.1
36	3	4.3	47.5	9
37	2	4.1	48.3	11.6
38	3	1.4	24.9	6.4
39	2	3	25	10.3
40	3	2.3	19.7	7.4
41	3	3.3	52.3	11.3

estimate the population of sand dwelling monitors by measuring certain track characteristics and clustering those that are alike. In a recent study I used tail width (amplitude), stride length (periodicity), foot length, and region (beach) to estimate the population of *Varanus* inhabiting a beachfront in tropical northern Australia over a two-year period.

The study site was a 5 km stretch of beach, at Fog Bay (12°43'S; 130°20'E to 12°40'S; 130°21'E), approximately 150 km southwest of Darwin, Northern Territory, Australia. The sand dunes lining the beach run parallel to the water's edge, vary in height from one to 13 m, and are set back approximately 35 m from the water's edge. The entire stretch of beach is divided into four smaller

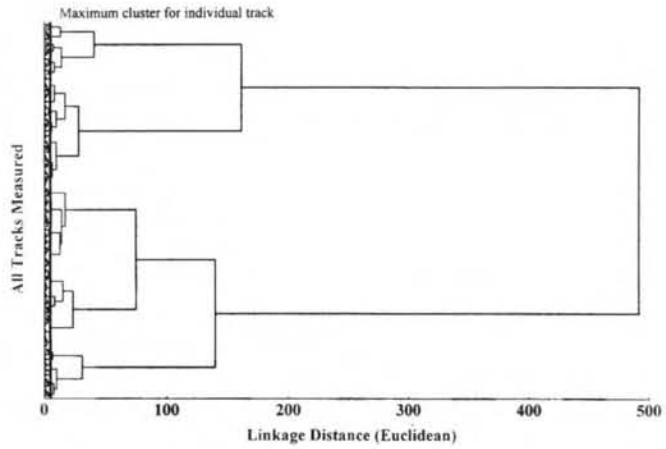


FIG. 2. Hieratical cluster analysis to differentiate individuals from track characteristics (amplitude, periodicity, and foot length). A Ward's (1963) minimum sum of squares linking criteria was used. Line representing the 95% separation point (maximum clustering for an individual) is indicated.

beaches, labelled beach 1 to 4, each of which is approximately 1.2 km long (Blamires and Guinea 1998). During a two-year extensive study of the area, the only monitor lizard species ever observed at the site was *Varanus panoptes* (Blamires 1999); therefore all the preceding measurements were assumed to be of this species.

The area was visited every two weeks for two to seven days over a two-year period. On each trip, all four beaches were walked at sunrise and sunset in order to view tracks when they were most visible (Pianka 1994). Each beach was walked approximately 200 times over two years. Each beach took approximately 0.5 h to walk.

Three measurements were made: amplitude, periodicity, and foot length. Monitor lizard tracks leave a sinusoidal imprint in the sand. Amplitude was measured as the width of the imprint (Fig. 1). Periodicity was the length of stride made by the hind feet and was measured as the straight distance between the heels of the hind footprints on the right side of the tail impression (Fig. 1). Foot length was measured from foot impressions, as the distance from the tip of the furthest claw to the base of the heel (Fig. 1). Foreprints were not measured, as they were usually covered by the hind foot print or the tail drag mark. Every track encountered on each beach was measured to the nearest 0.1 cm with a flexible metal measuring tape. Ten footprints per track were measured and an average taken. All measurements were taken on tracks on the beach scarp. The beach (1, 2, 3, or 4) each track was observed on was recorded. After measuring, each track was raked clear to ensure it was not recounted on subsequent visits. It was assumed that monitors on beaches 1 and 2, and 3 and 4 were isolated, since a creek divides beaches 2 and 3 and there was no evidence from tracks that any monitors crossed the creek.

A hierarchical cluster (Everitt 1980) was used to link like characteristics. Measurements taken for amplitude, periodicity, foot size, and beach were linked by a minimal sum of squares clustering criteria (Ward 1963). The number of branches in the cluster at 95% separation was assumed to equal the number of individual monitor tracks measured (Fig. 2). A *k*-means cluster analysis (Seber 1984) was used to determine the likely amplitude, periodicity, foot length, and the beach for individual monitors.

A total of 172 tracks were measured over the study period. From the cluster analysis, I estimated these represented the tracks of a minimum of 41 individual monitors. Amplitude, periodicity, foot length, and beach for individual tracks are shown in Table 1. Amplitude was positively correlated with periodicity (r = 0.343; P = 0.028) and foot length (r = 0.387; P = 0.013), and periodicity was positively correlated with foot length (r = 0.437; P = 0.004; Fig. 3).

Potential difficulties occur if individual lizards alter tail posture during running or certain displays (Green and King 1993) and change movement posture in response to a sloping terrain (Reichman and Aitchison 1981). Therefore, multiple measurements must be taken on numerous tracks, ensuring a consistent slope. I made no measurements of tracks that traversed the dunes. The population at Fog Bay may be overestimated due to the same individual's tracks having the same amplitude but different periodicity when re-encountered due to running or display. Accordingly, if any tracks with the same mean amplitude occur on the same beach they may be regarded as belonging to the same individual. Thus, there may be as few as 28 individuals inhabiting the area. From Table 1; tracks 1 and 2; 6 and 7; 4 and 12; 15 and 41; 5 and 16; 19 and 24; 23 and 27; 22 and 29; 26 and 30; 3 and 38; 35 and 39 and 28, 33 and 40 may be the same individual.

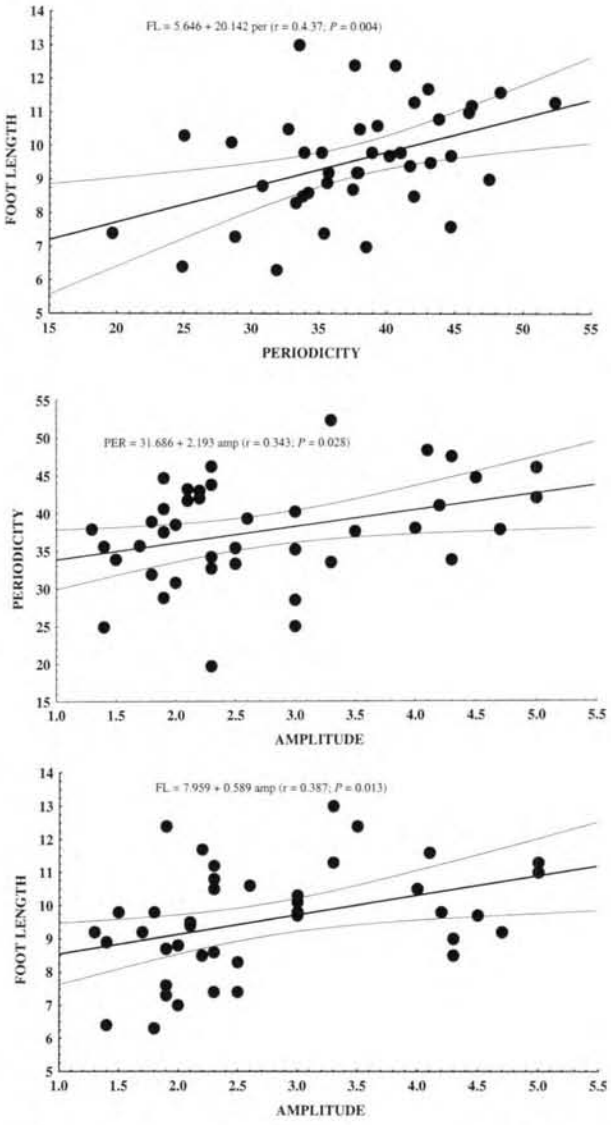


FIG. 3. Correlation plots and equations for associations between amplitude, periodicity and foot length.

Recognition of individual monitors from tracks on a sandy substrate, may prove useful in ways other than estimating the population, for example it may relieve the need to capture and release, or radio track individual monitors to estimate activity area. A database with track characteristics of individuals in an area may be created. Each individual's tracks can then be readily recognized by measuring the characteristics of any tracks left in the substrate. Each individual's movements may be determined by following its track. Furthermore, burrow sites of individuals may be determined, and by collecting and analyzing the contents of scats associated with an individual's track, the diet of each individual could be determined.

Following the tracks of sand-dwelling monitors has been used to determine foraging paths and daily distances moved for different species of *Varanus* (Pianka 1986, 1994). However, by taking further measurements additional knowledge may be gained about the habits of sand-dwelling monitors. This should reduce the need to locate individual lizards and eliminates any behavioral changes that might be caused from applying tags.

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Effectiveness of Three Trap Types in Drift Fence Surveys

JAMES L. CHRISTIANSEN*
Department of Biology, Drake University
Des Moines, Iowa 50311, USA
e-mail: James.Christiansen@drake.edu

and
TERRY VANDEWALLE
Earth Tech, 501 Sycamore Street, Suite 220
Waterloo, Iowa 50703, USA
e-mail: Terry_Vandewalle@earthtech.com

We frequently use drift fences along with other techniques to monitor terrestrial movements of turtles and other small animals in Iowa. Through the 1970s and early 1980s we used pitfall traps straddled by a drift fence as our primary terrestrial sampling method. Our observation of terrestrial turtles going great distances to avoid entering a pitfall trap caused us to seek alternatives. Iverson (1991) field-tested a funnel (box) trap, a rectangular version of his aquatic trap (Iverson, 1979) and sent us a sample to copy. This new device was initially much more effective for collecting terrestrial turtles than were our pitfall traps. However, we frequently observed turtles walking around wire box traps just as they had

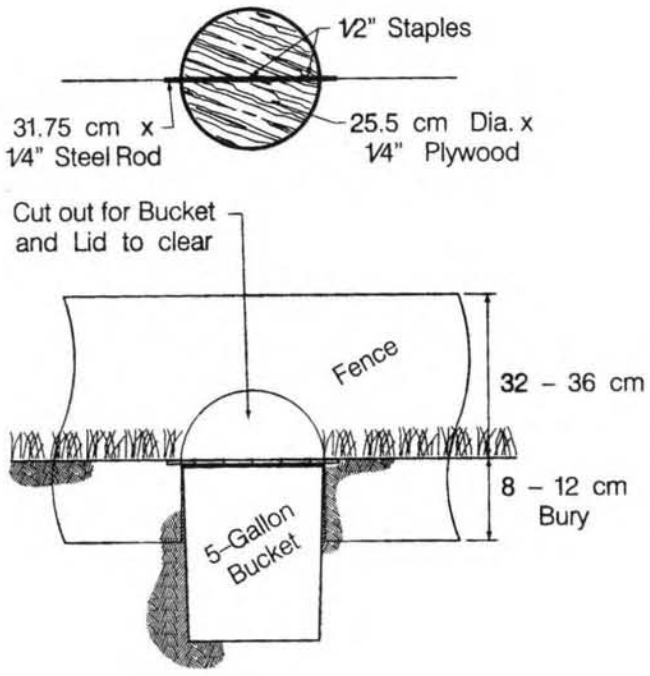


FIG. 1. Specifications of flip-top lid on 19-liter (5-gallon) bucket set in drift fence.



FIG. 2. Flip-top lid on 19-liter (5–gallon) bucket with basking *Cnemidophorus*. All traps tested were set in openings in the drift fence similar to the one shown.

our pitfall traps, especially after several recaptures. As a result, we began experimenting with other types of drift fence trap. This paper compares the effectiveness of open 19 liter (5-gallon) pitfall traps, Iverson's wire box traps set in the fence line rather than along the fence, and our final design of a flip-top lid 19 liter pitfall trap. It examines effectiveness in capturing a variety of turtles, lizards, amphibians, and a few small mammals and discusses our earlier designs for covered pitfall traps and our reasoning for selecting the design we now use.

Because turtles, especially adults of terrestrial forms such as *Terrapene ornata* and *Kinosternon flavescens*, usually walked around the open pit presented by an uncovered 19-liter pitfall trap, it appeared to be almost as effective a barrier as the drift fence. Because of our need to sample species that do not freely enter pitfall traps and can not be trapped effectively by wire box traps, we tried to develop a trap that was effective for turtles and reasonably effective for other species.

Our first attempt was to use pitfalls of a variety of sizes, 3.8–19 liter (1–5 gallon) covered with star-cut plastic of several different grades of thickness. The soft plastic top was spray painted the color of the sandy environment and fastened to wooden crochet rings that were slightly larger than the opening to the pitfall. The intent was to have a surface that was level with and the same consistency and color as the surrounding soil. The flaps of cut plastic were intended to bend downward as the animal reached the middle and to return to their original position when the animal fell through into the pitfall. Although we conducted numerous trials, we were unable to find a plastic with enough elasticity to return to the original position, especially in the hot sun, and enough flexibility to dump an animal even as heavy as a small turtle, into the trap. We rejected this design and began experiments with flip-top lids.

Our first 19-liter pitfalls with flip-top lids had circular, brown plastic tops supported by plastic rods that were glued to the top across the center of the circle with about 2.5 cm of rod projecting from each side. The lid was then fitted into two holes drilled in opposite sides of the pitfall bucket. While somewhat effective, we found that sand became wedged between the rod and the plastic of

TABLE 1. Number of captures (% of total) at the Big Sand Mound preserve for 5620 trap nights and chi-square values for open 19-liter (5-gallon), flip-top lid (covered) 19-liter, and wire box traps set along drift fences at Big Sand Mound in 1995 and 1997. Significance of difference from expected values among all three traps *=$p<.05$; **$p<.01$; *** = traps that were significantly more effective than the next best trap ($p<.05$) when Chi^2 was rerun comparing the two best traps.

Species	Box trap	Open 5-gal	Covered 5-gal	Total	Chi^2
Kinosternon flavescens (adult)	29 (17.7%)	18 (11.0%)	117 (71.3%)***	164	135.780**
K. flavescens (hatchling)	7 (21.9%)	10 (31.3%)	15 (46.9%)	32	5.272
Terrapene ornata (adult)	38 (33.3%)	14 (12.3%)	62 (54.4%)***	114	38.041**
Chrysemys picta (adult)	3 (5.4%)	6 (10.7%)	47 (83.9%)***	56	78.775**
C. picta (hatchling)	9 (25.7%)	11 (31.4%)	15 (42.9%)	35	3.348
Trachemys scripta (hatchling)	0 (0%)	11 (47.8%)	12 (52.2%)	23	14.197**
Graptemys pseudogeographica (h)	1 (6.7%)	12 (80.0%)***	2 (13.3%)	15	15.610**
Cnemidophorus sexlineatus	8 (6.8%)	73 (62.4%)***	36 (30.8%)	117	61.766**
Bufo woodhousii fowleri	42 (7%)	379 (63.0%)***	181 (30.1%)	602	332.564**
Rana catesbeiana	7 (10.4%)	50 (74.6%)***	10 (14.9%)	67	54.759**
Perognathus, Peromyscus, Zapus	0 (0.0%)	13 (65.0%)***	7 (35.0%)	20	14.221**
Sorex cinereus	0 (0.0%)	4 (57.1%)	3 (42.9%)	7	4.347
Blarina brevicauda	0 (0.0%)	6 (42.9%)	8 (57.1%)	14	9.252**
Microtus, Synaptomys	1 (2.9%)	24 (68.6%)***	10 (28.6%)	35	25.301**

the pitfall making it difficult for the lid to flip (rotate down, dumping the animal) and to return to its original position. In addition, the solar-heated glue tended to melt, allowing the lid to separate from the rod, and the plastic rod polymerized and easily broke.

These problems were corrected by using wooden tops supported by metal rods and by cutting grooves in the opposite sides of the pitfall bucket instead of drilling holes. We experimented with various designs in the early 1990s and produced our final design in 1995 (Fig. 1). The nearly circular lid was made of 6.5 mm (1/4 inch) plywood with a 31.8 cm metal rod stapled along the maximum diameter. Slight variations in lid diameter allowed the lid to rotate freely in buckets of slightly different size leaving a 7 mm space between lid and bucket wall (Fig. 2). Notches cut into the tops of the buckets allowed the rod to rotate without the binding that occurred with drilled holes. The rod was placed in line with the fence and an opening was cut in the fence to allow the lid to rotate and to tempt the animal to try to pass through the fence at that point (Fig 2).

We began testing our final design in April 1995 at Big Sand Mound, a large relict sand prairie just south of Muscatine, Iowa. Approximately 1500 m of drift fence was constructed along several pools at that site. The traps were spaced about 8 m apart with the flip-top lid pitfalls alternating with wire box traps set across openings in the fence, and open 19-liter pitfalls also set in openings in the fence, so that every 24 m had each trap type represented. Capture results based on 5620 trap nights at Big Sand Mound are shown in Table 1. Table 2 shows a comparison of a similar set of drift fences, but without the wire box traps, for 2062 trap nights at Eddyville dunes, a sand prairie in Wapello Co., south-central Iowa in spring 1997. Our traps were normally sampled four times each day at approximately 0800h, 1000h, 1700h, and 1900h.

Our tests confirmed Iverson's observation that wire box traps were more effective than open pitfalls in catching adult *Kinosternon flavescens* and *Terrapene ornata* although his traps were set along the two sides of the fence while ours were set in openings in the fence, making comparisons less precise. However, Tables 1 and 2 clearly show that adult turtles *(Terrapene, Chrysemys, Kinosternon)* were much more likely to enter flip-top lid traps than either open 19-liter traps or wire box traps. Hatchling turtles, except *Graptemys pseudogeographica,* were more frequently caught in flip-top lid traps than any other kind but not significantly more. Open pitfalls were more effective in collecting *Graptemys pseudogeographica*

TABLE 2. Number of captures (% of total) at the Eddyville Dunes for 2062 trap nights and chi-square values for open 19-liter (5-gallon) and flip-top lid (covered) 19-liter traps set along drift fences in 1998. Significance of difference from expected values *=$p<.05$; **$p<.01$.

Species	Open 5-gal	Covered 5-gal	Total	Chi-Square
Terrapene ornata (adult)	1 (25.0%)	3 (75.0%)	4	1.130
Chrysemys picta (adult)	1 (6.7%)	14 (93.3%)	15	10.355**
Chrysemys picta (hatchling)	6 (46.2%)	7 (53.6%)	13	0.096
Cnemidophorus sexlineatus	25 (62.5%)	15 (37.5%)	40	3.417
Ambystoma texanum & tigrinum	8 (47.1%)	9 (52.9%)	17	0.065
Bufo americanus	8 (42.1%)	11 (57.9%)	19	0.318
Rana clamitans	15 (71.4%)	6 (28.6)	21	4.667*
Hyla chrysoscelis	18 (56.3%)	14 (43.8%)	32	0.911
Perognathus, Peromyscus, Zapus	20 (60.6%)	13 (39.4%)	33	2.144
Sorex cinereus	36 (80%)	9 (20%)	45	18.548**
Blarina brevicauda	19 (63.3%)	11 (36.7%)	30	2.871
Microtus and Synaptomys	16 (57.1%)	12 (42.9%)	28	0.979

hatchlings, *Cnemidophorus sexlineatus*, *Bufo woodhousii*, *Rana catesbeiana* and *Rana clamitans*. Small mammals were usually more frequently found in open pitfalls than in flip-top lid traps and were almost never found in wire box traps.

We suspect that frogs and toads may be attracted to the open pitfalls by the abundant insects that accumulate there and this could be a feature in attracting lizards as well. *Cnemidophorus* sometimes used the flip-top lids as basking places, tilting the angle of the lid appropriately into the early morning sun (Fig. 2). The biases introduced by trap type should be considered along with the biases created by drift fences and proximity to other structures reviewed by Dodd (1991), Corn (1994), and Brown (1997). The results of this study suggest that flip-top 19-liter pitfall traps are much more effective in capturing adult terrestrial turtles than are either wire box traps or open pitfalls. Open pitfalls were more effective at capturing amphibians, lizards, and small mammals. Because of these observations, we suggest that a combination of open pitfalls and flip-top lid pitfalls be used in studies intended to sample reptile and amphibian species richness. Box traps set on the two sides of the fence need to be tested to determine their effectiveness in comparison to flip-top lid pitfalls.

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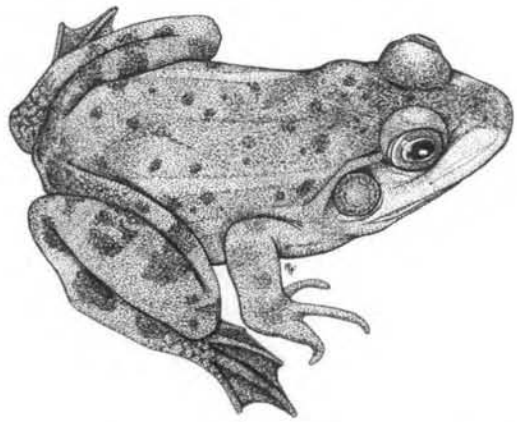
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Rana grylio (Pig Frog), young female. Illustration by Michael G. Frick.

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"Habitat Trap" for the Capture of Small- to Medium-Sized Lizards

G. MICHAEL ALLAN[1]
CHRISTOPHER J. PRELYPCHAN[2]
and
PATRICK T. GREGORY[3]
Department of Biology, University of Victoria
P.O. Box 3020, Victoria, British Columbia, Canada V8W 3N5

[1]Present address: 4034 Cumberland Road, Victoria, British Columbia, Canada V8X 2E6; e-mail: M&B_Allan@telus.net

[2] Present address: #3 – 795 West 8th Avenue, Vancouver, British Columbia, Canada V5Z 1C9

[3] Author to whom correspondence should be directed; e-mail: viper@uvic.ca

The study of animals in the field usually requires their capture and this often can be a challenging part of research. The number of possible techniques for capturing small- to medium-sized lizards continues to grow. "Active traps" include noosing (Strong et al. 1993; Durden et al. 1995), or elastic bands and varied grabbing devices (Bedford et al. 1995; Durtsche 1996; Witz 1996), but some lizards are particularly elusive and difficult to capture by these methods. "Stable traps" include drift fences (Greenberg et al. 1994; Enge 1997), pit traps (Greenberg et al. 1994), glue traps (Bauer and Sadlier 1992; Rodda et al. 1993; Zani and Vitt 1995; Whiting 1998), and wire mesh traps (Doan 1997; Zani and Vitt 1995), but these kinds of traps need to be checked frequently or animals may die in them.

We studied a growing population of European wall lizards (*Podarcis muralis*), introduced near Victoria, British Columbia, Canada. Although we were able to capture most animals with a simple noose, we noticed that some lizards consistently avoided the noose and that other lizards used habitat unsuitable for noosing (e.g., brush and tall grass). To capture these additional lizards, we installed pit traps around the habitat. These traps were successful, but we found that predatory animals, such as raccoons, were quick to prey on the trapped lizards. Raccoons were adept at catching the lizards despite partial lids over the traps, frequent checking of traps, and relocation of traps. As well, frequent relocation of traps led to considerable disruption of the habitat area.

To overcome these difficulties, we developed a "habitat trap" for *Podarcis muralis*. We believe that this kind of trap likely also would be effective for catching many other small- to medium-sized lizards and other terrestrial animals. The trap consists of an artificial construct of a preferred habitat, which is placed on a large piece of camouflaged plastic. Once the animals begin to occupy the artificial habitat, the plastic sheet is lifted at all edges and the animals are trapped.

To catch wall lizards, we decided to simulate a rockpile or woodpile, structures in which these animals naturally seek shelter. First, we excavated a shallow pit about 15 cm deep, gradually tapered in depth, with a total area of about 1 m^2. Whether a pit is a required part of the trap is not known, but we thought that it would increase the attractiveness of this artificial habitat to lizards by allowing

them to go deeper, especially at night. A clear plastic sheet was then laid in the shallow pit with a border of plastic approximately 30 cm beyond the excavated area. The edges of the plastic were buried in a shallow layer of soil or surrounding substrate. Then, we placed large cover structures, each approximately 30 cm^3, such as cinder blocks, stones or pieces of wood, centrally on the plastic. We arranged these objects to simulate a natural shelter habitat. Additional cover objects could have been added to assist in camouflaging the plastic and make the habitat structure more attractive to the lizards, but we found this to be unnecessary for wall lizards. Camouflaging the edge of the plastic sheet with cover leaves or grass also must be balanced against the added time of locating captured lizards in the clutter of excess camouflage litter when the edges of the plastic are lifted. For wall lizards, 2–3 days was sufficient time for lizards to be attracted to the trap.

A limiting feature of our trap is that at least two people are needed to lift the plastic and catch the entrapped lizards. We approached the trap from opposing sides, in order to reduce the likelihood of lizards fleeing the trap from a side away from us. This method in fact seemed to encourage the lizards to take refuge inside the shelter habitat, rather than attempting to leave. We then simultaneously lifted the edges of the plastic, while trying to ensure that soil at the perimeter fell to the outside of the plastic. We kept the edges of the plastic raised and rolled it while moving towards the center of the trap. The large stone and wood cover objects, along with any litter, were removed carefully to ensure that lizards were not injured. The trapped and exposed animals could then easily be collected from the bottom of the bowl formed by the plastic sheet. After we had recorded data on the lizards, we returned them to the now reassembled trap. This experience did not seem to have any long-term effect on the lizards and they continued to use the trap after re-assembly. It took about 20 minutes to disassemble the trap, capture the lizards, and then reassemble the trap.

Because we constructed only one trap and terminated the study shortly afterwards, we cannot give any experimental results that test its effectiveness. We used the trap from 15 July–19 August 1992. During this period, we caught 33 individual lizards at the study site, six of which were caught in the trap; one of the six was a recapture from earlier in the study. Repeated sampling at the trap resulted in repeated capture of the same lizards. Thus, it appears that lizards, at least temporarily, adopted the trap as a regular refuge. Because wall lizards do not move around very much (unpublished data), we would have needed to set up traps throughout the study site to sample the population more broadly. Nonetheless, the results of this short trial suggest that this is a feasible approach for studying this species.

The main advantage of this trap is that it allows the animals to live in their "natural" habitat with safe hiding places, without requiring us to check the traps at any particular time. The only cost is the expense of plastic sheeting and the brief period of time required for assembly and sampling. We believe that the habitat trap would be an effective way to catch various kinds of lizards and other terrestrial animals.

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Field Use of Propofol: a Rapid Recovery Anesthetic with Data from Brown Treesnakes (*Boiga irregularis*)

NANCY L. ANDERSON
BRAD COUPE
GAD PERRY*
THOMAS E. HETHERINGTON
and
JOSEPH B. WILLIAMS
Department of Evolution, Ecology, and Organismal Biology
The Ohio State University, Columbus, Ohio 43210, USA
e-mail (NLA): anderson.296@osu.edu

**Current address: Department of Zoology, University of Wisconsin*
430 Lincoln Drive, Madison, Wisconsin 53706, USA

In reptiles, prolonged anesthesia is often the frustrating consequence of a relatively slow metabolic rate combined with the use of traditional anesthetics. A drawn out anesthetic procedure is perhaps most problematic in field studies because prompt return of a fully recovered reptile to its habitat minimizes data artifacts which may be generated by stress, anesthesia, fasting, or dehydration. Propofol is a new generation, non-barbiturate, substituted isopropyl phenol anesthetic (Weaver 1990). Its benefits include rapid onset and rapid recovery from anesthesia, short duration of action, safety for use in physiologically compromised animals, lack of significant side effects, and minimal equipment requirements (Sebel and Lowden 1989; Smith et al. 1994). Its main disadvantage is that it must be administered into a blood vessel or bone marrow cavity. Propofol has a very large volume of distribution, which results in a rapid drop of anesthetic blood levels once the drug is discontinued (Biebuyck 1989; Branson and Gross 1994).

As a result, the recovery is rapid and virtually independent of metabolic rate. Several authors have reported useful doses for induction of anesthesia in captive boids, green iguanas, and turtles (Bennett et al. 1998; Divers 1996; Lawton 1992; Pye and Carpenter 1998). Although propofol has been evaluated in snakes under experimental laboratory conditions (Anderson et al. 1999), this is the first study to evaluate the use of propofol as a field anesthetic for the implantation of intracoelomic radio-transmitters in free ranging reptiles.

During November and December 1997, we collected 11 brown treesnakes (*Boiga irregularis*) using traps and visual surveys on the Northwest Fields region of Andersen Air Force Base on the island of Guam. This area consists of typhoon impacted, limestone rain forest interspersed with unused, paved runways. We weighed snakes to the nearest gram with spring scales (0 to 300 g, Pesola™, Pesola, Switzerland) and then prepared a 5 mg/kg dose of propofol, (10 mg/ml, Rapinovet™, Mallinckrodt Veterinary, Inc., Mundelein, Illinois, USA), (Anderson et al. 1999) in a 0.5 ml tuberculin syringe with a 3/8 inch, 27 gauge needle. Based on the history of propofol causing a brief (< 60 sec) apnea (temporary stoppage of breathing) in brown treesnakes (Anderson et al. 1999), we also prepared a 2.0 mg/kg dose of a respiratory stimulant (doxapram HCl, 20 mg/ml, Dopram®-V, Fort Dodge Laboratories, Inc., Fort Dodge, Iowa, USA; Carpenter et al. 1996) to administer if apnea lasting longer than one minute occurred in study snakes. Prior to administration of the anesthetic we recorded baseline respiratory and heart rates.

Although with proper training, propofol is easily administered to most snakes via the tail vein, the small size and fragility of these vessels in brown treesnakes required us to administer the anesthetic into the lumen of the heart. We used a standard cardiopuncture technique to administer the propofol (Jenkins 1996). Cardiopuncture is a relatively risk-free procedure in snakes (Anderson et al. 1999; Jenkins 1996; Johnson et al. 1997; Mader et al. 1985), but proper training and excellent restraint are essential to consistently place the tip of a needle in the lumen of the ventricle and to minimize trauma to the heart. Although the snakes resisted restraint, we did not recognize any additional response by the snakes to the intracardiac injection. All snakes were unconscious with little to no muscle tone within 45 sec of a complete injection. When induction of anesthesia was complete, one person finished the aseptic preparation of the skin for surgery and started the radio-transmitter implantation procedure while another person measured the snake's heart and respiratory rates. Maintenance of surgical anesthesia was monitored by the absence of a pain response (movement, increased heart rate) by the snakes. The length of the radio-transmitter implantation procedure from time of injection to placement of last suture ranged from 10–17 min. Excellent surgical anesthesia was achieved in all snakes for this time period. In addition to documenting induction time and length of procedure, we also recorded presence of apnea, heart rate, time until release, and condition of snake upon release to the wild.

In three out of eleven cases, movement by the snake during injection resulted in some or all of the propofol dose to be administered outside the lumen of the heart. Because propofol enters the blood stream extremely slowly after injection into peripheral tissues, additional doses of propofol were required to induce surgical levels of anesthesia. Supplementary doses of propofol ranged from 2–5 mg/kg. Lower doses were chosen when a decrease in muscle tone or righting ability indicated that a snake had received a part of the initial dose into the lumen of the heart. In other species of snakes, use of the tail vein would minimize the injection difficulties that we experienced.

The heart rate dropped from a baseline average of 93 beats per minute (SE = 2.3) to 76 beats per minute (SE = 2.8) by 1–5 min post-injection. Although this is a statistically significant change (Minitab, 2 sample t-test, $P = 0.0011$; Ramsey and Schafer 1997), the heart rates remained within expected values for anesthetized snakes (Muir and Hubbell 1995). All animals maintained normal perfusion judged from mucous membrane color and intra-operative evaluation of coelomic blood vessels. Although direct effects of propofol cannot be ruled out, the most likely explanation for the decreased heart rate is loss of consciousness and cessation of struggling against restraint. Because pain is associated with increased heart rate, the drop in heart rate is one indication that analgesia (pain relief) was adequate. The heart rate did not change significantly between 5 min after induction of anesthesia (mean = 76 bpm, SE = 2.8) and the end of the surgery (mean = 77, SE = 1.7) (Minitab, 2 sample t-test, $P = 0.88$; Ramsey and Schafer 1997) which suggests that the snakes' cardiovascular status was stable.

In general, propofol-induced apnea is short lived and self-limiting (Anderson et al. 1999; Bennett et al. 1998; Muir and Gadawski 1998). All of the brown treesnakes stopped breathing post-injection of propofol; all but three snakes resumed spontaneous respirations in < 1 min. Although brief apnea associated with propofol anesthesia in captive brown treesnakes did not seriously affect the partial pressure of oxygen of heart blood (Anderson et al. 1999) and is not likely to affect the health of a snake in general (Bennett 1991), we chose to be conservative and administered doxapram HCl intramuscularly to these three snakes after 1 min. Spontaneous respirations resumed within 1 min of receiving doxapram HCl in two of the three snakes. The snake that did not respond to doxapram HCl within 2 min had been particularly difficult to restrain and as a result required a total of four injections of propofol to induce anesthesia. We intubated the snake's trachea with a plastic urinary catheter and administered artificial ventilation at a rate of 1–4 breaths per min for 24 min, after which the snake commenced breathing on its own (Muir and Hubbell 1995). All three snakes recovered uneventfully and were indistinguishable from other snakes at release and during a two week radio-telemetric study that followed.

Twenty to 25 min after injection, seven snakes had righting reflexes and four of these snakes were making active escape attempts. After 2 h, all snakes were conscious and active. We released snakes by untying and placing a cloth bag containing the snake at the original capture site. At release, 2–3.5 h post-injection, most snakes immediately left the bag and some exhibited defensive strikes. As part of the field study, we caught, examined, and weighed these snakes every four days for a total of 12 days. Snakes appeared healthy at these times. No weight losses were noted. At the end of the study, lizard remains were identified in the stomachs of 70% of the snakes. No obvious temporal differences in distances traveled or refugia selected were observed over the 12-day tracking period (Anderson, unpubl.).

It is possible that lingering effects of anesthesia could bias subsequent data collection. The consequences of anesthesia can be

reduced by minimizing the time that an animal is removed from its regular environment and altered from its normal metabolic state. In reptiles, the use of traditional injectable forms of anesthesia (ketamine, barbiturates) at a surgical level often results in recovery times of several hours to days (Bennett 1991) and can cause death. The use of vapor anesthetics such as isoflurane or halothane usually results in shorter recovery times (0.5–4 h), but the open drop technique frequently used in the field allows little control of the concentration of anesthetic vapor administered to a snake. As a consequence, even when researchers follow seemingly similar techniques, small differences in ambient temperature, volume of the induction chamber, snake posture, or sponge material can result in marked changes in anesthetic concentration. Low concentrations are associated with prolonged inductions and high concentrations can be associated with prolonged recoveries or death (Bennett 1991). Precise control of vapor anesthetic concentrations requires vaporizers and pressurized oxygen tanks, which are unwieldy for field use. There are also potential health risks of escaped anesthetic vapors to human workers such as organ damage, spontaneous abortions, and birth defects that need to be considered (Hill et al. 1998). Use of propofol circumvents these problems.

Propofol has several limitations. Its short action time is a disadvantage for procedures lasting longer than 15–20 min. A continuous infusion or multiple venous injections (at lower doses) are required in such cases. Administration of an intravenous injection during a procedure can be challenging even with proper training and experience. The incidence and severity of complications increases as the dose and length of anesthesia are increased (Bennett et al. 1998). Once an animal begins to recover from propofol anesthesia, there is no maintenance of pain relief, so it is not useful for procedures likely to induce prolonged pain without the concurrent use of an analgesic. This characteristic also makes it extremely important to finish painful procedures prior to recovery from anesthesia (Branson and Gross 1994). Induction with propofol followed by vapor anesthesia or vapor anesthesia alone is recommended for prolonged procedures.

The dose of propofol required to induce anesthesia is species dependent. Due to the limited data base available for safe, effective dosages in reptiles, it is imperative to determine this information prior to use in experiments in the field. As an example, a common induction dose of propofol for boids is 10–12 mg/kg (Divers 1996). In pre-study testing of brown treesnakes, this dose resulted in a surgical level of anesthesia lasting 30 min to 2 h, apnea lasting up to 7 min, and return of righting reflex occurring in 2–4 h. Snakes receiving this dose of propofol did not return to a pre-anesthetized state for several hours. In continuing pre-study testing, one brown treesnake receiving a dose commonly used in turtles (15 mg/kg; Divers 1996), became apneic, did not respond to doxapram HCl, and required artificial ventilation for 2 h. Although the magnitude of the difference is not as great, dosage also varies by individual. In general, agitated and obese individuals require a 10–20% increase in propofol dose (Anderson et al. 1999).

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HERPETOLOGICAL HUSBANDRY

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An Inexpensive Method for Creating Cages for Large Reptiles

PAUL M. BEDOCS
LANCE McBRAYER*
and
JASON ELIAS
Department of Biological Sciences, Ohio University
Athens, Ohio 45701, USA
e-mail (LM): lance.mcbrayer@ohio.edu

**Author to whom correspondence should be sent*

Reptiles can be stored in a variety of containers; however, the most convenient and widely used are glass aquaria. Glass aquaria provide adequate housing for small reptiles, but are not very practical options for housing large reptiles because they are heavy and easily broken. Large reptiles are housed in a wide variety of containers. Frequently used cages include custom made wood and glass cages, cattle tanks, plastic terraria, and commercially available cages (Mason et al. 1991). While these certainly provide adequate housing options, they are often cost prohibitive, heavy, and difficult to properly sanitize.

We designed an inexpensive cage for large reptiles (1–5 kg) from materials available at any local hardware and/or department store. The cages consist of modified storage containers, hardware cloth and plastic cable ties. Each cage takes roughly 30 minutes to assemble and costs approximately US $12.00. In addition, the cages are lightweight (ca. 2 kg), very rugged, easily sanitized, and adhere to the general guidelines established for housing reptiles by the National Research Council *(Guide for the Care and Use of Laboratory Animals).*

Large storage containers (Sterilite®, ca. 30 gal) were purchased at a local department store. Two front windows (25 cm long x 15 cm high) were cut into the long side of the container with a utility knife. Instead of one large hole, two smaller holes were cut to lend structural integrity to the wall of the storage container (Fig. 1). Our containers were stored under lab benches in a university animal holding facility. Thus to provide a heat source for the animal, we cut another 20 cm x 20 cm window in the short side of the cage so that a heat lamp could heat and illuminate the cage. Additional windows may be cut into the container if so desired. One might rather cut a 22 cm x 44 cm window in the lid of the container for additional air flow or heating options. Any of these designs allow for sufficient heat and light sources while retaining the ability of the containers to be stacked for storage purposes.

Hardware cloth (grid size 0.65 cm x 0.65 cm) serves as a cover for the windows in the walls of the container. Using tin snips, hardware cloth cutouts were cut to the appropriate window size. The dimensions of the cutouts were one inch larger than each dimension of the window to allow for proper fastening. Holes were drilled around each window at roughly 8 cm intervals so that plastic cable ties could be threaded through the hardware cloth cutout, through a hole in the container wall, and then out through the adjacent hole and hardware cloth. Cable ties were secured with the female end of the tie on the outside of the container to keep any sharp edges away from the animal. Once secured, the ends of the cable ties were clipped.



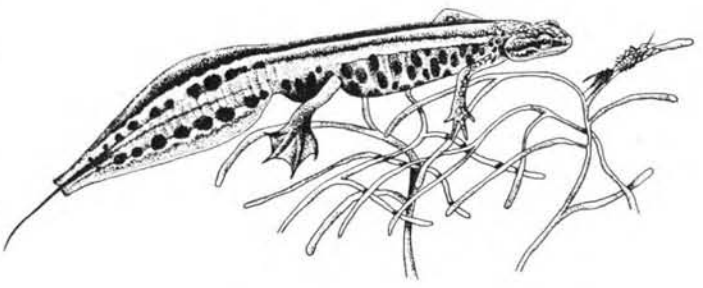
FIG. 1. Inexpensive cage designed to house large reptiles.

The lid of the container snaps to the container body. This alone should be sufficient to secure most 1–2 kg animals. However if additional security is needed for large or active snakes or lizards, two inch binder clips fit the lid and wall of the container well and provide considerable additional fastening strength. We housed large lizards (gold tegus, *Tupinambis teguixin*; savannah monitors, *Varanus exanthematicus*; ca. 1.5 kg, 30+ cm SVL) using two binder clips evenly spaced on each side of the lid. Over a nine month period, no lizards escaped with this arrangement. Thus, these cages proved to provide safe and adequate housing with the added benefits of being lightweight, inexpensive, and easy to sanitize.

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Triturus helveticus (Palmate Newt). Illustration by P. A. Benson.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 31, Number 1 (March 2000).

CAUDATA

AMBYSTOMA TIGRINUM (Tiger Salamander) **COCCIDIA.** Although endoparasites from midwestern *Ambystoma* salamanders have been studied (Muzzall and Schinderle 1992. J. Helminth. Soc. Washington 59:201–205; Bolek 1997. J. Helminth. Soc. Wash. 64:292–295; Bolek and Coggins 1998. J. Helminth. Soc. Wash. 65:98–102; Bolek 1998. MS Thesis, Univ. Wisc. Milwaukee. 134 pp.; Yoder 1998. Ph.D. Thesis Univ. Wisconsin, Milwaukee. 138 pp.), no reports exist on their coccidians from this area. Here I report on *Eimeria* spp. from a tiger salamander in Indiana. During the evening of 11 February 1999 a male *Ambystoma tigrinum* (wet weight 30.41 g, SVL 94 mm) was collected in West Lafayette, Tipicanoo County, Indiana, USA while heading for a breeding pond. The salamander was returned to the laboratory and maintained in a 75.7-liter aquarium with moist paper towels and allowed to defecate. Fecal material was collected on 12 February and left in a thin layer of tap water at room temperature for three days for oocysts to sporulate. Oocysts were concentrated using coverslip flotation with Shether's sugar solution (sp. gr. 1.30), centrifuged at 1300 RPM for 5 minutes, and measured using an ocular micrometer. All measurements are reported in micrometers and given as a mean followed by a range in parentheses. Two species of coccidians, *Eimeria urodela* and *E. ambysomae*, were found to infect *A. tigrinum*. *Eimeria urodela* oocysts (N = 9) were spheroid in shape and had a smooth colorless wall 1 mm thick and possessed no micropyle. Average size of oocysts was 21.56 x 21.25 mm (20.03–23.06 x 19.84–23.31) with 4 lanceolate shaped sporocysts 14.88 x 5.8 mm (13.12–15.90 x 4.7–6.8) and a granular sporocyst residuum. *Eimeria ambysomae* oocysts (N = 5) were ellipsoid in shape 27.94 x 16.51 mm (27.02–29.76 x 14.88–17.36) and had a smooth colorless wall 1 mm thick and possessed no micropyle. Sporocysts were lanceolate in shape 15.37 x 5.1 mm (14.91–16.33 x 5.1–7). Both species were previously reported from *A. tigrinum* from northeast Colorado and northern New Mexico (Duszynski et al. 1972. J. Protozool. 19:252–256). Additionally, *E. ambysomae* has been reported from *A. tigrinum* from Iowa by Saxe (1955. Proc. Iowa Acad. Sci. 62:663–673) and *A. texanum* from Arkansas and Texas by Upton et al. (1993. Can. J. Zool. 71: 2410–2418). No reports of these species exist from Indiana (see Upton et al., *op. cit.*). Therefore, this observation extends the range of both species. Coccidia in caudate amphibians are relatively rare. However, as stated by Upton et al. (*op. cit.*), many species remain to be surveyed and resurveyed from different locations. Fourteen blue-spotted salamanders, *A. laterale*, collected in Waukesha County, Wisconsin, a two-lined salamander, *Eurycea bislineata*, and four red-backed salamanders, *Plethodon cinereus*, collected in Tipicanoo County, Indiana during April–May 1999 were negative for coccidians.

I thank Melissa Ewert, Scott Storandt, and Brian Mack for help in collecting salamanders.

Submitted by **MATTHEW G. BOLEK**, Diagnostic Parasitology Laboratory, Department of Veterinary Pathobiology, Purdue University, West Lafayette, Indiana 47907, USA; e-mail mgb@vet.purdue.edu.

BOLITOGLOSSA MELIANA (NCN). **ANTIPREDATOR POSTURE.** Although neotropical plethodontids comprise almost half of all known salamander species, most aspects of their biology are poorly understood. A few authors (e.g., Dodd and Brodie 1976. Herpetologica 32:269–290; Brodie 1982. Natl. Geogr. Soc. Res. Rep. 14:77–87) have studied antipredator adaptations among these salamanders and found, that aside from tail autotomy and a few species with strong skin toxins, most species exhibit other antipredator behaviors. In many salamanders, specific postures are an important aspect of the behavioral responses to predators. The antipredator postures of salamanders are composed of different elements of which six, so far, have been observed in neotropical plethodontids (Brodie, *op. cit.*). *Bolitoglossa meliana* is a large, uniform black, species of the *B. franklini* group. The species is known from cloud and oak-pine forest at intermediate to high elevations in the provinces of El Quiché, Baja Verapaz, Zacapa, and El Progreso, Guatemala (Wake and Lynch 1982. Herpetologica 38:257–272).

On 4 July 1999, a young *B. meliana* was found inside a rotting log on a slope in humid oak-pine forest near Santa Rosa Pass (15°03'89"N, 91°06'76"W), 8–9 km NE Santa Cruz del Quiché, El Quiché, Guatemala, at an elevation of ca. 2600 m. Dislodging the specimen from its cover elicited the following antipredator posture (Fig. 1): the salamander coiled its body, placing its head near the base of the tail. The limbs were clasped to the sides of the body and the tail was placed on top of the head. The tip of the tail was elevated and slowly undulated. During tail undulation only

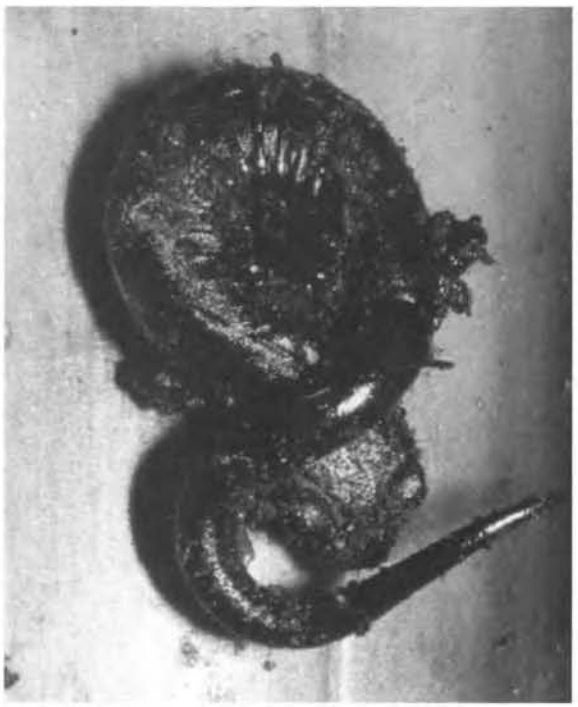


FIG. 1. A young *Bolitoglossa meliana* in antipredator posture, near Santa Rosa Pass, El Quiché, Guatemala.

the tip was moving, whereas the rest of the body was completely immobile.

The following elements (after Dodd and Brodie, *op. cit.* and Brodie, *op. cit.*) in the antipredator posture of *B. meliana* could be identified: 1. immobility; 2. body coiling; 3. tail elevation; 4. tail undulation; and 5. limbs clasped. These elements have also been observed in *B. franklini* and *B. lincolni*, both members of the *Bolitoglossa franklini* group (Brodie, *op cit.*). Both species also exhibited an arching of the body, which could not be identified in the antipredator posture of *B. meliana*.

I thank Rafael Fonoll, Sorin Damian, and Erik Keyster, who accompanied me on the field trip to Guatemala.

Submitted by **THOMAS BILLE**, Bellmansgade 40 st. tv., 2100 København Ø. Denmark.

EURYCEA QUADRIDIGITATA (Dwarf Salamander). **LARVAL PREDATION**. On 5 April 1999 in Natchitoches Parish, Louisiana, USA, in the Kisatchie National Forest in a small pool (3.6 m x 2.5 m; 22 cm deep), a larval *Eurycea quadradigitata* was found in the claws of a crayfish (*Procambus* sp.). The crayfish had eaten the head and gills of the salamander. The remains of the body were 6–7 mm long.

Petranka (1997. Salamanders of the United States and Canada. Smithsonian Institution Press. 592 pp.) suggested that crayfish may be a significant predator of larval *E. quadridigitata*. However, this is the first report of *E. quadridigitata* being preyed upon by a crayfish.

Pseudacris crucifer tadpoles were present and occupied the upper depths of the pool. The larvae of the *Eurycea* were found only beneath layers of dead leaves at the bottom of the pool. It is possible that this niche utilization may expose larval *E. quadridigitata* to other benthic predators of ephemeral pools.

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R.L. Thorton Fwy. (I-35), Dallas, Texas 75203, USA; e-mail HERPKING@ix.netcom.com.

NECTURUS MACULOSUS (Mudpuppy). **EGG PREDATION**. Several researchers have documented conspecific egg predation by *Necturus maculosus* (Bishop 1941. New York State Mus. Bull. No. 324:18–37; Eycleshymer 1906. Am. Nat. 40:123–136; Hamilton 1932. Copeia 1932:83–86; Harris 1959. Field and Laboratory 27:105–111) and have suggested that the eggs may be eaten by both breeding and non-breeding individuals. However, the reproductive states of the *N. maculosus* found eating eggs were not verified in the literature.

On 1 June 1999, while searching for *N. maculosus* nests in Little Yellow Creek (40°34'08"N, 79°01'06"W), Indiana County, Pennsylvania, USA, we discovered a heavily predated nest with an adult *N. maculosus* (184 mm SVL, 265 mm TL, 95 g mass) present. The adult was captured and taken to the laboratory at Indiana University of Pennsylvania where it was euthanized and dissected. Prior to anesthetization, the animal regurgitated 30 eggs in an 18.9-liter bucket used for transport. Dissection of the stomach revealed 22 additional eggs.

The animal was a sexually mature female as indicated by her size and the presence of ovaries and oviducts. The average diameter of twenty randomly chosen follicles was 0.97 mm (SD 0.18, range 0.48–1.22 mm). The presence of small follicles in the ovaries and thin oviducts indicated that the female was not reproductively active and could not have laid eggs this breeding season.

This is the first documentation of conspecific egg predation by a non-nesting female *N. maculosus*. There was no sign of the *N. maculosus* that laid the eggs and no indication whether she had abandoned the nest or was displaced by the nest intruder.

I thank Yellow Creek State Park for permission to conduct research within the park and Arthur Hulse for his help and comments on this manuscript. Research was conducted under scientific collector's permit 057 from the Pennsylvania Fish and Boat Commission. Partial funding was provided through a grant from the Graduate School and Research, Indiana University of Pennsylvania, Indiana, Pennsylvania.

Submitted by **OWEN M. LOCKHART**, Department of Biology, Indiana University of Pennsylvania, Indiana, Pennsylvania 15705, USA.

PLETHODON CINEREUS (Redback Salamander). **PREDATION**. Few reports of terrestrial arthropods preying upon amphibians have been published (McCormick and Polis 1982. Biol. Rev. 57:29–58). While two reports describe beetles preying upon anurans (Littlejohn and Wainer 1978. Victorian Nat. 95:251–252; Robertson 1989. Herpetol. Rev. 20:7–8), the following observation appears to be the first record of a beetle preying upon a salamander.

On 13 October 1999 at 1600 h, we observed a large rove beetle (*Platydracus viduatus* Fabricius 1801, formerly *Staphylinus maculosus*; Family Staphylinidae) consuming a live redback salamander (*Plethodon cinereus*). The beetle and salamander were found underneath a 1 ft^2 untreated coverboard at the USGS Patuxent Wildlife Research Center in Laurel, Maryland (UTM zone 18, 4323755 N, 345070 E, 30 m elevation, air 20.5°C). As the coverboard was lifted, the rove beetle (24 mm total length) was next to the redback salamander, but immediately retreated several cm and assumed a defensive posture in which the abdomen was raised and curved slightly over the body. The salamander (red phase, 40 mm SVL, 76 mm TL) was unusually thin. Its maximum width was 3.5 mm, 1 mm less than the average width of 15 other similar-sized redback salamanders (4.5 mm ± 0.66). The salamander had a 3 x 1 mm wound ca. halfway between the front and hind limbs and was partially eviscerated, but was still alive. The salamander's front limbs were on the ground, but the lower half of its body was twisted such that the lower legs, the puncture wound, and the eviscerated intestinal tract were facing upward. The last 18 mm of the salamander's tail was detached either by the beetle or as an autotomic response to the beetle attack.

Rove beetles such as *Platydracus viduatus* are generalist predators, eating a variety of invertebrates ranging from small nematodes, aphids, mites, dipterans, and collembolans, to larger organisms such as earthworms, larvae and adults of beetles and other insects (Krooss and Schaefer 1998. Ann. Appl. Biol. 133:1–16). *Platydracus viduatus* probably locates its prey by tactile contact during locomotor activity (Wheater 1989. J. Zool., Lond. 218:171–185). The rove beetle herein described may have been able to opportunistically attack and feed on the redback salamander

because the latter was weak and therefore unable to escape from or fend off the beetle.

We thank Lee Herman, Curator of Coleoptera at the American Museum of Natural History, for identifying the beetle, Sam Droege for establishing the coverboard transect, and Robert Fernandes for measuring the width of redback salamanders.

Submitted by **ROBIN E. JUNG, WENDY L. WARD, CARLOS O. KING**, and **LINDA A. WEIR**, USGS Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, USA.

ANURA

BUFO BOREAS (Boreal Toad). **PREDATION**. Several birds have been reported as predators of *Bufo boreas* and their tadpoles. Here we report predation on adult *B. boreas* by the red-tailed hawk (*Bueto jamaicensis*). Since 1995, we have been attaching radio transmitters to adult boreal toads as part of our monitoring procedures in a population near Berthoud Pass in Clear Creek County, Colorado, USA. Toads with transmitters are located weekly during the activity season. On two occasions in 1999 (14 July and 3 August), we tracked radio signals of two marked male *B. boreas* to a red-tailed hawk nest 10 m above the ground in an Engelmann spruce (*Picea engelmannii*). The hawk nest was located at 3200 m elevation ca. 400 m from the nearest *B. boreas* breeding site. Distances to the nest from the last recorded locations of the toads were 300 and 310 m. This is the first record of predation on *B. boreas* by a raptor in five years of observations at this site.

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Submitted by **MARK S. JONES** and **BUD STILES**, Colorado Division of Wildlife, 317 West Prospect Road, Ft. Collins, Colorado 80526, USA.

BUFO PUNCTATUS (Red-spotted Toad). **LARVAL COLORATION**. On 24 June 1999, I observed a single albino *Bufo punctatus* tadpole in No Thoroughfare Canyon, Colorado National Monument, Colorado, USA. The albino tadpole was within the same size and developmental range as ca. 50 normally colored tadpoles in the same pool (mean ± SD: SVL = 10 ± 1 mm, TL = 24 ± 3 mm, developmental stage = 31 ± 1; N = 10; Gosner 1960. Herpetologica 16:183–190). Although *B. punctatus* tadpoles occupied several pools within the canyon, this was the only albino observed. In 1979, Luepschen (1981. Herpetol. Rev. 12:79) observed six albino *B. punctatus* tadpoles in the same canyon. To my knowledge, albino adult *B. punctatus* have not been reported from Colorado National Monument or elsewhere (Dyrkacz 1981. Herpetol Circ. No 11). However, observations separated by 20 years of albino tadpoles within the same canyon suggest that this population retains at least low frequencies of the appropriate genotypes to produce albinos.

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Submitted by **LAUREN J. LIVO**, Colorado Division of Wildlife, 317 West Prospect Road, Ft. Collins, Colorado 80526, USA and EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

BUFO PUNCTATUS* and *BUFO WOODHOUSII (Red-spotted Toad and Woodhouse's Toad). **HYBRIDIZATION**. Many anurans are known to hybridize in nature and toads, genus *Bufo*, have long been subjects of hybridization research (Blair 1972. Evolution in the Genus *Bufo*. University of Texas Press, Austin. 459 pp.). Hybridization between *B. punctatus* and *B. woodhousii* explains morphologically intermediate toads collected from Lava Canyon (River Mile 65.5) of the Grand Canyon (Arizona State University 28398) and Glen Canyon (Museum of Northern Arizona Z6.527–528) in Arizona (Malmos et al. 1995. Great Basin Naturalist 55:368–371). Furthermore, other distantly related toad species (e.g., *B. alvarius* x *B. woodhousii* and *B. cognatus* x *B. woodhousii*) are known to hybridize in Arizona (Gergus et al. 1999. Copeia 1999:281–286). Although discovery of hybrids in nature implies mismating between species, heterospecific amplexus is rarely observed (KBM, pers. obs.). Here we report backcross amplexus between a hybrid *B. punctatus* x *B. woodhousii* and *B. woodhousii* and heterospecific amplexus between *B. punctatus* and *B. woodhousii*.

On 12 May 1998 at 1037 h, a male *B. punctatus* x *B. woodhousii* (verified as hybrid by B. K. Sullivan from photo, Fig. 1) was observed in amplexus with a female *B. woodhousii* at Nankoweap Twin Springs, ca. 4 km above the Colorado River (RM 52). The pair was found in shallow water over cobble. The male was diagnosed as a hybrid by possession of morphological characteristics intermediate to the two species: dorsum with some red warts, lack of a mid-dorsal stripe and dorsal blotches, parotoid gland wedge-shaped, weak cranial crests, and slightly flattened head. Two additional *B. woodhousii* were observed among cattails at the spring, but no other *B. punctatus* were found nearby.

On 11 May 1999 at 2040 h, a male *B. punctatus* was observed in amplexus with a female *B. woodhousii* in Hermit Creek, within



FIG. 1. Male *Bufo punctatus* x *B. woodhousii* in amplexus with a female *B. woodhousii* at Nankoweap Twin Springs, ca. 4.0 km from the Colorado River, Grand Canyon, Arizona.

100 m of the Colorado River (RM 95). The pair was found in shallow water flowing over exposed gravel. Water and air temperature were 19°C and 25.5°C. Approximately 12 *B. punctatus* were calling at this site, and no other *B. woodhousii* were seen or heard at this aggregation. Lack of enlarged, darkened thumb pads and failure to give release calls when the pair was in hand, indicated the *B. woodhousii* was female in both cases. During handling, the males never released females and amplexus continued after release. It is not known whether eggs were deposited in either case. Females of the less abundant species mating with males of the more common species is a typical pattern in hybridization (Wirtz 1999. Animal Behavior 58:1–12).

Submitted by **BRUCE CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA, **KEITH B. MALMOS** and **ANDREW T. HOLYCROSS**, Arizona State University, Department of Biology, Tempe, Arizona 85287-1501, USA, and **ROY C. AVERILL-MURRAY**, Arizona Game and Fish Department, 2221 West Greenway Road, Phoenix, Arizona 85023, USA.

ELEUTHERODACTYLUS COQUI (Coqui). **PREDATION**. The scorpion, *Tityus obtusus* is a known predation of preadult and adult *Eleutherodactylus coqui* in the field and in captivity (Steward and Woolbright 1996. *In* Reagan and Waide [eds.], The Food Web of a Tropical Rain Forest. Univ. Chicago Press.) although no information on prey size has been published. Here we report a predation event on a juvenile *E. coqui* in the field. At 2000 h on 18 September 1998 at the University of Puerto Rico El Yunque Field Station (18°17'58"N, 65°46'43"W) we found a scorpion (*T. obtusus*, Museo de Biología, Universidad de Puerto Rico-Recinto de Río Piedras UPRRP 154) under a fern frond (137 cm above the ground) grasping a juvenile *E. coqui* (17 mm SVL, UPRRP 5751). The scorpion used its left pedipalp to support the frog by the pelvic region, while keeping a firm grasp with its chelicerae on the prey's left hind leg (Fig. 1). The frogs's left tibio-fibula was completely exposed at the time the predation event was observed.



FIG. 1. *Eleutherodactylus coqui* captured by a scorpion, *Tityus obtusus*.

Submitted by **LUIS J. VILLANUEVA-RIVERA**, **RAFAEL L. JOGLAR**, and **FONG CING LI-OBJIO**, Departamento de Biología, Universidad de Puerto Rico-Recinto de Río Piedras, Apartado 23360, San Juan, Puerto Rico 00931-3360.

HYLA SQUIRELLA (Squirrel Tree Frog). **REPRODUCTION**. The squirrel treefrog ranges throughout the southeastern coastal plain of the United States, including all of Florida. (Conant and Collins 1991. Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). It is considered a spring/summer breeder and is known to reproduce from March through October in the southern portion of its range (Carr 1940. Univ. Florida Publ. Biol. Sci. 3:1–118; Wright and Wright 1995. Handbook of Frogs and Toads of the United States and Canada. 3rd ed. Comstock Publ. Co., Ithaca, New York, 640 pp.; Conant and Collins, *op. cit.*). We report an observation of breeding that occurred earlier than the reported reproductive period.

On 23 January 1999 at ca. 2000 h, we encountered a small chorus of *Hyla squirella* at a recently-mowed roadside ditch in Volusia County, Florida between Deland and Daytona Beach. Earlier that evening the ditch had been filled by heavy rainfall associated with a weak cold front. *Hyla squirella* males were observed calling from the shore of the ditch, at the water's edge, and while floating. We collected an amplectant pair (female 37 mm SVL, male 31 mm SVL) that was floating on the surface. Eggs were visible through the inguinal body wall of the female. *Pseudacris nigrita* and *P. ocularis* were heard calling in the distance. To our knowledge, this is the first published account of *H. squirella* breeding during January. The frogs were deposited in the herpetology collection of the Florida Museum of Natural History, University of Florida (UF 119001–119002).

Submitted by **STEVE A. JOHNSON** and **RYAN C. MEANS**, Department of Wildlife Ecology and Conservation, and Florida Museum of Natural History, University of Florida, Gainesville Florida 32611, USA.

LEPTOPELIS VIRIDIS (West African Tree Frog). **COCOON FORMATION**. *Leptopelis viridis* (Hyperoliidae) is a fossorial amphibian that occurs throughout West Africa both in the dry and humid savanna (Schiøtz 1967. Spolia Zool. Mus. Haun. 25:1–346.). Little is known about the ability of this species to conserve water during the dry season although this important life-history aspect has been studied in other West African savanna denizens (Linsenmair 1997. *In* Newbery et al. [eds.], Dynamics of Tropical Communities, pp. 221–241. Blackwell Science, Oxford). Here I describe cocoon formation in a specimen of *L. viridis* collected in the Guinea savanna region of the Comoé National Park, Ivory Coast, that was subsequently observed in other individuals. In 1997, an adult female was brought into the laboratory where she was kept in a terrarium at a day-night temperature and humidity cycle of 20–26°C and 60–70% RH. In February 1998, the female was left unattended, i.e., without spraying water, and she subsequently burrowed into the substrate. Approximately two months later the loose soil that filled the bottom of the terrarium was carefully sifted. The female was found in a characteristic water-conserving posture like that found in other cocoon forming species (Withers 1995. Aust. J. Zool. 43:429–441) 10 cm underground encased in a tight, semi-transparent cocoon that covered the eyes but left the external nares open (Fig 1.). The female was carefully handled and was immediately responsive to touch. She was left largely undisturbed



FIG. 1. Adult female *Leptopelis viridis* encased in a semi-transparent cocoon.

for 40 min, during which time limb movements and breathing increased. She was then sprayed with water. Shortly afterwards, the female repeatedly stretched her mouth, progressively increasing her gape width. At one point, this caused the cocoon to rip open dorsally, starting at the mouth. The female emptied her bladder and, using her limbs, completely stripped the cocoon from her body. Within the family Hyperoliidae, cocoon formation, although mentioned for *L. viridis* by A. Schiøtz (Loveridge 1976. Zoologica Africana 11:319–333) has been described only in *L. bocagei* (Loveridge and Craye 1979. S. Afr. J. Sci. 75:18–20.). The observation that *L. viridis* forms cocoons adds to the repertoire of water conservation strategies in West African anurans.

Submitted by **T. ULMAR GRAFE**, Department of Animal Ecology and Tropical Biology, Biozentrum, University of Würzburg, Germany.

RANA AREOLATA CIRCULOSA (Northern Crayfish Frog). **VOCALIZATION**. On 2 April 1999 at ca. 2000 h at a small, virgin tall-grass prairie in Dade County, Missouri, USA, we heard several unusual ranid frog calls. The calls were similar to *Rana areolata* but sounded muffled. Upon further investigation, we discovered a full chorus (>10 males) of *R. areolata* vocalizing underwater. PWF had searched this area on 29 March 1999 and heard a chorus (<8 males) of *R. areolata* vocalizing on the surface at the same location. That chorus could be heard from over 0.5 km away, however the 2 April chorus could be faintly heard at a maximum distance of 200 m. Underwater vocalization of *R. areolata* has been reported (Barbour 1971. Amphibians and Reptiles of Kentucky. Univ. of Kentucky Press. Lexington. 334 pp.). This behavior could adversely affect calling surveys.

Submitted by **PAUL W. FRESE** and **AARON M. SULLIVAN**, Department of Biology, Southwest Missouri State University, 901 South National, Springfield, Missouri 65804, USA; e-mail pwf035s@mail.smsu.edu.

RANA CAPITO AESOPUS (Florida Gopher Frog). **ECTOPARASITES**. *Rana capito aesopus* utilizes the burrow of the gopher tortoise (*Gopherus polyphemus*). This habit puts the frog in contact with numerous invertebrate species. On 21 May 1999 at Rock Springs Run State Reserve, Florida, USA, I caught a large female gopher frog (119.5 g; 9.7 cm SVL) and removed six nymphs of *Ornithodoros turicata* (US National Tick Collection RML122857) from the ventral surface of the frog. Although all the parasites were firmly attached to the frog, and were fairly difficult to remove, the individual appeared healthy and unharmed. On 13 September 1999, not far from the previous capture, I caught an adult male gopher frog (47.0 g; 7.5 cm SVL) with one *O. turicata* attached to its right front limb. Although this tick was larger, it still appeared to have no effect on the frog. Both the frogs were released at point of capture.

Although *Ornithodoros turicata* has been reported on gopher frogs previously (Milstrey 1987. Bionomics and Ecology of *Ornithodoros* (*P.*) *turicata americanus* (MARX) (Ixodoidea: Argasidae) and other Commensal Invertebrates Present in the Burrows of the Gopher Tortoise, *Gopherus polyphemus* Daudin. Univ. of Florida Dissertation, 131 pp.), this information has not been published in a herpetological journal.

Great thanks go to J. E. Keirans of the U.S. National Tick Collection at Georgia Southern University for identification of the tick specimens. Also, thanks to Jack Stout of the University of Central Florida, Shane Belson, and Stuart Fullerton.

Submitted by **W. BOYD BLIHOVDE**, Department of Biology, University of Central Florida, 4000 Central Florida Blvd., Orlando, Florida 32816, USA.

RANA CAPITO SEVOSA (Dusky Gopher Frog). **METAMORPH CAPTURES**. The dusky gopher frog is found primarily along the Coastal Plain region of the Florida panhandle westward across Alabama and into Mississippi. It is thought to spend most of its adult life underground, frequently using the burrows of the gopher tortoise, *Gopherus polyphemus*, and is considered to be a species at risk in Alabama (Means 1986. *In* Mount [ed.], Vertebrate Animals of Alabama in Need of Special Attention. Alabama Agri. Expt. Station, Auburn University. 124 pp.). Only six ponds in Alabama have been documented as traditional breeding ponds, one of which (Shelby County) has likely been ruined by a housing development under construction. Two of these ponds, Nellie Pond and Salt Pond, are found in the Conecuh National Forest, Covington County (M. Bailey, pers. comm.). Practically nothing is known about the life history of the adult, and especially the metamorphs. We find no published records of *R. c. sevosa* metamorph captures from the wild in Alabama. Mark Bailey and Chris Oberholster captured one metamorph from the edge of Nellie Pond in June 1993 (M. Bailey, pers. comm.).

On 21 May 1999 at Nellie Pond, we saw three *R. c. sevosa* metamorphs. One (SVL 37.5 mm) was captured at the mouth of a gopher tortoise burrow at 1950 h, just a few minutes before dark. It did not attempt to move until capture was imminent. Temperature and relative humidity at 1900 h were 24.4°C and 68% at the USDA Forest Service Work Center at Open Pond, a few miles away. Two additional metamorphs were seen at 2020 h hopping on the sand road just outside the Nellie Pond access gate, located about 30 m from the edge of the pond. While one escaped into a thicket, the other was captured (SVL 36.8 mm). By 2000 h the temperature

had decreased to 22.8°C and relative humidity had risen to 75%. For about another hour we slowly searched for metamorphs on the pond perimeter.

On 11 June, MRB, KNB, and AFB searched along the Nellie Pond perimeter road from 2030–2100 and 2210–2345 h, and along the entire margin of Nellie Pond from 2105–2210 h during a gentle rain with thunder and lighting in the distance. At 2235 h we captured a metamorph (SVL 32.3) in the middle of the sandy road. This frog never moved even though it was almost stepped on, indicating that searchers should anticipate little or no mobility of these frogs as they are approached. Temperature at 2200 h was 21.1°C with relative humidity at 99%. At 2300 h temperature was still 21.1°C with relative humidity at 100%.

MRB searched along the perimeter road from 0230–0315 h, then three of us searched along this road and in the gopher tortoise burrow fields for several hours beginning at 0500 h. At 0550 hr we captured a metamorph with an obvious tail remnant (SVL 34.6, tail 3.7 mm) about 3 m from the entrance to a different gopher tortoise burrow, out in the open on sand. This metamorph also moved only when being captured. At 0600 h temperature was 21.1°C and relative humidity was 100%. SVL of these metamorphs fall within the range reported from western Florida (Palis 1998. J. Herpetol. 32:217–223), but are less than those observed in South Carolina (Semlitsch et al. 1995. J. Herpetol. 29:612–614.).

We thank Rick Lint, USDA Forest Service, for temperature and relative humidity data.

Submitted by **MALCOLM R. BRAID**, Station 6480, Department of Biology and Chemistry, University of Montevallo, Montevallo, Alabama 35115, USA (e-mail: braidm@montevallo.edu), **KEVIN N. BUTLER**, Alabama 4-H Center, 892 4-H Road, Columbiana, Alabama 35051, USA, and **ALBERT F. BLANKENSHIP, III** and **AMANDA SCHULTZ-CANTLEY**, Station 6480, Department of Biology and Chemistry, University of Montevallo, Montevallo, Alabama 35115, USA.

RANA MUSCOSA (Mountain Yellow-legged Frog). **PREDATION**. *Rana muscosa* is a moderate-sized, high elevation frog restricted to California and the Lake Tahoe region of western Nevada (Zweifel 1968. Cat. Amer. Amphib. Rept. 65:1–2; Jennings and Hayes 1994. Amphibian and Reptile Species of Special Concern in California. California Dept. Fish and Game. 255 pp.). Native predators of *R. muscosa* include *Thamnophis elegans*, *Euphagus cyanocephalus* (Brewer's blackbird), *Nucifraga columbiana* (Clark's nutcracker), and *Canis latrans* (coyote) (Bradford 1991. J. Herpetol. 25:174–177; Camp 1917. Univ. California Publ. Zool. 17:115–125; Jennings et al. 1992. J. Herpetol. 26:503–505; Moore 1929. J. Mamm. 10:255). Here we report two additional predators of *R. muscosa*.

On 9 August 1999 during herpetological surveys of the Tahoe National Forest, we caught a male *T. sirtalis fitchi* (SVL 416 mm, tail 142 mm, 31.56 g, California Academy of Science 209984) at an unnamed pond 8.8 km. NE of Cisco Grove via Rattlesnake Rd., Nevada Co., California (39° 20'10.5"N, 120°28'48.0"W) from which we palped a partially digested juvenile *R. muscosa* (SVL ca. 33 mm, 1.97 g, stomach contents of CAS 209984).

We also encountered a juvenile *R. muscosa*. (SVL 30 mm, 1.64 g, CAS 210033) among the *Juncus* sp. and *Carex* sp. 1 m from the pond shore at the surface of water 30 cm deep. The *R. muscosa* was weakly struggling with a larval *Dytiscus* sp. (predaceous diving beetle) (total length ca. 50 mm, 1.16 g, held with CAS 210033) that was attached to the frog's left thigh by penetrating mandibles. We collected both *R. muscosa* and *Dytiscus* sp. at which time the dytiscid larva released the frog. Upon observing the *R. muscosa*, the left leg remained extended, apparently unusable, and the left thigh was discolored by massive hemorrhaging around the bite area. The *R. muscosa* was placed in a moist plastic bag, and kept cool until later that day. Inspecting the *R. muscosa* two hours later, we found it had died, probably from the effects of the proteases injected by the dytiscid larva's mandibles (Young 1967. Pan-Pac. Entomol. 43:113–117). Though an increasing number of incidents of predation by invertebrates, especially insects and spiders on both adult and tadpole frogs have been reported (e.g., predation of *Ascaphus truei* by a helgrammite, Jones and Raphael. 1998. Herpetol. Rev. 29:39; predation of *R. cascadae* by a giant water bug, Nauman and Dettlaffe. 1999. Herpetol. Rev. 29:93) this is the first case for *R. muscosa*, a state listed species of special concern in California, and suggests that newly metamorphosed *R. muscosa* may be vulnerable to other predatory aquatic macroinvertebrates (Formanowicz and Brodie 1982. Copeia 1982:91–97).

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Submitted by **CHRIS R. FELDMAN**, Department of Biology, San Francisco State University, San Francisco, California 94132, USA and **JEFFREY A. WILKINSON**, Department of Herpetology, California Academy of Sciences, San Francisco, California 94118, USA.

TESTUDINES

CARETTA CARETTA (Loggerhead Sea Turtle). **EPIZOANS**. Although epizoic organisms occur on all seven species of marine turtles, *Caretta caretta* hosts the largest and most diverse communities (Frick et al. 1998. Herpetol. Rev. 29:211–214). Much of the data concerning *Caretta* and its epibiota in the southeastern U.S. come from nesting females (Caine. 1986. J. Exp. Mar. Biol. Ecol. 95:15–26 and Frick et al. 1998. *op. cit.*). To our knowledge, only one study reports the occurrence of epizoa on subadult *Caretta* (Frazier et al. 1985. Mar. Ecol. 6:127–140). However, the two turtles sampled by Frazier et al. (1985. *op. cit.*) were dead strandings and it is therefore possible that epizoan attachment occurred post-mortem. Herein, we report four newly documented species of epizoans associated with living subadult *Caretta* in Georgia, USA.

From 12 to 16 February 1999, 33 subadult *Caretta* were collected from the St. Mary's River Entrance Channel (30°42.7'N, 81°20.1'W). Prior to channel dredging operations, a specially modified shrimp trawler was used to collect any sea turtles located within a specified hopper dredge digging area. While on board the trawler, turtles were measured, tagged, and sampled for epibiota. Turtles were then relocated to estuarine waters, away from the digging area, immediately west of Cumberland Island National Seashore (Cabin Bluff, 30°53.0'N, 81°30.8'W).

All captured turtles were *Caretta* of subadult age class (51.8–77.0 cm CCL) as defined by Dodd (1988. U.S. Fish Wildl. Serv.

Biol. Rep. 88:1–110). Every turtle sampled contained the following epizoan species: turtle barnacles (*Chelonibia testudinaria*), hermit crab anemones (*Aiptasia pallida*), pink-striped acorn barnacles (*Balanus amphitrite*), and wildflower hydroids (*Tubularia crocea*). Moreover, all turtles sampled had a similar colonization pattern. Barnacles abounded over the entire carapace, especially along the sutures where scutes met. Hydroids preferred any area on the carapace free of barnacle colonization. Anemones (1 or 2 attached to each turtle sampled) were located on the fourth and fifth costal scutes on either side of the turtle.

These observations are of interest because the relationship between sea turtles and their epibiota is a poorly studied aspect of sea turtle natural history. Noting the occurrence and prevalence of epibiont species may help us to better understand the natural history of these turtles away from their nesting beaches.

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Submitted by **MICHAEL G. FRICK**, Caretta Research Project, P.O. Box 9841, Savannah, Georgia 31412-9841, USA (e-mail: Caretta05@aol.com), and **CHRISTOPHER K. SLAY**, Coastwise Consulting, 173 Virginia Avenue, Athens, Georgia 30601, USA.

CHELONIA MYDAS AGASSIZII (East-Pacific Green Turtle). **DIET**. Immature and adult *Chelonia mydas agassizii* are known to have a more carnivorous diet than *Chelonia* of other regions (Bjorndal 1997. *In* Lutz and Musick [eds.], The Biology of the Sea Turtles, pp. 165–198. CRC Press, Boca Raton, Florida). Felger and Moser (1973. Science 181:355–356) and Hays-Brown and Brown (1995. *In* Bjorndal [ed.], Biology and Conservation of the Sea Turtles, pp. 235–240. Smithsonian Institution Press, Washington D.C.) reported these turtles feeding on a wide variety of invertebrates, and Casas-Andreu and Gomez-Aguirre (1980. Bolm. Inst. Oceanogr. Sao Paulo 29:87) and Fritts (1981. Mar. Turtle Newsl. 17:4–5) noted feeding on fish and fish eggs. Here we report on the consumption by *C. m. agassizii* of the solitary cnidarian, *Ptilosarcus undulatus* (fleshy sea pen), Order Pennatulacea.

Between June 1996 and September 1998, 109 *C. m. agassizii* were captured at the Bahia de los Angeles foraging grounds of the Gulf of California, Mexico (28°58'N, 113°33'W). *Ptilosarcus undulatus* was recovered from 5.8% (6 of 103) of gastric lavage samples and 29.3% (17 of 58) of fecal samples. Body mass and straight-carapace length (SCL) of turtles that consumed *P. undulatus* ranged from 42–104 kg and 64.7–89.2 cm, respectively. This SCL range includes both subadults and adults (Green 1993. J. Herpetol. 27:338–341).

Plotkin et al. (1993. Mar. Bio. 115:1–15) recorded sea pen (*Virgularia presbytes*) consumption by *Caretta caretta*, and Shaver (1991. J. Herpetol. 25:327–334) found the same species in the diet of *Lepidochelys kempii*. However, to our knowledge this is the first report of *Chelonia* foraging on Pennatulaceans, and appears to be the first account of sea pen consumption by sea turtles in the Pacific Ocean basin.

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Submitted by **JEFFREY A. SEMINOFF** and **WALLACE J. NICHOLS**, Wildlife and Fisheries Science, University of Arizona, Tucson, Arizona 85721, USA; e-mail (JAS): seminoff@u.arizona.edu; **ANTONIO RESENDIZ S. HIDALGO**, Centro Regional de Investigacion Pesquera, Ensenada, Baja California, Mexico.

CHRYSEMYS PICTA PICTA (Eastern Painted Turtle). **MAXIMUM SIZE**. The maximum size for *Chrysemys picta picta* is given as 18.1 cm carapace length (CL) by Conant and Collins (1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin, Boston, Massachusetts. 450 pp.). However, Rhodin and Mittlehauser (1994. Chel. Conserv. Biol. 1:148–150) reported capturing three specimens in Maine that exceeded this size, one of which was 18.7 mm CL. There are three female specimens from New Brunswick, Canada, in the New Brunswick Museum (NBM) collection that exceed 18.1 cm CL, including one that is larger than any of the Maine specimens (Table 1). Carapace measurements were taken in a straight line and did not include indentations in the nuchal and between the two rearmost marginals. The specimens were identified as *C. p. picta* on the basis of collection locality, lack of a plastral pattern (for NBM-01087 and 0637), low disalignment of carapacial scutes (using the method of Hartman 1958. Copeia 1958:261–265; values for

TABLE 1. Carapacial and collection data for three large female *Chrysemys picta picta* from New Brunswick, Canada. Carapace length given as mean ± S.E.

Catalog Number	Carapace length (cm)	% Disalignment of carapacial scutes	Light margin width (cm)	Collection Data
NBM-01087	18.58[a] ± 0.01	29.33	0.53	June 1985 Grand Lake, Queens County, D. F. McAlpine
NBM-0832	18.98[b] ± 0.01	33.99	0.54	25 June 1973 Gagetown, Queens County, J. Sinclair
NBM-0636	18.44[b] ± 0.00	48.88	0.60	Sept 1965 Hampton Kings County

[a] mean of 5 measurements taken with vernier calipers accurate to 0.01 cm.
[b] mean of 10 measurements taken using an electronic digital readout (Anilam Electronics Corp., Miami, Florida) on an adjustable drill press bench accurate to 0.001 cm.

C. p. marginata are typically >80%, Ultsch and LeBerte, unpubl. data), and the wide light anterior margins of the carapacial scutes (mean of the two 2nd laterals, Hartman *op. cit.*). The three specimens from Maine were the largest of a sample of 122 mature females, while the three from New Brunswick were from a sample of only 14. Our data supports Rhodin and Mittelhauser's (*op. cit.*) contention that size of eastern painted turtles increases with increasing latitude.

Submitted by **GORDON R. ULTSCH, CHERÉ M. LEBERTE**, Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama 35487, USA (e-mail: gultsch@biology.as.ua.edu), and **DONALD F. McALPINE**, New Brunswick Museum, St. John, New Brunswick, Canada E2K 1E5 (e-mail: dmcalpin@nbnet.nb.ca).

LACERTILIA

CROTAPHYTUS COLLARIS (Eastern Collared Lizard) and ***DIADOPHIS PUNCTATUS*** (Ringneck Snake). **PREDATOR-PREY**. On 13 April 1998 while marking collared lizards for behavioral studies at Arcadia Lake Dam, Edmond Oklahoma, USA, I observed a dead *Diadophis punctatus* (324 mm TL, 6.8 g) in the gullet of a female *Crotaphytus collaris* (99 mm SVL, 43.5 g w/ snake removed). The snake was 15.6% of the lizard's body mass, and over twice the length of the lizard. Eighty percent of the snake's length had been swallowed past the pharynx tail first, whereas the anterior 20% of the snake was folded back posteriorly in the lizard's esophagus. This position suggests that the ringneck was grabbed by the tail, which may be noteworthy because *Diadophis* uses its tail in defensive displays (Greene 1997. Snakes: The Evolution of Mystery in Nature. Univ. California Press, Berkeley, California. 351 pp). As far as I know, this is the only reported instance of collared lizard predation on *D. punctatus*. Collared lizards have been reported to take *Sonora semiannulata* (Best and Pfaffenberger 1987. Southwest. Nat. 32:414–426) and *Opheodrys aestivus* (Husak and Ackland 2000. Herpetol. Rev. 31:in press).

Submitted by **TROY A. BAIRD**, Department of Biology, University of Central Oklahoma, Edmond, Oklahoma 73034, USA (e-mail:tbaird@ucok.edu).

SERPENTES

CROTALUS MITCHELLII (Speckled Rattlesnake) and ***CROTALUS WILLARDI*** (Ridgenose Rattlesnake). **ENDOPARASITES**. The only report of endoparasites in *Crotalus mitchellii* involves the nematode *Thubunaea cnemidophorus* (Babero and Emmerson 1974. J. Parasitol. 60:595), and to our knowledge there have been no reports of endoparasites for *Crotalus willardi*. The purpose of this note is to report the presence of larval tapeworms (cestodes) and larval spiny-headed worms (acanthocephalans) in *C. mitchellii* and *C. willardi*. The body cavities of a total of 117 *C. mitchellii* from Arizona and California and 28 *C. willardi* from Arizona and New Mexico (USA), and Sonora and Chihuahua (México), from the herpetology collections of Arizona State University, Tempe (ASU), the Natural History Museum of Los Angeles County (LACM), the University of Arizona (UAZ), and the Museum of Southwestern Biology, University of New Mexico (MSB) were examined for helminths (*C. mitchellii*: ASU, LACM, UAZ; *C. willardi*: ASU, UAZ, MSB). A mid-ventral incision was made in the body wall, and organ surfaces and mesenteries in the posterior portion of the body cavity were visually checked for helminths. Oblong whitish bodies, ca. 1 x 3 mm, were occasionally seen. These proved, upon microscopic examination, to be larval cestodes (tetrathyridia of *Mesocestoides* sp.) in *C. mitchellii* (LACM 104938) and *C. willardi* (UAZ 27943; MSB 25354, 61239) and oligacanthorhynchid acanthocephalan cystacanths in *C. mitchellii* (ASU 1606) and *C. willardi* (MSB 61241). Prevalence of infection (infected snakes/sample examined x 100) for *Mesocestoides* sp. was 1% in *C. mitchellii* and 11% in *C. willardi*, and for oligacanthorhynchid cystacanths was 1% in *C. mitchellii* and 4% in *C. willardi*. Parasite specimens were deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland: tetrathyridia of *Mesocestoides* sp., *C. mitchellii* USNPC 88616, *C. willardi* USNPC 88535; oligacanthorhynchid cystacanths, *C. mitchellii* USNPC 88617, *C. willardi* USNPC 88536.

Tetrathyridia of *Mesocestoides* sp. have been found in *C. atrox* and *C. viridis* (Bolette 1997a. J. Parasitol. 83:751–752; Mankau and Widmer 1977. Jap. J. Parasitol. 26:256–259). Bolette (1998. J. Helm. Soc. Washington 65:105–107) also found them in *C. viridis*. Tetrathyridia of *Mesocestoides* sp. also occur in *C. molossus* and *C. pricei* (Goldberg and Bursey 1999. Herpetol. Rev. 30:44–45). Oligacanthorhynchid cystacanths have been found in other North American crotalids: *Crotalus atrox*, *C. scutulatus*, *C. viridis* (Bolette 1997a. *op. cit.*; Bolette 1997b. Southwest. Nat. 42:232–236; Bolette 1998, *op. cit.*), *C. lepidus* and *C. tigris* (Goldberg and Bursey 1999, *op. cit.*). Rattlesnakes serve as paratenic (transport) hosts for *Mesocestoides* sp. (Bolette 1997a, *op. cit.*) and oligacanthorhynchid cystacanths (Bolette 1997b, *op. cit.*). The presence of *Mesocestoides* sp. and oligacanthorhynchid cystacanths in *C. mitchellii* and *C. willardi* are new host records and represent the first records of helminths in *C. willardi*. Including findings presented herein, *Mesocestoides* sp. are known from 4/13 (31%) and oligacanthorhynchid cystacanths from 7/13 (54%) of United States *Crotalus*.

We thank Michael E. Douglas (Arizona State University) and Charles H. Lowe (The University of Arizona) for permission to examine *C. mitchellii* and *C. willardi*, Robert L. Bezy (Natural History Museum of Los Angeles County) for permission to examine *C. mitchellii* and Charles W. Painter (New Mexico Department of Game and Fish, Santa Fe) for permission to examine *C. willardi*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu), and **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA.

CROTALUS SCUTULATUS (Mojave Rattlesnake). **THERMAL STRESS**. At 1027 h on 22 July 1999, while driving on a dirt road in desert grassland habitat 44 km SE of Willcox, Arizona, USA, I observed a *Crotalus scutulatus* (ca. 1 m total length) outstretched and slowly moving with head down across the road. As my jeep approached and stopped, the snake quickly coiled and I observed a freshly killed adult ground squirrel (*Spermophilus spilosoma*)

about 50 cm in front of the snake. The snake then uncoiled and quickly crawled off the road in a direction opposite its approach to the squirrel, disappearing into roadside vegetation about 7 m from the squirrel. I responded by backing away to about 35 m from the encounter site and observed through binoculars while remaining in my jeep. At 1039 h the snake reappeared from the vegetation and crawled back and forth in the fencerow parallel to the road until abruptly turning 90° and moving directly to the dead squirrel in the road. Tongue flicking and trailing behavior was evident throughout what was obviously crotalid strike-induced chemosensory searching behavior (Chiszar et al. 1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 369–382. Selva, Tyler, Texas). At 1045 h the snake began swallowing the squirrel headfirst, advancing to the shoulder region when suddenly, at 1047 h, the snake ceased swallowing and appeared frantic as it made short, jerky, undirected movements which lifted portions of its body off the substrate. The snake then lifted the squirrel and rapidly moved headfirst until it was 4.5 m off the road in the shade of the fencerow vegetation. At that time it resumed swallowing and completed ingestion by 1054 h.

Daytime feeding in exposed habitat may result in overheating and thermal stress for reptilian predators (Swingland and Frazier 1979. *In* Amlaner and MacDonald [eds.], A Handbook on Biotelemetry and Radio Tracking, pp. 611–615. Pergamon Press, New York, New York), and this unusual rattlesnake behavior suggests that such may have been the case here. Given a choice, reptiles normally cease activity long before their body temperatures approach critical levels (Huey 1982. *In* C. Gans [ed.], Biology of the Reptilia, Vol. 12, Physiology C, pp. 25–91. Academic Press, New York, New York). However, initial trailing, subsequent re-trailing after disturbance, and swallowing, all while exposed on the bare dirt substrate of the road in late morning, may have resulted in the snake's body temperature approaching a critical level. The snake's actual body temperature was unknown but the operative temperature of a nearby *Terrapene ornata* thermal model located in exposed bare dirt microhabitat (similar to the road) was 40°C at 1047 h, far above the normal field body temperature (approximately 30°C) and approaching the CTMax (39–42°C) of several *Crotalus* spp. (Lillywhite 1987. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 422–477. MacMillan Publ. Co., New York, New York). It was unlikely that the snake's sudden cessation of swallowing and frantic retreat to shade was in response to my presence because, after I had moved my jeep 35 m away, the snake did not appear to be aware of me.

I thank J. D. Congdon for comments on the manuscript.

Submitted by **MICHAEL V. PLUMMER**, Department of Biology, Box 12251, Harding University, Searcy, Arkansas 72149, USA.

DRYMARCHON CORAIS COUPERI (Eastern Indigo Snake) and ***MICRURUS FULVIUS FULVIUS*** (Eastern Coral Snake). **PREDATOR-PREY**. *Drymarchon corais couperi* is a large, nonvenomous colubrid that is threatened throughout its range. It preys on a wide variety of vertebrates, including venomous snakes (Moler 1992. Rare and Endangered Biota of Florida. Vol. 3. Amphibians and Reptiles. University Press of Florida, Gainesville, Florida. 291 pp.). Descriptions of *D. corais* preying on venomous snakes specify viperids as prey (Moler, *op. cit.*; Wright and Wright 1957. Handbook of Snakes of the United States and Canada. Vol. 1. Comstock Publishing Associates, Ithaca, New York. 564 pp.). Here, I report predation by *D. corais* of an elapid.

On 7 October 1998 at 0959 h, I discovered a *D. corais* (ca. 125 cm total length) eating an adult *Micrurus fulvius fulvius* (ca. 75 cm total length), a semifossorial, aposematic elapid. This observation was made in a prairie hammock that is bisected by Long Bluff Road (T23S R34E NE 1/4 Sec 22) at Tosohatchee State Reserve, Orange Co., Florida, USA. When discovered, both snakes were in the road (unpaved and lightly traveled) and the *D. corais* had already captured the coral snake. The *D. corais* had ingested the head and several centimeters of the body of the *M. fulvius*, and the latter writhed alongside the body of its attacker. Six minutes of observation followed from a distance of ca. 5 m. At 1002 h, the *D. corais* elevated its head from the ground and, with its prey approximately half ingested, moved off the road. At 1005 h, consumption of the coral snake concluded and the indigo snake retreated into the hollow stump of a tree.

Submitted by **M. SHANE BELSON**, Florida Department of Environmental Protection, Tosohatchee State Reserve, 3365 Taylor Creek Road, Christmas, Florida 32709, USA (e-mail: matthec@ix.netcom.com).

MICRURUS CIRCINALIS (Trinidad Northern Coral Snake). **ARBOREALITY**. On 17 March 1999 in Arima Valley, Trinidad (10°41.57'N, 61°17.28'W), just after midnight, I observed an adult (total length ca. 40 cm) *Micrurus circinalis* 2.75 m above the ground climbing upwards on a vertical tree trunk (76 cm diam) covered with vines and aerial roots. The snake clung to the roots and bark with some determination and required several tries with a snake hook to remove it from the trunk. This is the first report of arboreal behavior in *M. circinalis*. Arboreality in *Micrurus* has previously been reported for only two species: *M. nigrocinctus* (Schmidt and Smith 1943. Publ. Field Mus. Nat. Hist., Zool. Ser. 12:129–134.) and *M. fulvius* (Carr 1994. A Naturalist in Florida: A Celebration of Eden. Yale University Press, New Haven, Connecticut. 264 pp.).

I thank Joel Friesch for his assistance in the field.

Submitted by **RICHARD A. SAJDAK**, 4 Callingham Road, Pittsford, New York 14534, USA (e-mail: rsajdak@frontiernet.net).

MICRUROIDES EURYXANTHUS (Western Coral Snake). **ENDOPARASITES**. There are, to our knowledge, no reports of endoparasites for *Micruroides euryxanthus*. The purpose of this note is to report the presence of larval spiny-headed worms (Acanthocephala) in the body cavity of *M. euryxanthus*.

Eighty-seven *M. euryxanthus*, 80 from Arizona and seven from Sonora, México, from the herpetology collections of the University of Arizona, Tucson (UAZ) and the Natural History Museum of Los Angeles County (LACM), respectively, were examined for helminths. A mid-ventral incision was made in the body wall; organ surfaces and mesenteries in the posterior portion of the body cavity were examined visually for helminths. Oblong whitish bodies, approximately 1 mm x 3 mm, were occasionally seen and these

proved, upon microscopic examination, to be oligacanthorhynchid cystacanths. Infected snakes were: UAZ 14431, 14440, 14442, 35829, 39680, 40859, 43602, 46444. Prevalence of infection (infected snakes/sample examined x 100) was 10% for the Arizona sample; none was found in the Sonora sample. Specimens were deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland, as USNPC 88779.

Oligacanthorhynchid cystacanths are known to occur in a variety of United States *Crotalus* (Bolette 1997a. J. Parasitol. 83:751–752; Bolette 1997b. Southwest. Nat. 42:232–236; Goldberg and Bursey 1999. Herpetol. Rev. 30:44–45) as well as colubrid snakes and teiid lizards (see Bolette 1997b. *op. cit.*). *Micruroides euryxanthus* appears to be a paratenic (transport) host for oligacanthorhynchid cystacanths. To date, there have been no reports of oligacanthorhynchid cystacanths from the two other species of coral snakes found in the United States, *Micrurus fulvius* and *Micrurus tener*. The presence of oligacanthorhynchid cystacanths in *M. euryxanthus* is a new host record.

We thank Robert L. Bezy (Natural History Museum of Los Angeles County) and Charles H. Lowe (University of Arizona) for permission to examine specimens.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu), and **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA.

THAMNOPHIS VALIDUS CELANO (Baja California Garter Snake). **DIET**. *Thamnophis validus celano* (sensu deQueiroz and Lawson 1994. Biol. J. Linn. Soc. 53:209–229) is endemic to the Cape Region of Baja California Sur, Mexico. This species is a known predator of *Bufo punctatus* (Blazquez 1996. Herpetol. Rev. 27:83–84; Conant 1969. Bull. Amer. Mus. Nat. Hist. 142:1–140) and the small fish *Mugil brasiliensis* (Van Denburgh 1895. Proc. California Acad. Sci. 5:77–162.). On 27 August 1996 at El Chorro, 2 km west of Aguas Calientes, I observed a *T. v. celano* (423 mm SVL) on a floating mass of vegetation eating a *Scaphiopus couchii* (54 mm SVL) vent first. This is the first record of *T. v. celano* preying on *S. couchii*.

Submitted by **JESSE L. GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

ILLINOIS SNAKES. YOUNG-OF-YEAR MORPHOLOGY AND FOOD HABITS. Little is known of the natural history of neonatal snakes from the time of hatching or birth until they begin hibernation (i.e., young-of-year = YOY) in temperate regions such as Illinois (Smith 1961. Bull. Illinois Nat. Hist. Surv. 28:1–298). Studies of food habits for snakes in Illinois involve older snakes (e.g., Klimstra 1959a. Herpetologica 15:1–5; Klimstra 1959b. Copeia 1959:210–214). Here, I report on food habits of YOY eastern garter snakes (*Thamnophis sirtalis sirtalis*), eastern hognose snakes (*Heterodon platirhinos*), blue racers (*Coluber constrictor foxii*), and prairie king snakes (*Lampropeltis calligaster*), all collected in Madison Co., Illinois, USA, during 1997 and 1998. These are the first details on YOY snakes of these species for Illinois.

All snakes were caught in pitfall traps (5-gal buckets) placed along drift fences (25 cm tall aluminum flashing). At each site visit, air temperature and soil temperature was measured to nearest degree. Pitfall traps were checked daily from 18 February 1997 to 31 October 1998. Fences were removed at the end of October 1998. All snakes greater than 400 mm SVL or not clearly identifiable as YOY (see Smith 1961, *op. cit.*) were excluded.

I measured SVL, tail length (to 1 mm), and mass (Ohaus model LS 200 portable scale to 0.1 g) for each snake. Snakes were forced to regurgitate food items, which were also weighed. Snake body mass was determined after regurgitation for snakes that regurgitated food items. All snakes were then uniquely marked by scale clipping and released. Snake handling was completed in the field at the time of capture. All vertebrate food items were preserved and deposited in the collections of the Illinois Natural History Survey (INHS 741, 742, 14508, 14474–14477).

Statistical tests were performed with SAS (SAS Institute 1996. SAS/STAT User's Guide, Statistical Analysis Systems Institute, Inc., Cary, North Carolina). I used analysis of covariance (ANCOVA) to compare least squares means (LSM) for body mass among species with SVL as the covariate. Slopes differed significantly among species ($F_{3, 23} = 15.76$, $P < 0.0001$) so I used a model for heterogeneous slopes. In the text, LSM are given ± one standard error.

Overall, 31 individual YOY snakes were captured (Table 1): 15 in 1997 and 16 in 1998. Thus, YOY snakes were equally common in both years. Most of the snakes caught were *Coluber constrictor* (N = 21).

One species differed significantly from the other three in relative weight per SVL ($P < 0.0005$). YOY *Heterodon platirhinos* (LSM = 29.4 ± 1.14 g) were relatively heavier (all pairwise comparisons $P < 0.0001$) than *Coluber constrictor* (10.2 ± 0.37 g), *Lampropeltis calligaster* (11.6 ± 1.03 g), and *Thamnophis sirtalis* (6.4 ± 2.77 g). The other three species did not differ in body mass LSM ($P > 0.09$).

Food items were found for three of the four species. One *Heterodon platirhinos* (217 mm SVL, 10.6 g) regurgitated a fresh 34 mm SVL, 5.2 g Fowler's toad (*Bufo woodhousii fowleri*). One *Lampropeltis calligaster* (340 mm SVL, 17.4 g) regurgitated two least shrews (*Cryptotis parva*), one of which weighed 5.5 g and the other 4.6 g. Food items were not found for *Thamnophis sirtalis*.

Three *Coluber constrictor* regurgitated food items. One of the snakes was 328 mm SVL and weighed 14.1 g. It regurgitated a field cricket (*Gryllus* sp.) that weighed 0.4 g. The other two *C. constrictor* reguritated YOY six-lined racerunners (*Cnemidophorus sexlineatus*). One of the *C. constrictor* (325 mm SVL, 14.8 g) contained a single *C. sexlineatus* (50 mm SVL, 2.8 g). The other *C. constrictor* (305 mm SVL, 10.3 g) had consumed three *C. sexlineatus* (40, 42, and 41 mm SVL; 1.6, 2.1, and 2.0 g, respectively).

Excepting the *Coluber constrictor* that contained the cricket, all snakes with food items contained relatively large meals. As a percentage of body mass, food item mass ranged from 20% (for one *C. constrictor*) to 58% (the *Lampropeltis calligaster*) of body mass of the snake post-regurgitation.

Environmental conditions that each species were found in were all broadly similar (Table 1). Generally rainfall was absent (0 ml in 1997, and 7.5 ml in 1998). *Coluber constrictor* tended to be

TABLE 1. Body size and mass (mean ± SD [range]) for young-of-the-year specimens of four species of snakes from west-central Illinois. First and last dates of collection are reported as month-day.

	Coluber constrictor	*Heterodon platirhinos*	*Lampropeltis calligaster*	*Thamnophis sirtalis*
Mass (g)	11.3 ± 4.2 (3.0–17.0)	23.5 ± 11.2 (10.6–30.9)	16.1 ± 7.5 (8.2–25.9)	3.1 ± 1.5 (1.8–4.7)
SVL (mm)	311 ± 47.4 (192–374)	272 ± 47.6 (146–242)	329 ± 49.1 (262–380)	188 ± 49.0 (146–242)
Tail (mm)	91 ± 14.9 (61–112)	46 ± 4.7 (41–50)	45 ± 8.7 (38–57)	57 ± 12.5 (48–71)
Air (°C)	28 ± 5.7 (8–34)	21 ± 5.4 (12–32)	22 ± 3.1 (19–26)	21 ± 5.4 (15–24)
Soil (°C)	21 ± 6.3 (3–30.8)	23 ± 8.9 (14–31)	18 ± 3.1 (14–21)	19 ± 7.0 (11–23)
First date	4 August	23 August	23 August	25 July
Last date	9 November	21 October	12 October	23 October
N	21	3	4	3
N with food	3	1	1	0

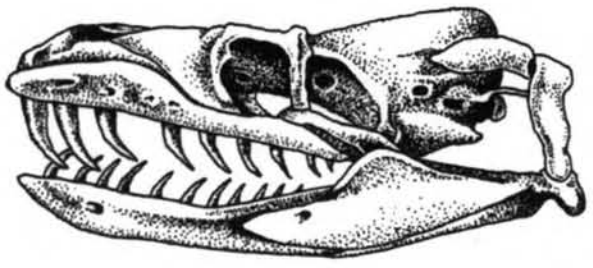
caught on warmer days (Table 1, mean air temperature). However, the small sample sizes of the other species made meaningful statistical comparisons impossible. Moreover, even though average air temperature was highest for *C. constrictor*, one individual was caught on 9 November which was the last date any YOY snake was caught during the study.

The data could be affected by trapping methodology. The pitfall traps also caught potential prey items along with snakes. Thus, snakes could have preyed on items that were caught in the pits with them. Nonetheless, these snakes did eat the items observed indicating that the food items are potential acceptable prey for these YOY snakes. Moreover, on eight other occasions YOY *Coluber constrictor* were found in pits containing living, uneaten YOY *Cnemidophorus sexlineatus*. Two of the four *C. sexlineatus* found as food items had been previously marked and released at pits more than 200 m from the pit in which the snake was eventually captured. This suggests that the snake may have consumed the lizards elsewhere before capture.

The food items that I found among these YOY snakes are prey that have been widely reported in the diets of older snakes of the same species in Illinois (Klimstra 1959a, *op. cit.*; Smith, *op. cit.*) and elsewhere (e.g., Fitch 1958. Univ. Kansas Mus. Nat. Hist. Publ. 11:11–62; Mitchell 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, D.C. 352 pp.; Palmer and Braswell 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, North Carolina. 412 pp.). What is interesting is the relatively large mass of the meals that these YOY snakes are able to consume. If early growth is important in determining survivorship (e.g., Ford and Seigel 1994. Funct. Ecol. 8:91–96), then such large meals may be important to YOY snakes. I note that smaller items may be missed where snakes are not dissected (Klimstra 1959a, b, *op. cit.*). However, I tried to induce regurgitation for snakes whose bodies were not obviously distended to induce regurgitation of small food items such as the cricket noted above.

I thank M. M. Tucker for assistance in the field. The shrews were identified by J. E. Hofmann (Illinois Natural History Survey). Collecting was done under Illinois Department of Natural Resources permit number A-93.0202 and extensions. This research was supported in part by a grant from the Illinois Department of Transportation and by the Illinois Natural History Survey and the Upper Mississippi River System Long Term Resource Monitoring Program.

Submitted by **JOHN K. TUCKER**, Great Rivers Field Station, Illinois Natural History Survey, 8450 Montclaire Avenue, Brighton, Illinois 62012, USA (e-mail: John_K_Tucker@usgs.gov).



Boa constrictor. Illustration by P. A. Benson.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 31, Number 1 (March, 2000).

GYMNOPHIONA

AULURA ANOMALA. BRAZIL: CEARÁ: Chapada da Ibiapaba, Municipality of Ubajara, Fazenda Buriti (03°50'S, 40°56'W, 820 m elev.). 29 November 1997. D. M. Borges-Nojosa. Universidade Federal do Ceará (UFC L2019); Municipality of São Benedito, Inhuçu (04°07'S, 40°50'W, 820m elev.). 9 October 1997. D. M. Borges-Nojosa. (UFC L2002). Verified by P. E. Vanzolini. First state record; from rainforest enclaves in the semiarid Caatingas of northeastern Brazil; extends eastern range ca. 510 km airline. Previously known from northern Brazil in states of Pará and Maranhão (Gans 1971, Am. Mus. Nov. 2475:1–32; Peters and Donoso-Barros 1970, Bull. U.S. Nat. Mus. 297:77).

Submitted by **DIVA MARIA BORGES-NOJOSA**, Laboratório de Herpetologia, Departamento de Biologia, Universidade Federal do Ceará, Caixa Postal 52.856, 60.151-970, Fortaleza, Ceará, Brazil (e-mail: dmborges@ufc.br), and **ULISSES CARAMASCHI**, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20.940-040, Rio de Janeiro, Rio de Janeiro, Brazil (e-mail: ulisses@acd.ufrj.br).

CAUDATA

AMPHIUMA MEANS (Two-toed Amphiuma). USA: FLORIDA: Hendry Co: Caloosahatchee River at LaBelle. 16 January 1995. L. Nico, W. Smith-Vaniz, and R. H. Robins. Verified by M. A. Nickerson. UF 119837. New county record.

Submitted by **ROBERT H. ROBINS** (e-mail: rhrobins@flmnh.ufl.edu), **KENNETH L. KRYSKO** (e-mail: kenneyk@flmnh.ufl.edu), and **SOPHIA L. FELICIANO** (e-mail: sophiaf@ufl.edu), Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: MINNESOTA: Aitkin Co: Savanna Portage State Park (46°50'N, 93°10'W). 11 May 1999. Gary S. Casper. JFBM 14159. Carlton Co: Nemadji State Forest, (46°25'N, 92°20'W). 4 May 1999. Gary S. Casper. JFBM 14161. Mille Lacs Co: Mille Lacs Kathio State Park (46°07'N, 93°42'W). 11 May 1999. Jeff LeClere. JFBM 14194. Pine Co: St. Croix State Forest (46°05'N, 92°28'W). 5 May 1999. Gary S. Casper. JFBM 14160. Specimens consist of females collected at nest sites, typically attending 20–30 eggs. Nests were often located in sphagnum hummocks at bases of alder (*Alnus* sp.) shrubs in shallow wetlands. Surrounding forests consisted of mixed hardwoods (*Acer* sp., *Betula* sp., *Populus* sp., and *Quercus* sp.). All specimens were verified by Tony Gamble and deposited at the James Ford Bell Museum of Natural History, University of Minnesota (JFBM). These specimens represent new county records and are the first records since the initial documentation of *Hemidactylium* in Minnesota (Dorff 1995, Herpetol. Rev. 26:150). The Minnesota records now represent the most northwestern distribution limits for this species, and are apparently not significantly disjunct from Wisconsin populations (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus., Milwaukee, Wisconsin. 87 pp.).

Submitted by **CAROL D. HALL**, Minnesota County Biological Survey, MinnesotaDepartment of Natural Resources, 500 Lafayette Road, St. Paul, Minnesota 55155, USA (e-mail: carol.hall@dnr.state.mn.us), **GARY S. CASPER**, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconson 53233, USA, and **JEFF LECLERE**, 878 Galtier Street, St. Paul, Minnesota 55117, USA.

NOTOPHTHALMUS VIRIDESCENS (Eastern Newt). USA: TENNESSEE: Jackson Co: Dodson Branch, NE of Hidden Springs Nursery on Spring Creek Road at the base of Hardscrabble Falls (36°19'20"N, 85°30'42"W). 9 October 1999. Laura Leininger. Austin Peay State University Museum of Zoology (APSU 5282 [color slide]). Verified by A. Floyd Scott. Two efts captured along the bank of Dodson Branch Stream just below the falls; photographed and released. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Misc. Publ. 12:1–94).

Submitted by **LAURA LEININGER** and **PRIYA NANJAPPA**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

TARICHA TOROSA (California Newt). USA: CALIFORNIA: San Joaquin Co: juvenile collected during an evening rain on Corral Hollow Road, 1.6 km E Alameda–San Joaquin county line. 13 February 2000. Ed Ely. CAS 211556; adult collected two days after last rain 4.8 km E county line. 15 February 2000. Daniel Buchholz and Ali Stuart. MVZ 230468. Verified by Jens Vindum and David Wake, respectively. Tissue samples for genetic analysis were deposited at the respective institutions. New county records.

Submitted by **DANIEL BUCHHOLZ**, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA, and **ED ELY**, Department of Herpetology, California Academy of Sciences, San Francisco, California 94118, USA.

ANURA

APARASPHENODON BRUNOI. BRAZIL: BAHIA: Una (15°18'S, 39°05'W), Estação Experimental Lemos Maia (CEPLAC/ESMAI). 17 November 1990. A. J. S. Argôlo, R. Nunes, and M. de Menezes. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau, Ilhéus, Bahia (CZGB 928–29). Verified by José Perez Pombal, Jr. One specimen was found at night in the cavity of a tree trunk near a pond. Species was previously known from the states of São Paulo, Rio de Janeiro, Minas Gerais, and Espírito Santo, the latter its northermost record (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). First record from northeastern Brazil; confirms the occurence of the species in the state of Bahia, as speculated by Sazima and Cardoso (1980, Iheringia Sér. Zool. 55:3–7).

Submitted by **ANTONIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil.

BATRACHYLA ANTARTANDICA. ARGENTINA: CHUBUT: DEPARTAMENTO RÍO SENGUER: Land between La Plata and La Plata Chico lakes, 72°00'S, 44°48'50"W, ca. 1000 m elev. 12 January 2000. C. Úbeda. Adult male (SVL 32.3 mm). Museo de Ciencias Naturales de La Plata, Buenos Aires (MLP A. 740). Verified by Néstor G. Basso. Specimen was collected in temperate humid deciduous austral beech forest of lenga (*Nothofagus pumilio*). Species inhabits austral forests of Chile and Argentina, with a narrow distribution on the eastern slopes of the Andes. This voucher represents a new record for the province of Chubut and extends known range of species in Argentina ca. 417 km airline S from previously cited localities at the Nahuel Huapi National Park in the Neuquén and Río Negro provinces (Cei 1980, Amphibians of Argentina, Monit. Zool. Ital. (N.S.), Monogr. 2:i–xii + 1–609). Specimen was found in axillar amplex within a small pool in a forest clearing (1.5 m diam. and about 1 m deep), along with several *B. antartandica* tadpoles. The area is also inhabited by *Pleurodema thaul* and *Bufo variegatus*.

Submitted by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, R 8400 FRF Bariloche, Prov. de Río Negro, Argentina.

BUFO DIVERGENS (Crested Toad). MALAYSIA: PENINSULAR MALAYSIA: Terengganu: Lata Belatan, on forest floor, 20 m from lower waterfalls (5°37'N, 102°35'E, ca. 75 m elev.). 25 December 1999. Tzi Ming Leong. Raffles Museum of Biodiversity Zoological Reference Collection (ZRC.1.3669, adult female with pigmented ova, 38.8 mm SVL). Verified by Kelvin K. P. Lim. Confirms literature record (Berry 1975, The Amphibian Fauna of Peninsular Malaysia. Tropical Press, Kuala Lumpur. x + 130 pp.); constitutes first voucher specimen for the Malay Peninsula and represents the northernmost extent of its range there. Within peninsular Malaysia, *B. divergens* has been reported from only two other localities: Selangor (Boulenger 1912, A Vertebrate Fauna of the Malay Peninsula from the Isthmus of Kra to Singapore Including the Adjacent Islands. Reptilia and Batrachia. Taylor and Francis, London. xiii + 294 pp.) and at Ulu Kinchin, Pahang (Lim 1990, Malaysia Nat. J. 43:322–325). This species also occurs in Borneo (Brunei, Kalimantan, Sabah, and Sarawak), Sumatra, and the Natuna Islands (Inger and Tan 1996, Raffles Bull. Zool. 44:551–574).

Submitted by **TZI MING LEONG**, Department of Biological Sciences, National University of Singapore, Singapore 119260 (e-mail: tziming@hotmail.com).

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: FLORIDA: ST. JOHNS CO: Anastasia Island, Fort Matanzas National Monument (29°42'56.3"N, 81°13'59.3"W). 12 December 1998. K. L. Krysko and F. W. King. Verified by M. A. Nickerson. UF 116160-61. New county record; collected near buildings in maritime forest.

Submitted by **KENNETH L. KRYSKO** (e-mail: kenneyk@flmnh.ufl.edu) and **F. WAYNE KING** (e-mail: kaiman@flmnh.ufl.edu), Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA.

HYLA ANCEPS. BRAZIL: BAHIA: Pau Brasil, Fazenda Água Santa (15°27'S, 39°37'W). 25 November 1997. J. Abade da Silva and A. J. S. Argôlo. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau, Ilhéus, Bahia (CZGB 1651). Collected at night over leaves on the border of a stream. Previously known from the states of Rio de Janeiro, where the type locality is located (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.), Espírito Santo (Haddad et al. 1985, Herpetol. Rev. 26:207) and Minas Gerais (Nascimento and Feio 1999, Herpetol. Rev. 30:49–50). First record from the state of Bahia and from northeastern Brazil.

Submitted by **ANTONIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil.

HYLA CINEREA (Green Treefrog). USA: TEXAS: POLK CO: Big Sandy Creek Unit, Big Thicket National Preserve, 900 m NE jct. Fire Tower Road and FM 943. 20 May 1999. Stephen D. Lewis and John D. Quine. Stephen F. Austin State University (SFA 4897). Verified by Fred L. Rainwater. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **STEPHEN D. LEWIS**, **JOHN D. QUINE**, and **ROBERT R. FLEET**, Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA.

MELANOPHRYNISCUS STELZNERI STELZNERI. ARGENTINA: LA RIOJA: Patquía (30°03'S, 66°53'W). 26 January 1935. A. Breyer. Herpetological Collection, Museo Argentino e Instituto de Investigación de las Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina (MACN 1178, two specimens). Verified by Gustavo Carrizo. First province record; nearest previous records were Cordoba and San Luis (Cei 1980, Mon. Zool. Ital. Mus. Reg. Sci. Nat. Torino. 609 pp.; Gallardo 1987, Librería Agropecuaria. 98 pp.; Gallardo y Varela de Olmedo 1992, Fauna de Agua Dulce de la República Argentina. Vol 21. Amphibia I. 114 pp.).

Submitted by **JORGE ABEL CESPEDEZ**, Cátedra de Anatomía Comparada, Departamento de Biología, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de julio 1449, Caixa Postal 3400, Corrientes, Argentina (e-mail: cespedez@exa.unne.edu.ar).

MICROHYLA PETRIGENA (Pothole Narrowmouth Frog). INDONESIA: EAST KALIMANTAN: Kayan basin, Sungai Panan (tributary of Sungai Iwan), small potholes on rocky bank of river (02°00'44"N, 115°03'34"E, 530 m elev.). 25 November 1999. Heok Hui Tan. Raffles Museum of Biodiversity Research Zoological Reference Collection (ZRC.1.3780–3826, 47 larvae, with one Stage 43 larva, total length 16 mm, exhibiting characteristics diagnostic of adults of the species). Verified by Kelvin K. P. Lim. New country record; confirms postulation of its probable occurrence in Kalimantan (Inger and Stuebing 1997, A Field Guide to the Frogs of Borneo. Natural History Publications, Kota Kinabalu, Sabah, Malaysia. ix + 205 pp.).

Submitted by **TZI MING LEONG** and **HEOK HUI TAN**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

RANA CAPITO (Gopher Frog). USA: GEORGIA: TAYLOR CO: isolated depressional wetland ca. 4 km WNW jct. Georgia Rt. 96 and Georgia Rt. 137 (exact locality withheld due to sensitivity of species). 25 February 1997. John B. Jensen. Georgia Museum of Natural History (GMNH 44320). Verified by M. E. McGhee. Several egg masses observed and one male found calling while submerged. First county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

RANA CATESBEIANA (Bullfrog). USA: COLORADO: FREMONT CO: Thizizit Ranch, 6701 Co. Rd. 19, 11 km SSE Florence. 20 June 1998. Richard L. Holland. UCM 59962. Verified by Kyle Ashton. First County record (Livo et al. 1997, Herpetological microbiogeography of Colorado II: Documented and potential county records: 1997 Interim summary. Publ. Colorado Herpetological Society. 25 pp.) and the westernmost record of the species on the eastern side of the continental divide in Colorado. The rancher, Charles Francis, stated that Bullfrogs have been present at the site throughout the five years of his ownership.

Submitted by **RICHARD L. HOLLAND** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

RANA SYLVATICA (Wood Frog). USA: TENNESSEE: JACKSON CO: Dodson Branch, NE of Hidden Springs Nursery on Spring Creek Road at the base of Dodson Branch (36°19'20"N, 85°30'42"W). 9 October 1999. Priya Nanjappa. Austin Peay State University Museum of Zoology (APSU 5283 [color slide]). Verified by A. Floyd Scott. Adult captured in leaf litter in a mixed forest near Dodson Branch; photographed and released. New county record (Redmond and Scott 1996, Austin Peay St. Univ. Misc. Publ. 12:1–94).

Submitted by **PRIYA NANJAPPA** and **LAURA LEININGER**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

SCAPHIOPUS HOLBROOKII (Eastern Spadefoot). USA: MASSACHUSETTS: FRANKLIN CO: Sunderland, jct. North Plain Road and Plum Tree Road. 8 July 1999. UMA A0895, adult female. Verified by Nathan J. Kley. Confirmation of an historic county record. Franklin County represents the northernmost limit of the species in the Connecticut River Valley of New England. Species was first collected in Franklin County by R. Wood in 1952 (UMA A0455). The specimen reported herein represents the first definitive evidence of the occurrence this species in Franklin County since 1952.

Submitted by **MARK MANDICA**, Department of Biology, University of Massachusetts, Amherst, Massachusetts 01003, USA, (e-mail: winhold@student.umass.edu) and **ALAN RICHMOND**, Department of Biology, University of Massachusetts, Amherst, Masssachusetts 01003, USA (e-mail: alanr@bio.umass.edu).

TESTUDINES

ACANTHOCHELYS SPIXII (Spinyneck Swamp Turtle). ARGENTINA: CORRIENTES: Saladas Department: 35 km N San Roque on National Highway 12; ca. 65 masl (28°16'46"S, 58°41'34" W—Datum: WGS84). 11 April 1999. T. Waller, M. D. Beccaceci, and P. A. Micucci. Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 37083). Verified by Gustavo Carrizo. In Argentina, this species is known from only three localities along the eastern banks of the Paraná river in Corrientes Province (Cabrera 1995, Ann. Mus. Hist. Nat. Valparaiso 23:41–52). Fourth and easternmost locality for species in Argentina and a new departmental record for Corrientes Province.

Submitted by **TOMAS WALLER**, IMAE/Universidad del Salvador, Zavalía 2090 3°B, Buenos Aires, Caixa Postal 1428, Argentina (e-mail: tomas@waller.com.ar), **MARCELO D. BECCACECI**, IMAE/Universidad del Salvador, Jacinto Díaz 114, Buenos Aires, Caixa Postal 1642, Argentina, and **PATRICIO A. MICUCCI**, Paraguay 2499 7°B, Buenos Aires, Caixa Postal 1121, Argentina.

APALONE MUTICA (Smooth Softshell). USA: ILLINOIS: CALHOUN CO: Mississippi River at Royal Landing (SW 1/4 SW 1/4 Sec. 14, T13S, R01W). 15 June 1999. Robert J. Cosgriff. INHS 15133. Verified by C. A. Phillips. New county record. Specimen drowned in minnow fyke net set along the channel border in sandy substrate. A second specimen was also caught and released.

Submitted by **JOHN K. TUCKER**, **ROBERT J. COSGRIFF**, and **J. BRIAN TOWEY**, Illinois Natural History Survey, 8450 Montclaire Avenue, Brighton, Illinois 62012-2032, USA.

APALONE MUTICA (Smooth Softshell). USA: MISSOURI: ST. CHARLES CO: Mississippi River in West Alton Bay (SW 1/4 Sec. 26, T48N, R07E). 16 October 1999. Robert J. Cosgriff and J. Brian Towey. Verified by C. A. Phillips. INHS 15389. New county record. Specimen drowned in fyke net set along the channel border.

Submitted by **JOHN K. TUCKER**, **ROBERT J. COSGRIFF**, and **J. BRIAN TOWEY**, Illinios Natural History Survey, 8450 Montclaire Avenue, Brighton, Illinois 62012-2032, USA.

CLEMMYS GUTTATA (Spotted Turtle). USA: CONNECTICUT: FAIRFIELD CO: Brett Woods, Fairfield. 10 June 1966. W. Bulmer. Verified by C. A. Phillips. INHS 14898. New county record (Klemens 1993, Amphibians and Reptiles of Connecticut and Adjacent Regions. State Geological and Natural History Survey of Connecticut. 318 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

DEIROCHELYS RETICULARIA (Chicken Turtle). USA: FLORIDA: FRANKLIN CO: St. Vincent National Wildlife Refuge, AOR jct. Windmill Road and Road G, E end of island. 8 January 2000. Terry Peacock. KU Color Slides 11768–770; AOR jct. Dune Road and Road B. 12 January 2000. Thom Lewis. KU Color Slides 11771–773. Photographs by Suzanne L. Collins. Both verified by Joseph T. Collins; ca. 100 m ENE jct Roads B and D. 20 February 2000. Thom Lewis. Clemson University Vertebrate Collection (CUSC 1898). Verified by Kelly J. Irwin. Skeletal remains consisting of disarticulated carapace and intact plastron, with few as-

sociated scutes. First island records (Blaney 1971, Herpetologica 27:406–430).

Submitted by **TERRY PEACOCK** and **THOMAS E. LEWIS**, St. Vincent National Wildlife Refuge, P.O. Box 447, Apalachicola, Florida 32329, USA.

DEIROCHELYS RETICULARIA MIARIA (Western Chicken Turtle) USA: TEXAS: Hill Co: Adult female found crossing I-35, 16.9 km S Hillsboro exit (jct. Rts. 77 and 81), 7.2 km S FM 1242. 0930 h. 7 June 1986. William B. Montgomery. KU Color Slide 11670. Verified by John E. Simmons. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **WILLIAM B. MONTGOMERY**, P.O. Box 656, Elgin, Texas 78621, USA.

DEIROCHELYS RETICULARIA RETICULARIA (Eastern Chicken Turtle). USA: VIRGINIA: Isle of Wight Co: 3.5 km NE Chuckatuck, Cat Pond ephemeral pond complex. 16 April 1999. Michael W. McCoy. KU Color Slides 11745–749. Verified by Don Schwab and Alan H. Savitzky. First record for county. Adult female (213 mm carapace length, 184 mm plastron length, body mass 1301 g) captured in pitfall trap adjacent to an ephemeral pond. Seven additional specimens subsequently were captured at this site. Extends range 53 km west of only other record of this species in Virginia. Formerly species was recorded only from one locality in the city of Virginia Beach, believed to be an introduced or isolated disjunct population (Mitchell 1994, The Reptiles of Virginia. Smithsonian Inst. Press, Washington, D.C. xv + 352 pp.). This record raises the probability that additional populations of this species may occur in southeastern Virginia and northeastern North Carolina.

Submitted by **MICHAEL W. McCOY** and **DONALD J. SCHWAB**, Virginia Department of Game and Inland Fisheries, Wildlife Diversity Division, Nongame and Endangered Wildlife Program, 5806 Mooretown Road, Williamsburg, Virginia 23188, USA, and **ALAN H. SAVITZKY**, Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266, USA.

MACROCLEMYS TEMMINCKII (Alligator Snapping Turtle). USA: TEXAS: Nacogdoches Co: Stephen F. Austin Experimental Forest (31°29'N, 94°47'W), Bonaldo Creek. 27 April 1999. Christopher S. Collins. Color slides SFAT1–4. Verified by Michael B. Keck. New county record. (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp.) An 11.5 kg female caught in a 4-foot diameter hoop net (Texas Permit Number SPR-0490-059) during an Alligator Snapping Turtle survey.

Submitted by **CHRISTOPHER S. COLLINS, DANIEL SAENZ**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA, and **JAMES R. McCORMICK**, Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA.

MANOURIA IMPRESSA (Impressed Tortoise). CAMBODIA: Province of Stung Treng: Siem Pang. 16 January 2000. Edgar Lehr and Rohan Holloway. Staatliches Museum für Tierkunde, Dresden (MTKDD 42504). Verified by Uwe Fritz. First country record. Previously known from neighboring countries (Moll 1989, *Manouria impressa*, Impressed Tortoise. Pp. 121–122 in Swingland and Klemens (eds.), The Conservation Biology of Tortoises. Occ. Pap. IUCN Species Survival Commission No. 5). Specimen (shell) was bought from an animal hunter in Veurn Sai (Province of Ratanakiri), who claimed to have caught it in the mountains north of Siem Pang.

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de), and **ROHAN HOLLOWAY**, Applied Ecology Research Group, University of Canberra, ACT 2601, Australia (e-mail: rohanholloway@hotmail.com).

PALEA STEINDACHNERI (Wattleneck Softshell). CHINA: YUNNAN: Hekou Autonomous County. 30 July 1975. Jiang Yaoming. Chengdu Institute of Biology (CIB 755201). Verified by J. R. Buskirk. First confirmed record for the province; extends the geographic range of the species ca.110 km westward (Iverson 1997, A Revised Checklist with Distribution Maps of the Turtles of the World. Green Nature Books, Homestead, Florida). There are striking differences between the distributions of Chinese turtles as reported by Iverson (1997, *op. cit.*) and Chinese herpetologists (Tian et al. 1986, Identification Manual for Chinese Amphibians and Reptiles. Science Press, Beijing [in Chinese]; Zhao and Adler 1993, Herpetology of China. SSAR, Oxford, Ohio). This is largely attributable to the relative inaccessibility of the Chinese literature and its lack of vouchered localities. For example, although not reported in Iverson (1997, *op. cit.*), *P. steindachneri* is known from two localities in southern Guizhou Province (Bangzha near Xingyi and Wangme; Wu et al. 1985, The Reptile Fauna of Guizhou. Guizhou People's Publishing House, Guiyang [in Chinese]). In addition to Guichou Province and the provinces listed by Iverson (1997), Tiang et al. (1986, *op. cit.*) and Zhao and Adler (1993, *op. cit.*) list *P. steindachneri* as occurring in Guangdong and Yunnan provinces, but do not give references, detailed localities, or vouchers. The specimen reported herein establishes the presence of this turtle in the Yuan Jiang/Song Hong river of Yunnan Province.

Submitted by **JAMES FORD PARHAM**, Department of Integrative Biology, University of California, Berkeley, California 94720-3140, USA (e-mail: parham@socrates.berkeley.edu) and **YUEZHAO WANG**, Chengdu Institute of Biology, Chengdu, Sichuan, 610041 People's Republic of China (e-mail: arcib@mail.cib.ac.cn).

STERNOTHERUS MINOR (Loggerhead Musk Turtle). USA: ALABAMA: Marion Co: 16 km E Hamilton, Buttahatchee River at U.S. Rt. 278 (34°08.211'N, 87°52.159'W). 26 March 1998. T. J. Near and R. S. Steinberg. Verified by C. A. Phillips. INHS 13961. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Auburn University Agricultural Experiment Station, Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **THOMAS J. NEAR**, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

LACERTILIA

ANOLIS CAROLINENSIS (Green Anole). TEXAS: KARNES CO: ca. 2.5 km ENE Runge city limits near jct. Texas Rt. 72 and Co. Road 322, Larry Dement Ranch near Ojo de Agua Creek. 10 April 1999. Valerie Shafer. Stephen F. Austin State University (SFA 4900). Verified by Michael Keck. First record for county (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **VALERIE SHAFER**, Department of Biology, P.O. Box 13003, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA; e-mail: z_shafervm@ titan.sfasu.edu.

BARISIA IMBRICATA CILIARIS (Northern Imbricate Alligator Lizard). MEXICO: CHIHUAHUA: under large oak log in Mesa de Agostadero, Cerro Blanco, Municipio Balleza, Km 102, Guachochi-Balleza Highway (26°54'38.7"N, 106°47'14.1"W), 235 masl. 26 July 1999. Julio A. Lemos-Espinal. Unidad de Biotecnología y Prototipas (UBIPRO 3034). Verified by Richard L. Holland. First precise record for the state of Chihuahua (Good 1988, Univ. California Publ. Zool. 121:80), although two previous records for unspecified localities in the state, all probably referable to *B. levicollis*, were noted by Guillette and Smith (1982, Trans. Kansas Acad. Sci. 85:32). Moreover, literature records (*loc. cit.* and Van Devender and Lowe 1977, J. Herpetol. 11:43) for Sierra del Nido are in error and actually are *B. levicollis*. Specimen reported herein is a northward range extension of about 125 km from Guanacevi, Durango (Guillette and Smith 1982, *op. cit.*).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecología, Unidad de Biotecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, UNAM, Apartado Postal 314, Avenida de los Barrios s/n. Los Reyes Iztacala, Tlalnepantla, Estado de México 54090, México, **ROBERT G. WEBB**, Department of Biological Sciences, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, **DAVID CHISZAR**, Department of Psychology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA, and **HOBART M. SMITH**, Department of EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA.

BOGERTIA LUTZAE. BRAZIL: BAHIA: Trancoso (16°39'S, 39°06'W). 25 November 1999. D. Vrcibradic and F. H. Hatano. Museu Nacional, Rio de Janeiro (MNRJ 7581–2); Prado (17°18'S, 39°13'W). 29–30 November 1999. C. F. D. Rocha, M. Van Sluys, F. H. Hatano and D. Vrcibradic. MNRJ 7583–6. Verified by M. T. Rodrigues. All individuals were collected among bromeliad leaves in open coastal sand-dune habitats ("restingas"). This little-known gekkonid lizard was, until recently, known only from a locality in the state of Pernambuco (Igarassu, 7°50'S, 34°54'W) and from Salvador (12°50'S, 38°25'W) in the state of Bahia (Vanzolini and Gomes 1979, Pap. Avulsos Zool. São Paulo 32:254). Rodrigues (1987, Arq. Zool. São Paulo 31:223–224) mentions the occurrence of this species in Cumuruxatiba (17°06'S, 39°11'W) in the state of Bahia, without citing vouchers. He commented that geckos from this locality were found in undisturbed rainforest habitat, unlike those of Salvador and Igarassu, which were recorded in restinga habitats. He suggested that his population may have been historically isolated from its congeners in Salvador, some 500 km away, due to a gradual rising of sea-level (which presumably altered previously favorable habitats south of Salvador, forcing the geckos to adapt to a different habitat). Conversely, our findings of populations of *B. lutzae* in coastal restinga habitats, both close to Cumuruxatiba and to the north of it, are suggestive that the distribution of this lizard may actually be fairly continuous along the coast of Bahia (at least from Salvador southward). The specimens here mentioned constitute the first vouchers reported from south of Salvador. Prado lies about 30 km south of Cumuruxatiba and is therefore the southernmost locality recorded for *B. lutzae*.

Submitted by **DAVOR VRCIBRADIC, FÁBIO H. HATANO, CARLOS FREDERICO D. ROCHA**, and **MONIQUE VAN SLUYS**, Setor de Ecologia, Departamento de Biologia Animal e Vegetal, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-019, Rio de Janeiro, Rio de Janeiro, Brazil.

CNEMIDOPHORUS TIGRIS (Western Whiptail). USA: NEW MEXICO: LINCOLN CO: White Sands Missile Range, 15 mi W Oscuro at Wood gravel pit off Range Road 12. NW 1/4 Sec 35, T9N, R7E. 17 August 1999. D. W. Burkett and D. Black. Verified by C. W. Painter. University of New Mexico Museum Southwestern Biology (MSB 61420). County record (Degenhardt et al. 1996, The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUGLAS W. BURKETT** and **DAVID BLACK**, MEVATEC Corporation, P.O. Box 399, White Sands Missile Range, New Mexico 88002, USA.

CNEMIDOPHORUS UNIPARENS (Desert Grassland Whiptail). USA: NEW MEXICO: OTERO CO: White Sands Missile Range, 14 mi W Three Rivers. Caught in pitfall bucket in Malpais Lava Flow. SE 1/4 Sec 16, T12N, R7E. 11 July 1999. D. W. Burkett and D. Black. Verified by C. W. Painter. University of New Mexico Museum Southwestern Biology (MSB 61417). County record (Degenhardt et al. 1996, The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUGLAS W. BURKETT** and **DAVID BLACK**, MEVATEC Corporation, P.O. Box 399, White Sands Missile Range, New Mexico 88002, USA.

CNEMIDOPHORUS VELOX (Plateau Striped Whiptail). USA: NEW MEXICO: MORA CO: Kiowa National Grasslands, Unit 91 along Canadian River, ca. 9.7 air km N and 15.3 km airline W jct. New Mex. Rt. 120 and New Mex. 39 at Roy, SW 1/4 Sec. 23, T21N, R24E. 22 June 1999. Don S. Sias. University of New Mexico Museum of Southwestern Biology (MSB 61479). Verified by W. G. Degenhardt. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **DONALD S. SIAS** and **LELAND J. S. PIERCE**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

EUMECES OBSOLETUS (Great Plains Skink). USA: NEW MEXICO: Harding Co: Kiowa National Grasslands, along upper reaches of Cañon Mesteño, ca. 11.3 km airline N and 11.1 km airline W jct. New Mexico Rt. 120 and New Mexico Rt. 39 at Roy, NE 1/4 Sec. 19, T21N, R25E (36°02.818'N, 104°18.634'W). 25 June 1999. Leland J. S. Pierce. University of New Mexico Museum of Southwestern Biology (MSB 61481). Verified by W. G. Degenhardt. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **LELAND J. S. PIERCE**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

HEMIDACTYLUS MABOUIA (Tropical Gecko). HONDURAS: COLÓN: Trujillo (15°55'N, 85°57'W), near sea level on wall of house in town. June 1998. Elizabeth Wilson. USNM 536064. Verified by R. Powell. First record for country for this introduced species; closest reported localities are the Los Tuxtlas region, Veracruz, México (Powell et al. 1998, Cat. Amer. Amph. Rept. 674.1–674.11) and the Canal Zone, Panamá (Auth 1994, Publ. Smithson. Herpetol. Inform. Serv. 98:1–59). The Honduran locality lies ca. 1000 km airline ESE of the Mexican locality and ca. 975 km airline NW of the Panamanian locality.

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157, USA, and **LARRY DAVID WILSON**, Department of Biology, Miami-Dade Community College, Kendall Campus, Miami, Florida 33176, USA (e-mail: lwilson@mdcc.edu).

OPHISAURUS ATTENUATUS ATTENUATUS (Western Slender Glass Lizard). USA: TEXAS: Bastrop Co: 90 m W jct. Sayers Road and Rt. 95, 11.5 km S Rt. 290. 16 May 1991. William B. Montgomery. KU Color Slide 11671. Verified by John E. Simmons. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **WILLIAM B. MONTGOMERY**, P.O. Box 656, Elgin, Texas 78621, USA.

SCELOPORUS MAGISTER (Desert Spiny Lizard). USA: NEW MEXICO: Lincoln Co: White Sands Missile Range, 15 mi W Oscuro at Wood gravel pit off Range Road 12. NW 1/4 Sec 35, T9N, R7E. 17 August 1999. D. W. Burkett and D. Black. Verified by C. W. Painter. University of New Mexico Museum Southwestern Biology (MSB 61419). County record (Degenhardt et al. 1996, The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUGLAS W. BURKETT** and **DAVID BLACK**, MEVATEC Corporation, P.O. Box 399, White Sands Missile Range, New Mexico 88002, USA.

UTA STANSBURIANA (Side-blotched Lizard). USA: NEW MEXICO: Lincoln Co: White Sands Missile Range, 15 mi W Oscuro at Wood gravel pit off Range Road 12. NW 1/4 Sec 35, T9N, R7E. 21 August 1999. D. W. Burkett and D. Black. Verified by C. W. Painter. University of New Mexico Museum Southwestern Biology (MSB 61418). County record (Degenhardt et al. 1996, The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUGLAS W. BURKETT** and **DAVID BLACK**, MEVATEC Corporation, P.O. Box 399, White Sands Missile Range, New Mexico 88002, USA.

SERPENTES

CROTALUS LEPIDUS LEPIDUS (Mottled Rock Rattlesnake). MEXICO: CHIHUAHUA: mountain near La Perla (= El Berrendo), Municipio Camargo (28°17'59.8"N, 104°33'5.0"W). 4 July 1999. Julio A. Lemos-Espinal. Unidad de Biotecnología y Prototipos, Universidad Nacional Autónoma de México (IBIPRO 3896). Verified by Richard L. Holland. First precise locality of record in the state of Chihuahua, although expected on the basis of general range (Gloyd 1940, Chicago Acad. Sci. Spec. Publ. 4:1–270; Klauber 1972, Rattlesnakes. Univ. California Press, Berkeley. 2 vols.). Extends range slightly farther west than hypothesized by Klauber (*op. cit.*).

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecología, Unidad de Biotecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México, Apartado Postal 314, Avenida de los Barrios s/n. Los Reyes Iztacala, Tlalnepantla, Estado de México, 54090 México, and **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

CROTALUS LEPIDUS MACULOSUS (Durangan Rock Rattlesnake). MEXICO: JALISCO: Volcán de Tequila, Municipio de Tequila, 2840 m (20°48'N, 103°51'W). 1 August 1999. Héctor and Rodolfo Romero Contreras. Universidad Autónoma de Guadalajara, México (UAGM R-425). Verified by H. M. Smith. New state record (Tanner et. al. 1972, Great Basin Nat. 32:16–24).

Submitted by **PAULINO PONCE-CAMPOS**, **RODOLFO ROMERO-CONTRERAS**, and **SARA M. HUERTA-ORTEGA**, Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: ARIZONA: Coconino Co: Walnut Canyon National Monument, picnic area rest rooms, 2042 m. 25 August 1973. Scott Archer. Flagstaff Area National Monuments collection (WACA 3029). Apache Co: Malpais (= Cave) Spring, SW of St. Johns, SW 1/4 NE 1/4 Sec. 26, T12N, R26E, 1884 m. Collected under rock beside marsh, along with a *Thamnophis elegans*. 2 June 1989. C. H. Lowe and G. L. Bradley. UAZ 48343. Both verified by Phil Rosen. First records for both Coconino and Apache counties, and first records for eastern Arizona north of the Mogollon Rim (Fowlie 1965, Snakes of Arizona. McGraw Hill, Inc., New York; Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second Ed. Houghton Mifflin Co., Boston, Massachusetts). Extends range ca. 69 km NNE and 71 km NNE from nearest records in Yavapai and Navajo counties, respectively (Fowlie, *op. cit.*).

Submitted by **TREVOR B. PERSONS**, Forest and Rangeland Ecosystem Science Center, Colorado Plateau Field Station, Box 5614, Northern Arizona University, Flagstaff, Arizona 86011, USA,

and **GEORGE L. BRADLEY**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

ENHYDRIS ENHYDRIS (Rainbow Water Snake). MALAYSIA: PENINSULAR MALAYSIA: PULAU TIOMAN: Sungai Paya mangroves (02°48'N, 104°08'E). 22 June 1999. Heok Hui Tan. Raffles Museum of Biodiversity Research Zoological Reference Collection (ZRC.2.4593, adult, SVL 435 mm, tail 103 mm, fresh wt. 64.0 g; liver tissue sample deposited FMNH). Verified by Kelvin K. P. Lim. New island record; second species of genus from island; *E. plumbea* recorded previously (Lim and Lim 1999, Raffles Bull. Zool. Suppl. No. 6:131–155).

Submitted by **TZI MING LEONG** and **HEOK HUI TAN**, Department of Biological Sciences, National University of Singapore, Singapore 119260.

LAMPROPELTIS TRIANGULUM ELAPSOIDES (Scarlet Kingsnake). USA: FLORIDA: FRANKLIN CO: St. George Island, 817 East Gorrie Drive. 15 May 1999. M. B. Capron and J. A. Capron. Verified by Richard Montanucci. Clemson University Vertebrate Collection (CUSC 1845). Adult found DOR in residentially developed coastal dune habitat. First record for St. George Island and Apalachicola Bay Barrier Islands (Blaney 1971, Herpetologica 27:406–430; Means 1974, *In* Livingston et al. [eds.], St. George Island: Biota, Ecology, and Management Program for Controlled Development. Rept. Develop. Regional Impact Franklin County Commission).

Submitted by **KELLY J. IRWIN**, 1618 Davis Creek Road, Seneca, South Carolina 29678, USA, and **MARTIN B. CAPRON** and **JILL A. CAPRON**, 1832 East 20th North Avenue, Oxford, Kansas 67119, USA.

LEPTOTYPHLOPS DULCIS DISSECTUS (New Mexico Blind Snake). USA: NEW MEXICO: MORA CO: Kiowa National Grasslands, Unit 91 along Canadian River, ca. 9.7 air km N and 15.3 air km W jct. New Mexico Rt. 120 and New Mexico Rt. 39 at Roy, SW 1/4 Sec. 23, T21N, R24E. 22 June 1999. Don S. Sias. University of New Mexico Museum of Southwestern Biology (MSB 61478). Verified by W. G. Degenhardt. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **DONALD S. SIAS** and **LELAND J. S. PIERCE**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

LEPTOTYPHLOPS HUMILIS (Western Blind Snake). USA: NEW MEXICO: LINCOLN CO: White Sands Missile Range, 15 mi W Oscuro at Wood gravel pit off Range Road 12. NW 1/4 Sec 35, T9N R7E. 7 September 1999. D. W. Burkett and D. Black. University of New Mexico Museum Southwestern Biology (MSB 61414); OTERO CO: White Sands Missile Range, 14 mi W Three Rivers. Specimen caught in pitfall bucket in Malpais Lava Flow. SE 1/4 Sec 16, T12N, R7E. 17 August 1999. D. W. Burkett and D. Black. MSB 61415. Both verified by C. W. Painter. County records (Degenhardt et al. 1996, The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUGLAS W. BURKETT** and **DAVID BLACK**, MEVATEC Corporation, P.O. Box 399, White Sands Missile Range, New Mexico 88002, USA.

MICRURUS DISTANS ZWEIFELI (Zweifel's Coral Snake). MEXICO: AGUASCALIENTES: Río Gil, municipality Calvillo (21°52'48"N, 102°37'47"W). 21 May 1994. Gustavo Quintero-Díaz and Joel Vázquez-Díaz. Museo de Zoología, Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VR 253); 1 km S Milpillas de Arriba, Calvillo (21°58'39"W, 102°33'12"W). 1 November 1997. Rigoberto Gómez-Torres. UAA-VR 269; 1 km SE La Labor, municipality Calvillo (21°58'15"N, 102°42'07"W). 13 August 1998. Gilfredo de la Riva-Hernández. UAA-VR 278. All in subtropical scrub and verified by Fernando Mendoza-Quijano. First record for the state of Aguascalientes; extends range 185 km NE Magdalena, Jalisco (Roze 1961, Amer. Mus. Novitates 2287:1–60).

Submitted by **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, Aguascalientes, Aguascalientes 20100, México, **JOEL VAZQUEZ-DIAZ**, Departamento de Investigación y Desarollo Tecnológico, Internacional de Relojes, Arte y Diseño S. A. de C. V., Avenida Aguascalientes Sur 203, Fracc. Prados del Sur, Aguascalientes, Aguascalientes 20280, México, and **HOBART M. SMITH**, Department of EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA.

OPHEODRYS AESTIVUS (Rough Green Snake). USA: KENTUCKY: CAMPBELL CO: California, 5 km N on Rt. 8, Thomas More College Ohio River Biology Field Station (38°57'31"N, 84°17'50"W). June 1996. Adam Mann. Thomas More College (TMC R5). Verified by C. Lorentz. New county record; first voucher specimen (Meade 1993, Doctoral Dissertation, Univ. Southern Mississippi. 608 pp.).

Submitted by **ADAM MANN**, **MELISSA R. OBERMEYER**, and **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.

RHINOCHEILUS LECONTEI (Longnose Snake). USA: NEW MEXICO: LINCOLN CO: White Sands Missile Range, 13 mi W Oscuro on Range Road 12. SW 1/4 Sec 26, T9N, R7W. 17 June 1999. D. W. Burkett and D. Black. Verified by C. W. Painter. University of New Mexico Museum Southwestern Biology (MSB 61421). County record (Degenhardt et al. 1996, The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUGLAS W. BURKETT** and **DAVID BLACK**, MEVATEC Corporation, P.O. Box 399, White Sands Missile Range, New Mexico 88002, USA.

SALVADORA GRAHAMIAE (Mountain Patchnose Snake). USA: NEW MEXICO: HARDING CO: Kiowa National Grasslands, along Cañon Mesteño, ca. 1.1 km airline upstream jct. Canadian River and ca. 14.5 km airline NW Roy, 36°00.165'N, 104°20.083'W. 23 June 1999. Charles W. Painter. University of New Mexico Museum of Southwestern Biology (MSB 61480). Verified by W. G.

Degenhardt. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.). An adult female of this species was observed, but not collected, near this site on 28 May 1989 (T. L. Brown, pers. comm.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **DONALD S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

TANTILLA BOCOURTI BOCOURTI (Bocourt's Blackhead Snake). MEXICO: NAYARIT: Sierra de Alicia, Bajio de las Palas, Municipio de La Yesca (21°45'N, 104°24'W), 2000 m elev. 20 July 1996. Paulino Ponce-Campos. Universidad Autónoma de Guadalajara, México (UAGM R419 a–b, two photographs). Verified by Hobart M. Smith. First record for mainland Nayarit, although species is known from Maria Cleofas Island (McDiarmid et al. 1976, Los Angeles Co. Mus. Nat. Hist. Contrib. Sci. 275:1–17).

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**. Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

TANTILLA MELANOCEPHALA. ARGENTINA: CORRIENTES: SANTO TOMÉ DEPARTMENT: Estancia San Pedro (28°09'S, 56°42'W). 27 December 1997. R. H. Aguirre and E. F. Schaefer. Herpetological collection of Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 6763, a female 231 mm SVL, 59 mm TL). Verified by A. Giraudo. Second province record with precise locality; extends range ca. 128 km airline east from the previous record in Mburucuyá National Park (Montanelli and Alvarez 1998, Herpetol. Rev. 29:179). Species was reported as ranging from Central America to northern Argentina (Peters and Orejas Miranda 1970, Bull. U.S. Nat. Mus. 297:295). In Argentina, it was reported without voucher specimens from Chaco, Corrientes, and Misiones provinces (Koslowsky 1898, Rev. Mus. La Plata 8:197, Serié P; 1921, Ann. Soc. Científ. Argentina 92:165, Serié P; 1936, Int. Mus. Univ. Nac. La Plata. Obra Cincuent.; Abalos and Mischis 1975, Bol. Acad. Nac. Cien. Córdoba 51[1-2]:72), and with a voucher in Entre Ríos province (Vuoto 1998, Mus. Cienc. Nat. y Antrop. "Prof. Antonio Serrano" Paraná, Entre Ríos, Argentina. Serie Vertebrados: Los Reptiles [6]:12 pp.).

Submitted by **EDUARDO FEDERICO SCHAEFER** and **BLANCA BEATRIZ ALVAREZ**, Cátedra de Anatomía Comparada, Departamento de Biología, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400 Corrientes, Argentina (e-mail: efs@exa.unne.edu.ar).

TANTILLITA LINTONI (Linton's Dwarf Short-tailed Snake). BELIZE: TOLEDO DISTRICT: Belize Foundation for Research and Environmental Education, ca. 10 km NE Medina Bank Village (16°31'N, 88°40'W). 15 August 1997. Jacob A. Marlin. Verified by Julian C. Lee. Campbell Museum, Clemson University, Clemson, South Carolina (CUSC 1613). Second specimen from Belize; extends distribution within Toledo District ca. 51 km NE of earlier record near San Jose Village (Lee 1996, The Amphibians and Reptiles of the Yucatan Peninsula. Cornell Univ. Press, Ithaca, New York. 500 pp.).

Submitted by **STEVEN G. PLATT**, Wildlife Conservation Society, P.O. Box 1620, Phnom Penh, Cambodia, **JACOB A. MARLIN**, Belize Foundation for Research and Environmental Education, P.O. Box 129, Punta Gorda, Belize, Central America, and **THOMAS R. RAINWATER**, Lamanai Field Research Center, P.O. Box 63, Orange Walk Town, Belize, Central America.

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New Kentucky Amphibian and Reptile Distribution Records

OMAR ATTUM
BASEM ATTUM
and
PERRI EASON*
Department of Biology, University of Louisville
Louisville, Kentucky 40292, USA

**Corresponding author; e-mail: perri.eason@louisville.edu*

Generalized Kentucky distributions for many reptiles and amphibians have been previously documented (Barbour 1971). However, for many species specific distributional data are lacking, especially for the counties of northern Kentucky, also known as the Bluegrass Region (MacGregor et al. 1997; MacGregor, unpubl. data). We here document 29 new county records for amphibians and reptiles in northern Kentucky (USA). Kentucky Educational Wildlife Collecting Permits were obtained to collect reptiles and amphibians for this distribution survey. All specimens were deposited at the University of Louisville Museum (UL), and were verified by Peter Sherman. Common names are those standardized by Collins (1997).

Eurycea cirrigera (Southern Two-lined Salamander). ROBERTSON CO: Road 617, stream running alongside road, N38.27.860, W84.05.415. 11 June 1998. O. Attum and B. Attum. UL 10013. HENRY CO: McMannis Road, N38.33.407, W85.07.777. 30 August 1998. O. Attum and B. Attum. UL 10019.

Eurycea lucifuga (Cave Salamander). HARRISON CO: 237 Moore's Mill Road, N38.32.358, W84.12.854. 12 July 1998. O. Attum and B. Attum. UL 10038.

Plethodon glutinosus (Slimy Salamander). ROBERTSON CO: Blue Lick State Park under debris at campground. 11 June 1998. O. Attum and B. Attum. UL 10014.

Acris crepitans blanchardi (Blanchard's Cricket Frog). ROBERTSON CO: Road 539, N38.32.181, W84.03.770. 17 July 1998. O. Attum and B. Attum. UL 10039.

Bufo americanus (American Toad). BRACKEN CO: Road 19, N38.32.244, W84.10.033. 17 June 1998. O. Attum and B. Attum. UL 10028. ROBERTSON CO: Blue Lick State Park. Parking Lot, N38.26.294, W83.59.790. 11 June 1998. O. Attum and B. Attum. UL 10011. DOR. HARRISON CO: Havelandsville Road, N38.34.665, W84.14.033. 12 July 1998. O. Attum and B. Attum. UL 10020.

CARROL CO: General Butler State Park campground. 8 August 1998. UL 10024.

Bufo woodhousii fowleri (Fowler's Toad). HENRY CO: McMannis Road, N38.33.408, W85.07.777. 30 August 1998. O. Attum and B. Attum. UL 10021. CARROL CO: Buffalo Creek Road, N38.37.433, W85.02.464. 28 August 1998. UL 10025. HARRISON CO: Havelandsville Road, N38.34.474, W84.16.087. 12 July 1998. O. Attum and B. Attum. UL 10036.

Hyla versicolor/chrysoscelis complex (Gray Treefrog). ROBERTSON CO: Road 539, N38.32.786, W84.04.574. 17 June 1998. O. Attum and B. Attum. UL 10018. HARRISON CO: Havelandsville Road, N38.34.474, W84.16.087. 12 July 1998. O. Attum and B. Attum. UL 10037.

Rana catesbeiana (Bullfrog). ROBERTSON CO: Road 539, N38.32.181, W84.03.770. 17 June 1998. O. Attum and B. Attum. UL 10029. HENRY CO: Road 574, N38.31.859, W85.11.016. 30 August 1998. O. Attum and B. Attum. UL 10031. Tadpole.

Rana clamitans melanota (Green Frog). HENRY CO: McMannis Road, N38.33.407, W85.07.777. 30 August 1998. O. Attum and B. Attum. UL 10030. ROBERTSON CO: Road 539, N38.32.786, W84.04.574. 17 June 1998. O. Attum and B. Attum. UL 10017. GALLATIN CO: Goulds Road, N38.43.139 ,W84.56.997. 13 September 1998. O. Attum and B. Attum. UL 10023. DOR.

Chelydra serpentina (Common Snapping Turtle). ROBERTSON CO: BlueLick State Park, road leading to "future developments." 23 May 1998. O. Attum and B. Attum. UL 10035.

Terrapene carolina carolina (Eastern Box Turtle). ROBERTSON CO: Road 617, N 38.27.860, W84.05.415. 11 June 1998. O. Attum and B. Attum. UL 10026. Trampled by cattle. HARRISON CO: Havelandsville Road, N38.34.474, W84.16.087. 17 June 1998. O. Attum and B. Attum. UL 10027. DOR. CARROL CO: Gilgal Road, N38.36.978, W85.08.47. 13 September 1998. O. Attum and B. Attum. UL 10022. DOR.

Coluber constrictor constrictor (Black Racer). ROBERTSON CO: Blue Lick State Park entrance road, N38.26.294, W83.59.790. 11 June 1998. O. Attum and B. Attum. UL 10012. DOR.

Diadophis punctatus edwardsii (Northern Ringneck Snake). ROBERTSON CO: Blue Lick State Park under trash can behind cottages. 11 June 1998. O. Attum and B. Attum. UL 10034.

Elaphe obsoleta obsoleta (Black Rat Snake). ROBERTSON CO: Road 3196, N38.31.153, W84.07.289. 11 June 1998. O. Attum and B. Attum. UL 10010. DOR.

Lampropeltis triangulum triangulum. (Eastern Milk Snake). BRACKEN CO: Road 62, N38.30.081, W84.12.775. 17 June 1998. O. Attum and B. Attum. UL 10033. DOR. ROBERTSON CO: Road 617, N38.32.786, W84.04.574. 12 July 1998. O. Attum and B. Attum. UL 10015. DOR.

Regina septemvittata (Queen Snake). ROBERTSON CO: Road 617, N38.32.860, W84.05.415. 11 June 1998. O. Attum and B. Attum. UL 10016.

Thamnophis sirtalis sirtalis (Eastern Garter Snake). HARRISON CO: Road 27 South, N38.32.382, W84.17.180. 12 July 1998. O. Attum and B. Attum. UL 10032. DOR.

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New Records of Amphibians and Reptiles from Hardee County, Florida

STEVEN P. CHRISTMAN
CAMERON A. YOUNG
SHANNON GONZALEZ
KAREN HILL
GEORGE NAVRATIL
and
PABLO DELIS
Biological Research Associates, Inc., 3910 U.S. Rt. 301 North
Tampa, Florida 33619, USA
e-mail (SPC): chrstmn@aol.com
e-mail (CAY): cayrip@yahoo.com
e-mail (SG): gonzalez@biolresearch.com

We have compiled the following records from Hardee County in the central Florida (USA) peninsula, based on Ashton (1988). All specimens have been deposited in the Florida Museum of Natural History, University of Florida, Gainesville (UF), and all are new county records. Common names are those standardized by Collins (1997).

Siren lacertina (Greater Siren). SE 1/4 Sec. 7, T35S, R24E. 6 June 1998. C. A. Young. Verified by D. Auth. UF 115607–610.

Pseudobranchus axanthus (Southern Dwarf Siren). SE 1/4 Sec. 7, T35S, R24E. 6 June 1998. C. A. Young. Verified by P. Moler. UF 115613–614.

Scaphiopus holbrookii (Eastern Spadefoot). NW 1/4 Sec. 18, T35S, R25E. 9 May 1998. S. P. Christman and C. A. Young. Verified by D. Auth. UF 115619.

Pseudacris ocularis (Little Grass Frog). S 1/2 Sec. 21, T34S, R24E. 22 December 1998. S. P. Christman and S. Gonzalez. Verified by D. Auth. UF 116076–079.

Hyla squirella (Squirrel Treefrog). NE 1/4 Sec. 34, T34S, R24E. 17 October 1998. S. P. Christman and C. A. Young. Verified by D. Auth. UF 115620.

Osteopilus septentrionalis (Cuban Treefrog). SW 1/4 Sec. 7, T35S, R25E, ca. 1.0 mi W Peace River. 3 March 1999. S. P. Christman

and C. A. Young. Verified by D. Auth. UF 117505.

Eleutherodactylus planirostris (Greenhouse Frog). NW 1/4 Sec. 8, T35S, R24E. 18 May 1998. P. Delis. Verified by D. Auth. UF 115621.

Rana grylio (Pig Frog). S 1/2 Sec. 7, T35S, R25E. 10 June 1998. S. P. Christman. Verified by D. Auth. UF 115622.

Kinosternon baurii (Striped Mud Turtle). NW 1/4 of SE 1/4 Sec. 9, T35S, R24E. 15 June 1998. S. P. Christman and C. A. Young. Verified by D. Auth. UF 115623.

Deirochelys reticularia (Chicken Turtle). CR 663, 2.0 mi S jct SR 64. 11 June 1998. S. P. Christman. Verified by D. Auth. UF 115624.

Hemidactylus garnotii (Indo-Pacific Gecko). NE 1/4 Sec. 34, T34S, R24E. 17 October 1998. S. P. Christman. Verified by D. Auth. UF 115628.

Anolis sagrei (Brown Anole). NE 1/4 Sec. 34, T34S, R24E. 11 June 1998. C. A. Young. Verified by D. Auth. UF 115625.

Cnemidophorus sexlineatus (Six-lined Racerunner). NE 1/4 Sec. 12, T35S, R24E. 12 June 1998. S. P. Christman. Verified by D. Auth. UF 115629.

Seminatrix pygaea. (Black Swamp Snake). SW 1/4 Sec. 6, T35S, R24E. Brushy Creek floodplain. 20 April 1999. S. Gonzalez and S. P. Christman. Verified by D. Auth. UF 117593.

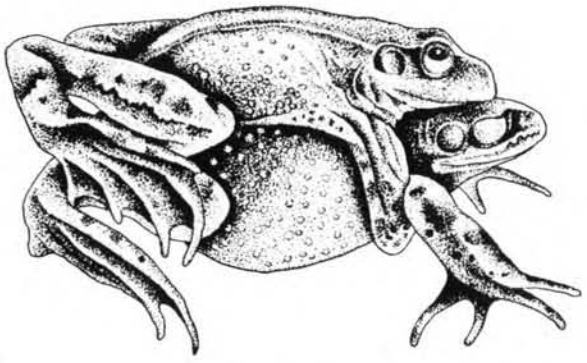
Storeria dekayi. (Brown Snake). NW 1/4 Sec. 6, T35S, R24E. Brushy Creek floodplain. 20 July 1999. S. Gonzalez and S. P. Christman. Verified by D. Auth. UF 119003.

Sistrurus miliarius (Pigmy Rattlesnake). CR 663, 1.0 mi S Ona. 20 October 1998. S. P. Christman. Verified by D. Auth. UF 115638.

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Rana temporaria (European Common Frog), amplectant pair. Illustration by P. A. Benson.

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New County Records of Amphibians and Turtles from the Western Highland Rim of Central Tennessee

A. FLOYD SCOTT
SCOTT SUTTON
and
SCOTT WILLIAMSON
Department of Biology and Center for Field Biology
Austin Peay State University
Clarksville, Tennessee 37044, USA
e-mail (AFS): scotta@apsu.edu

Recent field work on the western Highland Rim of central Tennessee, USA, has yielded several new county records and one substantial range extension for the state's herpetofauna. Most of these records, presented below, are from the contiguous counties of Houston and Humphreys, which border the east shore of Kentucky Lake (Tennessee River) between River Miles 74 and 118. One record is from the flood plain of the Cumberland River in Cheatham County. Records for amphibians were considered new if the species in question was not reported from a given county by Redmond and Scott (1996) or in literature having appeared since. Turtle records were deemed new based on a general search of the literature and range maps in Ernst et al. (1994), Mount (1975), Iverson (1977, 1992), Pritchard (1989), Lovich (1993), and Conant and Collins (1998). All collections were made by one or more of the authors and documented with photographs and/or voucher specimens deposited in the Austin Peay State University Museum of Zoology (APSU). Identifications were verified by David H. Snyder. Nomenclature and common names follow Collins (1997).

Ambystoma opacum (Marbled Salamander). HOUSTON CO: 150 m N of Billy Parchman Road at Tennessee Rt. 46, 10 km NE of Erin (36°22'01"N, 87°35'42"W). 21 November 1999. APSU 6056 (alcohol specimen). Adult found under rock near base of shallow forested ravine. New county record that fills gap between records in Dickson and Benton counties.

Ambystoma tigrinum (Eastern Tiger Salamander). HOUSTON CO: ca. 0.5 km SE of intersection of Old Tennessee Rt. 49 and Sine Road, 6.9 km SE of Erin (36°17'30"N, 87°37'31"W). 12 October 1999. APSU 5494 (alcohol specimen). One adult male under log among dead trees in abandoned hog lot, ca. 100 m from nearest pond. New county record.

Eurycea lucifuga (Cave Salamander). HOUSTON CO: Unnamed cave entrance along Brigham Branch, ca. 1.0 km upstream from confluence with Wells Creek, 3.5 km SE of Erin (36°20'45"N, 87°40'32"W). 13 October 1999. APSU 5495 (alcohol specimens). Two specimens collected from 17 observed around cave entrance. New county record.

Siren intermedia nettingi (Western Lesser Siren). CHEATHAM CO: flood plain of Cumberland River at River Mile 155, ca. 150 m N of Chapmansboro Road (36°17'56"N, 87°07'01"W). 22 March 1999. APSU 1678 (alcohol specimen). Two specimens taken from a palustrine wetland with emergent vegetation. New county record

that fills gap along Cumberland River between records from Montgomery and Davidson counties.

Bufo fowleri (Fowler's Toad). HOUSTON CO: Cedar Valley Road, 1.0 km S of Tennessee Rt. 49, 5.6 km SE Erin (36°17'47"N, 87°38'28"W). 1 September 1999. APSU 6051 (alcohol specimen). Juvenile found under rotting log in small wood lot. New county record that fills gap among records from five surrounding counties.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). HOUSTON CO: Cedar Valley Road, 1.0 km S of Tennessee Rt. 49, 5.6 km SE Erin (36°17'47"N, 87°38'28"W). 1 September 1999. APSU 6052 (alcohol specimen). Adult female found under rotting log in small wood lot. New county record that fills gap among records from five surrounding counties.

Acris crepitans blanchardi (Blanchard's Cricket Frog). HOUSTON CO: Sine Road, 1.1 km W of Old Tennessee Rt. 49, 6.0 km SE Erin (36°17'35"N, 87°38'08"W). 28 August 1999. APSU 6045 (alcohol specimen). One specimen taken from child's swimming pool; others heard in nearby ponds. New county record that fills gap among records from five surrounding counties.

Hyla cinerea (Green Treefrog). HOUSTON CO: East side of Kentucky Lake (Tennessee River) at back of Whiteoak Creek Bay, River Mile 81 (36°15'34"N, 87°53'36"W). 20 June 1999. APSU 6046 (alcohol specimen). Adult male found in buttonbush (*Cephalanthus occidentalis*) over water near shore; several others calling in vicinity. HUMPHREYS CO: Bakerville Road along outer edge of W flood plain of Buffalo River, 0.4 km S of Miller Road (35°58'53"N, 87°22'23"W). 5 June 1999. Adult male on road adjacent to palustrine wetland where others of the species were calling. APSU 6031 (alcohol specimen). New county records, the latter being the most upstream site for the species along Kentucky Lake.

Hyla chrysoscelis/versicolor complex (Cope's Gray Treefrog/Eastern Gray Treefrog). HOUSTON CO: Sine Road, 1.1 km W of Old Tennessee Rt. 49, 6.0 km SE Erin (36°17'35"N, 87°38'08"W). 24 August 1999. APSU 1396 (alcohol specimen). One specimen taken from child's swimming pool; others heard in nearby ponds. HUMPHREYS CO: Bakerville Road along outer edge of W flood plain of Buffalo River, 0.4 km S of Miller Road (35°58'53"N, 87°22'23"W). 5 June 1999. Adult male on road adjacent to palustrine wetland where others of the species were calling. APSU 6035 (alcohol specimen). New county records that fill N–S gap between Montgomery and Perry counties.

Pseudacris feriarum (Upland Chorus Frog). HOUSTON CO: 150 m N of Billy Parchman Road at a point 1.9 km NE of jct. with Tennessee Rt. 46, 10 km NE of Erin (36°22'01"N, 87°35'42"W). 21 November 1999. APSU 6047 (alcohol specimen). One specimen taken on a foggy morning (1100 h) from a fern glade (clump of *Polystichuma crostichoides*) near base of shallow, forested ravine; several others calling nearby, along with numerous *Pseudacris crucifer*. New county record that fills gap between Stewart and Humphreys counties.

Rana sphenocephala utricularius (Southern Leopard Frog). HOUSTON CO: 7.0 km SE of Erin, midway between Sine and Wolf Pit roads (35°58'53"N, 87°22'23"W). 6 September 1999. APSU 6055 (alcohol specimen). One juvenile individual captured at nearly dry farm pond; many others of the species present. New county record that fills gap among records from five surrounding counties.

Macroclemys temminckii (Alligator Snapping Turtle). HOUSTON CO: back of Whiteoak Creek Bay on East side of Kentucky Lake (Tennessee River) at River Mile 81 (36°15'18"N, 87°53'03"W). 31 December 1995. APSU 5526 (color slide). Adult male (midline carapace length 534 mm, plastron length 640 mm, preanal tail length 275 mm, weight 58.7 kg). Captured after it was discovered eating a freshly killed mallard duck; released at capture site after being measured, weighed, photographed, and fitted with a radio transmitter. Four other adult individuals (1 male and 3 females) have been documented from the lower Whiteoak Creek area since this discovery, the latest in June 1999. New county record that fills gap in distribution along the Tennessee River between records from Stewart and Humphreys counties.

Sternotherus minor peltifer (Stripeneck Musk Turtle). HOUSTON CO: lower Whiteoak Creek, 0.5 km downstream from Whiteoak Road bridge (Magnolia Bridge) (35°15'30"N, 87°52'30"W). 11 June 1999. APSU 6049 (color slide). Adult male (carapace length 90 mm, plastron length 53 mm) taken with dip net over firm mud substrate at depth of 1 m. Two additional individuals, one a juvenile (carapace length 53 mm, plastron length 33 mm), the other an adult female (carapace length 91 mm, plastron length 66 mm) captured and released at the same locality a few days later. These records come from an area that is ca. 160 km N of the nearest known population in Lauderdale County, Alabama (Mount 1975), and represent the only records for this species below Pickwick Dam in the Tennessee River drainage.

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BOOK REVIEWS

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Contributions to the Herpetology of the Belgian Congo, by Karl P. Schmidt and G. K. Noble, with Introductions by D. G. Broadley and J. C. Poynton. 1998. Society for the Study of Amphibians and Reptiles, Ithaca, New York (in cooperation with the Herpetological Association of Africa). 780 pp. (irregularly paginated). Hardcover. US $65.00. ISBN 0-916984-45-1.

BILL BRANCH
Port Elizabeth Museum, P.O. Box 13147
Humewood 6013, South Africa
e-mail: pemwrb@zoo.upe.ac.za

I am a herpetologist in a small museum sitting at the cold end of a hot continent that's noted for neither its infrastructure nor its surplus finance. As such the Facsimile Reprint series of the SSAR is a godsend. The title page of this volume, the first to be devoted to African herpetology, notes that it was produced in cooperation with the Herpetological Association of Africa. This is generous, for in truth the finance and publishing support were wholly SSAR, and I take this opportunity to thank them for their magnificent service, in this and other instances, to the herpetological community.

Schmidt and Noble's reviews of the *Herpetology of the Belgian Congo* (here jointly abbreviated to HBC) were originally published separately in the *Bulletin of the American Museum of Natural History*. The reptiles were reviewed by Karl P. Schmidt and appeared in two parts; Part 1 – Turtles, crocodiles, lizards and chameleons in vol. 39 (1919), and Part 2 – Snakes in vol. 49 (1923). These were followed by G. K. Noble's review of the amphibians (vol. 49, 1924). All issues have long been out of print, although the *AMNH Bulletin* is well known and not too difficult to obtain via normal library services. Therefore, the commitment of the SSAR to collating these contributions into a facsimile reprint cannot have been based on any great inaccessibility of the originals. Not, at least to European and American researchers. Rather, it seems to reflect a growing appreciation of the neglect of African herpetology, and the desire of the SSAR to stimulate interest in a unique herpetofauna. In keeping with their other recent facsimiles, SSAR has invited leading authorities (Don Broadley, reptiles; J. C. Poynton, amphibians) to review and update the taxonomy of the work, and to present updated checklists and biographic notes on the authors.

Most of the material that forms the basis of HBC was collected during the AMNH Congo expedition. This was the longest and largest colonial expedition to the "Dark Continent," and it lasted for six years (1909–1915) and covered nearly 15,000 miles, mostly on foot or by canoe (for details see Osborn 1919). This expedition yielded over 4000 herpetological specimens. For the most part the journey passed through colonial "Belgian Congo," subsequently Zaïre and more recently the Democratic Republic of the Congo (DRC). Both Schmidt and Noble, however, used the extensive HBC collections as a base from which to review existing knowledge of the regional herpetofauna. Neither took part in the prolonged field work. This fell under the control of Herbert Lang, who was later to undertake other important expeditions on the continent (e.g., the 1930 Vernay Lang Kalahari expedition).

Studying the HBC collection was the young Schmidt's first appointment, undertaken as a temporary assignment when he was only 26 and still an undergraduate student at Cornell University. Possibly stimulated by the excellent field notes and photographs of Lang, Schmidt brought a fresh approach to the HBC that resulted in it becoming one of the first modern treatments of a herpetofauna. Species became ecological components of their landscape, and not simply typical specimens and taxonomic constructs. It was a revolutionary integration of ecology and taxonomy, and reflected the movement away from the 19th century museum-based taxonomic treatise. It heralded a herpetology driven by field work and the awareness of biogeographic realms and ecological processes.

This approach was not obvious in the work of European or African museum scientists at the time, or even later. In Africa, Arthur Loveridge (Harvard) collected detailed natural history notes during his numerous African expeditions, but was rarely deflected from his monographic systematic reviews. Similarly, Vivian FitzSimons (Pretoria) also failed to embrace this new approach, which was surprising given his involvement in the Vernay Lang Kalahari expedition. In fact, in the past century, J. C. Poynton was the most notable student to use his taxonomic studies as a basis for detailed zoogeographic analysis of African amphibians. For reptiles, however, Schmidt's preliminary studies, including his simple maps of African lizard and snake distributions, remained the only overview attempted during the 20th century. Fortunately both Broadley and Poynton are currently involved in studies to redress this situation.

Schmidt commented (p. 391) on "... the vital influence of the plant distribution in determining that of African animals". In effect, he recognized the obvious division into savannah and forest biota, with the result that "Lines of equal rainfall, and not isotherms, are the chief climatic factors in African distribution." Schmidt was, like most herpetologists of his era, based in a northern temperate climate. Reviewers from tropical habitats, more familiar with the dominance of wet and dry seasons on the distribution and activity of faunas, would have been less surprised.

Given the era and its colonial perspective, it may surprise some readers to discover just how modern many of Schmidt's comments remain; e.g., "...it is possible that the genera *Coleonyx, Eublepharis, Hemitheconyx* and *Holodactylus* will be found to form a natural (monophyletic) group among the simpler geckos..." (p. 16). Knowledge of the Cordylidae (Zonuridae) was still formative at the time, with only seven *Cordylus,* three *Chamaesaura*, three or four *Platysaurus* and a single *Pseudocordylus* species known. Despite this, Schmidt corrected Cope's description of *Zonurus (= Cordylus) tropidosternum* from Madagascar, and was aware that the family was characteristically Afrotropical (Ethiopian) and had its evolutionary epicenter (was 'entogeneic') in the subcontinent (p. 18). It is an observation that has been subsequently refined by Mouton and Van Wyk (1997).

Obviously, in the intervening eight decades since Schmidt's reviews appeared, some of his conclusions have been challenged. Although he doubted that the webbed feet of *Palmatogecko* were suitable for burrowing (p. 16), Haacke (1976), among others, has

described in detail the daily burrow excavation of this beautiful gecko. Similarly, the distribution map (p. 25) for *Aporosaura anchietae* (= *Meroles*), then known from only a few specimens, extends too far north and too far inland. It is endemic to the shifting dunes of the Namib Desert (Branch 1998).

Broadley's admirable introduction to Schmidt's reviews gives an update of the taxonomic status of names discussed by Schmidt, the first reptile checklist for the country, as well as a bibliography of post-1963 herpetological literature for the DRC (the earlier period is detailed in Laurent 1965). A number of recent taxonomic changes affect Broadley's DRC checklist, most initiated by himself. He recently revived *Python natalensis* as a southern species (Broadley 1999), with probable sympatry occurring in Kenya, Tanzania, and Kiva Province (DRC). Similarly, *Elapsoidea boulengeri* was also validated as a full species (Broadley 1997), and enters extreme eastern Kiva Province (Tipoyo), although this was not noted by Broadley in his regional breakdown of the DRC herpetofauna. The remaining DRC records of *E. semiannulata* (from the southern, western, and central regions) are referable to *E. s. moebiusi* (Broadley 1997), which itself may best be regarded as an allopatric, phylogenetic species.

The races of other polytypic species, e.g., the *Mabuya striata* complex and *Thelotornis capensis*, are also to be treated as a suite of sibling, phylogenetic species (Broadley, pers. comm, October 1999), and this approach has been adopted in other parts of the checklist; e.g., *Rhinotyphlops mucruso*, which was previously treated as a race of *R. schlegelii* (Roux-Estève 1974). Hughes (1997) has indicated that *Dasypeltis atra* may occur in Eastern DRC, and also noted that southern and eastern African populations of the brown house snake, commonly referred to *Lamprophis fuliginosus*, may better be referred to *L. capensis* (Duméril and Bibron 1854). The status of populations of brown house snakes in southern DRC remains unresolved. The tree agama genus *Acanthocercus* is misspelled (as *Acanthocerus*), but this is my fault as it simply perpetuates a mistake occasioned by my poor proofing of various publications (e.g., Branch 1998).

At the time of Noble's review of HBC amphibians very little comparative African material existed in American museums. Noble therefore completely reviewed African amphibian literature, and "in order that this work may not be lost" appended both a detailed bibliography and a checklist of all African amphibians to his HBC review. For many years these remained the main summaries of the African Amphibia. The incorporation of Lang's detailed habitat notes, supplemented with stomach content details, added greatly to the biological value of Noble's review. Based on details from *The Phylogeny of the Salientia* (Noble 1922), the introductory sections for each family contained summaries of their phylogeny, distribution, and content. They still serve as useful historical summaries.

Although Noble did not discuss caecilians, several species are now known from the DRC and adjacent regions, and Poynton lists three species in his checklist. To these may be added a fourth—in a recent paper Nussbaum and Pfender (1998) added *Schistometopum thomense* to the DRC herpetofauna.

Noble, like so many subsequent workers despaired with hyperoliids: "In no genus of frogs are there so many undefinable, intergrading species as in *Hyperolius*. It is the most dominant tree frog in Africa and yet systematically it is the most unsatisfactory" (p. 250). Little has changed, and the state of hyperoliid systematics remains chaotic, despite fragmentary insight from the detailed field work of Schiøtz in the north and Channing in the south. It is, therefore, not surprising that there are numerous differences among Noble's treatment of hyperoliids, that in Poynton's checklist, and that in the recent review of African tree frogs by Arne Schiøtz (1999). The latter provisionally treats *Afrixalus upembae* (Laurent 1941) as a valid taxon; it is not included in Poynton's checklist, where it was presumably subsumed under *A. fulvovittatus* (of which it was originally described as a southern race). Poynton follows Laurent (1972) in treating Noble's *H. langi* as a race of *H. platyceps*. However, Schiøtz (1999) continues to recognize *H. langi*, albeit noting that "The status of this form is not clear." He also considers the single DRC record of *H. bolifambae* to be doubtful. The status of many of Laurent's (1943, 1951, 1964 and 1979) other DRC *Hyperolius* (e.g. *H. ferrugineus, H. ghesquieri, H. inornatus, H. obscurus, H. polli, H. polystictus, H. robustus., H. sankuruensis, H. vilhenai, H. leleupi* and *H. xenorhinus*), many of which remain known only from the types (described from single specimens or small samples from single localities), remains problematic. Resolution will depend on detailed fieldwork in a region of continued political strife and collapsed infrastructure. Poynton suggests that *Hyperolius acutirostris* and *H. pardalis* both occur in the western region of DRC, but this is conjecture as they are currently known only from Cameroon (Schiøtz 1999).

Like Broadley, Poynton has included a comprehensive updated bibliography in his contribution. I noted only one relevant title overlooked—Nussbaum and Hinkel (1994).

When they first appeared, Schmidt and Noble's reviews formed essential references, even for herpetologists working in northern and southern Africa. With the updated systematics, and appended bibliographies and checklists of Broadley and Poynton, their value is enhanced. This well-produced, strongly-bound, and aesthetically-pleasing SSAR facsimile reprint is a must for all herpetologists interested in the African fauna.

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Monitors, the Biology of Varanid Lizards, 2nd ed., by Dennis King and Brian Green. 1999. University of New South Wales Press, Ltd., Sydney 2052 Australia (published in the U.S. by Krieger Publishing Co., Malabar, Florida 32950-3323, USA). vi + 116 pp. Softcover. US $22.50. ISBN 1-57524-112-9.

SAMUEL S. SWEET
Department of Ecology, Evolution and Marine Biology
University of California, Santa Barbara, California 93106-9610, USA
e-mail: sweet@lifesci.ucsb.edu

Billed as an update of *Goanna, the Biology of Varanid Lizards* (1993), *Monitors* is in fact a limited revision. While remaining true to the original structure and emphases, the text has been refined or expanded throughout to reflect additions to the literature through mid-1999. This has been done very carefully indeed, and few if any significant citations have been overlooked. Unfortunately, the production schedule did not enable the incorporation of work published in the proceedings of the second international varanid conference (Horn and Bohme 1999), though there are brief references to some of the findings reported there.

Most of the revisions in this volume are relatively minor, and are evident only by direct comparison with the original version. The principal augmentations are a short section on foraging behavior, and a new chapter on endo- and exoparasites. Since the original edition was not widely available outside of Australia, there is merit in this conservative approach, but if you have the original edition the case for acquiring this revision is not as strong as it might be.

The book's stated aim is to interpret the research literature on the biology of varanids in a form accessible to the general public. It succeeds at this level, being both more comprehensive and more accurate than are other recent semitechnical books on monitors. The thematic thread is a focus on the biology of *Varanus rosenbergi*, which has been the subject of considerable physiological and ecological research by the authors. With the exception of some newly-reported information on the behavior of hatchling *V. rosenbergi*, these sections are essentially unchanged. The bulk of the new material thus consists of brief entries describing new work with other species. This has been faithfully done throughout the book's 11 chapters (on phylogeny, feeding, breeding, general behavior, thermal biology, respiration, water balance, energetics, parasites, and conservation and management).

Individual chapters generally provide enough introductory material to guide the non-specialist reader, but will be on the cusp of value to individuals already familiar with the topics. The presentation is more often descriptive and enumerative than analytical, commonly with general statements being followed by a parenthetical listing of species known to conform, and little further. The result is that a reader would often like to know more. This is sometimes provided under another subheading elsewhere in the book, but seldom with the linkages necessary to appreciate how the features are interrelated.

In my view, the strictly topical format is unforgiving. By partitioning the coverage, the opportunities to present an integrated outlook are orphaned for lack of the appropriate categories. Integration is most conspicuously absent at two levels: there is no formal coverage of the species diversity of varanids beyond a list in one table, and there is scant consideration of the roles of varanids in communities. An interested reader would have to look elsewhere for help in identifying varanids, or to learn which species might be expected in a given region; worse, the suggested readings omit all references of this sort! While it is not intended as a field guide, I do think that the book misses the mark by failing to provide an interested general reader with the means to satisfy these most basic of questions about monitors. Such a section on diversity could include much of the published information on general natural history that is presently treated in piecemeal fashion. In a similar vein, a chapter on "varanids in communities" would have provided a forum for a broader coverage of the comparative ecology of monitor lizards. Here the focus on *V. rosenbergi* as a largely allopatric, temperate-zone species cannot convey much about the excitement of the rich varanid communities of lower latitudes.

The new chapter on parasites of varanids is considerably more integrative precisely because it is comparative. It ably summarizes a considerable body of work on ticks and nematodes that is not widely known among herpetologists, but should be. In short, varanids harbor a diversity of ticks and nematodes, but with some unusual patterns both of regional occurrence and of the distribution of parasites among varanid species. This is fascinating material if you already know the ranges and ecologies of the monitor species discussed, but it will be difficult for the general reader to ascertain what the chapter conveys in the absence of a taxonomic or distributional background.

The final chapter on conservation and management stresses the potentially adverse effects of the extensive trade in varanid skins originating in Africa and southeast Asia, and documents that national and CITES regulations are widely stretched, if not flouted. This has been an issue for many years, and both the reported export volumes and the evident shifts in countries providing the largest consignments suggest that regional overharvesting is at hand.

By contrast, the Australian species are regarded as being secure, and well protected by "generally well enforced" legislation. This is surely true in the sense that Australian species do not figure into the skin trade, nor are their distributions under general pressure from habitat alienation. However, the new plates in the revision document an issue that the text does not discuss: five of the nine new photographs are of hatchlings or juveniles of Australian species that are being bred in Europe. While I cannot swear to it, I do not think that species such as *Varanus glauerti* or *V. pilbarensis* have ever been legally exported from Australia alive, yet they and most others are sold openly in Europe (and in the U.S. via European sources). This is incongruous in a book intended to foster an appreciation of the biology of varanids and an understanding of conservation issues.

The book is carefully produced, with very few typographical errors, and includes a list of suggested readings that provides an entry into the recent literature.

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A Kansas Snake Community: Composition and Changes over 50 Years, by Henry S. Fitch. 1999. Krieger Publishing Company, 1725 Krieger Drive, Malabar, Florida 32950, USA. 165 pp., 34 color photos, 37 figures, 106 tables. Hardcover. US $42.50. ISBN 0-89464-996-5.

RICHARD SHINE
Biological Sciences A08, University of Sydney
New South Wales 2006, Australia
e-mail: rics@bio.usyd.edu.au

If you are after a balanced evaluation of this book, look elsewhere. I am not capable of providing one. Like many (most) other snake ecologists of my generation, my postgraduate years were inspired by the herculean efforts of Henry Sheldon Fitch. His monographic publications on ecological and life-history characteristics of reptiles and amphibians of the University of Kansas Natural History Reservation (now appropriately named in honor of the man himself) were virtually the only references on snake ecology available in those dim and distant days (i.e., about 30 years ago). The situation is very different today, with snakes having become popular subjects of ecological research. Part of the reason for that transition involves methodological advances (snakes are ideally suited for radiotelemetry) and a general shift in community attitudes (increasingly, snakes are seen as worth conserving and hence, worth studying)—but another strong factor was the pioneering work by Henry Fitch. It is difficult to overstate the degree to which Fitch's methodological and conceptual innovations changed the field of snake ecology.

Well into retirement, Fitch continues to break new ground. In a research field where a six or eight-year study is generally regarded as "long-term," the 50-year data sets enshrined in this book are likely to break all records for all time. As resource managers grapple with the difficulty of translating "pure" research into conservation strategies, the value of these long-term data sets is becoming increasingly apparent. Herpetological ecology is fortunate indeed to have had prophets such as Henry S. Fitch and Donald W. Tinkle, who stimulated the next generation to maintain long-term projects at their study areas. The persistence required for such efforts is considerable, especially in light of three-year funding cycles from most grant agencies.

In the case of the Fitch Reservation, one of the most important benefits of the long-term study is to document the ways in which successional changes in the system (brought about by the cessation of livestock grazing in 1950) modified the vegetation of the reserve, and thus the availability of prey species and shelter sites for particular taxa of snakes. For example, the rapid post-grazing increase in herbaceous vegetation stimulated an increase in rodent numbers and thus, the abundance of copperheads (*Agkistrodon contortrix*) over the next five years. The subsequent encroachment of woody vegetation reduced small mammal numbers, with a consequent decline not only in copperhead numbers, but also in mean adult body sizes of the snakes. Those of us who go out and sample study areas over brief periods of time, and then interpret the determinants of body sizes and abundances from such data, would do well to reflect upon the immense temporal (as well as spatial) heterogeneity detected in Fitch's study.

Fitch's book on Kansas snake communities is a richly-illustrated account of the major findings from his studies over the period 1948 to 1997. During that period, he accumulated > 32,000 capture records of 18 snake species. Some taxa were captured very frequently, whereas others were found very infrequently, or only at certain times, in certain places and by particular methods. For example, Fitch found only three western earth snakes (*Virginia valeriae*), and only one redbelly snake (*Storeria occipitomaculata*) over the entire study! These extraordinarily low capture rates convey an important message for those who use short-term surveys to assess the presence or absence of a rare species (especially to decide if the next housing development can proceed!). For the common species, Fitch assembled a remarkable data set on a wide and eclectic diversity of variables—from behavior to diet, from thermal biology to spatial ecology, from food habits to parasite loads, from reproduction to growth trajectories, and from abundance to long-term responses to the profound vegetational shifts that occurred during the study. The text is organized species-by-species, and is well illustrated with tables, graphs and photographs. The book is not simply a re-hash of Fitch's many publications on the snakes of the Reserve. Many of those papers appeared decades ago, whereas the book is based on analyses up to the present. In many cases, the additional years of study have added substantially to the overall information on these species. For example, Fitch's classic monograph on copperheads was published in 1960, but the current book includes data on this species from most years up to 1997.

The prose is clear and the writing is tight. There are no flights of poetic fancy, but one is left with a vivid impression of a man who knows these animals and their habitats with an intimacy that few people ever achieve. The book also includes abundant references to published literature on these taxa, especially with respect to the ways in which the Kansas populations differ from those of conspecifics from other areas. The encyclopedic grasp of this litera-

ture is not surprising, from the man who wrote definitive reviews of topics such as reproductive cycles and sexual size dimorphism in reptiles (1970, 1981).

The strongest comparison with Fitch's book is surely Hajime Fukada's 1992 overview of his Japanese studies, "Snake Life History in Kyoto." Like Fitch, Fukada had to deal with low levels of funding and little external recognition of the value of his science. Like Fitch, he developed many of the techniques that are in common use today in field studies on snakes. And like Fitch, his study areas changed dramatically over the course of his research, to the point that snake numbers fell so low that further work was unproductive. In the current research environment, there is substantial pressure on scientists to conduct their studies quickly, then publish and move on to the next problem. Fitch was doubtless exposed to similar pressures: his studies did not enjoy popular acclaim until long after they had begun. Today, however, there is universal agreement among snake biologists that the lessons learned on this small reservation in Kansas have played a seminal role in the scientific development of our discipline. This volume bears eloquent testimony to that role, and to the monumental accomplishments of a stubborn individualist.

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Guide des Serpents et Amphisbènes de Guyane, by F. Starace. 1998. Ibis Rouge Editions, Guadeloupe, Guyane. 452 pp. Softcover, ca. US $68.00. ISBN 2-911390-27-x.

MARCIO MARTINS
Departamento de Ecologia Geral, Instituto de Biociências, Universidade de São Paulo, Caixa Postal 11461, 05422-970 São Paulo SP, Brazil
e-mail: jararaca@ib.usp.br

This new book by Fausto Starace, a French geographer, appeared about ten years after the publication of Chippaux's (1986) book on the snakes of French Guiana. It is a paperback printed on good quality paper and treats the 95 snakes and three amphisbaenians known to occur in French Guiana (although the author suggests that three more amphisbaenians and several additional snakes may also occur in the country).

The book begins with a 24-page section that illustrates and describes in detail the diverse habitats found in French Guiana. This section ends with a short text on the native people of French Guiana.

The first section is followed by a short, illustrated section in which Starace provides comments on snake classification, dentition types, and taxonomic characters used to identify snakes and amphisbaenians, and gives suggestions on how to use the book. This is followed by the 344-page section of species accounts. These in turn are followed by short sections (some detailed and interesting) on many subjects: collecting localities; snake envenomation (by V. Debons), collecting methods, biogeography, biology, behavior, biotopes and frequency of snake sightings, ethnoherpetology, legislation on conservation of reptiles of French Guiana, and a short conclusion with a review on the present knowledge of French Guianan snakes and amphisbaenians. The book terminates with a short glossary of scientific words used in the book (many of them pertaining to the vegetation), a literature cited section, an index of scientific names, and a table of contents.

Species accounts are preceded by summaries (diversity, natural history, gross morphology, and taxonomy) on the general group, family, and genus, as well as keys for identification (at all levels). Starace provides an English version for all keys (following those in French). In many keys, genera and species that the author thinks may occur in French Guiana are included, some of them very likely based on their Guyanan distribution (e.g., *Apostolepis*, *Atractus torquatus*, *Liophis poecilogyrus*, *Micrurus spixii*). Accounts of colubrids are presented in an artificial, outdated classification based solely on dentition types. This splits species from natural, monophyletic groups (e.g., snakes of the tribe Xenodontini appear both within the aglyphous and opisthoglyphous groups; e.g., *Xenodon* in the former and *Erythrolamprus* in the latter). No comment is made about recent systematic arrangements within the colubrids, and no subfamilial or tribal names are cited. Recent taxonomic changes are also omitted (e.g., *Corallus hortulanus* rather than *C. enhydris*; the genera *Taeniophalus* and *Xenoxybelis*; see review of these changes in Martins and Oliveira 1999).

In each species account Starace provides a list of synonyms, type locality, common name (none in most instances), vernacular names (including local native names in four languages, as well as Portuguese), description (only color pattern), size, sexual dimorphism, habits, diet (including effects of bites in humans), reproduction, habitat (including macrohabitat), distribution, number of specimens collected, and a short abstract in English. The accounts also include a small distribution map for French Guiana and a useful table with 13 characters based on lepidosis. At the end of each account, the author also provides a classification based on the dentition type followed by a comment on the potential danger of a bite for humans. One to five color photographs or a (generally poor) drawing of the head and neck (when no photograph is available) illustrate each account. For many species the photographs show different color morphs, ontogenetic variation in color pattern, and the venter. Most of these 179 photographs are of good quality and are very useful for identification.

The text of the species accounts is a mixture of good, substantiated data and dubious and even probably incorrect statements, especially about natural history. Original, useful data on behavior, reproduction, habitat, and microhabitat are provided in several accounts. On the other hand, original diet data are only rarely provided. Only in a few intances are references to literature containing original data cited. The author fails to provide the number of individuals on which most statements dealing with activity time, microhabitat, habitat, and diet are based.

Dubious statements about diet are especially common in the text. At least in part, Starace's statements seem to be based on unsubstantiated food records from the literature (e.g., Chippaux 1986; Cunha and Nascimento 1978, 1993; Wehekind 1955). Because the author provides neither literature citations nor specimen data that could substantiate his statements, most of the informa-

tion on diet is useless. Furthermore, in some instances the author provided apparently unsubstantiated guesses about food items. A good example is in the first account, on *Amphisbaena alba*. Starace states that its diet is composed "essentially of insects, arthropods, earthworms, and certainly of snakes of small size." What does "certainly" means in this context? Did the author find prey remains that could most probably be of a snake? Or is he just guessing that *A. alba* could eat small snakes?

To minimize the perpetuation of those putatively incorrect statements about the diet of several Amazonian snakes, I here provide a list of those that appear in Starace's book: birds and frogs in the diet of *Corallus caninus* (only mammals and lizards were found, according to Henderson 1993); lizards for *Atractus* spp. (apparently specialized on earthworms and arthropods; reviewed in Martins and Oliveira 1993; but see Chippaux 1986: Table VI); birds and mammals for *Chironius carinatus*, *C. fuscus*, *C. multiventris*, and *C. scurrulus* (all apparently specialized on amphibians and lizards; see Dixon et al. 1993; but see a record of a bird for *C. fuscus* in Beebe 1946; see also Wehekind 1955); birds and lizards for *Dendrophidion dendrophis* (a frog specialist; reviewed by Martins and Oliveira 1999); lizards for *Liophis typhlus* (apparently a frog specialist; reviewed by Martins and Oliveira 1999); mainly birds and mammals for *Siphlophis cervinus* (mainly lizards; reviewed by Prudente et al. 1998); birds for *Xenodon severus* (apparently a frog and lizard specialist; Beebe 1946; Dixon and Soini 1986; Duellman 1978; but see Cunha and Nascimento 1993); birds for *Xenoxybelis argenteus* (a frog and lizard specialist; Duellman 1978; Martins and Oliveira 1999; but see Chippaux 1986: Table VI); and birds for *Lachesis muta* (a mammal specialist; reviewed by Martins and Oliveira 1999).

Starace's book clearly is more directed to lay people than to scientists. However, despite some dubious and probably incorrect information on natural history, I recommend the book to herpetologists for the following reasons: 1) It is a very useful field guide for identification of northeastern Amazonian snakes (most species also occur in other Amazonian regions), especially because of the color photos, keys, and tables with scale counts; 2) Starace provides a large amount of good quality information on natural history (except for diet in some accounts; see above); 3) There are useful descriptions of the habitats of French Guiana, some of which characterize wide areas of northern South America.

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A Field Guide to the Snakes of Borneo, by Robert B. Stuebing and Robert F. Inger. 1999. Natural History Publications (Borneo), Sdn. Bhd., A913, 9th Floor, Wisma Merdeka, P.O. Box 13908, 88846 Kota Kinabalu, Sabah, Malaysia. (e-mail: chewlun@tm.net.my). viii + 254 pp. RM 150 (approx. US$ 41.00), Hardcover; RM 120 (approx. US$ 33.00), Paperback. ISBN 983-812-031-6 (Paperback); ISBN 983-812-038-3 (Hardcover).

INDRANEIL DAS

Institute of Biodiversity and Environmental Conservation
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak, Malaysia
e-mail: idas@mailhost.unimas.my

This book is the companion volume to *The Field Guide to the Frogs of Borneo*, written by the same team of authors (Stuebing and Inger). Given the scarcity of literature on the herpetology of Southeast Asia in general, and on snakes in particular (there had been no update on the snake fauna of the island of Borneo since De Rooij, 1917), the present work will be a great help, not only to biologists (many of them local students, without access to literature, such as the work of De Rooij, which, after all, does not include color photos), but also tourists, conservationists, and local laypeople. Technically, this is a well-produced work, in both paperback and hardcover (with dust jacket) editions, in the usual high standards of printing that characterize publications of Natural History (Borneo) Publications Sdn. Bhd. (which, apart from the frog and snake books already mentioned, have also published an introductory text on the natural history of Sabah's herpetofauna, and a reprint of the 1966 monograph to the Bornean amphibian fauna by Inger).

The front cover photograph of the snake book shows a *Trimeresurus popeorum*, the back cover illustrates a *Bungarus fasciatus*. Separate chapters include an introduction, a checklist, general aspects of snake biology, including adaptations and ecology, conservation, the relationships between snakes and humans on Borneo (which includes a small section on snake bite treatment), a field key to the species (using, whenever possible, col-

oration and other external features), and the species accounts, each typically 1–2 pages long, rounding out with an appendix of vernacular names of snakes and a short list of references. Many species have been illustrated for the first time. The photographs were provided by a large number of local and foreign biologists; their quality ranges from average (understandable, given that it is notoriously difficult to take a good photograph of uncooperative, fast-moving, dark-colored snakes) to startling (e.g., *Ahaetulla prasina* swallowing a lizard, p. 117). Bornean rarities illustrated range from the bizarre *Xenodermus javanicus* (p. 82) to the beautiful *Amphiesma flavifrons* (p. 169). There are a couple of misidentifications: the photograph of *Enhydris plumbea* on p. 93 is actually that of a *Xenopeltis unicolor* and those identified as *Zaocys fuscus* (p. 167) are actually *Z. carinatus*.

Other errors of omission and inconsistencies are enumerated here by topic, with the hope that these are removed if any subsequent editions are produced.

Partial or incomplete information.— For some species, detailed extralimital distributional information is provided; for others, only a brief mention that it is found in Southeast Asia or elsewhere. For example, the western part of the distribution of *Dendrelaphis pictus* includes Nepal, India, Bangladesh, and Myanmar, besides other countries mentioned. Other species that have ranges significantly larger than indicated include *Laticauda colubrina* and *Homalopsis buccata*. Patronyms are detailed in some instances, short in others. *Oligodon annulifer,* said to be known only from the unique holotype from Sabah, was re-collected in Batu Apoi, Brunei Darussalam (Das 1995). Also known from Brunei are *Ophisthotropis typica* and *Hydrablabes periops,* both of which are represented by museum specimens. The only other Sunda record of *Kolpophis annandalei* was thought to be from Sumatra, rather than Java (Das 1993). Given the confusion between *Trimeresurus borneensis* and *T. puniceus*, a sentence could be added here on the similarities between the two, and that the old Bornean reports of *T. puniceus* in fact refer to *T. borneensis*. There is published information on the diet of *Cylindrophis ruffus* in the wild, contrary to Stuebing and Inger, that indicates that it is a specialized snake-eater (see for instance, Shelford 1916:78; Smith 1943:97; Greene1997:161).

Problems with nomenclature and taxonomy.—Some taxonomic and distributional details of individual species are not made clear. Perhaps the most surprising of these is the allocation of *Xenelaphis hexagonotus* in the Xenodermatinae, rather than Colubrinae (p. 80). In the section on *Lycodon aulicus*, the species referred to and illustrated is *L. capucinus*, which earlier workers (e.g., Smith 1943) had considered a subspecies of *L. aulicus*. Taylor and Elbel (1958) and subsequent workers have treated it as a distinct species, and the Borneo record helps fill in the gap in its distribution. *Ophisaurus buettikoferi* is rendered as *Ophisaurus büttikoferi* (p. 3). Other inconsistencies include the allocation of *wagleri* (correctly) to *Tropidolaemus* (p. 14, 233, 235) and (incorrectly) to *Trimeresurus* (p. 28). A couple of species allocated to *Pareas* in this work (*laevis* and *malaccanus*) have been allocated to *Internatus* by Rao and Yang (1992), a usage followed by David and Vogel (1996). *Gongylosoma* Fitzinger, 1843 was revived from synonymy by Leviton (1964) for several Asian species previously referred to *Liopeltis*, including (in the present work) *G. baliodeirum* and *G. longicauda*.

Problems with type localities.—Page 91 gives the type locality of *Cerberus rynchops* as "?Ganjam?" Schneider's 1799 description of the species, based on watercolors in Russell (1796) was indeed from Ganjam (in Orissa State, southeastern India). The type locality of *Ophiophagus hannah* (Cantor 1836), given as unknown (p. 199), was, according to the original description, from "Sunderbuns" (= Sunderbans, at present a part of West Bengal State of eastern India and Bangladesh) and "jungle not far from Calcutta" (at present, Kolkata, West Bengal State, eastern India). The type locality of *Bungarus fasciatus*, which the authors mention as being Bengal, is, in fact, given in Russell (1796) as "Mansoor Cottah, Bengal" (at present a seaport ca. 24 km south of Ganjam, Orissa State, Southeast India), and not in the modern Indian state of Bengal.

Derivation of scientific names.—Derivations of some snake names are given as unknown or have erroneous etymology. For *Ramphotyphlops braminus*, the species name is the Latinized form of the word Brahmin (a caste among Hindus), perhaps in allusion to its brown coloration (the authors guess that the word is derived from Hindi). The derivation of the name *Chrysopelea paradisi* H. Boie in: F. Boie, 1827, can be either from the Latin ('paradisus') or the Greek ('paradeisos'), meaning an enclosed park ; it is probable therefore that the holotype was found in a park (and has nothing to do with paradise, as given in the work); the derivation of the genus *Bungarus* (as in *Bungarus fasciatus*) is from the Telugu vernacular, in which *Bungarum pambah/pamu* means 'golden snake,' and is not "New Latin" (as stated on p. 189). The species name of *Ophiophagus hannah* is derived from the name of tree-dwelling nymphs of Greek mythology, and refers to the arboreal habits of the snakes. In fact, Cantor (1838) provided a description of the habits of the species in the Sunderbans.

Omission.—Two snake species have not been listed in the checklist for Borneo: Vogel (1995) recorded *Dendrelaphis striatus* (Cohn 1905) from Kutei, Kalimantan, Borneo, and Vogel and Köhler (1996) recorded *Elapoidis fusca* Boie in Boie, 1827, from "northern Borneo." A questionable record for Borneo—*Ptyas korros*, is included, but *Oligodon semicinctus* (Peters 1862; see Wallach and Bauer 1996) is not. In the literature cited section, important works that have been missed include De Rooij (1917) and David and Vogel (1996). Details of pagination are given for some, not all, works. Incidentally, the book by Manthey and Grossmann (1997) was published in Münster, not Berlin (p. 241).

Other inconsistencies include the repetition of a paragraph in the account dealing with *Pelamis platurus* (pp. 219–220), and the use of British English in some cases and American English in others.

Despite these criticisms, this will be an invaluable reference for those working on the Southeast Asian snake fauna. The photographs will probably be more informative than the short textual descriptions, and a wise selection of photographs from 17 individual photographers contribute towards making this an attractive volume. Arguably, books like this do more for creating an interest in herpetology in the tropics than countless research papers.

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La Fauna de Serpientes del Chaco Sudamericano: Diversidad, Distribucion Geografica y Estado de Conservacion, by Gerardo C. Leynaud and Enrique H. Bucher. 1999. Academia Nacional de Ciencias, Cordoba, Miscelanea N° 98. 46 pp.

This monograph reviews the 63 taxa of snakes known to inhabit the Chaco of Argentina, Bolivia, and Paraguay. Each species account includes brief summaries of common names, distribution, key characterisitcs, and natural history and is associated with a point locality map. Additional species possibly occurring in the region are also listed and the biogeographic patterns and conservation status of the Chacoan snake fauna are assessed. The main Spanish text is accompanied by a short English abstract, a bibliography of more than 125 entries, and a full page color plate of *Philodryas baroni*, one of nine snakes strictly endemic to the Chaco.

Interpretive Atlas of Texas Lizards, by Ralph W. Axtell. 1986–1999, *et. seq*. Privately published by and available from the author (Ralph W. Axtell, 2814 Rock Hill Road, East Alton, Illinois 62024, USA). Individual accounts available separately. Cost: US $0.10/page + postage and handling.

The most recent installments (numbers 21–23) in this series are three closely related species of *Eumeces* occurring in Texas: *E. anthracinus* (Coal Skink), *E. septentrionalis* (Northern Prairie Skink), and *E. multivirgatus* (Many-lined Skink). These new accounts comprise 29 pages in addition to a detailed range map. Axtell provides an in-depth discussion of distribution for each species in Texas, along with current taxonomy, geographic variation, conservation status, and suggestions for future work. Based on distributional grounds, Axtell suggests that instead of three distinct species, this group may comprise a single, poltypic species (*E. anthracinus*, the oldest name) showing east–west clinal variation.

Studies of the Desert Tortoise, *Gopherus agassizii*, by Angus M. Woodbury and Ross Hardy. 2000 [reprint of 1948 original]. Bibliomania!, P.O. Box 58355, Salt Lake City, Utah 84158-0355, USA. 60 pp. Softcover. US$ 12.95 (plus shipping).

Woodbury and Hardy published their monograph of the desert tortoise (including morphological aspects, as well as a diversity of ecological and life history topics) in *Ecological Monographs* in 1948. This reprint edition has been issued in celebration of the 25th anniversary of the Desert Tortoise Council. The paper was based on observations conducted in southwestern Utah over a span of more than a decade and it remains a valuable compendium of biological information on this now well-studied species.

ERRATA

A recent article by Esqueda and La Marca (1999. New reptilian species records from the Cordillera de Mérida, Andes of Venezuela. Herpetol. Rev. 30:238–240) should have contained the following statement concerning the significance of the record for *Chironius carinatus*: "First documented record for this species in the Venezuelan Andes (Lancini 1979; Lancini and Kornacker 1989), although a general distribution map in Roze (1966) suggested its presence in this mountain range." The current e-mail address of the second author is lamarca57@cantv.net.

After reviewing the list of new Georgia county records recently published (Jensen and Moulis 1999), we discovered several errors we wish to rectify.

The *Eurycea cirrigera* record listed as Decatur County should read Dooly County. Additionally, because of problems associated with the search string applied to the database, the following records were erroneously reported as new:

Eurycea guttolineata – Spalding County, previously reported in Lacy (1997).

Plethdon glutinosus – Jasper County, previously reported in Lacy (1997).

P. serratus – Clayton County, previously reported in Smith (1999).

Bufo terrestris – Lee County, previously reported in Williamson and Moulis (1994).

Hyla avivoca – Lee County, previously reported in Camp et al. (1988).

H. cinerea – Bibb County, previously reported in Jensen and Moulis (1997).

Chelydra serpentina – Cobb County, previously reported in Jensen and Moulis (1997).

Kinosternon baurii – Dooly County, previously reported in Camp et al. (1988).

Sternotherus minor – Pike County, previously reported in Williamson and Moulis (1994).

Anolis carolinensis – Clayton County and Walton County, previously reported in Jensen and Moulis (1997).

Scincella lateralis – Jones County, previously reported in Williamson and Moulis (1994).

Elaphe obsoleta – Webster County, previously reported in Williamson and Moulis (1994).

Nerodia taxispilota – Baldwin County, previously reported in Lacy (1997).

Opheodrys aestivus – Fayette County, previously reported in Lacy (1997).

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—John B. Jensen and Robert A. Moulis



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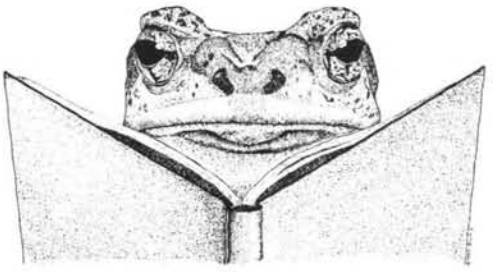
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Humboldt State University
sbm1@axe.humboldt.edu

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pstone@ucok.edu

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USDA Forestry Science Lab
dede.olson@orst.edu

GUNTHER KÖHLER
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Naturmuseum Senckenberg
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ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

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Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

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JENNIFER M. GARRISON
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
jmg1@ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey
2041 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
jerryj@laguna.epcc.edu

Geographic Distribution
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Instituto de Herpetología
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4000 Tucumán, Argentina
soniak@unt.edu.ar

Legislation & Conservation
TRAVIS J. RYAN
Savannah River Ecology Laboratory
Drawer E
Aiken, South Carolina 29802, USA
ryan@srel.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Natural History Notes
BRIAN P. BUTTERFIELD
Department of Biology
Freed-Hardeman University
Henderson, Tennessee 38340, USA
bbutterfield@fhu.edu

Copy Editors: *Anna Clarke, Eli Greenbaum, Jeff Parmelee, Jenny Pramuk*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

www.ukans.edu/~ssar



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2000 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@slu.edu.

Future Annual Meetings

2000 — Universidad Autónoma de Baja California Sur, La Paz, BCS, México, 14–21 June 2000 (Carlos Villavicencio, Chair).
2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 26–30 July 2001

About Our Cover: *Eleutherodactylus cochranae*



Eleutherodactylus cochranae is a small frog endemic to Puerto Rico and adjacent islands on the Puerto Rico bank (Schwartz and Henderson. 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville, Florida). Adult males typically range from 17 to 20 mm in snout–vent length, while females are slightly larger. The frogs are locally abundant in forested habitats, where their high-pitched (dominant frequency around 3800–4000 Hz), whistle-like advertisement calls can easily be mistaken for sounds of insects. Like many *Eleutherodactylus*, these frogs are secretive, and their reproductive behavior has seldom been observed. Our cover apparently is the first published photograph of the courtship of *E. cochranae* in nature and possibly of courtship of *Eleutherodactylus* species in general.

Frogs of the genus *Eleutherodactylus* are distributed widely in Central America, northern South America, and the islands of the West Indies, where their loud advertisement calls often dominate the night sounds. With over 500 species, *Eleutherodactylus* is among the largest vertebrate genera in the world. As far as is known, all species undergo direct development in non-aquatic sites, and terrestrial reproduction probably has contributed to their success (Lynch 1971. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 53:1–238); Hedges 1989. pp. 305–370 *In* Woods [ed.], Biogeography of the West Indies. Past, Present and Future. Sandhill Crane Press, Gainesville, Florida). At least one species, *E. jasperi* from Puerto Rico, is live-bearing (Drewry and Jones 1976. J. Herpetol. 10:161–165); unfortunately, this species has not been seen since 1981 and may now be extinct (Joglar and Burrowes 1996. pp. 371–380 *In* Powell and Henderson [eds.], Contributions to West Indian Herpetology: A Tribute to Albert Schwartz, SSAR. Ithaca, New York). Internal fertilization also occurs in *E. coqui* and possibly in other oviparous species (Townsend et al. 1981. Science 212:469–471). Depending on species the frogs exhibit various modes of parental behavior, including male-, female-, or biparental care of eggs and developing young (Townsend 1996. pp. 229–239 *In* Powell and Henderson, *op. cit.*). Reproductive behavior, including courtship, nest-site selection, and parental care, is undocumented for most species.

The cover photograph is a compilation of three images taken by **Kristiina Ovaska** on a wet October night in 1998 on Sage Mountain, Tortola, British Virgin Islands. A combination of serendipity and persistence allowed her to locate and photograph this courting pair entering a nest site inside a rolled-up leaf at a height of approximately 150 cm above the ground. Upon inspection of the leaf-roll two days later, a male frog attending a clutch of six eggs squirted a stream of urine at the face of the human intruder! Kristiina used a Nikon 601 camera body, AF Micro-Nikkor 60 mm f/2.8 D macro lens, and Nikon SB-23 flash to record the images on Fuji Sensia film. Dim light from a headlamp provided illumination for focusing. The three photographs were taken seconds apart as the male led the female to the nest site. Because of the short focal length of the lens, Kristiina had to be very close to the frogs—within about 25 cm—to capture these images. Although females typically are easily disturbed, these frogs in late courtship appeared impervious to her presence.

Over the past decade Kristiina has studied the courtship and reproductive behavior of *Eleutherodactylus* species and photographed these frogs in the West Indies and Panama. In addition to small, brown frogs, her photographic subjects include salamanders, snakes, and slugs. Presently she is a consultant with and principal of Biolinx Environmental Research Ltd., Victoria, British Columbia, and a research associate in the Forest Sciences Department, University of British Columbia. She lives on Vancouver Island, British Columbia.



Separation and imaging of Kristiina's photographs is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

SSAR Grants-in-Herpetology Committee Annual Report (2000)

An award in the amount of US $500 was made to each of the following individuals:

Field Research.—**John H. Malone**, University of Oklahoma. Project title: "Parental care in the Barking Frog, *Eleutherodactylus augusti*."

International.—**Antonio Freire L.**, Instituto Nacional de Higiene y Medicina Tropical "Leopoldo Izquieta Perez," Guayaquil, Ecuador. Project title: "Snake diversity of Zamora-Chinchipe Province, Southeastern Ecuador."

Conservation.—**Mike Westphal**, Oregon State University. Project title: "Long term monitoring of a diverse snake assemblage in a region facing urban expansion."

Bibliographic Research.—**Bryce A. Maxell**, University of Montana. Project title: "Herpetology in Montana, a history and an indexed bibliography of all published and gray literature."

Herpetological Education.—**Peter Uetz**, University of Washington. Project title: "A World-Wide-Web based reptile database."

Laboratory Research.—**Sarah Bouchard**, University of Florida. Project title: "Diet selection in the Slider Turtle, *Trachemys scripta*: ontogenetic shifts and associative effects between animal and plant diet items."

Travel.—**Ulrich Kuch**, University of Frankfurt. Project title: "Population systematics and biogeography of the southeast Asian temple vipers, genus *Tropidolaemus* Wagler, 1830."

2000 Grants-in-Herpetology Committee.—Anne Maglia, Richard King, Christopher Beachy, Christopher Sheil, Joseph Slowinski,

Ronald Gutberlet, Dawn Wilson, Peter Ducey, and Joseph Mendelson III (chair).

SSAR congratulates the 2000 GIH recipients and thanks the committee members for their efforts.

NEWSNOTES

Gopher Tortoise Council Awards

The Gopher Tortoise Council annually presents the J. Larry Landers Student Research Award to the best student research project concerning the biology of the gopher tortoise, *Gopherus polyphemus*, or any other relevant aspect of upland habitat conservation. Recent awards have been given for studies on gopher frogs, southern hognose snakes, and red cockaded woodpeckers, as well as those related to the gopher tortoise and its habitat. To be considered for the award, a detailed study proposal, budget, and curriculum vitae should be submitted to: *Bob Herrington, Chair, Research Advisory Committee, Department of Biology, Georgia Southwestern State University, Americus, Georgia 31709, USA (e-mail: bherring@canes.gsw.edu).* Deadline for receipt of proposals to be considered for the 2000 award is 15 August 2000.

Herpetological Collections at the University of Colorado Museum

The University of Colorado Museum encourages use of its herpetological collections. The collections include over 60,000 specimens, with particularly strong representation of the southwestern U.S. (Colorado, New Mexico, Arizona, and Utah: approximately 23,400 specimens) and Mexico (19,100 specimens). The collection of *Cnemidophorus* is one of the largest in the world, including 43 species and 11,500 specimens. Other taxa that are well-represented include *Sceloporus* (64 species and 8800 specimens), *Thamnophis* (21 species and 2300 specimens), and *Bufo* (44 species and 3800 specimens). The collections database is fully computerized, thus requests for specimen information can be answered quickly. In addition, the numbers of specimens of each species are available online at the California Academy of Science's Combined Index to Herpetology Collections website (http://research.calacademy.org/herpetology/Comb_Herp_Index.html). The collections will be moved to a renovated facility in summer, 2001, thus loan requests should be made by early 2001 or starting again in 2002. Loan or other requests can be submitted by regular mail or e-mail to Alan de Queiroz, Curator of Vertebrates, University Museum, Campus Box 218, University of Colorado, Boulder, Colorado 80309-0218, USA; e-mail: dequeiro@stripe.colorado.edu, or to Rosanne Humphrey, Collections Manager, address as above, e-mail: Rosanne.Humphrey@colorado.edu. Researchers and students are also encouraged to visit the collections. Additional information can be found at http://www.colorado.edu/CUMUSEUM/research/zoology/zoology.html.

A Working Guide to the Literature on Box Turtles (*Terrapene*)

An on-line bibliography covering life history, evolution, fossil record, external morphology, and conservation of the North American box turtles (*Terrapene*) has been compiled by C. Kenneth Dodd, Jr. The bibliography is available at:

http://www.fcsc.usgs.gov/Amphibians_and_Reptiles/Amphibians_and_Reptiles_Resear/box_turtle_bib1/box_turtle_bib1.html

MEETINGS

Societas Europaea Herpetologica 11th General Meeting

The Organizers, DPPVN/DAPTF Slovenia, the Society Radoziv and Faculty of Education, University of Maribor, are pleased to invite you to the 11th Ordinary General Meeting of Societas Europaea Herpetologica to be held in Slovenia, 16–20 July 2001. The meeting will be held in the Hall of Culture at Zalec, near Celje, with accommodations in the Hotel Zalec and elsewhere.

Details from: DPPVN/DAPTF Slovenia, Ptujska c. 91, SI-2327 Race, Slovenia; fax: +386 (0)2 788 30 51; e-mail: milan.vogrin@guest.arnes.si.

International Roundtable to Develop A Protocol on Chelonian Relocation and Heritage Collections

This working meeting will be held 26–28 September 2000 in Orlando, Florida. Special workshops and field trips are planned for 25 and 29 September. This meeting will bring together freshwater turtle and tortoise experts, veterinary and chelonian researchers, managers, educators, breeders, students, regulatory and conservation agencies, and enthusiasts from around the world and will result in a published Protocol addressing seven important areas: ethics, disease issues, genetic and systematic issues, environmental issues, socioeconomic considerations, intra-specific impacts, and heritage collection.

For registration information contact Ray Ashton or Ghislaine Guyot, Ashton Biodiversity Research & Preservation Institute, 5745 SW 75th Street #331, Gainesville, Florida 32608, USA; e-mail: Tortfarm2@aol.com. Tel. (352) 495-7449; fax (352) 495-7433.

Snake Ecology Group: Meeting 2000

The Snake Ecology Group will meet 22–24 September 2000 at the Ozark Natural Science Center, in northwestern Arkansas, USA. Workshops include "Physiological and Evolutionary Ecology," "Habitat Modeling and Habitat Utilization," "Molecular Techniques in Population Structure," and "Behavioral Ecology." Key-

note address by Dr. Stevan Arnold, of Oregon State University. Paper and poster sessions are planned. Field trips will take place following the meeting. For additional information, contact: Steven J. Beaupre, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA; e-mail: sbeaupre@comp.uark.edu; tel. 501-575-7561.

Third Annual International Virtual Conference in Veterinary Medicine

The Third Annual International Virtual Conference in Veterinary Medicine (IVCVM) will be hosted by the University of Georgia College of Veterinary Medicine. The conference theme will be "Diseases of Reptiles and Amphibians." A "virtual conference" is the same format as a regular conference, except that it is conducted by computer over the World Wide Web. There will be no registration fees or travel expenses!

Manuscripts are acceptable as case reports or larger studies of naturally occurring or experimental disease. Diagnostic techniques also are encouraged. Any veterinary, nutritional, husbandry, research, biological data, and review papers of selected diseases also will be considered for presentation. Conference manuscripts will be presented on the World Wide Web for two years and subsequently will be archived for future reference.

The manuscript submission deadline is 1 September 2000. The proposed conference dates will be 30 September–30 October 2000. During the conference, registered participants will be able to correspond electronically with manuscript presenters and other registrants. Questions and answers concerning manuscript presentations will be posted on a bulletin board for further viewing. A "Virtual Coffee Break" is included and participants are encouraged to partake and enjoy!

Sample manuscripts and instructions to authors may be viewed at the IVCVM website: http://www.vet.uga.edu/ivcvm/.

Meetings Calendar

22–24 September 2000—Snake Ecology Group, Ozark Natural Science Center, Arkansas, USA. *Refer to meeting announcement above for details.*

26–28 September 2000—International Roundtable to Develop A Protocol on Chelonian Relocation and Heritage Collections, Orlando, Florida, USA. *Refer to meeting announcement above for details.*

16–20 July 2001—Societas Europaea Herpetologica 11th General Meeting, Slovenia. *Refer to meeting announcement above for details.*

LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles. This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. We are in need of information at local, state, national, and international levels. Please direct all communications to the section editor, Travis Ryan (postal and e-mail addresses on inside front cover).

USA: Department of the Interior: The US Fish and Wildlife Service re-opened the comment period on a proposed ruling that would list populations of the mountain yellow-legged frog (*Rana mucosa*) as an endangered species in southern California under the Endangered Species Act of 1973. The mountain yellow-legged frog is distributed primarily in the Sierra Nevada Mountains of California with additional populations found in the San Gabriel, San Bernardino, and San Jacinto Mountains of southern California. Because they are separated by the Tehachapi Mountains and lie approximately 140 miles from the Sierra Nevada populations, the southern California populations are considered by the Fish and Wildlife Service to comprise Distinct Population Segments (DPS); this designation makes the southern California DPS eligible for federal protection as an endangered species. A limited, unpublished allozyme analysis suggests that the two groups are indeed distinct, although further studies are warranted to determine the degree of genetic divergence.

Rana mucosa in southern California are generally found at lower elevations (760–1820 m) than those in the Sierra Nevada Mountains (usually < 1800 m). Most adults in the southern California DPS are associated with shaded stream systems; larvae develop in the streams and require 1–2.5 yrs to reach metamorphosis. Populations were abundant in the DPS prior to the 1960's; presently *R. mucosa* is believed to be absent from more than 99% of its historical range. The leading causes of declines are likely habitat destruction (e.g., logging, water development, irrigation, etc.) and the introduction of non-native predators/competitors. The comment period on this proposal ended 19 April 2000.

For further information contact: Field Supervisor, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, 2730 Loker Avenue West, Carlsbad California 93003, USA.

USA: Department of the Interior: The US Fish and Wildlife Service proposed to designate over 400,000 acres of land in Contra Costa, Alameda, San Joaquin, and Santa Clara counties in California as critical habitat for the Alameda whipsnake, *Masticophis lateralis euryxanthus*. The Alameda whipsnake has been under federal protection since 5 December 1997 when it was listed as a threatened species under the Endangered Species Act of 1973. Adoption of critical habitat proposal would prohibit destruction or adverse modification of whipsnake habitat by activities funded, authorized, or carried out by the federal government. Critical habitat is that considered essential for the conservation of the species and may require special management and/or protection. In the case of *M. lateralis euryxanthus*, the critical habitat is chaparral, although individuals may occasionally use conjoining grassland, oak savanna, and (less frequently) oak-bay woodland. Males maintain overlapping home ranges that average about 14 acres. No less than five populations of *M. lateralis euryxanthus* have been documented, and the area covered by the proposal would protect critical habitat for all five populations. The comment period on this proposal ended 8 May 2000.

For further information contact: Field Supervisor, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Suite W – 2605, Sacramento, California 95825, USA.

USA: Department of the Interior: On 19 January 2000 the U.S. Fish and Wildlife Service, acting under the emergency rule of the Endangered Species Act of 1973, declared populations of the California tiger salamander (*Ambystoma californiense*) in Santa Barbara County as endangered. This emergency ruling is effective for 240 days, expiring on 15 September 2000. In justifying the ruling, the FWS noted that of the 14 known breeding sites for *A. californiense* in Santa Barbara County, more than half had been destroyed in the preceding year and a half, placing the population in peril of extinction. All of the breeding sites are located on privately owned land, much of which is scheduled for conversion to agricultural land. The Santa Barbara County populations are collectively regarded as a Distinct Population Segment (DPS); the FWS is permitted to treat DPSs as equivalent to species under the Act. Within the range of *A. californiense* there are at least seven genetically distinct populations and the Santa Barbara County DPS is effectively isolated from the other six populations by the coastal mountain ranges. More than 40 air miles separate the Santa Barbara County DPS from the closest population with which it shares recent ancestry. The isolated nature of the Santa Barbara County DPS eliminates the likelihood of recolonization in the event of a local extinction, which would therefore result in the loss of both geographic range and genetic diversity for the species.

Like most other *Ambystoma*, *A. californiense* breeds in vernal ponds or seasonal pools. The larval period is relatively short, with only 10 weeks or so required for larval development. Recently metamorphosed juveniles and adults travel considerable distances from the larval habitat, and spend the majority of the year in upland habitats (primarily grasslands, oak woodlands, and coastal scrub forests) that surround breeding sites. In addition to habitat alteration, loss, and fragmentation, introduced species such as bullfrogs and mosquitofish are potential factors that have led to the imperiled state of the Santa Barbara County population.

In addition to the temporary emergency action, the FWS has also proposed to list the Santa Barbara County DPS as an endangered species under the normal procedures of the Act. The comment period on this proposal ended 20 March 2000.

For further information, contact: Grace McLaughlin, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, 2493 Portold Road, Suite B, Ventura, California 93003, USA.

International: Convention on International Trade in Endangered Species: In last issue's Legislation and Conservation column (Herpetol. Rev. 31:5–6), a proposal submitted by the U.S. Fish and Wildlife Service to C.I.T.E.S. requesting an Appendix II listing for the spotted turtle (*Clemmys guttata*) was highlighted. This proposal was heard at the 11th meeting of the Conference of the Parties, held in Kenya 10–20 April 2000. The proposals listed below were also reviewed by the Animals Committee at the Conference. The fate of these proposals will be covered in upcoming Legislation and Conservation columns.

Reptiles: Testudinata: Emydidae: Inclusion in Appendix II: *Cuora amboinensis*, *C. aurocapitata*, *C. flavomarginata*, *C. galbinifrons*, *C. maccordi*, *C. pani*, *C. trifasciata*, *C. yunnanensis*, and *C. zhoui*.

Reptiles: Testudinata: Testudinidae: Transfer from Appendix II to Appendix I: *Geochelone sulcata*, *Malacochersus tornieri*.

Reptiles: Testudinata: Cheloniidae: Transfer from Appendix I to Appendix II (with restrictions): *Eretmochelus imbricata*.

Reptiles: Crocodylia: Transfer from Appendix I to Appendix II: *Crocodylus moreletii* (Sian Ka'an and Quintana Roo populations only).

Reptiles: Squamata: Sauria: Transfer from Appendix I to Appendix II: *Varanus melinus*.

Reptiles: Squamata: Serpentes: Inclusion in Appendix II: *Crotalus horridus*.

Amphibia: Anura: Bufonidae: Deletion from Appendix II: *Bufo retiformis*.

Amphibia: Anura: Ranidae: Inclusion in Appendix II: *Mantella* spp.

For a brief description of Appendix I and Appendix II, see Herpetol. Rev. 31:5–6; for a more thorough definition visit http://www.cites.org/CITES/eng/index.shtml.

CAMBODIA: Phnom Penh: The Workshop on Trade in Tortoises and Freshwater Turtles in Asia. This workshop, held 1–4 December 1999 and organized by the Wildlife Conservation Society, World Wildlife Foundation, and TRAFFIC, was convened to address the state of chelonian conservation throughout Asia. The number of Asian turtle species regarded as threatened and endangered is growing rapidly; the Asian Turtle Trade Working Group addressed short- and long-term strategies for stemming the loss of species. The Working Group identified two primary areas of turtle trade that threaten the status of Asian species: consumption trade and pet trade. Consumption trade includes both collection of wild turtles and turtle farming for subsistence, as well as the turtle shell by-product industry. The Asian pet trade is centered on exotic species such as *Geochelone elegans* (Indian star-nosed turtle) and Australian turtles in the genera *Chelodina* and *Carettochelys*. The Working Group concluded that the available trade data underestimate the annual take for virtually all species. Under-reporting hinders the generation of reliable data on the effects of trade on population and species status; however, an evaluation of the available data led to the conclusion that for 84 species under consideration, 63 species (75%) should be placed in one of the IUCN threatened categories (Extinct, Critically Imperiled, Endangered, or Vulnerable), and trade was a considerable factor for 52 species (62%).

The Working Group identified a number of conservation priorities and recommendations, including:

- enforcement of all existing local, state, and national legislation;
- improvement of existing legislation for turtle conservation throughout the region;
- development of adequate mechanisms to handle confiscated turtles;
- listing all 93 species of the Indomalayan, Autralasian, and eastern Palearctic biogeographic regions in CITES Appendix II (save for those species listed in [or appropriate for] Appendix I);
- consideration of listing all chelonian species worldwide in CITES Appendix II;
- monitoring field and market data to improve understanding of the market impact on natural turtle populations;
- supporting management programs that have as a primary goal the preservation of genetic diversity within natural populations; and
- establishment of outreach programs to educate the peoples in the Indo-australasian region (and the rest of the world) regard-

ing the consequences of the turtles trade and the loss of chelonian biodiversity.

The Workshop was funded by WCS, WWF, and TRAFFIC, with support from the German Federal Agency for Nature Conservation, Ministry of Environment, Nature Conservation and Nuclear Safety; the Office of Scientific Authority, U.S. Fish and Wildlife Service; the Chelonian Research Foundation, USA; Kari and Andrew Sabin; and the Kadoorie Farm & Botanic Garden, Hong Kong.

For further information contact: Kurt Buhlmann, Conservation International, c/o Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; e-mail: buhlmann@srel.edu; or Peter Paul VanDijk, e-mail: ppvandijk@hotmail.com.

CURRENT RESEARCH

Please refer to Vol. 31, Number 1 for information concerning submissions to this section. Section editor contact information is located on the inside front cover of this issue.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.herplit.com/contents

Defensive Strike of the Eastern Brownsnake

Eastern Brownsnakes are the most significant contributor to human snakebite fatalities in Australia. A previous study by the authors examined free-ranging, radio-tagged *Pseudonaja textilis* through repeated, intentional encounters, to document the ways that body size and temperature influence the probability of encountering this species, as well as the way that this species responds to these encounters. In this study, the authors investigated factors that led to a defensive strike, as well as the speed and accuracy of that strike, in captive brownsnakes. Responses to human harassment (neck displays, time taken to strike, strike accuracy and speed, and effectiveness of bite) were documented with high speed film. Results indicate that captive brownsnakes were tolerant to harassment at temperatures similar to those in the field, and that smaller snakes were more likely to attempt escape than were larger snakes. Body temperature was found to have little effect on many of the variables measured (frequency of display and bluff, duration of strike, strike distance, mean overall strike speed, mean fastest strike speed, and accuracy of strike). Results indicate that type of prestrike display (full neck display or minimal display) was related to strike speed and accuracy. Finally, the data indicate that captive *Pseudonaja textilis* is reluctant to deliver firm bites when continuously harassed by humans, and it is reported that only about 15% of recorded strikes had the potential to cause significant envenomation.

WHITAKER, P. B., K. ELLIS, AND R. SHINE. 2000. The defensive strike of the Eastern Brownsnake, *Pseudonaja textilis* (Elapidae). Functional Ecology 14:25–31.

Correspondence to: P. B. Whitaker, School of Biological Sciences, B10, University of Sydney, NSW 2006, Australia.

Effects of Age and Size on Performance and Metabolic Rates in Metamorph Southern Toads

During metamorphosis, individuals undergo significant changes in physiology, morphology, and behavior; body size and timing of metamorphosis are thought to have significant effects on fitness. Beck and Congdon studied the effects of individual variation in age and size at metamorphosis on performance and metabolic rates of *Bufo terrestris*. Variation in age and size at metamorphosis were experimentally induced by rearing ten clutches of eggs to metamorphosis under different food levels and temperature regimes. Sprint speed and endurance were measured as indicators of performance, whereas metabolic rate was measured indirectly with a closed circuit respirometer. Metabolic rate, sprint speed, and endurance of metamorphs were found to be negatively related to age at metamorphosis and positively related to mass at metamorphosis. The authors state that decreases in larval period duration and increases in mass at metamorphosis may be advantageous in terms of locomotor performance, but disadvantageous because of costs of increased energy expenditure on maintenance. Locomotor performance was not significantly affected by either of the treatments or their interaction, after effects of age and size at metamorphosis were removed. Finally, metamorph physiology, and possibly fitness, may be affected by aspects of the larval environment by mechanisms other than differences in age and size at metamorphosis.

BECK, C. W., AND J. D. CONGDON. 2000. Effects of age and size at metamorphosis on performance and metabolic rates of Southern Toad, *Bufo terrestris*, metamorphs. Functional Ecology 14:32–38.

Correspondence to: C. W. Beck, Department of Biology, Emory University, Atlanta, Georgia 30322, USA.

Wetland Size, Hydroperiod, Amphibian Species Richness, and Implications for Wetland Regulation

Using data on wetland size, relative hydroperiod, and relative species richness of amphibians in depression wetlands of the southeastern United States, the authors tested three assumptions: (1) small wetlands contain water for short periods of time; (2) smaller wetlands support fewer species than larger wetlands; and (3) species found in smaller wetlands can also be found in larger wetlands. The amount of time that a wetland holds water during an annual hydrological cycle was used as a drying score of relative measures of annual hydroperiod at the Savanah River Site, South Carolina. Eighty-six sites were visited fifteen times between January 1996 and December 1998. Wetland sizes were obtained from the literature. Adult and larval amphibian diversity was sampled with dip nets and traps at 22 wetlands. Results indicate a significant but weak relationship between wetland size and hydroperiod, but no relationship between amphibian species richness and wetland size. Amphibian species richness was found to be related to the hydroperiod of a wetland. Though the presence of most amphibian species was found to be random with respect to wetland size, results indicate that a pattern of species turnover exists along

a gradient of hydroperiod. Empirical studies based on synthetic models of lentic communities support their prediction that short-hydroperiod wetlands support unique groups of species. Based on these results, the authors conclude that wetland size is not a good predictor of wetland hydroperiod or amphibian species richness at the Savanah Research Sites. Hydroperiod length should be considered as a primary criterion in establishing wetland management and regulations.

SNODGRASS, J. W., M. J. KOMOROSKI, A. L. BRYAN JR., AND J. BURGER. 2000. Relationships among isolated wetland size, hydroperiod, and amphibian species richness: implications for wetland regulations. Conservation Biology 14(2):414–419.

Correspondence to: Joel W. Snodgrass, Department of Biology, Towson University, Towson, Maryland 21252-0001, USA; e-mail: jsnodgrass@towson.edu.

Rib Loss in Anurans

The absence of ribs has been considered a derived condition that is widespread among most anurans, whereas the presence of free ribs is presumed to be the plesiomorphic condition shared by only a few families of Recent anurans. Chondrification, ossification, and development of the neural arches, transverse processes, and ribs were examined in representatives of several families of frogs (Bufonidae, Discoglossidae, Hylidae, Pelobatidae, Pelodytidae, Pipidae, and Ranidae) to examine the morphological evolution of "vestigial" traits, as well as to investigate the similarity of developmental paths involved in apparent rib loss. Examination of cleared and double-stained anuran larvae and metamorphs corroborated the observation that free ribs are absent in several anuran groups; however, the authors provide evidence for the existence of larval rib rudiments in several anuran genera (*Bufo, Discoglossus, Hyla, Pelobates,* and *Rana*). The authors state that heterochrony may have played a significant role in processes underlying reduction of ribs. Finally, the authors identified a shift in the relative timing of ossification of vertebral elements among several lineages of frogs.

BLANCO, M. J., AND B. SANCHIZ. 2000. Evolutionary mechanisms of rib loss in anurans: a comparative developmental approach. Journal of Morphology 244:57–67.

Correspondence to: B. Sanchiz, Museo Nacional de Ciencias Naturales, J. Gutiérrez Abascal 2, Madrid E-28006, Spain; e-mail: mcnb105@mncn.csic.es.

Differential Effects of Calcium in the Skin of Tadpoles

Amphibian metamorphosis results in the reorganization of most tadpole tissues and organs, and is controlled by thyroid hormones. Ecological factors are known to effect developmental rate, and anuran skin is known to be sensitive to chemical signals (including ion concentrations) in the environment. The authors describe the effects of Ca^{++} (a known cellular signal expected to initiate metamorphic events) on the development of two larval organs (tail and skin) with different metamorphic fates; effects of Ca^{++} treatment on the thyroid also was examined. Treatment of tadpoles with calcium during early development induced early tail regression, shortening of the intestine, forelimb emergence, and keratinization of body epidermis. Results of this study suggest that a calcium-elicited signal leading to these effects is likely mediated by the thyroid gland.

MENON, J., E. E. GARDNER, AND S. VAIL. 2000. Developmental implications of differential effects of calcium in tail and body skin of anuran tadpoles. Journal of Morphology 244:31–43.

Correspondence to: Jaishri Menon, Department of Biology, William Paterson University of New Jersey, Wayne, NJ 07470; e-mail: menonj@wpunj.edu.

Functional Role of Trunk Muscles During Locomotion in Adult Amphibians

The authors review the functional roles played by amphibian epaxial and hypaxial trunk muscles during locomotion, and identify transitions in these roles that have taken place during the evolution of amphibians. The usual modes of locomotion for Caudata, Anura, and Gymnophiona are discussed, and particular attention is paid to those modes that rely heavily or exclusively on axial musculature. Despite the uncertain relationships among the Lissamphbia and morphological differences between modern lissamphibians and the earliest tetrapods, the authors propose that it is possible to reconstruct the configuration of the trunk muscles in the common ancestor of Lissamphibia. Based on evidence of fossil data and the assumption of lissamphibian monophyly, the authors conclude that the common ancestor of lissamphibia was most likely salamander-like in body form. Multiple functional and morphological elaborations of the axial musculature of amphibians are summarized, and these elaborations appear to be associated with movement in terrestrial habits, as well as with subsequent locomotor specializations in frogs and caecilians.

O'REILLY, J. C., A. P. SUMMERS, AND D. A. RITTER. 2000. The evolution of the functional role of trunk muscles during locomotion in adult amphibians. American Zoologist 40:123–135.

Correspondence to: James C. O'Reilly, Organismic and Evolutionary Biology Program, University of Massachusetts Amherst, Amherst, Massachusetts 01003-5810, USA; e-mail: oreilly@bio.umass.edu.

Effects of UV-B Radiation on Amphibian Embryos in the Southeastern United States

In order to test the sensitivity of pond-breeding amphibians in the southern Appalachian Mountains, the eggs of three species of frog (*Hyla chrysoscelis, Pseudacris triseriata,* and *Rana sylvatica*) and one salamander (*Ambystoma maculatum*) were exposed to varying levels of UV-B radiation. A randomized block design was utilized with experimental treatments consisting of: (1) blocking of 98% UV-B; (2) 80% transmission of ambient UV-B; and (3) direct exposure to solar radiation. Eggs were collected from natural breeding sites in early developmental stages. Though deformities were not common, anurans showed a weak correlation between higher deformity rates and unshielded (treatment 3) con-

trols. Between *Pseudacris* and *Hyla*, deformities were significantly lower in embryos shielded from UV-B; these species tend to oviposit small egg masses or monolayers on the water surface of sunny habitats. This may indicate an increased vulnerability to deformities induced by UV-B. There was no evidence of an increase in mortality due to increase in exposure to UV-B in any of the study species. Because of the complex nature of amphibian declines and the richness of amphibian species in the southeastern United States, the authors encourage further study of the sensitivity of these organisms to UV-B.

STARNES, S. M., C. A. KENNEDY AND J. W. PETRANKA. 2000. Sensitivity of embryos of southern Appalachian amphibians to ambient solar UV-B radiation. Conservation Biology 14: 277–282.

Correspondence to: James W. Petranka, Department of Biology, University of North Carolina, Asheville, North Carolina 28804-3299, USA; e-mail: petranka@cs.unca.edu.

Mechanism and Sensitivity of Pit Organs in *Python*

An investigation was undertaken by the authors to determine the spectral sensitivity of pit organs and the mechanism utilized in infrared signal transduction. Young Burmese (*Python molurus bivitattus*) and ball (*P. regius*) pythons were chosen for electron microscopy, immunocytochemical labeling, histology, and infrared imaging of pit organs. Compared to the photoreceptors of the retina, receptors of the pit organ were found to absorb a different range of infrared wavelengths and displayed distinctly different morphology. The range of wavelengths to which the boid and crotaline snakes showed greatest absorption is the emission range of the snakes' prey items. Further investigation did not reveal the make-up of the infrared absorber in the pit organs. The pit organ shows the greatest known sensitivity to infrared wavelengths. Therefore, elucidation of the mechanisms and neural pathways involved could lead to further developments in herpetology as well as the improvement of artificial infrared detectors.

GRACE, M. S., D. R. CHURCH, C. T. KELLY, W. F. LYNN, AND T. M. COOPER. 1999. The Python pit organ: Imaging and immunocytochemical analysis of an extremely sensitive natural infrared detector. Biosensors & Bioelectronics 14:53–59.

Correspondence to: Michael S. Grace, Department of Biology, University of Virginia, Charlettesville, Virginia 22904-4133, USA; e-mail: msg5y@virginia.edu.

The Role of Generalized Tadpoles as Macrophagous Predators

The authors challenge the beliefs that tadpoles are limited primarily to herbivory, and that ephemeral ponds contain fewer predators. In addition, they call for further investigation into the potential role of generalized tadpoles as keystone predators in organizing pond communities. Research was conducted using the wood frog (*Rana sylvatica*) and the green frog (*R. clamitans*) in both laboratory and natural pond settings. In the laboratory experiment, tadpoles were observed attacking and consuming macroinvertebrates, including some >5 times the length of the attacking tadpole. The survival of the prey items was significantly correlated to the presence of tadpoles. Field experiments conducted in eight ephemeral ponds revealed extensive egg predation of *R. sylvatica* by larval *R. clamitans*—egg masses of two ponds (totaling over 58,000 embryos) were completely consumed by larval *R. clamitans* within two weeks. The authors observed that many ecological models have been based on the assumption that generalized tadpoles do not function as macrophagous predators, an assumption which appears to be false. Finally, the authors provide an extensive table summarizing evidence from literature on macrophagy by generalized tadpoles.

PETRANKA, J. W. AND C. A. KENNEDY. 1999. Pond tadpoles with generalized morphology: Is it time to reconsider their functional roles in aquatic communities? Oecologia 120: 621–631.

Correspondence to: James W. Petranka, Department of Biology, University of North Carolina, Asheville, North Carolina 28804-3299, USA; e-mail: petranka@cs.unca.edu.

OBITUARIES

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Vittorio Erspamer (1909–1999)

JOSE MIGUEL CEI
Hilario Cuadros 81, 5501 Godoy Cruz
Mendoza, Argentina

and
RODOLFO RUIBAL
Biology Department, University of California
Riverside, California 92521-0427, USA

With the demise of Professor Vittorio Erspamer, on October 26, 1999, in Rome, the world of research biology lost one of its most active and significant investigators. The unique qualities of Erspamer's pharmacological research were augmented by his exceptional ability for scientific synthesis. He extended his research into the evolutionary and taxonomic ramifications of his results, and particularly as they applied to herpetology. The major subject of his studies were the biogenic amines and polypeptides that he isolated from the cutaneous glands of amphibians.



Erspamer was born in Malosco (Trento, Italy) on July 30, 1909, when this region was still part of the Austro-Hungarian empire.

After the return of the area to Italy he attended the University of Pavia, and graduated with a doctorate in medicine in 1935. During 1935–1938 he was a research assistant in the University Institute of Comparative Anatomy and Physiology. He worked under the director, Prof. Maffo Vialli, doing histochemical and comparative research. Erspamer always considered Maffo Vialli as an outstanding teacher and the person that transmitted to him the great value of comparative research. Erspamer spent a year (1939) in Germany on a fellowship at the Universities of Berlin and Bonn. From 1940–1947 he was an Assistant Professor at the Pharmacological Institute of the University of Rome. Despite the difficulties of the war years he was able to continue his research. In 1947 he became a full Professor and Chairman of Pharmacology in the faculty of medicine at the University of Bari, Italy. He remained there until 1955 and then continued in the same role at the University of Parma (1955–1967) and finally returned to the University of Rome (1967–1984) as professor of pharmacology and the director of the Institute of Medical Pharmacology. After his retirement in 1984 he was named Emeritus Professor of the University of Rome. From that date until one week before his death he continued active research in his laboratory at the institute. His energy and enthusiasm continued and in September 1999, when he was nearly 90 years old, he was eagerly soliciting collaboration to undertake research on the bradykinins of the skin of cyclostomes. His interest was to pursue the phylogeny of the bradykinins, which are frequent in the skin glands on many amphibians.

Erspamer's early research (1937–1946) emphasized the identification of the secretions of chromaffin cells in the cutaneous glands of amphibians. During this same period he also did some interesting research on the secretions of cephalopods. During this time he gave the name "enteramine" to a substance extracted from the amphibian glands. In 1949, in the United States, Rappaport isolated an identical substance, 5-hydroxytryptamine, and named it serotonin. In 1952, Erspamer and Asero isolated 5-hydroxytryptamine from the skin of *Discoglossus pictus* and started a search for indolealkylamines in the cutaneous gland of other amphibians. More than 500 species were screened and the taxonomic distribution of the secretions was mapped. Indolealkylamines were discovered, in various combinations, not only in the Bufonidae (where it was reported to be most common by Cei, Erspamer, and Roseghini in 1972) but also in a diversity of families, genera, and species—Pipidae, Liopelmatidae, Pelobatidae, Leptodactylidae, Myobatrachidae, Ranidae, etc. Using the same techniques, Erspamer undertook a search for other biogenic amines—imidazolealkylamines, monohydroxy-phenylalkylamines, and catecholamines. It was discovered that the patterns of distribution of these amines within the Amphibia were sometimes unique. For example, catecholamines (epinephrine and related amines) are exclusively found in species of *Bufo*, which contain all of the precursor enzymes in the skin. The presence of various amines has also been useful in the diagnosis of species and in taxonomic keys.

Simultaneous to the research on the amines, Erspamer and his collaborators also studied bioactive peptides of batrachian skins. Some of these molecules were equivalent to neurotransmitters, neuromodulators, and other neuroendocrine agents present in mammalian tissues. The extensive screening led to the identification of more than one hundred bioactive peptides, structurally and pharmacologically belonging to a diversity of biochemical families such as takykinins, bradykinins, caeruleins, sauvagins, bombesins, opioids, and others. Hundreds of anuran species were obtained for study from North and South America, Europe, Africa, eastern Asia and Australia. Since 1959, collaborators such as Cei, Endean, Visser, and others have been active doing field work. Erspamer himself participated in some of the field work in Chile, eastern Asia, and South Africa.

The interest in these studies and discoveries is the fact that these batrachian peptide components are also found in mammalian tissues. In some cases the molecular equivalence between the amphibian and mammalian compounds is striking—caerulein versus choleocystokinin and gastrin; physalaemin versus substance P. More surprising is the fact that some of the batrachian peptides were discovered first and led to the identification of the mammalian analogs (bombesin, sauvagine and opioid peptides). Erspamer (1994. *In* H. Heatwole [ed.], Amphibian Biology, Volume 1, The Integument, pp. 178–350, Surrey Beatty and Sons) has provided an excellent and detailed summary of his work and that of others on the bioactive peptides (and other secretions) of amphibian skin glands. He makes clear the fact that the availability of synthetic amphibian peptides (such as bombesin) permitted and preceded the discovery of mammalian equivalents.

The work of Vittorio Erspamer and his influence on other researchers can be appreciated in this brief résumé of his investigations. His contribution to the advancement of herpetology is clearly evident. Furthermore, his humane personality transmitted an example of enthusiasm, scientific integrity, and critical ability, combined with a modest approach. Those who collaborated with him are left with a clear memory of his generous cooperation and sincere friendship. He always expressed himself with crystal clarity. The high regard in which he was held by research biologists was clearly demonstrated at meetings and in publications. He was nominated several times for the Nobel Prize, which he certainly merited, but unfortunately did not receive. We will remember him with respect and fondness.

LETTERS TO THE EDITOR

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How Far North Would the Gecko Move if the Gecko Could Move North?

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA
e-mail: aaron.bauer@villanova.edu

The Geographic Distribution section of *Herpetological Review* typically contains new locality records of a number of lizard species that have recently become established in the United States. Among the most frequently documented taxa with expanding ranges is *Hemidactylus turcicus*, the Mediterranean gecko. The first American record for this species was from Key West, Florida (Fowler 1915) and it was subsequently introduced into Texas (Conant 1955; Flower 1933). Isolated populations have since been established throughout the Gulf states and those bordering Mexico,

as well as in Oklahoma, Arkansas, and Georgia (Conant and Collins 1998; Painter et al. 1992; Paulissen and Buchanan 1990). In a recent issue of *Herpetological Review*, Eason and McMillan (2000) documented a South Carolina state record for this species (Charleston County, 32°48.300'N, 80°03.157'W), which they reported as the northernmost distribution of *H. turcicus* in the southeastern United States. Although this does appear to be the first record for the state, it is certainly not the northernmost record of the Mediterranean gecko in eastern North America. Knight (1993) had earlier reported on an established population on the campus of Virginia Polytechnic Institute and State University in Blacksburg, Virginia (approx. 37°14'N, 80°25'W; 495 km N of the South Carolina site), which he regarded as the northernmost breeding population of Mediterranean geckos in America. The true northernmost record for *H. turcicus*, however, belongs neither to South Carolina nor to Virginia, but to Maryland, where Norden and Norden (1991) documented the establishment and persistence of this species in south Baltimore (approx. 39°30'N, 76°37'W; 405 km NE of Blacksburg and 784 km NNE of Charleston County). Although no more northern localities have been identified, the survival and reproduction of this species in Baltimore suggests that urban environments in Philadelphia and perhaps even New York could also support colonies of this successful lizard.

The locality records of an introduced species are hardly worth quibbling over, but this case is instructive as it suggests that some authors of Geographic Distribution accounts in *Herpetological Review* may be missing relevant citations that appear in region- or taxon-specific publications. Although Norden and Norden (1991) was not indexed by *Zoological Record*, Knight (1993) was and would have, therefore, been fairly easy to locate. Although *Herpetological Review* has become the most frequently used outlet for the publication of notes documenting amphibian and reptile range extensions, it is not the only such outlet and authors should make every effort to comb the herpetological literature thoroughly before coming to the conclusion that they have located all publications pertinent to their own work.

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Norden, A. W., and B. B. Norden. 1991. The Mediterranean gecko (*Hemidactylus turcicus*) in Baltimore, Maryland. Maryland Nat. 33(3–4) [1989]:57–58.

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POINTS OF VIEW

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A Brief History of Snakes

HUSSAM ZAHER
Departamento de Zoologia, Instituto de Biociências
Universidade de São Paulo, Caixa Postal 11461
05422-970, São Paulo, SP, Brazil
e-mail: hzaher@ib.usp.br

and

OLIVIER RIEPPEL
Department of Geology, Field Museum of Natural History
1400 South Lake Shore Drive, Chicago, Illinois 60615, USA
e-mail: rieppel@fmnh.org

With the introduction of Pythonomorpha, Cope (1869) implicitly proposed the derivation of snakes from a mosasauroid ancestor (see also Nopcsa [1923]; McDowell and Bogert [1954] linked snakes with aigialosaurs through *Lanthanotus*). Although this hypothesis is not without problems of its own (Underwood 1957; Rieppel 1988), the marine origin of snakes that this scenario implies also clashes with data derived from the sensory system (Senn and Northcutt 1973; Underwood 1970; Walls 1940), which suggest a terrestrial, indeed fossorial or burrowing, ancestry of snakes. The recent re-analysis by Caldwell and Lee (1997) of snake-like fossils with limbs first discovered by Haas (1979, 1980a, b) in marine sediments from the Lower Cenomanian (early Upper Cretaceous) of Ein Yabrud, north of Jerusalem, provided a new impetus for the discussion of snake origins. In his initial description of *Pachyrhachis*, Haas (1979) placed *Pachyrhachis* in the Varanoidea but outside Serpentes, because he realized that those characters which this fossil taxon does share with snakes are macrostomatan characters, i.e., features characteristic of relatively advanced snakes (Rieppel 1988, 1994). It therefore seemed prudent to interpret *Pachyrhachis* as a varanoid, convergent upon macrostomatans in some cranial characters (Haas 1979). In spite of these character conflicts, *Pachyrhachis* became the textbook example for an ideal intermediate between fossil varanoids (mosasauroids) and snakes (Carroll 1988). This interpretation of *Pachyrhachys* has recently been supported by a series of papers (Caldwell and Lee 1997; Lee 1997, 1998; Lee and Caldwell 1998; Scanlon et al. 1999) which we briefly review below.

In his initial analysis of snake relationships, Lee (1997) constrained the search for the sister-group of Serpentes to Varanoidea, excluding all other squamates from the data matrix by rooting the analysis with a hypothetical ancestor. This prevented a test of snake relationships with other squamates, such as the fossorial amphisbaenians and dibamids, which had previously been recognized as at least potential sister-taxa of snakes (Estes et al. 1988; Rage 1982). At a later stage, *Pachyrhachis* was added to the analysis, and found to be the most basal snake, linking this group again to mosasauroids (Caldwell and Lee 1997; Lee and Caldwell 1998). Still later, other squamates were added to the analysis to test for global relationships among the group, and the mosasauroid–*Pachyrhachis*–snake clade was again supported, in spite of the

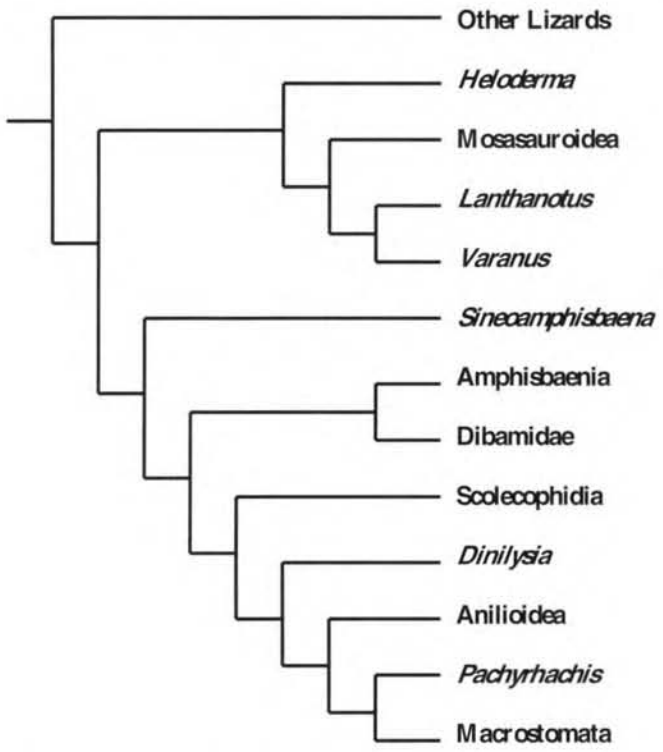


FIG. 1. Cladogram of higher-level interrelationships of snakes obtained by the reanalysis of the data of Lee (1998). This cladogram rejects Lee's hypothesis of sister-group relationships of mosasauroids and snakes as well as the basal position of *Pachyrhachis* with respect to extant snakes. See text and Rieppel and Zaher (2000b) for further discussion.

fact that *Pachyrhachis* had been found to be the sister-taxon of macrostomatans in a critical evaluation (Zaher 1998) of the data set presented by Caldwell and Lee (1997). The criticism raised by Zaher (1998) was rebutted by Lee (1998), but at the same time this latter study used all snakes other than *Pachyrhachis* as a single terminal, constraining the analysis in a way that would not allow an empirical test and potential refutation of Zaher's (1998) results.

We have conducted a detailed review and analysis of the characters offered by Lee (1998) in support of a basal position of *Pachyrhachis* among snakes, and a sister-group relationship of snakes with mosasauroids. This review was not intended to result in a well corroborated reconstruction of global squamate relationships, but instead, focused on the phylogenetic relationships of *Pachyrhachis* and its bearing on snake origins. A full scale reconstruction of squamate relationships would have to introduce additional terminals and/or split up terminals, coded at the family level by Lee (1998), in order to reduce polymorphism among terminals. Alternatively, the intrafamilial relationships of all terminals would have to be reconstructed in order to correctly infer the plesiomorphic character-states for each squamate family. This amounts to a long term project to be pursued in the future. At this time, we chose to critically assess the character definitions proposed by Lee (1998) as they relate to the anatomy of the dentition (Zaher and Rieppel 1999), of the braincase (Rieppel and Zaher 2000a), and of the lower jaw (Rieppel and Zaher 2000b). We corrected the data set of Lee (1998) where necessary, and subjected it to various manipulations in repeated searches (deletion versus retention of controversial characters, ordering versus not ordering of multistate characters, adding versus not adding characters that were not included in the original study, and rooting on the actual outgroups versus rooting on the reconstructed ancestor). In all cases, however, the terminal taxon Serpentes was broken up into Scolecophidia, *Dinilysia*, Anilioidea, and Macrostomata (for the validity of these terminal taxa see Rieppel, 1988; Kluge, 1991; Cundall et al., 1993). All searches uniformly showed *Pachyrhachis* to be the sister-taxon of Macrostomata, and the snakes did not group with mosasauroids, but always grouped with the amphisbaenian-dibamid clade (Fig. 1, Rieppel and Zaher 2000b). The implementation of Lee's (1998) tree on our corrected and amended data set (Rieppel and Zaher 2000b), using his own search procedure (i.e., retention of all characters, retention of the multistate characters as ordered, and rooting the tree on a reconstructed ancestor; Lee [1998]), results in a tree which is 15 steps longer compared to our most parsimonious solution (with a total tree length of 637 instead of 622 steps for 239 characters). Additionally, we applied the reverse successive weighting strategy developed by Trueman (1998) to our corrected data set and found that the amphisbaenian–dibamid–snake clade is retained as the most parsimonious solution after two iterations of deletion of unequivocal synapomorphies (ci = 1; given the initial data matrix of 239 characters, 76 unequivocal characters were deleted for the first iteration, and 9 characters for the second iteration). Only after three iterations of deleting unequivocal synapomorphies (another 15 characters were deleted) did we recover the varanoid–mosasauroid–snake clade, but the relative relationships among all snakes, including *Pachyrhachis*, remained unresolved. A fourth iteration recovered the amphisbaenian–dibamid–snake clade again, with *Pachyrhachis* as sister-taxon of Macrostomata in a tree devoid of any unequivocal synapomorphies. These results indicate that the data set does incorporate a weaker signal for a varanoid–snake–mosasaur relationship as compared to the signal for the amphisbaenian–dibamid–snake clade, and that both these signals are independent of the position of *Pachyrhachis*.

The reasons for the different results are manyfold: they range from changes of character delimitation to different codings to different search procedures. Of these, the character data base proved to be the most influential factor. To name but a few examples, the marginal teeth of mosasauroids are not thecodont, nor ankylosed to the rim of distinct sockets, but modified pleurodont as described and defined by Zaher and Rieppel (1999). A recumbent position of replacement teeth in mosasauroids is the result of post-mortem displacement (Edmund 1960; Polcyn et al. 1999; Zaher and Rieppel 1999). The plesiomorphic type of tooth implantation in snakes is again pleurodonty (as shown by scolecophidians), and *Pachyrhachis* shares with alethinophidian snakes a synapomorphic type of tooth attachment derived from pleurodonty (Zaher and Rieppel 1999).

The formulation of broad character definitions to accommodate distinct morphologies, typical of snakes and mosasaurs respectively, can lead to the oversimplification of complex, non-comparable, structures by lumping those within one character. For example, the character definition referring to the footplate of stapes as "tightly surrounded by flanges from prootic and opisthotic" refers to three distinct structures: the *crista prootica*, the *crista*

interfenestralis, and the *crista tuberalis* (*sensu* Oelrich 1956). The bony flanges surrounding the footplate of the stapes in non-ophidian squamates, including mosasauroids, are the *crista prootica* and *crista interfenestralis*, the plesiomorphic condition. In snakes, the footplate of the stapes together with the *fenestra rotunda* are surrounded by the *crista prootica* and the *crista tuberalis*, which together form a *crista circumfenestralis* enclosing a juxtastapedial recess. This juxtastapedial recess, recognized as an ophidian synapomorphy, is associated with the modification of the perilymphatic system which forms a re-entrant fluid circuit (Estes et al. 1970; Rieppel and Zaher 2000a; Wever 1978; Lee [1998] recognized this character delimitation as problematic, but continued to use it as a potential pythonomorph synapomorphy).

The definition of some characters fails to reflect ontogeny. For example, amphisbaenians, dibamids, and snakes share the formation of a "compound bone" which incorporates the (dermal) surangular and prearticular, and the (chondral) articular (a character wrongly polarized by Lee 1998). The absence of a "subcoronoid fenestra" (exposing the surangular between the coronoid and the prearticular on the medial surface of the lower jaw) is coded as a putative homology and accepted as a synapomorphy of mosasauroids, *Pachyrhachis*, and snakes (convergent in amphisbaenians and dibamids). However, this character is not applicable to taxa with a compound bone (snakes, amphisbaenids, and dibamids). Indeed, Bäckström (1931, fig. 17) shows the prearticular to completely conceal the surangular in the medial view of an embryonic jaw of *Natrix natrix* prior to the fusion of these elements to form a compound bone, and the same is observed in embryos of *Anilius scytale* (pers. obs., unpubl. data). For this reason, we reject the applicability of this character (i.e., surangular exposed, or not, on medial aspect of lower jaw) to taxa with a compound bone.

Another source of disagreement is the interpretation of the anatomy of *Pachyrhachis*. For example, Lee (1998) places great emphasis on the presence of a jugal in *Pachyrhachis* (as opposed to all other snakes) in his rebuttal of Zaher's (1998) criticism. We have re-examined the original material of *Pachyrhachis* as well as radiographs of the skull of the holotype, and concluded that a jugal is absent in this taxon. The element interpreted as a jugal by Lee and Caldwell (1998) is, in fact, the ectopterygoid, broken across the posterior tip of the maxilla. In all squamates which have a jugal with a suborbital process, the latter is a slender, anteriorly tapering process lining the ventral margin of the orbit. The putative jugal of *Pachyrhachis* is broadened anteriorly, as is the ectopterygoid of macrostomatan snakes, with which *Pachyrhachis* also shares the broad overlap of the ectopterygoid and maxilla.

Differences of opinion also exist with respect to search procedures. We agree with Lee (1998) that many of the characters shared by dibamids, amphisbaenians, and snakes might be due to convergence, resulting from character correlation due to burrowing habits (Rieppel 1984a). But instead of demonstrating this convergence empirically, Lee (1998) accepted the hypothesis of convergence due to character correlation as a valid *a priori* assumption in order to justify the arbitrary downweighting of those characters believed to be associated with the "fossorial ecomorph." It remains unclear why the threat of character correlation was used to justify the implementation of search procedures that would break the snakes away from the amphisbaenian–dibamid clade, while this latter clade is accepted on the basis of the very same characters of the burrowing ecomorph. As discussed by Gasc (1968), Rieppel (1984b), and Greer (1985), grouping dibamids with amphisbaenians results in homoplasy for those characters which dibamids share with other squamates such as gekkotans and scincomorphs. It also remains unclear why the characters believed to be associated with the "burrowing ecomorph" are downweighted in order to prevent "spurious" phylogenetic results, while the characters correlated with the development of intramandibular kinetics are not also downweighted in order to inspect their influence in the support of the mosasaur–snake clade. Lee (1998) treated a number of characters (110, 113 118, 119, 121, 123 124, 125, 126, 127, 130, 131, 135) as independent from one another, when in fact all of these reflect the development of intramandibular kinetics, and the correlated reduction of overlap between dentary and postdentary bones. Concerns that the intramandibular joint might have evolved independently in mosasauroids and snakes had been voiced earlier (Gauthier 1982), and distinct morphologies were confirmed in our recent study of the lower jaw of varanoids, mosasauroids, and basal snakes (Rieppel and Zaher, 2000b). For example, it is the surangular portion of the compound bone which supports the dentary in snakes, while in mosasaurs the dentary is primarily supported by the prearticular (Bäckström 1931; Gauthier 1982; pers. obs.). Also, the receiving part of the mobile splenial-angular contact is the splenial in mosasaurs, but the angular in snakes (Rieppel and Zaher 2000b).

Given a pattern of phylogenetic relationships showing terrestrial varanoids to be the sister-group of the (mosasauroid (*Pachyrhachis* (terrestrial snakes))) clade, the marine origin of snakes optimizes equivocally (Scanlon et al. 1999). The hypothesis of a marine origin of snakes therefore not only requires *Pachyrhachis* to be the most basal snake, but *Pachyrhachis* must also be accepted as an "excellent example of a transitional taxon" (Scanlon et al. 1999, p. 128) from a process point of view. This hypothesis cannot be maintained in view of the macrostomatan features shared by *Pachyrhachis* (Rieppel and Zaher 2000b; Zaher 1998) such as the elongate and posteriorly free-ending supratemporals, the elongate posterior dentigerous process of the dentary (the latter bone shows a single mental foramen only), the morphology of the palatine, the extensive ectopterygoid-maxillary overlap, the morphology of the postorbital-parietal contact (a postfrontal is absent), the presence of a long and slender shaft of the stapes, the presence of a posteriorly projecting opisthotic paroccipital process, and the posteroventrally sloping quadrate. Our re-analysis of the data set presented by Lee (1998) furthermore found strong support for a sister-group relationship of snakes with the amphisbaenian-dibamid clade (see also Estes et al 1988; Hallermann 1998).

We do recognize, as does Lee (1998), that this signal is suspect because of the threat of convergence due to fossoriality. However, the solution to this problem is not the *a priori* downweighting of characters believed to be correlated with the fossorial ecomorph, but the search for additional empirical evidence in a continued test of that hypothesis of relationships (Forstner et al. 1995; Reeder 1995).

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Further Evidence for Mites as Tertiary Prey in the Gastrointestinal Tract of Snakes and Frogs

ROD DOUGLAS
Department of Herpetology, National Museum
P.O. Box 266, 9300 Bloemfontein, South Africa
e-mail: reptile@nasmus.co.za

Although mites appear to be infrequently reported in reptile diet studies (Douglas 1992b; Schoener 1968; Schoener and Gorman 1968), in amphibian diet studies the occurrence of mites is far

more common (Dimmitt and Ruibal 1980; Norton and MacNamara 1976; Simon and Toft 1991). In many of these studies the occurrence of mites has been interpreted as them being part of the diet, when often the identification of mites is inadequate for the inferences and assumptions being made (Douglas, in preparation).

Van Dijk (1997) speculated that mites found in the gastrointestinal tracts of the snake *Psammophylax rhombeatus* could have originated from frogs, and not shrews, as was stated by Douglas (1992a). In the study by Douglas (1992a), information was presented that was part of a broader, more detailed, microscopic study on the diet of *P. rhombeatus* (Douglas 1992b). It would therefore be difficult to draw conclusions, similar to those made by Van Dijk (1997), from the former, without having consulted the latter. Van Dijk (1997) further speculated that mites in the gastrointestinal tracts of frogs, of which he found no evidence, might occur through the frogs ingesting their own molted skin. As a consequence of these assumptions, further clarification on mites as tertiary prey items in the gastrointestinal tracts of snakes and frogs is presented.

From 55 *Psammophylax rhombeatus* gastrointestinal tracts microscopically examined by Douglas (1992a), 20% contained free-living soil mites (Subclass Acari, Superorder Actinotrichida, Order Oribatida [N = 21]; and Superorder Anactinotrichida, Order Mesostigmata [N = 6]; classification after Evans 1992). The Orders were represented by eight genera: *Scheloribates, Brachioppia, Mikizetes, Passalozetes, Zygoribaula,* and *Mycobates*. These genera can be referred to as free-living soil mites which feed largely on live and decaying plant material, and are distinctly macrophytophagous, microphytophagous or, a combination of the two, panphytophagous. Although some mesostigmatid mites are known to be predatory, this is usually limited to prey which they can overpower, for example, nematodes and small arthropods (Evans 1992). None of the eight genera recorded by Douglas (1992a) was zoophagous, parasitic, or aquatic, and Evans (1992) did not mention any of these genera as being associated with frogs in any way. Being free-living soil mites would tend to rule them out as eating molted frog skin, or occurring on frogs.

In the gastrointestinal tracts of *Psammophylax rhombeatus*, 27 mites were recorded and accounted for 7.2% of identifiable items (N = 19) (Douglas 1992b). Only one species of anuran was recorded, *Cacosternum boettgeri* (N = 3). All the *C. boettgeri* were found in the same *P. rhombeatus* specimen and accounted for 1.8% of the occurrence of items (Douglas 1992b). Douglas (1990) further microscopically examined the remaining gastrointestinal tract of one of the three frogs and identified four major groups of insects (Coleoptera, Hemiptera, Chrysomelidae, with the bulk being Formicidae of the genus *Trinervitermes*), but no mites were found. This provided further evidence that the mites were not associated with the frogs.

As the shrew *Suncus varilla* was the primary prey of *P. rhombeatus*, representing 51% of prey species, a sample of 25 shrew gastrointestinal tracts also were examined. It was found that 43% of individuals contained oribatid mites. These mites were not at all damaged (e.g., through mastication) and were found only in association with earthworms (Douglas 1992a). Analysis of Churchfield's (1984) results on the diet of the shrew *Suncus araneus* showed a 53% correlation between the occurrence of mites and earthworms, a 65% correlation between the occurrence of mites and gastropods, and a 76% correlation between the occurrence of earthworms, gastropods, and mites (Douglas 1992a). The undamaged state of the mites and the aforementioned correlations tend to indicate that mites were not part of the diet of shrews, but were tertiary prey items incidentally ingested by the earthworms and gastropods.

The many assumptions and inferences in the literature, such as acariphagy, and which are based almost entirely on the occurrence of mites in the gastrointestinal tracts and not on any feeding observations, is the basis of a separate paper (Douglas, in preparation). Considering the evidence presented here, it is not clear how Van Dijk (1997) came to the conclusion that Douglas (1992a) did not consider frogs as an alternative source of mites.

On the other hand, Van Dijk (1997), without any evidence or references, put forward an alternative scenario of mites feeding on molted frog skin, which was then ingested by the frog. This scenario was based on an observation that ostracods occurred in the gastrointestinal tract of the aquatic frog *Xenopus laevis*, and that ostracods had been observed attacking the skin of *Kassina senegalensis* tadpoles (Van Dijk 1977). It may be asked whether the ostracods were actually feeding on the skin, or on the skin secretions? If ostracods and molted skin were found together throughout the gastrointestinal tract of *Xenopus laevis*, even as far as the rectum (Van Dijk 1997), this would clearly imply that neither were digestible items. If neither were digestible, then along with other indigestible prey remains such as insect exoskeletons, it would be very difficult to determine with any certainty whether the ostracods were specifically associated with the molted skin. That Van Dijk (1997) found ostracods in folds of the frog's ingested skin could also be explained by prey remains being shuffled and mixed while passing through the gastrointestinal tract.

There are other possible logical explanations for the occurrence of ostracods in the gastrointestinal tract of *Xenopus laevis*. The occurrence of ostracods would be analogous to indigestible mites found in gastrointestinal tracts of reptiles and amphibians, and the question would arise as to why the frogs would deliberately consume indigestible prey items such as ostracods? Because *X. laevis* is an aquatic species which feeds by hyobranchial pumping action (sucking in food and water and then expelling the water), ostracods could have incidentally been sucked up with other food items. This is highly probable because *X. laevis* is a scavenger and a predator (Lambiris 1989), and will consume almost any available food, including carrion, on which the ostracods could have been feeding. Alternatively, the ostracods could just as well have been incidentally ingested by other prey items and be of a secondary nature.

It was largely as a result of this type of inconclusive evidence that time was spent backtracking on the occurrence of mites in the *Psammophylax rhombeatus* gastrointestinal tracts. All the mite genera identified by Douglas (1992a) were free-living soil mites and very unlikely to be associated with frogs in any way. It is of course probable that certain mites may well utilize molted frog skin as part of their diet, but apparently not in this instance. At this stage it would appear that Van Dijk would have to look at other mite species to substantiate his alternative scenarios.

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ARTICLES

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On the Status of the Coral Snake *Micrurus nigrocinctus* (Serpentes, Elapidae) in Belize, and its Northernmost Distribution in Atlantic Middle America

PETER J. STAFFORD
The Natural History Museum
Cromwell Road, London SW7 5BD, UK
e-mail: pjs@nhm.ac.uk

In listing *Micrurus affinis alienus* (= *M. diastema sapperi*) from Belize, Schmidt (1941) made reference to a specimen in the Zoologisches Museum, Berlin, that fell entirely outside the definition of this species. The snake is said to have originated from "Corozal Island, British Honduras," with no other source stated except "Wien." Schmidt described it as having "very well developed supra-anal tubercles," and noting that this character was otherwise wholly absent in the coral snakes from the area, he suspected some confusion of data. Neill and Allen (1959), however, suggested that the locality cited by Schmidt might be Isla Corozal or Isla Corosalito, variant names for a station on the Rio Hondo in Orange Walk District [Belize], and that the snake in question might be *Micrurus nigrocinctus*. In a subsequent paper, Neill (1965) described a specimen of *Micrurus nigrocinctus divaricatus* (Hallowell) from Gallon Jug, a locality also in the Rio Hondo drainage of Orange Walk District, since when specimens of *Micrurus* purportedly attributable to this taxon have been collected in Belize on a number of other occasions.

Micrurus nigrocinctus divaricatus is an exceptionally variable coral snake otherwise known from central and northern Honduras (Roze 1967, 1970, 1996). Populations from this region are in many features similar to *M. diastema* and also examples of the other nominal species of *Micrurus* reported from Belize, *M. hippocrepis* (Peters). During an assessment of variation in Belizean material of the genus *Micrurus* for the purpose of compiling a guide to the reptiles of this country (Stafford and Meyer 2000), it became apparent that specimens were attributable only to *M. diastema* and *M. hippocrepis*, and that, as suspected by Schmidt (1941), the errant individual with supra-anal tubercles from "Corozal Island" almost certainly originated elsewhere. It also emerged that the combination of characters described by Neill (1965) for the Gallon Jug *Micrurus nigrocinctus divaricatus* is at variance with the definition given for this taxon, and more like that exhibited by some *M. diastema*. It is the purpose of this paper to determine the status of these two specimens, and to suggest that the reported occurrence in Belize of *Micrurus nigrocinctus* has been based on confusing examples of *M. diastema* and *M. hippocrepis*. The northernmost distribution of *Micrurus nigrocinctus* in its Atlantic versant range is also discussed.

Information on the current understanding of the presence of *Micrurus* in Belize, including a comprehensive list of distribution records, has most recently been provided by Lee (1996). *Micrurus diastema* occurs almost countrywide, except on the offshore islands and perhaps in the extreme south, and in virtually all habitats. *Micrurus hippocrepis* has a restricted distribution in the more mesic southern lowlands and Maya Mountains, and *M. nigrocinctus* is known from a small number of localities scattered generally throughout the country as a whole. The list of locality records given by Lee (1996) for *M. nigrocinctus* is partly inaccurate in that it includes a series of *M. hippocrepis* described by McCoy (1970) from Middlesex, Stann Creek District [UCM series and CM 48010] (Lee, pers. comm.). Notwithstanding this, however, Lee (1996) cited 6 other records of *nigrocinctus* from Belize [mi 39 on Western Hwy. (MCZ 152577); Caracol (photograph); upper Raspaculo River Basin (Stafford, 1991); Gallon Jug (Neill, 1965); Guinea Grass Rd. ca. 4 mi S Northern Hwy (CM 105735); Stann Creek (USNM 24906)].

Micrurus nigrocinctus, *M. diastema*, and *M. hippocrepis* are tricolored, single-banded coral snakes that resemble each other also in habitus, scutellation, and some finer details of color pattern. In the region concerned, all three species are highly variable (Campbell and Lamar 1989; Fraser 1973; Lee 1996; Roze 1996; Wilson and Meyer 1972, 1985). Supra-anal tubercles are present in adult male *nigrocinctus*, and this is perhaps the most unambiguous distinguishing character in that it is lacking in *diastema* and *hippocrepis*. From populations of *M. nigrocinctus* in northern Honduras, the area geographically nearest to Belize from which examples of this species are otherwise available, *diastema* and *hippocrepis* may be further differentiated by utilizing combinations of various scale and color pattern features (Table 1). Significant among these is the proportional number of divided and undivided subcaudal scales; in *M. nigrocinctus*, the subcaudal scales are usually all divided, whereas a sizable proportion of those in most *diastema* and *hippocrepis* are entire. Also of note is the con-

dition of the nuchal ring and corresponding number of black body rings. In *M. nigrocinctus*, the nuchal ring is usually complete, of more or less the same length dorsally and ventrally, and in examples with fewer than 19 black body rings, up to 2 dorsal scale lengths distant from the posterior tips of the parietals. In *diastema*, it is either interrupted or narrowly constricted ventrally, and involves at least the posterior tips and usually a larger proportion of the parietals. The anterior margin of the nuchal ring in *M. hippocrepis* is occasionally posterior to the parietals, but in these individuals is incomplete (laterally in four specimens examined and ventrally in one). *Micrurus hippocrepis* is further distinguishable from most *nigrocinctus* in its conspicuous lack of black pigment on the scales of the red rings. The red scales of this species may be dusky in appearance or edged with a dark border, whereas, in most geographically proximate populations of *nigrocinctus*, black pigment is present either in the form of conspicuous, uniformly distributed spots, coalesced blotches, or medially-oriented accessory rings (exceptions include 5 specimens from Lancetilla and La Lima, Dept. Atlántida, Honduras, in which the red rings are immaculate). Some *M. diastema* and *M. hippocrepis* have a pale spot on the snout that may be restricted to the rostral or involve as much as the internasals, adjoining margins of the prefrontals, nasals, and the anteriormost supralabial. Among specimens of *M. nigrocinctus* examined, however, this condition is apparent only in one (MCZ 32010; Lancetilla, Depto. Atlántida, Honduras), and it is a feature not otherwise associated with the species.

On the basis of these features, all but two of the specimens of *Micrurus* from Belize may be allocated to either the common species of the region, *M. diastema*, or *M. hippocrepis*. Of the two exceptions, one is the specimen from "Gallon Jug, Orange Walk District" tentatively referred by Neill (1965) to *M. n. divaricatus*. The combination of characters described for this individual, which I have been unable to locate and examine for myself, disagree in several notable respects with the definition given for *divaricatus*. The other, a male from "Corozal Island" with well developed supra-anal tubercles, is the same as that originally suspected by Schmidt (1941) as not having come from Belize. It thus would appear necessary to examine in greater detail the status of these particular specimens.

ZMB 26384 (Corozal Island, British Honduras).—As originally suggested by Neill and Allen (1965), this specimen is referable to *Micrurus nigrocinctus*. It has a snout–vent length of 492 mm and a tail length of 88 mm, and there are 198 ventrals, 49 subcaudals (all divided), and 1+1 temporals on each side. Supra-anal tubercles are well developed. The black head cap is regular in outline and does not extend posteriorly onto the parietals; the black nuchal ring is complete, between 4 1/2–5 dorsal scales long, and involves the posterior tips of the parietals. There are 19 other black body rings, of which 4 are incomplete ventrally, and these vary from 2–2 1/2 dorsal scales in length. The red rings have faded completely in preservative and the original distinction between these and the yellow rings (assuming the latter were present in life) is no longer discernible; black pigment on the scales of the "red" rings is limited to small, more or less uniformly distributed dots. There are 6 black rings on the tail, ranging between 5 and 6 dorsal scales in length; the pale (yellow?) interspaces range between 2 1/2–3 1/2 scales long. Ventrally, the pale rings are immaculate, with black pigment present on the mental and anterior infralabials only.

The collection locality of ZMB 26384, as given in the Zoologisches Museum catalogue and cited by Schmidt (1941), is "Corozal Island, British Honduras." The other source quoted, "Wien," apparently refers to the collector, and it has been brought to my attention (courtesy of R. Günther) that in the Zoologisches Museum archives is a letter written by Wien dating from the 1880's in which the origin of the specimen (and a *Leptophis mexicanus*, ZMB 26385) is stated as the island of "Cozumel." This is assumed to be a reference to the island of that name located north of Belize off the coast of Quintana Roo, Mexico. Given that neither of these species are known to occur on Cozumel, however, and only *M. diastema* has been recorded from the adjacent mainland (Lee 1996), the likelihood of ZMB 26384 originating from this locality seems remote. It is apparent from his letter that at least some of Wien's specimens were collected in the Corozal area of Belize, and in light of this it is possible that "Cozumel" has been corrected subsequently or otherwise changed to "Corozal." Another possibility is that the specimen came from All Pines, a locality south of Belize City at the mouth of the Sittee River, where the majority of Wien's collection appears to have originated [for reasons unknown, the source of these, as given in the Zoologisches Museum catalogue, is "Beguiella, Carosall" (R. Günther, pers. comm.)]. The fact that no other *M. nigrocinctus* has been forthcoming since, either from these particular areas or elsewhere in Belize (Neill's report notwithstanding), however, suggests that there has most probably been some other fundamental confusion of data. Wien's letter is one of two filed in the ZMB archives under "Briefe Wien, Bestan Zoologie Sig: SII."

WTN 2856 (Gallon Jug, Orange Walk District).—Neill (1965, pp. 111–112) described this specimen as "a female; total length 317 mm, tail length of 47 mm. Dorsal scale rows 15, ventrals 212, subcaudals 49. Black rings 10 on body, these rings 5 1/2 to 8 scales long. Each black ring with yellow borders, each yellow ring about 2 1/2 scales long. Scales of red interspaces uniformly tipped with black, but no other black pigment in the red areas. Tail with 4 black rings separated by yellow interspaces. All rings complete and regularly transverse. Snout completely black; a yellow band across back of head extending anteriorly to posterior margin of eye." Allocating it tentatively to *Micrurus nigrocinctus divaricatus* (Hallowell), Neill (1965) remarked that the specimen (hereinafter referred to by its field number, WTN 2856) agreed with this taxon in ventral count and its long yellow rings, but disagreed in having a high subcaudal count and in the distribution of black pigment in the red zones, as well as in having a low number of black rings.

With respect to the number and length of its black body rings, WTN 2856 is particularly unusual. Roze (1996) gave a range of 11–24 rings for a sample of 121 *Micrurus nigrocinctus divaricatus*, and described these as usually 3–4 dorsal scales and 2–4 ventrals in length. It may be the case that the distinctive length of the body rings is an expression of the relatively low number of rings in this specimen, or that the range in ring length specified includes the nuchal ring, which in snakes of the genus *Micrurus* is typically longer than the other black body rings. In 31 *M. nigrocinctus* examined by me for the purposes of this review (Table 1), the black body rings do not exceed 5 dorsal scales in length, and the nuchal ring does not extend longitudinally for more than 6 dorsal scales and 4 ventrals (one specimen).

Another peculiarity of WTN 2856 is its high number of subcaudals, which is inconsistent with the known range of female *M. nigrocinctus* [32–43], *M. diastema* [32–45], or *M. hippocrepis* [36–42] (Roze 1996; see also Table 1). Taken with the proportional length of the tail (calculable as 14.8% of the total length), it seems more likely that the specimen is a male. The number of ventrals indicated falls within the range of male *M. diastema* from Belize [198–212], but is notably higher than the maximum recorded for a male *M. nigrocinctus divaricatus* [206] (Roze 1996).

Perhaps also significant is that the color pattern described by Neill (1965) for WTN 2856 is evident in no other specimen of *Micrurus* examined from Belize. *Micrurus hippocrepis* occasionally has 10 black body rings or fewer, but these are invariably narrow (1–3 dorsal scales), and dark pigment on the red dorsal scales is either absent, limited to small, sparsely-distributed dots, or confined to the leading edges of occasional scales. The number of black body rings exhibited by specimens of *M. diastema* from Belize is 18–33. In this particularly variable species, however, the

TABLE 1. Comparative external features of *Micrurus nigrocinctus* from northern Honduras [data combined with that of Roze (1996) for *M. n. divaricatus*] and Belizean *M. diastema* and *M. hippocrepis*. *Notes:* [1]counts made using method of Dowling (1951); [2]terminal spine not included; [3]nuchal ring and a black ring enclosing vent (where present) included; [4]black tip less than one half the width of the other black rings not counted; [5]specimens with 1+1 on one side and 1+2 on the other scored as having a 1+2 arrangement. Specimens exhibiting characteristics intermediate between *M. diastema* and *M. hippocrepis* are not included.

	Micrurus nigrocinctus		*Micrurus diastema*		*Micrurus hippocrepis*	
Sex (N)	♂ (15)	♀ (16)	♂ (22)	♀ (10)	♂ (20)	♀ (13)
Ratio tail length/total length	0.130–0.166	0.080–0.115	0.122–0.165	0.098–0.118	0.133–0.162	0.098–0.114
Supra-anal tubercles	Present (SVL> ca. 400 mm)	Absent	Absent	Absent	Absent	Absent
Ventral scales[1]	190–206	206–221	198–212	215–226	196–210	212–221
Subcaudal scales[2]	44–53	32–41	45–55	37–43	45–56	36–42
Undivided subcaudals; % frequency occurrence	6.7%	0%	95.2%	100%	100%	69.2%
Proportional number of undivided subcaudals; % range	0–3.8%	0%	0–45.8%	12.5–45.2%	6.0–63.0%	0–14.3%
Number of black body rings[3]	11–24	12–23	18–28	22–33	4–16	10–18
Number of black tail rings[4]	3–8	2–7	5–9	5–7	3–6	3–5
Temporal scale arrangement[5]; % frequency	1+1 (81.3%) or 1+2		1+2 (96.8%) or 1+1		1+2 (93.9%) or 1+1	
Snout coloration; % frequency black/yellow on rostrum	Black (96.9%); 1 specimen with yellow blotch on rostrum		Black (61.3%) or rostrum with variable amount of yellow		Black (66.7%) or rostrum with variable amount of yellow	
Nuchal ring; % frequency complete/incomplete	Complete (93.8%) or open ventrally; dorsal and ventral length ± subequal		Complete (64.5%) or open ventrally; when complete usually narrowed ventrally		Incomplete ventrally/laterally (81.8%) or complete; when complete usually narrowed ventrally	
Position of nuchal ring	anterior margin up to 2 middorsal scales behind posterior edge of parietals in examples with 19 black body rings or fewer		anterior margin involves at least posterior tips of parietals		anterior margin involves at least posterior tips of parietals unless incomplete laterally	
Incomplete black body rings; % frequency occurrence	6.5%		31.3%		48.5%	
Black body rings; dorsal length	2.5–5 scales		1.5–6.0 scales		1.0–3.0 scales	
Yellow body rings; dorsal length	0–2 scales		0.5–2.0 scales		0.5–1.5 scales	
Presence (% frequency occurrence) and character of black pigment distribution on red dorsal scales	Usually present (84.4%); uniformly distributed, irregular, or suggestive of accessory bands		Present (100%); uniformly distributed, irregular, or suggestive of accessory bands		Usually absent (57.6%) or limited to small, sparsely-distributed dots/ marginal fringes of occasional scales, or scales dusky	

body rings range from 1.5–6 dorsal scales in length, and the yellow rings may be up to 2 dorsal scales long. Black pigment distribution within the red rings is typically irregular, although in some specimens is uniformly distributed with a well-defined spot on the tip of each scale. Many (61.3% of those examined) have a completely black snout. There is a particular resemblance between WTN 2856 and examples of *Micrurus diastema* allocated to *M. d. alienus* (Werner). An exceptionally similar specimen (USNM 24891, Yucatán, Mexico; male) has 11 black rings on the body, 4.5–7.5 dorsal scales long (nuchal ring included), yellow rings ca. 2 dorsals long, 4 black tail rings, uniformly distributed black tipping on the scales of the red rings, and a completely black snout. *Micrurus d. alienus* has not been reported from Belize, although it is known from the adjacent Guatemalan department of El Petén (Campbell 1998), and also intergrades with *M. d. sapperi* in southern Quintana Roo (Roze 1996). In consideration of this, and the discrepancies outlined above concerning the character of its color pattern and the number of ventral and subcaudal scales, it is suggested that WTN 2856 represents an example of *Micrurus diastema*, albeit a rather peculiar one.

Discussion of geographic distribution.—The northernmost distributional limit of *Micrurus nigrocinctus* in the Atlantic versant, as represented by specimens of known provenance and denomination, appears to be the Sula Plain area of Depto. Cortés, northern Honduras. Specimens from this locality are cited by Wilson and Meyer (1972, 1985). Schmidt (1933) listed *M. n. divaricatus* from the lowlands of eastern Guatemala, but did not elaborate on the source of his information, and Stuart (1963) included only the Pacific versant *M. n. zunilensis* in his Guatemalan list. No examples of *M. nigrocinctus* from eastern Guatemala appear to be available, and neither has recent exploration produced specimens or other evidence of the occurrence of this species in the region (J. A. Campbell, pers. comm.). A specimen in the Museum National d'Histoire Naturelle, Paris, labeled from "Guatemala" with no other locality data [MNHN 6082], is representative of the Pacific versant population. Given the proximity of eastern Guatemala to the department of Cortés, Honduras, however, it is possible that *nigrocinctus* may eventually be confirmed from this area. On the same basis, its occurrence in Belize, particularly in the relatively unexplored Maya Mountains, is also not inconceivable. From a biogeographical viewpoint, however, it is of some significance that the species has not been reported from El Petén (Campbell 1998; Campbell and Vannini 1989), with which southern Belize has greatest affinity, and that the respective herpetofaunas of southern Belize and northern Honduras are not more alike. Considering the short distance between southern Belize and northern Honduras, the proportion of species shared by these two regions is lower than might be expected (Stafford and Meyer 2000), a situation that may be a reflection of the area's geological history.

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Specimens examined.—*Micrurus diastema*: BMNH 1935.6.3.2-1935.6.3.4 (British Honduras), BMNH 1946.1.20.7 (Stann Creek), BMNH 1946.1.20.18-19 (Belize), BMNH 1978.2009 (northern Belize), CM 90989 (Belmopan, Cayo Distr.), CM 105711 (1.2 mi S Blancaneaux Lodge, Cayo Distr.), CM 105735 (Guinea Grass Rd., ca. 4 mi S Northern Hwy., Orange Walk Distr.), CM 105944 (Augustine, Cayo Distr.), CM 112110 (Chial, Cayo Distr.), CM 112118 (ca. 6 mi S Georgeville, Cayo Distr.), CM 112126 (Chiquibul Branch, S Granos de Oros Camp, Cayo Distr.), CM 112150 (Macal River at Guacamallo Bridge, Cayo Distr.); FMNH 4254 (Belize City, Belize Distr.), FMNH 71534 (Roaring Creek, Cayo Distr.); MCZ 152577 (mi 39 Western Hwy., Belize Distr.); MPM 7380, 7382, 7713-7714 (Tower Hill, Orange Walk Distr.), MPM 7381 (62 mi from Punta Gorda on Southern Hwy., Stann Creek Distr.), MPM 7383 (Santa Cruz, Corozal Distr.), MPM 7712, 10787 (near Orange Walk Town, Orange Walk Distr.); MPM 8187 (Baldy Beacon, Mountain Pine Ridge, Cayo Distr.); MPM 8188 (Central Farm, Cayo Distr.), MPM 8274 (Tropical Park, Belize City, Belize Distr.), MPM 8282 (Chan Pine Ridge, Orange Walk Distr.), MPM 13886 (Northern Hwy. W, 0.5 mi S Tower Hill Ferry, Orange Walk Distr.); OUM 21610 (Monkey Bay National Park, Belize Distr.); PJS 9813 (Las Cuevas, Cayo Distr.); USNM 024890-024892 (Yucatán, Mexico), USNM 024905 (Belize), USNM 026059 (Stann Creek, Toledo Distr.), USNM 325115-325116 (Big Falls, ca. 12 mi SE Lubaantun, Toledo Distr.), USNM 333101 (Cotton Tree, 2.1 km N of mile marker 24 on W Hwy., Belize Distr.).

M. hippocrepis: BMNH 91.3.4.6 (Stann Creek, Stann Creek Distr.), BMNH 95.2.21.1-95.2.21.3 (British Honduras), BMNH 1973.2843 (Silk Grass, Stann Creek Distr.); CM 48010 (Middlesex, Stann Creek Distr.); MPM 7384 (near Middlesex, Stann Creek Distr.), MPM 7679 (Mountain Pine Ridge River on Naval Road, Cayo Distr.); UCM 25710, 25722, 25726, 25749-25750, 25809, 25885-25888, 25890-25894, 29979-29980, 30885-30887 (Middlesex, Stann Creek Distr.); USNM 024906 (Belize); USNM 325117 (Maya Mountains, Swasey River Valley, Toledo Distr.); USNM 325118 (Swasey River Valley, Toledo Distr.); USNM 498224 (Richardson Creek Camp, Bladen Nature Reserve, Toledo Distr.); USNM 498225 (Ek Xux Camp, Bladen River, Toledo Distr.).

Intermediate "*M. diastema x hippocrepis*": BMNH 1973.2842 (Stann Creek), BMNH 1992.510 (Cuxta Bani, upper Raspaculo River, Cayo Distr.); FMNH 49355-49356 (Stann Creek Valley, Stann Creek Distr.); PJS 9314, 9702 (Cuxta Bani, upper Raspaculo River, Cayo Distr.).

M. nigrocinctus: AMNH 46968-71, 70237-38 (Lancetilla, Depto. Atlántida, Honduras); FMNH 5311 (Lake Ticamaya, Depto. Cortés, Honduras), FMNH 5312 (W of San Pedro Sula, Depto. Cortés, Honduras), FMNH 8083 (Garcia Plantation, Depto. Yoro, Honduras), FMNH 16115 (Colorado Distr., Depto. Atlántida, Honduras), FMNH 16116-16120 (Guaymas Distr., Depto. Atlántida, Honduras), FMNH 34720-34722 (Portillo Grande, Depto. Yoro, Honduras); LSUMZ 21773 (mountains above Corozal, Depto. Atlántida, Honduras), LSUMZ 24425 (La Lima, Depto. Cortés, Honduras), LSUMZ 24226 (15.5 mi S Puerto Cortés, Depto. Cortés, Honduras); MCZ 19945 (Ulua River, near Tela, Depto. Atlántida, Honduras), MCZ 21772-73 (Colorado Distr., Depto. Atlántida, Honduras), MCZ 29412-13, 32010-12, 32014, 33342, 38772-73 (Lancetilla, Depto. Atlántida, Honduras); MNHN 6082 (Guatemala); ZMB 26384 ("Corozal Island, British Honduras").

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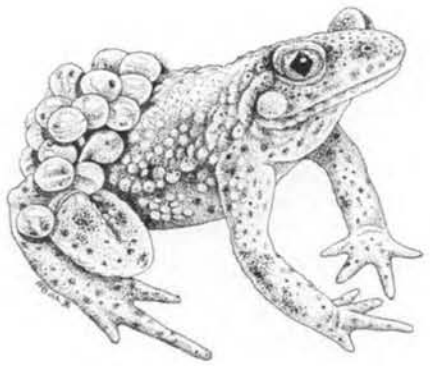
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Alytes obstetricans. Illustration by P. A. Benson.

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Seasonal Activity of the Scarlet Snake, *Cemophora coccinea*, in Florida

KEVIN M. ENGE
Florida Fish and Wildlife Conservation Commission
Joe Budd Wildlife Field Office, 5300 High Bridge Road
Quincy, Florida 32351, USA
e-mail: engek@gfc.state.fl.us

and

J. DANIEL SULLIVAN
Florida Fish and Wildlife Conservation Commission
Carrabelle Work Center, 1621 Highway 98 East
Carrabelle, Florida 32322, USA
e-mail: sullivd@gfc.state.fl.us

The semifossorial *Cemophora coccinea* apparently exhibits a unimodal peak of surface activity and is inactive during the cooler months, even during warm spells (Gibbons and Semlitsch 1987). However, Ernst and Barbour (1989) speculated that *Cemophora* might be active year-round in Florida during mild years. During a drift-fence survey in Tate's Hell Wildlife Management Area (WMA), Franklin County, Florida, USA, we observed anomalous cool-weather activity by *Cemophora coccinea* at one drift-fence array. In order to ascertain monthly activity patterns of *Cemophora*, we compiled additional data from throughout Florida that sampled most months of the year (Table 1).

Excluding the data from Franklin County, 96.4% of all *Cemophora* (N = 330) in Florida were captured between April and August, and 74.2% between May and July (Table 2). There is no apparent trend for more southerly populations in peninsular Florida to have a longer activity season than northern populations, although a specimen was captured on 16 November in Hernando County and on 16 December in Martin County. In subtropical Dade County, *Cemophora* were captured on roads from May through July (Dalrymple et al. 1991) and were observed eating *Terrapene carolina* eggs at night from 1 April through 16 June (Dickson 1948). Drift-fence studies in South Carolina yielded a similar window of activity to studies in Florida, with all *Cemophora* being captured from April through October (Gibbons and Semlitsch 1987). However, peak *Cemophora* activity in Florida (May–June) occurred one month earlier than in South Carolina (June–July). Specimens have been collected from 19 April through 7 November in Virginia (Mitchell 1994), but these records may have included animals collected from underground brumation sites. A *Cemophora* collected in Mississippi on 10 December from under a piece of bark near a swamp (Allen 1932) may have been brumating.

The observed May–July peak in surface activity for *Cemophora* probably corresponds with increased activity associated with the breeding season and foraging for food. Although *Cemophora* have been recorded taking a variety of prey, reptile eggs appear to be preferred (e.g., Brown 1979; Dickson 1948; Minton and Bechtel 1958; Neill 1951; Palmer and Tregembo 1970; Williams and Wilson 1967), and peak oviposition for most squamate and some turtle species in Florida occurs from April through July. *Cemophora* have been recorded moving 600 m in 26 days (Nelson and Gibbons 1972), and such long-distance movements may be necessary to

TABLE 1. Surveys listed from north to south in Florida, USA, from which *Cemophora coccinea* activity data were compiled.

County	Name of site	Survey method	Source
Gadsden	Joe Budd WMA	drift fences	Enge, unpubl. data
Baker	Olustee Battlefield Historic Site	drift fences	Enge, unpubl. data
Bradford	Bradford Forest	drift fences	Enge and Marion 1986
Taylor	Big Bend WMA	drift fences	Enge and Wood 1998
Franklin	Tate's Hell WMA	drift fences	this study
Putnam	Ordway Preserve	funnel traps	Dodd and Franz 1995
Marion	Rainbow River State Park	drift fences	Enge, unpubl. data
Hernando	Chassahowitzka WMA and Chinsegut Nature Center	drift fences	Enge and Wood, *in press*; Enge and Wood, unpubl. data
Pinellas	East of Lake Tarpon	drift fences	Enge, unpubl. data
Polk/Highlands	Arbuckle State Forest and Avon Park Air Force Range	drift fences	Branch et al. 1996
Polk/Highlands	Lake Wales Ridge scrubs	drift fences	Mushinsky and McCoy 1995
Martin	Jonathan Dickinson State Park	drift fences	Timmerman et al. 1994
Dade	Everglades National Park	road cruising	Dalrymple et al. 1991

TABLE 2. Monthly captures of *Cemophora coccinea* by county in Florida, USA, with data from this study in Franklin County highlighted. Missing numbers indicate months that were not sampled.

County	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Gadsden	0	0	0	1	15	2	14	0	3	0	0	0	35
Baker	0	0	0	5	10	10	0	0	0	0	0	0	25
Bradford	0	0	0	11	9	16	9	6	1	1	0	0	53
Taylor				1	7	18	9	3	0	0			38
Franklin	**0**	**1**	**0**	**1**	**18**	**12**	**8**	**7**		**6**	**7**	**1**	**61**
Putnam				0	4	5	3	0	0	0	0		12
Marion	0	0	0	1	1	2	2	4	0	0	0	0	10
Hernando	0	0	0	6	20	29	5	2	1	0	1	0	64
Pinellas	0	0	0	4	4	4	0	0	0	0	0	0	12
Polk/Highlands	0	0	0	5	3	3	10	3	0	0	0	0	24
Polk/Highlands		0		14	2	17	2	4		1		0	40
Martin	0	0	0	0	3	1	0	3	2	1	0	1	11
Dade	0	0	0	0	3	2	1	0	0	0	0	0	6
Total	0	1	0	49	99	121	63	32	7	9	8	2	391

find seasonally limited food resources which are spatially dispersed.

We collected data on *Cemophora* activity from 12 drift-fence arrays in scrub and mesic flatwoods habitats in Tate's Hell WMA from April 1998 through March 1999. Traps were open 10–13 days each month except for September. Tate's Hell WMA accounted for 75.0% of all *Cemophora* captures (N = 20) outside the April–September period (Table 2). All 15 captures of adult *Cemophora* from October–February came from only a single array, which accounted for 15.2% of captures (N = 46) during the remainder of the year (Table 2). This array was situated in open, sand-pine scrub ca. 1 km north of the Gulf of Mexico (29°47'43"N, 87°46'59"W).

We cannot explain the atypical dormant-season activity exhibited by *Cemophora* at one array in Tate's Hell WMA. Individuals were not marked, but several were responsible for the observed activity, because up to three specimens were trapped at one time. The winter was drier than normal; thus, *Cemophora* were not flooded from subterranean retreats by rising water tables. Ephemeral and permanent wetlands were situated ≥ 20 m from the array, and open, sandy areas at the site may have been used by nesting turtles. It is possible that *Cemophora* were feeding on eggs of "winter"-nesting *Deirochelys reticularia* and *Kinosternon subrubrum* during a time of the year when they are normally inactive. *Cemophora* are almost exclusively nocturnal (Gibbons and Semlitsch 1987; Nelson and Gibbons 1972; Palmer and Tregembo 1970), and nights in northern

Florida are typically too cool for reptile activity from October through March. However, apparently emaciated *Cemophora* have infrequently been observed engaging in diurnal surface activity during the winter in Gadsden County, Florida (S. P. Christman, pers. comm.), suggesting that the *Cemophora* trapped in Tate's Hell WMA from October through February may have been active during the daytime. It is possible that this one array at Tate's Hell WMA was situated near a hibernaculum or other important winter resource for *Cemophora*, and the individuals we trapped were displaying normal low-level activity during warm weather in winter.

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Reproductive Biology and Territoriality of *Phyllomedusa hypocondrialis* in Northeastern Brazil

ROSA HELENA RIBEIRO MATOS [1]
GILDA V. ANDRADE [2]
and
ADRIANI HASS [3]
Departamento de Biologia, Universidade Federal do Maranhão
Av. dos Portugueses, s/n, Campus do Bacanga
65080-040, São Luís, Maranhão, Brazil

[1] *Present address: Pós-Graduação de Zoologia*
Universidade Estadual Paulista, Avenida 24A, Nº 1515, Bela Vista
Rio Claro, São Paulo 13506-900, Brazil

[2] *Author for correspondence and reprints; e-mail: gandrade@ufma.br*

[3] *Present address: Pós-Graduação de Ecologia*
Universidade Estadual de Campinas, Caixa Postal 6109
Campinas, São Paulo 13083-970, Brazil

Available data concerning biology and aggressive behavior in species of *Phyllomedusa* come mainly from Colombia (Pyburn and Glidewell 1971), Uruguay (de Sá and Gerhau 1985), and Argentina (Laurent 1973). Pyburn and Glidewell (1971) and Laurent (1973) suggested that *Phyllomedusa hypocondrialis* is territorial, but a detailed study has not been conducted. This species has a wide distribution in South America (Frost 1985). We studied a population on the eastern border of its Amazonian distribution. Here we summarize the reproductive biology of this population and present data on territoriality from two breeding sites having different vegetation structure.

The study sites were two temporary ponds in open areas at the side of a main road at the Parque Estadual do Bacanga, São Luís (2°35'S; 44°15'W), Maranhão State, northeastern Brazil. These ponds differed structurally in terms of vegetation cover: a pond with widespread vegetation on its edge and interior (WVP), consisting of continuous tangled shrubs up to 1.7 m high; and a pond with marginal vegetation only (MVP), consisting of scattered shrubs and small trees, up to 2.5 m high. We collected data weekly from March to early July 1991, and between 1500 and 0300 h using a dim or red flashlight at night. We made preliminary observations in 1989, 1990, and January–February 1991 at the same and other sites. We marked calling sites and male positions

throughout the night with colored ribbons or clothes-pins. We recorded vocalizations, but we failed to obtain sonagrams due to technical problems. At MVP, where physical interactions between males were not observed naturally, we caught a calling male in a shrub, and released him 15 cm from another calling male in a neighboring shrub. We experimentally examined amplexus behavior in nature by separating an amplectant male and releasing him 10 cm from the female. We repeated this procedure, then also released another calling male 10 cm from the same female. In the laboratory we observed the development of five egg clutches and reared tadpoles until metamorphosis.

The breeding period (January to June) coincided with the rainy season. In January 1991 at MVP males called from inside the thick vegetation and we could frequently hear their vocal interactions. At the end of March they moved closer to the water line and called from exposed sites on the vegetation edge. We found egg clutches only after March.

Males called from 1745–0300 h. The advertisement call emitted by isolated males is composed of one note audible to the human ear. Upon the approach of a female, a male increased the calling rate. During the vocal interactions between males, a different note was emitted. This note was emitted by isolated males in response to playbacks. Upon the approach of a male into the territory of another male and during the wrestling bouts, both males emitted only these different notes.

During the first hours after sunset the males interacted vocally as they presumably established their territories since we did not find females or new clutches before 2300 h.

Males called from leaves or branches, either inside or near temporary ponds or more rarely, permanent ones, at heights of 0.4–3.5 m (mean = 1.4; SD = 0.9; N = 32) above the water. Generally, calling males moved to adjacent perches and changed their positions and postures. Thus, even on the same perch, males turned to call in different directions. Similar behavior was observed in *Agalychnis callidryas* and *Pachymedusa dacnicolor* (Pyburn 1970) and *P. hypocondrialis* (Pyburn and Glidewell 1971).

The calling male (N = 8) moved in a circle all night long. We considered this to be patrolling behavior. The area, about 1 m in diameter, usually patrolled by a male was considered to be its territory, since one patrolling male physically attacked another calling male that entered the area.

We observed calling males near call sites that had been occupied during the previous night. Our impression is that males return to the same territories in consecutive nights, although we did not mark the animals.

During the breeding season vocal interactions and fights between males in adjacent territories were common. We observed six fights at WVP. The typical agonistic behavioral sequence consisted of territorial calls and a fast approach, followed by a slow wrestle made up of head and leg pushing alternating with resting (Fig. 1). Wrestling bouts lasted from 10–60 min. Both males emitted only the different note during these bouts. In all encounters the winner was the resident male.

At MVP, the territories were not adjacent because of scattered vegetation, and each active male occupied one shrub. The interactions were strictly vocal, with the emission of both kinds of notes. In the experimental encounter, however, the aggressive behavior was similar to that described for WVP. After physical

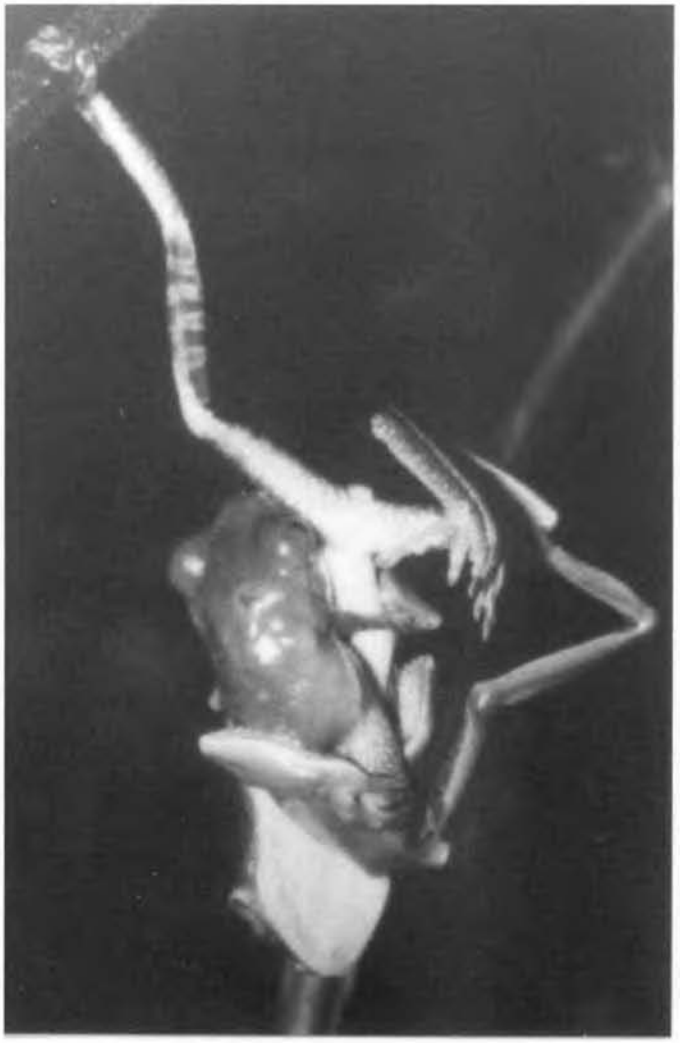


FIG. 1. Two males of *Phyllomedusa hypocondrialis* during a territorial fight, the resident grasping the branch. Photo by G. V. Andrade.

interaction, the intruder returned to its original territory in the neighboring shrub. We suggest that early in the breeding season before males approach the water line and clutches are deposited, each male, through aggressive behavior, establishes its territory in an isolated shrub or tree at MVP. Aggressive interactions in adjacent territories at WVP point out that resident males are intolerant of other calling males in the limits of their territories. Such behavior implies maintenance of spatial separation between males through vocalizations, as occurs in other species (Pyburn 1970; Wells 1977). Maintenance of inter-male space through vocalization, aggressive interactions, and patrolling behavior are characteristic of territoriality in *Phyllomedusa hypocondrialis*.

When we experimentally separated an amplectant male from the female, the female began walking in the direction opposite from the male. The male then started vocalizing, and increased the rate of advertisement calls. After that, the female stopped walking and the male walked in the direction of the female and jumped onto her back in axillary amplexus. When we released two males the intruder tried unsuccessfully to dislodge the original male from the female's back by inserting its head between the female's back and the original male's ventral region. The intruder then attacked the amplectant male by pushing and kicking its

opponent with its arms. The fight ended when the intruder moved away.

Oviposition followed by leaf folding behavior was similar to behavior observed by Pyburn (1980). Females oviposited on branches of shrubs or trees overhanging the ponds, and enclosed the egg masses in leaves. Two pairs were on herbaceous vegetation 15 and 90 cm above the water, respectively. Both amplectant females moved toward the petiole, and laid the eggs while undergoing abdominal contractions. The pair closed the leaf using their hind limbs and movements of their cloacae. We noted abdominal contractions of the male when its thigh was at right angles to its body. The male elongated and compressed its body against the female and then inserted its cloaca into the folded leaf. The movement of the pairs proceeded until the leaf was completely closed. Sometimes, during this behavior, the male emitted advertisement calls. In both cases the male released the female and resumed calling within 10 min after egg laying was completed. The female left the oviposition site after 20 min.

The clutches of *P. hypocondrialis* were laid on leaves that ranged between 2.1–6 cm wide (mean = 3.76 cm; SD = 1.02; N = 14), and 3.3–15 cm long (mean = 7.98 cm; SD = 3.22; N = 18). Generally the leaf was folded; when a leaf was too narrow, two leaves were joined together by the amplectant pair. Clutch size varied from 62–154 eggs per clutch (mean = 87.15; SD = 23.58; N = 13) and did not correlate significantly with leaf width ($r_S = 0.52$; $p > 0.05$).

The clutches were deposited from 5.5–210 cm (mean = 110 cm; SD = 59.6; N = 21) above the water. The water depth below the clutch sites ranged from 4–34 cm (mean = 18.04 cm; SD = 11.4; N = 12), and eggs were deposited from 24–120 cm (mean = 72.64 cm; SD = 34.37; N = 11) from the shoreline. In the laboratory (ca. 26°C) eggs hatched after 8 days and larvae metamorphosed after 43 days.

The simpler and less specialized reproductive pattern in Phyllomedusinae is exhibited by *Agalychnis callidryas* (Pyburn 1970), whose eggs are laid on open leaves with little or no male help other than fertilization. *Pachymedusa dacnicolor* also lays eggs on open leaves, but male assistance occurs (Pyburn 1970). *Phyllomedusa iheringi* (Ihering 1886), *P. trinitatis* (Kenny 1966), *P. distincta* (Castanho 1994), and *P. hypocondrialis* (Pyburn and Glidewell 1971; this paper) close the leaves with male assistance.

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TECHNIQUES

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The Extraction of DNA from Formalin-fixed, Ethanol-preserved Reptile and Amphibian Tissues

MARK E. CHATIGNY
Department of Biology, Utah State University
Logan, Utah 84322-5305, USA
e-mail; mchatigny@biology.usu.edu

Genetic studies are becoming a primary component of wildlife conservation. These studies are used to define the genetic structure of populations and provide estimates of genetic diversity. This information can aid in management of wildlife by providing a basis for the allocation of funds and prioritization of management activities for the preservation of genetic diversity.

An initial step in most genetic studies is the extraction of DNA from tissues. Once extracted, the DNA is often amplified using PCR (polymerase chain reaction) and analyzed by a variety of molecular techniques. PCR-based techniques require very small amounts of DNA, therefore it is not always necessary to extract the DNA from the tissues of living organisms. For example, DNA can be extracted from fur, shed skins, or scales.

Although DNA can be extracted from a variety of sources, if an organism is sufficiently rare or difficult to capture, as are many reptiles, it may be impossible to locate enough individuals. This highlights the desirability of using specimens from existing museum collections. These specimens are usually stored in ethanol after having been preserved initially with formalin. Formalin is a 1.3 M aqueous formaldehyde solution which has been used for preserving tissues almost since its development in 1865 (Fox et al. 1985). It hardens tissues without shrinkage or distortion by forming cross-linkages between the proteins (Fox et al. 1985).

The interaction of formaldehyde with DNA is not well understood, but there is evidence that cross-linkages are formed between the proteins and the DNA as well as between the strands of the DNA (Chaw et al. 1980; Chang and Loew 1994). The existence of these protein-DNA cross linkages has led to the belief that specimens fixed in formalin and stored in ethanol are, for the most part, unuseable for DNA analyses and, therefore, genetic analyses of museum collections have rarely been attempted (France and Kocher 1996).

Although extraction of DNA from formalin-preserved tissues is difficult, recent investigations have met with varying degrees of success. Medical researchers interested in genetic diseases were among the first to extract DNA from formalin-fixed, paraffin-embedded tissue sections, but the results were highly variable and dependent upon the fixation time and the storage conditions (Rogers et al. 1990; Forsthoefel et al. 1991). More recently, investigators have had greater success with the extraction procedures using a prolonged proteinase K digestion with times ranging from 24 to 50 h (France and Kocher 1996; Shiozawa et al. 1992). Some investigators have resorted to chemical means to break the protein cross linkages, adding DTT (Dithiothreitol) to the proteinase K digestion-stage (Johnson et al. 1995). France and Kocher (1996) reviewed the various extraction protocols using a rating system based upon the percentage of extractions that yielded a PCR product of the expected size. They determined that the most effective extraction protocols were those that utilized a prolonged digestion period, although the most successful protocol, developed by Shiozawa et al. (1992), was successful in only 66% of the extractions.

I have developed a modified protocol for the extraction of DNA from skin that can, in most cases, be rubbed from the bodies of formalin-fixed, ethanol-preserved specimens without damaging the specimens. This protocol has worked on both reptilian and amphibian specimens and has been used to extract DNA from specimens that were stored in formalin for extended periods of time. The protocol makes use of a prolonged proteinase K digestion, similar to that of Shiozawa et al. (1992), and also an additional chemical component, Dithioerythritol (DTE), to break the protein cross-links. Several other extraction protocols were tested along with this one, including some that used slightly different long digestion periods (France and Kocher 1996; Shiozawa et al. 1992) and some using additional chemical means to break the protein cross-linkages (Johnson et al. 1995) but none of them worked as well as the protocol using both methods. Extractions using this protocol yielded a quantity of DNA sufficient for amplification in 14 out of 15 repetitions, and the average size of the amplified product was approximately 700 base pairs.

Tissues were prepared for the extraction process by grinding them to a fine powder in liquid Nitrogen using a small mortar and pestle. Approximately 50 mg of ground tissue was placed in a 1.5 ml micro centrifuge tube along with 1 ml of STE buffer (0.1 M NaCl; 0.05 M Tris-HCl, pH 7.5; 0.001 M EDTA), 25 µl of 20 mg/ml proteinase K, 50 µl of 20% sodium dodecyl sulfate (SDS), and 2.5 µl of 20 mg/ml of DTE. The aggregate was gently mixed and then incubated in a gently shaking water bath for 24 h at 55°C. An additional 25 µl of proteinase K, 25 µl SDS, and 2.5 µl of DTE was then added and the mixture was placed back into the water bath for 48 h at 55°C. The mixture was then placed in a 15 ml centrifuge tube and subjected to two standard PCI (phenol, chloroform, and isoamyl alcohol in a ratio of 25:24:1) extractions, and two standard CI (chloroform and isoamyl alcohol in a ratio of 24:1) extractions. The aqueous layer was placed in a clean tube and one-tenth volume of 2 M sodium chloride was added. The mixture was precipitated with one volume of cold (–20°C) 95% ethanol and stored at –20°C overnight. Each tube was then centrifuged for 30 min at 7000 g and the supernatant was removed using a micro pipette. In most cases, there was no visible pellet so care was taken to avoid disturbing the liquid at the very bottom of the tube. The remaining liquid was evaporated in a convection oven for 2 h at 55°C. The pellet was resuspended in 50 µl of TE buffer (0.001 M Tris-HCl, pH 7.5; 0.0001 M EDTA). I attempted to establish the presence, concentration, and fragment length of the extracted DNA from each sample by size-fractioning the sample on a 1% agarose gel but I found that the concentration of DNA was often too low to produce a visible band. I therefore amplified all extraction products using an amplification profile specifically designed for samples with a low template concentration.

Primers used in PCR were designed to amplify the cytochrome *b* gene of mitochondrial DNA. These primers had been used extensively on samples from within the genus *Lampropeltis* and were known to amplify the specimens used for the study. The PCR reaction volume of 50 µl contained:
10 µl of template DNA, 5 µl reaction buffer (500 mM KCL; 100 mM Tris, pH 8.8; 15 mM $MgCl_2$; 30 mM DTT; 1 mg/ml BSA), 50 mM of each dNTP, 25 pmol of primers 462 (5'ACTTCAGGGTGCCCAAAGAATCA3') and 562 (5'TAAGCTATGGGGCTCATACC3') (Operon Technologies Inc. Alameda, California, USA), and 2.5 units of *Taq* DNA polymerase. The cycling profile included: melting for 1 min at 95°C , annealing for 2 min at 37°C, and elongation for 3 min at 72°C. The total number of cycles was 35.

The ability to extract sufficient quantities of amplifiable DNA from museum specimens could be of value to researchers working with rare or extinct organisms, and it may also be of some use to researchers wishing to compare individuals or populations on a temporal scale.

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Sampling Reptile Diversity in the West Indies with Mouse Glue-Traps

RICHARD E. GLOR*
Department of Biology, Washington University
St. Louis, Missouri 63130, USA; e-mail: glor@biology.wustl.edu

TED M. TOWNSEND
Department of Biology, Washington University
St. Louis, Missouri 63130, USA

MICHAEL F. BENARD**
Department of Ecology and Systematics, Cornell University
Ithaca, New York 14853, USA

and

ALEXANDER S. FLECKER
Department of Ecology and Systematics, Cornell University
Ithaca, New York 14853, USA

** Author to whom correspondence should be addressed.*

*** Current address: Population Biology Graduate Group*
University of California, Davis, California 95616-8755, USA

Mouse glue-traps have recently become a popular means of capturing lizards and other reptiles for ecological studies (Bauer and Sadlier 1992; Rodda et al. 1993; Whiting 1998). Previous technical notes have discussed glue-trap sampling on islands in the western Pacific (Bauer and Sadlier 1992; Rodda et al. 1993) and southern Africa (Whiting 1998). In this note we comment on the efficiency of glue-traps for sampling reptile diversity in the West Indies. In particular, we provide data concerning rates of capture and recapture, species sampled and missed by glue-traps, mortality of captured reptiles, accidental capture of non-target vertebrates, and the economics of glue-trap sampling.

All glue-trap sampling occurred in Los Haitises National Park and the immediately surrounding region in the Dominican Republic. The Los Haitises region is a karstic area on the southwestern border of Samana Bay that originally was characterized by broad-leaf humid tropical forest (Zanoni et al. 1990). The primary goal of our sampling was to determine the effects of human disturbance on lizard diversity (Glor et al., in review), but here we will concentrate strictly on the pros and cons of glue-trap sampling.

Our glue-trap sampling protocol involved thirty 10 x 10 m grids placed in nine different habitats. Each of these grids contained twenty Victor® mouse glue-traps (Woodstream Inc., Lititz, Pennsylvania 17543-0327, USA). These traps can be purchased in bulk from many commercial exterminators for US $0.25–$0.42 per trap. In each grid, five traps were placed in each of four microhabitats for a total of twenty traps per grid. Microhabitats sampled were: 1) open ground, at least 1 m away from the nearest tree; 2) ground at base of tree; 3) tree trunk or branch, 1 m above the ground; and 4) tree trunk or branch, 2 m above the ground. Ground traps were placed on bare soil or rock, while tree traps were stapled into position using a staple gun and 8–10 mm staples. An attempt was made to place the traps in five rows, each with a single trap in each microhabitat.

Traps were checked at least once every 24 h for the duration of the 120-h trapping cycles. Depending on the number of reptiles captured, it took two people 15–60 min to check traps, process and release animals, and replace damaged or missing traps. As has been reported previously (Rodda et al. 1993), the effectiveness of traps tends to decline with age, primarily as a result of exposure to the elements and accumulation of debris. In our study, wet or damaged traps were replaced regularly. Each trap was replaced approximately every 2.5 days during the course of a five-day trapping period.



FIG. 1. *Anolis chlorocyanus* in glue trap.

Most reptiles were released from the traps by loosening the glue around them with vegetable oil applied with a paintbrush (Bauer and Sadlier 1992; Rodda et al. 1993). Only large robust anguids (*Celestus stenurus* and *C. costatus*) could be released without oiling. All reptile species captured could be effectively removed without injury; though special care must be taken when removing small fragile-skinned lizards (e.g., *Sphaerodactylus*) as well as certain body parts of anoles such as the dewlap and tail. The toenail on the fourth rear digit was clipped to allow for identification of recaptures.

During ten weeks of sampling (spread over three trips) we ac-

TABLE 1. Rates of capture for each taxon sampled.

	Number Captured	Captured per Trap-hour
Anolis baleatus	19	0.00011
A. chlorocyanus	113	0.00067
A. cybotes	194	0.00115
A. distichus	866	0.00515
A. semilineatus	70	0.00042
A. spp.	15	0.00009
Celestus stenurus/costatus	81	0.00048
C. sepsoides	4	0.00002
Sphaerodactylus spp. (5 species)	38	0.00022
Antillophis parvifrons	4	0.00002
Epicrates striatus	6	0.00004
Tropidophis haetianus	1	0.00001
Total	1411	0.00840

TABLE 2. Success of traps in each different microhabitat. More trap-hours were accumulated in the open ground traps because one of the habitats sampled (active pasture) contained only open ground traps and no tree traps. Cost per lizard based on cost of $0.30 per trap and replacement every 2.5 days.

	Trap-hours	Lizards sampled	Lizards per trap-hour	Estimated cost per lizard sampled
Open ground	48,480	154	0.0032	$1.56
Tree base	39,840	306	0.0077	$0.65
1 m tree	39,840	462	0.0116	$0.43
2 m tree	39,840	489	0.0123	$0.41
Totals	168,000	1411	$\bar{X} = 0.0084$	$0.60

cumulated over 168,000 trap-hours (one trap set for one hour = one trap-hour). During this time 1411 reptiles representing 16 species were captured. Overall, traps captured reptiles at a rate of 0.0084 per hour or approximately one reptile every five days for a given trap. Because traps cost about US $0.30 and last an average of 2.5 days our cost per capture was approximately US $0.60.

The traps sampled 16 of the 20 reptile species known to occur in the Los Haitises region, based on available distribution records (Schwartz and Henderson 1991) and visual surveys that we conducted concurrent with glue-trap sampling (Table 1). No amphibians were captured, despite their abundance in and around the park, likely because of their moist skin. On several occasions frogs of the genus *Eleutherodactylus* were observed hopping onto and then off of the traps.

The reptile species known to occur in the region but never captured in traps included two primarily arboreal snakes (*Uromacer oxyrhynchus* and *U. catesbyi*), a fossorial blind snake (*Typhlops pusillus*), and the fossorial *Amphisbaena manni*. *Anolis* lizards dominated our samples, accounting for over 90% of captures (Fig. 1), while captures of snakes and small geckos were exceedingly rare (Table 1). Based strictly on capture rate per hour, a researcher seeking to capture a single individual of *Epicrates striatus* (rate = 0.00004 individuals per trap-hour) in a 24-h period would need to set 1000 traps. Though this suggests that glue-traps are a highly inefficient means of capturing certain species, the placement of our traps systematically targeted only a subset of available microhabitats. Additionally, the placement of our traps was random in that we made no attempt to target the locations that appeared most favorable as reptile shelters or basking sites.

Non-random targeting of specific habitats and microhabitats has the potential to considerably increase trapping success. For example, during the course of ten weeks of 'random' sampling only two individuals of *Sphaerodactylus samanensis* were captured (rate = 0.00001 individuals per trap-hour). However, on one occasion we placed 50 traps at the base of rock shelters in a habitat that appeared ideal for this species and recovered six individuals of *S. samanensis* in a 24-h period (rate = 0.005 individuals per trap-hour) increasing our success rate to 500 times that of random sampling.

Another form of selective trapping involves the placement of traps at the entrance to shelters or near basking sites where reptile activity has been observed (Whiting 1998). We used this technique with some success to capture *Sphaerodacytlus* that were observed running under rocks and *Celestus* that fled into cavities under tree roots. We only captured juveniles of *Anolis baleatus* and *Epicrates striatus*, suggesting that the adults of these species were either too large for the traps or did not occur in the microhabitats we sampled at sufficient densities.

The overall trapping success of 0.0084 reptiles per trap-hour masks finer scale variability in trapping success between traps placed in different habitats or microhabitats. Differences in trapping success in different habitats is discussed elsewhere (Glor et al., in review). Among the microhabitats sampled, traps in trees captured more than twice as many reptiles as traps on the ground (Table 2). The success of tree traps in our sample is undoubtedly the result of the overwhelming abundance of the arboreal anoles. Not surprisingly, previous reports suggest that success of tree versus ground traps depends on the specific reptile fauna of the area being sampled (Bauer and Sadlier 1992; Rodda et al. 1993).

Only eight lizards were recaptured during the course of our sampling. The reasons for this low rate of recapture are unclear and warrant further study. Although mortality following release is a possibility, a number of lizards that were maintained in captivity for several days following their capture appeared healthy and active. Other possible reasons for the low rate of recapture include: movement out of the trapping grid, avoidance of traps following capture, inability to stick to traps due to residual oil applied during the previous capture, and increased predation on previously trapped lizards.

One major drawback to glue-trapping is lizard mortality, which averaged 10.9% during our sampling. However, considerable variability in mortality existed between different habitats (range: 6–18.6%). Generally, mortality was higher in agriculturally disturbed or open sunny plots relative to forested plots. Although the cause of death was often unclear (32.5% of deaths), three identifiable factors (exposure [13.5%], ant predation [31.3%], and vertebrate predation [22.5%]) contributed to lizard mortality in traps. Ant predation was rare in most habitats except oil palm plantations and pastures. Based on the presence of rat hairs in a number of traps with dead lizards, the majority of vertebrate predation was likely caused by rats. However, mongoose hair was found on at least one occasion and two instances of snake predation and one possible case of attempted lizard predation were noted. In both cases of snake predation the predator was a juvenile *Epicrates striatus*. The case of suspected lizard predation involved shed scales of *Anolis baleatus*, which were found next to the body of an adult

male *A. chlorocyanus* with obvious bite wounds.

Although dead lizards were salvaged and preserved when possible, and these deaths are unlikely to seriously affect the reptile populations or the community as a whole, a reduction in mortality would clearly be desirable for future studies. More frequent checking of traps would probably reduce all forms of mortality. In the case of ants, a commercial ant repellent could potentially be applied around the margin of traps in habitats where ants are known to be problematic. In order to reduce mortality caused by exposure, traps should be placed in shaded areas when possible. If shade is unavailable or random sampling is required, traps should be placed on the underside of branches or could even be shielded from direct sun by a strategically placed leaf.

In addition to mortality, accidental capture of non-target animals was another problem associated with glue-trap sampling. Incidental capture of invertebrates occurred in nearly all traps, but captures of non-target vertebrates were rare. Non-target vertebrate captures included eight species of birds and two species of mammals. A total of eleven bird captures occurred during the course of our sampling. Therefore, the rate of bird capture for a single trap was approximately one bird every 640 days. Live birds were released from the traps with a paintbrush and oil. Bird species captured were: oven bird (*Seirus aurocapillus*), black-throated blue warbler (*Dendroica caerulescens*), broad-billed tody (*Todus subulatus*), bananaquit (*Coereba flaveola*), Hispaniolan woodpecker (*Melanerpes striatus*), ruddy quail dove (*Geotrygon montana*), and black crowned palm tanager (*Phaenicophilus palmarum*). The two migrant species (black-throated blue warbler [*Dendroica caerulescens*] and ovenbird [*Seirus aurocapillus*]) were caught only in the winter months. On a number of occasions, feathers from Hispaniolan lizard cuckoos (*Saurothera longirostris*) were found in traps although a cuckoo was never actually caught. These cuckoos might have been attracted to the traps by captured lizards; indeed, on several occasions cuckoo feathers were found on a trap along with a lizard which had beak-shaped bruises on its abdomen. These probably represent failed predation attempts.

Mammal captures were of less concern because the traps affected only two introduced species. Rat hair and the terminal portion of rat tails were found in traps regularly and on at least one occasion a small tuft of mongoose hair was found in a trap. On only one occasion was a live, immature rat captured in a trap.

Although unfortunate, we considered incidental captures of vertebrates rare enough to justify continued trapping in the Los Haitises region. However, traps should never be used in areas with abundant ground foraging or bark gleaning birds, native small mammals, or domestic animals. The potential for high rates of incidental captures suggests that trapping grids similar to ours could probably not be used in the mainland tropics. Trapping should never be conducted in areas where rare or threatened species are likely to encounter traps.

Overall, we found sticky traps to be an effective method for surveying reptile diversity in the West Indies. The majority of reptile species present in the Los Haitises region can be trapped; including large numbers of certain species, as well as several species that we were unable to locate during visual surveys. Additionally, the monetary cost associated with our glue-trap sampling, about US $0.30 per trap and US $0.60 per capture, was fairly reasonable. However, several serious drawbacks associated with the use of these traps may limit their utility for future ecological studies in some situations, particularly in the mainland tropics.

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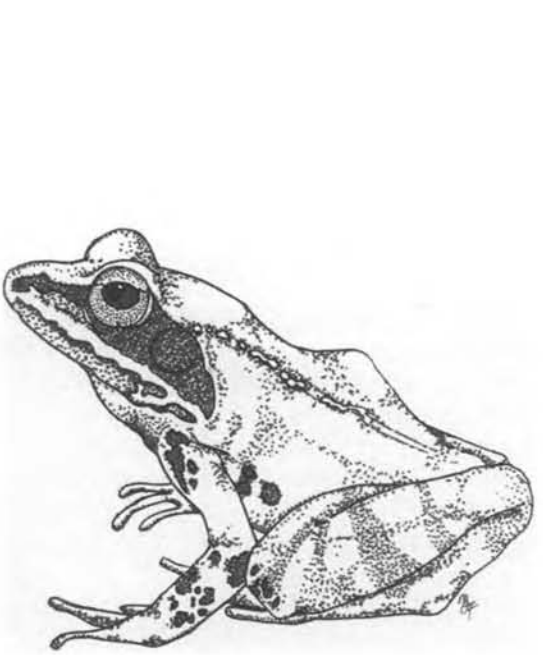
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Rana sylvatica (Wood Frog). Illustration by Michael G. Frick.

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A Funnel Trap Modification for Surface Collection of Aquatic Amphibians and Reptiles

MICHAEL L. CASAZZA
GLENN D. WYLIE
and
CHRISTOPHER J. GREGORY
United States Geological Survey, Western Ecological Research Center
Dixon Field Station, 6924 Tremont Road, Dixon, California 95620, USA
e-mail (MLC): Mike_Casazza@usgs.gov; (GDW): Glenn_Wylie@usgs.gov
(CJG): Chris_Gregory@usgs.gov

Funnel traps originally described by Imler (1945) and simplified by Fitch (1951) have been used in many terrestrial (Fitch 1951, 1963; Greenberg et al. 1994; Imler 1945; Vogt and Hine 1982), arboreal (Fritts et al. 1989; Rodda and Fritts 1992; Savidge 1987) and aquatic (Adams et al. 1998; Calef 1973; Carpenter 1953; Fraker 1970; Richter 1995; Riley and Bookhout 1990) field studies. Some aquatic studies (Calef 1973; Richter 1995) have used modified funnel traps with air chambers to prevent suffocation. Traps in these studies have been attached to buoys and placed on the surface, or attached to rods in the ground and placed at varying levels in the water column. However, typical methods for aquatic captures have involved placing unmodified traps half-submerged (without any flotation aid) along the shoreline (Fraker 1970; Keck 1994) or fully submerged (Adams et al. 1998; Carpenter 1953) on the water bottom. Two similar, significant problems exist when using these placements. Any reptile or adult amphibian (with the exception of paedomorphic salamanders) will drown in an underwater trap if not tended to often enough. Depending on changes in water level, animals captured in traps half-submerged run the risk of drowning, desiccating, or over-heating. Here we describe a safe and easy funnel trap modification for humane use in the field.

Eelpots (Cuba Special Manufacturing, Fillmore, New York, USA) measured 60.5 cm long and 22.5 cm in diameter (terminal funnel openings measured 4 cm in diameter), and were made from 0.5 cm gauge hardware-cloth (Fig. 1). Two pieces of Styrofoam measuring 30 cm x 6 cm x 5 cm (L x W x H) were attached with locking, 22.7 kg tensile strength nylon ties (Thomas and Betts Corporation, Memphis, Tennessee, USA) to the middle, opposing sides of each eelpot. A third nylon tie was attached in the middle for easy manipulation of the traps. The Styrofoam blocks were attached so the traps floated half-way out of the water. Two pieces of nylon rope, 1.5–2 m in length, were also attached to opposite sides of each eelpot. Traps were placed in the water and were aligned to facilitate entry of animals following along edges of the shoreline or of vegetation (Fig. 2). Each trap was tied to nearby vegetation or to stakes in the ground with enough play in the rope to compensate for fluctuating water levels. Traps were left out continuously for at least 10 days and were checked daily. During periods of non-trapping, plastic cups were used to close funnel openings and prevent captures. Diameter of funnel openings, dimensions of Styrofoam, placement of Styrofoam on traps, and length of rope can be easily altered as needed. Under normal conditions, the Styrofoam will support the weight of any captured animal and will last at least one year without need for replacement. Eelpots were the greatest expense (US $15/trap), but the additional materials were of negligible cost (~ US $1.50/trap). Funnel traps can be built from aluminum window screen (Greenberg et al. 1994) as a less expensive, but more labor-intensive alternative.

Fraker (1970) described his unmodified, aquatic funnel traps as "relatively inefficient," reporting a 2.3% success rate (2.3 snakes caught per 100 trapping-days) in 79 days of trapping northern water snakes (*Nerodia sipedon sipedon*) in a fish hatchery and the surrounding ponds and streams. Our modified traps are currently being used in the fifth year of an ongoing study of giant garter snakes (*Thamnophis gigas*) in deep and shallow water central California ponds, sloughs, and irrigation canals. During the first 79 days of trapping in 1997, we report a 3.7% rate of trap success. Although trap efficiency is relatively low in both studies, it is important to note that trap success was not negatively affected—and was actually greater—when using this modified design. Trap success may be improved if the traps are baited (Keck 1998) or when used in combination with other methods (Adams et al. 1997) such as drift fencing (modified from Lutterschmidt and Schaeffer 1996).

According to Adams et al. (1998), funnel traps detected the most species of all sampling methods compared, required the least effort to use, and was the only technique to detect presence of small populations. In a review of various aquatic sampling methods, Adams et al. (1997) felt the strongest reason for using funnel traps was that the skill and experience of the user has very little influence on results. Drawbacks noted by those two papers were that funnel traps capture few adult amphibians, potential trap locations are not maximized, and the problem of trap mortality. During the

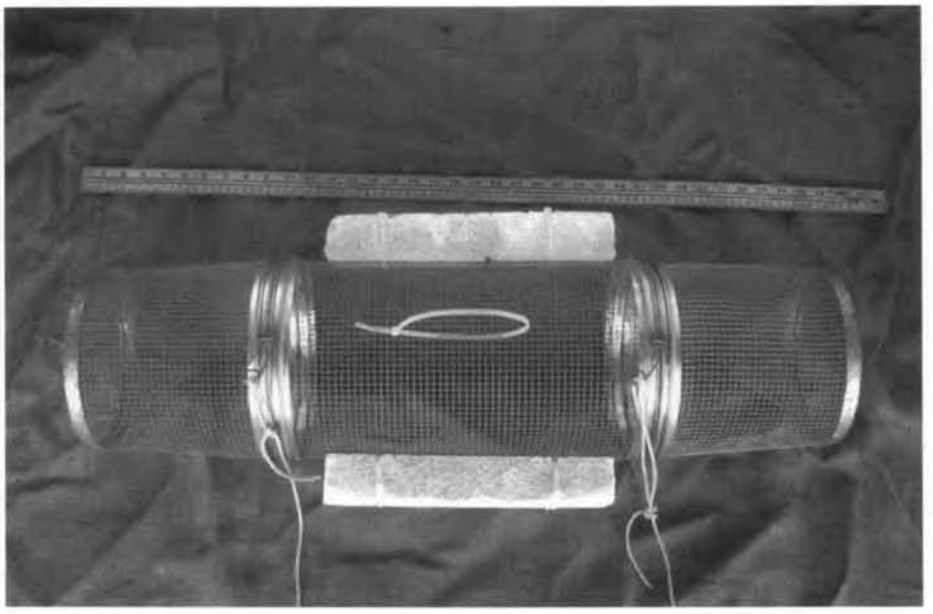


FIG. 1. Eelpot modified for placement on water surface.



FIG. 2. Modified trap in a marsh along edge of vegetation.

second year of our *T. gigas* study (the only year amphibian captures were recorded), our traps caught twice as many adult bullfrogs (*Rana catesbeiana*, N = 160) as larval bullfrogs (N = 81). Furthermore, our design allows for sampling an increased range of aquatic habitats. Future conservation work will depend on the quality of sampling done now. Being able to survey additional areas will provide a more accurate documentation of species presence and distribution. Finally, trap mortality is avoidable. No amphibian or reptile has died in our traps due to drowning, desiccation, or other trap-related causes (several bullfrogs have been partially consumed by crayfish, *Procambarus* and *Pacifastacus* spp.). Our trap design is appropriate for use in studies where animal safety is important or where habitats (i.e., stream banks with steep slopes) preclude deployment of unmodified funnel traps.

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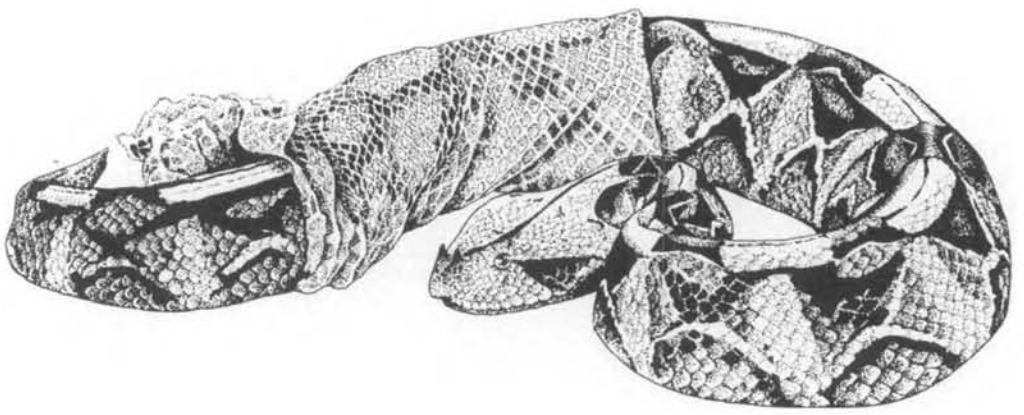
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Bitis arietans (Puff Adder). Illustration by P. A. Benson.

RECENT POPULATION CHANGES

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Decline in a Population of the Treefrog *Phyllodytes luteolus* After Fire

MARCOS G. PAPP *
and
CRISTINA O. G. PAPP
Departamento de Zoologia, Instituto de Biologia
Universidade Estadual de Campinas, 13081-970, Campinas, São Paulo, Brazil

**Present address: Section of Integrative Biology, School of Biological Sciences*
The University of Texas, Austin, Texas 78712-1064, USA
e-mail: mpapp@mail.utexas.edu

A considerable amount of literature is available on the effect of fire on vertebrates (deBano et al. 1998; Quinn 1994; Whelan 1995). Amphibians have been less studied than reptiles and mammals, but it is thought that they have a high survival rate to the direct effect of fire because they find shelter underground and in very wet areas that are inflammable (Friend 1993; Kirkland et al. 1996; Mushinsky 1985). Arboreal anurans, however, are not expected to burrow and have been suggested to suffer a higher mortality than the ones that do burrow (Friend 1993; Gillon 1983).

Phyllodytes luteolus (Wied) is a hylid that spends its entire life among bromeliad leaves (Bokermann 1966; Giaretta 1996). Males call and defend territories in the plants and females lay one to three eggs per leaf axil (Giaretta 1996; Weygold 1981). Teixeira et al. (1997) found densities of 0.2 (N = 36 rosettes) to 2.3 (N = 40 rosettes) adult frogs per bromeliad rosette near São Mateus, state of Espírito Santo, Brazil.

We compare the effects of a fire on the terrestrial bromeliad *Vriesea neoglutinosa* (Mez) and the frog *Phyllodytes luteolus*. The study site is a 210-ha open area surrounded by Atlantic Forest, with sandy soil, few trees, scattered shrubs, and strong dominance of *V. neoglutinosa* on the ground (Rocha et al. 1996). It is called Nativo do Parajú and it is located adjacent to the Reserva Florestal da Companhia Vale do Rio Doce, Linhares County, state of Espirito Santo, Brazil. The area has not been used for agriculture, and there are no records of previous burning.

In July 1993, before the fire, Giaretta (1996) studied the use of the same bromeliad (treated in his study as *Vrisea procera*) for reproduction by *Phyllodytes luteolus* at the same site. He sampled rosettes in the central part of the Nativo do Parajú, trying to approximate a random selection of rosettes. He defoliated 85 rosettes and found 14 adult male *P. luteolus*, 13 females, and 7 juveniles. Eggs were found in 15 rosettes and tadpoles in 25, and occupied rosettes had at least one egg or tadpole in 12.5% of the leaf axils. Adult males called during the afternoon but mainly at night (Giaretta, pers. comm.).

On 14 March 1995, a fire of unknown origin burned the whole area to its boundary with the forest. In April 1995, Rocha et al. (1996) determined that the fire burned more than 99.9% of the existing *Vriesea neoglutinosa* rosettes in the area to some extent, but the actual survival rate was not clear as the plants may recover from small, hidden unburned parts. They also sampled the remains of the plants and estimated that the population size of *V. neoglutinosa* was 2.6 million individuals before the fire.

In July 1995, four months after the fire, we visited the same site and heard only seven or fewer males calling on three different nights in the entire area. Large numbers of males were known to call in July in the area before the fire (Giaretta, pers. comm.). There was a rainy period immediately before the beginning of our study, and during the study we observed about ten individuals calling every night in an unburned, small group of bromeliads (11 x 22 m) near our lodge (8 km from the study area). To determine if the frogs were absent or just silent, we sampled the same area previously studied by Giaretta (1996). We repeated his methods of isolating a rosette with a net to prevent the escape of frogs and defoliating it while examining the leaves for the presence of frogs, tadpoles, and eggs. The precise location of the area sampled by Giaretta (1996) in the central part of the study site was unknown. To conduct a comparison with Giaretta's pre-fire data, we defined the central area as all points farther than 100 m from the forest. This area is flat with apparently homogeneous vegetation cover (Alves et al. 1996; Giaretta 1996; Rocha et al. 1996). In this central area, we sampled 5 randomly positioned transects (50 x 0.6 m). Three additional transects were sampled perpendicular to the limits of the burned area to determine if rosettes at the edge of the forest were functioning as refugia for the frogs. Transect sampling was opted to permit calculation of density estimates, to detect gradual change at the boundary between the burned area and the forest, and to facilitate future comparisons with data from site monitoring. We determined height, diameter, number of green leaves and volume of water stored among the axils of each rosette and searched for animals among the leaves while removing them. We only sampled rosettes that had the tip of the central axis within the limits of the transect. We also ignored rosettes that had the tip of the central axis closer than 1 m from a sampled rosette to avoid underestimating the fauna if the sampling procedures would cause animals to flee from neighboring rosettes.

Vriesea neoglutinosa were distributed in aggregates and even the remains of the heavily burned rosettes were sufficiently preserved to allow counting. In addition to measuring and defoliating the rosettes in the transects, we surveyed survival in all the rosettes of the aggregates crossed by transects. We considered each rosette to be an individual. Survivors were defined as rosettes that had green leaves. The limits of an aggregate were gaps >1 m between the tips of the leaves of any two adjacent rosettes.

The five transects crossed 32 aggregates of *Vriesea neoglutinosa* that contained a total of 885 rosettes. The weighted mean survival of rosettes in the aggregates was 30.6% (range 13.5–100%). In the transects, we examined 46 rosettes and found no *Phyllodytes luteolus* adults, juveniles, tadpoles, or eggs. The tips of most leaves were burned. The number of green leaves per rosette and the volume of water contained among leaves were smaller than the estimates by Giaretta (1996) before the fire (mean ± SD [N], two sample *t* test: no. leaves/rosette, 18.8 ± 5.3 [32] before fire, 14.6 ± 4.0 [46] after fire, $p<0.001$; volume water (ml) among leaves/rosette, 734.2 ± 207.8 [31] before fire, 11.9 ± 17.8 [46] after fire, $p<0.001$). At the edge of the forest and the limit of the burned area, fewer plants were dead and they were larger and had more leaves than the ones in the central area (Fig. 1). We analyzed 36 rosettes at the forest edge but found no *P. luteolus*.

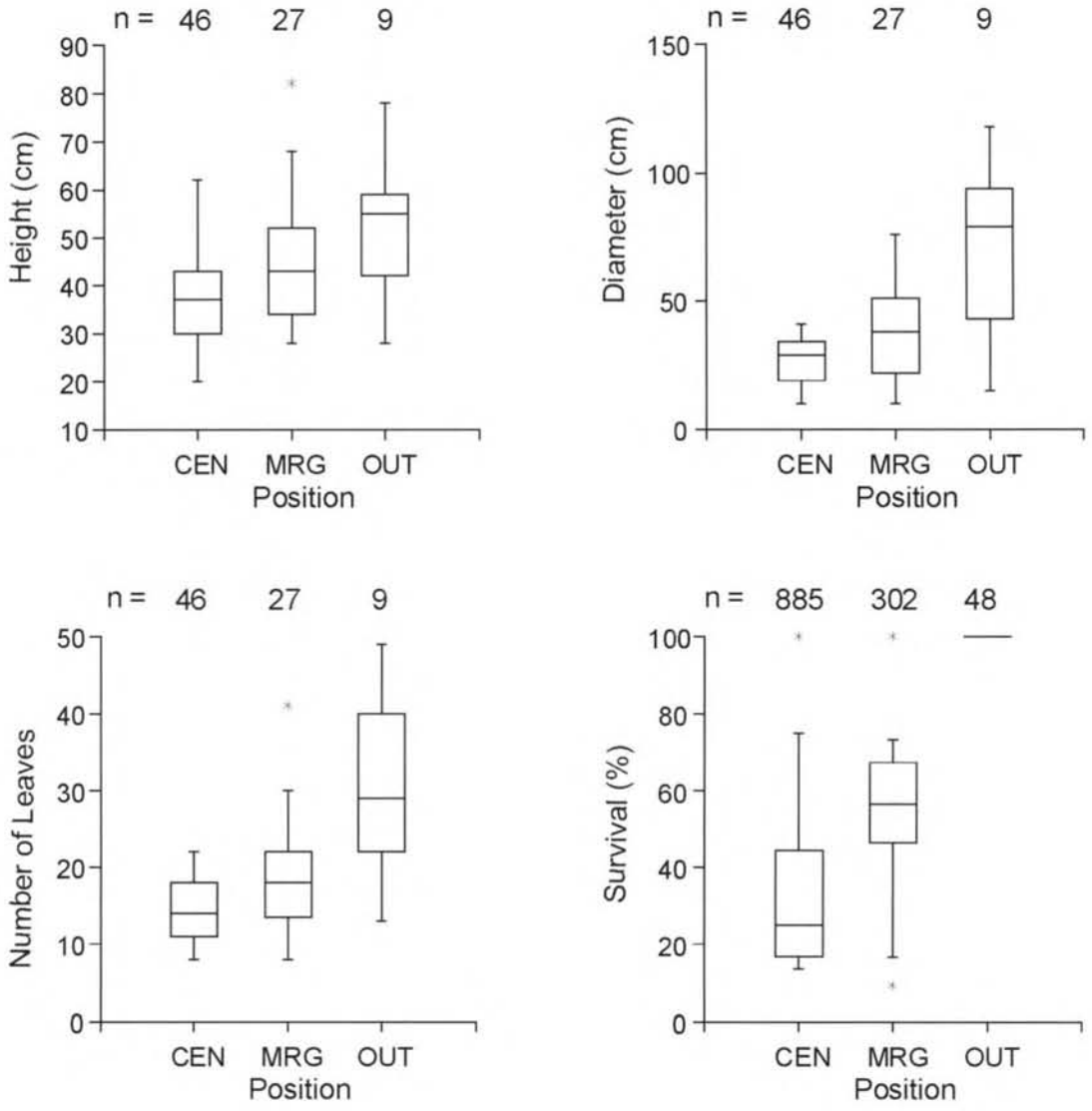


FIG. 1. Characteristics of rosettes of the bromeliad *Vriesea neoglutinosa* four months after a fire, in relation to their position in the burned area. CEN = center of the burned area, MRG = margin of the burned area, OUT = outside the burned area.

Studies on the effects of fire in amphibian assemblages have produced disparate results. Friend (1993) reviewed the literature on the effects of fire on Australian anurans. He found that most species were burrowers and were inactive during the dry season, when fires are more frequent. Those species were not significantly affected by fire. Arboreal frogs (*Litoria*) and species that were active in the dry season (*Limnodymastes dorsalis* and *Myobatrachus gouldii*) were found with higher frequency in long-unburned sites. Mushinsky (1985) studied the herpetofauna of sandhills in Florida in areas repeatedly burned at different time intervals. He did not find a decrease in abundance or diversity in the areas burned more frequently. Kirkland et al. (1996) sampled burned and unburned areas in central Pennsylvania and found more amphibians in the burned area. *Bufo americanus* accounted for most of the captures and the authors suggested that the difference may have been an artifact produced by a burst of activity after a rain. In African savannas, most species are inactive during the dry season and retreat to burrows or wet areas, so that the direct effects of fire are negligible (Gillon 1983). Populations are denser, however, and experience smaller annual fluctuation in savannas that have not been burned for long periods.

Our data indicate that *Phyllodytes luteolus* suffered a stronger population reduction than *Vriesea neoglutinosa* in the Nativo do Parajú. The fire might have killed relatively more frogs than bromeliads, or the microenvironment in the survivor rosettes might have been unsuitable for the frogs after the fire. *P. luteolus* may use bromeliads other than *V. neoglutinosa* for reproduction but it is selective to characteristics of individual rosettes (Eterovick 1999). Teixeira et al. (1997) found that *P. luteolus* avoids rosettes with less than 100 ml of water, and that they are more common in rosettes in open areas (mean ± SD: 2.68 ± 2.80; N = 60 frogs or tadpoles per rosette) than in rosettes shadowed by shrubs (0.53 ± 0.94; N = 36). Their results indicate that no part of our study area offered ideal conditions for recolonization because the plants that were alive in the burned area had little water and the ones that were not burned were shadowed under the forest canopy.

This study supports the suggestion by Friend (1993) that arboreal anurans may be strongly affected by fire. His suggestion also

may apply to other organisms associated with bromeliads. Various species of protozoans, worms, insects, crustaceans, spiders, and amphibians are commonly found in neotropical bromeliads that hold water and some of these animals may depend on the plant to complete their life cycle (Laessle 1961; Madeira et al. 1995; Oliveira et al. 1994). We found only spiders and ants among the leaves of the bromeliads affected by fire. In unburned rosettes, however, we found ants and spiders but also worms and larvae of beetles, mosquitoes, and dragonflies. This indicates that the fire also affected the invertebrate fauna found in the rosettes. It is not conclusive, however, because the effect of fire could be confounded with the effect of the forest. All the rosettes that escaped the fire were located at the border of the forest, where they were shaded and organic matter originated from the forest canopy accumulated among their leaves.

In many open areas dominated by grass, fire is common and native plants often have high survival and rapid recolonization (Coutinho 1982). However, the effect of fire on areas dominated by ground bromeliads is largely unknown (Alves et al. 1996). One year after our study, Alves et al. (1996) surveyed the bromeliads and found that the surviving individuals fully recovered their size and weight. The density, however, was only 28% of the density before the fire, about the same percentage that we detected as surviving rosettes (30.6%). This indicates that no substantial formation of new rosettes occurred in the first 18 months after the fire. Donnelly (1989) studied population dynamics of *Dendrobates pumilio*, a frog that uses bromeliads for tadpole development in Costa Rica. She artificially increased the availability of bromeliads in an area and detected increased immigration, recruitment, and survival of frogs. She concluded that the availability of bromeliads is a constraint for population size in *D. pumilio.* If the same is true for *P. luteolus,* recolonization in the Nativo do Parajú might be dependent on a successful recovery of the bromeliad population.

Long term monitoring in the area is necessary to determine if the pre-fire abundances of bromeliads and associated fauna will recover, and how long the process will take. Understanding the effects of fire in this community is necessary for proper management of land in relation to manmade fires, which are common in the region (Teixeira et al. 1997).

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Status of the Northernmost *Sceloporus grammicus* Population

CELIA GARCÍA-PRIETO
MORGAN R. McKELLER
and
MICHAEL JAMES McCOID
Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA
e-mail (MJM): mccoid@isni.net

Although the mesquite lizard (*Sceloporus grammicus*) is native to much of northern Mexico, including extreme southern Texas, the full extent of the species' range in Texas is apparently conjectural. Smith (1946) figured the range as the lower Rio Grande

Valley extending north along the coast to include Cameron, Willacy, and Kenedy counties to approximately Kleberg County. Conant (1958) showed only the Rio Grande Valley as the range of *S. grammicus* but noted an isolated record approximately in Kleberg County. Conant (1975) similarly pictured the lower Rio Grande Valley as the range in Texas but also included a disjunct population approximately in Kleberg County. Garrett and Barker (1987) showed the range of *S. grammicus* in Texas as similar to that presented by Conant (1975). In contrast, Dixon (1987) regarded the lower Rio Grande Valley as native range and stated that the population in Kleberg County and record in Refugio County were accidentally introduced. Axtell (1988) portrayed the lower Rio Grande Valley as native range and classified all other Texas records (including Cameron County) as extralimital or questionable. Most recently, Conant and Collins (1991; 1998) re-established the native range in Texas as the lower Rio Grande Valley extending north coastwise to Kleberg County, similar to that originally figured by Smith (1946). Evidence for uniting the disjunct population in Kleberg County with the lower Rio Grande population on a map is lacking; we are unaware of any specimens of *S. grammicus* from either Kenedy or Willacy counties (see Axtell 1988).

Despite the fact that *Sceloporus grammicus* is apparently missing from Kenedy and Willacy Counties, appropriate habitat occurs in this region. There is almost continuous scrub forest of mesquite (*Prosopis* sp.) and oak (*Quercus* sp.) extending north from the city of Raymondville (Willacy County) to the city of Kingsville (Kleberg County) (ca. 75 linear miles). An historical reference to habitat in this disjunct region of Kenedy and Willacy counties described this area in the 1830's as a "wilderness of plains...covered with small forests of oaks" (Berlandier 1980). Proudfoot and Beasom (1997) describe large tracts of land in Kenedy County as having a mesquite and oak forest at least 80 years old. This information suggests a continuity of habitat for at least the past 160 years. Presence of apparently suitable habitat, however, does not ensure the presence of *S. grammicus* in this distributional gap and suggests the absence of the species is real and not a collecting artifact. Recently, Proudfoot and Beasom (1997) analyzed the feeding habits of diurnal owls from Kenedy County and recorded nine species of lizards as prey, including four phrynosomatids, but not *S. grammicus*.

Axtell (1988) stated that *Sceloporus grammicus* had established "incredibly dense" populations in Kingsville by the early 1960's but had almost all inexplicably disappeared by 1973. The earliest specimen from Kleberg County catalogued in the Texas A&M University–Kingsville (TAIU) research collection was collected in 1965.

We endeavored to resurvey previous collecting sites in Kingsville to verify the continued presence of *Sceloporus grammicus* in Kleberg County. Locality data associated with some *S. grammicus* deposited in the TAIU collection were precise enough that we were able to visit eight specific sites that had yielded specimens 10 to 33 years earlier. Searches were also conducted in mesquite and oak groves at additional localities not previously identified as *S. grammicus* sites. Searches were intensively conducted during the month of April when daily high temperatures ranged between 27 and 35°C. No *S. grammicus* was sighted and we were unable to verify the recent presence of *S. grammicus* in Kleberg County at any site. Although we are aware of the dangers of relying on visual surveys to assess population parameters of reptiles (Rodda 1993; Henke 1998), one of us (MJM) has experience collecting *S. grammicus* in northern Mexico and has periodically surveyed appropriate habitat in Kleberg County since 1994 and failed (except as noted below) to observe any *S. grammicus*.

We are aware of two sightings in Kleberg County in recent years, but no specimens were obtained. One of us (MJM) moved into a Kingsville house in August 1993 that was landscaped with a small group of junipers (*Juniperus* sp.) and ashes (*Fraxinus* sp.). A group of three to five adult *S. grammicus* lived in these trees until July 1995 at which time they were replaced by two *S. olivaceus*. The second sighting (by MRM) was of a single adult lizard in October 1997 in southern Kleberg County.

Although we doubt that the species is extirpated in Kleberg County, we suspect that the population continues to decline and that the species never occurred in Kenedy and Willacy Counties. We support Dixon (1987) and Axtell (1988) in that the population in Kleberg County and record from Refugio County should be regarded as extralimital. We also predict that the population of *S. grammicus* in Kleberg County eventually will be extirpated.

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HERPETOLOGICAL HISTORY

Editor's Note.—With this first issue of 2000, we initiate a new section of *HR*, Herpetological History. Articles suitable for publication may address any aspect of the history of herpetology—the parameters are purposely broad so as not to limit, a priori, the scope of material. Manuscripts should be directed to the editor (RH).

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The Writings of Sherman Bishop: Part I. *The Salamanders of New York*

TODD HUNSINGER
Biological Survey, New York State Museum
3140 Cultural Education Center, Albany, New York 12230, USA
e-mail: Hunsitod@hvcc.edu

Sherman Bishop's (1941) classic monograph *The Salamanders of New York* is arguably one of the most influential herpetology works of the twentieth century. His peers immediately realized the impact of Bishop's work, for the reviews were very complimentary. Hubbs (1942) wrote "Experimental embryologists and other biologists...will join herpetologists in their gratitude to Dr. Bishop for his full compendium of published and original information on the natural history of the salamanders which occur in New York." Schmidt (1943) wrote "The work as a whole forms an extraordinarily satisfactory account of a rich and varied section of the North American salamander fauna." Bishop's detailed species accounts included original observations and data on mating behavior, egg masses and deposition, development from egg to maturity, habits, and habitat. At the time of Bishop's death, former student Arnold B. Grobman described *The Salamanders of New York* as "probably the most complete report on a group of animals from a state ever assembled" (Grobman 1952).

Although *The Salamanders of New York* was not printed until June 1941, Bishop had worked steadily on its development during his tenure as Zoologist at the New York State Museum, a position he held from 8 May 1916 to 31 August 1928 (Stoner 1937). Bishop completed herpetological surveys of Allegany State Park (Bishop 1927a) in addition to publishing on the herpetofauna of Albany County (Bishop 1923) and the mudpuppy (Bishop 1926). Field studies were completed on Long Island, Lake George, and in Putnam County. Bishop showed a strong interest in furthering his knowledge of the life history of salamanders and in educating others as well. In 1926 he prepared two exhibits for the State Museum (Bishop 1927d), *Life History group of Spotted and Jefferson Salamanders*, and *Habitat group of the Hellbender*, in which "the group will show a section of stream bottom with the nest and eggs of the Hellbender and guardian parent engaged in protecting the nest from enemies bent on foraging." All of this work was conducted in an attempt to gain the knowledge to complete a much larger project that Bishop had envisioned, the salamanders of New York.

A lack of support for the State Museum by the State Legislature and Board of Regents hindered Bishop's attempts to complete *The Salamanders of New York* and other projects much earlier than 1941. Bishop's own typewritten draft of the Report of the Zoologist (Bishop 1927d) for the 1926 fiscal year reveals his desire to complete this project, as well as his frustration over a lack of institutional support for his research and projects. Bishop reported:

> "Project No 2 The Salamanders of New York: Their Life Histories and Habits. Scope: In this study it is proposed to present a complete account of the life histories, habits and general development of New York salamanders."

Under the heading of 'Finances,' Bishop (1927d) wrote:

> "The most urgent need of the zoologist is for sufficient funds to bring to completion studies which have been carried out during the past eight or ten years. The report on, 'The Life History of New York Salamanders' has been delayed because of the impossibility of securing the services of an artist to complete the series of watercolor drawings. Funds for traveling expenses have been insufficient to enable the zoologist to complete the study on New York amphibians and reptiles."

This frustration came after Bishop had outlined what was needed to complete the project in earlier memos to Charles Adams, the Director of the State Museum (Bishop 1927b,1927c). *The Salamanders of New York*, which was two-thirds complete (Bishop 1927b) would require "$500.00 for the completion of color plates and about $150.00 for travelling expenses" (Bishop 1927c; see Fig. 1).

A lack of funding is evident again in Bishop's correspondences with close friend and colleague Francis Harper of the Boston Society of Natural History. In a letter dated 6 January 1928, Bishop writes, "My chief interest in accepting an offer to talk in Boston, if the opportunity presented itself, is this: It would give me an opportunity to examine specimens in the collection at Cambridge. Our funds for out-of-state travel are exhausted each year before I get a chance at them and cannot afford to take the trip unless I could make at least part of my expenses."

The minimizing of zoological research and publications was not unique to Bishop's tenure at the State Museum. During his 62-year affiliation with the State Museum, geologist James Hall (Museum Director 1870–1894) established it as one of the leading geological museums in the world (Fakundiny 1987). The tenure of zoologists during the early 20th century was rarely more than 2–3 years. During the 38 years from 1888 to 1926, the biologists produced a total of 29 museum publications, or less than one per year (Fakundiny 1987). The appointment of Charles Adams as director of the State Museum on 1 May 1926 marked the first time the Museum Director had not been a geologist.

Whether Bishop's tone denotes a final frustration with a perceivably unresponsive institution or an attempt to persuade the new director, it is evident that he was not satisfied with the speed at which he was able to work. Under the heading of 'Progress of Work,' Bishop (1927d) wrote:

> "Project No. 2. The Salamanders of New York: Their Life Histories and Habits. Status: The study of a considerable number of species has been brought nearly to completion. Certain critical stages of several species remain to be studied and will necessitate field work [sic] in various selected areas. This project has been held up for several years because funds have not been made available to secure the services of an artist competent to make the necessary color drawings.
>
> A considerable number of line drawings, color drawings and photographs have already been prepared. Plans: With few exceptions, the study of New York species may be carried out in the

vicinity of Albany. For the field study of the marble and Tiger salamanders it is necessary to visit Long Island; for the Mudpuppy and Hellbender, western New York."

Bishop's talents had not gone unnoticed in the herpetological community. He was approached on three separate occasions to join the staff of the American Museum of Natural History at a substantial increase in salary. G. Kingsley Noble visited Albany in 1922 to persuade Bishop to come to the American. The last offer from the American came in February of 1924 when Roy Chapman Andrews offered Bishop a position to work with the Asiatic collection, a project that already included noted herpetologist Clifford Pope. In all three incidents, Bishop declined the enticing offers from the American, "in part at least, because of promised salary increases that never materialized" at the State Museum (Bishop 1928).

Bishop left the State Museum in August 1928, to accept a teaching position at the University of Rochester. This moved him closer to his childhood home and increased his annual salary from $2,750 to $4,000, with the prospect of additional money from summer employment (Bishop 1928). In a letter to Francis Harper dated 14 March 1928, Bishop stated, "By April 4th I expect to be able to announce a change in my activities. I am contemplating a move to a much better position." In a response dated 19 March 1928 Harper wrote, "Aside from its financial drawbacks, however, it seems that your present position is quite a strategic one, and I shall certainly be sorry to see you leave it." After Bishop announced that the position had materialized, Harper wrote (7 May 1928), "There will be, I am sure, no small gain to you in peace of mind."

After leaving the State Museum, Bishop continued to press ahead with his manuscript on salamanders, believing that publication was imminent. The announcement of his appointment at the University of Rochester that appeared in the Rochester Democrat and Chronicle (1928) was entitled "U.R. Instructor Preparing Books on American Amphibia."

An early draft of the manuscript was nearing completion and the prospects for publication looked favorable in 1931. In a letter to Dr. Adams dated 27 March 1931 Bishop wrote,

> "The enclosure gives a brief outline of the items I have been covering in my account of the salamanders of New York. What is the news regarding the printing bill? I sincerely hope that it goes through and that the money will become available."

Further correspondences between the two men revealed that funds for printing could not be secured through the Museum or the University of Rochester. The Board of Regents, which appropriates the funds for the State Education Department, appears to have been reluctant to fund this project. This could be due to the fact that Bishop pursued "investigations in fields that may be regarded by some as having little economic importance" (Bishop 1928). This would not have been a unique mindset during that period. A few years earlier Bishop had corresponded with publisher G.P. Putnam about the prospects of publishing a field guide of salamanders. On 19 May 1927 Putnam wrote, "We here feel that a Field Book of Salamanders alone is likely not to have sufficiently wide appeal to warrant the rather heavy publishing investment."

In late 1931 Adams wrote, "there is a new prospect that looks hopeful" which did not materialize. In December of 1932, yet another attempt to gain appropriation of the funds failed. At this point the Great Depression was at its peak and the prospect of funds for publication was bleak.

While the New York State Archives does not contain any correspondences between Bishop and Adams in 1936, it was during that summer that Bishop wrote the text for *The Salamanders of New York* (B. B. Flory, pers. comm.). The fight to secure the funds to publish it continued until 1941. The final product was compromised because the color plates that Bishop had spent nearly 20 years collecting, and for which the University of Rochester had contributed $500, were photographed (i.e., black and white reproduction) to reduce the printing cost. Bishop's frustration over this was not lost on his friend and colleague Karl P. Schmidt. In review he wrote, "Those of Dr. Bishop's friends and colleagues who have seen the superb water-color paintings of the salamanders of eastern North America accumulated under his supervision over many years will have felt some regret at the appearance of his "Salamanders of New York" without color illustrations" (Schmidt 1943).

Bishop had established himself as a leading authority on salamanders by the time he began vocalizing his desires to finish *The*

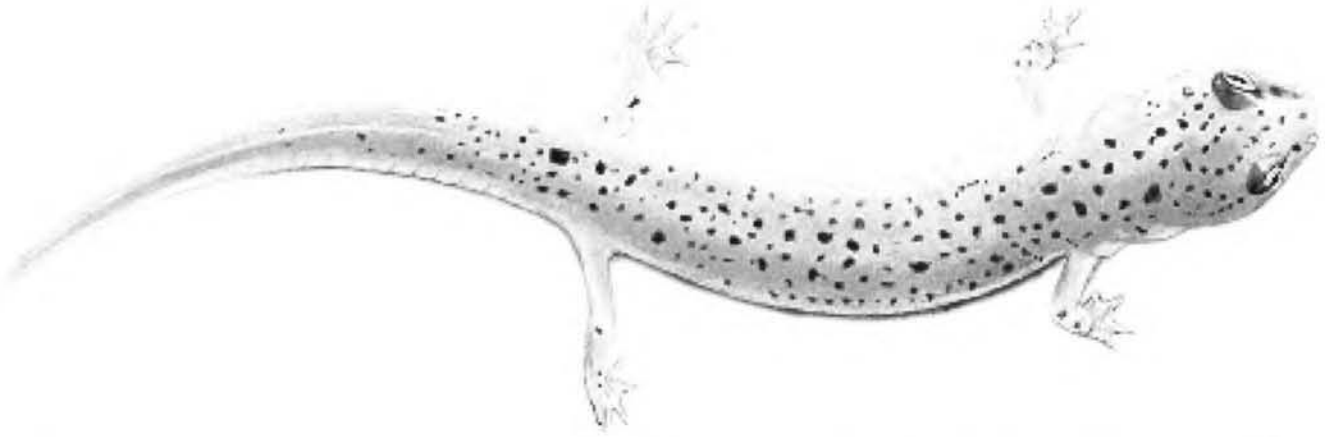


FIG. 1. Black-and-white reproduction of a watercolor depicting a larval *Pseudotriton ruber* (NYSM 3086) collected 10 June 1922 by S.C. Bishop in Albany County, New York, USA. The drawing (NYSM 940), by G. S. Barkentin, was prepared under the supervision of Bishop during fieldwork for *The Salamanders of New York*. It was not included in the monograph and is previously unpublished. To view the original watercolor and for more information on S.C. Bishop visit www.nysm.nysed.gov/biology/salamander/index.html.

Salamanders of New York in 1927, yet his knowledge of so many of the species was incomplete. It is interesting to consider what the document would have been if it had been published at Bishop's behest. The published bulletin contained 54 citations for works published after 1928. On the prospects of earlier publication, Bishop wrote to Adams on 30 November 1931, "This account should make a bulletin of about 200 pages." The bulletin, as it was printed in 1941, consists of 365 pages, a substantial increase from the estimate given by Bishop a decade earlier.

The species accounts given by Bishop (1927a) in *The Amphibians and Reptiles of Allegany State Park* provide a glimpse of his knowledge at the time he was pressing for completion of the larger work. Concerning the hellbender, Bishop wrote, "In New York State it is entirely confined to the Allegany river (sic) and a few of the larger tributaries except where introduced" (Bishop 1927a). By 1941 Bishop had changed his account to, "The distribution as at present known, may be summarized as follows: The Susquehanna and tributaries in New York and Pennsylvania; the Ohio river (sic) and tributaries including the Allegany in western New York" (Bishop 1941). He even goes so far as to correct the work of Stejneger and Barbour (1933), which failed to mention the Susquehanna populations. Based on Bishop's correspondences it is apparent that his views on the distribution of *Cryptobranchus* changed at the end of 1927. In a letter to Henry Fowler at The Academy of Natural Sciences, dated 30 December 1927, Bishop asked,

> "Can you tell me whether the Hellbender, *Cryptobranchus* is found in the Delaware River? I have records of the animal from the Susquehanna river (sic) both in Pennsylvania and New York, and have wondered if it were also introduced there. Baird reported it in 1850 and it is now so widely distributed in various tributaries of the river, it is perhaps native to the stream."

The record from the Susquehanna in New York was based on a recent correspondence with the Supervising Principal of Sidney Schools. In a letter to him dated 10 Januaury 1928, Bishop writes:

> "The Hellbender came through in fine condition this afternoon...so far as I know, is the first specimen recorded from the Susquehanna in New York...and has, undoubtedly been known to fisherman and others in New York; but records have not come to my attention."
>
> "Until now I have been going to the Allegany State Park to study the Hellbender. I now propose to have a look at the Susquehanna."

This specimen is not known to exist in any institutional collection. The first vouchered specimen from the tributaries of the Susquehanna in New York was collected on 11 May 1928 (NYSM 2732). The majority of specimens cited by Bishop (1941) from the Susquehanna were not collected until 1935.

At the time that Bishop (1927d) wrote the Report of the Zoologist, pressing to finish *The Salamanders of New York*, Wehrle's salamander (*Plethodon wehrlei*) had not been added to the herpetofauna of the State. It was late July of that year that Dr. R. E. Coker discovered their presence in Allegany State Park (NYSM 2653–2655) (Bishop 1927a). While the seven pages devoted to *P. wehrlei* is the shortest species account in *The Salamanders of New York*; it would have been even shorter had the publication been completed earlier.

The two species of *Desmognathus* also seemed to be of particular interest to Bishop during the early 1930's. In 1933 he published on the nests and young of *D. ochrophaeus* (Bishop and Crisp 1933). His personal collection, numbering more than 1000 individuals of both species (FMNH collection), was accumulated from numerous locations in western New York. Much of the data used by Bishop (1941) for the accounts of *D. ochrophaeus* are from fieldwork conducted during the 1930's.

By 1939, Bishop's health was failing due to stress-related illnesses. While it can only be speculated whether the decade-long struggle to see his work completed contributed to his failing health, it is known that if the timing of the publication of the bulletin had progressed according to Bishop's wishes, it quite possibly would not have had the impact on the discipline of herpetology that it has enjoyed. The additional time allowed him to expand his knowledge for the accounts of many of the species.

Bishop's work is a tribute to decades of persistence and perseverance by a strong-willed individual with a vision. Three popular publications on North American salamanders in print today are indebted to the precision of Bishop's accounts. It provided the basis for *The Handbook of Salamanders* (Bishop 1943), which remained the only composite work on North American salamanders for 55 years. *The Salamanders of Ohio* (Pfingsten and Downs 1989) was influenced heavily by Bishop's work. The recently completed *Salamanders of the United States and Canada* (Petranka 1998) relies on Bishop's descriptions of reproductive biology and ontogeny for species native to New York. Petranka's thorough review of each species has indirectly renewed focus on the extent of Bishop's work, placing it alongside subsequent salamander studies for comparison. It is now apparent that no other researcher has compiled as much information on egg clutches for the secretive red salamander (*Pseudotriton ruber*) as Bishop. Likewise, Bishop's accounts of the reproductive biology of the hellbender (*Cryptobranchus alleganiensis*) and four-toed salamander (*Hemidactylium scutatum*) are as complete as any published, while his earlier publications on the mudpuppy (*Necturus maculosus*) enabled him to write one of the most detailed original accounts of this species (Bishop 1926, 1932).

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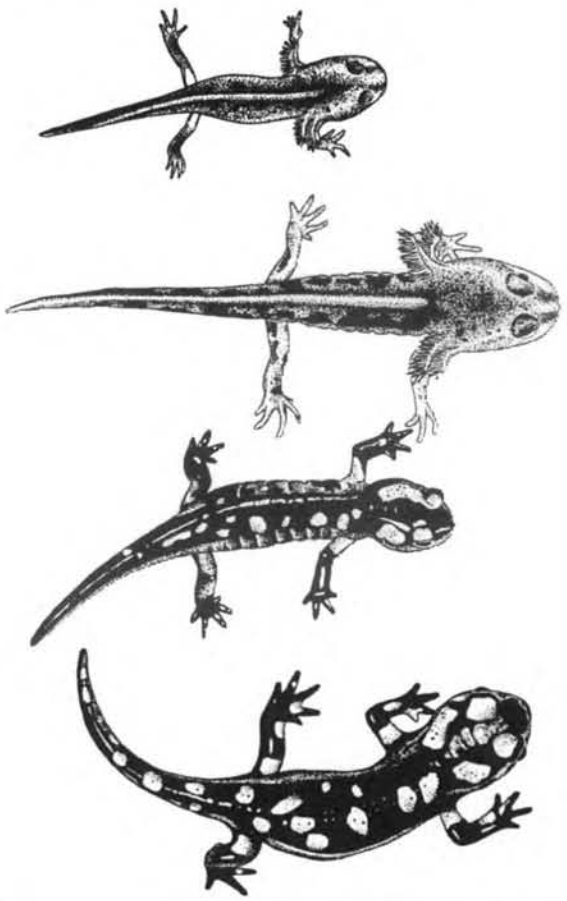
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Metamorphosis in the Fire Salamander (*Salamandra salamandra*). Illustration by P. A. Benson.

NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their note (e.g., Reproduction, Morphology, Habitat, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send three copies of manuscripts, double-spaced, directly to the appropriate section coeditor (addresses on inside front cover): J. Brian Hauge (lizards, amphisbaenians, crocodilians, *Sphenodon*); Charles W. Painter (amphibians); or Paul A. Stone (snakes, turtles). Authors are requested to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a text-only version of the file.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1997. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 4th ed., Herp. Circ. 25:1–40; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

DESMOGNATHUS IMITATOR (Imitator Salamander). **REPRODUCTION**. Eggs of many *Desmognathus* species are commonly deposited on the underside of rocks, in stream leaf litter, and in muddy seeps. Although there are two reports of eggs that were presumed to be those of *Desmognathus imitator*, neither was confirmed by identification of brooding females (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 587 pp.).

We found six *D. imitator* clutches on 30 June 1998 in Swain Co., North Carolina, USA, at ca. 1600 m elevation (35°36'20"N, 83°26'56"W). The clutches were found within a seep in saturated soil and eggs were in early developmental stages. We observed one red-cheeked *Desmognathus* (40 mm TL) with her body in direct contact with a clutch, and saw other red-cheeked *Desmognathus* within 10 cm of clutches when we overturned rocks, confirming that the eggs were those of *D. imitator*. Eggs were cream colored and attached in a monolayer to the underside of flat rocks that were embedded in the soil, although one clutch had a small number of eggs arranged in a bilayer. Two of the clutches were deposited within 22 cm of each other but were on separate rocks. Means and ranges (in parentheses) for clutch parameters for five nests are: clutch size 19 (13–24) eggs; clutch length 19 (9–27)

mm; clutch width 10.4 (6–17) mm; and egg diameter 3.5 (3.0–4.0) mm (N = 55 eggs). Two clutches illustrated by Petranka (1998) are from the same site and contained 23 and 30 eggs.

The lack of information about the breeding and nesting habits of *D. imitator* is likely due to their small range and secretive nesting in subsurface retreats.

Our observations suggest that females nest in late spring and early summer and guard their eggs, presumably through hatching. The mode of egg deposition is more similar to that of *D. monticola* than to other members of the *D. ochrophaeus* complex.

Submitted by **CAROLINE A. KOENINGS**, Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana 70402, USA, **CHARLES K. SMITH**, Department of Biology, High Point University, University Station, High Point, North Carolina 27262, USA, **ELIZABETH A. DOMINGUE**, 320 Laurel Valley Road, Townsend, Tennessee 37882, USA, and **JAMES W. PETRANKA**, Department of Biology, University of North Carolina at Asheville, Asheville, North Carolina 28804, USA.

PSEUDOTRITON RUBER RUBER (Northern Red Salamander). **ALBINISM**. Several plethodontid species have been documented as having some degree of albinism in North America, many of which are listed by Palmer and Braswell (1980. Brimleyana 3:49–52) and Dyrkacz (1981. SSAR Herpetol. Circ. 11:131 pp.). However, this is the first documented occurrence of albinism for *Pseudotriton r. ruber* and for the genus *Pseudotriton.*

On 18 March 1998 an albinistic *Pseudotriton r. ruber* (85 mm SVL, 146 mm total length, 16 costal grooves) was collected at the Radford Army Ammunition Plant, New River Facility, Pulaski County, Virginia, USA (Fig. 1). Dorsal pigmentation was pale orange with pinkish-white spots on the head, trunk, and tail regions. The ventral integument was similar in color to the venter of a normally pigmented individual also collected at the site. The toe tips were white. Some dark pigment was present and scattered across the entire dorsum in small flecks (indicating partial melanin production), and the eyes were pinkish-white and appeared red when viewed with a light beam. The overall coloration of this individual is defined by Dyrkacz (*op. cit.*) as partially albinistic with xanthophores and erythrophores present. The specimen was photographed and released after being held in captivity for two weeks. Color slides were deposited in the University of Kansas Natural History Museum (KU CT 11720–21).



FIG. 1. Albinistic *Pseudotriton r. ruber* from Virginia.

Submitted by **SHAY GARRIOCK**, Virginia Department of Game and Inland Fisheries, Blacksburg, Virginia 24060, USA. Present address: 8622 Chapel Hill Road, Cary, North Carolina 27513, USA.

ANURA

BUFO AMERICANUS (American Toad). **ENDOPARASITE**. New host records reveal previously unstudied host-parasite relationships that may be important to parasite-models of sexual selection (Hamilton and Zuk 1982. Science 218:384–387) and amphibian deformities (Johnson et al. 1999. Science 284:802–804). Although *Clinostomum marginatum* has been studied in *Hyla chrysoscelis* (Hausfater et al. 1990. Amer. Zool. 30:299–311), there are no records of *C. marginatum* metacercariae in *Bufo americanus*. Herein we report the presence of this digenean parasite encysted in adult *B. americanus*. During the 1997 breeding season (25 March–8 April), one of us (JMH) noted the encysted metacercariae in 17 of 69 (24.6%) adult *B. americanus* at a farm pond (ca. 0.04 ha) in Oklahoma County, Oklahoma, USA (35°41'13"N, 97°14'55"W). We collected one female and one male toad that were infected with encysted metacercariae on 19 September 1997 and 30 April 1998 to identify the parasite and describe the infection. We inspected the subcutaneous tissues, mesenteries, and internal organs for encysted parasites and removed 75 metacercariae from each toad. Cysts from which metacercariae did not escape were placed in amphibian Ringer's solution and were pulled apart to free the metacercariae. Flukes were fixed in CAFA (30% chloroform [v/v], 50% alcohol [v/v], 10% formalin [v/v] and 10% acetic acid [v/v]) and stained. Microscopic examination revealed the metacercaria to be the digenean fluke *C. marginatum* (C. R. Bursey, pers. comm.). Encysted and liberated *C. marginatum* were found in the abdominal subcutaneous tissues, mesenteries of the small and large intestine, pericardium, skeletal muscle, and in the brain immediately posterior to the eyes. No metacercariae were found inside viscera. Toad and parasite specimens were deposited into the Herpetology Collection of the University of Central Oklahoma (UCO 380, 712). The first intermediate host (*Helisoma* sp.) and potential definitive hosts (*Butorides striatus*, *Nerodia rhombifer*) have been observed at this pond (JMH). The convergence of hosts at the pond ensures a complete life cycle for this fluke as well as infestation of new *B. americanus* cohorts.

We thank Charles R. Bursey and Stephen R. Goldberg for the identification of metacercariae of this parasite and Marvin Mays for his assistance in the recovery and preliminary identification of this parasite.

Submitted by **KESHA CROSS** and **JOHN M. HRANITZ**, Department of Biology, University of Central Oklahoma, Edmond, Oklahoma 73034-5209, USA; e-mail (KC): keshmae@aol.com; (JMH): jhranitz@ucok.edu.

BUFO OCCIDENTALIS (Pine Toad). **FECUNDITY**. Anurans are well known for their ability to produce large clutches of eggs (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill Book Co., New York. 670 pp.), with the largest clutch recorded from a *Rana catesbeiana* that laid 47,840 eggs (McAuliffe 1978. Nebraska Game and Parks Report, Lincoln). North Ameri-

can bufonids also noted for laying large clutches include *Bufo cognatus* (45,054 eggs; Krupa 1994. J. Herpetol. 28:217–224), *B. americanus* (13,452 eggs; Kruse 1981. Herpetologica 37:228–233), and *B. woodhousii* (28,493 eggs; Krupa 1995. Herpetol. Rev. 26:142–143).

On 27 Oct 1998 at ca. 2030 h we collected a female (LOL-031; 86 mm SUL) and male (LOL-032; 81.5 mm SUL) *B. occidentalis* in amplexus at Zapotitlán de las Salinas, Puebla, México (18°07'18"N; 97°19'24"W) at 1420 m in deciduous tropical dry forest. Specimens were collected and taken to the Laboratoria de Ecología de la UBIPRO where amplexus continued until ca. 0400 h the next day. During that time, the female laid two clutches of eggs. The first clutch was laid at ca. 2030 h and contained 8380 eggs (mass 187.8 g); the second was laid ca. 0400 h and contained 2352 eggs (mass 59.5 g). Total clutch size and mass was 10,732 eggs and 247.4 g. This is the first report of large clutch size in Mexican bufonids.

We thank G. Woolrich, J. González, and V. Mata for their support. Funding was provided by the Dirección General de Apoyo al Personal Académico (DGAPA-UNAM), Project No. IN208398.

Submitted by **LUIS OLIVER-LOPEZ, AURELIO RAMIREZ-BAUTISTA**, and **JULIO A. LEMOS-ESPINAL**, Escuela Nacional de Estudios Profesionales Iztacala, Unidad de Biología, Tecnología, y Prototipos (UBIPRO), Lab. de Ecología, Universidad Nacional Autónoma de México. Av. de los Barrios s/n, Los Reyes Iztacala, Tlalnepantla, Edo. de México C.P. 54090, A.P. 314, Mexico; e-mail (ARB): raurelio@servidor.unam.mx.

GASTROPHRYNE OLIVACEA (Narrow-mouthed Toad). **VOCALIZATION.** Territorial calls in anurans are presumed to be used in agonistic interactions between males in close proximity (Duellman and Trueb 1986. Biology of Amphibians. McGraw Hill, New York. 577 pp.). There are no reports of territorial calls in the microhylid *Gastrophyrne olivacea*. Here I report *G. olivacea* in close proximity producing a distinctive call that was not the breeding advertisement call (Conant and Collins. 1991. Reptiles and Amphibians of Eastern and Central North America. Third edition. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.). Based on circumstances and associated behavior, I interpret this call as a territorial call.

On 18 June 1999 at 1530 h I heard 3 *G. olivacea* calling from a 1 m^2 area in a dry wash in Big Bend National Park, Texas, USA (UTM 680936e, 3262586n, Zone 13, Brewster Co., Texas, T_A = 33.0°C). The calls were 0.5 sec in duration and resembled a short, low-pitched nasal buzz. When one male called, the other two responded immediately. I confirmed species identification by capturing two males that were within 0.09 m of each other. One was underneath a clump of grass and the other was from a crack in the dirt bank. I did not capture the third individual calling from a rock crevice 0.8 m away from the others. There were 45 sec to 2 min of silence between calls. On 19 June 1999 at 2055 h I heard similar calls from five *G. olivacea*, within 8 m of one each other, located beneath four separate clumps of grass 20 m from a stock tank. Calls were separated by 10–40 sec. There were 2–5 individual responses for each call made.

These two observations document the existence of a call other than the typical advertisement call of *G. olivacea*. The calls were not associated with a breeding chorus and elicited strong response from nearby males. I suggest this call is agonistic between males and functions to establish territories. While breeding choruses of *G. olivacea* occur after heavy summer rains (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque, New Mexico. 431 pp.), it may be beneficial to amphibians living in stochastic environments to establish territories prior to the presence of water when rainfall events can create breeding environments in a matter of minutes.

I thank Lee A. Fitzgerald, Lily Ryder, and Ryan Nelson for their helpful comments and positive criticism. Raymond Skiles and Vidal Davila at Big Bend National Park provided tremendous logistical support. This study is part of DISPro (the Demonstration Intensive Site Program), a joint index site and ecological research program funded by the U.S. Environmental Protection Agency and National Park Service.

Submitted by **GAGE H. DAYTON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77840, USA; e-mail: gdayton@tamu.edu.

HYLA ALVARENGAI (NCN). **DEATH FEIGNING AND SIZE AT MATURITY**. *Hyla alvarengai* is a saxicolous, large-bodied hylid frog known only from parts of the Serra do Espingaço range, in the Brazilian state of Minas Gerais (Duellman 1993. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 21:1–372). Little is known about its biology and natural history, with most available information in Sazima and Bokermann (1977. Rev. Bras. Biol. 37:413–417) who discuss antipredator tactics including crypsis, leaping, seeking refuge in crevices, cutaneous exudation of a sticky substance, and the use of prepollical spines as defensive weapons by the males. Here we describe a new antipredator behavior for the species.

On 28 November 1998, during field collection at Sopa, Diamantina Municipality (18°12'S; 43°42'W), Minas Gerais, Brazil, we found an adult female (eggs could be seen through the skin) *H. alvarengai* (69 mm SUL) resting in the narrow space between two large boulders. At our first attempt to capture it, the frog leapt high and landed on a boulder where it remained still and was readily caught. Immediately after being captured, the frog thrust its front limbs upward to its eyes and remained motionless, with eyelids half-closed and the pollex of each hand below the corresponding eye and the remaining fingers above it. We then turned the frog belly-up and it remained in that position with hind legs tucked under the body for several seconds while photographs were taken, until it suddenly moved and appeared lively again. It then attempted to escape and was restrained, whereupon it again feigned death, this time with the front legs tucked under the body. It remained in that position for an even longer period, and was finally placed into a plastic bag while still feigning death. The specimen was fixed in 10% formalin and deposited at the Museu Nacional do Rio de Janeiro (MNRJ 23471). This specimen was smaller than the smallest of five mature female *H. alvarengai* (78 mm SUL) examined by Sazima and Bokermann (*op. cit.*) and is the smallest mature female of this species reported.

We thank Marcelo F. Nápoli and José P. Pombal Jr. for identification of the frog.

Submitted by **DAVOR VRCIBRADIC** and **MONIQUE VAN SLUYS**, Sector de Ecologia, Departamento de Biologia Animal e Vegetal, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-013, Rio de Janeiro, R.J. Brazil; e-mail (MVS): vansluys@uerj.br.

NECTOPHRYNOIDES VIVIPARUS (NCN). **DIET**. While conducting herpetological research in the Uzungwa Mountains rainforest, (Tanzania, Iringa Region, Kihanga Valley 1780 m, 08°22'24"S, 35°58'43"E), we collected data on the diet of the ovoviviparous toad *Nectophrynoides viviparus* (Lamotte and Xavier 1972. Bull. Soc. Zool. Fr. 97:413–428). To our knowledge, these data are the first published report of food habits of this species, which is endemic to central and southwestern Tanzania (Perret 1972. Ann. Fac. Sci. Cameroun 11:93–119).

During the rainy season of January 1999, we stomach flushed 20 *N. viviparus* specimens: 8 adults (mean SVL = 46.59 mm; SD = 4.75, range 38.4–53.4 mm) and 12 juveniles (mean SVL = 28.63 mm; SD = 3.40, range 24.1–34.0 mm). During the day toads were found under rotten logs and in the leaf litter and at night on vegetation up to 1.5 m above ground. Specimens were stomach flushed (Fraser 1976. Ecology 57:238–251) and immediately released at the capture site (Table 1).

The mean number of prey items per stomach was 8.3 (SD = 15.3). The highest number (64 ants) was obtained from a 34 mm SVL juvenile. Prey length varied from 1.5 to 15 mm, and prey volume from 0.3 to 18 mm^3. Plant material consisted of leaf remains and seeds. Results indicate these toads are opportunistic feeders, and at least during the rainy season, ants are their most frequent prey.

TABLE 1. Food habits of *Nectophrynoides viviparus* from Kihanga Valley, Uzungwa Mountains, Tanzania.

Prey taxa	Adults (N = 6)		Juveniles (N = 10)	
	No. items	% stomachs	No. items	% stomachs
Araneida	2	33	1	10
Diplopoda	1	17	0	0
Orthoptera	1	17	4	10
Coleoptera				
Tenebrionidae	—	—	1	10
Curculionidae	—	—	3	30
Carabidae	—	—	3	20
Staphylinidae	—	—	4	30
Unidentified	1	17	2	10
Hymenoptera				
Formicidae	10	33	84	50
Unidentified	—	—	1	10
Lepidoptera larvae	—	—	4	20
Diptera	—	—	5	20
Invertebrates				
Unidentified	5	67	2	20
TOTAL	20	—	114	—
Plant material	—	17	—	30

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Submitted by **MICHELE MENEGON**, Museo di Storia Naturale, via Calepina 14, C.P. 393, I-38100 Trento, Italy, and **SEBASTIANO SALVIDIO,** Dipartimento per lo Studio del Territorio e delle sue Risorse (DIP.TE.RIS) via Balbi 5, I-16126, Italy.

PSEUDACRIS STRECKERI ILLINOENSIS (Illinois Chorus Frog). **FROST INJURIES**. The fossorial chorus frog, *Pseudacris streckeri illinoensis*, is limited to sandy habitats in Illinois (Smith 1961. Bull. Illinois Nat. Hist. Surv. 28:1–298). Sandy habitats may be the only areas where the frog can burrow deeply enough to escape freezing, which is fatal to the species (Packard et al. 1998. J. Herpetol. 32:437–440).

Pseudacris s. illinoensis is moderately proficient at burrowing (Axtell and Haskell 1977. Nat. Hist. Misc. 202:1–8; Brown et al. 1972. Herpetologica 28:325–328; Tucker et al. 1995. Herpetol. Rev. 26:32–33). However, the actual depth that *P. s. illinoensis* burrows in winter is unknown. Nonetheless, unusually severe winters may affect this frog. For instance, the winter of 1995–1996 was unusually severe with one period during February where temperatures remained below –15° C for a week. Moreover, snow cover was absent during this period. Although I observed no direct evidence of mortality, 67% of 41 specimens caught at a study site in Madison County, Illinois, USA during spring 1996 had what I interpret to be frost injuries (Fig. 1). These injuries were similar among the 28 frogs observed. All frogs had areas of discolored skin located on the dorsal side above the illial prominences (Fig. 1). Most frogs also had discrete discolored areas at the ankles and knees (Fig. 1). Some frogs such as the one depicted in Fig. 1 had blistered skin on the ankles or knees.

I suggest that these injuries occurred when the sand froze to a depth deep enough to include the roofs of burrows containing overwintering frogs. In each case injuries occurred to portions of the frog most likely to be in contact with the roof of the burrow. The natural occurrence of such injuries following a particularly severe winter indicates the importance of substrates that allow deep burrowing by *P. s. illinoensis* in northern regions (Packard et al., *op. cit.*).

No frogs were found with suspected frost injuries to the abdomen or other ventral surfaces. These parts of the frog might also be expected to show signs of injuries given the small diameter of the frogs' burrows (Tucker et al., *op. cit.*). However, had the burrows become completely frozen, the frogs should have died given their intolerance of subfreezing temperatures (Packard et al., *op. cit.*) and would not be recovered. The lesions I report remain visible on frogs marked in spring 1996 and recaptured in spring of 1999. It seems unlikely that some sort of bacterial or fungal infection would be as persistent. Moreover, these naturally occurring lesions closely resemble those on other anurans made by freeze-branding (Daugherty 1976. Copeia 1976:836–838).



FIG. 1. Possible frost injuries to a female (42 mm SVL) Illinois chorus frog (*Pseudacris streckeri illinoensis*) suggested by the discolored areas above the illial prominences and blistering of the skin on the frog's right knee.

Gary L. Paukstis made the photograph of the frog and Gary C. Packard provided the print. Research on chorus frogs in Madison County, Illinois is supported by a grant from the Illinois Department of Transportation.

Submitted by **JOHN K. TUCKER**, Great Rivers Field Station, Illinois Natural History Survey, 4134 Alby Street, Alton, Illinois 62002, USA.

RANA CAPITO (Gopher Frog). **PREDATION**. Aresco and Reed (1998. Herpetol. Rev. 29:40) reported predation of larval *Rana capito* in southern Alabama by the banded water snake, *Nerodia fasciata*. Here, I report predation of adult *R. capito* by the same species at Holley Pond, Eglin Air Force Base, Okaloosa County, Florida, USA (30°33'56"N, 86°45'04"W). At ca. 2100 h on 3 October 1994, I collected an adult *N. fasciata*, ca. 100 cm TL, swimming on the water surface at Holley Pond. Forced regurgitation of a large food bolus in its mid-section yielded an adult *R. capito*. The frog was still alive, though lightly bleeding through several minor cuts and from the tympana. The specimen later died and was deposited in the Florida Museum of Natural History collection (UF 103332).

The following year on 3 May 1995, I collected an ca. 80 cm *N. fasciata* from the same pond and successfully forced regurgitation of its gut contents. Included among unidentifiable material was the hind limb of *R. capito*.

These observations, along with those of Aresco and Reed (*op. cit.*), suggest that *N. fasciata* may be an important predator of both larval and adult *R. capito*.

These observations were made in conjunction with a study of rare amphibians conducted by the Florida Natural Areas Inventory and supported by the U.S. Department of Defense Legacy Program.

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA; e-mail: john_jensen@mail.dnr.state.ga.us.

RANA SPHENOCEPHALA (Southern Leopard Frog). **SUBTERRANEAN VOCALIZATION**. Although male *Rana sphenocephala* typically call while floating at the water surface or from cryptic locations among inundated vegetation, they occasionally call while submerged (Wright 1932. Life Histories of the Frogs of Okefinokee Swamp, Georgia. MacMillan Co., New York. 497 pp). Herein I report a *R. sphenocephala* calling while submerged underground.

At 1420 h on 7 February 1999, I heard a muted call of *R. sphenocephala* adjacent to a roadside ditch in Union County, Illinois, USA (T12S R3W Sec 12). After taking two steps in the direction of the call, I pinpointed the call directly beneath me. Parting the low grass, I uncovered a 6 cm diameter crawfish burrow from which the call was still emanating. The frog was not visible at the water surface, indicating that it was calling while submerged in the burrow. I dug out two adult male and one gravid adult female *R. sphenocephala* from 0.7 m below the soil surface. The frogs likely retreated to that depth as I excavated the burrow. Both males had flaccid vocal sacs indicating they had been calling. The water within the burrow was 10°C and the air was 11°C. Subterranean calling by *R. sphenocephala* may provide protection from predators that locate frogs aurally but are unable to follow frogs into their underground retreat or extricate them from it.

Submitted by **JOHN G. PALIS**, P.O. Box 387, Jonesboro, Illinois 62952, USA.

SCAPHIOPUS HOLBROOKII (Eastern Spadefoot). **PREDATION**. Because *Scaphiopus holbrookii* is generally fossorial, observations of post-metamorphic predation are infrequent. Herein I report one probable and two confirmed predators of post-metamorphic *S. holbrookii* that, to my knowledge, have not previously been reported.

On 30 March 1993, while observing a *S. holbrookii* breeding chorus in Oklaoosa County, Florida, USA (T1N R24W Sec 34), I observed an ca. 0.6 m TL *Nerodia fasciata* holding an adult male *S. holbrookii* at midbody. The snake was manipulating its jaws towards the spadefoot's head. I watched a ca. 0.9 m TL *N. fasciata* swallow an adult male *S. holbrookii* at this same site on 1 March 1994.

On 28 May 1996, I observed 10 European starlings (*Sturnus vulgaris*) foraging on a lawn adjacent to a *S. holbrookii* breeding site in Union County, Illinois, USA (T12S R1W Sec 19). With the aid of binoculars I determined that the starlings captured and consumed at least two *S. holbrookii* metamorphs that had emerged from the pond six days earlier. The clearest observation was that of an immature starling taking a metamorph from the beak of an adult bird.

On 31 May 1996, I observed a common grackle (*Quiscalus quiscula*) on the lawn with an object in its beak the size on a *S. holbrookii* metamorph. I walked slowly towards the grackle which dropped the object and flew away. I found a metamorph on the ground where the bird had been, but I do not know if the metamorph was the object the bird dropped or if it coincidentally happened to be at that spot. However, given that grackles prey on small frogs (Terres 1991. The Audubon Society Encyclopedia of North American Birds. Wings Books. Avenel, New Jersey. 1109 pp.), it is likely that the bird was feeding on *S. holbrookii* metamorphs.

Observations in Florida were made while conducting a gopher frog survey of Eglin Air Force Base, financially supported by the U.S. Dept. of Defense Legacy Resource Management Program through contract with The Nature Conservancy. I thank Ronald Brandon for access to his library.

Submitted by **JOHN G. PALIS**, P.O. Box 387, Jonesboro, Illinois 62952, USA.

TESTUDINES

DERMOCHELYS CORIACEA (Leatherback Sea Turtle). **FISHING NET INGESTION**. The ingestion of marine debris such as plastic bags by *Demochelys coriacea* has been documented (Mrosovsky 1981. Marine Turtle Newsl. 17:5–7; Fritts 1982. Herpetol. Rev. 13:72–73). Frazier (1980. *In* Edge [ed.], Proceedings of the Second Symposium on Coastal and Ocean Management, Vol. III., pp. 2395–2411) noted that plastics and other marine debris are indigestible and may cause intestinal problems that lead to death. Marine debris such as plastics and pieces of fishing net may resemble jellyfish, the main prey item of *D. coriacea*, in both texture and color.

Here, we report a nesting *D. coriacea* that partially ingested a nylon fishing net. On 5 June 1998, a female *D. coriacea* (155 cm CCL) nesting on North Vogelkop Coast, Irian Jaya, Indonesia, was found to have two meters of nylon fishing net protruding from her mouth (Fig. 1). One end of the net was lodged within the digestive tract of the turtle, and the other end trailed out the left side of the turtle's mouth, where it had worn a fibrous groove at the joint of the mandibles. The net had a large cluster of gooseneck barnacles (*Lepas* spp., 0.5–2.0 cm length) attached. Two strands of the net (ca. 1 m) were pulled from the turtle's mouth; the distal ends of the net were covered with blood. Further attempts to extract the net were discontinued as it was obviously damaging the turtle internally. Nesting was successful although movements were hampered as the net wrapped around the fore-flippers of the turtle as she covered her nest.



FIG. 1. Nesting female *Dermochelys coriacea* with nylon fishing net protruding from mouth.

The impact of modern longline, drift, and set gill-net fishing on sea turtles is of increasing concern for both fisheries managers and sea turtle conservationists. Interactions between fishing gear and sea turtles are more frequent due to modernization of the fleet: vessels with greater operating distances, navigational aids, and more effective synthetic nets. Sea turtles that spend much of their lives in the open sea such as *Carreta carreta* and *D. coriacea* are at risk of encountering these fisheries. Nets that have broken free from fishing boats may attract large predators like *D. coriacea* who mistake them for prey.

Submitted by **CHRISTOPHER STARBIRD**, Institute of Marine Science, University of California at Santa Cruz, Santa Cruz, California 95064, USA (e-mail: chstarbird@aol.com), and **HAZEN AUDEL**, 1915 South Grand, Spokane, Washington 99203, USA.

TERRAPENE CAROLINA CAROLINA (Eastern Box Turtle). **INTRASPECIFIC COMBAT**. Apparent male-male combat has been observed in many turtles, but in some species it is debated whether apparently combative behavior represents aggression. Stickel (1989. J. Herpetol. 23:40–44) reported behavior between *Terrapene carolina* males analogous to male-female courtship behavior (Evans 1953. Herpetologica 9:189–192), and concluded that apparently aggressive male-male behavior does not represent aggression. I report here an observation of similar behavior between two male *T. carolina* that differs significantly from male-female courtship.

At 0945 h on 10 August 1995 (clear sky, no rain for at least two days) between U.S. Highways 11 and 129 in Jones Co., Georgia, USA, I encountered two *T. carolina*, one in pursuit of the other in a recently clear-cut pine forest. After all observations were made, I determined that both turtles were male. Neither turtle was measured, but the larger (X) had 18 distinct growth rings on the carapacial scutes, while the smaller (Y) had a pitted but otherwise smooth plastron and a pitted carapace with 14 growth rings.

The two stopped and began alternating sessions of head-on ramming. One turtle would initiate a series of 6–10 rams, with the other meeting each blow by either retreating into the shell or remaining within the shell from previous blows. The other turtle would then initiate a series of rammings; the two alternated in this manner for at least 10 min. Each turtle also bit the other repeatedly; the ramming/biting turtle lunged with mouth open at its opponent. Turtle X consistently landed bites on or near turtle Y's beak, at one time locking jaws. Turtle Y consistently bit its opponent on the rostral carapacial marginals.

After leaving for 10 min. to retrieve a camera, I returned to find turtle X mounted from the rear on Y's carapace; Y's shell was tightly closed. They remained in this position without apparent movement for 15 min., after which Y began to crawl away with X in pursuit. Both traveled apparently as fast as possible for about 3–4 m, with X in pursuit and repeatedly biting Y on the caudal marginals. When Y stopped and retreated into its shell, X again mounted Y for several min. (Fig. 1), after which X again chased Y for about 2 m. Then, X again mounted Y for several min. Y then quickly moved into brush about 10 m away without X in pursuit. X remained stationary for 25–30 min. after which he turned in the



FIG. 1. Male *Terrapene carolina* (X) mounted from rear on another male *T. carolina* (Y). No attempted copulatory behavior was observed. Y's plastron is tightly closed.

direction opposite Y's retreat and quickly crossed a logging road (in the direction from which both originally came).

Apparently aggressive behavior between males has been observed in several turtles including *Kinosternon baurii* (Carr 1940. Univ. Florida Biol. Sci. Ser. 3:1–118), *Clemmys guttata* (Ernst and Barbour 1972. Turtles of the United States and Canada. University of Kentucky Press, Lexington, Kentucky. 578 pp.), *Gopherus agassizii* (Ernst and Barbour, *op. cit.*), *G. berlandieri* (Weaver 1970. Bull. Florida St. Mus. 15:1–43), and *G. polyphemus* (Weaver, *op.cit.*). Weaver's observations on captive *Gopherus* indicate that male-male aggression is stereotyped and significantly different from male-female courtship. Conversely, male *T. ornata* mounted by other males exhibited snapping behavior analogous to that sometimes exhibited by mounted females (Brumwell 1940. Trans. Kansas Acad. Sci. 43:391). The behavior reported here is similar to initial phases of male-female courtship in *T. carolina*, but differs in that the pursued male never submitted to the pursuer, and in that the two turtles engaged in chasing behavior. More importantly, this observation differs from all reported observations of male-male *T. carolina* encounters in that the two individuals reported here alternated the initiation of sessions ramming and biting each other. Therefore, these observations indicate that aggressive encounters do occur between male *T. carolina*.

Submitted by **MICHAEL S. GRACE**, Department of Biology, Gilmer Hall, University of Virginia, Charlottesville, Virginia 22903-2477, USA (e-mail: msg5y@virginia.edu).

SERPENTES

BOIGA IRREGULARIS (Brown Tree Snake)**. SEASONAL ACTIVITY.** The introduced population of *Boiga irregularis* on Guam, Mariana Islands, is known to exhibit a seasonal activity pattern. Three lines of evidence support seasonal activity patterns of *B. irregularis* on Guam: power outages resulting from arboreal activity, envenomation reports of humans from medical facilities, and sighting rates from nocturnal surveys (Rodda et al. 1999. *In* Rodda et al. [eds.], Problem Snake Management: The Habu and the Brown Treesnake, pp. 44–80. Cornell University Press, Ithaca, New York). These data suggested that *B. irregularis* exhibit greater levels of activity at the beginning and during the rainy season (June–December). In the native range, Bull and Whittier (1996. Mem. Queensland Mus. 39:483–486) tabulated collecting dates of museum specimens from eastern Australia and surmised that these were also reflective of unimodal seasonal activity patterns. Bull and Whittier (*op. cit.*) concluded that heightened activity of *B. irregularis* was tied to increasing temperature and rainfall.

Highway mortality has been used as a measure of seasonal activity in temperate snakes (Gibbons and Semlitsch 1987. *In* Seigel, et al. (eds.), Snakes: Ecology and Evolutionary Biology, pp. 396–421. McGraw Hill, Inc., New York.). Between October 1988 and September 1990, a 20.4 km section of highway on Guam was driven daily and 184 DOR *B. irregularis* were collected (Fig. 1). DOR totals plotted by month against mean monthly rainfall (Anonymous 1990. NOAA Natl. Clim. Data Center, Asheville, North Carolina, 8 pp.) indicated an activity pattern similar to that reported by Rodda et al. (*op. cit.*) and Bull and Whittier (*op. cit.*). More DOR *B. irregularis* were encountered during the rainy season than during the dry season (G_{adj} = 10.596, 0.005>p>0.001).



FIG. 2. Male *Terrapene carolina* (X) in pursuit of male Y between alternating bouts of ramming and biting.

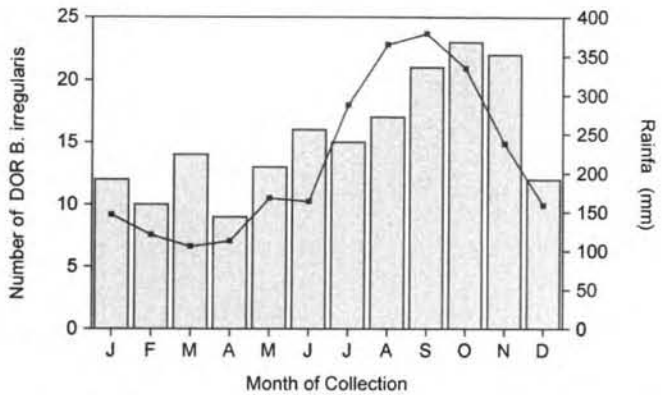


FIG. 1. DOR *Boiga irregularis* recorded between October 1988 and October 1990 along a 20.4 km section of highway on Guam, Mariana Islands. Columns represent total observations of snakes by month. Squares connected by lines represent mean monthly rainfall totals.

The data verify the activity pattern reported by Rodda et al. (*op. cit.*), support an activity pattern hypothesized by Gibbons and Semlitsch (*op. cit.*) for tropical snakes in seasonal environments, and suggest that seasonal activity patterns can be discerned for some species of tropical snakes using highway mortality statistics.

Submitted by **MICHAEL JAMES McCOID**, 2121 Ivy Street, Port Charlotte, Florida 33952, USA (e-mail: mccoid@isni.net), and **REBECCA A. HENSLEY**, Fish and Wildlife Conservation Commission, Florida Marine Research Institute, 1481 Market Circle, Port Charlotte, Florida 33953, USA.

BOTHROPS CAMPBELLI (Campbell's Lancehead). **DIET** and **REPRODUCTION**. The poorly known pitviper *Bothrops campbelli* Freire 1991 inhabits lower montane wet forests and cloud forests along the western versant of the Cordillera Occidental of the Andes in Colombia and Ecuador (Kuch 1997. Bull. Zool. Nomenclature 54:245–249). Here we provide the first data on diet and reproduction in this species. A large female *B. campbelli* (SVL 920 mm, tail length 137 mm), collected in Huagal, Cantón Pallatanga, Province of Chimborazo, Ecuador (1500 m elevation; ca. 79°02'W, 2°10'S) on 29 April 1992 by A. Lema, contained a partly digested, rat-sized rodent. In addition, this snake contained 36 follicles measuring 10 mm in diameter, nine of 5–10 mm, and about 50 of 2–4 mm. The specimens are deposited in the herpetological collection of the Instituto Nacional de Higiene y Medicina Tropical, Guayaquil (INHMT 2622). The reproductive potential of this *B. campbelli* resembles that of a large *B. microphthalmus* (750 mm SVL), which contained 36 embryos (Kuch and Freire 1995. Herpetozoa 8:81–83). *Bothrops microphthalmus* is found in comparable habitat and altitude in the Amazonian versant of the Andes in Colombia, Ecuador, and Peru.

Submitted by **ANTONIO FREIRE**, Departamento Ofídios, Instituto Nacional de Higiene y Medicina Tropical "Leopoldo Izquieta Pérez," Casilla 3961, Guayaquil, Ecuador, and **ULRICH KUCH**, Sektion Herpetologie, Forschungsinstitut Senckenberg, Senckenberganlage 25, D-60325 Frankfurt, Germany (e-mail: kuch@stud.uni-frankfurt.de).

BOTHROPS NEUWIEDI PAULOENSIS (Jararaca Rabo-de-osso). **PREDATION**. Records of predation on neotropical snakes are scarce. Here we report predation on *Bothrops neuwiedi pauloensis* by the burrowing owl *Athene cunicularia* (Aves: Strigidae). The observation occurred on 7 September 1998 at 2020 h in Parque Nacional da Emas (18°06'S, 52°55'W, 760–880 m elev.), municipality of Mineiros, Goiás, Brazil. *Bothrops neuwiedi pauloensis* occurs in high densities in open habitats in the park. The predation occurred in a recently burned area of "campo limpo" (open grasslands). The snake (young male, 365 mm SVL, 65 mm tail length) was found decapitated on the ground, where the owl left it as we approached. The snake was still showing motor reflexes, indicating that it had just been attacked. A termite mound (1.6 m high), 7 m from the prey, was apparently used by the owl as a perch, similar to the hunting tactics described by Martins and Egler (1990. Rev. Bras. Biol. 50:579–584). There were many bird droppings on the ground near this hunting perch, indicating frequent use of the site by the predator. Snakes are uncommon prey items of *Athene cunicularia*, and no reports of predation on *B. neuwiedi* are available (Clark et al. 1997. J. Raptor Res. Report 9:145–170). The snake was deposited in the herpetological collection of the Instituto Butantan (IB 59909).

Submitted by **PAULA H. VALDUJO** and **CRISTIANO NOGUEIRA**, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brasil, 1500, CEP 05503-900, São Paulo, SP, Brazil, and Depto. de Ecologia Geral, Instituto de Biociências, Universidade de São Paulo, CP. 111461, CEP 05508-900, São Paulo, SP, Brazil (e-mail: paulahv@ib.usp.br).

CROTALUS SCUTULATUS SCUTULATUS (Mojave Rattlesnake). **DEFENSIVE BEHAVIOR**. Neck spreading is a defensive display that previously has been reported in rattlesnakes only for *Crotalus scutulatus salvini* (Glenn and Lawler 1987. Herpetol. Rev. 18:15–16). An adult *C. s. scutulatus* ca. 1 m total length (TL) was AOR at 1700 h, 13 October 1996, on Hwy 54, 30 mi north of Van Horn, Culberson County, Texas, USA. A photograph of its defensive display showed the neck immediately posterior to the head to be spread laterally and the cervical spine to be straight and aligned with the head (Fig. 1). Based on an estimated SVL/TL proportion, this individual appears to be a male.

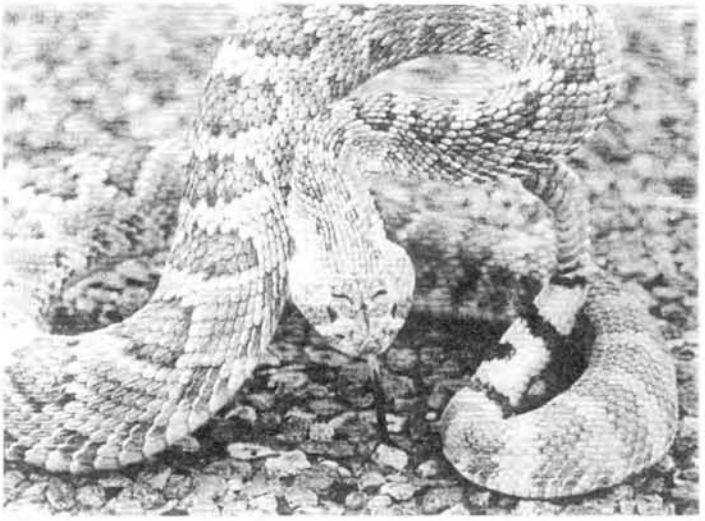


FIG. 1. Defensive display of *Crotalus s. scutulatus*, illustrating the neck spreading described in the text.

Submitted by **JAMES F. W. BROWN, WENDY M. MARDEN**, 4305 North Sanders Road, Tucson, Arizona, 85743, USA, and **DAVID L. HARDY, SR.**, 585 South Main Avenue, Tucson, Arizona, 85701-2229, USA.

EUNECTES MURINUS (Green Anaconda). **CANNIBALISM**. One instance of cannibalism in the green anaconda (*Eunectes murinus*) has been reported in the literature (O'Shea 1994. Herpetol. Rev. 25:124). This observation involved a female eating a smaller conspecific of unknown sex. Here, we report three other cases of female anacondas eating conspecifics. These observations occurred during the breeding (dry) season in the Venezuelan llanos, Distrito Muñoz, Apure State (7°30'N, 69°18'W).

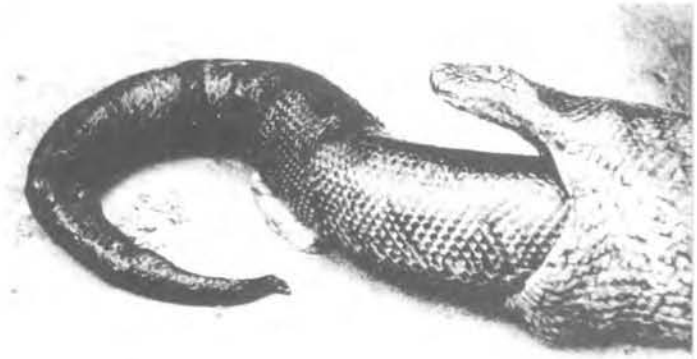


FIG. 1. Female anaconda regurgitating a male (note the hemipenis). Photograph courtesy of Tony Rattin.

The first observation involved a large female (434.7 cm total length [TL], 40 kg) that was caught 27 April 1995 next to a breeding aggregation (Rivas 1999. Life History of the Green Anaconda with Emphasis on its Reproductive Biology. Ph.D. dissertation. Univ. Tennessee, Knoxville. 269 pp.), but not participating in it. The snake had the engorged stomach that indicates a recent meal. After being put in a cage, she regurgitated a male anaconda (42 cm tail length, 283 cm estimated TL, 5.7 kg, Fig. 1). On 28 May 1996, at the end of the breeding season, we discovered another female constricting a medium-sized male (230 cm TL; 5 kg). The male was dead by the time we found it, and the female (370 cm estimated TL) managed to escape when we tried to capture her. Judging by the girth and overall condition of the snake, she was most likely breeding, and probably had just recently finished her mating activity. Lastly, on 18 March 1997 we collected a fecal sample that contained anaconda scales. The sample was from a female anaconda (300 cm TL, 14.8 kg) that was breeding that season.

All four records of cannibalism in green anacondas involve cannibalistic females, and the sex of the cannibalized individual has been male in the two instances in which sex could be determined. This asymmetry is probably a consequence of the strong sexual size dimorphism found in the species, with females much larger than males (Rivas, *op. cit.*). Green anacondas concentrate around the more permanent water sources during the dry season, and at this time breeding occurs (Rivas, *op. cit.*). Male anacondas looking for water and/or breeding females appear to be especially vulnerable to cannibalism by females. After mating, pregnant females do not eat for seven months (Rivas, *op. cit.*). It is possible that breeding females eat their mating partners in order to help them survive the long fast associated with pregnancy.

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JESÚS A. RIVAS, Graduate Program in Ethology, Department of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, Tennessee 37996-0900, USA (e-mail: anaconda@prodigy.net), and **RENEE Y. OWENS**, Vegueros Wildlife Biology, 348 Field Street, Brockton, Massachusetts 02302, USA. Current address for correspondence (JAR and RYO) : 17126 Lawson Valley Road, Jamul, California 91935, USA.

HELICOPS INFRATAENIATUS (NCN). **DIET**. *Helicops infrataeniatus* is a colubrid snake with aquatic habits, common in southern South America (Deiques and Cechin 1990. Acta Biol. Leopoldensia 12:313–326). Despite a lack of detailed information on the diet of this snake, it appears that its most frequent prey are fishes and frogs (Lema et al. 1983. Com. Mus. Ci. PUCRS. 26:41–121). We dissected 67 preserved *H. infrataeniatus* from Santa Maria, Rio Grande do Sul, Brazil (53°42'W, 29°43'S). Prey items in the esophagus and stomach were recorded. Of the 67 specimens, 14 (21%) contained food items that were recognizable to some taxonomic level. Twelve snakes contained fish scales and bones from the teleost families Characidae and Cichlidae. The other two snakes contained tadpoles of the frog *Phyllomedusa iheringii*; one of these snakes also contained bones of an adult *P. iheringii*. Tadpoles of *P. iheringii* have not previously been reported in the diet of *H. infrataeniatus*.

The specimens are deposited at Universidade Federal de Santa Maria (UFSM), Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP) and Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul (MCN). We thank Marcos Di-Bernardo (MCP) and Moema L. de Araújo (MCN) for permission to examine the snakes and José Francisco Pezzi da Silva and Paulo Cristiano Garcia for identifying the fish and tapdoles, respectively. The FAPERGS provided a grant to Aline Costa Feltrim (process # 94/60853.9).

Submitted by **ALINE COSTA FELTRIM** and **SONIA T. ZANINI CECHIN**, Departamento de Biologia, Setor de Zoologia, Universidade Federal de Santa Maria, Faixa de Camobi, KM 9, Santa Maria, Rio Grande do Sul, Brazil, CEP 97105-900 (e-mail [ACF]: afeltrim@zaz.com.br).

LEPTODEIRA BAKERI (Aruban Cat-Eyed Snake). **REPRODUCTION**. Although some information is available concerning reproduction of snakes of the genus *Leptodeira*, none has been published for *Leptodeira bakeri* (Ruthven 1936. Occas. Pap. Mus. Zool. Univ. Michigan 330:1–2; Duellman 1958. Bull. Am. Mus. of Nat. Hist. 114:5–152; Himmelstein 1980. Bull. New York Herpetol. Soc. 16:18–34; Fitch 1985. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 76:1–76; Lee 1996. The Amphibians and Reptiles of the Yucatan Peninsula. Cornell Univ. Press, Ithaca, New York. 500 pp.). On 1 August 1990, Toledo Zoo staff collected a pair of *Leptodeira bakeri* on Aruba. On 21 December 1992, the female produced a clutch of six eggs (mean ± SE mass = 3.6 ± 0.14 g). Eggs were incubated together at ca. 30°C in a small plastic container with several small holes punched in the top. Vermiculite and distilled water mixed at a 1:1 ratio by mass was used as an incubation substrate. One egg became rotten and was discarded on 2 February 1993. On 13 February 1993 the neonates slit their eggs. By the following day, all five of the neonates (139 ± 5.5 mm SVL, 2.6 ± 0.11 g mass) had emerged. The female weighed 72.0 g on 19 December, two days prior to oviposition, and 57.6 g on 21 December, immediately after oviposition. Total mass of the eggs was 21.7 g.

Submitted by **WILLIAM P. FLANAGAN III**, and **R. ANDREW ODUM**, Department of Herpetology, Toledo Zoological Society, 2700 Broadway, Toledo, Ohio 43609, USA (e-mail: herpers@toledozoo.org).

OPHEODRYS AESTIVUS (Rough Green Snake). **PREDATION.** On 9 July 1999, while conducting behavioral research on *Crotaphytus collaris*, we observed the posterior portion of a dead, hatchling *Opheodrys aestivus* hanging from the mouth of an adult female (94 mm SVL) *C. collaris*. The incident took place at Sooner Lake Dam, Pawnee Co., Oklahoma, USA. The lizard was noosed to confirm the identity of the prey. Examination of the visible portion of the snake suggested a total length of ca. 200 mm with ca. 98 mm hanging from the mouth. Upon release, the lizard completed its consumption of the snake within 2 min. Neither animal was collected.

To our knowledge this is the first report of lizard predation on *O. aestivus*. Its relative abundance probably renders *O. aestivus* susceptible to predation by many generalist predators such as *C. collaris*, which has been documented to feed on snakes (*Sonora semiannulata*; Best and Pfaffenberger 1987. Southwest. Nat. 32:415–426).

The research on *C. collaris* was partially funded by the Rob and Bessie Welder Wildlife Foundation.

Submitted by **JERRY F. HUSAK** and **EMILY N. ACKLAND**, Department of Zoology, Oklahoma State University, Stillwater, Oklahoma 74078, USA; e-mail (JFH): husak@okstate.edu.

SEMINATRIX PYGAEA (Black Swamp Snake). **DIET.** On 11 May 1998 we captured 29 *Seminatrix pygaea* under cover objects placed around the margins of Ellenton Bay, a 10-ha Carolina Bay on the Savannah River Site, Aiken Co., South Carolina, USA. Based on casual inspection, two females (captured between 1100 and 1200 h) appeared to contain relatively large food items, which we removed using forced regurgitation. The larger snake (451 mm SVL, 35.4 g after regurgitation) contained an undigested *Rana utricularia* (47 mm SVL, 8.0 g wet mass), a recently metamorphosed individual that had not yet completed tail resorption. The second snake (333 mm SVL, 28.7 g after regurgitation) contained a *R. utricularia* tadpole (23 mm SVL, 2.1 g wet mass; Gossner stage 37–38) and an unidentified leech.

These observations represent the first published records of *S. pygaea* preying on ranid frogs. Previous diet records include earthworms, leeches, small fishes, small frogs and tadpoles (*Acris*, *Bufo*), and salamanders (Dorcas et al. 1998. Cat. Amer. Amphib. Rept. 679.1–679.5). In the Ellenton Bay population, mosquitofish (*Gambusia affinis*) were the primary prey (82% of identified gut contents; Gibbons and Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. Univ. Georgia Press, Athens, Georgia. 131 pp.) prior to a drought (1985–87) that caused the extirpation of these fish (Seigel et al. 1995. Herpetologica 51:424–434). After the drought, amphibian larvae and aquatic invertebrates presumably have made up the bulk of the diet of *S. pygaea* at Ellenton Bay. Because of their size (usually <300 mm SVL), most *S. pygaea* are restricted to small prey. The two snakes reported here are near the upper end of the size range for this species (Kean and Tuberville 1995. Herpetol. Rev. 26:103), and were able to consume prey that is probably unavailable to smaller *S. pygaea*.

We thank J. Whitfield Gibbons for commenting on this note. This research was supported by Financial Assistance Award Number DE-FC09-96SR18546 from the U.S. Department of Energy to the University of Georgia Research Foundation.

Submitted by **MARK S. MILLS***, **SEAN M. POPPY**, **ANTHONY M. MILLS**, **TRAVIS J. RYAN**, and **MICHAEL E. DORCAS****, University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

* Present address for MSM: Division of Science and Math, Missouri Valley College, Marshall, Missouri 65340, USA.

** Present address for MED: Department of Biology, Davidson College, Davidson, North Carolina 28036, USA (e-mail: millsms@moval.edu).

THAMNOPHIS RADIX (Plains Garter Snake). **PREDATION.** There are no references specific to predation by the Virginia opossum (*Didelphis virginiana*) on live snakes. Reptiles are mentioned generically as a component of the diet of *Didelphis*, but whether they were obtained as carrion or prey was not specified (Hoffmeister 1989. Mammals of Illinois. University of Illinois Press, Urbana, Illinois. 348 pp.).

At 1445 h on 23 October 1998, I encountered a juvenile *Didelphis virginiana* in an area of open woods adjacent to a ca. 0.5-ha pond near Wheeling, Cook County, Illinois, USA. The opossum remained motionless, and upon closer approach was found to be standing over an adult female plains garter snake (*Thamnophis radix*; 51.5 cm SVL, 90 g.). The snake was immobile except for slight tail movements. Further inspection revealed a disarticulated and bleeding lower jaw and puncture wounds on the tail 3–4 cm from the anal plate.

The opossum appeared underfed and resisted minimally when captured with gloves. Its total length (snout to tip of tail) was ca. 53 cm. The *Thamnophis* was covered with damp silt, perhaps indicating recent emergence from the burrow of a crayfish (*Procambarus gracilis*) that was <1 m from the two animals. Temperatures the previous night were below 10°C, and the snake appeared sufficiently lethargic as to be unable to defend itself against attack by the opossum or to escape down the crayfish burrow. After examination, the opossum was released, and the still-living snake was retained overnight. The next morning, the snake appeared to have recovered, had re-aligned its lower jaw, and was active in the container. Bactine® was applied to the puncture wounds on the underside of the tail after the method of Martin and Hong (1991. Herpetol. Rev. 22:21). The snake was returned to the site and released.

Submitted by **THOMAS G. ANTON,** Field Museum of Natural History, Roosevelt Road at Lakeshore Drive, Chicago, Illinois 60605, USA (e-mail: TAnton2963@aol.com).

TALLGRASS PRAIRIE SNAKE ASSEMBLAGE. FOOD HABITS. Although the natural history of most reptiles within the central Great Plains (USA) is well known (e.g., Fitch 1989. Occas. Pap. Mus. Nat. Hist. Univ. Kansas 125:1–50), few studies have been conducted on reptiles inhabiting tallgrass prairie. This lack of basic information is a major impediment to the conservation of these species (Dodd 1987. *In* Seigel et al. (eds.), Snakes: Ecology and Evolutionary Biology, pp. 478–513. Macmillan Publ. Co., New York) and the tallgrass prairie in which they exist. During a study designed to document the natural history of a tallgrass prairie rep-

tile assemblage, I was able to collect dietary information from seven snake species.

These observations were collected at the Konza Prairie Research Natural Area (3487 ha) located in Riley and Geary counties, Kansas (USA), from 1995 to 1996 (for site description see Cavitt 1998. The role of food supply and nest predation in limiting reproductive success of brown thrashers (*Toxostoma rufum*): effects of predator removal, food supplements and predation risk. Ph.D. dissertation. Kansas State Univ., Manhattan. 148 pp.). Hardware cloth drift fences connected to funnel traps were used to capture most snakes (see Cavitt, *op. cit.*, for a description of the fences and traps), although a few individuals were captured by hand. All snakes were identified, and sexed by tail shape and by probing for the presence of hemipenes. Stomach contents were examined by palpating for undigested food items. Five ungrazed sites, which had all been burned within the previous five years, were monitored for snake activity. Two of the five sites were burned by a wildfire during the study (spring 1996). A total of 550 individuals were captured, however dietary information could only be obtained from 22 individuals of seven species. Table 1 lists the food items recovered from each of the snakes captured.

Despite the fact that snake food habits are one of the most readily studied aspects of their natural history, little is known about the diet of the tallgrass prairie snake community. Invertebrates, small mammals, and bird eggs or nestlings comprised over 80% of the food items recovered; all of these are abundant within the tallgrass prairie (Kaufman et al. 1998. *In* Knapp et al. [eds.], Grassland Dynamics: Longterm Ecological Research in Tallgrass Prairies, pp. 113–139. Oxford University Press, Oxford). This supports findings from other dietary surveys suggesting food habits may be largely controlled by prey availability (e.g., Fitch 1963. Univ. Kansas Mus. Nat. Hist Misc. Publ. 15:353–468). For example, ground nesting birds are very abundant within the tallgrass prairie and bird eggs or nestlings were the only items recovered from *Pituophis catenifer* in this study. Likewise, Imler (1945. J. Wildl. Manag. 9:265–273) found that within a northern Nebraska wetland, *P. catenifer* consumed primarily waterfowl eggs. However, in the Great Basin Desert, an area with fewer ground nesting birds, *P. catenifer* rarely consumed bird eggs (Parker and Brown. 1980. Milwaukee Public Mus. Publ. Biol. Geol. 7:1–104). Although the accounts presented here are not unique for the species collected, they do provide basic information on the dietary habits of snakes inhabiting tallgrass prairie.

Many thanks to T. Miller, J. Kretzer, A. Stevens, D. Belt, M. Hill, C. Oppert, and J. Goheen for their assistance in the field. Financial support for this project was provided by an NSF Doctoral Dissertation Improvement Grant (DEB-9520335) and from the NSF Konza Prairie Long-Term Ecological Research Program (DEB-9011662).

Submitted by **JOHN F. CAVITT**, Division of Biology, Kansas State University, Manhattan, Kansas 66506, USA. Present address: Department of Zoology, Weber State University, 2505 University Circle, Ogden, Utah 84408-2505, USA; e-mail: jcavitt@weber.edu.

TABLE 1. Stomach contents of snakes captured on the Konza Prairie Reseach Natural Area. An * indicates the record was obtained from an individual captured on recently burned prairie. All other records were from snakes captured on unburned prairie.

Species	Sex	SVL (cm)	Stomach Contents
Coluber constrictor flaviventris	M	—	grasshopper (Acrididae)
	M	70	grasshopper (Acrididae), Lepidopteran larvae
	F	—	grasshopper (Acrididae)
	U	—	three neonate rodents
Elaphe emoryi	M	89.5	upland sandpiper (*Bartramia longicauda*) egg
	M	35.5	two neonate rodents
Lampropeltis getula	M*	59	*Ophisaurus attenuatus*
	M*	70.5	tail of *O.attenuatus* (a tailless *O.attenuatus* was captured in a nearby trap)
	M	74	unidentified passerine egg
	M	81	unidentified snake (unable to remove)
	M	95	dickcissel (*Spiza americana*) egg, 2 brown-headed cowbird (*Molothrus ater*) eggs, day-old cowbird nestling
	F	76	3 cowbird nestlings (ca. 6 days old)
	F	70.5	*Peromyscus* sp.
L. calligaster	U*	—	*Peromyscus* sp.
L. triangulum	U*	57.5	*Peromyscus* sp.
Pituophis catenifer	M	135	five northern bobwhite quail (*Colinus virginianus*) eggs
	M	127	greater prairie chicken (*Tympanuchus cupido*) chick
Thamnophis sirtalis	M	—	two beetles (Carabidae)
	F	—	*Microtus* sp.
	U	48.5	Lumbricid earthworms
	U	25	frog (*Rana* sp.)
	U	51	*Peromyscus* sp.

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins 1997. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*. Fourth Edition. SSAR Herpetol. Circ. 25:1–40; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish.* Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al. 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985[3]:802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen *only* when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*) to make sure you are not duplicating a previously published record.

Please submit any geographic distribution records in the **standard format only** to one of the Section Co-editors: Joseph T. Collins (USA & Canadian records only), Kansas Biological Survey, 2041 Constant Avenue, Lawrence, Kansas 66047, USA; Jerry D. Johnson (Mexico and Central America, including the Caribbean islands), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA; Hidetoshi Ota (all Old World records), Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-01, Japan; or Gustavo J. Scrocchi (South American records), Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina. Short manuscripts are discouraged, and are only acceptable when data cannot be presented adequately in the standard format. **Submissions by e-mail are encouraged where possible**. Refer to inside front cover for e-mail addresses of section editors.

Recommended citation for new distribution records appearing in this section is: Marques, O. A. V., and G. Puorto. 1996. Geographic Distribution. *Chironius laevicollis*. Herpetol. Rev. 27:212.

GYMNOPHIONA

POTOMOTYPHLUS KAUPII. BRAZIL: AMAPÁ: Municipality of Macapá (00°02'N, 51°04'W), Rio Amazonas, between Fazendinha and Cascalheira. 25 May 1990. Collected by trawl net. Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (IEPA 030). Verified by M. Wilkinson. Previous general references to Amazon and Orinoco drainage systems of South America are in Taylor (1968, The Caecilians of the World. A Taxonomic Review. Univ. Kansas Press, Lawrence, xiv+848 pp.) and Frost (1985, Amphibian Species of the World. A Taxonomic and Geographical Reference. Allen Press, Inc., Lawrence, Kansas. vi+732 pp.). First record for the state of Amapá and for the delta of the Rio Amazonas.

Submitted by **ULISSES CARAMASCHI** and **JOSÉ P. POMBAL, JR.**, Departamento de Vertebrados, Museu Nacional/ UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Brazil.

TYPHLONECTES COMPRESSICAUDA. BRAZIL: AMAPÁ: Região dos Lagos (01°40'N, 50°50'W). March 1984. Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (IEPA 027). Verified by M. Wilkinson. Previous general reference to Guyana and French Guiana to Amazon drainage of Peru and Brazil is in Frost (1985, Amphibian Species of the World. A Taxonomic and Geographical Reference. Allen Press, Inc., Lawrence, Kansas. vi+732 pp.). First record for the state of Amapá, north and outside of the Amazon drainage.

Submitted by **ULISSES CARAMASCHI** and **JOSÉ P. POMBAL, JR.**, Departamento de Vertebrados, Museu Nacional/ UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Brazil.

CAUDATA

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: GEORGIA: Habersham Co: Nancytown Lake, 4.8 km S Mt. Airy. 26 January 1995. Carlos Camp. Georgia Museum of Natural History (GMNH 44319). Verified by M. E. McGhee. First county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **CARLOS CAMP**, Biology Department, Piedmont College, Demorest, Georgia 30535, USA, and **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

NOTOPHTHALMUS VIRIDESCENS (Eastern Newt). USA: TENNESSEE: Jackson Co: Dodson Branch, NE of Hidden Springs Nursery on Spring Creek Road at the base of Hardscrabble Falls (36°19'20"N, 85°30'42"W). 9 October 1999. Laura Leininger. Verified by A. Floyd Scott. Austin Peay State University Museum of Zoology (APSU 5282 [color slide]). Two eft-stage specimens captured along the bank of Dodson Branch stream just below the falls; photographed and released. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay State Univ. Misc. Publ. 12:1–94).

Submitted by **LAURA LEININGER** and **PRIYA NANJAPPA**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

ANURA

BUFO GLABERRIMUS. (Cundinamarca Toad). PERU: DEPARTAMENTO UCAYALI: Provincia de Atalaya: ca. 22 km E Bolognesi (10°06'S, 73°49'W, 230 m elev.). 11 June 1998. Edgar Lehr. Natur-Museum und Forschungs-Institut Senckenberg (SMF 80009). Verified by Javier Icochea. First state record (Rodríguez et al. 1993, Publ. Mus. Hist. Nat. UNMSM [A] 45:1–22).

Submitted by **EDGAR LEHR** and **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany, (e-mail [EL]: elehr@sng.uni-frankfurt.de).

ELACHISTOCLEIS OVALIS. VENEZUELA: ZULIA: Río Escalante, Hacienda Santa Rosa, 70 m elev. 20 December 1986. A. Díaz and P. Durant. Colección de Vertebrados, Facultad de Ciencias Universidad de los Andes, Mérida (CVULA 4873). Verified by Andrés Orellana. *Elachistocleis ovalis* has been known in Venezuela from three bioregions (Barrio 1998, Acta Biol. Venezuela 18[2]:1–93) as follows: "región Llanera" (the Great plains), "región Guayanesa" (savanna in Guianan shield), and "región Orocostense" (the Coastal Range), the latter a characteristic savanna batrachological element rising up to 1000 m elevation in some places of Andean and coastal piedmonts. The "Hoya de Maracaibo" region (Barrio, *op. cit.*) is isolated by two high chains of the Andean range, the Cordillera de Mérida in the southeast, and the Sierra de Perijá in the west. This is the first documented voucher and the only microhylid record for this region in Venezuela.

Submitted by **CÉSAR LUIS BARRIO**, Fundación Andígena, Apartado Postal 210, 5101-A Mérida, Venezuela (e-mail: cesarlba@yahoo.com), and **PEDRO DURANT**, Grupo de Ecología Animal, Departamento de Biología, Facultad de Ciencias, Universidad de los Andes, Mérida, Venezuela.

GASTROPHRYNE OLIVACEA. (Great Plains Narrowmouth Toad). USA: NEW MEXICO: Union Co: Kiowa National Grasslands just W USFS Unit 49, 36°33'09.5"N, 103°07'38.6"W. 6 August 1999. Emily C. Moriarty, Suzanne L. Collins, and Joseph T. Collins. KU 288999. Verified by John E. Simmons. Single adult male calling from ephmeral pool. Third known New Mexico locality and the first record for the northern half of the state (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **EMILY C. MORIARTY**, Department of Biology, Saint Mary's College, Notre Dame, Indiana 46556, USA, and **SUZANNE L. COLLINS**, The Center for North American Amphibians and Reptiles, 1502 Medinah Circle, Lawrence, Kansas 66047, USA, and **JOSEPH T. COLLINS**, Kansas Biological Survey, 2045 Constant Avenue, Lawrence, Kansas 66047, USA.

HYLA PUNCTATA (Rana Punteada, Polkadot Treefrog): VENEZUELA: ESTADO BARINAS: Barinitas, 600 m. 16 June 1990. A. J. Cardoso and J. Péfaur. Colección de Vertebrados, Facultad de Ciencias Universidad de los Andes, Mérida (CVULA 5280). Reserva de Fauna, Sabanas de Anaro. 28 October 1994. R. Rivero. Museo de la Estación Biológica Rancho Grande, MARNR, Maracay (EBRG 2850, 2856). Both verified by Andrés Orellana. ESTADO BOLIVAR: Reserva Forestal Imataca, 40 km ENE Tumeremo. 11 September 1990. A. Mijares and J. Ochoa. EBRG 267. Verified by Oswaldo Fuentes. First state records for Barinas. Species was previously known from three localities in Venezuela, two from the delta of the state of Amacuro (Orinoco delta) and another from the state of Bolivar (Hoogmoed 1979, Zool. Verh. 172:1–46; Barrio 1998, Acta Biol. Venezuela 18[2]:1–93). These records corroborate presence of species in lowlands, up to 600 m in Venezuela, including the Llanos and the foothills of the Andes, some 1000 km W of the former referred localities. To date, the species is known in four bioregions (sensu Barrio, *op. cit.*), the Andean, Delta, Llanos and Guayanan.

Submitted by **CÉSAR LUIS BARRIO**, Fundación Andígena, Apartado Postal 210, 5101-A, Mérida, Venezuela (e-mail: cesarlba@yahoo.com), **RAMÓN RIVERO**, Museo de la Estación Biológica Rancho Grande, MARNR, Maracay, Venezuela, and **ROGER MANRIQUE**, Fundación Andígena, Apartado Postal 210, 5101-A, Mérida, Venezuela.

LEPTODACTYLUS FLAVOPICTUS. BRAZIL: SANTA CATARINA: Guaramirim Municipality, Atlantic Rain Forest, 26°27'S, 49°00'W. 24 July 1999. Germano Woehl Jr. KU Color Slide 11726. Verified by José Peres Pombal, Jr. First record for the state and Atlantic forests of southern Brazil.

Submitted by **GERMANO WOEHL, JR**. and **ELZA N. WOEHL**, Santuario Ra-bugio, Estrada Rio da Prata, 89290-000 Guaramirim, Santa Catarina, Brazil (e-mail: germano@ieav.cta.br).

PSEUDACRIS CLARKII (Spotted Chorus Frog). USA: ILLINOIS: McLean Co: Moraine View State Park, 0.25 km NW of Dawson Lake along a creek (NW 1/4, SW 1/4, Sec. 26, T23N, R4E). 6 April 1999. H. M. Burdett. Illinois Natural History Survey (INHS 15044). Verified by L. E. Brown. First record of *P. clarkii* in Illinois; closest locality is Montgomery County, Kansas, ca. 700 km to the southwest (Collins 1993, Amphibians and Reptiles in Kansas. Third ed. Univ. Press of Kansas, Lawrence. xx + 397 pp.). A single adult male (26 mm SVL) was collected. It was probably introduced as a tadpole along with fish during stocking the previous year. There was no evidence of a breeding population in the spring and summer of 1999.

Submitted by **DONALD B. SHEPARD** and **HERBERT M. BURDETT**, Department of Biological Sciences, Illinois State University, Normal, Illinois 61790-4120, USA.

PSEUDACRIS CRUCIFER. (Spring Peeper). USA: KANSAS: Miami Co: SW 1/4 SW 1/4 Sec. 26, T17S, R25E. 14 April 1999. Keith Coleman. KU 288855–856; NW 1/4 Nw 1/4 Sec. 34, T17S, R25E. 14 April 1999. Keith Coleman. KU 288857. All verified by Joseph T. Collins. Single adult males taken as vouchers from choruses. Discovery of these populations corroborates a 71-year-old record (UMMZ 72390) from Pigeon Lake in the same county on 6 April 1929.

Submitted by **KEITH COLEMAN**, 2429 Ousdahl Road, Lawrence, Kansas 66046-4052, USA.

RANA GRYLIO (Pig Frog). PUERTO RICO: TOA BAJA: SABANA SECA: wetland area known as Ciénaga de San Pedro, 2.9 km on Rt. 867 within the North Tract sector of the U.S. Naval Security Group Activity (18°27'04"N, 66°12'42"W). 12 November 1998. Neftalí Rios-López. Verified by Julian C. Lee. Museu de Biología, Universidad de Puerto Rico-Recinto de Río Piedras. (UPRRP 5752, 5754). First record for Puerto Rico and the southeasternmost record for the species. A female (111.7 mm SVL) and a juvenile (68.6 mm SVL) were collected at 2200 h from a flooded channel, which runs parallel to a side road within the North Track area. Calling males were heard in March, August, and September 1995, and in October and November 1998. Females, subadults, and juveniles were observed while submerged (partially or up to the head) in open waters surrounded by vegetation. However, calling males were heard from within large clumps of *Typha dominguensis* and these animals were not seen openly exposed

while calling. The calling behavior might explain why the species was not previously reported and probably calling individuals were confused with birds calling within vegetation clumps throughout the area. *Rana grylio* is present also in the Tortugero Lagoon Reserve and associated nearby wetlands (Manati/Vega Baja, Tierras Nuevas Saliente, Rt. 686, 18°28'00"N, 66°27'48"W). A subadult (102.7 mm SVL, UPRRP 5761) and a juvenile (40.4 mm SVL, UPRRP 5762) were collected by Carlos Toledo and NRL (17 August 1999) at the edges of a small pool surrounded by *T. dominguensis*. Finally, the species was also found all along the Caño Tiburones (water channel which cuts through an associated wetland area) at the northwesternmost part of its geographic distribution within Puerto Rico (Arecibo, Factor, Rt. 682, 18°27'47"N, 66°38'21"W). A juvenile (53.6 mm SVL, UPRRP 5763) was collected (NRL) from within the channel on which males were heard calling in the water.

These data indicate that *R. grylio* is well established in northern Puerto Rico and it is reproductively active during most of the year. This frog ranges from southeastern South Carolina to southeastern Texas, and has been also introduced on Andros and New Providence islands in the Bahamas (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Sumitted by **NEFTALÍ RIOS-LÓPEZ** and **RAFAEL L. JOGLAR**, Universidad de Puerto Rico, Recinto de Río Piedras, Departamento de Biología, Apartado 23360, San Juan, Puerto Rico 00931-3360.

RANA SYLVATICA (Wood Frog). USA: TENNESSEE: Jackson Co: Dodson Branch, NE of Hidden Springs Nursery on Spring Creek Rd. near Dodson Branch (36°19'20"N, 85°30'42"W). 9 October 1999. Priya Nanjappa. Verified by A. Floyd Scott. Austin Peay State University Museum of Zoology (APSU 5283 [color slide]). Adult captured in leaf litter of a mixed forest near Dodson Branch; photographed and released. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay State Univ. Misc. Publ. 12:1–94).

Submitted by **PRIYA NANJAPPA** and **LAURA LEININGER**, Muncie Center for Medical Education, Ball State University, Muncie, Indiana 47306, USA.

SCINAX RUBRA. PUERTO RICO: TOA BAJA: SABANA SECA: wetland area known as Ciénaga de San Pedro, 2.9 km on Rt. 867 within the North Tract sector of the U.S. Naval Security Group Activity (18°27'30"N, 66°12'30"W). 12 November 1998. Neftalí Rios-López. Verified by Rafael L. Joglar. Museu de Biología, Univerisdad de Puerto Rico-Recinto de Río Piedras (UPRRP 5753, 5755–58). New record for the northcentral part of Puerto Rico. Five calling males (SVL 28.86 ± 1.19 mm, min. 27.4 mm, max. 30.4 mm) were collected at 2030 h from a flooded area two to three meters above sea level along both sides of a local road within the North Track area. Species is abundant within the more than 16 km^2 this wetland covers. These data suggest that the population is established and reproductively active throughout the year. The new geographic area reported herein is the northwesternmost record for the species. A previous report on its geographical range within Puerto Rico included the Bayamón-Carolina area (Rivero 1998, Los Anfibios y Reptiles de Puerto Rico/ The Amphibians and Reptiles of Puerto Rico. Segunda Ed. Editorial Universitaria U. P. R., San Juan. 510 pp.).

Sumitted by **NEFTALÍ RIOS-LÓPEZ**, Universidad de Puerto Rico, Recinto de Río Piedras, Departamento de Biología, Apartado 23360, San Juan, Puerto Rico 00931-3360.

TESTUDINES

APALONE SPINIFERA SPINIFERA (Eastern Spiny Softshell). USA: KENTUCKY: Campbell Co: Alexandria, jct. California Crossroads and Wesley-Chapel Roads, in 12-mile Creek, a second order stream; others seen in area (38°53'20"N, 84°18'35"W). 8 June 1998. C. Lorentz. Cincinnati Museum of Natural History (CMNH 5874). Verified by Jeffrey Davis. New county record (Kentucky Amphibians and Reptile Museum Voucher Database at the Thomas More College Ohio River Biological Field Station).

Submitted by **JOHN W. FERNER**, **CHRISTOPHER LORENTZ**, **MELLISA OBERMEYER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **PAUL J. KRUSLING**, Geier Collections and Research Center, Museum of Natural History and Science, Cincinnati Museum Center, 1720 Gilbert Avenue, Cincinnati, Ohio 45202, USA.

CHRYSEMYS PICTA MARGINATA (Midland Painted Turtle). USA: KENTUCKY: Boone Co: Belleview, Rt. 20, juvenile crossing road (39°01.416'N, 84°50.919'W). 25 April 1999. P. Krusling, J. Ferner, D. McCoy and R. Lohre. Cincinnati Museum of Natural History (CMNH 5853). Verified by Jeffrey Davis. New county record (Kentucky Amphibian and Reptile Museum Voucher Database at the Thomas More College Ohio River Biological Field Station).

Submitted by **PAUL J. KRUSLING**, Geier Collections and Research Center, Museum of Natural History and Science, Cincinnati Museum Center, 1720 Gilbert Avenue, Cincinnati, Ohio 45202, USA, and **JOHN W. FERNER**, **DEAN M. McCOY**, and **RICK G. LOHRE**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.

CHRYSEMYS PICTA MARGINATA (Midland Painted Turtle). USA: KENTUCKY: Kenton Co: Edgewood, Turkeyfoot Road, 0.3 km S Dudley Road, DOR (39°00'35"N, 84°34'45"W). 18 September 1998. J. Ferner. Cincinnati Museum of Natural History (CMNH 5886). Verified by Jeffrey Davis. New county record (Kentucky Amphibian and Reptile Museum Voucher Database at the Thomas More College Ohio River Biological Field Station).

Submitted by **JOHN W. FERNER**, **JODI P. FERNER**, **MELLISA OBERMEYER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **PAUL J. KRUSLING**, Geier Collections and Research Center, Museum of Natural History and Science, Cincinnati Museum Center, 1720 Gilbert Avenue, Cincinnati, Ohio 45202, USA.

CLEMMYS INSCULPTA (Wood Turtle). USA: MAINE: Waldo Co: Sandy Stream National Wildlife Refuge, 0.83 km N Rt. 139 on Sandy Stream (44°37.221'N, 69°21.102'W). 18 April 1999. Phillip G. deMaynadier. University of Massachusetts Museum (Color photograph UMA R1075). Verified by Alan M. Richmond. Adult male found basking on sandy riverbank in mature hardwood

floodplain forest. New county record; fills in the expected distribution (Hunter et al. 1999, Maine Amphibians and Reptiles, Univ. Maine Press, Orono, Maine. 252 pp.).

Submitted by **PHILLIP G. DEMAYNADIER**, Endangered Species Group, Maine Department of Inland Fisheries and Wildlife, 650 State Street, Bangor, Maine 04401, USA, and **MOLLY T. DOCHERTY**, Maine Natural Areas Program, 159 Hospital Street, Augusta, Maine 04333, USA.

EMYDOIDEA BLANDINGII (Blanding's Turtle). USA: ILLINOIS: DEKALB CO: Dekalb city limits, crossing Route 23 adjacent to a wetland area, located near the Target Store. Sec. 15, T40N, R4E. 11 June 1993. Sandra Lewis. HDW-NIU 1622. Verified by Dayle Saar. Smith (1961, Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298) cited Dekalb County on the basis of a hatchling (HDW 1033, presently housed in INHS collection) collected on 7 April 1960 from Wilkinson Renwick Marsh, 6 mi N Dekalb. Specimen reported herein represents the first adult from the county and second documented specimen.

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

GRAPTEMYS PSEUDOGEOGRAPHICA KOHNII (Mississippi Map Turtle). USA: TEXAS: MORRIS CO: Sulphur River, 0.5 km downstream from U.S. Rt. 259 bridge (33°18'28"N, 94°43'28"W). 1 August 1998. Michael N. Morgan. TCWC 80161. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp; Dixon 1996, Texas Herpetol. Soc. Spec. Publ. 2). Specimen was collected dead in an experimental gillnet.

Submitted by **MICHAEL N. MORGAN** and **NIKKOAL J. DICTSON**, Department of Wildlife and Fisheries Sciences, 210 Nagle Hall, Texas A&M University, College Station, Texas 77843-2258, USA.

LACERTILIA

AMEIVA EDRACANTHA (Bocourt's Ameiva). PERU: ANCASH: PROVINCIA HUARMEY: Huamba Alta (09°57'S, 77°51'W, 710 m elev.). 9 February 1997. Edgar Lehr. Natur-Museum und Forschungs-Institut Senckenberg (SMF 80011); Janca (09°46'S, 77°57'W, 870 m elev.). 16 March 1997. Edgar Lehr. SMF 80013; Huarmey (10°04'S, 78°10'W, 20 m elev.). 17 May 1998. Edgar Lehr. SMF 80014. PROVINCIA BOLOGNESI: Cajacay (10°10'S, 77°27'W, 2335 m elev.). 30 March 1997. Edgar Lehr. Museo de Historia Natural de San Marcos (MHNSM 20039). All verified by Gunther Köhler. First state record, and southernmost record for Peru (Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49:1–27).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de) and **CESAR AGUILAR**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

CNEMIDOPHORUS LACERTOIDES. ARGENTINA: ENTRE RIOS: Departamento Diamante: Diamante (32°04'S, 60°39'W). S. L. De Frers. 29 December 1924. Herpetological collection Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN 4511). Verified by G. Carrizo. First provincial record; extends known range 400 km NW of previous records (Cei and Martori 1991, Boll. Mus. reg. Sci. nat. Torino. 9[1]:33–38; Aún and Martori 1996, Cuad. Herpetol. 9[2]:95–99; Cei 1993, Boll. Mus. reg. Sci. nat. Torino. Monograf. XIV:362–385; Gallardo, Miranda and Tio Vallejo 1987, Revta. Mus. arg. Cs. nats. Bermardino Rivadavia Cienc. Zool. 14[5]:88–94).

Submitted by **LUCIA FEDERICO**, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Angel Gallardo 490, Buenos Aires, Argentina (e-mail: luciafed@hotmail.com or amf@fibertel.com.ar).

COSYMBOTUS PLATYURUS (Asian House Gecko). USA: FLORIDA: ALACHUA CO: 1800 block of NE 23rd Avenue, Gainesville. No date given. J. Brian Hauge and Brian P. Butterfield. Auburn University Museum (AUM 35156–57). Verified by R. D. Bartlett. Several individuals observed, two adults collected from warehouses near former location of Hogtown Herpetological Supply. As the herpetological supply business here closed several years ago, and specimens of various sizes were observed, we suspect that a reproductively active colony occurs at this site. New county record.

Submitted by **J. BRIAN HAUGE**, Department of Biology, Penn State University at Hazleton, Hazleton, Pennsylvania 19201-1291, USA, and **BRIAN P. BUTTERFIELD**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

EUMECES LATICEPS (Broadhead Skink). USA: KANSAS: NEOSHO CO: Sec. 22, T30S, R20E. 28 April 1978. N. J. Hilscher. Sternberg Museum of Natural History (MHP 5757). Verified by Kelly J. Irwin. New county record for this Kansas threatened species (Collins 1993, Amphibians and Reptiles in Kansas. Third Edition. Univ. Press Kansas, Lawrence. xx + 397 pp.).

Submitted by **TRAVIS W. TAGGART**, Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas 67601, USA, and **JOSEPH T. COLLINS**, Kansas Biological Survey, 2041 Constant Avenue, Lawrence, Kansas 66047, USA.

GEKKO GECKO (Tokay Gecko). USA: FLORIDA: ALACHUA CO: 1800 block of NE 23rd Avenue, Gainesville. 14 May 1999. Brian P. Butterfield and J. Brian Hauge. Auburn University Museum (AUM 35155). Verified by R. D. Bartlett. Juvenile collected from warehouses near former location of Hogtown Herpetological Supply. As the herpetological supply business here closed several years ago, and the specimen collected was a juvenile, we suspect that a small breeding colony occurs here. New county record (Wilson and Porras 1983, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9:1–89).

Submitted by **BRIAN P. BUTTERFIELD**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA, and **J. BRIAN HAUGE**, Department of Biology, Penn State University at Hazleton, Hazleton, Pennsylvania 19201-1291, USA.

HEMIDACTYLUS FRENATUS. HONDURAS: ATLANTIDA: La Ceiba, found at night on the wall of the Hotel Partenon. 5 June 1997. C. J. Franklin. University of Texas at Arlington (UTA R-42657). First record for department; CORTES: Oropendoles, ca. 650 m elev. 18 December 1996. E. N. Smith. UTA R-41280. Both verified by J. A. Campbell. First record for county.

Submitted by **CARL J. FRANKLIN**, Department of Herpetology, Dallas Zoo, 650 South R. L. Thornton Freeway, Dallas, Texas 75203, USA (e-mail: herpking@ix.netcom.com).

HEMIDACTYLUS MABOUIA (Tropical Gecko). ARGENTINA: CHACO: Departamento San Fernando: Resistencia (29°27'S, 58°59'W). P. M. Cacivio. 22 March 1999. Herpetological collection Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN 37129). Verified by G. Carrizo. First provincial record; extends known range 500 km SW from the previous known records (Genise and Montanelli 1991, Bol. A. H. A 7[1]:23; Cei 1993, Boll. Mus. reg. Sci. nat. Torino. Monograf. XIV:329–336; De Avila Pires 1995, Amazonia. Zool. Verh. Leiden 299:228–238).

Submitted by **LUCIA FEDERICO**, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Angel Gallardo 490, Buenos Aires, Argentina (e-mail: luciafed@hotmail.com or amf@fibertel.com.ar) and **PEDRO. M. CACIVIO**, Centro Productor de Suero Antiofidico (CE.P.S.AN), Costanera 99, Corrientes, Argentina (e-mail: cacivio@hotmail.com or cacivio@arnet.com.ar).

HEMIDACTYLUS MABOUIA (Tropical Gecko). USA: FLORIDA: ORANGE CO: Wekiwa Springs State Park. 12–13 May 1999. Brian P. Butterfield and J. Brian Hauge. No date given. Auburn University Museum AUM 35151–54. Verified by R. D. Bartlett. Several individuals observed on campground bathhouses at night. Specimens collected were two adult males, one gravid female, and one juvenile. Specimens of *H. garnotii* were also observed. New county record.

Submitted by **BRIAN P. BUTTERFIELD**, **ISRAEL FOX**, **JONATHAN GARNER**, and **KYLE CARTER**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA, and **J. BRIAN HAUGE**, Department of Biology, Penn State University at Hazleton, Hazleton, Pennsylvania 19201-1291, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). SOUTH CAROLINA: CHARLESTON CO: West Ashley residential community, Village Road (32°48.300'N, 80°00.434'W). Captured and photographed 12 July 1998. George W. Eason, Jr.; West Ashley residential community, Treescape Drive (32°50.665'N, 80°03.157'W). 18 December 1998. Dorian R. McMillan. ChM CR 2643; West Ashley residential community, Village Road (32°48.300'N, 80°00.434'W). 14 June 1999. Dorian R. McMillan and George W. Eason, Jr. ChM CR 2644. Confirms first capture (12 July 1998) which lacks a specimen voucher. Many individuals of different size classes have been observed at these sites. Both specimens verified by Albert Sanders. First records for the state (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin, Boston, Massachusetts. 616 pp.). These records represent the northernmost distribution of the species for the southeastern U. S., ca. 130 km (airline) northeast of the previous record in Chatham County, Georgia. (Frick 1997, Herpetol. Rev. 28:50).

Submitted by **GEORGE W. EASON, JR.**, South Carolina Department of Natural Resources, Land, Water and Conservation Division, 1201 Main Street, Columbia, South Carolina 29201, USA, and **DORIAN R. McMILLAN**, College of Charleston, Department of Biology, 66 George Street, Charleston, South Carolina 29424, USA.

LEIOCEPHALUS CARINATUS ARMOURI (Northern Curlytail Lizard). USA: FLORIDA: MARTIN CO: on grounds of Sea Treasures tourist shop, 18955 US Rt. 1. 16 May 1999. J. Brian Hauge and Brian P. Butterfield. Auburn University Museum (AUM 35158). Verified by Craig Guyer. Several individuals observed; one adult male collected. New county record (Wilson and Porras 1983, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9:1–89).

Submitted by **J. BRIAN HAUGE**, Department of Biology, Penn State University at Hazleton, Hazleton, Pennsylvania 19201-1291, USA, and **BRIAN P. BUTTERFIELD**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

LIOLAEMUS RIOJANUS. ARGENTINA: SAN JUAN: Ullum Department: 34 km from San Juan City on Bolson de Matagusanos (31°19'S, 68°41'W). March 1998. J. C. Acosta. Herpetological Collection, Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 384, male). Verified by Ricardo Martori. Extends the known range (Cei 1993, Mon. XIV Mus. Reg. Sci. Nat. Torino, 949 pp.) ca. 60 km northwest of Caucete.

Submitted by **JUAN CARLOS ACOSTA** and **FERNANDO MURÚA,** Departamento de Geofísica y Astronomía e Instituto y Museo de Ciencias Naturales, F.C.E.F. y N, Universidad Nacional de San Juan, Avenida España 400 (N). Caixa Postal 5400, San Juan, Argentina.

MABUYA FRENATA. BRAZIL: TOCANTINS: Parque Estadual do Cantão, along the Araguaia river (9°27'S, 49°50'W). 21 September 1999. Maria Goretti M. Pinto. Herpetological Collection, University of Brasília, Distrito Federal, Brazil (CHUNB 12401). Verified by Guarino R. Colli. Species has been recorded from widespread localities in South America, but this is the northernmost record, at a locality the border between Cerrado and Amazonia habitat. Two individuals, possibly fighting or trying to copulate, were seen in the morning, on the leaf litter along a trail of an open forest, but just one (male) was captured.

Submitted by **MARIA GORETTI M. PINTO** and **ALEXANDRE B. ARAUJO**, Departamento de Zoologia, Universidade de Brasília, 70910-900, Brasília, Distrito Federal, Brazil.

OPHIODES VERTEBRALIS. ARGENTINA: SANTIAGO DEL ESTERO: Departamento Figueroa: Caspi Corral (27°37'S, 63°31'W). 21 December 1987. J. Soroka. Herpetological collection of Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN 34249). Verified by G. Carrizo. Departamento Belgrano: Malbran (29° 21'S, 62° 27'W).

December 1978, J. Soroka (MACN 34576). First province records, extend known range 400 Km N from previous records (Cei 1993, Boll. Mus. reg. Sci. nat. Torino, Monograf. XIV:418–421; Gallardo 1966, Mus. arg. Cs. nats. Bermardino Rivadavia [Cienc. Zool.] 9[6]:124–146; Gallardo et al., 1985, Hist. Nat. Corrientes Argentina 5[13]:97–103).

Submitted by **LUCIA FEDERICO**, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Angel Gallardo 490, Buenos Aires, Argentina (e-mail: luciafed@hotmail.com or amf@fibertel.com.ar).

PHRYNOSOMA ORBICULARE (Mountain Horned Lizard). MÉXICO: GUERRERO: San Juan de las Joyas, Municipio de Ahuacuotzingo, (17°50'N, 99°04'W), 1200 m elev. 24 May 1998. Elizabeth Beltrán Sánchez. Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México, IBH 12451, 12452 (SVL 86 and 68 mm, TL 37 and 41 mm, respectively), adults, female, and male found in a disturbed oak forest. Both specimens verified by Víctor Hugo Reynoso Rosales. First record for state and not previously reported in the checklist by Saldaña de la Riva and Pérez-Ramos (1987, Herpetofauna del Estado de Guerrero, México. México, UNAM Tésis Prof. 389 pp.); extends range ca. 190 km SW and 155 km S from the closest known localities in San Diego Chalma, SE of Tehuacán, Puebla, and near Tres Marías (Km 57), Morelos, respectively (Smith and Taylor 1950, U.S. Natl. Mus. Bull. 199:1–253; Reeve 1952, Univ. Kansas Sci. Bull. 34[14]:817–960; Horowitz 1955, American Midl. Nat. 54:204–218; Baur and Montanucci 1998, Herpeton. Verlag Elke Köhler. Offenbach). This Guerrero population may be a relic of a formerly wider range for this lizard that linked the populations of Morelos and Puebla, which are currently recognized as two subspecies (*P. o. orbiculare* in Morelos and *P. o. cortezi* in Puebla), and may have significance in resolving the status of the subspecific taxa.

Submitted by **ELIZABETH BELTRÁN SÁNCHEZ**, Instituto de Investigaciones Científicas Area de Ciencias Naturales, Universidad Autónoma de Guerrero, Avenida Lazaro Cardenas S/N, Ciudad Universitaria, Interior del Jardín Botánico, Caixa Postal 39000, Chilpancingo, Guererro, México (e-mail: ebeltran@galeana.uagfm.mx), **FERNANDO MENDOZA QUIJANO**, Instituto Tecnológia Agropecuario No. 6, Km 5.5 Carr. Huejutla-Chalahuiyapa, Apartado Postal 94, Caixa Postal 43000, Huejutla de Reyes, Hidalgo, México (e-mail: mendozaq@mail.ibiología.unam.mx), and **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA (e-mail: wcs@amnh.org).

PHYLLOPEZUS PERIOSUS. BRAZIL: PERNAMBUCO: Municipality of Ibimirim (08°30'23"S, 37°42'46"W). October 1998. J. P. Pombal, Jr., O. C. Oliveira, and R. N. Feio. Museu Nacional-Rio de Janeiro (MNRJ 7381–85). PARAIBA: Municipality of Congo (07°48'01"S, 36°40'46"W). October 1998. J. P. Pombal, Jr., O. C. Oliveira, and R. N. Feio. MNRJ 7386–89. RIO GRANDE DO NORTE: Municipality of Serra Negra do Norte (06°33'–06°37'S, 37°14'–37°16'W). May 1999. A. A. Varela-Freire and B. Maggi. Coleção Taxonômica Interiorana da Estação Ecológica de Seridó (CTI-EES 3117–18). ALAGOAS: Municipality of Piranhas (09°28'–09°36'S, 37°47'–38°03'W). June 1994. Equipe Resgate de Fauna UHE Xingó. Museu de História Natural da Universidade Federal de Alagoas (MUFAL 1305, 1307–09). All verified by U. Caramaschi and R. Fernandes. Previously published distribution of the species was restricted to Cabaceiras (state of Paraíba) and Sítio dos Nunes (state of Pernambuco), suggesting a relictual distribution (Rodrigues 1986, Pap. Avuls. Zool. 36[20]:237–250). These new records expand significantly the known distribution and represent the first records for the states of Alagoas and Rio Grande do Norte.

Submitted by **ELIZA MARIA XAVIER FREIRE**, Departamento de Zoologia e Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade, 452, 57021-090 Maceió, Alagoas, Brazil, **RENATO NEVES FEIO**, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, 36571.000 Viçosa, Minas Gerais, Brazil, and **JOSÉ P. POMBAL, JR.**, Museu Nacional/UFRJ, Quinta da Boa Vista, 20.940-040 Rio de Janeiro, Brazil.

SERPENTES

COLUBER CONSTRICTOR LATRUNCULUS (Blackmask Racer). USA: TENNESSEE: Shelby Co: T. O. Fuller State Park (35°04'04"N, 90°07'27"W), grassy bank at the terminus of Mitchell Road, 8 m down slope from W shoulder of road: One predated specimen (APSU 5292). 18 April 1998. Donald L. Thomas; Second individual (APSU color slide 5290) collected same location. 10 June 1999. James T. Eubanks, Keith W. Pecor, and Donald L. Thomas; Edward J. Meeman Biological Station (35°21'05"N, 90°01'32"W), brush piles 40 m from W side of station: Three specimens (APSU color slides 5291a–c) collected from under woody debris. 18 May 1999. James T. Eubanks; Loosahatchie Biological Station (35°15'34"N, 89°48'32"W), woody debris in an open field 55 m N of Old Brownsville Road: Five individuals (APSU color slide 5293) including two gravid females. 20 May 1999. James T. Eubanks. All snakes listed above were considered adults (snout-vent length >90 cm). All specimens were verified by William H. N. Gutzke. New state record; northern range limit for this subspecies is reported as northern Mississippi (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd Ed. expanded. Houghton Mifflin Co, Boston, Massachusetts. 616 pp.).

Submitted by **DONALD L. THOMAS**, **JAMES T. EUBANKS**, and **KEITH W. PECOR**, Department of Biology, University of Memphis, Memphis, Tennessee 38152, USA.

CROTALUS ATROX (Western Diamondback Rattlesnake). USA: ARIZONA: Mohave Co: Grand Canyon, confluence of Diamond Creek and Colorado River: river mile (RM) 225.7: 35°46'N, 113°22'W. Summer 1997. William Walls. KU Color Slide 11725. Verified by Bruce Gomes. First verified record in the Grand Canyon. Miller et. al. (1982, Amphibians and Reptiles of the Grand Canyon. Publ. Grand Canyon Natural History Association. 114 pp.) make no reference to *C. atrox* inhabiting the Grand Canyon (Lee's Ferry to Lake Mead). Grater (1981. Snakes, Lizards, and Turtles of the Lake Mead Region. Publ. Southwest Parks and Monuments Association. 47 pp.) suggests that *C. atrox* is uncommon and has been found only in the southern part of the Lake

Mead-Lake Mojave Region. Lowe et. al. (1986, The Venomous Reptiles of Arizona. Publ. Arizona Game and Fish Department, Phoenix. 115 pp.) show the northern distribution of *C. atrox* as extending north of Peach Springs towards the Colorado River, but not to the river itself.

Submitted by **NIKOLLE L. BROWN**, 7779 North Leonard, Clovis, California 93611, USA.

CROTALUS MOLOSSUS (Blacktail Rattlesnake). USA: ARIZONA: Coconino Co: Colorado River, Lower Lava rapids, river mile (RM) 179.8, south rim: 36°11'N, 113°07'W. Summer 1991. John Running. KU Color Slide 11722. Verified by Cecil Schwalbe. Only one other specimen (SDSNH Z06066) referenced in the literature documents the occurence of *C. molossus* within the Grand Canyon (McKee and Bogert 1934, Copeia 1934:178–180.). However, Lowe et al. (1986, The Venomous Reptiles of Arizona. Arizona Game and Fish Department, Phoenix. 115 pp.) illustrate a range which includes the Grand Canyon region (north and south side of the river) from Pierce Ferry (RM 280) east to Havasu Canyon (RM 156.8), although these authors do not cite voucher specimens. This voucher slide provides the first evidence that *C. molossus* occurs down to river level in the Canyon. Two additional recent photographic vouchers of *C. molossus* from the Peach Springs road (KU Color Slides 11723–724) suggest this species may be more common above the river in the western Grand Canyon than indicated by the previous dearth of voucher specimens.

Submitted by **NIKOLLE L. BROWN**, 7779 North Leonard, Clovis, California 93611, USA.

DIADOPHIS PUNCTATUS REGALIS (Regal Ringneck Snake). USA: ARIZONA: Mohave Co: Grand Canyon: Fall Canyon: ca 0.25 mi. from Colorado River, river mile (RM) 211.5: 35°56'N, 113°20'W. August 1999. Daniel Hall. KU Color Slide 11728. Verified by Cecil Schwalbe. First verified record from the Grand Canyon. There are no references to *Diadophis punctatus* inhabiting the Grand Canyon (Lee's Ferry to Lake Mead; Miller et. al. 1982. Amphibians and Reptiles of the Grand Canyon. Grand Canyon Nat. Hist. Assoc. 114 pp.) or the Lake Mead-Lake Mojave Region (Grater 1981. Snakes, Lizards, and Turtles of the Lake Mead Region. Southwest Parks and Monuments Assoc. 47 pp.). Both Stebbins (1985, Peterson Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.) and Lowe et al. (1986, The Venomous Reptiles of Arizona. Arizona Game and Fish Department, Phoenix. 115 pp.) suggest there are only local populations of this species in northwestern Arizona.

Submitted by **NIKOLLE L. BROWN**, 7779 North Leonard, Clovis, California 93611, USA.

DRYMOLUBER DICHROUS. BRAZIL: ALAGOAS: Maceió (9°40'S, 35°43'W). 25 April 1996. Museu de História Natural, Universidade Federal de Alagoas (MUFAL 1460); Rio Largo (9°30'S, 35°50'W). 23 February 1994. MUFAL 462. 1 October 1994. MUFAL 1420. Eliza M. X. Freire, Selma T. Silva, and Edelmo M. Gonçalves. Both found in small patches of Atlantic Forest. All verified by Ronaldo Fernandes. First record for the northeastern Brazil; extends the range of the species ca. 1500 km SE Belém, Pará, Brazil (Cunha and Nascimento 1978, Publ. Avuls. Mus. Par. Emílio Goeldi 31:79–80).

Submitted by **ELIZA MARIA XAVIER FREIRE**, Departamento de Zoologia e Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade, 452, Maceió, Alagoas, 57021-090, Brazil, and Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

GASTROPYXIS SMARAGDINA (Emerald Snake). TANZANIA: Arusha Region: Minziro Forest Reserve, 1°05'S, 31°30'E. October 1998. A. Berggreen, M. Andersen, and P. Gravlund. ZMUC R602527. Verified by Jens Bødtker Rasmussen (following Pittman 1974). First record from Tanzania. Known from Uganda, Eastern Zaire, and West Africa (Pittman 1974, Guide to the Snakes of Uganda. Codicote, Wheldon & Wesley, Ltd.). The new record is situated ca. 180 km to the SW of the closest known locality in Uganda (Bunjako Island, Pittman 1974, *op. cit.*).

Submitted by **PETER GRAVLUND**, The Zoological Museum, Vertebrate Department, Herpetological Section, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen, Denmark.

HYPSIGLENA TORQUATA (Night Snake). MEXICO: BAJA CALIFORNIA NORTE: Isla Salsipuedes, Gulf of California, SW portion of island (28°44'N, 112°59'W). 31 March 1999. Allen McAfee and Jim Gilardi. Verified by Clark R. Mahrdt. LACM-PC 1332. Specimen was found under a rock next to a freshly killed *Uta stansburiana*. Species has also been reported from the nearby islands of San Esteban and San Lorenzo Sur in the Midriff Archipelago in addition to several islands throughout the Gulf of California (Grismer 1999, Bull. So. California Acad. Sci. 98: 45–56); represents the first record for Isla Salsipuedes.

Submitted by **ALLEN McAFEE**, 2144 Bancroft Street, San Diego, California 92104-5606, USA, and **JIM GILARDI**, Life Sciences Department, Palomar College, 1140 West Mission Road, San Marcos, California 92069, USA (e-mail: jgilardi@palomar.edu).

IMANTODES CENCHOA (Blunthead Tree Snake). BRAZIL: SANTA CATARINA: Municipality of Blumenau (26°56'S; 49°03'W, 20 m elev.). Two specimens: March 1986. M. A. Baptista, Herpetological Collection Museu de História Natural Capão da Imbuia, Curitiba (MHNCI 1961); 1996. H. Berckenbrock (MHNCI 7663). Municipality of Ibirama: (27°04'S; 49°31'W, 150 m elev.) 24 July 1990. D. Polini (MHNCI 8322). Municipality of Corupá: "Humboldt" (= Municipality of Corupá, 26°26'S; 49°14'W, 60 m elev.) 25 January 1916. W. Ehrhardt. Museu Nacional do Rio de Janeiro (MNRJ.448). All verified by Ronaldo Fernandes. All records are in the Atlantic Forest Domain. Species was recently recorded from southeastern and southern Brazil, from the states of São Paulo and Paraná (Marques 1996, Herpetol. Rev. 27:34; Moura-Leite et al. 1996, Herpetol. Rev. 27:216). First state records; extend range ca 180 km S nearest known locality in the state of Paraná (Piraquara Municipality, Volta Grande; Moura-Leite et al., *op. cit.*).

Submitted by **RENATO SILVEIRA BÉRNILS**, Sociedade Fritz Müller de Ciências Naturais, Caixa Postal 1644-80001-970, Curitiba, Paraná, Brazil (e-mail: bernils@ xmail.com.br), **SÉRGIO**

AUGUSTO ABRAHÃO MORATO, Companhia Paranaense de Energia (COPEL), Superintendência de Engenharia-Meio Ambiente, Rua Voluntários da Pátria, 233, 7º Andar-80020-942, Curitiba, Paraná, Brazil, and Museu de História Natural Capão da Imbuia (e-mail: samorato@mail.copel.br), and **JULIO CESAR DE MOURA-LEITE**, Laboratório de Herpetologia, Museu de História Natural Capão da Imbuia, Departamento de Zoológico (SMMA/PMC), Rua Prof. Benedito Conceição, 407-82810-080 Curitiba, Paraná, Brazil, and Curso de Pós-Graduação em Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil (e-mail: mleit@uol.com.br).

LAMPROPELTIS GETULA (Common Kingsnake, Culebra Real Común). MÉXICO: BAJA CALIFORNIA SUR: Isla Santa Cruz, 25°15'40.7"N, 110°43'39.9"W. 5 September 1999. L. Lee Grismer. Verified by Francisco Reynoso. LSUHC-PC S2349. A carcass of one individual was found at 0630 h on the SW side of the island in a narrow, rocky arroyo. The most recent checklist of amphibians and reptiles from the Gulf of California does not include this species from Isla Santa Cruz (Grismer 1999, Bull. South. California Acad. Sci. 98:45–56).

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515, USA, and **BRADFORD D. HOLLINGSWORTH**, P.O. Box 121390, Department of Heretology, San Diego Natural History Museum, San Diego, California 92119-1390, USA.

LEPTOTYPHLOPS DULCIS (Texas Blind Snake). USA: KANSAS: KIOWA CO: NW1/4 Sec. 8, T30S, R16W. 25 June 1999. Derek Moeller, Allie Kossoy, and Whitney Hamilton. (KU 289043). Verified by Joseph T. Collins. A juvenile found under a rock on S facing hillside ca. 1 mi NW Belvidere at 1200 h on 25 June 1999. Soil beneath rock was soft, sandy, and moist. An adult *Tropidoclonion lineatum* was found under the same rock. Weather was sunny and warm. There had been rain in the area several times during the past few days. County record and a range extension to the north for North America (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Edition, expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.; Collins 1993, Amphibians and Reptiles in Kansas. Third Edition. Univ. Press Kansas, Lawrence. xx + 397 pp.; Miller 1982, Kansas Herp. Soc. Newsl. 28:5; Miller 1987, Investigation of Four Rare Snakes in South-Central Kansas. Final Report Kansas Dept. Wildlife & Parks, Pratt. 24 pp.).

Submitted by **DEREK MOELLER**, Washburn Rural High School, 5900 SW 61st Street, Topeka, Kansas 66619, USA, **ALLIE KOSSOY**, **WHITNEY HAMILTON**, and **LARRY L. MILLER**, Topeka Collegiate School, 2200 SW Eveningside Drive, Topeka, Kansas 66614, USA.

LYCOPHIDION TAYLORI. TANZANIA: Arusha Region (two localities): Samaria, near Kilimanjaro National Airport, 3°28'S, 37°05'E; Lolkisale, ca. 50 km SW Arusha city, 3°46'00"S, 36°24'00"E. January 1998. Joseph Beraducci. Zoological Museum, University of Copenhagen. Samaria ZMUC R602328; Lolkisale ZMUC R602084–85. Verified by Jens Bødtker Rasmussen (following Broadley and Hughes 1993, Herpetol. J. 3:8–18). First records from Tanzania. Previously known from Chad, Kenya, Senegal, and Somalia (Broadley and Hughes, *op. cit.*). The new record is situated ca. 750 km southwest of the closest record in southern Somalia (Broadley and Hughes, *op. cit.*).

Submitted by **PETER GRAVLUND**, The Zoological Museum, Vertebrate Department, Herpetological Section, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen, Denmark.

NERODIA ERYTHROGASTER TRANSVERSA (Blotched Water Snake). USA: TEXAS: PRESIDIO CO: Big Bend Ranch State Park. Rio Grande between river miles 918 and 921. 2 October 1999. KU Color Slide 11727. Extends known range ca. 34 miles upstream of sightings (J. R. Dixon, pers. comm.) near the mouth of Santa Elena Canyon (RM 885), Big Bend National Park. An adult was observed and a juvenile captured (SVL = 260 mm, tail = 75 mm). Taken from riffle area at bend in the river. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). If found on the Mexican side of the river it would likely represent a new record for northern Chihuahua, Mexico (R. Conant, pers. comm.).

Submitted by **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87025, USA, **J. ERIC WALLACE**, 3414 West Sierra, Phoenix, Arizona 85029, USA, and **STEPHANIE C. BARTEL**, 907 Lockhart, Alpine, Texas 79832, USA.

NINIA HUDSONI (Amazon Coffee Snake). PERU: DEPARTAMENTO PASCO: Provincia Oxapampa: Alto Chinizo, ca. 14 km NW Pozuzo (10°07'S, 75°32'W), 1500 m elev. 19 December 1995. B. Vasques T. Collection of the Centro de Salud San Camilo Pozuzo (PE 1163) and photograph vouchers Natur-Museum und Forschungs-Institut Senckenberg (SMF-F 203–4). Verified by N. Carrillo de Espinoza. State record and northernmost locality for Peru.

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de) and **ROSARIO FERNANDEZ**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

OXYBELIS AENEUS. (Mexican Vine Snake). PERU: DEPARTAMENTO ANCASH: Provincia Huarmey: Janca (09°46'S, 77°57'W, 855 m elev.). 16 March 1997. E. Lehr. Museo de Historia Natural de San Marcos (MHNSM 20034); Huamba Alta (09°57'S, 77°51'W, 730 m elev.). 18 March 1997. E. Lehr. Natur-Museum und Forschungs-Institut Senckenberg (SMF 80010); Huamba Alta (09°58'S, 78°52'W, 625 m elev.). 20 May 1998. E. Lehr. MHNSM 20035. All verified by N. Carrillo de Espinoza. First record for state of Ancash (Keiser 1982, Cat. Am. Amph. Rept. 305.1–4; Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49:1-27).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de) and **CESAR AGUILAR**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

OXYBELIS FULGIDUS. VENEZUELA: ZULIA: Novito, Comunidad Yukpa del Cañon del Río Negro, Sierra de Perijá, Municipio Machiques de Perijá, 600 m. 10 October 1999. José Oviedo. Museo de Biología de la Universidad del Zulia, Maracaibo (MBLUZ R-452; 3 photographs B-R452 a–c, same individual). Verified by Luis Fernando Navarrete and Juan Carlos López Johnston. Previous authors (Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela. Ediciones de la Biblioteca, Universidad Central de Venezuela, Caracas; Lancini 1979, Serpientes de Venezuela. Armitano Ed. Caracas; Lancini and Kornacker 1986, Die Schlangen von Venezuela. Verlag Armitano, Caracas) mentioned the occurrence of this species only to the east and north of Venezuela. The present finding of *O. fulgidus* from Perijá region confirms its ocurrence in western Venezuela and extends the known range 800 km NW from previously published sites.

Submitted by **TITO BARROS** and **RAFAEL PIRELA**, Museo de Biología de la Universidad del Zulia (MBLUZ), Apartado Postal 526, Facultad de Ciencias, Departamento de Biología, Grano de Oro, Maracaibo, Estado Zulia, Venezuela.

OXYRHOPUS RHOMBIFER RHOMBIFER. BRAZIL: BAHIA: Lençóis (12°34'S 41°23'W). January–February 1999. M. A. de Freitas. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau/CEPLAC (CZGB 8853). Verified by Otávio Augusto Vuolo Marques. First record for state of Bahia and northeastern Brazil; subspecies was previously recorded from "provincia de Buenos Aires to east of Rio Paraná in Argentina and Uruguai; north to southern Minas Gerais and Rio de Janeiro, Brazil" (Peters and Orejas-Miranda 1970, Bull. U. S. Nat. Mus. 297: 235).

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz-UESC, Km 16 Rodovia Ilhéus-Itabuna, 45650-000, Ilhéus, Bahia, Brazil (e-mail: ajargolo@hotmail.com) and **MARCO ANTÔNIO DE FREITAS**, Universidade Estadual de Feira de Santana-UEFS, Avenida Universitária Km 03, BR 116, 44031-460, Feira de Santana, Bahia, Brazil (e-mail: sapirang@lognet.com.br).

PROSYMNA RUSPOLII KINIENSIS. TANZANIA: Arusha Region: Samaria, near Kilimanjaro National Airport, 3°28'S, 37°05'E. January 1998. Joseph Beraducci. University of Copenhagen (ZMUC R602327). Verified by Jens Bødtker Rasmussen (following Broadley 1980, Occas. Pap. Natl. Mus. Rhodesia B. Nat. Sci. 6[7]:481–556). First record from Tanzania. Previously known from Kenya (Broadley, *op. cit.*). This new record is situated ca. 175 km to the south of Sultan Hamud, the closest known locality in Kenya (Broadley, *op. cit.*).

Submitted by **PETER GRAVLUND**, The Zoological Museum, Vertebrate Department, Herpetological Section, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen, Denmark.

RHINOBOTHRYUM LENTIGINOSUM. (Amazon Banded Snake). PERU: DEPARTAMENTO UCAYALI: Provincia Atalaya: Bolognesi (10°06'S, 73°49'W, 230 m elev.). 29 January 1999. E. Lehr. Museo de Historia Natural de San Marcos (MHNSM 20006). Verified by Javier Icochea. First record for state of Ucayali (Carrillo de Espinoza and Icochea 1995, Publ. Mus. Hist. Nat. UNMSM [A] 49:1-27).

Submitted by **EDGAR LEHR**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (e-mail: elehr@sng.uni-frankfurt.de), and **CESAR AGUILAR**, Museo de Historia Natural, Departamento de Herpetologia, Universidad Nacional Mayor de San Marcos, Avenida Arenales 1256, Jesus Maria, Apartado 14-0434, Lima, Peru.

SISTRURUS CATENATUS EDWARDSII (Desert Massasauga). USA: NEW MEXICO: HIDALGO CO: DOR, 1.6 km S (by road) Rodeo on Rt. 80. 18 July 1967. Manny Rubio. AMNH R107537. Verified by Harry W. Greene. County record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. 431 pp). The AMNH catalog lists the collection locality of this specimen as Cochise County, Arizona. However, the field tag on the specimen reads "Cochise Cty, Arizona & Hidalgo Cty, N.M." on one side and "1 mile south of Rodeo on 80 on Arizona-New Mexico border" on the other side (L. Ford, pers. comm.). The collector's (MR) field notes from this period indicate he regularly recorded distances to the nearest 0.1 mile. Traveling on Rt. 80, the southern edge of the town of Rodeo is 2.7 km (1.7 miles) NNE of the Arizona-New Mexico border. This places the specimen 1.1 km NNE of the Arizona-New Mexico border. Thus, we recommend reassignment of this specimen to Hidalgo County, New Mexico. Conversion of desert grassland to desert scrub has probably led to severe population decline or extirpation at this site, although the species persists in reasonable densities in a relictual tobosa grassland ca. 50 km to the southwest.

Submitted by **ANDREW T. HOLYCROSS**, Department of Biology, Arizona State University, Tempe, Arizona 85287-1501, USA, and **MANNY RUBIO**, 1665 DeFoor Avenue, Atlanta, Georgia 30318, USA.

SISTRURUS MILIARIUS MILIARIUS (Carolina Pigmy Rattlesnake). USA: GEORGIA: HALL CO: Cagle Mill Road, 2.6 km WSW Lula. 4 September 1995. Rob Wainberg. Georgia Museum of Natural History (GMNH 44320). Verified by M. E. McGhee. First county record and only the fourth documented Georgia record for this species outside of the Coastal Plain (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **ROB WAINBERG** and **CARLOS CAMP**, Biology Department, Piedmont College, Demorest, Georgia 30535, USA, and **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

SPILOTES PULLATUS (Tigra Cazadora, Tropical Rat Snake). VENEZUELA: ESTADO MERIDA: Municipio Antonio Pinto Salinas: 1 km N Santa Cruz de Mora (8°23'50"N, 71°38'30"W). 24 July 1985. Collector unknown, but catalogued data indicates "Proyecto Uribante-Caparo." Colección de Vertebrados de la Universidad de Los Andes (CVULA) IV-3878. Verified by R. Casado. ESTADO TRUJILLO: Municipio Rafael Rangel: Isnotú (9°22'N, 70°42'W). No date. J. L. Portillo. CVULA IV-5683. Verified by L. F. Esqueda. Santa Cruz de Mora is the westernmost locality for the species in the country, besides one record about 75 km to the west in the state of Zulia. Isnotú lies about 250 km SW of the northernmost known collecting localities in the state of Falcon.

Both records constitute the first Venezuelan Andean documented records for this species (Roze 1966, La Taxonomia y Zoogeografia de los Ofidios de Venezuela: 217; Lancini 1986, Serpientes de Venezuela: 157; Lancini and Kornacker 1989, Die Schlangen von Venezuela: 229).

Submitted by **ENRIQUE LA MARCA**, Laboratorio de Biogeografía, Escuela de Geografía, Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Apartado Postal 116, Mérida 5101-A, Venezuela (e-mail: lamarca57@cantv.net), and **PASCUAL SORIANO**, Laboratorio de Ecología Animal-A, Departamento de Biología, Facultad de Ciencias, Universidad de Los Andes, Mérida, Venezuela (e-mail: pascual@ciens.ula.ve).

TELESCOPUS OBTUSUS (Large-eyed Cat Snake). TANZANIA: Arusha Region (two localities): Samaria, near Kilimanjaro International Airport, 3°28'S, 37°05'E; Lolkisale, ca. 50 km SW Arusha city, 3°46'00"S, 36°24'00"E. January 1998. Joseph Beraducci. Zoological Museum, University of Copenhagen (Samaria ZMUC R631350, R631352; Lolkisale ZMUC R631351). Verified by Jens Bødtker Rasmussen (following Broadley 1994, J.. African Zool. 108:[2]). First records from Tanzania. Previously known from Sudan, Ethiopia, Eritrea, Somalia, and Kenya. These new records are situated 350 km (Samaria) and 450 km (Lolkisale) to the west of the nearest record from Malindi, Kenya (Spawls 1978, J. East African Nat. Hist. Soc. Mus. 31:167).

Submitted by **PETER GRAVLUND**, The Zoological Museum, Vertebrate Department, Herpetological Section, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen, Denmark.

THAMNOPHIS RADIX. (Plains Garter Snake). USA: KANSAS: GREENWOOD CO: NE 1/4 Sec. 22, T23S, R8E. 24 September 1999. Steven L. Adams, Kelly J. Irwin, and Joseph T. Collins. KU 289049. Verified by Steven L. Adams. DOR adult. New county record; most southeastern record in the state (Collins 1993, Amphibians and Reptiles in Kansas. Third ed. Univ. Press of Kansas, Lawrence. xx + 397 pp.).

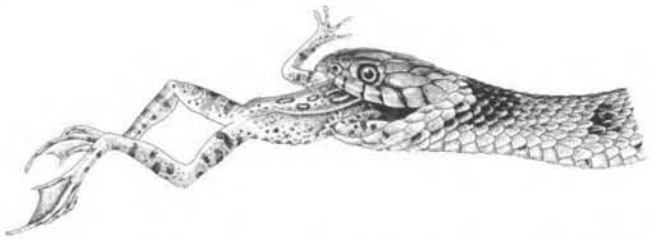
Submitted by **KELLY J. IRWIN**, 1618 Davis Creek Road, Seneca, South Carolina 29678, USA (e-mail: lkirwin@clemson.edu) and **JOSEPH T. COLLINS**, Kansas Biological Survey, 2041 Constant Avenue, Lawrence, Kansas 66047, USA (e-mail: jcollins@ukans.edu).

TRIMORPHODON BISCUTATUS (Lyre Snake, Codorniz). MÉXICO: BAJA CALIFORNIA SUR: Sierra Vizcaíno, Rancho San José de Castro, 27°32'20.3"N, 114°28'18.7"W. 16 September 1999. Bradford D. Hollingsworth. Verified by L. Lee Grismer. LACM-PC 1333. A single juvenile (SVL = 212) was observed at night (2030 h). The most recent herpetofaunal account of the region (Grismer et al. 1994, Bull. So. California Acad. Sci. 93:45–80) reports *Trimorphodon biscutatus* from the Sierra Santa Clara, located 85 km to the SE.

Submitted by **BRADFORD D. HOLLINGSWORTH**, Department of Herpetology, San Diego Natural History Museum, P.O. Box 121390, San Diego, California 92112-1390, USA, and **PATRICIA GALINA-TESSARO**, **ARADIT CASTELLANOS-VERA**, and **ABELINO COTA**, Centro de Investigaciones Biologicas del Noroeste, S.C., Km 0.5 El Conchalito, A.P. 128, C.P. 23000, La Paz, Baja California Sur, México.

VIRGINIA VALERIAE (Smooth Earth Snake). USA: TEXAS: ANGELINA CO: found under a very decayed hardwood log 50 m from the W shore of Kurth Lake, ca. 1600 m east of Rt. 59 and 800 m south of the Angelina River. 28 October 1999. Daniel Saenz (SFAVM 4898). Verified by Michael B. Keck. New county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Press, College Station. 434 pp.).

Submitted by **DANIEL SAENZ**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA, and **KRISTEN A. BAUM**, Department of Entomology, Texas A&M University, College Station, Texas 77843, USA.



Grass Snake (*Natrix natrix*) preying on a Common Frog (*Rana temporaria*). Illustration by P. A. Benson.

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BOOK REVIEWS

Herpetological Review, 2000, 31(1), 59–60.
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Tadpoles. The Biology of Anuran Larvae, edited by Roy W. McDiarmid and Ronald Altig. 1999. University of Chicago Press, Chicago, Illinois. xvi + 444 pp. Hardcover. US $70. ISBN 0-226-55762-6.

ALAN CHANNING
Zoology Department, University of the Western Cape
Private Bag X17, Bellville, 7535, South Africa
e-mail: achanning@uwc.ac.za

The increasing number of workers in the field of tadpole biology will receive this long-awaited book with joy. Here, at last, is a specialist publication, written by a team of 14 international experts, that both provides a review of basic information, and indicates directions requiring further attention.

The book radiates the humor and easy-going nature of the editors, while remaining an accurate scientific publication. It is divided into 12 chapters, a useful glossary, 69 pages of literature cited, and indices of authors, subjects, and taxonomy. Each chapter is complete and could serve as a core text in a course on amphibian larvae, and will no doubt become required reading for these and related vertebrate biology courses.

The introductory chapter by Roy W. McDiarmid and Ronald Altig gives an overview of what a tadpole is, including the meaning of the word 'tadpole' (Middle English for 'the toad that seems all head'). It also reviews tadpoles as research subjects and provides a brief but thoughtful overview of research on tadpoles from the earliest description by Gesner through the modern contributions of North Americans, Europeans, and regional workers in other parts of the world.

Tadpole researchers use a variety of special methods that allow them to capture, preserve, and photograph their study organisms. Chapter 2 by McDiarmid and Altig starts with a review of staging – the sequence of appearance of developmental landmarks that enables comparisons to be made. They discuss problems and suggest methods of fixation and observation, including a range of methods for looking at mouthparts. They offer a number of useful suggestions for illustrating tadpoles, both preserved and live, and conclude with a discussion on rearing the larvae. A table of ecomorphological diversity summarizes much of what is known.

The third chapter, on body plan development and morphology by Altig and McDiarmid, is significant as it proposes a standardized terminology. Presently, workers on different continents, or publishing in different languages, use a variety of terms. This book should rapidly become the standard work on tadpoles, and I believe that the authors will succeed in their desire to simplify the confusing and often contradictory terms available. They go on to discuss the morphology and ontogeny of the major tadpole components. The micrographs and useful explanatory diagrams will enable even a beginner to appreciate the subtle differences in, for example, the position of the vent tube relative to the fin. I was somewhat disconcerted to find that the tadpoles were drawn inverted, with the lower fin at the top of the illustration (Fig 3.5). However, I guess this was Altig and McDiarmid's way of testing the reader! The discussion of the oral apparatus terminology is critical, as this is an area of little agreement in the literature. They present numerous examples to illustrate the discussion and this chapter will surely serve as a baseline for future tadpole descriptions.

David Cannatella's fourth chapter on cranial and axial musculoskeletal architecture starts with a discussion of the early developmental morphology of tadpoles. It covers the skeleton and muscles of the chondrocranium, jaws, hyobranchium, and trunk. The information was derived from taxa as diverse as *Rana temporaria* and *Xenopus laevis*, reflecting the patchy coverage of detailed studies. A table summarizing the literature on tadpole chondrocrania, muscles, and gill apparatus is provided, and will be useful as a starting point for those entering this field. The detailed, well-labeled drawings, of both skeleton and muscles, will be of immense help for students. After the anatomy is discussed, Cannatella moves on to explore how the elements are involved in locomotion, gill irrigation, and jaw movement. The interplay between feeding and gill irrigation is discussed and illustrated with simple diagrams. All those interested in tadpoles will be aware of Orton's four tadpole types. The chapter concludes with an examination of the relationships of these types in terms of previous misinterpretation of larval anatomy and function, in a phylogenetic context. Cannatella suggests that retaining Orton's categories will only hinder our understanding, as the types are not homogenous.

Chapter 5, on the anatomy of the viscera and endocrines, is written by Bruno Viertel and Susanne Richter. Like the previous chapter, the information is based on studies from only a few genera, typically *Rana*, *Bufo,* and *Xenopus*. The authors carefully elaborate the origins, anatomy, function, and where known, the changes at metamorphosis. The circulatory, respiratory, digestive, urogenital, and endocrine systems are discussed. These are explained using clear drawings and micrographs.

Michael J. Lannoo considers the tadpole nervous system in chapter 6. This addresses the questions of how tadpole nervous systems function, what changes at metamorphosis, and which tissues developed in the tadpole are later used in the adult. Lannoo remarks on the variation known in the few taxa that have been studied so far. Detailed descriptions of the spinal cord, brain, and sensory systems are accompanied by excellent drawings. The literature is widely reviewed, and this chapter, like the others in the book, will serve as a useful synthesis. The summary emphasizes that some parts of the tadpole nervous system function only in the tadpole, while other parts are important only in the adult. Paradoxically, some elements are completely changed at metamorphosis, while the majority of neurons do not change at this time.

Although the 'typical' tadpole is a free-swimming, feeding organism, the next chapter on endotrophic anurans by Giselle Thibaudeau and Ronald Altig sets out to explore and document the structure and function of endotrophs—those larvae that obtain their food entirely from parental sources, frequently vitellogenic yolk. Thibaudeau and Altig start by comparing the development of endotrophs, followed by a discussion based on the best known example *Eleutherodactylus coqui*. Anyone who has attempted to follow the development of direct-developing species will be amazed at the volume of information presented, both on morphology and physiology. Because endotrophs are not restricted to open

water, they are able to occupy a range of special habitats. The evolution of endotrophy is considered in a carefully researched section. Endotrophy is compared in many of the lineages in which it is known, concluding with speculation on the genetic mechanisms that might have led to the evolution of direct development.

Frogs have served as model organisms in the study of vertebrate physiology for over a century. Tadpole physiology is well reviewed in chapter 8 by Gordon R. Ultsch, David F. Bradford, and Joseph Freda. The importance of respiration in an aquatic tadpole that later breathes air as an adult is reviewed in terms of hemoglobin function, oxygen uptake, gas exchange, carbon dioxide elimination, and acid-base balance. Gas exchange turns out to be complex in tadpoles, as they may have several sites, like gills, skin, and lungs, where it occurs. Tadpoles may live in habitats from those covered in ice, to those at more than 40°C in the tropics. Temperature tolerance, behavioral thermoregulation, and a host of related topics are reviewed. Many of the interesting examples presented encourage the reader to consult the list of cited literature. Some species are gregarious, and the relationship of thermoregulation and aggregation behavior is reviewed. Tadpole osmoregulation is incompletely known, but nevertheless the current state of knowledge is presented and the reader is pointed to questions that still need to be answered.

Tadpoles do not concern themselves with sex. Chapter 9 by Karin vS. Hoff, Andrew R. Blaustein, Roy W. McDiarmid, and Ronald Altig covers other behaviors associated with development, growth, and survival to metamorphosis. Tadpole behavior is not well studied—in fact many tadpoles in some parts of the world have never been seen. This chapter reviews the behaviors associated with general maintenance (feeding, respiration, thermoregulation, and locomotion), dispersion and within-species interactions (habitat selection, social interactions, kin recognition, and kin association), and sensory abilities and learning (vision, cutaneous senses, and chemical communication). In this very detailed chapter the authors review a wide range of studies and present a balanced interpretation. One example will suffice: The confusion in the literature from 1929 when Vincent Wager speculated on the maternal behavior of the African *Hemisus marmoratus*, has been perpetuated in every review until recently. Finally a correction published by Van Dijk in 1985, followed by field observations by M.-O. Rödel and others in West Africa put the matter to rest. This mess of inaccuracies is carefully documented and set straight.

Ross A. Alford contributed chapter 10 on tadpole ecology. This reviews the literature concerning tadpole habitats and communities (general features, resource use, and effect on resources), growth, development and survival, interactions with predators and competitors, and composition and ecology of species assemblages (density and resource use, field studies, effects of environmental uncertainty). The extensive experimental literature is reviewed and a balanced synthesis results that will be valuable to anyone entering the field of amphibian larval ecology. Tadpoles are widely used as model systems as they can be easily manipulated, and Alford concludes with a discussion of areas in need of further investigation.

Most aspects of the tadpole are covered in some detail in previous chapters, and Reid N. Harris is concerned in chapter 11 with the evolution of the complex anuran life cycle. Why have a tadpole stage? Harris approaches this by looking at the tadpole stage as an adaptation, examining growth and metamorphosis, and reviewing what is known of the ecological genetics of larval traits. The origin and maintenance of a complex life cycle are carefully reviewed. Harris argues that the tadpole is specialized for growth, but notes that several areas require further work.

The final chapter on diversity, another by Altig and McDiarmid, offers a list of pertinent literature with an indication of the presence of keys, a list of previously misidentified tadpoles in the literature, and a condensed summary of all known tadpoles. This consists of abbreviated information on numbers of taxa, geographic range, ecomorphological guild, mouthpart details, morphology, and a drawing of a representative morphotype. This summary will surely encourage new students into the study of tadpole diversity.

The last 100 or so pages of the book are taken up by a glossary, literature list, and indices. The glossary explains terminology and also indicates alternative accepted and unaccepted terms. This book will be a valuable addition to the library of everyone interested in amphibians. As tadpoles are useful model systems, I am sure it will become part of the core literature for all vertebrate biologists.

The book starts with a quote by Kermit the Frog, and I use this opportunity to mis-quote Kermit in conclusion: "When I was a young tadpole growing up back in the swamps, I never imagined that I would one day be discussed by such an outstanding group of scholars."

Herpetological Review, 2000, 31(1), 60–61.
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Los Coquis de Puerto Rico: Su Historia Natural y Conservacion. [The *Eleutherodactylus* of Puerto Rico: Their Natural History and Conservation], by Rafael L. Joglar. 1999. Editorial de la Universidad de Puerto Rico (San Juan, Puerto Rico, 00931-3360, USA; fax 787-751-8785). 232 pp. Hardcover. US $34.95 + postage. ISBN 0-8477-0332-0.

RAFAEL O. DE SÁ
Department of Biology, University of Richmond
Richmond, Virginia 23173, USA
e-mail: rdesa@richmond.edu

As the title indicates, this well-illustrated (115 photographs and 76 illustrations) book summarizes the current knowledge about the natural history of the 16 species of *Eleutherodactylus* inhabiting Puerto Rico. The book consists of eight chapters (including the epilogue) and it is clearly stated that it was written to serve both the scientific community and the nonspecialist reader. The goal of bridging these two audiences is ambitious and usually difficult; however, the book has probably accomplished this goal. The technical reader, i.e., students and professional herpetologists, will find a good summary of data and enough information to continue reading with interest. On the other hand, the nonspecialist reader will not be overwhelmed with technicalities and terminology beyond their reach. Indeed, it is the clear writing for a general audience that gives this book strength; furthermore, this will make the book a good general reference. The latter is important because this anticipated wide use could influence, for years to come, the general public and their approach to the island's environmental and conservation problems.

Chapter 1 serves as an introduction not only to the "world of coqui frogs" but to amphibians in general. The next three chapters represent species accounts for each of the Puerto Rican species of *Eleutherodactylus*. These accounts are most extensive for two species, *E. coqui* (Common Coqui, chapter 2) and *E. cooki* (Guajon or Puerto Rican Demon, chapter 3), the remaining 14 species of *Eleutherodactylus* are included in chapter 4. The more extensive focus on *E. coqui* and *E. cooki* probably results from the author's personal experience and the fact that more information has been accumulated over the years for these two taxa. However, all species accounts include a species description providing details of size, coloration, and morphology. References are given to additional illustrations of these species, and similar species are noted. Following the species descriptions are brief sections on distribution (with clearly-plotted maps) and natural history. The latter consists of data on habitat, behavior, reproduction, call characteristics, egg clutches, development, and other topics. The information on natural history is not uniform across taxa due to a lack of relevant data for several species. The gaps evident from these accounts could serve to guide students in the directions needed to further our knowledge of the basic biology of these species. The penultimate section includes recommendations on conservation and a summary of the current legal status of each species. I found this to be a unique and valuable contribution to the book. In particular it is very informative with respect to observed fluctuations in species populations, past conservation efforts, and responses to these efforts (mostly none!). Each species account ends with a brief section on systematics and nomenclatural history that will be of interest to the technical reader.

The remaining half of the book (chapters 5–7) is an overview of the ongoing research efforts to understand the biology of *Eleutherodactylus* species in Puerto Rico. Chapters 5 and 6, especially, present a variety of information collected by the author's research team over the last decade on species ecology, behavior, demography, conservation, and the effect of natural events (such as Hurricane Hugo) on natural populations. Although the data in these chapters may be of more interest to professional herpetologists and conservationists, it is presented clearly and should also be accessible to the non-specialist reader.

The final chapter, the epilogue, focuses on presenting the nonspecialist reader with an overview of the current environmental crisis and the responsibility that humans have in this crisis. This effort to educate the public is important and should never be dismissed or ignored.

A shortfall of the book is the lack of dichotomous keys to identify the species of *Eleutherodacytlus*. We are told at the beginning that this lack is a conscious effort to avoid the collection and handling of *Eleutherodactylus* for non-scientific or educational purposes. However, dichotomous keys would be a useful addition for the professional audience. Furthermore, if the idea is to protect critical populations and species, then I see a much greater danger in providing distributions maps with detailed plotting of previous collections.

In summary, the book is a welcome addition that brings together a good mixture of new data on the biology of Puerto Rican *Eleutherodactylus* and summary accounts of the status of each species. The book will be an excellent addition to the library of any professional or non-specialist reader interested in Puerto Rican frogs and natural history.

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The Amphibians and Reptiles of Nicaragua: A Distributional Checklist with Keys, by Gunther Köhler. 1999. Courier Forschungsinstitut Senckenberg 213, 121 pp, with 10 plates. (available from Senckenbergische Natuforschende Gesellschaft, Schriftentausch, Senckenberganlage 25, D-6025 Frankfut am Main, Germany). Softcover, DM 55 (approx. US $29.00). ISBN 3-929907-55-0.

JOSEPH R. MENDELSON III
Department of Biology, Utah State University, Logan, Utah 84322-5305, USA
e-mail: sapo@biology.usu.edu

Nicaragua is the largest country in Central America and has the most poorly documented herpetofauna in the region. Although distributional records for some species in the country have appeared in taxon-specific monographs (e.g., Duellman 1970; Myers 1974), the only reasonably comprehensive work for this country is Villa's (1972a) book on amphibians—which is difficult to locate. Consequently, for a country as poorly studied as Nicaragua, any work such as this new book by Gunther Köhler is likely to be of significance to researchers with interests in Middle America.

This book contains brief species accounts for 227 species of amphibians and reptiles known (or suspected) to occur in the country. Each account contains basic taxonomic information, a partial synonymy, general distributional information, and locality data taken from the literature and from specimens examined by the author. Subspecies are not considered in this work, but do appear in the taxonomic synonymies. Keys are presented for the genera in each order, and for each genus with more than one species occurring in Nicaragua. Dot maps are presented for most species and Köhler has carefully used different symbols to indicate locality records based on museum specimens, sight records, and unverified records taken from the literature. Numerous line drawings are used to illustrate specific morphological features mentioned in the keys. The plates contain photographs of general habitat types and 54 species photographed in life. A brief Introduction includes a checklist and list of taxa with type localities in Nicaragua.

The book is generally well typeset, organized, and easy to use. One apparent typesetting error (p. 71) appears to present a species account for the subspecies *Elaphe flavirufa pardalina,* when in fact it is simply an entry in the synonymy. The random taxonomic coverage of species illustrated in photographs suggests that the author used simply whatever was available. Nevertheless, the quality of the photographs ranges from good to excellent. The line drawings generally do an adequate job of illustrating the morphological details mentioned in the keys, but those for the squamate species are of generally much higher quality than those for the amphibians. At least one line drawing (fig. 104, showing details of squamation of *Geophis* spp.) is not referenced in the text and the details shown in figure do not appear in any key; it is not clear why this figure was included. My copy included a few small areas of poor print reproduction, but none so large that any passage was unusable. The maps are clear and well reproduced, but it would have been quite useful to include a map in the Introduction showing the names of the political departments. The writing is generally

good, with few instances of poor grammar or punctuation. One misspelling had "Slovinski" instead of "Slowinski" and one lapsus had "Atlántida Norte" instead of "Atlántico Norte." In all cases, however, the sense of the text is clear and overall the book is quite readable.

In any work involving taxonomy of so many species, the author has difficult choices to make regarding which taxonomic treatments to follow—knowing full well that everyone cannot be pleased. Nevertheless, the author owes the reader a few statements regarding the criteria used in selecting the taxonomy presented; Köhler does not present any such criteria. Consequently we see relatively uninformative, if traditional, taxa such as Iguanidae rather than Phrynosomatidae, Polychrotidae, etc.... used throughout the book. Generic allocations are inconsistent with respect to recent literature, as we see *Celestus* retained instead *Diploglossus,* and *Pliocercus* retained in favor over *Urotheca,* while other recent generic reallocations (e.g., *Cerrophidion* and *Atropoides*) have been adopted. The dipsadine taxon *sartorii* is referred inconsistently to *Sibon* and *Tropidodipsas* in the key, map, map legend, and species account.

The bulk of Köhler's work here—and potentially its most valuable contribution—is found in the checklist and distributional data presented in the maps. However, while Köhler acknowledges eight major museums for access to specimens and records in their collection, we see that nearly every museum record indicated here came from only two collections (The University of Kansas and the Senckenberg Museum). Consequently, I found gaps in distributional data representing specimens I know to exist in, for example, the American Museum of Natural History. Simply put, a week of work in a major herpetological collection will render this book outdated. This is regrettable because it is my opinion that a work such as this should summarize **all** of the existing data, in hopes that it will eventually become outdated as new information is generated by field work. Even more distressing is that a number of records from the scant literature on the Nicaraguan fauna have been apparently overlooked. For example, *Agalychnis callidryas* and *Hyla phlebodes* have both been reported from the Corn Islands (Barbour and Loveridge 1929; Villa 1972b) as have *Micrurus nigrocinctus* and *Elaphe flavirufa* (Dowling 1952; Roze 1967; Villa 1972c); the latter three species are represented by specimens at AMNH. The paper by Roze was cited by Köhler, but those by Barbour and Loveridge, Villa, and Dowling were not referenced in this book.

In the Introduction, Köhler discusses five species that are likely to occur in Nicaragua but have yet to be found there (e.g., *Anotheca spinosa)*; these species are rightfully included in the keys and species accounts. Another ten species, that have appeared on previous checklists for the country, but for which voucher specimens are lacking, are excluded because they are deemed "less likely to be found in Nicaragua." However, the rationale for excluding these latter species is only given in three cases; the remainder are dismissed without comment. Despite these special-case species, several others appear in species accounts for which there evidently are no records from the country (e.g., *Anomolepis mexicanus, Nothopsis rugosus, Pelamis platurus,* and all of the sea turtles). It is not clear why these were treated differently than the other species for which there are no records. Köhler has included these in the Nicaraguan fauna without any apparent data, justification, or commentary. Another species, *Sibon longifrenis,* also lacks any records from Nicaragua, but is included based on reasonable inference from specimens from Costa Rica. In any case, Köhler has been inconsistent with regards to his criteria for including or excluding species of questionable status for the country.

A particularly disturbing aspect of this book is that information from the literature has been presented without properly crediting the original source. In the Introduction Köhler states that the "....keys were modified from important works on the neotropical herpetofauna such as..." and he goes on to list ten citations. Major monographs by Myers (1974) and Duellman (1970) do not appear in this list even though it is clear that information from these works was used in preparing the keys. For example, Köhler's key to species of *Rhadinaea* contains data from scale counts that were clearly taken directly from Tables 6, 11, and 16 in Myers (1974). Each key in this book should have been clearly labeled as having been modified from the specific source. It is not appropriate to simply give broadscale—and incomplete—credit to "major works in neotropical herpetology." Other examples of this problem appear in each species account, where information regarding the geographic distribution of each species appears to have been taken in many cases directly from Peters et al. (1986), but without credit to these authors. In other cases, the original, uncredited source is not at all evident. For example, Köhler stated that *Eleutherodactylus bransfordi* ranges from "Southeastern Nicaragua to central Panama." This is rather detailed information, yet the source of this information is not credited. Because Köhler did not examine any specimens of this species, we cannot attribute this information to his own efforts.

I detected no real errors in this work, but I did find a number of omissions with respect to information that exists in museums and in the literature. Nonetheless, this book does represent a nicely prepared, conservative summary of information regarding the herpetofauna of Nicaragua and therefore will likely be of great use to researchers working in that region.

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Erratum

In HR 30(3):162, the note by Bernarde and Machado contains two errors. *Hyla faber* builds nests in small basins without foam, not in "foam nests" as indicated. The correct spelling of the first author's name is Paulo Sérgio Bernarde. We regret the errors.

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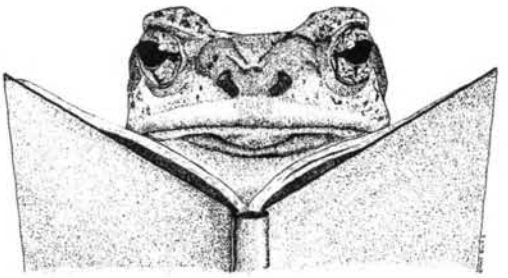
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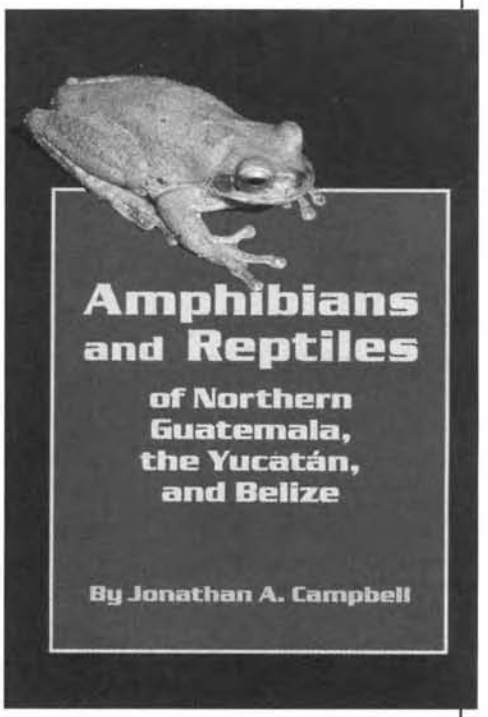
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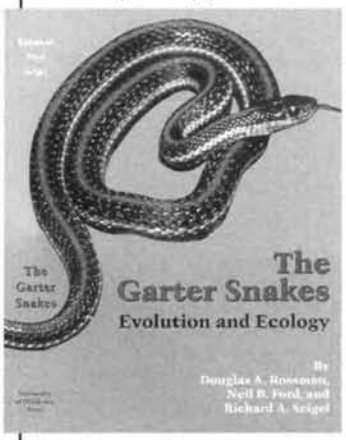


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Shoreview, Minnesota 55126, USA

Catalogue of American Amphibians and Reptiles
ROBERT POWELL, Editor
Department of Natural Sciences
Avila College
Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 327-6190 fax
rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
University of Florida
bowen@gnv.ifas.ufl.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

DARYL R. KARNS
Hanover College
karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
jeffrey_lovich@usgs.gov

SHARYN B. MARKS
Humboldt State University
sbm1@axe.humboldt.edu

JOSEPH R. MENDELSON III
Utah State University
sapo@biology.usu.edu

DEANNA H. OLSON
USDA Forestry Science Lab
dede.olson@orst.edu

GUNTHER KÖHLER
Forschungsinstitut und
Naturmuseum Senckenberg
gkoehler@sng.uni-frankfurt.de

ADAM P. SUMMERS
Museum of Vertebrate Zoology
asummers@uclink.berkeley.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
abauer@mail.villanova.edu

Current Research
JENNIFER M. GARRISON
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
jmg1@ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Kansas Biological Survey
2041 Constant Avenue
Lawrence, Kansas 66047, USA
jcollins@ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
soniak@unt.edu.ar

Legislation & Conservation
TRAVIS J. RYAN
Savannah River Ecology Laboratory
Drawer E
Aiken, South Carolina 29802, USA
ryan@srel.edu

Herpetological Husbandry
WINSTON CARD
Dept. of Herpetology, Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA
winstoncard@sprintmail.com

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
jbh10@psu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
pstone@ucok.edu

Copy Editors: Anna Clarke, Eli Greenbaum, Jeff Parmelee, Jenny Pramuk

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

www.ukans.edu/~ssar



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 2000 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@slu.edu.

Future Annual Meetings

2000 — Universidad Autónoma de Baja California Sur, La Paz, BCS, México, 14–21 June 2000 (Carlos Villavicencio, Chair).
2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 26–30 July 2001

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES
2000 ANNUAL MEETING

together with

AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

and

THE HERPETOLOGISTS' LEAGUE

14 – 21 June 2000
Universidad Autónoma de Baja California Sur, La Paz, BCS, México

La Universidad Autónoma de Baja California Sur is located in La Paz, BCS, in the southern part of the Peninsula, in the Gulf of California. Founded in 1535, La Paz is a small and quiet city, known for good drinks and food services.

Keynote Address: "FROGS, FOSSILS AND PHYLOGENY: A PERSPECTIVE ON THE LAST 140 MILLION YEARS AND PROSPECTUS FOR THE FUTURE," by Linda Trueb, The Herpetologists' League Distinguished Herpetologist for 2000 (The University of Kansas).

Symposium: "ECOLOGY AND EVOLUTION IN THE TROPICS: ESSAYS IN TRIBUTE TO JAY SAVAGE." *Organizers:* Maureen A. Donnelly, Florida International University (donnelly@fiu.edu); Brian I. Crother, Southeastern Louisiana University (bcrother@selu.edu); Craig Guyer, Auburn University (cguyer@acesag.auburn.edu); Marvalee H. Wake, University of California, Berkeley (mhwake@garnet.berkeley.edu); and Mary E. White, Southeastern Louisiana University (mwhite@selu.edu).

Symposium: "PARTNERS FOR AMPHIBIAN AND REPTILE CONSERVATION." *Organizers:* Henry Mushinsky, Department of Biology. University of South Florida. Tampa, Florida 33620-5150, USA; tel. 813-974-5218, fax 813-974-3263: (mushinsk@chumal.cas.usf.edu). Laura Herbeck, North Central Research Station, U.S. Forest Service, 202 Natural Resource Building, University of Missouri, Columbia, Missouri 65211, USA; tel. 573-875-5341 ext. 227. Cynthia Carey. Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA; tel. 303-492-6014.

Symposium: "THE NATURAL HISTORY AND EVOLUTION OF THE HERPETOFAUNA OF SOUTHERN CALIFORNIA AND BAJA CALIFORNIA." *Organizers:* Robert Fisher, USGS-Western Ecological Research Center, SDSU Field Stations, Department of Biology, San Diego State University, San Diego, California 92182-4614, USA; tel. 619-594-8026, fax 619-594-2035 (rfisher@sunstroke.sdsu.edu) and Robert Lovich, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA and Department of Biology, San Diego State University, San Diego, California 92182-4614, USA; (rlovich@sciences.sdsu.edu).

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day throughout the conference.

Meeting Site: SSAR, HL and CAH will meet in the Hotel Araiza Inn Palmira; palmira@balandra.uabcs.mx; tel. 121-6200, fax: 121-6227; International Reservations 1-800-9-ARAIZA, National Reservations 01-800-71-68-777. Other recommended close hotels are: Marina, El Moro, and La Concha (contact details and locational map are provided in the official meeting announcement).

Travel Arrangements: Everyone will need to make their own hotel reservation. The recommended airport is La Paz, but also you can fly into Los Cabos (220 km south), and then rent a car.

Student Travel Award: Ten travel grants of US $200 each will be available for SSAR student members. Refer to page 197 of the December 1999 issue of *HR* for details.

Student Paper Award: Henri Seibert prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the official Meeting Announcement for details.

Social Activities: General Reception at the Municipal Dock, SSAR Auction, SSAR Herp Silent Auction, Beach Barbecue, Graduate Student Reception, and ASIH Banquet.

Multimedia Events: Special Herpetologists' League Illustrated Lecture: "THE AMPHIBIANS AND REPTILES OF BAJA CALIFORNIA AND THE SEA OF CORTÉS," by Lee Grismer. SSAR Presidential Slide Show (presenters and titles to be announced).

Field Trips: Will be arranged to nearby desert areas and islands.

Costs: Preregistration US $185 regular, US $95 student, US $95 accompanying person. After March 15, 2000, costs are US $245, US $135 student.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Further Details: Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of the participating societies in January 2000. Overseas members wishing to receive this information may do so by contacting Carlos Villavicencio Garayzar, Local Chair, Universidad Autonoma de Baja California Sur. A.P.19-B. La Paz, B.C.S., México. CP23080; (cvilla@calafia.uabcs.mx & ASIH@calafia.uabcs.mx), Tel. & fax: 011-52-1-128-0775. Please visit the meeting web site at www.uabcs.mx/asih for additional and updated information.

About Our Cover: *Lachesis stenophrys*



From practically the earliest times that Europeans traveled to Latin America, one of the snakes that galvanized their attention, drawing forth lurid tales of destruction and agonizing death, was the bushmaster (among many, see Bancroft 1769. An Essay on the Natural History of Guiana. T. Becket and P. A. DeHondt, London. 402 pp.). Even recently, articles misrepresenting these imposing reptiles have been published. Bushmasters are nothing if not inspiring.

Despite obvious variation, for years this snake, the greatest of the pitvipers and largest of all venomous snakes in the Western Hemisphere, was regarded as a single species, *Lachesis muta* (Serpentes: Viperidae), with three races: *muta*, *stenophrys*, *rhombeata*, and (later) *melanocephala*. Its distribution, collectively, comprised lower Central America from Nicaragua south through Costa Rica, Panama, Trinidad, and throughout northern South America as far south as Bolivia. But tectonic and glacial events conspired to repeatedly separate and rejoin the primeval forests in which bushmasters make their homes, and because of the ensuing variation among the isolated populations (not to mention the advent of sophisticated techniques for analysis), we now recognize three species of these snakes: *L. stenophrys*, *L. melanocephala*, and *L. muta* (Zamudio and Greene 1997. Biol. J. Linn. Soc. 62:421–442). The last species is wide-ranging and comprises two or more somewhat distinctive races.

The Eastern Bushmaster, *Lachesis muta rhombeata*, is probably endangered, and restricted to the rapidly diminishing rainforests of Brazil's Atlantic Coast, from Ceará south to Rio de Janeiro. The Common Bushmaster, *Lachesis muta muta*, is found throughout the Amazon and Orinocoan Basins. The Black-headed Bushmaster, *Lachesis melanocephala*, is endemic to southwest Costa Rica; its population merits monitoring owing to reduced habitat. The Western Bushmaster, *Lachesis stenophrys*, is distributed from Nicaragua south through Costa Rica and Panama and including adjacent Colombia and Ecuador, east of the Andes mountains (Campbell and Lamar 1989. The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp.).

Bushmasters are magnificent and misunderstood reptiles. They naturally exist in low densities and specimens are seldom encountered in anything but primary rainforest. Owing to their largely sedentary lifestyle, finding a bushmaster is not an everyday event, and most local inhabitants never see them. Bushmasters are large, but, like most aspects of their behavior, their size has been exaggerated, and literature references to four meters or more in length remain unsubstantiated. However, large male bushmasters exceeding three meters are known. Bushmasters are among the few egg-laying pitviper species and they are unique in possessing a tail terminating in a scaly spine.

Usually torpid by day, bushmasters can be alert and formidable when moving from one location to another at night or during breeding season, when males engage in ritual combat and are often awake during daylight hours. So, while most brushes with *Lachesis* involve sluggish animals, sometimes their behavior is quite the contrary. Thus, true stories abound of naive or careless persons free-handling bushmasters with impunity. The occasional story of seemingly unprovoked attack, often with grave consequences, can also be true. It is rare for humans to sustain bites from these snakes, but they are usually serious medical emergencies when they occur because of the relatively long fangs, the potentially large amount of venom injected, and the location of the bite. Many of the vernacular names by which bushmasters are known refer to extreme lethality (ox-killer; silent death in the night, etc.), rugose appearance (pineapple snake, warty snake), or the odd tail (mute rattlesnake).

The specimen depicted on our cover is a 2.2 meter-long, male Western Bushmaster, *Lachesis stenophrys*. It was found in montane rainforest and photographed by **William W. Lamar** in Limón Province, Costa Rica. Lamar used a log-mounted Pentax LX camera, Vivitar Series 1 105mm f/2.5 macro lens, and Fujichrome Provia film. Exposure was at f/22 under natural light during a rainstorm. Lamar, who has worked with bushmasters in six countries, says that they are as misunderstood, and as deserving of protection, as Great White Sharks. Bill resides in Tyler, Texas, but spends much of his time assisting with Latin American wildlife documentaries and conducting natural history tours to Peru, Costa Rica, Ecuador, and Venezuela for **GreenTracks, Inc**. Bill is shown here playing with a spring-loaded model anaconda during filming for a BBC segment in Venezuela.



Separation and imaging of Lamar's photograph is the work of **Jim Bridges** of **Herpeto, Inc.**, Hollywood, Florida.

SSAR BUSINESS

Notice to La Paz 2000 Meeting Attendees

If you have experienced difficulty reaching reservations help, know that you may contact Rebeca Preciado Gregoire, Reservations Department, Araiza Inn Palmira: palmira@balandra.uabcs.mx for reservations. In the SUBJECT line, put: "For Rebeca Preciado Gregoire."

HR Staff Changes

Travis Ryan (Savannah River Lab) is the new Section Editor for Legislation & Conservation, replacing **Jeff Demuth**. **Winston Card** (Dallas Zoo) takes over as Section Editor for Herpetological Husbandry, replacing **Ardell Mitchell**, who has resigned following a nine-year tenure as section editor. **Adam Summers** (Museum of Vertebrate Zoology, UC Berkeley) has joined the ranks of Associate Editors. **Jennifer Garrison** (University of Kansas) has replaced **Anne Maglia** as a Section Editor for Current Research. On behalf of the SSAR Board, the editors thank Jeff, Ardell, and Anne for outstanding service to their colleagues and wish them well in future endeavors.

SSAR Election Results

Results of the recent SSAR election are as follows:

President-elect (to serve as President for a two-year term starting in 2001): ..... *David Green*
Secretary ..... *John Matter (unopposed).*
Treasurer ..... *Robert Aldridge (unopposed).*
For three-year term on Board of Directors:
..... *Karen Lips and Alvin Braswell.*

Amendment to Constitution* ..... *Approved*

*Provides for a two-year term of office for all SSAR Board positions. Refer to HR 30(1):2 for details.

NEWSNOTES

Highlands Biological Station Courses for 2000

Biology of Plethodontid Salamanders (22 May–3 June)—The southern Appalachians are renowned for their diverse salamander fauna. This course acquaints students with plethodontid salamanders and shows how studies of these animals have enhanced our understanding of a series of major evolutionary and ecological topics. This is a lecture, field, and laboratory course that will include discussions of original research papers. The instructor will be Stephen G. Tilley.

Conservation Biology of Amphibians (5–17 June)—This course is designed for advanced students and wildlife professionals interested in understanding the basic processes regulating natural amphibian populations and communities, as well as contemporary problems associated with the conservation of amphibian diversity. Students will participate in a class field project on the effects of forest management practices on woodland salamanders and sharpen their communication skills through individual presentations on selected topics. The instructor will be Raymond D. Semlitsch.

Three semester hours credit at the advanced undergraduate level are available for each course through either Western Carolina University or the University of North Carolina at Chapel Hill. For more information contact: *Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA. Tel. (828) 526-2602, fax (828) 526-2797, e-mail: hibio@wcu.edu, Internet: www.wcu.edu/hibio.*

Museum of Vertebrate Zoology Herpetological Collection Online

The collection of amphibians and reptiles in the Museum of Vertebrate Zoology (MVZ), University of California, Berkeley contains approximately 230,000 catalogued specimens (web site: http://www.mip.berkeley.edu/mvz/ and click on Collections). Of these, 123 specimens have been designated holotypes, 1713 are paratypes, two are syntypes, and three are neotypes. Most specimens are fluid-preserved, but the collection also contains skeletal preparations, sets of amphibian eggs and larvae, and several thousand specimen skeletons are cleared and stained. Other special collections include pineal organs, 800 sectioned heads, a series of dried anuran skins from California and Argentina, and stomach contents that have been removed from more than 3000 predatory reptiles. While the collection contains representatives from every continent, it is unsurpassed in its holdings from western North America and has important series from Latin America and from eastern and central Asia. Taxonomically, it contains representatives of every amphibian and reptile order. Approximately 82% of families and 62% of extant genera are represented.

All MVZ specimen data are now available online at http://elib.CS.Berkeley.EDU/mvz/. For questions please contact: *Museum of Vertebrate Zoology, 3101 Valley Life Sciences Building, University of California, Berkeley, California 94720-3160, USA (tel. 510-642-3567, fax 510-643-8238, e-mail: mvzquery@uclink.berkeley.edu).*

Request for Mexican Herp Literature

Almost two years ago I was asked by Dr. Hobart M. Smith to take over the continuation of the *Synopsis of the Herpetofauna of Mexico* series which consists of seven volumes to date. The literature search for volume seven ended in 1991. I have been collecting citations since then and scanning them for herpetological names from the generic level to the subspecific (if any). My search of the literature from 1991 to the present, with Dr. Smith's help, has yielded 3000+ citations from the scientific and lay literature. "Gray" literature is included when available.

I am requesting the assistance of the herpetological community to send me reprints (originals or photocopies) of papers dealing with the Mexican herpetofauna from 1991 through 1999 and for any references known to have been overlooked in previous volumes so that they may be included. DO NOT send items from the following: *Am. Mus. Novitates, Bol. Soc. Herpetol. Mex., Bull. Am. Mus. Nat. Hist., Bull. Chicago Herpetol. Soc., Caribbean J. Sci., Chelonian Conserv. Biol., Copeia, Herpetologica, Herpetol. Monogr., Herpetol. Rev., HISS, J. Herpetol., Int. Wildl., Marine Turtle Newsl., Nat. Geog. Mag., Nat'l Wildlife, Proc. Biol. Soc. Washington, Proc. Louisiana Acad. Sci., Reptile & Amphibian Hobbyist, Reptile & Amphibian Mag., Reptiles, Smithsonian, Sonoran Herpetologist, Trans. Kansas Acad. Sci., Southwest. Nat., The Vivarium,* and *Tulane Stud. Zool. Bot.*, as I receive these regularly. If any books are involved please provide the bibliographic citation; if I don't have it I will possibly request that it be scanned for names. Please send reprints or direct inquiries to: *Ernest A. Liner, 310 Malibou Boulevard, Houma, Louisiana, USA 70364-2598; e-mail: eliner@mobiletel.com.*

Internet News List of St. Petersburg State University

An e-mail subscription list has been organized under the auspices of the Department of Vertebrate Zoology of St. Petersburg State University (Russia) and the Department of Terrestrial Vertebrates of the Zoological Institute (St.-Petersburg). The List also contains information about current issues of the *Russian Journal of Herpetology* (www.folium.ru/rjh), new books and periodicals in the field, expeditions, job opportunities, grants, fellowships, conferences, and information of general interest. Much attention in the List is given to Morphology, Evolution, Developmental Biology, Speciation, and Palaeontology as these are the areas of interest of the List Owner and his Collegues from the Morphology Team of the Department of Vertebrate Zoology. All interested persons are invited to participate in the list as a subscriber and active participant. To subscribe either visit the homepage of the List at http://morphology.listbot.com or send a blank message to morphology-subscribe@listbot.com. For additional information, please contact the List owner: Yegor B. Malashichev (email: Yegor@EM1915.spb.edu).

Kansas Herpetological Society Annual Meeting

The KHS held its 26th annual meeting on 6 November 1999 at Pratt Community College in Pratt, Kansas, and included attendees from Kansas, Oklahoma, and Nebraska. Gregory Sievert (Emporia State University) received the "Suzanne L. & Joseph T. Collins Award for Excellence in Kansas Herpetology." The prize is awarded for photography in odd-numbered years, and for published contributions in even-numbered years. John Tollefson, an Emporia State University graduate student, was the recipient of the KHS Howard K. Gloyd/Edward H. Taylor Scholarship for a project on the Common Musk Turtle in Kansas. The scholarship honors the memory of two great biologists with strong ties to Kansas. Dwight R. Platt, Emeritus Professor at Bethel College, and graduate student Nicole Gerlanc, Kansas State University, Manhattan, were recognized as the first recipients of "The Big Croaker Awards," sponsored by the Kansas Department of Wildlife and Parks and the Kansas Amphibian Monitoring Program, and given to those individuals involved in the monitoring of amphibian populations during the spring of 1999. Each spring, over 100 KAMP volunteers census choruses of amphibians on eighty 15-mile routes across Kansas, establishing baseline information that will eventually be used to determine whether amphibian populations are declining, increasing, or remaining stable.

Southwestern Research Station Positions And Grants For 2000

VOLUNTEERS—Approximately 30 volunteer positions are open in 2000 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 14 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 2000. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin mid-March 2000 through September 2000. Five-day week; salary $235/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

Wildlife Links: Request for Proposals

The National Fish and Wildlife Foundation, through a cooperative agreement with the United States Golf Association, requests pre-proposals for projects that address wildlife conservation needs on golf courses. Areas of interest include: analysis of management and design techniques for increasing biodiversity on golf courses; research to determine if certain habitat characteristics result in wildlife corridors or barriers on golf courses; preparation of management guidelines for specific species or species suites; programs to monitor the success of wildlife habitat conservation programs on golf courses; and the effects of golfer and maintenance activities on wildlife. All projects must address issues of direct management concern to the golf industry, and should provide management recommendations applicable on at least a regional basis. Applicants selected to submit full proposals will be required to list contact information for partnering golf courses. Request should not exceed $30,000 per year, yet multi-year funding is possible. Deadline for preproposals is Friday, July 21, 2000. Applicants will be notified in August if a full proposal is requested. Full proposals will be due in October 2000, with funding available in February of 2001. For Wildlife Links preproposal guidelines, please visit the Wildlife Links program page on the National Fish and Wildlife Foundation's website, www.nfwf.org/nfwfusga.htm.

Rossman Retires from LSU

Douglas A. Rossman, Curator Emeritus at the Louisiana State University Museum of Natural Science, Baton Rouge, has retired from that institution and moved to Decorah, Iowa, where he has been appointed Research Associate in Biology at Luther College.

He continues to actively pursue research in snake systematics (especially on *Thamnophis* and *Helicops*), and he would welcome an ongoing exchange of ideas and reprints with colleagues. Correspondents may contact him at the Department of Biology, Luther College, Decorah, Iowa 52101, USA; tel. (319) 387-0988.

MEETINGS

International Roundtable on Chelonians: Heritage Collection Development, Restocking, and Relocation: 18–20 April 2000

Organized by the Ashton Biodiversity Research & Preservation Institute and the Desert Tortoise Council, and sponsored by the Chelonian Research Foundation, this three-day International Roundtable on Chelonians will be held immediately prior to the Desert Tortoise Council's Silver Anniversary Meeting in Las Vegas, Nevada (USA). The Roundtable Meeting will consist of presentations made by both Roundtable Members and by selected speakers. The goal of the International Chelonian Roundtable is to produce a very practical Protocol from which relocation and heritage collection programs can be planned, carried out, and evaluated using current knowledge. The Protocol will include both tortoises and turtles (excluding sea turtles). The target audience for the Protocol includes government conservation officials, conservation organizations, protected and natural areas managers and planners, animal welfare organizations, project managers, environmental consultants, private and public collection managers, and local community leaders. Registration and hotel reservation information may be obtained by contacting the conference organizers: Ghislaine Guyot or Ray Ashton, Ashton Biodiversity Research & Preservation Institute, Inc., 5745 SW 75th Street #331, Gainesville, Florida 32608, USA; fax 352-495-7433; tel. 352-495-7449; e-mail: GhGuyot@aol.com or Tortfarm2@aol.com.

Meetings Calendar

1–2 April 2000—All Florida Herpetology Conference, Florida Museum of Natural History, Gainesville, Florida. For more information contact Max Nickerson, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (e-mail: maxn@flmnh.ufl.edu).

18–20 April 2000—International Roundtable on Chelonians: Heritage Collection Development, Restocking and Relocation. Las Vegas, Nevada, USA. *(Refer to meeting announcement above for details).*

15–20 May 2000—Workshop of Herpetologists, Tbilisi, Georgia. Contact: Prof. Zurab Tskvitinidze, Chairman, Society of Ecological Security, 150, Ave. David Agmashenebeli 380012, Tbilisi, Georgia; e-mail: ses@ip.osgf.ge or nhdc@ip.osgf.ge. Tel: (995032) 95-01-20, 96-78-38, 34-20-80, 38-74-56.

14–20 June 2000—43rd Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists, Universidad Autónoma de Baja California Sur, La Paz, BCS, México. *(Refer to meeting announcement on page 1 of this issue).*

11–15 July 2000—Sixth Biennial Joint Meeting of Portuguese and Spanish Herpetologists and the Tenth Biennial Congress of the Spanish Herpetological Association, Valencia, Spain. For more information contact: VI Congreso Luso-Espanol, X Congreso Espanol de Herpetologia, Departamento de Biologia Animal, Facultad de Ciencias Biologicas, Universidad de Valencia, 46100 - Burjasot, Valencia (Spain); e-mail: herp2000@uv.es. Web site: http://bioweb.uv.es/zoologia/AHE.

16–20 July 2000—Fourth Asiatic Herpetological Conference, Chengdu Institute of Biology, Chinese Academy of Sciences, Chengdu, China. For more information contact: Dr. Theodore J. Papenfuss, Museum of Vertebrate Zoology, Berkeley, California 94720-3160, USA; tel. (510) 642-3567; fax: (510) 643-8238; e-mail: asiaherp@uclink4.berkeley.edu.

LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles and their habitats. Please direct all communications to the section editor, **Travis Ryan** (postal and e-mail addresses on inside front cover).

USA: U.S. Fish and Wildlife Service—Office of Scientific Authority: On 12 November 1999 the Office of Scientific Authority—United States Fish and Wildlife Service submitted a proposal requesting that the spotted turtle (*Clemmys guttata,* Schneider 1792) be included in Appendix II of C.I.T.E.S. Briefly, the differences in Appendix I vs. II are the following: taxa listed in Appendix I are those species threatened with extinction, and are at present, or in the future, adversely affected by international trade. In general, Appendix I species are prohibited from entering international trade for commercial purposes. Conversely, Appendix II species may be traded internationally for commercial purposes, if all specimens are legally acquired and proper documentation is provided. Species categorized as Appendix II include those that may become threatened in the near future if international trade is not brought under strict control; therefore, such trade can not be detrimental to the species in question (USFWS 1998, *What you need to know about CITES permits & certificates. Fact Sheet Series, Office of Management Authority*). Trade in wildlife is a lucrative business that exploits numerous species both as living specimens and products. The importance of C.I.T.E.S. is clear. It is a conservation tool that assists with the controlled regulation of trade in endangered species and without it many species would perish. Therefore, the proposal concerning *Clemmys guttata* was drafted to circumvent a future Appendix I listing. This proposal will be evaluated and voted upon at the 11th meeting of the Conference of the Parties (COP11) in Nairobi, Kenya on 10–20 April 2000. A final statement expressing the outcome of the vote will be presented after adjournment of the convention. This proposed action was initiated by several factors, and these are mentioned below.

Spotted turtle habitats have been increasingly encroached upon

by urbanization and agricultural activities, and few areas remain unaltered. Specifically, habitat alteration and fragmentation can be caused by the introduction of invasive exotic plant species, grazing of livestock, draining and filling of wetlands, damming, ecological succession, and pollution. These events, if not curtailed, will only continue to add to the demise of this species (Behler 1996, Spying on Spotties. Wildlife Conservation 99[5]:38–45; Ernst et al. 1994, Turtles of the United States and Canada, Smithsonian Institution Press).

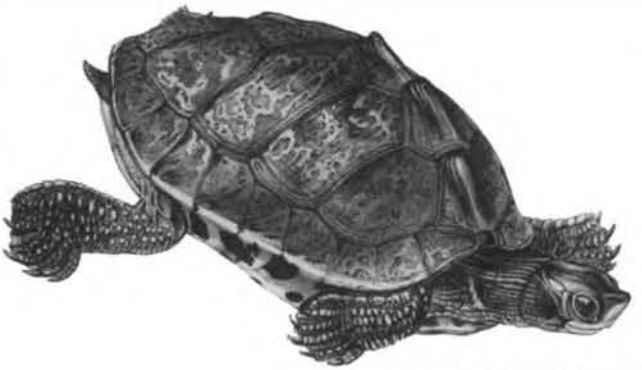
The Nature Conservancy (Heritage Distribution Ranking System) classified the spotted turtle as critically imperiled, imperiled, or vulnerable in 64% of its range (Data adapted from the Natural Heritage Central Databases, 1999). This, when compounded with low population densities, slow growth, delayed maturity, and high mortality of eggs and juveniles, makes *Clemmys guttata* especially vulnerable to population declines (Wilson et al. 1999, [Abstract] Symposium on the Conservation and Ecology of Turtles of the Mid-Atlantic Region).

Commercial trade at both the national and international levels is a problem. In a five-year period the United States has legally exported over 1200 adult specimens to overseas markets (*Note: 1999 data are incomplete; Data from USFWS-Division of Law Enforcement*). However, this estimate may be considered low due to undocumented or illegal activities. The domestic pet trade numbers are difficult to quantify; however, it has been suggested that a commercial collector in North Carolina legally took over 1100 spotted turtles over a two-year period (1993–94) (USFWS 1999, Proposal 11.37-Inclusion of *Clemmys guttata* in Appendix II). Over-collecting has been a concern in many states. Herpetologists and conservationists in Ohio and Indiana have expressed their concerns since the 1970s and 1980s, respectively. Legal, as well as illegal trade continues to impact spotted turtle populations, and such trade has been suggested to be responsible for population declines in 50% of the species' range (Litzgus 1996, Life-history and demography of a northern population of spotted turtles, *Clemmys guttata*. M.S. Thesis, University of Guelph).

Clemmys guttata qualifies for an Appendix II listing under the terms of the Resolutions of the Conference of the Parties 9.24, which states that, "Article II, paragraph 2(a), provides for the inclusion of species which may become threatened with extinction in Appendix II, in order to avoid utilization incompatible with their survival" (http://www.cites.org). This is explained in a brief summary below. Because the spotted turtle faces several threats, including international trade, it can be inferred that unless trade is regulated, it will meet minimally one of the biological criteria for an Appendix I listing. In addition, harvesting from the wild has a detrimental impact on the species by exceeding the level that it can be sustained indefinitely, thus further reducing population levels, to a point where the species can not rebound.

Additional information about this and other proposed listings can be obtained by visiting the C.I.T.E.S. website at http://www.cites.org/CITES/eng/index/shtml.

Questions regarding this notification should be directed to the author: Thomas P. Wilson, MSN 3E1, Department of Biology, George Mason University, Fairfax, Virginia, USA. Tel: 703/993-1044, e-mail: twilson3@gmu.edu.



JUST REISSUED

SOWERBY & LEAR'S

TORTOISES, TERRAPINS, and TURTLES

This book is generally regarded as **THE FINEST ATLAS OF TURTLE ILLUSTRATIONS EVER PRODUCED**, drawn by the famous 19th century artists James de Carle Sowerby and Edward Lear. The short text is by John Edward Gray. Originally published in London in 1872, the book was reprinted by the Society for the Study of Amphibians and Reptiles in 1970 and again in 1984 but these copies were sold out some years ago. The reprint includes an extensive introduction by the late Ernest E. Williams, of Harvard University, detailing the history of the book and its authors and artists, and equating the scientific names to current nomenclature.

The atlas includes 61 black-and-white plates of turtles, depicting species from all parts of the world. The book measures 8½ by 11 inches (about 22 by 28 cm) and is clothbound. Copies can be purchased for US$40 ($35 to SSAR members, if ordered before June 2000) from the SSAR Publications Secretary, Robert D. Aldridge, Department of Biology, Saint Louis University, 3507 Laclede, St. Louis, Missouri 63103–2010, USA. Postage is extra (in USA, add $3.00; non-USA, add $5.00). Payments can be made on USA banks, by International Money Order, or may be charged to MasterCard or VISA (include account number and expiration date of credit card). Books can also be ordered by e-mail at ssar@slu.edu.

SSAR also publishes *Journal of Herpetology, Herpetological Review, Facsimile Reprints in Herpetology, Herpetological Circulars, Catalogue of American Amphibians and Reptiles, Contributions to Herpetology,* and *Herpetological Conservation*. Inquiries about membership in the Society can be addressed to Dr. Aldridge (address above). A complete list of SSAR publications can be consulted at http://www.ukans.edu/~ssar/. Prices are effective through December 2001.



Testudo marginata. Illustration by P. A. Benson.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, **Jennifer Garrison** or **Christopher Sheil**; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.herplit.com/contents

Emergence Time of *Lacerta monticola* from Refugia

Martín and López studied variation in the emergence time of *Lacerta monticola* from refugia in the field, under different levels of predation risk. The authors present a special case of the Ydenberg and Dill model that describes the trade-off between risks and costs for prey fleeing to a refuge. Their model predicts that emergence time of *L. monticola* (or other ectotherms) from a refuge should vary as a function of risk of predation and thermal costs of refuge time. Field experiments support the conclusion that optimization of refuge utilization strategies might help lizards to deal with changes in predation risk without incurring excessive physiological costs.

MARTÍN, J., AND P. LÓPEZ. 1999. When to come out from a refuge: risk-sensitive and state-dependent decisions in an alpine lizard. Behavioral Ecology 10(5):487–492.

Correspondence to: J. Martín, Departamento de Ecología, Museo Nacional de Ciencias Naturales, CSIC, José Gutiérrez Abascal 2, 28006 Madrid, Spain; e-mail: Jose.Martin@mncn.csic.es.

Female Preference for Temporal Order of Call Components in *Physalaemus pustulosus*

The authors employed a Bayesian statistical approach to study female preferences for temporal relationships of the two parts of advertisement calls of conspecifics in *Physalaemus pustulosus*. Advertisement calls in this Neotropical frog are comprised of a whine (necessary for species recognition) and one or more chucks (which make the whine more attractive to females). Tests were conducted to compare the attractiveness of a whine with a chuck in a variety of positions relative to the start of the whine, against a normal whine or against a normal whine/chuck. Results of their experiments suggest that female *P. pustulosus* do have preferences for the temporal relationship of the two parts of the male advertisement call and that this preference exceeds the vocal signals produced by males. They also suggest that male calls have evolved to exploit one peak of this function.

WILCZYNSKI, W., A. S. RAND, AND M. J. RYAN. 1999. Female preferences for temporal order of call components in the túngara frog: a Bayesian analysis. Animal Behaviour 58:841–851.

Correspondence to: W. Wilczynski, Department of Psychology, 330 Mezes Hall, University of Texas, Austin, Texas 78712, USA; e-mail: wilczynski@psy.utexas.edu.

Phenotypic Plasticity in Metamorphosing *Rana temporaria*

Phenotypic plasticity is a common phenomenon in nature that has been documented in many taxa. The authors examined tadpoles of *Rana temporaria* to determine whether or not they would exhibit phenotypic plasticity in metamorphic traits. Developing larvae were studied in laboratory experiments and were found to metamorphose sooner, and at smaller sizes, in response to decreasing water volume. Tadpoles were also less active in decreased water levels. It was determined that there was a positive correlation between activity late in the experiment and size at metamorphosis. Tadpoles also were found to develop more slowly in the presence of predators (dragonfly larvae). The authors conclude from their results that *R. temporaria* larvae do respond to pond-drying adaptively by increasing developmental rates, that temperature advantage is not needed to induce this adaptive plasticity, and that pond-drying is a more important determinant of developmental rate than is the presence of dragonfly predators.

LAURILA, A., AND J. KUJASALO. 1999. Habitat duration, predation risk and phenotypic plasticity in common frog (*Rana temporaria*) tadpoles. Journal of Animal Ecology 68:1123–1132.

Correspondence to: A. Laurila, Department of Population Biology, Evolutionary Biology Centre, Uppsala University, Norbyvägen 18d, S-752 36, Uppsala, Sweden; e-mail: annsi.laurila@evolution.uu.se.

Phylogeography of *Emys orbicularis*, the European Pond Turtle

Mitochondrial nucleotide sequences of the cytochrome *b* gene were analyzed by DNA sequencing and RNA heteroduplex analysis to infer the phylogeny and phylogeography of *Emys orbicularis*. This analysis of 423 individuals revealed incredible intraspecific differentiation in 20 haplotypes with distinct geographic ranges. Seven main lineages were identified within this species, and the authors suggest that this may reflect separations during the late Pliocene. Haplotype distribution revealed a substantial effect of glacial periods. The authors also suggest that this historical perspective indicates the existence of multiple glacial refugia, as well as considerable Holocene range expansion that was modulated by climatic traits.

LENK, P., U. FRITZ, U. JOGER, AND M. WINKS. 1999. Mitochondrial phylogeography of the European pond turtle, *Emys orbicularis* (Linnaeus 1758). Molecular Ecology 8:1911–1922.

Correspondence to: P. Lenk, HMR Deutschland GmbH, DG Metabolism, Bldg H825, D-65926 Frankfurt am Main, Germany; e-mail: Peter.Lenk@hmrag.com.

Phylogeography of *Lampropeltis zonata*, the California Mountain Kingsnake

Rodríguez-Robles et al. studied the phylogeography of *Lampropeltis zonata* by examining mitochondrial DNA sequences from specimens belonging to seven recognized subspecies collected throughout the range of the species. Their analyses identified a basal split that corresponds to the southern (i.e., southern California and northern Baja California, Mexico) and northern segments of the species' distribution. Within the northern clade, the authors identified two subclades, a "coastal" subclade (populations from the central coast of California, as well as the southern Sierra Nevada Mountains of eastern California), and a northeastern subclade (populations north of the San Francisco Bay and the majority of the Sierra Nevada). These results suggest that the two deepest divergences within *L. zonata* may be the result of past seaways in southwestern California and the embayment of central California, both likely candidates as barriers to gene flow. The northern clade has apparently undergone instances of range contraction, isolation, differentiation, and then expansion followed by secondary contact. Recognition of seven geographical races in *L. zonata* may not be appropriate, owing to their lack of diagnosibility using conventional criteria of pattern and scalation differences as well as the lack of congruence with patterns of mtDNA differentiation.

RODRÍGUEZ-ROBLES, J.A., D.F. DENARDO, AND R.E. STAUB. 1999. Phylogeography of the California mountain kingsnake, *Lampropeltis zonata* (Colubridae). Molecular Ecology 8:1923–1934.

Correspondence to: J. A. Rodríguez-Robles, Museum of Vertebrate Zoology and Department of Integrative Biology, University of California, Berkeley, California 94720-3160, USA; e-mail: javier@socrates.berkeley.edu.

Ontogeny of the Bizarre

Trueb et al. describe the skeletal morphology and ontogeny of the direct-developing frog, *Pipa pipa*, based on observations of alcohol-preserved museum specimens. Osteologically, adult *P. pipa* may be distinguished from other pipids by its extremely depressed and hyperossified skull; however, the authors found the general sequence of chondrification and ossification to resemble that of another basal anuran, *Xenopus laevis*. Allometric transformations that result in the morphologically bizarre skulls of adults of this species were found to commence after metamorphic climax (marked by resorbtion of the tail), and ontogenetic comparisons reveal that the sacrum forms differently in *Discoglossus sardus, Silurana tropicalis,* and *P. pipa*.

TRUEB, L., A. PÜGENER, AND A. M. MAGLIA. 2000. Ontogeny of the bizarre: an osteological description of *Pipa pipa* (Anura: Pipidae), with an account of skeletal development in the species. Journal of Morphology 243:75–104.

Correspondence to: L. Trueb, Natural History Museum and Biodiversity Research Center—Dyche Hall, The University of Kansas, Lawrence, Kansas 66045-2454, USA; e-mail: trueb@ukans.edu.

The Influence of Habitat Structure on Migrating Juvenile Amphibians

The authors investigate the effects that different levels of canopy closure have on the movements of juvenile amphibians dispersing into upland habitats. Natural populations of Wood Frogs (*Rana sylvatica*) and Spotted Salamanders (*Ambystoma maculatum*), as well as artificial populations of *R. sylvatica* were monitored for four months using mark/recapture and pitfall traps in both linear and circular arrangements. The natural populations were located adjacent to a recent forest clearcut, where experimental pools were placed bordering a power line right-of-way. In all cases, juveniles were found to emigrate preferentially to closed-canopy habitat. In natural populations, where adult density was also monitored, the adults of both species were more abundant in mature forest interior habitats than in either edge or clearcut habitats. Density of foliage in both the understory and canopy layers was found to be important to anuran density and diversity. Management implications include the importance of habitat connectivity between upland and breeding habitat for migratory populations of amphibians. The authors suggest further investigation be undertaken on a larger scale to determine the effects of canopy removal on genetic and demographic characteristics of similar populations.

DEMAYANDIER, P. G., AND M. L. HUNTER, JR. 1999. Forest canopy closure and juvenile emigration by pool-breeding amphibians in Maine. Journal of Wildlife Management 63(2):441–450.

Correspondence to: Phillip G. deMayandier, Department of Wildlife Ecology, University of Maine, Orono, Maine 04469, USA; e-mail: demaynad@umenfa.edu.

Effects of Land Use on Anuran Abundance

Anuran call surveys and land use maps were used to examine landscape-level patterns of habitat use by frogs and toads in Iowa and Wisconsin. The authors measured landscape variables including land use (e.g., amount forested, presence of urban land and area of permanent and temporary wetlands), amount of edge, and fractal patch dimensions. Multiple regression and principal components analysis (PCA) were employed to determine the effects of individual landscape variables on anuran abundance and richness, and on guild associations, respectively. The strongest correlations were between urban land use and anuran guilds in both states (negative), and a positive correlation between forests (both upland and wetland) and emergent wetlands and anurans. The authors stress the importance of determining such landscape-level relationships between habitat and anuran abundance and species richness in efforts to reverse the widespread amphibian decline. They suggest that the definition of these areas will allow a prioritizing of sites for conservation and restoration.

KNUTSON, M. G., J. R. SAUR, D. A. OLSEN, M. J. MOSSMAN, L. M. HEMESATH, AND M. J. LANNOO. 1999. Effects of landscape composition and wetland fragmentation on frog and toad abundance and species richness in Iowa and Wisconsin, U.S.A. Conservation Biology 13(6):1437–1446.

Correspondence to: Melinda G. Knutson, Upper Midwest Environmental Sciences Center, U.S. Geological Survey, 2630 Fanta Reed Road, La Crosse, Wisconsin 54603, USA; e-mail: melinda_knutson@usgs.gov.

The Influence of Historical Factors on the Community Ecology of Amazonian Lizards

Contrary to the often-held belief that present-day factors (e.g. competition, predation) drive patterns of community structure, the authors found historical factors exerted the greatest influence on the lizard assemblage in the Curuá-Una in the central Brazilian Amazon. The nineteen co-occurring species were found to separate on the basis of micro-habitat and prey type, but not on the basis of time (of activity). The dietary similarities were correlated with phylogenetic similarities, while microhabitat similarities were not. The authors regard these results as suggestive of an historical impetus for the current community structure. The lizards found at this site are from a variety of families, suggesting that historical factors may play a more important role in phylogenetically deeply rooted assemblages than in those that are more shallowly rooted.

Habitat niche breadth was found to be a poor predictor of dietary niche breadth. Ecological factors that allow for species to coexist may have been present before the species came into contact with one another. If true, this could reduce the importance of in situ species interactions. This study investigates several niche axes (time, space, food) quantitatively, in an evolutionary framework.

VITT, L. J., P. A. ZANI, AND M. C. ESPÓSITO. 1999. Historical ecology of Amazonian lizards: implications for community ecology. Oikos 87:286–294.

Correspondence to: Laurie J. Vitt, Oklahoma Museum of Natural History and Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019-0606, USA; e-mail: vitt@ou.edu.

Drinking Mechanisms in Two Iguanid Species

The authors investigated the hypothesis that iguanid species found in areas with different patterns of water availability would utilize different drinking mechanisms. The study animals were the arboreal species *Anolis carolinensis*, found in the southern United States, and *Oplurus cuvieri*, of northwestern Madagascar. While water is constantly available to *A. carolinensis*, it is only seasonally plentiful for *O. cuvieri*. The kinematic analysis using x-ray and high-speed cinematography film revealed a similar drinking mechanism used by both species when water is rare. However, whereas *A. carolinensis* uses the observed pattern regardless of water availability, when water becomes more available, the role of the tongue in the process of water collection and swallowing is diminished in *O. cuvieri*. The authors suggest that this, and further studies, will allow for the modeling of the evolution of the lingual and hyoid elments.

WAGEMANS, F., M. CHARDON, J.-P. GASC, S. RENOUS, AND V. L. BELS. 1999. Drinking behaviour in *Anolis carolinensis* (Voigt, 1837) and *Oplurus cuvieri* (Gray, 1831) (Reptilia: Iguania: Iguanidae). Canadian Journal of Zoology 77:1136–1146.

Correspondence to: F. Wagemans, Laboratory of Functional Morphology, University of Liége, Bâtiment de chimie, B6, Sart Tilman, 4000 Liége, Belgium; e-mail: F.Wagemans@student.ulg.ac.be.

Origin of Clouded Salamanders on Vancouver Island and a New Species of *Aneides*

Jackman uses genetic evidence (both allozymes and mitochondrial DNA) to establish that populations of *Aneides ferreus* (Clouded Salamander), which are widespread on Vancouver Island and nearby smaller islands, are nearly identical with those from an area in northwestern California. Jackman makes a case for introduction of salamanders to Vancouver Island via extensive shipments of Tan Oak bark during the nineteenth century. Historical records of shipments and the methods by which bark was gathered and stored prior to shipment lend support to Jackman's hypothesis. Additonally, the genetic evidence indicates that California and Vancouver Island populations are distinct from those in Oregon, and in an appendix, Wake and Jackman describe these as a new species, *Aneides vagrans*. The two species meet and narrowly overlap in extreme northwestern California, and there is evidence of some introgression, but no clear hybrid individuals have been identified.

JACKMAN, T. R. 1999 (1998). Molecular and historical evidence for the introduction of clouded salamanders (genus *Aneides*) to Vancouver Island, British Columbia, Canada, from California. Canadian Journal of Zoology 76:1570–1580.

Correspondence to: Todd R. Jackman, Department of Biology, Villanova University, Villanova, Pennsylvania 19085, USA; e-mail: todd_jackman@villanova.edu.

The Use of Electronic Temperature Devices In Thermoregulation Investigations

A replicated experiment was used to test the ability of electronic temperature recording devices to generate measurement series similar to those produced using standard copper models of lizards. The authors tested both an external probe device (HOBO XT™) and a self-contained (Tidbit™) temperature recording device against models constructed of copper and painted with acrylic paint to represent *Sceloporous undulatus* and *Scincella lateralis*. The temperature probes were both found to produce results almost identical to those obtained from the more expensive and complex copper models. This suggests that the electronic devices might be effective as proxies for biophysical models in some investigations, and that size, morphology, scale architecture, and color contribute little to temperature change in the models of small vertebrates. Pilot studies of these devices should be performed in investigations of other animals, as the present study focuses exclusively on small-bodied lizards. The authors advise that the external probes provide excellent null temperature distributions, but do not respond as quickly to temperature change as copper models or Tidbits.

VITT, L. J., AND S. S. SARTORIUS. 1999. HOBOs, Tidbits and lizard models: the utility of electronic devices in field studies of ectotherm thermoregulation. Functional Ecology 13:670–674.

Correspondence to: Laurie J. Vitt, Oklahoma Museum of Natural History and Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019-0606, USA; e-mail: vitt@ou.edu.

OBITUARIES

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Ernest Edward Williams 1914–1998

CARL GANS
Department of Biology
The University of Texas, Austin, Texas 78712, USA
e-mail: carolus@uts.cc.utexas.edu

On 1 September 1998 died Ernest E. Williams, long the Curator of Herpetology at the Museum of Comparative Zoology at Harvard College. He was born in Easton, Pennsylvania on 7 January 1914 and his death marked the end of an era of spectacularly diverse herpetological researches at the Museum.



Photograph by M. Graham Netting, courtesy of Kraig Adler.

Ernest was a very private person; even those of his students who knew that he would visit relatives in Pennsylvania at the end of the year did not know details of the relationship nor had they met the relatives. In Cambridge, his residence proved to be in various sets of furnished rooms and he subsidized local restaurants all within walking distance of the Museum. The available kinds of mixed alcoholic beverages provided a key for the selection of restaurants. Visitors would be taken to lunch at whatever the current restaurant of choice; these were mostly located in the vicinity of Harvard Square. Graduate students were generally permitted to join these lunches, which were highly desirable events for them, as beyond the current visitors, lunch might include the company of A. S. Romer and Brian Patterson, and later of Ben Shreve. The conversations were generally wide-ranging and questions were encouraged. Beyond these lunches, Williams developed the pattern of arranging spectacular parties, designed in part to reciprocate the hospitality of colleagues. Often the execution was turned over to graduate students and their companions, but Ernest always provided an open purse and maintained quality control.

Ernest had spent much of W.W. II with the U.S. army in Europe. Whereas he rarely talked about this period, one was reminded thereof as he had obtained the stamp of the registrar's office of a German village and this became the "Ex libris" of the M.C.Z. herpetological library. After discharge from the army, he matriculated at Columbia under William King Gregory and after the latter's untimely death, became the student of G. G. Simpson. His dissertation topic was the neck skeleton of turtles, later published on in the American Museum *Bulletin* and these animals Recent and fossil provided Ernest with many research topics for the following decade.

In 1950, Ernest moved to Cambridge to become Assistant Professor with Alfred Romer, mainly assisting in teaching the famous Comparative Anatomy course. He also loosely supervised some of Romer's students, such as Thomas S. Parsons and Paulo E. Vanzolini. Furthermore, he collaborated with Arthur Loveridge who had long curated the Museum's herpetological collections. Their monograph of the African cryptodire turtles (published as a M.C.Z. *Bulletin*) proved a hallmark in African herpetology, although their viewpoints were hardly congruent [see footnote on the first page]. 1957 marked Loveridge's retirement from the curatorship and move to Saint Helena. Harvard appointed Karl P. Schmidt as head of the succession committee and Williams was appointed to take over the curatorship that fall. The occasion was marked by a new card gracing the entry to the main herpetology office and proclaiming that "persons bearing turtles will be received."

The implication of this announcement proved to be very much of an overstatement, as Ernest had personal interest in many other topics, involving a wide range of organisms and many, generally evolutionary, research topics. It seems useful to mention pattern variation of *Hyla crucifer*, and *Plethodon cinereus* as these and many other distinct evolutionary studies were never completed. With Tom Parsons he carried out reports on the dentitional patterns of the three major groups of amphibians. A bit later he revisited the embryologic and phylogenetic pattern of the vertebral column of amphibians and reptiles, an issue that had long been confused by reliance on Hans Gadow's notes, which had regrettably been published in a posthumous book. As critical as Ernest's eclectic research interests was Ernest's willingness to supervise and help with the research by many undergraduate and graduate students on a very wide range of topics. He was known to concentrate on the project being presented and to offer his full attention during oft-extended discussions, no matter how long it took. I shall never forget the two full days during which he dissected the "final" version of my dissertation and the resulting and to me astonishing improvement he generated.

Ernest liked to write and took great pride in polishing his products. His expository style was concise and subtle and has been referred to as inspirational. Whatever, he was unexcelled in his ability to summarize areas and crisply to state the issues involved. The resulting summaries were often less than kind whenever they addressed the failings of students, colleagues or administrators. Ernest's ability to handle the English language was clearly associated with his enormous capacity for the consumption of literature, both highbrow and profane.

Ernest gradually changed the pattern of collection acquisition for herpetology as he encouraged students to acquire major sets of specimens from diverse regions. He concurred that it was critical to collect and store series of specimens, rather than individual exemplars. Some such materials could be obtained as he had Mr. Benjamin Shreve member of a distinguished Boston family who served for decades as an unpaid volunteer herpetologist in the department. Shreve's willingness and ability to identify materials and to publish on individuals of new forms increased the capacity

of the MCZ to handle small collections. Whereas, Mr. Loveridge had been severely limited in the funds available to him and had consequently restricted the magnitude and number of exchanges, Ernest managed to overcome this limitation, in part by use of grant [and personal] funds. Repeatedly he hosted visitors [such as Ray Laurent from Zaire] for protracted periods and helped them with their research, also trying to obtain some portion of the collections involved for the MCZ. A special example of this help and exchange procedure involved the extensive collections of Fred Parker from Papua New Guinea and the Solomon Islands. Fred had failed to interest other curators, but Ernest accepted the collections and the responsibility of dealing with them. He arranged for the publication of large portions thereof, but [with Parker's permission] also transferred series to other museums. Many frogs went to the American Museum and snakes to the California Academy of Sciences.

The result of these activities was that the Museum's collections increased from 72,550 to 303,925 during his tenure. These numbers hardly characterize the importance of the collections, which included many types and representative examples of vast African holdings. These resources allowed Ernest to collaborate with the paleontologist Richard Estes and he allowed the students of Estes to prepare skeletal materials even of rare species. Estes' several later monographs of lizard systematics derive primarily from these materials. Some time in the nineteen seventies the collections achieved the benefit of a full-time collections manager, under an NSF grant and July 1977, marked the advent of Mr. José Rosado, who not only cared for the museum materials, but appreciated Ernest as a person and helped him extensively during his final years as his health became more fragile.

During the first years of his curatorship, Ernest became deeply interested in the fauna and biogeography of the Caribbean islands. This led to a concentration on iguanid lizards, particularly on the genus *Anolis*. As his studies expanded he published an "Anolis Newsletter," initially planned as progress reports to the National Science Foundation. Even a brief scan of these reports showed the vast range of Ernest's interests, zoogeography, ethology, morphology, whatever were grist for his mill. Many ecological and zoogeographical principles were thus exemplified. The historical account in the SSAR "Contributions to West Indian Herpetology" provides an excellent overview of the importance to the Caribbean studies, both in the work Ernest carried out himself and in his encouraging the efforts of many students and other colleagues. Issues of island zoogeography were expanded with the aid of collaborative studies with P. E. Vanzolini that stressed issues of continental zoogeography. Indeed he had discussed his plans for a volume of zoogeography, but this never came to fruition. Another topic that remained in draft stage was an enormously ambitious analysis of lizard scalation using scanning microscopy; some hundreds of notebooks filled with photographs still remain unpublished.

After the academic program at Harvard allowed it, he started to teach a single course entitled "Biology of Amphibians and Reptiles," which was basically herpetology from the perspective of evolutionary biology and taught the course from the point of view of contemporary problems. Not only did this allow the students to recognize current problems, but it kept the course fresh and interesting for himself. The rich resources of the department, both literature and specimens, underpinned the course.

Although he was not a joiner, or meeting goer, and the large number of students he supervised never came to be seen as a "school," a concept that amused him, he did receive numerous recognitions, such as a Guggenheim Fellowship. A volume in his honor (edited by A. Rhodin and K. Miyata) appeared upon his retirement in 1980, and the diversity of the 68 contributors and of their chapter topics documents the breadth of his interests [the incorporated biographical statement by P. E. Vanzolini contains an interesting and somewhat different viewpoint of his professional career.] Ernest remained as a half-time Professor until his official retirement in June 1984. Throughout his career he was a scholar with diverse interests. He had an outstanding influence on many herpetologists and other biologists, on students and colleagues, not only because of his scholarly publications, but also through his discerning and stimulating discussions. We all learned much from him.

LETTERS TO THE EDITOR

Herpetological Review, 2000, 31(1), 11–12.
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Annual Meetings

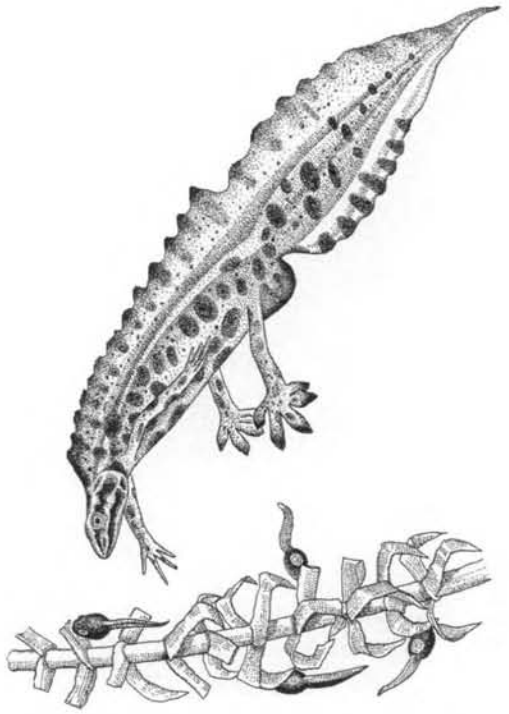
HENRY R. MUSHINSKY
Department of Biology, University of South Florida
Tampa, Florida 33620, USA
e-mail: mushinsk@chuma.cas.usf.edu

So, where will the next annual herpetology meeting be held? Did you go to the annual herp meetings at Pennsylvania State University this past summer? Are you planning to go to the meetings in La Paz, Mexico next June? What about the 2001 annual meeting scheduled for Indianapolis; will you go to that one? As many of you who read *Herpetological Review* already know, attending the annual meeting of herpetologists is always rewarding, informative, and just plain fun. For most, the annual meeting is a chance to renew oneself, an opportunity to recharge. Annual meetings provide a venue to see old friends, past graduate committee members, and former students. For students and other neophytes to the field of herpetology, an annual meeting provides an opportunity to meet, face to face, the authors of the papers and books they have read. Virtually without disagreement, those who attend and participate in the annual herpetology meetings leave the venue feeling refreshed, rejuvenated and ready to meet the next set of challenges. You have had the opportunity to publicize your research, get some informal feedback, and incorporate the ideas of your colleagues into your research. You also have had the opportunity to learn what others in the field are doing a year or two before you will have the chance to read about the research results in your favorite journal. The reasons for attending annual meetings of herpetologists are manifold and varied, but virtually all who go are glad they did.

Consider this essay your personal invitation to get more involved with your fellow herpetologists, by hosting an annual meeting at your institution. As Chair of the Meeting Site Selection Commit-

tee for both the Society for the Study of Amphibians and Reptiles and The Herpetologists' League, I invite you to get involved. While hosting an annual meeting is a large responsibility that requires considerable planning and forethought, the rewards for a well-executed meeting are equally large. You get an opportunity to showcase your university, to put your research laboratory on the national herpetological map, and to entice students to apply to work with you. Depending upon location and timing, a typical SSAR/HL meeting will attract between 400 and 600 individuals. Many relatively small universities can readily accommodate groups of this size during the summer months. I and others who have gained experience running annual herp meetings are very willing to help you organize your meeting and will provide any needed guidance.

One comment heard frequently at recent annual meetings has been that the high costs of the meeting are preventing graduate students from attending, a trend that likely will continue at the La Paz and Indianapolis meeting sites as well. Meeting in large hotels or conference centers causes the costs to be much higher than the more traditional meetings held on a college campus. You can help yourself and your professional societies by getting involved in our annual meetings. Please give this invitation your serious consideration. If interested, please contact me at the email provided above. I look forward to working with you to create the best meeting ever.



Triturus vulgaris (Smooth Newt) stalking *Rana temporaria* (Common Frog) tadpoles. Illustration by P. A. Benson.

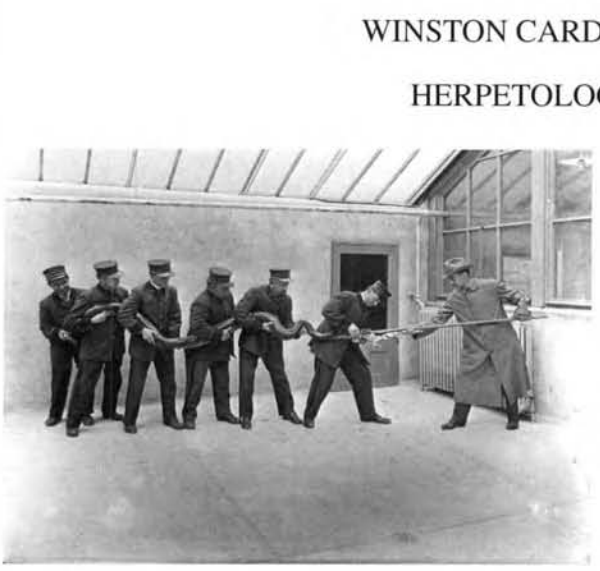
A New Herpetological Circular from the Society for the Study of Amphibians and Reptiles

LINEAGES AND HISTORIES OF ZOO HERPETOLOGISTS IN THE UNITED STATES

BY

WINSTON CARD AND JAMES B. MURPHY

HERPETOLOGICAL CIRCULAR 27



This new publication provides a complete lineage of over 200 zoo herpetologists and keepers for 57 US zoos. An historical section provides short vignettes of all retired zoo herp curators dating back to Arthur Brown in 1876, and includes 54 photos, most of which have never been published. Card and Murphy offer new insights into the world of zoo herpetology. iii + 44 pages. ISBN 0-916984-51-6. February 2000.

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ARTICLES

Herpetological Review, 2000, 31(1), 13–15.
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How Many Reptile Species?

PETER UETZ
Department of Genetics, University of Washington
Box 357360, Seattle, Washington 98195, USA
e-mail: uetz@u.washington.edu

Vertebrates are certainly the best-studied animals of which most species have been identified. Accordingly there are comprehensive compilations that list all known 4675 mammal species (Hutterer 1995; Wilson and Reeder 1993), all 9702 birds (Sibley and Monroe 1993), 4780 amphibians (Duellman 1993; Frost 1985; Glaw and Köhler 1998) and 23,250 fish (Eschmeyer et al. 1998). Nevertheless, new fish, amphibians, and reptiles continue to be described at a rate of about 200, 80, and 60 species per year, respectively (Bauer 1999; Eschmeyer et al. 1998; Glaw and Köhler 1998; this work). Two comprehensive lists of reptile species have been attempted recently (Ananjeva et al. 1988; Frank and Ramus 1995) which list 7712 and ~6700 reptile species, respectively. However, both have shortcomings: they are mere lists of names that do not distinguish between original and secondary names (Frank and Ramus 1995) or do not give the year of description (Ananjeva et al. 1988); they do not list synonyms, statistics, or distributional data; and they provide no references to individual species. Finally, as with most printed lists, corrected updates are not forthcoming and likely would soon be out of date again. Interestingly, misconceptions about the diversity of reptiles persist. For example, two randomly selected textbooks on biodiversity (Becher 1998:92; Margulis and Schwartz 1998:331) mention the existence of 6300 and 5000 reptile species, respectively. The latter number neglects 37% of all described species!

To overcome such shortcomings we started an online database of reptile species about four years ago (Uetz and Etzold 1996). This list currently contains 7870 extant reptile species and provides not only synonymies and distributional data, but also attempts to give references for every species. The database has been assembled mainly from published monographs and checklists and from submissions by individual contributors. Currently, it contains original references for about 75% of the known reptile species and provides links to photographs of more than 1000 species on the World Wide Web. Eventually the database should serve as a guide to descriptions and keys in the literature or even contain them as online information. Together with the recently established amphibian species checklist (http://www.mabnetamericas.org/; see also http://research.amnh.org/herpetology/amphibia/index.html), this database completes the lists of more than 50,000 vertebrate species names that are available online.

The majority of reptile species are the lizards (4470 species) and snakes (2920), whereas the turtles (295), crocodiles (23), and tuataras (2) represent only 4.1% of all living reptiles. 51% of known reptile species belong to one of only three families: the colubrid snakes (about 1850 species), the skinks (1200), and the geckoes (1000). Fig. 1 summarizes the assignment of extant reptile species to their families. Furthermore, I assembled a preliminary world reptile diversity map that illustrates species richness in different geographic areas of the world (Fig. 2). The database is easily queried for individual countries or subordinate areas, although incomplete data yield more erroneous results for national and subnational regions like states or provinces.

I am aware that such a database will never be complete, simply because new species are constantly being discovered and because new phylogenetic insights lead to taxonomic and nomenclatural rearrangements. Furthermore, species concepts in herpetology changed, especially with the influential paper of Frost and Hillis (1990), who proposed adoption of an evolutionary species concept (ESC) as opposed to the hitherto used biological species concept (BSC). The ESC suggests the recognition of "diagnosable" evolutionary units or populations as species. This suggestion led to the elevation of many subspecies to species status. Unfortunately, the ESC has been applied very unevenly and often without proper study and therefore many taxonomic and nomenclatural changes will follow. In fact, this is also true for other vertebrates such as birds (Haffer 1997). The increasing popularity of molecular studies is another factor that will cause significant rearrangements and nomenclatural changes within many taxa, simply because morphological analysis often does not resolve the phylogenetic relationships between both distantly and closely related taxa or even gives contradictory results (see for instance Hedges and Poling 1999). Retrieval of DNA sequence data from the reptile species database is facilitated by its location on the European Molecular Biology Laboratory server which not only hosts GenBank and related databases but also uses the same query interface.

The EMBL Reptile Database (http://www.embl-heidelberg.de/~uetz/LivingReptiles.html) is a starting point for further developments. Its shortcomings can be overcome by regular review by specialists. Collaborations with several herpetological societies are currently being negotiated. Until decisions are reached, I solicit all systematic herpetologists to communicate taxonomic changes as well as errors or omissions.

Acknowledgments.—The database described here could not have been realized without the help of many individuals, too many to list here but who are listed on the database's website. I thank Gerard Cagney, Bill Duellman, Jakob Hallermann, Ray B. Huey, Mirco Sole Kienle, and George Zug for helpful comments on earlier versions of this manuscript.

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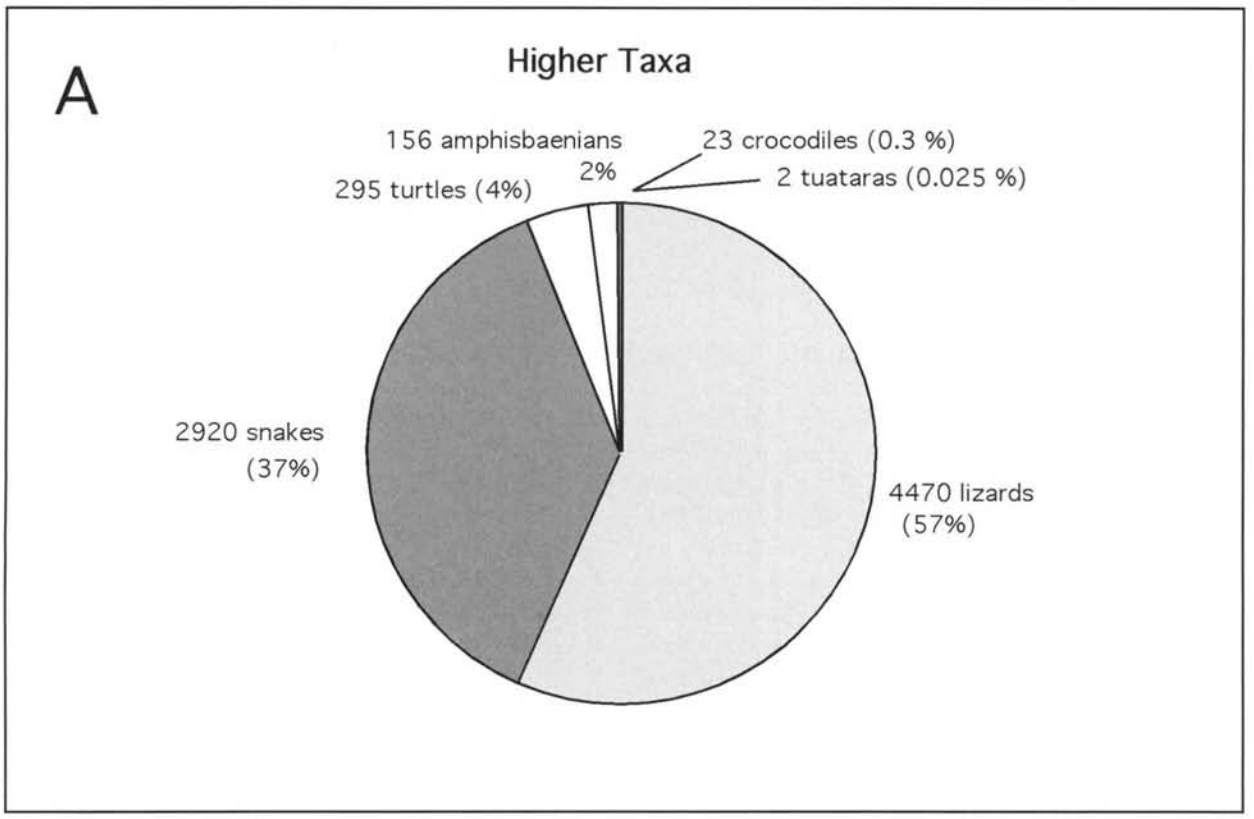
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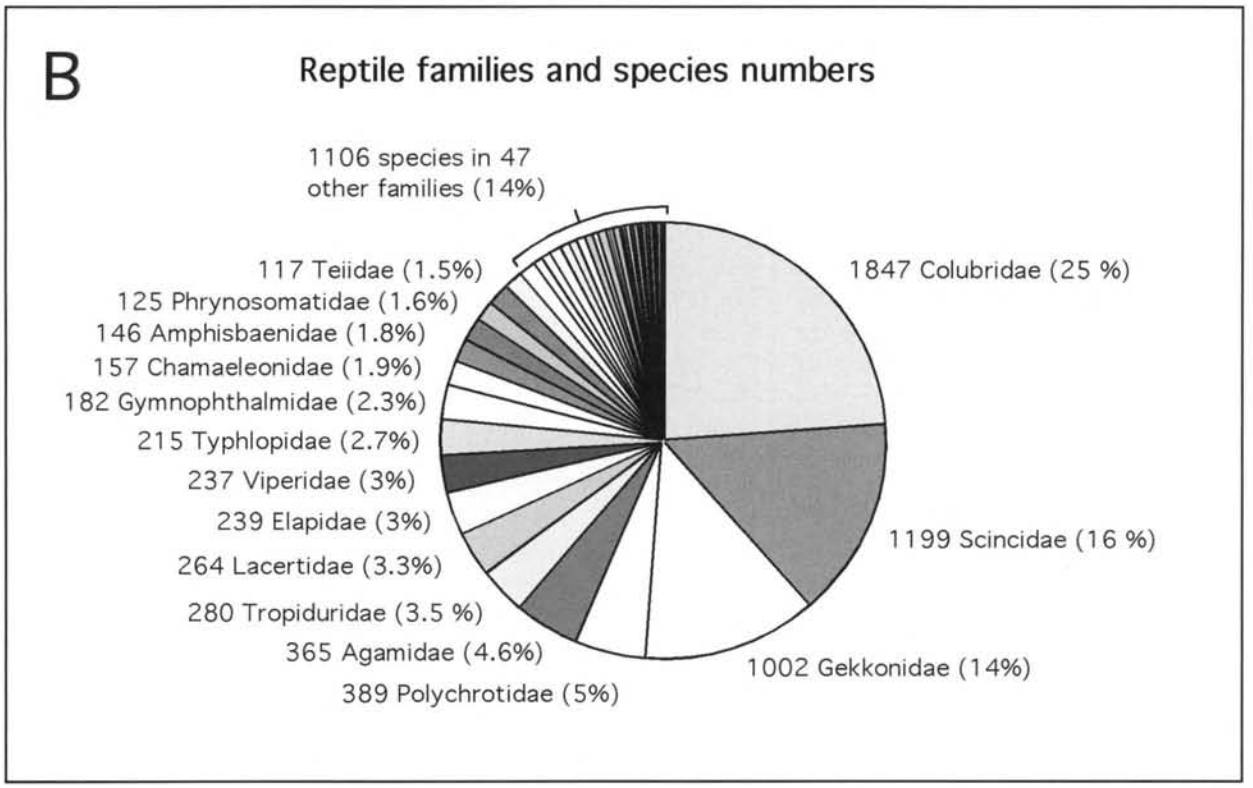


FIG. 1. Absolute species numbers and their percentage of the major extant reptile families. A. Higher taxa. B. Individual families. This chart uses a rather traditional classification with the Gekkonidae containing the Eublepharidae but not the Pygopodidae. The iguanian families have been split according to Frost and Etheridge (1989). Some authors have suggested reverting to the traditional family "Iguanidae" (e.g., Macey et al. 1997), which would form the fourth-largest family with 865 species. Elapidae and Hydrophiidae are treated as separate families. Numbers for the smaller families can be retrieved from our web site. The numbers are available at our web site and will be updated regularly.

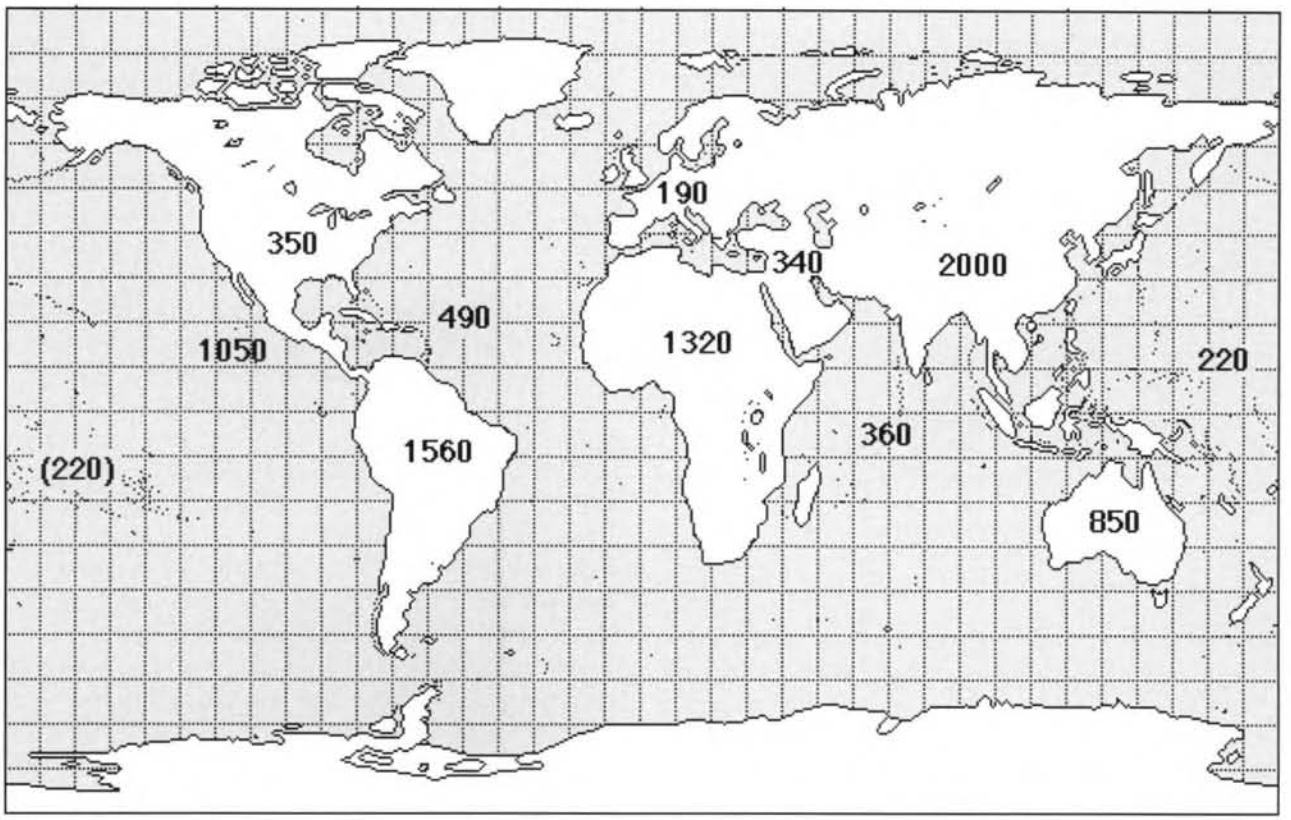


FIG. 2. Species numbers for different continents or geographic areas: Africa (1320), Asia incl. New Guinea (2000), Australia (850), Caribbean (490), Europe incl. Canary Islands (190), Indian Ocean incl. Madagascar, Comoros, etc. (360), Middle America (1050), Near East incl. Iran, Iraq (340), North America (350), Oceania incl. New Zealand (220), South America (1560). The sum of these numbers (8750) exceeds the total number of species (7870) because some species occur in several of these areas (e.g., 125 species occur both in Panama and Colombia, i.e., Middle and South America). Numbers in the figure have been rounded to the nearest 10. Numbers for individual countries can be found online in the EMBL Reptile Database. This map is available at the web site and will be updated with future releases of the database.

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Great Diving Beetle larva (*Dytiscus marginalis*) consuming Common Frog (*Rana temporaria*) tadpole. Illustration by P. A. Benson.

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Diet of the Midland Painted Turtle (*Chrysemys picta marginata*) on Beaver Island, Michigan

JOHN W. ROWE
Natural Sciences Department, Daemen College
Amherst, New York 14226, USA
e-mail: jrowe@daemen.edu

and

WILLIAM PARSONS *
Department of Biology, Central Michigan University
Mount Pleasant, Michigan 48588, USA

**Present address: Department of Conservation*
Little River Band of Ottawa Indians, P.O. Box 314
Manistee, Michigan 49660, USA

A substantial degree of broad and local scale geographic variation in life history traits (e.g., body size, age and size at maturity, egg size, clutch size and frequency) has been documented in the painted turtle (*Chrysemys picta*)(Iverson and Smith 1993; Lindeman 1996; Rowe 1994, 1997). Painted turtles are generally omnivorous (Ernst et al. 1994) and high degrees of carnivory may be positively related to growth rates, body size, and reproductive output among populations of painted turtles (Gibbons 1967; Gibbons and Tinkle 1969; Lindeman 1996; MacCulloch and Secoy 1983). Recently, Lindeman (1996) summarized the literature on painted turtle dietary habits and found extreme carnivorous or herbivorous populations throughout the range of the species. In order to attribute some of the variation in life history traits to variation in dietary habits of painted turtles, we clearly need more data on the diets of painted turtles throughout their distribution (Lindeman 1996).

We studied the dietary habits of adult midland painted turtles *(Chrysemys picta marginata)* at Miller's Marsh on Beaver Island (W85°30.89'; N45°38.06') located in northern Lake Michigan, USA. Miller's Marsh was a small marsh system (max depth approx. 1.5 m and about 4–5 ha in surface area) with dominant submergent vegetation that included *Nuphar variegatum*, *Potamogeton amplifolius*, and *P. natans*. We collected painted turtles in baited fyke nets between 30 June and 5 July, 1994 and between 5 June and 2 August, 1995. Upon capture, carapace length was measured to the nearest 1 mm using calipers, body mass was measured to the nearest 10 g using a spring scale, and stomach contents were obtained by stomach flushing (Legler 1977). A weed spray can was used to deliver water through a rubber tube (0.5 cm diameter) that was inserted through the mouth and into the stomach. Turtles were held by hand and a rubber stopper was used to keep the turtle's mouth open during flushing. Stomach contents were collected in a screen strainer and placed in 10% formalin until processing. We conducted flushing on each turtle until we were reasonably sure that no more food would be obtained. To evaluate the efficacy of our flushing technique, we dissected three males after obtaining positive flushes and found that one individual had a minute quantity of filamentous algae adhered to the mucosa of the stomach. We otherwise found no measurable quantity of food in the stomachs which indicates that our flushing technique was probably a reliable way of obtaining food samples. Samples were later sorted, taxa identified, separated into animal and plant matter, and then dried in an oven for 24 h at 75°C. To determine the amount of organic material present in the diet, the dried samples were weighed to the nearest 1 mg and burned in a furnace at 550°C for 1.5 h to determine ash free dry mass (Steinman and Lamberti 1996) measured to the nearest 1 mg.

We obtained prey items from 35 (11 in 1994; 24 in 1995) of 48 turtles flushed. Mean (± 1 SD) carapace length and body mass were 151.1 ± 7.46 mm (112–162 mm) and 417.3 ± 77.41 g (190–580 g) respectively for females (N = 21) and 139.6 ± 5.07 mm (132–145 mm) and 320.7 ± 53.68 g (220–340 g) respectively for males (N = 14). Frequencies of ingested prey items are presented in Table 1. The most frequently ingested animal prey were damselfly larvae (Zygoptera) and caddisfly larvae (Tricoptera), each present in about one third of all stomach samples. Other aquatic insect larvae or pupae were of lesser importance and included dipterans, especially midge larvae (Chironomidae; up to 168 individuals per stomach), dragonflies (Anisoptera), and beetles (Dytiscidae). A few adult insects were also eaten, particularly back swimmers (Notonectidae) and bees (Hymenoptera). Crustaceans were not a substantial dietary component although a few stomachs contained cladocerans (>1000 per stomach in one individual turtle) and an occasional scud (Amphipoda). Vertebrates were not frequently ingested although we did find some aquatic salamanders (two *Ambystoma laterale* larvae and one adult *Notophthalmus viridescens*) and an anuran tadpole. The most frequently ingested plant material was unidentified plant material and detritus although *Nuphar variegatum* seeds (up to 140 per stomach) and pulp were found in about 50% of all stomach samples. Filamentous algae was represented in only about 11% of all stomach samples.

The painted turtles of our population were omnivorous. On a frequency of occurrence basis, plants and animals were ingested with about equal frequency (plants: 83.3% of all stomachs vs. animals: 77.8 % of all stomachs; $\chi^2_{df=1} = 2.1$, $P > 0.05$). Both animal and plant matter were found in 21 of 35 stomachs although some stomachs contained only animal matter (N = 6) or only plant matter (N = 8). On an ash free dry mass basis, the percent of animal versus plant material expressed as the total quantity of food ingested was 18.2% and 81.8% respectively. However, this disparity probably reflects the effects of a few stomachs that contained substantial quantities of *Nuphar variegatum* and it should be noted that the seeds of *Nuphar variegatum* are apparently not digested as evidenced by their presence in turtle feces. The average percent of plant ash free dry mass in individual stomachs was 52.4% (SD = ± 0.44%, N = 35) while animal material represented the other 47.6% (SD = ± 0.44 %, N = 35). There was no significant difference in the amount of animal versus plant ash free dry mass consumed by individuals (Wilcoxon signed-rank matched pairs test, $P = 0.46$).

A number of animal and plant prey items have been reported for *C. picta* (see Ernst et al. 1994 and Lindeman 1996) and our sample seems fairly typical for the species. Our painted turtles were probably active predators that obtained much of their food by foraging along the soft benthos or aquatic vegetation for aquatic insect larvae and occasionally catching adult arthropods or amphibians as was observed by Sexton (1959). Cladocerans have been reported

TABLE 1. Frequency of occurrence of prey items expressed as a percentage of the total number of stomachs (N = 35) that contained a particular prey item in *Chrysemys picta*. Adult = a, larva = l, pupa = p, and UID = unidentified.

Taxon	Frequency of Occurrence (%)
ANIMAL MATERIAL	77.8
Insects	
Odonata	52.8
Anisoptera	19.4
Zygoptera	33.4
Diptera	38.9
Chironomidae (l)	19.4
UID (a)	2.8
UID (l)	2.8
UID (p)	13.9
Tricoptera	33.4
UID insects	19.4
Hemiptera	27.7
Corixidae (a)	8.3
Notonectidae (a)	19.4
Coleoptera	8.3
Dytiscidae (l)	8.3
Nematoda	16.7
Vertebrates	11.2
Salamandridae (a)	5.6
Ambystomatidae (l)	2.8
Anura (l)	2.8
Cladocera	8.3
Amphipoda	5.6
PLANT MATERIAL	83.3
UID plant	52.8
Nuphar	50.0
Algae	11.1

previously in the diets of painted turtles (Brown 1992; MacCulloch and Secoy 1983). Juvenile *C. picta* apparently ingest cladocerans individually (Brown 1992) although because our turtles were relatively large adults, we doubt whether the large numbers of minute cladocerans were ingested individually. More likely, turtles located aggregates of cladocerans and ingested several simultaneously by forming a vacuum with the pharynx. While adult aerial insects, such as flies and bees, may have been scavenged after they fell into the water, it is possible that some prey were eaten by extending the head from the water and capturing stationary prey located on overhanging vegetation as we have observed on three separate occasions.

It is often difficult to determine whether plant matter is ingested incidentally with animal prey or is the primary food item (Lindeman 1996). The relatively large quantity of *Nuphar variegatum* present in our samples however, indicates that this plant matter was intentionally ingested. Turtles apparently ate the flower heads when the aging stems bent and allowed the formerly upright flower heads to become submerged. However, some unidentified decomposed vegetation and small quantities of small unidentified fresh plant particles may have been incidentally ingested during the consumption of animal prey.

A number of factors are likely to influence variation in the dietary composition within and among painted turtle populations. Lindeman (1996) detected seasonal effects in Idaho and Washington western painted turtle populations. In our population, such seasonal effects probably occurred as aquatic insect pupae metamorphosed early in summer and *Nuphar variegatum* flower heads became available and then deteriorated later in the summer. While we did not statistically account for seasonal effects, our samples were obtained throughout the summer months and so our data should be representative of the dietary habits of the adults of our population during that time period. Because it is difficult to stomach flush small individuals, we were unable to address whether juveniles were more carnivorous than adults as has been observed in other populations (Gibbons 1967) but not others (Lindeman 1996).

Acknowledgments.—We thank J. C. Gillingham and Central Michigan University Biological Station for laboratory space and logistic support during the study. We also thank R. Ballinger, G. Smith, R. King, D. Wujek, and B. Young for their assistance during preparation of the manuscript. The study was funded partially by the Faculty Research Funds at Daemen College.

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Lizards of Cayo Pisaje, Dominican Republic, Hispaniola

MELISSA L. YESKA
Department of Biology, Wayne State College, Wayne, Nebraska 68787, USA

ROBERT POWELL*
and
JOHN S. PARMERLEE, JR.
Department of Natural Sciences, Avila College
Kansas City, Missouri 64145, USA

** Author to whom all correspondence should be addressed;*
e-mail: powellr@mail.avila.edu

Cayo Pisaje is a small key (0.29 km^2) located 0.35 km off Punta Regalada near the town of Juancho on the eastern coast of the Barahona Peninsula, Dominican Republic (Fig. 1). The island, with a maximum elevation of <3 m, supports five different habitats: 1) sandy beach littered with flotsam; 2) high tide limits, representing an area of integradation between short scrub and beaches and dominated by sea purslane *(Sesuvium portulacastrum)*; 3) short scrub; 4) arborescent areas composed of mangrove trees *(Rhizophora mangla)* and sea grapes (*Coccoloba uvifera*); and 5) a grassy depression, centrally located and retaining water at least during the rainy season. The mean temperature of Enriquillo, a coastal town, situated ca. 9 km to the north, is 26.9°C, and the mean annual rainfall is 1349.2 mm (Salcedo et al. 1983). Precipitation in the area follows a bimodal pattern, one wet season occurring in the late spring, the other in late summer/early fall. The island is uninhabited although unoccupied campsites, used occasionally by fishermen, are present.

Schwartz and Henderson (1991) listed three lizard species from this island: *Leiocephalus barahonensis barahonensis, Aristelliger expectatus,* and *Sphaerodactylus randi strahmi*. This number seemed low in light of the island's proximity to the main island and in comparison to the number of species in adjacent areas on the main island. We spent 22 person hours on Cayo Pisaje on 14 June 1999 in order to survey the herpetofauna. Only a few voucher specimens of each species encountered were collected in order to minimize any impact on island populations; all were deposited in the Bobby Witcher Memorial Collection (BWMC) at Avila College.

We found three species of lizards, representing three families. *Anolis brevirostris wetmorei* had not been recorded previously. We failed to find one species, *Sphaerodactylus randi strahmi,* listed by Schwartz and Henderson (1991).

Leiocephalus barahonensis barahonensis (Tropiduridae) is a xerophilic to mesophilic species of moderate size (Schwartz and Henderson 1991). This generalist/opportunist consumer (Micco et. al. 1997 [1998]) was common all over the island, especially on the beach, where it probably was taking advantage of arthropods associated with human refuse. *Aristelliger expectatus* (Gekkonidae) is a small, xerophilic species often associated with trees (Schwartz and Henderson 1991). A number of individuals were observed under the loose bark of stumps and fallen trees. *Anolis brevirostris wetmorei* (Polychrotidae) is a sun-tolerant trunk anole (Williams

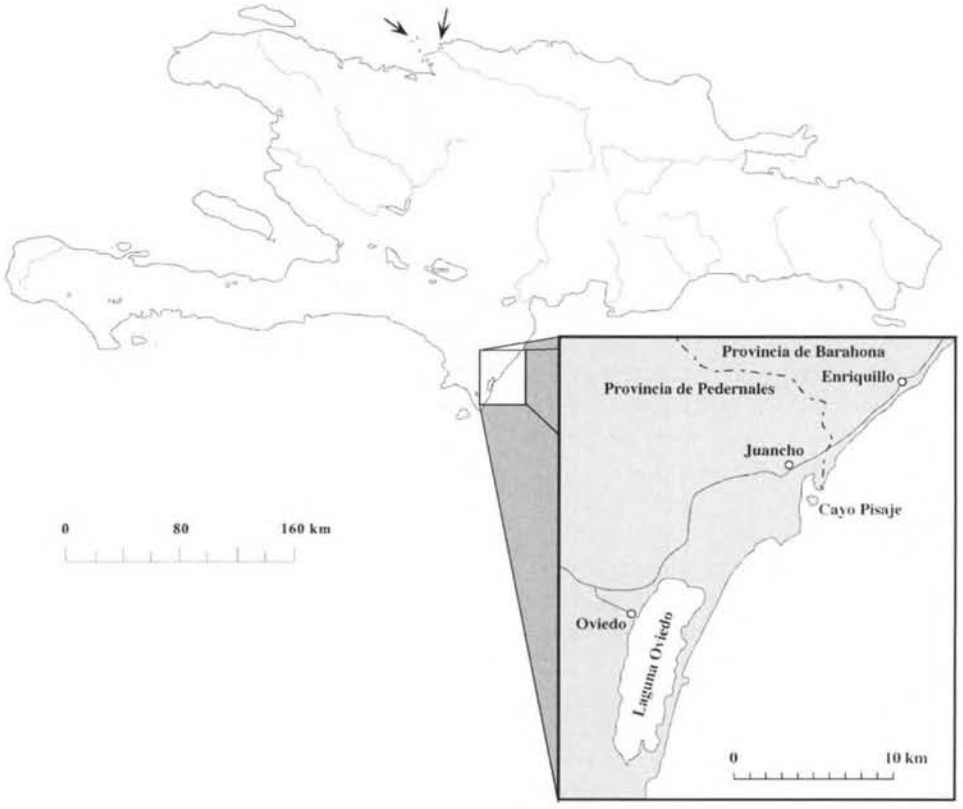


FIG. 1. Map of Hispaniola showing the location, size, and shape of Cayo Pisaje. Arrows indicate the locations of Isla Cabras and the Cayos Siete Hermanos (see also maps in Burns et al. 1992).

1983) adapted to xeric conditions (Schwartz and Henderson 1991). Anoles do not appear to be common on this island as only one specimen, a female, was found on a mangrove tree. *Sphaerodactylus randi strahmi* (Gekkonidae) is a xerophilic species, usually found beneath debris (Schwartz and Henderson 1991). Because this small, secretive species could have easily been overlooked, our failure to find any individuals should not be construed as an indication of its absence.

Island biodiversity tends to increase with size and decrease with spatial isolation (Brown and Lomolino 1988). Isla Cabras, off the northwestern coast of Monte Cristi Province, Dominican Republic, is about the same size as Cayo Pisaje and is almost twice as far from the mainland (Table 1). Equal size and closer proximity to the main island would suggest that Cayo Pisaje should support a greater biodiversity than Isla Cabras. However, Isla Cabras has six known species of lizards (Burns et al. 1992), whereas Cayo Pisaje has only four. Although all habitats present on Cayo Pisaje are also present on Isla Cabras, the topography of the two islands is very different. Isla Cabras has steep rocky slopes not present on Cayo Pisaje (Burns et al. 1992), and this greater topographical relief leads to different and more numerous microhabitats, allowing for greater biodiversity.

Although Cayo Pisaje is closer to the main island and equal in size to Isla Cabras, its species diversity is closer to that of some of the Cayos Siete Hermanos (Burns et al. 1992), seven small keys off the northwestern coast of Monte Cristi Province. Information regarding area, distance to main island, and number of species present on these islands is presented in Table 1. For each island, including Isla Cabras, area and distance to the main island were plotted against number of species in order to compare effects of island area and spatial isolation on species diversity (Fig. 2). Although species number was significantly correlated with distance (Kendall Correlation, $Z = -1.99$, $p = 0.05$), species number was not correlated significantly with area ($Z = -1.06$, $p = 0.29$). As we compared species diversity on these small Hispaniolan satellites, habitat heterogeneity and spatial isolation appear to have a greater effect on species number than area.

Each key of the Cayos Siete Hermanos is smaller and farther from the main island than Cayo Pisaje. Tercero has vertical structure and habitat complexity similar to Cayo Pisaje but is farther from the main island. Because distance was correlated with species number, greater spatial isolation would account for decreased faunal diversity. Arenas, Muertos, Ratas, and Tororú have less ver-

TABLE 1. Number of species recorded from Cayo Pisaje, Isla Cabras, and the Cayos Siete Hermanos along with area of each island and its distance to the main island.

Island	Area (km²)	Distance to main island (km)	Number of species
Cayo Pisaje	0.29	0.4	4
Isla Cabras	0.29	0.6	6
Arenas	0.04	14.8	0
Monte Chico	0.09	7.1	5
Monte Grande	0.12	10.0	5
Muertos	0.12	9.8	3
Ratas	0.13	11.3	1
Tercero	0.15	12.3	3
Tororú	0.12	6.0	3

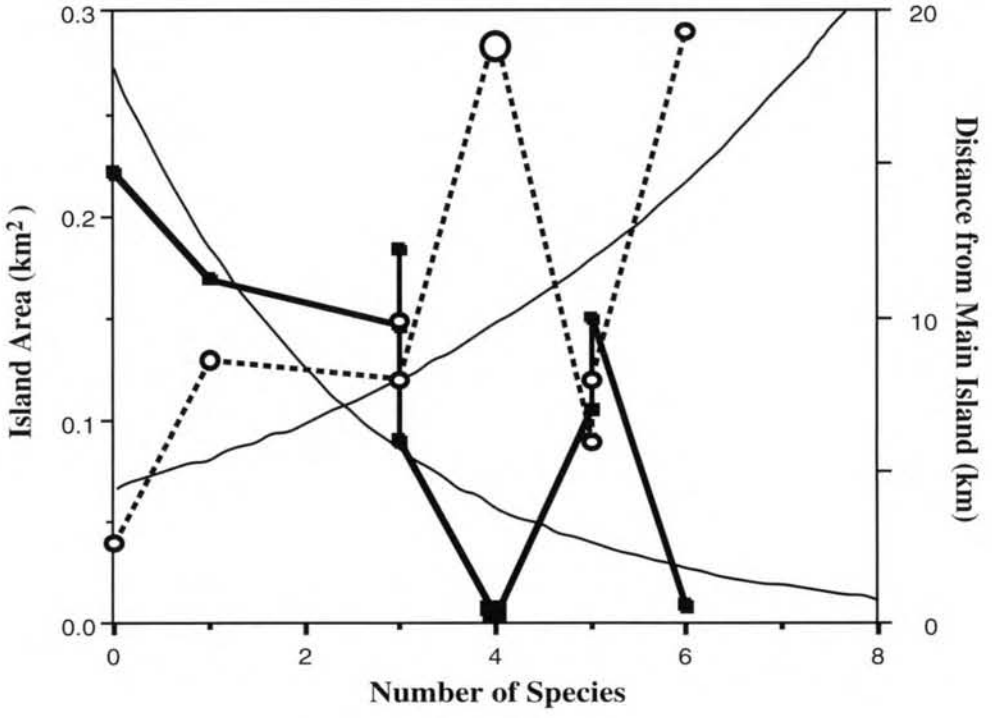


FIG. 2. Number of lizard species related to island area (dotted line) and distance from the main island (solid line) for Cayo Pisaje, Isla Cabras, and the Cayos Siete Hermanos, Hispaniola. Curve fits are exponential.

tical structure and/or less habitat heterogenity when compared with Cayo Pisaje, which may explain, along with the greater spatial isolation, the fewer species present on these keys.

Surprisingly, five species are present on both Monte Chico and Monte Grande (Burns et al. 1992). Unlike Isla Cabras, Monte Chico and Monte Grande are similar in topographical relief to Cayo Pisaje. In addition, sea grapes, present on Monte Grande, and arborescent scrub (predominately *Acacia*), present on Monte Chico (Burns et al. 1992), add a vertical dimension comparable to that of Cayo Pisaje. Because Monte Grande and Monte Chico are similar to Cayo Pisaje in topography and habitat heterogeneity and are smaller, the greater number of species on these keys compared to Cayo Pisaje contradicts the expected pattern.

Anolis cybotes cybotes, Ameiva chrysolaema ficta, Ameiva taeniura vulcanalis, Celestus costatus oreistes, and *Celestus curtissi aporus* are all ecological generalists present along the coast of the main island adjacent to Cayo Pisaje (Schwartz and Henderson 1991). That none has been recorded on Cayo Pisaje is surprising. *Anolis c. cybotes,* a heliophilic trunk-ground anole, requires vertical structure, such as that provided by mangroves and sea grapes, which are present on Cayo Pisaje. *Ameiva c. ficta* and *A. t. vulcanalis,* opportunistic foragers found sympatrically on the main island (Sprosten et al. 1999), can be found in habitats such as mangrove borders and scrublands (Schwartz and Henderson 1991), which are present on Cayo Pisaje. Debris along the beach seemed to be suitable habitat for either *Celestus c. oreistes* or *C. c. aporus* (Schwartz and Henderson 1991). Consequently, this key is seemingly capable of supporting at least some of these additional species, rendering its low diversity of lizard species all the more surprising.

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Home Ranges of Rat Snakes (Colubridae: *Elaphe*) in Different Habitats

STEPHEN J. MULLIN*
WILLIAM H. N. GUTZKE
GARY D. ZENITSKY
Department of Biology, University of Memphis
Memphis, Tennessee 38152-6080, USA

and
ROBERT J. COOPER
Daniel B. Warnell School of Forest Resources
University of Georgia, Athens, Georgia 30602, USA

** Current address: Department of Biological Sciences*
Eastern Illinois University, Charleston, Illinois 61920-3099, USA
e-mail: cfsjm@eiu.edu

Several researchers (Durner and Gates 1993; Fitch 1963; McAllister 1995; Stickel and Cope 1947; Stickel et al. 1980; Weatherhead and Hoysak 1989) have examined home range size and habitat use patterns in black rat snakes (*Elaphe o. obsoleta*). Calculated home range sizes vary from 1.4 ha for females in a radio-telemetry study (Weatherhead and Hoysak 1989) to 28.3 ha for males in a mark-recapture study (Stickel et al. 1980). In spite of these data, home range estimates for other members within the genus are relatively scant. We examined movements of radio-telemetered gray rat snakes (*Elaphe obsoleta spiloides*) from both riparian and upland habitats along the northwestern extent of their geographic range. This report provides information concerning home range sizes, body temperatures recorded at time of relocation, and general patterns of habitat use at each of the study sites. Gray rat snakes have a narrow area of sympatry with black rat snakes (Ernst and Barbour 1989); as such, we also discuss briefly our findings relative to those reported for black rat snakes in similar habitats.

Adult gray rat snakes (three females and eight males) were collected from four forested sites in Shelby County, Tennessee, and from a 1500-ha bottomland hardwood site in the White River National Wildlife Refuge (WRNWR), Arkansas County, Arkansas, USA. The sites in Shelby County ranged between 124.7 and 251.2 ha and patches of old field habitat were present at each site. Subjects were returned to the laboratory for snout–vent length (SVL; ± 0.5 cm) measurement, and sex determination (cloacal probe). Transmitters weighing less than 5% of snake body mass (L.L. Electronics model LF1-11357-RS-T) were implanted into the peritoneal cavity of each subject using procedures modified from Wang et al. (1977) and Reinert and Cundall (1982). Following a minimum 3-day recovery period, subjects were released at the site of capture and relocated every 2 or 3 days thereafter (exception below). When relocations were separated by shorter time intervals (e.g., every 24 h), change in subject position was infrequently observed (pers. obs.).

TABLE 1. Sex, locality, home range size (ha, estimated using minimum convex polygon method), inclusive tracking dates, and summary data for gray rat snakes (*Elaphe obsoleta spiloides*) radio-telemetered in two different habitats. Shelby = localities within Shelby County, Tennessee; WRNWR = White River National Wildlife Refuge, Arkansas.

Snake #	sex (M/F)	locality	home range (ha)	tracking dates
15	M	Shelby	13.4	22 Oct 1994 – 14 Jun 1995
20	M	Shelby	0.4	22 Oct 1994 – 16 Apr 1995
27	F	Shelby	1.3	13 May 1997 – 24 Jul 1997
34	M	Shelby	1.8	13 May 1997 – 28 Jul 1997
36	F	WRNWR	5.3	20 Apr 1997 – 13 Jul 1997
37	M	WRNWR	6.8	20 Apr 1997 – 12 Jul 1997
38	M	WRNWR	4.8	5 May 1997 – 14 Jul 1997
40	M	Shelby	0.7	30 May 1997 – 17 Aug 1997
		Pooled home range data (mean ± 1 SE)		
All male subjects		—	6.3 ± 2.1	—
All female subjects		—	3.3 ± 1.9	—
All Shelby subjects		—	5.5 ± 2.7	—
All WRNWR subjects		—	5.6 ± 0.6	—

Two of the Shelby County snakes were telemetered between 22 October 1994 and 14 June 1995. The relocation interval for these individuals was extended to 2 weeks during their hibernation (2 December 1994 to 17 March 1995). Each hibernaculum was located within the area where the snake was radio-tracked during the activity season and snakes did not have separate winter and summer ranges; thus, home range estimates did not exclude movements to and from hibernacula (e.g., Brown and Parker 1976). All other subjects were telemetered between 2 April and 17 August 1997 and relocated at least once every 3 days. During 1997, we were unable to locate three snakes for more than 30 days following their release (possibly a result of transmitter failure, or predation on the subjects). Available data for these individuals underestimated their home range sizes (Rose 1982). Therefore, we excluded data from these subjects, leaving two females and six males for consideration in this study (see Table 1 for summary data).

Relocation sites for telemetered individuals in Shelby County (N = 5) were recorded with a global positioning system (GPS; hand-held Trimble units, accurate to ± 5 m). These relocation data were post-corrected using base station data from the University of Memphis Ground Water Institute (resulting in an accuracy of ± 5 m), and imported into CALHOME software (U.S. Fish and Wildlife Service, in collaboration with Microsoft, Inc., 1992). The relocation sites of the WRNWR snakes (N = 3) were plotted using measured distances and azimuth values from points on a 50 x 50 m grid that was established across a 50 ha study area as part of a separate project at that site (Wilson 1997). Home ranges for each subject were calculated using the minimum convex polygon procedure (MCP; Jennrich and Turner 1969) in CALHOME. Home range MCP estimates were used to facilitate comparison with other studies on rat snakes (Durner and Gates 1993; Weatherhead and Hoysak 1989), and also because of their use in other studies of reptilian spatial activity patterns (Gregory et al. 1987; Rose 1982). Furthermore, differences between home range sizes calculated using the MCP method and the harmonic mean method were absent (t- test; $p > 0.05$). Separate analyses of variance (ANOVA; $a = 0.05$) were used to determine if home range size differed by study site or tracking season. A low sample size of females (N = 2) precluded analysis of home range size as a function of sex. Differences in home range size as a function of SVL were determined using a Pearson's regression.

At the time of each relocation air temperature (± 0.2°C), cloud cover, and subject position were recorded. If the subject was visible, we also recorded substrate of subject's position (if arboreal, tree species and tree diameter at breast height [DBH, ± 0.5 cm] also were recorded), and subject activity. Subject concealment in arboreal habitats (positioned in a tree cavity or among vines) often prevented accurate measurement of subject height off forest floor. If the snake was accessible, cloacal temperature was obtained using a quick-reading thermometer (Miller & Weber, Inc.).

Sexes did not differ in size (mean SVL ± 1 SE equaled 120.9 ± 7.3 cm and 123.4 ± 8.1 cm for female and male individuals, respectively; unpaired t-test, $P > 0.05$), nor was there any relationship between individual size and home range size ($r^2 = 0.21$, $P = 0.25$, $N = 8$). The mean home range size equaled 5.6 ± 1.6 ha (range = 0.4–13.4 ha; Table 1); males had a mean home range size of 6.3 ± 2.1 ha, whereas females had a mean home range size of 3.3 ± 1.9 ha. Home range sizes did not vary as a function of study site ($F = 1.07$; $df = 3,4$; $P = 0.46$) or tracking season ($F = 0.21$; $df = 1,6$; $P = 0.66$).

Subjects were observed ascending into the arboreal habitat on five occasions and were positioned in the arboreal habitat 53.5 ± 11.9 % of all relocations (a grand mean of values for each snake). The DBH of the occupied trees averaged 40.4 ± 10.9 cm. Vines (e.g., *Toxicodendron* [poison ivy], *Vitis* [wild grape], *Parthenocissus* [Virginia creeper]) were present along the trunks of 84% of the trees occupied by snakes, but this value did not differ from the availability of vines on trees in either habitat (based on sampling of all trees within 10 m radius from relocation point; Chi-square test, $P > 0.05$). Use of the arboreal habitat was a function of the habitat in which the snakes were studied ($F = 29.2$; $df = 1,6$; $P = 0.002$); snakes in bottomland hardwood forest (WRNWR, N = 3) were relocated in arboreal habitat more often than snakes in upland forest sites (N = 5; 90.7 ± 2.3 % and 31.2 ± 8.2 % of relocations, respectively). Accessibility to subjects limited the number of occasions when cloacal temperature could be recorded; these values ranged between 17.8 and 36.6°C.

Although a low sample size precluded statistical verification of the results, the mean male home range size (6.3 ± 2.1 ha) was larger than that estimated for female subjects (3.3 ± 1.9 ha). Weatherhead and Hoysak (1989) reported that home range size for male black rat snakes in Ontario was over five times that of

females, and attributed the disparity to differences in activity associated with mate location (Gibbons and Semlitsch 1987; Gregory et al. 1987).

Several observations of predation by subjects occurred during the study. Snakes were recorded ingesting prey on two occasions (*Cardinalis cardinalis* [northern cardinal] nestlings and *Sigmodon hispidus* [cotton rat]). Following initial collection, one of the WRNWR subjects regurgitated three wood duck (*Aix sponsa*) eggs. Additionally, a regurgitated rock dove (*Columba livia*) hatchling was found within 3 m of the subject's position.

Gray rat snakes are known predators of arboreal nest contents (Jackson 1970, 1978; Mullin et al. 1998) and among North American *Elaphe*, tend to be more arboreal than other subspecies (Jackson 1976). Snakes in our study were positioned in arboreal settings in over half of the relocations. Peaks in breeding activity of many forest bird species overlap broadly between April and mid-June (Baker 1938). Thus, snakes remaining in the arboreal habitat throughout the bird breeding season may not experience any decline in prey availability while simultaneously avoiding their terrestrial predators. Snakes were observed in arboreal habitat as early as 20 March and as late as 21 November, but were relocated in this habitat type most often between 1 May and 15 June (56.0 % of relocations within that period).

Snakes in bottomland forests (WRNWR) were positioned in arboreal habitat more often than snakes in upland forests. Part of this discrepancy is a result of portions of the WRNWR site being flooded between March and late-May. Mean home range size for these snakes (5.6 ± 0.6 ha, N = 3) did not differ from the mean size estimate for subjects studied in the upland forest habitat (5.5 ± 2.7 ha, N = 5), suggesting that inundation of bottomland forest habitat does not restrict rat snake movements. Use of aquatic habitats during the activity season has also been shown in black rat snakes in Ontario (McAllister 1995).

The estimated home range size for gray rat snakes (5.6 ± 1.6 ha) fell within the range of home range sizes reported for a closely-related subspecies, the black rat snake. Home range sizes reported elsewhere for black rat snakes studied in a variety of habitats vary 20-fold (Durner and Gates 1993; Fitch 1963; Stickel et al. 1980; Weatherhead and Hoysak 1989). While some of this discrepancy could be attributed to differences in movement patterns associated with habitat or sex (Weatherhead and Hoysak 1989), the relocation method used may confound estimates of home range size. While we concede that our sample size is limited (possibly resulting in a lack of significance in our analyses), our home range estimates were similar to those of other researchers using radio-telemetry to relocate snakes. We suggest that the relatively large home range estimates based on mark-recapture methods (≥ 12 ha: Fitch 1963; Stickel et al. 1980) should be interpreted with caution because individuals cannot be relocated often enough during a single activity season (Madsen 1984; Rose 1982).

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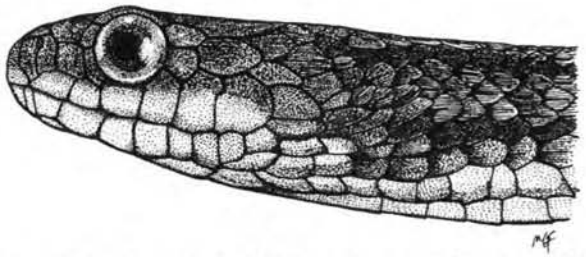
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Regina rigida (Glossy Crayfish Snake). Illustration by Michael G. Frick.

TECHNIQUES

An article suitable for publication in the Techniques section should describe either a novel technique or a substantial modification of an existing one. Description of methods, materials, costs, study sites, etc., should be sufficiently detailed to permit an assessment of the utility of the technique for other areas or taxa.

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Sticky Trapping and Lizard Survivorship

G. ADRIAN VARGAS
KEITH L. KRAKAUER
JOSE L. EGREMY-HERNANDEZ
and
MICHAEL JAMES McCOID
Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA
e-mail (MJM): mccoid@isni.net

There are many inexpensive collecting techniques available to lizard biologists (Simmons 1987). The development of some of these techniques appears to have been driven by attempts to maximize catch rates of small to medium-sized cryptic, rare, or wary reptiles while minimizing specimen damage. Some of the most cost-effective collecting techniques, in terms of initial financial outlay, are noosing and projectiles (rubberbands and blowguns). However, these latter techniques occasionally mutilate specimens and cause injuries to live animals which may result in premature death. Recently, the mouse glue board (sticky trap), a technique touted as inexpensive, non-destructive, and non-lethal (Rodda et al. 1993; Whiting 1998), was introduced to the herpetological community as a sampling and censusing tool.

We collected a common south Texas lizard (*Anolis carolinensis*, Polychrotidae) via three collecting techniques (rubberband, noose, and sticky trap). We were interested in differences in fatality rates, if any, associated with the three techniques and, because *A. carolinensis* is territorial, differences in sex ratios of samples obtained via the three different techniques. Rubberbanding was accomplished using two #107 rubberbands tied together and stretched over the end of a wooden dowel rod to a premarked distance (50 cm). This was done in an attempt to standardize the impact force experienced by each lizard. Noosing was accomplished via 167.6 cm length fishing poles with monofilament nooses tied to the pole tips. Noosing and rubberbanding were done at a number of sites in the City of Kingsville, Kleberg County, Texas, USA. Sticky trapping was conducted using 20 Catchmaster® 13 x 21 cm Baited Mouse, Insect, & Snake Glue Boards (Atlantic Paste & Glue Co., Inc., 4-53rd Street, Brooklyn, New York 11232, USA) placed at irregular intervals in the backyard of a residence in Kingsville, Texas. Sticky traps were attached to the sides and tops of buildings, walls, and fences. Traps were checked every 15 min and after gentle removal from sticky traps, each lizard was placed in a plastic bag with several ml of canola oil facilitating removal of the adhesive (Bauer and Sadlier 1992). Collection of all lizards was completed within a two-week span (28 March–10 April 1998) and each collection technique was completed within a 24 h period. Diurnal temperatures during collection periods ranged from 27 to 35°C. After each collection, all lizards were transported to the laboratory, measured, sexed, and communally housed for one week in a covered 40-liter aquarium maintained at 25°C. Lizards were given water *ad libitum* and fed crickets *ad libitum* on days three and six of confinement. Surviving lizards were released on day eight at the approximate sites of collection.

There was a considerable difference in survivorship of lizards collected during this study. Deaths occurred during the week-long confinement period and not during collection. Rubberbanded lizards (N = 20) experienced a 25% fatality rate (5 dead). Sticky trapped lizards (N = 21) experienced a 47.6% fatality rate (10 dead). Sticky trapped lizards had a statistically higher fatality rate than did rubberbanded lizards (G_{adj} = 4.0348, 0.05>p>0.025). Noosed lizards (N = 26) experienced a 0% fatality rate. Sex ratios were also different for each of the collection techniques. Sex ratios of rubberbanded lizards were 15:5 (male:female), noosed lizards 22:4, and sticky trapped 11:10. Rubberbanded (G_{adj} = 6.399, 0.025>p>0.01) and noosed (G_{adj} = 15.5, p<0.001) lizards were significantly different from a 1:1 sex ratio. Sticky trapped lizards were not significantly different from a 1:1 sex ratio (G_{adj} = 1.902, 0.5>p>0.1). There was no significant difference in mean sizes of lizards captured via all three techniques ($MSD_{1,3}$ = 160.68; Sokal and Rohlf 1981).

Rodda et al. (1993) mentioned that not all lizards survived being removed from sticky traps followed by coating with cooking oil to remove the adhesive. Rodda et al. (1993) suggested these deaths from sticky trapping may have had a species-related component. All specimens of *Emoia atrocostata* (Scincidae, N = 54) collected by sticky trapping and included in Rodda et al. (1993) expired within 6 h of capture. Conversely, virtually all *Carlia* cf. *fusca* (Scincidae, N = 858) that were sticky trapped by Michael McCoid and included in Rodda et al. (1993) survived 4–8 h until deliberately sacrificed. Similar to *E. atrocostata*, our data suggest that a species of phylogenetically unrelated lizard (*A. carolinensis*) also does not respond well to sticky trapping.

These trapping events suggest that before a field project is begun, experimental trapping should be conducted. If population phenomena to be investigated require mark-recapture, then species-specific sensitivity to sticky trapping should be tested. If collection and preservation of all captured individuals is desired, then sticky trapping is probably the best unbiased collection technique available. In contrast, collection by the more sex-biased techniques of rubberbanding and noosing of territorial lizards might yield fewer fatalities during collection, but, because specimens are biased towards males, be less valuable in estimating certain population parameters.

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Design and Construction of an Outdoor Enclosure for the Study of Snake Thermal Ecology

JOHN R. LEE*
and
MARK S. MILLS**
Savannah River Ecology Laboratory, Drawer E
Aiken, South Carolina 29802, USA

**Present Address: Department of Biological Sciences, Idaho State University*
P.O. Box 8007, Pocatello, Idaho, 83209, USA
e-mail: leejohn@isu.edu

***Present Address: Division of Math and Science, Missouri Valley College*
Marshall, Missouri, 65340, USA
e-mail: millsms@moval.edu

In this article, we describe the construction of an enclosure specifically designed to study the thermal ecology of snakes. Though previous studies have used enclosures to examine ophidian thermoregulation (Dill 1972; Hammerson 1977, 1979, 1987, 1989; Johnson 1973; McGinnis and Moore 1969; Moore 1978; Osgood 1970; St. Girons 1975), few collected appropriate data to adequately address the effects of environmental variation on the behavior and consequent body temperature (T_b) variation of the animals (Charland 1995; Charland and Gregory 1990). To do so requires data on the limits of potential T_b's as set by the thermal environment, the actual T_b's of the animals, and their behaviors (Peterson et al. 1993; Stevenson 1985). The enclosure should ideally be large enough to offer a wide range of microhabitats and thermal environments. Our enclosure was designed so the T_b's of multiple animals, their thermal environments, and their behaviors could be monitored on a broader scale than that of previous studies.

We constructed the enclosure at the Savannah River Ecology Laboratory on the U.S. Department of Energy's Savannah River Site near Aiken, South Carolina, USA. The main function of the enclosure was to relate observed patterns of snake T_b variation to the thermal environment and behavior of the animals. We did this by designing the enclosure to combine natural habitat features with an automated monitoring system. We created habitat typically associated with southeastern species of semi-aquatic snakes by enclosing the area around an artificial pond and adding native plants, prey items, and retreats. The walls were constructed of 185 cm-high panels of cypress privacy fencing to which we mounted corrugated vinyl roofing. Sealing the seams between the overlapping sheets with siliconized acrylic latex caulking resulted in a smooth surface that the snakes were unable to climb. To further prevent escapes, we added a 50 cm-deep concrete barrier inside the base of the fence to exclude burrowing rodents (Fig. 1). The resulting fence enclosed a 20 x 30-m area around a 15 x 20-m plastic-lined pond. A spigot provided well water, and plugs spaced at vertical 50-cm intervals along a drainpipe located in the deepest part of the pond (2.5 m) controlled water depth. We covered the pond liner and banks with soil and leaf litter as a substrate for native aquatic and terrestrial vegetation. Animals added to the enclosure as prey included native fishes, amphibians, and snakes. Habitat within the enclosure was improved for both the prey species and the study animals through the addition of numerous retreats.

Retreats added in and around the pond included both natural and artificial structures. Natural structures consisting of brush tops and limbs were weighted and sunk in the pond for aquatic habitat or piled on the bank for semi-aquatic and terrestrial retreats. We constructed artificial dens for winter thermal ecology studies by simulating structures (e.g., rotting stumps or tunnels in banks) commonly used by local snakes for overwintering (Neill 1947,1948). For stumps, we buried 14 wooden barrels (each with a 10-cm hole in the top and filled with a leaf/ wood chips mixture) to a depth of 75 cm with 35 cm above the ground (Fig. 1). We made 14 tunnels by placing cypress boards in the bottoms of trenches in the pond bank and back-filling. During construction of the tunnel and stump dens, we added thermocouples to each so that the only available winter retreats were thermally monitored. We placed one thermocouple in the deepest part, middle, and top of each stump. Each tunnel den was similarly monitored with a thermocouple in the entrance and in the deepest end (Fig. 1).

We continuously monitored snake T_b's with an automated data acquisition system that combined a datalogger with radiotelemetry equipment (Peterson 1987; Peterson and Dorcas 1992; Peterson et al. 1993). The datalogger also measured operative environmental temperatures (T_e's) from the den thermocouples and from operative models (Bakken and Gates 1975; Peterson et al. 1993). By combining T_b, T_e, and observational data, we could determine the thermal consequences of behavior and microhabitat selection by each snake. An example is illustrated by graphing a sample of T_b and T_e data for a cottonmouth (*Agkistrodon piscivorus*) using a tunnel den in the enclosure (Fig. 1, inset). The snake was radiotelemetrically located in the retreat at 0830 h on 07 Dec 94 and was observed basking outside the tunnel at 1330 h. The graph shows the snake moving from the tunnel entrance deeper into the retreat around 0330 h and remaining there until emerging around 1015 h (Fig. 1, inset). Near 1700 h, it entered the retreat and slowly cooled until matching the tunnel temperature at 2130 h.

Enclosures present a level of inquiry intermediate between laboratory and field studies (Fitch 1987). Laboratory studies must often be conducted in unnatural settings, but have control over the number of variables, while field studies generally suffer the opposite problem. In field studies of thermal ecology, adequately characterizing the thermal environment in all possible microhabitats can be difficult if not impossible (Peterson at al. 1993). Our retreats were monitored better than can be accomplished in the field, and the main advantage of our enclosure is that its size allows a wide range of thermal options among and within retreat types. The significance of this is illustrated by translating 24-hr T_b into metabolic expenditures (Blem and Blem 1990) for snakes using different potential thermoregulatory strategies. For example, on the day shown in Fig. 1, a 600 g cottonmouth acclimated to 22°C seeking to maximize T_b by remaining in the warmest retreat would have a 24-h average T_b ($T_{b\,avg}$) of 23.5°C, representing a metabolic expenditure of 17.9 KJ. But by doing so, it would have expended 57% more energy than had it sought to minimize T_b in the coolest retreat, where its 24-h $T_{b\,avg}$ would have been 13.7°C with a metabolic expenditure of only 11.4 KJ. By continuously measuring T_b over the course of a winter, energy usage estimates could be compared to mass changes observed in the animals.

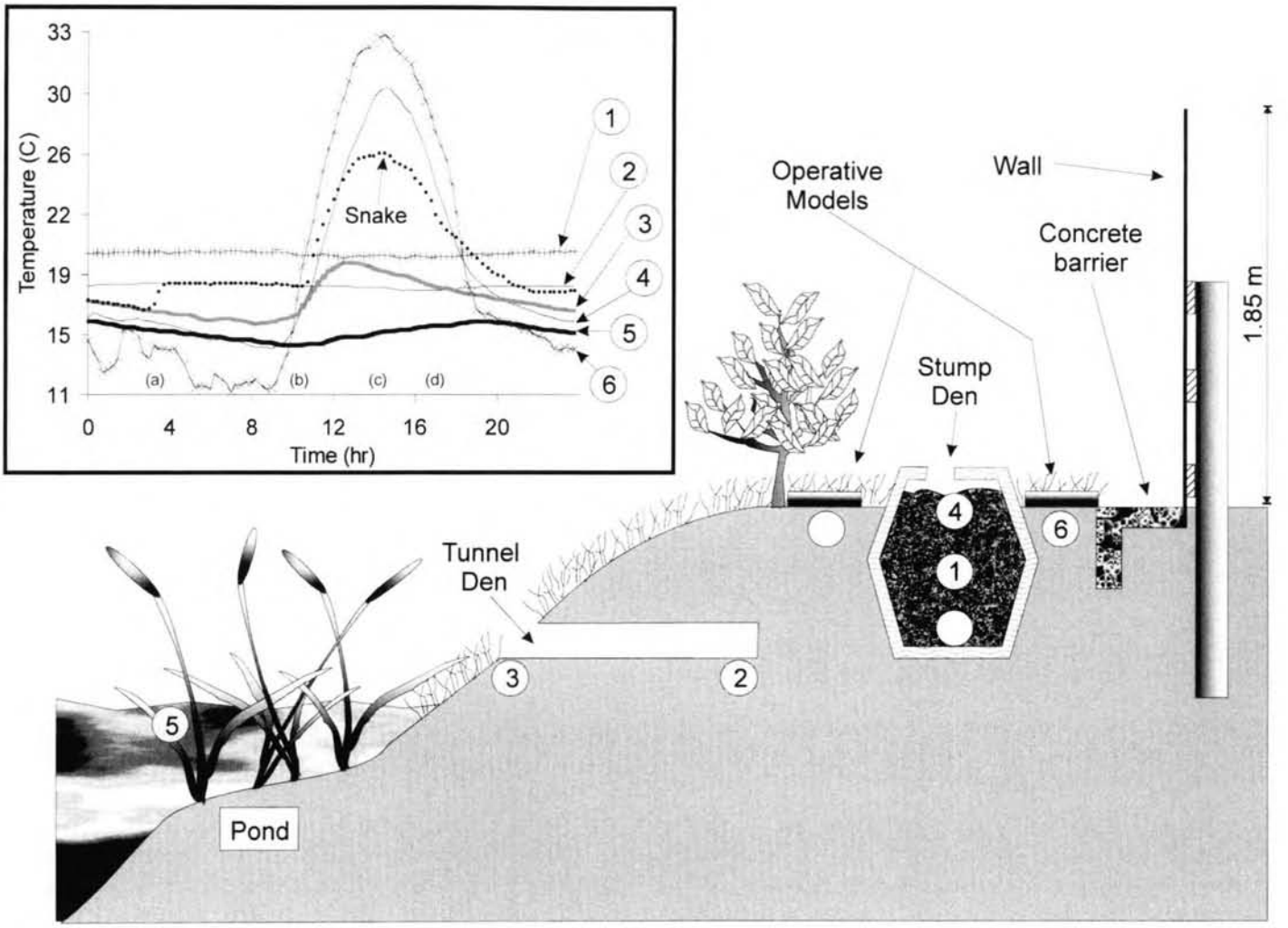


FIG. 1. Schematic diagram of the SREL snake enclosure showing a cross section of the wall and den construction. Numbered thermocouple locations correspond to numbered lines on the inset 24-hour plot. Data for the unnumbered thermocouples were omitted from the inset for clarity. Data for the inset were from 7 December 1994 for a tunnel den occupied by a 820 g cottonmouth (*Agkistrodon piscivorus*). Stump den data were taken from the retreat nearest to the snake's tunnel. Letters on the inset plot correspond to times at which the snake (a) moved deeper into the retreat, (b) emerged from the tunnel, (c) was observed basking, and (d) entered the retreat.

Continuous monitoring of multiple animals in an enclosure allows for the generation of field-testable predictions on the effects of the interaction between environment and behavior on T_b. Additionally, the completeness with which we can characterize both the aboveground and subterranean thermal environments allows for direct hypothesis testing. Such potential studies could include the role of temperature on habitat selection, activity times, foraging behavior, mating behavior, etc. However, intended studies must allow for the potential behavioral artifacts due to an enclosure being smaller than the active season home range for the species in question. We feel the size of our enclosure is adequate for exploring behavior outside of the active season for larger snake species (e.g., *Nerodia* spp.), and may be of use for active season work with smaller snakes, such as *Seminatrix*. Thus far, our enclosure has been used to associate specific patterns of T_b variation with overwintering behavior in cottonmouths (Lee 1996). Combining this knowledge with patterns of T_b variation collected from free-ranging cottonmouths permitted determination of the effects of environmental variation on the expression of various behaviors in the field. Though designed primarily to study overwintering thermal ecology, other potential uses for such an enclosure include studies of foraging ecology, species interactions/competition, mating behavior, and reproduction (e.g., multiple paternity, sexual selection, life history characteristics, etc.).

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Comparison of Two Radio Transmitter Attachments on Columbia Spotted Frogs (*Rana luteiventris*)

EVELYN L. BULL
Pacific Northwest Research Station
Forestry and Range Sciences Laboratory, 1401 Gekeler Lane
La Grande, Oregon 97850, USA
e-mail: ebull/r6pnw_lagrande@fs.fed.us

Radio telemetry permits determination of critical aspects of anuran ecology, such as summer movements and overwintering behavior, which would otherwise be difficult to study. However, the sensitive, moist skin of frogs prevents direct attachment of transmitters to the skin. Alternatives such as implantation (Werner 1991), ingestion (Oldham and Swan 1992), and attachment with external harnesses have been investigated with amphibians (Richards et al. 1994; van Nuland and Claus 1981). Implantation has been used successfully with toads but has limited application to frogs because of their thinner skin (Werner 1991). The limitations of this method include trauma, reduced activity, and infection (Oldham and Swan 1992). Ingestion of transmitters eliminates the need for an incision and the risk of infection, yet transmitters are frequently rejected by the animals (*Bufo bufo* and *Rana temporaria*; Oldham and Swan 1992).

A variety of external harnesses have been tested. Van Nuland and Claus (1981) used an external harness made of latex on *Bufo bufo*. However, toads were able to escape from the harness, particularly in water (van Gelder et al. 1986), and the harness caused skin irritations if not fitted properly. Another method of external attachment involved sewing a piece of Velcro to the dorsum of *R. palustris* (Johnson 1984). This method caused bacterial/fungal infections under the Velcro patch when used on *B. americanus* (Werner 1991). Rathbun and Murphey (1996) attached transmitters to California red-legged frogs (*R. aurora draytonii*) with a waist-belt made of aluminum balls. Although this method was successful some of the time, they experienced radio-belt loss and frog mortality from entanglement with vegetation. Peter Ritson and David Pilliod (pers. comm.) developed another waist-belt method using a satin ribbon fastened around the waist of adult Oregon spotted (*R. pretiosa*) and Columbia spotted (*R. luteiventris*) frogs, but they encountered problems with abrasions and entanglement with vegetation with this attachment.

Robustly gravid females are a particular challenge to track because transmitters attached with waist-band type harnesses are shed around the time of oviposition. The ability to tag females just prior to oviposition is important because females are typically easily encountered only in early spring before or during amplexus at oviposition sites. After egg deposition, they usually leave the oviposition site and are frequently difficult to locate. This difficulty led me to compare waist-band versus arm-band methods of transmitter attachment using Columbia spotted frogs and to examine the relative effectiveness of each for tracking gravid frogs in the spring and non-gravid frogs in the summer and fall.

Transmitters (model BD2, Holohil Systems Ltd., 112 John Cavanagh Rd., Carp, Ontario, Canada KOA 1L0, tel. 613/839-

0676) weighed 1.8 g and had a life of 6 months with a range of about 200 m. Transmitters represented about 2–5% of female and 3–8% of male body weight. Frogs were radio-tagged in seven breeding ponds and along the river in the Grande Ronde River watershed (Union County, Oregon, USA). The river lacked aquatic vegetation, while vegetation at six of the ponds was predominantly duckweed (*Lemna minor*). One pond contained pondweed (*Potamogeton* sp.), cattails (*Typhia latifolia*), and spike-rush (*Eleocharis palustris*).

The waist-band attachment was a satin ribbon (6 mm wide) with the transmitter glued (cyanoacrylate superglue) to the ribbon. The ribbon was adjusted around the abdomen, tight enough to prevent it from slipping over the hind legs. The ribbon ends were stitched together with carpet thread (cotton-coated polyester).

The arm-band method involved tying the transmitter around the upper arm of the frog with carpet thread (Fig. 1). Thread was inserted through the transmitter tunnel, and the ends were tied in a square knot on top of the transmitter. The loose ends were then tied around the upper arm of the frog using a square knot and a half hitch. A drop of glue was put on the knot to secure it, being careful to avoid contact with the frog's skin. Adjustment of thread tightness around the upper arm was critical. The thread was tight enough to prevent slipping over the elbow joint, yet loose enough to allow circulation. The forearm diameter is larger than that of the upper arm, so transmitters may remain on the forearm even if they slip over the elbow. One person can apply either attachment method in about 5–10 minutes.

I compared the two methods on robustly gravid females by radio-tagging six females with waist-bands and nine females with arm-bands in April and May 1998. In June 1998, arm-bands were put on two males and three non-gravid females. Waist-bands were put on 15 males and 17 non-gravid females radio-tagged in April and May 1998, and on six males and 13 non-gravid females radio-tagged in August and September 1998.

Radio-tagged frogs were located with a portable TR4 receiver and hand-held antenna (Telonics, Mesa, Arizona 85204, USA). When possible, gravid females were located one day after attachment of transmitters and every 3–5 days thereafter until egg deposition. To reduce abrasion risk, arm-bands were replaced with waist-bands as soon as possible following oviposition. I attempted to capture all non-gravid frogs every 2–4 weeks from May until December to check for abrasions. However, most frogs were inaccessible after October because ponds were frozen or frogs were overwintering underground.

Eighty-nine percent of gravid females with arm-band attachments retained them, compared to only 17% of those with waist-band attachments. No abrasions were observed with either technique, but arm-bands were kept on frogs only 1–15 days (mean = 5 days). The one waist-band attachment that was retained was tightened after one day and remained on the frog for more than a month.

There was 100% retention of arm-band attachments on males and non-gravid females, but all frogs developed severe abrasions through the muscle on the upper arm from the thread. Frogs carried these transmitters between 11 and 59 days (mean = 30 days). The upper arm on the frog captured after 59 days had healed over completely with the muscle enclosing the thread. The upper arm muscle of another frog, captured 31 days after the arm-band was removed, was healed and functional.

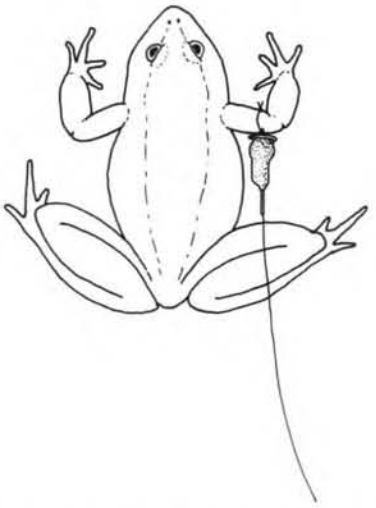


FIG. 1. Transmitter attached to the upper arm of a Columbia spotted frog.

Waist-bands were retained by 67% of frogs (10 males and 11 non-gravid females) radio-tagged in April and May. I recovered slipped harnesses and transmitters for the remainder (5 males and 6 females) and assumed that the frogs either slipped out of the harness or were depredated. Of the 21 frogs that were monitored for 18–126 days between May and August, about half had abrasions around the waist. The abrasions were in the subcutaneous layer or in the underlying muscle. Incidence of abrasion was higher on males (70%) than on females (27%).

Eighty-nine percent (6 males and 11 non-gravid females) of the waist-bands applied in August and September remained on the frogs. These frogs were monitored for 27–77 days and recaptured once or twice. Twenty-one percent had deep abrasions extending into the muscle, and an additional 16% had slight abrasions on the skin surface. The slight abrasions healed within two weeks after applying Neosporin and trimming the harness to about half the normal width.

Transmitters with arm-band attachments stayed on all but one frog. Arm-bands attached in April and May caused no injuries, but all arm-bands attached in June caused severe abrasions on the upper arm. I suspect abrasions on frogs in June and July were the result of the longer arm-band wear time and increased frog activity. Frog skin may also change physiologically with water temperature, phenology, or activity levels, making it more susceptible to abrasions. As a consequence, I believe the arm-band attachment is appropriate to use on gravid females in the spring for up to a week.

The high rate of loss of waist-band attachments from robustly gravid females was striking. Females about ready to deposit eggs may be severely hampered during egg-laying with a waist-band attachment, which essentially surrounds the tube through which eggs must pass. Waist-bands may be shed prior to oviposition, or the reduced girth of the female after oviposition allows the waist-band to easily slip off.

Other investigators have reported transmitter entanglement with vegetation as a problem, but I observed few instances of entanglement and none to which mortality could be attributed. Rathbun and Murphey (1996), using the ball-chain band, encountered mortality in dense, large bulrushes during its growth phase. Entangle-

ment with vegetation also has been observed with the satin-ribbon band (M. P. Hayes and K. R. McAllister, pers. comm). Differences among studies may reflect the risks posed by different types of vegetation. All but one of my study sites had limited vegetation besides duckweed.

Both techniques described here have limitations, but the advantage of the arm-band attachment clearly lies with gravid females for which waist-band options probably interfere with oviposition. Since abrasion with the arm-band technique can occur rapidly, I recommend application of this technique for intervals no longer than a week. As such, the arm-band technique is probably best applied to females of explosive breeding anurans, which generally oviposit with a high degree of synchrony over a few days. Waist-band attachments appear less likely to induce abrasions and thus remain the preferred class of attachment techniques for non-gravid females. However, abrasion risk with the waist-band attachment is significant over long time intervals, and application of this technique should be done only where relatively frequent inspection (weekly) of frogs is possible.

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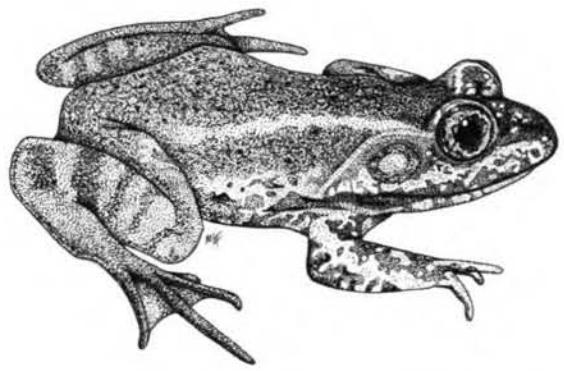
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Rana virgatipes (Carpenter Frog). Illustration by Michael G. Frick.

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Use of Oxytetracycline in Batch-Marking Post-Metamorphic Boreal Toads

ERIN MUTHS
PAUL STEPHEN CORN *
and
THOMAS R. STANLEY

USGS Midcontinent Ecological Science Center, 4512 McMurry Avenue
Fort Collins, Colorado 80525, USA
e-mail (EM): Erin_Muths@usgs.gov

**Mailing address: USGS, Aldo Leopold Wilderness Research Institute*
PO Box 8089, Missoula, Montana 59807, USA

Captive rearing and translocation have been discussed as management tools in the recovery of the natterjack toad (*B. calamita*), common frog (*Rana temporaria*), common toad (*B. bufo*), and boreal toad (*B. boreas*)(Cooke and Oldham 1995; Denton et al. 1997; and Loeffler 1998, respectively). Translocation is fraught with many concerns and difficulties (Dodd and Seigel 1991), foremost among these is determining the survival rate of released individuals. To estimate survival, long term monitoring is necessary (Dodd and Seigel 1991) as well as the availability of a reliable method with which to mark individuals before translocation or release (Burnham et al. 1987). Marking allows the translocated individuals to be distinguished from a resident population or potential emigrants, and allows recaptures to be assigned to a particular experimental treatment or cohort release.

Current methods for marking amphibians require the handling of each individual. Toe clipping (Donnelly et al. 1994; van Gelder and Strijbosch 1996) and PIT tags (Brown 1997; Corn et al. 1997) have been used to effectively mark adult anurans, but these techniques are ill-suited for new metamorphs. Metamorphs are too small to receive implanted PIT tags, and toe clipping is labor intensive, difficult to perform and can be injurious to small animals. Additionally, young anurans may partially regenerate clipped toes (e.g., *Bufo boreas*, C. Carey and K. Scherff-Norris, pers. comm.), causing identification errors. Fluorescent dye has been used to mark small amphibians with limited success (Schlaepfer 1998). Recently, fluorescent dye has been mixed with semi-liquid elastomer and then injected under the skin of several amphibians, successfully marking them (Anholt et al. 1998; Woolley 1973; Davis and Ovaska 1998). However, amphibian reintroduction may involve thousands of individuals, reducing the feasibility of a mark which must be delivered individually. A batch marking method is needed that allows released individuals to be identified at least until they attain a size where, upon recapture, adult marking methods can be applied.

Tetracycline has been used to batch mark hatchery-reared fish by immersion bath, through diet or by injection (Peterson and Carline 1996; Unkenholz et al. 1997; Weber and Ridgeway 1967). Tetracycline deposition in bone matrix follows the pattern of new mineralization (Frost 1969; Recker 1983) providing a label which can be seen with fluorescent microscopy (Frost 1969; Minaire et al. 1974; Recker 1983). Weber and Ridgeway (1967) determined that low doses of tetracycline caused little distress or damage to

fish. Unkenholz (1997) reported <1% mortality in perch fingerlings immersed in oxytetracycline solutions of 309–748 mg/L. The first studies to use tetracycline labeling in amphibians were by Smirina (1972) and Francillon (1979, 1980) on *Rana temporaria* and *Triturus cristatus cristatus*, respectively. The use of tetracycline in amphibians and reptiles was reviewed by Frazier (1985a).

The effectiveness of tetracycline batch marking in fish and the high permeability of amphibian skin led us to evaluate the efficacy of oxytetracycline for batch marking young boreal toads. Oxytetracycline was chosen because of its recent, successful use in marking experiments (e.g., Unkenholz et al. 1997). Additionally, oxytetracycline has a low systemic toxicity (Suzuki and Mathews 1966; Weber and Ridgeway 1967), no "local effect on calcification" (Suzuki and Mathews 1966), and has a high intensity of fluorescence (Saxen 1969). Tetracycline markers have been used in rabies vaccinations and are acceptable in the food animal industry (L. Wolfe, DVM, pers. comm.).While the use of tetracycline ultimately requires a toe clip to read the mark, adult animals often are toe clipped as part of mark–recapture population studies (Donnelly et al. 1994). Handling stress and toe regeneration are presumably reduced in the larger adults and the excised toes would be available to determine the presence or absence of a batch mark.

Boreal toadlets were reared in captivity at the Research Fish Hatchery in Bellvue, Colorado by the Colorado Division of Wildlife from eggs collected in Clear Creek County, Colorado, USA (UTM: Zone 13, 429324 E, 4402598 N). Tadpoles and toadlets were maintained in outside raceways. Sixty, approximately three-month old toadlets were selected randomly from the raceway. Toadlets were weighed to the nearest 0.01 g and assigned randomly to one of six treatments (Table 1).

Oxytetracycline HCL (OXY-TET® 100, Anchor Division Boehringer Ingelheim Animal Health Inc., St. Joseph, Missouri, USA) baths (5–15 mm deep) of three concentrations were prepared using filtered water in clean plastic containers with ventilated lids. Toadlets were placed in the baths and left undisturbed in an environmental chamber (6 or 24 h).

After the baths, toadlets were rinsed with filtered water and placed in corresponding aquaria. Clean aquaria (45.5 L) were furnished with a layer of aquarium gravel (rinsed twice with filtered water), a layer of plastic lighting grating (approximately 10 mm x 10 mm mesh, washed with mild detergent and chlorine bleach, rinsed in filtered water and dried), and a layer of sheet moss. Filtered water was added to the level of the grating. A moisture gradient was provided by slightly elevating the substrate at one end. Toadlets were fed 5 d per wk on live, first-instar crickets dusted with Reptavite® vitamin powder. Water was changed once per month for the first month and once per wk thereafter. Moss was changed once per month and aquaria were misted occasionally with filtered water. Aquaria were kept in an environmental chamber for the entire 24 wk experiment (12 h:12 h light:dark cycle; 22°C during light and 15°C during dark; humidity: 96.6 ± 0.1%). The position of the aquaria in the environmental chamber was randomized and rotated each week.

After 24 weeks, the 3rd toe on the left front foot and the 2nd toe on the right hind foot were removed (Donnelly et al. 1994) from each toadlet, placed in ethyl alcohol, and kept in opaque containers. If toadlets died before the end of the experiment, toes were collected and analyzed. Only data from front toes were used in the analyses, except where data were missing due to difficulties in histological preparation (N = 6). In these cases, data from a hind toe were substituted.

Toes were processed using a methyl methacrylate method for calcified bone (Aquino, unpubl.; Ruhl-Fehlert and Ludl 1987; Sanderson et al. 1990). Methacrylate blocks were cut to approximately 1 x 1 cm squares. The side containing the bone was ground by sanding belt and by hand (wet grinding paper P800 and P1000) until a clear cross section of bone was visible on a 20x microscope. Each sample was numbered and placed in a small, opaque envelope.

Samples were examined under a Leitz microscope (36x) with a 100 W mercury source (Short Arc Lamp Power Supply, E. Leitz Co. Rockleigh, New Jersey, USA) using 400–440 (blue violet) excitor filter with a 470 barrier filter. Samples were scored and assigned numeric values as follows: 5) very good label; 4) good label; 3) poor label; 2) ambiguous fluorescence, unknown if label or autofluorescence; 1) no fluorescence or autofluorescence, bluish and diffuse; or 0) missing samples. Scoring was based on brightness and color. All samples were randomized and then examined "blind"; the scorer (EM) did not know which block or treatment she was examining. Data were analyzed using ordinal logistic regression (Agresti 1996) under a proportional odds model (SAS 1989). A design matrix was supplied to account for the categorical nature of the treatments (see, for example SAS 1989:1099–1101). Significance levels were set at 0.05 for single comparisons and 0.006 (corrected using the Bonferroni method) for multiple comparisons.

Initial masses of toadlets in the 6 treatments were not different (Table 1; $F_{5,54} = 0.270$, $P = 0.927$). Growth during the experiment was uniform among treatments; the final masses averaged at least three times the starting masses and were not different among treatments ($F_{4,43} = 0.573$, $P = 0.683$).

All the toadlets in treatment 2 died in February, probably due to a buildup of ammonia in the tank. We tested the water in all the tanks for ammonia (Jr. Ammonia Water Test Kit®, Wardley Corporation, Secauscus, New Jersey, USA). The test indicated ammonia levels in excess of 5.0 mg/L in the treatment 2 aquarium.

TABLE 1. List of treatments and mean mass of toadlets present at the start and end of experiment. * Approximate mass at death after 11 wks of treatment.

	Mean mass of toadlets (S.E., N)	
Treatment	Start	End
1) Control A: 6 h filtered water	0.69 (0.07, 10)	2.61 (0.22)
2) 6 h oxytetracycline (1000 mg/L)	0.80 (0.07, 10)	0.77 (0.08)*
3) Control B: 24 h filtered water	0.71 (0.12, 10)	2.37 (0.23)
4) 24 h oxytetracycline (250 mg/L)	0.72 (0.05, 10)	2.23 (0.16)
5) 24 h oxytetracycline (500 mg/L)	0.75 (0.08, 10)	2.37 (0.13)
6) 24 h oxytetracycline (1000 mg/L)	0.74 (0.07, 10)	2.32 (0.18)

The other aquaria had ammonia levels (≤ 0.25 mg/ L). Toadlets were frozen at death and later thawed, blotted dry, and weighed. One toadlet in controls 1 and 3 also died in February. These were the smallest animals and may have starved.

Bone sections of toadlets exposed to tetracycline usually (36/39 = 92%) had distinguishable fluorescent labels (Figs. 1 and 2). Neither tetracycline concentration nor exposure time influenced the detectability or brightness of the label ($P \geq 0.038$). Control A (6 h) differed significantly from treatment 2 (6 h; $\chi_1^2 = 5.60$, $P = 0.018$), control B (24 h) differed significantly from treatments 4, 5, and 6 ($P \leq 0.002$), and control A (6 h) did not differ from control B (24 h; $\chi_1^2 = 2.57$, $P = 0.108$; Table 2).

Autofluorescence was a significant problem. In 3 of 39 treated samples, we were unable to determine whether the fluorescence resulted from the label or autofluorescence. Eleven of 20 control samples showed no fluorescence or only a diffuse, bluish glow indicating autofluorescence but in 9 of 20 control samples we observed fluorescence indistinguishable by eye from samples with labels. Three of the 9 fluorescing control samples and 3 of the clearly labeled samples were chosen at random, sectioned (10 µm), mounted, examined microscopically, and photographed. In sections of two control samples, the fluorescence appeared diffuse and bluish suggesting that the tissue was autofluorescing, but the third control section appeared to have a label. Color slides of these samples and the labeled samples revealed a difference between control bone and labeled bone, with all labeled specimens being distinctly more gold in color than the autofluorescence in the controls. One roll of film was used for all slides; the same exposure and ASA was used on all slides.

We found that oxytetracycline labeled the bones of soaked toadlets, but under low power magnification of the blocks, it was sometimes difficult to distinguish the yellow gold color of the oxytetracycline label from the natural, bluish-green, diffuse autofluorescence of the bone. These results, which agree with an experiment conducted concurrently on pickerel frogs (*Rana palustris*) and green frogs (*R. clamitans*) by Hatfield et al. (unpubl.), indicate that this method is not completely reliable.

Yellow green autofluorescence has been detected in turtles, but it was less intense and more diffuse than the label fluorescence at the line of active bone growth, where the label is expected (Frazier 1985b). In our study, neither oxytetracycline concentration nor length of treatment influenced the brightness of the label, contrary to Frazier's (1985a) findings. This may have been partly due to method. Frazier injected tetracycline whereas we soaked animals in a oxytetracycline solution. We soaked the toadlets in specific concentrations of oxytetracycline because toads absorb water readily through their skin and other methods of administration such as intramuscular, subcutaneous injection or oral dosing are problematic due to the size of the toadlet and the time necessary to handle thousands of animals. Although Milch et al. (1958) found no evidence that the route of administration affected the distribution of the label, the experimental toadlets were occasionally observed to place a limb on the side of the container, out of the solution. This may have affected the standardized uptake of the oxytetracycline and may have been related to the concentration of the solution. Hatfield et al. (unpubl.) found the soaking method to be ineffective. According to Milch et al. (1958) variation in fluorescence occurs between species and age in tetracycline labels.



FIG. 1. Cross section of phalange of boreal toadlet (24 h exposure in 1000mg/L tetracycline bath) viewed at 20x magnification under fluorescent light. Tetracycline label is visible as bright line in the cortex, below the periosteal layer, marrow tissue visible in center.

TABLE 2. Number of samples in each treatment for each label category: assigned ordinal values in brackets.

Treatment	N	very good label [5]	good label [4]	poor label [3]	auto- or label [2]	none or auto-fluorescence [1]	missing samples [0]
1) Control A: 6 h filtered water	10	0	0	0	6	4	0
2) 6 h oxytetracycline (1000 mg/L)	10	4	4	1	1	0	0
3) Control B: 24 h filtered water	10	0	0	0	3	7	0
4) 24 h oxytetracycline (250 mg/L)	10	6	2	1	0	0	1
5) 24 h oxytetracycline (500 mg/L)	10	0	7	2	1	0	0
6) 24 h oxytetracycline (1000 mg/L)	10	3	5	1	1	0	0

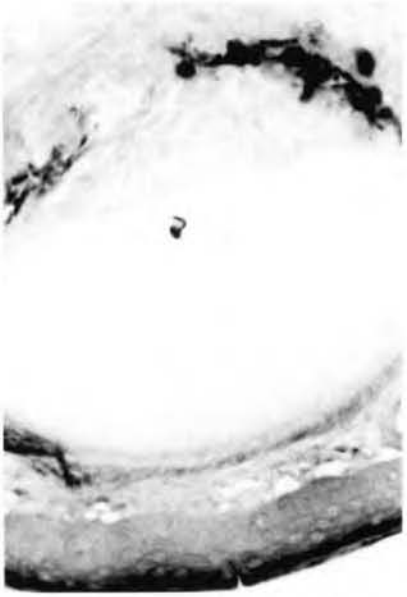


FIG. 2. Cross section of phalange of boreal toadlet (control, 24 h exposure in filtered water) viewed at 20x magnification. No tetracycline label visible.

The toadlets in this experiment were within 1 wk of the same age.

There may have been an aquarium effect as all toadlets in each treatment were housed in the same aquarium. However, we believe this possibility is minimized given our care in cleaning the aquaria before the experiment and our randomization of aquaria position during the experiment.

This method is impractical as a field tool for several reasons. First, the toe must be processed and viewed in the laboratory. This introduces complexity and considerable cost, especially because thin sections and photography may be necessary to distinguish between a labeled bone and an autofluorescing bone. Histological costs were US $850.00 (120 specimens) plus an additional cost of US $7.00 per slide for the thin sectioning. Microscope time and photography of the sections were donated by CSU. Treatment costs including aquaria set up, oxytetracycline, and food was approximately US $450.00.

Second and perhaps most importantly, marks may appear ambiguous; unmarked toads can easily be scored incorrectly as having been marked and marked toads may be scored as unmarked. This violates an important assumption in all capture-recapture models (Pollock et al. 1990). The overall mis-identification rate for microscopic (36x) examination was 20% (Table 2). Due to cost constraints, we applied additional identification methods (e.g., thin sectioning and photography) to a small subsample; three of the potentially mis-identified specimens and three of the labeled and correctly identified specimens. These methods allowed us to differentiate between label and autofluorescence and determine that the three mis-identified specimens were exhibiting autofluorescence. Unfortunately, these results cannot be extended beyond our study due to sample size.

Finally, the longevity of tetracycline labeling has not been tested in amphibians although tetracycline labeling in green turtles (*Chelonia mydas*) was evident one and three years after treatment for live and frozen specimens respectively (Frazier 1985b). Although we do not recommend this particular method of tetracycline marking, batch marking with an appropriate method (e.g., Taylor and Deegan 1982) is a sound technique to use with very small or juvenile anurans.

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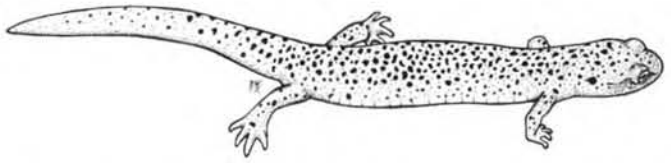
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Pseudotriton ruber (Red Salamander). Illustration by Michael G. Frick.

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Modifications to the Stomach Flushing Technique for Turtles

JACQUELINE R. FIELDS *
THOMAS R. SIMPSON
RICHARD W. MANNING
and
FRANCIS L. ROSE
Department of Biology, Southwest Texas State University
San Marcos, Texas 78666-4616, USA
e-mail (TRS): r_simpson@swt.edu

**Present address: Texas Parks and Wildlife Department*
102 North LBJ #307, San Marcos, Texas 78666, USA
e-mail: rfields@itouch.net

Determining fractional composition of dietary items is necessary when developing a complete ecological inventory for a species. Techniques for gathering data on food habits of turtles include direct observation, examination of fecal material (Demuth and Buhlmann 1997), and collection of stomach contents (Legler 1977; Parmenter and Avery 1990). Examination of the digestive tract contents has advantages over other methods (Parmenter and Avery 1990)

As with other species (Demuth and Buhlmann 1997; Killebrew 1991), we experienced problems with the stomach flushing method in our dietary studies of the Texas river cooter (*Pseudemys texana*) and the red-eared slider (*Trachemys scripta elegans*). Problems encountered ranged from little or no contents obtained to serious internal damage to the turtles. Here we offer modifications to the stomach flushing technique which enhance its effectiveness.

Initially, we used a modification of Legler's technique and a restraining device similar to that described by Parmenter (1980). The restraining table (60 cm x 28 cm) was tilted at a 35 degree angle allowing gravity to facilitate the flow of contents from the stomach. A turtle was secured to the table with a web strap and a non-skid pad mounted on the table surface prevented the turtle from sliding out of the webbing. A hand operated fluid transfer pump, mounted on the side of a laboratory bench, supplied water for flushing through a small animal feeding tube (3.5 mm OD) (Fig. 1).

Difficulties were encountered when using a hook and cable apparatus (Parmenter 1980) to extend the neck and hold open the mouth of an agitated turtle. These included trauma to the jaws and palate. Additionally, rupture of the esophagus due to blockage by the flushing tube and food mass was noted in two post-procedural necropsies.

Administration of a tranquilizer, ketamine HCl, significantly reduced this problem. Ketamine HCl is a dissociative anesthetic (Bennett 1996) which is currently a federal schedule III drug requiring a prescription from a licensed veterinarian. Individuals were injected intramuscularly in the left forelimb with 25mg/kg ketamine HCl (Aiello 1998; Bennett 1996). The effect of the drug, evinced by total relaxation with head extended, was noted in 20 to 30 minutes. The sedated turtle was positioned (carapace down, head oriented downward) on the pad and the belt was tightened at mid-plastron. No hooks were required to extend the head or hold it in place. An adjustable buret clamp on a threaded rod mounted

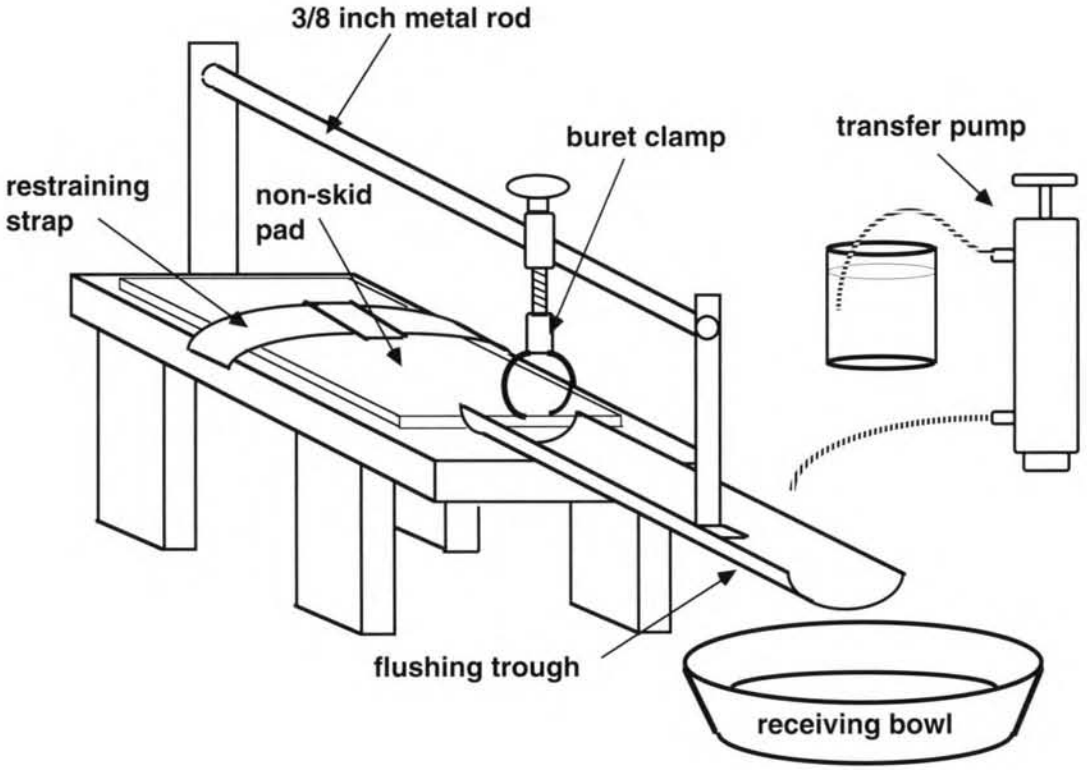


FIG. 1. Diagram of a table (60 cm x 20 cm) used in flushing turtle stomach contents for dietary analysis.

above the table surface secured the neck behind the skull (Fig. 1). The feeding tube was coated with lubricating jelly and slowly inserted into the esophagus (a small volume of water provided additional lubrication). Constant water pressure was maintained to prevent air from entering the tube. The cardiac sphincter relaxed under the influence of ketamine so that little resistance was felt until the tube reached the stomach. Occasionally, in the case of larger specimens, the turtle was turned head up, then down in an attempt to mobilize the stomach contents.

Our technique reduced stress and prevented damage to mouthparts. Relaxation of the digestive tract also reduced internal damage caused by attempting to force a tube through the closed cardiac sphincter or the inability to flush food past this sphincter resulting in a ruptured esophagus. Passage of food through the esophagus was eased by the relaxing effects of the ketamine and the percent rate of successful flushings increased. Stomach contents were collected from 79% of the turtles (N = 38) flushed after the introduction of ketamine compared to 38.5% (N = 39) before its use. Damage to the mouth, stomach, or esophagus, as indicated by blood, was also reduced from 30 turtles using hooks to one turtle after the introduction of ketamine.

If the receiving bowl filled with flushed water without any food items, the turtle's stomach was assumed to be empty. Stomach contents often existed in clumps that resisted passage through the esophagus with the tube in place. Because clots of vegetation were common and could be felt as an increase in pressure at the pump, care was exercised while flushing each turtle. After flushing, turtles were held 24 hours to allow recovery from the effects of anesthetic and to ascertain that no adverse reaction or physical damage occurred.

Turtles that could not be flushed immediately were placed in a refrigerator to slow their rate of digestion. Prior to flushing, each individual was removed from the refrigerator and allowed to warm to room temperature for approximately 20 minutes.

Stomach flushing has proven to be an effective method to study the food habits of turtles. Further improvements to the method are possible. Research into ketamine dosages and gravity flow methods could refine the technique.

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A New Design for a Lightweight Squeeze Box for Snake Field Studies

CHAD L. CROSS
Department of Biological Sciences, Old Dominion University
Norfolk, Virginia 23529-0266, USA

Current Address: U. S. Environmental Protection Agency
Environmental Sciences Division
Landscape Ecology Branch, P.O. Box 93478
Las Vegas, Nevada 89193-3478, USA
e-mail: viperhuntr@aol.com

Handling venomous snakes is an inherently dangerous task. To reduce the risk of snakebite, many methods of snake capture and handling, including the use of nooses, acrylic tubes, and snake tongs (Fitch 1987), have been suggested. There is, however, still the issue of safely obtaining measurement data on captured snakes. The squeeze box technique for obtaining morphological measurements of live snakes was first introduced by Quinn and Jones (1974). The squeeze box works by firmly holding a snake between a soft base (generally foamed rubber) and a plexiglass cover while measurements are made. The design of Quinn and Jones (1974) is quite useful in a laboratory setting; however, alterations were necessary for it to be useful in the field. My work on *Agkistrodon p. piscivorus* required an alternative design for a squeeze box. The new design is lightweight, easily carried or pulled through a research site, allows head and body measurements to be made, and permits the tail of the snake to be safely extracted for measurements, determination of sex, and ventral or subcaudal scale clipping.

A plastic, rectangular storage container ("sweater box") approximately 85 cm long, 40 cm wide, and 15 cm deep was used for the body of the squeeze box. The top of the box was made from plexiglass (0.5 cm thickness). A plastic cabinet handle was bolted onto each end of the top to facilitate its removal and replacement. The bottom of the box was lined with 5 cm of foamed rubber. In each end of the container, a small porthole was cut to allow the extraction of the tail. One porthole was 2 cm in diameter, the other 3.5 cm—one for large snakes and one for small snakes. To prevent snakes from escaping through these openings, a sliding door was placed over each opening. The sliding doors were constructed from the same plexiglass as the top. Runners for the doors were constructed from plastic aquarium edging (readily available at most pet centers). A small knob was attached to each sliding door. A shoulder strap was bolted onto the device to allow the box to be easily carried. Due to the aquatic nature of the animals I studied, closed-cell foamed rubber flotation was attached to the bottom of the device so that it could be pulled through the water (Fig. 1).

As with the squeeze box of Quinn and Jones (1974), the total length of the animal is easily marked on the plexiglass lid along the midline of the snake using a grease pencil or water-based marker. Additionally, I marked head width and length on the plexiglass lid. The tail of the animal is easily extracted with a small noose constructed from string and a hollow tube. Tail length is determined directly by measurement (and subtracted from total length to obtain SVL), sex is easily determined, and scale-clipping is easily accomplished.



FIG. 1. A lightweight squeeze box for snake field studies. The plexiglass top, foamed rubber lining, portholes and their accompanying sliding doors, shoulder carrying strap, and closed-cell foam flotation attachments are visible. Design and dimensions are discussed in the text.

All measurements were taken with a flexible metric tape. Measurements (N = 10) taken in the field and then repeated in the laboratory on anesthetized animals differed by less than 1 cm for all morphological categories that I examined (total length, SVL, tail length, head width, and head length; Cross 1998), suggesting that this technique is adequate for most field studies.

This lightweight squeeze box is useful for field studies of snakes, particularly for venomous snakes where a researcher wishes to minimize direct handling of specimens. Additionally, the box can be easily modified to facilitate particular uses—such as the addition of backpack straps, or the removal of flotation devices.

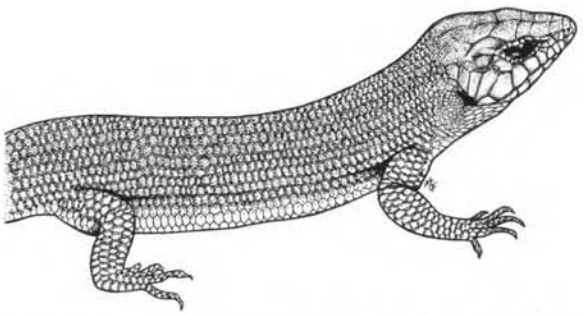
Notice.—The research described here was developed by the author (CLC) prior to his employment with the U.S. Environmental Protection Agency's Office of Research and Development. The manuscript has been subjected to EPA's administrative review but the conclusions drawn are soley those of the author. Mention of trade names or commercial products does not constitute endorsement or recommendations by EPA for use.

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Eumeces laticeps (Broad-headed Skink). Illustration by Michael G. Frick.

and often grasped fecal pellets in their jaws and repeatedly shook them. The hatchlings' interest in the fecal pellets gradually waned after 15 minutes, and by 20 minutes, the plate of dried feces was largely ignored. However, thirteen days later, a plate of dried feces was placed in the cage with the 7 Agua Caliente hatchlings. Two of the hatchlings again tried to eat the feces, but the others showed no interest.

TABLE 1. Food choice of hatchling chuckwallas.

Locality	(N)	Ate lettuce first	Ate feces first
Agua Caliente, AZ	(19)	4	15
Crater Range, AZ	(4)	0	4
Picacho Mts., AZ	(8)	1	7
Salt River Mts., AZ	(3)	2	1
Apple Valley, CA	(6)	4	2
Desert Center, CA	(9)	0	9
Palm Springs, CA	(5)	1	4
Totals		12	42

The feces of adult chuckwallas were generally too large for the hatchlings to ingest. However, the neonates seized the dried fecal droppings in their mouths, usually at the tapered ends of the pellets, attempted to bite them, and subsequently shook them violently. In some instances, this repeated shaking behavior (up to 8 bouts observed), successfully led to breaking off small bits of the fecal pellet which could be ingested. Whether ingestion of fecal material is necessary for inoculation of symbionts remains conjectural. Only a few hatchlings succeeded in actually eating bits of fecal material, but all lizards eventually demonstrated normal food digestion. Hence, the repeated "mouthing" of the fecal pellets was probably sufficient to inoculate the neonates with symbiotic microbes.

The gut symbionts of iguanas are obligate anaerobes and presumably do not survive long outside the intestinal environment. Thus, Troyer (1982) concluded that a brief association between juvenile and adult iguanas was necessary to effect microbial transfer. While the microbial symbionts in chuckwallas have not been studied, presumably they are also anaerobes. The strong social component to chuckwalla behavior (Berry 1974), would facilitate parent to offspring transfer (via coprophagy) of these colonic microbes.

Coprophagy was not observed during the subsequent months that the hatchlings were reared, except on two occasions. A juvenile was observed tongue-flicking and briefly "mouthing" a fecal pellet from a sibling that shared its cage, and another hatchling actually ate an entire fecal pellet. These instances occurred after a two-day period of food deprivation and may simply have been due to hunger.

Acknowledgments.—Chuckwallas were collected in California under scientific permit numbers 0301 and 9044, and in Arizona under several nonresident hunting licenses. I wish to thank Jay Chance, Jerrold J. and Martin J. Feldner, Tom Greb, Ellen M. Kiley (USFWS), Jim McGuire, Tony Mills, Lester Milroy III, Regis Opferman, and Jeff Wines for help in procuring adult chuckwallas. T. Greb assisted in recording observational data.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 20, Number 1 (March 1999).

CAUDATA

PLETHODON IDAHOENSIS (Coeur d'Alene Salamander) **SKELETAL ABNORMALITY.** Natural occurrence of scoliosis has been reported in *Plethodon glutinosus* (Marvin 1995. Herpetol. Rev. 26:30). Herein we report a similar condition in an adult male (4.2 cm SVL) *Plethodon idahoensis* collected in the Kootenai River Gorge, Lincoln Co., Montana, USA, on 30 May 1985. A radiograph of the individual (Fig. 1) reveals that trunk and anterior caudal vertebrae were affected. Opacities more dense than bone also appear in the trunk and may represent ingested mineral.

A comparison with cleared and stained *P. idahoensis* specimens indicates that this abnormal salamander's SVL would have exceeded 5 cm if not for the unusual spine curvature. The individual was therefore at least 4 yrs old when collected (Lynch 1984. Reproductive Ecology of *Plethodon idahoensis*. M.S. Thesis, University of Idaho, Moscow). Thanks to Chris Davitt for the radiograph and Dan Bivens for photography.

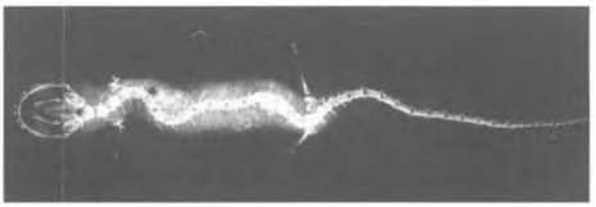


FIG. 1. Scoliosis in an adult *Plethodon idahoensis*.

Submitted by **SARA M. PETERSON** and **ALBERT G. WILSON, JR.**, Department of Life Sciences, MS 3180, Spokane Falls Community College, 3410 Fort George Wright Drive, Spokane, Washington 99224, USA, and **EVELYN M. WILSON**, Deer Park Animal Medical Center, 31207 North Short Road, Deer Park, Washington 99006, USA.

ANURA

BUFO SPECIOSUS (Texas Toad). **DIET.** Reports of food items for *Bufo speciosus* are nonexistent. However, like other xeric toad species, it is presumed to feed on a diverse array of terrestrial and flying arthropods (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. 431 pp.) On 7 August 1998 at ca. 0100 h, a subadult (54 mm SUL, 18.5

g) *B. speciosus* was collected alive on road (AOR) from Kerr County, Texas, USA, 10.6 rd km E of junction of US Hwy 83 and St Hwy 39, on St. Hwy 39. The stomach and intestines were removed and preserved in 70% ETOH the following day. Upon later examination, the following prey species were found, with number of individual prey items in parentheses. Hymenoptera: *Odontomachus clarus* (1), *Pogonomyrmex barbatus* (48), *Solenopsis invicta* (8); Coleoptera: *Agrypnus* sp. (2), *Harpalus* sp. (3); Hemiptera: *Cnemodus marvoritus* (1).

The *B. speciosus* specimen has been deposited in the Texas Cooperative Wildlife Collection, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas (TCWC 79864). Stomach contents were deposited in the Texas A&M University Insect Collection (TAMUIC 627), Department of Entomology, College Station, Texas. I thank Edward G. Riley, Department of Entomology, Texas A&M University, for correcting and verifying insect identifications.

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas Cooperative Wildlife Collections, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA.

HYLARANA ALBOLABRIS (NCN). **PREDATION.** In western Uganda, *Hylarana albolabris* (Ranidae) is found exclusively in waters with low dissolved oxygen, typically permanent pools and streams. Unlike most North American species (Wassersug and Seibert 1975. Copeia 1975:86–103), *H. albolabris* tadpoles begin air breathing immediately after hatching. This reliance on atmospheric air as a source of oxygen is no doubt requisite to their survival under extreme hypoxia. However, air breathing increases tadpole vulnerability to visual predators, such as turtles (Feder 1983. Physiol. Zool. 56:522–531). For air-breathing fish, wading birds are the dominant predators (Kramer 1987. Envir. Ecol. Fish 18:81–92), and they may also be important tadpole predators. *Hylarana albolabris* tadpoles possess seven discrete glandular regions that produce toxins which deter vertebrate predators (*Clarias* catfish and *Xenopus* frogs), but these glands seem to be ineffective against invertebrate predators.

During a field study of the ecology of *H. albolabris* tadpoles in Kibale National Park in western Uganda (0°33'S, 30°21'E), I observed the fishing spider *Thalassius spinosissimus* (or possibly *T. margaritatus*) (Pisauridae) consume air-breathing *H. albolabris* tadpoles at two different sites. In each case, the spider seized a tadpole as it surfaced to breathe. After struggling to subdue the tadpole as it swam downward, the spider resurfaced and carried the tadpole to the shoreline or a nearby perch above the water, where it was consumed without evidence of toxicity. *Hylarana albolabris* tadpoles can reach 3.8 g wet mass and 74 mm TL. Both spiders captured tadpoles of approximately the same length as their leg span (ca. 50 mm) and of a much greater mass.

Thalassius fishing spiders are among the most common invertebrate predators found at many forest pools and streams in Kibale National Park. *Hylarana albolabris* may be particularly susceptible to fishing spiders because they must breath air regularly, and thus are often exposed to surface predators. Although breeding in chronically hypoxic waters may reduce the diversity or efficiency of predators to which *H. albolabris* are exposed (McIntyre and McCollum, in prep.), it increases their susceptibility to certain predators, such as fishing spiders, which attack air breathers. This may explain why *H. albolabris* does not rest near the surface or use aquatic surface respiration (Kramer and Mehegan 1981. Envir. Biol. Fish 6:299–313), as observed in some North American tadpoles. The importance of fishing spiders as predators on air-breathing tadpoles should be explored elsewhere, particularly in the tropics.

Submitted by **PETER McINTYRE**, Harvard University, Cambridge, Massachusetts 02138, USA.

PTYCHADENA MASCARENIENSIS MASCARENIENSIS (NCN). **DIET**. During February 1999, we observed an adult *Ptychadena m. mascareniensis* (Ranidae) consuming other frogs at two sites in southeastern Madagascar. On 5 February, in a rice paddy near the village of Amboavola (25°4'S, 46°46'E) a large (ca. 50 mm SUL) *P. m. mascareniensis* was observed beginning to swallow a smaller live conspecific (ca. 30 mm SUL). Processing of the prey required ca. three minutes as it was slowly engulfed head-first. The second observation was made in a bog at the Mandena littoral forest (25°58'S, 47°00'E) on 16 February. A 49 mm SUL *P. m. mascareniensis* was seen lingering for more than 30 minutes near a small (70 cm diam) temporary pool where more than ten male *Mantidactylus wittei* were calling. It seized one of the *M. wittei* (18 mm SUL) by a rear leg, and began attempting to swallow it. The prey struggled intensely for the first two minutes, them moved little in the following three minutes as it was swallowed. It was consumed posterior first, as the *P. mascariensis* employed a slightly inertial feeding strategy, especially early in the process, when it opened its mouth quickly, then rapidly made a small anterior movement of its body. In the *P. m. mascareniensis'* stomach, one rear limb of the *M. wittei* was in the normal resting position while the other was extended forward to the head. We did not observe the initial seizure of the prey, so cannot comment on the use of the tongue. When it had completely swallowed the prey, we captured and preserved the *Ptychadena* for dissection. In addition to the *M. wittei*, the stomach contained a snail (6 mm diam), a small grasshopper (5 mm), a beetle grub (6 mm), and two types of vegetation. The vegetation may have been secondarily ingested along with the frog.

This is the first record of carnivory by *P. m. mascareniensis*, which is widely distributed across all of Madagascar. In most disturbed areas, it is the largest and most abundant frog, and can be found active during day and night. Thus, if carnivory is a regular habit of *P. m. mascareniensis*, it may be an important predator on syntopic small frogs such as *Heterixalus* and *Mantidactylus*. We also note that inertial feeding is atypical of anurans and merits further investigation.

Submitted by **PETER McINTYRE**, Harvard University, Cambridge, Massachusetts 02138, USA, and **JEAN-BAPTISTE RAMANAMANJATO**, QIT Madagascar Minerals, B.P. 225, Fort Dauphin 614, Madagascar.

RANA CATESBEIANA (Bullfrog) **RECORD SIZE.** A record size *Rana catesbeiana* from Oklahoma, measuring 20.4 cm SVL, was reported by Lutterschmidt et al. (1996. Herpetol. Rev. 27:74–75). Here we report a larger female, 22.0 cm from the tip of the snout to the posterior edge of the vent, in the collection of the Museum of Comparative Zoology, Harvard University. The specimen (MCZ-A-25600) was collected June 1942 (collector unknown) from the north shore of Lake Verret, Atchafalya Basin, Assumption Parish, Louisiana, USA.

We thank James D. Lazell, Jr. for the measurement, and José P. Rosado for confirmation of the measurement and for use of the MCZ collection.

Submitted by **LESLIE A. THOMAS** and **GUINEVERE O.U. WOGAN**, Department of Herpetology, Museum of Comparative Zoology, 26 Oxford Street, Cambridge, Massachusetts 02138, USA.

SCYTHROPHRYS SAWAYAE (NCN). **DEFENSIVE BEHAVIOR**. Stiff-legged defensive behavior that involves limb immobility and distention was described by Sazima (1978. Biotropica 10[2]:158) for the anurans *Proceratophrys appendiculata* (Leptodactylidae) and *Stereocyclops parkery* (Microhylidae), leaf litter inhabitants of the Atlantic Rainforest of southeastern Brazil. This behavior is also known for *Zachaenus parvulus* (Leptodactylidae) (Sazima, *op. cit.*) and *Proceratophrys boiei* (Leptodactylidae) (Pombal Jr., pers. com.). During studies at Rancho Queimado (27°30'S 49°00'W, 800 m), Serra Geral in Santa Catarina State, Brazil, this behavior was also observed in the leptodactylid frog, *Scythrophrys sawayae*, an inhabitant of the leaf litter in the Atlantic Rainforest of Paraná and Santa Catarina in southern Brazil. Nineteen *S. sawayae* were collected from 1991 to 1995 and were maintained in captivity for 3–5 days. While handling the frogs, I observed that, after being disturbed, individuals would leap 10–20 cm and fall immediately with their vent down, their body fixed to the ground, and their limbs outstretched and rigid (Fig. 1). They remained stationary in this posture for between 30 sec and 10 min. All individuals, independent of sex, including amplexed pairs, demonstrated this behavior while in captivity (Fig. 2). During December 1997 this behavior was observed in the field in individuals engaged in reproductive activity. Some individuals fled from capture by jumping into shallow ponds (± 20 cm deep) where they remained stiff-legged, even while submerged.

Sazima (*op. cit.*) suggested that this defensive behavior would be associated with the cryptic coloring of the dorsum (similar to dead leaves), although *S. sawayae* shows a different coloration. The specimens present three patterns of dorsal coloring: dark brown (50%, N = 16), green (28%, N = 9), and light brown (22%, N = 7). The dorsal surface of the limbs is yellowish brown, diverging from the dorsal coloring of the body. Dorso-lateral ridges are defined by a fine white line, and extend from the posterior region of the eyelids to the inguinal region. Below these, there is a lateral black strip. While the individual is immobile, the dorso-lateral ridges are more pronounced, and in conjunction with the color difference between the dorsum and the limbs this creates a disruptive effect, breaking the image of the animal from a distance. The chromatic polymorphism also camouflages the individual as it occupies a heterogeneous environment on the forest ground (Edmunds 1974. Defense in Animals. Longman, Harlow. 357 pp.; Krebs and Davies 1978. Behavioural Ecology. Blackwell, London. 494 pp). These chromatic characteristics achieve the same cryptic effect as the "dead leaf" coloration (Sazima, *op. cit.*) and, with the stiff-legged behavior, act by impeding the formation of search images by visually oriented predators that disturb the litter in search of food.

Observation of this behavior in *S. sawayae* reinforces the observation of Sazima (*op. cit.*) that there is behavioral convergence among anuran species that inhabit leaf litter and are subject to the same type of predation pressure.

Voucher specimens include: Coleção Célio Fernando Baptista Haddad (CFBH 2976–2978), deposited in Universidade Estadual Paulista, Departamento de Zoologia, Rio Claro, SP, Brazil; Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP 2064–75), Porto Alegre, RS, Brazil.

I thank Christine Strussmann and Célio F. B. Haddad for reviewing this note and CAPES for the fellowship.



FIG. 1. *Scythrophrys sawayae* (CFBH 2976, male, 16 mm) in stiff-legged behavior.



FIG. 2. Amplectant *S. sawayae* pair (CFBH 2977, male, 15.5 mm; CFBH 2978 female, 18 mm) in stiff-legged behavior.

Submitted by **PAULO CHRISTIANO DE ANCHIETTA GARCIA,** Curso de Pós-Graduação em Zoologia, Dept. Zoologia, I.B., UNESP, C.P. 199. Cep 13506-900. Rio Claro, São Paulo, Brazil.

TESTUDINES

CHELONIA MYDAS (Green Sea Turtle). **NESTING DISTRIBUTION.** The waters off the North Carolina (USA) coast have been historically viewed as feeding grounds for the green sea turtle, *Chelonia mydas* (Hirth 1971. FAO Fish. Synop. 85). North Carolina beaches have not been considered nesting grounds for this species (Meylan et al. 1995. Florida Mar. Res. Publ. 52:1–51), although Schwartz et al. (1981. ASB Bull. 28:96) reported one tagged individual that nested five times in North Carolina during the summer of 1980. Here, we demonstrate that the green sea turtle regularly nests on North Carolina beaches.

From 1980 to 1994, 34 green sea turtle nests were recorded on North Carolina beaches. Nests were reported from 10 different beaches with the highest concentrations occurring at Camp Lejuene Marine Base (N = 17), Bald Head Island (N = 7), and Cape Hatteras National Seashore (N = 3). The remaining seven beaches had one nest each. The number of nests per year varied from zero to nine and averaged (± standard error) 2.27 ± 0.73 nests. We know that more than one turtle is responsible for these nests due to multiple tag returns in 1992 and 1994. For 32 nests, the average number of eggs per nest was 165 ± 4.27. Four tagged individuals laid an average of 3.40 ± 0.68 nests per season with 11 nesting intervals averaging 12.64 ± 1.60 days. The average hatch rate was 77.84 ± 4.68% for 32 nests and the average incubation was 62.48 ± 1.16 days for 25 nests. Hatch rate was significantly (one-way ANOVA, df = 2, 29, P = 0.003) greater for nests laid in June (90.73 ± 1.99%) and July (82.38 ± 6.97%) than for those laid in August (52.75 ± 10.83%).

Historically, Amelia Island, Florida, was thought to be the northern boundary for green sea turtle nesting (Dodd 1982. Brimleyana 7:39–54). However, due to the regular nesting for the past 15 years on North Carolina beaches by the green sea turtle, North Carolina should be considered the northernmost limit of the nesting range of this species.

Submitted by **HEATHER MILLER WOODSON** and **WM. DAVID WEBSTER**, Department of Biological Sciences, University of North Carolina at Wilmington, Wilmington, North Carolina 28403-3297, USA (e-mail: WEBSTE@uncwil.edu).

CHRYSEMYS PICTA MARGINATA (Midland Painted Turtle). **RETICULATE MELANISM**. Reticulate melanism (RM) in painted turtles refers to a netlike or vermiculate pattern of black markings on the carapace, found in addition to any normal carapacial patterns. The pattern was first reported by Smith et al. (1969. J. Herpetol. 3:173–176) as occurring occasionally in adult male western painted turtles (*Chrysemys picta bellii*) from North Dakota. Ernst and Ernst (1972. J. Minnesota Acad. Sci. 38:77–80) found RM in six male and three female *C. p. bellii* from Lake Shetuck in Minnesota, MacCulloch (1981. J. Herpetol. 15:181–185) noted the pattern in Canadian *C. p. bellii*, and Schueler (1983. Blue Jay 41:83–91) added that Canadian *C. p. bellii* with carapacial RM also typically have the dorsal head stripes interrupted by a reticulate or vermiculate pattern. Stuart (1998. Herpetol. Rev. 29:80–82) found RM to be common in, and restricted to, male *C. p. bellii* from New Mexico, with a developmental sequence of cephalic RM appearing initially, followed by a progressive anterior-to-posterior spread of carapacial RM.

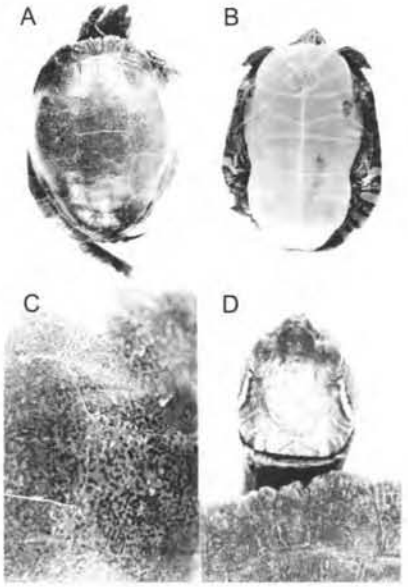


FIG. 1. A female midland painted turtle (*Chrysemys picta marginata*) collected in Shiawassee County, Michigan, in July, 1998. A. dorsal view, showing vermiculate patterning on entire carapace; B. ventral view, showing lack of typical plastral patterning of *C. p. marginata*; C. close-up of upper right quadrant of carapace, showing details of melanistic patterning; D. dorsal aspect of head, showing lack of reticulate or vermiculate pattern.

All reports of RM have been for *C. p. bellii*, and all except that of Ernst and Ernst (*op. cit.*), have found it only on adult males. Here I report a pattern resembling RM in a female *Chrysemys picta marginata* (14.1 cm straight-line carapace length, Fig. 1A). The animal (deposited at the Florida Museum of Natural History, UF 116102) was the only one of 86 turtles collected in 1998 in Shiawassee and Clinton Counties, Michigan (USA), to display this pattern. It had a typical *C. p. marginata* degree of disalignment of carapacial scutes (90.1%, using the method of Hartman 1958. Copeia 1958:261–265), but lacked the usual plastral patterning (Fig. 1B); however, the lack of a plastral pattern is not unusual in *C. p. marginata*: seven others in this sample also lacked a plastral pattern. The RM occurred on the entire carapace (Fig. 1A), and is perhaps more aptly termed vermiculate than reticulate (Fig. 1C). There was no clear evidence of cephalic RM (Fig. 1D).

This is apparently the first report of RM in a subspecies of *Chrysemys picta* other than *bellii*, and the only one other than that of Ernst and Ernst (*op. cit.*) for a female. In a study in progress, we have seen RM in other *C. p. bellii*, but we have not seen it in *Chrysemys picta picta* (29 from Massachusetts, 12 from Rhode Island, 107 from Connecticut, 28 from Virginia, 21 from North Carolina, 29 from South Carolina, 44 from Georgia), *C. p. dorsalis* (15 from Mississippi, 38 from Louisiana, 5 from Arkansas), or other *C. p. marginata* (24 from Michigan, 9 from Ohio, 4 from Tennessee).

I thank M. Nie for aiding in the collection of turtles in Michigan, and H. Smith-Somerville for taking and preparing the photographs. This investigation was partly supported by grant #IBN-9603934 from the National Science Foundation.

Submitted by **GORDON R. ULTSCH**, Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama 35487, USA (e-mail: Gultsch@biology.as.ua.edu).

CLEMMYS INSCULPTA (Wood Turtle) and ***EMYDOIDEA BLANDINGII*** (Blanding's Turtle). **HYBRIDIZATION.** Intergeneric hybridization in turtles is apparently uncommon; most reported instances have occurred under captive conditions (Fritz 1995. Herpetofauna 17:19–34). Here we report repeated occurrences of hybridization between the emydine turtles *Clemmys insculpta* and *Emydoidea blandingii* in a semi-natural enclosure.

In August 1997 a clutch of 12 hatchling turtles was discovered during the examination of a prepared sand nesting mound within a 0.1 ha research enclosure in Ingham County, Michigan, USA. The enclosure includes a 670 m^2 pond with an average depth of about 1 meter. A variable number of freshwater turtles are maintained within this enclosure; these include research specimens as well as several donated specimens of pet trade or unknown origin, used for educational purposes. In spring of 1997 this population included four mature *Clemmys insculpta* (one male and three females) and two mature *Emydoidea blandingii* (one male and one female), as well as various deirochelines (*Chrysemys, Pseudemys, Graptemys*) and several *Sternotherus odoratus*. The male *Clemmys insculpta* had previously lost two limbs and had suffered severe damage to its cloaca and penis in a raccoon attack; it was assumed to be incapable of reproduction.

The hatchling turtles were recognized to be anomalous based on coloration and details of morphology; a hybridization event was suspected but could not be confirmed based on external morphology. Tissues of one hatchling (killed accidentally during nest excavation) were subjected to DNA analysis (by SKD at Texas A&M University). Comparison of mitochondrial DNA confirmed that the mother of the hatchlings had been *Clemmys insculpta*. Paternity was resolved by using the microsatellite method (Weber and Wong 1993. Hum. Mol. Gen. 2:1123–1128); this confirmed that the clutch had been fathered by an *Emydoidea blandingii*.

In June 1998 one of the captive female *C. insculpta* deposited a clutch of 12 eggs in the enclosure. Hatchlings resulting from this nesting were also obvious hybrids. It is presently unknown whether the 1997 and 1998 clutches shared the same mother. The presumed father (*Emydoidea blandingii*) of the 1997 clutch had been released in June 1997, and a second male *E. blandingii* had been present for

about three weeks in May 1998. Thus, the 1998 hatchlings were either fathered by a different *E. blandingii* than the 1997 hatchlings, or were the result of long-term sperm storage in the female *C. insculpta*, a phenomenon presently unreported for this species, but known in *Emydoidea* (unpublished data).

The hybrid turtles display coloration and morphology that can be interpreted as intermediate between parental species, as well as features that may be unique: the hatchling carapace is light tan to dark brown, mottled with black pigment, and is keeled, broad but slightly elongate, with posterior marginal serrations; the lateral sutures of the first vertebral scute are nearly aligned with the lateral sutures of the first anterior marginal scutes; the terminus of the upper jaw is weakly notched, without cusps; the head is black or brown above, prominently marked with lateral and descending tan or yellow stripes and blotches; there is a large light spot or blotch on each side of the neck; the throat is pale yellow, invaded by dark striping. With growth, the carapace tends to elongate and darken, while becoming heavily flecked with yellow; the chin and throat become mostly yellow; and the soft skin on the neck and under the legs becomes a darker yellow-orange. The post-hatchling plastral pattern is yellow with black lateral blotches, a trait shared by both parental species. Hybrid specimens are being captive-raised to investigate questions about adult coloration and morphology, possible plastral hinge development, fertility, sex determination, and behavior.

We speculate that hybridization between *Clemmys insculpta* and *Emydoidea blandingii* could occur under natural conditions, as they are sympatric over portions of the Upper Great Lakes region. While *C. insculpta* prefers lotic habitats, as opposed to the lentic tendencies of *Emydoidea*, one of us (JHH) has frequently noted each species in habitat more typical of the other.

Submitted by **JAMES H. HARDING**, Michigan State University Museum, East Lansing, Michigan 48824, USA (e-mail: hardingj@pilot.msu.edu), and **SCOTT K. DAVIS**, Department of Animal Science, Texas A&M University, College Station, Texas 77843, USA.

PHRYNOPS WILLIAMSI (Williams' Side-necked Turtle). **PREDATION**. The mayuato, *Procyon cancrivorus*, is a nocturnal mammal (Carnivora: Procyonidae) that feeds mainly on crabs, fish, insects, molluscs, amphibians, and occasionally on fruits (Bisbal 1986. Mammalia 50:329–339; Emmons 1990. Neotropical Rainforest Mammals. Univ. of Chicago Press, Chicago, Illinois. 281 pp.). Individual mayuatos eat in specific places called rompederos, which are normally located on the banks of rivers and streams, and are so characteristic that they can be used to confirm the presence of this species in an area. On 9 June 1993, one of us (SB), travelling along a river at Iguazú National Park (25°39'S, 54°20'W) in Misiones Province, Argentina, found crabs and portions of the shell of a juvenile turtle (est. one year of age), identified as *Phrynops williamsi*, in the rompedero of a mayuato. As far as we know, this is the first account of mayuatos feeding on turtles. The reference material is housed at the Herpetological Collection, Fundación Miguel Lillo (FML 07764). The identification of the turtle was verified by Gustavo Scrocchi (FML).

Submitted by **ENRIQUE RICHARD**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina, and Reserva Experimental Horco Molle, Fac. de Cs. Nat. e IML, Univ. Nac. de Tucumán, casilla de correo 454, 4000 Tucumán, Argentina (e-mail: enrique.richard@tucbbs.com.ar), and **SAUL BORBOLLA**, Reserva Experimental Horco Molle, Fac. de Cs. Nat. e IML, Univ. Nac. de Tucumán, casilla de correo 454, 4000 Tucumán, Argentina.

TRACHEMYS GAIGEAE (Big Bend Slider). **ENDOPARASITES**. In the only study of parasites of *Trachemys gaigeae*, McAllister et al. (1995. J. Parasitol. 81:804–805) reported seven species of *Eimeria* (Apicomplexa: Eimeriidae) from turtles collected at Bosque del Apache National Wildlife Refuge, Socorro Co., New Mexico, USA (33°48'N, 106°53'W). Herein we report two species of helminths from a *T. gaigeae* taken in the same study area.

On 1 August 1996, a previously-marked *T. gaigeae* (immature female; 182 mm maximal straight-line carapace length, SCL; 790 g) was found drowned in a hoop trap in a pond that was ca. 1 m deep. The specimen was frozen and later dissected, at which time the stomach, intestines, kidneys, and lungs were removed and examined for helminths. The contents of the gastrointestinal tract (mostly filamentous algae, with fragments of aquatic insects, crayfish, and aquatic vascular plants) were also examined. Helminths were found only in the small intestine and included the digenetic trematode *Telorchis corti* (N = 11) and the spirurid nematode *Serpinema trispinosum* (N = 2 females). Trematodes were fixed in 10% buffered formalin, stained with Semichon's aceto-carmine, dehydrated in an alcohol series, mounted in Canada balsam, and identified using characteristics in MacDonald and Brooks (1989. Can. J. Zool. 67:2301–2320). Nematodes were cleared with lactophenol and identified using characteristics in Baker (1979. Can. J. Zool. 57:934–939) and Moravec and Vargas-Vázquez (1998. J. Nat. Hist. 32:455–468). Voucher specimens are deposited in the U.S. National Parasite Collection (Animal Parasitology Institute, Beltsville, Maryland, USA) as USNPC 88139 (*T. corti*) and 88140 (*S. trispinosum*). Both helminths are the first records for *T. gaigeae* and for New Mexico.

The *T. gaigeae* (University of New Mexico Museum of Southwestern Biology, MSB 60413) was first captured and released in a pond ca. 200 m from her drowning site on 19 July 1994 when she was 122 mm SCL and 228 g. A fecal sample obtained at that capture included six species of *Eimeria* (McAllister et al. 1995, *op. cit.*).

Telorchis corti parasitizes many turtle species, including emydids (Ernst and Ernst 1977. Bull. Maryland Herpetol. Soc. 13:1–75); metacercariae occur in aquatic snails, fingernail clams, and amphibian larvae. *Serpinema trispinosum* parasitizes Nearctic turtles (Baker 1979, *op. cit.*); paratenic hosts include lymnaeid snails and fish (Bartlett and Anderson 1985. J. Invert. Pathol. 46:153–159; Moravec et al. 1998. J. Parasitol. 84:454–456). *Trachemys gaigeae* is an omnivore and scavenger (JNS, pers. obs.), and probably consumes various potential intermediate and paratenic hosts for these helminths.

We thank J. Taylor, M. Oldham, and P. Norton (U.S. Fish and Wildlife Service) for facilitating work at the refuge under Special Use Permit No. 73599 (to JNS), and two anonymous reviewers for comments. Work by JNS was funded by the New Mexico Department of Game and Fish Share With Wildlife Program.

Submitted by **WADE D. WILSON**, **JOHN A. HNIDA**, and **JAMES N. STUART**, Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA (e-mail: stuartjn@unm.edu). Present addresses: (**WDW**) 47 West Main Street, Apt. 1R, Millbury, Massachusetts 01527, USA; (**JAH**) Division of Sciences and Technology, Peru State College, Peru, Nebraska 68421, USA.

LACERTILIA

COLEONYX VARIEGATUS (Western Banded Gecko). **DIET.** *Coleonyx variegatus* is not known to consume centipedes (Pianka 1986. Ecology and Natural History of Desert Lizards. Princeton University Press, Princeton, New Jersey. 208 pp.), nor have they been reported to consume carrion. Parker and Pianka (1974. Copeia 1974:528–531) reported the stomach contents of 185 *C. variegatus*, none of which contained centipede remains. On 16 May 1998 at 2015 h in Pima County, Arizona (USA), one of us (JRM) discovered an adult male *C. variegatus* (SVL 64 mm) attempting to consume a road-killed *Scolopendra* sp. much larger than itself (TL 82 mm; Fig. 1). The temperature was 21°C.

The centipede was adhered to the road by dried entrails and the gecko was observed struggling to engulf it for approximately 5 minutes. After this time we took a photograph and the camera flash appeared to cause the gecko to regurgitate the centipede and attempt to escape; our measurements indicate that ca. 30 mm of the centipede had been ingested. Because of the size of the centipede, it seems unlikely that this gecko was capable of consuming this prey item whole. The fact that this centipede was apparently dead before the gecko attempted ingestion appears significant because large *Scolopendra* spp. have been reported to prey upon small lizards (Lewis 1981. The Biology of Centipedes. Cambridge University Press, Cambridge. 476 pp.).

Both the *C. variegatus* and the *Scolopendra* sp. are deposited in the University of Texas at Arlington, Collection of Vertebrates (UTA R-45195).



FIG. 1. *Coleonyx variegatus* attempting to ingest a DOR *Scolopendra* sp.

Submitted by **STEPHANIE GARDNER** and **JOSEPH R. MENDELSON, III**, Department of Biology, Utah State University, Logan Utah 84322-5305, USA.

CROTAPHYTUS COLLARIS (Eastern Collared Lizard). **HIBERNACULUM.** Temperate lizards often survive freezing winter temperatures by digging burrows in which they hibernate (Gregory 1982. *In* C. Gans and H. Pough [eds.], Biology of the Reptilia Vol. 13, pp. 53–154. Academic Press, New York). *Crotaphytus collaris* has been previously reported to dig hibernacula on sloping terrain beneath flat rocks that are partially embedded in soil (Legler and Fitch 1957. Copeia 1957:305–307). On 24 March 1998, I observed a collared lizard emerging from a subterranean burrow on nearly flat open grassland, not beneath surface rocks. The burrow was almost certainly used as a winter hibernaculum because this was the first of five survey dates that lizards were active, and because the integument of this lizard was covered with caked mud. The observation was made at the flood control spillway at the Arcadia Lake Dam (AL) located 9.6 km east of Edmond, Oklahoma (USA), on State Hwy 66. Capture and examination of the animal revealed that it was a male (84 mm SVL) that had been toe-clipped as a hatchling on 3 August 1997, and was beginning its first full season of activity in 1998. The burrow was dug in clay soil interspersed with small (1–4 cm) rocks, 1 m from the edge of a patch of larger boulders inhabited by collared lizards at AL, and 22.2 m (minimum linear distance) from the home range occupied by this lizard as a hatchling. To study burrow architecture, I made an internal cast by pouring marine resin down the entrance (Chapman et al. 1990. J. Kansas Ent. Soc. 63:641–643). The burrow cast revealed a round entrance 4.5 cm in diameter that led into the burrow neck (8–9 cm diameter), which penetrated the substrate at a 80° angle relative to the surface horizontal (Fig. 1). At a depth of 11 cm, the shaft turned in a J-shape to form a blind-ended chamber (20 cm long and 9–11 cm in diameter). Unlike the chambers described by Legler and Fitch (*op. cit.*), this chamber was more than large enough to accomodate the lizard that I saw emerging from it. The bottom of the chamber was loose sand located 21 cm below the surface, which is 3.5 cm deeper than the average frost penetration of 17.5 cm in central Oklahoma (Anonymous 1938. Heating and Ventilating 35[6]:84).

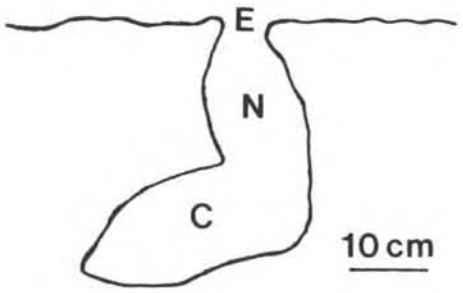


FIG. 1. *Crotaphytus collaris* hibernaculum showing the entrance (E), burrow neck (N), and chamber (C).

Submitted by **TROY A. BAIRD**, Department of Biology, University of Central Oklahoma, 100 North University Drive, Edmond, Oklahoma 73034, USA.

SERPENTES

HETERODON NASICUS NASICUS (Plains Hognose Snake). **LACK OF PARALYSIS FOLLOWING VERTEBRAL DISJUNCTION.** On 30 September 1997 at 1008 h, a male *Heterodon nasicus nasicus* (57.0 cm SVL) was found on County Rd B.5 at the junction of County Rd 12, Two Buttes State Wildlife Area, Prowers County, Colorado, USA. The snake has three scars on its dorsum; the most posterior caused constriction of the tail, the middle scar was a large patch with missing scales and the most anterior had bone protruding through the skin but no missing scales. At the point at which the bone protruded (26 cm from snout), the vertebral column was obviously misaligned. Radiographs of the snake showed near complete disjunction of the vertebral column at the region where the bone protrudes through the skin, an area of calcification associated with the large patch of missing scales and constriction of the tail but no internal injury associated with the posterior scar. The vertebral column is upturned anterior to a 0.75 mm separation at the anterior scar, and one vertebra is disarticulated and damaged, and protrudes through the skin (Fig. 1); however, limited muscle control indicates the spinal column is at least partially intact. The snake has fed on young mice since its capture and normal defecation has followed. The snake has limited voluntary muscle control posterior to the vertebral misalignment, although some localized areas appear not to respond to stimulus. The snake compensates for the posterior portion of the body with the anterior portion, which has resulted in some hypertrophy of the anterior and slight atrophy of the posterior musculature of the body. The extensive healing of

the scarred regions, and the level of muscle hypertrophy/atrophy suggests that this snake had survived in the wild for some time (>1 year) after being injured.

Smith and Fitzgerald (Herpetol. Rev. 1983. 14:46) reported the first trauma-induced kyphosis in a snake, *Thamnophis radix haydeni*. This specimen had normal motor function and was eating well, although gross vertebral deviations were apparent in radiographs. Complete paralysis posterior to a vertebral column break has been noted previously in a female *Thamnophis elegans vagrans* (Kasper 1997. Herpetol. Rev. 28:46). This snake was feeding normally and gave birth to three low-birth-weight young, which subsequently died. The fact that these garter snakes and the hognose snake were alive and functioning close to normally, in spite of a broken vertebral column, is indicative of the resiliency of snakes in general.

The hognose snake is currently housed in the Animal Facility of the University of Northern Colorado and will be deposited in the UNC Museum of Natural History Herpetology collection upon its death. A scientific collecting permit (97-0456) was issued to Stephen P. Mackessy by the Colorado Division of Wildlife (CDOW). We thank CDOW and the Great Outdoors Colorado Program for funding the project under which this specimen was collected. We thank Roger Klingenberg for assistance with interpreting radiographs.

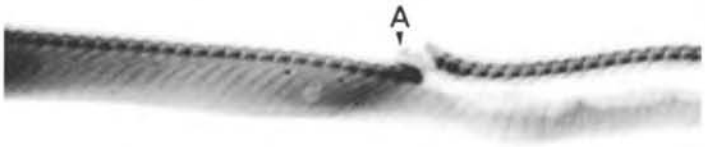


FIG. 1: Lateral view of anterior scar. Note discontinuity of vertebral column and disarticulated vertebra at A.

Submitted by **CHAD MONTGOMERY** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, 501 20th St., Greeley, Colorado 80639, USA (e-mail [SPM]: spmacke@bentley.unco.edu).

LAMPROPELTIS GETULA NIGRA (Black Kingsnake). **ENDOPARASITES**. Although internal parasites have been reported in *Lampropeltis getula* and a congener (Lindsay et al. 1992. J. Helminth. Soc. Washington 59:9–15; Klingenberg 1993. Understanding Reptile Parasites. Advanced Vivarium Systems, Lakeside, California. 81 pp.), specific endoparasites have yet to be described. I identified internal parasites and calculated their relative prevalence and intensity (Goldberg and Bursey 1996. Herpetol. Rev. 27:19) in the cloacal discharges (primarily feces) of naturally infected *L. g. nigra*.

Snakes were captured from the Anderson County Wildlife Sanctuary (ca. 36°03'N, 84°10'W) located in Anderson County, Tennessee, USA. Metal and wood cover objects (N = 150) were scattered over a 10-ha area (environments included recovering landfill, old field habitat, and woodland-field ecotone), and were searched for ca. 4 h/wk between 1 April and 1 October, 1994–1997. Cloacal discharges were collected from captured *L. g. nigra* by gently massaging the ventral side sequentially from anterior to posterior, down to the cloaca. Samples were stored in 10% formalin, and upon examination were treated with sodium nitrate as described in Kelly (1977. Canine Parasitology. Univ. Sydney Post-Graduate Foundation in Veterinary Science, Sydney, Australia. 110 pp.). Suspensions of discharges were examined using a compound microscope, and parasite ova and larvae were identified as described in Barnard (1986. Compendium on Continuing Education 8:145–369), and Barnard and Upton (1994. A Veterinary Guide to the Parasites of Reptiles. Krieger Publ. Co., Malabar, Florida. 164 pp.).

Twenty-two cloacal discharges were collected from 22 different snakes (13 M, 9 F; mean ± SD [range] SVL = 67.0 ± 21.0 cm [31.5 ± 106.0 cm]). Prevalence (number of infected individuals/number individuals examined) and mean intensity (mean number parasites per infected host) were recorded for each parasite (Table 1). Infection by both species of nematodes was observed in 3 (13.6%) samples. While nematodes were the most prevalent parasites, cestodes (tapeworms) were observed in zero (0%) samples. This observation is consistent with past research, which has demonstrated that wild reptiles are primarily infected by nematodes and generally not infected by cestodes (Frank 1994. Endoparasites. *In* Cooper and Jackson (eds.), Diseases of the Reptilia, pp. 291–321. Academic Press, New York, New York). Voucher parasite specimens will be deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland.

I especially thank John G. Byrd for the opportunity to conduct this study, and John E. Fauth for helpful suggestions concerning the manuscript. This study was funded by DOE grant DE-FG05-930R22105.

TABLE 1. Prevalence and mean intensity of endoparasites in cloacal discharges of *Lampropeltis getula nigra* (N = 22).

Parasite	Prevalence (%)	Intensity (Mean ± SD)
Nematoda		
Strongyloides spp.	45	2.8 ± 2.4
Ascaris spp.	14	1.3 ± 0.5
Trematoda		
Ochetosoma spp.	18	1.3 ± 0.5
Coccidia		
Eimeria spp.	18	24 ± 15

Submitted by **STRANT T. COLWELL, JR.**, Department of Chemistry, University of Virginia, Charlottesville, Virginia 22903, USA.

MICRURUS FULVIUS TENER (Texas Coral Snake). **DIET**. *Micrurus fulvius* is reported to feed primarily on small snakes and slender lizards (Conant and Collins 1998. Reptiles and Amphibians of Eastern/Central North America. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.). Greene (1984. Spec. Publ. Univ. Kansas Mus. Nat. Hist. 10:147–162) reports that throughout its range *Micrurus fulvius* feeds almost entirely on elongated lizards, amphisbaenians, and small snakes including young *Elaphe obsoleta*. Here we report predation on *E. obsoleta lindheimeri* by *M. fulvius tener* in Texas.

On 9 September 1998, at 0800 h, an adult male *M. fulvius tener* was captured crossing a park road in Cedar Hill State Park, Dallas Co., Texas, USA. The snake (56.3 cm total length, 138.0 g) was placed in a five-gallon bucket for ca. six hours. During that time it regurgitated a juvenile *E. obsoleta lindheimeri* (ca. 24.0 cm total

length), which was partially digested and missing the anterior third of its body. The remains of the *E. obsoleta lindheimeri* were preserved and placed in the University of Texas at Arlington Collection of Vertebrates (UTA R-45192). The *M. fulvius tener* was released.

We thank Ardell Mitchell for reviewing this manuscript, and the staff of the Dallas Zoo Department of Herpetology for their support. We also thank the Texas Parks and Wildlife Department (Permit # 51-98), and the staff of Cedar Hill State Park.

Submitted by **RICHARD D. REAMS** and **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, Dallas, Texas 75203, USA, and **JOHN M. DAVIS**, Texas Parks and Wildlife, P.O. Box 941 Cedar Hill, Texas 75106, USA (e-mail: Hylareams@aol.com).

PSEUDOBOA NIGRA (NCN). **PREY**. The limited available data on the diet of *Pseudoboa nigra* (Colubridae) suggest that it feeds primarily on lizards (Cunha and Nascimento 1983. Bol. Mus. Paraense Emílo Goeldi, Ser. Zool. 122:1–42; Vitt and Vangilder 1983. Amphibia-Reptilia 4:273–296; Strussman 1992. M.S. thesis. Universidade Estadual de Campinas, São Paulo, Brasil. 135 pp.).

On 4 May 1997 at 2230 h, while traveling on a dirt road from Barra do Cahy village to Cumuruxatiba village (17°37'S, 39°33'W) in Prado municipality, southern Bahia State, northeastern Brazil, we found a subadult female *P. nigra* (Museu Nacional do Rio de Janeiro, MNRJ 6670) preying on an adult male *Tropidurus torquatus* on the ground at the edge of roadside vegetation. The observation occurred in restinga habitat of the Atlantic Rainforest Domain. The snake (161.5 cm SVL, 18 cm tail length, 91.0 g preserved mass) was ingesting the lizard (86.7 mm SVL, 12.6 g preserved mass) head first, and the lizard's head and neck were completely ingested. Upon our arrival, the snake regurgitated and released the lizard and attempted to escape. The lizard moved ca. 2 m and stopped, remaining motionless for several minutes. Both specimens were collected and placed in the same plastic bag. The following morning, the lizard was completely ingested by the snake. This observation reinforces previous reports that *P. nigra* consumes lizards and indicates that this nocturnal snake preys on the diurnal *T. torquatus*.

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Submitted by **CARLOS FREDERICO DUARTE ROCHA**, **HELENA GODOY BERGALLO**, **LENA GEISE**, and **LUCIANA G. PEREIRA**, Departamento de Biologia Animal e Vegetal, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524 Maracanã, Rio de Janeiro, RJ, Brazil (e-mail [CFDR]: cfdrocha@uerj.br).

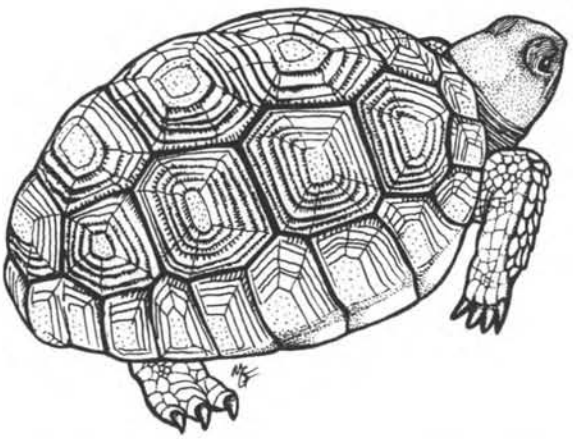
THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). **CARRION FEEDING**. On 15 May 1998 we observed a DOR (dead on the road) *Thamnophis sirtalis sirtalis* on State Hwy 23, 2.6 km south of the intersection with County Hwy ZZ (USA: Wisconsin: Iowa Co: T6N, R3E, Sec 4). The snake (55 cm SVL) was lying next to an unidentified DOR adult passerine bird. Although both specimens were badly crushed, it was clear that the garter snake was in the process of swallowing the dead bird when it, too, was run over (Fig. 1). Owing to the badly crushed condition of the specimens, neither was retained.

The diet of *T. sirtalis* includes "young birds" (Wright and Wright 1957. Handbook of Snakes of the United States and Canada. Vol. 2. Comstock Publ. Assoc., Ithaca, New York. 1105 pp.). Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.) describe the diet of the genus *Thamnophis* as ". . . birds, and carrion, are eaten occasionally." We believe this to be the first record of *T. s. sirtalis* feeding on bird carrion.



FIG. 1. DOR *Thamnophis sirtalis*, killed while ingesting a DOR passerine bird.

Submitted by **RICHARD A. SAJDAK**, 4 Callingham Road, Pittsford, New York 14534, USA, and **S. LINN SAJDAK**, Department of Biology, University of Rochester, Rochester, New York 14627, USA.



Gopherus polyphemus. Illustration by Michael Frick.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 30, Number 1 (March 1999).

CAUDATA

EURYCEA TYNERENSIS (Oklahoma Salamander). USA: OKLAHOMA: LeFlore Co: Cucumber Creek, ca. 1.2 km upstream from where US Rt. 259 intersects Cucumber Creek (34°36'26"N, 94°36'54"W), Sec. 8, T1N, R25E, Octavia quadrangle. 20 May 1999. Sam Houston State Vertebrate Museum (SHSVM 1-99 and 2-99). Verified by R. D. Durtsche. New county record; extends geographic range ca. 96.5 km S of Sequoyah County into the most south-central part of LeFLore County. Cucumber Creek is an intermittent stream with small isolated pools along the creek bed. Pool substrates consists of large boulders to small limestone cobbles with some organic detritus. At the time of specimen collection, the creek had moderate flow with only a few isolated pools observed within higher levels of the creek bed.

Submitted by **WILLIAM I. LUTTERSCHMIDT**, Department of Biological Sciences, Sam Houston State University, Huntsville, Texas 77341, USA (email: bio_wil@shsu.edu), **JULIAN G. HILLIARD**, Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA, and **TAMMY R. LANGE**, Department of Biological Sciences, Sam Houston State University, Huntsville, Texas 77341, USA.

ANURA

BUFO STERNOSIGNATUS (Sapito con Cruz). VENEZUELA: COJEDES: municipio San Carlos, El Candelo, SW "La Sierra" (Tucuragua) (09°50'54"N, 68°40'22"W). 31 February 1983. Reyes López. Museo de la Estación Biológica de Rancho Grande, Maracay (EBRG 3605–3606). Verified by R. Rivero. First state record. Previously known from several localities in states of Aragua, Carabobo, Distrito Federal, Falcón, Portuguesa, and Yaracuy (La Marca 1992, Catálogo Taxonómico, Biogeográfico y Bibliográfico de las Ranas de Venezuela; La Marca and Manzanilla 1998, Herpetol. Rev. 28:207; Marnr 1993, Diccionario Geográfico del Estado Cojedes. Servicio Autónomo de Geografía y Cartografía Nacional).

Submitted by **GILSON RIVAS**, Fundación La Salle de Ciencias Naturales, EDIAGRO, Avenida Bolivar No. 20-1219, San Carlos 2201, Estado Cojede, Venezuela (email: quisyl@cantv.net), and **JESÚS MANZANILLA**, Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Estado Aragua, Venezuela (email: jmanzanil@cantv.net).

BUFO WOODHOUSII (Woodhouse's Toad). USA: COLORADO: Eagle Co: ca. 1 km NW El Jebel near Blue Lake, Sec. 34, T7S, R87W. 26 July 1999. John Talbot and Dana Talbot. UCM Ancillary Collection of Herpetological Slides and Prints 134–136. Verified by Hobart Smith. First county record.

Submitted by **CHARLES W. LOEFFLER**, Colorado Department of Natural Resources, Division of Wildlife, 6060 Broadway, Denver, Colorado 80216, USA.

EUPSOPHUS EMILIOPUGINI. ARGENTINA: CHUBUT: Cushamen Department: Lago Puelo National Park, Arroyo Melo (42°07'50"S, 71°43'18"W), 415 m elev. 12 March 1998. C. A. Úbeda. Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" MACN 36786. Verified by J. R. Formas. First record for Argentina. Two mature females were found in a forest that represents the only ingression of the Chilean valdivian rain forest at low altitude toward the east through the Andes. Species is distributed in Chile from Puyehue (40°42'S, 72°18'W) to Caleta Vidal (45°16'S, 73°27'W) (Formas 1989, Proc. Biol. Soc. Washington 102[3]:568–576). The nearest previously known locality was Río Lenca (41°37'S, 72°27'W) in Chile. Extends the distribution of the species 98 km SE from Río Lenca, to the E of the Andes, at the proximity of a trans-Andean pass of low altitude (200 m elev. at Río Puelo).

Submited by **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, 8400 Bariloche, Argentina (email: cubeda@bariloche.com.ar), **EDUARDO RAMILO** and **CLAUDIO CHEHÉBAR**, Administración de Parques Nacionales, Delegación Regional Patagonia, C.C. 380, 8400 Bariloche, Argentina (email: pndrp@bariloche.com.ar), and **FÉLIX VIDOZ**, Parque Nacional Lago Puelo, 8431 Puelo, Argentina.

HYLA BOANS (Giant Gladiator Treefrog). VENEZUELA: ESTADO TÁCHIRA: Valle del Río Doradas, 650 m elev. 10 November 1984. Collected by Proyecto Uribante-Caparo, Facultad de Ciencias, Universidad de los Andes. Colección de Vertebrados, Universidad de los Andes, Facultad de Ciencias (CVULA 3573). Verified by A. Orellana. Species was known in Venezuela (Barrio 1998, Acta Biol. Venezuela 18[2]:28) in three bioregions: Amazonian Venezuela, Guianan Shield, and Orinoco Delta, all related to lowland rainforests in southern and eastern Venezuela. Only known report of this species in western Venezuela; extends distribution 600 km NW of the nearest known record in the country at Tobogán de la Selva, 30 km out of Puerto Ayacucho, Amazonas (Barrio 1998, *op. cit.*; Hoogmoed 1990, Zool. Meded. 64:71–93). Presence of *Hyla boans* in the Río Doradas valley was anticipated as this zone is the only Amazonian relict in Andean Venezuela, as appears in Barrio´s map (1998, *op. cit*: 93) of the biogeographic regions in relation to amphibian distribution.

Submitted by **CÉSAR LUIS BARRIO AMORÓS**, Fundación ANDÍGENA, Apartado 210, 5101-A Mérida, Venezuela (email: clba@hotmail.com).

HYLA URUGUAYA. BRAZIL: PARANÁ: Palmas municipality (ca. 26°30'S, 52°00'W). 6 September 1998. P. S. Bernarde and A. A. Giaretta. Museu de História Natural da Universidade Estadual de Campinas, Campinas, São Paulo (ZUEC 11551). Verified by Ariovaldo A. Giaretta. Species was previously known from a few localities in Uruguay and the state of Rio Grande do Sul, Brazil (Langone 1990, Com. Zool. Mus. Hist. Nat. Montevideo 12[172]:1–9). First state record and the northernmost known locality; extends the known distribution ca. 480 km NE airline from previous records (Porto Alegre Municipality, state of Rio Grande do Sul). Individuals were found calling near ground at night in low vegetation bordering a lake.

Submitted by **PAULO SÉRGIO BERNARDE**, Curso de Pós-Graduação em Zoologia, Departamento de Zoologia, Universidade Federal do Paraná, C.P. 19020, 81531-990, Curitiba-PR, Brazil (email: bernarde@garoupa.bio.ufpr.br).

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog). USA: Florida: St. Johns Co: Anastasia Island, Fort Matanzas National Monument (29°42'56.3"N, 81°13'59.0"W). 10 June 1999. K. L. Krysko and F. W. King. Florida Museum of Natural History (UF 117746). Verified by Joseph T. Collins. New county record collected at 2130 h on nature boardwalk in maritime forest. During the course of monthly surveys of amphibians and reptiles of FOMA

conducted on behalf of the U.S. National Park Service from September 1998 through September 1999, we found a total of five *Osteopilus septentrionalis,* the first as noted above. The remaining four include one specimen on 12 June 1999 at 2200 h (UF 117747), one on 10 July 1999 at 2155 h (UF 117774), and two on 10 September 1999 at 2025 h and 2115 h. A majority of the introduced amphibians and reptiles in southern Florida have been unable to expand their range north of Lake Okeechobee because of cold winter temperatures (Wilson and Porras 1983, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9). However, some species including the Brown Anole (*Anolis sagrei*) and Greenhouse Frog (*Eleutherodactylus planirostris*) are more cold-tolerant, and edificarian species like the Indo-Pacific Gecko (*Hemidactylus garnotii*) and Mediterranean Gecko (*H. turcicus*) have found refuge from the cold in warm cracks and crevices on buildings. As a consequence, these species have established breeding populations farther north within peninsular Florida and along both coasts. Because all five *O. septentrionalis* we collected at FOMA are adults of variable sizes, this suggests that if not already, there soon may be breeding populations of this non-indigenous frog species all along the northeastern coast of peninsular Florida.

Submitted by **KENNETH L. KRYSKO** (email: kenneyk@flmnh.ufl.edu), Department of Wildlife Ecology and Conservation and Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA, and **F. WAYNE KING** (email: kaiman@flmnh.ufl.edu), Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA.

PHYLLOMEDUSA HYPOCONDRIALIS. VENEZUELA: COJEDES: municipio Rómulo Gallegos, Asentamiento La Blanca, Sector Rincón Moreno, SW San Carlos City, 09°34'18"N, 68°37'14"W, 140–150 m elev. 1996 (exact date not given). Numa Hurtado. Museo de la Estación Biológica de Rancho Grande, Maracay (EBRG 3582). Verified by R. Rivero. Previously known from states of Barinas, Bolívar and Apure (Rámos and Busto 1989–90, Mem. Soc. Cienc. Nat. La Salle 52–53[131-134]:287–308; Hoogmoed and Gorzula 1979, Zool. Med. Leiden 54[13]:183–206; La Marca 1992, Catálogo Taxonómico, Biogeográfico y Bibliográfico de las Ranas de Venezuela). First state record; extends range more than 150 km from the previous records.

Submitted by **GILSON RIVAS**, Fundación La Salle de Ciencias Naturales, EDIAGRO, Avenida Bolivar No. 20-1219, San Carlos 2201, Estado Cojede, Venezuela (email: quisyl@cantv.net) and **JESÚS MANZANILLA**, Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Estado Aragua, Venezuela (email: jmanzanil@cantv.net).

PHYLLOMEDUSA TOMOPTERNA. VENEZUELA: AMAZONAS: Mavaca (Yanomami village), Mavaca River, upper Orinoco drainage. 28 June 1981. J. Finkers. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 2938). BOLÍVAR: Reserva Forestal Imataca, 180 m elev. May 1990. L. Balbás. EBRG 2455. Both verified by Gilson Rivas. Species has been reported previously in Venezuela from only two localities, one at the base of the Cerro de la Neblina (state of Amazonas) by McDiarmid and Paolillo (1988, *In* Brewer-Carías [ed.], Cerro de la Neblina, Resultados de la Expedición 1983–1987. FUDECI, Caracas), on the basis of voucher specimens apparently deposited in USNM and the other by Duellman (1997, Univ. Kansas Nat. Hist. Mus. Sci. Pap. 2:1–52) at Km 13 on the road between El Dorado and Santa Elena de Uairén, Estado Bolívar (KU 167188). We report the first vouchered specimens discovered in a Venezuelan museum; corroborates the above records and extends known distribution ca. 200 km NNE in state of Amazonas, and 100 km NNE in state of Bolivar.

Submitted by **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, 1010-A, Venezuela (email: fudeci@reacciun.ve and cesarlba@yahoo.com), and **RAMÓN RIVERO**, Museo de la Estación Biológica Rancho Grande, MARNR, Apartado 184, Maracay, Aragua, Venezuela.

PLEURODEMA NEBULOSA. ARGENTINA: RIO NEGRO: Departamento de San Antonio Oeste: Las Grutas (40°48'S, 64°44'W). 24 January 1997. R. Martori and L. Aun. Colección de Vertebrados Universidad Nacional de Río Cuarto, Córdoba, Argentina (ZVUNRC 4047). Verified by G. Scrocchi. First provincial report, mentioned as probably occurring by Cei (1980, Amphibians of Argentina. Monit. Zool. Ital. Monogr. 2[1]:609) and cited by Christie (1995, *In* Ubeda and Grigera [eds.], Recalificación del estado de conservación de la fauna silvestre Argentina. Consejo Asesor Regional Patagonico de la Fauna Silvestre), but no voucher specimen was referenced. Specimen was found chorusing at night in a temporary pond after a storm.

Submitted by **LILIANA AUN** and **RICARDO MARTORI**, Zoologia de Vertebrados, Universidad Nacional de Rio Cuarto, 5800 Rio Cuarto, Córdoba, Argentina (email: rmartori@exa.unrc.edu.ar).

RANA GRYLIO (Pig Frog). PUERTO RICO: TOA BAJA: SABANA SECA: wetland area known as Ciénaga de San Pedro, 2.9 km, Rt. 867 within the North Tract sector of the U.S. Naval Security Group Activity (18°27'04"N, 66°12'42"W). 12 November 1998. Neftalí Rios-López. Museo de Biología, Universidad de Puerto Rico-Recinto de Río Piedras. UPRRP 5752–54. Verified by Julian Lee. First record for Puerto Rico and the southeasternmost record for the species. A female (111.7 mm SVL) and a juvenile (68.6 mm SVL) were collected at 2200 h from a flooded channel, which runs parallel to a side road within the North Track area, where there is an apparently large population from which calling males were heard in March, August, and September 1995, and in October and November 1998. Females, sub-adults, and juveniles were observed while submerged, partially or up to the head, in open waters surrounded by vegetation. However, calling males were heard from within large clumps of *Typha dominguensis,* and these animals were not openly exposed while calling. This calling behavior might explain why the species was not previously reported. It is possible that chorusing individuals were confused with birds calling within vegetation clumps throughout the area. *Rana grylio* is present also in the Tortugero Lagoon Reserve and associated nearby wetlands (MANATI/VEGA BAJA, Tierras Nuevas Saliente, Rt. 686, 18°28'00"N, 66°27'48"W). A sub-adult (102.7 mm SVL, UPRRP 5761) and a juvenile (40.4 mm SVL, UPRRP 5762) were collected by Carlos Toledo and Neftalí Rios-López on 17 August 1999 at the edge of a small pool surrounded by *T. dominguensis.* The species was also found all along the Caño Tiburones (water channel which cuts an associated wetland area) at the northwesternmost part of its geographic distribution within Puerto Rico (Arecibo, Factor, Rt. 682, 18°27'47"N, 66°38'21"). A juvenile (53.6 mm SVL, UPRRP 5763) was collected (NRL) from within the channel on which males were heard calling in the water. All these data indicate that *Rana grylio* is well established in northern Puerto Rico and it is reproductively active during most of the year. The previous geographical range of this species includes southern South Carolina to extreme southern Florida and extreme southeastern Texas. It has been also introduced on Andros and New Providence islands in the Ba-

hamas (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **NEFTALÍ RIOS-LÓPEZ** and **RAFAEL L. JOGLAR**, Universidad de Puerto Rico, Recinto de Río Piedras, Departamento de Biología, Apartado 23360, San Juan, Puerto Rico 00931-3360, USA.

RANA SPHENOCEPHALA (Southern Leopard Frog). USA: ILLINOIS: WAYNE CO: Bedford Twp. (Sec. 34, T1N, R7E). Found dead in culvert at jct. County Roads 1550N and 1500E. 27 April 1999. J. W. Walk and T. Esker. Southern Illinois University voucher number H05719. Verified by S. Ballard. New county record (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. His. Surv. Bull. 298 pp.).

Submitted by **DANIEL J. OLSON** and **JEFF W. WALK**, Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, Illinois 61801, USA.

RANA SYLVATICA (Wood Frog). USA: OKLAHOMA: ADAIR CO: Ozark Plateau National Wildlife Refuge, SW 1/4 Sec. 34, T15N, R26E. 8 September 1999. Richard C. Stark, Kevin C. Stubbs, and Steven L. Hensley. Sam Noble Oklahoma Museum of Natural History (OMNH 35836). Verified by Janalee P. Caldwell. First state record (Black and Sievert 1989, A Field Guide to Amphibians of Oklahoma. Publ. Oklahoma Dept. Wildlife Conserv. 80 pp.). Extends range ca. 30 km SW from nearest location in Washington County, Arkansas (Trauth 1995, Bull. Chicago Herpetol. Soc. 30[3]:46–51).

Submitted by **RICHARD C. STARK**, **KEVIN C. STUBBS**, and **STEVEN L. HENSLEY**, United States Fish and Wildlife Service, Oklahoma Ecological Services, 222 South Houston Avenue, Suite A, Tulsa, Oklahoma 74127, USA.

SCAPHIOPUS HOLBROOKII (Eastern Spadefoot). USA: TENNESSEE: BLOUNT CO: Great Smoky Mountains National Park: Gum Swamp in Cade's Cove (35°35'21"N, 83°50'21"W). 12 July 1999. Kelly J. Irwin, C. Kenneth Dodd, Jr., and Marian L. Griffey. USNM 533211, adult male. Verified by Steve Gotte. A small chorus of <5 males calling from the center of the pond during an extremely heavy rainfall (134 mm total rain, 10–13 July). Collected 1130–1300 h; air temp 22°C; substrate temp 21°C; water temp 20°C; relative humidity 88%. Breeding evidently was successful inasmuch as a 20 mm juvenile was found at this location at dusk on 20 September 1999, during a light rain shower. New Park and county records (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol.Misc. Publ. 12. 94 pp.). These records extend the range of the *S. holbrookii* ca. 55 km ENE from the nearest known populations in McMinn County, Tennessee, and verify Huheey and Stupka's (1967, Amphibians and Reptiles of Great Smoky Mountains National Park. Univ. Tennessee Press, Knoxville. 98 pp.) speculation that this species eventually might be found within the Park. Although generally considered absent from east Tennessee, this species might be more widespread than presently indicated and occur in other cove valleys adjacent to nearby mountainous regions.

Collections were made under permits from Great Smoky Mountains National Park (GRSM-98-031) and the Tennessee Wildlife Resources Agency (No. 1103).

Submitted by **KELLY J. IRWIN**, **C. KENNETH DODD, JR.**, and **MARIAN L. GRIFFEY**, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA.

SCINAX RUBRA. PUERTO RICO: TOA BAJA: SABANA SECA: wetland area known as Ciénaga de San Pedro, 2.9 km, Rt. 867 within the North Tract sector of the U.S. Naval Security Group Activity (18°27'30"N, 66°12'30"W). 12 November 1998. Neftalí Rios-López. Museo de Biología. Universidad de Puerto Rico-Recinto de Río Piedras (UPRRP 5753, 5755–58). Verified by Rafael L. Joglar. New record for the north-central part of Puerto Rico. Five calling males (mean SVL 28.86 ± 1.19 mm., min. 27.4 mm, max. 30.4 mm) were collected at 2030 h from a flooded area, 2–3 masl, along both sides of a local road within the North Track area. The species is highly abundant within the more than 162 km this wetland covers. These data suggest that the population is established and reproductively active throughout the year. The new geographic area reported herein is the northwesternmost record for the species. The frog was previous reported in Puerto Rico from the Bayamón-Carolina area (Rivero 1998, Los Anfibios y Reptiles de Puerto Rico/The Amphibians and Reptiles of Puerto Rico. Segunda Ed. Editorial Universitaria U.P.R., San Juan. 510 pp.).

Submitted by **NEFTALÍ RIOS-LÓPEZ**, Universidad de Puerto Rico, Recinto de Río Piedras, Departamento de Biología, Apartado 23360, San Juan, Puerto Rico 00931-3360, USA.

SPHAENORHYNCHUS LACTEUS: VENEZUELA: ESTADO AMAZONAS: Mavaca (Yanomami village), Mavaca River, upper Orinoco drainage. 15 September 1981. J. Finkers. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 1947). Verified by Gilson Rivas. Species has been reported in Venezuela from the east edge of the country, in scattered localities in the states of Bolívar, Monagas and Sucre (Hoogmoed and Gorzula 1979, Zool. Meded. Leiden 54[13]:183–216). This specimen from the center of the state of Amazonas extends distribution 600 km to the SW. First state record and southernmost in the country.

Submitted by **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, 1010-A, Venezuela (email: fudeci@reacciun.ve and cesarlba@yahoo.com), and **RAMÓN RIVERO**, Museo de la Estación Biológica Rancho Grande, MARNR, Apartado 184, Maracay, Aragua, Venezuela.

SYRRHOPHUS CYSTIGNATHOIDES CAMPI (Rio Grande Chirping Frog). USA: TEXAS: LIBERTY CO: Davis Hill State Area, 21.9 (air) km ESE of Cleveland. 7 January 1999. John H. Malone. TCWC 82252. Verified by James R. Dixon. First specimen documented from Liberty County (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp; and Dixon 1996, Tex. Herpetol. Soc. Spec. Publ. No. 2). The specimen was collected during a herpetofaunal inventory for the Texas Parks and Wildlife Department under the authority of State Park Scientific Study Permit 60-98.

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA.

TESTUDINES

CLEMMYS INSCULPTA (Wood Turtle). USA: MAINE: WALDO CO: Sandy Stream National Wildlife Refuge, 0.83 km N Rt. 139 on Sandy Stream (44°37.221'N, 69°21.102'W). 18 April 1999. Phillip G. deMaynadier. University of Massachusetts Museum (UMA Color Photograph R1075). Verified by Alan M. Richmond. Adult male found basking on sandy riverbank in mature hardwood flood plain forest. New county record (Hunter et al. 1999, Maine Amphibians and Reptiles. Univ. Maine Press, Orono. 252 pp.).

Submitted by **PHILLIP G. DEMAYNADIER**, Endangered Species Group, Maine Department of Inland Fisheries and Wildlife, 650 State Street, Bangor, Maine 04401, USA, and **MOLLY T. DOCHERTY**, Maine Natural Areas Program, 159 Hospital Street, Augusta, Maine 04333, USA.

PSEUDEMYS TEXANA (Texas River Cooter). USA: TEXAS: REAL CO: Frio River, 2 km SE of Leakey, 100 m upstream of northern crossing of Rt. 1120. 24 May 1999. Peter V. Lindeman, Tara P. Allen, Damien Edwards, Julie Lovell, and Luke Lovell. KU Color Slides 11672–675. Verified by Joseph T. Collins. Two females (PL 266 mm and 210 mm) captured by snorkeling in 3–4 m deep pool. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Press, College Station. 434 pp.). Species has not previously been reported from the Nueces drainage (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.; Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Privately printed. Richmond, Indiana. 363 pp.; Ernst et al. 1994, Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D. C. 578 pp.), although a Uvalde County record in Dixon (*ibid*; TNHC 14620, no collecting locality information other than county) must also be from the Nueces drainage.

Submitted by **PETER V. LINDEMAN**, **TARA P. ALLEN**, **DAMIEN EDWARDS**, **JULIE LOVELL**, and **LUKE LOVELL**, Division of Biological Sciences and Related Technologies, Madisonville Community College, 2000 College Drive, Madisonville, Kentucky 42431, USA (email [PVL]: Lpeter0@pop.uky.edu).

STERNOTHERUS ODORATUS (Common Musk Turtle). USA: OHIO: HAMILTON CO: Harrison, Whitewater Township, Dry Fork Creek under bridge on Kilby Road, River Mile 0.45. 3 October 1996. M. Sisson. Cincinnati Museum of Natural History (CMNH 4915). Verified by Jeff Davis. County record replacing lost specimen CMNH 1067, a plastron collected by W. H. Weller in 1931 (Conant 1938, Reptiles of Ohio. Am. Midl. Nat. 20:1–200).

Submitted by **MIKE SISSON**, 6611 Hearne Road, Cincinnati, Ohio 45248, USA, **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **PAUL J. KRUSLING**, Geier Collections and Research Center, Museum of Natural History and Science, Cincinnati Museum Center, 1720 Gilbert Avenue, Cincinnati, Ohio 45202, USA.

AMPHISBAENIA

AMPHISBAENA ANAEMARIAE. BRAZIL: MINAS GERAIS: Nova Ponte (19°08'S, 47°41'W). September 1995. A. Bernardes. Museu Nacional, Rio de Janeiro (MNRJ 6463; 7212-14); Indianápolis (19°02'S, 47°55'W). October 1995. A. Bernardes. MNRJ 7309. All verified by J. Duarte de Barros Filho. Species was recently described by Vanzolini (1997, Pap. Avulsos. Zool., São Paulo 40[3]: 65–85) from a site in the Serra da Mesa range (14°02'S, 48°13'W), in the state of Goiás, and also reported by that author to occur at Anápolis (16°20'S, 48°58'W) in the same state. Previously known only from those two localities. This report extends the range of the species ca. 310 km south of previous southernmost locality (Anápolis), and represents a new state record.

Submitted by **DAVOR VRCIBRADIC**, Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, 20550-011, Rio de Janeiro, Rio de Janeiro, Brazil, and **MARCELO SOARES**, Departamento de Vertebrados, Museu Nacional do Rio de Janeiro, Quinta da Boa Vista, 20940-040, Rio de Janeiro, Rio de Janeiro, Brazil.

SAURIA

ANOLIS ALLISONI (Allison's Anole). MÉXICO: QUINTANA ROO: Municipio Othón Pompeyo Blanco, Banco Chinchorro, Cayo Centro, ca. 30 km E Majahual (18°35'N, 87°21'W). June 1996. F. Méndez, H. Gadsden, O. Cuéllar, and R. Rodríguez. Museo de Zoología de la Facultad de Ciencias de la Universidad Nacional Autónoma de México (MZFC 10175–76). Verified by O. Flores-Villela. First positive state and country record. A former record from Isla Cozumel, Quintana Roo, was regarded as questionable by Lee (1996, The Amphibians and Reptiles of the Yucatán Peninsula. Cornell Univ. Press, Ithaca, New York. 500 pp.) on the basis that no other specimens of the species had been collected at that site. Extends range of species about 150 km N of the closest record on the continent at Half Moon Cay, Belize (Lee 1996, *op. cit.*). The referred specimen and many others (not collected) were found perched on the trunks of coconut palms at heights of ca. 2 m or more.

Submitted by **ADRIÁN NIETO-MONTES DE OCA**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México 04510, Distrito Federal, México, **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México, and **FAUSTO MENDEZ DE LA CRUZ**, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México 04510, Distrito Federal, México.

CNEMIDOPHORUS SEXLINEATUS SEXLINEATUS (Six-lined Racerunner). USA: WEST VIRGINIA: MORGAN CO: SW entrance of Randolph tunnel (39°35'56"N, 78°23'89"W), ca. 3.0 km SW Doe Gully, along CSX railroad, elev. ca. 165 m. 27 July 1999. Zachary I. Felix and W. Jeffrey Humphries. West Virginia Biological Survey, Marshall University (WVBS 12080–81). Verified by Thomas K. Pauley. Two specimens collected from shrubs along blasted shale outcrop on NW side of railroad tracks, ca. 50 m from entrance of tunnel. Ten additional adults were observed on outcrop and in xeric, open areas on ground. New state record (Green and Pauley 1987, Amphibians and Reptiles in West Virginia. Univ. Pittsburgh Press, Pittsburgh. 241 pp.). Suitable habitat occurs near railroad tracks along the Potomac River in Morgan and Hampshire counties. It is expected that *C. s. sexlineatus* will be discovered in other areas in eastern West Virginia.

Submitted by **ZACHARY I. FELIX** and **W. JEFFREY HUMPHRIES**, Department of Biological Sciences, Marshall University, 400 Hal Greer Boulevard, Huntington, West Virginia 25755, USA, and **W. H. MARTIN**, Route 3, Box 804, Harpers Ferry, West Virginia 25425, USA.

ELGARIA KINGII FERRUGINEA (Rusty Alligator Lizard). MÉXICO: AGUASCALIENTES: Arroyo Ibáñez, Municipality of Calvillo (21°45'06"N, 102°45'41"W) in subtropical scrub and oak forest, 1845 m elev. 23 August 1997. Gustavo Quintero-Díaz and Joel Vázquez-Díaz. Museo de Zoología "Alfredo L. Herrera", Facultad de Ciencias, UNAM (MZFC) 11318. Same area (21°45'06"N, 102°45'41"W) in subtropical scrub and oak forest, 1847 m elev. 30 August 1997. MZFC 11319. Same area (21°45'06"N, 102°45'41"W), in subtropical scrub and oak forest. 1848 m elev. 15 August 1998. Gustavo Quintero-Díaz and Joel Vázquez-Díaz. Museo de Zoología, Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VR) 272. Veri-

fied by Fernando Mendoza-Quijano and Oscar Flores-Villela. First record for state of Aguascalientes: extends range ca. 183 km NE Sierra de Ixtlán, San Marcos, Jalisco (Zweifel 1954, Herpetologica 10:146) and ca. 79.2 km SE Teul de Ortega, Zacatecas (Webb 1970, Cat. Amer. Amphib. Rept. 97:1–4).

Submitted by **GUSTAVO QUINTERO-DÍAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño S.A. de C. V. Avenida Aguascalientes Sur 203, Fracc. Prados del Sur, C.P. 20280 Aguascalientes, Aguascalientes, México, and **HOBART M. SMITH**, EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA.

EUMECES OBSOLETUS (Great Plains Skink). USA: TEXAS: Sterling Co: 9.7 km NE Sterling City. 7 April 1966. Bryce C. Brown. SMBU 16061. Verified by Stephen L. Williams. First record for county (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press. 434 pp; Dixon 1997, Texas Herpetol. Soc. Spec. Publ. 3:1–14).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA, **DAVID LINTZ** and **BRYCE C. BROWN**, Strecker Museum, Baylor University, Waco, Texas 76798-7154, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

GEKKO HOKOUENSIS (Kwangsi Gecko). TAIWAN: Taitung Co: Lutao Island (or Green Island), 100 m N Woonchueng Village (22°38'59"N, 121°29'23"E), 10 m elev. 28 June 1999. Simon Creer and Wen-hao Chou. National Museum of Natural Science, Taiwan (NMNS 3370). Verified by Wen-san Huang. The specimen was found on a rock at a dry stream in a subtropical forest. Species has been known from southeastern China, the main island of Taiwan, Lanyu Island, and southern Japan, including the Ryukyu Archipelago and southern Kyushu (Ota 1991, Proc. First Internatl. Symp. Wildl. Conserv. pp. 52–53). First record for Lutao Island, which is located 60 km N of Lanyu Island.

Submitted by **WEN-HAO CHOU**, National Museum of Natural Science, Taichung, Taiwan, Republic of China.

SCELOPORUS CLARKI BOULENGERI (Stejneger's Spiny Lizard). MÉXICO: AGUASCALIENTES: Río Gil, municipality of Calvillo (21°51'48"N, 102°37'48"W) in subtropical scrub. 13 May 1995. Gustavo Quintero-Díaz and Joel Vásquez-Díaz. Museo de Zoología "Alfredo L. Herrera," Facultad de Ciencias, UNAM (MZFC 11322); Arroyo Ibáñez, municipality of Calvillo (21°45'05"N, 102°45'38"W) in oak forest, 1989 m elev. 23 August 1997. Joel Vásquez-Díaz and Gustavo Quintero-Díaz. MZFC 11321. Verified by Oscar Flores-Villela and Fernando Mendoza-Quijano. First record for state of Aguascalientes; extends range from ca. 1.6 mi N Santa Rosa (along the Guadalajara-Zacatecas highway), Zacatecas (Baker et al. 1967, Am. Midl. Nat. 77:224), from Hostotipaquillo, Jalisco (Smith 1939, Field Mus. Nat. Hist. Zool. Ser. 26:132), and from 9 mi S Zacualco, Jalisco (Smith 1992, Bull. Maryland Herpetol. Soc. 29:9).

Submitted by **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño S.A. de C.V. Avenida Aguascalientes Sur 203, Fracc. Prados del Sur, C.P. 20280 Aguascalientes, Aguascalientes, México, **GUSTAVO QUINTERO-DÍAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, and **HOBART M. SMITH**, EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA.

SCINCELLA GEMMINGERI GEMMINGERI (Cope's Forest Ground Skink). MÉXICO: TABASCO: 43 km E Coatzacoalcos (Veracruz), near Río Tonalá. 3 June 1964. Bryce C. Brown. SMBU BCB series 12260. Verified by David Lintz. First record for state of Tabasco (Flores and Gerez 1994, Biodiversidad y Conservación en México, UNAM, México, D. F. P. 318).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA, **BRYCE C. BROWN**, Strecker Museum, Baylor University, Waco, Texas 76798-7154, USA, **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

SCINCELLA LATERALIS (Ground Skink). USA: FLORIDA: Gulf Co: White City. 2 May 1998. K. Krysko and A. Reppas. Verified by F. Wayne King. Florida Museum of Natural History, University of Florida (UF 113012). New county record and first record along the southwestern edge of the Apalachicola River.

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation and Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (email: kenneyk@flmnh.ufl.edu), **ANTHONY T. REPPAS**, Department of Interdisciplinary Studies, University of Florida, Gainesville, Florida 32611, USA, and **JACK R. TANNER**, P.O. Box 5003, White City, Florida 32465, USA.

SPHAERODACTYLUS MACROLEPIS MACROLEPIS (Big Scale Dwarf Gecko). BRITISH VIRGIN ISLANDS: Carval Rock (0.8 ha island, ca. 2 km SSW from Ginger Island), ca. 18°38'N, 64°49'W. 28 October 1998. Alejandro J. Sánchez Muñoz. USNM 529979–80. Verified by James D. Lazell. Found in litter on a 5–6 m rock ledge below two *Coccoloba unifera* trees. New island record.

Submitted by **ALEJANDRO J. SÁNCHEZ MUÑOZ,** P.O. Box 502218, Saint Thomas, Virgin Islands 00805, USA, and **GORDON H. RODDA**, United States Geological Survey, Midcontinent Ecological Science Center, 4512 McMurry Avenue, Fort Collins, Colorado 80525-3400, USA.

TEIUS SUQUIENSIS (Lagartija Verde). ARGENTINA: CÓRDOBA: Departamento General San Martín, Villa María (32°25'S, 63°15'W). 31 December 1997 and 6 December 1998. C. Rozzi Giménez and F. Gallego. Colección de Vertebrados, Universidad Nacional de Río Cuarto, Río Cuarto, Córdoba, Argentina (ZVUNRC 4246 and 4665). Verified by R. A. Martori. Specimens extend the known range at least 100 km SE (following the riparian margins of the Río Tercero) from previously cited localities (Ávila and Martori 1991, Trop. Zool. 4:193–201).

Submitted by **CRISTINA ROZZI GIMÉNES** and **FERNANDO GALLEGO**, Departamento de Ciencias Naturales, Universidad Nacional de Río Cuarto, 5800, Río Cuarto Córdoba, Argentina.

VANZOSAURA RUBRICAUDA. ARGENTINA: CÓRDOBA: Departamento Punilla, Villa Carlos Paz (31°25'S, 64°21'W). 1 January 1999. F. Gallego. Colección de Vertebrados, Universidad Nacional de Río Cuarto, Río Cuarto, Córdoba, Argentina (ZVUNRC 4666). Verified by R. A. Martori. *Vanzosaura rubricauda* is a rare

lizard in Córdoba. Localities of record are Cruz del Eje, El Sauce, Orcosuma, Serrezuela, Mancha and Cabana (Gallardo 1969, Neotropica 15[47]:73–81). Specimen constitutes the first record for the Valle de Punilla, and extends the distribution 45 km SW of previous localities.

Submitted by **FERNANDO GALLEGO**, Zoologia Vertebrados, Universidad Nacional de Río Cuarto, Agencia Postal 3, 5800, Río Cuarto, Córdoba, Argentina.

SERPENTES

CONIOPHANES IMPERIALIS IMPERIALIS (Black-striped Snake). MÉXICO: PUEBLA: Tuzamapan de Galeana, 1.25 km N Tetelilla de Islas (20°06'N, 97°33'W), ca. 160 m elev. 21 February 1997. Sol de Mayo A. Mejenes-López. Colección Nacional de Anfibios y Reptiles, Instituto de Biología, UNAM (IBH 12200, formerly SMML 78). Verified by Luis Canseco Márquez. Young female found under stone in secondary vegetation near tropical moist forest. First record for Puebla; extends range ca. 50 km airline SW of the closest known locality at Poza Rica, Veracruz, reported by Pérez-Higareda and Smith (1991, Ofidiofauna de Veracruz, Análisis Taxonómico y Zoogeográfico. Publs. Espec. Inst. Biól. UNAM 7, 122 pp.).

Submitted by **SOL DE MAYO A. MEJENES-LÓPEZ, FERNANDO MENDOZA QUIJANO,** Instituto Tecnológico Agropecuario No. 6, Km 5.5 Carr, Huejutla-Chalahuiyapa, Apartado Postal No. 94, Huejutla de Reyes, C P. 43000, Hidalgo, México (e-mail fmendoza@mail.ibiología.unam.mx), and **CAROLINA MADERO VEGA, ADA KARLINA MOLLEDA CONTRERAS**, Escuela de Biología, BUAP, Edificio 76, Unidad de Ciencias, Ciudad Universitaria, Avenida San Claudio y Boulevard Valsequillo, Col. San Manuel, C. P. 72570, Puebla, Puebla, México.

FARANCIA ERYTROGRAMMA ERYTROGRAMMA (Rainbow Snake). USA: FLORIDA: GADSDEN CO: Apalachicola River, ca. 1.0 mi S I-10. 10 April 1999. K. L. Krysko, R. C. Means, UF Herpetology class. Florida Museum of Natural History (UF Color Slide 119243). Verified by F. W. King. New county record collected at 1000 h on rocky bank of river where water level was low.

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, and Division of Herpetology, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (email: kenneyk@flmnh.ufl.edu), and **RYAN C. MEANS**, Department of Wildlife Ecology and Conservation and Division of Herpetology, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (email: rcmeans@flmnh.ufl.edu).

FICIMIA HARDYI (Hardy's Hooknose Snake). MÉXICO: SAN LUIS POTOSÍ: San José de las Flores (22°44'17"N, 100°23' 24"W, 1850 m elev.) in chaparral. 15 March 1997. Carlos Gómez. Instituto de Biología, Universidad Nacional Autónoma de México (XR 0559); San José de los Cervantes (22°32'55"N, 100°27'46"W, 1588 m elev.) in chaparral. 30 November 1998. Xóchitl Hernández and Ricardo Torres. Unidad de Biología, Tecnología y Prototipos (UBIPRO), ENEP-Iztacala, Universidad Nacional Autónoma de México (XR 0767); and El Realejo municipality of Guadalcázar (22°40'46"N, 100°24'52"W, 2160 m elev.) in grassland. 2 December 1998. Xóchitl Hernández and Ricardo Torres (XR 0775). All specimens verified by Julio Lemos-Espinal. First records for the state of San Luis Potosí; northern range extensions of ca. 290–300 km from several localities in Hidalgo (Mendoza-Quijano and Smith 1993, J. Herpetol. 27:406–410).

Submitted by **XÓCHITL HERNÁNDEZ-IBARRA, AURELIO RAMÍREZ-BAUTISTA, RICARDO TORRES-CERVANTES**, Escuela Nacional de Estudios Profesionales-Iztacala, Unidad de Biología, Tecnología y Prototipos, Laboratorio de Ecología, Avenida de los Barrios s/n, Los Reyes Iztacala, Estado de México, C.P. 54090, A.P. 314, México (email: xrgjthic@servidor.unam.mx, raurelio@servidor.unam.mx, rjtcxh@servidor.unam.mx) and **HÉCTOR HERNÁNDEZ-MACÍAS**, Instituto de Biología, Universidad Nacional Autónoma de México, Ciudad Universitaria, Circuito Exterior, C.P. 04510, México, D.F., México.

GEOPHIS DUGESI AQUILONARIS (Chihuahuan Earth Snake). MÉXICO: AGUASCALIENTES: 0.5 km from Los Alisos, municipality of Calvillo (21°44'28"N, 102°43'17"W) in oak forest. 19 April 1997. Gustavo Quintero-Díaz. Museo de Zoología, Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VR 271). Verified by Oscar Flores-Villela. First record for state of Aguascalientes; extends range ca. 9.3 km N Ciénega, Jalisco (Rodríguez and Vázquez-Díaz 1990, Bol. Soc. Herpetol. Mex. 2[1]:9–12).

Submitted by **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño S.A. de C.V. Avenida Aguascalientes Sur 203, Fracc. Prados del Sur, C.P. 20280 Aguascalientes, Aguascalientes, México, and **GUSTAVO QUINTERO-DÍAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México.

HYPSIGLENA TORQUATA (Night Snake). USA: NEW MEXICO: HARDING Co: Kiowa National Grasslands, Mills Canyon Campground, 11.3 air km N and 16.1 air km W jct. New Mexico Rt. 120 and New Mexico Rt. 39 at Roy. SE 1/4 Sec 15, T21N, R24E. 1 June 1999. Terry Hibbitts. University of New Mexico Museum of Southwestern Biology (MSB 61279). Verified by W. G. Degenhardt. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **TERRY HIBBITTS**, 602 Hilltop Circle, Wylie, Texas 75098, USA, **ANDREW R. WILDS**, 815 North A Street, Apt. 3, Silver City, New Mexico 88061, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

LACHESIS MUTA RHOMBEATA (South American Bushmaster). BRAZIL: CEARÁ: Serra de Baturité, Santana, Pacoti municipality (4°14'02.8"S, 38°53'09.1"W), 800 m elev. July–August 1990. D. M. Borges. Universidade Federal do Ceará (UFC 2064, female with eggs; UFC 2065, young male). Verified by F. L. Franco and D. Fernandes da Silva. First state record; extends known distribution ca. 550 km airline west of previously known range within Atlantic Forest in Rio Grande do Norte or Paraíba to the state of Rio de Janeiro (Campbell and Lamar 1989, The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. xii + 425 pp.; Zamudio and Greene 1997, Biol. J. Linn. Soc. 62:421–442).

Submitted by **DIVA MARIA BORGES-NOJOSA**, and **JOSÉ SANTIAGO LIMA-VERDE**, Universidade Federal do Ceará, Caixa Postal 52.856, 60.151-970, Fortaleza, Ceará, Brazil (email: dmborges@ufc.br).

LEPTOTYPHLOPS DULCIS (Texas Blind Snake). USA: NEW MEXICO: OTERO Co: found alive in building at 2507 North White Sands Boulevard (Alamogordo), SW 1/4 Sec 18, T16S R10E,

105°57'30"N, 32°55'00"W. 18 May 1999. Carl R. Braziel. University of New Mexico Museum of Southwestern Biology (MSB 61409). Verified by W. G. Degenhardt. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **GEOFFREY C. CARPENTER**, New Mexico Natural Heritage Program, Southern New Mexico Office, 7 Orchard Road, La Luz, New Mexico 88337, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

NERODIA ERYTHROGASTER NEGLECTA (Copperbelly Water Snake). USA: ILLINOIS: WAYNE CO: Bedford Twp. (Sec. 25, T1N, R7E). 27 April 1999. J. W. Walk and T. Esker. Southern Illinois University voucher number R03161. Verified by S. Ballard. The tail of this specimen was dropped by a perching Red-tailed Hawk. There is some chance that this *Nerodia* may have been taken from a different area and brought into the county via the raptor, but this is unlikely due to the highly territorial nature of Red-tailed Hawks during this part of the breeding season. Peterson (1979, Wisconsin Dept. Nat. Resour. Tech. Bull. No. 111) found the spring home ranges of male Red-tailed Hawks to be a maximum of 179 ha and females to be more restricted than that of males. This range falls well within Wayne County leaving little evidence that it came from elsewhere. Specimen extends the known distribution of *N. erythrogaster neglecta* one county to the north and is ca. 48 km from any known population of this federally proposed threatened snake (Blanford and Brandon 1995, Final Rep. Illinois Dept. Nat. Resources).

Submitted by **DANIEL J. OLSON** and **JEFF W. WALK**, Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, Illinois 61801, USA.

NERODIA SIPEDON SIPEDON (Northern Water Snake). USA: ILLINOIS: WAYNE CO: Elm River Twp. (T1N, R8E, Co. Rd. 1800N). DOR on Elm River Bridge. 27 April 1999. J. W. Walk and T. Esker. Southern Illinois University voucher number R03160. Verified by S. Ballard. New county record (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 298 pp.).

Submitted by **DANIEL J. OLSON** and **JEFF W. WALK**, Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, Illinois 61801, USA.

OPHEODRYS AESTIVUS (Rough Green Snake). USA: ILLINOIS: MACOUPIN CO: 5 km NNW of Mount Olive, 0.3 km W Redwood Road on E Panther Creek Road (NW 1/4 Sec. 22, T8N, R6W, 39°07'24"N, 89°44'48"W). DOR. 10 MAY 1998. Eric C. Axtell. INHS 14862. Verified by Christopher A. Phillips. New county record.

Submitted by **CAROL A. BRYANT**, 7841 South Panther Creek Road, Mount Olive, Illinois 62069, USA (email: cabryant2@aol.com).

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). EGYPT: Al Qahirah Governate: El Ma'adi (29°58'N, 31°15'E), 14 km SE of Cairo, run over by bike. July 1992. Jason Auric(a). MVZ 230077. Verified by Gwilym S. Jones. First country record and first record north of subsaharan Africa, extending range 1300 (airline) km NW of nearest locality in Saudi Arabia (Gasperetti 1988, Fauna of Saudi Arabia 9:197), and 3500 km NNW of nearest African locality (Lanza 1983, Monit. Zool. Ital. 18:219). Data include 20 scale rows, 318 middorsals, 10 subcaudals, 168 mm overall length, length/width ratio 56.

Submitted by **V. WALLACH**, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138, USA.

RHADINAEA HESPERIA (Western Graceful Brown Snake). MÉXICO: AGUASCALIENTES: 2 km S Mesa el Roble, municipality of Calvillo (21°45'11"N, 102°45'44"W), in guava grove and oak forest, 1891 m elev. 15 August 1998. Joel Vázquez-Díaz and Gustavo Quintero-Díaz. Museo de Zoología "Alfredo L. Herrera", Facultad de Ciencias, UNAM (MZFC 11320). Verified by Oscar Flores-Villela. First record for the state of Aguascalientes; extends range ca. 89 km NE of Mezquital del Oro, Zacatecas (Myers 1974, Bull. Am. Mus. Nat. Hist. 153:1–262).

Submitted by **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño S.A. de C.V. Avenida Aguascalientes, Aguascalientes, México, **GUSTAVO QUINTERO-DÍAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, and **HOBART M. SMITH**, EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA.

RHADINAEA LAUREATA (Crowned Graceful Brown Snake). MÉXICO: JALISCO: 40 km NW Sayula. 24 June 1967. Brent Brown. SMBU BCB series 67-888, 67-889, 67-890; 50 km NW Sayula. 25 June 1967. Bryce C. Brown. SMBU BCB series 67-968. All verified by David Lintz. First precise record for the state of Jalisco (Myers 1974, Bull. Am. Mus. Nat. Hist. 153:54–57, citing, but not plotting [nor has anyone else ever plotted] a literature record for "La Cumbre de los Arrastrados, Jalisco;" Flores and Gerez 1994, Biodiversidad y Conservación en México. UNAM, México, D. F. p. 321).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA, **BRYCE C. BROWN**, Strecker Museum, Baylor University, Waco Texas 76798-7154, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

STORERIA OCCIPITOMACULATA (Redbelly Snake). USA: ILLINOIS: MACOUPIN CO: 3.4 km ENE Benld and N New Mount Olive Lake at Bryant Sawmill (SE 1/4 Sec. 28 T8N, R6W, 39°06'23"N, 89°45'35"W) 4 June 1999. Carol A. Bryant. INHS 14865. Verified by Christopher A. Phillips. New county record. One of two specimens collected raking leaf litter behind maintenance shed.

Submitted by **CAROL A. BRYANT**, 7841 South Panther Creek Road, Mount Olive, Illinois 62069, USA (email: cabryant2@aol.com).

STORERIA OCCIPITOMACULATA (Redbelly Snake). USA: NEBRASKA: HALL CO: 4.5 mi N and 1 mi E Prosser (40°45'N 98°35'W) along Platte River. 6 April 1999. William Beachly. University of Nebraska State Museum (UNSM ZM-16282). Verified by David McLeod. New county record and the third county (along with Dawson and Buffalo) in central Nebraska in which this species has been recorded (Lynch 1985, Trans. Nebraska Acad. Sci. 13:53; Peyton 1989, Herpetol. Rev. 20:13). Extends the central Nebraska distribution 60 km eastward along the Platte River and hints at the possibility that the species will be recorded along the Platte River corridor eastward to the Missouri River, where the only other Nebraska locality for the species is known. As noted by Lynch (1985, *op. cit.*) for another central Nebraska specimen, the spots on

the posterior edge of the head are faint. In the case of this specimen, only the outermost spots are barely evident.

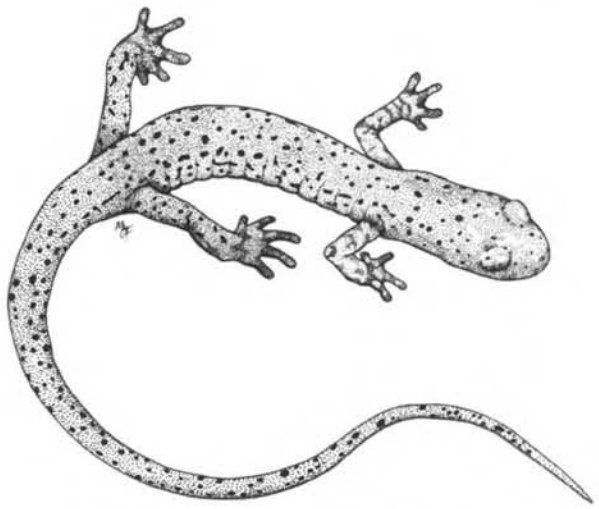
Submitted by **ROYCE E. BALLINGER**, School of Biological Sciences, University of Nebraska-Lincoln, Lincoln, Nebraska 68588-0118, USA, and **WILLIAM BEACHLY**, Department of Biology, Hastings College, Hastings, Nebraska 68901, USA.

THAMNOPHIS SCALIGER (Short-tailed Alpine Garter Snake). MÉXICO: AGUASCALIENTES: municipality of Jesús María (21°59'10"N, 102°34'28"W) in grassland and oak forest. 2 August 1995. Gustavo Quintero-Díaz. Museo de Zoología "Alfredo L. Herrera," Facultad de Ciencias, UNAM (MZFC 12323); 1 km NE Santa Rosa, municipality of San José de Gracia (22°01'10"N, 102°34'50"W) in grassland and oak forest. 10 October 1998. Gustavo Quintero-Díaz. Museo de Zoología Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VA 274). Verified by Fernando Mendoza-Quijano and Oscar Flores-Villela. First record for state of Aguascalientes: extends range ca. 103 km NW Matanzas, Jalisco (Rossman and Lara Góngora 1997, Occas. Pap. Mus. Nat. Sci. Louisiana St. Univ. 74:1–14.)

Submitted by **GUSTAVO QUINTERO-DÍAZ**, Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, **JOEL VÁZQUEZ-DÍAZ**, Departamento de Investigación y Desarrollo Tecnológico, Internacional de Relojes, Arte y Diseño S.A. de C.V. Avenida Aguascalientes, Aguascalientes, México, and **HOBART M. SMITH**, EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA.

VIRGINIA VALERIAE (Smooth Earth Snake). USA: ILLINOIS: Macoupin Co: 3.1 km ENE Benld, N New Mount Olive Lake spillway at Bryant Sawmill (SE 1/4 Sec. 28, T8N, R6W, 39°06'25"N, 89°45'40"W) 2 October 1998. Carol A. Bryant. INHS 14866. Verified by Christopher A Phillips. New county record. Found under fresh sawdust dumped on an oak-hickory forest floor two days previously.

Submitted by **CAROL A. BRYANT**, 7841 South Panther Creek Road, Mount Olive, Illinois 62069, USA (email: cabryant2@aol.com).



Eurycea lucifuga. Illustration by Michael Frick.

New Records of Amphibians and Reptiles for Nassau County, Florida

KENNETH WRAY
Department of Biology, University of Texas at Arlington
Arlington, Texas 76019, USA
e-mail: kpw4791@utarlg.uta.edu

and

RICK OWEN
Department of Wildlife Ecology, University of Florida
Gainesville, Florida 32611, USA
e-mail: bublou@yahoo.com

During a survey of the lower vertebrates of the White Oak Plantation, Nassau County, Florida, USA, several new county records of amphibians and reptiles were collected and deposited into the Florida Museum of Natural History (UF). These records were checked against a database compiled of all Florida specimens in U.S. museum collections (courtesy of Paul Moler) and also records of the Florida Museum of Natural History. While searching in the UF, an overlooked record of *Crotalus horridus* was found by David L. Auth and therefore included in the list below. The following specimen identifications were verified by David L. Auth, Department of Herpetology, Florida Museum of Natural History, Gainesville. All records are USA: Florida: Nassau County.

Amphiuma means (Two-Toed Amphiuma). White Oak Plantation, creek near Windgate Cemetery, Sec. 32, T4N, R26E. 15 July 1997. L. R. Franz, Kenneth Wray, Rick Owen, and Kevin Zippel. UF 106663.

Siren intermedia (Lesser Siren). White Oak Plantation, first culvert south of jct. Brumley Road and Gilman Drive on Brumley Road, Sec. 44, T4N, R25E. 13 July 1997. Kenneth Wray and Rick Owen. UF 106662.

Eleutherodactylus planirostris (Greenhouse Frog). White Oak Plantation, Tortoise Relocation Site, Sec 44, T4N, R25E. 10 June 1997. Cheryl Cheshire. UF 106681.

Hyla chrysoscelis (Gray Treefrog). White Oak Plantation, Gilman Drive, near Kentucky Gate, Sec. 43, T4N, R26E. 30 June 1997. Kenneth Wray. UF 106678.

Chelydra serpentina (Common Snapping Turtle). White Oak Plantation, near center of property, Sec. 43, T4N, R26E. 19 July 1997. Rick Owen and Kenneth Wray. UF 106644.

Trachemys scripta (Slider). White Oak Plantation, near Tortoise Barn, Sec. 43, T4N, R26E. 2 July 1997. Kenneth Wray and Michael Taylor. UF 106643. Extends known range ca. 125 km NNE of the most easterly Florida locality and approximately 25 km S of the nearest Georgia locality (Conant and Collins 1991).

Cemophora coccinea (Scarlet Snake). White Oak Plantation, entrance road, 0.1 mi. southeast of the Little St. Mary's River, Sec. 29/42, T4N, R26E. 4 August 1997. Cheryl Cheshire. DOR.

Diadophis punctatus (Ringneck Snake). White Oak Plantation, jct. Gilman Drive and Rainbow Canal, Sec. 43, T4N, R26E. 4 August 1997. Cheryl Cheshire and Jennifer Staiger. UF 106693.

Heterodon platirhinos (Eastern Hognose Snake). White Oak Plantation, near the Gut Hole, Sec. 24, T4N, R25E. 14 July 1997. Rick Owen and Kenneth Wray. UF 106694.

Crotalus horridus (Timber Rattlesnake). U.S. Rt. 17, 3 miles NW jct. with A1A. August 1976. Dale R. Jackson and Ken Campbell. UF 42563.

Acknowledgments—We thank David L. Auth for his assistance in searching the collection at the Florida Museum of Natural History. We also thank Paul Moler for the use of his database and Dick Franz for his comments on this note.

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New County Records from Dimmit and La Salle Counties, Texas, USA

DONALD C. RUTHVEN III
Texas Parks and Wildlife Department
Chaparral Wildlife Management Area
P.O. Box 115, Artesia Wells, Texas 78001, USA
e-mail: cwma@vsta.com

RICHARD T. KAZMAIER
Department of Zoology, Oklahoma State University
Stillwater, Oklahoma 74078, USA
e-mail: rkazmai@okstate.edu

and
JOE K. MOODY
Department of Biology, 701 North C Street
Simpson College, Indianola, Iowa 50125, USA
e-mail: moody@storm.simpson.edu

The following accounts represent new county records for Dimmit and La Salle counties, Texas. All records, except *Coluber constrictor*, were collected from Chaparral Wildlife Management Area as a result of increased baseline inventory and monitoring activities. All identifications were verified by David Cannatella and vouchers have been deposited in the Texas Memorial Museum (TNHC). Justification for new county record status was based upon distribution data from Dixon (1987).

Bufo debilis (Green Toad). Dimmit Co: Chaparral Wildlife Management Area, 8 mi W of Artesia Wells. 13 July 1996. D. C. Ruthven. TNHC color slide 55694. Collected while road-cruising.

Cnemidophorus sexlineatus (Six-lined Racerunner). Dimmit Co: Chaparral Wildlife Management Area, 10 mi W of Artesia Wells. 9 May 1997. D. C. Ruthven. TNHC 56012. Collected in pitfall trap.

Coleonyx brevis (Texas Banded Gecko). LaSalle Co: Chaparral Wildlife Management Area, 6 mi W of Artesia Wells. 2 May 1997. D. C. Ruthven. TNHC Color Slide 55690. Collected in pitfall trap; Dimmit Co: Chaparral Wildlife Management Area, 10 miles west of Artesia Wells. 8 May 1997. D. C. Ruthven. TNHC Color Slide 55693. Collected in pitfall trap.

Coluber constrictor (Eastern Racer). Dimmit Co: U.S. Rt. 83, within city limits of Catarina. 7 May 1997. D. C. Ruthven. TNHC 56015. DOR.

Eumeces obsoletus (Great Plains Skink). LaSalle Co: Chaparral Wildlife Management Area, 6 mi W of Artesia Wells. 6 May 1997. R. T. Kazmaier. TNHC 56010. Collected in pitfall trap.

Leptotyphlops dulcis (Texas Blind Snake). LaSalle Co: Chaparral Wildlife Management Area, 6 mi W of Artesia Wells. 6 August 1996. D. C. Ruthven. TNHC Color Slide 55691. Collected in pitfall trap.

Salvadora grahamiae (Mountain Patchnose Snake). LaSalle Co: Chaparral Wildlife Management Area, 10 mi W of Artesia Wells. 18 April 1997. J. K. Moody. TNHC Color Slide 55692. Collected while road cruising.

Tantilla gracilis (Flathead Snake). Dimmit Co: Chaparral Wildlife Management Area, 8 mi W of Artesia Wells. 3 July 1997. R. T. Kazmaier. TNHC 56014. Collected in pitfall trap.

Tantilla nigriceps (Plains Blackhead Snake). Dimmit Co: Chaparral Wildlife Management Area, 10 mi W of Artesia Wells. 6 May 1997. R. T. Kazmaier. TNHC 56011. Collected in pitfall trap.

Terrapene ornata (Ornate Box Turtle). Dimmit Co: Chaparral Wildlife Management Area, 10 mi W of Artesia Wells. 18 April 1997. D. C. Ruthven. TNHC Color Slide 55695. Collected while road cruising.

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New Reptilian Species Records from the Cordillera de Mérida, Andes of Venezuela

LUIS FELIPE ESQUEDA
Centro Universitario Herpetológico Forestal
Facultad de Ciencias Forestales y Ambientales
Universidad de Los Andes, Mérida 5101, Venezuela
e-mail: center@forest.ula.ve

and
ENRIQUE LA MARCA
Laboratorio de Biogeografía
Facultad de Ciencias Forestales y Ambientales
Universidad de Los Andes, Apartado Postal 116
Mérida 5101-A, Venezuela
e-mail: ulabg@ciens.ula.ve

The Venezuelan Cordillera de Mérida is a mountain range located in the northernmost Andes in South America, extending some 400 km in a southeastern direction from the Táchira Depression to the Lara Depression, in Western Venezuela (La Marca 1997a). In this extension of land covering semiarid to humid habitats and seasonal and cloud forest to paramo environments, there is an urgent need to document the geographic distributions of reptiles. We had an opportunity to examine specimens of reptiles deposited in the herpetological collection of the Laboratorio de Biogeografía, Universidad de Los Andes (ULABG). These specimens were found to be significant records of previously unrecorded or undocumented (i.e., not supported by voucher specimens) species. Marcos Nattera verified identifications. Taxonomy follows La Marca (1997b).

COLUBRIDAE

Chironius monticola. ESTADO MÉRIDA: Municipio Andrés Bello: Páramo El Tambor, 2930 m elev. 7 October 1987. E. La Marca and J. E. García. ULABG 2057; 17 km from El Paramito, near Las Cruces, road to La Azulita, 1500 m elev. 29 July 1988. P. Soriano. ULABG 2236. This species has been reported from the Andean

States of Táchira (Roze 1966) and Mérida (Dixon et al. 1993:152, 264); however, only the latter is documented by voucher specimens. ULABG 2057 constitutes an elevation record (Dixon et al. 1993, p. 148). Both specimens bridge a distribution gap of more than 1000 km between the Táchira Andes and the Venezuelan coastal range or Cordillera de la Costa (Roze 1966).

Chironius carinatus. ESTADO PORTUGUESA: Municipio Sucre: Biscucuy (9°20'05"N, 69°59'32"W, 455 m elev.). 21 April 1998. L. F. Esqueda and E. La Marca. ULABG 4383.

Dipsas latifrontalis. ESTADO LARA: Municipio Morán: Potrerito de la Virgen, near road intersection to the village of Anzoátegui, in the road Chabasquén–Guarico, 9 km from the Portuguesa-Lara state border (9°35'14"N, 69°51'29"W, 1320 m elev.). 23 April 1998. L. F. Esqueda and E. La Marca. ULABG 4441. First state record and northernmost record for the species, extending the known range about 230 km NE of the type locality.

Imantodes cenchoa. ESTADO MÉRIDA: Municipio Campo Elias: Laguna de Caparú, 900 m elev., 25 km SW Mérida City. May 1984. J. E. García. ULABG 4099. First documented record for the Andes of Venezuela and the state of Mérida (Roze 1966; Lancini 1979; Lancini and Kornacker 1989).

Liophis lineatus. ESTADO MÉRIDA: Municipio Libertador: campus of Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, city of Mérida, 1750 m elev. 22 July 1998. J. Achuelo. ULABG 4442; the finding of this species in the city of Mérida is a surprise since all documented records come from lowlands in northern South America (Dixon 1989). The closest locality east of the Venezuelan Andes is the city of Acarigua (Roze 1966); the only record west of the Andes appears to be "Hoya del Rio Negro" in the Sierra de Perijá (Alemán 1953). We do not discount the possibility of an accidental introduction of this specimen into the urban area of Mérida City.

Liophis reginae zweifeli. ESTADO TRUJILLO: Municipio Carache: Hacienda El Rincón, via Potreritos de Cendé-Miquimú, 2275 m elev. 1 December 1989, J. E. García and E. La Marca, ULABG 2765. First state and Venezuelan Andes records (Roze 1966; Lancini 1979; Lancini and Kornacker 1989).

Masticophis mentovarius suborbitalis. ESTADO MÉRIDA: Municipio Sucre: road to La Trampa, near Lagunillas. 25 August 1990. C. Ferrer. ULABG 3047; Municipio Campo Elias: road to Pueblo Nuevo del Sur, near Puente Real. 29 August 1990. C. Ferrer. ULABG 3048. First state and Venezuelan Andes records for the species (Roze 1966; Lancini 1979; Lancini and Kornacker 1989).

Mastigodryas plei. ESTADO MÉRIDA: Municipio Campo Elias: Pueblo Nuevo del Sur, 1500 m elev. 10 May 1989. M. Molinari. ULABG 3050; Laguna de Caparú, 900 m elev., 25 km SW Mérida City. 5 April 1988. A. Mijares. ULABG 3078. First records for the state of Mérida and the Venezuelan Andes (Roze 1966; Lancini 1979; Lancini and Kornacker 1989; Peters and Orejas-Miranda 1970). Southernmost record for this taxon.

Oxybelis aeneus. ESTADO MÉRIDA: Municipio Campo Elias: Laguna de Caparú, 900 m elev. September 1989. Collector unknown. ULABG 2967. The only Venezuelan Andean record in the literature is from Mérida (Roze 1966). This is the second documented specimen and the southernmost locality for the species in the Venezuelan Andes. Extends range ca. 30 km SW of the city of Mérida.

Oxyrhopus petola petola. ESTADO MÉRIDA: Municipio Andrés Bello: La Azulita, 915 m elev. 7 July 1990. M. Molinari. ULABG 2952. First documented record for the state of Mérida (Lancini 1979; Lancini and Kornacker 1989) even though Roze (1966) included this state in a distribution map for the species.

Pseudoboa neuwiedii. ESTADO MÉRIDA: Municipio Caracciolo Parra Olmedo: Tucaní, on road to El Charal. 30 August 1991. Alex Finol. ULABG 3181. To our knowledge, this constitutes the first documented record for the species in the Cordillera de Mérida (Lancini 1979; Lancini and Kornacker 1989; Roze 1966).

Tantilla semicincta. ESTADO MÉRIDA: Municipio Campo Elias: San Juan de Lagunillas. 12 March 1996. B. Hernández. ULABG 4195. First documented record for the species in the Cordillera de Mérida (Lancini 1979; Roze 1966), even though Lancini and Kornacker (1989) indicated that the species occurs in the northern Venezuelan Andes and provided a distribution map for the genus which included the Andean states of Mérida and Trujillo. This is also the southernmost documented record for the species in the Venezuelan Andes.

VIPERIDAE

Bothrops venezuelensis. ESTADO LARA: Municipio Morán: near mountain stream 3 km on road Guarico-Chabasquén, 1270 m elev., 9°33'24"N; 69°52'52"W. 23 April 1998. L. F. Esqueda, A. Markezich, and E. La Marca. ULABG 4443. First documented state record for the species (Campbell and Lamar 1989:224; Lancini 1979:209; Lancini and Kornacker 1989:289; Roze 1968).

ANOMALEPIDIDAE

Liotyphlops albirostris. ESTADO MÉRIDA: Municipio Libertador: Mérida, 1600 m elev. 12 May 1994. M. Molinari. ULABG 3925. Lancini and Kornacker (1989) indicated that this species occurs in the Distrito Federal, and in the states of Miranda and Mérida; they also illustrated a distribution map for the genus which included the Andean states of Mérida, Táchira, and Trujillo. Nonetheless, this is the first confirmed record for the entire Venezuelan Andes, and the southernmost locality for the species.

AMPHISBAENIDAE

Amphisbaena alba. ESTADO TRUJILLO: Municipio Carache: on road between Silos de Monay and Carache, ca. 2 km from crossroad to Chejendé, 300 m elev. 1 December 1989. E. La Marca and J. García. ULABG 2704; Loma de Bonilla, 8 km Carache, 1400 m elev. 1 December 1989. E. La Marca and J. García. ULABG 2705; vicinities of La Playa, between La Playa and La Concepción de Carache, 1175 m elev. 20 December 1989. E. La Marca and J. García. ULABG 2854. First records for the state of Trujillo.

GYMNOPHTHALMIDAE

Bachia heteropa. ESTADO MÉRIDA. Municipio Andrés Bello: La Azulita, 1000 m elev. 1 April 1990. M. Molinari. ULABG 3064. First record for the state of Mérida and the Venezuelan Andes (Donoso-Barros 1968; Peters and Donoso-Barros 1970).

TEIIDAE

Ameiva ameiva praesignis. ESTADO TRUJILLO: Municipio Carache: vicinities of La Playa, between La Playa and La Concepción de Carache, 1175 m elev. 20 December 1989. J. García and E. La Marca. ULABG 2855. First voucher specimen for the state of Trujillo and the Venezuelan Andes.

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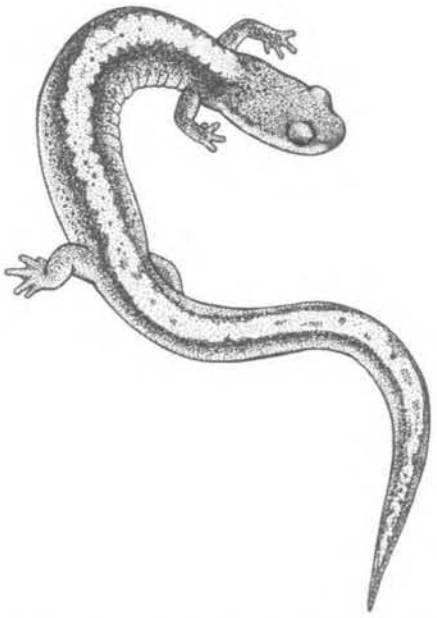
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Plethodon cinereus. Illustration by Michael Frick.

The Georgia Herp Atlas: Year II County Records

JOHN B. JENSEN
Georgia Department of Natural Resources
Nongame-Endangered Wildlife Program
116 Rum Creek Drive, Forsyth, Georgia 31029, USA
e-mail: john_jensen@mail.dnr.state.ga.us

and

ROBERT A. MOULIS
Savannah-Ogeechee Canal Museum
681 Fort Argyle Road, Savannah, Georgia 31419, USA
e-mail: socm@csam.net

The second year of the volunteer-supported Georgia Herp Atlas, sponsored by the Georgia Department of Natural Resources, was again very successful. Participants from across the state submitted distributional information on a wide variety of reptiles and amphibians. Records reported herein are substantiated by specimens or good quality photographs. A host of previously published materials was used to determine the new county records for each species listed below (including Jensen and Moulis 1997, Lacy 1997, and Williamson and Moulis 1994). All specimens and photographs were deposited in the University of Georgia Museum of Natural History (UGAMNH), Savannah-Ogeechee Canal Museum (SOCM), or at the University of Missouri–Columbia (UMC), as indicated. UGAMNH specimens and photographs were verified by either M. Elizabeth McGhee or the late Joshua Laerm, those at SOCM were verified by Gerald K. Williamson, and the one specimen residing at UMC was verified by Richard E. Daniel.

CAUDATA

Ambystoma maculatum (Spotted Salamander). CLAYTON Co: near confluence Wallis Creek and Flint River (33°28'N, 84°23'W). 5 February 1997. S. Graham. SOCM 1352. MONROE Co: Georgia Rt. 18, 10.3 km NE Bolingbroke (33°06'27"N, 83°47'52"W). 21 November 1997. M. P. Wallace and R. A. Moulis. SOCM 500. POLK Co: Cove Springs Road near Polk-Floyd county line (34°01'31"N, 85°15'35"W). March 1995. S. Sorrells and J. Stewart. SOCM 1353. TAYLOR Co: ca. 50 m N Georgia Rt. 96, 4.0 km W jct. with Georgia Rt. 137. 25 February 1997. J. B. Jensen. UGAMNH 37071.

Ambystoma opacum (Marbled Salamander). CAMDEN Co: Maple/gum pond 5.8 km NW Waverly (31°07'21"N, 81°46'40"W). 2 April 1997. G. K. Williamson and R. A. Moulis. SOCM 127. CLAYTON Co: near South Hampton Court, Jonesboro (33°28'04"N, 84°22'49"W). 11 January 1997. S. Graham. SOCM 1354. COLUMBIA Co: Brezelia Road, Grovetown (33°26'47"N, 82°12'36"W). 1 August 1997. M. Hogue and C. Hogue. SOCM 1355. EARLY Co: Shackleford-Williams Preserve (The Nature Conservancy) near Hilton. 25 January 1997. J. B. Jensen, D. Stevenson, and K. Tassin. UGAMNH 32444. JASPER Co: Charlie Elliott Wildlife Center, Shepard Creek area. 27 May 1997. J. B. Jensen. UGAMNH 37072. MERIWETHER Co: Flint River area off Georgia Rt. 18 (32°59'22"N, 84°31'45"W). 3 May 1997. M. P. Wallace, R. A. Moulis, R. S. Redmond, and J. M. Waters. SOCM 0148. PIKE Co: Georgia Rt. 362 at Flint River (33°10'19"N, 84°30'21"W). 3 May 1997. R. A. Moulis, R. S. Redmond, J. M. Waters, and M. P. Wallace. SOCM 0145.

Ambystoma talpoideum (Mole Salamander). EARLY Co: Shackleford-Williams Preserve (The Nature Conservancy) near Hilton. 25 January 1997. J. B. Jensen, D. Stevenson, and K. Tassin. UGAMNH 32445. MERIWETHER Co: County Road 327 at White

Oak Creek (33°07'21"N, 84°31'13"W). 3 May 1997. R. A. Moulis, R. S. Redmond, J. M. Waters, and M. P. Wallace. SOCM 0146. RANDOLPH Co: ca. 100 m SW Georgia Rt. 41, 1.1 km SE County Road 125. 10 April 1997. J. B. Jensen. UGAMNH 37069. WORTH Co: 0.5 km S County Road 118, 1.3 km W County Road 28. 7 April 1997. J. B. Jensen. UGAMNH 37070.

Ambystoma tigrinum tigrinum (Eastern Tiger Salamander). CRISP Co: Georgia Veterans State Park, 0.2 km SE jct Claypit Rd & Ferry Landing. 9 January 1997. J. B. Jensen. UGAMNH 32454. RANDOLPH Co: ca. 100 m SW Georgia Rt. 41, 1.1 km SE County Road 125. 10 April 1997. J. B. Jensen. UGAMNH 37068.

Amphiuma means (Two-toed Amphiuma). BURKE Co: Yuchi Wildlife Management Area, 0.35 km E Daniel Landing (33°06'21"N, 81°40'15"W). 29 March 1997. A. Davis, Jr., D. Stevenson, and M. Hohmann. SCHLEY Co: Big Muckalee Creek at Georgia Rt. 153 (32°10'50"N, 84°22'06"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 483.

Desmognathus auriculatus (Southern Dusky Salamander). STEWART Co: Hodchockee Creek off Georgia Rt. 27 (32°03'08"N, 84°46'36"W). 4 May 1997. R. A. Moulis, M. P. Wallace, R. S. Redmond, and J. M. Waters. SOCM 206–7.

Desmognathus conanti (Spotted Dusky Salamander). JASPER Co: Charlie Elliott Wildlife Center, Pittman Creek. 24 May 1997. J. B. Jensen. UGAMNH 37074-75.

Eurycea cirrigera (Southern Two-lined Salamander). CLAYTON Co: South Hampton Court, Jonesboro (33° 28'04"N, 84° 22'49"W). 4 February 1997. S. Graham. SOCM 1356. DECATUR Co: Pennahatchee Creek at County Road 62 (32°05'43"N, 83°55'03"W). 12 September 1997. R. A. Moulis and J. M. Waters. EARLY Co: Shackleford-Williams Preserve (The Nature Conservancy) near Hilton. 25 January 1997. J. B. Jensen, D. Stevenson, and K. Tassin. UGAMNH 32446. JOHNSON Co: Ohoopee River at County Road 174, Pullen Bridge (32°37'04"N, 82°36'44"W). 7 September 1997. R. A. Moulis and J. B. Blue, Jr. SOCM 402–3. JONES Co: Piedmont National Wildlife Refuge, 8.2 km E-ENE of East Juliette (33°08'23"N, 83°41'40"W). 21–22 November 1997. R. A. Moulis and M. P. Wallace. SOCM 501, 507. SCHLEY Co: Buck Creek at County Road 131 (32°18'10"N, 84°20'27"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 474–5; and Big Mucklee Creek at Georgia Rt. 153 (32°10'30"N, 84°22'06"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 479–80. STEWART Co: artesian well off Georgia Rt. 39 (32°08'18"N, 84° 51'00"W). 4 May 1997. R. S. Redmond and M. P. Wallace. SOCM 0204; and Hodchockee Creek off Georgia Rt. 27 (32°03'05"N, 84°46'36"W). 4 May 1997. R. A. Moulis, M. P. Wallace, R. S. Redmond, and J. M. Waters. SOCM 208. TREUTLEN Co: Ohoopee River at Georgia Rt. 56 (32°28'15"N, 82°26'15"W). 7 September 1997. R. A. Moulis and J. B. Blue, Jr. SOCM 406–7. WEBSTER Co: along western fork Kinchafoonee Creek off Georgia Rt. 45 (31°58'01"N 84°26'54"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 486.

Eurycea guttolineata (Three-lined Salamander). APPLING Co: 2.4 mi W jct. Georgia Rt. 15 and Altamaha River (31°56'41"N, 82° 23'17"W). 30 August 1996. W. F. Prince. SOCM 1357. CRAWFORD Co: tributary to Ulcohatchee Creek off County Road 85 (32°44'04"N, 84°08'29"W). 28 June 1997. R. A. Moulis and J. M. Waters. SOCM 0215. DOOLY Co: Pennahatchee Creek at Georgia Rt. 27 (32°05'40"N, 83°48'50"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 421–4; Pennahatchee Creek at County Road 62 (32°05'43"N, 83°55'03"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 428–9; and Turkey Creek at County Road 59 (32°06'15"N, 83°56'22"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 433–39. FAYETTE Co: Morning Creek floodplain, just upstream from its confluence with Flint River (33°27'58"N, 84°23'11"W). 26 September 1997. S. Graham. SOCM 1361. GILMER Co: Mountaintown Creek ca. 1.6 km upstream from confluence with Bear Creek (34°49'14"N, 84°33'00"W). 4 July 1997. T. Carroll and L. Carroll. SOCM 1360. JASPER Co: Charlie Elliott Wildlife Center, Pittman Creek 0.8 km downstream of Henderson Road (33°28'30"N, 83°43'20"W). 24 May 1997. B. Rothermel and W. Knapp. SOCM 1359. MACON Co: Flint River at Georgia Rt. 49 (32°17'53"N, W84°02'38"). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 455–6; and Flint River at Georgia Rt. 127 (32°25'56"N, 84°01'28"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 0447. SPALDING Co: 1.6 km N Georgia Rt. 92 on east side Flint River (33°19'N, 84°23'W). 2 May 1997. E. O'Neill. SOCM 1358. WEBSTER Co: along western fork of Kinchafoonee Creek off Georgia Rt. 45 (31°58'01"N, 84°26'54"W). 1 October 1997. G. K. Williamson and R. A. Moulis. SOCM 487.

Eurycea quadridigitata (Dwarf Salamander). BROOKS Co: Okapilco Creek at Georgia Rt. 33 bridge. 16 May 1997. J. B. Jensen and M. Frick. UGAMNH 37076.

Necturus alabamensis (Alabama Waterdog). MACON Co: Flint River at Georgia Rt. 49 (32°17'53"N, 84°02'38"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 444. SUMTER Co: Lime Creek at County Road 53 (32°02'07"N, 83°59'32"W). 29 June 1997. R. A. Moulis, R. S. Redmond, J. M. Waters, and M. P. Wallace. SOCM 232.

Notophthalmus viridescens viridescens (Red-spotted Newt). GILMER Co: private residence on N. Jones Mill Road, 12.1 km N Ellijay (34°49'N, 84°25'W). 8 June 1997. G. Hyde and K. Hyde. SOCM 1362. MONROE Co: Nongame Wildlife Program office, Rum Creek Drive, Forsyth. 29 April 1997. T. Schneider. SOCM 1363.

Plethodon glutinosus (Northern Slimy Salamander). JASPER Co: along Pittman Creek ca. 0.8 km downstream from Henderson Road, Charlie Elliott Wildlife Center (33°28'30"N, 83°43'20"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1364.

Plethodon grobmani (Southeastern Slimy Salamander). DOOLY Co: Pennahatchee Creek at Georgia Rt. 27 (32°05'40"N, 83°48'50"). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 425–6.

Plethodon serratus (Southern Redback Salamander). BIBB Co: Forest Hill Road (32°52'50"N, 83°41'40"W). 1 March 1997. P. Minder and B. Minder. SOCM 1368. CLAYTON Co: near confluence Wallis Creek and Flint River (33°28'N, 84°23'W). 5 February 1997. S. Graham. SOCM 1366. POLK Co: Davis Road, Cedartown (34°06'58"N, 85°18'40"W). March 1997. J. Mullen and J. Stewart. SOCM 1367. WALTON Co: private residence on Clarence Odum Road (33°52'04"N, 83°42'05"W). 2 February 1997. W. Knapp. SOCM 1365.

Pseudotriton montanus flavissimus (Gulf Coast Mud Salamander). EARLY Co: Shackleford-Williams Bluff Preserve, ca. 7.0 km SSW Hilton. 26 January 1997. D. Stevenson and K. Tassin. SOCM 111. STEWART Co: Hodchockee Creek off Georgia Rt. 27 (32°03'05"N, 84°46'36"W). 4 May 1997. R. A. Moulis, M. P. Wallace, R. S. Redmond, and J. M. Waters. SOCM 209.

Pseudotriton ruber ruber (Northern Red Salamander). JASPER Co: tributary of Shepard Creek, Charlie Elliott Wildlife Center. 24 May 1997. J. B. Jensen. UGAMNH 37073. JONES Co: Piedmont NWR, 8.2 km E-ENE of East Juliette (33°08'23"N, 83°41'40"W). 22 November 1997. R. A. Moulis and M. P. Wallace. SOCM 509–11.

Pseudotriton ruber schencki (Blackchin Red Salamander). GILMER Co: private residence on N. Jones Mill Road, 12.1 km N Ellijay (34°49'N, 84°25'W). 25 April 1997. K. Hyde. SOCM 1369.

Pseudotriton ruber vioscai (Southern Red Salamander). LONG Co: Fort Stewart, just N Pineview Lake (31°57'29"N, 81°52'00"W). 5 December 1996. D. Stevenson. SOCM 105. SCHLEY Co: Buck Creek at County Road 131 (32°18'10"N, 84°20'27"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 478.

Siren intermedia intermedia (Eastern Lesser Siren). TREUTLEN Co: Ohoopee River at Georgia Rt. 56 (32°28'02"N, 82°26'02"W). 7 September 1997. R. A. Moulis and J. B. Blue, Jr. SOCM 408. WORTH Co: ca. 0.5 km E County Road 31, 1.3 km N County Road 115. 10 April 1997. J. B. Jensen. UGAMNH 37078.

Siren lacertina (Greater Siren). ECHOLS Co: ditch along Georgia Rt. 376 at Grand Bay Creek. 7 August 1997. D. Stevenson and J. B. Jensen. UGAMNH 37077. WEBSTER Co: along western fork Kinchafoonee Creek off Georgia Rt. 45 (31°58'01"N, 84°26'54"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 488.

ANURA

Acris crepitans crepitans (Northern Cricket Frog). GRADY Co: Ochlockonee River at Hadley's Ferry Road. 15 May 1997. J. B. Jensen and M. Frick. UGAMNH 37064. STEWART Co: North Glory Hole at Georgia Rt. 39C (32°04'12"N, 84°56'17"W). 4 May 1997. R. A. Moulis and J. M. Waters. SOCM 168. SUMTER Co: Flint River at County Road 170, Reeves Landing (32°07'29"N, 84°00'44"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 441.

Acris gryllus gryllus (Southern Cricket Frog). TREUTLEN Co: Ohoopee River at Georgia Rt. 56 (32°28'15"N, 82°26'15"W). 7 September 1997. R. A. Moulis and J. B. Blue, Jr. SOCM 405.

Bufo americanus americanus (American Toad). BIBB Co: jct. Unalyi Trail & Conestoga Trail in Lake Wildwood Community. 13 March 1997. J. B. Jensen. UGAMNH 37060. CARROLL Co: private residence on McClendon Circle, Carrollton (33°31'16"N, 85°06'31"W). 4 October 1996. C. Bergquist. SOCM 1323. FANNIN Co: Old Dial Road, ca. 6.5 km S Morganton (34°50'07"N, 84°13'49"W). July 1997. J. Warren. SOCM 1326. FAYETTE Co: pond ca. 0.8 km W confluence Morning Creek and Flint River (33°28'N, 84°23'W). 4 February 1997. S. Graham. SOCM 1324. POLK Co: John Redding Road, Cedartown (39°N, 85°19'W). March 1997. J. Stewart and B. Hatch. SOCM 1325. WALTON Co: private residence on Clarence Odum Road, Monroe (32°52'N, 83°42'W). 22 June 1997. W. Knapp. SOCM 1327.

Bufo terrestris (Southern Toad). EARLY Co: 1.6 km S Clay-Early county line near Chattahoochee River. 28 June 1997. D. Stewart. UGAMNH 37059. LEE Co: Kinchafoonee Creek at Georgia Rt. 32 (31°43'12"N, 84°11'08"W). 29 June 1997. M. P. Wallace, R. S. Redmond, J. M. Waters, and R. A. Moulis. SOCM 230. STEWART Co: Georgia Rt. 39, 8.1 km S-SSW Omaha (32°04'29"N, 85°02'19"W). 4 May 1997. R. A. Moulis and J. M. Waters. SOCM 179–80.

Bufo quercicus (Oak Toad). DECATUR Co: International Paper-Southlands Experimental Forest; east-side Lake Seminole (30°46'N, 84°41'W). June 1997. E. J. Williams. SOCM 1328.

Bufo fowleri (Fowler's Toad). JASPER Co: Charlie Elliott Wildlife Center, Clubhouse Lake (33°27'29"N, 83°43'46"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1330. POLK Co: Lynton Drive, Cedartown (34°01'22"N, 85°16'07"W). April 1997. Janice Stewart. SOCM 1329.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). APPLING Co: 2.4 km west jct. Georgia Rt. 15 and Altamaha River (31°56'38"N, 82°23'20"W). 30 August 1996. W. Prince. SOCM 1331. JONES Co: Piedmont National Wildlife Refuge, Pippin Lake campground. 13 June 1997. J. Bell. UGAMNH 37062. McDUFFIE Co: Foster Sprouse Road. 23 September 1997. V. VanSant. UGAMNH 40065.

Hyla avivoca (Bird-voiced Treefrog). GRADY Co: Ochlockonee River at Hadley's Ferry Road. J. B. Jensen and M. Frick. 15 May 1997. UGAMNH 37054. LEE Co: Muckalee Creek at Georgia Rt. 32 (31°43'56"N, 84°07'29"W). 29 June 1997. J. M. Waters, R. A. Moulis, R. S. Redmond, and M. P. Wallace. SOCM 224.

Hyla chrysoscelis (Cope's Gray Treefrog). BIBB Co: W side Lake Wildwood. 14 June 1997. J. B. Jensen. UGAMNH 37055. DOUGLAS Co: Sweetwater Creek State Park (33°45'36"N, 84°37'36"W). 5 November 1996. D. Emsweller and M. Emsweller. SOCM 1333. FAYETTE Co: private residence on Summer Place (33°20'54"N, 84°31'55"W). 15 June 1997. B. Koehn and A. Harlfinger. SOCM 1335. MERIWETHER Co: Georgia Rt. 362 at Flint River (33°10'18"N, 84°30'22"W). 3 May 1997. R. A. Moulis, R. S. Redmond, J. M. Waters, and M. P. Wallace. SOCM 147. WALTON Co: private residence on Clarence Odum Road (33°52'N, 83°42'W). 26 May 1997. W. Knapp. SOCM 1332.

Hyla cinerea (Green Treefrog). BIBB Co: W side Lake Wildwood. 14 June 1997. J. B. Jensen. UGAMNH 37056. CARROLL Co: private residence on McLendon Circle, Carrollton (33°31'16"N, 85°06'31"W). 10 August 1996. D. Bergquist. SOCM 1336. JOHNSON Co: Pringle Road. 28 March 1997. J. Harrison. SOCM 1338. WALTON Co: private residence on Clarence Odum Road (83°52'12"N, 83°41'42"W). 25 March 1997. W. Knapp. SOCM 1337.

Hyla gratiosa (Barking Treefrog). DECATUR Co: roadside pond off County Road 8, 4.5 km NE Eldorendo (31°03'56"N, 84°36'51"). 30 August 1997. R. A. Moulis, R. S. Redmond, and J. M. Waters. SOCM 366; and County Road 10, 9.7 km SW Bainbridge. (30°51'39"N, 84°39'37"W). 30 August 1997. J. M. Waters, R. S. Redmond, and R. A. Moulis. SOCM 375. MILLER Co: Hardee's parking lot in Colquitt (31°10'12"N, 84°43'54"W). 31 August 1997. R. A. Moulis, J. M. Waters, and R. S. Redmond. SOCM 382. POLK Co: Valley Grove Road, Cedartown (34°03'40"N, 85°17'08"W). April 1997. D. Bonds and J. Stewart. SOCM 1339.

Hyla squirella (Squirrel Treefrog). TOOMBS Co: Bostick Circle Road, Vidalia (32°11'04"N, 82°25'35"W). 20 March 1997. B. Femster. SOCM 1340.

Pseudacris crucifer crucifer (Northern Spring Peeper). CRISP Co: Georgia Veterans State Park, 0.2 km SE jct. Clay Pit Road and Ferry Lane. 27 January 1997. J. B. Jensen. UGAMNH 32455. FAYETTE Co: near confluence of Morning Creek and Flint River (33°28'N, 84°23'W). 4 February 1997. S. Graham. SOCM 1342. GORDON

Co: Slate Mine Road, Fairmount (34°26'N, 84°43'W). 27 February 1997. K. Bailey and K. Bailey. SOCM 1343. JONES Co: Georgia Rt.18, East Juliette (33°06'31"N, 83°47'32"). 21 November 1997. M. P. Wallace and R. A. Moulis. SOCM 503–4. POLK Co: Cut Log Road (34°03'47"N, 85°11'31"W). February 1997. J. Stewart. SOCM 1341. WALTON Co: private residence on Clarence Odum Road, Monroe (33°52'N, 83°42'W). 26 April 1997. W. Knapp. SOCM 1344. WAYNE Co: cypress pond 0.8 km NW Brentwood (31°42'00"N, 82°07'39"). 14 April 1997. G. K. Williamson and R. A. Moulis. SOCM 336.

Pseudacris feriarum (Upland Chorus Frog). CRISP Co: jct. US Rt. 280 & Coney Road. 27 January 1997. J. B. Jensen. UGAMNH 32456. EARLY Co: Shackleford-Williams Preserve (The Nature Conservancy), near Hilton. 25 January 1997. J. B. Jensen, D. Stevenson, and K. Tassin. UGAMNH 32450. GRADY Co: Waterfall Cave entrance pit. 15 October 1997. J. B. Jensen, J. Ozier, and K. Buhlmann. UGAMNH 40081.

Pseudacris nigrita nigrita (Southern Chorus Frog). EARLY: Shackleford-Williams Preserve (The Nature Conservancy), near Hilton. 25 January 1997. J. B. Jensen, D. Stevenson, and K. Tassin. UGAMNH 32448. TELFAIR Co: near jct. U.S. Rt. 280 & Georgia Rt. 165. J. B. Jensen. UGAMNH 32459. WORTH Co: ca. 0.8 km S County Road 118, 1.3 km W Georgia Rt. 313. 5 March 1997. J. B. Jensen. UGAMNH 32452.

Pseudacris ocularis (Little Grass Frog). LOWNDES Co: Grand Bay Wildlife Management Area (30°56'32"N, 83°11'04"W). 5 March 1997. J. B. Jensen. UGAMNH 32458.

Pseudacris ornata (Ornate Chorus Frog). CRISP Co: Georgia Veterans State Park, 0.2 km SE jct. Clay Pit Road and Ferry Lane. 9 January 1997. J. B. Jensen. UGAMNH 32457. EARLY Co: Shackleford-Williams Preserve (The Nature Conservancy), near Hilton. 25 January 1997. J. B. Jensen, D. Stevenson, and K. Tassin. UGAMNH 32449. WAYNE Co: cypress pond 0.8 km NW Brentwood (31°42'00"N, 82°07'39"W). 14 April 1997. G. K. Williamson and R. A. Moulis. SOCM 338. WORTH Co: (31°46'08"N, 83°54'09"W). 5 March 1997. J. B. Jensen. UGAMNH 32451.

Rana catesbeiana (Bullfrog). BIBB Co: W side Lake Wildwood. 14 June 1997. J. B. Jensen. UGAMNH 37057. CRAWFORD Co: Ulcohatchee Creek at County Road 92 (32°42'34"N, 84°11'15"W). 28 June 1997. R. A. Moulis and J. M. Waters. SOCM 217. DECATUR Co: roadside pond off County Road 8, 4.5 km NE Eldorendo (31°03'56"N, 84°36'51"W). 30 August 1997. R. A. Moulis, R. S. Redmond, and J. M. Waters. SOCM 367, 371–3. GORDON Co: private residence on Love Bridge Drive, Calhoun (34°30'N, 84°52'W). 30 January 1997. K. Bailey, K. Bailey, T. Bailey, and M. Bailey. SOCM 1345. JASPER Co: Margery Lake, Charlie Elliott Wildlife Center (33°27'23"N, 83°43'49"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1346. PIKE Co: Flint River at County Road 246. (33°04'01"N, 84°31'25"W). 3 May 1997. J. M. Waters, R. A. Moulis, M. P. Wallace, and R. S. Redmond. SOCM 169; and off Georgia Rt. 18, 3.7 km SW Concord (33°03'45"N, 84°27'45"W). 3 May 1997. R. S. Redmond, J. M. Waters, M. P. Wallace, and R. A. Moulis. SOCM 143.

Rana clamitans (Green Frog). BIBB Co: Jeffersonville Road, Macon (32°51'.01"N, 83°35'56"W). 24 May 1997. L. Walcott-Moreley. SOCM 1348. EARLY Co: tributary to Chattahoochee River at County Road 81 (31°14'47"N, 85°05'00"W). 2 July 1997. R. A. Moulis and G. K. Williamson. SOCM 253. GILMER Co: private residence on North Jones Mill Road (34°47'48"N, 84°25'48"). 30 March 1997. K. Hyde, A. Hyde, and K. Hyde. SOCM 1347. MACON Co: Flint River at Georgia Rt. 49 (32°17'53"N, 84°02'38"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 443. MONROE Co: 4.8 km N Forsyth on Georgia Rt. 42. 22 June 1997. D. Stewart. UGAMNH 37058. WALTON Co: private residence on Clarence Odum Road, Monroe (33°52'N, 83°42'W). 20 June 1997. W. Knapp. SOCM 1349.

Rana palustris (Pickerel Frog). GILMER Co: private residence on North Jones Mill Road (34°46'N, 84°27'W). 15 May 1997. K. Hyde and A. Hyde. SOCM 1350.

Rana sphenocephala (Southern Leopard Frog). BIBB Co: Lower Popular Street, ca. 1.6 km SE jct. with 12th Street. 29 November 1997. J. B. Jensen. UGAMNH 40070. JOHNSON Co: Ohoopee River at County Road 174, Pullen Bridge (32°37'04"N, 82°36'44"W). 7 September 1997. R. A. Moulis and J. B. Blue, Jr. SOCM 405. WALTON Co: private residence on Clarence Odum Road, Monroe (33°52'N, 83°42'W). 25 April 1997. W. Knapp. SOCM 1351.

Rana sylvatica (Wood Frog). WHITE Co: Smithgall Woods, on S side Tsalaki Trail, ca. 1.6 km E Georgia Rt. Alt. 75. 4 February 1997. J. B. Jensen and K. Brooks. UGAMNH 32460.

Scaphiopus holbrookii holbrookii (Eastern Spadefoot). TAYLOR Co: ca. 200 m N Georgia Rt. 96, 4.0 km W jct. with Georgia Rt. 137. 24 February 1997. J. B. Jensen. UGAMNH 32438.

TESTUDINES

Apalone ferox (Florida Softshell). WORTH Co: along Rt 300, 1.6 km S jct. with Georgia Rt. 32 (31°42'37"N, 83°59'25"W). 21 April 1997. K. Buhlmann. SOCM 1370.

Apalone spinifera aspera (Gulf Coast Spiny Softshell). EARLY Co: Kirkland Creek at County Road 92 (31°06'28"N, 85°00'32"W). 2 July 1997. G. K. Williamson and R. A. Moulis. SOCM 300. JONES Co: Walnut Creek, ca. 100 m upstream from Bibb County line (32°53'22"N, 83°36'44"W). 5 May 1997. T. Truman and L. Walcott-Moreley. SOCM 1371. MACON Co: Flint River at Georgia Rt. 127 (32°25'56"N, 84°01'28"W). 28 June 1997. R. A. Moulis, R. S. Redmond, M. P. Wallace, and J. M. Waters. Live specimen at Savannah-Ogeechee Canal Museum. TATTNALL Co: Ohoopee River at Georgia Rt. 147 bridge (32°00'36"N, 82°09'19"W). 3 May 1996. D. Stevenson. SOCM 94. TAYLOR Co: Flint River at U.S. Rt. 80/19 (32°43'19"N, 84°13'55"W). 28 June 1997. R. A. Moulis, M. P. Wallace, R. S. Redmond and J. M. Waters. SOCM 285; and Flint River at Georgia Rt. 137/128 (32°40'09"N, 84°05'54"). 28 June 1997. R. A. Moulis, R. S. Redmond, M. P. Wallace, and J. M. Waters. SOCM 286.

Chelydra serpentina serpentina (Common Snapping Turtle). COBB Co: Cameron Station Apartments, Marietta (33°56'N, 84°30'W). 1 March 1997. T. Matthews. SOCM 1373. GWINNETT Co: Georgia Rt. 125 between Lawrenceville and Grayson (33°56'48"N, 83°59'10"W). 27 May 1997. B. Vaughn and J. Vaughn. SOCM 1376. JASPER Co: Charlie Elliott Wildlife Center, Margery Lake (33°27'23"N, 83°43'49"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1375. MERIWETHER Co: Georgia Rt. 109 N Greenville (33°03'N, 84°40'W). A. Atkins. SOCM 1378. MORGAN Co: U.S. Rt. 441, 16 km S Madison (33°29'N, 83°26'W). June 1997. E. Pack. SOCM 1377. POLK Co: Cedartown

(34°02'16"N, 85°15'35"W). November 1996. J. Mullen and J. Stewart. SOCM 1372. PUTNAM Co: Reynolds Drive 1.6 km NE Wards Chapel Road (33°23'18"N, 83°14'37"W). 22 May 1997. G. West. SOCM 1374.

Chrysemys picta (Painted Turtle). COBB Co: private residence on Old U.S. Rt. 41, Kennesaw (33°58'48"N, 84°33'56"W). 3 May 1997. N. Kirk, J. Kirk, B. Kirk, and M. Kirk. SOCM 1381. HENRY Co: Paul's Lake (33°27'N, 84°11'W). 12 June 1997. L. Walcott-Moreley and T. Truman. SOCM 1383. JASPER Co: Charlie Elliott Wildlife Center (33°25'15"N, 83°44'21"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1382. PAULDING Co: U.S. Rt. 278 at Pumpkin Creek (33°54'59"N, 84°52'41"W). 30 March 1997. M. P. Wallace. SOCM 344. ROCKDALE Co: Old Honey Creek Road (33°36'N, 84°04'W). 3 August 1997. B. Dunn and T. Dunn. SOCM 1384. WALKER Co: Georgia Rt. 136, 3.2 km E Villanow (34°42'07"N, 85°16'23"W). 2 May 1997. B. McCartney. SOCM 1380. WALTON Co: Double Springs Road at John T. Briscoe Reservoir. 30 March 1997. W. Knapp. SOCM 1379.

Dermochelys coriacea (Leatherback). GLYNN Co: Sea Island Beach at 22nd Street access. May 1996. B. Winn, S. Pete, and B. Zoodsma. UGAMNH 40064.

Gopherus polyphemus (Gopher Tortoise). TOOMBS Co: Georgia Power's Plant Hatch (31°57'08"N, 82°20'29"W). 20 May 1997. E. J. Williams. SOCM 1385.

Graptemys barbouri (Barbour's Map Turtle). CRAWFORD Co: Flint River at Georgia Rt. 137/128 (32°40'09"N, 84°05'52"W). 28 June 1997. J. M. Waters, R. S. Redmond, M. P. Wallace, and R. A. Moulis. SOCM 235–6. MACON Co: Flint River, 3.5 km SE Oglethorpe (32°16'39"N, 84°02'18"W). 12 September 1997. R. A. Moulis, J. Harkins, and J. M. Waters. SOCM 536. WORTH Co: Killebrew Park State Park [Flint River, 2.9 km NE Warwick] (31°50'51"N, 83°56'35"W). 30 August 1997. R. A. Moulis, J. M. Waters and R. S. Redmond. SOCM 361–3.

Kinosternon baurii (Striped Mud Turtle). BURKE Co: Georgia Rt. 23, 3.2 km WNW Girard (33°03'55"N, 81°45'36"W). 14 March 1997. R. A. Moulis and R. A. Moulis, Jr. Live specimen at Savannah-Ogeechee Canal Museum. DOOLY Co: Pennahatchee Creek at Georgia Rt. 27 (32°05'40"N, 83°48'50"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 453–4.

Kinosternon subrubrum subrubrum (Eastern Mud Turtle). FAYETTE Co: near confluence Morning Creek and Flint River (33° 28'06"N, 84° 23'12"W). 14 March 1997. S. Graham. SOCM 1386. PIKE Co: off Georgia Rt. 18, 3.7 km SW Concord (33°03'45"N, 84°27'45"W). 3 May 1997. M. P. Wallace, R. A. Moulis, R. S. Redmond, and J. M. Waters. SOCM 188. UPSON Co: Elkins Creek at County Road 48 (32°58'14"N, 84°30'58"W). 3 May 1997. M. P. Wallace, R. A. Moulis, J. M. Waters, and R. S. Redmond. SOCM 178. WAYNE Co: cypress pond 0.8 km NW Brentwood (31°42'00"N, 82°07'39"W). 14 April 1997 G. K. Williamson and R.A. Moulis. SOCM 303; and cypress/hardwood pond, 4.7 km W-WNW Odum (31°40'27"N, 82°04'30"W). 14 April 1997. R. A. Moulis and G. K. Williamson. SOCM 302.

Macroclemys temminckii (Alligator Snapping Turtle). CHATTAHOOCHEE Co: Chattahoochee River within Fort Benning Military Reservation. 4 September 1997. J. B. Jensen and L. Andrews. UGAMNH 37066. GRADY Co: Ochlockonee River near Georgia Rt. 93 bridge. 15 May 1997. J. B. Jensen and T. Schneider. UGAMNH 35165–66. LANIER Co: Alapaha River near Georgia Rt. 37 bridge. 5 June 1997. J. B. Jensen and W. Whitesell. UGAMNH 36536.

Pseudemys concinna concinna (Eastern River Cooter). DEKALB Co: Stone Mountain area (33°48'N, 84°10'W). 25 May 1997. S. Sellers. SOCM 1389. DOUGLAS Co: Sweetwater Creek State Park (33°45'36"N, 84°37.36"W). 2 November 1996. D. Emsweller. SOCM 1387. PIKE Co: Georgia Rt. 18, 3.5 km SW Concord (33°04'03"N, 84°27'36"W). 3 May 1997. J. M. Waters and R. A. Moulis. UMC 6257. PUTNAM Co: Lake Oconee (33°13'N, 84°11'W). May 1997. E. Pack and W. Pack. SOCM 1388.

Sternotherus minor minor (Loggerhead Musk Turtle). EARLY Co: Georgia Rt. 200, 10.2 km E U.S. Rt. 27 (31°21'51"N, 84°49'35"W). 1 July 1997. G. K. Williamson and R. A. Moulis. SOCM 238; and Factory Creek at County Road 141 (31°26'05"N, 85°02'49"W). 1 July 1997. G. K. Williamson and R. A. Moulis. SOCM 301. JOHNSON Co: Ohoopee River at County Road 174, Pullen Bridge (32°37'04"N, 82°36'44"W). 7 September 1997. J. B. Blue, Jr. and R. A. Moulis. SOCM 395. PIKE Co: County Road 83, 3.5 km NW Concord (33°06'37"N, 84°28'08"W). TATTNALL Co: Ohoopee River at Georgia Rt. 147 bridge (32°00'36"N, 82°09'19"W). 5 May 1996. D. Stevenson. SOCM 94.

Sternotherus odoratus (Common Musk Turtle). CARROLL Co: Oak Grove Road, 0.8 km E Hays Mill Road (33°31'25"N, 85°06'41"W). 25 August 1996. S. Poe. SOCM 1390. DECATUR Co: Big Slough at Georgia Rt. 311 (30°56'07"N, 84°32'59"W). 30 August 1997. R. S. Redmond, J. M. Waters, and R. A. Moulis. Live specimen at Savannah-Ogeechee Canal Museum. DOUGLAS Co: Sweetwater Creek State Park (33°45'23"N, 84°38'22"W). 13 September 1997. D. Emsweller. SOCM 1392. JASPER Co: pond ca. 100 m NW jct. Murder Creek Church Road and Shepard Road, Charlie Elliott Wildlife Center (33°26'22"N, 83°43'44"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1391.

Terrapene carolina (Eastern Box Turtle). CAMDEN: U.S. Rt. 17 near Woodbine (30°59'48"N, 81°43'30"W). 14 May 1997. C. Belcher and R. Belcher. SOCM 1395. CARROLL Co: McLendon Circle ca. 200 m S Oak Grove Road (33°31'16"N, 85°06'31"W). 3 October 1996. D. Bergquist, C. Bergquist, M. Bergquist and K. Bergquist. SOCM 1393. HARRIS Co: Hasty Road, Callaway Gardens (32°50'N, 84°52'W). 28 May 1997. A. Waite. SOCM 1397. JASPER Co: Pittman Creek ca. 0.8 km downstream from Henderson Road, Charlie Elliott Wildlife Center (33°28'30"N, 83°43'20"W). 24 May 1997. J. B. Jensen and W. Knapp. SOCM 1396. POLK Co: private residence on Wilson Road, Cedartown (33°58'16"N, 85°16'08"W). 30 October 1996. J. Stewart. SOCM 1394.

Trachemys scripta scripta (Yellowbelly Slider). DOOLY Co: (32°12'20"N, 83°40'00"W). July 1995. D. Guynn, Jr. SOCM 1398. GREENE Co: Curtis Sand Pit on Wraywood Rd, 0.6 km W Georgia Rt. 15. 4 May 1997. T. Schneider. UGAMNH 37079. JASPER Co: Margery Lake, Charlie Elliott Wildlife Center (33°27'23"N, 83°43'49"W). 24 May 1997. J. Jensen and W. Knapp. SOCM 1399.

LACERTILIA

Anolis carolinensis (Green Anole). CHEROKEE Co: Georgia Rt 372, 3.2 km E Ball Ground (34°19'30"N, 84°21'24"W). 12 March 1997. R. Holcomb. SOCM 1404. CLAYTON Co: private residence on South Hampton Court, Jonesboro (33°28'04"N, 84°22'49"W). 29 October 1996. S. Graham. SOCM 1401. COBB Co: Kennesaw Mountain National Park (33°57'49"N, 84°35'43"W). 4 November 1996. G. Beaton. SOCM 1403. GORDON Co: off Shope Lake Road,

3.2 km S Rt 53 in Sonoraville (34°25'31"N, 84°49'53"W). 28 October 1996. B. McCartney. SOCM 1402. HOUSTON Co: private residence on Grovania Road (32°22'31"N, 83°43'17"W). March 1997. D. Guynn, Jr. and P. Guynn. SOCM 1406. MACON Co: Buck Creek at Georgia Rt. 240 (32°18'34"N, 84°09'43"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 473. NEWTON Co: private residence on Cardinal Ridge Road, between Georgia Rt. 20 and Georgia Rt. 212 (33°32'22"N, 84°00'52"W). 29 May 1997. L. May. SOCM 1407. POLK Co: Pine Pitch Road, Cedartown(34°02'58"N, 85°12'31"W). March 1997. A. Beck. SOCM 1405. WALTON Co: private residence on Clarence Odum Road, Monroe (33°52'04"N, 83°42'05"W). 22 August 1996. W. Knapp. SOCM 1400.

Eumeces fasciatus (Five-lined Skink). EARLY Co: ca. 1.6 km S Clay County line, near Chattahoochee River. 28 June 1997. D. Stewart. UGAMNH 37050. MACON Co: Flint River at Georgia Rt. 49 (32°17'36"N, 84°02'41"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 452.

Eumeces inexpectatus (Southeastern Five-lined Skink). USA GEORGIA: HOUSTON Co: private residence on Grovania Road (32°22'32"N, 83°43'06"W). 11 June 1997. D. Guynn, Jr. SOCM 1408. STEWART Co: Georgia Rt. 39, 3.4 km SW Omaha (32°07'20"N, 85°02'10"W). 4 May 1997. R. S. Redmond and M. P. Wallace. SOCM 186; and Ga Rt. 39, 8.1 km S-SSW Omaha (32°04'29"N, 85°02'19"W). 4 May 1997. J. M. Waters and R. A. Moulis. SOCM 182.

Eumeces laticeps (Broadhead Skink). BUTTS Co: Indian Springs State Park (33°14'42"N, 83°55'49"W). 9 June 1997. L. Walcott-Moreley, T. Walcott, M. Walcott and D. Moreley. SOCM 1410. FAYETTE Co: private residence on Summer Place, Peachtree City (33°20'54"N, 84°31'55"W). 14 June 1997. B. Koehn and A. Harlfinger. SOCM 1409. SEMINOLE Co: off County Road 25, 7.4 km S-SSW Iron City (30°57'00"N, 84°49'47"W). 2 July 1997. R. A. Moulis and G. K. Williamson. SOCM 287–8. STEWART Co: Georgia Rt. 39, 8.1 km S-SSW Omaha (32°04'29"N, 85°02'19"W). 4 May 1997. J. M. Waters and R. A. Moulis. SOCM 181.

Scincella lateralis (Ground Skink). EARLY Co: ca. 1.6 km S Clay County line near Chattahoochee River. 28 June 1997. D. Stewart. UGAMNH 37080. GORDON Co: 1.6 km E Interstate 75 off Boone Ford Road (34°28'31"N, 84°54'04"W). 10 April 1997. Bryan McCartney. SOCM 1411. JASPER Co: ca. 100 m NW jct. Murder Creek Church Road & Shepherd Pond Road, Charlie Elliott Wildlife Center (33°26'22"N, 83°43'43"W). 24 May 1997. S. Graham and W. Knapp. SOCM 1414. JONES Co: Twin Creek Farm on Huckabee Road (37°57'22"N, 83°35'13"W). 5 May 1997. L. Walcott-Moreley and T. Truman. SOCM 1412. WALTON Co: private residence on Clarence Odum Road, Monroe (33°52'N, 83°42'W). 3 June 1997. W. Knapp. SOCM 1413.

SERPENTES

Agkistrodon contortrix mokasen (Northern Copperhead). FANNIN Co: Old Dial Road, S Morganton (34°50'N, 84°14'W). July 1997. J. Warren. SOCM 1415.

Cemophora coccinea copei (Northern Scarlet Snake). QUITMAN Co: 8 km NE Georgetown on un-named dirt road N Georgia Rt 82 (31°56'N, 84°58'W). 8 June 1997. J. Sewell and C. Lambert. SOCM 1416.

Coluber constrictor constrictor (Northern Black Racer). CARROLL Co: private residence on McLendon Circle (33°31'16"N, 85°06'31"W). 29 August 1997. D. Bergquist, C. Bergquist, and M. Bergquist. SOCM 1419.

Crotalus adamanteus (Eastern Diamondback Rattlesnake). CLINCH Co: 0.8 km N jct. Georgia Rt. 177 and US Rt. 441 (30°40'50"N, 82°32'54"W). 7 July 1997. M. Beebe and R. Henderson. SOCM 1420.

Crotalus horridus (Timber Rattlesnake). PICKENS Co: Henderson Mountain ca. 1.2 km SE Carlan Road (34°25'29"N, 84°32'29"W). 10 September 1997. M. Kersey. SOCM 1421. PUTNAM Co: Sparta Rt. at Long Shoals Road (33°20'41"N, 83°13'04"W). September 1997. E. Pack. SOCM 1422.

Diadophis punctatus punctatus (Southern Ringneck Snake). MONROE Co: 4.8 km N Forsyth on Ga Rt. 42. D. Stewart. UGAMNH 37103. POLK Co: Prior Station Road 4 km W Cedartown (34°01'16"N, 85°22'30"W). 2 March 1997. M. Kersey. SOCM 1423.

Elaphe guttata guttata (Corn Snake). JOHNSON Co: Georgia Rt. 57 between Wrightsville and Kite (32°42'N, 82°39'W). 5 October 1997. J. Harrison. SOCM 1425. LAURENS Co: 3.2 km W U.S. Rt. 441 on Firetown Road, Dublin (32°30'20"N, 82°56'35"W). 18 May 1997. J. Dorminy. SOCM 1424. MILLER Co: Georgia Rt. 45, 6.3 km S-SSW Colquitt (31°07'38"N, 84°46'19"W). 31 August 1997. J. M. Waters, R. S. Redmond, and R. A. Moulis. SOCM 349.

Elaphe obsoleta obsoleta (Black Rat Snake). CLAYTON Co: private residence on South Hampton Court, Jonesboro (33°28'29"N, 84°22'55"W). 19 April 1997. S. Graham and J. Eldridge. SOCM 1427. MURRAY Co: Conniston Road W U.S. Rt. 411(34°38'N, 84°44'W). 27 May 1997. M. Kersey. SOCM 1426.

Elaphe obsoleta obsoleta x *spiloides* (Intergrade or hybrid Eastern Rat Snake). WEBSTER Co: off County Road 123, 8.5 km NW Preston (32°07'00"N, 84°36'14"W). 4 May 1997. R. A. Moulis, R. S. Redmond, M. P. Wallace, and J. M. Waters. SOCM 191.

Elaphe obsoleta spiloides (Gray Rat Snake). SCHLEY Co: Big Muckalee Creek at Georgia Rt. 153 (32°10'30"N, 84°22'06"W). 1 October 1997. R. A. Moulis and G. K. Williamson. SOCM 498.

Farancia abacura abacura (Eastern Mud Snake). CRISP Co: Airport Road, ca. 0.3 km N Farmers Market Road, (32°00'24"N, 83°45'49"W). T. Johnson. UGAMNH 40077. MILLER Co: Georgia Rt. 91, 4.4 km S Colquitt. 29 June 1997. R. Birkhead. UGAMNH 37083.

Farancia abacura abacura x *reinwardtii* (Intergrade or hybrid Mud Snake). EARLY Co: Georgia Rt. 39, 5.3 km N Georgia Rt. 273 (31°13'15"N, 84°55'41"W). 2 July 1997. G. K. Williamson and R. A. Moulis. SOCM 814. STEWART Co: Georgia Rt. 39, 1.6 km N Florence (32°06'20"N, 85°02'18"W). 4 May 1997. J. M. Waters and R. A. Moulis. SOCM 159.

Heterodon platirhinos (Eastern Hognose Snake). DOUGLAS Co: Douglas Boulevard 0.4 km W Georgia Rt. 5 (33°43'31"N, 84°45'59"W). 27 August 1997. D. Emsweller. SOCM 1429. GORDON Co: off Boone Ford Road, 0.4 km E Interstate 75 (34°28'32"N, 84°54'40"W). 1 March 1997. B. McCartney. SOCM 1428. TAYLOR Co: Georgia Rt. 137, 6.1 km WSW Butler (32°30'54"N, 84°19'32"W). 4 May 1997. J. M. Waters, R. A. Moulis, M. P. Wallace, and R. S. Redmond. SOCM 160.

Heterodon simus (Southern Hognose Snake). MILLER Co: Eufaula National Wildlife Refuge's Kimbrell Tract, ca. 15 km ESE Colquitt

(31°07'55"N, 84°34'56"W). 10 March 1997. R. Birkhead and B. Birkhead. SOCM 1430.

Lampropeltis getula getula (Eastern Kingsnake). CARROLL Co: private residence on Greenwood (33°34'00"N, 85°07'18"W). 1 September 1996. S. Poe. SOCM 1431. COFFEE Co: U.S. Rt. 221/ Georgia Rt. 135, 6.0 km N West Green (31°39'58"N, 82°43'30"W). 31 August 1997. R. S. Redmond, J. M. Waters, and R. A. Moulis. SOCM 350. GORDON Co: Private residence on Sylvan Drive, Calhoun. 7 October 1997. M. Kersey. UGAMNH 40076. JASPER Co: Murder Creek Road, Charlie Elliott Wildlife Center (33°28'N, 83°44'W). 21 May 1997. M. DeSart. SOCM 1433. MILLER Co: County Road 192, 2.3 km SSW Boykin (31°05'29"N, 84°42'18"W). 2 July 1997. G. K. Williamson and R. A. Moulis. SOCM 0266. MURRAY Co: near jct. Mountain Road and County Line Road (34°36'59"N, 84°54'14"W). 25 July 1997. M. Kersey. SOCM 1434. PIKE Co: off County Road 100, 4.5 km SW Concord (33°04'07"N, 84°28'34"W). 3 May 1997. R. A. Moulis, R. S. Redmond, and J. M. Waters. SOCM 496. STEWART Co: Hodchockee Creek off Georgia Rt. 27 (32°03'05"N, 84°46'36"W). 4 May 1997. J. M. Waters, R. S. Redmond, M. P. Wallace, and R. A. Moulis. SOCM 464.

Masticophis flagellum flagellum (Eastern Coachwhip). APPLING Co: off Georgia Rt. 169, 0.5 km W the Wayne Co. line. 29 March 1997. J. B. Blue, Jr. SOCM 190. PUTNAM Co: Harmony Road 1.6 km east US Rt. 441 (33°26'59"N, 83°15'11"W). 1 May 1997. G. West. SOCM 1436. TOOMBS Co: private residence on Forest Lake Drive, Vidalia (32°11'43"N, 82°26'06"W). 25 April 1997. B. Feimster. SOCM 1435. WEBSTER Co: Georgia Rt 27, 1.6 km W County Road 49. 2 June 1997. T. Schneider. UGAMNH 37084.

Nerodia erythrogaster erythrogaster (Redbelly Water Snake). BLECKLEY Co: ca. 8 km NW jct. Georgia Rt. 26 and Georgia Rt. 126 (32°25'N, 83°17'W). 11 May 1997. P. Guynn and D. Guynn. SOCM 1437. DOOLY Co: Georgia Rt. 27, 0.2 km W Interstate 75 (32°07'19"N, 83°45'50"W). 1 June 1997. P. and D. Guynn. SOCM 1438. JOHNSON Co: Ohoopee River at County Road 174, Pullen Bridge (32°37'04"N, 82°36'44"W). 7 September 1997. J. B. Blue, Jr. and R. A. Moulis. SOCM 393. MACON Co: Flint River at Georgia Rt. 49 (32°17'36"N, 84°02'41"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 449–50.

Nerodia fasciata fasciata (Banded Water Snake). APPLING Co: 2.4 km W jct. Georgia Rt. 15 and Altamaha River (31°56'38"N, 82°23'20"W). 30 September 1996. W. F. Prince. SOCM 1439. CRAWFORD Co: U.S. Rt. 341, 4.8 km S Roberta (32°40'43"N, 84°00'20"W). 28 June 1997. R. S. Redmond, R. A. Moulis, and J. M. Waters. SOCM 197.

Nerodia sipedon pleuralis (Midland Water Snake). CRAWFORD Co: Ulcohatchee Creek at County Road 92 (32°42'34"N, 84°11'15"W). 28 June 1997. R. A. Moulis and J. M. Waters. SOCM 280. MONROE Co: private residence on Georgia Rt. 42, 6.5 mi S Forsyth (32°56'16"N, 83°57'13"W). 8 August 1997. R. Thackston. SOCM 1441. WALTON Co: Double Springs Road at John T. Briscoe Reservoir (33 50'N, 83°47'W). 3 May 1997. W. Knapp. SOCM 1440.

Nerodia taxispilota (Brown Water Snake). BALDWIN Co: private residence on Lakeview Drive at Lake Sinclair (33°10'07"N, 83°15'00"W). July 1997. C. Hodges and D. Hodges. SOCM 1442. ECHOLS Co: Alapaha River at Georgia Rt. 94 bridge, Statenville (30°42'15"N, 83°01'59"W). 7 August 1997. D. Stevenson and J. B. Jensen. SOCM 1443. MITCHELL Co: Flint River along County Road 307, 7.6 km N-NNE Baconton (31°26'22"N, 84°08'29"W). 30 August 1997. R. A. Moulis, J. M. Waters, and R. S. Redmond. SOCM 357; and Flint River at County Road 254 (31°04'46"N, 84°30'28"W). 30 August 1997. R. A. Moulis, J. M. Waters, and R. S. Redmond. SOCM 348.

Opheodrys aestivus (Rough Green Snake). CARROLL Co: private residence on McLendon Circle (33°31'14"N, 85°06'34"W). 26 September 1996. J. Dyer. SOCM 1444. FAYETTE Co: private residence on Summer Place, Peachtree City (33°20'53"N, 84°31'55"W). July 1997. B. Koehn. SOCM 1448. HALL Co: Chicopee Woods Golf Course, 50 m SE Atlanta Rt. (34°15'12"N, 83°50'42"W). 9 October 1996. D. Harrell. SOCM 1445. LAMAR Co: private residence on Sappington Road, Redbone Community (32°59'40"N, 84°05'04"W). 26 April 1997. J. Ozier. SOCM 1446. LAURENS Co: Georgia Rt. 257, 2.9 km W-WSW Dexter (32°25'42"N, 83°05'07"W). 1 July 1997. G. K. Williamson and R. A. Moulis. SOCM 263. MONROE Co: Rt 18 near Lake Juliette (33°01'N, 83°46'W). 5 May 1997. T. Truman and L. Walcott-Moreley. SOCM 1447. TAYLOR Co: Georgia Rt. 137, 16.3 km SW Butler (32°27'36"N, 84°21'39"W). 4 May 1997. J. M. Waters, R. A. Moulis, M. P. Wallace, and R. S. Redmond. SOCM 156. UPSON Co: jct. County Road 48 and County Road 51 (32°58'01"N, 84°29'52"W). 3 May 1997. J. M. Waters, R. A. Moulis, R. S. Redmond and M. P. Wallace. SOCM 155.

Storeria dekayi wrightorum (Midland Brown Snake). USA: COBB Co: private residence on Dobbs Crossing, Marietta. April 1997. E. Rasmus. UGAMNH 40071. FORSYTH Co private residence on Chimney Cove Drive, Cumming (34°10'58"N, 84°04'41"W). 1 March 1997. P. Shaffer. SOCM 1449. MONROE Co: 4.8 km N Forsyth on Georgia Rt. 42. 12 March 1997. D. Stewart. UGAMNH 37081. PIKE Co: Georgia Rt. 362 at Flint River (33°10'19"N, 84°30'21"W). 3 May 1997. R. S. Redmond, R. A. Moulis, J. M. Waters, and M. P. Wallace. SOCM 173. POLK Co: Wilson Road, Cedartown (33°57'49"N, 85°16'36"W). April 1997. A. Beck. SOCM 1450. WASHINGTON Co: private residence on Ridgeland Drive (32°59'17"N, 82°48'53"W). 7 May 1997. B. Strange. SOCM 1451.

Storeria occipitomaculata occipitomaculata (Northern Redbelly Snake). GORDON Co: off Boone Ford Road, 0.8 km E Interstate 75 (34°28'32"N, 84°54'40"W). 10 September 1996. B. McCartney. SOCM 1452.

Tantilla coronata (Southeastern Crowned Snake). UPSON Co: County Road 429, 15.8 km WNW Thomaston (32°56'52"N, 84°28'48"W). 3 May 1997. J. M. Waters, R. S. Redmond, M. P. Wallace, and R. A. Moulis. SOCM 0174. WILKINSON Co: County Road 158. 11 April 1997. R. S. Redmond and J. M. Waters. SOCM 150.

Thamnophis sauritus sauritus (Eastern Ribbon Snake). MACON Co: Flint River at Georgia Rt. 49 (32°17'36"N, 84°02'41"W). 12 September 1997. R. A. Moulis and J. M. Waters. SOCM 451. PIKE Co: off Georgia Rt. 18, 3.7 km SW Concord (33°03'45"N, 84°27'45"W). 3 May 1997. R. S. Redmond, R. A. Moulis, J. M. Waters, and M. P. Wallace. SOCM 175.

Thamnophis sirtalis sirtalis (Eastern Garter Snake). CARROLL Co: private residence on McLendon Circle (33°31'16"N, 85°06'31"W). 9 October 1996. M. Bergquist. SOCM 1454. FAYETTE Co: near confluence Morning Creek and Flint River (33°27'53"N, 84°23'05"W). 9 May 1997. S. Graham. SOCM 1456. GORDON Co: private residence on Sylvan Drive, Calhoun (34°29'20"N,

84°55'29"W). 30 May 1997. M. Kersey. SOCM 1457. WASHINGTON Co: 3.2 km S Oconee, on Georgia Rt. 272 (32°49'39"N, 82°55'59"W). 2 July 1997. L. Schlup. SOCM 1458.

Virginia valeriae valeriae (Eastern Smooth Earth Snake). STEWART Co: Hodchockee Creek off Georgia Rt. 27 (32°03'05"N, 84°46'36"W). 4 May 1997. R. S. Redmond, J. M. Waters, M. P. Wallace, and R. A. Moulis. SOCM 271.

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BOOK REVIEWS

Philippine Amphibians: An Illustrated Field Guide, by Angel C. Alcala and Walter C. Brown. 1998. Bookmark Inc., 264-A Pablo Ocampo Sr. Avenue, Makati City, Philippines (e-mail: bookmark@info.com.ph). 116 + xii pp, 69 color plates. Softcover, Philippine P 350 (approx. US $9.20). ISBN 971-569-314-8.

CHRIS B. BANKS
Melbourne Zoo, P.O. Box 74
Parkville, Victoria 3052, Australia
e-mail: cbanks@zoo.org.au

This book is co-authored by two of the most knowledgable researchers on Philippine amphibians and reptiles who, between them, have published more than 70 papers and books on systematics, ecology, and natural history of Philippine reptiles and amphibians.

Intended as a semi-popular introduction to Philippine amphibians, this book is the first guide to discuss this group exclusively. It covers 78 species of anurans and three caecilians, although the authors acknowledge that approximately ten additional frog taxa have either been, or are in the process of being, described since the book went to press in mid-1998. This highlights the increasing level of attention now being paid to herpetofauna of the Philippine Archipelago.

After a brief introduction to Philippine amphibians, there is a short chapter on how to use the book, followed by the species accounts. These are each divided into three sections: 1) Basic information including snout-vent length (mm), habitat type (explained in more detail in the "How to use" chapter), diet, mode of reproduction, area of most activity (terrestrial, arboreal, etc.), status (endemic, non-endemic or introduced), and frequency of occurrence (rare, uncommon, common or undetermined); 2) Remarks on such aspects as diagnostic features, specific microhabitats and life history, altitudinal range and conservation status; and 3) Geographic range in the Philippines and Asia. The information in the first and third sections is presented in telegraphic style. The book concludes with a short list of selected references and indices of common and scientific names.

This book is designed for the general reader and "students of biodiversity." If one is seeking more detailed morphological data or habitat descriptions of Philippine amphibians, the earlier publications by Alcala (1986) and Inger (1954) will be more useful. Nevertheless, the new book covers considerably more taxa tha these earlier volumes, with two additional caecilians and thirteen additional frogs in comparison to Alcala (1986). It is also the first book to present such a large number of color photographs of Philippine amphibians.

The book has good production values, is readable, and is a size that easily fits into a good-sized pocket or any day-pack. Hopefully it will help to make the broader wildlife and conservation community more aware of Philippine amphibians and the threats they face. Indeed, a recent assessment of all species suggests that as many as 40% are threatened to some degree (Banks 1999). Significantly, the book is the second to be published on Philippine wildlife and environments by a Filipino publisher within the last year, a welcome trend and one that I hope continues.

Whether one is doing a serious field study on Philippine frogs, or is merely interested in knowing more about Philippine wildlife, this is a book that belongs on the shelf.

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Status and Conservation of Midwestern Amphibians, edited by Michael J. Lannoo. 1998. University of Iowa Press, 100 Kuhl House, Iowa City, Iowa 52242-1000, USA. ISBN 0-87745-631-3 (cloth), ISBN 0-87745-632-1 (paper), 528 pp. US $49.95 cloth, US $29.95 paper.

STANLEY K. SESSIONS
Department of Biology , Hartwick College
Oneonta, New York 13820, USA
e-mail: sessionss@hartwick.edu

Amphibian decline is one of the most troublesome environmental issues of the last decade and, as with many other environmental issues, the cause and even the extent of the problem are not understood. Many researchers are now beginning to realize that a major impediment to understanding amphibian decline is the lack of sufficient baseline information by which to compare current apparent trends. Part of the problem is that many amphibian populations may undergo large inflations and contractions in size depending on short-term local and regional climatic fluctuations. An apparent decline, for example, may actually be a "deflation" (or contraction) of an unusually large ("inflated") population. Clearly there is a need for more information about baseline natural history and population biology of amphibians everywhere. This book is a welcome attempt to help fill this need.

The book grew out of the first meeting (1994) of the DAPTF Central Division at St. Mary's University's Reis Biological Station in St. Louis, Missouri. It presents available information on the status of midwestern amphibians with the explicit purpose of assessing the current situation and providing a useful reference for future studies. The book is large, carefully organized, and includes, in addition to an introduction and conclusion, 42 chapters divided among six sections: landscape patterns and biogeography (five chapters), species status (10 chapters), regional and state status (10 chapters), diseases and toxins (four chapters), conservation (seven chapters), and monitoring and application (six chapters). The book is obviously the product of a gargantuan effort, to say the least, and the editor and authors should be congratulated.

As in any edited book with contributed chapters, however, the quality of the contributions ranges from truly excellent to disappointingly poor. The most useful parts of the book are those that include distribution maps, historical data, and methodologies. An example of an outstanding chapter in this regard is a chapter by Michael J. Mossman et al. which reports the results of a study of long term trends in Wisconsin frog and toad populations. A no-nonsense chapter by Ralph A. Pfingsten consists basically of a series of 42 updated distribution maps of the amphibians of Ohio. For those interested in geographic information systems in relation to landscape ecology and spatial modeling, I can recommend a truly excellent chapter by Anthony Krzysik. Unfortunately, salamanders (which are somewhat more diverse, though less widely distributed, than anurans in the Midwest) get short shrift in this book, and it is not clear whether this is mostly because of lack of information or interest, or both. If salamander decline is a neglected area then this is a clarion call to herpetologists to fill this gap.

My attention was particularly drawn to the chapters on amphibian diseases and deformities, partly because of the inviting cover photograph and frontispiece illustration of deformed frogs with supernumerary limbs, but also because this is an area of my own current research interest. The chapter on diseases by Sandra A. Faeh et al. seemed to be fairly comprehensive in breadth but disappointingly short on details. The authors are to be forgiven, however, since it would have taken an entire book to have done this topic justice.

Nevertheless, I thought the coverage of helminth parasites was astonishingly inadequate since trematodes have been specifically implicated as a major cause of amphibian deformities (Sessions and Ruth 1990), and the evidence has recently grown stronger (Johnson et al. 1999; Sessions et al. 1999).

Much more disappointing was the chapter on deformities by Judy Helgen et al. of the Minnesota Pollution Control Agency (MPCA). Although generously billed by the editor as "an extensive account of the nature of Minnesota northern leopard frog limb and eye malformations", this is one of the weakest chapters in the whole book, both in organization and scope. This is unfortunate because it is the one most likely to attract the attention of non-specialists because of the recent prominence of "deformed frogs" in the media (not to mention the cover illustrations). The authors present no tables of data, almost no indication of frequencies, no serious attempt at analysis, and no review of possible developmental mechanisms, even though these are available specifically for supernumerary limbs both from laboratory experiments (Bryant et al. 1981) and in natural populations of amphibians (Sessions and Ruth 1990). Instead, the authors present a series of anecdotal descriptions of individual frogs and their deformities. To make matters worse, the authors make no attempt to use current terminology from studies of amphibian limb development and regeneration, thus it is difficult to place their observations within the context of the available research literature, not to mention possible developmental mechanisms. The authors consider a wide range of possible causes, including various toxic chemicals, endocrine disrupters, and chromosome rearrangements, but there is no attempt to sort through the possible causes in terms of how they best fit the actual observed deformities. Interestingly (to me, at least), the authors provide little discussion of parasites, even though the role of trematode cyst infection in the induction of the same kinds of deformities as seen in Minnesota was established nearly a decade ago (Sessions and Ruth 1990). They correctly point out, however, that what is needed is to determine empirically whether parasites can cause the observed malformities in the lab. This has now been done (Johnson et al. 1999).

Among the take-home lessons of the book is that the clearest cause of amphibian disappearances is destruction of habitat. There can be little disagreement, for example, that draining of wetlands for housing developments can result in the overt elimination of amphibian populations. Much less understood is the role that chemical pollutants, including pesticides, are having on regional amphibian distribution and health. Least understood (although in many ways the most ominous) is the role of global environmental phenomena such as increased ultraviolet irradiation as a consequence of ozone depletion.

Another important take-home lesson concerns the shifting status of different amphibian species. If "amphibian decline" is the icon of current environmental issues, then Blanchard's cricket frog is the icon of current issues in midwestern amphibian conservation. Twenty years ago that icon would have been *Rana pipiens*, but Leopard frogs are apparently on the rebound in the Midwest, for reasons just as mysterious as their original declines. Blanchard's cricket frogs are clearly disappearing at an alarming rate over most of their range in midwestern states and nobody knows why. What are these animals telling us? Are there patterns here? Are amphibian population increases and decreases, like pistons in a healthy engine, a normal aspect of amphibian natural history, or do the observed fluctuations represent the convulsions and sputtering of dying ecosystems? No answers are forthcoming from this book, which is not surprising since it is merely a step in the right direction and we have a long, long way to go. The weaknesses notwithstanding, this book is a valuable positive contribution to our understanding of amphibian natural history in the midwestern U.S., and future biologists will be grateful for its existence. It belongs on the bookshelf of every serious herpetologist.

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Sea Snakes, by Harold Heatwole. 1999. University of New South Wales Press, Ltd., Sydney 2052 Australia (published in the U.S. by Krieger Publishing Company P.O. Box 9542, Melbourne, Florida 32902-9542, USA). i–vi, 148 pp. Softcover. US $27.50 + $3.00 shipping. ISBN 1-57524-116-1.

HAROLD K. VORIS

Field Museum of Natural History, Department of Zoology
1400 South Lake Shore Drive, Chicago, Illinois 60605-2496, USA
e-mail: hvoris@fmnh.org

This book is the second edition of a semi-popular review of the biology of marine snakes. It represents a very substantial increase in volume and subject matter over the original edition. It is logically organized, well written and it is largely free of editorial errors. Its coverage of sea snake natural history and biology is broad and thorough. Although the title suggests that the book may concern itself only with the true sea snakes (Hydrophiidae), this is happily not the case. In fact, Professor Heatwole takes an ecological approach and includes coverage of all marine snakes, fossil and living. This approach makes the book infinitely more interesting and allows the reader to appreciate the breadth of ecological ex-

perimentation that several independent snake lineages have undergone.

This new edition is organized into ten chapters and an appendix as opposed to five chapters in the first edition. Because progress has been uneven in different areas of sea snake biology some chapters have warranted expansion into several new chapters while others have simply benefited from new information being incorporated into the existing treatment. Chapter 1, "What are Sea Snakes?," has been strengthened by a well formulated section on the origin and evolution of sea snakes, and Chapter 2, on the distribution and biodiversity of sea snakes, is 80% new material. Although a section within Chapter 2 is titled "Regional Distributions," it is, in fact, essentially a summary of sea snake distributions according to national boundaries. This approach of using political boundaries has serious limitations. For example, Pakistan, India, Sri Lanka, Bangladesh, and Burma are treated as independent elements rather than parts of geographic or ecological regions. This problem spreads over into a large, two-page map (Figure 2.3) showing the number of species occurring in these political regions. Here Sri Lanka, India, and Bangladesh are depicted as having 18, 23, and 12 species of marine snakes respectively. The differences in these numbers are largely due to differences in past collection efforts and differences in the extent of the sea coasts of each region, and they detract the reader from the important "center of origin" message that is the purpose of the map. It is also unfortunate that there was no attempt to summarize species compositions by region, so it is not possible to learn, for example, that perhaps all the 18 "Sri Lanka species" in Figure 2.3 are among the 23 "Indian species." On the other hand, the section on the distribution patterns of Australian marine snakes employs more of a regional analysis and is well done. In addition, Table 2.1 is a commendable attempt at summarizing the adult size, habitat, and food habits of all marine snake species. Chapter 3, "Natural History," has a much expanded treatment of reproduction and development and a comprehensive table that provides a summary of clutch size and sexual dimorphism for nearly all marine snake species. In addition, this chapter summarizes the results of recent studies of the local movements of the olive sea snake (*Aipysurus laevis*) on several reefs within the Great Barrier Reef system. Chapters 4, 5, and 6, on diet, enemies, and population and community ecology, have been updated but remain largely the solid coverages of the first edition. Both chapters 7 and 8 on adaptations to life in salt water and diving adaptations have enhanced illustrations and expanded tables. In particular, Table 8.1 nicely summarizes hematocrit, blood volume, oxygen capacity, and habitat data for a wide range of marine snakes as well as some terrestrial snakes, turtles, crocodilians, and lizards. In addition, a mostly new section describes how both pulmonary and cutaneous respiration are accomplished and how they relate to the submergence cycle. Numerous subjects related to the venoms of sea snakes are treated in Chapter 9. Here the venom apparatus is described and a good, simplified explanation of neurotoxins, myotoxins, hemotoxins, and nephrotoxins is furnished. The last chapter, "Sea Snakes and Humans," has been expanded three-fold in this edition. This segment will be particularly useful to popular writers and producers of film documentaries who always seem to want to include information on how deadly sea snakes are and which snakes are the most dangerous of all. To this end, Table 10 gives fang length, venom yield, mean toxicity, temperament, and fatality information for 25 species of true sea snakes. Table 10.2 goes even further for the thrill-seeking popular readers by providing estimates of the "number of humans that could be killed" by a mean venom yield and a maximum venom yield from 22 marine and terrestrial poisonous snakes.

This edition represents a serious expansion and enhancement of the first edition. Besides the increase in coverage it provides a much greater photographic coverage with the introduction of 29 color plates of good to excellent quality. I highly recommend this volume to both students and teachers of herpetology as well as serious lay readers. Its comprehensive coverage even suggests that a course devoted to the biology of aquatic snakes may soon be an attractive offering.

Treefrogs of Africa, by Arne Schiøtz. Edition Chimaira, Chimaira Buchhandelsgesellschaft GmbH, Friedberger Anlage 14, 60316 Frankfurt am Main, Germany (distributed in the United States by Zoo Book Sales and Bibliomania!). 352 pp. Hardcover. DM 98,– (approx.US $59.00). ISBN 3-930612-24-0.

K. M. HOWELL
P.O. Box 35064, Department of Zoology and Marine Biology
University of Dar es Salaam, Dar es Salaam, Tanzania
e-mail:khowell@twiga.com

At last—a book that covers all of the "tree" frogs (members of the families Hyperoliidae, Rhacophoridae, and Hylidae) of Africa! The name treefrog is itself a misnomer, because in addition to being found on trees, many of these frogs also occur on sedges and grasses. Dr. Arne Schiøtz has used experience gained conducting field work in West and East Africa from the 1960's to produce a book which allows even the uninitiated to quickly gain information, scant as it is in some cases, on this most colorful group of African anurans. There is probably no living herpetologist who has seen more species of African treefrogs alive in the field than Schiøtz. For those species with which he is less familiar, he has admirably summarized the information available in the literature and has obtained color photographs from colleagues, who have also made a very real contribution to the effectiveness of this book.

Throughout the book, Schiøtz's highly personal touch and approach are evident. This is perhaps most obvious in the introductory section in the brief discussion of species concepts. From a very practical point of view, he notes the difficulties in assigning names to taxa described only from preserved specimens and notes his own emphasis is on non-morphological characters such as voice, habitat preference, and calling site.

There are no numbered chapters, but major topics are provided in a table of contents. After introducing the reader to his basic approach, the author discusses various aspects of treefrog distribution, reproduction, vocalization (termed "the love song"), and conservation. A brief section on collection and preservation is followed by a more detailed portion on keeping treefrogs in captivity, and one entitled "how to use this book." A short acknowledgment section follows.

The section labeled "Systematics" is the heart of the book. For each genus, Schiøtz provides a description which includes details of size, color, pattern, skin texture, condition of the pupil, and other morphological characters. Information on development is also provided, including egg deposition, description of eggs, tadpole, tooth formulae of tadpoles, and general ecological notes on the species in the genus are presented. Where required, further comments are provided on problems of naming species and their relationships with others.

Species accounts are then given in detail, often with information on habitat and altitude, and it is here that the contribution of the field experience of the author is most obvious. A description of the voice, usually accompanied by a sonogram, is presented. Black and white illustrations of particular morphological features of interest

are provided, and the distributions are indicated on an outline map. Color photographs by the author or others are usually presented; in the few cases in which these were not available, black and white or color illustrations from other sources are presented.

This book is not simply a guide. Rather, Schiøtz highlights areas where information is missing and does not avoid pointing out where differences of opinion exist over taxonomic treatments at the generic, specific and subspecific levels. For example, in his presentation of members of the genus *Phylictimantis* he notes that four species are currently recognized but that this situation is by no means settled, and that alternatively, they might all be regarded as subspecies of a single species. The most controversial aspect of the book is Schiøtz's treatment of the *Hyperolius viridiflavus* group, in which he notes that there is variation in color pattern which is probably greater than in any other vertebrate group. He further states "It can be argued that since all the forms probably belong to one or a few reproductive continua where clear-cut delimitation between the different forms are lacking the subspecies concept can not be used in this case." He argues that therefore the current subspecies names for this group are used only as a practical shorthand way of distinguishing distinct forms but are treated as vernacular names and that "future workers can then attach them to any species they choose."

There are many positive features of this book; the most outstanding are the color plates and the clear information presented on each species. These photographs and the accompanying figures will greatly assist in the identification of many species of African treefrogs. The maps indicating the distribution of the species in Africa are another useful feature, allowing the reader to gain a continent-wide rather than regional picture of the species distributions. However, the book would have benefited from a tighter review and editing process which would have reduced some basic omissions and errors. Some of these are simply errors of English usage, others indicate a need for systematic proofreading and checking of facts and details.

Given the importance of the photographs and the contributions made by many colleagues with an interest in African treefrogs, it is somewhat surprising that these are not credited consistently, nor is a list of those who contributed photographs and other such material presented. Sometimes the photographer's name appears in capital letters (e.g., Plate 21: SWITAK), and without initials on some occasions but not others (is Loumont on p. 310 the same as C. Loumont on p. 311?), or with institutional affiliation of the photographer in some cases (e.g., Plate 66: R.C. Drewes), but not others. It is also unclear in cases if the illustrations, both photographs and sonograms, have appeared in other publications (e.g., p.39, sonogram of *Chiromantis xerampelina*, MASON is cited but not included in the reference list).

I found a few places where the meaning of the phrasing was unclear: p. 199, "Laurent ...recognizes hybrids between subspecies, which may be saying the same", p. 309, "*Nesionixalus* differs from *Hyperolius* in its large size, larger testicles [sic]." References cited in the text were generally present in the literature section, but Drewes and Altig (cited in text on p. 68) was not listed. On page 177, Schiøtz makes the interesting observation that it is known that juveniles and subadults have very granulated skin in the dry season, while adults have smooth skin; a literature reference would be of interest to the reader here.

For a book which deals with species, the use and citation of names is critical. I found a few typographic errors in which specific names were capitalized or not italicized. In addition, on p. 177, the name *Hyperolius kihangensis* is used, but the document in which it is purportedly published is, as far as I can tell, not strictly a formal publication. On p. 315, a figure is labeled as *Kassina obscura*, but referred to in text as *Paracassina obscura* (the associated distribution map is correctly labeled).

While good color photographs are important as part of the data gathering process, as the author points out, specimens are also needed. It is somewhat surprising that although he discusses in some detail the care of specimens in captivity and the need to obtain the relevant export documents, less emphasis is paid to the equally important need to obtain the relevant research clearances and collecting permits before undertaking fieldwork, and the necessity of depositing voucher specimens in the host country as a means of increasing local capacity for amphibian studies.

Thanks to his willingness to share his considerable field experience and his ability to synthesize and present information, Arne Schiøtz has provided biologists and indeed anyone interested in African treefrogs with an important basic reference on this group. The criticisms mentioned above by no means detract from this book as a pioneering first, as were his earlier studies on West and East African frogs decades ago. Virtually single-handedly, Arne Schiøtz has produced an extremely valuable contribution to African herpetology—at a very reasonable price. It will no doubt generate many further studies, encourage others to generate and test hypotheses, and in the long run, contribute to the conservation of this group of anurans about which Schiøtz expresses deep concern.

Contributions to a "*Herpetologia Arabica*," edited by Uwe Fritz, Jurgen Obst, and Britta Andreas. 1998. Faunistische Abhandlungen des Staatlichen Museums für Tierkunde, Supplement to vol. 21, 182 pp. Softcover. DM 60,– (approx. US $35.00). ISBN 0375-213511.

STEVEN C. ANDERSON
California Academy of Sciences, Golden Gate Park
San Francisco, California 94118, USA
and
Department of Biological Sciences, University of the Pacific
Stockton, California 95211, USA
e-mail: asaccus@aol.com

This volume contains 17 papers by 16 of the most active researchers on the herpetofauna of Arabia in the broad sense, i.e., embracing the low countries of Southwest Asia, including Saudi Arabia, Yemen, Oman, the UAE, Syria, Jordan, Iraq, and the Levant. One paper deals with the Taurus Mountains of Turkey, as well. These constitute the proceedings of a meeting March 21–23, 1997 at the Staatliches Museum für Tierkunde in Dresden. Nine papers are in German, eight in English, and all have titles and abstracts in both languages.

As is typical for meetings proceedings, there are shortcomings in terms of coverage, consistency of nomenclature, theme, and style, but the collection is an important contribution to Southwest Asian herpetology, nonetheless. Perhaps of greatest general interest to all students of Southwest Asian zoology are the updated lists of species from Lebanon (in den Bosch), Socotra and Abd el Kuri (Wranik), Israeli desert (Werner), Taurus Mountains, Turkey (Schmidtler), Jordanian turtles (Disi), Jordanian lizards (Disi and Amr), Yemeni and Socotran geckos (Rösler and Wranik). Most of these papers also include remarks on taxonomy, habitat, and distribution. There are also papers with species lists covering more restricted areas: Thumamah Nature Park near Riyadh, Saudi Arabia (Kordges), Barr al Hikman and Masirah Island, Sultanate of Oman (Meinig and Kessler), and Jebel Shams, Oman Mountains (Meinig).

Papers in this volume also contain observations on a number of little-known or little-studied species, e.g., *Uromastyx aegyptia*

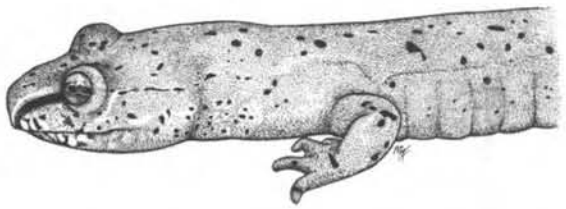
(growth and longevity; Brinsre), *Testudo kleinmanni* and *T. graeca* (distribution in the Negev Desert; Brinsre and Buskirk), *Ophisops elegans blanfordi* and *Eirenis barani* (new for Syria; Moravec), and *Agamodon arabicus* (new records; Obst and Wranik) in addition to such observations in the previously mentioned papers. Although no new taxa are described, a number of important range extensions are recorded, e.g., *Testudo kleinmanni* (Brinsre and Buskirk), *Tropiocolotes* cf. *steudneri* (Kordges), several species for the Barr al Hikman peninsula, Oman (Meinig and Kessler), *Ophisops elegans blanfordi* and *Eirenis barani* (Moravec), *Agamodon arabicus* (Obst and Wranik), *Acanthodactylus longipes* and *Eumeces taeniolatus* (Werner). Collectively, the papers in this volume fill many gaps in our knowledge of the habitats of the species covered. Particularly noteworthy in this regard is the paper by Wranik on the natural history of Socotra, and the paper by Disi and Amr on Jordanian lizards. A felicitous addition to the latter is the appendix providing latitude and longitude coordinates for Jordanian localities. Several of the papers include habitat photographs.

Of particular interest to me, is the publication of photographs (black and white) of species rarely or never before photographed, especially in life. These include *Trapelus persicus fieldi* (Kordges), *Pristurus carteri* (Meinig and Kessler), *Eirenis barani* (Moravec), *Tropiocolotes nattereri, T. steudneri, Eumeces taeniolatus, Acanthodactylus longipes, A. opheodurus* (Werner), *Phyllodactylus trachyrhinus, Mesalina balfouri, Mabuya socotrana, Chamaeleo monachus, Pachycalamus brevis, Coluber socotrae, Agamodon arabicus, Coluber thomasi, Bufo arabicus*, and *Euphlyctis ehrenbergii* (Wranik).

Several of the papers concern, or at least touch on, descriptive and/or ecological biogeography (in den Bosch, Disi and Amr, Kordges, Schmidtler, and Wranik). Of these, only Schmidtler's paper on the distributional patterns of the herpetofauna of the Taurus Mountains is devoted specifically to biogeography. This is particularly important, as the mountains of Turkey present a complex pattern of distributions as a consequence of their ecological and geographic history. None of the papers deals with the historical biogeography of Southwest Asia, nor do they incorporate recent techniques whereby phylogenies and geological events are compared.

The entire collection of papers falls under the general rubric of systematics (there are no papers dealing with behavior, physiology, anatomy, toxicology, parasitology, or ecology in the modern sense). However, none of the papers incorporates the molecular, cladistic, and phylogenetic techniques that have recently come to dominate systematics. In large part, this is a consequence of the stage of development of systematics and natural history in this part of the world. We are still in a generally descriptive stage and inadequate access to several areas of Southwest Asia has hitherto prevented the collection of fresh material for biochemical analysis.

The editors are to be commended for their timely publication of these papers, many of which are essential to the establishment of an overview of the herpetofauna of Southwest Asia.



Gyrinophilus porphyriticus danielsi. Illustration by Michael Frick.

Essentials of Reptiles: A Guide for Practitioners, by Thomas H. Boyer. 1998. American Animal Hospital Association Press, Denver, Colorado. vi + 253 pp. Softcover (Spiral-bound). US $46.95 (ISBN 0-941451-65-8).

ANGELO J. L. LAMBIRIS
Department of Zoology, University of Durban-Westville, Private Bag X54001, Durban 4000, South Africa
e-mail: lambiris@pixie.udw.co.za

This update of a previous guide is directed to veterinarians not fully *au fait* with reptile husbandry. The eight chapters discuss matters relating to captive environmental requirements, egg incubation and quarantine; care, medical techniques and diseases of chelonians, lizards, snakes and caimans; reptile anesthesia; and a drug formulary. There is also a list of references and 63 colour photographs illustrating a variety of medical and surgical conditions. Despite the extensive overlap of subject matter in the different chapters, it is probably preferable to review the content by chapter rather than by topic.

As a general statement of the principles of reptile husbandry, the first chapter contains some useful information, but much has been needlessly repeated (frequently almost verbatim) in Chapters 2–6 and much pertinent information on general physiology, behavior and psychology, environmental cues and interactions, biology of stress, and management of wild-caught versus captive-bred animals has been entirely omitted. Helpful as it would be to the layman requiring some guidance on cage design and maintenance, this chapter cannot be considered adequate for the veterinarian who needs a good grounding in reptile biology. I have a few quibbles. Dr. Boyer suggests that it is best to determine the preferred optimal temperature zone for each species, but does not indicate how this should be done. Experimental determinations on captive animals in artificial conditions may not reflect preferences of wild animals in natural surroundings, and it may be helpful to consult museum or university research workers who may have field knowledge of particular species. As with temperatures, so with humidity levels. Although Dr. Boyer recommends PVC tubing for arboreal reptiles to climb on, it is no mechanical or tactile substitute for the real thing. There are some rather curious statements about water bowls, scattered through the various chapters. For example, the suggestion that snakes suffering from dysecdysis "may start swimming and drown" if allowed to soak in too large a container is baffling. It may be clearer to suggest that the bowl should be large enough to accommodate the whole animal comfortably, shallow enough to preclude the risk of drowning. The discussion on ultraviolet light is rather vague, and seems to be of limited value in a guide for the perplexed—some species seem to require ultraviolet light, others can do without it provided that supplements of Vitamin D3 are given (Warwick et al. 1995:13). The papers by Gehrmann (1987) and by Pough (1991) are useful guides to the problems and their solutions in this still poorly known aspect of reptile physiology. Similarly, the section on incubation of eggs is littered with essentially meaningless statements ("Certain species, such as chameleons and some geckos, are often incubated at lower temperatures") and lacks specific detail on important matters such as temperature dependent sex determination.

The chapter on chelonians begins with a "Taxonomy" section, which is really an outline of vernacular nomenclature (paragraph 1), or systematics (paragraph 2). Dr. Boyer does not seem to have sufficiently distinguished between aestivation, from which tortoises may be more or less safely aroused, and hibernation, from which disturbance could well be fatal. The bald statement that "chronic

nutritional problems are typical for most [captive] box turtles yet difficult to appreciate" is unhelpful. How are such deficiencies recognized? How is a corrective regime decided upon? Without anything to go on, how can the given guidelines be interpreted "liberally"? There is a useful, if brief, account of hypovitaminosis A; while it may not be so important a problem as formerly thought in some parts of the world, in other regions it is still common and should always be considered. Mention should be made of the potential hazard of beak overgrowth when providing tortoises with chopped foods. Aquatic chelonians must be provided with adequate land surfaces for basking and other activities. Very large tortoises should not be kept indoors, and clean cement or hay are unacceptable substrata. *Geochelone pardalis* is a savanna, not a desert species. Considering the popularity of African chelonians, some other references than just Boycott and Bourquin would be desirable. The references by Branch (1998), Ernst and Barbour (1989), and Patterson (1987) are invaluable additional references for the veterinarian dealing with African chelonians. There is some useful information on locating and puncturing the radiohumeral venous plexus and the jugular vein. Anterior ventral midline needle insertion for epicoelomic fluid administration may be safer than the scapulohumeral approach, and certainly easier. A Tuohy needle introduced through a skin stab, with the patient held in antero-left lateral recumbency is advised for intracoelomic access. Where acidosis is likely to be a problem, bicarbonate should be administered according to the formula 0.5x(BD.0.3.kg) = mmol bicarbonate required, giving not more than 10 mmol per hour. Red rubber tubing is an irritant, and should not be used for esophagostomies. Plastic tubes should be used for gastric and cloacal washes rather than steel gavage tubes. Putting an open-ended syringe case over a chelonian's head before it can withdraw into the shell, to facilitate nasal irrigation, is one of several ingenious techniques mentioned in this book that was new to me. A simple smear stained with Gram, Methylene Blue and/or Thionine is an effective, inexpensive means of distinguishing between upper respiratory tract infections and other problems such as hypovitaminosis A. Scrubbing abscesses, recommended by Dr. Boyer, could aggravate the problem; gentle sponging is preferred. Topical Gentian Violet, or adding Malachite Green to the water, should also be considered. Maggot cysts can also be flushed with hydrogen peroxide. In repairing shell injuries, gentle sponging rather than scrubbing should be preferred. Sealing fracture sites such as the skin/shell interface with aquarium glue should be strongly condemned - no wonder healing is so slow! Drilling the shell and uniting with suture-ligatures (overlaid with Jelonet, if necessary) is a far better expedient. The surgeon inexperienced in reptile work should be aware that the chelonian plastron is not uniformly thick, and that incision with a trephine and Gigli saw may be slower but safer than an oscillating or circular saw. Three mattress sutures in a 120-degree pattern is safer than two in penile amputations, and cross-clamping, cutting and oversewing with a continuous haemostatic pattern is just as good. I would not wish to wait "several weeks" for resolution of intestinal impaction; a severely compromised patient is a poor surgical risk. Stabilisation and early surgery are probably much safer in the long run.

I have no personal experience of iguana husbandry, but this third chapter seemed to me one of the most useful in the book. One curious omission was a discussion of humidity levels and cycles; these must surely be important, given their natural habitats, with regard to digital and tail necrosis. Giving saline by slow caudal intramuscular drip works wonders in restoring renal perfusion and function in varanids, and presumably the same would hold good for iguanas as well.

In contrast to Chapter 4, that on leopard geckos is surely the least satisfactory in the book. Coverage is so brief and superficial that it hardly merits a separate chapter. Only two and a half pages are devoted to *Eublepharis*, and nearly four address "Feeding Insectivorous Reptiles and Amphibians." (Why amphibians in a reptile handbook?) Indicating calcium/phosphorus ratios "Ca-to-P contents" as "0.1 to 1.2" could be mis-read as indicating ranges rather than ratios—surely "0.1:1.2" would be a more appropriate notation? Newly molted mealworms are much less likely to cause intestinal obstruction than those with well-hardened exoskeletons.

As with chelonians, the taxonomic section in the chapter on snakes is loosely defined, generally unhelpful, and not very comprehensible. The section on housing is certainly not up to South African standards—the suggestion that animals be housed in shoe and sweater boxes, and that a cage "should be almost as long as the snake and half as wide" would bring instant and well-merited prosecution in this country. Patterson (1987) should be consulted for more realistic advice. Much of this chapter repeats earlier ones. The statement that snakes "prefer thawed rodents over freshly killed ones" does not seem entirely in accordance with my own experience; perhaps temperate species behave differently from tropical and subtropical ones. Similarly, while hibernation may be important for stimulating breeding in temperate colubrids, a simple drop in temperature and reduced activity is often sufficient for tropical species. In a supposedly comprehensive handbook, it is irritating to see such comments as "See Barten (1996) for more information on physical examinations," when this is only a two-page article. Cardiocentesis is preferable to buccal vein puncture—it is much less traumatic. One of the most important causes of anorexia has been mentioned so briefly that its importance is simply not apparent—that of psychological stress consequent on inappropriate environmental and handling conditions (e.g., cage size, furnishings, sensory deprivation, etc.) as discussed by Warwick et al. (1995).

In Chapter 6, on caimans, housing is dealt with rather briefly. Despite emphasizing the importance of basking areas in aquaria, and the hygiene problems associated with gravel, there is no constructive advice on how best to manage the problem—again, a serious omission in a handbook which claims to give the practicing veterinarian all he needs! The discussion of infections is very brief, presumably because veterinarians in private practice do not see many caimans. As in snakes, paracentesis cardii is safe and effective for obtaining blood samples, but the surgeon should be aware of how far back the heart is set - the ventricles lie approximately one head length behind the cervico-occipital articulation.

The chapter on anesthesia is disappointingly brief, and rather superficial, with some curious omissions. Premedication is barely mentioned and it should not be assumed that veterinarians unfamiliar with reptiles will not have some questions about such matters. (Aceprom is good for reducing pre- and post-anesthesia excitement, for smooth induction and for reducing the amount of anesthetic needed.) Inhalant anesthetics other than isoflurane are not mentioned, although halothane or halothane/ether are very good as well. The statement that "In reptiles the glottis is open only in inhalation and remains closed otherwise ..." seems functionally untenable. Similarly, the instruction to "gently force" a tube through the glottis is a contradiction in terms. An esophageal stethoscope is very useful for monitoring reptile hearts, especially in chelonians.

The reptile formulary is adequate as far as it goes, but has important gaps and is rather vague in places. "Little is known about long-term drug accumulation, yet the slow metabolism of reptiles often dictates long-term drug usage." The first statement is true, but the second, without extensive discussion, is potentially misleading. It may be more appropriate to say that at lower temperatures the intervals between doses should be extended; but since sick snakes should be kept at higher temperatures than usual to boost the immune system, this may not always be the case. The whole matter is

complex and requires much more in-depth discussion than Dr. Boyer has given. It does, however, highlight how much there is still to learn about even basic chemotherapy in reptiles. It would be desirable to include in the guidelines for specific drugs a clear statement that especially with nephrotoxic drugs adequate hydration is essential and that if necessary bicarbonate may be given to increase pH in order to improve bioavailability and to reduce toxicity. This section is rather brief and uninformative, discussing drug classes rather than specific drugs.

There were some twenty errors in the text—mostly not serious, but careless lapses that should not have crept in; for example, "to allow temperatures to equalize [= stabilize] (p.17); giving food, not a "feeding formula" (p. 55); "caudal tail vein" (p. 87); applying "pressure" [= traction] to the plunger of a syringe when withdrawing blood (p. 87); *Chamaeleo dilepis*, not *dilepsis* (caption to fig. 32); the colon courses between, not through, the kidneys (caption to Fig. 37, renomegaly in *Iguana*).

Although not specifically stated as such, this book is clearly aimed at the American veterinarian; it would be of much more limited scope to practitioners in other parts of the world. The publisher's press release claims that this book is "a comprehensive resource that includes information on the recent advances in the veterinary care of reptiles." It is highly selective, patchy, and incomplete. It is certainly not a compendium, and the all too many referrals to other texts renders the usefulness of the present volume questionable. The book is also said to be "divided by species and covers basic care and nutrition, treatment techniques and common diseases of turtles, green iguanas, reptiles and amphibians (sic!), snakes and caimans." This largely speaks for itself. The book is divided mostly by higher taxa, not by species; amphibians are not included, and reptile coverage is far from complete. Husbandry and some medical aspects are covered, but treatment techniques as such are very superficially discussed. The book is also said to include "numerous helpful illustrations and photographs and an extensive formulary." There are no illustrations in the text at all; the 63 photographs are interesting but not particularly comprehensive; and the formulary, while useful as far as it goes, is by no means comprehensive either. "Practitioners ... can use the book as a reference to teach clients how to house, feed and care for their exotic pets."

In short, this is a book that does not deliver what it promises to its intended readers, and cannot be recommended as a comprehensive professional reference. It would have been far better written (with some modification of the basic content and deletion of those points on medical and surgical practice necessary for the veterinarian) as a general guide for the serious reptile keeper, who would benefit immensely from Dr. Boyer's knowledge of reptile husbandry. The veterinarian requiring specific technical information would be far better served by a judicious selection from the page-and-a-half long list of more definitive texts mentioned by Dr. Boyer—for example, Mader (1996), Frye (1991, 1995), Beynon et al. (1992), and Reichenbach-Klinke and Elkan (1965). The two volumes of *Acta Zoologica et Pathologica* (1984, 1986) dedicated to reptile husbandry and medicine are still an invaluable guide.

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Atlas of Amphibians and Reptiles in Virginia, by Joseph C. Mitchell and Karen K. Reay. 1999. Virginia Department of Game and Inland Fisheries, 4010 West Broad Street, Richmond, Virginia 23230, USA. 122 pp. Softcover. US $7.50. ISBN 0-9671339-0-4.

This publication offers point locality distribution maps for 74 species of amphibians and 61 species of reptiles known to occur within the state. Also included are a history of herpetofaunal exploration in Virginia, a description of Virginia's environmental features, a review of conservation needs, and an extensive bibliography. It is designed to provide a comprehensive source of distributional data for individuals engaged in surveys, monitoring programs, conservation and management, and education. Together with Mitchell's "The Reptiles of Virginia" (1994), herpetologists now have available two excellent compendia of biological data concerning that state's herpetofauna.

Chameleons, Nature's Hidden Jewels, by Petr Neças. 1999. Edition Chimaira, Frankfurt am Main, Germany. North American distributor: Krieger Publishing Company, 1725 Krieger Drive, Malabar, Florida 32950, USA (email: info@krieger-pub.com). 348 pp. Hardcover. US $47.50. ISBN 1-57524-137-4.

This is the English edition of a book originally published in German in 1995 (reviewed in Herpetol. Rev. 28:106–107). Like the original edition, this book provides species accounts for 50 species of chameleons, along with sections on systematics, biology, and herpetoculture. The new edition is also expanded relative to the first, with an updated bibliography of approximately 1000 references, a listing of all recent and fossil species (including primary synonyms, type localities, and distribution), and 323 illustrations and photos (actually more, as several full page illustrations from classic works on chameleons are not numbered), mostly in color. The layout of the book is improved relative to the German original, and the color photos are conveniently distributed throughout the text. The English translation is, unfortunately, rather awkward and perhaps too literal. This and the lack of a general index are the greatest faults of the book. Nonetheless, the book serves as a thorough and current compendium of information on chameleons and will be of interest to both amateur and professional herpetologists.

A Monograph of the Testudinata, by Thomas Bell. 1999. Octavo Corporation, 580 Second Street, Oakland, California 94607, USA (www.octavo.com; info@octavo.com). CD-ROM. US $35.00. ISBN 1-891788-22-1.

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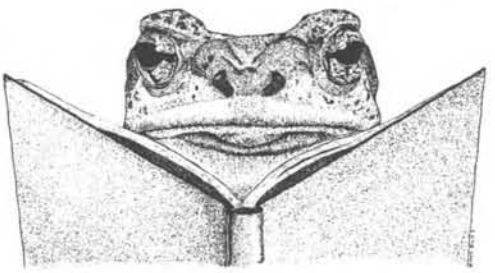
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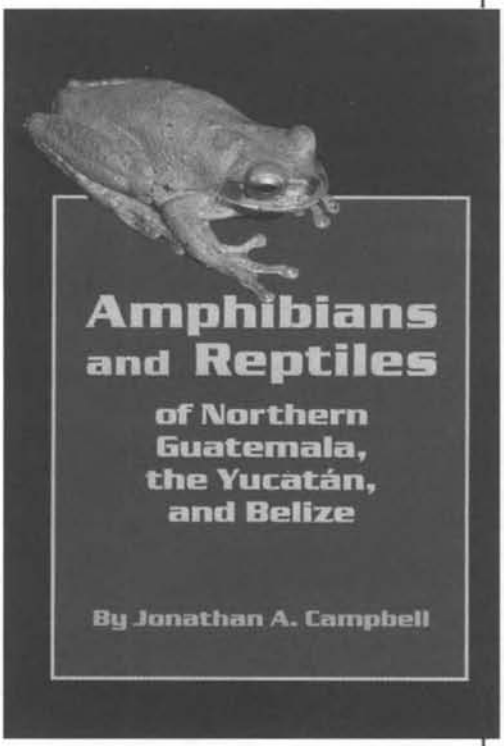
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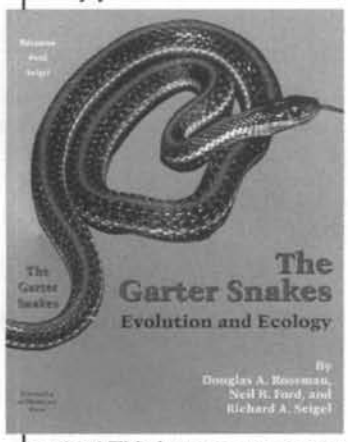
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P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 298-6333 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Berkshire Community College
1350 West Street
Pittsfield, Massachusetts 01201, USA
e-mail: ttyning@cc.berkshire.org

Associate Editors

BRIAN W. BOWEN
University of Florida
e-mail: bowen@gnv.ifas.ufl.edu

BRADFORD HOLLINGSWORTH
San Diego Natural History Museum
chuckwalla@earthlink.net

DARYL R. KARNS
Hanover College
e-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
e-mail: jeffrey_lovich@usgs.gov

SHARYN B. MARKS
Humboldt State University
e-mail: sbm1@axe.humboldt.edu

JOSEPH R. MENDELSON III
Utah State University
e-mail: sapo@biology.usu.edu

DEANNA H. OLSON
USDA Forestry Science Lab
e-mail: dede.olson@orst.edu

GUNTHER KÖHLER
Forschungsinstitut und Naturmuseum Senckenberg
e-mail: gkoehler@sng.uni-frankfurt.de

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
e-mail: abauer@mail.villanova.edu

Current Research
ANNE M. MAGLIA
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: magliaa@falcon.cc.ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: soniak@unt.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biology
Indiana University
Bloomington, Indiana 47405, USA
e-mail: jdemuth@bio.indiana.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
e-mail: jbh10@psu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@ucok.edu

Editor-at-Large: *Adam P. Summers*
Copy Editors: *Anna Clarke, Eli Greenbaum, Jeff Parmelee, Jenny Pramuk*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

www.ukans.edu/~ssar



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1999 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology,* and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

2000 — Universidad Autónoma de Baja California Sur, La Paz, BCS, México, 14–21 June 2000 (Carlos Villavicencio, Chair).
2001 — Indiana University/Purdue University, Indianapolis, Indiana, USA, 26–30 July 2001

Society for the Study of Amphibians and Reptiles
2000 Annual Meeting

together with

American Society of Ichthyologists and Herpetologists

and

The Herpetologists' League

14 – 21 June 2000

Universidad Autónoma de Baja California Sur, La Paz, BCS, México

La Universidad Autónoma de Baja California Sur is located in La Paz, BCS, in the southern part of the Peninsula, in the Gulf of California. Founded in 1535, La Paz is a small and quiet city, known for good drinks and food services.

Keynote Address: "Frogs, Fossils and Phylogeny: A Perspective on the Last 140 Million Years and Prospectus for the Future," by Linda Trueb, The Hepetologists' League Distinguished Herpetologist for 2000 (The University of Kansas).

Symposium: "Ecology and Evolution in the Tropics: Essays in Tribute to Jay Savage." *Organizers:* Maureen A. Donnelly, Florida International University (donnelly@fiu.edu); Brian I. Crother, Southeastern Louisiana University (bcrother@selu.edu); Craig Guyer, Auburn University (cguyer@acesag.auburn.edu); Marvalee H. Wake, University of California, Berkeley (mhwake@garnet.berkeley.edu); and Mary E. White, Southeastern Louisiana University (mwhite@selu.edu).

Symposium: "Partners for Amphibian and Reptile Conservation." *Organizers:* Henry Mushinsky, Department of Biology. University of South Florida. Tampa, Florida 33620-5150, USA; tel. 813-974-5218, fax 813-974-3263: (mushinsk@chumal.cas.usf.edu). Laura Herbeck, North Central Research Station, U.S. Forest Service, 202 Natural Resource Building, University of Missouri, Columbia, Missouri 65211, USA; tel. 573-875-5341 ext. 227. Cynthia Carey. Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA; tel. 303-492-6014.

Symposium: "The Natural History and Evolution of the Herpetofauna of Southern California and Baja California." *Organizers:* Robert Fisher, USGS-Western Ecological Research Center, SDSU Field Stations, Department of Biology, San Diego State University, San Diego, California 92182-4614, USA; tel. 619-594-8026, fax 619-594-2035 (rfisher@sunstroke.sdsu.edu) and Robert Lovich, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA and Department of Biology, San Diego State University, San Diego, California 92182-4614, USA; tel. 619-594-8025 (rlovich@sciences.sdsu.edu).

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day throughout the conference.

Meeting Site: SSAR, HL and CAH will meet in the Hotel Araiza Inn Palmira; palmira@balandra.uabcs.mx; tel. (dialing from USA): 011 52 11216200, fax: 011 52 11216227; International Reservations 1-800-9-ARAIZA, National Reservations 01-800-71-68-777. Other recommended close hotels are: Marina, El Moro, and La Concha (contact details and locational map are provided in the official meeting announcement).

Travel Arrangements: Everyone will need to make their own hotel reservation. The recommended airport is La Paz, but also you can fly into Los Cabos (220 km south), and then rent a car.

Student Travel Award: Ten travel grants of US $200 each will be available for SSAR student members. Refer to page 197 in this issue of *HR* for details.

Student Paper Award: Henri Seibert prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the official Meeting Announcement for details.

Social Activities: General Reception at the Municipal Dock, SSAR Auction, SSAR Herp Silent Auction, Beach Barbecue, Graduate Student Reception, and ASIH Banquet.

Multimedia Events: Special Herpetologists' League Illustrated Lecture: "The Amphibians and Reptiles of Baja California and the Sea of Cortés," by Lee Grismer. SSAR Presidential Slide Show (presenters and titles to be announced).

Field Trips: Will be arranged to nearby desert areas and islands.

Costs: Preregistration US $185 regular, US $95 student, US $95 accompanying person. After March 15, 2000, costs are US $245, US $135 student.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Further Details: Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of the participating societies in December 1999. Overseas members wishing to receive this information may do so by contacting Carlos Villavicencio Garayzar, Local Chair, Universidad Autonoma de Baja California Sur. A.P.19-B. La Paz, B.C.S., México. CP23080; (cvilla@calafia.uabcs.mx & ASIH@calafia.uabcs.mx), Tel. & fax: 011-52-1-128-0775. Please visit the meeting web site at www.uabcs.mx/asih for additional and updated information.

About Our Cover:

Stenophis citrinus, recently described by Domergue (1995. Arch. Inst. Pasteur, Madagascar 61[2]:121–122) is a small (ca. 50 cm total adult length), live-bearing Malagasy colubrid known from only a handful of museum specimens. All were collected in the dry, deciduous forests of west-central Madagascar. This recent addition to science is a perfect example of the high rate of new herpetological species still being discovered and described in Madagascar today.

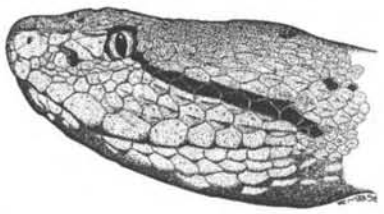
Stenophis (formerly included in the genus *Lycodryas*) is currently comprised of 15 species whose collective range covers the entire country, occupying diverse habitats and microclimates. Little is known of their natural histories aside from their strongly nocturnal activity preferences. While some species are known egglayers, *S. citrinus* has been documented as a livebearer (Vences, Glaw, and Love 1998. Brit. Herpetol. Soc. Bull. No. 64:13–14).

Their slender profiles, bulbous heads, and overall size give *Stenophis* an appearance that is remarkably similar to that of the neotropical tree snakes of the genus *Imantodes*. Snakes of the genus *Stenophis* likewise lead arboreal lives in bushes and trees, but they have also been found on roads at night. Natural prey is presumed to include lizards, although the few live specimens imported from Madagascar to date have refused to accept any of a plethora of potential food items in captivity, with the possible exception of hatchling day geckos (*Phelsuma* sp.) (Chris Estep, pers. comm.).

The cover image was taken by **Bill Love** at the Exotic Butterfly Farm near Mandraka in east-central Madagascar, owned by French naturalist and exporter André Peyrieras. This special rare animal was kindly shown, and subsequently allowed to be photographed, during a 1995 visit while Bill was leading a herp photo tour to that facility for his company **Blue Chameleon Ventures**. The snake's identity was unknown to him at the time since its formal description had not yet appeared. Its purposefully slow movements and spectacular color and pattern were enough to warrant permanent capture on film.

Bill's passion for photography has resulted in his amassing a collection of tens of thousands of slides of reptile and amphibian subjects from all over the world. Supplying herp imagery has become an important aspect of his business. This shot was taken with a Nikon 4004 camera, a Nikon 55 mm macro lens, and a Nikon Macro Speedlight SB-21 on Fujichrome Velvia. The background in this case is merely a convenient clump of foliage and is not intended to represent authentic habitat.

Separation and imaging of Love's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.



Atropoides nummifer. Illustration by R. Michael Burger.

SSAR BUSINESS

1999 Annual Meeting: Penn State

The 42nd annual meeting of SSAR occurred from 24 to 30 June 1999 in State Center, Pennsylvania. Once again this year, SSAR met jointly with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists on the campus of Pennsylvania State University. The University and local committee, chaired by Jay Stauffer, hosted 1,150 delegates, of whom 45% were students and 43% women. Most of the meeting's events took place at the Penn Stater Conference Center located near the Penn State campus.

Social Programs

Numerous social events served to counterpoint the scientific presentations at this year's annual meeting. On Thursday evening (24 June), an unsponsored social at the Legends Pub in the Penn Stater Conference Center Hotel served as a convenient gathering locale. A general reception, again held at the Conference Center, provided opportunities for discussions and exchange of ideas at the close of the first full day of the meetings (25 June). The Student Reception served as the only official social event on Saturday, a day largely devoted to student presentations. Additionally, the confines of the meeting site contributed to formation of small social groups and the planning of breaks during the day provided ample opportunities for informal interactions.

On Sunday (27 June), the threat of evening showers did not dampen the atmosphere at the Barbecue Picnic held on the Penn State University campus. Ribs and chicken formed the basis for a meal that had many folks returning for seconds between lively discussions with friends, colleagues, and old acquaintances.

Unusually warm and humid conditions lead to impressive thunderstorms on the evening of the SSAR Auction (28 June). Draconian policies with respect to alcohol distribution on campus cost the Society some money, but an ample supply of beer was avail-



Harry Greene (left) congratulates David Wake for receiving the Henry Fitch Award at the annual banquet. Greene made the presentation on behalf of ASIH, which initiated the Fitch Award in 1998 to recognize excellence in the field of herpetology.



Nate Kley, Al Richmond, and Chris Feldman enjoy the atmosphere at the Barbecue Picnic.

able. The Straub Brewery (Saint Marys, PA) generously donated several barrels of quality, all-grain brew for the event. Active building renovation at the Penn State HUB Ballroom presented interesting logistical problems. Large fans, poor acoustics, and extended walks to facilities did not seem to hinder bidding. Many quality items were offered for consideration and the lively tag-team approach implemented by primary auctioneer David Morafka, assisted by John Moriarty, kept the evening moving briskly. Throughout several days of the meeting, the SSAR Frameable Silent Art Auction raised revenues from bidding on numerous quality art objects. Revenues generated from both auctions approximated $5,000 and will be used to support student travel to future meetings.

Tuesday evening marked the return of the David Dennis-Eric Juterbock-Kraig Adler lavish multimedia presentations. The beauty, artistry, and historical nature of these shows are always crowd pleasing, regardless of how many times you see them.

The close of the meetings was marked by the Banquet, sponsored jointly by all the attending societies. This event allowed for a more refined set of behaviors on the part of the membership in attendance. While members at the Banquet enjoyed the reserved nature of the event, others seeking louder nightlife found it in various clubs and pubs of downtown State College.

Institutional animal care guidelines precluded a live animal exhibit, but the indigenous herpetofauna was available for those willing to investigate local habitats.

Business Meeting

President Hutchison called to order the 42nd Annual Business Meeting of the SSAR at 1500 h in the Presidents I Room of the Penn State Conference Center at the University of Pennsylvania on Sunday, June 27th. He reported that the Presidential Challenge that was initiated last year has been very successful. The challenge was put forward for all past presidents of SSAR to donate $500 each to the Endowment Fund. To date, $6,500 has been raised. He discussed building the endowment so that the society will have more flexibility in the future.

President Hutchison announced that the *Directory of Herpetologists* by Harold Dundee and George Pisani was completed and available at the meetings. Everyone was encouraged to pick up his or her copy. This is a combined listing of all herpetologists from each society (SSAR, HL, and ASIH) and each society provided money for production so that all herpetology members would receive a free copy. Hutchison thanked the two editors for their time and effort. He then announced that he had extracted all of the names of herpetologists of HL and ASIH that were not members of SSAR (978 people). With these names, he initiated a membership drive. All officers of SSAR and several other volunteers were recruited to write a letter to these non-members asking them to join. The hope is that we will gain several new members. New members provide further revenue for activities that the society supports.

Several new appointments were announced including Darrel Frost as ASC representative, Laurie Vitt as SSAR representative to PARC, Theodora Pinou as the Membership Committee Chair, and Lynette Sievert as Elector. In addition, all chairs of committees were reappointed except for the International Cooperation Committee which had accomplished its goals and was disbanded. Marty Crump and the committee were thanked for their efforts. Two resignations were announced: Ellen Censky as Secretary had resigned with the effective date yet to be determined and Rich Seigel would resign as Editor of *Journal of Herpetology* effective 31 Dec 2000. President Hutchison stressed that we need to fill positions with new blood and asked that anyone who was interested in helping the society contact President-elect Julian Lee or him.

The President announced a new committee to oversee publications, the Publications Task Force. The PTF will be comprised of three people and will be charged with keeping the society current with regards to electronic publishing, ethics, etc.

Kraig Adler announced that Mrs. Bailey had donated Joe Bailey's library to SSAR. SSAR will sell the library. Mrs. Bailey asked that the proceeds be used for publishing books and for support of student research. Adler and Steve Busack will be organizing the sale.

Secretary Censky read the proposed amendment to the Bylaws which involved changing the terms of office for President, President-elect and Past President from one year to two year terms, and the terms for Secretary, Treasurer and Publications Secretary from one year to three year terms. The proposal was open for discussion at this meeting and will be put to a vote later in the year.

Secretary Censky presented much of the remaining business conducted at the Board Meeting. The treasurer's report noted that we had a drop in membership for the past year but that the society was on the rebound. There was no logical explanation for the drop. It was announced that Life Memberships would be offered for a one-installment payment of $1250 or four installments of $325. The board approved a 2000 budget of $208,947.

Journal of Herpetology editor Rich Seigel reported that submission rates continued to be extraordinarily high during the past year. There was a record number of 277 submissions in 1998. There were



Hinrich Kaiser, Jan Caldwell, and Laurie Vitt were among the many herpetologists and ichthyologists attending the annual banquet.



SSAR President Vic Hutchison (right) discussed the benefits of holding a future SSAR meeting at Cornell with potential hosts Kelly Zamudio (center) and Harry Greene (left).

signs, however, that submission rates were leveling off. He also reported that the current backlog of 9–12 months to publication should be maintained due to three factors: an increase in the 1999 budget, lower submission rate for 1999, and reduction in costs from Allen Press. *Herpetological Review* editor Bob Hansen also reported that the number of submissions has steadily increased but seems to have leveled off in the past year. The expansion of the journal last year to 64 pages has helped to deal with the increased submissions. Hansen reported several changes to his editorial staff: Liz Johnson (Ad manager), Hal Avery (Associate Editor), and Kathryn Vaughan (Section Editor) resigned. Hansen expressed his appreciation for their long hours and dedication. New appointments include J. Brian Hauge (Section Editor), Joe Mendelson (Associate Editor), and Sharyn Marks (Associate Editor).

The *Catalogue of American Amphibians and Reptiles* report to the board stated that a total of 89 printed pages were produced this year. The 20 accounts consisted of one caecilian, four salamander, two frog, two turtle, six lizard, four snake and one crocodilian accounts. Color plates were included in seven accounts. Contribution and Facimiles editor Kraig Adler reported that two works will be published in 1999: "Lizards of Iran," by Steven C. Anderson and "General Zoology: Volume 3 Amphibia," by George Shaw. There were three books published in 1998: "Biology of the Reptilia, volume 19: Visceral Organs," edited by Carl Gans and Abbot Gaunt, "Contributions to the Herpetology of the Belgian Congo," by Karl P. Schmidt and G. K. Noble, and "The Gigantic Land Tortoises of the Galapagos Archipelago," by John VanDenburgh. Future publications include "Anatomy of the Salamander," by Eric T. B. Francis, "Herpetofauna of New Caledonia and Surrounding Islands," by Aaron Bauer and Ross Sadlier, "Herpetological Illustrations from the Spencer Library, University of Kansas," compiled by Sally Haines, "Amphibians of Honduras," by James R. McCranie and Larry David Wilson, and "Hylid Frogs of Middle America," by William E. Duellman.



A highlight of the meeting was a symposium in honor of Richard Etheridge, recently retired from San Diego State University. Friends, colleagues, and former students later gathered for an evening roast. Shown here, from left to right, are: Jim McGuire, Troy Baird, Lee Grismer, Kevin de Queiroz, Chuck Crumly, Richard Etheridge, Bill Presch, Greg Pregill, Jacques Gauthier, Julian Lee, Brad Hollingsworth, Van Wallach, and Bobby Espinoza.

Herpetological Circulars editor John Moriarty reported that "Lineages of Zoo Herpetologists in the United States," by Card and Murphy will be published in late 1999. "State and Provincial Amphibian and Reptile Publications for the United States and Canada," by Moriarty and Bauer is currently under review and should be published in Spring 2000. "Standard Common and Scientific Names" is finished, as reported by Brian Crother, Chairman of the Common and Scientific Names Committee. Moriarty reported that it should be published late in the year 2000. The *Herpetological Conservation* report to the board stated that work was progressing on Volume 2 "Ecotoxicology of Amphibians and Reptiles."

The Grants-in-Herpetology Committee (M. Dorcas, J. Wicknick, C. Beachy, T. Reeder, P. Ducey, A. Maglia, D. Wilson, D. Kizirian, R. King, J. Mendelson) report stated that there were a total of 51 applicants: Travel (13), Conservation (8), Laboratory (16), Field (17), International (3), and Education (2). Chairman Joe Mendelson noted that previous winners would be discouraged from seeking more funds from these limited resources. The board approved an increase of $1,000 for two additional grants. The annual report of the Kennedy Student Award Committee (R. Andrews, D. Duvall, M. Mendonca, T. Schwaner, R. Gatten, chair) announced the winner of this year's competition, "Predator mediated patch use by tadpoles (*Hyla regilla*): risk balancing or consequences of motionlessness?" by Sarah J. Kupferberg. There were a total of nine manuscripts in competition.

The Student Travel Award Committee (Lance McBrayer) presented 18 awards of $200 each to defray the costs of travel to meetings. In addition, several items for the auction were secured. Chairman Kelly McCoy, Seibert Student Award Committee, reported that there were 53 presentations in competition this year: seven in systematics, 28 in ecology and evolution, 12 in conservation and six in physiology and morphology. The judges were K. McCoy, S. Beaupre, P. Stone, W. Lutterschmidt, and J. Mendelson.

Carlos Villavicencio reported on the 2000 meetings in La Paz, Baja California Sur, México, where SSAR again will meet jointly with HL and ASIH. The dates for the meeting are June 14–20. Several hotels have been reserved. The Araiza Inn Palmira has been chosen as the hotel that will host herpetologists. The Hotel Marina and Hotel La Concha are for overflow. There will be a website soon. Stan Fox will be the SSAR representative to the local committee. Henry Mushinsky, Chairman of the Future Meeting Site Committee announced that the 2001 meeting will be held in Indianapolis at the DoubleTree Hotel from July 26–30.

Nominations for election to SSAR Board of Directors for 2000 were presented to the membership and accepted: President, David Green and Gregory Pregill; Director, Karen Lips and Rafael de Sá; Regional Director, Alvin Braswell and David Hardy, Sr.

—Respectfully submitted by Ellen J. Censky and John Matter.

1999 Resolutions

Resolution of Support for Partners in Amphibian and Reptile Conservation (PARC), a New Multi-Sector Conservation Initiative

WHEREAS, the mission of Partners in Amphibian and Reptile Conservation (PARC) is to conserve reptiles, amphibians, and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public/private partnerships; and

WHEREAS, PARC and its members from both public and private sectors seek to form a coordinated and cooperative conservation partnership in this endeavor; and,

WHEREAS, the comprehensive national conservation strategy for reptiles and amphibians to be developed by PARC will incorporate issues in research, management, monitoring, policy/regulation/trade, and education outreach;

THEREFORE, be it
RESOLVED that the members of the Society for the Study of Amphibians and Reptiles express their support to the Partners in Amphibian and Reptile Conservation for their vision and commitment to the long-term conservation of reptiles, amphibians, and their habitats.

Adopted by the Society for the Study of Amphibians and Reptiles, 27 June 1999, at its Annual Business Meeting.

Honoring Outgoing SSAR Officers and Editors

WHEREAS, the following individuals have given freely of their time, skills, insight, and knowledge to the Society for the Study of Amphibians and Reptiles in this past year; and,

WHEREAS, they have therefore been instrumental in advancing the Society's goals and furthering its growth as an international scientific society; and,

WHEREAS, SSAR is dependent upon the generosity of these persons and those who have gone before them, and is greatly indebted to them for their fine efforts in its behalf;

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles offers its most sincere thanks to the following persons who have served in these capacities:

STEPHEN C. ADOLPH — Editorial Board, *Journal of Herpetology*
ROBIN M. ANDREWS — Nominating Committee
JAMES P. BOGART — Director, Local Committee Chair
JOSEPH T. COLLINS — Editor, Herpetological Circulars
DAVID CREWS — Editorial Board, *Journal of Herpetology*
C. KENNETH DODD, JR. — Conservation Committee
TODD ESQUE — Student Travel Awards
JEFF ETTLING — Zoo Liaison
LEE A. FITZGERALD — Associate Editor, *Herpetological Review*
TERRY E. GRAHAM — Meetings Committee
LOUIS J. GUILLETTE, JR. — Long Range Planning Committee
DAVID L. HARDY, SR. — Elector
JOHN B. IVERSON — Director
ELIZABETH A. JOHNSON — Advertising Manager, *Herpetological Review*
JULIAN C. LEE — Associate Editor, *Journal of Herpetology*, Grants-in-Herpetology Committee
KEN R. MARION — Kennedy Student Award
HENRY R. MUSHINSKY — Immediate Past President
GEORGE R. PISANI — Resolutions Committee
MARTIN J. ROSENBERG—Regional Societies Liaison
DOUGLAS E. RUBY — Associate Editor, *Journal of Herpetology*
BETH STOKES — Editorial Assistant, *Journal of Herpetology*
R. KATHRYN VAUGHAN — Section Editor, *Herpetological Review*
DAWN S. WILSON — Seibert Awards

BE IT FURTHER RESOLVED that the SSAR urges these persons not to disappear into the woodwork, but to be available as resources, with or without official titles, to guide those who follow in their service to the Society.

Adopted by the Society for the Study of Amphibians and Reptiles, 27 June 1999, at its Annual Business Meeting.

Seibert Award Winners for 1999 Announced

The eighth annual Seibert Awards were presented at the 42nd Annual Meeting of the SSAR at Penn State, 24–30 June 1999. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). In recognition of outstanding student presentations at the annual meetings, a single award was given in each of the following categories: Systematics, Ecology/Evolution, Physiology/Morphology, and Conservation. All four awardees received a check for US $200 and a book from Academic Press.

The Winners.—Conservation: Jeannine A. Ott, Department of Zoology, Auburn University (co-authors William Michener, Craig Guyer), "Home range and cohabitation patterns of a population: estimating gopher tortoise area requirements." Ecology/Evolution: Matthew A. Flowers, Department of Biology, Arizona State University, "Population variation in male color pattern and female preference in chuckwallas, *Sauromalus obesus*." Systematics: Rafe Brown, Department of Zoology, University of Texas, Austin (co-author Sheldon Guttman), "Phylogenetic systematics and historical biogeography of the *Rana signata* complex of Philippine and Bornean stream frogs." Physiology and Morphology: Jennifer Yeh, Department of Zoology, University of Texas at Austin (co-author David Cannatella), "The ontogeny of skull ossification in pipoid frogs."

Honorable Mention.—Systematics: Christoffer R. Feldman, Department of Biology, San Francisco State University (co-author Greg Spicer), "Comparative phylogeography of three squamate reptiles in California: *Contia tenuis, Diadophis punctatus* and *Elgaria multicarinata*."

The judges were: Bill Lutterschmidt (University of Oklahoma), Steve Beaupre (University of Arkansas), Joe Mendelson (Utah State University), Paul Stone (University of Central Oklahoma), and Kelly McCoy, chair (Angelo State University).

SSAR Student Travel Awards Call for Applications

Awards of US $200 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author (or co-author, see below) of a paper or poster to be presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that

states: he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Student Travel Awards Committee are excluded from applying for a travel award.

APPLICATIONS MUST BE POSTMARKED BY 15 MAY 2000. Award recipients will be notified by 1 June 2000 and award checks will be disbursed at the meeting. Direct requests for information to: *Stephen C. Richter, Department of Biology, The University of Oklahoma, Norman, Oklahoma 73019-0235, USA. Tel: (405) 325-4821; fax: (405) 325-6202; e-mail: richter@ou.edu.*

SSAR Student Awards Fund-raiser: 1999 Results and Call For 2000 Donations

Thanks to the many generous donations from several individuals to the 1999 silent auction at Penn State, the SSAR Student Travel Awards Committee (SSAR STAC) awarded seven US $200 travel grants to the following individuals: Matthew Bealor, Jennifer Yeh, Marc Mazerolle, Stefan Kaminsky, Meredith Mahoney, Emily Taylor, and Alison Hamilton. The SSAR STAC wishes to thank all who donated items to the 1999 auction at Penn State: Kraig Adler, Breck Bartholomew, David Dennis, S. R. Goldberg, Jackie Grant, Victor Hutchison, Julian Lee, Ernie Liner, R. Ruibal, Alan Savitzky, Norm Scott, and SSAR. The fifth annual Frameable Art Silent Auction raised over $1460 for future student travel awards. On behalf of the SSAR, thanks to all who helped, including Kristen Hickey and the Penn State meeting organizers. Special thanks for a job well done to the SSAR STAC Chairman, Lance McBrayer.

The SSAR STAC announces the Sixth Annual Frameable Art Silent Auction to be held at the 2000 SSAR meeting at La Paz. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *Stephen C. Richter, Department of Biology, The University of Oklahoma, Norman, Oklahoma 73019-0235, USA. Tel: (405) 325-4821; fax: (405) 325-6202; e-mail: richter@ou.edu.*

Notice to La Paz 2000 Meeting Attendees

Due to customs regulations involving the transportation of merchandise from outside of México, it may be difficult to obtain many of the usual SSAR auction items from vendors and publishers. Therefore, the Society is requesting that meeting attendees consider bringing auction items with them as gifts to the Society.

Grants-in-Herpetology Donations Sought

Financial contributions by SSAR members, institutions, and other benefactors support this program significantly and can increase the number and/or size of awards. Your tax-deductible (for U.S. residents) contribution to this program will directly benefit meritorious research and education in herpetology. Contact the Treasurer of SSAR for additional information on contributing to the Grants-in-Herpetology Program. If you are employed by an organization that will match donations made to nonprofit organizations, please notify your employer that you have made a donation to the Grants-in-Herpetology Program.

New Category for Grants-in-Herpetology Program

SSAR's Grants-in-Herpetology program has a new look for 2000. Thanks to a generous donation from long-time SSAR supporters Itzchak and Carolyn Gilboa, a new category has been added: Bibliographic Research. Proposals must address a major need to consult library holdings or other information resources in the context of herpetological research. Graduate students and other prospective applicants are encouraged to consult the detailed guidelines published in *Herpetological Review* 30(3):143.

NEWSNOTES

Reptile Database

Since last profiled in *HR* 27(4):174–175, the EMBL Reptile Database, developed and maintained by Peter Uetz, has grown, now containing taxonomic information (synonyms and distribution) for nearly all ca. 7900 living species of reptiles (exclusive of birds). There are links to photos for more than 1000 species.

www.embl-heidelberg.de/~uetz/LivingReptiles.html

Ashton Biodiversity Institute

The Ashton Biodiversity Research & Preservation Institute is a non profit organization which was incorporated in September, 1999. It is the organization which operates the conservation research and education programs on Finca de la Tortuga Biological Reserve, located on the Brooksville Ridge, 15 miles west of Gainesville, Florida, USA. The Institute is devoted to promote, support, and provide opportunities for research and management on biodiversity. In particular, it will contribute to the development of knowledge in conservation biology on endangered species and in sustainable use of natural resources. Along with research the Institute has at its core, the education and training of students of all ages from school students to graduate students and professionals on wildlife preservation and management. A special emphasis is given to reptiles and amphibians. The Board of Directors include herpetologists and ecologists representing different expertise: Patricia. S. Ashton and Ray E. Ashton, Jr. (Ashton, Ashton and Associates, Florida); Dave Collins (Tennessee Aquarium, Chattanooga, Tennessee); Elliott Jacobson (College of Veterinary Medicine, University of Florida); Henry R. Mushinsky (Department of Biology, University of South Florida): Peter C. H. Pritchard (Chelonian Research Institute, Florida). Its research director, Dr. Ghislaine Guyot from Lyon (France) has studied ecology and conservation biology of tortoises *Testudo hermanni* in France and rare side-necked turtles *Pseudemydura umbrina* and *Chelodina oblonga* in western Australia. She is here on a post doctoral position jointly sponsored by the Institute and the University of South Florida. In its first year, the Institute and the Preserve have hosted a number of intern and graduate students. A great deal of effort has been put to developing infrastructure (lab/library, living quarters, and baseline data gathering

and monitoring of the flora and fauna of the upland habitat). Two major projects which are on-going include a long term study on relocation and behavior of gopher tortoises, and the development of long term management strategies for maintaining highly endangered species of savannah dwelling tortoises. Currently this cooperative study includes the use of the Indian star tortoise, *Geochelone elegans* and the radiated tortoise, *Geochelone radiata* to develop management protocols. To obtain further information about the involvement with the Institute, graduate studies, internships and cooperative research possibilities, contact: *Ghislaine Guyot, Research Director, Ashton Biodiversity Research & Preservation Institute, PMB 331, 5745 SW 75th St., Gainesville, Florida 32608, USA; e-mail: GhGuyot@aol.com; Tel. 352-495-7449; Fax 352-495-7433.*

New Curator at MCZ

Dr. James Hanken has joined Harvard University as Curator in Herpetology at the Museum of Comparative Zoology and Professor in the Department of Organismic and Evolutionary Biology. All loan requests should be submitted in writing to Dr. James Hanken, Dept. of Herpetology, Museum of Comparative Zoology, 26 Oxford Street, Cambridge, Massachusetts 02138, USA. Collection-related questions and other materials (e.g., reprints) should be sent to José P. Rosado, Collections Manager (617-495-2496, voice; 495-5667, fax; jrosado@oeb.harvard.edu, e-mail).

The herpetology department encourages use of its research collections, which currently number more than 320,000 specimens. Limited funds for travel are available from the Ernst Mayr Grants to utilize the collections for systematic studies. Applications are reviewed semiannually, following submission deadlines of 15 September and 15 April. Awards are announced within two months after these dates. Correspondence related to these awards should be addressed to the Director of the Museum, Dr. James McCarthy.

Dr. Hanken's interests include evolutionary biology, morphology, development, and systematics. His research focuses on vertebrates, especially amphibians, but otherwise encompasses a broad range of organisms and problems. These include the morphological and developmental correlates and consequences of alternative reproductive modes, such as direct development; life history evolution; mechanisms of cranial pattern formation during embryonic and metamorphic development; and taxonomy and systematics of neotropical salamanders. Interested students should contact the OEB Graduate Program for further information regarding opportunities for advanced study <http://www.oeb.harvard.edu/GradProg/index.html>.

Information Sought on Argentine Lizards

The Wildlife Fauna and Flora National Agency of Argentina is re-evaluating the conservation status of amphibians and reptiles of Argentina. One of the criteria used for the evaluation concerns the commercialization of species—for the pet trade, zoo exhibits, food, or skin.

As lizard group coordinator, I am gathering information about Argentinean lizard commercialization in developed countries. We were surprised to learn that *Phymaturus patagonicus*, a rare and little known species (Chiszar et al. 1999. Herpetol. Rev. 30:98), is present in the U.S. pet trade. Like other *Phymaturus* species, it has a restricted geographical distribution.

A principal goal is to establish rules to control commercial activities with species vulnerable to extinction. If you have information about the commercialization of Argentinean species of the genera listed below, in United States, Europe, Japan or elsewhere, please send all the information available (species, origin, date, pet catalogue, etc.) to: Dr. Luciano Javier Avila, CRILAR-CONICET, Mendoza y Entre Ríos s/n, 5301 - Anillaco (La Rioja), Argentina; tel. 54 (0) 3827- 494251 Interno 113; fax 54 (0) 3827-494231; e-mail: lavila@crilar.com.ar.

International Society for the History and Bibliography of Herpetology

The International Society for the History and Bibliography of Herpetology was founded in 1998 in Guelph, Canada. The profound interest among many professional and amateur herpetologists in the history of their science or hobby was demonstrated in recent international herpetological meetings. The founders' conception was to launch a society that can provide a forum for herpetologists, bibliophiles, and historians of biology to meet and share their common interests. The initial founding group consisted of twelve persons. A constitution was laid down and an executive committee was elected. The Society is a not-for-profit organization.

Thus, the aims of the Society are to bring together individuals who have a serious interest in the history as well as the bibliography of herpetology and to support the spread of knowledge of these topics among members and the general public. Opportunities are created for the members to meet other people with the same interest and to extend and cultivate their acquaintances.

The Society will achieve its aims by organizing formal meetings with lectures, discussions, and other similar activities. These meetings will normally be held in connection with other herpetological meetings, such as congresses with international participation. Activities that include visits to private and public libraries, museums, research stations, antiquarian bookshops, etc., will be other means of assembly. The founders also feel that a dedicated channel for publishing papers in the disciplines is lacking. A printed bulletin with brief articles, essays, bibliographies, and news of people and events in our field will therefore be a central pillar of the Society. This will, as demands arise, be supplemented by a less formal newsletter that will be distributed either as a leaflet or e-mail.

The executive committee of five people is representing academic professionals, students, and amateurs from Canada, Sweden, and USA. The first bulletin was published in May 1999. Meetings were held in Pennsylvania, USA later in the summer. Members as a group were invited to an exclusive presentation of the library of the Academy of Natural Sciences in Philadelphia. The Academy is the oldest extant natural history museum in the United States and its exceptional book and journal holdings in herpetology were displayed.

Elected officers for 1999–2000 are: Prof. Kraig Adler (Secretary/Treasurer, USA), Prof. Aaron Bauer (Meeting Organizer, USA), Ronald Javitch (Vice Chairperson, Canada), Ralph Tramontano (Editor, Sweden), and Richard Wahlgren (Chairperson, Sweden). The next meeting is planned for La Paz, Baja California, México in June 2000.

Membership fee for two years (2000–2001) is US $30 (student $10) or life $300. Anyone interested in more information about the Society is invited to visit our web site: www. teorekol.lu.se/~rana/ISHBH, and contact us from there or write to: *International Society for the History and Bibliography of Herpetology, Box 2123, SE-220 02 LUND, Sweden.*

Southwestern Research Station Positions And Grants For 2000

VOLUNTEERS—Approximately 30 volunteer positions are open in 2000 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

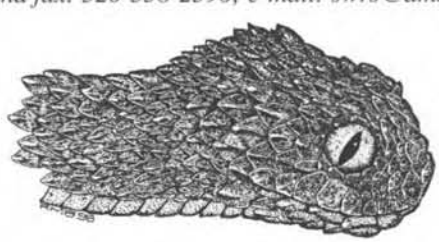
Volunteers are needed between March 14 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 2000. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin mid-March 2000 through September 2000. Five-day week; salary $235/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*



Atheris squamiger. Illustration by R. Michael Burger.

MEETINGS

Meetings Calendar

27–29 January 2000—Annual Conference of the Western Section of The Wildlife Society. Riverside Convention Center, Riverside, California, USA. Session on "Ecology and Conservation of Amphibians and Reptiles" included. Information and registration available via the society's website at: www.tws-west.org.

1 April 2000—All Florida Herpetology Conference, Florida Museum of Natural History, Gainesville, Florida. For more information, contact Max Nickerson, Florida Museum of Natural History, University of Florida, Gainesville, Florida, 32611 USA (e-mail: maxn@flmnh.ufl.edu).

14–20 June 2000—43rd Annual Meeting, Society for the Study of Amphibians, together with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists, Universidad Autónoma de Baja California Sur, La Paz, BCS, México. *(Refer to meeting announcement on page 193 of this issue).*

11–15 July 2000—Sixth Biennial Joint Meeting of Portuguese and Spanish Herpetologists and the Tenth Biennial Congress of the Spanish Herpetological Association, Valencia, Spain. For more information contact: VI Congreso Luso-Espanol, X Congreso Espanol de Herpetologia, Departamento de Biologia Animal, Facultad de Ciencias Biologicas, Universidad de Valencia, 46100 - Burjasot, Valencia (Spain). E-mail: herp2000@uv.es. Web site: http://bioweb.uv.es/zoologia/AHE.

16–20 July 2000—Fourth Asiatic Herpetological Conference, Chengdu Institute of Biology, Chinese Academy of Sciences, Chengdu, China. For more information contact: Dr. Theodore J. Papenfuss, Museum of Vertebrate Zoology, Berkeley, California 94720-3160, USA; tel. (510) 642-3567; fax: (510) 643-8238; e-mail: asiaherp@uclink4.berkeley.edu.

LEGISLATION & CONSERVATION

Utila Iguana Conservation

The Utila Iguana (*Ctenosaura bakeri*) is an island endemic now restricted to Utila Island (41 km^2) in Caribbean Sea on the Honduras coastline. This large iguana is threatened with extinction. The "Conservation Project of the Utila Iguana" has been developed to address various threats to extinction. The Project is under the joint sponsorship of the Frankfurt Zoological Society and the Senckenberg Nature Research Society. Project activities include: a broad education and information program for the local community; support a ban on hunting of the species through presence of game wardens and conservations on a nature reserve; research on the species' biology; a survey of the fauna and flora of Utila; creation and maintenance of a reserve; and the reproduction of Utila iguanas in a scientifically run breeding program.

Volunteers are needed. Undergraduate and graduate students in biology will gain experience in the conservation of species and field experience in the tropics. However, participants need not be formally trained in biology, but simply have a desire to be actively engaged in a species preservation project. Housing is available at

the IGUANA Research and Breeding Station for volunteers willing to commit themselves to 2–3 months of work.

For additional information, please contact the Project Director: Dr. Gunther Köhler, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt; e-mail: gkoehler@sng.uni-frankfurt.de or visit the Project Web site at: http://senckenberg.uni-frankfurt.de/fis/herp_ut_e.htm

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.herplit.com/contents

Larval and Metamorphic Skeletal Development of *Pyxicephalus adspersus*

Haas studied the development and ontogenetic change of *Pyxicephalus adspersus* (the African Bull Frog) raised in the laboratory at 29°C. Haas reports the development of this species being complete in 17 days from hatching, and metamorphosis taking only five days. He also states that the skeletal differentiation reached at the end of metamorphosis is similar to other species of frogs, despite the relatively rapid phase of development. No shift of cranial bone formation was reported after metamorphosis, and the majority of species compared to *P. adspersus* in this study were found to be particularly similar in the sequence of formation of elements of the postcranial skeleton; however, clear differences were found among species in the timing of these elements relative to the larval growth trajectories, absolute time, and certain developmental markers. Comparisons among taxa show that newly metamorphosed *P. adspersus* possess strong jaws with fang-like teeth, and a prominent squamosal-maxilla contact (likely enabling this frog to catch and swallow vigorous prey).

Haas, A. 1999. Larval and metamorphic skeletal development in the fast-developing frog *Pyxicephalus adspersus* (Anura, Ranidae). Zoomorphology 119:23–35.

Correspondence to: Alexander Haas, Institut für Spezielle Zoologie und Evolutionsbiologie, Friedrich-Schiller-Universität Jena, Erbertstrasse I, D-07743 Jena, Germany; e-mail: b5haal@rz.uni-jena.de

Utilizing Characters of Isozymes in Systematics

Buth and Murphy summarize several classes of isozyme characters that can be of value in systematic studies. Of these classes, some of the more robust are recognized. The authors also state that in any study isozyme characters should be evaluated in terms of their advantages and limitations. A discussion of the taxonomic level of utility of isozymes is also included.

Buth, D. G., and R. W. Murphy. 1999. The use of isozyme characters in systematic studies. Biochemical Systematics and Ecology 27(1999):117–129.

Correspondence to: D. G. Buth, Department of Biology, University of California, Los Angeles, California 90095-1606, USA; e-mail: dbuth@ucla.edu.

Gene Expression in the Desert Tortoise, *Gopherus agassizi*

Optimal electrophoretic conditions for allozyme and isozyme studies were identified by examining the products of 73 enzyme loci with eight different buffer systems, for studies of *Gopherus agassizi*. Levels of enzyme activity were reported for extracts from blood, brain, eye, gonad, heart, kidney, liver, muscle, and stomach. The authors state that the systematic utility of these isozyme characters lies in the tissue distribution of some gene products, as well as the number of genes that control some enzyme systems.

Buth, D. G., and W. J. Rainboth. 1999. Gene expression in the desert tortoise, *Gopherus agassizi*; tissue sources and buffer optima for the gene products of 73 loci. Biochemical Systematics and Ecology 27(1999):185–200.

Correspondence to: D. G. Buth, Department of Biology, University of California, Los Angeles, California 90095-1606, USA; e-mail: dbuth@ucla.edu.

Salamander Pheromone Isolated

In plethodontid salamanders, pheromones are used by males during courtship to induce copulation. Despite the fact that the behavioral effects of pheromones are well documented, few vertebrate pheromones have been isolated. Rollman and colleagues performed biochemical analyses on plethodontid courtship pheromones and identified a single protein, termed plethodontid receptivity factor (PRF), for which they also determined the DNA sequence. They tested the effects of PRF on female receptivity by applying the protein to females' nares and allowing them to interact with males whose natural pheromones had been removed. They found that 9/11 of the females responded positively to the pheromones. They suggest that because this pheromone changes the receptivity of females that are not ovulating, it may serve as a model system to study receptivity independent of ovulation.

Rollman, S. M., L. D. Houck, and R. C. Feldhoff. 1999. Proteinaceous pheromone affecting female receptivity in a terrestrial salamander. Science 285:1907–1909.

Correspondence to: S. M. Rollman; e-mail: smrollma@midway.uchicago.edu.

Taxonomic Status of the Black Turtle

For over a century, the Black Turtle, *Chelonia agassizii*, has been recognized as a distinct species. However, there has been much debate about the validity of this taxon. Karl and Bowen conducted an analysis of sequences from three nuclear DNA loci of 11 indi-

viduals representing *C. agassizii* and the Green Sea Turtle (*C. mydas*), which is regarded by some workers as conspecific. Based on their results, they conclude that the variation between the *agassizii* and *mydas* is no greater than variation within the latter species as a whole, and therefore, these taxa should be synonymized. They point out, however, that recognition of the Black Turtle as distinct is, in part, based on conservation concerns. They conclude that rather than recognizing an invalid species, conservation efforts should target the Black Turtle as a distinct evolutionary unit, termed a Geopolitical Management Unit, within the species *C. mydas*.

KARL, S. A., AND B. W. BOWEN. 1999. Evolutionary significant units versus geopolitical taxonomy: molecular systematics of an endangered sea turtle (genus *Chelonia*). Conserv. Biol. 13:990–999.

Correspondence to: S. A. Karl; e-mail:karl@chuma.cas.usf.edu.

Feeding Systems of Agamids

Many ecological studies have examined the interaction between morphology and ecology; however, few of these have been conducted on lizard feeding mechanics. The authors examined the anatomy and function of the feeding apparatus in lizards with different feeding strategies—the insectivorous *Plocederma stellio* and herbivorous species of *Uromastyx*. They found that the skulls of the herbivorous lizards are adapted for strong, forceful biting and are thermally dependent, whereas those of the insectivorous lizard are made to be fast and forceful during static biting. They conclude that the mechanics and morphologies examined are tightly linked to the lifestyles of these animals.

HERREL, A., P. AERTS, J. FRET, AND F. DE VREE. 1999. Morphology of the feeding system in agamid lizards: Ecological correlates. Anatomical Record 254:496–507.

OBITUARIES

Sylvana Silvi Cei
1920–1998



Sylvana Cei, wife of long-time SSAR member José Miguel Cei, died suddenly on 21 February 1998. Together with her husband, Sylvana participated in numerous expeditions in search of amphibians and reptiles, traveling some 350,000 km in 25 years of field work in Patagonia, Peruvian Amazonia, Chaco, the Andean belt, Angola, and Namibia. One of her discoveries, the iguanian *Liolaemus silvanae*, endemic to an isolated mesa in Argentina, is named in her honor. Born near Pisa, Italy, on 4 November 1920, Sylvana was educated in Florence in the fine arts, mainly drawing and painting, and her exceptional aquarelles have long graced José's books and papers. She was also responsible for reorganizing the herpetological collections of the museum in Turin. Her death is a loss to our field, and we will miss her generous contributions to herpetology, her outstanding artistry, and her passion for natural history.

In Remembrance of Sherman A. Minton, Jr.
1919–1999

H. BERNARD BECHTEL
1307 Cold Spring Lane
Valdosta, Georgia 31602, USA



Madge and Sherman Minton. Photograph courtesy of H. B. Bechtel.

I met Sherman Minton in 1955 in west Texas where, with Madge and his three young daughters, he was living in a simple cabin just north of Big Bend National Park. On leave from IU Medical School, he was researching ectoparasites of reptiles. I am an amateur herpetologist and was with a group hunting reptiles in the area. I must have been the only herpetologist, amateur or professional, who did not know of him, because he had already attained a position of prominence in the field of herpetology. I certainly did not know that this would be the start of a friendship, but it was.

A result of his stay in Texas was publication of the outstanding local faunal study, "Observations on Amphibians and Reptiles of the Big Bend Region of Texas." This paper contained the first published mention of the all-female populations of *Cnemidophorus* and also the first report of the extreme toxicity of the venom of *Crotalus scutulatus*, documented by his own toxicity studies on mice.

While in Texas, he also described a new snake, *Tantilla cucullata*, which subsequently has been reduced to a subspecies of *rubra*.

Sherm was born in New Albany, Indiana, and attended public schools. His father was a United States Senator from Indiana, and subsequently was appointed to the United States Supreme Court by President Harry Truman. From an early age, Sherm was fascinated with insects and natural history, but his life was transformed when he discovered Raymond Ditmars' "The Reptiles of North America." He had correspondence with Ditmars concerning a scarlet snake that he collected near New Albany in 1935, the first recorded Indiana specimen.

He earned a bachelor's degree in zoology from Indiana University in 1939, and graduated from IU Medical School in 1942 into a world consumed by war. Enlisting in the navy, he served as a Medical Officer in the Pacific Theatre of Operations from 1943 to 1946, both ashore and afloat.

While a student at Indiana University in 1937, Sherm met Madge Rutherford. They were engaged, but postponed marriage when the Civilian Pilot Training Program enabled Madge to realize her dream of flying. She then was accepted by the Women Airforce Service Pilots (WASPS). The WASPS flew military planes from point of manufacture, and handed them over to regular military pilots. In this capacity WASP pilots flew all of the military aircraft of the time. In 1943, between two flight assignments and just before Sherm reported for duty aboard the destroyer USS Brooks, they were married. The war ended for the USS Brooks when it was attacked by a Japanese kamakaze, too late in the war to be repaired and return to action.

From the beginning, Sherm and Madge collaborated as a team, with Madge assisting in the field and laboratory, and with writing and research on their books. It is really not possible to understand Sherm, or talk about him, except in association with Madge. She permitted Sherm to be completely absorbed in his work, while maintaining her own active role in the retired WASP association.

Upon discharge, he did graduate study in Microbiology and Herpetology at the University of Michigan, and joined the faculty of Indiana University School of Medicine. Sherm chose an academic career without the enthusiastic support of his father, who was "more practical" and felt that a medical degree would be better used practicing medicine. From 1948 until his retirement in 1984, he was a member of the Department of Microbiology and Immunology at the IU Medical School, and was Professor Emeritus at the time of his death. From 1957 on, he was a research associate in the Department of Herpetology at the American Museum of Natural History.

Sherm's position as a professor at the IU School of Medicine enabled him to pursue his real love, herpetology, which he did with single-mindedness for the remainder of his life. In 1958 he accepted an offer to be a visiting Professor of Microbiology at Jinnah Postgraduate Medical Centre in Karachi, Pakistan, staying until 1962. Closing their home in Indianapolis and moving the entire family to Pakistan was a tremendous upheaval, but it was an opportunity he could not pass up. His primary duties in Pakistan were teaching and providing short-term medical care for employees, students, and staff of the institute, allowing him to pursue herpetology, which he did with his customary vigor. He did limited work on snake and scorpion venoms, made clinical observations on snakebite cases, and carried out extensive field studies on the herpetofauna of Pakistan, resulting in the publication of "A Contribution to the Herpetology of West Pakistan," a crucial regional work and a natural history classic. While the Mintons were in Pakistan, I received a steady stream of cardboard boxes in the mail, containing lizards and snakes that I only vaguely knew existed. I must have been the first person in America to possess a fat-tailed gecko or a Turkestan plate-tailed gecko, neither of which I had ever seen, even in zoos.

Sherm's activities included extensive travel. In 1965 he visited parts of Iran and Pakistan as a member of the American Museum of Natural History. He was a delegate to conferences on venomous animals and venoms at Instituto Butantan, São Paulo, Brazil, in 1966 and 1981. In the winter of 1972–1973 he was a member of a Scripps Institute of Oceanography expedition to the Timor Sea and Australia to study the biology of seasnakes and other dangerous marine animals. He was a member of a second expedition to the Philippines in the fall of 1975, and a third to the Chesterfield Islands and Great Barrier Reef in the summer of 1981. In 1976 he was a delegate to the U.S.-Republic of China Binational Seminar on Protein Chemistry and Snake Venoms. For six months in 1980 he was visiting professor in the Department of Zoology, University of New England, Arimdale, Australia. He was delegate to WHO-sponsored meetings on venoms in Switzerland in 1979 and Japan in 1980. In 1983 he returned to Pakistan for the 25th anniversary of the Jinnah Postgraduate Medical Centre. He made professional visits to England and Yugoslavia in 1985, Mexico in 1987, and the People's Republic of China in 1991. Madge accompanied him on all of these trips.

Sherm's most recent research activity involved envenomation by non-native snakes in the U.S., distribution and natural history of Indiana reptiles and amphibians, the decline of amphibian populations in Indiana, and the bites and venoms of colubrid snakes. When he published an article on this last subject in a magazine for general readership, we often discussed how this might be misinterpreted by the public, who have long been reassured that gartersnakes are harmless.

He was author or coauthor of about 150 technical papers and monographs as well as articles in textbooks, encyclopedias, and nontechnical publications, and editorials and book reviews. He and Madge coauthored two popular books: "Giant Reptiles" and "Venomous Reptiles." "Venomous Reptiles" was extremely well-received, crammed with facts not readily available elsewhere, and is often quoted in peer-reviewed articles. He published "Venom Diseases," a source book for physicians and those with potential contact with venomous animals and their venoms, and was co-author of "Handbook to Middle East Amphibians and Reptiles." He was chairman of the committee that produced the U.S. Navy's official publication on poisonous snakes of the world and treatment of their bites, and edited a book on snake venoms and envenomation.

Sherm was consultant on snakebite and other envenomations for three major zoos and several poison information centers. In this position he shared by phone his knowledge of snakebite treatment with physicians struggling in emergency rooms with snake bites about which they had little knowledge.

His research, publications, and consultations on toxinology have been diverse and influential. A 1954 paper by Sherm indicated that Wyeth Laboratories' original antivenin was not effective against the venoms of major North American pit viper species. It is likely that this research led to significant changes by Wyeth, and the new formulation has remained essentially unchanged since 1955. His broad interests included toxicity and immunological relationships of snake venoms.

Sherm was a member of many scientific societies, and a leader in most of them: American Society of Ichthylologists and Herpetologists (former member of Board of Governors); American Society of Tropical Medicine and Hygiene; The Herpetologists' League; Indiana Academy of Science (Fellow, 1967, Speaker Of The Year, 1982); International Society on Toxinology (President 1966–1968, recipient of Redi Award, 1985); New York Academy of Sciences; Society for the Study of Amphibians and Reptiles (former member

of Board of Directors, President, 1985–86); and Wilderness Medical Society. He belonged to Sigma XI and the medical honorary society, Alpha Omega Alpha, and in 1996 Indiana's governor declared Sherm a "Sagamore of the Wabash," a singular honor for outstanding Hoosiers.

This list does not even begin to convey what Sherm meant to these organizations. With diverse interests and ongoing research, he was on the program too many times to list. Between sessions and at mixers, a crowd could always be found around him. In addition to being well informed in all aspects of herpetology, he was more widely traveled than most, and above all was the authority on venomous snakes and their venoms. Almost all herpetologists, no matter what field they were working in, are interested in snakebite, even if only as potential victims. He also was a popular speaker for regional herpetological societies.

Sherm and Madge often shared Thanksgiving in Valdosta with us and our local friends, and we have spent much time in their home. They were great hosts, and remarkably comfortable to have as guests. In spite of the fact that we spent so much time together, I am embarrassed to confess that I was not aware of all of Sherm's accomplishments until I undertook this obituary. Our friendship was such that he rarely discussed in depth his many trips unless asked about them.

The two of us spent a lot of time tramping around in south Georgia and southern Indiana, resulting in some of my fondest memories. Despite the fact that he had collected exotic specimens everywhere he went, he never lost his enthusiasm for local "herps," and he was a thorough observer. He always carried with him in the car a box containing preserving materials, which Bette, my wife, referred to as the "black box." Road kills were generally preserved on the spot, and notes made before the facts faded. On our tramps together, he invariably carried a camera, photographing not only reptiles, but flowers and most living things. In spite of the fact that south Georgia is reputed to be the home of many rattlesnakes, we only once came upon one, and it passed up the opportunity to bite us. Sherm pulled over a piece of corrugated metal, revealing a neatly coiled eastern diamondback rattlesnake. As he was bending over to photograph it and I was holding the metal, the snake noted some light under the tin and dived for it before we could react, passing within inches of our legs, and we both were wearing low shoes.

Sherm was, above all, a modest and self-effacing man, without pretense. For budding herpetologists, he was easy to approach, unfailingly helpful and encouraging, even when corresponding with those he had never met. The Mintons' unpretentiousness extended to their life style. They drove battered little Toyotas for the most part. Their home was unremarkable from the outside, but "lived in." It was filled with mementos from their travels, a huge herpetological library, walls of slides, stacked manuscripts and book reviews in progress, a few favorite live specimens, and Madge's archival material from the retired WASP organization. Finally, the basement was crammed with thousands of preserved specimens, donated upon Sherm's death to the American Museum of Natural History.

It was not all herpetology. When the opportunity arose, Sherm and Madge were the first on the dance floor. They were worthy opponents at bridge. Their politics were to the left of ours, but Sherm and I mellowed somewhat. Madge, however, always had with her a stack of liberal periodicals for my reading benefit. The Mintons enjoyed scuba diving, which they did as long as they were physically able, always stopping at Valdosta on the way to south Florida. Bette considered Sherm "easy to cook for!" His martinis conformed to the original recipe: no vodka substituted for gin; no onion substituted for the olive. At motel pools Sherm dived in without testing the water. He and Madge swam regularly, and on his 82nd birthday he swam a mile, but according to Madge, "very slowly."

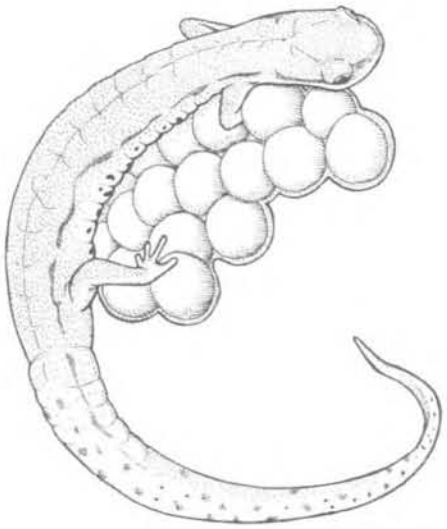
A few weeks before he became ill, we had made arrangements to meet the Mintons in North Carolina for a few days' relaxation and salamander hunting, the two being synonymous. On March 15 Sherm had a seizure, and found out that he had carcinoma of the lung with brain metastases. He was in the field in southern Indiana the day before.

Upon learning of his illness, we drove to Indianapolis for a final visit. Sherm was not in pain but could not stand or walk, was able to talk only in a whisper. We did manage to lift him into a car and drive to Brown County, where he spent a few minutes looking at a small pond well-known as a breeding site for spotted salamanders, and released some captive native snakes that he had. I think that our friendship was so great because we were both physicians, of the same generation, and our wives got along so well. The last night of the visit, Bette and I helped Madge put Sherm to bed, the last time we saw him alive.

Sherm spent many hours of his last years in the field and at his word processor revising "Reptiles and Amphibians of Indiana." He was fond of Indiana and knew its herpetofauna as no other person does, and no other herpetologist probably ever will, because the Indiana he knew is disappearing fast. A great disappointment to him and all of us who knew him, was that he never lived to see the revised edition published.

Other herpetologists are also medical doctors, but no other physician-herpetologist has matched the herpetological accomplishments of Sherman A. Minton. Nor is there any physician-herpetologist working on snakebite treatment and basic research in snake venoms with a similar knowledge and publication record in herpetology. Being a herpetologist enhanced Sherm's toxinological work with a unique integration of medicine, toxinology, and herpetology. By any standard, Sherman Minton will be remembered as one of the leading herpetologists of this century. This is all the more remarkable considering his career as a professor in a major medical school.

Sherman Minton died June 15, 1999 at a hospice, with Madge at his side. He is survived by Madge; daughters Brooks Cervantes, April Kieser, and Holly Minton; sister Marriane Callanan; brother John Evans Minton; and two grandchildren.



Hemidactylium scutatum. Illustration by Michael Frick.

ARTICLES

Monthly Distributions of Size Classes and Reproductive Status in *Cnemidophorus tesselatus* (Sauria: Teiidae) from Southeastern Colorado

HARRY L. TAYLOR
Department of Biology, Regis University, Denver, Colorado 80221, USA
e-mail: htaylor@regis.edu

JAMES M. WALKER
Department of Biological Sciences, University of Arkansas
Fayetteville, Arkansas 72701, USA
e-mail: jmwalker@comp.uark.edu

and

JAMES E. CORDES
Division of Sciences, Louisiana State University, Eunice, Louisiana 70535, USA
e-mail: jcordes@lsueccgt.lsue.edu

It is known that *Cnemidophorus tesselatus* (as redescribed by Walker et al. 1997) originated from hybridization between *C. tigris marmoratus* and *C. gularis septemvittatus* (Dessauer and Cole 1989; Neaves 1969; Parker and Selander 1976). This species exhibits remarkable morphological and ecological variation despite its parthenogenetic mode of reproduction and clonal pattern of inheritance (Dessauer and Cole 1986). *Cnemidophorus tesselatus* is, therefore, of considerable interest for what it can reveal about evolution in a parthenogenetic species.

Variation in *C. tesselatus* is evident as fundamental color pattern classes, designated as C, D, and E by Zweifel (1965) and as C, Colorado D, New Mexico D, and E by Taylor et al. (1996) and Walker et al. (1997). Parker and Selander (1976) and Parker et al. (1989) presented evidence that genetic variation within certain color pattern classes could have originated from different hybridizations or fertilizations between the two progenitor species. However, three lines of evidence suggest that color pattern classes were derived subsequent to the origin of *C. tesselatus*. First, histocompatibility between pattern classes C and E, as revealed by skin transplants (Maslin 1967), indicates that these populations originated from the same fertilization. Second, sympatric populations of pattern classes C and New Mexico D are identical at 30+ loci (Dessauer and Cole 1986), supporting the probability of a monophyletic origin. Third, mtDNA evidence has identified *C. tigris marmoratus* as the maternal progenitor of all color pattern classes, thus eliminating reciprocal crosses with *C. gularis septemvittatus* as an explanation for the color pattern differences (Densmore et al. 1989; Dessauer et al. 1996).

Although the genetic basis of color pattern classes in *C. tesselatus* has not been determined, recognition of color pattern differences was essential for correcting misconceptions regarding the community structure of sympatric color pattern classes of *C. tesselatus* (2n) and *C. neotesselatus* (3n) in the vicinity of Higbee, Otero County, Colorado (Walker et al. 1995). As a grouping variable, color pattern class has also demonstrated its value in revealing ecological differences within *C. tesselatus*; i.e., between populations of pattern classes C and Colorado D from the Higbee area (Walker et al. 1997[1998]). The present study compares monthly frequency distributions of body size and reproductive activity in these same populations (Fig. 1). With the exception of condensed data for pattern class C from northwest Texas (Tinkle 1959), this information is lacking for all populations of *C. tesselatus*.

Methods and Materials.—Specimens were collected from sites separated maximally by approximately 11 km; specific information is provided in Appendix I. The snout-vent length (SVL) of each available specimen was measured to the nearest mm from tip of snout to the posterior margin of the preanal scales. Reproductive status of each individual was determined by dissection, using either vitellogenic ovarian follicles (≥ 3 mm in diameter) or oviductal eggs as indicators of sexual maturity. Monthly distributions of SVL were compared between color pattern classes using the Mann-Whitney U test.

Results and Discussion.—Although specimens collected in different years (Appendix I) were pooled to depict composite frequency distributions, variances for SVL were homogeneous (Levene's test) between pattern classes for both non-gravid ($F = 1.603$, $P = 0.21$) and gravid ($F = 0.028$, $P = 0.87$) groups. There were no significant differences between pattern class C and D in SVL distributions in either gravid females (June: Mann-Whitney $U = 134.5$, $P = 0.20$; July: $U = 8.0$, $P = 0.57$) or non-gravid individuals for three of four months (June: $U = 7.0$, $P = 0.24$; July: $U = 161.0$, $P = 0.37$; September: $U = 295.0$, $P = 0.38$). During August, however, SVL distributions differed significantly between pattern classes C and D ($U = 863.0$, $P = 0.001$), apparently due to a greater number of hatchlings in pattern class D (Figs. 2, 3). Our interpretation of the frequency distributions follows.

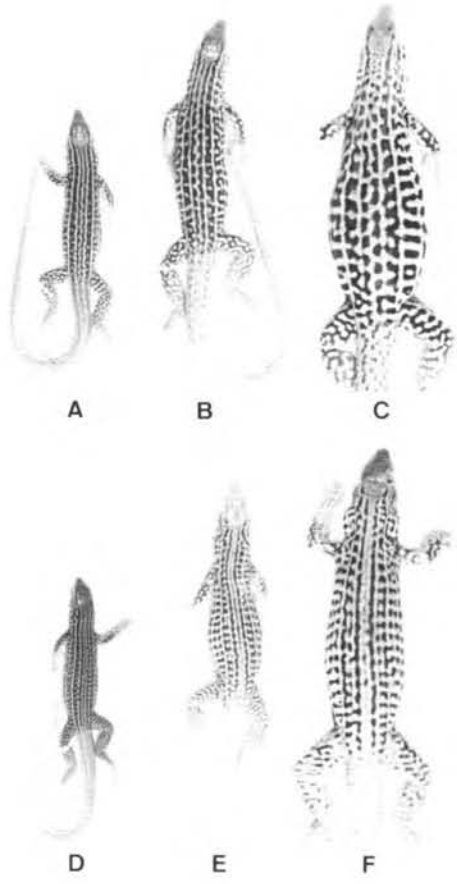


FIG. 1. Consistent ontogenetic color pattern differences between color pattern classes C and D of *Cnemidophorus tesselatus* from the vicinity of Higbee, Otero County, Colorado. Representative specimens are identified by UADZ numbers followed by their snout–vent length (SVL). TOP ROW—Pattern class C: A. 6343 (55 mm); B. 3187 (73 mm); C. 3184 (101 mm). BOTTOM ROW—Pattern class D: D. 6339 (48 mm); E. 3161 (71 mm); F. 4483 (98 mm).

September: Individuals 37–53 mm SVL likely represent a pooled cohort hatched between 11 August and the first week of September. Collecting records indicate that a majority of adults enter hibernation during this same time period, thus coincidentally reducing the overlap of activity between hatchlings and larger conspecifics.

June: Individuals emerge from hibernation in May, but activity is sporadic until June. Individuals hatched in the previous year are now 53–68 mm SVL; a second group is composed of reproductively mature individuals 78–105 mm SVL.

July: Individuals hatched in the previous year have grown to 67–78 mm SVL. A few individuals in the 92–105 mm size range are still ovipositing, but the absence of gravid individuals of both pattern classes in samples collected on 9 and 10 July indicate that reproduction is essentially over by the second week of July.

August: Hatchlings (32–47 mm SVL) are present. Most individuals hatched the previous year have now surpassed the minimum body size (approximately 78 mm SVL) at which reproductive maturity is achieved.

Gravid individuals of pattern classes C and D from the Higbee vicinity are similar in mean SVL and clutch size (Taylor et al. 1999). Reproduction in both pattern classes appears to begin in year three. This reproductive pattern is also apparently characteristic of pattern class C from northwestern Texas (Tinkle 1959) and pattern class C from Sumner Lake State Park in east-central New Mexico (Taylor et al. 1997). Any disadvantage accrued from delaying reproduction until the third year is evidently balanced by larger clutches made possible by larger body sizes attained from an additional year of somatic growth (Taylor et al. 1997).

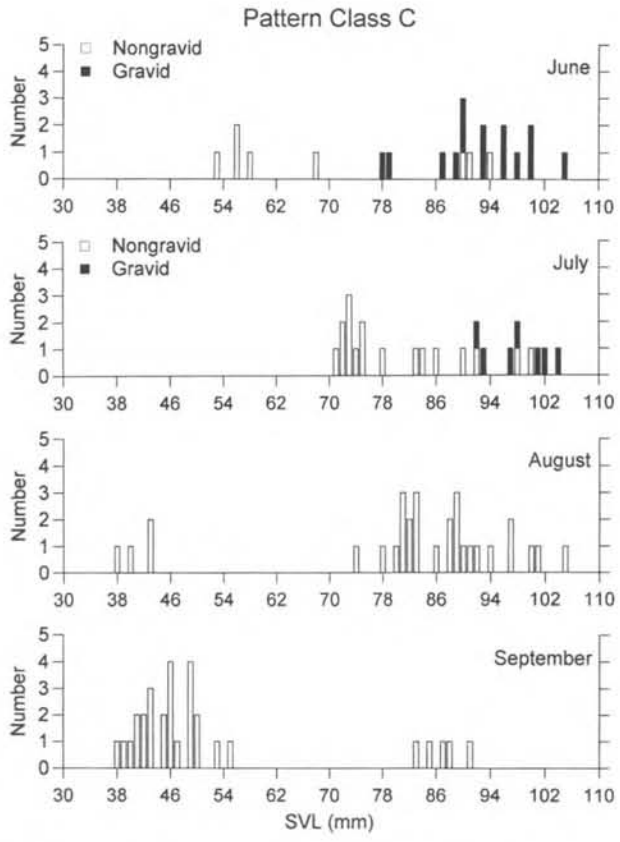


FIG. 2. Annual pattern of body sizes (SVL) and reproductive condition in pattern class C of *Cnemidophorus tesselatus* from the vicinity of Higbee, Otero County, Colorado.

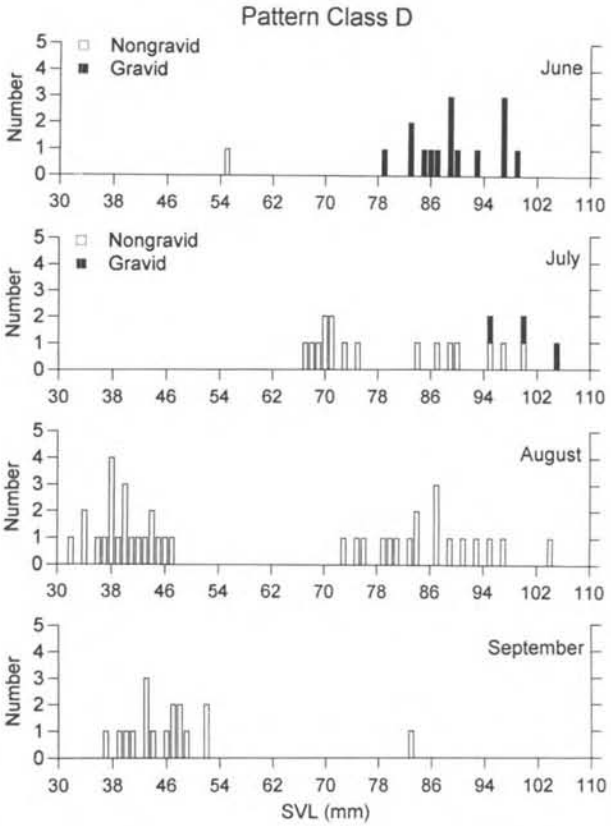


FIG. 3. Annual pattern of body sizes (SVL) and reproduction condition in pattern class D of *Cnemidophorus tesselatus* from the vicinity of Higbee, Otero County, Colorado.

We conclude that pattern classes C and Colorado D from southeastern Colorado have similar annual patterns of growth and reproductive activity despite certain morphological and ecological differences. Collecting records indicate that both pattern classes are active on suitable days from the middle of May through early October in southeastern Colorado. Pooled data were used to produce a population model (Figs. 2 and 3) from which it is possible to predict the monthly composition of populations of both pattern classes. Our most recent visits to the area (6 September 1998 [six juveniles collected] and 23 May 1999 [observations of three juveniles hatched in 1998 and three large adults]) fit the expectations predicted from the model.

Acknowledgments.—We are grateful to the Division of Wildlife, State of Colorado, for collecting permits. We thank S.–K. Wu, A. de Quiroz, and R. Humphrey, University of Colorado Museum, for accessioning samples, loans of specimens, and information concerning certain specimens in their care. Our appreciation is extended to K. K. Taylor and J. M. Walker, Jr. for field assistance, and we are indebted to B. E. Leuck, Centenary College, for information initially clarifying the distributions of color-pattern classes of *Cnemidophorus* in the Higbee vicinity.

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APPENDIX I

Colorado: Otero County: Comanche National Grassland, Vogel Canyon Picnic Area and Trailhead, 22.3 km S La Junta by Colorado Hwy. 109 to road 802, then 2.24 km W, then 2.4 km S to trailhead and picnic area. *Cnemidophorus tesselatus* D: [8 June 1993] University of Colorado Museum (UCM) 57219; [9 June 1993] UCM 57220–57223; [10 June 1993] UCM 57224; [30 June 1993] University of Arkansas Department of Zoology (UADZ) 5003–5006; [16 August 1993] UADZ 5148 = American Museum of Natural History (AMNH) 141903, neotype; [6 July 1994] UADZ 5574; [7 July 1994] UADZ 5575; [6 September 1998] UADZ 6339, 6340; [23 May 1999] three juveniles and three adults observed by HLT.

Colorado: Otero County: Higbee, 9.7 km NE Higbee. *Cnemidophorus tesselatus* D: [15 September 1949] UCM 4955.

Colorado: Otero County: Higbee, Ninemile Valley of the Purgatoire River, 1.6 km S Higbee School (= vicinity entrance to Vogel Canyon, 4.3 km SW Colorado Hwy. 109) on road 804. *Cnemidophorus tesselatus* C: [15 July 1973] UADZ 3936; [31 August 1960] UCM 14835, 14838, 14854, 14860; [9 July 1988] UADZ 3168. *Cnemidophorus tesselatus* D: [15 September 1949] UCM 4956; [31 August 1960] UCM 14830–14834, 14836, 14837, 14842–14848, 14850, 14851, 14853, 14855–14859; [15 July 1973] UADZ 4330–4335.

Colorado: Otero County: Higbee, Ninemile Valley of the Purgatoire River, 3.2 km S Higbee School (= 6.0 km SW Colorado Hwy. 109) on road 804. *Cnemidophorus tesselatus* D: [14 August 1960] UCM 17339–17341; [31 August 1960] UCM 14839–14841.

Colorado: Otero County: Higbee, Ninemile Valley of the Purgatoire River, 8.6 to 9.0 km SW Colorado Hwy. 109 on road 804. *Cnemidophorus tesselatus* C: [9 July 1988] UADZ 3147; [4 June 1990] UADZ 4091.

Colorado: Otero County: Higbee, Ninemile Valley of the Purgatoire River, 11.5–13.0 km SW Colorado Hwy. 109 on road 804. *Cnemidophorus tesselatus* C: [12 August 1973] UADZ 3937, 3938; [9 July 1988] UADZ 3150, 3155, 3156, 3159, 3160, 3167, 3170, 3174, 3176; [10 July 1988] UADZ 3182, 3184, 3185, 3187, 3188, 3193–3195, 3198, 3199, 3203, 3204; [11 August 1988] UADZ 3409–3412, 3414–3423, 3426–3428; [1 August 1989] UADZ 3710–3713; [2 September 1989] UCM 56116; [3 September 1989] UCM 56117–56123; [4 September 1989] UCM 56126–56132; [16 September 1989] UCM 56138–56142; [17 September 1989] UCM 56148–56155; [4 June 1990] UADZ 4088–4094, 4097; [5 June 1990] UADZ 4104–4106, 4108, 4109, 4111–4113, 4115–4119, 4122; [10 August 1990] UADZ 4323–4325, [29 May 1993] UADZ 5000; [6 September 1998] UADZ 6342, 6343. *Cnemidophorus tesselatus* D: [12 August 1973] UADZ 4336; [9 July 1988] UADZ 3149, 3161, 3162, 3166, 3175; [10 July 1988] UADZ 3186, 3189, 3202, 3205; [11 August 1988] UADZ 3407, 3408, 3413, 3424, 3425, 3429, 3430; [1 August 1989] UADZ 3714, 3715; [3 September 1989] UCM 56124, 56125; [4 September 1989] UCM 56133–56135; [15 September 1989] UCM 56136; [16 September 1989] UCM 56143–56146; [17 September 1989] UCM 56156, 56157; [4 June 1990] UADZ 4098, 4099; [5 June 1990] UADZ 4102, 4103, 4107, 4110; [13 July 1991] UADZ 4483, 4484; [6 September 1998] UADZ 6344.

Discovery of *Cnemidophorus neomexicanus* in Arizona

TREVOR PERSONS
USGS Forest and Rangeland Ecosystem Science Center
Colorado Plateau Field Station, P.O. Box 5614
Northern Arizona University, Flagstaff, Arizona 86011-5614, USA
e-mail: tbp@usgs.nau.edu

and

JOHN W. WRIGHT
Section of Herpetology, Natural History Museum
Los Angeles, California 90007, USA

The parthenogenetic whiptail lizard *Cnemidophorus neomexicanus* is known primarily from the vicinity of the Rio Grande Valley from Espanola, Rio Arriba Co., New Mexico south to near Candelaria, Presidio Co., Texas, and extending westward in southwestern New Mexico to west of Lordsburg, Hidalgo Co. (Fig. 1; Axtell 1966; Cole et al. 1988; Cordes et al. 1989; Degenhardt et al. 1996; Pough 1961; Wright 1971). An isolated population at Conchas Lake, San Miguel Co., New Mexico is possibly introduced (Leuck et al. 1981, but see Walker et al. 1992). Throughout its range *C. neomexicanus* occupies sandy, disturbed habitats such as flood plains (along the Rio Grande), sandy washes, and the edges of playas in closed basins (Cole et al. 1988; Cordes et al. 1989; Wright 1971; Wright and Lowe 1968), and is even common in weedy fields and vacant lots in and around cities and towns such as Albuquerque and El Paso (pers. observ.).

As this is not a taxonomic article, we will not review the extensive debate on the nomenclatural status of *C. neomexicanus* (see Smith et al. 1997 for a review). In anticipation of a ruling by the International Commission on Zoological Nomenclature to conserve the name *C. neomexicanus* (Smith et al. 1997), we continue to use it here.



FIG. 1. Approximate distribution of *Cnemidophorus neomexicanus*. Circle in NE New Mexico represents isolated population at Conchas Lake (Leuck et al. 1981), and circle in NE Arizona represents newly discovered population at Petrified Forest National Park. Map modified from Cole et al. (1988) and Wright (1971).

Here we report on a newly discovered population of *Cnemidophorus neomexicanus* at Petrified Forest National Park (PEFO), Apache Co., Arizona (USA). This constitutes the first record for the species in Arizona. In the course of herpetofaunal surveys being conducted in the park, numerous individuals of *C. neomexicanus*, of all age classes, were observed during the summer of 1998 along the flood plain of the Puerco River in section 9, Township 18 North, Range 24 East, Gila and Salt River Base Meridian, Apache Co., Arizona. A voucher specimen collected 13 August 1998 is deposited in the herpetology collection of the Natural History Museum of Los Angeles County (LACM 144792). This specimen is also cross-catalogued with the National Park Service as PEFO 14756. The only other whiptail species occurring sympatrically with *C. neomexicaus* at this site, *C. velox*, is more abundant. Other lizard species observed at this site were *Sceloporus undulatus*, *S. graciosus*, and *Phrynosoma douglassii*. *Crotaphytus collaris* and *Uta stansburiana* were common in rocky areas nearby. The habitat is sandy flood plain with the shrubs *Chrysothamnus nauseosus*, *Atriplex canescens*, *Artemisia tridentata*, and *Forestiera neomexicana* dominant. Scattered large cottonwoods (*Populus* spp.) provide habitat in the form of downed limbs and leaf litter. Tamarisk (*Tamarix* spp.) is dense in areas, and *C. neomexicanus* appears to be less common in these stands. Overall the habitat is similar to that inhabited by conspecifics in the Rio Grande Valley.

As with the population at Conchas Lake in northeastern New Mexico (Leuck et al. 1981), this new population could have resulted from an introduction. Currently, a distance of ca. 240 km separates PEFO from the closest known populations near Laguna, Cibola (=Valencia) Co., New Mexico (Axtell 1966). While on the basis of biogeography and habitat *C. neomexicanus* could conceivably occur as far west as Grants, along the Rio San Jose (a tributary of the Rio Grande), it would still have to cross ca. 95 km of unsuitable habitat straddling the continental divide, until it could again reach apparently suitable habitat near Gallup (along the Puerco River, a major tributary of the Little Colorado River, that runs through PEFO). Introduction is suggested by several factors. One is the apparent disjunction of this population and the fact that both Interstate 40 and the Santa Fe railroad are major routes that connect the Rio Grande Valley and Albuquerque to PEFO. Both routes parallel the valleys of the Rio San Jose and Puerco River, where suitable riparian and urban habitats are common. Additionally, this new locality is immediately adjacent to the Puerco Ruins visitor site, one of the most visited areas at PEFO, and is only ca. 2 km east of the Adamana Station and Siding of the Santa Fe railroad. Skin grafting studies (in progress) will help to determine if this new population is identical to New Mexico populations of *C. neomexicanus*, and ongoing surveys will determine the extent of its distribution in Arizona.

The existence of an apparently healthy, reproducing population of *C. neomexicanus* at PEFO is significant. Histocompatibility, mitochondrial DNA, and protein electrophoresis studies suggest that *C. neomexicanus* is an extremely young species that has colonized its entire range in New Mexico and Texas in perhaps hundreds rather than thousands of years (Cuellar 1977; Densmore et al. 1989; Parker and Selander 1984). In New Mexico, *C. neomexicanus* has expanded its range at the expense of *C. inornatus*, especially where the habitat has been disturbed by humans and their livestock (Wright and Lowe 1968). Suitable disclimax habitats are extensive in the Little Colorado River basin of northeastern Arizona and northwestern New Mexico, and once established (as at PEFO), *C. neomexicanus* could rapidly colonize much of the watershed. We can only speculate on what effect *C. neomexicanus* may have on other species of *Cnemidophorus* (e.g., *C. velox, C. tigris, C. inornatus)* in the Little Colorado River basin.

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Oviposition Behavior in the Red-backed Salamander (*Plethodon cinereus*): Implications of Suspending a Clutch

DALE M. MADISON*
KATHY WAREING
JOHN C. MAERZ
and
VICTOR S. LAMOUREUX
Department of Biological Sciences, Binghamton University (SUNY)
Binghamton, New York 13902-6000, USA

**Author to whom correspondence should be sent (e-mail: dmadison@binghamton.edu)*

Egg attendance is a widespread form of parental care in salamanders (Crump 1995), and it commonly co-occurs with egg suspension from overlying surfaces (Petranka 1998). This association between egg attendance and suspension implies that the latter is an important component of the reproductive strategy of many caudate amphibians, notably plethodontids (Petranka 1998). Brief descriptions of egg suspension among terrestrial salamanders indicates that it requires unconventional postures, is protracted over many hours, involves the synthesis and application of attachment substances, and entails precise egg placement and manipulation (Bishop 1941; Cupp 1991; Nobel and Richards 1932; Piersol 1914). Curiously, not all females within a species may suspend eggs (e.g., *Plethodon cinereus*; Bishop 1941; Wareing 1998), which leads to further questions of what factors influence clutch suspension within and across species.

The occurrence and complexity of egg suspension indicates the fundamental importance of this behavior, yet neither detailed descriptions of oviposition behavior nor experiments clarifying function have been reported. For this reason, we recorded details of oviposition during a broader study of maternal care by the red-backed salamander, *Plethodon cinereus* (Wareing 1998). Females typically lie on their backs and suspend a clutch of 3–14 eggs from a rock or log within an underground cavity during June and July in New York, and then the female attends the clutch for approximately 60 days until hatching (Bachmann 1964; Bishop 1941; Piersol 1914; Wareing 1998). To induce egg-laying for laboratory studies, we injected visibly gravid females in mid-June with an agonist of LH-RH (Verrell 1989; Wareing 1998); 21 of 29 injected females oviposited. Five females were observed during oviposition, all in the process of suspending a clutch. The behavior of one of these females was monitored during oviposition of an entire clutch on 19 June 1997 beginning at 1100 h. This sequence is described below because it accurately represents the shorter segments of oviposition behavior observed in the other four females.

Two days after injection, the "focal" female was in the process of laying her first egg. She had been isolated in a plastic chamber (30 cm x 15 cm x 12 cm) lined with a moist paper towel and a piece of rotting hemlock log used to simulate a natural nest cavity. Space was available for either suspension or substrate placement of the eggs, and the female was allowed to remain isolated with her eggs for the duration of brooding. The room was kept at 20°C in constant darkness, and observations were made under dim red light.

The female was found on her back under the log in a "sigmoid" posture with her two hind limbs contacting the log and only a portion of her tail and back supporting her body (Fig. 1). That the female was not suspended by her hind legs was suggested from observations on another captive female, whose log was lifted up when she was ovipositing. This female remained on the bottom of the chamber rigidly fixed on her back in the sigmoid position supported by her torso and tail. Had she been suspended by her hind limbs, she should have been displaced when we moved the log. Thus, the hind limbs of the focal female probably stabilized her position under the log while her back and tail push against the substrate to force the vent against the log.

When observations began, the focal female was motionless in a "resting" sigmoid posture with her head on the substrate and her forelimbs extending posteriorly and resting on the ventral surface of her body. A milky viscous substance seeped from her vent, and 3–4 eggs were clearly visible through the abdominal wall. She remained in this position for 10 min and then her body became more tensed, her head was raised off the substrate, and her forelimbs were held rigidly out from her body (Fig. 1). The first egg appeared suddenly at the vent, and in two seconds, the entire egg

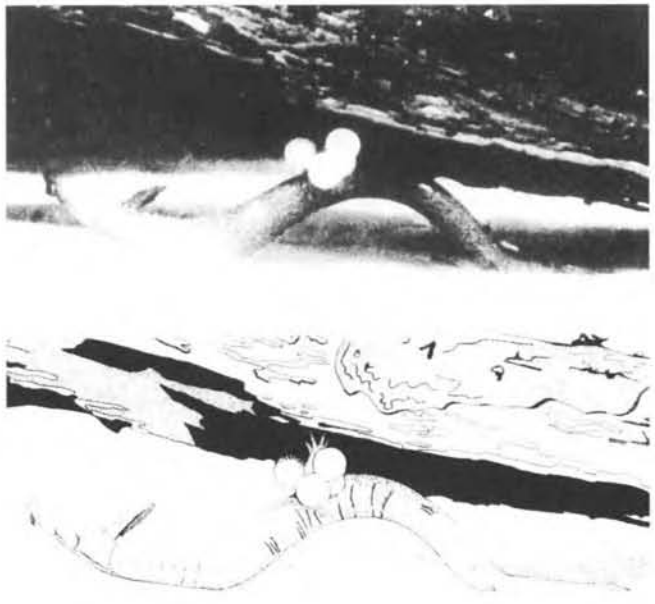


FIG. 1. Photograph and illustration of an ovipositing female *Plethodon cinereus* in an upside-down "sigmoid" position while suspending a clutch in a laboratory chamber. This female took 4.5 h to produce a clutch of 7 eggs and remained in the sigmoid over 6 h.

was deposited and adhered to the underside of the log. The female then returned to the "resting" sigmoid for 12 min until the beginning of the next oviposition sequence.

The remaining 6 eggs in the clutch were deposited in the following, more elaborate manner with about 45 min between eggs (18–65 min range). Each egg appeared only after numerous "contractions" had occurred. With each contraction, the female raised her head off the substrate, extended her forelimbs, and moved her forelimbs up and down either alternately or together for 10–30 sec. Then, she relaxed her head and forelimbs but otherwise remained in the sigmoid posture. An exact number of contractions was recorded for the second egg, which appeared following 13 contractions; there were intervals ranging from 5 sec to 12 min between contractions. It took the female 4.5 h between the appearance of the first and last eggs to complete oviposition of the clutch. Since she probably had initiated contractions before we began observations, and since she remained in the sigmoid posture for 105 min after ovipositing the last egg, the duration of the entire egg-laying process probably lasted for about 6.5 h.

The female righted herself and left the egg mass at 1715 h. At this point, the clutch resembled a suspended mound of eggs with three eggs in direct contact with the log. At 1730 h, the female returned and pushed and rubbed the eggs with her snout and chin, appearing to make contact with all surfaces of each egg in the clutch of 7 eggs. This nudging continued unabated for an hour, gradually became less vigorous over the next hour, and by 2100 h the female was quiescent under the clutch with the dorsal surface of her snout in contact with the clutch. As a result of the thorough nudging, the female rearranged and partially rotated the clutch into a grape-like cluster suspended by a single stalk leaving no eggs in contact with the log.

The eggs were solid whitish masses (no gelatinous outer membrane or layer evident) that adhered and/or were attached to each other. The milky secretion observed initially at the female's vent may form into the strands that are reported to hold the eggs together and merge to form the stalk (Piersol 1910, 1914).

These observations corroborate and extend the descriptions of oviposition for *P. cinereus* by Piersol (1910, 1914). In particular, the sustained upside-down arching posture, the cloacal placement and adherence of eggs on an overlying surface, and the prolonged maintenance of the oviposition posture well after the appearance of the last egg are identical to previous descriptions. The intensity and repetition of the contractions required for oviposition and the formation of the stalk by manipulations of the clutch after oviposition are new observations for caudate amphibians.

The occurrence and complexity of egg suspension implies that suspended eggs have some advantage over those on the substrate. Egg suspension may facilitate female protection of eggs against pathogens, predators or dehydration, which are functions given for egg attendance (Austin 1997; Crump 1995). We have no direct evidence of benefits to suspension, but tailed females in our laboratory studies cannibalized 100% of their non-suspended eggs compared to 50% of their suspended eggs (Wareing 1998). Because some female plethodontids improve egg survivorship by eating dead or dying eggs in their own clutches (e.g., *Desmognathus ochrophaeus*, Forester 1979), our laboratory observations may indicate greater viability in suspended eggs.

Another important implication of egg suspension is that females without tails may be particularly handicapped during oviposition. One handicap would be a reduction in the energy available for suspension and subsequent egg care. Maiorana (1977) reported less frequent reproduction among female *Batrachoseps* without tails, and she attributed this to the loss of stored energy in the tail. A second handicap would be the loss of the propping action of the tail, which our observations indicate would make suspension difficult. Bishop (1941) observed a "bobbed-tailed" *Hemidactylium scutatum* ovipositing, but the relative success of females with and without tails has not been evaluated. Salamanders lose tails in interactions with predators (Arnold 1982; Wake and Dresner 1967) and conspecifics (Jaeger 1981; Mathis 1991), and we speculate that one cost of losing a tail may be compromised egg suspension during oviposition. Clearly, egg suspension needs more critical examination as an important component of caudate reproduction.

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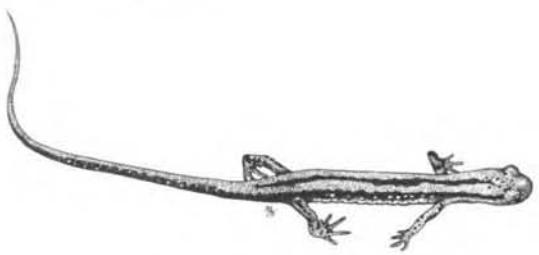
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Eurycea longicauda guttolineata. Illustration by Michael Frick.

Shedding Aggregations of *Crotalus viridis concolor*

KYLE G. ASHTON
Department of E.P.O. Biology, Campus Box 334
University of Colorado, Boulder, Colorado 80309, USA
e-mail: ashtonk@colorado.edu

In the past, it was thought that the social behavior of snakes was limited to fighting and mating (Gillingham 1987). However, observations of aggregations of gravid females (Gillingham 1987; Gregory et al. 1987; Graves and Duvall 1993), females with their developing eggs (Gillingham 1987), neonates (Burghardt 1983), feeding individuals (Gillingham 1987; Gregory et al. 1987), female rattlesnakes with their recently born young (Butler et al. 1995; Duvall et al. 1985; Graves 1988; Greene 1997; Price 1988; Reinert and Zappalorti 1988), and denning aggregations (reviewed by Gregory 1982, 1984) suggest that snakes are more gregarious than previously thought. Gregory et al. (1987) report shedding aggregations in *Crotalus viridis*, but no details of these aggregations are provided. In this paper I describe aggregations associated with shedding by *Crotalus viridis concolor*, the midget faded rattlesnake.

These observations were made in June and July of 1997 and 1998 as part of a larger study on the population biology of *C. v. concolor* that took place from May–October 1997 and May–early July 1998. The study population was located near the east side of Flaming Gorge National Recreation Area, Sweetwater County, Wyoming (USA) at an elevation ca. 2000 m. During 1997 and 1998 each snake was captured at or near the den site and was measured to obtain SVL and mass, sexed via probing and everting the hemipenes (Gregory 1983), and given a unique identification via scale clipping (Brown and Parker 1976). In addition, radiotransmitters were implanted in some snakes. Reproductive status (pregnant vs. non-pregnant) of adult females was ascertained by palpation. Age status (i.e., adult vs. juvenile) was determined based on body size (adult females are at least 44.5 cm SVL, adult males are at least 39.5 cm SVL; unpubl. data from examination of museum specimens). During June to July of 1997 and 1998 I relocated snakes with transmitters daily. In addition, recaptured snakes without transmitters were recorded as they were encountered. At each recapture I noted whether the snake was pre-shed (signified by cloudy, bluish eyes and/or loose skin and a faded pattern), and if it was located within five meters of any other snakes. I also plotted the snake's location on a map of the study site. Distances between snakes were measured with a Roadrunner measuring wheel (accurate to 0.01 m; Keson). Any snake found to be within a five meter radius of any other was considered to be aggregated. If a snake was located with any other, I noted how many comprised the group, as well as the sex and age class (juvenile or adult) of each individual.

The following is an example of an aggregation of pre-shed individuals of *C. v. concolor*. On 13 June 1997 I found five adult *C. v. concolor* coiled within 2 m of each other. All five snakes had loose skin (i.e., the outer layer was loose and soon to be shed) and cloudy eyes, to varying degrees. Four of the five snakes (one adult male, one non-gravid female, and two gravid females) were coiled together in a large mass; the other snake, a gravid female, was 2 m away. These snakes remained together until 19 June 1997. Beginning on this date, individuals began leaving once they had completed shedding. By 8 July 1997 all individuals had completed shedding. Within a day of shedding the non-gravid female and the adult male moved more than 10 m away, whereas the gravid females remained at the same site.

Thirty-five *C. v. concolor* were captured between the beginning of June and the beginning of July in 1997 and 1998. Seventeen of these were found within five meters of other *C. v. concolor* (49%), and of these, 15 were pre-shed (88%). In contrast, 18 *C. v. concolor* were initially located more than five meters away from any other *C. v. concolor*, and of these, only three were pre-shed (17%). There was a significant association between shedding and being found in an aggregation ($\chi^2 = 17.93$, df = 1, $P < 0.001$).

Throughout 1997 and 1998 twenty snakes were captured prior to shedding. Of these snakes, 80% (16/20) were found in aggregations while they shed. Of the 16 shedding snakes that were found in aggregations, 14 were adults. Four individuals that were captured in the process of shedding did not aggregate to shed (i.e., were not found within 5 m of another snake). Of these, two were juveniles, one was a gravid female and one an adult male. It appears that most adults aggregate to shed, whereas juveniles may not (although the sample size of juvenile snakes is low).

Crotalus v. concolor at this site do not appear to hibernate in aggregations. Emergence at this site (Den 1), as well as another site ca. 15 km away (Den 2), took place at roughly the same time each year (mid–late May); however, the spatial distribution of snakes at each site differed. At Den 2 all snakes were found near a communal hibernaculum for 2–3 weeks after emergence. In contrast, snakes at Den 1 were not found together during this same time period. Thus, it seems that *C. v. concolor* at this site hibernate individually or in small groups, then come together to shed during June and July.

Additional evidence suggesting that snakes are not aggregated as a result of their recent emergence is provided by examining the dates that aggregated and non-aggregated snakes were captured. Between June and July, there is no significant difference between the dates when aggregated individuals versus non-aggregated individuals were caught (Mann-Whitney $U = 43.0$; $P = 0.20$). In addition, each aggregated individual (with the exception of gravid females) left its shedding site within a day of ecdysis; this suggests that shedding condition was an important determination of the location of a snake.

Although several shedding aggregations were observed between June and July 1997, only one small aggregation of two shedding snakes was observed in 1998. This aggregation took place on 26 June and occurred at a rock that was used in 1997 as a shedding site by multiple snakes at the same time. The weather was much colder during May and June of 1998 than in 1997. This may have delayed most shedding aggregations for a couple of weeks in 1998; the 1998 field season was cut short in early July and I was unable to verify this possibility.

If these shedding aggregations took place near hibernacula, I would expect that individuals would be found near these shedding sites year after year in the spring because snakes tend to use the same hibernacula each year (Gibbons and Semlitsch 1987; pers. obs. for *C. v. concolor*). However, in 1998, only two snakes were found at one of the 1997 shedding sites and both of these snakes were in the process of shedding. No snakes were found at any other 1997 shedding site from May–July 1998. In addition, no shed skins were found at these sites in 1998. This provides additional evidence that the aggregations are not simply the result of recent emergence of groups of snakes near the hibernaculum.

The aggregations that I have described were not for mating. Mating in this population began the first week of July during 1997 (no observations of mating behavior were made during 1998), which is near the end of the period when snakes were shedding. An adult male *C. v. concolor* did shed after the mating season began, yet he was found at a site where gravid females were gathered, and gravid females in this population have not been observed mating. In addition, shedding aggregations often consisted of multiple males with no females present. Groups with multiple males, non-gravid females,

and gravid females did occur. However, no mating behavior or male-male aggression was observed.

Adult *C. viridis* typically shed once per year, whereas juveniles shed more frequently and possibly less synchronously (e.g., Heyrand and Call 1951; King and Duvall 1990; Klauber 1972; Macartney et al. 1990; Ashton, unpubl. data). In addition, shedding of adult snakes occurs simultaneously during a period of two–four weeks (King and Duvall 1990; this study). However, shedding aggregations have not been previously described for this species (but see Gregory et al. 1987). One possible difference between *C. v. concolor* and other populations of *C. viridis* may be the availability of suitable sites for shedding. Thermal and hydric conditions seem to be very important to shedding snakes (Klauber 1972; Peterson et al. 1993). It is possible that there are fewer sites with adequate environmental conditions for shedding at the Wyoming study site than in other areas that *C. viridis* occupies. Another potential explanation is the decreased movements of *C. v. concolor* relative to other populations of *C. viridis*. While many populations of *C. viridis* migrate long distances each year, (Cobb 1994; Duvall et al. 1985; King and Duvall 1990; Macartney et al. 1988), *C. v. concolor* moves significantly less and does not migrate seasonally (Ashton, unpubl. data). In short, the decreased movements of adult *C. v. concolor*, coupled with a limited availability of sites with appropriate hydric and/or thermal conditions for shedding, may explain why shedding aggregations are observed in this population but not other populations of *C. viridis*.

Pre-shed *C. v. concolor* also may be actively choosing to aggregate with other individuals, possibly by following chemical trails of other pre-shed snakes (Gregory et al. 1987). It has been shown that aggregation reduces heat loss (Aleksiuk 1977; Graves and Duvall 1987; Myres and Eells 1968), and may decrease water loss (Duvall et al. 1985; Thomas 1965). Aggregating to decrease water loss may be especially important for snakes that are shedding because of the increased water loss associated with this process (Klauber 1972). Snakes also may be vulnerable to potential predators during shedding because of impaired function of the sensory system; they therefore may aggregate for increased protection from predators (Alcock 1993; Gregory et al. 1987). Thus, aggregations of shedding snakes may be actively sought out for the benefits of decreased water loss, heat loss, or increased protection from predators.

In conclusion, *C. v. concolor* formed shedding aggregations in June and July of 1997 and 1998. Shedding aggregations did not occur at communal hibernacula and mating behavior was not observed in these aggregations. These aggregations consisted mainly of adult snakes, which may be because of synchronous shedding of adults in this population. Other factors that may be important to the formation of shedding aggregations are decreased seasonal movements of *C. v. concolor* and the availability of sites with suitable environmental conditions for shedding. In addition, pre-shed snakes may be actively choosing to aggregate to decrease heat loss, water loss or predation while they shed.

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The Visibility Hypothesis: An Explanation for the Correlation Between Habitat and Defensive Display in Snakes

PHIL SENTER
Department of Biological Sciences, Northern Illinois University
DeKalb, Illinois 60115, USA
e-mail: beccafaye@worldnet.att.net

Greene (1979) classified the defensive displays of snakes into three major categories—tail displays, horizontal head displays, and vertical head displays—and found that defensive displays in snakes are correlated with habitat. Tail displays, in which the tail's posture shifts such that the tail becomes more prominent, are typical of fossorial or terrestrial species. Horizontal head displays, in which the anterior part of the snake's body is flattened dorsoventrally, are typical of terrestrial species. Vertical head displays, in which the anterior part of the snake's body is dorsoventrally expanded, are typical of arboreal species (Greene 1979).

Within major snake taxa, defensive display appears to correlate better with habitat than with phylogeny (Greene 1979). The case of *Telescopus* illustrates this well. *Telescopus* spp. are terrestrial, employ horizontal head displays, and do not employ vertical head displays (Werner 1983). However, Cadle (1994) found that the successive outgroups to *Telescopus* among African colubrines are *Dasypeltis*, *Thrasops-Thelotornis-Dispholidus*, and *Philothamnus* (Fig. 1). These outgroups are composed of arboreal species which employ vertical head displays (Gans and Richmond 1957; Pitman 1974; Marais 1992). Apparently, both arboreality and employment of vertical head displays are primitive to the clade, and *Telescopus* has changed its defense display to match its change in habitat.

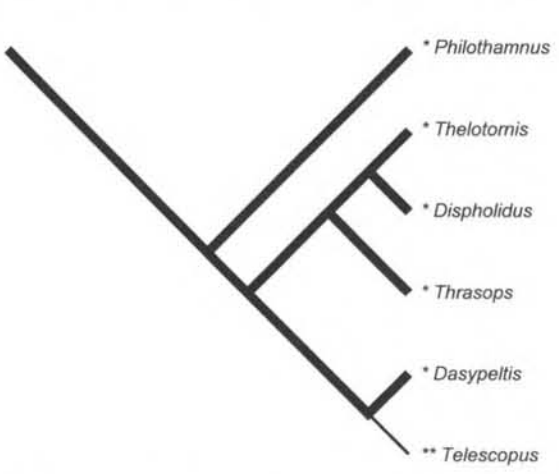


FIG. 1. Cladogram of African colubrines, modified from Cadle (1994). Bold line indicates arboreality, and thin line indicates terrestriality. Asterisk indicates vertical head display, and double asterisk indicates horizontal head display.

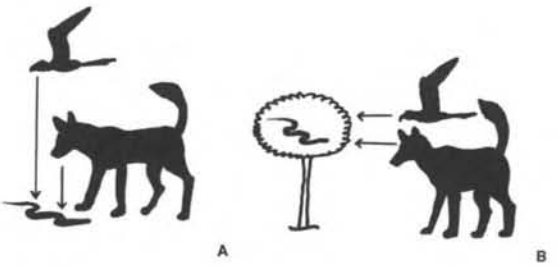


FIG. 2. The position of a snake influences the view obtained by an approaching predator. (a) A predator approaching a snake on the ground is more likely to obtain a dorsal view than a lateral view of the snake. (b) A predator approaching a snake on a branch is more likely to obtain a lateral view than a dorsal view.

As such, there is probably a selective advantage in employing a given defensive display only in the corresponding habitat. Greene (1979) did not hypothesize a specific advantage. I suggest that the advantage is related to the line of vision of approaching predators. Horizontal expansion maximizes the area of the snake in dorsal view, and is therefore most visible to a predator approaching from above. This is more likely to occur if a snake is on the ground than if the snake is above the ground, and is therefore more advantageous for a terrestrial snake than for an arboreal snake (Fig. 2a). Vertical expansion maximizes the area of the snake in lateral view, and is therefore most visible to a predator approaching from the side. This is more likely to occur if the snake is above the ground than if the snake is on the ground, and is therefore more advantageous for an arboreal snake than for a terrestrial snake (Fig. 2b). A tail raised by a snake in a tree may be hidden by leaves, whereas a tail raised by a snake on the ground will likely rise above ground litter. A tail display, then, will be more effective for a ground-based snake than for an arboreal snake.

The partitioning of defensive displays according to habitat among snakes is therefore probably not accidental. The partitioning appears to be related to the visibility of each display in each habitat. Unless future experiments refute this idea, the visibility hypothesis is a reasonable explanation for the correlation between habitat and defensive display in snakes.

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Shell Disease in Turtles in the Rappahannock River, Virginia

CARL H. ERNST
THOMAS S. B. AKRE
JAMES C. WILGENBUSCH
THOMAS P. WILSON
Department of Biology, George Mason University
Fairfax, Virginia 22030, USA
e-mail (CHE): cernst@gmu.edu

and
KENNETH MILLS
150 Sanford
Falmouth, Virginia 22405, USA

There is rising concern about increased incidences of environmentally induced abnormal conditions and disease among turtle populations in the United States and Canada (Ernst 1995, 1997; Murphy and Collins 1983). Some problems may be related to an increase in environmental pollutants, which have been discovered in various populations of snapping turtles (*Chelydra serpentina*). These are the presence of chemical toxicants (PCBs, dioxins, furans, heavy metals, and pesticides) in turtle eggs, fat, liver, and other tissues (see discussion and lists of literature in Ernst 1995, 1997).

These pollutants were found through chemical testing, but other abnormal conditions in turtles have become visibly apparent. Fibropapilloma disease of marine turtles is occurring in alarming frequency in the form of unsightly tumors caused by a herpes-like virus that eventually leads to death of the turtle (Herbst 1994). Necrotic, spreading, bacteria-caused skin lesions have attacked pen-reared hatchling sea turtles (Wiles and Rand 1987; Witham 1973), and other captive turtles (Elkan and Reichenbach-Klinke 1974; Frye 1981; Kaplan 1957). A disease that results in emaciation and lesions on the plastron is suspected to be a cause of major population declines of the flattened musk turtle (*Sternotherus depressus*) in Alabama (Dodd 1988). Diseased shells have also been observed in wild desert tortoises (*Gopherus agassizii*) in southern California (Jacobson et al. 1994), and upper respiratory disease is a problem in some desert tortoise populations (Jacobson et al. 1991, 1995). More recently an apparent bacteria-caused shellrot disease was discovered in river cooters (*Pseudemys concinna*) and sliders (*Trachemys scripta*) from Georgia (Garner et al. 1997; Herrington and Herrington 1994; Lovich et al. 1996).

During the late winter and spring of 1993, several damaged turtles were collected from the Rappahannock River by Mills near his property at Falmouth, Stafford County, Virginia, USA. These turtles exhibited various stages of unnatural shell erosion. Mills continued to collect diseased turtles in the Rappahannock River until 1995. From 1993 to 1995 he recorded abnormal conditions in 14 turtles of six species: five painted turtles (*Chrysemys picta*), four redbellied turtles (*Pseudemys rubriventris*), three snapping turtles (*Chelydra serpentina*), one river cooter (*Pseudemys concinna*), and one stinkpot (*Sternotherus odoratus*).

In 1995 Mills brought diseased *C. picta* to Ernst for evaluation. Damage to the turtles seemed severe enough to warrant an attempt to determine the prevalence of the infection. This paper presents a preliminary study to determine the geographical area affected, the turtle species involved, and the extent of damage to the turtle population. The study area is the Rappahannock River from the I-95 Bridge Crossing at Fredricksburg, Virginia upstream to Raccoon Ford on Rt. 611 on the tributary Rapidan River.

Four sites along the Rappahannock River in Stafford County, Virginia, were sampled from July through early October, 1996. Site 1 was on the Woodland property, which lies on the north bank approximately 6 mi upstream from Fredericksburg and less than 0. 5 mi west of the Mills property (USGS Salem Quad.). Site 2 was upstream of Fredericksburg, near the I-95 bridge on the north bank. Site 3 was at England Run, approximately 1 mi west of Site 1. Site 4 was at the confluence of the Rappahannock River with its tributary, the Rapidan.

Most turtles were caught in hoop-net traps baited with fresh fish or canned sardines. *Pseudemys rubriventris* and *P. concinna* were captured by hand or with a dip net. Unfortunately, the summer of 1996 was one of wettest in the history of the Commonwealth of Virginia making field collection difficult at best. Several periods of heavy rain in July and August raised the river level to a depth in which trapping or other methods of collecting could not be conducted. Additionally, two hurricanes caused extensive long-term flooding on the river. Associated turbidity also prohibited hand capture. These setbacks resulted in a low number of captured turtles.

All captured turtles were identified to species, sexed, aged (when possible), weighed, and measured (carapace length, plastron length, abdominal scute length, second pleural scute length). Presence or absence of shell or skin damage was noted, and, if damage was present the turtle and its injury were photographed, and the extent of damage was quantified. Position of ectoparasites or algal colonies on the shell were also noted, because these may be contributing factors to shell damage. Undamaged turtles were marked for future identification using a series of code notches filed in the marginal scutes (Ernst et al. 1974) and released at the capture site.

Damaged turtles were brought to George Mason University (GMU) for further examination, and two severely diseased *Chelydra serpentina* and a *Pseudemys rubriventris* were dissected. Organ and tissue samples from the *P. rubriventris* were taken to Dr. John C. Harshbarger, at the Registry of Tumors in Lower Animals, George Washington University Medical Center, Washington, D.C., for tumor studies (see Lovich et al. 1996). The spleen had minute lesions scattered over its surface; the lung showed signs of pneumonia; septicemia and chronic inflammation were present within the spleen, liver, and digestive tract; and bacteria were found in blood within the heart. Harshbarger attributed some of the damage to vascular or intestinal helminths, but thought it strongly possible that microbes were involved (unfortunately, his laboratory does not identify microbes, and further identification of microbes will need to be conducted elsewhere).

Because of low sample size, data were tested only with a univariate probability test of binomial distribution (Conover 1980) with alpha set at 0.05. Data were tested against an expected 2% disease rate (Ernst, pers. obs., Pennsylvania; see below).

Twenty-eight individuals of five turtle species were collected in 1996. Of these, 14 (binomial test, $p < 0.005$) exhibited some form of damage: 10 *Chrysemys picta*, 4 damaged (40%); 8 *Chelydra serpentina*, 3 damaged (37.5%); 5 *Pseudemys rubriventris*, 100% damaged; 2 *Sternotherus odoratus*, 1 damaged (50%); 2 *Trachemys scripta*, 1 damaged (50%); and 1 undamaged *Pseudemys concinna*. Mills had previously found 14 damaged turtles from 1993 to 1996 (5 *C. picta*, 3 *C. serpentina*, 4 *P. rubriventris*, 1 *S. odoratus*, and 1 *P. concinna*). Between the two collections, 28 turtles had either visible shell or skin damage: 9 *P. rubriventris*, 9 *C. picta*, 6 *C. serpentina*, 2 *S. odoratus*, 1 *T. scripta,* and 1 *P. concinna.* Damage consisted of lesions on the skin of the head or limb sockets and lesions and eroded patches on the carapace or plastron. Grayish-white and pinkish skin sores resembled leprosy-like lesions described in Frye (1981), but some of the more reddish eroded patches on the shell more closely resembled multifocal petechial hemmorrahages (often caused by protozoans), also described by

Frye (1981). The skin lesions resembled those described from desert tortoises (*Gopherus agassizii*) by Jacobson et al. (1994). Kaplan (1957) reported the bacterial condition septicemic cutaneous ulcerative disease in turtles, which caused skin ulceration, lethargy, anorexia, filmed eyes, and general paralysis, and was extremely contagious and fatal in a captive colony. Description of the skin ulcers matched the ulcers found in Rappahannock turtles.

Based on combined data for all species captured, 20 of 31 adult turtles (64.5%) and 2 of 9 juveniles (22.2%) were damaged (the low incidence in juveniles may be misleading as some may have been too small to be captured in the nets used). Among sexed adults, 13 of 16 females (81.3%) were damaged, while 3 of 6 males (50%) showed abnormalities.

Of the four sites sampled (Table 1), damage was found in 55.5% (10 of 18) of the turtles at Site 2 (I-95), 50.0% (10 of 20) of those at Site 1 (Mills property, Falmouth), and in 100% (2 of 2) of the individuals caught at Site 4 (confluence of Rappahannock and Rapidan Rivers). Neither of the two turtles captured at Site 3 (England Run) showed damage. Although most damage seems to be in turtles at the two downstream collecting sites, this may be misleading since more effort to collect turtles occurred there than at the two upstream sites, preventing a statistical comparison of sites.

A total of 29 trap-days x 24 hours x 6 traps, or 2448 total trap hours were spent attempting to collect turtles during the study. An additional eight days were spent by GMU personnel and four more days by Mills attempting other means of turtle capture, for a total of 46 days in the field. The rate of turtle capture was exceedingly low, only 0.61 turtles per field day (0.96 per trap day), and only 0.6 turtles were observed basking per field day. During the course of the study GMU students saw only 12 turtles basking, and Mills another 20 in four days.

Both data sets indicate that a serious problem exists in the Rappahannock River. Usually, diseased individuals, or individuals showing the types of damage seen in this study, are rare in turtle populations (less than 2% of about 7000 individuals of six turtle species studied in Lancaster County, Pennsylvania, by Ernst from 1965 to 1988).

Also the diversity of species involved is high; six of six species in three families. Included are not only basking turtles (*Chrysemys*, *Pseudemys*, *Trachemys*), but also bottom dwellers that infrequently bask (*Chelydra*, *Sternotherus*). During a similar study on the Flint River, Georgia, only basking turtles were found with shell erosion (Lovich et al. 1996). The damage to Rappahannock River turtles does not resemble that of the Georgia turtles and is not as severe. That *Pseudemys rubriventris*, a strict herbivore as an adult (Ernst et al. 1994), showed a 100% incidence of damage during this study may indicate an ecological correlation. It is possible that damaged tissues on the turtles are the result of secondary bacterial or protozoan infection(s) after initial chemical pollutant damage to skin and shell scutes. From studies elsewhere, it seems that increases in some pollutants (or introduction of a new pollutant) initiates damage to turtles, which then allows viruses, bacteria, protozoa, or fungi to invade, causing greater damage and even death of the individual. Environmental factors, such as increases in ultraviolet radiation, may cause damage, especially in basking species, as found in recent studies on declining amphibian species.

As the data stand after the 1996 study, due to small sample size, all that can be accurately inferred is that the damage is widespread among turtles in the Rappahannock River (6 of 6 species collected), it is of high incidence (about 50% of individuals), and it extends along the river from Falmouth/Fredericksburg upstream to the confluence of the Rappahannock and Rapidan Rivers.

A serious health problem exists among the turtle species in the Rappahannock River. If a higher than normal incidence of disease exists in the turtles in the Rappahannock River, it may be an indication of a much more widespread problem that probably is affecting other species as well.

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TECHNIQUES

A Cost-Effective Method for Locating Herpetofaunal Field Sites from the Air

JOHN E. FAUTH
Department of Biology, College/University of Charleston
Charleston, South Carolina 29424-0001, USA
e-mail: fauthj@cofc.edu

WILLIAM J. RESETARITS, JR.*
Illinois Natural History Survey, 607 East Peabody Drive
Champaign, Illinois 61820-6242, USA

and

ERIN M. LEVESQUE
Graduate Program in Marine Biology, University of Charleston
205 Ft. Johnson Road, Charleston, South Carolina 29412-9110, USA

**Current address: Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266, USA*

Aerial surveys often are used to find and enumerate wildlife, particularly large or conspicuous species such as waterfowl, marine mammals, and terrestrial megavertebrates (Caughley 1977; Eggeman et al. 1997; Mattson 1997; Pojar et al. 1995; Yoshida et al. 1998). Few studies of amphibians and reptiles have employed aerial surveys (e.g., Rhodes and Wilkinson 1994; Shoop et al. 1982) because most species are small, secretive, and difficult to spot from aircraft. In addition, studies of amphibians and reptiles historically have received limited funding (Gibbons 1988), making aerial surveys too expensive for most researchers. However, concern about a potential global decline in amphibian populations (Blaustein and Wake 1990) and increasing use of herpetofauna in environmental assessment (e.g., Beiswenger 1988; Bonin et al. 1997) has heightened interest in these taxa. Many large-scale surveys of amphibians and reptiles have been published (e.g., Bradford 1989; Drost and Fellers 1996; Hecnar and M'Closkey 1996; Spillers and Speake 1988) or are underway. Aerial surveys can be useful for biologists searching for amphibian and reptile habitat. Here we describe an economical method to locate amphibian breeding ponds from a helicopter. Our technique could be used for other small-scale amphibian and reptile habitat, such as alligator nests, rattlesnake dens, gopher tortoise borrows, and talus slopes harboring salamanders.

As part of an ongoing wetland research project, we had to locate 31 wildlife ponds (approx. 19 x 4 x 1.25 m deep) scattered in nine groups within the 100,000 ha (250,000 acre) Francis Marion National Forest (FMNF), Charleston and Berkeley Counties, South Carolina, USA. The wildlife ponds were excavated with a bulldozer in June 1982 and June 1983, but had not been studied since their creation. We were given approximate pond locations on FMNF compartment maps, standard U.S. Geological Survey (USGS) topographic maps revised to show tree stands. Pond locations were not marked on the ground by paint blazes on trees or permanent markers, and the ponds were too small to appear on National Aerial Photography Program (NAPP, USGS) color infrared photographs taken from aircraft flying at 6100 m.

Standard methods for locating the ponds were inefficient. Ground searches conducted December–January were hampered by dense pocosins (shrub bogs), which an early settler accurately described as "being very wet and low lands and so full of Cane and Underwood, that there is no passing through them, many of which are several miles in length" (Wells 1932). Undergrowth regenerating after Hurricane Hugo in 1989 and a subsequent moratorium on prescribed burning made ground searches very difficult. The heavy vegetation concealed most ponds until we came within a few meters of them; we almost fell into several before realizing they were underfoot. After a month of ground searches, including one that deployed 22 students in an intense but unsuccessful search for a pond just 245 m from a major road, we had located just thirteen ponds (42%).

We explored the use of alternative aerial techniques to locate the ponds. We contracted a local helicopter service with experience operating over the FMNF to do low-level reconnaissance. Usually, they use a very labor and time-intensive method: after spotting the desired location from the air, the helicopter hovers and directs a ground crew to the site using two-way radios. In more open terrain, Cyalume Lightsticks™ (Omniglow Corporation, Novato, California, USA) are dropped in a line between the ground crew and their target. Both methods require coordinating ground crews with the helicopter pilot and spotters, and use considerable helicopter time, which costs US $600/h in our area. We knew from prior experience that it could take ground personnel over an hour to traverse 300 m through the dense vegetation, making this method far too helicopter-intensive. We needed a more cost-effective technique.

As a solution to these problems, we chose a dual strategy of using the helicopter's global positioning system (GPS) to record each pond's position, and then dropping an emergency strobe nearby to broadcast its exact location. The strobe manufacturer (Nordic Technologies, Salt Lake City, Utah, USA) stated that the light could be seen for 5 km under unobstructed viewing conditions and would initially flash 50–70 times/min, with the rate steadily declining until the "D" cell expired after 72 h. We attached the emergency strobes to homemade, 56 cm (22") square parachutes made of bright red nylon fabric. We tied bright pink nylon cords (56 cm long) to the fabric with overhand knots, and to the strobe attachment pin with two half hitches. This knot was further secured with red duct tape. The result was an inexpensive (total cost approx. US $20), highly visible unit that survived a 13 m test drop and was neutrally buoyant with the battery installed. We expected that the weak overhand knots securing the cords eventually would come loose from the parachute material, allowing us to retrieve strobes caught in trees. We planned to find the ponds at night using headlamps, a compass and hand-held GPS (GARMIN GPS 45XL Personal Navigator™, GARMIN Corporation, Olathe, Kansas, USA), homing in whenever possible on the flashing strobe. We then would mark a trail with vinyl flagging to allow easy return. We notified the local sheriff and air traffic controllers of our plans, so they would not waste time responding to reports of rescue beacons flashing in the FMNF.

We used our method on two occasions. Each time, we flew parallel search lines 5–60 m above the trees in a Bell Jetranger BIII helicopter with its doors removed. We used laminated aerial photographs (NAPP 1991 or 1994) to navigate; aerial survey targets placed at known road junctions served as ground reference points. Aerial searches initially were centered on the ponds' mapped locations but we expanded the search radius when necessary. Both the pilot and two observers searched for ponds. Even with the entire region heavily flooded and pond margins supporting natural growth of pocosin shrubs, we recognized the distinctive rectangular shape of the manufactured ponds and the small dirt mounds pushed up by the bulldozer, which were now covered by dense young pine trees. When a pond was located, we hovered, recorded its coordinates from the helicopter's GPS (Apollo Model 360), and tossed out a strobe. We noted the strobe's landing position (in the water, on the ground, or in a shrub or tree) and recorded the compass bearing and approximate distance from the beacon to the pond. If we failed to find a pond after 2–3 overlapping searches, we quit and flew to the next site.

We returned to the FMNF at night, scanning each area for flashing strobes. We saw about one-half of the strobes from roads, and simply hiked to the beacon, using a compass to maintain a straight course when the flashing light was obscured by vegetation. We used our handheld GPS and the coordinates provided by the helicopter's unit to navigate to the remainder. We often lost the GPS signal when overhead satellite coverage was poor; at other times, dense thickets blocked satellites from view. We overcame these problems by using the initial GPS waypoint bearing (the compass direction from our access point to the pond, taken from the helicopter's GPS), and navigating with a compass. This proved highly accurate, usually bringing us within 50 m of the pond. By then we usually could see the strobe, even if it was on the ground or was emitting a weak light after several days of operation. From the strobe we followed the compass bearing (recorded while in the helicopter) to the pond. Without the strobe, we would have been forced to search > 31,416 m^2 of terrain, because the GPS signal became unreliable at distances below about 100 m. In more open forest compartments, daylight searches quickly found the bright red parachute.

We made only two adjustments to our technique between flights. The first was using a commercial aerial survey target (Forestry Suppliers, Inc., Jackson, Mississippi, USA; US $17) instead of yellow vinyl flagging to mark ground locations. The black and white commercial target proved much easier to spot while flying search lines. The second adjustment was pitching the parachute and strobe directly into the tallest nearby tree, instead of allowing it to freefall. This modification ensured the beacon was seen from afar, instead of sometimes landing in low-lying shrubs.

Our methods proved highly successful. We located 14 of the 18 missing ponds (78%) in two flights totaling 3.75 h. Several ponds located by aerial search were far from their mapped locations (> 340 m), as determined later using more sophisticated GPS units with submeter accuracy (Sokkia GIR1000, Sokkia Corporation, Overland Park, Kansas, USA). These ponds would have been virtually impossible to find with a ground search. In addition, the aerial survey indirectly helped locate three additional ponds. We discovered one while orienteering to a beacon, and two more using the USFS compartment maps with some ponds now precisely plotted using GPS coordinates. From the spatial pattern on the maps, we deduced that one pond was located beyond our aerial search radius, and another had been misplotted on the FMNF map (i.e., four ponds that formed a backwards "L" pattern actually had their long axis running east-west instead of north-south). Thus, in just six days we found 17 of the 18 (94%) missing ponds. To date, we also have recovered > 50% of our strobes.

Our aerial search technique proved successful under adverse spotting conditions, including a dense shrub layer in a forest regenerating from a major hurricane, severe local flooding, and dangerously gusting winds that forced one pilot to end a search. Despite these hindrances, the helicopter enabled us to find more ponds in a few hours than we located in a month of ground searches. The cost of finding a pond was about 25% lower using our aerial search technique than reconnoitering on foot (approx. US $220 versus $300/pond), and far less frustrating. Helicopter time is less expensive (US $100–200/h) in regions served by multiple companies, making aerial surveys elsewhere likely to be more economical than our study suggests. Using both GPS coordinates and the flashing strobes ensures the method will work, even in dense forest or mountains. In hospitable terrain, it will be easy to locate, mark, and access amphibian and reptile habitat, making helicopter surveys a rapid and cost-effective method for many herpetological studies.

Acknowledgments.—We thank HeliEast Inc. Charter & Aerial Productions, and especially pilots Scott Newsome and Scott Yackel, for their assistance conducting this survey and returning three herpetologists safely back to *terra firma*. We also thank the staff of the Francis Marion National Forest, particularly District Ranger Glen Stapleton and Wildlife Biologists Danny Carlson and Craig Watson, for aiding our studies. This research was supported by EPA Grant R825795, NSF Grant DUE 9851239 and DEB 9727039, and Challenge Grant 97-231 from the National Fish & Wildlife Foundation. The University of Illinois, the Illinois Natural History Survey, the E. J. Westfeldt-Bunting Foundation, and the Gaylord and Dorothy Donnelly Foundation provided challenge funds. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government.

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Genetic Tools for Forensic Identification of Snapping Turtle (*Macroclemys temminckii* and *Chelydra serpentina*) Products in Commercial Trade

JOSEPH ROMAN*
Department of Wildlife Ecology and Conservation, University of Florida, 303 Newins-Ziegler Hall, Gainesville, Florida 32611, USA

DEETTE WALKER
Department of Genetics, University of Georgia, Athens, Georgia 30602, USA
e-mail: walker@arches.uga.edu

and

BRIAN W. BOWEN
Department of Fisheries and Aquatic Sciences, University of Florida Gainesville, Florida 32606, USA
e-mail: bowen@gnv.ifas.ufl.edu

**Present address:*
Department of Organismic and Evolutionary Biology, Harvard University, 16 Divinity Avenue, Cambridge, Massachusetts 02138, USA
e-mail: jroman@oeb.harvard.edu

The alligator snapping turtle (*Macroclemys temminckii*) is found along Gulf of Mexico drainages of the southeastern United States from Texas through Florida. In recent decades, population numbers have declined throughout the turtle's range as a result of habitat alteration and unregulated harvesting for meat and related products (Pritchard 1979, 1989). In response to this decline, commercial harvest is prohibited in every state where *M. temminckii* occurs, except Louisiana.

Because the common snapping turtle (*Chelydra serpentina*) is still relatively abundant and not subject to strong harvest regulations, meat from illegally harvested alligator snapping turtles may be sold as common snapper. In order to enforce restrictions on the harvest and sale of alligator snapping turtle meat, wildlife managers must be able to identify *M. temminckii* products quickly and with a high degree of confidence. One traditional way to identify meat products is through monoclonal antibodies designed for each candidate species. However, these antibodies are expensive to develop and maintain, and have limited utility with cooked or prepared meat products. An emerging alternative is to use genetic markers identified with polymerase chain reaction (PCR) methodology (Baker et al. 1996; Encalada et al. 1994; Guglich et al. 1994). These markers can be applied to very small tissue samples, dried skin, partially degraded meat, and some cooked products.

At the request of the Florida Game and Fresh Water Fish Commission, we developed a simple genetic test to differentiate meat and by-products of *M. temminckii* from those of *C. serpentina*. This assay is quick, relatively inexpensive, and may provide results of sufficient quality to be considered evidence in a court of law.

We extracted DNA with standard phenol-chloroform procedures and resuspended the isolations in 0.5 ml TE buffer (Hillis et al. 1996). Primers employed by Lamb et al. (1994) were modified to amplify products from a portion of the $tRNA^{PRO}$ gene and adjoining 5' end of the mtDNA control region in chelydrids (5' TCT TCC TAG AAT AAT CAA AAG 3' in the $tRNA^{PRO}$ gene; 5' ATG ACC CTG AAG AAA GAA CCA 3' in the central control region). We performed PCR reactions (50 µL) with a Biometra Personal Cycler under the following conditions: 5 µL 10x buffer, 3 mM $MgCl_2$, 0.5 mM dNTPs, 1 µM each primer, 0.5–1 unit *Taq* DNA polymerase, and 2 µL of the DNA extractions. Amplifications (35 cycles: 1 min 94°C, 1 min 50°C, 2 min 72°C) were purified with Ultrafree-MC 30,000 filters (Millipore).

The search for an appropriate restriction-site marker was based on published mtDNA control-region sequences of the two turtle species (N = 158 for *M. temminckii*, Roman et al. 1999; N = 66 for *C. serpentina*, Walker et al. 1998). The common snapping turtle had very low mtDNA diversity, whereas *M. temminckii* had considerable interdrainage variation. Nonetheless, the high divergence between the two species (d = 0.1027–0.1253) allowed for ready identification of diagnostic restriction sites using Sequencher 3.0 software (Gene Codes Corporation). We employed three enzymes for the restriction endonuclease assays: *Mbo*I, *Bsp 1286* I, and *Hpa*II (New England BioLabs). Five µL of PCR product was digested for 90 min at 37°C, with 7.5 units of enzyme in 1.0 µL of 10x buffer and 3.25 µL H_2O. Digestion products were separated and visualized on 2% agarose gels, using ethidium bromide staining and UV illumination.

Each of the three enzymes proved diagnostic in distinguishing the two chelydrid species (Fig. 1). An unanticipated benefit was that one of the three enzymes, *Hpa*II, differentiated *M. temminckii* samples in western drainages from those of eastern drainages (Fig. 1; see also Roman et al. 1999). The 220 bp and 190 bp fragments observed in western samples (Louisiana, Alabama, and Pensacola Bay drainages, N = 25) contrasted with a 410 bp fragment found in samples from the Choctawhatchee, Econfina, Apalachicola, and other eastern drainages (N = 16).

Independent analyses confirmed that the genetic assay is easy to use, reliable, and robust. A survey of 30 *C. serpentina* was conducted at the University of Georgia by DW to confirm restriction-site patterns for enzyme *Hpa*II. The restriction profiles for enzymes *Mbo*I and *Bsp 1286* I were confirmed at the University of Florida with *C. serpentina* (N = 8) and *M. temminckii* (N = 10) from throughout its range. In each instance, the enzymes produced the predicted fragment pattern.

In cases where suspected illicit products are found (such as the *M. temminckii* profiles in Fig. 2), it may be desirable to corroborate these results through direct sequencing (Roman and Bowen 1999). These sequences can be compared to control-region haplotypes of *C. serpentina* and the western, central, and eastern lineages of *M. temminckii* posted on GenBank (accession numbers AF029986 and AF056522-AF056524). The drainage-specific haplotypes of the

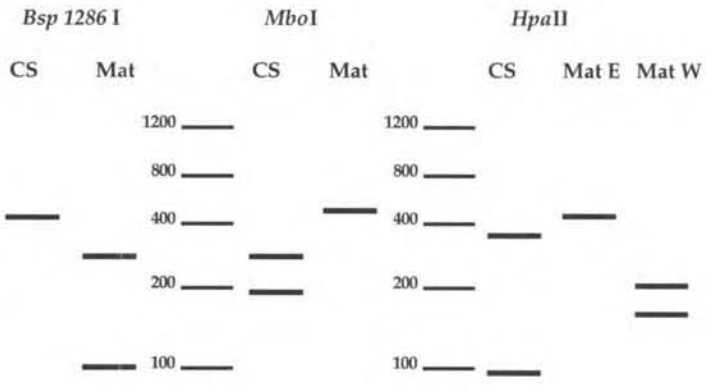


FIG. 1. Schematic representation of *Bsp 1286* I, *Mbo*I, and *Hpa*II digests of the 424 bp control-region fragment in *C. serpentina* (CS) and *M. temminckii* (Mat). *Bsp 1286* I cuts *M. temminckii* but not *C. serpentina*; *Mbo*I cuts *C. serpentina* but not *M. temminckii*. Note the 220 bp and 190 bp fragments on the extreme right lane of *Hpa*II. These fragments distinguish western *M. temminckii* samples (of the Pensacola Bay drainage westward) from eastern and *C. serpentina* samples. The third and sixth lanes represent molecular weight standards.

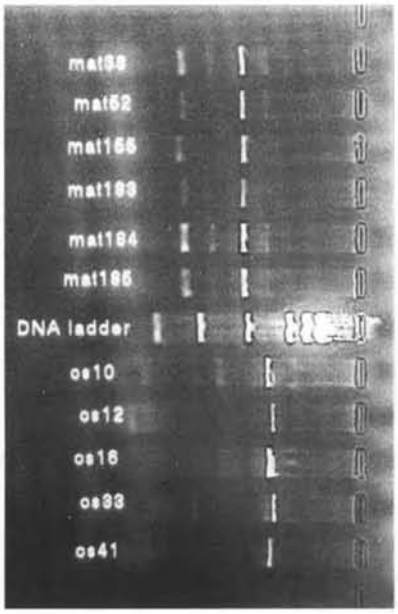


FIG. 2. mtDNA digestion profile of *Mbo*I. Restriction fragments were separated on 2% agarose gels and visualized by ethidium bromide staining and UV illumination. In states where commercial trade in alligator snapping turtle products is prohibited, profiles matching the first six lanes would indicate an illegally harvested turtle. Lane 7 is a molecular weight standard (Low DNA Mass Ladder, Gibco BRL) with fragment sizes as indicated in Fig. 1.

alligator snapping turtle may assist wildlife managers and enforcement agencies in identifying region of origin of confiscated material (Roman et al. 1999).

With the growing genetic database available on the Internet, additional turtle species can be readily distinguished using sequencing data. Samples that do not amplify with our control-region primers can be sequenced with cytochrome *b* primers and compared to more than 30 species of turtle currently posted on GenBank. The broad range of taxa available to wildlife forensic scientists will be useful for litigation and surveying the marketplace, even in the absence of suspicious circumstances. The susceptibility of many turtle species to unsustainable commercial harvests makes such surveys of eminent concern.

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HERPETOLOGICAL HUSBANDRY

An Investigation of Obligate Oophagy of *Dendrobates pumilio* Tadpoles

JENNIFER B. PRAMUK
Natural History Museum and Biodiversity Research Center
Department of Ecology and Evolutionary Biology
The University of Kansas, Lawrence, Kansas 66045-2454, USA
e-mail: pramuk@eagle.cc.ukans.edu

and

B. IAN HILER
The Audubon Institute, Aquarium of the Americas
#1 Canal Street, New Orleans, Louisiana 70130, USA

Weygoldt (1980) first described the extensive parental care of *Dendrobates pumilio* in a study of captive frogs. Since then, *D. pumilio* tadpoles have been described as obligate egg-eaters because of their reduced mouthparts and behavioral observations made in the laboratory and the field (Brust 1993; Myers and Daly 1983; Weygoldt 1984). The obligatory oophagy of these tadpoles is shared by several unrelated lineages of anurans (e.g., the hylids *Anotheca spinosa*, *Osteocephalus oophagus*, and *Osteopilus brunneus*, and the microhylid *Hoplophryne rogersi*) (Jungfer 1996; Jungfer and Schiesari 1995; Lannoo et al. 1987; Noble 1929, respectively).

Dendrobates pumilio, a small, diurnal dendrobatid, ranges from northern Nicaragua through Costa Rica to western Panama. Many aspects of the reproduction and parental care of this species have been studied extensively (Brust 1993; Donnelly 1989a,b; Limerick 1980; Myers and Daly 1983; Weygoldt 1984). Reproduction in *D. pumilio* involves deposition of eggs in leaf litter. Males guard the eggs for about seven days, after which females return to the oviposition site to carry the tadpoles to a phytotelm (water-filled leaf axil). At La Selva Biological Station, Costa Rica, the preferred plants for tadpole deposition are *Dieffenbachia* sp. (Araceae) and bromeliads (Bromeliaceae) (pers. obs.). Females deposit only one tadpole per leaf axil. The females visit each tadpole every 1.6–4.2 days to deposit from one to five unfertilized eggs for a period of six to eight weeks until metamorphosis is completed (Brust 1993).

Female *Dendrobates pumilio* rear tadpoles in leaf axils that are relatively small spaces. In this small area, shared by many organisms for rearing larvae (e.g., mosquitoes and chironomid flies), arboreal tadpoles potentially may benefit from eating young predaceous insect larvae, thereby preventing the development of future predators (Caldwell 1993).

This study addressed whether *Dendrobates pumilio* tadpoles consume items other than conspecific eggs. The first part of the study was performed in a field laboratory where we tested the ability of wild-caught tadpoles to eat insect larvae commonly found in their microhabitats. The second part involved F_1 generation captive offspring of *D. pumilio* and tested the ability of the tadpoles to consume alternate food items. Because herpetoculturists have had success raising *Dendrobates histrionicus* and *D. lehmanni* tadpoles on chicken egg yolk (Zimmermann and Zimmermann 1980), captive *D. pumilio* tadpoles were offered raw chicken egg yolk and the eggs of other species of frogs (including eggs of congeneric *Dendrobates auratus*).

Field studies.—On 26 July 1997, 14 tadpoles were collected from the forest at La Selva Biological Station, Heredia Province, Costa Rica. Seven were obtained from leaf axils of *Dieffenbachia*, and seven were collected from bromeliads. A disposable pipette was used to extract the tadpoles from their microhabitats, and the volume of each leaf axil was measured with a syringe. Leaf-axil height above the ground was recorded, and each axil was marked with flagging tape to facilitate the eventual return of each tadpole to its respective axil. The developmental stage of each tadpole was determined (Gosner 1960). Tadpoles were housed in a field laboratory at ambient temperature and under natural light. Each tadpole was kept in a glass test tube containing the water from the leaf axil in which it had been living. An electronic pH meter (Corning® pH Meter 245) was used to measure the pH of each water sample. Midge (Chironomidae) and mosquito (Culicidae) larvae used in the feeding trials were collected from the same plots where the tadpoles had been collected.

After a two-day starvation period in the laboratory, each tadpole randomly was offered either one chironomid (ca. 3–5 mm long) or one mosquito (ca. 4–5 mm long) larva. The test tubes were observed for two hours and the tadpole behaviors noted. The presence or absence of prey items was recorded 24 h later and uneaten larvae were removed from the test tubes. The condition (e.g., alive, dead, intact, or damaged) of the removed insect larvae was recorded. One hour later, each tadpole was offered a larva of the type that had not been offered previously, and the test tubes were again observed for two hours. The presence or absence of fly larvae was noted 24 h later. The tadpoles then were returned to their original capture sites. Wild-caught *D. pumilio* tadpoles consumed neither chironomid fly larvae nor mosquito larvae. During our two-day observations the tadpoles never struck at or attempted to capture the dipteran larvae. In addition, the insect larvae showed no signs of damage that may have resulted from feeding attempts by the tadpoles.

Laboratory studies.—The following assays were performed in order to improve the captive productivity of *D. pumilio* as part of the captive-breeding program at the Aquarium of the Americas in New Orleans, Louisiana. The adult frogs in the collection were wild-caught in April 1983 in a small stand of remnant primary forest, east of Guapiles, Limon Province, Costa Rica (ca. 40.3 km from the La Selva Biological Research Station). The tadpoles used in this study were the F_1 generation of these wild-caught individuals.

After hatching, *D. pumilio* tadpoles were housed separately in clear plastic 7.5 x 15.0 x 12.5 cm boxes filled with 2.5–5.0 cm of rainwater with a tannic solution additive. The tannic solution ("tadpole tea") is adapted from a protocol used by fish culturists to decrease bacterial and fungal growth in fish water (Scheel 1975). See the appendix for the recipe for this solution.

The laboratory was 23°C throughout the period of study. In the first trial, raw chicken egg yolk was fed to 28 tadpoles for a period of up to 10 months. Next, three sets of eight additional tadpoles each were offered eggs of one of the following local frog species: *Rana grylio* (Ranidae), *Bufo valliceps* (Bufonidae), and *Hyla cinerea* (Hylidae). The eggs of these frogs were collected in rearing ponds from a fish farm in Lacomb (St. Tammany Parish), Louisiana, USA. For the first trial, the eggs were collected and quick-frozen to reduce the time required for egg collection. After the tadpoles expressed no interest in thawed frog eggs, fresh eggs of the same taxa were offered. In the last trial, 41 tadpoles were offered fresh *D. auratus* eggs over a five-month period. These eggs were obtained from the second author's captive breeding production, which has an ongoing surplus of *D. auratus* eggs. The frog eggs were offered in one of two ways: whole or with the jelly coats removed prior to feeding. After several weeks, it was observed that tadpoles fed *D. auratus* eggs preferred them with the jelly coats removed; therefore, only eggs of this type were used for the remainder of the study.

Each of the tadpoles of *D. pumilio* was offered one frog egg (or an equivalent portion of raw chicken egg yolk) per day and was observed for 20 min after food introduction. Each food type (except the chicken egg yolk) was left in the water with the tadpoles for 24 h, after which time any remaining food was removed. The chicken egg yolk fouled the water and was removed after eight hours. Feeding responses were recorded, and times to metamorphosis were noted.

Tadpoles ate no local frog eggs, but consumed chicken egg yolk and congeneric eggs; this differential food consumption was significant ($P < .000001$; Fisher Exact Test). Normally, time to metamorphosis in captivity is approximately 10 weeks, but when fed chicken egg yolk, the tadpoles remained in Gosner stage 34–36 well into their tenth month. None of the tadpoles offered local frog eggs survived to metamorphosis. Of the 41 *D. pumilio* tadpoles fed eggs of *D. auratus*, 7.3% survived (N = 3). Survival is defined as the percent of tadpoles that reached metamorphosis. The average time to metamorphosis for these individuals was 154 days.

The lack of interest shown by tadpoles when offered local frog eggs contrasted markedly with the strong feeding response that was elicited by the presence of eggs of *D. auratus*. The tadpoles wriggled their tails and frantically darted about as soon as an egg was added to their container. This "dancing" behavior is identical to that displayed by wild tadpoles of *D. pumilio* when they solicit egg laying from their mother (Brust 1993). The tadpoles fed congeneric eggs were the only ones to metamorphose. Tadpoles fed eggs of *D. auratus* had development periods comparable to those of captive, parent-raised tadpoles. Although the percent survival of these individuals is low (7.3%), it is close to the percent survival of captive, parent-raised tadpoles (8%) (Hiler, unpubl. data).

Although it has been demonstrated by Brust (1993) that *D. pumilio* tadpoles rely solely on conspecific eggs provided by their mothers for development there have been no published data indicating rejection of fly larvae. The first part of this study supports literature that states that tadpoles of *D. pumilio* are obligate egg-eaters that do not consume fly larvae that coexist with them in phytotelmata. The second part of this study suggests that captive-raised *D. pumilio* tadpoles can distinguish between congeneric eggs and those of more distantly related species. Although captive *D. pumilio* tadpoles also will eat chicken egg yolk, this diet does not appear to offer the nutrition necessary for proper development.

Feeding congeneric eggs to tadpoles is a labor-intensive technique; however, in raising rare or endangered species of obligate egg-feeding dendrobatids, it may be the only available option.

Acknowledgments.—J. Pramuk thanks J. P. Caldwell for recommending the field component of this project; M. Maple for her assistance in the field; and the Organization for Tropical Studies and the Natural History Museum, The University of Kansas, for financial support. We thank J. P. Caldwell, A. Clarke, W. E. Duellman, J. Parmelee, H. da Silva, A. Sproston,

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Appendix.—Recipe for making tannic solution additive for tadpole water: Combine 28 g of alder "cones" (*Alnus* sp.), 28 g German Peat Moss (Eheim Ltd.), and two liters rainwater in a medium saucepan and heat to a low boil. Simmer the mixture for 20 minutes and allow the extract to cool. Filter the extract through a strainer. Dilute 12 ml of the extract with 19 liters of rainwater (or with enough water to yield a light amber solution). This recipe will yield approximately 152 liters of tadpole water.

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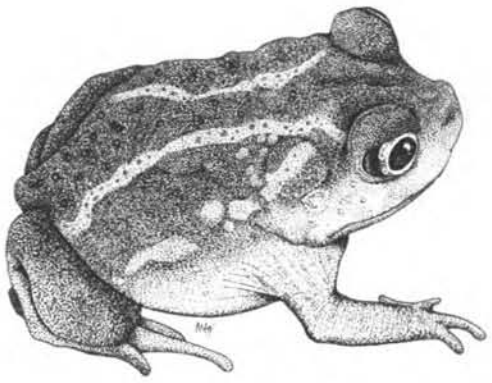
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Scaphiopus holbrookii. Illustration by Michael Frick.

Preferential Coprophagy in Neonate Chuckwallas (*Sauromalus*, Lacertilia, Iguanidae)

RICHARD R. MONTANUCCI
Department of Biological Sciences, Clemson University
Clemson, South Carolina 29634-1903, USA
e-mail: rrmnt@Clemson.edu

The family Iguanidae (*sensu* Frost and Etheridge 1989), comprises an assemblage of predominantly herbivorous lizards, characterized by having an enlarged, septate colon where fermentative cellulose digestion occurs (Iverson 1982). The gut microbial symbionts (required for the breakdown of cellulose into simple compounds) are not passed directly from the parents to their offspring. Instead, as noted by Troyer (1982), hatchlings of *Iguana iguana* disperse into the forest to associate with adults, whereupon they encounter and eat the adults' feces, thus becoming inoculated with gut symbionts.

Coprophagy in neonate chuckwallas (*Sauromalus obesus*) was first reported by Montanucci (1997). Herein, I comment further on coprophagic behavior in chuckwallas, and show by means of a simple choice test, that it is not random behavior, but entails preferential feeding that occurs soon after hatching.

Observations are based on a total 54 captive-bred neonates between the ages of 4 and 7 days. The hatchlings were produced during the 1997 and 1998 breeding seasons by 8 breeding pairs from 7 localities. Captive management and propagation of the chuckwallas followed procedures described in Montanucci (1997). The hatchlings (which had not been previously fed) were simultaneously offered two identical food plates: one of finely chopped romaine lettuce, the other containing day-old, air-dried feces from adult chuckwallas. Each hatchling was tested individually for its food choice and any subsequent feeding behavior noted during a five minute observation period. The food plates were placed in front of, and equidistant from, the hatchling. The feeding trials were performed inside a "40 breeder" tank (ca. 91.5 x 45.8 x 43.3 cm), lined with white paper towels as flooring material. A 75-watt indoor flood lamp was mounted near one end of the cage as a heat and light source. The results of the feeding trials are summarized in Table 1.

The chuckwalla's approach to the food plates was apparently stimulated by visual cues. Subsequent feeding behavior involved chemosensory stimuli when the food was tongue-flicked. The majority (42 of 54; 77.7%; $\chi^2 = 16.666$; $P < 0.001$) of the hatchlings attempted to eat feces first over lettuce. Although the lettuce appeared to be more conspicuous visually than dried feces, only 6 of the 42 hatchlings were attracted to the lettuce, tongue-flicked it, but then selected the feces. Among the 12 hatchlings that ate lettuce first, all consumed only a small amount (1 to 3 small pieces), and then 8 lizards focused their attention on the dried feces, never returning to the plate of lettuce. Only 4 hatchlings failed to demonstrate any interest in the feces during the observation period. Several hatchlings, when returned to a holding box after the feeding trials, were observed biting the brown tail tips of their siblings; they may have mistaken the tail tips for fecal pellets.

After completion of the initial trials, two sets of siblings (7 from Agua Caliente, Arizona; 3 from Salt River Mts., Arizona) were observed as groups for a 20 minute period during which the plates of lettuce and feces remained in the cage. During this time, the hatchlings ran rapidly about the cage, periodically basked under the heat lamp, and scampered past, or over, the two food plates. They showed little interest in the plate of lettuce, but occasionally stopped to tongue-flick the feces (or tongue-flicked while running),

and often grasped fecal pellets in their jaws and repeatedly shook them. The hatchlings' interest in the fecal pellets gradually waned after 15 minutes, and by 20 minutes, the plate of dried feces was largely ignored. However, thirteen days later, a plate of dried feces was placed in the cage with the 7 Agua Caliente hatchlings. Two of the hatchlings again tried to eat the feces, but the others showed no interest.

TABLE 1. Food choice of hatchling chuckwallas.

Locality	(N)	Ate lettuce first	Ate feces first
Agua Caliente, AZ	(19)	4	15
Crater Range, AZ	(4)	0	4
Picacho Mts., AZ	(8)	1	7
Salt River Mts., AZ	(3)	2	1
Apple Valley, CA	(6)	4	2
Desert Center, CA	(9)	0	9
Palm Springs, CA	(5)	1	4
Totals		12	42

The feces of adult chuckwallas were generally too large for the hatchlings to ingest. However, the neonates seized the dried fecal droppings in their mouths, usually at the tapered ends of the pellets, attempted to bite them, and subsequently shook them violently. In some instances, this repeated shaking behavior (up to 8 bouts observed), successfully led to breaking off small bits of the fecal pellet which could be ingested. Whether ingestion of fecal material is necessary for inoculation of symbionts remains conjectural. Only a few hatchlings succeeded in actually eating bits of fecal material, but all lizards eventually demonstrated normal food digestion. Hence, the repeated "mouthing" of the fecal pellets was probably sufficient to inoculate the neonates with symbiotic microbes.

The gut symbionts of iguanas are obligate anaerobes and presumably do not survive long outside the intestinal environment. Thus, Troyer (1982) concluded that a brief association between juvenile and adult iguanas was necessary to effect microbial transfer. While the microbial symbionts in chuckwallas have not been studied, presumably they are also anaerobes. The strong social component to chuckwalla behavior (Berry 1974), would facilitate parent to offspring transfer (via coprophagy) of these colonic microbes.

Coprophagy was not observed during the subsequent months that the hatchlings were reared, except on two occasions. A juvenile was observed tongue-flicking and briefly "mouthing" a fecal pellet from a sibling that shared its cage, and another hatchling actually ate an entire fecal pellet. These instances occurred after a two-day period of food deprivation and may simply have been due to hunger.

Acknowledgments.—Chuckwallas were collected in California under scientific permit numbers 0301 and 9044, and in Arizona under several nonresident hunting licenses. I wish to thank Jay Chance, Jerrold J. and Martin J. Feldner, Tom Greb, Ellen M. Kiley (USFWS), Jim McGuire, Tony Mills, Lester Milroy III, Regis Opferman, and Jeff Wines for help in procuring adult chuckwallas. T. Greb assisted in recording observational data.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 20, Number 1 (March 1999).

CAUDATA

PLETHODON IDAHOENSIS (Coeur d'Alene Salamander) **SKELETAL ABNORMALITY.** Natural occurrence of scoliosis has been reported in *Plethodon glutinosus* (Marvin 1995. Herpetol. Rev. 26:30). Herein we report a similar condition in an adult male (4.2 cm SVL) *Plethodon idahoensis* collected in the Kootenai River Gorge, Lincoln Co., Montana, USA, on 30 May 1985. A radiograph of the individual (Fig. 1) reveals that trunk and anterior caudal vertebrae were affected. Opacities more dense than bone also appear in the trunk and may represent ingested mineral.

A comparison with cleared and stained *P. idahoensis* specimens indicates that this abnormal salamander's SVL would have exceeded 5 cm if not for the unusual spine curvature. The individual was therefore at least 4 yrs old when collected (Lynch 1984. Reproductive Ecology of *Plethodon idahoensis*. M.S. Thesis, University of Idaho, Moscow). Thanks to Chris Davitt for the radiograph and Dan Bivens for photography.

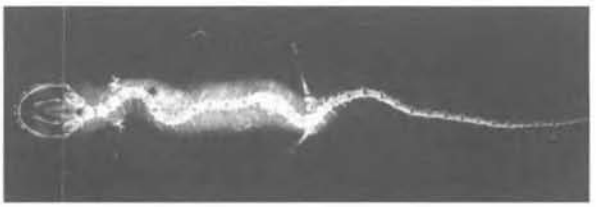


FIG. 1. Scoliosis in an adult *Plethodon idahoensis*.

Submitted by **SARA M. PETERSON** and **ALBERT G. WILSON, JR.**, Department of Life Sciences, MS 3180, Spokane Falls Community College, 3410 Fort George Wright Drive, Spokane, Washington 99224, USA, and **EVELYN M. WILSON**, Deer Park Animal Medical Center, 31207 North Short Road, Deer Park, Washington 99006, USA.

ANURA

BUFO SPECIOSUS (Texas Toad). **DIET.** Reports of food items for *Bufo speciosus* are nonexistent. However, like other xeric toad species, it is presumed to feed on a diverse array of terrestrial and flying arthropods (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. 431 pp.) On 7 August 1998 at ca. 0100 h, a subadult (54 mm SUL, 18.5

NATURAL HISTORY NOTES

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CAUDATA

AMBYSTOMA GRACILE (Northwestern Salamander). **PREDATION** and **CANNIBALISM**. Lack of information concerning predatory interactions between *Ambystoma gracile* and *Ambystoma macrodactylum* (long-toed salamander) larvae, as well as potential cannibalism within *A. gracile* populations, prompted us to conduct a field experiment to investigate the potential for this inter- and intraspecific predation. This field experiment was conducted at a lake in Mount Rainier National Park, Washington, USA.

The experiment, consisting of two trials, was conducted during August 1998. In the first trial, six *A. gracile* larvae (58–94 mm SVL) were collected from lake LW24, and one larva was placed into each of six 11.3 L plastic containers filled with 8 L of water from the lake. Five *A. macrodactylum* hatchlings (10–15 mm TL), which emerged from eggs collected from a pond (UK01) ca. 0.5 miles from the lake, were added to each of the six containers. Ten hatchlings were added to a seventh container, which held no *A. gracile* larva, and this container was used as a control. All hatchlings were added to each container immediately after the addition of the *A. gracile* larvae to the containers. Container lids were secured and the containers were placed under trees on the ground near the lake. Each container was checked ca. five hours after the trial began, and the following morning, for surviving hatchlings. The second trial was conducted the same as the first trial, except that *A. gracile* hatchlings (10–15 mm TL) which emerged from two egg masses collected from lake LW24 were placed into the containers. Six new *A. gracile* larvae (56–80 mm SVL) collected from the lake were used in the second trial.

The results of this experiment indicate that *A. gracile* larvae, when given the opportunity, will prey on *A. macrodactylum* hatchlings and cannibalize conspecific hatchlings. In the first trial, all of the *A. gracile* larvae consumed the *A. macrodactylum* hatchlings. Within ca. five hours from the beginning of this trial, 29 of 30 hatchlings in the six containers had been consumed and the one remaining hatchling was consumed by the following morning. All *A. macrodactylum* hatchlings in the control container were alive the following morning. In the second trial, *A. gracile* larvae also consumed the *A. gracile* hatchlings. Within a little over five hours from the beginning of this trial, *A. gracile* larvae (62–80 mm SVL) in three of the containers had consumed all but one of the hatchlings (i.e., 14 of 15 hatchlings), while 14 of 15 hatchlings still survived in the three containers with smaller larvae (56–60 mm SVL). By the following morning, the last remaining *A. gracile* hatchling in one of the containers with a 62–80 mm SVL larva had been consumed, eight hatchlings were still alive in the containers with the smaller larvae, and all hatchlings in the control container were alive. Survival of the eight *A. gracile* hatchlings in the containers with smaller larvae indicates that the rate of consumption of *A. gracile* hatchlings may, in part, be related to larval size.

We thank Barbara Samora for her continued support of aquatic research at Mount Rainier National Park, and our field assistants Bill Warncke and Michael Clancy.

Submitted by **ROBERT L. HOFFMAN**, Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, Oregon 97331, USA, and **GARY L. LARSON**, USGS, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, Oregon 97331, USA.

AMBYSTOMA RIVULARE (Michoacan Stream Siredon). **CANNIBALISM.** Instances of cannibalism have been well studied in larval *Ambystoma* (Pfennig et al. 1994. Behav. Ecol. 5:225–232; Walls et al. 1993. Oecologia 96:162–168; Wildy et al. 1998. J. Herpetol. 32:286–289). Here we report an observation of larval cannibalism in another ambystomid, *Ambystoma rivulare*, an endemic of the Transvolcanic Belt of México. On 24 August 1991, while censusing a population of these salamanders in a water canal near Buenavista (State of México, km 19 Highway Toluca-Valle de Bravo, 3100 m elevation), we placed two small larvae (20 mm SVL) in a container with two large larvae (55 and 57 mm SVL) to hold them until measured and released. Within 10 min, the small larvae had been eaten. Although the cannibalism took place in an artificial and confined space, our observation points out that cannibalism could occur naturally. It is interesting to note that in the canal, ≤ 20 mm SVL larvae were only found in areas where large larvae (> 20 mm SVL) were absent. Thus, cannibalism in this population may be driving spatial segregation of larval size classes.

Submitted by **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecologia, Unidad de Biología, Tecnología y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Av. de los Barrios s/n, Los Reyes Iztacala, Estado de México, 54090 México, **ROYCE E. BALLINGER**, School of Biological Sciences, University of Nebraska, Lincoln, Nebraska 68588, USA, and **GEOFFREY R. SMITH**, Department of Biology, William Jewell College, Liberty, Missouri 64068, USA.

AMBYSTOMA TIGRINUM STEBBINSI (Sonoran Tiger Salamander). **PREDATION.** The federally endangered Sonoran tiger salamander is only known from within 31 km of Lochiel, Santa Cruz County, Arizona, USA (U.S. Fish and Wildlife Service 1997. Fed. Register 62:665–689). Little is known about its natural predators. On 19 July 1997, two adult turkey vultures (*Cathartes aura*) were observed feeding on larval or adult tiger salamanders at the edge of a rapidly drying pool with much of the remaining water confined to cattle hoof prints. The pool, a rainfall run-off catchment was located at 1450 m in the San Rafael Valley ca. 2 km north of the USA-Mexico border at Lochiel in a tributary to the nearby upper Santa Cruz River.

Using binoculars and a spotting scope from a distance of ca. 100 m, I observed vultures feeding on the salamanders. It is unknown if the vultures detected the salamanders from the air or if they took advantage of the opportunity when the came to the tank for water.

Submitted by **RUSSELL B. DUNCAN**, 7441 Calle Maicoba, Tucson, Arizona 85710, USA.

ANEIDES FERREUS (Clouded Salamander). **HABITAT.** *Aneides ferreus* is typically described as an inhabitant of Douglas-fir, redwood, cedar, and alder forests over its range (Bury and Martin 1973. J. Herpetol. 7:331–335; Stebbins 1985. Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, Massachusetts. 336 pp.; Whitaker et al. 1986. Great Basin Natur. 46:228–240). Habitat studies reveal that *A. ferreus* utilizes stands of various age classes, ranging from old growth to young stands (Stemlock and Harestad 1979. Syesis 12:71–75), and is primarily found in rotting logs and stumps, within loose bark and underneath coarse, woody debris on the forest floor (Bury and Corn 1988. USDA For. Serv. Gen. Tech. Rep. RM-166, pp. 11–22; Harestad and Stemlock 1983. Syesis 16:39–41). Anecdotal accounts of arboreality indicate that the species may also utilize canopy epiphytes as habitat (Welsh

and Wilson 1995. Herpetol. Rev. 26:196–197). Furthermore, *A. ferreus* has been found within rocky substrates near road banks and forest clearings (McKenzie and Storm 1970. Herpetologica 46:228–240).

Though most studies were conducted in or around forests, few mention *A. ferreus* utilizing urban landscapes as habitat. McKenzie and Storm (*op. cit.*) collected *A. ferreus* "from under boards, concrete, and litter," in what they termed an "urban backyard," but did not elaborate. Here, we document the presence of *A. ferreus* in an urban environment at a home built in 1895 in Arcata, California, USA (40°52'23"N, 124°05'04"W). The home is bordered on the west and south by frequently traveled, paved roads, on the north by a paved alleyway, and on the east by a vacant church, which is next to an active gas station. The nearest area of "natural" habitat (i.e., second and third growth redwood forest) exists ca. 0.80 km to the east, but is separated from the house by roads, homes, and a freeway trough.

The following observations were made from October 1997 through March 1998, between 1900 and 2300 h. Seven individuals representing three age classes (Whitaker et al., *op. cit.*) were observed. All age classes were observed in flowerbeds or beneath wooden planter boxes within ca. 1.2 m of the house. Adults were also found within the deteriorated masonry lining the base of the house. Salamanders were most frequently observed following bouts of rain, fog, or watering of the surrounding yard. Repeated observations of salamanders occurred in three separate areas. These areas were separated by ca. 3 m and occupied different aspects of the site. Although no feeding was observed, each activity area contained a conspicuous invertebrate food source, consisting of spiders, ants, and sowbugs (Whitaker et al. *op. cit.*; Storm and Aller 1947. Herpetologica 4:59–60).

No eggs were found, but the presence of several age classes suggests that *A. ferreus* is reproducing on site. *Aneides ferreus* occurrence in this urban environment leads to questions regarding their origin at this location and the levels of development which affect their survival. This area was redwood forest prior to the establishment of the township in the latter half of the 19th century, thus it is possible that these salamanders represent a population that has survived the transformation of the landscape. Alternatively, they might represent recent colonization from a nearby population in the neighborhood. Given the apparent insurmountable barriers that exist between the house and redwood forest, it is unlikely that *A. ferreus* migrated to this area recently from its "natural" habitat. These observations suggests that microsite characteristics may be more relevant than macrohabitat characteristics as determining factors of *A. ferreus* presence. Moreover, this account provides additional habitat information regarding a species commonly thought to be a specialist (Welsh and Lind 1988. USDA For. Serv. Gen. Tech. Rep. RM-166, pp. 439–455) in forested areas.

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Submitted by **ROBERT B. DOUGLAS**, Department of Biology, San Francisco State University, 1600 Holloway Avenue, San Francisco, California 94132, USA, and **DANIEL J. McKONE**, Environmental Systems Graduate Program, Humboldt State University, Arcata, California 95521, USA.

PLETHODON CINEREUS (Red-backed Salamander). **HABITAT**. While studying invertebrate inhabitants of leaves of the bog-dwelling purple pitcher plant, *Sarracenia purpurea*, we discovered two dead *Plethodon cinereus*. The first was recovered in September 1996, at Big Run Bog in the Monongahela National Forest, Tucker County, West Virginia, USA (30°07'N, 79°35'W), when the tube being used to suction the liquid contents from the leaves became clogged with a dead salamander. The second was found on 24 March 1997 at Christner Bog in Mount Davis State Forest, Somerset County, Pennsylvania, USA (40°43'N, 70°11'W). This individual was found wedged tightly into the leaf stem, facing head down. These specimens were catalogued into the Howard University Museum Collection as HUMC 550 (73 mm TL) and HUMC 551 (57 mm TL).

The stomach contents of each salamander were analyzed. Although the stomach of the Christner Bog specimen was empty, the leaf from which it was recovered contained 85 midge larvae (Chironomidae). The stomach of the Big Run Bog specimen held eleven ants (*Myrmica* sp.) and one midge larva. The leaf in which this salamander was found contained 59 midge larvae, six ants (*Myrmica* sp.), one spider (Araneae), ten mites (Acari), seven small beetles (Coleoptera), and seven small wasps (Hymenoptera).

The extent to which *P. cinereus* forages in bogs remains to be documented. Why or how these salamanders died in the leaves is unknown. However, pitcher plant leaves provide a rich food source including dead insects and larvae of several inquilines that feed on dead prey or microorganisms associated with the leaves. The inquilines include the midge, *Metriocnemus knabi*, and the mosquito, *Wyeomyia smithii* (Rymal and Folkerts 1982. J. Alabama Acad. Sci. 53:131–149).

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Submitted by **MELANY HUGHES, RAYMOND PETERSEN**, and **RICHARD M. DUFFIELD**, Department of Biology, Howard University, Washington, D.C. 20059, USA.

PLETHODON HOFFMANI (Valley and Ridge Salamander). **PREDATION**. On 28 April 1998, I collected a northern ringneck snake, *Diadophis punctatus edwardsii*, (24.5 cm SVL; 6.5 cm tail) in Fulton County, Pennsylvania, USA (40°02'00"N, 77°59'05"W) that regurgitated a partially digested *P. hoffmani*. These specimens are catalogued as USNM 531134 (*D. punctatus*) and USNM 531135 (*P. hoffmani*) in the U.S. National Museum.

Although it is known that small salamanders are a common prey of *Diadophis* (Cupp 1994. Anim. Behav. 48:232–235; Lancaster and Wise 1996. Herpetologica 52:98–108), no published reports of predation on *P. hoffmani* exist (Petranka 1998. Salamanders of the United States and Canada, Smithsonian Institution Press, Washington. 587 pp.). *Plethodon cinereus* has been found to comprise a significant proportion of the diet of *D. punctatus* (Blanchard et al. 1979. J. Herpetol. 13:377–402). Because *D. punctatus* occurs at geographic localities inhabited by *P. hoffmani* but not *P. cinereus* (unpubl. data), it seems likely that *D. punctatus* is an important predator of *P. hoffmani*.

Submitted by **DEAN C. ADAMS**, Department of Ecology and Evolution, State University of New York, Stony Brook, New York 11794-5245, USA.

RHYACOTRITON VARIEGATUS (Southern Torrent Salamander). **NEST SITE.** The reproductive ecology of *R. variegatus* remains poorly known. Here I report the first *R. variegatus* nest from Cali-

fornia with information on oviposition and development timing. On 28 September 1995, a *R. variegatus* nest was found in McDonald Creek drainage ca. 10 km S of Orick, Humboldt County, California, USA. The nest was discovered in a stream riffle ca. 30 m above a road culvert. An adult male *R. variegatus* was found with the eggs beneath the boulder. The nest site occurred in a 1st-order stream on managed forestland. The stream had a NW aspect with 12% gradient and was 0.5 m wide. Large cobble characterized the substrate, and woody debris was abundant within and near the stream channel. Overstory vegetation was primarily 50–70 year-old coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), and grand fir (*Abies grandis*), with 97% canopy closure.

The clutch consisted of 11 large (mean diameter = 5.6 mm, SD = 0.39, exclusive of jelly layers), cream-colored eggs, deposited singly beneath a small boulder (28 cm x 20 cm) near the center of the stream channel. One egg was lost in the current when the site was disturbed. Ten remaining eggs were placed in a small perforated plastic container, submerged near the location of the original nest site, and anchored in the stream with rebar and large boulders. When possible, the site was visited weekly. The eggs were checked with a hand lens, but embryological development was difficult to document due to the location of the nest and poor lighting conditions. The forelimbs began developing before the hindlimbs, with forelimbs first obvious at 110 days after discovery and hindlimbs at 120 days, external gills were first visible at 132 days. Two eggs decomposed within the first two months of observation and were removed from the container. Seven of the eight eggs in the container hatched between 9 April and 15 May 1996 (193–229 days after discovery), and the last egg hatched between 15 May and 13 June 1996.

Although it is unknown if any predation of eggs occurred before their discovery, the clutch size (N = 11) is similar to that reported for *Rhyacotriton* spp. in Oregon and Washington. A *R. variegatus* nest found in Tillamook County, Oregon contained 34 eggs and likely contained three clutches (mean = 11.3 eggs per clutch) (Nussbaum 1969. Herpetologica 25:277–278). Nussbaum (*op. cit.*) discovered a nest of the Columbia torrent salamander (*R. kezeri)* in Wahkiakum County, Washington which contained 75 eggs and determined the eggs were laid by at least 8 females (mean = 9.4 eggs per clutch). Oviposition timing was estimated as mid-August for the Washington clutch and late October or early November for the Oregon clutch. No embryological development was evident when the California clutch was found, suggesting that oviposition occurred in mid- to late September.

Although a male *R. variegatus* was found beneath the rock at the nest site, I believe the salamander's presence was coincidental. Parental care in *R. variegatus* is unlikely due to the relatively long incubation period of the ova. Additionally, the small size of *R. variegatus* compared to a potential predator, the Pacific giant salamander (*Dicamptodon tenebrosus*), would limit the species' ability to defend nests.

The location of the California nest site is probably not typical for *Rhyacotriton* spp. The two nests described by Nussbaum (*op.cit.*) were communal nests found in the wetted cracks of sandstone, while the California nest was in the middle of the stream channel. Winter storms during the subsequent year altered the stream channel considerably, and boulders of the size covering the nest were moved in the storms. A nest located in mid-stream, like the California nest, would have been disturbed, and the eggs washed downstream.

Submitted by **NANCY E. KARRAKER**, USDA Forest Service, Redwood Sciences Laboratory, Arcata, California 95521, USA.

SALAMANDRA SALAMANDRA (Fire Salamander). **PREDATION**. *Salamandra salamandra* is the most common terrestrial salamander in Europe. Its aposematic black-yellow pattern is associated with skin serous glands (Klewen 1991. Die Landsalamander, Tel 1. Ziemsen Verlag) which may produce serious toxic syndrome in occasional predators (Saracini 1981. Proc. Congr. Hispano-Francés de Herpetología. Jaca. Spain). Unlike other amphibians, this species remains almost completely absent from the diets of both carnivorous and omnivorous mammals. Here we report the predation of *S. salamandra* by an omnivorous ungulate, the wild boar (*Sus scrofa*).

An extensive study of the diet of the wild boar was carried out in the Montseny massif (NE Iberia, UTM 31T DG31), an area dominated by humid Submediterranean forest. The stomach contents of 53 wild boar (30 females and 23 males) obtained from hunting (1986–1990) were analyzed. Prey items were dried, identified under a binocular lens, and weighed. Although the diet was mainly vegetarian (96% dry mass), vertebrates appeared in 45% of contents and represented 2.13% of the biomass (Rosell 1998. Ph.D. Diss. Barcelona University). *Salamandra salamandra* was the only amphibian consumed, appearing in six stomachs (11%, 0.14% dry mass). One of them contained remains (skin and limbs) of three adult salamanders, the other five contained only one salamander each. Both male and female boars 1-4 years of age consumed salamanders (Rosell, unpubl. data) and lacked symptoms of poisoning.

Wild boar foraging involves moving rubbish, stones, and fallen trunks used as refugia by *S. salamandra*. Prey captured in such a way are usually animals which constitute a proportion (ca. 5% biomass consumed) that remains stable between individuals and populations (Massei et al. 1996. Acta Theriol. 41:307–320; Tucak 1996. Zeitschrift für Jadwissenschaft 42:165–172; Taylor and Hellgren 1997. Southwest. Nat. 42:33–39). Some anurans and the urodele *Pleurodeles waltl* were found in the diet of the wild boar population at Doñana, southwestern Spain (Garzón et al. 1984. II Reunión Iberoamericana Cons. Zool. Vert., pp. 466–475). Moreover, unidentified American salamanders were eaten by European feral hogs in the Great Smoky Mountains, USA (Scott and Pelton 1975. Proc. 29th Annual Conf. Southeast. Assoc. Game and Fish Comm., pp. 585–593). However, to our knowledge this is the first report of predation on *S. salamandra* by *Sus scrofa* although both species share most of their ranges in Europe.

Both consumption by several predators and repeated predation by the same individual rule out accidental ingestion with other prey. In NE Iberia, *S. salamandra* is especially abundant in humid forest areas such as Montesny (Llorente et al. 1995. Atlas dels Amfibis and Reptiles de Catalunya i Andorra. El Brau. Figures. Spain). Apparently, skin toxicity does not protect *S. salamandra* from predation by wild boar in such conditions. Alternatively, wild boars could be exploiting carrion of road-killed salamanders, which are observed active in large numbers after rain in some parts of the study area (pers. obs.). This is unlikely, at least in this case, because the wild boars were killed in sectors with few roads and low traffic density. Although salamander contribution to the diet of this ungulate is low, this may have been one of the main causes of mortality for adult *S. salamandra*. It is also noteworthy that some adult *S. salamandra* have been found in Montseny killed, but not ingested, by the American mink (*Mustela vison*), an accidentally introduced species (Arrizabalaga, pers. comm.).

Submitted by **MIGUEL A. CARRETERO** and **CARME ROSELL**, Departmento de Biologia Animas (Vertebrados), Facultad de Biologia, Universitat de Barcelona, Av. Diagonal 645, E-08028 Barcelona, Spain (e-mail: llorente@porthos.bio.ub.es).

SIREN LACERTINA (Greater Siren). **PARASITISM**. *Siren lacertina* commonly inhabits shallow freshwater environments in the Coastal Plain from Washington, D.C. south to southern Alabama (Wilson 1995. Land Manager's Guide to the Amphibians and Reptiles of the South. Nature Conservancy Press. Chapel Hill, North Carolina. 324 pp.). Such habitats also support a wide variety of copepod species including parasitic forms like *Achtheres micropteri* (Pennak 1953. Freshwater Invertebrates of the United States. Ronald Press. New York, New York. 769 pp.). On 16 October 1995, a large *S. lacertina* was captured at Basin Road Pond (32°01'N, 81°14'W) in Chatham County, Georgia, USA. The specimen was housed at the Savannah Science Museum where museum curators found seven *A. micropteri* with their distal ends embedded within the gill region along the right side of the siren. The aquarium was immediately treated with a combination of sodium chloride, dimethyl (2.2.2.-tricholor-1-hydroxyethyl) phosphonate, and carmoisine B.A. to combat the parasite infection. Removal of the parasites and subsequent treatments of the tank appeared to have eliminated all signs of *A. micropteri*. On 18 December 1995, the siren developed a recurrence of the *A. micropteri* infection. Thirty-nine *A. micropteri* were removed from the body of the siren and preserved in 95% isopropyl alcohol. Twenty-six more *A. micropteri* were left attached and preserved with the siren. The preserved specimen was donated to Armstrong Atlantic State University in Savannah, Georgia as an educational specimen. Additionally, two *Necturus m. maculosus*, housed in neighboring aquaria developed massive *A. micropteri* infections which killed both specimens. It is presumed the *N. maculosus* were infected due to improper sterilization of the lab equipment used to clean the aquaria.

Submitted by **MICHAEL G. FRICK**, Carretta Research Project, P.O. Box 661, Tybee Island, Georgia 31328, USA.

ANURA

BUFO BOREAS (Boreal Toad). **PHORETIC HOST**. Several reports describe amphibians serving as phoretic hosts for sphaeriid bivalves. In most cases the clams attach to the feet of the amphibian, but in one case a *Pisidium* was attached to the lower jaw of a newt (Rees 1952. British J. Herpetol. 1:125–129). Kwet (1995. Salamandra 31:61–64) observed male *Bufo bufo* with *Sphaerium corneum* attached to the distal end of toes on the hind feet.

Here we report phoretic attachment of *Pisidium* sp. to recently metamorphosed *Bufo boreas*. In 1996 and 1997 ca. 24,000 hatchery reared *B. boreas* toadlets were reintroduced to Lost Lake, Boulder County, Colorado, USA. In 1997, the site was surveyed ca. three times per week between 3 June and 18 August. During the survey on 4 Aug 1997, two of 303 (0.7%) recently metamorphosed toadlets were found with *Pisidium* sp. attached. Both toadlets were on a muddy surface and had the clam attached to the distal end of a toe on the rear foot. The specific identity of the clams is unknown, as at least three species of *Pisidium* (*P. milium*, *P. nitidum*, and *P. variabile*) have been reported from Lost Lake (Wu 1989. Colorado Freshwater Mollusks. Nat. Hist. Inventory of Colorado. 11. Univ. Colo. Museum, Boulder).

Relatively few accounts of phoretic attachment by sphaeriid bivalves mention the season, but of those that do, most attachments appear to occur in the spring. Spencer (1964. J. Colorado-Wyoming Acad. Sci. 5:43–44) observed *Pseudacris triseriata* throughout their activity season, but only observed phoretic attachment by *Pisidium* during May. Our observations demonstrate that phoretic attachment also occurs during late summer.

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Submitted by **KIRSTA L. SCHERFF-NORRIS**, Colorado Division of Wildlife, 317 W. Prospect, Fort Collins, Colorado 80526, USA, and Graduate Degree Program in Ecology, Colorado State University, Fort Collins, Colorado 80523, USA, and **LAUREN J. LIVO**, Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526, USA, and EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

HYLA FABER (Smith Frog). **LARVAL CANNIBALISM**. Martins (1993. Amphibia-Reptilia 14:411–421) observed that during droughts most *Hyla faber* tadpoles occurring in high densities in the foam nests had their tail tips mutilated, probably by their siblings. During the nights of 25 April and 27 June 1998, in a permanent pond (2 x 3 m) at Guarani River margin, Três Barras do Paraná County, Paraná State, Brazil, we found two dead *H. faber* tadpoles (ca. 65 mm TL; stage 25, Gosner 1960. Herpetologica 16:183–190) being consumed by four tadpoles of the same species and similar size. Although cannibalism in tadpoles of the *H. boans* group is known for *H. rosenbergi* (Kluge 1981. Misc. Publ. Mus. Zool. Univ. Michigan 160:1–170), this is the first report of cannibalism in *H. faber* tadpoles. The tadpoles were verified by A. A. Giaretta and deposited at Museu de História Natural da Universidade Estadual de Campinas (ZUEC 11546–548), Campinas, SP, Brazil.

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Submitted by **PAULO SÈRIGO BERNARDE**, Curso de Pós-Graduação em Zoologia, Depto. de Zoologia, Universidade Federal do Paraná, CP 19020, Curitiba, PR, 81531-990, Brazil (e-mail: bernarde@garoupa.bio.ufpr.br), and **REGINALDO ASSÊNCIO MACHADO**, Rua 1° de maio n° 509 - Centro, Ibiporã - Paraná – Brazil (e-mail: machado@sercontel.com.br).

LITORIA LESUEURI (Stony Creek Frog). **PREDATION**. Eels are generally known to prey upon invertebrates, fish, and crustaceans (Allen 1989. Freshwater Fishes of Australia. T.F.H. Publications, Neptune, New Jersey. pp. 24–26) and are ubiquitous throughout streams of eastern Australia. In southern Australia a number of unidentified adult frogs were encountered in the diet of short-finned eels (*Anguilla australis*) (Beumer 1979. J. Fish Biol. 14:573–592); but no frogs were found in the diet of sympatric long-finned eels (*A. reinhardtii*). The impact of long-finned eels on anuran assemblage structure in the streams of eastern Australia, where short-finned eels are absent, is unknown.

During a routine survey at Cedar Creek Falls in southeastern Queensland (27°53'40.6"S 153°11'16.2"E), predation by a long-finned eel on an adult frog was observed. At ca. 1930 h on the 23 October 1998, a male *Litoria lesueuri* jumped from the bank into the stream, landing above a long-finned eel partially hidden among aquatic vegetation. The eel immediately seized the frog and only the hind legs were seen protruding from the eel's mouth. Within seconds, a second bite ensured the frog was swallowed entirely. The eel showed no signs of rejection and continued its foraging activity. Interestingly, tadpoles of *L. lesueuri* are toxic or distasteful to fish predators (J.-M. Hero, unpubl. data), while this observation suggests that adult *L. lesueuri* are not distasteful to vertebrate fish predators. Furthermore, this observation suggests that long-

finned eels may be important predators on adult amphibians in freshwater systems of eastern Australia.

Submitted by **MATHEW ADRIAN HARVEY, CLARE MORRISON,** and **JEAN-MARC HERO**, School of Environmental & Applied Science, Griffith University Gold Coast, PMB 50 Gold Coast MC, Queensland 9726 Australia (e-mail: M.Hero@mailbox.gu.edu.au).

RANA LUTEIVENTRIS (Columbia Spotted Frog). **MORTALITY and SITE FIDELITY.** Ranid frogs primarily occupy permanent wetlands. That they persist in desert streams that expand and contract greatly (Stanley et al. 1997. BioScience 47:427) is remarkable. While several species of ranids aestivate to cope with surface climate conditions beyond their limits of physiological tolerance (Pinder et al. 1992 *In* Feder and Burggren (eds.)., Environmental Physiology of the Amphibians, pp. 250–274. Univ. Chicago Press, Chicago), our observations indicate that *Rana luteiventris* at the southernmost extent of its range has not evolved such behavior.

On 14 July 1997, we observed three dead frogs (1 J, 1 M, 1 F), four living frogs (1 J, 2 M, 1 F), and 15 tadpoles (water 29°C; Gosner stage 43–44; Gosner 1960. Herpetologica 16:183–190) at an elevation of 1745 m along a 150 m intermittent portion of Cloverdale Creek, Nye County, Nevada, USA (T8N R39E NW1/4 Sec. 13; air 32°C). This site is heavily used by livestock as evinced by a mean of 13.3 (SD = 2.55) livestock hoof prints per m^2.

The three dead frogs were above ground in awkward postures that suggested traumatic deaths. One adult male was thin (60 mm SUL; 12 g [the mean weight of seven other 60 mm males from nearby areas was 20.9 g, SD =1.87]) and lethargic and possessed a partially everted bladder. Of the living frogs, one adult male and one juvenile were observed in two small (2.0 m x 1 m) pools ca. 5 cm in depth. The adult female was observed ca. 75 m up the dry creek bed, partially hidden in the moist soil of a cow hoof print. One of the adult males emerged from water-saturated clay substrate during the survey. We PIT tagged all living *R. luteiventris* > 45 mm SUL.

We revisited this site on 23 July 1997 (water temp: 25.5°C; raining steadily during survey) and observed one dead adult male with a crushed backbone and broken left rear foot in the impression of a cow hoof. We located two live adult frogs on moist soil in the dry creek bed. One frog was observed in the open, the other partially hidden in a cow hoof print. Both frogs were implanted with PIT tags.

We returned to the site on 23 July 1997 and found two dead adult frogs (one desiccated, other recently dead) and one live adult male. Eight net sweeps of the two pools did not reveal the presence of tadpoles.

On 28 July 1997 (overcast; air temp 16.5°C), we surveyed the transect, now devoid of pooled water, and located three adult males and one juvenile. The first adult and the subadult were hidden under rocks (0.3–0.7 m diam) embedded in the creek bed. The second was moving up the dry creek bed. The final adult male was recaptured beneath a boulder, 40 m upstream from where it was marked on 23 July 1997.

In North American arid systems, due to a variety of anthropogenic impacts and natural desertification, many streams are in the process of drying and now have intermittent flow patterns. Amphibians that depend on permanent water systems are increasingly at risk because they lack the behavioral mechanisms to cope with the new stochastic nature of their aquatic habitats. While long-range dispersal has been documented in this system in "wet years" (Reaser 1996, Herpetol. Rev. 27:196), the rapid loss of water from a stream may not enable emigration of all frogs. At this site, the presence of desiccated algal mats along the dry streambed indicated that stream flow extended an additional km downstream earlier in the season. Sparse clumps of dried filamentous algae, and water pennywort (*Hydrocotyle* sp.) remained on moist soil, indicating that pooled water had also been present. At the time of the surveys, the nearest pooled water existed ca.1 km upstream from the transect.

The majority of dispersal data for this system (Reaser, in prep.), however, indicate that site fidelity (Sinsch 1990. Ethol. Ecol. Evol. 2:65) is extremely high. A low propensity to emigrate would further exacerbate vulnerability of frogs that don't have successful physiological means to cope with rapid climate shift.

These observations illustrate the presence of declining habitat at the southernmost location known for the species (Green et al. 1996. Evolution 50:375). As a result of rapid stream retreat, frogs concentrate in pools and are vulnerable to mortality due to dehydration and livestock trampling. Additionally, observations such as these have led resource managers and users in the region to consider alternatives to intensive livestock grazing. Under a conservation agreement for *R. luteiventris* in the Toiyabe Range (in progress), the U.S. Forest Service (USFS) and the Yomba Shoshone Tribe will be fencing livestock out of sensitive wetlands. Further, the USFS has acquired previously ranched lands and no longer grants grazing permits in certain riparian areas.

These observations were made as part of a four-year study of the conservation ecology of *R. luteiventris* in Nevada. We thank the USFS (Tonopah Ranger District) for logistical support, the U.S. Bureau of Land Management for allowing access to their lands, and Nevada Division of Wildlife for the necessary permits. Funding was provided to JKR by the Nevada Biodiversity Initiative, Doctoral Research Fellowship of Stanford University, U.S. Fish and Wildlife Service, National Fish and Wildlife Foundation, Nevada Mining Association, IUCN Declining Amphibian Task Force, Theodore Roosevelt Memorial Fund, and Morrison Institute for Population and Resource Studies. We thank C. R. Peterson and D. S. Pilliod for constructive comments on this note.

Submitted by **DAVID A. ROSS**, U.S. Fish and Wildlife Service, Klamath Basin Ecosystem Restoration Office, 6610 Washburn Way, Klamath Falls, Oregon 97603, USA; **JAMIE K. REASER**, 6210 Julian Street, Springfield, Virginia 22150, USA; **PATRICK KLEEMAN,** Department of Wildlife, Humboldt State University, Arcata, California 95521 USA; and **DANA L. DRAKE,** Department of Biology, Drexel University, Philadelphia, Pennsylvania 19104, USA.

RANA MUSCOSA (Mountain Yellow-legged Frog). **DIET**. On three occasions during August 1997, I observed adult *Rana muscosa* consuming *Hyla regilla* tadpoles. The events occurred in water <5 cm deep in two ponds <0.2 ha in upper Dusy Basin, Kings Canyon National Park, California, USA. On all occasions, the *R. muscosa* were basking in warm, shallow water (>18°C) surrounded by numerous *H. regilla* tadpoles. In the shallow regions of the pond at mid-day, there were 15 adult *R. muscosa* and ca. 1500 *H. regilla* tadpoles within a 2 m^2 area. Occasionally a *H. regilla* tadpole passed in front of an adult *R. muscosa,* which would lunge at the tadpole open-mouthed. When successful, the frog would swallow the tadpole head first. On another occasion an adult *R. muscosa* was captured with a *H. regilla* tadpole tail protruding from its mouth. Tom Jenkins (pers. comm.) observed *R. muscosa* feeding on *H. regilla* tadpoles in a pond in the Mills Creek drainage, John Muir Wilder-

ness in August 1996. Thus this behavior is not restricted to the population of *R. muscosa* at the Dusy Basin site. This is the first reported case of *R. muscosa* feeding on *H. regilla* tadpoles.

Submitted by **KAREN L. POPE**, U.S. Forest Service Pacific Southwest Research Station, P.O. Box 245, Berkeley, California 94701, USA (e-mail: kpope/psw@fs.fed.us).

RANA SYLVATICA (Wood Frog). **PREDATION**. Anurans and waterstriders (Insecta: Hemiptera: Gerridae) often co-exist in small ponds, where waterstriders may represent a significant prey item for adult anurans (Callahan 1974. Proc. Entomol. Soc. Washington 76:15–21). Here we report predation on *Rana sylvatica* larvae by waterstriders. On 28 May 1998, we observed ca. 78 *R. sylvatica* larvae trapped in a small pool (25 x 14 cm; max. depth 2 cm), all that remained of a drying pond (ca. 55°11'45"N, 113°39'30"N). On 13 May this pond had been 17 x 14 m, with a max. depth of 20.5 cm. Ten *R. sylvatica* egg masses had been found in the pond at that time. The pond was located in a cutblock logged in winter 1996/97, in the aspen (*Populus tremuloides*) dominated boreal forest of Alberta, Canada.

The tadpoles trapped in the pool were aggregated in the deeper water in the center. We observed fewer than 20 waterstriders in the immediate area of the pool, with one to five waterstriders feeding on the tadpoles at any given time. We never observed more than one waterstrider feeding on a single tadpole simultaneously. The majority of tadpoles appeared moribund or dead, although several exhibited weak swimming motions, either in the normal orientation or upside-down. We observed waterstriders inserting their rostrum into the portion of the tadpole's body that was closest to the surface of the water, and apparently feeding. Some tadpoles exhibited weak escape responses, trying to swim away, but the attacking waterstriders were able to maintain their position over the tadpole and continue to feed. Individual waterstriders were observed feeding on single tadpoles for up to 5 minutes.

We collected a number of tadpoles and waterstriders at the site. All tadpoles were *R. sylvatica* with small hind limb buds present (mean developmental stage 27.2, SD = 1.85, N = 13) (Gosner 1960. Herpetologica 16:183–190), and a mean body length of 1.79 cm (SD = 0.23, N = 18). Two species of waterstriders were collected: *Gerris pingreensis* (body length 0.65 cm, N = 1), and *G. buenoi* (mean body length = 0.83 cm, SD = 0.042, N = 4). All waterstriders collected were adults; the *G. pingreensis* had fully developed wings, while *G. buenoi* lacked wings, meaning that they would perish as the pond disappeared. Lack of wings in adult waterstriders is common in populations in Alberta (Spence 1989. Can. J. Zool. 76:2432–2447). Waterstriders generally feed on soft-bodied arthropods trapped in the surface film of the water; prey items may be insects blown onto the water from terrestrial habitats, or adults emerging from aquatic larval stages (Andersen 1982. The Semiaquatic Bugs. Entomonograph Vol. 3. Scandianvian Science Press, Ltd., Klampenborg, Denmark). It is unlikely that waterstriders are often able to prey on anuran larvae, as tadpoles generally remain submerged, while waterstriders are usually confined to the surface itself. We have similarly observed aggregations of waterstriders feeding on individual fathead minnows (*Pimephales promelas*) that were floating dead on the surface of ponds (C. Paszkowski, pers. obs.).

This is the first published report of which we are aware that describes waterstriders feeding on anuran larvae, although this phenomenon has been observed previously in the field by entomologists (J. Spence, pers. obs.). Many species of waterstriders are known to be opportunistic unspecialized feeders (Spence and Scudder 1980. Can. Entomol. 112:779–792); our observation of waterstriders feeding on a novel vertebrate prey supports this characterization.

Submitted by **BRIAN R. EATON** and **CYNTHIA A. PASZKOWSKI**, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9, Canada.

SCAPHIOPUS COUCHII (Couch's Spadefoot). **PREDATION**. Ants have been shown to prey upon juvenile and adult frogs and toads (Clerke and Williamson 1992. Austr. Zool. 28:64–67; Fritz et al. 1981. Biotropica 13:158–159), and eggs of the salamander *Desmognathus ochrophaeus* (Forester 1979. Herpetol. Rev. 10:3–4). The following observation appears to be the first record of ant predation upon anuran eggs.

On 2 July 1998, we observed a group of ants (*Forelius mccooki*) (2.2 mm TL) eating *Scaphiopus couchii* eggs. The eggs were attached to a blade of grass suspended into the water at the edge of an ephemeral pool located in Big Bend National Park, Brewster Co., Texas, USA (UTM zone 13, 3256531N, 0680510E, 843 m elev., air 35.3°C, water 33.6°C, relative humidity 49%, pool ca. 3.5 m x 3.0 m x 0.50 m deep). The eggs were viable and had been laid ca. 12–15 h earlier. The ants walked along the blade of grass and onto the top of the gelatin of the egg mass on the water surface. Approximately 100 ants had eaten through the gelatinous envelope of the eggs (10% of egg mass) and were harvesting the ovum and returning to their nest.

Forelius mccooki typically forage on live and dead insects as well as tend honeydew-excreting insects (Wheeler and Wheeler 1986. The Ants of Nevada. Natural History Museum of Los Angeles County, Los Angeles, California. 138 pp.). Collected ants were deposited in the collection of the Department of Entomology of the National Museum of Natural History.

We thank A. F. Van Pelt and Ted R. Schultz for identifying *Forelius mccooki* and Raymond Skiles at Big Bend National Park for the tremendous amount of help he has given us. This study is part of DISPro (the Demonstration Intensive Site Program), a joint index site and ecological research program funded by the U.S. Environmental Protection Agency and National Park Service.

Submitted by **GAGE H. DAYTON** and **ROBIN E. JUNG**, USGS Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, USA.

TESTUDINES

CHELUS FIMBRIATUS (Matamata). **MAXIMUM SIZE**. The maximum straight-line carapace length (CL) of *Chelus fimbriatus* reported by Pritchard and Trebbau (1984. Turtles of Venezuela. SSAR Contributions to Herpetology, No. 2. 403 pp.) is 456 mm. Sánchez Villagra et al. (1995. Chel. Cons. Biol. 1:293–300) reported a matamata with a CL of 464 mm. A *C. fimbriatus* captured by local fishermen in the vicinity of Puerto Ayacucho, Departamento Atures, Estado Amazonas, Venezuela had a CL of 482 mm. Other measurements (all straight-line) include: 430 mm plastron length; 380 mm carapace width; 170 mm shell height. This specimen was deposited in the collection of the Estación Biológica Rancho Grande, Maracay (EBRG 3596). We believe this is the largest *C. fimbriatus* ever reported in the literature.

Submitted by **CÉSAR L. BARRIO** and **ÍÑIGO NARBAIZA**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas

y Naturales FUDECI, Apto Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve or fudeci3@telcel.net.ve).

DERMOCHELYS CORIACEA (Leatherback Sea Turtle), ***LEPIDOCHELYS KEMPI*** (Kemp's Ridley Sea Turtle), and ***CARETTA CARETTA*** (Loggerhead Sea Turtle). **PELAGIC FEEDING.** Hendrickson (1980. Am. Zool. 20:597–608) discussed differences in the niches occupied by extant sea turtles. However, other studies have reported a high degree of dietary overlap among *Lepidochelys kempi, Caretta caretta,* and *Dermochelys coriacea* (Grant and Ferrell 1993. Brimleyana 19:77; Frick 1997. Herpetol. Rev. 28:149; Frick and Mason 1997. Herpetol. Rev. 29:166–168). Here, we report aerial observations of *D. coriacea*, *L. kempi*, and *C. caretta* feeding together within large flotillas of cannonball jellyfish (*Stomolophus meleagris*), as well as observations of *L. kempi* and *C. caretta* feeding together within large schools of migrating cownose rays (*Rhinoptera bonasus*). To our knowledge, *S. meleagris* and *R. bonasus* have never been reported from the diets of *L. kempi* and *C. caretta*. Additionally, our observations suggest a lack of resource partitioning between *D. coriacea, L. kempi*, and *C. caretta*.

Our observations occurred on 29 and 31 March 1998 (1011–1454 h). Water temperature was 20°C and water depth at feeding locations was 1.8–23.4 m. Our observations were made during aerial surveys conducted by the New England Aquarium along coastal waters from southeastern Georgia (31°17'N, 81°00.0'W) to northeastern Florida (30°14'N, 81°05.0'W). For more detailed information regarding similar surveys see Scott and Gilbert (1982. U.S. Dept. Interior Rep. AA551-CT8-48. 120 pp.) and Knowlton et al. (1994. Can. J. Zool. 72:1297–1305.).

During the spring, large, surface-active schools of cownose rays begin to migrate north through the coastal waters off Georgia and Florida (R. Kenney, unpubl. data). Schools of cownose rays can number up to 30,000 individuals. However, schools of 200–300 individuals are more common. Similarly, large flotillas of cannonball jellyfish also appear off the coast during much of the year (March–November), until colder weather drives them south.

On 16 separate occasions, 34 *C. caretta* and 4 *L. kempi* were observed feeding on cownose rays. Turtles were observed biting pieces from the wings of any *R. bonasus* that passed within ca. 0.9 m. Large schools of unidentified fish were observed swimming beneath feeding turtles. These fishes appeared to be feeding on injured rays. On 10 separate occasions, 17 *C. caretta* , 2 *D. coriacea*, and 4 *L. kempi* were observed feeding on cannonball jellyfish. Larger turtles appeared to be eating jellyfish whole, whereas smaller turtles appeared to be manipulating jellyfish with their foreflippers, and consuming them as smaller, manageable pieces. On four occasions, ocean sunfish (*Mola mola*) and sharptail molas (*Mola lanceolata*) were seen feeding on jellyfish alongside of turtles.

It is unclear to what extent sea turtles utilize the seasonal influx of potential prey items that migrate through their foraging areas. By combining low energy behavioral activities such as basking and pelagic foraging, sea turtles may attain enough energy to perform activities that require a high energy expenditure. Grant and Ferell (1993, *op. cit.*) suggest that the low-cost benefits associated with simultaneous basking and pelagic feeding may enable leatherbacks to perform more lengthy migrations while following jellyfish, their primary food. Studies that address diet selectivity in sea turtles by relating relative abundance of potential food items in the environment to the food items that are ingested would help us to better understand the foraging ecology of sea turtles (Bjorndal 1997. *In*: Lutz and Musick (eds.), Biology of Sea Turtles, pp. 199–232. CRC Press, Boca Raton, Florida).

Submitted by **MICHAEL G. FRICK**, Caretta Research Project, P.O. Box 661, Tybee Island, Georgia 31328, USA (e-mail: Caretta05@aol.com), **CATHERINE A. QUINN**, New England Aquarium, Central Wharf, Boston, Massachusetts 02110, USA, and **CHRISTOPHER K. SLAY**, Coastwise Consulting, 173 Virginia Avenue, Athens, Georgia 30601, USA.

NATATOR DEPRESSUS (Flatback Sea Turtle). **PREDATION.** *Natator depressus* hatchlings are up to 1.5 times larger than those of other cheloniids (Limpus 1989. Aust. Wildl. Res. 16:517–525). It has been widely accepted that their large size provides protection from predation by ghost crabs (Walker and Parmenter 1990. J. Biogeogr. 17:275–278).

On 21 June 1998 at 0240 h at a mainland rookery at Fog Bay, Northern Territory, Australia (12°42'S; 130°20'E), SJB discovered a nest where *N. depressus* had recently hatched. The tracks of a ghost crab were seen intercepting the tracks of a hatchling. About 5 m further along the beach, a ghost crab, *Ocypode cordimana* (George and Knott 1965. J. Roy. Soc. W.A. 48:15–21), was carrying a *N. depressus* hatchling by the neck. The crab dropped the hatchling when approached. Although there have been reported sightings of predation on flatback hatchlings by the ghost crab *Ocypode ceratophthalma* (Limpus 1971. Herpetologica 27:431–446), this is the only known report of *O. cordimana* preying on a flatback hatchling.

The hatchling was dead, and had wounds to the neck, like those reported for crab attacks on hatchlings of other species of sea turtles (Bustard 1972. Australian Sea Turtles. Collins, Sons and Comp., London. 220 pp.). SDW has made similar observations on Bare Sand Island, but the crabs involved were not identified. It may be that ghost crab predation on *N. depressus* hatchlings is more prevalent than previous authors have acknowledged.

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Submitted by **SEAN J. BLAMIRES**, **SCOTT D. WHITING**, and **MICHAEL L. GUINEA**, Faculty of Science, Northern Territory University, Darwin, Northern Territory 0909, Australia (e-mail [SJB]: sblamire@banda.ntu.edu.au).

LACERTILIA

BARISIA IMBRICATA IMBRICATA (Popocatepetl, Imbricate Alligator Lizard). **OOPHAGY**. Mitchell and Groves (1993. Herpetol. Rev. 24:126–129) published an excellent review of reports of oophagy in reptiles; herein I report oophagy in captive female *Barisia imbricata imbricata*. Five gravid *B. i. imbricata* females were collected on 1 June 1992 in Cahuacán, State of México, and were maintained in captivity in individual terraria. Within two weeks, parturition occurred in every individual. After the birth of each neonate, the mother tongue-licked it and ate the extraembryonic membranes. Two of these females gave birth to live neonates as well as non-viable eggs and dead neonates. The number of tongue-licks was greater for non-viable products than for live neonates and the females subsequently ate the nonviable eggs and the dead neonates. This behavior suggests that the females distinguish between viable young and non-viable products. Similar behavior has been observed in *Tiliqua rugosa* (Bull et al. 1994. J. Herpetol. 28:117–120), where parents can distinguish their own young from the young of other parents of the same species. It has been proposed that in-

traspecific oophagy is probably a form of parental care. Although several hypotheses have been advanced to explain causes of this behavior in oviparous reptiles, for viviparous reptiles there is no explanation.

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Submitted by **MARTÍN MARTÍNEZ TORRES**, Laboratorio de Biología de la Reproducción, Escuela National de Estudios Profesionales Iztacala UNAM, Los Reyes Iztacala, A.P. 314, Tlalnepantla Edo. de México C.P. 54090, México.

GALLOTIA ATLANTICA (Atlantic Lizard). **PREDATION.** Shrikes are probably not the most important predators of lizards, but they have developed an innovative way of killing their prey—by impaling them. During the breeding season in Poland, *Lanius collurio* (red-backed shrike) have been observed impaling *Lacerta agilis* (Fiala 1986. Ziva. 34:158). We report here on another instance of the same technique observed on Timanfaya (Lanzarote, Canary Islands). On 24 March 1998, eight individuals of *Gallotia atlantica* were found impaled on the leaves of a palm tree. The bird responsible for this larder was *Lanius excubitor koenigi* (great grey shrike). The lizards were positioned just above the ground and ca. 20 m from a nest containing four young shrikes. Six of the lizards were almost completely eaten, with only the skulls remaining. Of the other two carcasses, one was completely dry, while the other was fresh with the eyes, tail, and part of the abdomen already eaten. These last two individuals had been skewered lengthwise—cloaca to head—on the palm leaves. The size of the lizards (by comparison with preserved specimens) corresponded to that of adults (ca. 70–80 mm SVL). Thus predation on *G. atlantica* by shrikes during the latter's breeding season could be an important factor in the population dynamics of both species. Future field studies are needed to determine whether the grey shrike also impales lizards at other times of the year.

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Submitted by **IRMA HERRERA-BRAVO DE LAGUNA**, Departamento de Biología, Lab-B202, Campus Universariodo Tarifa 35017, Universidad de Las Palmas de Gran Canaria, Islas Canarias (Spain) and **FABIOLA BARAHONA**, Department of Anatomy and Developmental Biology, Rockefeller Building, University College London, University Street, London WC1E 6JJ, UK.

HEMIDACTYLUS BROOKI (Spotted House Gecko). **COMMUNAL BREEDING.** *Hemidactylus brooki* is a common gecko inhabiting households in Dharwad, South India (15°17'N, 75°3'E). It is also found in Sri Lanka, Burma, Indonesia, and the Malaysian and Philippine Islands. In Dharwad, *H. brooki* reproduces from October until June (Shanbhag et al. 1998. J. Herpetol. 32:566–572), producing two eggs per clutch. The eggs are usually deposited on a horizontal surface, hidden from view. On 14 May 1997 I observed 16 *H. brooki* eggs adhering to a wall behind a framed photograph measuring 75 cm x 50 cm. The 16 eggs were deposited in an area of 15 cm x 20 cm, suggesting communal breeding. One group of four were clumped together, eight were deposited in pairs, and the remaining four were attached singly.

Communal deposition of eggs has been reported in the Australian gecko, *Oedura lesueri* (Bustard 1967. Herpetologica 23:276–284), and in *Hemidactylus turcicus* (Flower 1933. Proc. Zool. Soc. London: 735–851., R. K. Vaughan, pers. comm.).

Submitted by **BHAGYASHRI A. SHANBHAG**, Department of Zoology, Karnatak University, Dharwad—580 003, India.

LEPIDODACTYLUS LUGUBRIS (Mourning Gecko). **NECTIVORY and DAYTIME ACTIVITY.** With few exceptions, geckos are nocturnal insectivores. A few species occasionally feed on natural or man-made sweet semi-liquids such as nectar or honey. *Lepidodactylus lugubris* is one such species (Greer 1989. The Biology and Evolution of Australian Lizards. Surrey Beatty & Sons, Hong Kong. 264 pp). McCoid and Hensley (1993. Herpetol. Rev. 24:87–88) suggested *L. lugubris* will regularly change activity patterns to feed on such resources. Here we report on several instances of such behavior and provide statistical support suggesting these were indeed systematic, rather than incidental. We made our observations on the island of Guam. They include chance sightings, when the behavior occurred during the day and involved a large number of individuals, and a small-scale systematic study.

McCoid and Hensley (1993, *op. cit.*) reported that consumption of sweet scraps in households is not unusual. We have also received incidental reports and witnessed additional cases of house-dwelling mourning geckos feeding on jam and sugar crystals. In households where they are not molested, geckos may descend to lick dinner plates clean after a meal (R. D. Anderson, pers. comm.) or feed on ripe fruit left on the kitchen table (C. S. Lobban, pers. comm.). Several people reported encountering them in discarded cans of sweetened drinks (D. S. Vice, pers. comm.; G. J. Wiles, pers. comm.). However, such events are apparently not limited to sweet foods. In one of our households they will sometimes drink milk from meal bowls. Our incidental observations also include sightings of geckos licking what appears to be nectar from the flowers of ornamental orchids and papaya trees (*Carica papaya*).

Our systematic observations were mostly made on the grounds of the Guam National Wildlife Refuge. Like McCoid and Hensley (1993, *op. cit.*), we repeatedly observed *L. lugubris* attracted to the blooms of coconut trees (*Cocos nucifera*). Geckos would lick closed flowers, the drops of clear sweet liquid emanating from them, and the scars where flowers had previously been, as well as open flowers. At times, more than ten individuals of various sizes and color morphs would be engaged in this behavior on a single inflorescence, though on most occasions we only saw a single gecko. On many cases, most recently during September 1998, this behavior occurred during mid-day, both on cloudy and on clear days. The lizards would retreat during the sunniest periods, but seemed nearly oblivious to the presence of observers. They would occasionally engage in agonistic behavior, with individuals apparently fighting over access to the resource. During early September 1998, nearly every flowering tree we could find had at least one *L. lugubris* feeding on nectar during the day. To quantify this behavior we carefully searched 46 short coconut trees. Most either had flowers ($N = 9$) or had wilted flower stalks, often with developing fruit on them ($N = 28$). Of trees with flowers, seven (78%) had active geckos during the day, whereas we observed a gecko on only one (3%) of those without flowers. This difference was highly significant ($p < 0.001$, Fisher's exact test). In two cases we observed an adult *Hemidactylus frenatus* near an inflorescence occupied by a *L. lugubris*. Neither engaged in aggressive behavior, and we saw no indication of a change in *L. lugubris* behavior as a result of this presence.

Mourning geckos would occasionally feed on the many insects, mostly ants and flies, that were also attracted to the flowers. Most

insects were ignored, suggesting that obtaining nectar was the main incentive for this flower-seeking behavior. To further investigate this we also examined 15 flowering ornamental palms (*Veitchia merrillii*). Though most had insects in their inflorescences we saw no liquid on these flowers and found no active geckos on them. Feeding on invertebrates thus appears to be an opportunistic secondary activity. Given the large number of individuals involved in nectar feeding, *L. lugubris* could potentially serve as a pollinator for *Cocos nucifera*, which contains both male and female blossoms. Other species of flowering plants might also benefit from this behavior.

We thank M. J. McCoid for helpful comments on this note.

Submitted by **GAD PERRY**, Department of Zoology, Ohio State University, Brown Tree Snake Project, P.O. Box 8255, MOU-3, Dededo, Guam 96912, USA (e-mail: Gad_Perry@compuserve.com), and **MIKE RITTER**, U.S. Fish and Wildlife Service, Guam National Wildlife Refuge, P.O. Box 8134, MOU-3, Dededo, Guam 96912, USA.

LEPOSOMA GUIANENSE (NCN). **PREDATION.** *Leposoma guianense* is a small gymnophthalmid lizard reaching ca. 40 mm SVL and a maximum weight of 1.9 g. This diurnal species lives in leaf litter and is often observed preying on small arthropods. The species is very common at the St. Eugène Paris Natural History Field Museum field station (4°51'N, 53°3'W) in French Guiana (Convention EDF-Muséum GP 7531). On 25 April 1997 at 1528 h, on the side of a small lane, a spider was observed biting an adult *L. guianense* on the neck. The lizard was already dead and the spider had begun to eat it head first. Photographs were taken and both specimens were collected and placed in a small box for further identification. Less than 30 min later, only a small piece of the tail remained of the lizard. The spider was identified as a juvenile of the genus *Ctenus* (Ctenidae). This genus has previously been reported to prey on *Anolis nitens chrysolepis* in French Guiana (Massary and Ineich 1997. Rev. Fr. Aquariol. 24:3–4). Ctenid spiders are very common in leaf litter and may play an important role in the regulation of populations of leaf litter lizards.

Submitted by **JEAN-CHRISTOPHE DE MASSARY**, Muséum National d'Histoire Naturelle, Laboratoire de Zoology (Reptiles et Amphibiens), 25 rue Cuvier, F-75005 Paris, France (e-mail: massary@cimrsl.mnhn.fr).

PHRYNOSOMA DITMARSI (Rock Horned Lizard). **TESTIS CYCLE.** The purpose of this note is to report on a histological examination of testes from four *P. ditmarsi* from Sonora, México. Specimens were examined from the herpetology collection of the University of Arizona, Tucson (UAZ) 32357, 32358, 39540, 50565. Mean SVL was 66.8 mm ± 6.1 SD (range = 59–73 mm). Specimens 32357 and 32358 were collected 26 September–8 October 1970, 26–32 km SE of Cananea, 39540 was collected 13 July 1974, 26 km (by road) NE of Baviacora, 50565 was collected 5–6 September 1972, ca. 22 km NE of Baviacora. The left testis, epididymis, and vas deferens were removed and embedded in paraffin for histological examination. Sections were cut at 5 µm and stained with hematoxylin followed by eosin counterstain. Spermiogenesis was in progress in the testes from September–October males. The seminiferous tubules were lined by dense clusters of sperm behind which were several rows of metamorphosing spermatids. Epididymides and vasa deferentia contained sperm. The smallest spermiogenic male measured 59 mm SVL. The testis from the July male was in recrudescence. Primary spermatocytes were the predominant cell. No sperm were present in the epididymis or vas deferens. Lowe and Howard (1975. Southwest. Nat. 20:265–270) reported from sight observations of preserved material that *P. ditmarsi* testes were regressed (minimum activity) in mid-summer and at maximum recrudescence in autumn, suggesting a testis cycle similar to that of *Phrynosoma douglasii*, a late winter, early spring breeder in Arizona (Goldberg 1971. Herpetologica 27:311–314). However, from the above histological observations, male *P. ditmarsi* undergo testicular recrudescence in July and breed during autumn. The testis cycle of *P. ditmarsi* therefore appears similar to that of *Sceloporus jarrovii*, an autumn breeder in Arizona (Goldberg 1971. Herpetologica 27:123–131).

I thank Charles H. Lowe (The University of Arizona) for permission to examine *P. ditmarsi*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA.

PLACOSOMA GLABELLUM (NCN). **REPRODUCTION.** During sampling of the leaf litter in the Atlantic forest in Ilha de São Sebastião, southeastern Brazil (23°47'S; 45°24'W), we found two clutches belonging to *Placosoma glabellum*. The first clutch consisted of one egg (not measured) collected on 12 January 1998, 300 m elevation. The second clutch consisted of two eggs (11.40 x 8.25 mm, 0.40 g; 11.35 x 8.15 mm, 0.39 g) collected on 25 January 1998, 300 m elevation. The clutches were found ca. 13 km apart. The clutches were kept separately in plastic boxes (13.5 x 13.5 x 4.5 cm), in which they were placed on layers of damp cotton and maintained at air temperatures of 25–29°C. The egg in the first clutch hatched between 17 and 25 February 1998, and the hatchling was not measured. The two eggs of the second clutch hatched between 1 and 3 March 1998. The hatchlings were measured and deposited in the Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZUSP) (SVL 24.35 mm, tail length 42.40 mm, MZUSP 83479; and SVL 23.35 mm, tail length 43.20 mm, MZUSP 83480). We also collected one adult female *P. glabellum* (SVL 52.90 mm, tail length 73.80 mm, 2.28 g, MZUSP 83478) from the same locality as the second clutch. This female was dissected, revealing two vitellogenic ovarian follicles (one in each ovary) measuring 5.4 x 4.2 mm and 5.8 x 4.3 mm, respectively.

There are no published accounts of reproduction in *P. glabellum*. Our data suggest that the life history strategy of this species is to produce relatively small clutches of relatively large offspring.

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Submited by **RICARDO J. SAWAYA**, Universidade de São Paulo, Departamento de Zoologia, Instituto de Biociências, CP 11461, 05422-970 São Paulo, São Paulo, Brazil (e-mail: rjsawaya@mandic.com.br), **CARLOS HENRIQUE F. VASCONCELOS**, Universidade Federal de Minas Gerais, Departamento de Zoologia, Instituto de Ciências Biológicas, Av. Antônio Carlos, 6627, 31270-090 Belo Horizonte, Minas Gerais, Brazil (e-mail: cep@rbeep.com.br), and **RENATO NUNES**, Universidade Estadual Paulista, Departamento de Zoologia, IB, 13506-900 Rio Claro, São Paulo, Brazil (e-mail: renatonunes@uol.com.br).

URANOSCODON SUPERCILIOSUS (NCN). **DIVING.** Our observation was made during an ecological impact study of a hydroelectric power dam on the Sinnamary River in French Guiana (Convention EDF-MusÈum GP 7531). The study area was near the St. Eugène station, a Paris Natural History Museum field station (4°51'N, 53°4'W), ca. 24 km from the dam. On 11 April 1996, we observed a specimen of *Uranoscodon superciliosus* diving, and we were able to time the exact duration of its dive. The specimen, an adult male (145 mm SVL, with a 262 mm regenerated tail) was captured, photographed, measured, and released at 1545 h from a boat ca. 9 m from shore. The specimen dived just in front of us and remained at a depth of ca. 22 cm for 24 min 40 sec. The lizard then emerged for ca. 1 sec, took a single breath, and submerged a second time.

Submitted by **JEAN-CHRISTOPHE DE MASSARY** and **IVAN INEICH**, Muséum National d'Histoire Naturelle, Laboratoire de Zoologie (Reptiles et Amphibiens), 25 rue Cuvier, F-75005 Paris, France (e-mail: massary@cimrsl.mnhn.fr).

SERPENTES

CONTIA TENUIS (Sharp-tailed Snake). **DEFENSIVE BEHAVIOR.** On four occasions, we observed and photographed seven juvenile *Contia tenuis* in an apparent defensive posture in response to disturbance by observers. When picked up, the snakes coiled into tight balls, with their heads hidden inside their coils, and maintained this position for several minutes. The tail of one snake protruded from the coil in an upright position. On one occasion, two snakes assumed the coiled posture upon exposure when we lifted the cover under which they were sheltered (Fig. 1). All snakes were 78–115 mm in SVL, the smallest being approximately the body size at hatching (Brodie et al. 1969. Herpetologica 25:223–227). While handling *C. tenuis* on more than a hundred occasions, we have never seen adults or larger juveniles exhibit this posture. The observations occurred on Saltspring Island (26 September 1996, two snakes; 14 March 1997, three snakes), and North Pender Island (24 April 1998, one snake; 7 June 1998, two snakes, including the same individual as seen on 24 April), British Columbia, Canada.



FIG. 1. Two juvenile *Contia tenuis* coiled with the head hidden in a presumed defensive posture.

Coiling into a ball while hiding the head occurs in a wide range of snake species and is especially well documented for boids (Carpenter 1977. *In* Gans and Tinkle [eds.], Biology of the Reptilia, Vol. 7A, Ecology and Behavior, pp. 335–402. Academic Press, New York; Greene 1997. Snakes. The Evolution of Mystery in Nature. Univ. California Press, Berkeley, California. 351 pp.). Looping the body and hiding the head has also been reported for lizards (Bille 1997. Herpetol. Rev. 28:202). The posture apparently functions in protecting the head and other vital parts of the body against predatory attacks. The bulky shape of a coiled snake may also discourage smaller predators from attempting ingestion. We interpret the behavior of juvenile *C. tenuis* as a defense against predators and suggest that an ontogenetic shift in anti-predator behavior occurs during this snake's first year of life.

Submitted by **KRISTIINA OVASKA**, Department of Forest Sciences, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4 (e-mail: kovaska@jdmicro.com), and **CHRISTIAN ENGELSTOFT**, Alula Biological Consulting, 1967 Nicholas Road, Saanichton, British Columbia, Canada V8M 1X8 (e-mail: alula@islandnet.com).

CROTALUS LEPIDUS MORULUS (Rock Rattlesnake). **REPRODUCTION**. Little is known about the litter size of *Crotalus lepidus morulus*. Data from other subspecies of *C. lepidus* indicate that litter size is between 3–9 (Armstrong and Murphy 1977. The Natural History of Mexican Rattlesnakes. Univ. Kansas Mus. Nat. Hist. Special Publ. 5:1–188; Liner and Chaney 1986. Herpetol. Rev. 17:89). On 25 July 1992, a pregnant female *C. lepidus morulus* (515 mm SVL, 161.8 g) was collected by Fernando Mendoza at Ciénaga del Toro, Nuevo León, México. This snake was maintained in captivity on a diet of mice at the Laboratorio de Herpetología, Universidad Nacional Autónoma de México, Campus Iztacala. On 30 August 1992, the female gave birth to 10 living offspring. The SVL (mean ± SE) of the neonates was 126 ± 12.6 mm (125–146 mm range), and their mass averaged 4.22 ± 0.174 g (3.08–5.30 g). Relative clutch mass was 0.353 (Vitt and Price 1982. Herpetologica 38:237–255).

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Submitted by **FELIPE CORREA SANCHEZ** (e-mail: scorrea@servidor.unam.mx), **AMAYA GONZALEZ RUIZ**, **ENRIQUE GODINEZ CANO** (e-mail: egodinez@servidor.unam.mx), Laboratorio de Herpetología, Universidad Nacional Autónoma de México, Campus Iztacala, Av. de Los Barrios s/n, Los Reyes Iztacala, Edo. de México, C.P. 54090, México, and **JUAN ALFONSO DELGADILLO ESPINOSA**, Herpetario, Zoológico de Chapultepec, 1ª Secc. Bosque de Chapultepec s/n, C.P. 11850, Distrito Federal, México.

CROTALUS WILLARDI SILUS (Ridge-nosed Rattlesnake). **REPRODUCTION**. There are few accounts of reproduction in *Crotalus willardi silus* (Martin 1975. Bull Maryland Herpetol. Soc. 11:187–189; Armstrong and Murphy 1977. The Natural History of Mexican Rattlesnakes. Univ. Kansas Mus. Nat. Hist. Special Publ. 5:1–188). On 2 May 1993, a gravid female *C. willardi silus* (SVL 500 mm, 144 g) was collected by Mario Mancilla, 2 km south of San Juanito, Chihuahua, México. This snake was maintained in captivity on a diet of mice at the Laboratorio de Herpetología, Universidad Nacional Autónoma de México, Campus Iztacala. On 28 July 1993, the snake delivered two dead embryos and two infertile ova. Later, on 9 August 1993, the snake delivered five live neonates. The SVL (mean ± SE) of the five live young was 169.4 ± 4.28 mm (165–174 mm range), and the average mass was 8.3 ± 0.45 g (7.5–8.5 g). The relative clutch mass was 0.402 (Vitt and Price 1982. Herpetologica 38:237–255). Martin (1975, *op. cit.*) reported the same number of living young for this subspecies.

Although the long period of captivity prior to parturition may have influenced neonate size, our observation is noteworthy because of the paucity of data on reproduction in *C. willardi silus*.

Submitted by **JUAN ALFONSO DELGADILLO ESPINOSA**, Herpetario, Zoológico de Chapultepec, 1ª Secc. Bosque de

Chapultepec s/n C.P. 11850, Distrito Federal, México, **ENRIQUE GODINEZ CANO** (e-mail: egodinez@servidor.unam.mx), **FELIPE CORREA SANCHEZ** (e-mail: scorrea@servidor.unam.mx), and **AMAYA GONZALEZ RUIZ**, Laboratorio de Herpetología, Universidad Nacional Autónoma de México, Campus Iztacala, Av. de los Barrios s/n, Los Reyes Iztacala, Edo. de México, C.P. 54090, México.

ELAPHE OBSOLETA (Black Rat Snake). **ANTIPREDATOR BEHAVIOR**. On 24 April 1998, an adult *Elaphe obsoleta* was observed defending itself against a red-tailed hawk (*Buteo jamaicensis*). This occurred on a forest access road on the Clemson University Experimental Forest near Central, South Carolina, USA. An adult *B. jamaicensis* was observed standing on top of the *E. obsoleta*. The pronounced size difference between the hawk and the snake, the talon wounds on the snake, the mantling behavior exhibited by the hawk, and the fact that the snake was shedding (as indicated by its blue-opaque eyes), all suggest that initially the hawk was trying to prey upon the snake, and not vice versa. However, the snake had wrapped the lower half of its body around the neck and chest of the hawk, and the hawk had its beak open and tongue protruding. As the struggle continued, the hawk appeared to lose strength and slowly sank to the ground. Even after the hawk appeared dead, the snake retained its hold for at least 10 minutes. The snake was aware of the observer during the struggle as it struck several times. Neither animal was collected so it is unknown if the hawk was diseased.

Submitted by **DAVID B. VANDERMAST**, Clemson University, Department of Forest Resources, 261 Lehotsky Hall, Clemson, South Carolina 29634, USA (e-mail: dvander@clemson.edu).

LAMPROPELTIS TRIANGULUM BLANCHARDI (Blanchard's Milk Snake). **DIET**. Lee (1996. The Amphibians and Reptiles of the Yucatan Peninsula. Cornell Univ. Press, Ithaca, New York. 500 pp.) suggests that *Lampropeltis triangulum blanchardi* from the Yucatan Peninsula feed primarily on mammals. Here we report a lizard in the diet of *L. t. blanchardi* from the Yucatan Peninsula.

During 1973, C. Radcliffe collected a female *L. t. blanchardi* (43.0 cm SVL, 24.4 g) from the state of Yucatan, México (University of Colorado Museum 60036). This snake contained one intact *Cnemidophorus angusticeps* (8.5 cm SVL, 6.6 g) that had been swallowed headfirst (catalogued under the same UCM number as the snake). These measurements were made on the preserved specimens, after each had been blotted dry with paper towels. This prey item, along with the small size of the snake, suggests that *L. t. blanchardi* on the Yucatan Peninsula may undergo an ontogenetic shift in diet from lizards to mammals, as has been observed for several other species of snakes (e.g., Mackessy 1988. Copeia 1988:92–101).

Submitted by **KYLE G. ASHTON** (e-mail: ashtonk@colorado.edu) and **HOBART M. SMITH**, Department of E.P.O. Biology, University of Colorado, Boulder, Colorado 80309, USA.

MICRURUS BROWNI BROWNI (Brown's Coral Snake). **DIET**. A *Micrurus browni browni*, collected on 16 September 1972 from Ocozocautla, México and deposited in the California Academy of Sciences Herpetology Collection (CAS 163739), was discovered by JBS to contain a *Tantilla rubra* (identified by J. A. Campbell) in its stomach. The *M. b. browni* (545 mm SVL, 32.15 g preserved mass) swallowed the *T. rubra* (224 mm SVL, 4.45 g preserved mass) head first. Coral snakes are common predators on snakes, especially small, leaf-litter or fossorial snakes (Greene 1984. Spec. Publ. Univ. Kansas Mus. Nat. Hist. 10:147–162; Seib 1985. Feeding Ecology and Organization of Neotropical Snake Faunas. Ph.D. Dissertation. University of California, Berkeley. 229 pp.). *Micrurus browni* is known to eat *Adelphicos quadrivirgatus*, *Leptotyphlops goudoti bakewelli*, *Tantilla* spp., and *Typhlops braminus* (Blaney and Blaney 1978. Herpetol. Rev. 9:92; Casas-Andreu and Lopez-Forment 1978. An. Inst. Biol. Univ. Nal. Auton. México 49, Ser. Zoología 1:291–294; Greene 1973. The Feeding Habits and Feeding Behavior of New World Coral Snakes. M.A. Thesis. University of Texas at Arlington, 66 pp.). This appears to be the first record of *Micrurus browni browni* eating *Tantilla rubra*.

Submitted by **CAROL L. SPENCER**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA (e-mail: cspencer@exchange.uta.edu), **MICHELLE S. KOO** (e-mail: mkoo@calacademy.org) and **JOSEPH B. SLOWINSKI** (e-mail: jslowins@cas.calacademy.org), Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.

NERODIA SIPEDON INSULARUM (Lake Erie Water Snake). **DIET**. The round goby (Gobiidae: *Neogobius melanostomus*), a fish native to the Black and Caspian Seas, has become established in the North American Great Lakes in this decade, presumably through release of ballast water by foreign tankers (Jude et al. 1992. Can. J. Fish. Aquatic Sci. 49:416-421). Here we document the inclusion of round gobies in the diet of water snakes (*Nerodia sipedon insularum*) inhabiting the island region of western Lake Erie. As part of an investigation of the distribution and abundance of this snake on the Ohio islands in 1996–1998, 46 prey items were recovered by spontaneous regurgitation or palpation from 41 individual snakes (Table 1). Round gobies constituted 24% of prey recovered from water snakes in 1996–1998. In contrast, gobies were absent among 45 prey items recovered from island snakes in 1989–1992 (King 1993. J. Herpetol. 27:90–94). Spottail shiners (*Notropus hudsonius*) and yellow perch (*Perca flavescens*) were also absent from previous Lake Erie water diet samples, but other Percidae were consumed (King, *op. cit.*; Hamilton 1951. Can. Field Natur. 65:64–65). Mudpuppies (*Necturus maculosus*) were present in previous Lake Erie water snake diet samples but constituted a larger proportion of water snake prey in 1996–1998 than in 1989-1992 (33% vs. 13%, Fisher exact test: $P = 0.045$).

Round gobies are bottom dwellers (Jude et al., *op. cit.*), and so their inclusion along with other benthic vertebrates in the diet of the Lake Erie water snake is not surprising. Whether round gobies will have a net positive or negative effect on water snake populations remains uncertain. Gobies currently occur in high densities in the island region of western Lake Erie (5–7 gobies per m^2 have been observed near some islands; K. Baker, pers. comm.) and thus may represent an abundant food source for water snakes. However, round gobies feed on zebra mussels (Ghedotti et al. 1995. J. Great Lakes Res. 21:665–669), and as a consequence of filter feeding by zebra mussels, may accumulate environmental toxins that could harm water snakes. In addition, round gobies may reduce the densities of other water snake prey (e.g., log perch, *Percina caprodes*, Jude et al. 1995. *In* Munawar et al. (eds.), The Lake Huron Ecosystem: Ecology, Fisheries and Management, pp 447–460. SPB Academic Publishing, Amsterdam).

TABLE 1. Prey species (common name), number of individual prey (number of snakes containing that prey, if different), mean ± SD prey mass (range), mean ± SD snake mass (range), and mean ± SD ratio of prey mass to snake mass (range) for 46 prey items recovered from 41 Lake Erie water snakes.

Prey Species	N	Prey Mass (g)	Snake Mass (g)	Prey:Snake Mass
Neogobius melanostomus (Round Goby)	11 (10)	13.5 ± 8.95 (3.7–30.7)	391.6 ± 158.08 (154.5–568.6)	0.04 ± 0.018 (0.01–0.06)
Notropus hudsonius (Spottail Shiner)	7	4.9 ± 1.51 (2.8–7.3)	424.15 ± 231.90 (76.2–540.0)	0.03 ± 0.043 (0.01–0.10)
Notorus flavus (Stonecat Madtom)	4	73.3 ± 39.91 (32.0–126.0)	570.9 ± 137.49 (418.1–684.6)	0.16 ± 0.053 (0.09–0.19)
Etheostoma blenniodes (Greenside Darter)	3	0.5 ± 0.12 (0.4–0.6)	11.5 ± 4.95 (8.0–15.0)	0.05 ± 0.071 (0.04–0.05)
Perca flavescens (Yellow Perch)*	2	40.9	330.7 ± 382.97 (59.9–601.5)	0.07
Percina caprodes (Log Perch)	4	1.2 ± 0.32 (1.0–1.6)	19.3 ±7.71 (10.0–28.2)	0.09 ± 0.061 (0.05–0.16)
Necturus maculosus (Mudpuppy)	15	53.0 ± 38.08 (14.2–139.5)	528.6 ± 153.63 (237.5–788.0)	0.11 ± 0.060 (0.03–0.24)

* Only one yellow perch was measurable

Prey items recovered in this study will be deposited at the Field Museum of Natural History, Chicago, Illinois. Financial support was provided by the Ohio Division of Wildlife.

Submitted by **RICHARD B. KING, ALEJANDRO QUREAL-REGIL, TONYA D. BITTNER, JAMES M. KERFIN**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA (e-mail: rbking@niu.edu), and **JOHN HAGEMAN**, F. T. Stone Laboratory, Ohio State University, Put-in-Bay, Ohio 43456, USA.

PHILODRYAS PATAGONIENSIS (NCN). **PREDATION.** *Philodryas patagoniensis* feeds on a wide range of prey including frogs, lizards, snakes, fishes, birds, and mammals (Leitão de Araújo and Ely 1980, Iheringia, Sér. Zool., Porto Alegre 55:87–106; Sazima and Haddad 1992, *In* L. C. P. Morellato [ed.], História Natural da Serra do Japi, pp. 212–236. Editora da Unicamp/Fapesp, Campinas; Vanzolini 1948. Rev. Brasil. Biol. 8:308–311). Here we report bird nestlings taken as food in the wild by *P. patagoniensis* in southeastern Brazil.

An individual of this species, ca. 800 mm total length, was found by SPCS in a nest of *Troglodytes aedon* (house wren, Passeriformes, Troglodytidae) that contained three young on 1 April 1984 around 1300 h near Teresópolis, Rio de Janeiro State, Brazil (22°26'S, 42°59'W; 950 m elevation). The nestlings were ca. seven days old. The nest was inside a cavity located at the top of an eroded fence post ca. 5 m from a house. Occasionally, the activity of birds at this nest had been watched in previous days. When the snake was noted, the anterior portion of its body was inside the nest cavity holding one of the young in its mouth; the other two young birds had disappeared from the nest and might have already been swallowed by the snake, which showed a lump in its body. This record supports the idea that *P. patagoniensis* is an opportunistic predator.

We thank Luiz Antonio Pedreira Gonzaga for suggestions, comments on this note, and providing additional information.

Submitted by **SERGIO POTSCH DE CARVALHO E SILVA** and **JOSÉ DUARTE DE BARROS FILHO**, Laboratório de Anfíbios e Répteis, Departamento de Zoologia, Universidade Federal do Rio de Janeiro, Caixa Postal 68044, CEP 21944-970, Rio de Janeiro, RJ, Brazil (e-mail [SPCS]: spotsch@acd.ufrj.br).

THAMNOPHIS SIRTALIS CONCINNUS (Red-spotted Garter Snake). **DIET.** The common garter snake, *Thamnophis sirtalis*, is one of the few known predators of the newt *Taricha granulosa*. Only *T. sirtalis* that occur sympatrically with *T. granulosa* are able to resist the neurotoxin (tetrodotoxin) produced by these newts, and this resistance is variable within and between sympatric populations (Brodie and Brodie 1991, Evolution 45:221–224). Documented resistant populations of garter snakes occur in Benton Co., Oregon; western Lane Co., Oregon; Vancouver Island, British Columbia (Brodie and Brodie 1990, Evolution 44:651–659; Brodie and Brodie 1991, *op. cit.*); and the San Francisco Peninsula (Fox 1952, Herpetologica 8:4–8). We report two separate cases of *Thamnophis sirtalis concinnus* consuming rough-skinned newts, *T. granulosa*, in eastern Lane County, Oregon (USA). To the best of our knowledge, we also provide the first published account of *T. sirtalis* consuming *Plethodon dunni*.

On 25 June 1996 we found a *T. sirtalis concinnus* (449 mm SVL, 26.1 g) dead on USFS road 1506 in the Lookout Creek watershed (T15S R5E sec. 31). Upon dissection, we found two prey items in the stomach of the snake. The most posterior was a partially di-

gested *T. granulosa* (newly metamorphosed) swallowed head first. Anterior to the newt was a Dunn's salamander, *P. dunni* (69 mm SVL, 3.1 g) that was swallowed tail first. Several cerci from nymphal stoneflies (*Calineuria* sp.) were in the small intestine of the snake. These insects likely represent secondary prey items (Fitch 1965, Univ. of Kansas Publ. Mus. Nat. Hist. 15:493–564). Even though the snake was dead when collected, we believe it was not adversely affected by tetrodotoxin because the newt was partially digested when found and because the snake ate the Dunn's salamander after eating the newt.

On 28 July 1997 we found another *T. sirtalis concinnus* (427 mm SVL, 36.0 g) dead on USFS road 15 in the Blue River watershed (T15S R5E sec. 31), 2.4 km NW of the location of the first snake. This animal had swallowed a *T. granulosa* (53 mm SVL, 5.5 g) tail first. No other prey items were found. Intrapopulation resistance to tetrodotoxin in *T. sirtalis* is variable such that certain individuals are immobilized after consuming a newt. Because this specimen was found DOR shortly after consuming a newt, we can not rule out that the newt was the proximal cause of the snake's death.

Individual *T. sirtalis* can move as much as 17 km in a season (Gregory and Stewart 1975, Can. J. Zool. 53:238–245). Because these snakes were found only 2.4 km apart and in connecting watersheds, it is probable that they are from the same population. This population of snakes occurs sympatrically with *T. granulosa* and appears to include individuals that are resistant to tetrodotoxin.

All specimens were deposited in the Texas Natural History Collections of the Texas Memorial Museum, Austin, Texas (1996 *T. sirtalis* and prey = TNHC 59342; 1997 *T. sirtalis* and prey = TNHC 59341) .

Submitted by **MARY F. POTEET,** Department of Integrative Biology, University of California, Berkeley, California 94720, USA and **CHRISTOPHER J. BELL,** Department of Geological Sciences, University of Texas at Austin, Austin, Texas 78712, USA.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 30, Number 1 (March 1999).

CAUDATA

AMBYSTOMA MACRODACTYLUM (Long-toed Salamander). USA: ALASKA: ALEXANDER ARCHIPELAGO: Vank Island Group, Sokolof Island, NW 1/4 of Sec.15, T62S, R82E, vernal pond off abandoned logging road just upslope of tidal influence on S side of small cove on W side of island. 5 May 1992. Aquatic Collection of the University of Alaska, Fairbanks (UAF 1993-10:28a; also UAF 1993-10:28b [11 larvae]). Verified by Jeff Stoneman. UAF 1993-10:28a is a recently transformed sub-adult specimen taken from under a moss-covered piece of downed-woody debris partially buried in leaf and forest litter about 5 m upslope of the vernal pool in which UAF 1993-10:28b were taken as eggs attached to alder twigs. These specimens represent the first records for the Alexander Archipelago, the first insular records for the species in Alaska, the westernmost state records for the species, and the first records for Sokolof Island and outside the Stikine River drainage. The nearest known mainland records occur in the Stikine River drainage which enters the Pacific Ocean ca. 11 km to the NE (Hodge 1973, HISS News J. 1:23; Hodge 1976, Amphibians and Reptiles in Alaska, the Yukon and Northwest Territories. Alaska Northwest Publ. Co., Anchorage).

Submitted by **BRADFORD R. NORMAN**, 69 Midway Court, Arcata, California 95521, USA.

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: TENNESSEE: HARDIN CO: Shiloh National Military Park, located on road adjacent to a temporary pond near Indian Mounds. 7 March 1998. APSU Color Slide 5584. Verified by A. Floyd Scott. Time of collection was 8:00 pm. Conditions at time of collection were 10°C and raining. Extends the presence of disjunct populations from the Coastal Plain in western Tennessee eastward (Redmond and Scott 1996, Atlas of Tennessee Amphibians. Center for Field Biol. Austin Peay St. Univ. Misc. Pub. 12:1–94).

Submitted by **CRAIG D. WILMHOFF, LIN WILLIAMS, RONALD MACDONALD, SHARON FISHER**, and **JOLENE SLOTHOUBER**, Department of Biology, University of Memphis, Memphis, Tennessee 38152, USA.

ENSATINA ESCHSCHOLTZII (Ensatina). CANADA: BRITISH COLUMBIA: Kitlope, 53°13'N, 127°51'W. 6 April 1992. John Kelson. RBCM 1911. Verified by Stan Orchard. Clayoquot River, Vancouver Island, 49°12'49"N, 125°29' 41"W. 7, 15, and 21 October 1998. Robyn Scott, David White, Jamie Johansen, and Chris Addison. RBCM Photograph File. Verified by Theodore M. Davis. Specimen from Kitlope was found under a downed log along a river bank in mature forest, and those from Vancouver Island were found at night on the surface of the forest floor, also in mature forest. Kitlope record extends the known range of the species ca. 110 km northward from South Bendinct Arm on the mainland coast. Within a stretch of close to 400 km north of Redona Bay, the salamander is now known from only two localities. To our knowledge, the record from Clayoquot River is the first documentation of the species from the west coast of Vancouver Island. We have an additional record of *E. eschscholtzii* (collected and released on 27 September 1996 after examination by Elke Wind) from 11 km W of Port McNeill on Vancouver Island (50°30'30"N, 127°16'20"W), ca. 160 km northward of the nearest previous locality in Miracle Beach Provincial Park. The paucity of locality records likely reflects a lack of search effort on northern and western Vancouver Island and in the remote, largely roadless mainland coast rather than the absence of the species from the intervening areas.

Submitted by **JOHN KELSON**, P.O. Box 1078, Kitimat Village, British Columbia, Canada V0T 2B0, **BARBARA BEASLEY**, Long Beach Model Forest, 243 Main Street, P.O. Box 1119, Ucluelet, British Columbia, Canada V0R 3A0, **ELKE WIND**, Centre for Applied Conservation Biology, Department of Forest Sciences, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4, and **KRISTIINA OVASKA**, Department of Forest Sciences, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4, and Biolinx Environmental Research Ltd., 1759 Colburne Place, Sidney, British Columbia, Canada V8L 5A2.

GYRINOPHILUS PORPHYRITICUS PORPHYRITICUS (Northern Spring Salamander). USA: TENNESSEE: HARDIN CO: Shiloh National Military Park, ca. 100 m from Owl Creek Beaver Pond. 7 March 1998. APSU Color Slide 5583. Verified by A. Floyd Scott. Larval individuals were found in an inground, spring fed cattle trough at 1330 h. Conditions were 12°C and drizzling. Extends range from northern Mississippi to southwestern Tennessee (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts, pp. 285–286). Provides first evidence of this species west of the Central Basin in Tennessee (Redmond

and Scott 1996, Atlas of Tennessee Amphibians. Center for Field Biol. Austin Peay St. Univ. Misc. Publ. 12:1–94).

Submitted by **CRAIG D. WILMHOFF, LIN WILLIAMS, RONALD MACDONALD, SHARON FISHER**, and **JOLENE SLOTHOUBER**, Department of Biology, University of Memphis, Memphis, Tennessee 38152, USA.

NOTOPHTHALMUS VIRIDESCENS LOUISIANENSIS (Central Newt). USA: TEXAS: Upshur Co: 4.8 km S Big Sandy. 11 March 1967. Edward Jacquet. SMBU 9317–22. Verified by Stephen L. Williams. First record for county (Dixon 1987, Amphibians and reptiles of Texas, Texas A & M Univ. Press. 434 pp; Dixon 1997, Texas Herpetol. Soc. Spec. Publ. 3:1–14).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA; **DAVID LINTZ** and **BRYCE C. BROWN**, Strecker Museum, Baylor University, Waco, Texas 76798-7154, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

PLETHODON SERRATUS (Southern Redback Salamander). USA: GEORGIA: Clayton Co: Hampton, Clayton County Water Authority Wetlands Center, 2755 Freeman Road. Swamp located 100 m SW jct. of Pate's Creek and Freeman Road. Two individuals found on hill between the location where Turkey Creek and Pate's Creek enter the wetland. 14 February 1998. Stacy Smith. SOCM 813. Verified by John Jensen. New county record (Williamson and Moulis 1994, Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Spec. Pub. 3:1–712).

Submitted by **STACY N. SMITH**, Clayton County Water Authority Wetlands Center, 2755 Freeman Road, Hampton, Georgia 30228, USA.

PSEUDOTRITON RUBER VIOSCAI (Southern Red Salamander). USA: TENNESSEE: Hardin Co: Shiloh National Military Park, 10m from headwaters underneath bark of log. 7 March 1998. APSU Color Slide 5582. Verified by A. Floyd Scott. Individual was found at 10 am. Conditions were 12°C and drizzling. Provides further evidence of the disjunct populations of this species in the eastern two-thirds of the Coastal Plain in western Tennessee (Redmond and Scott 1996, Atlas of Tennessee Amphibians. Center for Field Biol. Austin Peay St. Univ. Misc. Publ. 12:1–94).

Submitted by **CRAIG D. WILMHOFF, LIN WILLIAMS, RONALD MACDONALD, SHARON FISHER**, and **JOLENE SLOTHOUBER**, Department of Biology, University of Memphis, Memphis, Tennessee 38152, USA.

ANURA

EUPSOPHUS VERTEBRALIS. ARGENTINA: RÍO NEGRO: Bariloche Department Nahuel Huapi National Park, Puerto Blest, 41°02'S, 71°49'W. March 1973. A. Barrio. CENAI 7281 (presently deposited at Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires). Verified by J. R. Formas. First record for Argentina. Adult male (SVL 49.5 mm) collected in a temperate humid forest of coihue (*Nothofagus dombeyi*) with some elements of Chilean Valdivian forest, e.g., mañiú hembra (*Saxegothaea conspicua*), palo santo (*Dasyphyllum diacanthoides*), and huahuán (*Laureliopsis philippiana*). This frog is found in the richest region of amphibian species inhabiting the Patagonian temperate forests east of the Andes, sharing the area with *Eupsophus calcaratus, Batrachyla antantardica, B. leptopus, B. taeniata, Hylorina sylvatica, Alsodes australis, A. monticola, Pleurodema thaul, Bufo variegatus*, and *Rhinoderma darwinii*. The species is distributed in Chile from Ramadillas, 37°18'S, 73°17'W to Bahía Mansa, 40°30'S, 73°40'W (Formas 1989, Proc. Biol. Soc. Washington 102:568–576). Extends the distribution of the species to E of the Andes mountains, 168 km SE from the southernmost, previously known locality.

Submitted by **NÉSTOR G. BASSO**, Sección Herpetología, Departamento Científico Zoología Vertebrados, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina, and **CARMEN A. ÚBEDA**, Centro Regional Bariloche, Universidad Nacional del Comahue, Unidad Postal Universidad, 8400 Bariloche, Argentina.

HYLA BIOBEBA. BRAZIL: GOIÁS: Municipality of Silvânia: Estaçao Florestal de Experimentação (ca. 16°39'26"S, 48°36'16"W; 900 m elev.). 2 June 1995. R. P. Bastos, J. A. O. Motta, and D. Blamires. Verified by J. P. Pombal, Jr. Museu Nacional – Universidade Federal do Rio de Janeiro (MNRJ) 17422–23. First documented state record.

Submitted by **ROGÉRIO P. BASTOS** and **DANIEL BLAMIRES**, Departamento de Biologia Geral, UFG, C.P. 131, 74001-970, Goiâna, Goiás, Brazil, **REUBER A. BRANDÃO** and **ANTÔNIO SEBBEN**, Laboratório de Fisiologia Animal, UnB, 70910-900, Brasília, DF, Brazil.

HYLA CINEREA (Green Treefrog). USA: TENNESSEE: Stewart Co: Land Between The Lakes (LBL), Bear Creek Waterfowl Management Area, W shore of Barkley Lake at River Mile 85 in slough adjacent to Cow Creek (36°31'30"N, 87°52'47"W). Four adult males in submerged black willow trees (*Salix nigra*). 14–15 June 1998. Brant Smith and Christina Therrell. Austin Peay State University Museum of Zoology (APSUMZ 5744–45); Barkley Wildlife Management Area, E side of Barkley Lake at River Mile 88 N of Dover (36°29'40"N, 87°50'30"W). Adult male in black willow tree in flooded field. 28 June 1998. Brant Smith. APSUMZ 5743; Cross Creeks National Wildlife Refuge (CCNWR), W side of Barkley Lake at River Mile 91 just N of CCNWR headquarters (36°30'00"N, 87°47'15"W). Three adult males in black willows in adjacent river sloughs (many more calling from surrounding vegetation). 28 July 1998. Brant Smith and Christina Therrell. APSUMZ 5954. All specimens verified by A. Floyd Scott. First records from Cumberland River drainage in Tennessee (Snyder 1972, Amphibians and Reptiles of Land Between The Lakes, Tennessee Valley Authority, Golden Pond, Kentucky. 90 pp.; Redmond and Scott 1996, Atlas of Amphibians in Tennessee, Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **BRANT T. SMITH** and **CHRISTINA L. THERRELL**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

ODONTOPHRYNUS CULTRIPES. BRAZIL: GOIÁS: Municipality of Silvânia: Estaçao Florestal de Experimentação (ca. 16°39'26"S, 48°36'16"W; 900 m elev.). 9 October 1995. R. P. Bastos, J. A. O. Motta, and D. Blamires. Verified by J. P. Pombal, Jr. Museu Nacional – Universidade Federal do Rio de Janeiro (MNRJ) 17426. Adult male (SVL 61.1 mm) captured during vocalization. First state record.

Submitted by **ROGÉRIO P. BASTOS**, Departamento de Biologia Geral, UFG, C.P. 131, 74001-970, Goiâna, Goiás, Brazil, **JOSÉ AUGUSTO O. MOTTA**, IBAMA, Rua 229, n. 95, Sl. Universitário, 74605-080, Goiâna, Goiás, Brazil, **REUBER A. BRANDÃO** and **ANTÔNIO SEBBEN**, Laboratório de Fisiologia Animal, UnB, 70910-900, Brasília, DF, Brazil.

OSTEOCEPHALUS LANGSDORFFII. BRAZIL: SÃO PAULO: ITIRAPINA: 22°13'52"S, 47°51'11"W, 770 m elev. 15 October 1998. M. T. Almeida and R. Nunes. Collection Célio F. B. Haddad, deposited in Departamento de Zoologia da Universidade Estadual Paulista, Rio Claro, SP; Brazil. (CFB 2980, adult male). Verified by C. F. B. Haddad. Extends known range ca. 76 km NW from Poá Municipality, São Paulo (Cochran 1955, Bull. U.S. Natl. Mus. 206:73–75).

Submitted by **MARÍLIA T. DE ALMEIDA** (e-mail: matal@rc.unesp.br) and **RENATO NUNES** (e-mail: renatonunes@uol.com.br), Departamento de Zoologia, Instituto de Biociências, Universidade Estadual Paulista, C.P. 199, 13506—900, Rio Claro—São Paulo, Brazil.

OTOPHRYNE PYBURNI. VENEZUELA: ESTADO AMAZONAS: Parima B, Sierra Parima, 1100 m elevation. 7 August 1986. J. Chiappino. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 1868). Upper Cuao River. 30 August 1987. S. Zent. EBRG 1872. Apepada, Upper Ventuari River, 28 June 1980. M. Colchester. EBRG 1905. All verified by Gilson Rivas. This recently described species (Campbell and Clarke 1998, Herpetologica 54:301–317) has been reported formerly as *Otophryne robusta* in southern Venezuela by McDiarmid and Paolillo (1988, *In* Brewer-Carmas (ed.), Cerro de la Neblina, Resultados de la Expedición 1983–1987. FUDECI, Caracas) and by Rivero (1967, Carib. J. Sci. 7:145–154). EBRG 1872 represents the northernmost known locality for the species, 500 km NW of the previous northernmost report, Ugueto, upper Orinoco (Rivero 1967, *op. cit.*).

Submitted by **CISAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matematicas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

OTOPHRYNE STEYERMARKI. VENEZUELA: ESTADO BOLÍVAR: Río Marajano, Meseta de Jaua. 1800 m elev. 2 March 1974. P. A. Bermúdez. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 0008). Verified by Gilson Rivas. Elevated to specific status by Campbell and Clarke (1998, Herpetologica 54:301–317), previously considered a subspecies of *Otophryne robusta* (Rivero 1967, Carib. J. Sci. 7:155–158). Until now, this species has been considered endemic to the Chimanta massif in southern Venezuelan Guayana (Gorzula 1985, Herpetol. Rev. 16:102–103; Gorzula 1992, *In* O. Huber [ed.], El Macizo del Chimanta. Oscar Todtmann Editores, Caracas, Venezuela). Extends known distribution of species 250 km to the WSW, displaying a wider distribution through the pantepui region.

Submitted by **CISAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matematicas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

PSEUDACRIS BRACHYPHONA (Mountain Chorus Frog). USA: TENNESSEE: HARDIN CO: Shiloh National Military Park, temporary pond near Indian Mounds. 7 March 1998. APSU Color Slide 5585. Verified by William H. N. Gutzke. Found calling from a temporary pond at 2000 h. Conditions at time of collection were 10°C and rainy. Extends range westward to the eastern portion of the Coastal Plain of western Tennessee (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts, pp. 329–330). Provides first evidence of the species west of Marion County in Tennessee (Redmond and Scott 1996, Atlas of Tennessee Amphibians. Center for Field Biol. Austin Peay St. Univ. Misc. Publ. 12:1–94).

Submitted by **CRAIG D. WILMHOFF**, **LIN WILLIAMS**, **RONALD MACDONALD**, **SHARON FISHER**, and **JOLENE SLOTHOUBER**, Department of Biology, University of Memphis, Memphis, Tennessee 38152, USA.

RANA PALUSTRIS (Pickerel Frog). USA: TEXAS: SABINE CO: 16.1 km S Hemphill. 26 April 1969. Dennis Spence. SMBU 9063. Verified by Stephen L. Williams. First record for county (Dixon 1987, Amphibians and Reptiles of Texas, Texas A & M Univ. Press. 434 pp.; Dixon 1997, Texas Herpetol. Soc. Spec. Publ. 3:1–14).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA; **DAVID LINTZ** and **BRYCE C. BROWN**, Strecker Museum, Baylor University, Waco, Texas 76798-7154, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0334, USA.

SAURIA

ANOLIS CRISTATELLUS (Puerto Rican Crested Anole). USA: FLORIDA: BREVARD CO: on grounds of Riverside Inn (formerly Howard Johnson's Inn) on U.S. Rt. 1, ca 2.4 km S jct. of Florida Rt. 402 and U.S. Rt. 1 (28°35'61"N, 80°48'08"W). 4 August 1998. Benjamin J. Seigel. LSUMZ 80413. Verified by Brian I. Crother and Frank Burbrink. New county record; extends range ca. 310 km N of localities in Dade County (Wilson and Porras 1983, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9:1–89) and represents the second Florida county in which this introduced species is known to occur (Walter Meshaka, pers. comm.). No other specimens were found in two subsequent visits to this site, but local residents report having seen similar lizards in recent months.

Submitted by **BENJAMIN J. SEIGEL**, **NADIA A. SEIGEL**, and **RICHARD A. SEIGEL**, Department of Biological Sciences, Southeastern Louisiana University, SLU 10736, Hammond, Louisiana 70402, USA (e-mail: rseigel@selu.edu).

CROTAPHYTUS COLLARIS (Eastern Collared Lizard). USA: ARIZONA: PINAL CO: N slope Gold Mine Mountain, Santan Mountains, 33°11'05"N, 111°38'24"W. 3 June 1999. Matthew Flowers and Brian K. Sullivan (BKS 1125; LSUMZ 80951). Verified by Jim McGuire. Adult male in rocky, Arizona Upland Biotic Community, 520 m elev. Extends range 35 km SW of previous locality in the Superstition Mountains, and documents taxon in low elevation Sonoran Desert, within 25 km of *C. nebrius* (Sacaton Mountains).

Submitted by **MATTHEW A. FLOWERS**, Department of Biology, Arizona State University, Tempe, Arizona 85287, USA, and **BRIAN K. SULLIVAN**, Department of Life Sciences, Arizona State University West, Phoenix, Arizona 85069, USA.

CYRTOPODION KOTSCHYI (Kotschy's Gecko). HUNGARY: SOMOGY COUNTY: Siofok municipality, Balatonszeplak-felso. August 1998. G. Koszegi. Verified by Zoltan Korsos. Hungarian Natural History Museum (HNHM photographs F-98/1–6, three individuals). First country record. This species is not a native member of the Hungarian herpetofauna. Specimens of Bulgarian origin were released by an amateur herpetologist in his house in 1985, which resulted in the establishment of a viable and reproducing colony. Current numbers are believed to be less than a few dozen individuals. Another colony was introduced to a house wall in Budapest Municipality, District 11, Budaorsiut, by another hobby-

ist in the early 1980s. This second colony still flourishes, but due to intensified usage and reconstruction works in the area, it is unlikely to grow and expand substantially in the future.

Submitted by **BALAZS FARKAS**, **BEATA UJVARI**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary, and **GABOR KOSZEGI**, Nemetvolgyi ut 34, H-1126 Budapest, Hungary.

OPHISAURUS COMPRESSUS (Island Glass Lizard). USA: GEORGIA: GLYNN CO: NE end of Little St. Simons Island. 11 September 1996. John Jensen and Bruce Means. UGAMNH 32465. First island record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712). Many individuals observed in muhley grass (*Muhlenbergia capillaris*) and wax myrtle (*Myrica cerifera*) dominated interdunal swales.

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA (e-mail: john_jensen@mail.dnr.state.ga.us).

PHYMATURUS PATAGONICA. ARGENTINA: RIO NEGRO: 25 de Mayo Department: S edge of Ruta Provincial Nº 8, 40°17'13"S, 68°27'32"W, 900–1000 m elev., 17 km S San Antonio del Cuy. 11 March 1999. L. J. Avila, M. Morando, and D. R. Perez. Herpetological collection, Fundación Miguel Lillo, Tucumán, Argentina (FML 8394–95). Verified by F. Lobo. Northernmost record in Argentina and first record for Río Negro Province (Cei 1986, Mon. IV Mus. reg. Sci. Nat. Torino. 527 pp.). Nearest record for species is Dolavon (43°18'S, 65°40'W), Gaiman Department, Chubut, ca. 400 km airline SE (Cei and Castro 1973, J. Herpetol. 7:237–247). This species has geographic variation that makes it difficult to identify some populations, and many diagnostic characters for its differentiation from *P. somuncurensis* may be of doubtful value. The individuals of this population show a remarkable chromatic variation, from almost black to olive green, with variations in the dorsal pattern ranging from white dots to transverse black bands. More than 20 specimens were collected basking on isolated rock outcrops or taking refuge in small crevices.

Submitted by **LUCIANO JAVIER AVILA**, **MARIANA MORANDO**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, C.P. 5301, Anillaco (La Rioja), Argentina, and **DANIEL ROBERTO PEREZ**, Instituto Superior de Formación y Perfeccionamiento Docente de Villa Regina, San Luis 327, Villa Regina (Río Negro), Argentina.

SERPENTES

BOIGA MULTOMACULATA (Marble Cat Snake). LAO P.D.R.: LUANG PRABANG PROVINCE: Route 13, 12 road km S Luang Prabang proper. 23 May 1998. B. Buzas, B. Farkas, and Z. Karacsonyi. Verified by Zoltan Korsos. Hungarian Natural History Museum (HNHM photographs D-98/4–6, one individual). Deuve (1970, Serpents du Laos. Mem. ORSTOM 39:1–251) stated that this species occurred in all Laotian provinces, but provided only four actual localities, none of which is in Luang Prabang.

Submitted by **BALAZS FARKAS**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary, and **UWE FRITZ**, Staatliches Museum fur Tierkunde, A.-B.-Meyer-Bau, Konigsbrucker Landstrasse 159, D-01109 Dresden, Germany.

CLELIA BICOLOR. ARGENTINA: MISIONES: Departamento Apostoles: on Provincial Route 105 (27°47'S, 55°46'W). 22 January 1999. P. M. Cacivio. Herpetological Collection of Fundación Miguel Lillo, San Miguel de Tucumán, Argentina (FML 8475). Verified by G. Scrocchi. First province record; confirms presumed distribution and extends known range at least 285 km NW from previous sites (Scrocchi and Viñas 1990, Boll. Mus. reg. Sci. nat. Torino 8[2]:490–495; Cei 1993, Monogr. XIV. Mus. reg. Sci. nat. Torino, p. 532; Alvarez et al. 1996, Facena 12:127; Williams and Francini 1991, Mus. reg. Sci. nat. Torino 9[1]:62).

Submited by **PEDRO MATIAS CACIVIO**, Centro de Producción de Sueros Antiofidicos, José Mármol 243, Caixa Postal 3500, Resistencia, Chaco, Argentina (e-mail: cacivio@arnet.com.ar & cacivio@hotmail.com).

CROTALUS HORRIDUS (Timber Rattlesnake). USA: TEXAS: SAN AUGUSTINE CO: roadkill found on FM 353, ca. 4 km S Shelby County line. Rattles had been removed. 22 May 1999. J. Howard Williamson. SFAVM 4894. Verified by Michael B. Keck. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Press, College Station. 434 pp.).

Submitted by **DANIEL SAENZ**, **D. CRAIG RUDOLPH**, and **J. HOWARD WILLIAMSON**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA.

ENHYDRIS PLUMBEA (Yellowbelly Water Snake). LAO P.D.R.: VIENTIANE MUNICIPALITY: Vientiane proper, city "wasteland." 16 May 1998. B. Buzas, B. Farkas, and Z. Karacsonyi. LUANG PRABANG PROVINCE: Luang Prabang proper, city "park." 21 May 1998. Same collectors. Verified by Zoltan Korsos. Hungarian Natural History Museum (HNHM 98.47.1–48.1). Deuve (1970, Serpents du Laos. Mem. ORSTOM 39:1–251) stated that this very common species occurred in all Laotian provinces, but provided no actual localities.

Submitted by **BALAZS FARKAS**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary, and **UWE FRITZ**, Staatliches Museum fur Tierkunde, A.-B.-Meyer-Bau, Konigsbrucker Landstrasse 159, D-01109 Dresden, Germany.

LAMPROPELTIS TRIANGULUM ANDESIANA. VENEZUELA: MIRIDA: La Carbonera. 25 August 1961. J. Ojasti. Museo de Biología, Universidad Central de Venezuela, Caracas (MBUCV-1654). Vía La Azulita, 2000 m elev. 1980. J. Pefaur. Colección de Vertebrados Universidad de los Andes (CVULA 3150). La Otra Banda, 2.4 km SSW Bailadores, 1850 m elev. 2 October 1995. Collector unknown. TACHIRA: Betania, distrito Junín, Tama. 17 July 1977. P. M. Delgado. Museo de Ciencias Naturales, Caracas (MCNC 6830, 6843, 6864, 6868). All verified by O. Fuentes. Previous authors (Aleman 1952, Mem. Soc. Cien. Nat. La Salle 13[35]:205–225; Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela. Ediciones de la Biblioteca, Universidad Central de Venezuela, Caracas; Lancini 1979, Serpientes de Venezuela. Armitano Ed., Caracas; Lancini and Kornacker 1986, Die Schlangen von Venezuela. Verlag Armitano, Caracas) assigned this population to *Lampropeltis triangulum micropholis*, previously the only subspecies recognized in South America until the description of *L. t. andesiana* by Williams (1978, Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*. Publ. Biol. Geol. Milw. Publ. Museum 2:258). Specimens of *Lampropeltis triangulum* from Venezuela are easily distinguished from the western subspecies, *L. t. micropholis*, using Williams (1978, *op. cit.*). Distribution in Venezuela is restricted to the Andes, in the Cordillera de Mirida (Mirida state), Tama (Tachira state), and Sierra de Perija (Zulia state). The single citation out of the Andean range in "El Avila" (Distrito Federal) at the Coastal Range can not be con-

firmed, because the voucher specimen (MHNLS 1434) is apparently lost.

Submitted by **CISAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matematicas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve), and **LUIS FERNANDO NAVARRETE**, Colección de Herpetología, Fundación Museo de Ciencias, Caracas, Venezuela (e-mail: mcienci2@reacciun.ve).

PHALOTRIS NASUTUS. BRAZIL: MATO GROSSO DO SUL: Xavantina between the Paraná River and the highlands of the Serra de Maracajú, 21°15'S, 52°48'W. Universidade Federal de Mato Grosso, herpetological collection (UFMT 958). Young male. Verified by M. Di Bernardo. Found in a region that is transitional from Cerrado to Chaco ecophysiographic districts; enlarges substantially distribution to the west, based on the revision by Ferrarezzi (1993, Mem. Inst. Butantan 55[1]:27); author stated that *P. nasutus* was the easternmost species of the *nasutus* group, but this record is far to the west, making this taxon the most widespread member of that group.

Submitted by **THALES DE LEMA**, Departamento de Biologia, Faculdade de Biociências, Pontificia Universidade Catolica de Rio Grande do Sul, P.O. Box 1429, Porto Alegre, RS 90619-900, Brazil (e-mail: crothales@pucrs.br).

PSEUDOXENODON MACROPS (Big-eyed Bamboo Snake). LAO P.D.R.: CHAMPASSAK PROVINCE: Dong Hua Xao National Biodiversity Conservation Area, 2 km S Nong Luang village, bank of Touay-Guai stream, 15°4'N, 106°13'E, 800 m. 5 April 1998. O. Merkl and G. Csorba. Verified by Zoltan Korsos. Hungarian Natural History Museum (HNHM photographs D-98/1–3, one individual). Deuve (1970, Serpents du Laos. Mem. ORSTOM 39:1–251) did not provide any Laotian locality for *Pseudoxenodon angusticeps*, of which he considered *P. macrops* a synonym.

Submitted by **BALAZS FARKAS**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary, and **UWE FRITZ**, Staatliches Museum fur Tierkunde, A.-B.-Meyer-Bau, Konigsbrcker Landstrasse 159, D-01109 Dresden, Germany.

UMBRIVAGA PYGMAEA. BRAZIL: AMAZONAS: Tefé (03°22'S, 64°42'W). Collected during an Instituto Butantan expedition from September to November 1952. Instituto Butantan (IB 15104). Verified by R. Fernandes. Species was originally described as *Liophis pygmaeus* by Cope (1868, Proc. Acad. Nat. Sci. Philadelphia 103) based on a Peruvian specimen from Marañon River, near the mouth of Napo River. Peters and Orejas-Miranda (1970, U.S. Natl. Mus. Bull. 297) recorded this taxon from the upper Amazonian region of Colombia and Ecuador. There is no previous record of this species or genus from Brazil. The record reported herein extends the known distribution more than 800 km east of the type locality.

Submitted by **DANIEL S. FERNANDES**, **FRANCISCO L. FRANCO**, and **VALDIR J. GERMANO**, Laboratório de Herpetologia, Instituto Butantan, Avenida Vital, Brazil 1500, CEP 05503-900, São Paulo, São Paulo, Brazil.

XENOCHROPHIS PISCATOR (Checkered Keelback). LAO P.D.R.: VIENTIANE PROVINCE: Vang Vieng, bank of Nam Song River. 18 May 1998. B. Buzas, B. Farkas, and Z. Karacsonyi. Hungarian Natural History Museum (HNHM 98.49.1). Verified by Zoltan Korsos. Deuve (1970, Serpents du Laos. Mem. ORSTOM 39:1–251) stated that this very common species occurred throughout the tributary of the Mekong River, but provided no actual localities.

Submitted by **BALAZS FARKAS**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary, and **UWE FRITZ**, Staatliches Museum fur Tierkunde, A.-B.-Meyer-Bau, Konigsbrucker Landstrasse 159, D-01109 Dresden, Germany.

New Parish Records of Amphibians and Reptiles from Louisiana

JOHN G. HIMES
Museum of Life Science, Louisiana State University in Shreveport
One University Place, Shreveport, Louisiana 71115-2399, USA

Present address: Department of Biological Sciences, Box 5018
University of Southern Mississippi, Hattiesburg, Mississippi 39406-5018, USA

Louisiana harbors 49 species of amphibians and 96 species of reptiles (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana State Univ. Press, Baton Rouge. 300 pp.). Dundee and Rossman (1989, *op. cit.*) mapped the known distributions of amphibian and reptile species in Louisiana. However, published records for most amphibian and reptile species in Louisiana are lacking from many parishes, particularly in the north. The following is a list of specimens representing new locality records and filling in some of the current distribution gaps. All specimens are deposited in the Louisiana State University in Shreveport Museum of Life Sciences (LSUS). All species identifications were verified by Laurence M. Hardy.

Ambystoma talpoideum (Mole Salamander). USA: LOUISIANA: Bienville Parish: 0.2 mi. N and 0.2 mi. W jct. T16N, R7W. L. M. Hardy and J. G. Himes. 11 August 1996. LSUS 6993.

Plethodon serratus (Southern Redback Salamander). De Soto Parish: SE Mansfield. A. B. McPherson. April 1995. LSUS 6378. Extends distribution northwestward from nearest known locality in Natchitoches Parish (Keiser and Conzelmann 1969, J. Herpetol. 3:189–191).

Acris gryllus gryllus (Southern Cricket Frog). St. Charles Parish: Bonnet Carre Spillway, E Border, 7 mi. off Airline Highway. M. Haik. 9 April 1979. LSUS 6676.

Hyla avivoca (Bird-voiced Treefrog). Bossier Parish: Bodcau Wildlife Area near Whittington Road. D. Wyrick. April 1991. LSUS 68050. Webster Parish: 5.6 mi. W and 1.0 mi. S Leton. L. M. Hardy and L. R. Raymond. 2 June 1998. LSUS 6986–90. First records from the northwestern quarter of the state (Dundee and Rossman 1989, *op. cit.*).

Chrysemys picta dorsalis (Southern Painted Turtle). De Soto Parish: 0.2 mi. W and 0.5 mi. S Wallace Lake Dam Spillway. 1992. LSUS Herpetology Class. 26 February 1992. LSUS 5429. Skeleton only.

Graptemys pseudogeographica kohnii (Mississippi Map Turtle). Webster Parish: 5 mi. S Sibley. L. Sanders. 27 April 1984. LSUS 5361.

Sternotherus odoratus (Common Musk Turtle). Bossier Parish: no specific locality data. T. Cottrell. 25 February 1984. LSUS 1999.

W bank Red River, 1.2 mi. E and 1.6 mi. N LSUS campus. L. M. Hardy. 2 October 1980. LSUS 5418. De Soto Parish: Wallace Lake at spillway. Collector unknown. 9 August 1972. LSUS 3424. S end Wallace Lake Dam. L. M. Hardy. 1 October 1972. LSUS 4297. 0.2 mi. W and 0.5 mi. S Wallace Lake Dam Spillway. 1992. LSUS Herpetology Class. 26 February 1992. LSUS 5426–27. Skeleton only.

Terrapene carolina triunguis (Three-toed Box Turtle). Claiborne Parish: 2.4 mi. W and 1.7 mi. N Summerfield on paved road. L. M. Hardy. 31 July 1970. LSUS 5709. Skeleton only.

Anolis carolinensis (Green Anole). Webster Parish: 32°25'77"N, 93°25'10"W. C. B. Erickson. 2–3 March 1974. LSUS 6979–81.

Eumeces anthracinus pluvialis (Southern Coal Skink). West Feliciana Parish: Tunica Hills SPG–1965. Collector and date unknown. LSUS 6813. Extends distribution westward from nearest known localities in East Feliciana Parish (Dundee and Rossman 1989, *op. cit.*).

Ophisaurus attenuatus attenuatus (Western Slender Glass Lizard). De Soto Parish: 1.5 mi. N and 3.8 mi. E (via Linwood Avenue) Stonewall. L. M. Hardy. 5 August 1970. LSUS 1138. 5.8 mi. E from jct. of Stonewall-Frierson Road and Linwood Avenue. S. Micinski. 14 June 1976. LSUS 3985.

Crotalus horridus (Timber Rattlesnake). Claiborne Parish: 4 mi.S Haynesville on Rt. 79. D. Bounds. 13 October 1975. LSUS 3436. De Soto Parish: 3.7 mi. E and 3.5 mi. S jct. De Soto, Caddo, Red River Parishes. C. Warren. 26 August 1986. LSUS 5215. 0.5 mi. S Rt. 346. J. R. Harris. 29 September 1987. LSUS 5338.

Lampropeltis getula holbrooki (Speckled Kingsnake). Claiborne Parish: 3.6 mi. N and 4.3 mi. W Scottsville. L. M. Hardy. 30 July 1970. LSUS 1451.

Micrurus fulvius tener (Texas Coral Snake). De Soto Parish: Logansport. Collector unknown. 23 August 1991. LSUS 5729. Red River Parish: 3 mi. S (via U.S. Rts. 71 and 84), 1 mi. into woods from highway, T12N, R8W. C. Diramus. 9 May 1972. LSUS 1790. 2 mi. W Coushatta. M. Sloan. 1 June 1972. LSUS 1994. Coushatta, Alex Penny Farm. S. Penny. 23 November 1973. LSUS 2471. Coushatta. G. Wise. 23 November 1973. LSUS 2724. Coushatta, Alex Penny Farm. L. A. Dye. 23 November 1973. LSUS 2728.

Nerodia rhombifer rhombifer (Diamondback Water Snake). Lafourche Parish: Rt. 1, 3 mi. outside of Thibodeaux. B. Wilson. 16 April 1993. LSUS 6886.

Regina grahamii (Graham's Crayfish Snake). Bienville Parish: Loggy Bayou. Cox and Divers. 3 April 1993. LSUS 6274.

Regina rigida sinicola (Gulf Crayfish Snake). Bienville Parish: 2.1 km E Kepler Creek Lake Bridge. 14 September 1996. J. G. Himes. LSUS 6991.

Storeria occipitomaculata obscura (Florida Redbelly Snake). De Soto Parish: 2 mi. N (via Louisiana Rt. 175) Frierson. L. M. Hardy. 23 June 1970. LSUS 930. on Linwood Avenue, 6 mi. S Flournay-Lucas Road. B. Legrande. 29 July 1970. LSUS 3437. 0.4 mi. E jct. of Stonewall-Frierson Road and Linwood Avenue. S. Micinski. 14 June 1976. LSUS 3995. 5.3 mi. N and 1.3 mi. E Mansfield (jct. U.S. Rt. 84 and Louisiana Rt. 175). S. Micinski. 8 September 1976. LSUS 4031. 3.8 mi. E and 0.4 mi. N Stonewall. L. M. Hardy. 15 June 1992. LSUS 5798. Red River Parish: 1.9 mi. E and 4.4 mi. S Hall Summit. L. M. Hardy. 9 September 1974. LSUS 3473.

Thamnophis sauritus sauritus (Eastern Ribbon Snake). East Baton Rouge Parish: 14157 E Covett Road, Baton Rouge. T. Papaneri. 15 April 1989. LSUS 6396. Extends distribution southward from nearest known locality in East Feliciana Parish and represents furthest southwestern locality recorded for this species (Dundee and Rossman 1989).

Virginia striatula (Rough Earth Snake). Claiborne Parish: Corney Lake campground. A. B. McPherson. April 1989. LSUS 6290.

Virginia valeriae elegans (Western Earth Snake). Claiborne Parish: 1 mi. NW (via Louisiana Rt. 2) Summerfield. L. M. Hardy. 31 July 1970. LSUS 270. 1.5 mi. NW Haynesville. D. Bounds. 23 February 1975. LSUS 3515. De Soto Parish: 2 mi. N (by road) jct. Linwood and Frierson Roads. L. M. Hardy. 29 June 1970. LSUS 268. 0.25–0.5 mi. N (by Colquitt Road) jct. Colquitt Road and Williams Road. L. M. Hardy. 30 June 1970. LSUS 269. 3 mi. N (on Linwood Avenue) jct. with Frierson Road. L. M. Hardy. 18 September 1970. LSUS 272.

New Anuran Records from the Floresta Nacional de Caxiuanã, Eastern Amazon, Brazil

JOSÉ ANTÓNIO RENAN BERNARDI
RUTH AMANDA STUPIÑÓN
and
ULISSES GALATTI*
Departamento de Zoologia, Museu Paraense Emílio Goeldi
C.P. 399, 66040-170 Belém, Pará, Brazil
e-mail (UG): ulisses@museu-goeldi.br
** corresponding author*

The first list of the herpetofauna of Caxiuanã was published by Avila-Pires and Hoogmoed (1997) and represents one of the few anuran lists available for the eastern Amazon Basin (other than Crump 1971). Considering that most anuran species in Amazonia have sparse distribution records or those only vaguely described in the literature, for example "Brazilian Amazon Basin," the records for Caxiuanã, whether or not they extend the range of a particular taxon, may help to fill the ranges for many little-recorded species. The Floresta Nacional de Caxiuanã (FNC) is a major Conservation Unit (333,000 ha) located between the basins of the Xingu and Tocantins Rivers, in the southern drainage of the Rio Amazonas (01°42'33"S, 51°31'45"W), in the eastern Brazilian Amazon, 340 km from Belém, in the state of Pará, Brazil. Annual rainfall in the region is between 2000 and 2500 mm, mean temperature around 26°C, and relative humidity not less than 85% (Lisboa 1997). A distinct dry season occurs between late June and middle November. About 85% of the FNC is covered by primary forest not subjected to seasonal flooding ("terra-firme"); other habitats include savannas, secondary vegetation and seasonally flooded areas of "várzeas" and "igapós" (Almeida et al. 1993; Lisboa et al. 1997).

Below we present the results of the most recent field work, conducted mainly by the senior author during eight field trips (each of about twenty days) between February 1996 and April 1998, which added eleven anuran species to the 29 described in Avila-Pires and Hoogmoed (*op. cit.*). Verifications of the specimens and respective

identifications were supplied by Marinus S. Hoogmoed, except for *Bufo castaneoticus*, which was identified earlier by Janalee P. Caldwell (March 1996) and M. S. Hoogmoed (April 1997). All the specimens are housed in the herpetological collection of the Department of Zoology, Museu Paraense Emílio Goeldi (MPEG).

Hylidae

Hyla lanciformis. Laranjal Stream, in aquatic vegetation. 7 February 1998. MPEG 8829. Laranjal Stream, in aquatic vegetation. 4 April 1998. MPEG 8830. Distribution of the species has been described as "middle and upper Amazon basin and Venezuela" (Frost 1985), with published records in the Juruá, Urucu, Purus and Madeira River basins (Heyer 1977; Gascon and Pereira 1993). This is the first record for the state of Pará and the eastern Amazon basin.

Hyla leucophyllata. Laranjal Stream, in aquatic vegetation. 7 February 1998. MPEG 8801–08. The species has a broad distribution in the Amazon basin and was recorded in the Belém region by Crump (1971).

Hyla melanargyrea. Bank of the Curuá River, inside a house. May 1997. MPEG 8811–12. This is not a characteristic Amazonian species. It occurs mostly in central and northeastern Brazil and Suriname (Frost 1985; Duellman 1993), and has been recorded for the Belém region (Crump 1971).

Hyla punctata. Laranjal Stream, in aquatic vegetation. 4 April 1998. MPEG 8813. First record for the state of Pará, extends distribution ~1000 km eastward in the Brazilian Amazon, from the easternmost published record in the Rio Madeira (Heyer 1977).

Scinax boesemani. Laranjal Stream, secondary vegetation. 28 October 1997. MPEG 8819. Arauá River, in aquatic vegetation. 22 June 1997. MPEG 8820. A species of wide distribution in the Brazilian Amazon and Guyana region, it has been recorded in the Belém region (Crump 1971).

Leptodactylidae

Hydrolaetare schmidti. Mouth of the Laranjal Stream, "várzea." 6 April 1998. MPEG 8790. First record for state of Pará, extends distribution ~1000 km eastward in the Amazon basin, from the easternmost published record in the Rio Madeira (Heyer 1977).

Leptodactylus pentadactylus. Edge of the Curuá River, in an area of secondary vegetation. 18 October 1997. MPEG 8785. Edge of the Laranjal Stream, secondary vegetation. April 1998. MPEG 8786–87. Edge of the Arauá River, secondary vegetation. 22 June 1997. MPEG 8788. Edge of the Curuá river, in primary forest. 22 April 1998. MPEG 8789. A species of broad distribution in Central and South America, which has been recorded in Belém (Crump 1971).

Leptodactylus rhodomystax. Laranjal Stream, in primary forest. 30 July 1997. MPEG 8823. Species of general occurrence in the Amazon basin; this record confirms its presence at almost all sites researched in the region.

Pipidae

Pipa pipa. Camuin channel, "igapó." 28 October 1998. MPEG 8791–94. Laranjal Stream, in aquatic vegetation. October 1998. MPEG 8795–98. Laranjal Stream, in aquatic vegetation. 4 April 1998. MPEG 8799–800. Species known from state of Pará from Belém, Bragança and Marajó region (Trueb and Cannatella 1986); the record reported herein is along a range margin in the Amazon River drainage.

Ranidae

Rana palmipes. Laranjal Stream, "várzea." 6 April 1998. MPEG 8776–84. The species has a broad distribution in northern South America, but published data are lacking for most of Brazilian Amazon (Miranda-Ribeiro 1923; Hillis and de Sá 1988). This record confirms its occurrence close to the mouth of the Amazon River.

Bufonidae

Bufo castaneoticus. Edges of the Curuá River, primary forest. February 1996. MPEG 8110–12. Edges of the Curuá River, primary forest. August 1996. MPEG 8235-36, MPEG 8238-41. Published data for the distribution of this toad are restricted to the type locality in the species description (Caldwell 1991). Recent inventories, however, demonstrated the species occurrence in four other Brazilian sites, in the state of Rondônia, Amazonas, and Pará (Caldwell, unpubl. data). Record reported herein is about 183 km north of the published distribution for this anuran.

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New County Records for Butte, Nevada, Plumas, and Yuba Counties, California, USA

MICHELLE S. KOO
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118-4599, USA
e-mail: mkoo@calacademy.org

CINDY ROBERTS
Feather River Ranger District, Plumas National Forest
875 Mitchell Avenue, Oroville, California 95965-4699, USA

and

JENS V. VINDUM
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118-4599, USA
e-mail: jvindum@calacademy.org

In the course of conducting herpetological surveys for the Plumas and Tahoe National Forests, eight new county records for reptile species were noted. These are represented by six species not previously documented by museum records from Butte, Nevada, Plumas, or Yuba Counties.

The following eighteen museum collections were queried for their holdings of Butte, Nevada, Plumas, and Yuba counties, California: AMNH, BYU, CAS, Chico State University, CM, FMNH, KU, LACM, MCZ, MVZ, SDSNH, SSU, TNHC, UMMZ, University of Nevada (Las Vegas), UNR, USNM, and UTA (museum codes follow Leviton et al. 1985). R. C. Drewes verified all specimen identifications.

Charina bottae (Rubber Boa). BUTTE CO: Plumas National Forest, Golden Trout Crossing Campground, opposite camp entrance S side of river (SE side of bridge), SE 1/4 of NE 1/4 Sec. 11, T20N, R7E (39°36'57.2"N, 121°08'31.7" W, 960 m elev.). 5 June 1998. J. A. Wilkinson and J. V. Vindum. CAS 205637–38. BUTTE CO: Plumas National Forest, Forest Rd 94, 2.25 km N (by road) of Fall River bridge, NE 1/4 of NE 1/4 Sec. 21, T21N, R7E (39°40'00.9"N, 121°11'35.5"W, 1067 m elev.). 9 June 1998. J. A. Wilkinson and J. V. Vindum. CAS 205711. YUBA CO: Plumas National Forest, Gold Run Creek, S bank at first large waterfall downstream from Forest Road 21N67Y, SE 1/4 of SE 1/4 Sec. 1, T20N, R8E (39°36'50.724"N, 121°01'29.1"W, 1158 m elev.). 9 July 1998. C. A. Reading and J. V. Vindum. CAS 205988. YUBA CO: Plumas National Forest, Forest Road 21N11, 2.9 km S (by road) of Forest Road 690, SW 1/4 of SE 1/4 Sec. 14, T20N, R8E (39°35'24.5"N, 121°02'57.5"W, 1183 m elev.). 1 October 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206320.

Although Hayes and Cliff (1982) list *C. bottae* from Butte County, it is only known from a color slide in the first author's personal collection and from "scattered" sightings (Hayes 1999, pers. comm.). CAS 205637, 205638, and 205711 represent the first voucher specimens from Butte County.

Clemmys marmorata (Western Pond Turtle). NEVADA CO: Rt. 49, just N of North San Juan (ca. 610 m elev.). 5 May 1998. G. Frailey and M. M. Tierney. CAS 207045.

Diadophis punctatus (Ringneck Snake). PLUMAS CO: Plumas National Forest, road cut by Slate Creek Reservoir Dam (N side), SE 1/4 of SW 1/4 Sec. 2, T20N, R8E (39°36'52.6"N, 121°03'08.5"W, 1067 m elev.). 8 June 1998. J. A. Wilkinson and J. V. Vindum. CAS 205681. PLUMAS CO: Plumas National Forest, road cut on S side of Slate Creek bridge, NW 1/4 of NW 1/4 Sec. 11, T20N, R8E (39°36'44.3"N, 121°03'19.9"W, 1059 m elev.). 8 June 1998. J. A. Wilkinson and J. V. Vindum. CAS 205685. YUBA CO: Plumas National Forest, North Star-Slate Creek Reservoir road, 3.38 km NE (by road) of Quincy-La Porte Road, NW 1/4 of SW 1/4 Sec. 11, T20N, R8E (39°36'22.9"N, 121°03'42.3"W, 1158 m elev.). 8 June 1998. J. A. Wilkinson and J. V. Vindum. CAS 205667. YUBA CO: Plumas National Forest, Slate Creek above Slate Creek Reservoir, ca 100 m below 2nd dam, N side of creek, NW 1/4 of SW 1/4 Sec. 1, T20N, R8E (39°37'7.1652"N, 121°02'16.1988"W, 1091 m elev.). 29 September 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206298.

Hayes and Cliff (1982) stated that in adjacent Butte County, *D. punctatus* is infrequent above 700 m elevation, but may extend to 1000 m. All specimens from Plumas and Yuba counties were collected from above 1000 m (between 1059 m and 1158 m).

Elgaria coerulea (Northern Alligator Lizard). YUBA CO: Plumas National Forest, Forest Road 35, 2.57 km E (by road) of Forest Road 04, SE 1/4 of NE 1/4 Sec. 22, T20N, R8E (39°34'45.8"N, 121°03'47.1"W, 1090 m elev.). 18 June 1998. M. S. Koo and J. V. Vindum. CAS 205714. YUBA CO: Plumas National Forest, Brushy Creek at Forest Road 35, near jct. of Forest Road 35 and Forest Road 21N11.4, NW 1/4 of SE 1/4 Sec. 23, T20N, R8E (39°34'32.7"N, 121°02'49.4"W, 1097 m elev.). 18 June 1998. M. S. Koo and J. V. Vindum. CAS 205716. YUBA CO: Plumas National Forest, Slate Creek above Slate Creek Reservoir, NW 1/4 of SE 1/4 Sec. 1, T20N, R8E (39°37'1.776"N, 121°02'21.624"W, 1103 m elev.). 28 September 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206290. YUBA CO: Plumas National Forest, Slate Creek, above Slate Creek Reservoir (NE side), NW 1/4 of SE 1/4 Sec. 1, T20N, R8E (39°37'5.808"N, 121°02'19.356"W, 1103 m elev.). 28 September 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206291. YUBA CO: Plumas National Forest, Forest Road 35, 1.77 km NE (by road) of Forest Road 20N68, SW 1/4 of SE 1/4 Sec. 24, T20N, R8E (39°34'20.6"N, 121°01'48.2"W, 1189 m elev.). 1 October 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206319.

Lampropeltis getula (Common Kingsnake). YUBA CO: Marysville Road, 0.80 km N (by road) of Loma Rica Road (39°20'03.7"N, 121°20'21.4"W, 311 m elev.). 6 June 1998. J. A. Wilkinson and J. V. Vindum. CAS 205665.

Thamnophis couchii (Sierra Garter Snake). YUBA CO: Plumas National Forest, Brushy Creek at Forest Road 35, 100 m downstream from Forest Road 35, NW 1/4 of SE 1/4 Sec. 23, T20N, R8E (39°34'30.576"N, 121°02'49.2"W, 1097 m elev.). 19 June 1998. M. S. Koo and J. V. Vindum. CAS 205719. YUBA CO: Plumas National Forest, Gold Run Creek, ca. 300 m upstream of the end of Forest Road 21N67Y, NE 1/4 of NW 1/4 Sec. 7, T20N, R9E (39°37'13.728"N, 121°00'56.052"W, 1288 m elev.). 9 July 1998. C. A. Reading and J. V. Vindum. CAS 205987. YUBA CO: Plumas National Forest, Gold Run Creek, ca. 200 m downstream of first large waterfall downstream from Forest Road 21N67Y, SE 1/4 of SE 1/4 Sec. 1, T20N, R8E (39°36'49.536"N, 121°01'37.92"W, 1143 m elev.). 9 July 1998. C. A. Reading and J. V. Vindum. CAS 205989. YUBA CO: Plumas National Forest, Slate Creek, above Slate Creek Reservoir (NE side), NW 1/4 of SE 1/4 Sec. 1, T20N, R8E (39°37'5.808"N, 121°02'19.356"W, 1103 m elev.). 28 September 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206293. YUBA CO: Plumas National Forest, Slate Creek above Second dam, N bank, NW 1/4 of SW 1/4 Sec. 1, T20N, R8E (39°37'6.348"N, 121°02'9.564"W, 1091 m elev.). 29 September 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206300. YUBA CO: Plumas National Forest, Slate Creek above dam upstream from Slate Creek Reservoir, SE side of tailings, SE 1/4 of SW 1/4 Sec. 1, T20N, R8E (39°36'59.22"N, 121°02'4.632"W, 1105 m elev.). 30 September 1998. J. A. Wilkinson and K. D. Wiseman. CAS 206301.

Prior to this report, only one specimen of *T. couchii,* collected in 1899, was allegedly recorded from Yuba County, but its exact locality remains difficult to pinpoint. Fitch (1940) lists the specimen (CAS-SU 6309) from Strawberry Valley, Yuba County. The Stanford catalog (now at CAS) describes the original locality as "near Strawberry Valley, Butte and Sierra Co. line". However, Butte and Sierra counties do not share a common border. The Butte-Yuba county border is within a kilometer of the town of Strawberry Valley. Because the locality description indicates that the specimen is from "near Strawberry Valley," it is not clear if the specimen came from Butte or Yuba County. The current documentation of six specimens clearly establishes the occurrence of *T. couchii* in Yuba County.

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New Records of Snakes from Argentina

ALEJANDRO R. GIRAUDO
Instituto Nacional de Limnología (INALI-CONICET)
José Maciá 1933, (3016), Santo Tomé, Santa Fe, Argentina
e-mail: inali@arcride.edu.ar

Several checklists and general revisions of Argentine snakes have been published since 1861 (Abalos and Mischis 1975; Berg 1898; Burmeister 1861; Cei 1986, 1993; Koslowsky 1898; Serié 1921, 1926; Williams and Francini 1991). However, knowledge about the composition and distribution of the ophidiofauna from many areas of the country are incomplete. During the last ten years, a survey of snakes of northeastern Argentina was been conducted by the author, collecting new material during one hundred field trips and reviewing the herpetological collections in Argentine museums. As a result, significant enhancement of distributional data for several species were obtained as well as some new records for some Argentine provinces and for the country.

All records are based on specimens deposited in the following herpetological collections: Museo Argentino de Ciencias Naturales, Buenos Aires (MACN), Fundación Miguel Lillo, Tucumán (FML), Universidad Nacional de Misiones, Posadas, Misiones (UNAM), Centro de Investigaciones Ecológicas Subtropicales del Parque Nacional Iguazú, Iguazú, Misiones (CIES), Centro Nacional de Iología, Buenos Aires (CENAI), and Colección Félix de Azara, Consejo Nacional de Investigaciones Científicas y Técnicas, Buenos Aires (CFA). The two last collections were recently deposited in the MACN. Identifications were verified primarily by G. Scrocchi and S. Kretzschmar (Fundación Miguel Lillo, Tucumán, Argentina), and F. Franco (Instituto Butantan, São Paulo, Brazil), kindly verified the specimen of *Clelia quimi*. The following abbreviations were used: TOL, total length; SVL, snout-vent length; and TL, tail length.

LEPTOTYPHLOPIDAE

Leptotyphlops munoai. MISIONES PROV: CAINGUÁS DEPARTMENT: Dos de Mayo. J. Soroka (MACN 32050, 126 mm TOL, 6 mm TL; MACN 32051, 171 mm TOL, 8 mm TL); CANDELARIA DEPARTMENT: Loreto, Estación Experimental del INTA. September 1933. A. Ogloblin (MACN 1033). First province records and the northernmost record for the species; extends range ca. 150 km air line N from the nearest known record in Corrientes Province (Orejas Miranda 1961; Miranda and Tio Vallejo 1985; Williams and Francini 1991; Cei 1993). CORRIENTES PROV: ITUZAINGÓ DEPARMENT: Estancia Puerto Valle. 1 September 1994. A. Giraudo (CFA 726, 132 mm TOL, 8 mm TL). Specimen was caught in a flooded area by the closing of Yacyreta dam. Species had been reported from Corrientes Province by several authors (Miranda and Tio Vallejo 1985; Williams and Francini 1991; Cei 1993), but they did not report a specific locality, repository or specimen catalogue number. Recently, Alvarez et al. (1996), did not include this species in their list of herpetofauna of Corrientes.

COLUBRIDAE

Clelia quimi. MISIONES PROV: CAPITAL DEPARTMENT: Posadas City, 180 m elev. 27 April 1995. R. Stetson Jr. (CUNAM 323, an adult male, 955 mm TOL, 186 mm TL). First record for Argentina and the southernmost record for the species; extends range ca. 700 km air line SW from the nearest populations known in the state of Santa Catarina, Brazil (Franco et al. 1997). Species was known from highlands in the Southern Plateau, Atlantic Plateau and Central Plateau of Distrito Federal and the states of Espírito Santo, Minas Gerais, Sao Paulo, Paraná and Santa Catarina, Brazil (Franco et al. 1997).

Liophis frenatus (False Coral Water Snake) MISIONES PROV: CAPITAL DEPARTMENT: Posadas City. 8 January 1954. A. Scarso (CENAI 1156, an adult female 530 mm TOL, 77 mm TL). Second record for the province and for Argentina. Extends range ca. 300 km air line south from the nearest known Argentinian record at Iguazú Falls (Giraudo et al. 1993). Also reported from the Paraguayan Paraná islands, flooded by the closing of Yacyretá dam, on the border with Argentina (Alvarez et al. 1995; Aquino et al. 1996).

Oxyrhopus clathratus (False Coral Snake). MISIONES PROV: CAINGUÁS DEPARTMENT: Dos de Mayo. March 1972. A. Barrio, F. Contino and Piorot (CENAI 3187, an adult); IGUAZÚ DEPARTMENT: two specimens from Arroyo Urugua-í, 30 km E Puerto Bemberg. 9 and 30 November 1960 respectively. W. H. Partridge (MACN 12762, male, 347 mm TOL, 65 mm TL; and MACN 12761, female 399 mm TOL, 70 mm TL); GENERAL M. BELGRANO DEPARTMENT: Cabureí, ca. 5 km E Iguazú National Park. 1 May 1995. A. Jhonson (CIES 227, male, 623 mm SVL) and San Antonio, Reserva Natural Estricta. 16 November 1995. A. Arce (CIES 249, female, 394 mm TOL, 67 mm TL); SAN PEDRO DEPARTMENT: Tobuna. February 1952. W. H. Partridge (MACN 12642, a female, 1011 mm TOL, 163 mm TL). Species was known in Argentina only from Barracón, Misiones (now Bernardo de Irigoyen), the unique precise locality published by

Cranwell (1943). Other authors had mentioned this species for "Misiones," probably based on Cranwell's record (Abalos and Mischis 1975; Williams and Francini 1991; Cei 1993), but did not report new specific localities. The five localities reported herein extend the known range of the species in Argentina and Misiones ca. 80 km northwest and 135 km southwest.

Oxyrhopus petola (Calico Snake or False Coral Snake). MISIONES PROV: IGUAZÚ DEPARTMENT: Ten specimens from the Iguazú National Park, Secional Yacuí. 24 January 1995 (CIES 211); Arroyo Santo Domingo and Ruta Nacional 101. July 1993. S. Acosta (CIES 151); Campamento Yaguareté. May 1993. S. Acosta (CIES 159, female, 300 mm TOL, 61 mm TL); Puerto Canoas. 4 November 1994. S. Chediack (CIES 210); Seccional Timbó. 29 March 1994. J. Calo (CIES 189, female, 870 mm TOL, 240 mm TL); Control de Acceso: 20 November 1993. S. Acosta (CIES 174, male, 340 mm TOL, 78 mm TL). 14 August 1997. A. Caradonna (CIES 301). 29 March 1998. J. Zocatelli (CIES 302); Acceso a Cataratas: 2 March 1995. D. De La Torre (CIES 215). 16 June 1996. S. Acosta and F. Del Castillo (CIES 273). Species was known in Argentina from three specimens collected in the Iguazú National Park (Giraudo et al. 1993). Specimens reported herein extend the known range ca. 30 km east of the previous records.

Phalotris reticulatus. CORRIENTES PROV: GENERAL SAN MARTÍN DEPARTMENT: Colonia Carlos Pellegrini. Ince Apóstol (MACN 36085, unknown sex, 239 mm TOL, 19 mm TL). Lema (1984) reported this snake from northeastern Misiones Province, but a precise locality, repository and specimen catalogue number was not given. This is the first province record, and extends range ca. 350 km southwest from the closest locality in Misiones. These are also the first voucher specimens for Argentina.

Pseudablabes agassizii. CHACO PROV: MAYOR LUIS FONTANA DEPARTMENT: Coronel Dugraty. 2 October 1968. Collector unknown (CENAI 2614, female, 458 mm TOL, 101 mm TL); FRAY J. SANTA MARIA DE ORO DEPARTMENT: Zuberbuhler. 20 September 1967. A. Galarza (CENAI 2380, female, 526 mm TOL, 115 mm TL). MISIONES PROV: CANDELARIA DEPARTMENT: Santa Ana. 1901. A. Llamas (MACN 1523); APOSTOLES DEPARTMENT: San José. 22 November 1968. Collector unknown (CENAI 2594, female, 395 mm TOL, 87 mm TL); Misiones without specific locality. 1915. Doello Jurado (MACN 2724). SANTIAGO DEL ESTERO PROV: COPO DEPARTMENT: Reserva El Copo. 1988 (MACN 33551). First record for both Provinces and the northernmost records for Argentina; extend range ca. 550 km northeast (Misiones record) and 400 km northwest (Santiago del Estero record) from the nearest records in Santa Fe, Entre Ríos and Córdoba provinces (Gallardo 1982; Viñas 1985; Viñas et al. 1989; Williams and Francini 1991).

Pseudoboa haasi. MISIONES PROV: GENERAL BELGRANO DEPARTMENT: San Antonio, Ruta Nacional 101 and Arroyo Tigre. 20 March 1995. A. Arce (CIES 257, male, 1288 mm TOL, 290 mm TL). Known in Argentina from two specimens collected in northern Misiones Province (Giraudo 1992; Morato et al. 1995). Extends the range ca. 30 km southeast from the nearest known locality, and is the third specimen known from Argentina.

Pseudoeryx p. plicatillis. FORMOSA PROV: PILCOMAYO DEPARTMENT: Pilcomayo. Collector unknown (MACN 4166, female, 490 mm TOL, 11.4 mm TL). Species was cited by several authors from the provinces of Chaco, Corrientes, Formosa and Misiones (Berg 1898; Koslowsky 1898; Serié 1921, 1936; Williams and Francini 1991; Cei 1993), but all records lack a precise locality, repository, and specimen catalogue number. Probably for this reason, Williams and Francini (1991) suggested that the presence of this species needed confirmation. The Pilcomayo specimen represents the first precise locality published for this snake in Argentina.

Furthermore, three additional specimens were recorded in Paraguay, 1 km airline east from southern Formosa Province (Argentina), as follows: ÑEEMBUCÚ DEPARTMENT: Pilar City. 10 March 1995. A. Contreras (CFA 820 and CFA 821, two specimens, females, 794 mm and 807 mm TOL, 108 mm and 114 mm TL, respectively); Yatayty, 5 km E from Pilar. 1 June 1994. A. Giraudo (FML 06499, male, 790 mm TOL, 172 mm TL). These records are the southernmost known for the species, and the first with precise locality.

Sibynomorphus ventrimaculatus (Ñandurirey). CORRIENTES PROV: ITUZAINGÓ DEPARTMENT: Estancia Puerto Valle. 21 January 1990. E. Franke (CFA 105, unknown sex, 412 mm SVL); SANTO TOMÉ DEPARTMENT: Santo Tomé. April 1993. S. Gonzalez (CFA 409, male, 509 mm TOL, 116 mm TL). Second and third localities recorded for the province of Corrientes, and extends range ca. 75 km south and 65 km airline west from the previous record (Lions and Alvarez 1996).

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New Distribution Records from the Wisconsin Herpetology Atlas Project, 1998

GARY S. CASPER
Section of Vertebrate Zoology, Milwaukee Public Museum
800 West Wells Street, Milwaukee, Wisconsin 53233, USA
e-mail: gsc@mpm.edu

Collected here are fifteen new county records for Wisconsin, USA. All material is deposited at the Milwaukee Public Museum (MPM), and has been verified by Robert W. Henderson. MPM-H numbers denote specimen collections, MPM-P numbers denote photographic vouchers.

Ambystoma maculatum (Spotted Salamander). Sheboygan Co: SW 1/4 Sec. 29, T15N R20E, along Rt. U, one mile south of Hilltop Lane, under log in mixed hardwood forest along Greenbush Trails, Kettle Moraine State Forest. 10 May 1997. Christine Stanke. MPM-P 652. New county record within expected range, further documenting this species within the southward extension of the northern hardwood forest along glacial moraines in southeastern Wisconsin (Casper 1996). Ca. 65 km from nearest previously mapped location (Vogt 1981).

Necturus maculosus (Common Mudpuppy). Eau Claire Co: Chippewa River in Putnam Park, Eau Claire, NW 1/4 Sec. 29, T27N R10W. 1 May 1997. Eric Hopper. MPM-H 30341. Caught while fishing. New county record within expected range (Casper 1996). Ca. 45 km from nearest other record in Chippewa River basin (Vogt 1981). Marquette Co: Sec. 35, T17N R10E, Mecan River at upper dike road bridge. 16 September 1997. Jerry Reetz. MPM-P 642. New county record within expected range (Casper 1996). Ca. 15 km from nearest mapped Fox River watershed locality (Vogt 1981).

Pseudacris c. crucifer (Northern Spring Peeper). Racine Co: Buck's Trail Archery Club, S side of Burlington, N 1/2 Sec. 5, T2N R19E. 16 April 1997. Beth Goeppinger. MPM Herpetology Audio Tape 4-16-97. New county record within expected range (Casper 1996). Accredits reported observations from Racine County Wisconsin Frog and Toad Survey Routes (Mossman et al. 1998)

Hyla chrysoscelis (Cope's Gray Treefrog). Kenosha Co: Bong State Recreation Area, T2N R20E. 25 April 1990. Beth Goeppinger. MPM-P 616–18 with audio tape on file. New county record within expected range (Casper 1996). Accredits reported observations from Kenosha County Wisconsin Frog and Toad Survey Routes (Mossman et al. 1998).

Chelydra serpentina (Common Snapping Turtle). Winnebago Co: Neenah Slough at 36 Jewlers Drive, SW 1/4 Sec. 33, T20N R17E. 25 July 1997. Randy Grimes. MPM-P 632. New county record within expected range (Casper 1996). Green Lake Co: NW 1/4 Sec. 17, T17N R12E. 13 August 1997. Jerry Reetz. MPM-P 640; S 1/2 Sec. 8, T17N R12E, jct South Road and Marsh Road on section line, Sucker Creek nearby. 9 June 1998. Jerry Reetz. New county record within expected range (Casper 1996).

Emydoidea blandingii (Blanding's Turtle). Rock Co: SW 1/4 Sec. 3, T4N R14E, 1.1 miles E of Rt. KK on Rt. N. 14 June 1998. Jeff Riedi. MPM-P 645. New county record within expected range (Casper 1996).

Graptemys geographica (Common Map Turtle). Kenosha Co: Powers Lake, NE 1/4 Sec. 18, T1N R19E. 18 August 1994. Mathew G. Bolek. MPM-H 29588. Netted from boat, six others observed. New county record (Casper 1996). Part of East Branch of Nippersink Creek within Fox River watershed, and ca. 26 stream km from nearest Fox River records in Lake County, Illinois (FMNH 22080; Smith 1961).

Apalone spinifera (Spiny Softshell). Dodge Co: Crawfish River at Old Rt. 73, SW 1/4 Sec. 6, T10N R13E. 8 June 1997. Ben Lenz and Hansel Hallman. MPM-P 630. New county record within expected range (Casper 1996). Extends records from Rock River watershed north by ca. 45 km (Vogt 1981).

Elaphe v. vulpina (Western Fox Snake). Ozaukee Co: Thiensville, NE 1/4 Sec. 15, T9N R21E, Rt. 57, south of Highland Road. 9 June 1993. Lon Carriveau. MPM-H 30350. Roadkill. New county record (Casper 1996). Additional record for previously reported range gap in east-central Wisconsin (Vogt 1981).

Lampropeltis t. triangulum (Eastern Milk Snake). Winnebago Co: Sec. 10, T17N R14E. 26 May 1997. Jerry Reetz. MPM Herpetology-P 641. New county record within expected range (Casper 1996). Continues to fill prior range gap in east-central Wisconsin, with this record ca. 30 km from nearest previously mapped location (Vogt 1981).

Storeria o. occipitomaculata (Northern Redbelly Snake). Outagamie Co: Mosquito Hill Nature Center, New London, NW 1/4 of SE 1/4 Sec. 17, T22N R15E. 23 May 1996. James S. Anderson. MPM-P 620. New county record within expected range (Casper 1996). Green Lake Co: NW 1/4 Sec. 31, T17N R12E. 29 April 1997. Jerry Reetz. MPM-P 639. New county record within expected range (Casper 1996).

Storeria dekayi (Brown Snake). Pepin Co: jct Wisconsin Rts. 25 and 10, NW 1/4 Sec. 20, T25N R13W. 5 July 1997. David Linderud. MPM-P 631. New county record within expected range (Casper 1996).

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New Distributional Records and Natural History Notes for Reptiles from Southern Argentina

FELIX B. CRUZ
CRILaR - CONICET, Entre Rios y Mendoza
5301 Anillaco, La Rioja, Argentina
e-mail: fcruz@crilar.com.ar

JAMES A. SCHULTE II
Department of Biology, Washington University
Campus Box 1137, St. Louis, Missouri 63130-4899 USA
e-mail: schulte@biology.wustl.edu

and
PATRICIO BELLAGAMBA
Bélgica 858, 7600 - Mar del Plata, Argentina
e-mail: patricio@copetel.com.ar

The present note provides six new records for the Patagonian herpetofauna and La Pampa Province in Argentina. Distributional records are two new localities of the genus *Liolaemus,* one confirmation for the eastern distribution of a species of *Liolaemus,* a new provincial record for a species of *Pristidactylus,* new southernmost records for a species of *Phymaturus* (considered endemic to the Somuncura Plateau) and a colubrid snake (*Pseudotomodon trigonatus*). All species were verified by Laura Vega. Voucher specimens are deposited at the Universidad Nacional de Mar del Plata collection (UNMdP) and the Centro Regional de Investigaciones y Transferencia Tecnologica La Rioja collection (CRILaR).

IGUANIDAE

Pristidactylus scapulatus. RIO NEGRO: Dpt. 25 de Mayo, 77 km NW Sierra Colorada (2 km S Esperanza) on the roadside of Provincial Rt. 68 (40°26'S, 68°22'W). 2 February 1999. P. J. Bellagamba, J. A. Schulte II, and F. B. Cruz. CRILaR PT 4810. First record for the province. Cei (1986) cites this species as occurring in Neuquén and Chubut provinces, but not from Rio Negro. The specimen was collected on small rock boulders (less than a meter high) in sympatry with *Diplolaemus* var. *altopatagonica, Liolaemus melanops, L. bibroni,* and *Homonota darwinii.* A second specimen (UNMDP 525) was found on rock boulders on the roadside of provincial road 13 (42°26'S, 69°41'W) in Chubut Province, being sympatric with *Liolaemus petrophilus, L. rothi,* and *Homonota darwinii.*

Phymaturus somuncurensis. RIO NEGRO: Dpt. 25 de Mayo, 43 km N Moligüe on rock boulders near Provincial Rt. 76 (41°35'S, 69°22'W). 1 February 1999. P. J. Bellagamba, J. A. Schulte II, and F. B. Cruz. CRILaR FBC 106–111. This species was considered endemic to the Meseta Somuncura (Cei 1986); however, the present record is at least 100 km west of the Somuncura foothills, and the first for Department 25 de Mayo. *Liolaemus elongatus, Diplolaemus* var. *altopatagonica,* and *Homonota darwinii* were also found in this type of habitat.

Liolaemus xanthoviridis. CHUBUT: Dpt. Biedma, Peninsula de Valdéz, Bahia Fracaso Beach (42°25'S, 64°07'W). 29 January 1999. A. Marcus, P. J. Bellagamba, J. A. Schulte II, and F. B. Cruz. CRILaR PT 4773. First record for Peninsula de Valdiz and northernmost locality. Cei (1986) cites this species from Chubut River (in the south) to Punta Clara. Halloy et al. (1998) mention Laguna de los Indios as the northern limit of this species. This record extends the range 70 km north of the preceding citations and is a new department record.

Liolaemus cuyanus. LA PAMPA: Dpt. Limay Mahuida, 88 km W La Reforma on the roadside of Road 20, (37°39'S, 67°11'W). 3 February 1999. P. J. Bellagamba, J. A. Schulte II, and F. B. Cruz. CRILaR FBC 0067-69. First record for the province. Tiranti and Avila (1997) do not mention this species occurring in the province and one of the authors (S. Tiranti, pers. comm.) mentions that no observations were made of species not on their checklist in his most recent field trips. Habitat of this species was scrub vegatation in Monte desert found in sympatry with *Liolaemus darwinii, Liolaemus gracilis,* and *Cnemidophorus longicaudus.*

Liolaemus kriegi. CHUBUT: Dpt. Cushamen, 25 km S of Moligüe, on rock boulders on the roadside of Provincial Rt. 13 (42°04'S, 69°31'W). 1 February 1999. P. J. Bellagamba, J. A. Schulte II, and F. B. Cruz. CRILaR PT 4848–50. This record confirms the eastern distribution for the species (Cei 1986), but is more than 100 km to the south of Ing. Jacobaci (the easternmost locality) and 20 km south of the northern border of Chubut Province. Cei (1986) mentions the geographic range of this lizard as the occidental region of Rio Negro Province to the border of Chubut, but the presence of this species in the province of Rio Negro remains unclear.

COLUBRIDAE

Pseudotomodon trigonatus. CHUBUT: Dpt. Florentino Ameghino, Cantera las lajas 20 km S Punta Tombo, 1 km E Provincial Route 1 (44°07'57"S, 65°26'W). 27 January 1999. P. J. Bellagamba, J. A. Schulte II, and F. B. Cruz. UNMDP 524. Cei (1986) mentions Puerto Madryn as the southern limit for the species. This record is the southernmost locality and extends the range of this species 120 km farther south than any previously known locality. The type of habitat was a meteorized rocky hill (lajas), where *Homonota darwinii* was also captured.

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BOOK REVIEWS

Reptiles. *In* Fauna Ibérica, vol. 10, by Alfredo Salvador (Coord.). 1998. Departamento de Publicaciones del CSIC, Museo Nacional de Ciencias Naturales, c/José Gutiérrez Abascal, 2, Madrid, E 28006, Spain. 705 pp. Hardcover. 7200 PTE (approx. US $52.00). ISBN 84-00-07713-X.

CLAUDE-PIERRE GUILLAUME
Laboratoire de Biogéographie et Écologie des Vertébrés,
Ecole pratique des Hautes Études, case courrier 094
UM II, Place Eugène Bataillon, F – 34095 Montpellier Cedex 5, France
e-mail: ephebev@crit.univ-montp2.fr

This monograph, devoted to the reptilian orders Chelonii and Squamata of the Iberian Peninsula and Balearic islands, is the tenth in the series *Fauna Ibérica*, the proceedings of a project aimed at acquiring basic zoological, and especially systematic, information about the Ibero-Balearic area.

The book begins with an introduction to the biology of reptiles, including classification, morphology, natural history, and study methods. The body of the book consists of systematic accounts of 26 genera and 47 species of reptiles (in alphabetical order within families). This is followed by a very important list of 2303 bibliographic references, and finally a partially annotated list of synonyms and combinations, and a short glossary.

The same format is used for each species, with each account consisting of sections devoted to (1) scientific name, senior synonym and common name, (2) external morphology, (3) skeleton, (4) sexual dimorphism, (5) genetic data, (6) variation, (7) distribution, (8) fossil record, (9) habitat, (10) activity, (11) food habits, (12) predators, (13) parasites, (14) reproduction and growth, (15) population structure and dynamics, and (16) conservation. For each species, one or more judiciously selected black and white drawings by Pedro Salgado and a distribution map (and often a comparative table of food habits in different countries) complete the account.

Including the coordinator, eight authors shared editing duties: A. C. Andreu and L. F. López-Jurado for the nine species of Chelonii, A. Salvador for the seven species of Iguania, Amphisbaenia, and Scleroglossa (except the Lacertidae), V. Pérez-Mellado for the 18 species of Lacertidae, A. Bea, Fl. Braña, P. Galán, and J. M. Pleguezuelos for the 13 species of Serpentes.

The goal of the editors was to publish a work "intermediate between a technical book and a popular field guide" (MNCN-CSIC 1998). I think that they have attained their objective, however, I do have some critical observations of this otherwise enjoyable book. These comments concern both major and minor points of detail, distribution maps, taxonomy, and systematics.

The first error, undoubtedly due to the delay of printing, appears at the top of p. 4, where the suggested citation format of the book is given as "Salvador, A. (Coordinador), 1997... " instead of 1998, the date of publication which figures at the bottom of the same page. The same date is erroneously mentioned on page 152 in connection with *Chalcides bedriagai cobosi* nom. nov., authorship of which should correctly be cited as Valverde, 1998.

At a time when molecular studies have proven their utility in systematics, it is unfortunate that the "collection, preservation and methods of study" chapter completely omits aspects of tissue collection. Further, the only recommended preservatives are those containing formaldehyde, which causes disastrous effects on both the quantity and quality of the DNA that can be extracted from samples. Alternative methods include both cryopreservation and ethanol or fluid buffer preservation (e.g., Dessauer et al. 1996; Sibley and Ahlquist 1981).

As presented in the book, bibliographic citations always appear to refer to the original literature rather than to secondary sources or other authors' interpretation of subsequent citations. This, however, was clearly not the case, for example, in the chapter devoted to *Lacerta vivipara*, where V. Pérez-Mellado writes on p. 233: "A notable enzymatic variability exists within the European populations (Grenot and Heulin, 1990)." The original sentence of Grenot and Heulin (1990)—whose article has nothing to do with enzymes—is (p. 17): "Although an important enzymatic variability was recognized between populations (Salvidio et al. 1990; Bea et al. 1990), this species...." This article of Grenot and Heulin (1990) is again misquoted two times on p. 240, once with respect to the distribution of oviparous populations of *Lacerta vivipara*, referring to Fig. 1b from Heulin and Guillaume (1989), and the other about the different forms of egg membranes, a subject that is not mentioned in Grenot and Heulin (1990)! It would have been better to quote Heulin (1988), Heulin (1990, not in the bibliographic list) and Heulin et al. (1992). In the same section, on p. 242, an article of Spitz (1971), devoted to *Lacerta viridis* and *Lacerta agilis*, erroneously serves as reference for the area of the home range of *Lacerta vivipara*! Finally, neither Nettmann and Rykena (1984) nor Goose and Castanet (1989) (cf. p. 229) assign the subspecies *Lacerta viridis prasina* to the Iberian peninsula (but rather *L. v. bilineata*). On the same page, a correctly referenced, but truncated quotation produces a misleading sentence. It is not: "*Lacerta viridis* possess *characteristic* bands for the GOT [nowadays called ATA] and the LDH-1 isoenzymes" but "*Lacerta viridis* possess bands (...) *diagnostic for the differentiation between L. viridis and L. trilineata.*"

Other misprints include 19 families instead of 18 as on Fig. 4 (p. 16); *Vipera latastei* instead of *V. latasti* (p. 269); and the number of erythrocytes must be 1,442,000/mm^3, not 442,000 (p. 411).

From my point of view, the distribution maps are the most problematic part of the book. The maps are without any names of Universal Transverse Mercator (UTM) squares (although the limits of provinces are drawn) and the only symbol used is a black dot (a separate symbol should at least have been provided for introduced populations).

We learn in the introduction that the maps were derived "from the atlas published by the Spanish Herpetological Association (1989), completed and in some cases corrected with subsequently published (Pleguezuelos, 1997) or original data, using UTM squares of 50 x 50 km." It is unclear why the former work is attributed to the "Asociación Herpetologica Española" instead of Martínez-Rica (1989) who is the volume's coordinator. On this basis, one might think that except for the difference of scale (the atlas of Pleguezuelos [1997] uses UTM squares of 20 x 20 km), the distribution maps of this book should be similar to those of Pleguezuelos (1997). This is true, however, for only ten species (turtles and terrestrial tortoises, *Lacerta perspicillata*, *Podarcis lilfordi*, and *P. sicula*). More often (26 species) one or a few dots have been added and/or removed. For nine species (*Chalcides bedriagai*, *C. striatus*, *Acanthodactylus erythrurus*, *Lacerta agilis*, *Blanus cinereus*, *Natrix maura*, *N. natrix*, and *Vipera latasti*) the differences are rather significant, and they are very important for *Emys orbicularis*, *Podarcis hispanica*, and

Coronella girondica. For *Podarcis hispanica*, the addition of 30 locality points is understandable as the map of Pleguezuelos (1997), because of data from Portugal confusing *P. hispanica* and *P. bocagei*, would suggest that these lizards are lusitanophobes. For *Coronella girondica*, I noticed eight added dots and 27 deleted ones, leading one to believe that this snake is severely threatened. On the other hand, the range of the European terrapin appears to be expanding as 28 points have been added and only one removed. There is no doubt that these differences are justified, but such differences should have been objectively discussed in the text, all the more because the European atlas (Gasc et al. 1997), published at about the same time, illustrates yet another set of distributions. Finally, the introduced population of *Podarcis pityusensis* in Barcelona, which is noted in the text, does not appear on the accompanying map. And, among the numerous regional atlases referenced in the bibliographic list, I didn't encounter the one of Basque country (Alvarez et al. 1985).

Systematics is supposed to have been the focus of the project upon which this book is based. After a good synthesis of the systematic position of the reptiles, with phylogenetic results at the familial level, a list of the 26 genera and 47 species is presented. The generic allocation of some species within the families Lacertidae and Colubridae has been the focus of discussion for many years. For the Colubridae, the problem is well reviewed on page 347, and J. M. Pleguezuelos explains that "more by convention than by conviction [he] continues to speak about the genus *Coluber* on the broad sense ..." but comparable problems are not dealt with in the case of Lacertidae (merely one sentence in the section devoted to *Lacerta perspicillata*). The reference used by V. Pérez-Mellado (p. 164) for higher order lacertid nomenclature is Arnold (1989), who recognized five genera in the Ibero-Balearic fauna: *Acanthodactylus, Algyroides, Psammodromus, Podarcis*, and *Lacerta* sensu lato, the last (a paraphyletic assemblage) including the subgenera *Lacerta, Thimon* (sic!), *Archaeolacerta*, and *Teira*. Since that time, numerous publications have tried to improve the systematic picture of the group (e.g., Bischoff 1991; Mayer and Benyr 1994; Olmo et al. 1990, 1992). To my knowledge, the last important contribution is that of Mayer and Bischoff (1996), which validates the genera *Zootoca* (with only the species *Z. vivipara*), *Timon* (with *T. lepidus, T. pater*), and *Teira* (*T. perspicillata*). For this last species, Bons and Geniez (1996) have also proposed *Scelarcis perspicillata*. Without reference to an universally accepted generic concept, the taxonomy at this level involves a good deal of subjectivity and permits the authors to take a particular position, but I feel that, in a book focused on systematics, a more explicit discussion of the controversies involved should be presented.

A book such as this presents a real opportunity to put the nomenclature of the species and subspecies occurring in a country in order. Specific changes are very rare and generally do not pose a problem. Nevertheless, I have noted the following ones. *Lacerta aranica* and *L. aurelioi* are not dealt with in a separate chapter, but are discussed in a section devoted to *L. bonnali,* with the conclusion that "it is necessary to make a deeper study of those populations...before accepting without reserve the specific separation and the proposed subspecies...." (p. 195). However, *Lacerta aranica* and *L. aurelioi* figure as full species in the final taxonomic list. On the contrary, *Lacerta cyreni*, recently described by Arribas (1996), is discussed in the section devoted to *Lacerta monticola*, with the conclusion that "The arguments presented do not seem convincing.... These results have to be compared with future works to permit the definitive acceptance or rejection of such taxonomic novelties." (p. 210). It remains in the final taxonomic list as a subspecies of *Lacerta monticola*. The bases for these differences in treatment are unclear. Concerning *Lacerta viridis*, it would have been best to precede the nomenclatural change by citing the possible revalidation of the name *L. bilineata* recently made by Amann et. al. (1997).

The subspecific changes are relatively numerous. The real taxonomic novelty concerns *Chalcides bedriagai cobosi* nom. nov., a replacement name for *C. b. albaradae* Valverde 1968, proposed in accordance with the code of ethics (recommendation no. 3, Appendix A) of the International Code of Zoological Nomenclature (Ride et al. 1985). Most of the other changes are discussed and confirm the opinion expressed by earlier works (for instance the placing in synonymy with their respective nominal subspecies of *Eretmochelys imbricata bissa, Dermochelys coriacea schlegelii, Hemidactylus turcicus spinalis*, or *Algiroides marchi niethammeri*). Some others, however, reflect only the opinion of the authors: for instance, A. C. Andreu and L.-F. Lopez-Jurado provide a description for and maintain the recognition of more or less disputable subspecies of *Emys* whose distributions are not precise. The same authors also have decided to conserve the subspecies *Testudo graeca graeca*. For the Lacertidae, V. Perez-Mellado has invalidated *Lacerta agilis garzoni, L. lepida iberica, Podarcis hispanica cebennensis,* and *P. h. sebastiani,* but prefers to maintain 24 valid subspecies of *Podarcis pityusensis* (the 23 of the list of Salvador [1986] plus *P. pityusensis canensis*), rather than the six recognized by the revision of Cirer (1987; Cirer *in* Pleguezuelos 1997).

In the case of *Podarcis hispanica*, I cannot accept the synonymy of *P. h. cebennensis* with the nominal subspecies on the basis of a superficial comparison based on the book of Pérez-Mellado and Galindo Villardon (1986) published at the same time as the description of this subspecies (Guillaume and Geniez 1986), and as a consequence not containing any samples of French *P. hispanica*. I have had the opportunity to express myself on the subject of this book and I maintain more than ever that "we may wonder whether all the calculations are of any help to...a preconceived taxonomy" (Guillaume and Pasteur 1989). Further, the citation of the name of the authors must be *P. h. cebennensis* Guillaume and Geniez *in* Fretey (ICZN [Ride et al. 1985], article 51, recommendation B).

Concerning *L. lepida iberica,* the work of Mateo et al. (1996), which is not cited, presents new evidence to prove that this subspecies is valid!

As "the series Fauna Ibérica joins a collection of monographs edited by specialists..." (MNCN-CSIC 1998), the fundamental question, beyond the systematic squabbles, is to define the taxonomic level (species, genus, family...) of a specialist. For instance, had José Antonio Mateo written the chapter on *Lacerta lepida* or Maria-Antonia Cirer that on *Podarcis pityusensis* (I intentionally cite people who prepared their theses on those respective taxa), the taxonomic conclusions would have been different.

A final remark concerning a minor taxonomic issue: the name of Valverde was put in brackets for *Algyroides marchi* (Valverde 1958). According to the ICZN (Ride et al. 1985), in pursuance of the articles 33 b ii ("a 'justified emendation' is the correction of an incorrect original spelling..." and 51 c i ("The use of parentheses applies only to changes in the name of the genus...; it is not affected...by emendation of the generic name..."), it seems to me that we may continue to write: *Algyroides marchi* Valverde, 1958, even if this author described *Algiroides marchi.*

To conclude, I think that, despite these criticisms, this book will, without any doubt, delight the Spanish and foreign hispanophilous reptile fanciers—although, for the general public, the addition of a photographic iconography could have been appropriate. This book provides a great service to professional herpetologists, who will appreciate the volume as a very good synthesis of current information, and because of its extensive and current list of bibliographic references.

Last but not least, volume 10 of "Fauna Ibérica" will probably become *the* reference for students working on the biology or ecology of Iberian reptiles and for administrators and managers concerned with the problems of conservation. I hope that other countries will follow such an example.

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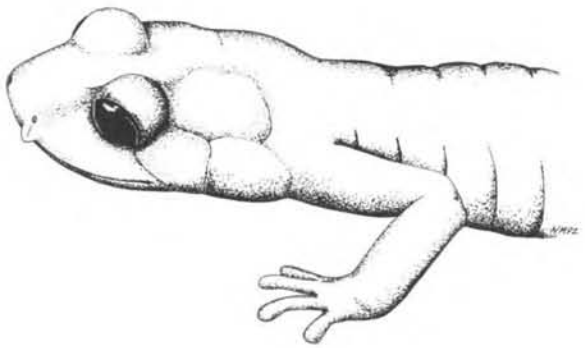
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Plethodon vandykei. Illustration by Michael Frick.

Field Guide to Snakes and other Reptiles of Southern Africa. Third edition, by Bill Branch. 1998. Ralph Curtis Books. 368 pp, 462 maps. US $32.50. ISBN 0-88359-042-5.

DARREL FROST
Department of Herpetology, American Museum of Natural History
Central Park West at 79th Street, New York, New York 10024, USA
e-mail: frost@amnh.org

Field guides such as this can have enormous impact on the field of herpetology, as evidenced in North America by those written by Conant (1958) and Stebbins (1966). Compact sources of information, these kinds of books make information readily accessible for professionals and amateurs alike. More importantly, scientifically sound field guides promote scientific inquiry by delineating geographic and taxonomic questions. Branch's original *Field Guide to Snakes and other Reptiles of Southern Africa* (1988) was one of those important guides that allowed nonspecialists, really for the first time, a solid appreciation for the state of reptile systematics and distribution in southern Africa. The revised and updated guide, rewritten to address the great increase from 397 to 480 species, continues this extremely important contribution.

Having said that this is an important contribution, I am going to make a few minor criticisms. Book reviews never make you any friends, so I might as well. The first criticism is that I would have liked to see the standard formats of the first edition more improved than they have been. As in the first edition, technical keys are presented to the genus, then you are pretty much on your own to figure out what species is in hand. This can be reasonably difficult for the non-African specialist because of minor disorganization in the volume. One has to essentially construct a character matrix in one's head derived from the accounts, which are frequently not written in parallel among species within genus. Frankly, I was brought up on the Stebbins (1966) field guide for the western United States so I am probably biased towards the Houghton-Mifflin standard of noting 'key' characters, but the addition of these toeholds would have improved the utility of this volume considerably.

I am also not sure how the order of the accounts was arrived at; not alphabetical and seemingly not arranged by any measure of similarity. It would have been nice to have accounts arranged alphabetically, or by similarity clusters or with more extensive references to similar species and how to distinguish them. In addition, in an ideal world, field guides would have photographs and maps with the accounts, although I certainly understand the fiscal reasons for isolating photographs in signatures.

I was also confused by the checklist and common names list in an appendix. Because the species accounts in the body of the book are not arranged in alphabetical order and common names do not appear in the index, it is impossible to get from the checklist/common names list to the accounts. The index should have included these common names.

In summary, if you have any interest in the squamates of southern Africa, buy this book. Bill Branch has produced something that is useful and scientifically sound, something that not only reports on the state of knowledge about southern African reptiles, but also a volume that will focus research efforts.

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Rattlesnake: Portrait of a Predator, by Manny Rubio. 1998. Smithsonian Institution Press, Washington, D.C. 240 pp. Hardcover. US $39.95. ISBN 1-56098-808-8.

JEFFREY V. YULE
4315 Willshire Avenue, Baltimore, Maryland 21206, USA
e-mail: Jakita@aol.com

Manny Rubio's study of rattlesnakes is aptly titled. Relying as much on photography as prose, Rubio, a photographer, deftly and effectively presents a portrait of rattlesnakes. In a foreword, William S. Brown suggests that Rubio's book could become the "semipopular replacement for Klauber's monumental tome on rattlesnakes" (xvi). It is difficult to disagree. The strengths Brown singles out in support of that claim are numerous and readily apparent. Drawing on the most recent research available, Rubio offers readable treatments of a diverse range of topics, presents a host of exceptional photographic illustrations, and disseminates crucial information on rattlesnake conservation. Certainly, he places rattlesnakes in their ecological and evolutionary contexts. Perhaps more uniquely, however, he also situates them within the various contexts of human thought, belief, and fear, allowing readers the opportunity to understand how our perceptions, misperceptions, and actions have become the single most significant factor in the continued existence of these animals.

Chapters competently cover the expected range of topics: rattlesnake origins, habitat, anatomy, sensory perception, feeding, physiology, thermal regulation, reproduction, movement, and envenomation. Rubio also addresses relevant topics that are a bit further afield, offering chapters on rattlesnake roundups, the economic and medicinal value of rattlesnakes, their role in folklore and religion, their function as crosscultural symbols, and, finally, their conservation. Although the book necessarily merits particular attention from those concerned with rattlesnakes, readers with even a casual interest in snakes, conservation, or anthropology will find it of interest. In addressing some of the nonscientific, nontechnical dimensions of his subject, however, Rubio does not diminish the usefulness of this study. He admirably achieves his goal of presenting a thorough, semitechnical introduction to rattlesnakes, thoughtfully including the exact combination of basic and supplementary information such a text should contain. In the main text, Rubio uses both Latin and common names for the species discussed, and in two appendices, provides species listings along with Spanish names for species indigenous to Spanish-speaking countries. Other useful features include an appendix of North American herpetological societies, a glossary, and an extensive bibliography.

Rubio's many photographs are exceptional for their clarity and vivid colors as well as for their illustrative effectiveness. A five-picture sequence succinctly demonstrates the distinctive facial markings of each subspecies of ridgenose rattlesnake (49), while a photograph of a subadult southern Pacific rattlesnake, *Crotalus viridis helleri*, taking a defensive posture against a California kingsnake, *Lampropeltis getula californiae*, provides an equally helpful complement to the text's description of that behavior (59). Among the many noteworthy photographs, several deserve particular mention. A selection of photos depicting aberrantly colored rattlesnakes gives some sense of how unusual these animals can appear. Included are oddities from patternless western diamondback and red diamond rattlesnakes (*Crotalus atrox* and *Crotalus ruber ruber*, respectively) to a hypererythristic, cranberry-colored Humantlan rattlesnake, *Crotalus scutulatus salvini*. Perhaps the most impressive photographs, however, are a sequence showing an immature banded rock rattlesnake, *Crotalus lepidus klauberi*, feeding on a large banded centipede, *Scolopendra polymorpha* (73, 76).

Rubio's very personal document is clearly inspired by a genuine affection for his subject. Not surprisingly, his approach places the book squarely in two traditions: natural history essay and semi-technical science writing. That the personal and the scientific should collide at the point of conservation is both rhetorically and technically appropriate. Certainly, virtually every issue bearing on rattlesnake survival and diversity is directly dependent on human activities. Thus, while Rubio's tone is measured on matters of fact and science, it is indignant and sometimes scathing when assessing how people treat rattlesnakes. This is not, however, a defect. Rubio makes no claim to objectivity in addressing what he sees as the shortcomings of human behavior. Moreover, he takes great care to place human activities in the rattlesnake's ecological landscape—where, as for so many species, human activities loom very large. Like virtually all animals, rattlesnakes face a variety of dangers (120). Particularly when young, they are preyed upon by such creatures as ravens, skunks, roadrunners, and, occasionally, even bullfrogs and ants. Those that reach their second year remain subject to predation by coyotes, eagles, hawks, owls, javelinas, kingsnakes, feral pigs, badgers, indigo snakes, and even other, larger rattlesnakes. At all ages, but especially when young, they risk being struck by cars while crossing roadways. Inadequate hiding spots during temperature extremes or severe weather and insufficient small prey also take a heavy toll. First-year rattlesnake mortality can reach 80%, but a snake that reaches the age of four has a high probability of living ten or more years. Adults are large, have the advantage of well-established territories, and can accept a larger variety of prey items, while only a few animals (e.g., large hoofed stock animals, hogs, badgers, and alligators) will risk confronting them. Rubio emphasizes that humans pose the greatest threat to adult rattlesnakes, as they do to many top order predators.

Some of the dangers rattlesnakes face from humans result from something like good sense—or, at least, good intentions. Native American, Hispanic, Chinese, and Thai folk medicine all value rattlesnakes or rattlesnake parts for their various purported benefits. Ongoing research should eventually shed light on their various claims. Currently, however, it is clear that those who seek to benefit by eating dried rattlesnake flesh—as do some members of Hispanic communities in larger American cities—face exposure to powerful strains of *Salmonella* bacteria (e.g., *Salmonella arizona*). Closer to the mainstream of Western thought, rattlesnake venom is a matter of considerable biochemical interest—often without fatal results for the snakes involved. In medicine (both Western and nonwestern) and science, the use of snakes is arguably justified by the fact that there is a reasonable expectation that some good will result from a snake's death or removal from the wild. Too often, unfortunately, humans kill snakes gratuitously or, while hiding behind claims of safety, for short-term monetary gain. Studies have shown that even though most motorists swerve to avoid other animals, a disturbingly high percentage encountering snakes attempt to hit them. Humans intent on eliminating a perceived threat or earning some extra money focus on denning sites, where rattlesnakes can be gathered or killed—sometimes in large quantities—during the spring and fall. Entire den sites have also been dynamited or sealed with cement in an attempt to eliminate local populations (99), directly killing numerous snakes in the process and lowering the chances of future survival for others. Roundups encourage both mass killing of rattlesnakes and habitat destruction. When hunters gas suspected rattlesnake holes in an effort to gather animals for these events, they often injure or kill both their intended targets and other inhabitants of these spaces, in the process contaminating the sites and rendering them unfit for future use. Because the gestating females of some rattlesnake species gather in birthing rookeries in summer, they are particularly vulnerable to commercial collection at this time. Rubio observes that such snake hunting is thought to be the single most important factor in the decline of the timber rattlesnake, *Crotalus horridus horridus* (100), although he does not differentiate between collection for the pet or skin trades and collection for the roundups—perhaps because the differences between these varieties of commercial gathering are insufficiently distinct.

Current opinion suggests that rattlesnakes originated in north-central Mexico (9), but certainly they have been successful throughout the Americas. Apparently, they remain capable of successfully dispersing, even across water barriers. An eastern diamondback, *Crotalus adamanteus*, was seen swimming in salt water 22 miles from shore, and others have been seen negotiating the waters of the Florida Keys and Georgia Barrier Islands (128). From an evolutionary standpoint, rattlesnakes have become varied enough that some no longer even possess rattles. One insular form, the Santa Catalina Island rattlesnake, *Crotalus catalinensis*, lacks the structure. Mature specimens of other island species (e.g., the San Lorenzo Island diamondback, *Crotalus ruber lorenzoensis*, and the San Esteban Island blacktail, *Crotalus molossus estebanensis*) have also been found without rattles, which suggests that these insular species could also eventually become rattleless (54). Rattlesnakes embody an impressive degree of diversity and adaption. As Rubio sees it, the main problem with evolution's ongoing experiment with the rattlesnake design is that the human species will cut it short through ignorance, fear, greed, and shortsightedness.

The Boa Manual, by Philippe de Vosjoli, Roger Klingenberg, and Jeff Ronne. 1998. Advanced Vivarium Systems, Inc., Santee, California. 84 pp. and 30 color photos. Softcover. US $8.95. ISBN 1-882770-41-2. (Available from Zoo Book Sales, 403 Parkway Avenue N, P.O. Box 405, Lanesboro, Minnesota 55949-0405, USA).

PETER D. STRIMPLE
Reptile Research and Breeding Facility
4655 Glenway Avenue, Cincinnati, Ohio 45238, USA
e-mail: pds0404@aol.com

Currently, there are no fewer than four series of books readily available on the husbandry of various reptiles and amphibians (i.e., AVS, Barron's, TFH, and T-Rex). The quality and utility of these publications varies, and in my opinion the AVS (Advanced Vivarium Systems) series is the best. With the popularity of boas in herpetoculture it is no wonder that the original edition of the red-tailed boa booklet (de Vosjoli 1990) was revised. The new version has been expanded to include color photos and additional text. It is divided into 15 sections including "Responsible Herpetoculture", "Quarantine and the Dark Shadow of IBD", "Maintenance", "Feeding", "Breeding Colombian Boa Constrictors", "The Recognition and Treatment of Diseases and Disorders in Boa Constrictors", and an Index.

In the Introduction, Philippe de Vosjoli explains why co-authors were involved with the revised edition and states the goal of the book: to provide "a thorough introduction to keeping and breeding boas." This is followed by a "General Information" section that lists the subspecies of *Boa constrictor* (as recognized by the authors), and discusses the size, longevity, sexing, and growth of this species.

Next is a one-page, but important section detailing what a person should do before purchasing a boa. Here, the authors point out a few of the mistakes made by many first time buyers: 1) they fail to realize the size attained by large boas; 2) they don't consider the large enclosures needed for adults; and 3) they don't understand that someday their snake may be eating animals such as large rab-

bits. In addition, the authors go on to discuss what is involved in the decision to purchase a large snake such as a boa.

One of the most important parts of this book is titled "Responsible Herpetoculture." Considering the number of news reports about escaped reptiles (including large constrictors) in the U.S. each year, the inclusion of this information seems prudent. Essentially it is a list of recommendations proposed by the American Federation of Herpetoculturists for the keeping and handling of large constrictors. Included are suggestions such as: 1) not displaying these animals in public settings unless in an appropriate forum (e.g., pet stores, herpetological exhibits); 2) transporting them in a secure manner; 3) utilizing secure caging designs; 4) handling them only when an assistant is present; and 5) not allowing minors to keep these animals. There is also an interesting discussion about the increase in the number of agencies proposing legislation that governs the keeping of large constrictors.

Under the heading "Quarantine and the Dark Shadow of IBD," the authors provide a brief discussion of Inclusion Body Disease, a devastating disease that mainly afflicts boas and pythons. They go on to discuss some general rules of proper quarantine that are applicable to the husbandry of all reptiles, not just boas.

For novices, the section titled "Selecting Boa Constrictors" will be particularly useful as it covers the advantages to selecting a captive-bred animal versus one that is wild caught. Also, there is a step-by-step procedure for evaluating the health of a boa being considered for purchase. At the end of this section there is information on keeping groups of boas for breeding and on proper handling.

"Housing Boa Constrictors," "Heating and Lighting," and "Feeding" are the next sections, and they really provide the bulk of information needed to properly care for these snakes in captivity. Topics covered include enclosures (types, size, design, landscaping), substrates, shelters, temperature, heating elements, proper lighting, prey size, feeding schedules, feeding problems, and supplying water. Here, readers will find a wealth of practical information that may not be available in more generalized books about reptile husbandry. Following the above information are short sections titled "Shedding" and "Maintenance"; in the latter there are some general guidelines for routine cleaning which will benefit novices.

While many people will most likely be content with maintaining a single boa, seasoned herpetoculturists will find the eight-page section titled "Breeding Colombian Boa Constrictors" (written by Jeff Ronne) of interest. It starts out with a discussion of maturation in boas, and then proceeds to cover topics such as care of breeding boas, cycling, courtship, preovulation swelling, copulation, and ovulation (the information provided is detailed and very useful). The last three pages are concerned with parturition, and include observations about female behavior during and after birth, infertile ova, and the feeding of neonates.

The final section of this book is "The Recognition and Treatment of Diseases and Disorders in Boa Constrictors" (written by Roger Klingenberg, DVM). Included is a detailed discussion of IBD (seven pages) which provides the reader with a solid understanding of this disease. Other ailments discussed include respiratory infections, gastrointestinal disorders, constipation, parasitism, and salmonellosis. Concluding this section are three tables containing additional information about IBD, and a five-page troubleshooting chart for boa health. Undoubtedly, the health chart will be of great value to most herpetoculturists.

Overall, this care book is well done and quite useful. The text is well written and informative, the typeface is clean, and the binding and cover are of decent quality. Furthermore, the inclusion of 41 black-and-white photos and the addition of 30 color photos (not found in the first edition) greatly improve its overall appeal. While a couple of the pictures are of rather poor quality, most range from good to very good. Other assets of this book are the sections on "Responsible Herpetoculture" and "Selecting Boa Constrictors," both of which are topics overlooked all too often by reptile enthusiasts.

One small problem with this book is the location of a two-page section titled "Quarantine and the Dark Shadow of IBD." It would have made more sense to incorporate it into Dr. Klingenberg's section covering diseases and disorders.

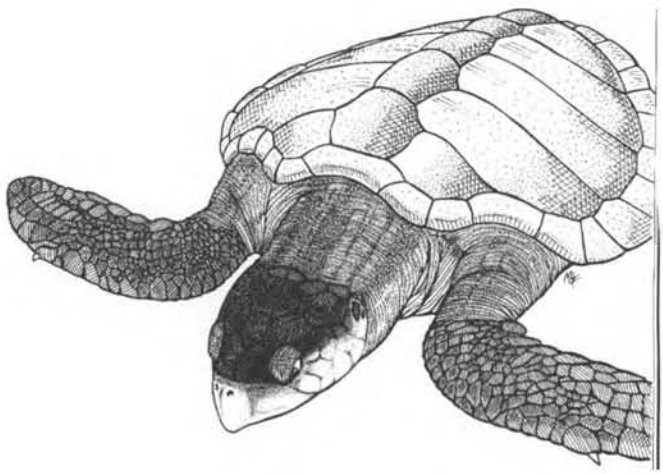
The text is relatively free of typos, though I did find a couple (e.g., "asses" for "assess"; p. 30). A couple of incorrectly worded sentences also appear (e.g., on p. 32 it is suggested that you feed one prey item to your snake and then offer it a second. It then goes on to say that if the snake is still hungry you can feed it a second prey item; on p. 60 a sentence reads "During the gestation period the gravid female will typically move toward the warm end of the cage every and spend the night sitting…").

Other problems with this book (some of which are minor) are as follows: 1) the inconsistent presentation of state names (on p. 20 "Kansas" is spelled out but California is abbreviated CA); 2) the "Reference Sources" list at the end of the book is only for Dr. Klingenberg's section on diseases and disorders. It would have been helpful, especially for novices, to have a reference list that applied to the entire book; 3) on p. 22 under the heading "Substrates" there is the subheading "Newspaper and other kinds of paper", though wood shavings, potting soil, and leaf litter are also discussed; and 4) in the Introduction, de Vosjoli says he was impressed by a piece Jeff Ronne wrote for *Reptiles* magazine, but there is no citation for that reference.

Criticisms aside, I encourage novices and boa enthusiasts alike to purchase *The Boa Manual*. Undoubtedly, the amount of information they glean from the pages will vary, but they will easily get their money's worth. The authors have succeeded in fulfilling their goal of providing "a thorough introduction to keeping and breeding boas."

LITERATURE CITED

DE VOSJOLI, P. 1990. The General Care and Maintenance of Red-tailed Boas. Advanced Vivarium Systems, Lakeside, California. 48 pp.



Lepidochelys kempi. Illustration by Michael Frick.

The Origin and Evolution of Larval Forms, edited by Brian K. Hall and Marvalee H. Wake. 1998. Academic Press Inc., 525 B Street, Suite 1900, San Diego, California 92101-4495, USA. xiv + 425 pp. Hardcover. US $79.95. ISBN 0-12-730935-7.

RICHARD WASSERSUG
Department of Anatomy and Neurobiology, Dalhousie University
Sir Charles Tupper Medical Building
Halifax, Nova Scotia, B3H 4H7, Canada
e-mail: tadpole@is.dal.ca

The eleven chapters that make up this book, not counting the editors' Introduction and Epilogue, are packaged under three headings: 1) Larval Types and Larval Evolution, 2) Mechanisms of Larval Development and Evolution, and 3) Larval Functional Morphology, Physiology and Ecology. That's a lot of territory to cover in a single volume.

Not surprisingly, the coverage is uneven and sufficiently spotty that no major syntheses or conceptual breakthroughs come out of this volume. One gets the feeling from the editors' own contributions that even they would accept that criticism. Indeed, one notes that Hall and Wake end their book with an Epilogue titled "Prospects for Research..." rather than a section titled "Conclusions."

The origin and evolution of larval forms is just too broad a topic to ever be covered adequately by a handful of authors, in a dozen or so disparate chapters. The fact is that any all-encompassing advances in our understanding of the origin and evolution of larval forms will ultimately have to deal with the origin and evolution of most metazoan life, for most Metazoa (think insects) have some sort of larval stage. Yet the basic biology of larvae—particularly those of marine fishes and invertebrates—is still too poorly known to yield firm conclusions on their evolution, either in terms of history or mechanisms.

However, such a clip critique of the book as a whole does not do justice to the many superb chapters in *Larval Forms*. Thus, although I do not recommend that anyone attempt to plow through this book cover to cover, some chapters here do deserve broad readership. The four chapters that deal explicitly with vertebrates—my focus in this review—fill over half the pages and are, in my mind, among the best in the book.

If one needs a single article for students to read during that solitary week or so typically devoted to fish larvae in one's single semester ichthyology course, Jackie Webb's 49-page chapter, "Larvae in Fish Development and Evolution," would do the job nicely. It is one of the most readable chapters in the book. Webb doesn't attempt to solve any major controversies in fish evolution, but admirably introduces the diversity of strange adaptations found in fish larvae.

The 47-page chapter "Larvae in Amphibian Development and Evolution" by Jim Hanken does not reach any grand or surprising conclusions either. Hanken focuses strongly on his own work, in areas such as the cranial development of tadpoles. Along the way though he manages to cite a wealth of literature on amphibian developmental biology, much of it within the historical framework that has become something of a trademark in his writing.

Chris Rose does a stellar job in his 49-page review of "Hormonal Control in Larval Development and Evolution—Amphibians," demonstrating an impressive knowledge of endocrinology, amphibian morphology, systematics, and developmental biology. Any researcher studying amphibian metamorphosis who feels insecure in one or more of these areas, would profit from reading Rose's chapter. Despite many excellent chapters on amphibian metamorphosis in the Gilbert et al. (1996) book and the recent (1997) *American Zoologist* symposium devoted to this topic, I have not seen anything as comprehensive as Rose's chapter in *Larval Forms*.

Rose particularly enriches our understanding of salamander metamorphosis, consistently and appropriately formulated in a phylogenetic context. After reading his chapter even I, as an anuran aficionado, had to acknowledge that metamorphosis in urodeles was neither as minor nor monotonous as I had previously supposed. [My one criticism of this chapter is that Rose does not discuss the possible role of peptide growth factors in the control of amphibian larval development.]

The last chapter on vertebrates is Laurie Sanderson and Sarah Kupferberg's 76-page contribution, "Development and Evolution of Aquatic Larval Feeding Mechanisms." Despite its title, this chapter only mentions invertebrates in passing and really deals with fish and amphibians. However, like Rose's, this chapter is otherwise outstandingly comprehensive. Sanderson is, by training, a fish ecomorphologist and Kupferberg an amphibian ecologist. Together they demonstrate a wonderful ability to assimilate and summarize an enormous amount of literature in areas far beyond their own core research. Hopefully they will continue to collaborate. I could find only a few things to quibble about in this chapter and they were all minor. For example, there is a statement that "flaps on the nares serve as external valves," when tadpoles pump water through their mouths. This may mislead some readers, who don't know tadpole morphology, into thinking that those narial valves are external, whereas in most tadpoles narial valves are internal. Much of the anuran larval biology covered in this chapter will undoubtedly also be covered in the new McDiarmid and Altig (1999) *Tadpole* book. Nevertheless I would be surprised if the literature summary there, on tadpole feeding, is more exhaustive than Sanderson and Kupferberg's.

In general, the literature reviewed within this book is a major strength and makes the volume a valuable resource, despite any criticism that I or others might raise overall. A bit more than a quarter of the pages from the chapters mentioned above are reference lists. Collectively those four chapters cite over a thousand papers!

This, however, does not mean that the information in this book is easily absorbed. Unfortunately most of the chapters, including those listed above (Webb's is an exception) assume that the readers are knowledgeable in anatomy, systematics, or both. Whereas much of the book is devoted to the embryonic origins of larvae or their metamorphic transformation, not much space is given to introducing or illustrating larval forms *per se*. Thus the undergraduate, who has not had some morphology and taxonomy courses, will probably find the book overwhelming. The invertebrate zoologist, who has not worked with fishes and amphibians, would similarly have a hard time grasping all the information in the chapters mentioned above.

Another caveat: the word "heterochrony" gets used by most of the authors in this book, but if one is not sure whether heterochrony is a powerful explanatory concept in evolutionary biology or just overused jargon, this book will not help them decide. The problem is that the term is used in slightly different contexts by the various authors. Mike Hart and Greg Wary, in a brief chapter (7 pp.), succinctly titled "Heterochrony," are down on the term, arguing that it is of limited value in the discussion of larval origins at the highest levels. Evidently, though, few if any of the other contributors to this book read the Hart and Wary chapter before signing off on their own submissions. If one takes the time to struggle with the subtleties of definitions, one can reconcile the different uses of "heterochrony" in the different chapters. However, on a first pass, the average reader may feel more confused than enlightened about the term.

In their Epilogue, the editors reiterate areas for additional work—an appropriate action in the absence of any big breakthroughs in our understanding of larval evolution. There, Hall and Wake make the following statement (p. 412): "An 'ancient and honorable' question that is not fully answered, nor even fully grasped, is why larvae evolved at all. The facile answer usually provided is that larvae contribute to the survivorship of species by diversifying both the larval and adult life forms and thereby the habitat and resources available." I believe that this so-called "facile answer" is a bit of a strawman, and a dated one at that. This answer has certainly been recognized for some decades *not* to apply to taxa such as many marine invertebrates that have non-feeding larvae which are simply a dispersal stage for otherwise sessile organisms.

It similarly does not hold for holometabolous insects or anurans, that have obligate metamorphosis. From an ecoevolutionary perspective, the larval stage of these taxa evolved to allow these organisms access to patchy resources, limited in time and space. This view, I believe, is accepted by most ecologists who work with these organisms.

That is not to say that the question of "Why have larvae evolved?" is fully answered. It is not. But it is as absurd to expect one true answer to this question as it is to expect the topic of the origin and evolution of larval forms to be adequately covered in a single multi-authored volume.

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HAYES, T. B. (ORGANIZER). 1997. Amphibian metamorphosis: An integrative approach. Amer. Zool. 37:121–207.

MCDIARMID, R. W., AND R. ALTIG (EDS.). 1999. Tadpoles: The Biology of Anuran Larvae. The University of Chicago Press, Chicago, Illinois. 456 pp.

PUBLICATIONS RECEIVED

Of Frogs and Toads, Poems and Short Prose Featuring Amphibians, edited by Jill Carpenter. 1998. Ione Press, P.O. Box 3271, Sewanee, Tennessee 37375, USA. xii + 131 pp. Softcover. US$ 10.95 ($3.50 shipping for first copy, $1.00 each additional). ISBN 0-9666674-0-9.

This volume contains 88 contemporary poems and (very) short stories relating to amphibians. The majority of these focus on anurans, but urodeles are also treated in a number of works (no caecilians, however). Although some contributions are purely fanciful, others touch on a variety of aspects of amphibian biology, including reproduction, vocalization, and metamorphosis. Many of the poems make reference to the phenomenon of disappearing amphibians. The literary works are supplemented by ten line drawings.

The Gigantic Land Tortoises of the Galapagos Archipelago, by John Van Denburgh. 1998. Society for the Study of Amphibians and Reptiles, Ithaca, New York. xiii + 172 pp., 101 pls. Hardcover. US $55.00 ($3.00 shipping). ISBN 0-916984-46-X.

This is a facsimile reprint of the classic work by Van Denburgh on Galapagos tortoises based on the extensive material collected by the California Academy of Sciences expedition to the islands during 1905–1906. The original work contained detailed measurements for all of the 266 specimens collected on an island by island basis. Representatives of each of the forms recognized by Van Denburgh are represented in dorsal, lateral, and frontal view in the black and white photographs that constitute the majority of the 101 plates. The text includes a historical overview of early accounts of giant tortoises, as well as an extensive systematic account of the animals. This facsimile edition is accompanied by a nine-page foreword by Peter C.H. Pritchard that places the Academy expedition in its historical context and highlights the importance of Van Denburgh's monograph. Also provided are a map of the expedition's route through the archipelago, several historical photos, and a table comparing Van Denburgh's taxonomy to that employed by several more recent workers.

Frogs, A Wildlife Handbook, by Kim Long. 1999. Johnson Books, 1880 South 57th Court, Boulder, Colorado 80301, USA (e-mail: books@jpcolorado.com). Softcover. US $15.95. ISBN 1-55566-226-9.

This is an idiosyncratic guide to anurans of North America, their biology, and their place in human culture. Each species account includes an illustration (most in color), range map (with some inaccuracies), brief description, and comments on vocalization. Oddly, the author has segregated all species with the word "toad" in their common names. These do not have color illustrations and are not provided with full species accounts. Short sections on reproduction, larval life, anatomy, and other basic frog biology are also presented. Much of the remainder of the book deals with frogs in mythology, folklore and Native American tradition. A section on frog names provides foreign language terms for frogs as well as derivations of the specific names of most North American taxa. Although this is an interesting feature not present in competing titles, readers should be aware that there are errors (for example, collectors and describers are not differentiated, resulting in some misleading statements). The book concludes with a short bibliography and list of other sources and is indexed by common name and subject.

Interpretive Atlas of Texas Lizards, by Ralph W. Axtell. 1986–1998, *et. seq.* Privately published by and available from the author (Ralph W. Axtell, 2814 Rock Hill Road, East Alton, Illinois 62024, USA). Individual accounts available separately. Cost: US $0.10/page + postage and handling.

The most recent installments (numbers 18–20) in this series are the three species of *Holbrookia* occurring in Texas: *H. maculata* (Lesser Earless Lizard), *H. propinqua* (Keeled Earless Lizard), and *H. lacerata* (Spot-tailed Earless Lizard). These new accounts comprise 44 pages in addition to a detailed range map. Axtell provides an in-depth discussion of distribution for each species in Texas, along with current taxonomy, geographic variation, conservation status, and suggestions for future work. Among the taxonomic changes proposed are the elevation to species status of *H. m. approximans* and *H. m. elegans*.

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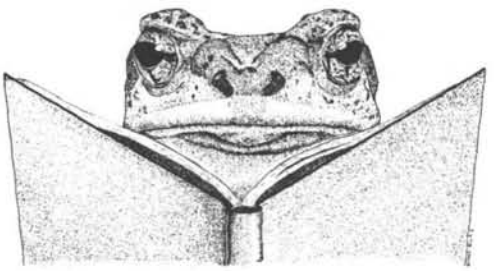
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HERPETOLOGICAL REVIEW

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 298-6333 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
208 South Great Road
Lincoln, Massachusetts 01773, USA
e-mail: ttyning@massaudubon.org

Associate Editors

BRIAN W. BOWEN
University of Florida
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BRADFORD HOLLINGSWORTH
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e-mail: jeffrey_lovich@usgs.gov

SHARYN B. MARKS
Humboldt State University
e-mail: sbm1@axe.humboldt.edu

JOSEPH R. MENDELSON III
Utah State University
e-mail: sapo@bioserver.vsb.usu.edu

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USDA Forestry Science Lab
e-mail: olsond@ccmail.orst.edu

GUNTHER KÖHLER
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e-mail: gkoehler@sng.uni-frankfurt.de

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

Current Research
ANNE M. MAGLIA
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: magliaa@falcon.cc.ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: soniak@unt.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biology
Indiana University
Bloomington, Indiana 47405, USA
e-mail: jdemuth@bio.indiana.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
e-mail: jbh10@psu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@ucok.edu

Editor-at-Large: *Adam P. Summers*
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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1999 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

2000 — Universidad Autónoma de Baja California Sur, La Paz, BCS, México, 14–20 June 2000 (Carlos Villavicencio, Chair).
2001 — Indiana University/Purdue University, Indianopolis, Indiana, USA, 26–30 July 2001

About Our Cover: *Anolis transversalis*

Anolines comprise a large group of lizards within the Polychrotidae, with more than 300 known species (Lee 1996. The Amphibians and Reptiles of the Yucatán Peninsula. Comstock Publishing Associates. Ithaca, New York. 500 pp.). Collectively, they range from the southeastern United States, through México, Central America, and the Antilles to approximately 20° S in South America. Although primarily arboreal, there are semiarboreal, terrestrial, and even semiaquatic species known.

Anolis transversalis, described by Duméril in 1851, occurs in western Amazonia in Colombia, Ecuador, and Peru, and in the Brazilian states of Acre, Amazonas, and Rondônia (Avila-Pires 1995. Lizards of Brazilian Amazonia [Reptilia: Squamata]. Zoologische Verhandelingen. [299]:1–706). It is readily distinguished from all other anoles found within its range by the combination of smooth head scales and a distinctive color pattern of transverse markings on the body (Duellman 1978. The Biology of an Equatorial Herpetofauna in Amazonian Ecuador, Univ. Kansas Misc. Publ. No. 65, 352 pp.). Adult color pattern is sexually dimorphic, with females prominently banded; the dorsum of males tends toward black speckling rather than banding. Owing to differences in coloration, males were described in 1880 by O'Shaughnessy (1880. Proc. Zool. Soc. London 1880:491–493) as another species, *A. buckleyi*, which was demonstrated by Williams and Vanzolini (1966. Papeis Avulsos 19:197–204) to be conspecific with *A. transversalis*.

Adults of both sexes possess a well-developed dewlap and beautiful cerulean eyes. Female dewlap coloration is chocolate brown with the enlarged scale rows and the ventral edge yellowish tan. Male dewlap colors vary from lemon-orange to reddish-orange with the enlarged lateral scale rows varying from light green to yellowish (Dixon and Soini 1986. The Reptiles of the Upper Amazon Basin, Iquitos Region, Peru. Milwaukee Public Museum. 154 pp). Males are 79–83 mm SVL, females 69–81 mm SVL.

Although most frequently seen descending trunks of large trees in closed canopy forest, specimens have been collected on leaves and small branches as low as 1.5 m. The species is thought to occupy mainly the upper levels of the forest, in or near the canopy of large trees (Dixon and Soini, *op. cit.*; Duellman, *op. cit.*).

The adult female depicted on the cover was photographed by **David T. Roberts** at the Madre Selva II Biological Station located on the Río Orosa, Loreto, Peru. The Río Orosa is a small tributary on the south bank of the Amazon River approximately 125 km east of the city of Iquitos. The photograph was taken with a tripod-mounted Canon F1 camera and a Vivitar 100mm macro lens. The natural light exposure was made during the early afternoon on Fujichrome Velvia film, at an aperture setting of f11 and a shutter speed of 8 seconds. David is a research technician at the Dallas Zoo's Department of Herpetology. He has spent the past 15 years photographing a variety of life forms in North, Central, and South America. His favorite photographic subjects include reptiles, amphibians, insects, and arachnids. David frequently teaches rainforest photography workshops at the Madre Selva II Biological Station for Nature's Images, Inc. His photographs have appeared in a variety of scientific and popular publications.

Separation and imaging of Roberts' photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

Kennedy Student Award Committee Annual Report—1999

The Kennedy Award Committee has completed its work for Volume 32 of the *Journal of Herpetology*. The Committee has selected "Predator mediated patch use by tadpoles (*Hyla regilla*): risk balancing or consequences of motionlessness?" by Sarah J. Kupferberg (Vol. 32:84–92). The Kennedy Award carries with it a cash prize of US $200 or the winner's selection of any SSAR publications valued at twice that amount.

Nine manuscripts were in competition this year. The Committee noted the high quality of the submitted papers. Committee members were: Robin Andrews (Virginia Polytechnic Institute & State University), David Duvall (Oklahoma State University), Mary Mendonça (Auburn University), Terry D. Schwaner (Southern Utah University), and Robert E. Gatten, Jr., Chair (University of North Carolina).

SSAR Board Appoints New Secretary

John Matter has been appointed SSAR Secretary, replacing Ellen Censky, who has resigned owing to the press of duties associated with her recent appointment as Director of the Connecticut Museum of Natural History. SSAR extends its gratitude to Ellen for her service to the Society. As of September 1, 1999, all matters pertaining to the Secretary's office should be directed to: *Dr. John M. Matter, Biology Department, Juniata College, Huntington, Pennsylvania 16652, USA; e-mail: matter@juniata.edu.*

Membership Options for the Society for the Study of Amphibians and Reptiles Effective for the Year 2000

Life membership is now available for the Society for the Study of Amphibians and Reptiles. You can make a single payment of US $1250 or four equal annual payments of US $325. Look for the renewal envelope in the September issue of *Herpetological Review*. You may renew your regular individual membership for up to three years or your student membership for two years at the current rate. You can also renew via e-mail with your VISA/MasterCard at *ssar@slu.edu*.

Managing Editor Sought for *HR*

Herpetological Review is seeking to fill the position of Managing Editor, to replace Tom Tyning, who would like to step down in the not-too-distant future. Among other qualifications, the Managing Editor should be skilled in the use of page composition software, such as PageMaker. Inquiries may be directed to the Editor, Robert Hansen, by e-mail at *rwh13@csufresno.edu*.

HR Staff Changes

Brad Hollingsworth (San Diego Natural History Museum) and Gunther Köhler (Forschungsinstitut und Naturmuseum Senckenberg) have joined the *Herpetological Review* staff as Associate Editors. Dan Beck, Associate Editor, has resigned following several years of outstanding service to the herpetological community. On behalf of SSAR, the editors thank Dan for his efforts.

SSAR Web Site Moved

After many years at http://falcon.cc.ukans.edu/~gpisani/SSAR.html we recently have moved the SSAR web site to

http://www.ukans.edu/~ssar/.

The old site will forward users for sometime to come, but links and bookmarks should be updated to reflect the change. The mirror site at http://www.ukans.edu/cwis/units/biol/SSAR/SSAR.html will remain operational.

NEWSNOTES

Graduate and Post-Graduate Research Grants

The Biological Research Station of the Edmund Niles Huyck Preserve offers grants (max. = $2500) to support biological research which utilizes the resources of the Preserve. Among the research areas supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2000-acre Preserve is located on the Helderberg Plateau, 30 miles southwest of Albany, New York. Habitats include northeast hardwood-hemlock forests, conifer plantations, old fields, permanent and intermittent streams, 10 and 100-acre lakes, and several waterfalls. Facilities include a wet and dry lab, library, and houses/cabins for researchers. Deadline = 1 February 2000. Application material: *Dr. Richard L. Wyman, Executive Director, E.N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, New York 12147, USA.*

MEETINGS

Meetings Calendar

2–4 October 1999—Australian Herpetological Society, 50th Anniversary Conference on Captive Husbandry and Conservation of Reptiles, Sydney, Australia. Contact: Daniel Holloway (e-mail: ozherps@zip.com.au) or visit the Society's web page (www.ozherps.zipworld.com.au).

5–9 October 1999—The Sixth Annual Conference of the Association of Reptilian and Amphibian Veterninarians, Columbus, Ohio, USA. For conference registration information contact: Wilbur Amand, VMD, PO Box 605, Chester Heights, Pennsylvania 19017, USA; fax: 610-892-4813.

8–11 October 1999—Second Symposium on the Status and Conservation of Florida Turtles, Eckerd College, St. Petersburg, Florida, USA. Contact: Gopher Tortoise Council, c/o George L. Heinrich, 1223 Alhambra Way S., St. Petersburg, Florida 33705-4620, USA; tel. (813) 865-6255; e-mail: highpine@gte.net.

15–18 October 1999—Canadian Amphibian and Reptile Conservation Network/Rèseau Canadien de Conservation des Amphibiens et des Reptiles Annual Meeting, Quèbec City, Quèbec, Canada. Contact: Stan A. Orchard, Chairman, CARCNet, 1745 Bank Street, Victoria, British Columbia, Canada V8R 4V7; Tel/Fax: 250-595-7556; e-mail: sorchard@islandnet.com.

25–28 October 1999—The 5th Biennial Conference on Research on the Colorado Plateau, Flagstaff, Arizona, USA. For more information see the conference web site (www.usgs.nau.edu/conference).

12–17 December 1999—5th Latin American Congress of Herpetology, University of Uruguay, Montivideo, Uruguay. Abstract deadline 30 June 1999. For registration and information contact: Lic. José A. Langone, Secretario Ejecutivo V CLAH, Museo Nacional de Historia Natural, CC 399, 11000 Montivideo, Uruguay (e-mail: vclah@fcien.edu.uy). Within the U.S. or Canada, contact: Dr. Rafael de Sá, Department of Biology, University of Richmond, Richmond, Virginia 23173, USA (e-mail: rdesa@richmond.edu). Web site: http://zvert.fcien.edu.uy/clh.

1 April 2000—All Florida Herpetology Conference, Florida Museum of Natural History, Gainesville, Florida. For more information, contact Max Nickerson, Florida Museum of Natural History, University of Florida, Gainesville, Florida, 32611 USA (email: maxn@flmnh.ufl.edu).

LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles and their habitats. Please direct all communications to the section editor, Jeffery Demuth (postal and e-mail addresses on inside front cover).

USA: Louisiana: Act 81 of the 1999 Session of the Louisiana Legislature prohibits the commercial harvest of Louisiana's native box turtle (*Terrapene* spp.) populations. The law was unanimously passed by both the Louisiana Senate and House of Representatives and goes into effect August 15, 1999. This victory for one of Louisiana's turtles also will impact box turtles in other states.

Any box turtles native to the state of Louisiana will be considered as originating from Louisiana. Therefore, it will no longer be possible to smuggle box turtles out of other states, where harvest is also illegal, and claim they originated in Louisiana. Additionally, recreational possession is limited to four box turtles.

Since January of 1995, approximately 29,896 box turtles were collected for the pet trade and shipped from Louisiana. This law will help to ensure the future of box turtles in Louisiana and throughout their range.

For more information contact: *Martha Ann Messinger, 2022 Gemini Drive, Bastrop, Louisiana USA 71220-3467, Tel.: (318) 281-0113, e-mail: gpatton@bayou.com.*

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.herplit.com/contents

Interactions Between Mole Salamanders and Sirens

The author utilized field sampling and experiments in artificial and natural ponds to study the interactions between two top amphibian predators (branchiate adult *Ambystoma talpoideum* and *Siren intermedia*) of temporary ponds in southeastern United States. The author found the abundance and distribution of these species to be independent; however, *A. talpoideum* was more abundant and widespread than *S. intermedia*. Within a particular pond, captures of these two species were negatively correlated, and results of this research suggest that paedomorphic *A. talpoideum* avoid those traps containing *S. intermedia*—experiments in artificial ponds supports this asymmetrical interaction. Interestingly, experiments in artificial ponds also indicated that *S. intermedia* reduced both recruitment and growth of *A. talpoideum* and did not experience reciprocal negative or positive effects. These results suggest that *S. intermedia* competes with, and is an intraguild predator of, *A. talpoideum*.

FAUTH, J. E. 1999. Interactions between branchiate mole salamanders (*Ambystoma talpoideum*) and lesser sirens (*Siren intermedia*): asymmetrical competition and intraguild predation. Amphibia-Reptilia 20:119–132.

Correspondence to: John E. Fauth, Department of Biology, College of Charleston, Charleston, South Carolina 29424-0001, USA; e-mail: fauthj@cofc.edu.

Amphibians and Reptiles Introduced into Colorado

The authors summarize records (University of Colorado specimens, literature review [including newspapers], contacting field biologists, and conducting field surveys of sites) of amphibians and reptiles introduced into Colorado, providing a list of those species introduced and the modes by which they likely were released, and they discuss which species have subsequently established populations. Information included by the authors can be used in the development of policies concerning importation, translocation, and release of captive specimens.

LIVO, L. J., G. A. HAMMERSON, AND H. M. SMITH. 1998. Summary of amphibians and reptiles introduced into Colorado. Northwestern Naturalist 79:1–11.

Correspondence to: Lauren J. Livo, Department of EPO Biology, University of Colorado, Boulder, Colorado, 80309-0334, USA.

Reproduction in the Suwannee Cooter

From 1988 to 1993, the authors studied the reproductive biology of *Pseudemys concinna suwanniensis*, the largest North American emydid, in the headwaters of the Wakulla River in northern Florida. At the study site, various aspects of the reproductive biology of these turtles were determined. Based on these data, the authors found size at sexual maturity to be more a function of size than of age and females were found to lay as many as five or more clutches at 16–25 day intervals; most females were found to lay eggs annually. Average annual production of eggs was approximately 70 eggs per female; clutch mass was found to increase with body size, but relative clutch mass did not. Data from hatchlings also were collected, and hatchlings were found either to exit nests in fall or to overwinter and leave the nest in early spring. Temperature-dependent sex determination is the means of sex determination in *P. concinna suwanniensis*, and the primary predators of eggs at this site were raccoon (*Procyon lotor*) and fish crows (*Corvus ossifragus*). The authors present management recommendations for this and other species of turtles in Florida.

JACKSON, D. R., AND R. N. WALKER. 1997. Reproduction in the Suwannee Cooter, *Pseudemys concinna suwanniensis*. Bulletin of the Florida Museum of Natural History 41(2):69–167.

Correspondence to: Managing Editor, Bulletin, Florida Museum of Natural History, University of Florida, P.O. Box 117800, Gainseville, Florida, 32611-7800, USA.

Distribution of Northern Redback Salamanders

The authors examined the effects of selective logging (a process that leaves gaps in the forest canopy) on the distributions of individual *Plethodon cinereus* in a patch of forest that had been selectively logged one year earlier. Leaf litter searches and inspection under cover objects were made to assess salamander densities and distributions. Comparisons were made between quadrats inside gaps, along the edges of gaps, and within the forest. Though variation in salamander numbers was found among transects, no significant differences were found in the densities of salamanders among the three quadrat catagories. The result of this investigation suggest that newly formed tree gaps did not strongly affect the distributions of *P. cinereus* in the first year following selective harvest of trees.

MESSERE, M., AND P. K. DUCEY. 1998. Forest floor distribution of northern redback salamanders, *Plethodon cinereus*, in relation to canopy gaps: first year following selective logging. Forest Ecology and Management 107(1998):319–324.

Correspondence to: Peter K. Ducey; e-mail: duceyp@cortland.edu.

Molecular Phylogeny of Endangered Madagascan Tortoises

Employing mitochondrial DNA sequences for the 12S and 16S rDNA and cyt *b* genes, the authors address the controversial issue of the phylogenetic relationships among the four endemic and

endangered tortoises (*Pyxis arachnoides, P. planicauda, Geochelone radiata,* and *G. yniphora*) of Madagascar; a fifth species is not endangered and is not endemic to Madagascar. For their analysis, outgroup taxa were selected from mainland Africa (*G. pardalis*), Galápagos (*G. nigra*), and North America (*Gopherus polyphemus*). The results of their analysis indicate that both species of *Pyxis* are sister taxa and that *Pyxis* is grouped within *Geochelone*. Also, the authors propose that the two species of Madagascan *Geochelone* are sister taxa, and that the endemic Madagascan taxa form a monophyletic group as the result of a single colonization event. The authors suggest founding by rafting as the means of colonizing the island some time after the separation of Madagascar from other land masses (90–165 mya).

CACCONE, A., G. AMATO, O. C. GRATRY, J. BEHLER, AND J. R. POWELL. 1999. A molecular phylogeny of four endangered Madagascar tortoises based on MtDNA sequences. Molecular Phylogenetics and Evolution 12(1):1–9.

Correspondence to: Adalgisa Caccone, YIBS Molecular Systematics and Conservation Genetics Laboratory, Yale University, New Haven, Connecticut, 06520-2106, USA.

Predation on Lizard Eggs by Ants

One explanation for long-term fluctuations in population density of a species is that the intensity of interactions between species in a community is variable. The authors state that the population may experience variation in the intensity of species interactions if density of a species with which the population directly interacts changes, and/or if the strength of the interaction changes. Previous work on *Anolis limifrons* at Barro Colorado Island, Panama indicated that the density of this lizard is negatively correlated with the amount of wet-season rainfall, that fluctuations in density are related more to variation in egg mortality than to variation in lizard mortality or fecundity, and that most egg mortality is the result of predation by ants (*Solenopsis*). By manipulating litter moisture at experimental plots to simulate wettest and driest wet seasons over the last two decades, as well as monitoring the density of *Solenopsis*, amount of egg mortality, and rate of predation, the authors tested these previous hypotheses. Results of these experiments indicate that egg mortality was greater in the wettest, rather than driest, treatments, and that all egg mortality was the result of predation from *Solenopsis*. Also, as indicated by ANCOVA, the amount of egg mortality was higher on plots with greater densities of ants; however, treatment effects explained more variation than did *Solenopsis* density, and water manipulations did not change the density of *Solenopsis*. These results support the hypothesis that annual variation in the amount of wet-season precipitation indirectly produces parallel variation in annual density of *A. limifrons* populations by modifying the rate of ant predation on eggs.

CHALCRAFT, D. R., AND R. M. ANDREWS. 1999. Predation on lizard eggs by ants: species interactions in a variable physical environment. Oecologia 119(1999):285–292.

Correspondence to: D. R. Chalcraft, Department of Ecology, Ethology, and Evolution, University of Illinois, Urbana, Illinois, 61801 USA; e-mail: chalcraf@pop.life.uiuc.edu.

Evidence for the Monophyly of Australian Gekkonoid Lizards

Mitochondrial 12S rRNA and nuclear c-*mos* genes were partially sequenced for twelve members of the four major lineages of geckos of the Australian region (Pygopodidae, Gekkoninae, and Diplodactylini, and Carphodactylini [Carphodactylinae]) and an outgroup in the Eublepharinae. Sequences from both genes were combined into a single data matrix and both maximum likelihood and parsimony algorithms were employed to generate phylogenetic hypotheses for the thirteen taxa. The molecular-based hypotheses of relationships were used to comment on the debate over relationships among these groups, the monophyly of the diplodactyline tribes, and the conflicting hypotheses of relationships of the pygopods and the genus *Oedura*. The results of these analyses support the monophyly of the Diplodactylini, with *Oedura* as a member of this tribe. The Carphodactylini was found to be a paraphyletic group, with the four genera positioned at the base of the Diplodactylini. Pygopods were found to be well nested within the Gekkonidae, with pygopods and diplodactylines forming a well-supported monophyletic group.

DONNELLAN, S. C., M. N. HUTCHINSON, AND K. M. SAINT. 1999. Molecular evidence for the phylogeny of Australian gekkonoid lizards. Biological Journal of the Linnean Society 67(1999):97–118.

Correspondence to: Stephen C. Donnellan, South Australian Museum, North Terrace, Adelaide, Australia 5000; e-mail: sdonnell@genetics.adelaide.edu.au.

Costs of Exploiting Poisonous Prey

The authors discuss and present evidence of an evolutionary trade-off in a predator-prey interaction in which a species of garter snake (*Thamnophis sirtalis*) has evolved resistance to the extreme neurotoxin (tetrodotoxin) of its prey (*Taricha granulosa*). Within a population of *T. sirtalis*, resistance to tetrodotoxin varies among individuals, and this variability has a genetic basis. Among populations, the levels of newt toxicity and snake resistance, though somewhat variable, roughly match. The authors suggest that this represents a geographic mosaic of coevolutionary outcomes in this predator-prey interaction. Employing bioassays to detect individual differences in suceptibility to tetrodotoxin, the authors investigated whether resistance and locomotor performance were negatively associated (i.e., whether they represent a trade-off between predatory and antipredatory abilities of *T. sirtalis*). Patterns of among-family variation in this system suggests a genetic basis of the trade-off exists, and the regression of postinjection speed on baseline speed indicates the existence of a trade-off in resistant and nonresistant populations of *T. sirtalis*.

BRODIE, E. D., III, AND E. D. BRODIE, JR. 1999. Costs of exploiting poisonous prey: evolutionary trade-offs in a predator-prey arms race. Evolution 53(2):626–631.

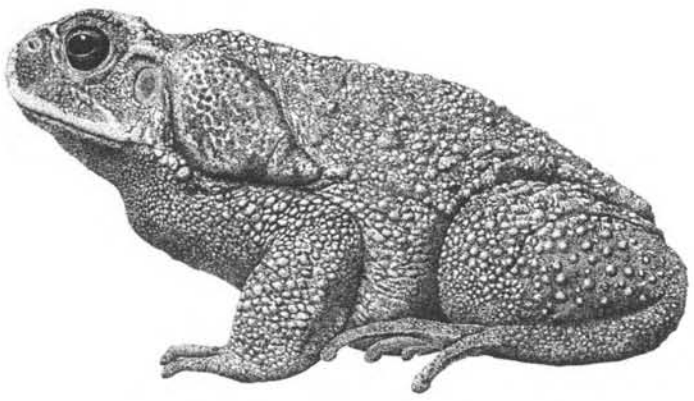
Correspondence to: Edmund D. Brodie III, Department of Biology, Indiana University, Bloomington, Indiana 47405, USA; e-mail: edb3@bio.indiana.edu.

International Conservation: Sustainable Use of Crocodilians

Thorbjarnarson reviews the history of the exploitation of crocodilians for their skins over the past century and the effects of that exploitation on the conservation status of species involved in international trade. Of particular concern are the boom-and-bust cycles of these markets, as well as fears of lack of market elasticity that demonstrate the vulnerability of conservation programs based on the sale of wildlife products for luxury markets. Thorbjarnarson presents the history of the international trade of products from crocodilians as an insight into the value (and perhaps more importantly the limits) of a sustainable-use approach to conservation.

THORBJARNARSON, T. 1999. Crocodile tears and skins: international trade, economic constraints, and limits to the sustainable use of crocodilians. Conservation Biology 13(3):465–470.

Correspondence to: John Thorbjarnarson, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460, USA; e-mail: jcaiman@aol.com.



Bufo marinus. Illustration by Dan Erickson.

INSTITUTIONS

Herpetological Collections in New Zealand Museums

B. J. GILL
Auckland Museum, Private Bag 92018
Auckland, New Zealand

and

RAYMOND COORY
Museum of New Zealand, P.O. Box 467
Wellington, New Zealand

New Zealand's major museums were founded in the Victorian era in the second and third decades after New Zealand became a British Colony in 1840. Four main museums developed, one in each of the country's four main towns. Distributed across the country from north to south, they are: Auckland Museum, Auckland (AIM), Museum of New Zealand, Wellington (NMNZ), Canterbury Museum, Christchurch (CMC) and Otago Museum, Dunedin (OM). (Institutional acronyms follow Leviton et al. [1985].)

In the very early years, with few staff and small budgets, locally-obtained natural history material was readily available, but there was a problem in having specimens expertly prepared, and in properly storing and displaying them. It was a time when much material continued to be sent directly to northern hemisphere experts and institutions, particularly in Britain, for identification or description. As a result, New Zealand museums tend to have little local natural history material from before 1880, and those specimens that survive from this era tend to be documented poorly.

TABLE 1. Taxonomic spread of herpetological specimens in New Zealand museums. Refer to text for explanations of museum acronyms.

	AIM	NMNZ	CMC	OM	Total
Anura	185	512	119	42	858
Other Amphibia	20	7	1	10	38
TOTAL AMPHIBIA	205	519	120	52	896
Testudines	45	56	19	33	153
Crocodilia	20	15	11	7	53
Sphenodontida	80	272	222	46	620
Squamata	1592	5005	283	376	7256
Other Reptilia	80	93	85	0	258
TOTAL REPTILIA	1817	5441	620	462	8340
Grand Total	2022	5960	740	514	9236

Since 1900 the museums have striven to develop and maintain comprehensive collections of local natural history both for research and display. All four main museums have valuable reference collections and good natural history displays; the latter either recently refurbished or in process of upgrading. Among the various branches of natural history, herpetology has tended to be a relatively minor activity in New Zealand museums, reflecting the size of the herpetofauna. The New Zealand herpetofauna numbers more than 60 species. In contrast there are nearly 400 species of birds on the New Zealand list, and ornithology has always attracted more attention in museums than herpetology.

There has been little large-scale systematic collecting of amphibians and reptiles for New Zealand museums. The most notable exception is the large collection of New Zealand lizards built up by Tony Whitaker and colleagues for Ecology Division of the Department of Scientific and Industrial Research. After the closure of the latter department these herpetological collections were incorporated with those of NMNZ. Smaller and less well-documented research collections include the skinks collected by Graham Hardy while a student at Victoria University, Wellington, (specimens now at NMNZ), and the lizards collected by J. Robb during her teaching career at Auckland University (specimens now at AIM).

TABLE 2. Geographic spread of collecting localities of herpetological specimens in New Zealand museums.

	AIM	NMNZ	CMC	OM	Total
New Zealand	965	5108	520	286	6879
Pacific Islands	727	330	32	19	1108
Other	330	522	188	209	1249

The four main New Zealand museums have herpetological collections numbering over 9000 specimens. The breakdown of the collections by taxonomic group, geographic source, and mode of preservation is shown in Tables 1–3. The largest collections are at NMNZ and AIM, and further details of herpetology at these institutions follow. Squamates (mainly lizards) are the biggest single taxonomic group reflecting the dominance of lizards in the New Zealand herpetofauna. The 620 tuatara specimens (Sphenodontida) include large numbers of subfossil bones. Three-quarters of the specimens in New Zealand museums are New Zealand species, while 12% are from islands of the Pacific.

Museum of New Zealand, Wellington (NMNZ)

New Zealand's national museum (funded by the government, unlike the others which are funded by local bodies) began in 1865 as the Colonial Museum and Geological Survey, after which it became the Dominion Museum (1907), then National Museum of New Zealand (1973). The present name Museum of New Zealand Te Papa Tongarewa ("Te Papa" for short) was adopted in 1992.

The Museum of New Zealand has the largest and most comprehensive collection of New Zealand amphibians and reptiles, and incorporates the collection of the former Ecology Division (Department of Scientific and Industrial Research). The collection includes 20 holotypes and about 35 other type specimens. The fossils in the collection are Cretaceous marine reptiles from Canterbury and Kaikoura, and include the oldest items in the collection, some having been collected in 1869.

The collection is biased in favor of material from northern North Island and the Wellington and Marlborough areas. The museum has never had a full-time herpetologist, but curators of other vertebrate groups have managed the herpetological collections and pursued herpetological research. Past curators include Charles McCann (1899–1980), who wrote a monograph on New Zealand lizards (McCann 1955), and Graham Hardy, who revised the New Zealand skinks (Hardy 1977). Currently the collection is maintained by a part-time collection manager. An electronic database of the collection is being developed but is not yet complete.

Auckland Museum, Auckland (AIM)

Sometimes referred to as the Auckland War Memorial Museum, and known until recently as the Auckland Institute and Museum, this museum was founded in 1852. The herpetological collection is managed by a curator and part-time technician who deal also with the other land vertebrates, especially birds.

TABLE 3. Mode of preservation of herpetological specimens in New Zealand museums.

	AIM	NMNZ	CMC	OM	Total
Whole in alcohol	1707	5200	227	331	7465
Bones & subfossil bones	110	596	365	79	1150
Fossils (including casts)	140	34	110	0	284
Mounts (including casts & models)	35	10	35	82	162
Other	30	120	3	22	175

Little locally-collected material survives from last century, but large exchanges with northern hemisphere museums in the last 25 years of last century brought in much foreign material that still survives. The oldest herpetological specimen is a skink (*Oligosoma smithi*) in alcohol (H613; paralectotype of *Mocoa smithi* Gray, 1845) collected in the Bay of Islands, New Zealand, in 1841 by the *Erebus* and *Terror* Antarctic Expedition. It was obtained by exchange from the British Museum (Natural History). The oldest New Zealand specimen originally collected by the museum is a sea snake *Pelamis platurus* (H335) that was probably collected c. 1868. No tuatara or lizard specimens survive in the collection from last century. The oldest specimen exchanged last century is a skeleton of *Python sebae* (H644) received from the Paris Natural History Museum in 1878.

The herpetological collection grew slowly and exceeded 1000 specimens only within the past 15 years. The collection records are now computerized. Most New Zealand species are represented in the collection, with a bias towards those of the northern North Island. Specimens from the islands of the southwest Pacific make up 36% of the collection (Table 2).

The collection contains some seven primary type specimens of New Zealand species, and about 28 secondary types. Graham Turbott (1914–) was in charge of land vertebrates at Auckland Museum when he described the third New Zealand native frog *Leioplema archeyi* (Turbott 1942).

Acknowledgments.—We thank Erena Barker (OM) and Geoff Tunicliffe (CMC) for providing statistics for the collections that they manage, and Tony Whitaker for comments on a draft of this report.

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ARTICLES

Standard Field Codes for North American Amphibians

JOHN E. FAUTH
Department of Biology, College/University of Charleston
66 George Street, Charleston, South Carolina 29424-0001, USA
e-mail: fauthj@cofc.edu

Coordination of amphibian monitoring efforts would be aided by simple, easy to remember field codes for amphibian species. Much as standard common names (Collins 1997; U.S. Department of Agriculture 1999) aid communication, standardized field codes facilitate computerized entry, storage, retrieval, searching, and exchange of data. Other biological disciplines have standard field codes: ornithologists use alphabetical ("alpha") and numerical codes for birds based on their common names (American Ornithologists' Union 1983; U.S. Geological Survey 1999a), while studies of amphibians and reptiles have used alphabetical codes for organisms based on their scientific names (e.g., Corn 1994:116; Scott 1994:82). The North American Amphibian Monitoring Project (U.S. Geological Survey 1999b) has a numerical code (AMP#) for amphibians, but the correspondence between species names and numbers is obscure (how many herpetologists know what species is AMP# 228?), so researchers would have to carry a list of species names and numbers into the field to avoid making mistakes. This defeats one purpose of a code, namely ease of use.

TABLE 1. Field codes for currently recognized North American amphibians and others assigned AMP# (U.S. Geological Survey 1999b, based on U.S. Department of Agriculture 1999) that are exceptions to the standard convention of using the first letter of the genus followed by the first three letters of the specific epithet. Only RCAC and RCAS co-occur. Note that using a longer code (5 or 6 letters) would only separate two-thirds of these problematic cases.

Code	Scientific name (common name)	Original code retained by
AMAR	*Ambystoma macrodactylum* (long-toed salamander)	*A. maculatum* (AMAC)
DAUC	*Desmognathus auriculatus* (southern dusky salamander)	*Dendrobates auratus* (DAUR)
PCAV	*Pseudacris cadaverina* (California treefrog)	*Plethodon caddoensis* (PCAD)
PHUR	*Phaeognathus hubrichti* (Red Hills salamander)	*Plethodon hubrichti* (PHUB)
PSTC	*Pseudacris streckeri* (Strecker's chorus frog)	*Pseudobranchus striatus* (PSTR)
RCAC	*Rhyacotriton cascadae* (Cascade's torrent salamander)	*Rana cascadae* (RCAS)
SINR	*Spea intermontanus* (Great Basin spadefoot)	*Siren intermedia* (SINT)

I use a simple four-letter code in the field and add the AMP# in the data processing stage using "if . . . then . . ." statements in my computer program. The field code is easy to remember: the first letter of the genus is followed by the first three letters of the specific epithet (e.g., *Rana areolata* = RARE). This system provides 26^4 (456,976) unique combinations, with only seven codes shared by different species of North American amphibians (Table 1). For these cases, a unique combination is created using two rules. 1. The species with the shorter specific epithet retains the original code, and the last letter of the other species' code is replaced by the next consonant in its specific epithet. 2. If species in different genera share the same specific epithet, then the species with the shorter genus retains the original code and the other substitutes the next consonant in its epithet (Table 1). Only one pair of species that requires using these rules co-occurs (*Rhyacotriton cascadae* and *Rana cascadae*), reducing the chances of recording the wrong code in the field.

This system has six advantages. 1) It is simpler to remember and use in the field than the AMP#. It should be easy to remember —or to decipher —that *Rana catesbeiana* is RCAT (AMP# 228). This is especially important for beginning herpetologists or volunteers monitoring populations, who often have trouble remembering obscure codes. Basing the field code on scientific names instead of common names reinforces the importance of systematics, and helps bridge the communication gap between layperson and scientist. 2) New codes can be devised when new species are described, allowing researchers to add the AMP# once it is assigned. 3) The basic system yields fewer shared codes than a system using the first two letters of the genus plus the first two letters of the specific epithet (for examples, see Corn 1994:116; Scott 1994:82). That system has 34 species sharing field codes, including three sets of triplets (e.g., AMMA = *Ambystoma mabeei*, *A. maculatum*, and *A. macrodactylum*). Fewer exceptions means fewer irregular codes to remember, which is important because the number of described amphibian species will exceed 5000 by the turn of this century (Glaw and Köhler 1998). 4) The code is based on scientific names and is responsive to systematic revisions. For example, elevating *Eurycea longicauda guttolineata* to specific status (Carlin 1997) required the new code EGUT for it, restricting ELON for *E. longicauda* (if EGUT had been taken, the new code for *E. guttolineata* would have been EGUL). Linking field codes to AMP# in the processing stage enables tracking of taxonomic changes, because the AMP# is also "meant to remain stable, linking old and new computer files without the worry of name and taxonomic changes" (U.S. Geological Survey 1999b). 5) The code has easy-to-apply rules, allowing its use with other faunas. My lab uses the same system for the reptiles, fishes, and aquatic macroinvertebrates that coexist with the 45 species of amphibians and reptiles in the Francis Marion National Forest, South Carolina, USA. 6) The alphabetic system recognizes that species are nominal variates, preventing them from being confused with continuous variates, as might be done with the AMP#. A researcher shouting out "RCAT, 6.9 total length " as he or she returns a bullfrog tadpole to the pond presents fewer numbers for the recorder to transpose than "#228, 6.9 total length."

The alphabetical field code presented here is intended solely to supplement the numerical code; herpetologists intending to share data should always include the AMP# in their files. Both AMP# and the "alpha" code discussed here are available on-line (U.S. Geological Survey 1999b). By adopting a uniform system of alphabetical field codes and linking it to AMP# in the processing stage, herpetologists can record data easily and with few errors in the field, simplifying accurate data gathering and enabling data transfer and linkage from diverse sources.

Acknowledgments.—Herpetology students at the College of Charleston forced me to devise codes they could remember in the field. I thank David Chalcraft and Jamie Schurbon for entering species names and codes into the computer. Chris Binckley, David Chalcraft, Stephen Corn, and Sam Droege made many helpful suggestions on the manuscript. This research was supported by EPA Grant R825795 (to W. J. Resetarits, Jr. and J. E. Fauth) and Challenge Grant 97-231 from the National Fish & Wildlife Foundation. The University of Illinois, the Illinois Natural History Survey, the E. J. Westfeldt-Bunting Foundation and the Gaylord and Dorothy Donnelly Foundation provided challenge funds. The views and conclusions contained in this document are those of the author and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government.

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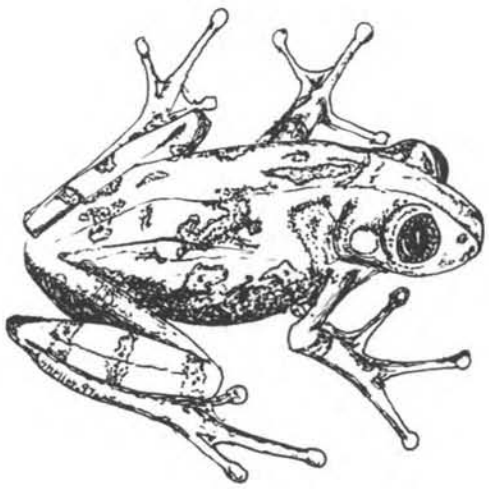
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Leptopelis natalensis. Illustration by Shelly Hickman.

SSAR Auction of Joseph R. Bailey's Herpetological Library



Joseph R. Bailey, who died in 1998, was a leading expert on the snakes of tropical America and coauthor of the book "Amphibians and Reptiles of the Carolinas and Virginia" (University of North Carolina Press, 1980). He was professor of zoology at Duke University where he supervised many outstanding graduate and undergraduate students. A full obituary was published in *Herpetological Review* (vol. 30, pp. 70–71, June 1999).

Joe was also a staunch supporter of SSAR and joined the society in the late 1950s when it was still called The Ohio Herpetological Society. He attended many of its meetings, most recently at Appalachian State University, North Carolina, in 1995, and he regularly supported society projects involving students and books. It is most fitting, therefore, that his wife, Mike Bailey, has donated Joe's herp library to SSAR on the condition that it be auctioned and with the proceeds being used to continue Joe's interests in society activities. Accordingly, the Board of Directors of SSAR has gratefully accepted Mrs. Bailey's generous donation and decided to use the auction proceeds to set up in perpetuity The Joseph R. Bailey Endowment. The income on this investment will be used to support student activities, book-length publication projects, and other activities in keeping with Joe Bailey's interests. The Baileys' generosity will thus continue to be acknowledged in SSAR books and on student research papers, and be associated with other society activities that will be supported by the endowment.

Joe Bailey had an excellent herpetological library. Some of the books have been donated to the Duke library, but the bulk of the library—consisting of about 300 books—will be auctioned. The collection is especially rich on North and South American topics. A complete list can be obtained on request from Kraig Adler (*address*: Neurobiology and Behavior, Seeley G. Mudd Hall, Cornell University, Ithaca, New York 14853–2702, USA). **Please send a self-addressed mailing label with your request OR, better yet, send your e-mail address.** The auction will be conducted entirely via the post. Full auction instructions are given with this list. (Deadline for receipt of bids will be February 1, 2000).

Addenda to the Checklist of West Indian Amphibians and Reptiles

ROBERT POWELL
Department of Natural Sciences, Avila College
Kansas City, Missouri 64145–1698, USA
e-mail: powellr@mail.avila.edu

and

ROBERT W. HENDERSON
Section of Vertebrate Zoology, Milwaukee Public Museum
Milwaukee, Wisconsin 53233–1478, USA
e-mail: rh@mpm.edu

Hedges (1996a) presented a "discovery curve" of West Indian amphibians and reptiles that illustrated a recent sharp increase in the number of known herpetofaunal species. In fact, since the publication of the most recent checklist of West Indian species by Powell et al. (1996), a number of new forms have been described, reevaluated, or discovered for the first time in the region. In addition, one introduced species is removed from the list because it has not been encountered by herpetologists. With the exception that we now advocate the omission of squamate suborders (see Pough et al. 1998), we use the format of the 1996 checklist in providing all of the new records that have come to our attention.

Class Amphibia, Order Anura
Family Leptodactylidae

Eleutherodactylus blairhedgesi. *Eleutherodactylus blairhedgesi* Estrada, Díaz, and Rodríguez 1997:19. • CUB • Estrada, A. R., L. M. Díaz, and A. Rodríguez. 1997. Nueva especie de *Eleutherodactylus* (Anura: Leptodactylidae) del litoral norte de la Habana, Cuba. Rev. Esp. Herpetol. 11:19–24.

Eleutherodactylus casparii. *Eleutherodactylus casparii* Dunn 1926: 215. • CUB • Dunn, E. R. 1926. Additional frogs from Cuba. Occ. Pap. Boston Soc. Nat. Hist. 5:209–215. — Re-elevated from subspecific status by Estrada and Hedges (1997).

Eleutherodactylus iberia. *Eleutherodactylus iberia* Estrada and Hedges 1996: 853. • CUB • Estrada, A. R., and S. B. Hedges. 1996. At the lower size limit in tetrapods: a new diminutive frog from Cuba (Leptodactylidae: *Eleutherodactylus*). Copeia 1996:852–859.

Eleutherodactylus glamyrus. *Eleutherodactylus glamyrus* Estrada and Hedges 1997:365. • CUB • Estrada, A. R., and S. B. Hedges. 1997. A new species of frog from the Sierra Maestra, Cuba (Leptodactylidae, *Eleutherodactylus*). J. Herpetol. 31:364–368.

Eleutherodactylus goini. *Eleutherodactylus ricordi goini* Schwartz 1960: 19. • CUB • Schwartz, A. 1960. Nine new Cuban frogs of the genus *Eleutherodactylus*. Reading Pub. Mus. Art Gall., Sci. Publ. 11:1–50. — Elevated from subspecific status by Estrada and Hedges (1997).

Eleutherodactylus jaumei. *Eleutherodactylus jaumei* Estrada and Alonso 1997:41. • CUB • Estrada, A. R., and R. Alonso. 1997. Nueva especie de grupo *limbatus* (Leptodactylidae: *Eleutherodactylus*) de la región oriental de Cuba. Carib. J. Sci. 33:41–44.

Eleutherodactylus neodreptus. *Eleutherodactylus neodreptus* Schwartz 1965 was allocated to the synonymy of *E. audanti* Cochran 1934 by Hedges (1996b).

Eleutherodactylus principalis. *Eleutherodactylus principalis* Estrada and Hedges 1997:222. • CUB • Estrada, A. R., and S. B. Hedges. 1997. Nueva especie de *Eleutherodactylus* (Anura: Leptodactylidae) del Macizo Sagua-Baracoa, Cuba. Carib. J. Sci. 33:222–226.

Eleutherodactylus riparius. *Eleutherodactylus riparius* Estrada and Hedges 1998:222. • CUB • Estrada, A. R. and S. B. Hedges. 1998. Sistemática de las ranas rivereñas de Cuba (Leptodactylidae: *Eleutherodactylus*) con la descripción de una especie nueva. Carib. J. Sci. 34:218–230.

Eleutherodactylus sierramaestrae. *Eleutherodactylus sierramaestrae* Schmidt 1920 was allocated to the synonymy of *E. cuneatus* (Cope 1862) by Estrada and Hedges (1998).

Eleutherodactylus tetajulia. *Eleutherodactylus tetajulia* Estrada and Hedges 1996:436. • CUB • Estrada, A. R., and S. B. Hedges. 1996. A new frog of the genus *Eleutherodactylus* from eastern Cuba (Anura: Leptodactylidae). Herpetologica 52:435–439.

Eleutherodactylus tonyi. *Eleutherodactylus tonyi* Estrada and Hedges 1997:227. • CUB • Estrada, A. R., and S. B. Hedges. 1997. A new species of frog from the Meseta de Cabo Cruz, eastern Cuba (Leptodactylidae, *Eleutherodactylus*). Carib. J. Sci. 33:227–232.

Family Hylidae

Pseudacris crucifer. *Pseudacris crucifer* (Wied 1838) was believed to have been introduced to Cuba, but it has not been encountered by herpetologists and therefore should be removed from the checklist.

Class Reptilia, Order Squamata
Family Amphisbaenidae

Amphisbaena barbouri. *Amphisbaena cubana barbouri* Gans and Alexander 1962:97. • CUB • Gans, C., and A. A. Alexander. 1962. Studies on amphisbaenids (Amphisbaenia: Reptilia). 2. On the amphisbaenids of the Antilles. Bull. Mus. Comp. Zool. 128:65–158. — Elevated from subspecific status by Thomas and Hedges (1998a).

Amphisbaena carlgansi. *Amphisbaena carlgansi* Thomas and Hedges 1998:93. • CUB • Thomas, R., and S. B. Hedges. 1998. A new amphisbaenian from Cuba. J. Herpetol. 32:92–96.

Amphisbaena hyporissor. *Amphisbaena gonavensis hyporissor* Thomas 1965:5. • HISP • Thomas, R. 1965. Two new subspecies of *Amphisbaena* (Amphisbaenia, Reptilia) from the Barahona Peninsula of Hispaniola. Breviora (215):1–14. — Elevated from subspecific status by Powell et al. (1999).

Family Anguidae

Celestus badius. *Celestus badius* Cope 1868:126. • N • Cope, E. D. 1868. An examination of the Reptilia and Batrachia obtained by the Orton Expedition to Ecuador and the Upper Amazon, with notes on other species. Proc. Acad. Nat. Sci. Philadelphia 20:96–140. — Re-elevated from subspecific status by Powell (1999).

Diploglossus garridoi. *Diploglossus garridoi* Thomas and Hedges 1998:98. • CUB • Thomas, R., and S. B. Hedges. 1998. New anguid lizard (*Diploglossus*) from Cuba. Copeia 1998:97–103.

Diploglossus nigropunctatus. *Diploglossus delasagra nigropunctata* Barbour and Shreve 1937:378. • CUB • Barbour, T., and B. Shreve. 1937. Novitates Cubanae. Bull. Mus. Comp. Zool. 80:377–387. — Elevated from subspecific status by Thomas and Hedges (1998b).

Family Boidae

Corallus cookii. *Corallus Cookii* Gray 1842:42. • LA • Gray, J. E. 1842. Synopsis of prehensile-tailed snakes, or family Boidae. Zool. Misc. 1842:41–46. — Re-elevated from subspecific status by Henderson (1997); replaces, in part, *Corallus hortulanus*.

Corallus grenadensis. *Corallus grenadensis* Barbour 1914:327. • LA • Barbour, T. 1914. A contribution to the zoögeography of the West Indies, with especial reference to amphibians and reptiles. Bull. Mus. Comp. Zoöl. 44:209–359. — Resurrected by Henderson (1997); replaces, in part, *Corallus hortulanus*.

Family Colubridae

Thamnophis sauritus sackenii. *Eutaenia Sackenii* Kennicott 1859:98. • BAH • Kennicott, R. 1859. Notes on *Coluber calligaster* of Say, and a description of new species of serpents in the collection of the North Western University of Evanston, Ill. Proc. Acad. Nat. Sci. Philadelphia 11:98–100. — Presence of a waif (but not necessarily a breeding population) in the West Indies was recorded by Buckner and Franz (1998a).

Thamnophis sirtalis sirtalis. *Coluber Sirtalis* Linnaeus 1758:222. • BAH • Linnaeus, C. 1758. Systema Naturae per Regna Tria Naturæ, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis. Tomus I. 10th ed. L. Salvius, Stockholm. — Presence of a waif (but not necessarily a breeding population) in the West Indies was recorded by Buckner and Franz (1998b).

Family Gekkonidae

Gekko gecko. *Lacerta gecko* Linnaeus 1758:205. • LA • Linnaeus, C. 1758. Systema Naturæ per Regna Tria Naturæ, Secundum Classes, Ordines, Genera, Species cum Characteribus, Differentiis, Synonymis, Locis. Tomus I. Editio decima. Reformata. L. Salvii, Holmiae. — Presence of a breeding population on Martinique confirmed by Henderson et al. (1993).

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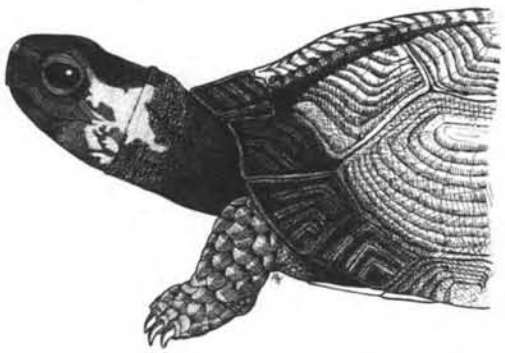
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Clemmys muhlenbergii. Illustration by Michael Frick.

Using the Internet to Establish the Status of an Easily Distinguished, Vulnerable Species, the Wood Turtle (*Clemmys insculpta*) in New Brunswick, Canada

DONALD F. MCALPINE
New Brunswick Museum, 277 Douglas Avenue
Saint John, New Brunswick E2K 1E5, Canada
e-mail: dmcalpin@nb.aibn.com

and

STEFEN H. GERRIETS
Atlantic Canada Conservation Data Centre
Box 6416, Sackville, New Brunswick E4L 1G6, Canada
e-mail: stefen.gerriets@ec.gc.ca

The wood turtle, *Clemmys insculpta*, is a terrestrial species that ranges discontinuously from Nova Scotia and New Brunswick south to Virginia and west through southern Quebec, southern Ontario, and New York, to northern Michigan, Wisconsin, eastern Minnesota, and northeastern Iowa (Litzgus and Brooks 1996). Over much of the species' range the wood turtle is now considered threatened, vulnerable, or even endangered, largely through habitat loss and collecting for the pet trade (Harding and Bloomer 1979; Litzgus and Brooks 1996). In New Brunswick the wood turtle is considered vulnerable (Heward and McAlpine 1994), however there have been no formal surveys of the species in the province. Although the wood turtle currently receives no protection under New Brunswick legislation, wildlife managers have flagged the species as of special concern and wood turtles and their riparian habitat are now routinely considered during environmental impact assessments.

Until recently, knowledge of the status of the wood turtle in New Brunswick was sketchy, and it remains incomplete. There are only 10 specimens in the New Brunswick Museum collection, acquired since 1966. With requests from provincial wildlife and environmental impact personnel growing, but no funds, personnel, or time for wood turtle surveys, it was decided to try soliciting observations via NatureNB, an Internet discussion group established 12 April 1996 and maintained by provincial naturalists. There are currently 257 subscribers. In the second and third years of operation the subscriber base grew by 39% and 30% respectively, and continues to grow (D. S. Christie, pers. comm.). Here we describe our success with this approach and review those circumstances where it may be applied usefully to other species.

Prior to 1997, when we placed our first request for information, wood turtle status in New Brunswick was based on the 10 specimens noted above, one specimen in the Canadian Museum of Nature, and two in the Royal Ontario Museum, and on a file of correspondence held at the New Brunswick Museum. The latter was partly the result of requests for information on the species published in naturalist's newsletters by Museum Curator, Dr. Austin Squires, in 1950 and 1968, plus a few observations provided by naturalists in conjunction with their regular bird sighting reports to the museum.

Our Internet requests netted 63 observations during the 1997 and 1998 field seasons. The approach has proven to be an effective, rapid, and low-cost method of acquiring data on this species; 34% of our 185 databased observations from 41 New Brunswick localities were Internet-solicited over only two field seasons (31.5 records/yr). By contrast, the remaining 122 (66%) observations, from 45 localities, were acquired over 48 years, starting in 1950 (2.5 records/yr). We have considered wood turtle locations as distinct if they are 1 km or more apart. The review of Litzgus and Brooks (1996) suggests wood turtles are relatively sedentary over a period of dec-

ades, moving over home ranges that may be little more than several hundred meters in diameter. However, lumping records that are in the same watershed and within 3 km of each other reduces the total number of localities only marginally, to 73. A specimen in the Royal Ontario Museum (ROM 2224) collected in 1925 has locality given only as New Brunswick and could therefore not be included in our analysis.

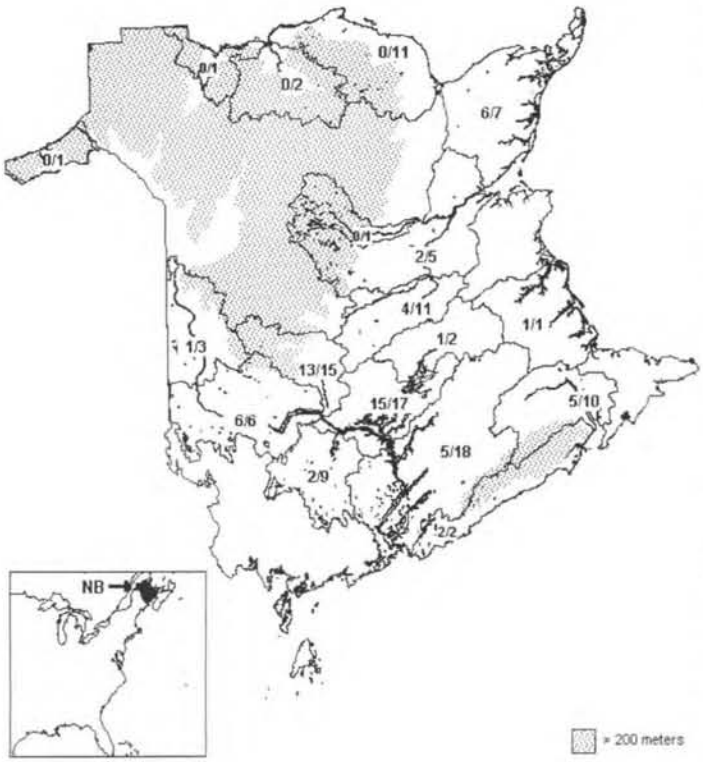


FIG. 1. Preliminary distribution of the wood turtle in New Brunswick. Records are mapped by tertiary watersheds showing the total number of Internet solicited wood turtle records/ and the total number of all other wood turtle records per watershed. Highland areas with elevations over 200 m are stippled.

Acquiring observations via the Internet has prompted us to prepare the first detailed distribution map for the wood turtle in New Brunswick, a region where the species reaches the northern limit of its range. In an effort to provide some protection for populations we have plotted records to tertiary watersheds only (Fig. 1). Data remain preliminary, but suggest that wood turtles are largely absent from highland areas which are present in the central and northwestern part of the province. Lack of records from the southwest is most likely due to the paucity of field work and observers in the region.

Some of the Internet observations are supported by photographs and several also have provided data on nesting periods. Many of the observations are repeat sightings from the same location. In our first year we also had many historical sightings reported, some dating back several decades. Historical and repeat sightings are valuable as they can help establish the persistence of populations, as well as help separate sightings based on transient or human displaced animals. We strongly suspect that some observations represent translocated wood turtles. Our inquiries in the future will be directed especially at trying to determine the distribution of breeding populations of wood turtles in New Brunswick.

Specialized Internet e-mail lists are growing in number. Several provinces and states now have such discussion groups organized for those with an interest in natural history. Although these e-mail lists are dedicated largely to reporting bird sightings, there are many experienced naturalists signed on who are regularly in the field and who are eager to contribute data to any natural history project. We have found that maximum interest can be generated in the following manner: 1) repeat the request for information annually, at the start of the field season, 2) post a summary of some of the most interesting reports at intervals through the season, 3) encourage respondents to report historical sightings or consult their field journals, 4) make personal contact via e-mail with all respondents, 5) post an annual summary at the end of each season in which respondents are noted by name.

Although this approach is not a substitute for in-depth study or detailed monitoring by field scientists, we believe it can help investigators in circumstances where the species of concern is easily identified and the distribution of the species is patchy, or the species is rare or hard to find.

In New Brunswick there are only three species of native freshwater turtles; the wood turtle, the painted turtle (*Chrysemys picta*), and the snapping turtle (*Chelydra serpentina*). Separating the species is straight-forward. Even if observers do not know the identity of the turtle species involved, a few questions from an investigator can quickly establish its identity. Additionally, we have encouraged observers to submit photographs of any turtle reported. These photos, along with written descriptive information, are archived in the New Brunswick Museum files. These files offer some degree of verifiability for observations. Wood turtles seem to be widespread in New Brunswick, although discontinuous in distribution. However, populations may be small and individuals are infrequently encountered. It is impractical for the few field herpetologists in New Brunswick to survey all suitable habitat. Soliciting observations from naturalists via the Internet has allowed us to overcome the opportunistic nature of wood turtle sightings in the region.

Acknowledgments.—We are grateful to each of the NatureNB subscribers who responded to our requests for wood turtle information. David Christie, co-owner of NatureNB, kindly provided information on the history and growth of this Internet discussion group. We thank Ross MacCulloch (Royal Ontario Museum) and Michèle Steigerwald (Canadian Museum of Nature) for details on wood turtle specimens in their collections.

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Twinning in Lizards

RUSTON W. HARTDEGEN
Department of Herpetology, Dallas Zoo
650 South R.L. Thornton Freeway (I-35E)
Dallas, Texas 75203, USA
e-mail: rustonh@sprintmail.com

and
MARK K. BAYLESS
1406 Holly Street
Berkeley, California 94703, USA

Twinning in lizards has been recorded in a few species (Carpenter and Yoshida 1967; Shaw 1954). In this note we document twinning in three additional species of lizards—*Hydrosaurus pustulatus*, *Pogona vitticeps*, and *Varanus gouldii*—that have produced twin neonates at the Dallas Zoo Department of Herpetology. See Tables 1–2 for morphometric data.

In addition to lizards, twinning has been recorded in other reptiles, including turtles (Crooks and Smith 1958; Marion 1980; Tucker and Funk 1976; Yntema 1971), snakes (Gudynas and Gambarotta 1981; Shuette 1978; Singh and Thaphiyal 1973), and crocodilians (Bloomberg 1979). Twinning has also occurred with *Morelia viridis* (Siamese twins) and *Aspidites melanocephalus* (D. T. Roberts, pers. comm.) at the Dallas Zoo. In our experience the occurrence of twins in reptiles is uncommon, as only a few species have produced twin neonates in this institution's history.

Acknowledgments.—We thank the staff of the Dallas Zoo Department of Herpetology, C. M. Garrett, and three anonymous reviewers for their help in improving this manuscript.

TABLE 1. Clutch morphometrics for three species of lizards at the Dallas Zoo. Data for individual eggs containing twin embryos are in bold face type. Dates of hatching are indicated for each clutch. Standard deviation indicated in parentheses.

Species	Mean Diameter (mm)	Mean Length (mm)	Mean Mass (g)	No. of Eggs
Hydrosaurus pustulatus	24.7 (0.2)	50.0 (0.7)	17.8 (0.8)	4
17 January 1987	**25.0**	**52.0**	**19.3**	
Pogona vitticeps	16.5 (0.6)	28.3 (3.0)	3.8 (0.6)	17
1 March 1989	**17.5**	**25.5**	**4.3**	
Varanus gouldii	33.7 (NA)	59.8	38.6	8
23 January 1993	**27.2**	**39.4**	**18.0**	

TABLE 2. Length and weight data for twin and non-twin siblings. Measurements are in mm and g. Standard deviation indicated in parentheses. Twin sibling data are in bold face type.

SVL	TL	Mass
Hydrosaurus pustulatus[1]		
75.0 (0.3)	252.0 (1.5)	15.2 (1.8)
63.5 (0.7)	**206.5 (3.5)**	**7.2 (0.6)**
Pogona vitticeps		
43.6 (3.2)	105.3 (9.4)	3.2 (0.6)
35.0 (0.0)	**79.0 (0.0)**	**1.7 (0.6)**
Varanus gouldii[2]		
131.0	311.0	36.0
58.0 (5.7)	**117.0 (4.2)**	**7.7 (3.3)**

[1]Clutch mate sibling data not available, non-clutch mate sibling data are provided for comparison.
[2]Standard deviation for non-twin siblings measurements not available.

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A Comparison of Defensive Behavior in the African Colubrid Snakes *Hapsidophrys smaragdinus* and *Philothamnus irregularis*

PHIL SENTER
Department of Biological Sciences, Northern Illinois University
DeKalb, Illinois 60115, USA
e-mail: beccafaye@worldnet.att.net

Hapsidophrys smaragdinus and *Philothamnus irregularis* are slender, green, arboreal colubrids from tropical Africa. From 1984 to 1989, I collected four *H. smaragdinus* and six *P. irregularis* in Liberia, and noted their respective behaviors. Each species exhibited a characteristic suite of defensive behaviors, much of which is unrecorded in the literature.

Neck Inflation.—Both *H. smaragdinus* and *P. irregularis* inflate the neck when approached or grasped. Documentation of this behavior exists for *P. irregularis* (FitzSimons 1970; Pitman 1974; Sweeney 1961), but is missing in works that mention *H. smaragdinus* (e.g., Cansdale 1961; Pitman 1974; Villiers 1950).

In both species, neck inflation results in the display of a three-colored pattern. The dorsal scales are grass-green in both species. When the neck is inflated, the black interstitial skin becomes visible, as do light-colored spots. In *H. smaragdinus*, these spots are light blue and occur on every-other dorsal scale. In *P. irregularis*, the spots are white and occur on each dorsal scale.

Neck inflation in these species is probably an anti-predator device, as it was observed only in response to the approach or grasp of a human. The resulting increase in neck diameter is slight in these species; therefore, the predator-deterring element in the display is probably not size increase. If a predator is deterred by the display, this is more likely due to startling or confusion caused by the sudden appearance of the three-colored pattern.

Hapsidophrys and *Philothamnus* are sister groups (V. Wallach, pers. comm.). Their common neck-inflating defense display is therefore probably an example of behavioral homology.

Gaping and striking.—Philothamnus irregularis tends to gape widely while employing the neck inflation display. This adds more color to the display, because it showcases the iridescent blue tongue and the shiny, black interior of the mouth. The gape is no empty threat, as these snakes usually strike repeatedly. Pitman (1974) records gaping and striking behavior in this species, and FitzSimons (1970) considers *P. irregularis* "aggressive." Neither author, however, mentions the display of oral and lingual color during the gape.

Hapsidophrys smaragdinus is singularly nonaggressive. One individual bit me when I seized it by the tail; however, this occurred but once, and none of the other three *H. smaragdinus* struck at all. None of the four specimens that I observed employed a gaping display.

Shimmying.—One of the *P. irregularis* exhibited a behavior which could be described as "shimmying." As the snake explored its cage, it slid around with its neck raised and its head slightly cocked forward. After every two to five cm, the snake would pause and throw lateral undulations up its neck toward the head. This appeared to be a simulation of grass in the breeze. Identical behavior has been recorded in *Philothamnus semivariegatus* (Marais 1992), *Dispholidus typus* (Marais 1992), and *Thelotornis capensis* (Sweeney 1961). In the latter two species, the shimmy is associated with the stalking of prey (Marais 1992; Sweeney 1961). The *P. irregularis* which I observed was not stalking prey, and was perhaps engaging in a form of predator-eluding camouflage.

Other defensive behaviors.—The samples of both species included individuals that would freeze when first approached, then flee if the approacher did not move away. Other individuals of both species fled from the first approach, rather than freezing.

Three of the four *H. smaragdinus*, if grasped in the hand, would roll about the body's longitudinal axis in an apparent attempt to escape the grasp. This behavior did not occur in the sample of *P. irregularis*.

Acknowledgments.—I thank Earl and Ken Williams and the Yeanay family of Yekepa, Nimba County, Liberia, for helping me to locate and capture several of the snakes used in this study. I also thank the three couples who allowed me to temporarily house the specimens under their garage or porch roofs: Jim and Jane Park, John and Marie Taylor, and my parents, George and Libby Senter. I thank Robyn Senter, Richard Seigel, Van Wallach, and anonymous reviewers for constructive comments about this manuscript. Thanks also to Mata S. for her patronage.

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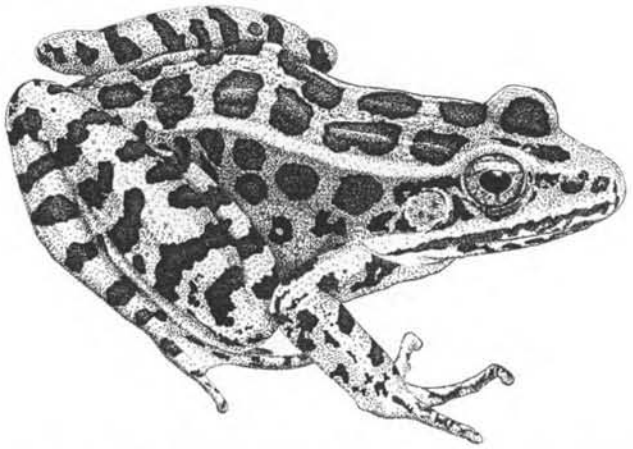
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Rana palustris. USA: Missouri: Taney Co. Illustration by Dan Erickson.

SSAR Grants-in-Herpetology

Proposals are now being accepted for the 2000 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include in-situ behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

6. INTERNATIONAL. Proposals may address needs in any of the above five categories, but applicants must be from countries where herpetological research has historically been underfunded, and where alternative sources of financial support are scarce or nonexistent.

7. BIBLIOGRAPHIC RESEARCH. This is a special category for 2000, thanks to a donation from Itzchak and Carolyn Gilboa. Proposals should address a major need to consult library or other information resources. The project must focus on a herpetological topic. Proposals from individuals only, accompanied by a letter of support from someone knowledgeable about the applicant and about the importance of the project.

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be members of the SSAR with the exception of those applying for support of regional herpetological society projects, or those applying in the international category. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 1999 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. Past recipients of an SSAR GIH award in any category are not eligible for future awards. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) TITLE PAGE giving the title of the project, the name, mailing address, office and home telephone numbers and, if possible, fax number and e-mail address of the applicant. The title page should include a statement indicating that applicants "will comply with all applicable permit regulations, and adhere to all appropriate animal care guidelines in the course of conducting funded projects." (B) BACKGROUND AND OBJECTIVES of the proposed project. (C) METHODS of carrying out the project. (D) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). Include an explicit explanation of how an SSAR award of $500 would be applied toward the objectives of the project, and provide a listing of all current and pending support for the project. (E) BRIEF RESUMÉ of the applicant or project coordinator. (F) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed 1200 words, excluding title page, literature cited, resumé, and budget. Applicants must indicate word count on their application.

Applicants must designate to which of the seven categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than **31 DECEMBER 1999** to be considered. Failure to meet these guidelines may result in elimination of a proposal from consideration. The awards will be announced on or around 1 April 2000. Successful applicants are encouraged to submit the results of their research for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Joseph R. Mendelson III, Chair, SSAR Grants-in-Herpetology, Department of Biology, Utah State University, Logan, Utah 84322-5305, USA. Tel. (435) 797-2097; Fax (435) 797-1575; e-mail: sapo@biology.usu.edu.*

RECENT POPULATION CHANGES

Distribution Records of *Rana virgatipes* and Associated Anuran Species along Maryland's Eastern Shore

MAC F. GIVEN
Division of Arts and Sciences, Neumann College
One Neumann Drive, Aston, Pennsylvania 19014-1298, USA
e-mail: mgiven@neumann.edu

Status assessments of rare species are required in our managed urban and rural landscapes. The inventory and monitoring programs of amphibians, in particular, are needed due to declining populations issues unique to this fauna (Blaustein 1994; Phillips 1994; Sarkar 1996). Historical data, when available, provide a basis for examining recent population trends (Lips 1998; Pechmann and Wilbur 1994). In Maryland, the anuran *Rana virgatipes*, the carpenter frog, is of concern. The species has a range along the east coast of the U.S. from southern New Jersey to Georgia. While abundant in some states such as New Jersey, it is classified as threatened in Maryland. According to historical records, populations have been observed at 22 Maryland sites, all but one on the East Shore of the Chesapeake Bay. The primary purpose of this study was to revisit these historical sites and assess the current status of these populations.

The scope of this study was expanded in light of the general need for baseline data so that declines of amphibian populations can be documented. First, I collected additional data at each site, including the presence/absence of other anuran choruses, measurements of water pH, and qualitative descriptions of habitat. pH measurements from the habitats of natural populations have become an important supplement to baseline population data. For example, laboratory experiments suggest synergistic interactions between pH and other environmental parameters that may determine anuran distributions and account for some of the population disappearances (Beattie and Tyler-Jones 1992; Bradford et al. 1992; Brodkin et al. 1992). I also examined likely additional habitats that were along my travel routes or in close proximity to the historical sites.

Methods.—In 1990 the Wildlife and Heritage Division of the Maryland Department of Natural Resources supplied topographic maps showing locations of 22 sites with historical records of *R. virgatipes*. These were distributed among seven counties, all but one on the Eastern Shore of the Chesapeake Bay. I visited all of these sites plus 12 additional sites, one to three times each, between 23 May and 17 July 1990 (Table 1). The additional sites included observations of wetlands along my travel routes and close to historical sites that appeared to have suitable *R. virgatipes* habitat. In addition, Bill Grogan (Salisbury State University), who has published site locations for *R. virgatipes* (Grogan 1974), suggested two additional sites where he was confident that I would find choruses: Big Mill and Swans Gut Ponds. Multiple visits were made whenever possible; once the exact location of a site was known, it was convenient to make observations en route to a more distant site. Copies of mapped locations are available at the Wildlife and Heritage Division of the Maryland Department of Natural Resources and can be obtained by contacting Katharine McCarthy, Tawes State Office Building E-1, 580 Taylor Avenue, Annapolis, Maryland 21401, USA.

I used the following protocol. During daylight hours, I located and photographed sites, and measured surface water pH and temperature. I measured pH with a Whatman pH μ-Sensor (Cat. No. 6240-0000), calibrating with standardized buffer solutions. Consistency of these data was supported in 1994 when I remeasured pH at three sites; measurements were either identical (two sites) or within 0.4 pH units (one site) of the 1990 measurements. I also made a qualitative assessment of the habitat. First, was the water in the habitat best characterized as a pond, stream, or estuary? Second, what was the general abundance of emergent vegetation? Third, was the site in a headwater region and if so, was it separated from agricultural fields by a forest or other vegetational buffer?

At night, I returned after 2100 h (EDT) to estimate the number of male *R. virgatipes* calling (categories: none, <6, >12, >25 and >100). Other calling anuran species were noted and later confirmed by listening to tape recordings taken at each site. Recordings were made with a Superscope EC-33S microphone and Marantz PMD430 stereo cassette recorder, and are kept by the author.

To study patterns among all of the species surveyed, I conducted a test of association (Ludwig and Reynolds 1988) on the presence/absence of seven anuran species at the 34 sites. Two species were excluded from analysis: 1) *Rana clamitans* because it was present on all but one site and 2) *Pseudacris crucifer* because it was observed only once (most breeding in this species occurred before my survey began). *Hyla versicolor* and *Hyla chrysoscelis* were treated as one species; given the range of temperatures experienced in the field, they could not always be distinguished from each other (although both species were observed along the roadside near Pristine Pines).

Results.—Only 9 *R. virgatipes* populations were identified: 8 of 22 historical localities, and 1 of 12 additional sites (Table 1). The one new site, Pristine Pines North, was within a kilometer of two historical sites that still have *R. virgatipes* present (Pristine Pines and Pristine Pines South). The *R. virgatipes* populations were located in Queen Anne, Caroline, and northern Dorchester counties; populations were not found in Charles, Talbot, southern Dorchester, or Worcester counties despite historical records. All of these populations were in pond habitats in headwater regions, separated from agricultural fields by forest or other vegetational buffers. Males called from shallow water with abundant emergent vegetation. Most of the populations were small; the two largest choruses were found at Baltimore Corners 3 (>100 calling males) and Johnson Road Pond (25–50 calling males).

Rana virgatipes appears to be acid tolerant; six of the populations were in acidic water with pHs ranging from 3.6 to 4.2 (Table 1). The only population in markedly less acidic water, with a pH of 5.6, was at Pristine Pines South. This site had the smallest number of calling males (fewer than six on three separate visits), suggesting that their presence may be explained by emigration from two neighboring populations with more suitable habitat (Pristine Pines and Pristine Pines North). *Rana clamitans* showed the greatest range of acid and habitat tolerance; it was present in all but one site surveyed.

The test of association demonstrated a positive association between *R. virgatipes* and the southern leopard frog, *Rana utricularia* ($P < 0.01$ with Yate's correction). This means that populations of these species were more likely to occur together than if their distributions were random. There were no other significant associations.

My observation of a morph of *R. utricularia* similar to *R. virgatipes*, coupled with the association between these two species, suggests a potential source of error in the historical records. Typically, the back of *R. utricularia* is a patchwork of brown and green with large dark spots. I caught several with entirely brown backs and small dark spots, a pattern similar to *R. virgatipes*. However, these specimens had several *R. utricularia* characteristics: pointed snout, white ventrum, copper coloration on the lateral sides of the

TABLE 1. Species composition, *R. virgatipes* population estimates, and pH of sites visited in 1990. Key to species: R1 = *Rana virgatipes*, R2 = *Rana utricularia*, R3 = *Rana clamitans*, R4 = *Rana catesbeiana*, A = *Acris crepitans*, B = *Bufo fowleri*, H1 = *Hyla versicolor/chrysoscelis*, H2 = *Hyla cinerea*, P = *Pseudacris crucifer*.

County	Name of site	Historical *R. virgatipes* site?	Dates visited	Species calling	Number of *R. virgatipes* males calling	pH
Caroline	Baltimore Corners 1	yes	5/24;6/21&22;7/17	R3		4.0 (6/21)
Caroline	Baltimore Corners 2	yes	5/24;6/22	R1,R2,R3	>12[1]	
Caroline	Baltimore Corners 3	yes	5/24;6/21&22;7/17	R1,R2,R3	>100	3.8 (6/21); 3.6 (7/17)
Caroline	Mt. Zion Pothole	yes	6/1	R3,R4,P		4.4
Caroline	Persimmon East	yes	5/24;6/1	R3		3.8 (5/24)
Caroline	Persimmon Preserve	yes	5/24;6/1	R2,R3	1?[2]	3.7 (5/24)
Caroline	Marydel East	yes	6/1	R3,R4		5.0
Caroline	Bridgetown Pond	yes	6/2	R1,R2,R3	>12[3]	3.5 & 4.3[3]
Caroline	J.A. Thomas Pond		6/1	R3		4.8
Caroline	Tuckahoe Park Bridge		6/1	R3,R4,B,H1		
Caroline	Jones Road Pond		7/17	R3,R4		4.2
Cecil	Sammy's Pond		5/23	R3,R4		>6[4]
Charles	Mason Springs	yes	5/26	R3,H1		5.4
Dorchester	Savanna Lake	yes	5/26;6/3	R2,R3,H2		4.7 (5/26)
Dorchester	Blackwater Refuge	yes	5/26;6/3	R3,R4,A,H2		
Dorchester	Johnson Road Pond	yes	6/2	R1,R2,R3,R4,H1,H2	>25	3.6
Dorchester	Marshyhope	yes	6/2;7/17	R1,R3,R4,H1	>12	3.8 (7/17)
Dorchester	Brookview Pond	yes	6/2;7/17	R3		3.9[5] (7/17)
Dorchester	Decoursey Bridge		5/26;6/2	R3,R4,B,H2		
Dorchester	Wright's Millpond		6/2	R3,R4,A,B,H1		5.2
Queen Annes	Pristine Pines S	yes	5/24;6/1&20	R1,R3,A,H1	<6	5.6 (5/24)
Queen Annes	Pristine Pines	yes	5/24;6/1&20	R1,R2,R3,R4,H1	>12	3.9 (5/24), 4.2 (6/20)
Queen Annes	Pristine Pines N		6/21	R1,R2,R3,H1	>12	3.9
Queen Annes	Kane Crossroads	yes	6/1,6/21	R1,R3	>12	3.9 (6/21)
Queen Annes	Unicorn Mill South		6/21	R3		
Talbot	Third Haven Woods	yes	5/26;6/1	H1		3.5 (5/26)
Worcester	Nassawango Creek 1	yes	5/25;6/3	R3,R4,B		5.1 (5/25)
Worcester	Nassawango Creek 2	yes	5/25	R3		5.5
Worcester	Powell Creek	yes	5/25	R3		6.1 & 6.4
Worcester	Delaware Wildlands	yes	6/3	R3		4.4
Worcester	Powellville		6/3	R3,R4,B		
Worcester	Big Mill Pond		6/3	R3,R4,A,H2		5.6
Worcester	Swans Gut Pond		6/3	R3,A,B,H1,H2		5.6
Worcester	Shad Landing Pond		5/26	R3,R4		5.5

Notes: [1] *R. virgatipes* heard to the south, not at this specific site. [2] One male may have called once on 6/1; presence of species unlikely. [3] *R. virgatipes* heard in south pond; pH measurements taken from two locations near this pond. [4] Measurement taken 6/13/94. [5] Measurement taken from location near this pond; actual pond not found.

abdomen, and a yellow spot in the middle of each tympanum. Thus, any historical record not based on vocalizations may have involved the misidentification of *R. utricularia*.

Discussion.—*Rana virgatipes* populations were found at only nine sites on the East Shore of Maryland. This species apparently needs a habitat consisting of partially submerged vegetation in the permanent, acidic water of glades/potholes of headwater regions. This is consistent with studies of New Jersey populations (Given 1987, 1988a), where males called from clumps of partially submerged vegetation either along the banks of ponds or in the shallow water of cranberry bog reservoirs. The apparent association of *R. virgatipes* with low pH may confine their distribution to areas protected from large amounts of runoff. For example, ponds bordering agricultural fields and large streams tended to be less acidic than habitats with *R. virgatipes* populations (pers. observ.). The association of *R. virgatipes* with low pH is also consistent with data which showed that their eggs and tadpoles develop in acidic water that is lethal to many other species (Gosner and Black 1957). This may allow *R. virgatipes* to use acidic ponds as refuges from less tolerant competitors and predators (Freda and Dunson 1986; Freda and Taylor 1992).

Rana clamitans was found at all but one site and may be in the process of displacing *R. virgatipes* populations. In New Jersey, *R. virgatipes* is the most numerous ranid species of acidic cranberry bog reservoirs (pers. observ.), presumably due to *R. clamitans* being less acid tolerant (Gosner and Black 1957). In contrast, all of the Maryland sites with *R. virgatipes* present had much larger populations of chorusing *R. clamitans*. One study of behavioral interactions suggests that *R. clamitans* males displace *R. virgatipes* males (Given 1990). Males of both species chose similar microhabitats for calling sites which they vigorously defended from conspecifics. A playback experiment showed that male *R. virgatipes* respond

to *R. clamitans* advertisement calls with aggressive calls. However, because *R. virgatipes* males are smaller and unable to displace their heterospecific opponents, they eventually move to another calling site. The populations at Kane Crossroads Pond in this report may be an example of this type of interaction. *Rana clamitans* were numerous and distributed throughout the wetland site; calling *R. virgatipes* were restricted to a small island of habitat that was surrounded and greatly outnumbered by calling *R. clamitans* (pers. observ.).

I was especially concerned about my inability to find *R. virgatipes* choruses in southern Dorchester and Worcester counties, including the additional sites suggested by Bill Grogan. It is possible that some of these sites may have become seriously degraded. In the Delaware Wildlands, what was described as a sphagnum bog in 1948 (Meanley 1951) was no longer a bog (at least based on the map location provided to me); the area also had piles of trash and animal remains. The Nassawango Creek area was noteworthy in that there was very little chorusing activity of any anuran species. A second possible explanation is that *R. virgatipes* never was in these counties and were misidentified, perhaps due to the similarities in appearance of *R. virgatipes* and *R. utricularia* discussed earlier.

A third, less likely explanation, is that the breeding season of *R. virgatipes* may have begun and ended earlier at these more southern sites. In New Jersey, breeding seasons began in late April and continued until late July–early August (Given 1988b). In addition, the population at Cedar Run Lake, New Jersey, chorused from dusk to dawn except for a few early May nights when the air temperature approached freezing, and some marked individuals called every night (Given 1988b). Thus, if a chorus existed at a Maryland site and exhibited behavior similar to New Jersey populations, it should have been heard at any time on nights from May through July. Consistent with this, the six Maryland sites with *R. virgatipes* present that were visited more than once always had choruses present. For example, choruses were present at Pristine Pines and Pristine Pines South on all three visits (24 May, 1 June, and 20 June). Thus, if *R. virgatipes* exists in southern Maryland, my failure to find it can be explained if the breeding season had ended by mid-May.

Given that there are fewer populations of *R. virgatipes* in Maryland than the historical record suggests and that most of these populations are small, continuation of their threatened status is recommended. Fortunately, several populations are on land owned by the Nature Conservancy (Baltimore Corners 2 & 3, Johnson Road Pond, and Pristine Pines), suggesting that there are other distinctive flora and fauna that already have brought these areas to the attention of naturalists. It is unclear, however, if such small populations are sustainable long-term. These populations should continue to be monitored with special attention to pH fluctuations and to abundances of *R. clamitans*. In addition, given the positive association between *R. virgatipes* and *R. utricularia*, a more exhaustive survey should include historical *R. utricularia* sites in the hope of finding more populations of *R. virgatipes*.

Acknowledgments.—I appreciate the residents of Maryland who, without exception, welcomed a stranger on their properties. I had several helpful conversations with Bill Grogan and Katharine McCarthy. Funding was provided by the Maryland Natural Heritage Program. C. Bevier reviewed an earlier draft of this manuscript.

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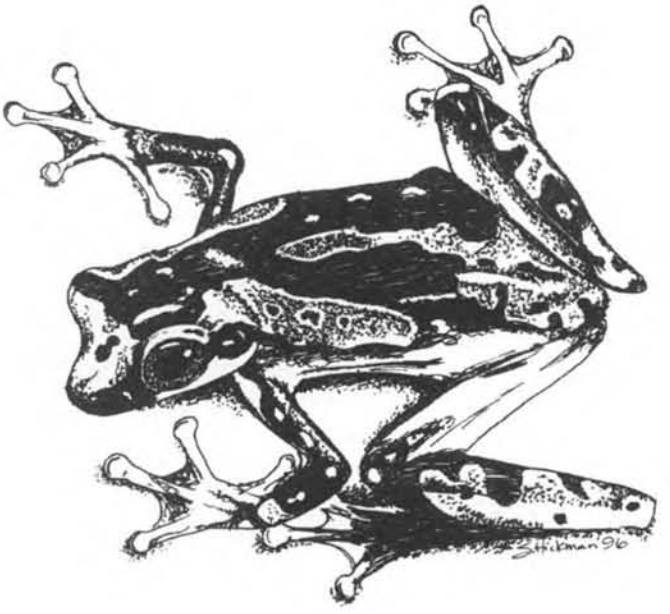
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Hyla ebraccata. Illustration by Shelly Hickman.

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GEORGE SHAW'S "GENERAL ZOOLOGY"

THE FIRST WORLD SUMMARY OF AMPHIBIANS AND REPTILES IN ENGLISH

With a Systematic Review of Shaw's Nomenclature by Hobart M. Smith and Patrick David

GEORGE SHAW (1751–1813), an English naturalist who became Keeper of Zoology at the British Museum, is one of the most familiar names in herpetology. His volume on amphibians and reptiles in his series "General Zoology" comprises the first world review of herpetology in English. Shaw's book, published in 1802, covered 432 species which represent a large fraction of the species known at the time. Of these, Shaw described 109 as new and two dozen of his taxa survive, including some of the most familiar species in the world: *Ambystoma maculatum, Rana catesbeiana, Caecilia gracilis, Geochelone radiata, Ctenosaura acanthura, Python regius,* and *Bitis nasicornis*. The text includes scientific and common names, extensive references to previous literature, natural history, and useful historical information. The 141 plates (see the samples at the bottom of this page) are typical of the era: excellent likenesses at their best, but sometimes amusing, fanciful, or even purloined from other works. Taken together, the text and plates represent an authoritative and classic survey at the start of the century during which herpetology became a science.

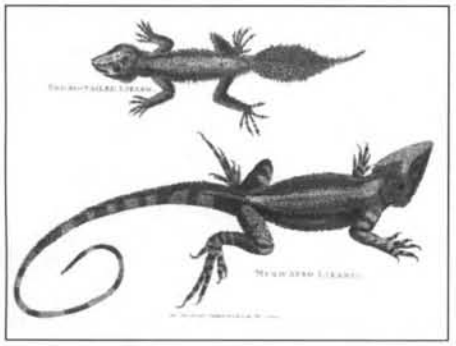


Hobart M. Smith (Boulder) and Patrick David (Paris) provide an extensive introduction in which Shaw's species are correlated with modern taxa. Many of Shaw's names have not been previously synonymized. They also provide a comprehensive index to Shaw's names.

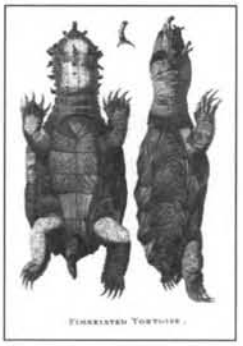
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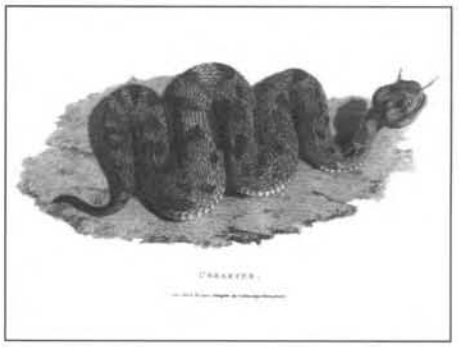
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TECHNIQUES

A Non-destructive Source of DNA from Hatchling Freshwater Turtles for Use in PCR Base Assays

S. W. MOCKFORD
Department of Biology, Dalhousie University
Halifax, Nova Scotia, Canada, B3H 4H6
e-mail: mockford@is2.dal.ca

J. M. WRIGHT
Department of Biology, Dalhousie University
Halifax, Nova Scotia, Canada, B3H 4H6
e-mail: jmwright@dal.ca

M. SNYDER
Biology Department, Acadia University
Wolfville, Nova Scotia, Canada, B0P 1X0
e-mail: marlene.snyder@acadiau.ca

and

T. B. HERMAN
Biology Department, Acadia University
Wolfville, Nova Scotia, Canada, B0P 1X0
e-mail: tom.herman@acadiau.ca

In recent years, a number of turtle species have been designated at risk. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) currently lists five turtle species: leatherback turtle (*Dermochelys coriacea*; endangered), eastern spiny softshell turtle (*Apalone spinifera*; threatened), Blanding's turtle (*Emydoidea blandingii*; threatened), spotted turtle (*Clemmys guttata*; vulnerable), and wood turtle (*Clemmys insculpta*; vulnerable), with seven additional species yet to be assessed.

Molecular genetics has provided an increasingly valuable tool in gathering information germane to conservation status and management plans (Lambert and Millar 1995; Moritz 1995; Prior et al. 1997). The development of highly variable genetic markers (for review see O'Reilly and Wright 1995) and the polymerase chain reaction (PCR; Mullis et al. 1986) allows examination of population genetic structure at fine spatial and temporal scales as well as examination of relatedness and parentage, using very small amounts of DNA.

In adult turtles, DNA can be obtained non-destructively from blood samples. However, hatchling freshwater turtles are often too small to be effectively sampled by drawing blood. Toe clipping, which yields DNA in amphibians (Gonser and Collura 1996), is undesirable in turtles as claws are used in mating for both titillation and mounting. Blood has been collected from both the dorsal cervical sinus and the occipital sinus in sea turtle hatchlings (Wibbels et al. 1998 and references therein), however these sinuses either do not exist or are insufficiently developed in freshwater turtles to use as a blood sampling site. Until now, DNA could be obtained from hatchling freshwater turtles in two ways: sacrifice the hatchlings (see Galbraith 1993) or raise hatchlings in captivity until they are large enough for blood sampling (Mockford et al. 1999). We describe here a non-destructive source of DNA from hatchling turtles for use in PCR-based assays.

As part of the monitoring program of the Nova Scotia population of Blanding's turtle (*Emydoidea blandingii*) newly emerged hatchlings are given nest-specific marks (Herman et al., in press). Marking is done by notching up to three marginal scutes (Standing et al. 1995), from each of which a small fragment of carapace (approximately 2 mm^2) is removed. The underside of these carapace fragments is not yet ossified bone, and serves as our source of DNA.

Scutes are notched using a nail clipper and resulting fragments are placed in 1 ml of 70% ethanol at collection and stored at –20°C for up to one year. Nail clippers are rinsed in 100% ethanol and allowed to air dry between samples. Prior to extraction, individual fragments are removed from the ethanol and rinsed in 50µl high TE (100mM Tris-base, 40mM EDTA, pH 8.0) for approximately one minute, then placed in 25µl extraction buffer (10mM Tris-base [pH 8.3], 50mM KCl, 0.8% Tween 20) to which 2.5µl of Proteinase K (1mg/ml) has been added. The extraction buffer is incubated at 45°C overnight, and subjected to centrifugation at 11000 g for 1 minute. 20µl of the supernatant is pipetted into a new tube. We use the undiluted product of this crude extraction in PCR reactions for microsatellite assays.

While this crude extraction can be used directly, the DNA is likely contaminated with proteins (A260/A280 < 1.0) and may not be stable for long term storage. Where longer storage is desired DNA can be precipitated in 1/10 volume 3M sodium acetate and 2 volumes cold 100% ethanol. Following precipitation and resuspension in 25µl TE the average yield per fragment was 3.02µg (SE 1.02, N = 12; Beckman DU-64 spectrophotometer) with an A260/A280 of 1.56 (SE 0.22, N = 12). The comparison of absorbance at 260nm and at 280nm provides a measure of the purity of the DNA; pure DNA = 1.8.

Seventy-eight percent of samples were successfully PCR amplified in the first attempt from the crude extraction, and this did not improve following precipitation. Subsequent PCR reactions of the remaining samples required adjustment of the DNA concentration. This protocol has been used in a variety of tissue types including muscle tissue (McConnell et al. 1995) and fish eyeballs (Ruzzante et al. 1996) with similar results (D. Cook, pers. comm.).

As molecular genetics continue to be integrated into conservation biology the need for non-destructive sampling techniques increases. The technique described here has been used to sample hatchlings as small as 6.1 g with carapace lengths as short as 30 mm. While we have only used this technique on samples from Blanding's turtles, similarity in carapace anatomy suggests that this technique will work with many freshwater turtle species.

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Comparing the Use of Pitfall Drift Fences and Cover Boards for Sampling the Threatened Sand Skink (*Neoseps reynoldsi*)

PHILLIP E. SUTTON [1]
HENRY R. MUSHINSKY [1,2]
and
EARL D. McCOY [1,2,3]

[1]Department of Biology and [2]Center for Urban Ecology
University of South Florida
Tampa, Florida 33620-5150, USA
[3]Corresponding author; e-mail: mccoy@chuma.cas.usf.edu

The sand skink (*Neoseps reynoldsi* Stejneger) is a fossorial lizard found only in xeric upland habitats (sandhill, scrub, scrubby flatwoods) in central Florida, USA. It is a small species, adults typically are only 100–130 mm in total length, and it displays a variety of morphological characters probably related to a fossorial existence. Among these characters are small limbs, lateral grooves to accept limbs during subsurface locomotion ("sand swimming"), wedge-shaped head, subterminal jaw, and small eyes.

The sand skink is a federally threatened species, with poorly-understood patterns of distribution and abundance among habitats (Campbell and Christman 1982a; Christman 1992; Cooper 1953; McCoy et al. 1999; Myers and Telford 1965; Telford 1959; U.S. Fish and Wildlife Service 1993). The development of precise methods for recognizing patterns of distribution and abundance is vital to its recovery (U.S. Fish and Wildlife Service 1993). A first step in developing such methods is to compare how well different sampling techniques detect its presence and accurately reflect its abundance. We compared two common herpetological sampling techniques, pitfall drift fences and cover boards.

Recent studies of the sand skink have used pitfall drift fences almost exclusively (e.g., Andrews 1994; McCoy and Mushinsky 1994; McCoy et al. 1999; Mushinsky and McCoy 1995). Pitfall drift fences are effective in capturing individuals, but they are relatively expensive to construct and maintain. Cover boards (Grant et al. 1992), on the other hand, are relatively inexpensive to construct and maintain, but are not as effective as pitfall drift fences in capturing individuals. Although individuals occasionally may be found under cover boards and other kinds of ground cover, they are not constrained to remain there. The fact that they do not constrain individuals may not necessarily be a shortcoming of cover boards, however, in many studies of the sand skink.

We compared the relative effectiveness of the two sampling techniques at seven sites, all of which were in scrub habitat and were known from preliminary surveys to harbor the sand skink (McCoy et al. 1999). We had little a priori information about the abundance at the seven sites, which made it difficult to decide how many cover boards and pitfall drift fences to install. We settled on a density of 1 cover board per 100 m^2 (a total of four cover boards at each site), based on previous studies. This density is lower than the density recommended for intensive field studies (e.g., Fellers and Drost 1994), but higher than the density employed in previous comparative studies (e.g., Campbell and Christman 1982b; Grant et al. 1992). We installed pitfall drift fences at a four-fold higher density than cover boards (a total of 16 at each site). Although matched numbers of cover boards and pitfall drift fences at each site would have provided a parsimonius experimental design, we installed additional pitfall drift fences to provide the higher level of trapping intensity that we thought would be required to estimate overall activity and reflect total abundance accurately (see below).

A pitfall drift fence consisted of a 2 m length of aluminum flashing with two 3.8 L buckets countersunk at each end, so that individuals diverted by the fence fell into the buckets. The combined lengths of the 16 drift fences at a site approximately equals the combined lengths of the four drift fences in a standard pitfall drift fence array (Campbell and Christman 1982b), but the number of pitfall traps is quadrupled. We assumed that the increase in the number of traps per meter of drift fence would increase the chance of capturing individuals of the small sand skink. Pitfall drift fences were centered on 16 stakes, evenly spread over a 20 m x 20 m area. Drift fences were buried to a depth of 30 cm, to ensure that individuals would not pass under them. Buckets were countersunk to depths between 3 cm and 8 cm below ground surface. The bottom of each bucket was perforated with at least ten 0.32 cm holes to promote drainage, and a lid was positioned over the bucket on clothespin supports to provide shade. We placed a layer of sand, at least 5 cm deep, in each bucket to provide substrate for burrowing.

A cover board consisted of a 1.27 cm-thick piece of plywood, 60 cm x 60 cm, which is intermediate in size to those used in most previous studies, 30 cm x 30 cm to 66 cm x 133 cm (Fellers and Drost 1994; Grant et al.1992). One cover board was placed at random within each quarter of the grid created by the pitfall drift fences at a site. The area where a cover board was placed was gently raked to bare sand and then leveled, so that the cover board rested on the ground at all points. In a few places where roots were at the surface, sand was added to create a uniform sandy surface under a cover board.

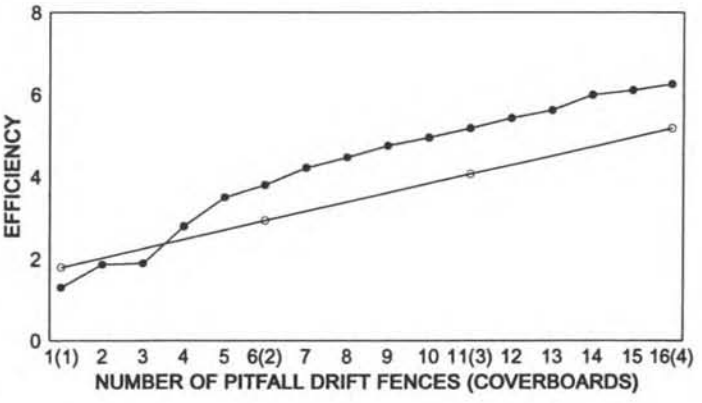


FIG. 1. Efficiency of detection (reciprocal of number of days to detect presence x 100) for 1–4 cover boards (open circles) and 1–16 pitfall drift fences (closed circles).

Pitfall drift fences were checked for captured individuals and the sand under cover boards was checked for the characteristic sinusoidal patterns that the sand skink leaves behind as it moves ("tracks"). Pitfall drift fences and cover boards were checked every 5–7 days during the potential peak activity period (14 weeks from February to mid-May), the summer (two weeks in July), and the early autumn (three weeks in September), 1995. Because we could not check the pitfall drift fences any more often, captured individuals could have been exposed to high rates of predation (Gibbons and Semlitsch 1981). That the lids positioned over the buckets were disturbed only twice, and only at one of the arrays near the end of the study, indicates that predation by the most likely predator, the racoon, probably was not an important source of mortality. We marked each individual captured by the pitfall drift fences with a hand-held cauterizer (McCoy et al. 1999), held it for one week to ensure that it was not harmed by the marking, and then released it near where it was captured. Initially, we tried to count tracks under cover boards, but we were unable to distinguish individual tracks when many of them were packed together, so we simply recorded the presence/absence of tracks.

We compared the data obtained from pitfall drift fences (individuals) and from cover boards (tracks) in four ways. Because of the difference in numbers of cover boards (4) and pitfall drift fences (16) at each site, direct comparisons would be misleading; therefore, we made probabilistic comparisons. The first comparison determined which technique detected presence of the sand skink at more sites. We counted the number of pitfall drift fences that detected no individuals at a site and then used a hypergeometric distribution to calculate the probability that any four pitfall drift fences selected at random would have detected no individuals. The second comparison determined which technique detected presence of the sand skink in the shorter time ("efficiency"). We used a randomization procedure: (1) select subsets of pitfall drift fences (1, 2...15 drift fences) or cover boards (1, 2, 3 cover boards) at random from each of the seven sites; (2) for each subset, locate the drift fence or cover board at each site that first detected presence; (3) record the number of days required to detect presence; (4) repeat 100 times; (5) calculate the mean of the 100 replicates for each site; (6) calculate the grand mean for all sites; (6) compare the grand means for pitfall drift fences and cover boards. The third comparison determined which technique reflected overall activity (number of captures by all 112 [= 16 pitfall drift fences per site x 7 sites] pitfall drift fences per week) more closely. We correlated (Spearman's Rank Correlation) cumulative (summed over all seven sites) number of captures per week by four randomly selected pitfall drift fences (ten replicates), and cumulative number of cover boards with tracks per week, with overall activity. We included this comparison in response to concern that tracks under cover boards might not represent levels of activity well, because cover boards may not be completely passive samplers (i.e., they may attract individuals of the sand skink by altering the microclimate of the soil or promoting unusually high densities of prey or cover) (Grant et al. 1992). The fourth comparison determined which technique reflected total abundance (number of individuals captured by all 16 pitfall drift fences at a site over the 19 weeks of the study) more closely. We correlated (Spearman's Rank Correlation) cumulative (summed over 19 weeks) number of individuals captured by four randomly selected pitfall drift fences (ten replicates), and cumulative number of cover boards with tracks, with total abundance.

Cover boards and pitfall drift fences proved to be about equally capable of detecting presence of the sand skink, but cover boards were more efficient at doing so. Four cover boards detected presence of the sand skink with certainty at all seven sites. In fact, only two of the 28 cover boards never had tracks under them. Four pitfall drift fences detected presence of the sand skink with virtual certainty at four of the seven sites; probabilities of detection at the other three sites were 0.98, 0.96, and 0.73. Although cover boards tended to be a more efficient technique for detection than pitfall drift fences with relatively low trapping effort (Fig. 1), the tendency could be confirmed only marginally. The median number of days required for at least one of four pitfall drift fences per site to detect presence of the sand skink was 21 (range = 7–63), and for at least one of four cover boards per site, it was 14 (range = 2–56) ($W = 63$, $P = 0.10$, N = 7/7). Even with much greater trapping effort, pitfall drift fences tended to be only about equally as efficient as cover boards (Fig. 1). The median number of days required for at least one of 16 pitfall drift fences per site to detect presence was 14 (range = 7–28) ($W = 53$, $P = 0.50$, N = 7/7). Increasing the number of pitfall drift fences from four to 16, to match the efficiency of four cover boards, comes at substantial cost, however. We estimated the cost of each pitfall drift fence to be US $11.43, including materials and labor, but the cost of each cover board to be only US $2.17.

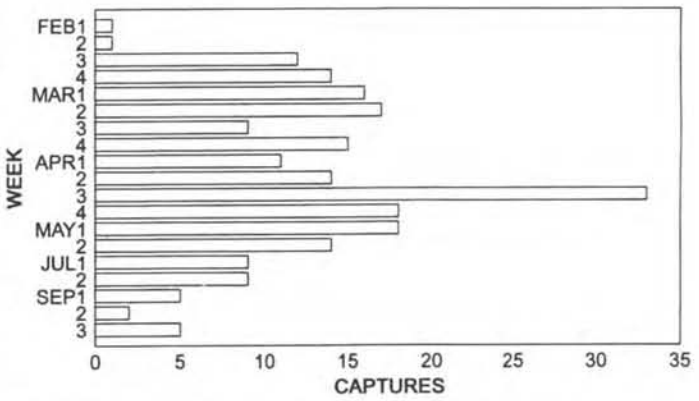


FIG. 2. Overall activity (number of captures by all pitfall drift fences) of the sand skink.

Cover boards and pitfall drift fences also were about equally capable of reflecting overall activity and total abundance of the sand skink accurately. Overall activity was low until late February, peaked in late April, and then diminished steadily over the summer and early autumn (Fig. 2; Telford 1959). Cumulative (over sites) number of cover boards with tracks and cumulative number of captures by four pitfall drift fences per site both were correlated strongly with overall activity ($r_S \geq 0.67$, $P < 0.05$, N = 19). Total abundance ranged from 5 to 26 individuals per site, yielding density estimates ranging from 125 to 650 individuals per ha (McCoy et al. 1999). Cumulative (over time) number of cover boards with tracks was correlated strongly with total abundance ($r_S = 0.82$, $P < 0.05$, N = 7). Cumulative number of individuals captured by four drift fences per site was correlated strongly with total abundance for about half of the replicates ($r_S = 0.43$–0.96, $P = < 0.05$–0.34, N = 7), probably reflecting the fact that the four selected pitfall drift fences were competing with twelve others for captures at each site.

Our results suggest that monitoring tracks under cover boards may be preferable to capturing individuals with pitfall drift fences for much of the survey work designed to recognize patterns of distribution and relative abundance of the threatened sand skink. Cover boards provide at least as reliable information as pitfall drift fences, plus they are less expensive and probably cause less environmental disturbance.

We illustrate how cover boards can be used effectively to sample the sand skink with a survey carried out in the vicinity of the seven

sites. The area encompassing the seven sites contained a heterogeneous grouping of habitats, ranging from swamps and swales to the xeric uplands in which the sand skink resides. The patchiness of this area provided an excellent opportunity to test existing ideas about habitat preferences of the sand skink (Christman 1992; McCoy et al. 1999; Telford 1959). We spaced cover boards at 5-m intervals along transects across the intersections of pairs of relatively dry habitats to document sand skink distribution and abundance more rigorously than typically has been done in the past at this scale. The habitat pairs available to us were scrub and scrubby flatwoods (N = 13 transects), scrub and pine flatwoods (N = 16 transects), and sandhill and scrubby flatwoods (N = 9 transects). Habitat descriptions are in Abrahamson and Hartnett (1990) and Myers (1990). Transect length was variable, depending on the perceived width of the transition zone between habitats. Regardless of length, each transect was divided into six sections: 0–10 m, 11–20 m, 21–30 m, 31–40 m, 41–50 m, and > 50 m from the terminus in what we pre-judged to be the better habitat for the sand skink (scrub > sandhill > scrubby flatwoods > pine flatwoods). Cover boards were set out in early June and then checked for tracks once in August and once in September, 1994. Along each transect, we noted the cover boards that had tracks under them, and then computed percentages of cover boards with tracks within each of the six sections. Percentages of cover boards with tracks along transects from scrub to scrubby flatwoods were 59% at 0–10 m, 55% at 11–20 m, 32% at 21–30 m, 7% at 41–40 m, and 0% thereafter; from scrub to pine flatwoods were 60% at 0–10 m, 50% at 11–20 m, and 0% thereafter; and from sandhill to scrubby flatwoods were 33% at 0–10 m, 0% at 11–20 m, 12% at 21–30 m, 25% at 31–40 m, and 0% thereafter. The sand skink left tracks more often under cover boards in scrub than in any of the other three habitats, and individuals penetrated farther from scrub into scrubby flatwoods than from scrub into pine flatwoods. These results confirm that the sand skink has a preference for drier habitats over wetter ones, and that our initial "educated guesses" about its relative preferences among habitats largely were accurate (McCoy et al. 1999).

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Method for Attaching Radio Transmitters to Medium-sized Reptiles: Trials on Tuatara (*Sphenodon punctatus*)

GRAHAM T. USSHER

School of Environmental and Marine Sciences, University of Auckland
Private Bag 92019, Auckland, New Zealand
e-mail: g.ussher@auckland.ac.nz

The need to know why species translocations succeed or fail places added emphasis on post-release monitoring of individual animals. In New Zealand, a rare endemic reptile, the tuatara (*Sphenodon punctatus*), has recently been re-introduced to the first of many locations within its historical range. Tuatara are nocturnal, extremely cryptic, and often inhabit deep underground burrows which make them difficult to monitor. Hand catching of tuatara when they are active above ground has traditionally been the most efficient method of gaining morphological or dispersal information from individual animals, but can result in considerable environmental disturbance and disruption of tuatara natural activity patterns (see Cassey and Ussher 1999 for alternatives). Investigations planned to study the use of habitats by translocated tuatara required that a more efficient and less invasive method of yielding information be developed. Miniaturized radio transmitters were viewed as the most favorable method of obtaining this information.

The history of transmitter use with tuatara is brief. Hind-quarter mounted transmitters and temperature probes were used in the late 1960's–1970's, although attachment was for periods of nine days or less (Barwick 1982). In tracking trials during 1976–1977, New Zealand government scientists used a leather harness system for the then bulky transmitters (Newman 1980), but the design was not adopted because of fears for tuatara safety. Direct fixture of the transmitter to the dermis using surgical tape (C. Tyrrell, pers. comm.)

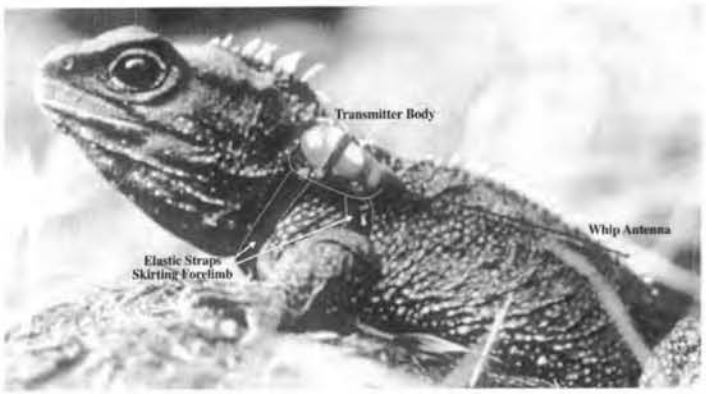


FIG. 1. Male tuatara (*Sphenodon punctatus*) fitted with a backpack harness and radio transmitter.

or with adhesive glues (B. Goetz, pers. comm.) has been attempted, although duration of trials on captive tuatara have been less than four weeks and adhesion beyond nine days in the field has yet to be successful.

The translocation study undertaken by me required that the attachment method be effective for periods of four months or more (long-term attachment) because I was unable to visit offshore island study sites on a regular or predictable basis. Potential avenues for long-term transmitter attachment were also constrained by aspects of tuatara biology. Tuatara grow to 700–1000 mm in total length and weigh from 300–800 g, meaning that force of contact with ground surfaces, and therefore wear on harness materials during locomotion, can be considerable. Compounding this is the tendency for tuatara to use small crevices as retreats, often among abrasive rock piles. Additional problems are an annual shedding cycle, susceptibility to dermal infection under non-porous skin coverings, and extremely slow rates of healing following surgical procedures (such as sub-dermal transmitter implantation) (R. Jacob-Hoff, pers. comm.).

During trials on captive animals, I focused on indirect transmitter attachment at the anterior region of the animal, using a modified harness system similar to that employed by Fisher and Muth (1995) for small horned lizards. The design was a modification of the harness constructed by N. Nelson (Victoria University, Wellington, New Zealand) and D. Newman (Department of Conservation, New Zealand). This design was successfully tested for 2.5 months (the average period between sampling visits to the islands) on captive animals and met additional criteria of being simple in design, readily repairable, and possible to assemble in the field from inexpensive materials. Below, I detail the final design of the transmitter harness, which can also be used on other similar-sized reptiles.

The radio transmitters used are tear-drop, single stage transmitters (Sirtrack Ltd.) measuring 20 mm x 10 mm with a 70 mm whip antenna and weigh < 4 g (Fig. 1). Ventral surfaces of transmitters are flat to maximize contact with transmitter pad and to aid in fit to tuatara body shape. The harness comprises two major sections: the transmitter pad, and the backpack straps (Fig. 1). The pad is constructed from a 30 mm x 20 mm strip of porous polypropylene webbing. Edges are heat sealed and smoothed to prevent abrasion of the dermis. Two lengths of polyester 13 mm wide braid elastic are sewn to each side of the longer edge of the pad. Two thin retainer straps of 4 mm wide polyester cord are sewn across the pad to act as anchors for the transmitter sitting atop the pad. Cyanoacrylic glue (Superglue™) is used to affix the transmitter to pad. When fitting the harness, the transmitter pad is placed on the upper ventral surface directly above either scapula with the transmitter aerial pointing posteriorly and the two straps pointing dorsally up and over the back. The most anterior strap is then pulled dorsally over the back, down anterior to the forelimb, under and across the ventral surface to rise posteriorly to the other forelimb and meet the diagonally opposite edge of the transmitter pad.

The procedure is repeated with the other strap, passing it over the back, down posterior to the forelimb and diagonally across the ventral surface. Both straps are pulled firmly to the pad edge and measured for trimming and attachment. Fit must be tight enough to account for the probable thorax expansion being exerted by the animal (adpression of the ribs when the animal relaxes following harness attachment will reduce tension in harness straps). Straps are trimmed to the required length and the ends are heat sealed to prevent fraying. Straps are attached to the pad with cotton thread using no more than 4–5 simple stitches. This serves as a 'weak link' which will part if the animal becomes entangled and will release it from the harness (and transmitter). Final weight of the transmitter package (transmitter + harness) is < 6 g.

For this study, 29 tuatara were fitted with backpack transmitters for a total of 8300 days. Harness performance was assessed by looking at wear of materials, reliability of weak links, and gross impact on animal welfare and behavior. Wear on materials over the 14–16 months was negligible in most cases. Harnesses endured temperatures from 3°C (winter) to 25°C (summer), frequent wetting and drying, abrasion against rock surfaces, and inundation with particulate soils and mud. Harness straps maintained elasticity throughout the study and webbing pads did not deteriorate. A single elastic strap frayed slightly at the edge. The weak links exceeded performance expectations. Trials on captive animals identified minimum stitching required to part under strain exerted by different sized tuatara (this may differ for smaller or larger species). Unfortunately, environmental degradation of weak links was not sufficiently taken into consideration. Harnesses worn by animals throughout the spring and summer months (minimum duration of 120 days) were discarded when autumn rains deteriorated the exposed cotton link fibers.

Impact on animal welfare was determined by presence of harness-induced injury to individuals or as loss of body condition compared to tuatara without transmitter packages released at the same location. Animals in one release population (N = 9) showed no signs of physical injury, but 80% (N = 20) of tuatara on the other island exhibited varying degrees of abrasion under one or both axillae. This effect was attributed to the larger-sized tuatara in the unaffected population (mean snout-vent length [SVL] males: 265 mm (± S.E. 10 mm); females 247 mm (± S.E. 23 mm), while those in the affected population were inherently smaller individuals (SVL males: 203 mm (± S.E. 4 mm); females 174 mm (± S.E. 1 mm). This influence of body size on harness effect did not eventuate during trials, probably because tuatara in trials were large animals of similar size to those in the unaffected population.

In most cases (13 out of 16), abrasion only resulted in damage or removal of scales within a small area of the axilla. In three cases, abrasion was sufficient to also break the skin surface, but abrasions healed within two months. It is probable that, shortly after fitting, the elastic straps of the harness stretch a small amount and conform to the animal's body shape, with most abrasive stress being applied during this easement period. Replacement harnesses were fitted less firmly to animals and no further problems of strap-induced abrasion were recorded. Additional abrasion problems in the form of small cuts to the dorsal spine projections were seen on three animals, and seem to have also been caused by overly tight harnesses.

The impact of harnesses on foraging and mating behavior was of paramount concern at the study's conception. Increased probability of predation was not an important consideration, as it is unlikely that the natural predators of tuatara are able to prey on adult individuals in forested habitats (but see Saint Girons et al. 1980 for predation by Australasian harriers (*Circus approximans*) in modified grassland habitat). All individuals fitted with transmitter packages were mature adults. Analysis of fecal pellets from transmittered and non-transmittered animals indicated no recognizable difference in either the type or size of prey appearing in diets. Effect of transmitter packages on foraging efficiency would manifest itself as long-term weight loss in affected animals. Weight changes for tuatara fitted with transmitters were comparable to weight changes for animals without transmitters (e.g., release population 1: % body weight change since release for tuatara with harnesses = -3.6%–0.9% [N = 2]; without harnesses = -1%–10.8% [N = 5] over the same period). Additionally, mating behavior was exhibited by both transmitted and non-transmittered animals during the study. Differential mating success of transmittered and un-transmittered animals was not investigated.

In summary, the backpack harness system for attaching radio transmitters to medium-sized reptiles such as tuatara is a safe, reliable design which ensures the safety of the study animal and enables long-term (> 4–5 months) attachment. Correct fitting of harnesses will prevent abrasion seen for some tuatara in this study. Materials used for the harnesses weathered New Zealand seasonal climatic variations as well as the wear caused by tuatara habits. Weak links incorporated to protect study animals need to be improved to ensure that harnesses are not shed solely due to climate-induced degradation of cotton links. Perhaps sealing cotton links in weatherproof materials will ensure greater efficiency. Harness materials may also have to be modified for use on smaller reptiles to prevent abrasion-related problems seen in this study.

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A Vietnamese Trapping Technique for Capturing Butterfly Lizards (*Leiolepis*)

THOMAS ZIEGLER
Zoologisches Forschungsinstitut und Museum Alexander Koenig
Adenauerallee 160, D-53113 Bonn, Germany
e-mail: uzsmdb@uni-bonn.de

During recent field studies in Vietnam (June–September 1997, August–October 1998), a simple but very effective trapping technique to live capture butterfly lizards (*Leiolepis* sp.) was observed at Cua Lo (Nghe An province). The trap was used to capture adult specimens of *Leiolepis r. reevesii* at the entrances to their burrows and consists only of bamboo cane and nylon line.

A section of bamboo cane approximately 40 mm long and with 27 mm internal diameter (wall thickness about 5 mm) is required. The cane is punctured at the top about 10 mm away from the front end (Fig. 1a: A). A second bamboo stick (approximately 210 mm long, 10 mm wide and 1 mm thick) consisting of young and therefore very elastic bamboo is needed (Fig. 1a: B). It is important that this flexible stick is neither too weak nor too strong, to both assure successful trapping and avoid injuries to the trapped lizard. The stick is fixed along the longitudinal axis of the bamboo cane on the underside. It projects approximately 140 mm from the rear edge of the bamboo cane. For attachment, a nylon line is drawn repeatedly through the bamboo cane and firmly connected to the bamboo stick immediately in front of and behind the bamboo cane (not obvious from Fig. 1). This simple but adequate attachment of the flexible stick to the rigid bamboo cane facilitates movement of the stick to adjust leverage during use. This projecting part of the stick is notched 10 mm from the end to allow attachment of a nylon line (about 220 mm in total length). Forty mm from the knot at the stick, the end of a solid, non-elastic bamboo wedge (approximately 50 mm long, 5 mm wide and 7 mm thick) is tied to the nylon line (Fig. 1a: C). On the upper half of this wedge, a notch (about 4 to 5 mm deep) is required which can hold the upper rear edge of the bamboo cane. The remaining nylon line (about 150 mm from the upper end of the wedge) is threaded from outside to inside through the puncture on the top of the front end of the bamboo cane (Fig. 1a: D). Finally, a small loop is made at the end of the nylon line (a small metal ring can also be used) to allow construction of a noose for capturing the butterfly lizards.

To set the trap, the notch in the wedge is carefully fitted on to the back end of the bamboo cane, so that the linked stick gets tightened (Fig. 1b). Then a noose of about the size of the internal diameter of the bamboo cane is made in the end of the nylon line, which finally is carefully fit by hand to the inner wall of the anterior opening of the bamboo cane. The trap is now carefully introduced with its anterior opening directed into the entrance of an inhabited *Leiolepis* burrow (Fig. 2). Upon exiting its burrow, the butterfly lizard has to pass through the bamboo cane and place its head or body into the noose. As the lizard approaches the opening of the bamboo cane, it will push the basal part of the wedge and release tension in the tightened stick which will spring back and tighten the nylon line. As a consequence, the noose is tightened on the neck or anterior body of the lizard and holds it on to the tube of the trap. Now the trap can be taken out of the entrance of the burrow and the noose carefully removed from the lizard. To prevent overheating of the trapped lizard and to avoid possible injuries from the nylon noose, the lizard should be set free from the trap as soon as possible. However, because most lizards were captured by the noose between the front and hind limbs, injuries were rare.

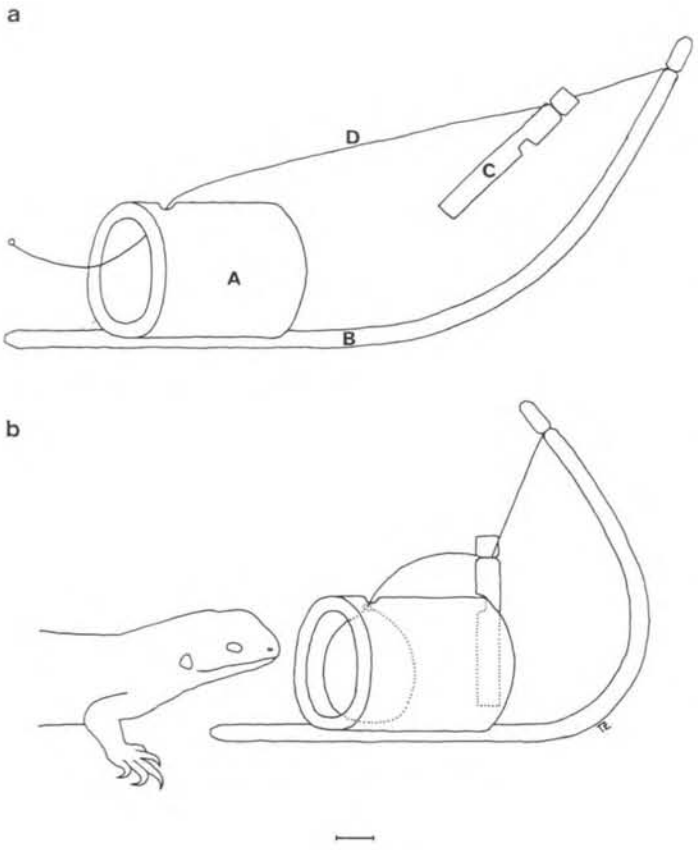


FIG. 1. Schematic drawing of the described bamboo trap (a, in resting position and b, armed). A: rigid bamboo cane, B: flexible bamboo stick, C: rigid bamboo wedge, D: nylon line. Scale bar equals 10 mm.

Local children reported capturing up to 20 to 30 lizards per day, depending on the number of traps used and the number of inhabited burrows found. However, lizards are less likely to exit their burrow entrances with a trap present and sometimes try to dig another way out. Writing about *Leiolepis belliana*, Smith (1935) probably referred to the same trapping technique used by Thai hunters in his statement "The Siamese trap them by means of a cleverly constructed spring noose placed at the entrance to the burrow." An advantage of this effective trapping technique is that lizard burrows do not have to be destroyed. Because it mainly consists of natural products, the trap is inexpensive (about $0.50 per trap in 1998), and it is easily constructed and used. It also should be possible to construct such a trap from other materials such as timber or plastic, and to apply the trapping technique to other burrow-inhabiting species. For example, it could be used to capture spiny-tailed lizards (*Uromastyx*), the sister group of the genus *Leiolepis* (Moody 1980; Peters 1971). Vyas (1990) already presented a similar trapping technique to capture *Uromastyx hardwickii* by using a plastic noose set at the entrance of the lizard's burrow and tied to a long stick. Leaving its burrow, the lizard passes the noose, which snares the lizard anterior to the hind limbs. When the lizard reenters its burrow, the long stick acts as an anchor at the relatively smaller entrance. According to Vyas (1990) a trapper may catch 50 to 80 lizards in a day using this simple method. Bouskila (1985) described another interesting method for capturing *Uromastyx aegyptia* and other burrow-inhabiting lizards using a "hooped fishing net trap" instead of a noose (for trapping of burrow-inhabiting tortoises, see Recht 1981).



FIG. 2. The trap at the entrance to a burrow of *Leiolepis r. reevesii* at Cua Lo beach, Vietnam.

Although I present a Vietnamese trapping technique for scientific purposes, it should be mentioned that laws exist in Vietnam since 1989 concerning the protection of endangered fauna, and since 1992 restricting or prohibiting the trade of endangered species. According to the Red Data Book of Vietnam (Ministry of Science, Technology and Environment 1992) *Leiolepis belliana guttata*, currently *Leiolepis guttata* (Peters 1971, Darevsky and Kupriyanova 1993) is listed in the category "threatened."

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Estimating Egg Mass in Lizards Using X-radiography

MICHAEL J. ANGILLETTA JR.
Department of Biology, University of Pennsylvania
Philadelphia, Pennsylvania 19104-6018, USA
e-mail: angillet@sas.upenn.edu

Data on age-specific reproduction are critical to testing life history theory, and frequently yield greater insight regarding the evolution of life histories (Stearns 1992). Such data can be difficult to acquire for reptiles in natural populations, because determination of egg masses and clutch mass may require destructive sampling or that individuals be maintained in captivity until oviposition. X-radiography is a non-invasive means of determining egg number and egg size in reptiles (Gibbons and Greene 1979; Hinton et al. 1997; but see Kuchling 1998), and has been widely used on individuals to determine population demographics (e.g., Congdon and van Loben Sels 1991, 1993). Another potential application of X-radiography is estimation of egg mass (Congdon et al. 1983; Girardin 1993). Here, I demonstrate that: 1) X-radiography produces adequate resolution of eggs in small lizards, and 2) egg dimensions can be used to accurately predict egg mass in the lizard *Sceloporus undulatus*. These data suggest that X-radiography is a valuable tool for measuring age-specific reproductive traits in lizards.

In the springs of 1997 and 1998, I collected gravid females of *S. undulatus* on the Savannah River Site, Aiken, South Carolina, USA. X-radiographs of these females were made with a table-top unit (Emerald 130, Eureka Xray Tube Co., Chicago, Illinois, USA). Lizards were photographed while lying on their dorsal surface, at a distance of 100 cm from the X-ray tube, using Cronex 10 film and a fast detail screen (STERLING Diagnostic Imaging, Newark, Delaware, USA). X-radiographs were taken over a wide range of output settings to determine settings that maximized clarity of eggs.

To determine the relationship between egg size and egg mass, I used eggs laid by gravid *S. undulatus* in the laboratory. Gravid females were collected from a population in Burlington County, New Jersey, USA, during the summers of 1997 and 1998. Females were transported to the laboratory, where they were maintained in 6 L terraria on a layer of damp sand or sphagnum moss. Terraria were checked twice daily for newly laid eggs. When eggs were discovered they were removed and weighed to the nearest 0.01 mg using an electronic balance. Egg width and egg length were measured to the nearest 0.01 mm with digital calipers. I used multiple linear regression to produce a model to predict egg mass based on egg length and egg width.

A sensitivity analysis of the model was performed to determine the accuracy with which egg length and egg width must be measured to satisfy the requirement of estimating egg mass within 5% of actual mass. Average length and average width were used as values for the regression model parameters to calculate a reference value for predicted egg mass. Length or width was then varied systematically in 1% intervals and predicted egg mass was recalculated. Percent deviation of the new prediction from the reference value was used as an indication of percent error in estimation of egg mass associated with a given percent error in measurement of egg length or egg width.

A total of 175 eggs from 22 females were measured. Both egg length and egg width were significantly correlated with egg mass (Fig. 1). Multiple linear regression produced the following model, relating egg length (L), egg width (W), and egg mass (M),

$$M = 0.0378 \cdot L + 0.081 \cdot W - 0.682$$

The model explained 92% of the variation in egg mass ($F_{2,172} = 965.51$, $p < 0.01$, adj. $r^2 = 0.92$). The average residual was $3 \cdot 10^{-10} \pm 0.002$ indicating that the data were distributed evenly around the regression line. When the regression equation was used to predict egg mass for the 175 eggs, average error in predicted egg mass was $0.1 \pm 0.6\%$. The absolute deviation of predicted egg mass from actual egg mass averaged $3.1 \pm 0.4\%$. Thus, the regression equation was capable of predicting egg mass with high accuracy.

Using X-radiography procedures described above, I obtained clear images of lizard eggs. An output of 5 mAs and 44 kV provided the sharpest detail for measurement of egg dimensions (Fig. 2). Similar output can be achieved using a less expensive, portable X-ray unit (Model 903, MinXray Inc., Northbrook, Illinois, USA). Therefore, X-radiographs can be taken at a remote field station or, if necessary, in the field. Such a design would permit determination of egg mass and clutch mass with little disturbance, and would be ideal for use with animals included in demographic studies.

Measurements of egg dimensions from X-radiographs should produce highly accurate estimates of egg mass. Sensitivity analysis

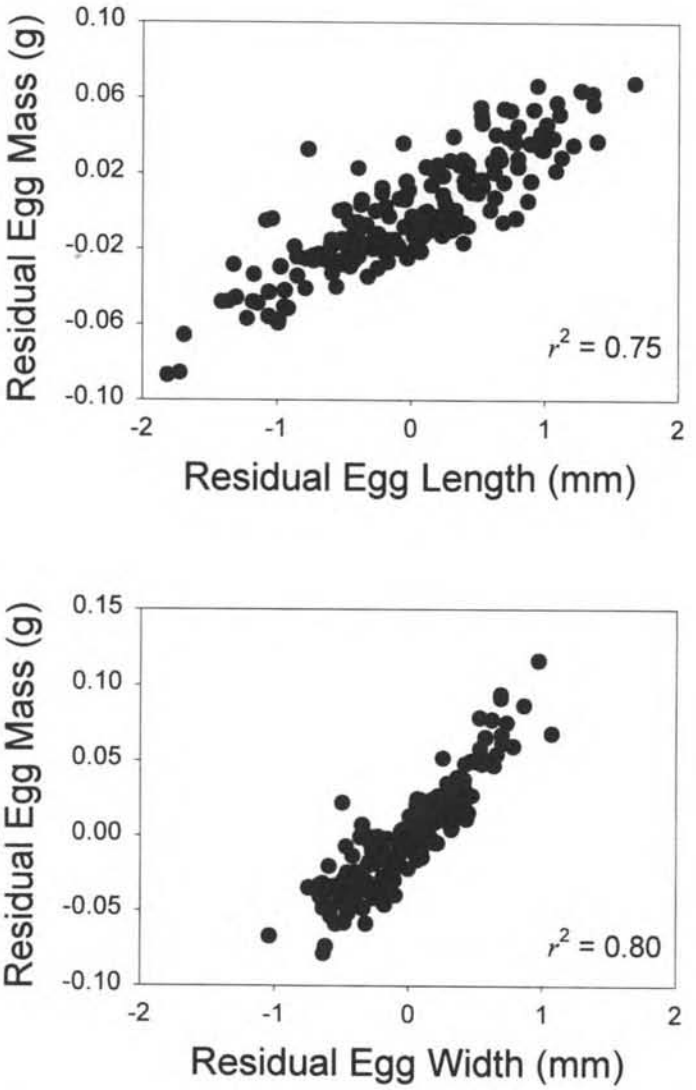


FIG. 1. Relationships between residual egg dimensions and residual egg mass in the lizard *Sceloporus undulatus*. Partial correlations for both egg length (N = 172, $t = 22.6$, $p < 0.001$) and egg width (N = 172, $t = 26.2$, $p < 0.001$) were highly significant.



FIG. 2. X-radiograph of a gravid female obtained with an output of 5 mAs and 44 kV (see text for details). This individual was carrying eight eggs, all of which were clearly visible and could be measured directly from the X-radiograph.

indicates that a deviation of less than 5% from actual egg mass requires that egg length and egg width each be measured within 0.17 mm of actual values. This is a very reasonable margin of error, considering the accuracy of digital calipers (± 0.01 mm). The most likely source of error in egg dimensions is magnification of the image, caused by the X-ray technique (≈6.4%, Congdon and van Loben Sels 1991). The magnitude of error caused by image distortion can be reduced by including objects of standard length in each X-radiograph, which can be used to determine a correction factor for egg dimensions (Graham and Petokas 1989). To assess the accuracy of egg dimensions determined from X-radiographs, I measured egg dimensions of a clutch of eggs laid one day after being X-rayed. On average, egg length and egg width measured from X-radiographs deviated 0.15 mm and 0.13 mm, respectively, from measures of actual eggs (N = 5), which would result in an average error in egg mass estimation of 4%. At least one source of error would be eliminated when egg dimensions are obtained from X-radiographs. Because lizard eggs have a flexible shell, measures of egg dimensions are prone to error resulting from compression of the egg. X-radiographs provide a fixed image for measurement, eliminating errors resulting from compression by hands or calipers.

I conclude that egg mass, and thus reproductive output and relative clutch mass, in *S. undulatus* can be inferred from dimensional measurements of eggs in X-radiographs. This technique provides a valuable tool for following reproductive output of individuals in a demographic setting, and will add to our existing knowledge of reproductive patterns in reptiles. Undoubtedly, predictive equations for estimating egg mass from X-radiographs can be generated for other species (e.g., Girardin et al. 1993). Future studies of reproductive allocation should exploit the advantages of X-radiography to determine aspects of offspring size, as well as offspring number.

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A Simple Device for Safely Capturing Herpetofauna from Roads: The "Herp Scoop"

GREGORY A. SIEVERT
Division of Biological Sciences
Emporia State University
Emporia, Kansas 66801, USA
e-mail: sievertg@emporia.edu

PAUL T. ANDREADIS
Department of Ecology and Evolutionary Biology
569 Dabney Hall, University of Tennessee
Knoxville, Tennessee 37996, USA
e-mail: nerodia@utk.edu

and

TODD S. CAMPBELL
Department of Ecology and Evolutionary Biology
569 Dabney Hall, University of Tennessee
Knoxville, Tennessee 37996, USA
e-mail: lizardman@utk.edu

How many times have you been collecting on a rainy night and seen a salamander wriggling across the road? You stop the car and jump out to get the slippery creature, only to see the high-beams of a car quickly coming up behind you. You are left with three choices: 1) step off to the side of the road and watch the animal get crushed; 2) try to quickly grab the small, slippery animal (a difficult task on flat, wet roads); or 3) get back in your car and drive off, never knowing the identity of the animal or if the animal survived. Even if you do manage to capture the animal, when you rush back to your dark car and drive off, the wet squirming animal may escape into the vehicle before you can secure it into a container. Shaffer and Juterbock (1994) also suggest that night driving to collect herpetofauna can be dangerous and that safety issues should be considered. After many frustrating encounters while night driving, we developed a simple, inexpensive device for quickly and safely retrieving amphibians, reptiles, and other small animals. Our device functions similarly to the skink scooper (Brattstrom 1996), but

has the additional advantage of being transparent and having a very pliable lip. This flexibility allows the scoop to be pressed flush against uneven surfaces.

The device is made from a one-, two-, or three-liter clear polyethylene soft drink bottle. Soft drink bottles equipped with thicker opaque, plastic bases work best for lids, as they provide a snug fit when pushed into the bottle opening. Most soft drink companies have stopped putting the thicker opaque bases on their bottles, but the naked bases still provide a relatively snug fit.

The scoop is constructed by cutting the bottom off of the bottle just above the opaque base, or if the bottle lacks a base, the cut can be made 1–2 cm above the point where the base tapers inward (Figs. 1A and B). The base is inverted and pushed into the opening of the bottle to form a snug-fitting lid.

A V-shaped notch about 3–5 cm wide and about 2 cm deep should be cut into the bottom lip of the bottle (Fig. 1C). Placing the notched side of the bottle on the roadway greatly facilitates the capture of small animals that tend to dart off in random directions, because it allows the collector to position the animal head-first and part way inside the bottle prior to capture. The animal is then prodded with the bottle base or a finger to run into the scoop. The notch improves capture rate substantially and also provides a convenient place to grasp the base/lid when removing it from the scoop. The scoop's versatility can be increased by making two different-sized notches on opposite edges of the bottle opening.

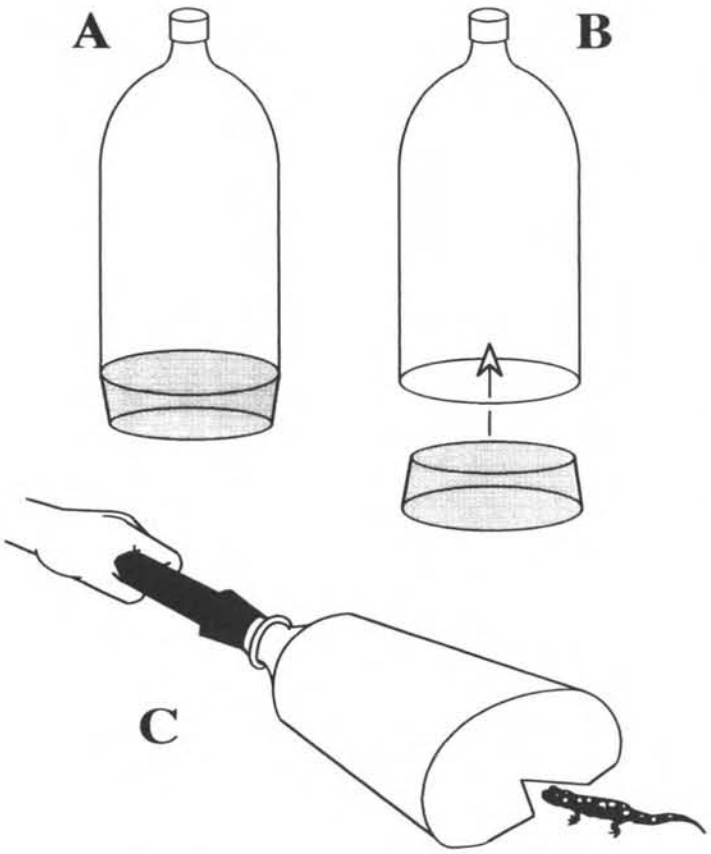


FIG. 1. The scoop is made from (A) a polyethylene soft drink bottle with (B) the base cut off and inverted to act as a lid. (C) A V-shaped notch and a flashlight should be added to make the scoop more useful.

On the other end, the screw cap can either be left on the bottle, removed to form an air hole or access port, or replaced with a small flashlight to make it more useful at night (Fig. 1C). The Tuff Lite® by Garrity® fits best in 3-L bottles, uses two 'AA' batteries, and has the on/off switch in the end of the flashlight. Depending on the soft drink brand, the opening may have to be enlarged slightly using fine sandpaper. The rubber covering on the end of the Tuff Lite® should be peeled back so that the end of the flashlight can be inserted into the opening, then the rubber sheath is rolled back onto the threads of the bottle mouth. By doing this, the rubber covering grips the threads and holds the flashlight securely on the scoop. To avoid losing the screw cap when using the flashlight, the cap can be attached to the inside of the original base with velcro, or connected to the neck of the bottle with a short, knotted string punched through the center of the cap. At night, the light aids in positioning the notch, helps to disorient the animal momentarily prior to capture, and effectively illuminates the animal after capture so it can be identified. The modified herp scoop can be completely assembled for under US $5.00 which includes the cost of the flashlight.

We have found the modified herp scoop very useful for rapidly catching many species of herpetofauna on wet roadways. We have even used this device to capture large ranids (*Rana*), small venomous snakes (*Agkistrodon* and *Sistrurus*), musk-emitting snakes (*Thamnophis* and *Nerodia*), tarantulas, and small mice on the road at night. When captive sirens (*Siren*) or amphiumas (*Amphiuma*) jump out of their tanks onto the floor, the herp scoop is helpful in retrieving them and could also be used in capturing them from seines or dredges.

A major advantage of the scoop is that the pliable plastic can be molded to fit irregular surfaces. While it conforms nicely to road surfaces, the scoop is also effective for catching salamanders in rock crevices, cliff faces, or rocky stream beds. Since salamanders often sit with their heads extending from their retreat, it is best to hold the scoop vertically with the opening molded to fit the lip of the retreat. The salamander can often be coaxed out of the retreat and into the scoop by gently touching its tail or back with a slender stick. Although this technique works extremely well, the real advantages of this inexpensive device are more often realized during road cruises conducted during rainy nights on busy roadways, where concern for personal safety often conflicts with successful animal collection.

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A Novel Snake Restraint Device

RICHARD E. MAULDIN
and
RICHARD M. ENGEMAN
National Wildlife Research Center
4101 LaPorte Avenue, Fort Collins, Colorado 80521-2154, USA

The restraint and immobilization of snakes without the use of chemicals have a variety of research and veterinary applications. These applications include scale counts, band counts, and delicate invasive procedures like blood or tissue sampling and introduction of an oral catheter. Techniques requiring secured snakes are usually accomplished by two handlers, one holding the snake and the other performing the procedure. A wide variety of snake restraint devices and techniques have been described. Some involve allowing snakes to crawl into transparent plastic tubes which are either flexible (Johansen 1959; Sutherland and Hampton 1961), or rigid (Presst 1971), or made of a series of rigid tubes with decreasing diameters (Murphy 1971). Noose or strap sticks frequently have been used (Bellairs 1967; Conant 1958; Fowler 1978; Gregory et al. 1989; Schmidt and Davis 1941) and have been combined with clear plastic tubing to form a "noose tube" (King and Duvall 1984). Many devices have involved using tape or Velcro strips to restrain snakes against flat boards (Ward and Harrell 1978) or wooden dowels (McDonald 1964), or in wooden troughs (Luck and Keebler 1929). Lidded buckets with notched lips have allowed the snake's posterior half to be handled while the head was restrained in the bucket (Gillingham et al. 1983), while plastic freezer containers with holes in the lid have also been used to hold a snake's head during handling (Freed and Freed 1983).

These methods have been useful in various circumstances, but they also have limitations. Some limit the handler's access to all parts of the snake, while others leave enough of the snake unrestrained that injury to the animal can occur as it struggles to escape. Many of these techniques require construction of the restraining device. Here we describe a device which can be purchased and used "off the shelf," and a method whereby a single individual can immobilize a snake in a straight position indefinitely.

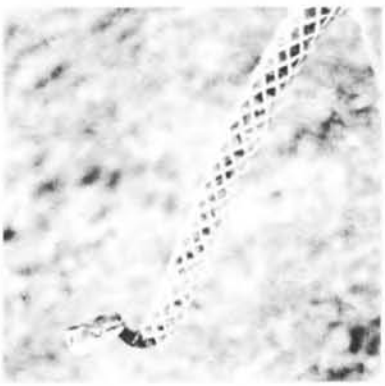


FIG. 1. An effectively immobilized California kingsnake (*Lampropeltus getula californiae*).

Wire mesh cable holders operate on the same principles as a finger puzzle, a tube of woven fiber which, when longitudinally compressed, allows the insertion of cylindrical objects. Subsequent longitudinal extension of the tube tightens the fibers around the object, preventing its withdrawal. Cable holders are available through electrical equipment suppliers and come in a variety of lengths and diameters. Compression of the ends of the cable holder toward the center maximizes the internal diameter for insertion of the snake. The handles of the cable holder are double-looped and easily spread at the time of insertion, although we find that modification of the handles by cutting the loops and putting caps on the wire ends increases the ease of operation. After the snake is advanced through the cable holder to the desired position, the cable holder is drawn to full length by pulling on the handles. This secures the snake in a rigid, straight position and permits it to be controlled by one person using one hand. The wide gaps of the mesh of the cable holders permit easy visual observations, such as scales counts, and invasive procedures, such as blood draws. Optimum immobilization and stability are achieved if the size of the internal diameter of the cable holder is selected correctly for the size of the snake (Figs. 1–2). The diameter of the snake should be slightly greater than the diameter of the tightened cable holder. We have successfully applied this device to a variety of species besides those in the figures, including bullsnake (*Pituophis melanoleucas*), corn snake (*Elaphe guttata*), Dumeril's boa (*Acrantophis dumerili*), and Haitian boa (*Epicrates striatus striatus*). We have not attempted to insert any dangerously venomous snakes into a cable holder, although once properly secured in a cable holder of appropriate size, manipulations should be easily conducted in a safe manner.



FIG. 2. The effects of using a cable holder with too large diameter, allowing a brown tree snake (*Boiga irregularis*) too far beyond the end of the cable holder.

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GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 30, Number 1 (March 1999).

CAUDATA

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: TENNESSEE: Blount Co: Great Smoky Mountains National Park, Gum Swamp in Cade's Cove (35°35'21"N, 83°50'21"W). 9 June 1998. C. Kenneth Dodd, Jr. and Marian L. Griffey. National Museum of Natural History and Great Smoky Mountains National Park photographic archives. Verified by Steve Tilley. Two adults found under logs on the west side of the swamp. Collected 1515–1650 h (air temp 18°C, substrate temp 16°C, relative humidity 77%); Great Smoky Mountains National Park, 3 sinkhole ponds located ca. 1.2 km E Crib Gap on Cades Cove Road (250–300 m downhill [NE] from Finley Cane trailhead) (35°36'38"N, 83°44'39"W). 4 July 1998. C. Kenneth Dodd, Jr. and Marian L. Griffey. USNM 524377–8. Verified by Steve Gotte. Large numbers of larvae found in Sinkhole Ponds 1 and 2. USNM 524378 consists of nine larvae (20.6–24.6 mm SVL, mean = 23.2) collected from rapidly drying Sinkhole Pond 1. USNM 524377 is a single recently transformed juvenile (18.3 mm SVL, 29.5 mm total length) found under cover adjacent to dry Sinkhole Pond 3. Additional larvae (N = 5; 18.8–22.0 mm SVL, mean = 20.0) from Sinkhole Pond 1 are deposited in the collection of Great Smoky Mountains National Park. New Park and county records (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94). Extends the range of the Mole Salamander ca. 50 km NE from the nearest known populations in Monroe County, Tennessee, and verifys Huheey and Stupka's (1967, Amphibians and Reptiles of Great Smoky Mountains National Park. Univ. Tennessee Press, Knoxville. 98 pp) speculation that this species eventually might be found within the Park. Collections were made under permits from Great Smoky Mountains National Park (GRSM-98-017) and the Tennessee Wildlife Resources Agency (No. 1103).

Submitted by **C. KENNETH DODD, JR.** and **MARIAN L. GRIFFEY**, U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA.

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: TENNESSEE: Henderson Co: 0.6 km N Jones Road off Rt. 22A (35°36.67'N, 88°26.13'W). 4 May 1998. B. P. Butterfield, B. Britt, and J. Hobbs. Austin Peay State University (APSU 5994). Verified by Floyd Scott. First county record with exact locality data (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **BRIAN P. BUTTERFIELD, BRYAN BRITT**, and **JEREMY HOBBS**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

BOLITOGLOSSA BORBURATA: VENEZUELA: YARACUY: Fila la Guerrillera, Sierra de Aroa. 600 m elev. 10 August 1995. R. Rivero. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 3173). Verified by Oswaldo Fuentes. First record for state of Yaracuy and outside of the Venezuelan Central Coastal Range. Previous localities were all in the states of Aragua and Carabobo (Brame and Wake 1963, Contrib. Sci. Nat. Hist. Mus. Los Angeles County 69), being at their nearest 100 km E of this record.

Submitted by **CÉSAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

NECTURUS MACULOSUS (Common Mudpuppy). USA: KENTUCKY: Kenton Co: Covington, Devou Park, in Prisoner's Lake (39°04.996'N, 84°32.133'W). September 1996. D. McCoy and R. Lohre. Cincinnati Museum of Natural History Herpetological Photographs (CMNH HP4–8). Verified by William S. Bryant. First specimen from county since 1933; previous specimen from Baker Hunt Foundation Museum lost (Kentucky Amphibian and Reptile Museum Voucher Database at the Thomas More College Ohio River Biological Field Station).

Submitted by **RICK G. LOHRE, DEAN R. McCOY**, and **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.

NOTOPHTHALMUS VIRIDESCENS LOUISIANENSIS (Central Newt). USA: TENNESSEE: Henderson Co: 0.6 km N Jones Road off Rt. 22A (35°36.67'N, 88°26.13'W). 4 May 1998. B. P. Butterfield, B. Britt, and J. Hobbs. Austin Peay State University (APSU 5995). Verified by Floyd Scott. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **BRIAN P. BUTTERFIELD, BRYAN BRITT**, and **JEREMY HOBBS**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

THORIUS MINYDEMUS (Minute Pigmy Salamander). MÉXICO: VERACRUZ: 6 km ENE Chiconquiaco, on Microondas Road "Loma Alta," (19°45.29'N, 96°46.97'W), 2160 m. 16 October 1997. M. García-Paris, G. Parra, and D. B. Wake. MVZ 229269. Verified by D. B. Wake and J. Hanken. Range extension of 25 km NE (by air) from vicinity of La Joya (19°38.08'N, 97°09.13'W) (Hanken and Wake 1998. Copeia 1998:312–345). This report represents the northernmost locality for the genus *Thorius*.

Submitted by **G. PARRA-OLEA**, and **M. GARCIA-PARIS**, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA.

ANURA

ACRIS CREPITANS CREPITANS (Northern Cricket Frog). USA: TENNESSEE: Chester Co: 2 km E Jacks Creek off McAdams Road (35°28.02'N, 88°29.74'W). 26 March 1998. B. P. Butterfield, R. Sharp, and M. Williams. Austin Peay State University Museum of Zoology (APSU 5996). Verified by Floyd Scott. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **BRIAN P. BUTTERFIELD, RACHEL SHARP**, and **MELISSA WILLIAMS**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

BUFO CAMPBELLI. (Campbell's Forest Toad). HONDURAS: Departamento de Gracias a Dios: ca. 30 km south of Mocorón. 10 June 1997. C. J. Franklin and J. Franklin. UTA-A 50474. Verified by J. A. Campbell. New departmental record (Meyer and Wilson 1971. Los Angeles Co. Mus. Nat. Hist. Contr. Sci. 218:1–47).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R. L. Thornton Fwy (I-35), Dallas, Texas 75203, USA (e-mail: HERPKING@ix.netcom.com) and **JACQUELINE FRANKLIN**, Louise Wolf Kahn Elementary School, 610 Franklin Avenue, Dallas, Texas 75211, USA.

BUFO CAMPBELLI (Campbell's Forest Toad). BELIZE: STANN CREEK DISTRICT: Sabal's Cassava Farm, 9 km S Dangriga on the Southern Highway. 15–23 March 1998. Omar Attum. University of Louisville Museum (UL 10002). Verified by Peter Sherman. *Bufo campbelli* has been confused with *B. valliceps* (Mendelson 1994, Occ. Pap. Mus. Nat. Hist. Univ. Kansas 166:1–21) and as a result, its true distribution in Belize is not known (Meyer and Foster 1996, A Guide to the Frogs and Toads of Belize. Krieger Publ. Co., Malabar, Florida. 80 pp). Mendelson (1994, *op. cit.*) suggested that *B. campbelli* is restricted in Belize to areas of primary rainforest in the Maya mountains of the Toledo district. The Stann Creek record was found in a cultivated area where cassava and citrus are grown. This record documents a new district record and refutes earlier claims that this toad is restricted to primary rainforests on low mountain slopes.

Submitted by **OMAR ATTUM**, Department of Biology, University of Louisville, Louisville, Kentucky 40292, USA, and **PERRY EASON**, Department of Biology, University of Louisville, Louisville Kentucky 40292, USA.

BUFO COGNATUS (Great Plains Toad) USA: ARIZONA: Coconino Co: North of Williams, Robinson's Dam, Cataract (= Havasu) Canyon. 20 July 1938. M. A. Wetherill. Museum of Northern Arizona (MNA 2773). Verified by Charles H. Lowe. First record for Grand Canyon National Park area (Miller et al. 1982, Amphibians and Reptiles of the Grand Canyon National Park. Grand Canyon Nat. Hist. Assoc. Monogr. No. 4. 144 pp.). Fills gap between eastern Coconino County, Arizona and Clark County, Nevada (Krupa 1990, Cat. Amer. Amph. Rept. 457.1–457.8).

Submitted by **DAVID A. ROSS**, Herpetology Laboratory, Department of Biological Sciences, Campus Box 8007, Idaho State University, Pocatello, Idaho 83209-8007, USA.

COCHRANELLA GRANULOSA. HONDURAS: OLANCHO: Quebrada de Las Marías (15°18'N, 85°21'W), 680 m elev. 3 August 1998. J. R. McCranie, K. L. Williams and L. D. Wilson. USNM 529986. Verified by J. M. Savage. First record for country; extends range ca. 160 airline km N of the site at 3 km SE Ayapal at Río Curinwas, Departamento de Jinotega, Nicaragua (Köhler and Seipp 1998, Natur und Mus. 128:170–175).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA, **LARRY DAVID WILSON**, Department of Biology, Miami-Dade Community College, Kendall Campus, Miami, Florida 33176, USA, and **KENNETH L. WILLIAMS**, Department of Life Sciences, Northwestern State University of Louisiana, Natchitoches, Louisiana 71497, USA.

ELACHISTOCLEIS BICOLOR. ARGENTINA: CÓRDOBA: Barreto (33°20'43"S, 63°18'20"W, 153 m elev.), Km 148, Ruta provincial No. 4. 9 March 1999. A. L. Martino. Herpetological Collection of Universidad Nacional de Río Cuarto, Ecología (UNRC ECO637–638). Verified by R. Martori. New locality record, previously known only from one locality in Córdoba Province (Río Calamuchita, Villa María) (Gallego and Giménez 1998, Cuad. Herp., 12[1]:49). Extends range 105 km S in the center of Argentina. The two males (SVL 28 mm and 29 mm) were collected while they were calling in a temporary pond in the afternoon.

Submitted by **ADOLFO L. MARTINO**, **SUSANA JIMÉNEZ TEJEDOR,** and **ISMAEL E. DI TADA**, Ecología, Departamento de Ciencias Naturales, Facultad de Ciencias Exactas, Físico-Químicas y Naturales, Universidad Nacional de Río Cuarto, Km 601, Ruta Nacional No. 36, (5800) Río Cuarto, Córdoba, Argentina (e-mail [ALM]: amartino@exa.unrc.edu.ar).

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: FLORIDA: Franklin Co: W edge Apalachicola along Rt. 98. 25 December 1998. K. J. Irwin, L. Irwin, N. Weaver, S. L. Collins, and J. T. Collins. KU 288624–627. Verified by Joseph T. Collins. New county record and first record of this alien species within the Apalachicola lowlands of the Florida panhandle (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.).

Submitted by **KELLY J. IRWIN**, Museum of Natural History, University of Georgia, Athens, Georgia 30602-1882, USA (e-mail: kjirwin@arches.uga.edu).

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: FLORIDA: Franklin Co: Timber Island, SW of Carrabelle. 7 March 1999. K. L. Krysko and A. T. Reppas. Verified by David Auth. Florida Museum of Natural History, University of Florida (UF 117393). New county record and second record of this non-indigenous species within the Apalachicola Lowlands in the Florida panhandle (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.).

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, and Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA (e-mail: kenneyk@flmnh.ufl.edu), and **ANTHONY T. REPPAS**, Florida Museum of Natural History, Division of Herpetology, University of Florida, Gainesville, Florida 32611, USA.

***GASTROTHECA OVIFERA*:** VENEZUELA: YARACUY: Los Bacos, Sierra de Aroa. 1600 m elev. 21 April 1996. R. Rivero. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 3325). Verified by G. Rivas. First record for the state of Yaracuy, 100 km W from previous localities known in other northern states: Aragua, Carabobo and Distrito Federal (Rivero 1961, Bull. Mus. Comp. Zool., 126[1]), all in the Venezuelan Coastal Range. This record constitutes the first locality outside of this mountain range.

Submitted by **CÉSAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

GASTROTHECA WALKERI: VENEZUELA: YARACUY: Hacienda El Jaguar, 15 km NNW Aroa, La Horqueta. 13 April 1994. R. Rivero. Museo de la Estación Biológica Rancho Grande, Maracay, Venezuela (EBRG 2744). Verified by G. Rivas. First record for the state of Yaracuy. Previously known only from a few localities in Distrito Federal and Aragua (Duellman 1980, Occas. Pap. Mus. Zool. Univ. Michigan 690:1–7) in the central Venezuelan Coastal Range. This record constitutes an extension of the range of the species 140 km W of previous localities known, and the only record outside of the Venezuelan Coastal Range.

Submitted by **CÉSAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

HYLA LANCIFORMIS. (Rana Lanceolada Común, Lancehead Treefrog). VENEZUELA: TÁCHIRA, Represa Uribante,1100 m elev. 5 July 1985. R. Pérez. Colección de Vertebrados, Facultad de

Ciencias, Universidad de los Andes, Mérida, Venezuela (CVULA 3858). Verified by O. Fuentes; Quebrada Honda, Potosí. No date (CVULA 3307). Grupo de Ecología Animal. Verified by D. Torres; La Alcantarilla, Uribante. 18 July 1985. (CVULA 3860). Proyecto Uribante-Caparo, ULA. Verified by L. F. Navarrete. *Hyla lanciformis* was known to have a distribution in Venezuela similar to that of *Hyla lanciformis guerreroi*, based on specimens from Guatopo, Estado Miranda, in the north-central part of the country. McDiarmid and Paolillo (1988, *In* Brewer Carías (ed.), Cerro de la Neblina, Resultados de la Expedición 1983–1987. FUDECI, Caracas) reported the nominal form from the River Baría at the S edge of Estado Amazonas, indicating that voucher specimens from that area were deposited in the American Museum Natural of History, New York (AMNH), United States National Museum of Natural History, Washington, D.C. (USNM), and Museum of Biology of the Central University of Venezuela, Caracas (MBUCV). We located the catalog numbers of these vouchers (MBUCV 131168–69). Péfaur and Díaz de Pascual [1987, Rev. Ecol. Latinoamerica 1(3–4): 9–19] mention this species from the state of Barinas in the Andean piedmont in the western part of the country, but without indicating the catalog numbers of the specimens. The animals to which they referred, collected in La Soledad, Barinas, are deposited in the Colección de Vertebrados, Facultad de Ciencias, Universidad de los Andes, Mérida, Venezuela (CVULA 2138, 2247, 2689, 2719–20). These records increase the distribution of the species about 700 km to the WSW from Guatopo and about 1000 km to the NW of the Río Baría.

Submitted by **CÉSAR LUIS BARRIO A.**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve), **ANDRÉS ORELLANA**, Apartado Postal 210, 5101-A, Mérida, Venezuela (e-mail: aorell@ciens.ula.ve), and **ROGER MANRIQUE**, Apartado Postal 210, 5101-A, Mérida, Venezuela.

HYLA SCHUBARTI. BOLIVIA: PANDO: Cobija, Río Acre, Province Nicolás Suárez (11°02'S, 68°46'W). 15 February 1982. C. M. Fugler. USNM 281678–682. Verified by W. R. Heyer. First record for the country. Presence was predicted by De la Riva (1990, Boll. Mus. reg. Sci. Nat. Torino 8[1]:261–319). The nearest record is at Cuzco Amazónico, Peru (69°05'S, 12°35'W) (Duellman and Salas 1991, Occas. Pap. Mus. Nat. Hist. Univ. Kansas 143:1–13).

Submitted by **IGNACIO DE LA RIVA,** Museo Nacional de Ciencias Naturales, C/ José Gutiérrez Abascal 2, 28006 Madrid, Spain.

HYLA WAVRINI (Upper Orinoco Treefrog). BRAZIL: AMAPÁ: Amapá: Fazenda Itapuã (2°03'N, 50°48'W). 7 July 1997. A. K. Péres Jr., D. S. Zamboni, and Guarino R. Colli. Coleção Herpetológica da Universidade de Brasília (CHUNB 02676). Verified by M. T. U. Rodrigues. First record for the state of Amapá; calling from a small tree next to a stream in gallery forest within a large patch of Amazonian Savanna. Extends range ca. 654 km NE from previous eastern limit of distribution (Alter do Chão, near Santarém; Hoogmoed 1990, Zool. Med. Leiden 64[6]:71–93).

Submitted by **AYRTON K. PÉRES, JR.** and **GUARINO R. COLLI**, Departamento de Zoologia, Universidade de Brasília, 70910-900, Brasília, Distrito Federal, Brazil (e-mail: grcolli@unb.br).

PSEUDACRIS CRUCIFER. (Spring Peeper). KANSAS: LINN CO: center Sec. 16, T21S, R25E. 3 April 1999. Joseph T. Collins and Suzanne L. Collins. KU 288677. Verified by John E. Simmons. Discovery of this population corroborates a 63-year old record (KU 20359) collected in the same county on 9 April 1936. Single adult male taken as voucher from a chorus of ± 20 specimens. Other anurans chorusing or present at same site were *Bufo americanus, Hyla chrysoscelis/H. versicolor, Pseudacris triseriata, Rana catesbeiana,* and *Rana sphenocephala.*

Submitted by **SUZANNE L. COLLINS**, The Center for North American Amphibians and Reptiles, 1502 Medinah Circle, Lawrence, Kansas 66047, USA, and **JOSEPH T. COLLINS**, Kansas Biological Survey, 2041 Constant Avenue, Lawrence, Kansas 66047, USA.

RANA CLAMITANS CLAMITANS (Bronze Frog). USA: TENNESSEE: HAYWOOD CO: Hatchie National Wildlife Refuge, Oneal Lake (35°29.96'N, 89°15.89'W). 24 April 1998. B. P. Butterfield, M. Hargreaves, and A. Reed. Austin Peay State University Museum of Zoology (APSU 5995). Verified by Floyd Scott. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **BRIAN P. BUTTERFIELD, MICHELLE HARGREAVES**, and **AKEIA REED**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

SCAPHIOPUS COUCHII (Couch's Spadefoot) USA: COLORADO: BENT CO: found in town of Hasty, Colorado, following rain (Sec. 25, T22S, R50W, 1185 m elev.). 2 October 1990. The specimen is catalogued as BS/FC 7773 in the U.S. Geological Survey, Biological Survey Collection, in the Museum of Southwestern Biology, University of New Mexico, Albuquerque (USNM 155835). Verified by Stephen Corn. New county record; this locality represents an ENE range extension of ca. 30 miles (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639-0017, USA, **DEAN E. BIGGINS**, U.S. Geological Survey, Biological Resources Division, Midcontinent Ecological Science Center, 4512 McMurry Avenue, Ft. Collins, Colorado 80525-3400, USA, and **BRIAN MILLER**, Conservation Department, Denver Zoological Foundation, 2300 Steele Street, Denver, Colorado 80205-4899, USA.

SCINAX PERERECA. ARGENTINA: MISIONES: DEPARTAMENTO GENERAL BELGRANO: 30 km E Bernardo de Irigoyen. November 1986. M. Canevari and G. R. Carrizo. Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina (MACN 33042–43). Deseado: Km 2, Ruta Provincial 19. 11 January 1995. J. Faivovich. MACN 36957–59. DEPARTAMENTO GUARANY: San Vicente: Campo anexo INTA "Cuartel Rio Victoria" Ruta nacional 14, Km 1272. 7–20 February 1994. M. López, J. C. Basiluk, and J. Faivovich. MACN 35096–105 and, 5 February 1995, Fundación Miguel Lillo, Tucumán, Argentina (FML 7931–32). DEPARTAMENTO CAINGUÁS: Aristóbulo del Valle: Balneario Cuña Pirú. 6 October 1997. A. Giraudo and R. Abramson. MACN 36833–35. All verified by G. J. Scrocchi. Extend the known range of species (Pombal et al. 1995, J. Herpetol. 29:1–6) ca. 550 km SW and constitute the first records of the species for Argentina.

Submitted by **JULIÁN FAIVOVICH** and **GUSTAVO R. CARRIZO**, División Herpetología, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Avenida Angel Gallardo 470 (1405) Buenos Aires, Argentina (e-mail: jfaiv@tecnolab.com.ar).

SCARTHYLA OSTINODACTYLA. BOLIVIA: PANDO: Cobija, Río Acre, Province Nicolás Suárez (11°02'S, 68°46'W). 11 February 1982. C. M. Fugler. USNM 281671. Verified by W. R. Heyer. First record for the country. Presence was predicted by De la Riva (1990, Boll. Mus. reg. Sci. Nat. Torino 8[1]:261–319), because the type locality is only 175 km from Cuzco Amazónico, Peru (69°05'S, 12°35'W) (Duellman and De Sá 1988, Trop. Zool. 1:117–136).

Submitted by **IGNACIO DE LA RIVA,** Museo Nacional de Ciencias Naturales, C/ José Gutiérrez Abascal 2, 28006 Madrid, Spain.

TESTUDINES

CHELONOIDIS (= *GEOCHELONE*) *CHILENSIS* (Chaco Tortoise). ARGENTINA: MENDOZA: San Carlos Department: Villa Chilecito District: Campos Las Aguadas. 2 February 1996. E. Richard. Herpetological collection, Fundación Miguel Lillo (FML 7765). Verified by G. Scrocchi. First record for the department. The species was previously recorded from the departments of Mendoza, Santa Rosa, and San Rafael (Waller 1986, Fundación Vida Silvestre Argentina Amph. y Rept. Conserv. 1[2]:36–48; and Lavalle and Rivadavia, Asoc. Herpetol. Argentina Cuad. Herp. 8[1]:131–140, but not documented by vouchers) and for departments of San Rafael and Lujan de Cuyo (Waller 1986, *op. cit.*, documented with vouchers).

Submitted by **ENRIQUE RICHARD**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina and Reserva Experimental Horco Molle, Fac. de Cs. Nat. e IML, Universidad Nacional de Tucumán, casilla de correo 454, 4000 Tucumán, Argentina (e-mail: enrique.richard@tucbb.com.ar).

CHELYDRA SERPENTINA (Common Snapping Turtle). USA: KENTUCKY: Campbell Co: Alexandria, along Wesley-Chapel Road in 12-Mile Creek (38°53.284'N, 84°18.547'W). 5 August 1998. C. Brown, N. Crooker, S. Culman, J. Gels, J. D. Schaeffer, and W. Stamm. Cincinnati Museum of Natural History (CMNH 5721). Verified by Melissa Obermeyer. New county record (Kentucky Amphibians and Reptiles Museum Voucher Database at the Thomas More College Ohio River Biological Field Station).

Submitted by **CHRISTOPHER LORENTZ** and **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.

CLEMMYS MUHLENBERGII (Bog Turtle). USA: GEORGIA: Towns Co: 11 km NNE Blairsville. 3 May 1992. Kenneth M. Fahey and Brian Fahey. An adult female (CL = 86.47 mm) was found in a seepage in a cow pasture. Museum of Natural History, University of Georgia, Athens (UGAMNH 40138, color slide). A total of seven adult individuals have been observed at this site. This locality represents a new county record and fills the hiatus between Rabun and Union counties. (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Pub. No. 3; Esco and Jensen 1996, Georgia Herp Atlas, Matrix of Georgia's Amphibians and Reptiles. Ver. 1.0. Georgia Dept. Nat. Resources, Wildlife Res. Div., Nongame-Endangered Wildlife Prog.). Union Co: 21 km SSW of Blairsville. 7 June 1992. Kenneth M. Fahey and Brian Fahey. Skeletal remains, shell (CL = 41.5 mm) with scutes, hind feet, and tail, of a juvenile (2+ annuli on marginal scutes) found in a sphagnum bog (UGAMNH 40139). Thirteen additional adult individuals have since been observed at this site; extends range of the species ca. 13 km SW of the currently known range in Georgia (Williamson and Moulis 1994, *op. cit.*) and represents the most southerly known point in the geographic distribution of this species (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.); 7 km NE of Suches. 10 May 1994. Kenneth. M. Fahey. An adult female (CL = 90.63 mm) was found in a sphagnum bog (UGAMNH 40140, color slide). Eight additional adult individuals have since been observed at this site. This locality extends the range of the bog turtle an additional 15.5 km WSW of previously known Georgia localities (Williamson and Moulis 1994, *op. cit.*); 3 km N of Suches. 7 June 1996. Kenneth. M. Fahey. An adult female (CL = 90.75 mm) found in a spring seepage (UGAMNH 40141, color slide). This site is between the above mentioned Union County sites and is separated from both by 2.5 km and 6 km, respectively. Rabun Co: 16 km ENE from Clayton. 15 June 1996. Kenneth. M. Fahey and Douglas Walker. A nearly complete shell (CL = 82.9 mm) of an adult female was found in a sphagnum bog (UGAMNH 40142). The carapace, plastral scutes, and pelvis were still attached to the shell indicating that the remains were relatively recent. The xiphiplastral elements and associated scutes are missing. This represents the third known locality for Rabun County (Williamson and Moulis 1994, *op. cit.*). Prior to this report, only three records, two from Rabun County and one from Union County, existed for the bog turtle in the state of Georgia. These records represent one new county record and four new localities for this taxon in the state of Georgia. All specimens were verified by Dennis W. Herman and John Jensen.

Submitted by **KENNETH M. FAHEY**, 439 Pinewood Drive West, Dahlonega, Georgia 30533, USA.

GRAPTEMYS PSEUDOGEOGRAPHICA OUACHITENSIS (Ouachita Map Turtle). USA: OKLAHOMA: Garfield Co: 11.3 km E Waukomis, Skeleton Creek. Summer 1997. Jerrod Burchart. St. Gregory's University, Shawnee, Oklahoma collection (SGU 707). Verified by Doyle L. Crosswhite. First county record at the extreme northwestern edge of range (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.).

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

KINOSTERNON FLAVESCENS FLAVESCENS (Yellow Mud Turtle). USA: TEXAS: Kenedy Co: Ecino [sic] (King Ranch). 13 April 1991. No specific collector. TAIC 5816. Verified by Steve A. Smith. Ecino is a misspelling of Encino. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **MICHAEL JAMES McCOID**, Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA.

TRACHEMYS SCRIPTA ELEGANS (Red-eared Slider). USA: NEBRASKA: Richardson Co: 2 mi N and 0.5 mi E Rulo (T1N, R16E) in an overflow pond along the west side of the Missouri River. April 1994. John Lynch. University of Nebraska State Museum (UNSM 15557). A dozen or more specimens were seen in this 150' by 300' and 10' deep pond. The referenced specimen is a skeleton, collected along the shoreline and represents a new county and state record for the species. *Trachemys s. troostii* (Hudson 1942, The Amphibians and Reptiles of Nebraska. Nebraska Cons. Bull. 24:1–146; Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.) has been recorded from Adams County in south central Nebraska based on a mounted specimen in the Hastings College Museum. No addi-

tional specimens have been collected in that vicinity and that specimen probably represents a pet release. *T. s. elegans* has been reported on the eastern side of the Missouri River in Holt County, Missouri (Johnson 1987, The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. x + 368 pp.) as well as in Brown and Doniphan Counties in northeastern Kansas (Collins 1997, Amphibians and Reptiles in Kansas. Third Edition. Univ. Press of Kansas, Lawrence. xx + 397 pp.), so the record in Nebraska is not unexpected.

Submitted by **ROYCE E. BALLINGER** and **JOHN D. LYNCH**, School of Biological Sciences, University of Nebraska-Lincoln, Lincoln, Nebraska 68583-0118, USA.

TRACHEMYS SCRIPTA (Slider). USA: TEXAS: SAN AUGUSTINE CO: DOR female found 800 m east of the Attoyac River bridge on the eastbound shoulder of Texas Rt. 103. 27 April 1999. Daniel Saenz. SFAVM 4893. Verified by Michael B. Keck. New county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Press, College Station, 434 pp.). Specimen was quite damaged and eggs were scattered on the roadway. When this turtle was found, two American crows (*Corvus brachyrhynchos*) were eating the eggs and picking at the carcass.

Submitted by **DANIEL SAENZ** and **CHRISTOPHER S. COLLINS,** Wildlife Habitat and Silviculture Laboratory, Southern Research Station, U.S.D.A. Forest Service, Nacogdoches, Texas 75962, USA.

LACERTILIA

AMEIVA WETMOREI (Wetmore's Ameiva). PUERTO RICO: Isla Guayacan. 25 December 1977. A. Resetar, R. Evers, and M. Evans. Verified by A. Resetar. FMNH 207299–300. First record for island (Heatwole et al. 1981, Atoll Res. Bull. 251:1–63).

Submitted by **GREGORY C. MAYER**, Department of Biological Sciences, University of Wisconsin-Parkside, Kenosha, Wisconsin 53141, USA.

ANOLIS BIPORCATUS (Giant Green Anole). HONDURAS: DEPARTAMENTO DE GRACIAS A DIOS: ca. 30 km south of Mocorón. 10 June 1997. C. J. Franklin and J. Franklin. UTA color slide 22641. Verified by J. A. Campbell. New departmental record (Meyer and Wilson 1973. Los Angeles Co. Mus. Nat. Hist. Contr. Sci. 244:1–38).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R. L. Thornton Fwy (I-35), Dallas, Texas 75203, USA (e-mail: HERPKING@ix.netcom.com) and **JACQUELINE FRANKLIN**, Louise Wolf Kahn Elementary School, 610 Franklin Avenue, Dallas, Texas 75211, USA.

ANOLIS CAPITO (Big-headed Anole). HONDURAS: DEPARTAMENTO DE GRACIAS A DIOS: ca. 30 km south of Mocorón. 11 June 1997. C. J. Franklin and J. Franklin. UTA-R 42656. Verified by J. A. Campbell. New departmental record (Meyer and Wilson 1973. Los Angeles Co. Mus. Nat. Hist. Contr. Sci. 244:1–38).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R.L. Thornton Fwy (I-35), Dallas, Texas 75203, USA (e-mail: HERPKING@ix.netcom.com) and **JACQUELINE FRANKLIN**, Louise Wolf Kahn Elementary School, 610 Franklin Avenue, Dallas, Texas 75211, USA.

CNEMIDOPHORUS INORNATUS (Little Striped Whiptail). USA: ARIZONA: NAVAJO CO: Petrified Forest National Park (PEFO), SW 1/4 Sec 34, T17N, R23E. 19 June 1998. T. Persons and M. Spille. LACM 144791 and PEFO 14757; APACHE CO: Petrified Forest National Park, NW 1/4 Sec 20, T17N, R24E. 2 June 1998. T. Persons. LACM 144790 and PEFO 14758. Both verified by David Kizirian. Specimens constitute the first records for Navajo and Apache counties, and extend known geographic range ca. 107 km ESE and 138 km SW (Wright and Lowe 1994, J. Arizona-Nevada Acad. Sci. 27[1]:129–157). Specimens appear most similar to *C. inornatus pai* known to the west in Coconino County, Arizona, suggesting that the range may be more continuous in northeastern Arizona.

Submitted by **TREVOR PERSONS,** USGS/BRD, Colorado Plateau Field Station, P.O. Box 5614, Northern Arizona University, Flagtaff, Arizona 86011-5614, USA, and **JOHN W. WRIGHT**, Section of Herpetology, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA.

CNEMIDOPHORUS NATIVO (Brazilian Whiptail). BRAZIL: BAHIA: Prado Municipality, Cumuruxatiba District (17°05'S, 39°10'W), 35 km N Prado city. 3 January 1995. C. F. D. Rocha and H. G. Bergallo. Museu Nacional Nacional do Rio de Janeiro (MNRJ 7047); Alcobaça District, Guaratibas Beach (17°25'S, 39°12'W), 15 km S Prado city. 25 October 1997. C. F. D.Rocha and G. F. Dutra (MNRJ 7048); Nova Viçosa Municipality, (18°00'S, 39°03'W). 6 January 1995. C. F. D. Rocha and H. G. Bergallo (MNRJ 7049). ESPÍRITO SANTO: Itaúnas Municipality, (18°24'S, 39°43'W). 8 January 1995. C. F. D. Rocha and H. G. Bergallo (MNRJ 7050); Conceição da Barra Municipality (19°10'S, 39°45'W). 10 January 1995. C. F. D. Rocha and H. G. Bergallo (MNRJ 7051). All verified by U. Caramaschi. Recently described by Rocha et al. (1997. Herpetologica 53:374–382) and was known only from the type locality (Linhares Municipality, state of Espírito Santo). Extends the range of the species ca. 200 km N along coast from type locality; first documented records for the state of Bahia in northeastern Brazil.

Submitted by **CARLOS FREDERICO DUARTE ROCHA, VANDERLAINE AMARAL DE MENEZES,** and **HELENA GODOY BERGALLO**, Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier 524, Maracanã, Rio de Janeiro, 20550-011, Rio de Janeiro, Brazil, and **GUILHERME FRAGA DUTRA**, Projeto Abrolhos 2000, Conservation International do Brasil, Caravelas, Bahia, Brazil.

CNEMIDOPHORUS SEXLINEATUS (Six-lined Racerunner). MÉXICO: TAMAULIPAS: Playa Bagdad and Playa Lauro Villar (25°51.424'N, 97°09.015'W), 35 km E Matamoros, sea level. 14 July 1997 and 29–30 April 1998. D. Jiménez-Ramos, E. Pérez-Ramos, and J. A. Vargas-Contreras. Verified by Adrián Montes de Oca. Museo de Zoología "Alfonso L. Herrera" (MZFC 11178–87). Several authors have suggested that *Cnemidophorus sexlineatus* might be found in northeastern México (Duellman and Zweifel 1962, Bull. Am. Mus. Nat. Hist. 123:155–210; Smith and Dixon 1987, Bull. Maryland Herpetol. Soc. 25[4]:154–157; Wright 1993, *In* J. W. Wright and L. J. Vitt [eds.], Biology of Whiptail Lizards [Genus *Cnemidophorus*]. Publ. Oklahoma Mus. Nat. Hist. 417 pp.; Flores-Villela 1993, Herpetofauna Mexicana. Carnegie Mus. Nat. Hist. Spec. Pub. No. 17:1–97). Corroborates first record for México with a series of 10 specimens collected in halophytic vegetation.

Submitted by **DAVID JIMÉNEZ-RAMOS**, Escuela de Biología de la Universidad Autónoma de Puebla, Puebla, Puebla, 72570 México, **EDMUNDO PÉREZ-RAMOS**, Museo de Zoología, Facultad de Ciencias Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México, and **JORGE A. VARGAS-CONTRERAS**, Instituto de Ecología

y Alimentos de la Universidad Autónoma de Tamaulipas, Blvd. Adolfo López Mateos No. 928, Ciudad Victoria, Tamaulipas, 87040 México.

EUMECES ANTHRACINUS (Coal Skink). USA: TENNESSEE: HENDERSON CO: 0.6 km N Jones Road off Rt. 22A (35°36.39'N, 88°25.79'W). 9 April 1998. B. P. Butterfield, J. Hobbs, and B. Britt. Austin Peay State University Museum of Zoology (APSU 5991). Verified by Floyd Scott. New county record (Redmond et al. 1990, Annotated Checklist and Bibliography of Amphibians and Reptiles of Tennessee [1835 through 1989]. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 4:1–173). A second individual was collected at the same site on 4 May 1998 (APSU 5992). Fewer than ten individuals have previously been reported from Tennessee (Redmond et al., *op. cit.*).

Submitted by **BRIAN P. BUTTERFIELD, JEREMY HOBBS,** and **BRYAN BRITT**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

EUMECES TETRAGRAMMUS BREVILINEATUS (Short-lined Skink). USA: TEXAS: HUDSPETH CO: near Squaw Spring at the University of Texas at El Paso Indio Mountains Research Station (30°48.03'N, 105°00.82'W), 1268 m elev. 13 June 1998. G. Walker Johnson. UTEP 17707. Verified by Carl S. Lieb. New county record; extends range of the subspecies ca. 26 airline miles NE of C. E. Miller Ranch, 11 mi W Valentine, Presidio County, Texas (Lieb 1985, Contr. Sci. Nat. Hist. Mus. Los Angeles Co. 357:1–19). Squaw Spring is located in a rocky canyon containing Chihuahuan Desert scrub vegetation.

Submitted by **G. WALKER JOHNSON** and **JERRY D. JOHNSON**, Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998, USA.

GYMNOPHTHALMUS UNDERWOODI. ANTIGUA: PARISH OF SAINT JOHN: 1.3 km W Cedar Grove. 21 August 1998. R. Powell. Bobby Witcher Memorial Collection, Avila College (BWMC 06239). Verified by S. Blair Hedges. Specimen represents the first record for the island and the northernmost record for the species (Schwartz and Henderson 1991, Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville. 720 pp.). This parthenogenetic lizard is an effective colonizer with a distribution ranging from northern South America (Guyana and Suriname) through Trinidad and Tobago and into the Lesser Antilles (Barbados, St. Vincent, Guadeloupe, and now Antigua).

Submitted by **ROBERT POWELL**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145-1698, USA (e-mail: powellr@mail.avila.edu), and **KEVEL LINDSAY**, Island Resources Foundation, P.O. Box 103, St. John's, Antigua (e-mail: klindsay@irf.org).

HEMIDACTYLUS GARNOTII (Indo-Pacific Gecko). USA: FLORIDA: VOLUSIA CO: 2226 Magnolia Drive, South Daytona. 26 November 1998. Anthony T. Reppas. Florida Museum of Natural History, University of Florida (UF 116050). Verified by David L. Auth. New County Record; gravid female found at 2200 h on window pane in residential neighborhood. This introduced species has been observed in 25 counties throughout the Florida pennisula, including Baker County which lies on the Florida/Georgia border.

Submitted by **ANTHONY T. REPPAS**, Department of Interdisciplinary Studies, University of Florida, Gainesville, Florida 32611, USA.

HEMIDACTYLUS MABOUIA (Tropical Gecko). PUERTO RICO: Isla Cueva. 19 January 1977. Collector unknown. Verified by K. de Queiroz. USNM 211432. 25 December 1977. A. Resetar, R. Evers, and M. Evans. FMNH 207302. Verified by A. Resetar. First records for island (Heatwole et al. 1981, Atoll Res. Bull. 251:1–63). La Parguera: Hotel Casablanca. 24 December 1977. A. Resetar, R. Evers, and M. Evans. FMNH 207301. Verified by A. Resetar. Sabana Seca: Caribbean Primate Research Center. 26 December 1977. A. Resetar, R. Evers, and M. Evans. FMNH 207303. Verified by A. Resetar. Historically, in the Puerto Rican region this species was known only from smaller islands, such as Mona, Vieques, Culebra, and the Virgins, while *H. brookii* occurred on the mainland of Puerto Rico (Grant 1932, J. Dept. Agric. Puerto Rico 15:51–57; Kluge 1969, Misc. Pub. Mus. Zool. Univ. Michigan 138:1–78). Garcia Diaz (1967, Stahlia 10:1–6) first reported *H. mabouia* from Puerto Rico proper at Isabela. The last two records add two widely-spaced mainland localities, from a little west of San Juan and the far southwest of the island.

Submitted by **GREGORY C. MAYER**, Department of Biological Sciences, University of Wisconsin-Parkside, Kenosha, Wisconsin 53141, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: ARKANSAS: CLARK CO: Arkadelphia, vicinity of Caddo and Second Sreets, Sec. 20, T7S, R19W. 7 October 1998. Greg White. Henderson State University collection 513–518. Verified by Stan Trauth. About 30 individuals seen on wall of building, 8 collected. Population has been observed for several years. Second record for Arkansas (Paulissen and Buchanan 1990, Herpetol. Rev. 21:22).

Submitted by **GREG WHITE** and **RENN TUMLISON**, Department of Biology, Henderson State University, Arkadelphia, Arkansas 71999, USA.

LIOLAEMUS GRACILIS. ARGENTINA: SAN LUIS. JUNÍN DEPARTMENT: Ruta Nacional No. 20, Km 250, 4 km S Paraje La Unión (32°11'S, 65°40'W). 3 March 1999. M. Morando, L. J. Avila, and L. Belver. Herpetological collection, Fundación Miguel Lillo, Tucumán, Argentina (FML 8190). Verified by F. Lobo. First record for province of San Luis and easternmost record for the species in central Argentina; nearest record for this species is in Mendoza province near Mendoza-San Luis border, Desaguadero River edge, ca. 160 km W (airline) (Cei 1986, Mon. IV Mus.reg. Sci. Nat. Torino. 527 pp.).

Submitted by **MARIANA MORANDO** and **LUCIANO JAVIER AVILA**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, C. P. 5301, Anillaco, La Rioja, Argentina.

OPHISAURUS ATTENUATUS ATTENUATUS (Western Slender Glass Lizard). USA: OKLAHOMA: LOGAN CO: 0.7 km S and 4.3 km E Marshall. R. Lardie. 26 May 1991. Female, DOR from an unsurfaced road in bottomland forest. St. Vincent's University, Shawnee, Oklahoma collection (SGU 306). Verified by Jeffrey T. Burkhart. First record for county and fills gap in distribution.

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

SCELOPORUS SCALARIS BROWNORUM (Brown's Bunch Grass Lizard). MÉXICO: NAYARIT: Sierra de Alica, Bajío de las Palas, municipality of La Yesca, 2000 m (21°45'N, 104°24'W). 21 July 1996. Paulino Ponce-Campos. One specimen, female; Facultad de Ciencias Naturales y Agropecuarias, Universidad Autónoma de Guadalajara, México (UAGM R-398). Verified by H. M. Smith. New state record. Previously recorded from Aguascalientes, Durango, Jalisco, and Zacatecas (Smith et al. 1997, Southwest. Nat., 42:290–301).

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**, Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

SCELOPORUS TORQUATUS MELANOGASTER (Blackbelly Crevice Swift Lizard). MÉXICO: NAYARIT: Sierra del Pinabete, municipality of El Trapiche (21°21'N, 104°14'W). 6 February 1995. Paulino Ponce-Campos. Three specimens photographed. Facultad de Ciencias Naturales y Agropecuarias, Universidad Autónoma de Guadalajara, México (UAGM R-420, one specimen at 2225 m elev.), and two specimens (UAGM R-421a-b at 2165 m elev.). Verified by H. M. Smith. New state record (Olson 1990, Bull. Chicago Herpetol. Soc. 25:117–127).

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**, Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

SCELOPORUS UNDULATUS SPEARI (Cabeza de Vaca Prairie Lizard). USA: NEW MEXICO: Doña Ana Co: 4.7 km W Sunland Park city hall. 12 May 1996. C. G. Schmitt. MSB 60752; 31 km E Luna County line on Rt. I-10. 15 May 1985. J. Camper field class. TCWC 63639; Anapra Study Plot, 31°47'10"N. 106°35'08"W. 9 October 1970. 8 May 1975. 30 May–1 June 1977. R. G. Worthington. UTEP 561, 2679, 3018; near Aden Crater, ca. 26 km S Las Cruces. 1 September 1974. T. R. Van Devender. UTEP 2557. Grant Co: 8 km W Hachita, Rt. 9. 25 September 1974. T. R. Van Devender. UTEP 2562–3. Luna Co: 1.4 km S Victorio ranch, Rt. 9. 18 May 1978. R. G. Webb et al. UTEP 3536; Cedar Mts., ca. 14.5 km E Hachita. 6 July 1996. D. I. Lannutti et al. UTEP 16403; 22.5 km W on Rt. 27, 5.7 km NW Nutt (32°36'09"N, 107°29'16"W), 1453.6 m elev. 15 July 1977. R. W. Axtell and R. G. Webb. UTEP 17433. Otero Co: ca. 51 km ENE jct Hueco Inn (on Rts. 62/180) & side road into New Mexico (32°07'26"N, 105°36'23"W), 1501.8 m elev. 17 July 1977. R. W. Axtell and R. G. Webb. UTEP 17432. Sierra Co: 0.5 km N Engle. 7 September 1981. G. M. Ferguson, C. S. Lieb, R. G. Webb. UTEP 8955-7. Verified by Richard L. Holland. Extend known range (Smith et al. 1995, Trans. Kansas Acad. Sci. 98:44–60) from north-central Chihuahua ca. 185 km northward into the Jornada del Muerto Basin, and eastward across the southern part of the Tularosa Basin to the southern part of the Salt Basin in New Mexico.

Submitted by **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 90309-0334, USA, **RALPH AXTELL**, Biological Sciences, Southern Illinois University, Edwardsville, Illinois 62025, USA, and **ROBERT G. WEBB**, Biological Sciences, University of Texas at El Paso, El Paso, Texas 79999, USA.

SCELOPORUS UNDULATUS TEDBROWNI (Mescalero Prairie Lizard). USA: TEXAS: Lamb Co: 8.5 km E Whiteface Rest Area, Rt. 114. 17 July 1984. TCWC 62968; Hockley Co: 8.5 km N Sudan, Rt. 303. 17 July 1984. TCWC 62971; Terry Co: Mound Lake. 18 July 1984. TCWC 62965; Yoakum Co: 16.9 km E Plains, Rt. 380. 11 July 1984. TCWC 62964. All collected by D. King and D. Kizirian. Verified by Richard L. Holland. Extends known range (Smith et al. 1992, Bull. Maryland Herpetol. Soc. 28:123–149) from Andrews County, the only county in Texas from which it was previously recorded, about 190 km northward and eastward into extreme western Lamb and Hockley counties. The Cochran and Yoakum county records in Dixon (1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station), there referred to *S. u. garmani,* fall likewise into the range of *S. u. tedbrowni,* which recent collections show has a latitudinal range in New Mexico about the same as in Texas, from southern Roosevelt County to southern Lea County.

Submitted by **HOBART M. SMITH** and **DAVID CHISZAR**, Museum of Natural History, University of Colorado, Boulder, Colorado 80309, USA.

SPHAERODACTYLUS NICHOLSI (Nichols' Least Gecko). PUERTO RICO: Isla Guayacan. 25 December 1977. A. Resetar, R. Evers, and M. Evans. FMNH 207306. Verified by A. Resetar. Isla Cueva. 25 December 1977. A. Resetar, R. Evers, and M. Evans. FMNH 207307–8. Verified by A. Resetar. First records for both islands (Heatwole et al. 1981, Atoll Res. Bull. 251:1–63).

Submitted by **GREGORY C. MAYER**, Department of Biological Sciences, University of Wisconsin-Parkside, Kenosha, Wisconsin 53141, USA.

SPHAERODACTYLUS ROOSEVELTI (Roosevelt's Least Gecko). PUERTO RICO: Isla Cueva. 25 December 1977. A. Resetar, R. Evers, and M. Evans. FMNH 207305. Verified by A. Resetar. First record for island (Heatwole et al. 1981, Atoll Res. Bull. 251:1–63).

Submitted by **GREGORY C. MAYER**, Department of Biological Sciences, University of Wisconsin-Parkside, Kenosha, Wisconsin 53141, USA.

SPHENOMORPHUS ASSATUS (Red Forest Skink). HONDURAS: Santa Lucía (13°55.17'N, 88°23.43'W), 370 m elev. 23 October 1998. E. Köhler, G. Köhler, and J. R. McCranie. Verified by L. D. Wilson. SMF 78933. First record for country; extends range ca. 75 airline km ESE of Hacienda El Morito, Departamento de Chalatenango, El Salvador (Mertens 1952, Abh. senckenb. naturf. Ges. 487:1–120).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA, and **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt, Germany.

STENOCERCUS PECTINATUS. ARGENTINA: SANTA FE: San Martín Department: El Trébol (32°20'S, 61°37'W). Pasquali and Trucchio. CENAI 359. 9 de Julio Department: Gregoria Perez de Denis (Estación El Nochero) (28°14'S, 61°32'W). CENAI 360, Escuela 842. Verified by G. R. Carrizo. CENAI collection (ex Centro Nacional de Investigaciones Iológicas) is now housed in Museo Argentino de Ciencias Naturales Bernardino Rivadavia. First records for the province, northeasternmost record for the species in Argentina and extends the known distribution 420 km (airline) NE from previous and northernmost vouchered citation (Genise 1985, Boletín Asoc. Herp. Argentina 1[1–3]:18). Formerly published records for Mendoza, Santa Cruz, and Chubut provinces are very doubtful and not confirmed by vouchers. Records for Santiago del Estero and Tucumán, published by Cei (1986, Reptiles del Centro, Centro-oeste y Sur de la Argentina. Mon. IV. 527 pp., and 1993, Reptiles del Noroeste, Nordeste y Este de la Argentina, Mon. XIV, 949 pp.) are not included in the last regional lists (Gallardo et al. 1985, Hist. Nat. 5[13]:97–103; Lavilla et al. 1993, Claves para la identificación de los anfibios y reptiles de la provincia de Tucumán (Argentina). Misc. 95. Fund. M. Lillo. 30 pp.). Reported distribution by Cei (1986, 1993, *op. cit.*) for Brazil and Uruguay may have resulted from confusion of this taxon with *Stenocercus azureus*, because no citations were given for *S. pectinatus* in these countries. Voucher records restrict the distribution to La Pampa, San Luis, Córdoba, Río Negro, Buenos Aires, and Santa Fe provinces.

Submitted by **LUCIANO JAVIER AVILA**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, C.P. 5301, Anillaco, La Rioja, Argentina.

XANTUSIA VIGILIS VIGILIS (Desert Night Lizard). USA: CALIFORNIA: Inyo Co: 13 km W Bishop; Starlite Drive (37°20'N, 118°32'W), 1780 m elev. 25 May 1997. Richard Scott. Verified by Kent Beaman. LACM 145078. Extends range along E slope of the Sierra Nevada 90 km N from previous record near Lone Pine (LACM 121550; plotted in Bezy 1982, Cat. Amer. Amph. Rept. 302.1) and W across the Owens Valley from the Inyo-White Mountains (Macey 1986, *In* C. A. Hall, Jr. and D. J. Young [eds.], Natural History of the White-Inyo Range, Eastern California and Western Nevada and High Altitude Physiology. Univ. California White Mountain Res. Station Symposium 1, pp. 119–128; Papenfuss 1986, *ibid*, pp. 129–136). Vegetation at the site consists of sagebrush (*Artemisia tridentata*) and blackbrush (*Coleogyne ramosissima*); as with other records from this part of the range of *X. vigilis*, the specimen was found under rocks rather than yucca.

Submitted by **RICHARD R. SCOTT**, 8800 Starlite Drive, Bishop, California 93514, USA, **ROBERT L. BEZY**, Herpetology, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA, and **NORMAN J. SCOTT, JR.**, U.S. Geological Survey, Piedras Blancas Research Station, P.O. Box 70, San Simeon, California 93452, USA.

SERPENTES

AGKISTRODON CONTORTRIX LATICINCTUS (Broad-banded Copperhead). USA: OKLAHOMA: Logan Co: 0.75 km S and 8.3 km E Marshall. Female collected at 1107 hrs under a red sandstone rock in a roadside ditch near a gully in oak woods. 9 June 1991. R. Lardie. St. Vincent's University, Shawnee, Oklahoma collection (SGU 637). Verified by Jeffrey T. Burkhart. First record for county on northwestern edge of Oklahoma range (Conant and Collins 1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.). Specimen was maintained alive until November 1996.

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

AGKISTRODON CONTORTRIX MOKASEN (Northern Copperhead). USA: KENTUCKY: Owen Co: Eagle Creek Campground. 28 September 1996. M. Bramlage. Thomas More College (TMC R1). Verified by Melissa Obermeyer. New county record. Known previously only from an anecdotal account in Funkhouser (1925, Wild Life in Kentucky, Kentucky Geol. Surv., Frankfort. 385 pp.) (see also Meade 1993, Ph.D. Dissertation, University of Southern Mississippi. 608 pp.).

Submitted by **JOHN W. FERNER, MICHAEL BRAMLAGE**, and **WILLIAM S. BRYANT**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.

ARRHYTON EXIGUUM EXIGUUM (Virgin Islands Racer). BRITISH VIRGIN ISLANDS: ANEGADA: on road between The Settlement and Loblolly Bay, ca. 0.5 km N The Settlement. Collected and photographed 24 April 1998. Todd Campbell (UF 115972A–B). New record for Anegada (Schwartz and Henderson 1991, Amphibians and Reptiles of the West Indies, Univ. Florida Press, Gainesville. 720 pp.; Richard Thomas, pers. comm.).

Submitted by **TODD CAMPBELL**, Department of Ecology and Evolutionary Biology, 569 Dabney Hall, University of Tennessee, Knoxville, Tennessee 37996, USA (e-mail: lizardman@utk.edu), USA, and **KYM ROUSE CAMPBELL**, The Cadmus Group, 136 Mitchell Road, Oak Ridge, Tennessee 37830, USA.

BOTHRIECHIS SCHLEGELII (Eyelash Palm-pitviper). HONDURAS: Departamento de Gracias a Dios: Mocorón. 13 June 1997. C. J. Franklin and J. Franklin. UTA Color Slide # 22642. Verified by J. A. Campbell. New departmental record (Wilson and Meyer 1985. The Snakes of Honduras. Milwaukee Public Museum).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R.L. Thornton Fwy (I-35), Dallas, Texas 75203, USA (e-mail: HERPKING@ix.netcom.com) and **JACQUELINE FRANKLIN**, Louise Wolf Kahn Elementary School, 610 Franklin Avenue, Dallas, Texas 75211, USA.

CARPHOPHIS AMOENUS HELENAE (Midwest Worm Snake). USA: KENTUCKY: Campbell Co: Grants Lick, below Fairlane Drive on S-facing slope, 0.5 km N Licking River (38°48.750'N, 84°23.039'W). 17 May 1998. P. J. Krusling and J. W. Ferner. Cincinnati Museum of Natural History (CMNH 5731). Verified by J. G. Davis. New county and regional northern Kentucky record (Meade 1993, Ph.D. Dissertation, University of Southern Mississippi. 608 pp.).

Submitted by **PAUL J. KRUSLING**, Geier Collections and Research Center, Museum of Natural History and Science, Cincinnati Museum Center, 1720 Gilbert Avenue, Cincinnati, Ohio 45202, USA, and **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.

CROTALUS HORRIDUS (Timber Rattlesnake). USA: OKLAHOMA: Garfield Co: 11 km S and 2.1 km E Covington. Small female collected at 2235 h near Crowsnest Creek in bottomland forest. 14 May 1984. R. Lardie. Maintained alive until November 1996. St. Gregory's University, Shawnee, Oklahoma Collection (SGU 636); complete dried skin of a *C. horridus* from 11.2 km S and 4.5 km E Covington, collected from a concrete dam of a small lake on 4-D Creek. Spring 1983. SGU 601. Both specimens verified by Jeffrey T. Burkhart. These are voucher specimens for the county on the extreme northwestern edge of the range of *C. horridus* (Conant and Collins 1998. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.). A specimen reported earlier from 11 km SE Covington (Lardie 1979, Herpetol. Rev. 10:24–25) in the private collection of Cline Hereford Farm, no longer exists.

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA.

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). USA: COLORADO: El Paso Co: Edison. 17 April 1993. H. M. Smith. UCM 56796. Verified by Richard L. Holland. First county record (Hammerson 1986, Amphibians and Reptiles on Colorado. Publ. Colorado Div. Wildlife. 131 pp.); at the western known edge of the range of the species on southeastern Colorado, more or less on a line with the records for Pueblo County (Hammerson, *op. cit.*) and Elbert County (Chiszar et al. 1992, Bull. Chicago Herpetol. Soc. 27:165). A partial shed skin about 1200 mm in length, lacking the tail, head and several inches of the neck (as evident from the scale row counts). The snake would be of record or near record maximum size, presumably even larger than the one that left the skin in Elbert County (Chiszar et al., *op. cit.*).

Submitted by **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

ELAPHE OBSOLETA LINDHEIMERII (Texas Rat Snake). USA: OKLAHOMA: Dewey Co: 6.5 km E and 8.1 km N Canton (in Blaine County). 3 May 1992. R. Lardie. St. Gregory's University, Shawnee, Oklahoma (SGU 326); Major Co: Williams Scout Reservation. 3.3 km E and 6.5 km S Cleo Springs. 12 June 1989. D. Crosswhite and J. Stewert. SGU 168; 15.2 km S Waynoka, 7 km E Bouse Junction on U.S. Rt. 412. 18 May 1996. Gary Lardie. SGU 674; 9 km N Ames. 24 July 1994. R. Lardie. SGU 604; 4.5 km W Ames. 24 July 1994. R. Lardie. SGU 605; Alfalfa Co: 12.7 km E Byron. 29 May 1995. R. Lardie and George Lardie. SGU 703; Grant Co: 10 km S and 4.3 km W Manchester. 6 June 1981. R. Lardie. Oklahoma Baptist University, Shawnee, Oklahoma (OBU 1938); 13 km N Nash on S-132. 5 September 1976. R. Lardie. OBU 1559; Kingfisher Co: 10.3 km W and 0.3 km S Lacey. 5 April 1981. R. Lardie. OBU 1832; Garfield Co: 1.3 km S and 5.4 km E Carrier. 25 July 1995. R. Lardie. SGU 479; Fairgrounds, north Enid. 17 October 1996. A. Lardie. SGU 628; 5.4 km N Imo. 17 June 1995. R. Lardie. SGU 484; 7 km N and 0.6 km E Imo. 13 June 1977. R. Lardie. SGU 477; 1.2 km S and 3.6 km E Carrier on S-45. 18 May 1996. R. Lardie. SGU 552; 3.8 km N and 1.6 km W Waukomis. 17 May 1996. R. Lardie. SGU 550; Douglas. 17 May 1992. R. Lardie. SGU 292; Breckenridge. Summer 1991. M. Meier. SGU 702. All SGU specimens were verified by Jeffrey T. Burkhart. All OBU specimens were verified by Jeffrey H. Black. These 18 specimens exhibit many color and pattern characteristics of *E. o. lindheimerii*, described in Conant and Collins (1998, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.). These include distinct dorsal blotches, usually set in reddish color, a series of smaller lateral blotches on each side, frequently connected by a stripe 3–3.5 scale rows wide, yellow-gray to yellow background color and a gray to black head. One specimen from southeastern Garfield County (SGU 646) and most observed from Williams Scout Reservation in Major County were typical of *E. o. obsoleta*. All specimens reported here are considered intergrades between the two subspecies. SGU 326 is the first verified record of *E. obsoleta* for Dewey County. These records further corroborate the predicted distribution published by Conant and Collins (1998, *op. cit.*) for *E. o. obsoleta* x *lindheimerii* in western Oklahoma.

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA, **DOYLE L. CROSSWHITE**, Division of Science, St. Gregory's University, 1900 West MacArthur Drive, Shawnee, Oklahoma 74801, USA, and **MARTIN K. MEIER**, 1529 Smith Circle, Wichita, Kansas 67201, USA.

ELAPHE SITULA (Leopard Snake). CROATIA: Sipan Island, ca. 20 airline km NW Dubrovnic. 14 September 1954. M. Radovanovic. Hungarian Natural History Museum (HNHM 65.137.1). Verified by B. Buzas. First island record; previously documented for nearby islands of Mljet and Korcula (Obst et al. 1993, pp. 431–453 *In* W. Bohme [ed.] Handbuch der Reptilien und Amphibien Europas, Vol. 3/I, Schlangen [Serpentes], I. Aula, Wiesbaden; K. Schulz 1996, A Monograph of the Colubrid Snakes of the Genus Elaphe Fitzinger. Koeltz, Havlickuv Brod. 439 pp.). Corbett (1989, Conservation of European Reptiles and Amphibians. Helm, London. 274 pp.) stated that this species is in rapid decline throughout its range. It is thus probable that this snake has since become extinct on Sipan.

Submitted by **BÁLAZS FARKAS**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary, and **TAMÁS TÓTH**, Budaorsi ut 92/b, H-1118 Budapest, Hungary.

GYALOPION CANUM (Western Hooknose Snake). MÉXICO: MICHOACAN: Cerro El Obispo, 3 km south of Carapan, 2100 m (19°49'N, 102°03'W). 15 November 1991. Paulino Ponce-Campos. Facultad de Ciencias Naturales y Agropecuarias, Universidad Autónoma de Guadalajara, México (UAGM R-246). Verified by H. M. Smith. New state record. Previously recorded from Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosí, Sonora, and Zacatecas. (Hardy 1976, Cat. American Amph. Rept. 182.1–182.4).

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**, Bosque Tropical, A. C., Apartado Postal 5-515, Guadalajara, Jalisco 45042, México.

HETERODON PLATIRHINOS (Eastern Hognose Snake). USA: KENTUCKY: Boone Co: Rt. 20 just S Petersburg, DOR (39°02.430'N, 84°52.180'W). 13 July 1997. J. W. Ferner and P. J. Krusling. Cincinnati Museum of Natural History (CMNH 5749). Verified by Melissa Obermeyer. New voucher specimen for county record; previous vouchers from Baker Hunt Foundation of Covington, Kentucky have been lost (Meade 1993, Doctoral Dissertation, University of Southern Mississippi. 608 pp.).

Submitted by **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **PAUL J. KRUSLING**, Geier Collections and Research Center, Museum of Natural History and Science, Cincinnati Museum Center, 1720 Gilbert Avenue, Cincinnati, Ohio 45202, USA.

LAMPROPELTIS TRIANGULUM DIXONI (Dixon's Milk Snake). MEXICO: GUANAJUATO: "Guanajuato." 1875. Alfredo Dugés. MHNL (Mus. Hist. Nat. Lyon) 42000709. Verified by Richard L. Holland. First record for state, extending known range of subspecies about 160 km SW of vicinity of Rio Verde, San Luis Potosí (Williams 1988, Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*. 2nd ed. Publ. Milwaukee Pub. Mus. 176 pp.), assuming, as is highly likely, that the specimen was taken in the vicinity of Ciudad Guanajuato. It is a logical extension into an area from which no other records of the species are available, and north of the range of *L. t. nelsoni* in the southern part of the state.

Submitted by **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA, and **JOËL CLARY** and **JEAN-LOUIS MARTELLI**, Muséum d'Histoire Naturelle, 28 Boulevard des Belges, 69006 Lyon, France.

LEPTOTYPHLOPS DULCIS DULCIS (Texas Blind Snake). USA: OKLAHOMA: Johnson Co: 1.6 km E and 1.6 km N Ponotoc, under a limestone rock in an open rocky area. 31 May 1995. St. Gregory's University, Shawnee, Oklahoma collection (SGU 700). Verified by Jeffrey T. Burkhart. County record at eastern edge of range where Webb (1970, Reptiles of Oklahoma, Univ. Oklahoma Press, Norman. 370 pp.) considered *L. dulcis* to be intergrades of *dulcis* x *dissectus*. This specimen has one supralabial on each side (*L. d. dulcis*) instead of two supralabials (*L. d. dissectus*).

Submitted by **RICHARD L. LARDIE**, 313 Flintridge Road, Enid, Oklahoma 73703, USA, **DOYLE L. CROSSWHITE**, Division of Sciences, St. Gregory's University, 1900 West MacArthur Drive, Shawnee, Oklahoma 74801, USA, and **JEFFREY T. BURKHART**, Division of Sciences, Paradise Valley Community College, Phoenix, Arizona 85032, USA.

LIOPHIS ALMADENSIS (Jararaquinha do Campo). BRAZIL: MARANHÃO: Municipality of Balsas (07°31'40"S, 52°02'31"W). 19 May 1987. Museu Paraense Emílio Goeldi (MPEG 19323). Veri-

fied by T. de Lema. Young male. According to Dixon (1989, Smithson. Herpetol. Inform. Ser. 79:1–28), this species is know from all plant formations in Brazil except Caatinga and Amazon rainforest. The municipality of Balsas is located in a Caatinga region and this specimen is the first record for the state of Maranhão.

Submitted by **NELSON RUFINO**, Linha de Pesquisa em Herpetologia, Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga, s/n. CEP: 90619-900, Porto Alegre, Brazil.

MASTICOPHIS MENTOVARIUS (Neotropical Coachwhip). HONDURAS: DEPARTAMENTO DE GRACIAS A DIOS: Mocorón. 12 June 1997. C. J. Franklin and J. Franklin. UTA-R42649. Verified by J. A. Campbell. New departmental record (Wilson and Meyer 1985. The Snakes of Honduras. Milwaukee Public Museum).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R.L. Thornton Fwy (I-35), Dallas, Texas 75203, USA (e-mail: HERPKING@ix.netcom.com) and **JACQUELINE FRANKLIN**, Louise Wolf Kahn Elementary School, 610 Franklin Avenue, Dallas, Texas 75211, USA.

NERODIA ERYTHROGASTER TRANSVERSA (Blotched Water Snake). USA: TEXAS: ARKANSAS CO: Arkansas National Wildlife Refuge. 14 April 1985. A. Chaney and party. TAIC 5504. Verified by Steve A. Smith. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **MICHAEL JAMES McCOID**, Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA.

OXYRHOPUS RHOMBIFER BACHMANNI. ARGENTINA: RIO NEGRO: DEPARTAMENTO GENERAL ROCA: on Ruta Provincial N° 6 (38°32'S, 67°33'W), 59 km N General Roca. 12 March 1999. L. J. Avila and M. Morando. Verified by G. Scrocchi. Herpetological collection, Fundación Miguel Lillo, Tucumán, Argentina (FML 8191). First record for Rio Negro province and southernmost record for the species (Cei 1986, Mon. IV Mus. reg. Sci. Nat. Torino. 527 pp.). Nearest record for taxon is Lihué Calel, Departmento Lihué Calel, La Pampa Province, ca. 175 km airline NE (Tiranti and Avila 1997, Bull. Maryland Herpetol. Soc. 33[3]:97–117).

Submitted by **LUCIANO JAVIER AVILA** and **MARIANA MORANDO**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, C. P. 5301, Anillaco, La Rioja, Argentina.

PSUESTES POECILONOTUS (Bird-eating Tree Snake). HONDURAS: DEPARTAMENTO DE GRACIAS A DIOS: ca. 30 km south of Mocorón. 10 June 1997. C. J. Franklin and J. Franklin. UTA-R42655. Verified by J. A. Campbell. New departmental record (Wilson and Meyer 1985. The Snakes of Honduras. Milwaukee Public Museum).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo Department of Herpetology, 650 South R.L. Thornton Fwy (I-35), Dallas, Texas 75203, USA (e-mail: HERPKING@ix.netcom.com) and **JACQUELINE FRANKLIN**, Louise Wolf Kahn Elementary School, 610 Franklin Avenue, Dallas, Texas 75211, USA.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). MÉXICO: NUEVO LEON: metropolitan area of Monterrey. 1990–97. Manuel Nevárez de los Reyes. Universidad Autónoma de Nuevo León Herpetological Collection (UANL 5248–53). Verified by Arturo Contreras Arquieta. Records confirm the establishment of the species in the state, previously recorded for Colonia Ancira at Monterrey (Alvarez and Murillo 1996, Vert. Mex. 2:1–2).

Submitted by **MANUEL NEVÁREZ**, Laboratorio de Herpetología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Apartado Postal 513, San Nicolás de los Garza, Nuevo León, México, C.P. 66450.

SENTICOLIS TRIASPIS (Green Rat Snake). USA: ARIZONA: PIMA CO: Baboquivari Mountains, Thomas Canyon, ca. 1460 m elev. (NE quadrant SW quadrant Sec. 24, R7E, T19S). 27 September 1998. D. Emmons. ASU living specimen (KU Color Slide 11610). Male (785+242 mm, 128 g) captured crawling among oak leaf litter at 1645 h. First documented specimen from the main massif of the Baboquivari Mountains (Price 1991, Cat. Amer. Amphib. Rept. 491:1–3). Substantiates sight records from Brown Canyon. Previous specimens reported from this range (e.g., Fowlie 1965, Snakes of Arizona. Azul Quinta Press, Fallbrook, California. xxiii + 164 pp.; Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Houghton Mifflin, Boston, Massachusetts. 336 pp.) are apparently from the adjoining Quinlan Mountains (Kitt Peak).

Submitted by **ANDY HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA.

STORERIA DEKAYI (Brown Snake). USA: KANSAS: STAFFORD CO: Quivira National Wildlife Refuge, 0.25 km E of western refuge boundary, Richardson Tract (SW 1/4 of SE 1/4 of Sec. 20, T21S, R11W), ca. 527 m elev. 14 Nov 1998. G. H. Farley. KU 288629. Verified by Joseph T. Collins. First record for county; confirms presence in this portion of the Lower Arkansas River Basin. One of seven similar-sized individuals observed within 0.75 km of the collection locality on the same date. DOR; collected under Kansas Special Use Permit 98012.

Submitted by **GREG H. FARLEY**, Department of Biological Sciences and Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas 67601, USA.

TANTILLA NIGRICEPS FUMICEPS (Texas Black-headed Snake). MÉXICO: NUEVO LEON: Fraccionamiento del Lago, San Nicolás de los Garza. 9 September 1993. Manuel Nevárez de los Reyes. Universidad Autónoma de Nuevo León Herpetological Collection (UANL 5241). Verified by James R. Dixon. Fourth record for Mexico and second for the state; extends range ca. 90 km W of the previous record at Rancho el 86 in Cerralvo (Liner et al. 1978, Herpetol. Rev. 9:22).

Submitted by **MANUEL NEVÁREZ**, Laboratorio de Herpetología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Apartado Postal 513, San Nicolás de los Garza, Nuevo León, México, C.P. 66450.

TRIMORPHODON TAU TAU (Mexican Lyre Snake). MÉXICO: NUEVO LEON: Cerro de la Silla at Monterrey. July 1991. Collector unidentified. Universidad Autónoma de Nuevo León Herpetological Collection (UANL 5243). Verified by David Lazcano Villarreal. Third record for state; species was recorded at the same locality (Martin del Campo R. 1953, Contribución al Conocimiento de la Herpetologia de Nuevo Leon. Universidad) and from Iturbide (Blody et al. 1987, Herpetol. Rev. 18:21).

Submitted by **MANUEL NEVÁREZ**, Laboratorio de Herpetología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Apartado Postal 513, San Nicolás de los Garza, Nuevo León, México, C.P. 66450.

Additional New Regional and Local Records of Amphibians and Reptiles from the State of Falcón, Venezuela

ABRAHAM MIJARES-URRUTIA
and
ALEXIS ARENDS R.
Centro de Investigaciones en Ecología y Zonas Áridas (CIEZA)
Universidad Francisco de Miranda, Apartado 7506
Coro 4101-A, Venezuela
e-mail (AM): amijares@funflc.org.ve
e-mail (AA): aarends@reacciun.conicit.ve

The herpetological survey of the state of Falcón developed by CIEZA personnel has resulted in several new species records for the region (Mijares-Urrutia and Arends 1993). We take this opportunity to report additional records and extensions of distributional ranges of other species of amphibians and reptiles already recorded within the state of Falcón. Specimens reported herein are deposited in the following Venezuelan museums: Colección Herpetológica Regional del Centro de Investigaciones en Ecología y Zonas Aridas, Universidad Francisco de Miranda, Coro (CIEZAH); Museo de Ciencias Naturales de Caracas, Caracas (MCNC); Estación Biológica de Rancho Grande, Ministerio del Ambiente y de los Recursos Naturales Renovables, Maracay (EBRG); Museo de Biología de la Universidad del Zulia, Maracaibo (MBLUZ).

ANURA

Hyla pugnax. VENEZUELA: FALCÓN: Municipio Miranda, La Florida, ± 45.0 km (by road) west of Coro (± 11°14'N, 70°04'W). Collected by A. Mijares-Urrutia, F. Sánchez, and D. Paaton. Verified by J. Aranguren. CIEZAH 401. First record from the state of Falcón and second record from Venezuela (La Marca 1996).

Scinax x-signata. VENEZUELA: FALCÓN: Municipio Colina, La Barranca, 53.6 km (by road) from Coro road to Pueblo Nuevo de la Sierra, ± 310 m (± 11°13'N, 69°27'W). Collected by A. Mijares-Urrutia. Verified by J. Aranguren. CIEZAH 399. First report from the state of Falcón and northwesternmost record of the species in Venezuela (La Marca 1992).

LACERTILIA

Anadia steyeri. VENEZUELA: FALCÓN: Municipio Petit, Cataratas de Hueque, Sierra de San Luis, about 600 m (± 11°11'N, 69°32'W). Collected by T. Barros. Verified by J. E. García. MBLUZ-R 282. Second record from the state of Falcón, and 42.8 km. Northwesternmost record of the species in Falcón (Oftedal 1974; Shreve 1947).

Bachia heteropa lineata. VENEZUELA: FALCÓN: Municipio Colina, Cueva de Chipare, 6.5 km (by road) from Guaibacoa road to Chipare, about 325 m (± 11°25'N, 69°26'W). Collected by A. Mijares and A. Arends. Verified by J. Aranguren. CIEZAH 398. Second record from the state of Falcón and extend in 114.2 km westernmost record of the subspecies (Dixon 1973).

SERPENTES

Liophis reginae zweifeli (Reinita): VENEZUELA: FALCÓN: Municipio Bolívar, Cerro El Danto, Sabanas de Paraguariba, 9.0 km (by road) NE of La Tabla, Sierra de San Luis, about 1350 m (± 11°10'N, 69°42'W). Collected by A. Mijares-Urrutia and D. Daal. Verified by J. Aranguren. CIEZAH 397. First record from the state of Falcón and westernmost record of the species (Dixon 1983; Roze 1966).

Xenodon severus (Sapa): VENEZUELA: FALCÓN: Municipio Colina, near Barrancas, Hueque Dam, Sierra de San Luis, ± 245 m (± 11°14'N, 69°27'W). Collected by J.-M. Hero, F. Sánchez and M. Lampo. Verified by Wolfgang Wüster. CIEZAH 303. First record from the state of Falcón and westernmost record of the species (Lancini and Kornacker 1989; Roze 1966).

Acknowledgments.—We thank those who gave us access to museum specimens and/or catalogues, in particular Francisco Bisbal and Ramón Rivero (EBRG), and Pedro Delgado and Luis Fernando Navarrete (MCNC). Also, our thanks to those who kindly helped corroborate the identity of these specimens. Partial finantial support was provided by grant N° S1-9112-030 from Fundacite-Falcón.

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New Lizard Records for La Rioja and Catamarca Provinces, Northwestern Argentina

LUCIANO J. AVILA
and
FERNANDO LOBO
CRILAR-CONICET, Mendoza y Entre Ríos s/n
C.P. 5301, Anillaco, La Rioja, Argentina
e-mail: (LJA) lavila@crilar.com.ar
e-mail: (FL) flobo@crilar.com.ar

Cei (1993) summarized the geographic distribution of lizards in northwestern Argentina, and Etheridge (1993) and Etheridge and Espinoza (1997) added some additional data about *Liolaemus* and *Pristidactylus* species. Recent field work in western Catamarca Province and northern La Rioja Province, and a review of herpetological material housed at the herpetological collection of the Fundación Miguel Lillo, has revealed new records for three species

of *Liolaemus*. Field work was carried out during October and November 1998 and voucher specimens have been deposited at Fundación Miguel Lillo (FML), San Miguel de Tucumán, Tucumán, Argentina. Latitude and longitude were determined with a Garmin™ GPS 38 global positioning device, for the species collected by us. Geographic coordinates for localities of specimens in the FML collection were determined with Atlas de la República Argentina (I-Parte Política. Instituto Geográfico Militar. 1972). Species identification were verified by Gustavo Scrocchi.

Liolaemus elongatus

CATAMARCA PROVINCE: Tinogasta Department: 17.8 km W Chaschuil (27°48'S, 68°13'W). 13 November 1998. F. Lobo and L. J. Avila. FML 7706–09. Record constitutes a range extension of ca. 200 km N (airline) for the species, previously reported (unvouchered) from Cordillera de San Guillermo, north San Juan Province (Cei et al. 1983). We found a voucher specimen from the Cordillera de San Guillermo in FML collection (FML 3550). LA RIOJA PROVINCE: General La Madrid Department: Agua Quemada, on road to Laguna Brava, 47 km NW Alto Jagüé (28°39'S, 68°24'W). 14–15 November 1996. O. Pagaburo and J. Bracamonte. FML 2737 (6 specimens). Quebrada del Leoncito, on road to Laguna Brava, NW Alto Jagüé (28°39'S, 68°24'W). January 1993. O. Pagaburo. FML 2965 (4 specimens). These records fill the gap between our new record in Catamarca Province and previous record in San Juan Province; they are the first records of *Liolaemus elongatus* for La Rioja Province.

Liolaemus robertmertensi

CATAMARCA PROVINCE: Pomán Department: Mollecito (27°47'S, 66°12'W). 18 December 1986. O. Pagaburo, T. Noriega, G. Esteban and L. Claps. FML 1847 (9 specimens). Mollecito (27°47'S, 66°12'W). 16–26 October 1983. O. Pagaburo and E. Terán. FML 1488 (14 specimens). Southernmost extreme of Bolsón del Pipanaco, 3 km S Salar de Pipanaco, SW Mollecitos (27°47'S, 66°12'W). 31 October–1 November 1982. O. Pagaburo and E. Terán. FML 1308 (8 specimens). From Puesto Río Blanco to NW Salar de Pipanaco, SW Mollecito (27°47'S, 66°12'W). October 1984. E. Terán, G. Scrocchi and O. Pagaburo. FML 1616 (7 specimens). Puesto Río Blanco. (27°47'S, 66°12'W). 12 June 1985. O. Pagaburo and R. Montero. FML 1706 (5 specimens). NE Salar de Pipanaco, SW Mollecito (27°47'S, 66°12'W). 19 October 1983. E. Terán and O. Pagaburo. FML 1482 (4 specimens). 15 km W Ruta Provincial Nro. 46 between Siján (28°16'S, 66°14'W) and El Pajonal (28°22'S, 66°18'W). 19 October 1983. E. Terán and O. Pagaburo. FML 1478 (3 specimens). Belén Department: Hualfín (27°15'S, 66°50'W). 22 December 1985. L. Budin. FML 1725 (1 specimens). Hualfín (27°15'S, 66°50'W). 20 March–3 April 1986. A. Budin. FML 1753 (3 specimens). Quebrada Los Viscos. Campamento Central Farallón Negro. (2430 m). 16 December 1995. F. Lobo, A. Marcus, J. Montero and R. Montero. FML 3600 (7 specimens). Andalgalá Department: Villa Vil (27°06'S, 66°49'W). 4 November 1982. O. Pagaburo and E. Terán. FML 1312 (1 specimen). Toma del Río Potrero (27°29'S, 66°18'W). 15 November 1997. G. Scrocchi. FML 6785 (1 specimen). Toma del Río Choya. 5 September 1997. E. Lavilla. FML 6599 (1 specimen); 15 November 1997. G. Scrocchi. FML 06784 (1 specimen). Cerro Choya, near Puesto de Soria (27°25'S, 66°21'W) (2080 m). 29 August 1997. G. Scrocchi. FML 6596 (1 specimen). Rio Blanco near confluence of Rio Candado. 2 September 1997. G. Scrocchi. FML 6601 (1 specimen). Toma del Río Andalgalá. 4 September 1997. G. Scrocchi. FML 6598 (1 specimen). 14 November 1997. G. Scrocchi. FML 6782–83 (2 specimens). Puesto Río Blanco (27°24'S, 66°15'W) 17 November 1997. G. Scrocchi. FML 6786–87 (2 specimens); 14 March 1998. G. Scrocchi. FML 7127–28 (2 specimens). Puesto Río Blanco. Proyecto Agua Rica. (27°27'S, 66°16'W). 24–25 May 1997. G. Scrocchi. FML 6403 (2 specimens). TINOGASTA DEPARTMENT: Medanitos (27°31'S, 67°35'W). 5–8 November 1987. O. Pagaburo and J. Bracamonte. FML 2027 (1 specimen). Los Medanitos, Saujil (27°34'S, 67°37'W) 9–11 November 1991. O. Pagaburo and J. Bracamonte. FML 2699 (1 specimen). Rocky valley 2 km N Termas de Fiambalá (near a old mine campament) (27°43'S, 67°32'W). 12 November 1998. F. Lobo and L. Avila. FML 7710 (1 specimen). Tinogasta (28°04'S, 67°34'W). October 1984. G. Scrocchi, E. Terán and O. Pagaburo. FML 1621 (1 specimen). 4 km Río La Puerta. 31 Km S Tinogasta (28°04'S, 67°34'W) on ruta Provincial Nro. 45. October 1984. G. Scrocchi, E. Terán and O. Pagaburo. FML 1623 (2 specimens). Near Ruta Nacional 60, 33 km S Tinogasta (28°04'S, 67°34'W). October 1998. F. Lobo and M. Halloy. FML 7711. Villa Luján (28°16'S, 67°23'W, specimens Río Colorado). 21 May 1988. G. Scrocchi and P. Blendinger. FML 2134 (1 specimen). These are the first vouchered records for Pomán and second records for Belén Departments despite the imprecise type locality records in the mountains near Belén (Hellmich, 1964). Cei's (1993) citations for Belén localities are unvouchered. It is our experience that *L. robertmertensis* is typically found in association with rocky hillsides, but in the eastern edge of the Salar de Pipanaco, this species is found in open woods of *Prosopis* and shrubs with sandy and salty soils. Department Andalgalá citations are the first vouchered records. Medanitos and Termas de Fiambalá localities are the westernmost records for this species, first records for Sierra de Fiambalá formation, and extends the range ca. 55 km (airline) W of the type locality. Localities near Tinogasta, Villa Luján, and Río La Puerta extend the range ca. 90 km SW (airline) of the type locality in Catamarca Province. All records are the first for Tinogasta Department. LA RIOJA PROVINCE: Famatina Department: "Chiquero del Pío," near Antinaco (28°49'S, 67°19'W), Sierra de Velazco (3000 m). December 1985. E. Pereyra, O. Pagaburo, and J. Bracamonte. FML 1792 (1 specimen). "Saladillo," near Antinaco (28°49'S, 67°19'W). Sierra de Velazco (1900 m). December 1985. E. Pereyra, O. Pagaburo, and J. Bracamonte. FML 1793 (1 specimen). Arauco Department: 2 km N Señor de la Peña (28°44'S, 66°47'W) 17 October 1998. L. Avila, L. Belver and F. Lobo. FML 7746. 4 km N Señor de la Peña (28°44'S, 66°47'W). 17 October 1998. L. Avila, L. Belver and F. Lobo. FML 7747. La Calera (near Señor de la Peña), 20 km E de Anjullón (28°44'S, 66°56'W). 22 February 1972. R. F. Laurent. FML 525 (1 specimen). First records for La Rioja Province, southernmost records for the species, first record for Sierra de Velasco formation, and extends range ca. 150 km (airline) S of the type locality.

Liolaemus bitaeniatus

CATAMARCA PROVINCE: Belén Department: 2.5 km W Condor Huasi (27°30'S, 67°07'W). 14 November 1998. F. Lobo and L. Avila. FML 7705. Valle Viejo Department: Sierra de Ancasti. 27 km de Portezuelo. 28 December 1982. A. Marcus. FML 1689 (3 specimens). First vouchered records for Belen and Valle Viejo departments. Cei's (1993) citations for Catamarca Province are unvouchered.

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New County Records of Amphibians and Reptiles from Northern Indiana

ROBERT BRODMAN
Biology Department, Saint Joseph's College
Rensselaer, Indiana 47978, USA
e-mail: bobb@saintjoe.edu

The distribution of amphibians and reptiles in Indiana, USA, has been documented by Minton (1972) and Minton et al. (1982). However, distributional records are lacking in many counties, including those of the Grand Prairie and Bluffton till plain sections of northern Indiana. Voucher specimens of new county records are reported here from Newton, Jasper, Pulaski, Benton, White, Miami, Wabash, Huntington, and Adams counties. Identification of *Ambystoma jeffersonianum/Ambystoma laterale* complex and *A. texanum* were verified electorphoretically by James P. Bogart. All other specimens were verified by Sherman A. Minton, Jr. Voucher specimens and color photographs were deposited in the Saint Joseph's College zoological collection (SJC). Except where noted, all specimens were collected by the author.

CAUDATA

Ambystoma jeffersoniaum (Jefferson Salamander). WABASH CO: Salmonie Lake State Forest. 12 April 1998. SJCAM 101. Four larvae taken and raised to metamorphosis in the lab, several egg masses seen in the field. HUNTINGTON CO: 1 km S Salmonie Lake. 4 June 1998. SJCAM 126. One larvae taken and raised to metamorphosis in the lab. All five specimen from these sites were LJJ triploids. These records fill the gap between Allen and Clinton counties.

Ambystoma laterale (Blue-spotted Salamander). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 12 May 1997. SJCAM 102. Five larvae taken and raised to metamorphosis in the lab, several more seen. These were all pure LL diploids. Unidentified members of the *Ambystoma jeffersonianum* complex were previously collected from Pulaski County (Minton 1972). Extends the range ca. 30 km S of nearest record in Starke County.

Ambystoma maculatum (Spotted Salamander). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 12 May 1997. SJCAM 103. Two larvae taken. Fills distribution gap in northwest Indiana between Marshall and Clinton counties and extends the range ca. 35 km to the W in this portion of the state.

Ambystoma texanum (Smallmouth Salamander). HUNTINGTON CO: Salmonie Lake State Recreation Area. 12 April 1998. SJCAM 105. Five larvae taken and raised to metamorphosis in the lab, dozens of egg masses seen in the field. Fills the gap among surrounding counties. WHITE CO: Lowe's Nature Preserve, 3 km E Monon. 18 April 1998. SJCAM 104. Three larvae taken, two were raised to metamorphosis in the lab. Extends range ca. 50 km W of Cass County and ca. 70 km NE of Warren County.

Ambystoma tigrinum (Eastern Tiger Salamander). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 12 May 1997. SJCAM 106. Four larvae taken, many others seen. NEWTON CO: Willow Slough Fish and Wildlife Area. 6 June 1997. SJCAM 107. Four larvae taken. These records complete the county sequence in NW Indiana to the Illinois border. HUNTINGTON CO: Salmonie Lake State Recreation Area. 12 April 1998. SJCAM 108. Four larvae taken, dozens of egg masses seen.

Notophthalmus viridescens viridescens (Red-spotted Newt). JASPER CO: Jasper-Pulaski Fish and Wildlife Area. 15 June 1997. SJCAM 109. One voucher specimen and photos of adults were taken from four ponds. Extends the range in NW Indiana ca. 50 km S of nearest record in Porter County, and ca. 50 km W of nearest record in Pulaski County.

Siren intermedia (Lesser Siren). PULASKI CO: Jasper-Pulaski Fish and Wildlife Area. 15 November 1996. SJCAM 110. Two adults were taken from a ditch along SR 421. This species had been reported from a site in Jasper County. Fills gap between Starke and White counties.

ANURA

Bufo americanus (American Toad). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 2 June 1997. SJCAM 111. One adult male taken from a small chorus. WHITE CO: Lowe's Nature Preserve, 3 km E Monon. 18 April 1998. SJCAM 114. One adult male taken from a large chorus. MIAMI CO: 1 km S Macey. 12 April 1998. SJCAM 112. One adult male taken from a large chorus. HUNTINGTON CO: Salmonie Lake State Recreation Area. 12 April 1998. SJCAM 113. One adult male taken from a moderate sized chorus. These record complete a series from Adams County on the Ohio border to Newton County on the Illinois border.

Bufo fowleri (Fowler's Toad). HUNTINGTON CO: Majenica Marsh, 1 km E Salmonie Lake State Recreation Area. 4 June 1998. SJCAM 127. Numerous tadpoles were seen; six tadpoles were taken and raised to metamorphosis in the lab. Fills gap between Allen and Wabash counties.

Pseudacris crucifer (Spring Peeper). MIAMI CO: 1 km S Macey. 12 April 1998. SJCAM 115. One adult male taken from a moderate sized chorus. HUNTINGTON CO: Salmonie Lake State Recreation Area. 12 April 1998. SJCAM 116. One adult male taken from a small chorus. BENTON CO: Robert Feldt Marsh, 13 km E Fowler. 17 April 1998. SJCAM 117. One adult male taken from a moderate sized chorus. These records complete a series from Allen County on the Ohio border to Benton County on the Illinois border.

Pseudacris triseriata (Western Chorus Frog). HUNTINGTON CO: Salmonie Lake State Recreation Area. 12 April 1998. SJCAM 118. One adult male taken from a moderate sized chorus. Completes series from Adams County on the Ohio border to Newton County on the Illinois border.

Hyla versicolor (Eastern Gray Treefrog). BENTON CO: Robert Feldt Marsh, 13 km E Fowler. 28 April 1998. SJCAM 119. One adult male taken from a moderate sized chorus. HUNTINGTON CO: Salmonie Lake State Recreation Area. 4 June 1998. SJCAM 128. Numerous tadpoles were seen; five were taken and raised to metamorphosis in the lab. These records complete a series from Adams County on the Ohio border to Benton County on the Illinois border.

Rana catesbeiana (Bullfrog). PULASKI CO: Jasper-Pulaski Fish and Wildlife Area. 11 June 1997. SJCAM 120. One adult taken from

small chorus. NEWTON CO: Willow Slough Fish and Wildlife Area. 6 June 1997. SJCAM 121. One adult taken from large chorus. BENTON CO: 3 km N Robert Feldt Marsh, 13 km E Fowler. 2 June 1998. SJCAM 132. One adult male taken from a moderate sized chorus. MIAMI CO: 1 km S Perrysburg. 4 June 1998. SJCAM 133. One adult taken from small chorus. WABASH CO: 11 km W North Manchester. 4 June 1998. SJCAM 129. One adult taken from small chorus. HUNTINGTON CO: Majenica Marsh, 3 km N Mt. Etna. 4 June 1998. SJCAM 130. One adult taken from small chorus. These records complete a series from Adams County on the Ohio border to Benton and Newton counties on the Illinois border.

Rana clamitans (Green Frog). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 2 June 1997. SJCAM 122. One adult male taken from a small chorus. BENTON CO: 3 km N Robert Feldt Marsh, 13 km E Fowler. 2 June 1998. SJCAM 131. One adult male taken from a moderate sized chorus. MIAMI CO: 1 km S Perrysburg. 4 June 1998. SJCAM 132. One adult taken from small chorus. WHITE CO: Lowe's Nature Preserve, 3 km E Monon. 18 April 1998. SJCAM 126. One adult male taken from a small chorus. HUNTINGTON CO: Salmonie Lake State Recreation Area. 4 June 1998. SJCAM 124. Numerous adults were seen, one was taken. These records complete a series from Allen County on the Ohio border to Benton County on the Illinois border.

Rana pipiens (Northern Leopard Frog). MIAMI CO: 1 km S Macey. 12 April 1998. SJCAM 123. One adult male taken from a small chorus. Fills gap among surrounding counties.

Rana sylvatica (Wood Frog). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 30 March 1998. SJCAM 125. One adult male taken from a small chorus. Extends range 17 km SW from nearest record from Starke County.

TESTUDINES

Terrapene carolina (Eastern Box Turtle). PULASKI CO: Berns-Meyer Nature Preserve, 3 km NE Pulaski. 12 May 1997. SJCRP 101. Carapace of a dead specimen (length 118 mm) and a color photograph of one large (carapace length 145 mm) female. Fills distribution gap between Jasper and Cass counties.

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New Illinois Amphibian and Reptile Distribution Records from the Kaskaskia River Drainage

ALLAN K. WILSON
Department of Zoology, Southern Illinois University
Carbondale, Illinois 62901-6501, USA
e-mail: akwilson@siu.edu

The last large Illinois contribution to the Geographic Distribution section of *Herpetological Review* was Petzing et al. (1998). The 26 new county records and four within-state range extensions in this article are a result of field work carried out in the Kaskaskia River drainage of Clinton, St. Clair, and Washington counties in Illinois (USA) during 1997 and 1998. The amphibian and reptile species of this area had been poorly documented prior to this inventory. Most of the land in the study areas is privately owned and is not open to public access which may account for the lack of herpetofaunal records. Habitats in this area are diverse and include floodplain forests with vernal, buttonbush (*Cephalanthus*) swamps and permanent oxbows, upland oak-hickory dominated flatwoods with vernal pools, and man-made pools and ponds. The study areas are located within the "Kaskaskia Bottoms" which is the largest unfragmented forest tract in the state. Kaskaskia Bottoms is one of 30 resource rich areas in Illinois identified by the Illinois Department of Natural Resources and The Nature of Illinois Foundation (1996).

Specimens taken for vouchers are deposited in the collections of the Illinois Natural History Survey (INHS) and Southern Illinois University at Carbondale (SIUC). County records were verified by checking the Illinois Herpetological Vouchered Database in the Illinois Natural History Survey at Champaign, Illinois, which contains data on Illinois amphibian and reptile species from 30 U.S. collections. A web page developed from the database information has been created which provides county-level distribution data for Illinois herpetofauna. This web site is accessible through the URL: http://www.inhs.uiuc.edu/cbd/collections/herp.html.

CAUDATA

Ambystoma maculatum (Spotted Salamander). CLINTON CO: 6.8 km N and 0.8 km W Okawville. (SE 1/4 Sec. 29, T01N, R04W; UTM Zone 16: N4263690m, E276903m; 38°29'37"N, 89°33'29"W). 1 March 1998. Elizabeth A. Fusek and A. K. Wilson. Verified by J. E. Petzing. INHS 14084. Collected as an egg mass in a semi-permanent pool in a young oak-hickory flatwoods stand and raised to metamorphosis in lab by J. E. Petzing. New county record which extends the known range ca. 64 km to the NW of the nearest vouchered locality in Jefferson County; ST. CLAIR CO: 5.2 km NE Fayetteville and N end Wagon Lake Road (UTM Zone 16: N4253803m, E260574m; 38°24'01"N, 89°44'30"W). 5 April 1998. A. K. Wilson, E. A. Fusek, Richard Harms and David Harms. Verified by J. E. Petzing. INHS 13989. One adult collected at the edge of a floodplain forest. Previously unvouchered record. Smith (1961) reported to have examined specimens from St. Clair County but to-date none have been found in museum collections; WASHINGTON CO: 8 km W Okawville. (SE 1/4 SE 1/4 Sec. 21, T01S, R05W; UTM Zone 16: E268440m, N4256480m; 38°25'26"N, 89°39'07"W). 15 June 1997. INHS 13365. Verified by J. E. Petzing. Collected from ditch along east side of agriculture field and raised to metamorphosis in the laboratory by JEP. New county record.

Ambystoma opacum (Marbled Salamander). CLINTON CO: 6.7 km N and 0.8 km W Okawville. (SE 1/4 Sec. 29, T01N, R04W; UTM Zone 16: N4263730m, E276639m; 38°29'38"N, 89°33'40"W). 1 March 1998. E. A. Fusek and A. K. Wilson. Verified by J. E. Petzing. INHS 14080. Collected as larvae in a vernal pool near an oak-hickory flatwoods stand. New county record which extends the known range ca. 18 km to the W of the nearest locality in Washington County.

Ambystoma texanum (Smallmouth Salamander). WASHINGTON CO: 3.5 km NW Venedy near Calamus Lake. (SW 1/4 Sec. 21, T01S, R05W; UTM Zone 16: N4256423m, E267595m; 38°25'33"N, 89°39'44"W). 26 April 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13122. New county record.

Notophthalmus viridescens (Eastern Newt). WASHINGTON CO: 9 km W Okawville, temporary ditch E Calamus Lake. (SE 1/4 SE 1/4 Sec. 21, T01S, R05W; UTM Zone 16: N4256480m, E268440m; 38°25'36"N, 89°39'10"W). 6 July 1997. A. K. Wilson and J. E. Petzing. Verified by C. A. Phillips. INHS 13427. Larva collected from an agriculture field ditch and raised to metamorphosis by AKW.

New county record which extends the known range ca. 30 km ESE of the nearest locality in St. Clair County at Belleville.

ANURA

Bufo americanus (American Toad). CLINTON CO: 0.1 km N Co. Road 250N on Co. Road 100E and 1 km W New Memphis Station (border of SE 1/4 NE 1/4 Sec. 07 and SW 1/4 NW 1/4 Sec. 08, T01S, R05W; UTM Zone 16: N4260423m, E265673m; 38°27'41"N, 89°41'08"W). 7 September 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13447. Found dead on road (DOR). Previously unvouchered record. Smith (1961) reported to have examined specimens from Clinton County, but to date none have been found in museum collections; ST. CLAIR CO: just E of S end High Banks Road and 8.6 km SW New Memphis. (SW 1/4 Sec. 22, T01S, R06W; UTM Zone 16: N4256397m, E259929m; 38°25'25"N, 89°40'00"W). 1 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13118. New county record. Previously unvouchered record. Hurter (1911) reported an observation record for this species but no voucher was taken.

Bufo woodhousii (Woodhouse's Toad). WASHINGTON CO: 3.5 km NW Venedy near Calamus Lake. (SW 1/4 Sec. 21, T01S, R05W; UTM Zone 16: N4256423m, E267500m; 38°25'33"N, 89°39'48"W). 26 April 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13131. New county record.

Hyla chrysoscelis (Cope's Gray Treefrog). CLINTON CO: 6.6 km N Okawville and 0.7 km NE Shoal Creek-Kaskaskia River confluence. (SW 1/4 NW 1/4 Sec. 32, T01N, R04W; UTM Zone 16: N4262998m, E275936m; 38°29'14"N, 89°34'08"W). 8 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 14082. New county record. The species was verified by occilligram output of the calling specimen prior to capture; ST. CLAIR CO: Just E of South end of High Banks Road and 8.6 km SW New Memphis (SW 1/4 Sec. 22, T01S, R06W; UTM Zone 16: N4256397m, E259929m; 38°25'25"N, 89°45'00"W). 1 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13119. New county record. Species was verified by occilligram output from an audio recording of the calling specimen prior to capture.

Pseudacris crucifer (Spring Peeper). CLINTON CO: 6.8 km N and 0.8 km W Okawville. (SE 1/4 Sec. 29, T01N, R04W; UTM Zone 16: N4263733m, E276786m; 38°29'38"N, 89°33'34"W). 1 March 1998. A. K. Wilson and E. A. Fusek. Verified by J. E. Petzing. INHS 13896. Collected one adult male in a vernal pool in an oak-hickory flatwoods stand. New county record.

Pseudacris triseriata (Western Chorus Frog). CLINTON CO: 10.6 km E-SE Mascoutah at New Memphis on Ill. Rt. 177 (SW 1/4 Sec. 08, T01S, R05W; UTM Zone 16: N4260349m, E266467m; 38°27'39"N, 89°40'35"W). 8 March 1998. A. K. Wilson and E. A. Fusek. Verified by J. E. Petzing. INHS 13897. Adult male collected while calling in a roadside ditch. New county record.

Rana catesbeiana (Bullfrog). CLINTON CO: farm pond on S side Posey, 0.2 km S railroad crossing on Ill Rt.127 (NE 1/4 NE 1/4 Sec. 18, T01N, R02W; UTM Zone 16: N4267678m, E264926m; 38°32'02"N, 89°21'10"W). 22 April 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13120. Collected as a large larva in an extremely bloated state. New county record.

TESTUDINES

Chelydra serpentina (Common Snapping Turtle). CLINTON CO: 6.7 km N and 0.8 km W Okawville. (Sec. 32, T01N, R04W; UTM Zone 16: N4263573m, E276717m; 38°29'33"N, 89°33'37"W). 29 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13141. One AOR juvenile collected. Previously unvouchered record (Cahn 1937).

Terrapene carolina (Eastern Box Turtle). CLINTON CO: 6.8 km N and 0.8 km W Okawville. (SE 1/4 Sec. 29, T01N, R04W; UTM Zone 16: N4263733m, E276786m; 38°29'38"N, 89°33'34"W). 16 August 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13451. Carapace collected. New county record.

LACERTILIA

Eumeces laticeps (Broadhead Skink). ST. CLAIR CO: 4.8 km W and 3.5 km S New Memphis Station (Sec. 23, T01S, R06W; UTM Zone 16: N4257107m, E261458m, 38°25'49"N, 89°43'58"W). 21 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13135. Previously unvouchered record (Taylor 1935). The specimen referred to by Taylor has not been located, but another specimen was located at the U.S. National Museum of Natural History with the following information: ST. CLAIR CO: Belleville. September 1874. Dr. A. Reuss. USNM 8767. Catalogued on 15 March 1877. New county record not previously published. USNM 8767 was originally misidentified as *E. fasciatus* and later reidentified as *E. laticeps* by James A. Peters on 21 December 1964 (R. Reynolds, pers. comm.); WASHINGTON CO: 6.7 km W Okawville (SW 1/4 Sec. 14, T01S, R05W; UTM Zone 16: N4257465m, E270731m; 38°26'10"N, 89°37'36"W). 29 September 1997. L. Schuetz and A. K. Wilson. Verified by J. E. Petzing. INHS 13434. Juvenile. New county record. Previously unvouchered record. Smith (1961) reported to have examined specimens from Washington County, but to date, none has been found in museum collections.

SERPENTES

Nerodia erythrogaster (Plainbelly Water Snake). CLINTON CO: 6.7 km N Okawville. (NW 1/4 Sec. 32, T01N, R04W; UTM Zone 16: N4263089m, E275729m; 38°29'17"N, 89°34'17"W). 8 June 1997. A. K. Wilson. Verified by R. A. Brandon. SIUC R-3053. New county record.

Nerodia rhombifer (Diamondback Water Snake). CLINTON CO: 0.5 km W Kaskaskia River Bridge on Ill. Rt. 177 (Se 1/4 SE 1/4 Sec. 10, T01S, R05W; UTM Zone 16: N4258688m, E269694m; 38°26'48"N, 89°38'21"W). 16 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13117. DOR juvenile. New county record; WASHINGTON CO: 8.6 km W Okawville near Clear Lake (NW 1/4 SW 1/4 Sec 22, T01S, R05W; UTM Zone 16: N4256555m, E268980m; 38°25'39"N, 89°38'47"W). 13 September 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13437. Collected from a residential opening in an oak-hickory flatwoods. New county record.

Nerodia sipedon (Northern Water Snake). CLINTON CO: roadside pool on U.S. Rt. 50 below Carlyle Lake Dam (SE 1/4 Sec. 18, T02N, R02W; UTM Zone 16: N4276185m, E295216m; 38°36'38"N, 89°21'07"W). 22 April 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13113. Juvenile. New county record.

Regina grahamii (Graham's Crayfish Snake). CLINTON CO: 1.2 km W New Memphis Station and 1.2 km E St. Clair County line on Co. Road 250N (SE 1/4 Sec. 07, T01S, R05W; UTM Zone 16: N4260118m, E265177m; 38°27'31"N, 89°41'28"W). 14 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13413. Adult found AOR near a 10–20 year old timber stand surrounding a floodplain pond. New county record.

Storeria dekayi wrightorum (Midland Brown Snake). CLINTON CO: Gravel road 6.9 km NNW Okawville and 0.7 km NNW Shoal Creek/Kaskaskia River confluence (SW 1/4 NE 1/4 Sec. 31, T01N, R04W;

UTM Zone 16: N4263139m, E275729m; 38°29'18"N, 89°34'17"W). 8 June 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13416. Adult female collected which gave birth in captivity. New county record.

Storeria occipitomaculata (Redbelly Snake). WASHINGTON CO: 8.6 km W Okawville and S Clear Lake (SW 1/4 Sec. 22, T01S, R05W; UTM Zone 16: N4256617m, E269071m; 38°25'41"N, 89°38'44"W). 14 July 1997. A. K. Wilson, E. A. Fusek, and J. B. Taft. Verified by J. E. Petzing. INHS 14079. Collected near a residential opening in an oak-hickory flatwoods. New county record.

Thamnophis proximus (Western Ribbon Snake). ST. CLAIR CO: 6.75 km SW New Memphis Station (SW 1/4 NE 1/4 Sec. 23, T01S, R06W; UTM Zone 16: N4257149m, E261702m, 38°25'51"N, 89°43'48"W). 25 May 1997. A. K. Wilson. Verified by J. E. Petzing. INHS 13112. This specimen extends the species known range to the E and is 41 km ESE of the nearest vouchered locality record at Cahokia. This voucher is also the first of this species to be taken in the Kaskaskia River drainage.

Acknowledgments.—I thank John E. Petzing and Christopher A. Phillips for reviewing the manuscript. The Illinois Natural History Survey provided needed field equipment and museum records information. Elizabeth A. Fusek, John E. Petzing, Glen Schuetz, Nathan Schuetz, Jennifer Malacarne, William J. Poly, and Steve Daniels assisted with field work. Mike Redmer provided oscillograms of pre-recorded anuran calls. Robert Reynolds provided museum records information from the U.S. National Museum of Natural History. Field work was supported by funding from the Wildlife Preservation Fund and the Conservation 2000 Fund, both of the Illinois Department of Natural Resources. Many thanks are due to the study area landowners for their cooperation in this project.

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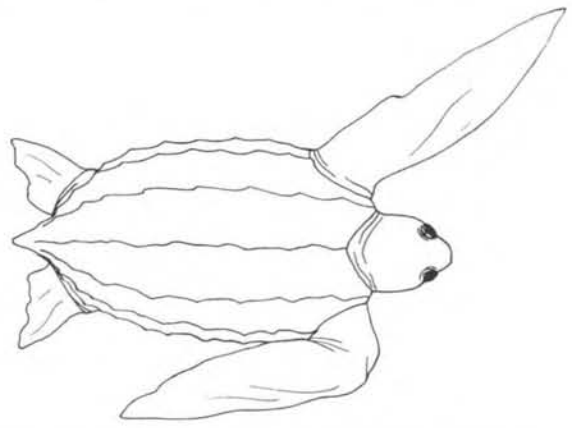
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Dermochelys coriacea. Illustration by Michael Frick.

New County Distribution Records of Amphibians and Reptiles from Southwestern Kansas

DALE W. SPARKS
Department of Life Sciences, Indiana State University
Terre Haute, Indiana 47809, USA
e-mail: lssparks@scifac.indstate.edu

ANDREW G. BURR
Black and Veatch, 11401 Lamar, Overland Park, Kansas 66211, USA

M. NEIL BASS
Rt. 2 Box 494, Greenfield, Missouri 65661, USA

and

GREGORY A. LIGGETT
Sternberg Museum of Natural History, Fort Hays State University
Hays, Kansas 67601, USA

Reichard et al. (1995) identified southwestern Kansas, USA, as an area where information is limited about the distribution of reptiles and amphibians. We surveyed six counties (Haskell, Grant, Gray, Seward, Stanton, and Stevens counties) in southwestern Kansas from April through August 1996. In addition, a notable frog record was obtained from Rush County.

Amphibians and reptiles were considered as new county distribution records if they were not reported in Collins (1993), or in a subsequent issue of the *Kansas Herpetological Society Newsletter*. All specimens were collected by the authors, deposited in the herpetological collections of the Sternberg Museum of Natural History (formerly Museum of the High Plains), and verified upon accession by Eugene D. Fleharty. New county distribution records are as follows:

ANURA

Rana catesbeiana (Bullfrog). GRANT CO: Ulysses Golf Course. (MHP 6715). 3 May 1996. County record; captured in a water hazard. RUSH CO: 10.5 km S Rush Center (MHP 6716). 26 July 1996. County record; found dead on US Rt. 183. STEVENS CO: 8.9 km N and 4 km W Feterita (MHP 6717). 29 June 1996. County record; captured from a windmill-fed pond.

TESTUDINES

Chelydra serpentina (Common Snapping Turtle). GRANT CO: 0.8 km N and 3.6 km E Ulysses. (MHP 6718). 4 May 1996. County record; captured in water pooled under a railroad bridge.

Kinosternon flavescens (Yellow Mud Turtle). STEVENS CO: 1.6 km N and 4 km E Cave. (MHP 6724). 30 June 1996. County record; found dead on US Highway 56.

Terrapene ornata (Ornate Box Turtle). GRANT CO: 5.6 km N & 5.6 km E Ulysses. (MHP 6719). 4 May 1996. County record; captured at an abandoned gravel pit.

Trachemys scripta (Slider). GRANT CO: 0.8 km N and 3.6 km E Ulysses. (MHP 6720). 4 May 1996. County record; captured from water pooled under a railroad bridge. GRAY CO: 1.2 km S Cimarron. (MHP 6721). 16 June 1994. County record; shot while sunbathing on a log, which was floating in a gravel pit.

LACERTILIA

Sceloporus undulatus (Prairie Lizard). STEVENS CO: Cimarron National Grasslands, 9.7 km N and 3.2 km W Feterita. (MHP 6722).

29 June 1996. County record; captured under a fallen tree.

SERPENTES

Arizona elegans (Eastern Glossy Snake). STEVENS CO: Cimarron National Grasslands, 9.7 km N and 3.2 km W Feterita. (MHP 6723). 29 June 1996. County record; captured while crawling through vegetation.

Five of the nine specimens reported herein were captured from artificial pools of water. These records may represent animals overlooked by previous surveys, but it is possible they represent the first evidence of a more interesting phenomenon—the invasion of artificial water sources by wildlife.

The Ogallala aquifer underlies the western one-third of Kansas. Southwestern Kansas is the most heavily irrigated area of the state (Socolofsky and Self 1988). Jenkins (1983) reported that irrigation wells pump ca. 6,615 hm^2 (5,000,000 acre/ft) per year to irrigate 1,214,100 hm^2 (3,000,000 acres) of agricultural land. This high rate of water removal from the aquifer combined with a low recharge rate from precipitation (typically 40–56 cm/yr) has led to a declining water table (Socolofsky and Self 1988). One effect of lowering the water table is a reduced amount of surface water in the natural springs, rivers, and streams (Kromm and White 1992).

In contrast, numerous artificial water sources have been created, either as a result of irrigation for agriculture, or for recreational or municipal use. These new water resources include farm ponds, gravel pits, stock tanks, municipal reservoirs, and state fishing and recreation lakes. The net effect of this change with regard to the amount of surface water in southwestern Kansas is presently unknown. However, the nature of the surface water has undoubtedly changed since the introduction of large-scale irrigation in the region. This change in the nature of surface water in a relatively short time-period may impact the distribution of organisms associated with water. Some of the new records reported herein could be the result of a distributional shift of these species in response to a change in the availability of appropriate aquatic habitats.

Acknowledgments.—This study would not have been possible without the cooperation of the following people and organizations who allowed us access to land they either managed or owned, and offered their knowledge of local animals: D. Bozone; M. Christianson; J. Cline, Cimarron National Grasslands; R. Daniels; S. Dorris; D. Foreman, R. Fox, J. Krie; J. C. Nelson; J. Smith; T. Stewart; and J. Unsell. Ken Brunson (Kansas Department of Wildlife and Parks) provided us with a permit that allowed us to maintain the *Arizona elegans* captured during this study. We are also indebted to the following people who provided assistance both in the laboratory and in the field: K. C. Chapman, S. M. Hilgers, S. R. Hoofer, L. and M. Walker, and J. and L.Watson.

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BOOK REVIEWS

Yucatán, Guatemala, and Belize in Fashion

OSCAR A. FLORES-VILLELA
Museo de Zoología, Facultad de Ciencias, UNAM
Apartado Postal 70-399, México, D.F. 04510, México
e-mail: ofv@hp.fciencias.unam.mx

The Amphibians and Reptiles of the Yucatán Peninsula, by Julian C. Lee. 1996. Cornell University Press, Ithaca, New York. i–xii, 500 pp., 403 figures (210 in color), 188 maps. Hardcover. US $175.00.

This is a book written for professional herpetologists, but it can also be very instructive for amateurs. Julian Lee should be regarded as Mr. Yucatán herpetologist, as there is no other person who knows better the herpetofauna of this part of the world.

This book is organized into six parts (these are not numbered as chapters or sections): Introduction, The Environment of the Yucatán Peninsula, Habitats of Amphibians and Reptiles, A Brief History of Herpetology in the Yucatán Peninsula, and Species Accounts. At the end of the species accounts section, there is a small section on Ethnoherpetology that probably should be a separate section. At the end of the main text, there is a Gazetteer and a Glossary. There are Subject and Taxonomic indices.

Amphibians and Reptiles of Northern Guatemala, the Yucatán, and Belize, by Jonathan A. Campbell. University of Oklahoma Press, Norman, Oklahoma. i–xix, 380 pp., 189 figures (176 in color). 1998. Hardcover US $100.00; softcover US $29.95.

This is a semi-popular book, which can be of widespread use for professionals as well. Jon Campbell is a well known herpetologist, with vast field experience in Guatemala and México.

This book is organized into three main sections. The Introduction contains a brief history of exploration in the area, as well as information on identification, conservation, and how to find herps. The other two sections are devoted to Amphibians and Reptiles, respectively. Six appendices (with taxonomic keys) and a glossary are at the end of the book. The section containing species accounts includes 15 boxed natural history vignettes, including personal adventures, that are fun to read. There is an alphabetical index of scientific names, place names, and general terms.

The quality of the printing in both books is very good, with a nice organization and excellent photographs. It is hard to compare them, especially when they are not intended for the same audience, but I will try. Lee's book is a work for an audience of mostly herpetologists and amateurs that are herpeto fans. The book has numerous drawings, photographs (most of them of a very good quality), and distributional maps, as well as several color photographs showing habitats in the peninsula. Many of the drawings illustrate the terms used to identify the species in question. The book presents in each section bilingual identification keys (in English and Spanish), that in fact work very well. Lee´s book has tadpole keys which are absent from Campbell's. Each species account in Lee's book is very detailed, including information on the original description, holotype and type locality, a description, similar species, distribution, natural history, subspecies, etymology, a comment section, and locality records in the peninsula. Each account also contains distribution maps, drawings of tadpoles for most of the species with indirect development (frogs and toads), and audiospectrograms of ad-

vertisement calls. One hundred and eighty-six color photographs illustrate 148 species. The accounts range from about a page to three and a half pages. A ten-page glossary, with about 400 definitions and terms, completes Lee's book.

Campbell´s is a book for a general audience, and is replete with numerous photographs, most of them of very good quality. It includes black-and-white habitat photos, two maps of the area covered by the book, and four plates with numerous drawings. Unfortunately, there is no a general lepidosis with nomenclature for the lay person, even when some of those terms are used in the species descriptions. This book, as well as Lee´s, has identification keys. In Campbell´s book these are included in an appendix, and are bilingual which make the keys very useful for both North Americans and native scholars who do not speak English. Each species account presents a detailed description, natural history (these vary in length according to how much is known for each particular species), distribution, and many accounts offer a small section with general remarks. The species accounts are easy to read for the person familiar with herpetological terminology, and all are very informative. There are 175 photographs that illustrate all of the amphibians and all of the reptiles but two species (*Ameiva chaitzami* and *Rhadinaea anachoreta*). The accounts vary in length from about half of a page to two and a half pages. A nine-page glossary containing just over 200 terms is at the end of the text.

Numerous original, natural history observations permeate both books, which testifies to the field experiences of both authors, and adds considerably to the reference value of each work.

There are a few differences in the treatment of some taxonomically problematic groups. For example, Lee treats anoles as the genus *Anolis*, while Campbell places them in *Norops*. Lee uses *Urotheca* and *Celestus* for Campbell's *Pliocercus* and *Diploglossus*, respectively. There are also a few differences at the species level. Within the anoles, what Lee calls *pentaprion* is referred to as *beckeri* by Campbell; Lee's *lemurinus* is Campbell's *burgeaei*. Lee uses *Mabouya unimarginata, Cnemidophorus cozumela*, and *Leptodeira septentrionalis* for species Campbell refers to as *M. brachypoda, C. maslini*, and *L. polysticta*, respectively. *Bufo campbelli* is part of *B. valliceps* in Lee´s book, maybe because the species description was not published when the Yucatán book was already in press. Also *Rhadinaea anachoreta* is not included in Lee´s book, possibly for the same reason.

Both authors used common names, although Lee not only used an English name but also the local names for different parts of the peninsula (including some Mayan names), and had the good idea to not translate them into Spanish. Many of the common names used by Campbell are made up for this book and then translated into Spanish, making for some odd-sounding names. This kind of practice has been done in the past with very little success. Common names without relation to local meaning and that sound unnatural in Spanish have no practical utility.

Campbell arranged the identification keys in several appendices, while Lee inserted them directly in the text; each approach offers certain advantages. I hope that future works in English include bilingual identification keys as standard practice. There are several Latin Americans that will benefit from this practice and who would be willing to translate keys into Spanish, as I did for Lee´s book. I have made extensive use of his keys and they work just fine. I have not had the chance to test Campbell´s keys.

These two books are of the highest quality, both by their contents and the quality of printing. In brief, I highly recommend both, especially if you are a bibliophile. Julian Lee´s book certainly sets a standard for future regional monographic works, which will be difficult to meet, whereas Campbell´s is an excellent contribution to the semi-popular literature of the region. The major problem with Lee´s book is its price, in particular for Mexicans students, which may preclude the book's inclusion in many institutional and personal libraries in México.

TABLE 1. Species distribution in Lee's and Campbell's books.

	Lee	in common	Campbell
Caecilians	2	2	2
Salamanders	6	5	6
Frogs & Toads	35	29	36
Crocodiles	2	2	2
Turtles	16	9	9
Lizards	48	36	36
Snakes	73	66	69

A Field Guide to the Frogs of Borneo, by Robert F. Inger and Robert B. Stuebing. 1997. Natural History Publications, Kota Kinabalu in association with Science and Technology Unit, Sabah. Available from Natural History Publications (Borneo), Sdn. Bhd., A913, 9th Floor, Wisma Merdeka, P.O. Box 13908, 88846 Kota Kinabalu, Sabah, East Malaysia, or The Borneo Company, 10 Locust Hill Road, Cincinnati, Ohio 45245, USA. M $49.00 or US $25.00. ISBN 983-812-016-2.

INDRANEIL DAS
Institute of Biodiversity and Environmental Conservation
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak, East Malaysia
e-mail: idas@mailhost.unimas.my

In 1966, Bob Inger treated the entire Bornean amphibian fauna in a monographic review (still available, thanks to a 1990 reprint from Malaysia). Still a classic, it contained detailed morphological descriptions, keys, ecological notes, and discussion on the systematics, nomenclature, and biogeography of a highly interesting fauna. Now, over three decades later, Inger, Emeritus Curator at the Field Museum of Natural History, has teamed up with Robert B. Stuebing, formerly Associate Professor, Universiti Kebangsaan Malaysia–Sabah Campus, to produce a more accessible guide to the fauna. The same team of authors gave us a field guide to the frogs of Sabah (Inger and Stuebing 1989). This particular publication sets an even higher standard for regional field guides, for which part of the credit should go to Natural History Publications (Borneo). The long list of books on the region's natural history published by this company also includes the admirable little book by Inger and Tan (1996) on the natural history of Sabah's amphibians and reptiles.

There have been considerable changes in the faunal list of this island, thanks largely to the efforts of these two authors. The 1966 monograph listed 88 species of amphibians as occurring on Borneo. The checklist in the present work shows 142 species (excluding the five caecilian species; see Frost 1985). During the 30 years that have elapsed between the publication of the two volumes, new areas have been inventoried, taxonomically cryptic species dealt with, and questions on the higher relationships in amphibians of the region addressed. This has resulted in many generic changes (not all of which, however, have been accepted by the authors). The present work concentrates on the adult anuran amphibians: caecilians are not dealt with, and tadpoles of anurans, when known, are briefly

described, but not illustrated. In all, 97 species are covered in detail.

The contents of the book include a Foreword by Sabah State's Deputy Chief Minister; a Preface (overlooking a magnificent portrait of a rainforest stream); followed by chapters on the general biology of frogs, frogs in local culture (including folklore and as food), the distribution and classification of Bornean frogs (including a key to adult frogs and a checklist of the anuran amphibian fauna of Borneo). Two important chapters deal with the ecology of frogs and their larvae, and will serve as a useful guide for field collectors, and finally, the all-important issue of conservation. Individual species accounts include the current scientific name and authority; a recommended English name; descriptions of adults, including size ranges for mature males and females; descriptions of tadpoles, including notes on their habitats; habits and habitat of adults; a description of calls; and distribution within (and when relevant, beyond) Borneo. Generic treatments are not just brief taxonomic definitions, but field notes on natural history of frog and toad groups, which make them invaluable for field identifications as well as museum collection work. What makes this book unique is that, between them, the two authors have nearly 70 years of field experience on Bornean frogs, which is abundantly clear in the species descriptions. Further, both wield the pen and the camera with equal dexterity. The high quality photographs of virtually every species they choose to describe attest to their industry. All photographs are of live amphibians, the only "museum piece" being the apparently rare *Barbourula kalimantanensis*. A list of ten references rounds out the book. As mentioned by Inger and Stuebing, the inventory of Borneo's amphibian fauna is far from complete. Most of the new discoveries have been made from the more accessible Malaysian states of Sarawak and Sabah, while the Indonesian sector, Kalimantan, has remained largely unknown. One hopes that future generations of biologists will explore these dark forests, armed with an adequate supply of collector's paraphernalia, and of course, a copy of Inger and Stuebing's amazing field guide.

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Bufo marinus. Paraguay. Illustration by Dan Erickson.

Objectivos y Métodos Biogeográficos. Aplicaciones en Herpetología (Objectives and Methods of Biogeography, Herpetological Applications), edited by J. M. Vargas, R. Real, and A. Antúnez. Monografías de Herpetología, Vol. 2. 1992. Softcover, 136 pp. ISSN 1130-8443. Pts 1,800 (approx. US $15.00).

Distribución y Biogeografía de los Anfibios y Reptiles en España y Portugal (Distribution and Biogeography of the Amphibians and Reptiles of Spain and Portugal), edited by J. M. Pleguezuelos. Monografías de Herpetología, Vol. 3. 1997. Softcover, 542 pp. ISBN 84-338-2341-8. Pts 6,500 (approx. US $45; non-members), Pts 5,000 (approx. US $35; members). Both titles available from: Asociación Herpetológica Española (attn: Ms. Elisa Martínez), Calle Senador Castillo Olivares 10, bajo, 35005-Las Palmas de Gran Canarias, Spain.

STEPHEN D. BUSACK

North Carolina Museum of Natural Sciences
P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA
e-mail: steve_busack@mail.enr.state.nc.us

With the production of these two volumes, the monograph series produced by the Spanish Association of Herpetologists provides both a review of general biogeographic theory and principles, and an analysis of the biogeography of the Iberian herpetofauna. *Objectivos y Métodos Biogeográficos* is a slim, well-produced volume providing an informative primer to the history, principles, and results of various approaches to the study of herpetological biogeography. Eight authors contribute to the nine chapters comprising the book; each chapter can be read (and understood) either as a single (and quite independent) entity, or as a chapter in a much larger story.

The volume opens with a brief preface, followed by three chapters introducing conceptual origins and development of the study of biogeography (J. M. Vargas), objectives and methods of various analyses (R. Real and J. M. Ramírez), and effects of scale on a study's result (A. Antúnez and A. L. Márquez). Following this introduction are three chapters detailing methods of preparing an atlas of species distribution (L. J. Palomo and A. Antúnez), determining factors contributing to the geographic range of a species (A. Antúnez and M. Mendoza), and elucidating biogeographical units (R. Real, J. M. Vargas, and J. C. Guerrero). The final three chapters discuss patterns of species richness (R. Real), contributions to environmental management and species conservation (J. M. Ramirez and J. M. Vargas), and schools and trends in historical biogeography (J. M. Vargas).

All contributions serve well as summaries of our state of accomplishment and understanding within this field of study. I found the chapter on the prospective role of biogeography in environmental management and species conservation to be particularly relevant, especially in today's world of declining natural environments, endangered species, and disappearing ecosystems.

As I read through these essays, I wondered for whom this volume was intended. There can be only one practical application for this monograph—to support the student conversant in Spanish who has an interest in biogeography. As the centerpiece for a seminar on biogeography—herpetological or otherwise—this volume would be excellent. If you teach in a setting where the instructional language is Spanish, or if you have a general interest in biogeography, you will want to consider purchasing this monograph.

Distribución y Biogeografía de los Anfibios y Reptiles en España y Portugal summarizes data resulting from the project "A Provisional Atlas of the Amphibians and Reptiles of Spain and Portugal." Sixty-four authors document and summarize the distribution

and biogeography of the Spanish and Portuguese (including non-continental possessions) herpetofauna. The first section ("Introduction," 24 pages) is partitioned into three chapters that provide background information regarding the original project, document the methodology employed, and review the history of biogeographic work concerning the herpetofauna. The second section ("The Iberian Peninsula") contains five chapters: "Origins and evolutionary relationships of the Iberian herpetofauna" (54 pages, illustrated with maps [some in color] and diagrams); "The Iberian herpetofauna" (206 pages, including distribution maps and color photographs of the species); "Biogeography of the amphibians and reptiles of the Iberian peninsula" (14 pages); "Altitudinal distribution of the Iberian herpetofauna" (21 pages, including histograms of elevational ranges for 63 species); and "The islets and small islands of littoral Iberica" (7 pages with maps, faunal lists, and color photographs).

Section Three, "The Balearics", presents the herpetofauna of the Balearic Islands in one chapter (16 pages, with maps and color photographs), and the biogeography of the islands in another (9 pages, including a table listing all named islets, their surface areas, elevations, and reptile and amphibian inhabitants). Section Four reviews the herpetofauna and biogeography of the Canary Islands, the Azores, and the Islands of Madeira and Salvajes in two chapters (45 pages with maps and color photographs). Section Five, aptly named "Miscellany", includes accounts of five marine turtles (18 pages, including maps and color photographs), the amphibians and reptiles of Ceuta, Melilla, Isla Chafarinas and (the large rocks of) Alhucemas and Vélez de la Gomera (14 pages, including a generalized map, species checklist, and 21 color photographs), and the species known to be introduced (11 pages, including photographs and maps). The volume concludes with a chapter on legislation, protection, and the state of conservation of the Spanish amphibians and reptiles (40 pages, including a table) followed by a similar chapter devoted to the amphibians and reptiles of Portugal (13 pages). The table of contents is located in the rear of the volume.

The first section of this volume is interesting and generally well written; it provides the background information one will need to make the most of this contribution. I must confess, however, that I do not care much for the mapping procedure. Provincial boundary lines are not provided, making orientation (especially mid-peninsula) more difficult than necessary. Although I certainly understand why decreasing quadrant size increases resolution, I don't see how reducing quadrant size from 20 km x 20 km to 10 km x 10 km would move the actual locality for a terrestrial salamander from land to sea (see quadrant CF, Fig. 1, p. 30)! This problem, unfortunately, is not confined to the map chosen to illustrate and explain the mapping procedure; several maps throughout the volume suffer the same problem and users will want to pay close attention to the errata sheet provided with the volume before attempting to use any of the maps.

Barbadillo, García-París, and Sanchíz are to be congratulated for their complete and thorough review of the evolutionary history of Iberian amphibian and reptile species. Their presentation serves well as an up-to-date review of the fossil record and our understanding of phylogenetic relationships among most lineages. Molecular clock data for cladogenetic events are compared with paleogeographic data to provide the reader with a retrospective look into the biogeographic history of the regional herpetofauna, and color diagrams representing geographical change from late Cretaceous to most recent glaciation serve to make this chapter easily understood. Figure 29b (p. 82), however, was printed in error; a corrected version appears on the reverse of the errata sheet. If you study the evolution of the European fauna, or are interested in biogeography in general, you will find this section most rewarding.

Most readers, however, will be drawn immediately to the species accounts. Each account explains the distribution and habitat preference of each taxon while providing a (mostly) superb color portrait-like photograph of each, a map of its distribution, and a listing of the "most significant" references. In a volume produced with cooperation from 64 authors, it is difficult to control the level of thoroughness and accuracy for each contribution and some problems result. Busack and Salvador (1984), for example, published significant distributional data for *Hemidactylus turcicus, Coronella girondica, Natrix natrix,* and *Vipera latastei* but were not cited in the accounts for any of these species. And I have to wonder why Busack (1985) is considered a "most significant" reference to *Podarcis hispanica* when the research to which it refers was neither presented at the meeting for which the abstract was prepared, nor published. Omissions and errors such as these reduce the general utility of the accounts in which they occur, and made me wonder about the thoroughness of other accounts in this section of the book.

Vargas and Real's chapter on biogeography is rather a disappointment, given the excellent presentation of the same topic presented earlier. In a major work such as this, one expects a thoroughly researched treatment. There is little depth to this analysis, and I was left wondering why contributions to Iberian biogeography by Busack (1977, 1986), Busack and Jaksic (1982), Busack and Hedges (1984), Delibes and Salvador (1986), and Pleguezuelos and Moreno (1990), to name but a few, were not incorporated into the discussion.

Section Three considers only two amphibian and three reptile species from the Balearic Islands, yet several additional species are known to inhabit these islands. Only by perusing the species accounts presented for continental Iberia, and examining the maps, may one assemble a complete listing of the herpetofauna of these islands. Why was a checklist of species known to occur on these islands (cross-referenced to the account provided elsewhere) not provided? A similar problem arises in the chapter concerning introductions when intra- and inter-continental introductions are listed. Why, for example, are *Discoglossus pictus, Testudo graeca, T. hermanni,* and *Chamaeleo chamaeleon* considered in the section on the continental fauna if introductions are considered separately and these taxa are known to be introductions? Adding to the confusion, the dot indicating the introduction site of *Bufo mauritanicus* is placed incorrectly on the map, the illustration of *Anolis carolinensis* indicates a specimen from Barcelona but the map documents only a much more southern locality, and the illustration labeled *Chrysemys picta* (p. 474) is actually that of a juvenile *Pseudemys floridana.*

Impressed as I was by the chapter contributed by Barbadillo, García-París, and Sanchíz, the thoroughness of some of the species accounts, and the quality of the photographs, I cannot recommend this volume to those not already well acquainted with the fauna. In a volume whose main purpose is to present a complete account of faunal distribution, one expects the maps to be accurate and complete; casual inspection indicates that neither is the case for several of the species with which I am familiar, and the book falls short of its primary mission.

If your research interest is Iberia, or is associated with its fauna in any way, you will need to have this book for some of the data it contains. But I caution against considering this volume a standalone reference to current knowledge regarding the Iberian fauna. The generalist will find the presentation enticing, even exciting, but the researcher requiring accurate distribution maps and complete summaries of the literature will find that reference to Salvador (1985, 1998) and García-París (1985) remains essential.

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Reptiles and Herbivory, by Gillian King. 1996. Chapman & Hall, London. 160 pp. Hardcover. US $74.95. ISBN 0-412-46110-2.

ROBERT E. ESPINOZA
Ecology, Evolution & Conservation Biology, MS 314
University of Nevada, Reno
Reno, Nevada 89557, USA
e-mail: espin_r@unr.edu

Scientific curiosity is piqued by uncommon biological phenomena. That which is rare demands explanation. For these reasons, herbivorous reptiles have captured the attention of herpetologists for decades. Indeed, fewer than 1% of nonavian reptiles—both extinct and modern—were, or are, herbivorous. The paucity of herbivorous reptiles has been attributed to numerous factors including constraints associated with morphology, physiology, behavior, biogeography, evolutionary history, and divergence capabilities. Yet, despite a long and rich history of interest, no comprehensive treatise has been provided for this understudied trophic group of the Reptilia. This void is now partly filled by Gillian King's *Reptiles and Herbivory*.

King, a paleontologist specializing in mammal-like reptiles (primarily dicynodonts), has produced a book that convenes much of the disparate literature on both extant and extinct reptilian herbivores. *Reptiles and Herbivory* provides a blend of taxonomic and functional perspectives on the shared challenges and specializations associated with a herbivorous lifestyle. The book is organized into seven chapters, most of which are titled by taxonomic group (e.g., Lizards, Mammal-like Reptiles, etc., see below). For this review, I will focus primarily on the two chapters concerning extant herbivorous reptiles (lizards and chelonians) because of both space constraints and the predominantly neontological interests of readers of *Herpetological Review*. Those interested in a paleontological perspective are directed to Weishampel (1996).

The first chapter discusses herbivory and reptiles in general and provides some working definitions. For 'herbivore,' King adopts a pluralistic definition: "...eating any part of a plant: root, stem, leaf, seed, fruit and so on" (p. 2). However, little discussion is provided here or elsewhere regarding the biological relevance of different types of plant tissues. It would be informative to consider how particular plant tissues (e.g., fruits vs. leaves) translate into certain opportunities and challenges for some herbivorous reptiles. It also would have been helpful if King had defined herbivore in terms of the minimum proportion of plant materials required to be in the diet to be classified as a herbivore. The diets of many reptiles lie on a continuum from carnivory to herbivory, and it is not clear if the author would categorize a lizard with a 75% plant diet as a herbivore. Despite acknowledging its limitations, King also follows the Linnean hierarchical system for defining 'reptile' and specific reptilian groups (following Carroll 1988). While this decision may raise eyebrows among contemporary systematists who advocate phylogenetically based taxonomies (e.g., de Queiroz and Gauthier 1994), King maintains that her primary interest is in discussing particular life strategies, not taxonomic relationships (p. 4).

Chapters two through five summarize most of what is known about herbivory in specific taxonomic groups: (2) Lizards; (3) Turtles and Tortoises; (4) Dinosaurs; and (5) Mammal-Like Reptiles. Chapter six provides a discussion of a hodgepodge of "Other Herbivores," all of which are extinct. Included in this chapter is a discussion of the Malawi crocodile (*Malawisuchus*) from the Lower Cretaceous which is one of at least two Mesozoic crocodylians considered to be herbivorous (see also Wu et al. 1995). The perspective in these chapters is principally functional morphological, but King does a commendable job of integrating much of what is known about the physiology, behavior, and ecology of members of these groups as well. I found the chapters dealing with extinct herbivorous reptiles to be both comprehensive and detailed. The information provided in the two chapters on extant groups was, however, somewhat less exhaustive. This is undoubtedly a reflection of King's principal research interests.

At the beginning of the 'Lizard' chapter, King provides a table of "Herbivorous lizards—important genera." This list is, however, incomplete. Notably, missing genera include: *Hydrosaurus* (Agamidae; Pough 1973), *Phymaturus* and some *Liolaemus* (Tropiduridae; Cei 1986; Troyer 1988, 1991), *Cnemidophorus* (*C. arubensis* and *C. murinus*; Schall and Ressel 1991; Dearing and Schall 1992, respectively [although both species are discussed later in the text]), and *Angolosaurus* (Gerrhosauridae; Pietruszka et al. 1986). It could be argued that these do not constitute "important genera," but within this same table King also includes other genera of questionable importance. For example, *Klauberina* (now *Xantusia riversiana*) is listed, but this species is usually considered an omnivore (Johnson and Lillywhite 1979), as are most species of *Tiliqua* and *Egernia* (Dubas and Bull 1991; Cogger 1992). Later in this chapter, King draws on evidence from studies of juvenile (< 20 g) herbivorous lizards to appropriately dismiss the 100-g minimum body-size hypothesis for herbivorous reptiles. Minor criticisms of this chapter include the use of "babies" for referring to juvenile nonhuman animals, the misspelling of *Uromastyx* (as *Uromastix*), and not following generally accepted taxonomic revisions (e.g., Frost and Etheridge [1989] for iguanian lizards). Also lacking in this chapter is a discussion of the role of omnivory as an evolutionary transition to herbivory. Many lineages of otherwise insectivorous lizards contain one or more species that are known to eat considerable amounts of plant matter, yet lack the adaptations seen in entirely herbivorous lizards. These may represent important cases of dietary "evolution in action" and, as such, warrant further consideration.

In the turtle and tortoise chapter, King contrasts the proportionately more successful herbivorous chelonians (ca. 25%) to the relatively uncommon herbivorous lizards (ca. 3%). She attributes this

disparity to the more robust skull, lack of teeth, moderate chewing abilities, and protective shell in chelonians, but finds no evidence for comparable physiological differences between the two groups. However, when examined from a phylogenetic perspective, chelonians have fewer independent radiations into the herbivorous lifestyle than lizards. This is because the vast majority of herbivorous chelonians are in the Testudinidae (tortoises). If the common ancestor of this clade was herbivorous (which seems likely), then herbivory probably evolved only once in this lineage prior to its radiation. Some ecological interactions are also overlooked. For example, the possibility that modern herbivorous reptiles may be (or have been) important seed dispersers or pollinators is not addressed.

Although a summary is provided at the end of each chapter, few novel insights are extracted from the admittedly meager, and diffuse data. Therefore, I hoped that the final chapter, "Patterns of Reptilian Herbivory," would provide a synthesis of the entire book and provide some new directions for research. Instead, King provides a temporal distribution—from the Late Paleozoic to the present—of various lineages of herbivorous reptiles. The various strategies for being herbivorous are compared among these groups. She finishes the chapter with a list of morphological specializations shared by members of various herbivorous reptilian lineages. Two take-home messages are woven throughout. First, despite their diverse evolutionary histories, herbivorous reptiles share numerous convergently evolved specializations. These include changes in the skull, teeth, gut, physiology, and behavior, as well as the acquisition of gastrointestinal microsymbionts. Second, the paucity of herbivorous reptiles, present and past, cannot be explained by their 'inferior design' or any other single factor.

In places, *Reptiles and Herbivory* is unavoidably laden with technical terminology—owing primarily to anatomical descriptions—otherwise, King keeps the language simple and her points are easily understood. This will likely make the book accessible to a wider audience; however, a familiarity with basic anatomy (primarily osteology) is assumed, albeit not explicitly. Most of the text is written in an authoritative style, with citations included only when studies are specific. While this editorial style may provide a smoother text flow, on a few occasions I found myself with no means of differentiating the author's ideas from her abstractions of the literature. The text is relatively free of typesetting mistakes, and the few missing words or grammatical errors that I detected were not distracting. Most of the figures are line drawings (redrawn from other sources) and are of excellent quality. There are no photographs. A short (six page) literature cited section and taxonomic and subject indices are included. The pages are of heavy weight and my frequent highlighting of sections with a solvent-based marker did not bleed through to the other side. The binding is sturdy and the hard cover is quite durable.

This is not the type of book that will incite much controversy, but it provides a laudable service by uniting most of what is known about herbivorous reptiles. I suspect history will show that this book's greatest contribution was in rejuvenating research on herbivorous reptiles. Clearly, there is still much to be learned. In contrast to most books that cover both modern and extinct taxa, neontological herpetologists may be disappointed by the greater emphasis on extinct forms, whereas paleontologists will likely stand up and cheer! Yet, at nearly $0.50 (US) per printed page, most would-be buyers will balk at the cost. This, unfortunately, will limit its distribution—especially for students. Despite these relatively minor shortcomings, anyone interested in the biology of herbivorous reptiles would be well served to own a copy (or check one out from their local library), and will likely turn to it often as a valuable source of information.

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ROBERT GEORGE SPRACKLAND
Young Forest Company, P.O. Box 370422
Montara, California 94037-0422, USA
e-mail: youngforest@compuserve.com

There can be no question that the European herpetological community is taking their native fauna seriously, for if the British Ordnance Survey is intent on mapping every square meter of Britain, the European herpetological community is dedicated to accounting for the reptiles and amphibians in every plotted square—and beyond. *The Atlas of Amphibians and Reptiles in Europe* is a massive collaborative undertaking, representing the efforts of 95 authors and 14 editors, representing practically the whole of the continent's academic herpetological community, plus the input of a larger contingent of both professional and "non-professional" biologists.

It is easy to examine any book, doomed to being dated even before it is received by the publisher, and find points to negatively critique. This point is merely magnified when one deals with multiple authors and editors. However, I cannot see such important and Herculean efforts disparaged. My only negative comment here shall be minor: more native English-speaking editors were needed. The text is sprinkled with misspellings ("ant" for "and"; "speciesí" for "species' ") and a few quaint challenges to syntax ("…that give an idea of the extraordinary adaptability of the only European reptile strictly arboreal" or "The species inhabits throughout Europe"). I

encountered no phrase that challenged me to interpret the meaning.

What the battalion of authors has presented us is a true atlas, a map depicting the best-guess status of the distribution of every herpetological taxon for a continent. This is not a field guide, and the few pictures are mainly silhouettes, with each account, representative of each family. I would personally liked to have at least a line drawing of each taxon, following the format of the very similar *Atlas de Repartition des Amphibiens et Reptiles de France* (Castanet and Guyetant 1989), but such was not the intent of this atlas. Identification and illustration are still better left to Arnold et al. (1992), Matz and Weber (1983), or Lanka and Vít (1985), though there have been several updates to terminology that still require access to the journals. The present work, however, uses the newest taxonomy, including for example the sheltopusik as *Pseudopus* rather than *Ophisaurus*, and *Macrovipera* for some former *Vipera*.

That said, the *Atlas* is a quintessential set of range maps, accompanied by the latest information on the status and distribution of populations. In fact, this work represents a *sine non qua* for any serious research into either biodiversity or conservation. Non-specialists are given abbreviated synonymies of names most likely to be encountered in earlier literature, and bibliographic sources for systematic, distributional, and general biology of each species. Ecological parameters and environmental influences on each taxon are presented, providing solid groundwork for detailed studies at taxon or population levels. Even herpetoculturists, who would generally avoid works such as the *Atlas*, will find the habitat information extremely useful if they intend to properly care for European species in captivity. Indeed, much of the information for the *Atlas* was collected by "non-professional" herpetologists, to the extent that "many national herpetological associations were born since the onset of the project," ostensibly to help better coordinate the vast data being collected regionally.

The European continent was drawn into grids for this project, giving the compilers the added, and intriguing, ability to relate the percentage of the continent inhabited by each species (given in European style, with a comma instead of a decimal point). Thus, we now know that *Podarcis muralis* occupies 15,00% of Europe, *Rana esculenta* 25,30%, and *Macrovipera schweizeri* a mere 0,02%. Such objective statistics must be of use to conservation policy-makers when deciding about issues pertaining to endangered listings, preservation of critical habitat, and enacting protective legislation.

The *Atlas of Amphibians and Reptiles in Europe* is a splendid book, a rare exception to the generally poor quality of multi-authored tomes. How, I wonder, could a herpetologically active nation like the United States still have no equivalent work? The SEH and its members have provided a wonderful template that other nations (dare I say continents?) would do well to follow. It seems unlikely that any meaningful study of either European herpetofauna or the larger biodiversity issues can credibly proceed without consulting this *Atlas*. The price may set many potential purchasers off; nevertheless, no serious biological library should be without this book. It is a grand testament to the results that can be obtained by concerted and open cooperation among naturalists across borders and professional standings. I hope that the *Atlas* inspires other works of a similar nature to follow for other areas of the globe.

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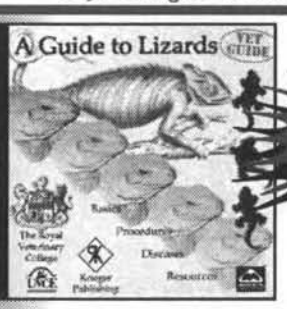
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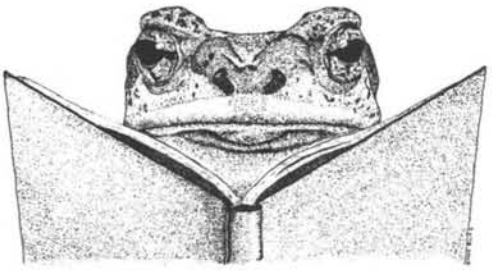
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Clovis, California 93611, USA
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e-mail: rwh13@csufresno.edu

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Geographic Distribution
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Geographic Distribution
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Tropical Biosphere Research Center
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1 Senbaru
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Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
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About Our Cover: *Hoplocercus spinosus*

South and east of the great basin of the Amazon, the Central Plateau slopes gently across the face of Brazil. Among the distinctive biomes that etch its surface is a region of savannas and twisting gallery forests filled with glabrous, deep-rooted trees with names like *Curatella*, *Piptadenia*, and *Kielmeyeria* (Eiten 1972. Bot. Rev. 38:201–341; UNESCO 1981. Vegetation Map of South America. Explanatory Notes. UNESCO, Paris, 189 pp.). The canopy is low, perhaps 15 meters in height, wrapped around granitic outcrops, and studded with titanium-hard termite mounds. Dry-season fires burn away the dense grass cover brought by the rains. This is Brazil's cerrado. Second only to the Amazon Basin in extent (it covers about 2,000,000 km^2), the cerrado has, until recently, languished while research centered on the Amazon and Brazil's dwindling Atlantic forest (Vanzolini 1963, *In* Simpósio sobre ô Cerrado, Ed. Universidade, São Paulo, pp. 307–321). Perhaps owing to its ragged appearance—cerrado is a mosaic of xeric scrub, buritî palm stands, and open formations—it has been viewed as wasteland, and thus has been destroyed at an alarming rate. In the present decade, over 60% of cerrado has been eradicated or altered seriously. Not only is it fire that sculpts the cerrado, but also ferocious cycles of insolation and irradiation that can encompass as much as 45°C in 24 hours. Permeable soil has provided favorable habitat and much of the region's fauna is fossorial and nocturnal. There are even subterranean trees with only the branches exposed (Cabrera and Willink 1973. Biogeografía de América Latina. OAS, Washington, 120 pp.)!

The lizards depicted on the cover are Brazilian Spinytails, *Hoplocercus spinosus*, a species endemic to cerrado. Much like *Sauromalus* of North America, these lizards retreat into tunnels and inflate the body when threatened. The burrows, usually beneath stones, contain an enlarged terminal chamber. *Hoplocercus* emerge to bask or in the evening to forage; otherwise they tend to remain at the burrow's entrance, with just the spiny tail exposed (Nascimento et al. 1988. Bol. Mus. Pa. Emilio Goeldi, ser. 4:21–66). Spinytails are monotypic, sharing affinities with *Morunasaurus* and *Enyalioides*. Collectively, these genera comprise the Hoplocercidae. They are sexually dimorphic and the banded males display shades of rust and yellow during the breeding season. Spinytails are not known to exceed 150 mm in length, and their diet consists of a variety of arthropods (Carvalho 1949. Publ. Av. Mus. Nac. 5:7–19.). Their distribution, like that of many other cerrado lizards, is patchy (Vitt and Caldwell 1993. J. Herpetol. 27:46–52). They occur in Mato Grosso, Goiás, Maranhão, southern Pará, and Rondônia (Ávila-Pires 1995. Zool. Verh. Leiden 299:1–706; Sick 1951. Natur und Volk 81:30–35.).

The cover is a composite of three photographs, all taken at the Serra da Mesa Hydroelectric Reservoir on the upper rio Tocantins in Goiás, Brazil. The photographer, **Danté Fenolio**, used a Minolta 9xi camera, Fuji Velvia film, and a 100mm Minolta macro lens with flash (lizards), and a 24mm Minolta lens plus natural light (cerrado background). Danté, who is Director of the Amphibia Research Group, will soon begin graduate studies at the University of Oklahoma. He worked in Brazil courtesy of Dr. Nelson daSilva, with financial support provided by FURNAS - Centrais Elétricas S.A. and VBC Energia S.A.

Separation and imaging of Fenolio's photographs is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

SSAR Grants-in-Herpetology Committee Annual Report (1999)

An award in the amount of $500 was made to each of the following individuals:

Field Studies.—**W. Bryan Jennings**, University of Texas. Project title: "Ecological morphology of Australian pygopodid lizards."

Laboratory Studies.—**Jonathan Q. Richmond**, San Diego State University. Project title: "Evolution of the *Eumeces skiltonianus* species group (Squamata: Scincidae), with emphasis on the phylogeography of *Eumeces gilberti*."

Conservation.—**Daniel W. Carpenter**, Brigham Young University. Project title: "Conservation genetics and preservation of the endangered Shenendoah salamander (*Plethodon shenandoah*)."

Travel.—**Wendy L. Hodges**, University of Texas. Project title: "Phylogenetic components in the evolution of ecological traits in a unique lizard genus, *Phrynosoma*."

International.—**Irena Grbac**, Croatian Natural History Museum. Project title: "Seasonal variation in thermoregulatory behavior in the lizards *Podarcis muralis* and *Podarcis melisellensis*."

Education.—**Catherine Lynch**, ZooMontana. Project title: "Amphibian surveys for Montana."

1999 Grants-in-Herpetology Committee.—Dawn Wilson, University of Nevada-Reno; Jill Wicknick, John Carroll University; Tod Reeder, San Diego State University; Richard King, Northern Illinois University; Anne Maglia, University of Kansas; David Kizirian, Los Angeles County Museum of Natural History; Michael Dorcas, Davidson College; Peter Ducey, State University of New York at Cortland; Christopher Beachy, Minot State University; Joseph Mendelson III (Chair), Utah State University.

SSAR congratulates the 1999 GIH recipients and thanks the committee members for their efforts.

NEWSNOTES

Upstate Herpetological Association Grants

The Upstate Herpetological Association is now accepting applications for a grant in the amount of US $1,000. This grant is intended to support herpetological conservation, education, or research. All proposals must be received on or before 30 September 1999. The successful applicant will be notified on or about 15 December 1999.

Successful applicants will be expected to submit a report of their work for publication in the Association's newsletter, the *Herp Beat*, and/or give a presentation to either the Albany or Syracuse Chapter of the UHA. Successful applicants are expected to acknowledge UHA's support in any publications that result in whole or in part based on funding by UHA.

Applicants should include the purposes for which the grant is requested, the uses to which the grant will be put, and enough background information on the applicant to enable the reviewers to access the applicant's ability to accomplish the grant objectives. A

letter of reference from a person familiar with the applicant's work in the field is desirable but not mandatory. All applications should include a completion date for the project. All applications should be typed, double spaced, and are not to exceed five pages.

The UHA reserves the right to reduce the grant, divide the grant between two or more individuals, or make the grant to an organization as a whole. All proposals will be considered, but preference will be given to original research, New York herpetology, and captive husbandry and propagation of reptiles. Applicants need not be members of UHA.

Questions and applications should be directed to: *Upstate Herpetological Association, c/o Robert C. Cunningham, 409 Waldorf Parkway, Syracuse, New York 13224-2241, USA; e-mail: rcunn1@twcny.rr.com; Tel. 315-446-9292.*

Brett Stearns Award for Chelonian Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round-trip transportation and limited per diem expenses—to researchers who wish to visit our collections to support their work in chelonian biology. Preference will be given to graduate students.

Proposals should include a short, one page description of the research project and a budget. In the case of graduate students, a letter of support from the student's faculty advisor is required.

Proposals are due on 15 October 1999; notification will be made by 1 December 1999. Awardees are expected to complete their Academy visit by 15 September 2000. Please call (415) 750-7039 for further information.

Proposals should be sent to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

The CAS chelonian holdings are included in the Department of Herpetology database: www. calacademy.org.

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 1999, with notification by 1 December 1999. Grantees are expected to complete their Academy visit by 15 September 2000. Please call (415) 750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

Gopher Tortoise Council Awards

The Gopher Tortoise Council annually presents the J. Larry Landers Student Research Award to the best student research project concerning the biology of the gopher tortoise, *Gopherus polyphemus,* or any other relevant aspect of upland habitat conservation. Recent awards have been given for studies on striped newts and red cockaded woodpeckers. The amount of the award is variable, but has been limited to $1000. A proposal should consist of a maximum of four pages and should include a description of the project, a budget, and a brief resume of the student. Proposals should be sent to: *Bob Herrington, Chair, Research Advisory Committee, Department of Biology, Georgia Southwestern State University, Americus, Georgia 31709, USA.* Deadline for receipt of proposals to be considered for the 1999 award is 31 August 1999.

Literature Support Requested for Colección Boliviana de Fauna

The Colección Boliviana de Fauna (CBF) was established in 1990 under an agreement between the National Museum of Natural History (Bolivia) and the Institute of Ecology of the Universidad Mayor de San Andrés (La Paz, Bolivia). Its main goals are to develop a voucher collection of Bolivian fauna and to promote scientific research in zoology.

Currently, one of the priorities of the Herpetology Division is to improve the research library in order to offer better literature support to researchers and students at local and national levels. The CBF is seeking donations of any reprints, research reports, or other documents pertaining to Bolivian herpetology. Donations should be sent to: *James Aparicio E., Curator, Herpetology Division, Colección Boliviana de Fauna, P.O. Box 8706, La Paz, Bolivia. E-mail: herpeto.cbf@mail.megalink.com.*

Wildlife Links: Request for Proposals

The National Fish and Wildlife Foundation, through a cooperative agreement with the United States Golf Association, requests pre-proposals for projects that address wildlife conservation needs on golf courses. Areas of interest include: analysis of management and design techniques for increasing biodiversity on golf courses; research to determine if certain habitat characteristics result in wildlife corridors or barriers on golf courses; preparation of management guidelines for specific species or species suites; programs to monitor the success of wildlife habitat conservation programs on golf courses; and the effects of golfer and maintenance activities on wildlife. All projects must address issues of direct management concern to the golf industry, and should provide management recommendations applicable on at least a regional basis. In addition, proposals should indicate that golf courses have been contacted and will be formal project partners. Request should not exceed $25,000 per year, yet multi-year funding is possible. Deadline for pre-proposals is 16 July 1999. Applicants will be notified by the end of July if a full proposal is requested. Full proposals will be due by 14 September 1999, with funding available in February of 2000. For pre-proposal guidelines, please visit the National Fish and Wildlife Foundation's website: http://www.nfwf.org/nfwfusga.htm or contact Katie Distler, NFWF, via e-mail: distler@nfwf.org.

MEETINGS

Meetings Calendar

6–10 September 1999—10th Ordinary General Meeting of the Societas Europaea Herpetologica, Natural History Museum of Crete (University of Crete), Irakleio, Crete (Greece). Contact: Natural History Museum of Crete, University of Crete, Knosou Av, 71409, Irakleio, Crete. Tel./fax +30 81 324 366; e-mail: nhmc_vtb@cc.uch.gr.

2–4 October 1999—Australian Herpetological Society, 50th Anniversary Conference on Captive Husbandry and Conservation of Reptiles, Sydney, Australia. Contact: Daniel Holloway (e-mail: ozherps@zip.com.au) or visit the Society's web page (www.ozherps.zipworld.com.au).

5–9 October 1999—The Sixth Annual Conference of the Association of Reptilian and Amphibian Veterninarians, Columbus, Ohio, USA. For conference registration information contact: Wilbur Amand, VMD, PO Box 605, Chester Heights, Pennsylvania 19017, USA; fax: 610-892-4813.

8–11 October 1999—Second Symposium on the Status and Conservation of Florida Turtles, Eckerd College, St. Petersburg, Florida, USA. Contact: Gopher Tortoise Council, c/o George L. Heinrich, 1223 Alhambra Way S., St. Petersburg, Florida 33705-4620, USA; tel. (813) 865-6255; e-mail: highpine@gte.net.

15–18 October 1999—Canadian Amphibian and Reptile Conservation Network/Rèseau Canadien de Conservation des Amphibiens et des Reptiles Annual Meeting, Quèbec City, Quèbec, Canada. *(Refer to detailed information below).*

12–17 December 1999—5th Latin American Congress of Herpetology, University of Uruguay, Montivideo, Uruguay. Abstract deadline 30 June 1999. For registration and information contact: Lic. José A. Langone, Secretario Ejecutivo V CLAH, Museo Nacional de Historia Natural, CC 399, 11000 Montivideo, Uruguay (e-mail: vclah@fcien.edu.uy). Within the U.S. or Canada, contact: Dr. Rafael de Sá, Department of Biology, University of Richmond, Richmond, Virginia 23173, USA (e-mail: rdesa@richmond.edu). Web site: http://zvert.fcien.edu.uy/clh.

International Symposium on Herpetological Education: Call for Papers

As part of the 1999 annual meeting of the Canadian Amphibian and Reptile Conservation Network/Rèseau Canadien de Conservation des Amphibiens et des Reptiles, a full day has been set aside for the symposium: "Perspectives on Herpetological Education and its Relation to Conservation Biology." The CARCNet meeting will be held in Quèbec City, 15–18 October 1999, and the symposium is scheduled for 15 October.

Further information is available from the co-organizers: Stan A. Orchard, Chairman, CARCNet, 1745 Bank Street, Victoria, British Columbia, Canada V8R 4V7; Tel/Fax: 250-595-7556; e-mail: sorchard@islandnet.com; Henry R. Mushinsky, Department of Biology/Center for Urban Ecology, University of South Florida, Tampa, Florida USA, 33620-5150; Tel: 813-974-5218; Fax: 813-974-3263; e-mail: Mushinsk@chuma1.cas.usf.edu.

LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles and their habitats. Please direct all communications to the section editor, Jeffery Demuth (postal and e-mail addresses on inside front cover).

USA: U.S. Fish and Wildlife Service: Effective May 3, 1999 the flatwoods salamander (*Ambystoma cingulatum*) will be protected as a threatened species under the Endangered Species Act. Flatwoods salamanders occur throughout the southeastern U.S. coastal plain of Florida, Georgia, and South Carolina. The following factors are listed as primary causes for threatened status.

First, habitat alterations from agriculture, urbanization, and silvicultural practices have resulted in loss of approximately 82% of the salamander's historical habitat. The losses of both terrestrial and breeding habitats are the primary cause of decline throughout the species' range. Second, there were inadequate existing regulatory mechanisms to protect critical habitats. No federal protection is currently afforded the necessary non-breeding habitats and only limited protection for breeding sites under the Clean Water Act. State regulations in Georgia and South Carolina prohibit direct take of flatwoods salamanders but do not protect habitat. Third, "other natural or manmade factors affecting its continued existence" include fire management, habitat fragmentation, and pesticide (and herbicide) use. Fire suppression is a contributor to the degradation of remaining longleaf pine forests that are primary habitat for *A. cingulatum*. Habitat fragmentation results in decreased opportunity for recolonization after local extinction and disruption of breeding migration routes. Agricultural chemicals pose a variety of threats via direct absorption through the skin and habitat degradation. Finally, overutilization for commercial, recreational, scientific, or educational purposes is listed as a potential threat.

The determination not to designate critical habitat was made on the basis that publication of breeding localities might lead to increased vulnerability to illegal collecting. The final rule lists several activities that would likely violate the Endangered Species Act by affecting *A. cingulatum* breeding sites and surrounding habitat within 450 meters. Additional information can be located in the *Federal Register* 64(62):15691–15704.

Questions regarding this listing should be directed to: *Linda LaClaire, Jackson Field Office, U.S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Suite A, Jackson, Mississippi 39213, USA. Tel: 601/965-4900 ext. 26, e-mail: linda_laclaire@fws.gov.*

USA: U.S. Geological Service – Biological Resource Division: A new long-term frog and toad monitoring program has been launched by the USGS – BRD. The new program, entitled Frogwatch USA, aspires to engage the public in conservation, while helping to compile information about frog and toad population distributions, population trends at individual wetlands, and yearly calling phenologies. Volunteers and scientists from the United States, including Puerto Rico and the Virgin Islands, can contribute to the Frogwatch USA effort by periodically monitoring a convenient wetland site for the presence of calling frogs and toads. After surveying the wetland, they can directly submit their findings via the Frogwatch USA website: www.mp2-pwrc.usgs.gov/frogwatch/www.mp2-pwrc.usgs.gov/frogwatch/. At the end of each season, results will be posted on the website. Potential participants should visit the website to register and find out more information.

The Frogwatch USA initiative is independent from both the North American Amphibian Monitoring Program (www.mp1-

pwrc.usgs.gov/amphibs.htmlwww.mp1-pwrc.usgs.gov/amphibs.html) and the North American Reporting Center for Amphibian Malformations (www.npwrc.usgs.gov/narcam/). The three programs are all concerned with amphibian monitoring and conservation and are overseen by the USGS – BRD, but each program requires different data collection (see websites).

For more information on Frogwatch USA contact: *Gideon Lachman, Frogwatch Coordinator, Patuxent Wildlife Research Center, USGS-BRD, 12100 Beech Forest Road, Laurel, Maryland 20708-4038, USA. Tel: (301) 497-5819, Fax: (301) 497-5784, e-mail: FROGWATCH@usgs.gov.*

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.herplit.com/contents

Herpetofauna as Predators of Killer Flatworm?

The terrestrial flatworm *Bipalium adventitium* was introduced to the United States from Asia earlier this century, and in the last 40 years, it has become widespread in suburban gardens and lawns. It is a fierce predator of earthworms that kills its prey by covering it with digestive enzymes, which turn the earthworm into a pink viscous mass. The invasion of this exotic predator may have severe ecological consequences, particularly if there is no native species that preys upon the flatworm. Because herpetofauna often prey upon soil invertebrates, Ducey et al. examined whether six species of salamanders and two species of snakes would eat *B. adventitium* offered to them in the laboratory. They found that none of the herpetofauna treated the flatworm as a prey item. The authors suggest that a combination of gliding movements, chemosensory clues, and distasteful secretions make the flatworms an unlikely prey item for salamanders and snakes.

Ducey, P. K., M. Messere, K. Lapoint, and S. Noce. 1999. Lumbricid prey and potential herpetofaunal predators of the invading terrestrial flatworm *Bipalium adventitum* (Turbellaria: Tricladida: Terricola). Am. Midl. Nat. 141:305–314.

Correspondence to: Peter K. Ducey, Department of Biological Sciences, State University of New York at Cortland, Cortland, New York 13045, USA.

Turtle Densities and Deadwood in Southern River Drainages

Deadwood is an important component in the ecology of river map turtles because they utilize this substrate for basking, foraging, and resting/sleeping. To determine the basking frequencies of five map turtles and the relationship between deadwood abundance and turtle abundance, Lindeman conducted spotting-scope counts of basking turtles in Missisippi, Louisiana, and Kentucky. He found that there was a correlation between low numbers of basking turtles and lack of deadwood in rivers and that some populations, such as *Graptemys flavimaculata* from the Pascagoula drainage, were spotted in much lower densities than expected. Based on these results, he suggests that the practice of "snagging" (the removal of deadwood from river channels) should be limited and that *G. flavimaculata* habitat in the Pascagoula drainage should be protected.

Lindeman, P. V. 1999. Surveys of basking map turtles *Graptemys* spp. in three river drainages and the importance of deadwood abundance. Biol. Conserv. 88:33–42.

Correspondence to: Peter Lindeman, Division of Biological Sciences and Related Technologies, Madisonville Community College, 2000 College Drive, Madisonville, Kentucky 42431, USA; e-mail: LPeter0@pop.uky.edu.

Salamanders as Keystone Species in Carolina Ponds

Keystone species are organisms that when removed from a community will result in a decline of species richness. Fauth tested for keystone species in several South Carolina ponds by trapping, dipnetting, and using call censuses. He compared the species diversity of the ponds with the presence/absence of several species and found that, although *Notophthalmus viridescens* and *Siren intermedia* were found to be keystone species in previous studies, there was no evidence of these taxa as keystones in the South Carolina ponds. He did find that *Ambystoma talpoideum* was a keystone species. He concludes that the identity of keystone species varies regionally and with pond characteristics, and several species may be functional equivalents in the role of keystone species.

Fauth, J. E. 1999. Identifying potential keystone species from field data—an example from temporary ponds. Ecology Letters 2:36–43.

Correspondence to: John E. Fauth, Department of Biology, University of Charleston, 66 George Street , Charleston, South Carolina 29424-0001, USA; e-mail: fauthj@cofc.edu.

Neural Bones Distinct in Indian Ocean Giant Tortoises

The carapase of turtles is made up of several dermal bones; of these, the neural bones, which lie over top of the vertebral column, are the most structurally significant. In an investigation of the neural bones of six species of *Dipsochelys*, Gerlach found that the anterior neurals (I–V) vary less in structure than the posterior neurals and that the different species of *Dipsochelys* can be identified by particular arrangements of these bones. He suggests the arrangement of neurals relates to carapace shape (e.g., domed, flattened) and the structures associated with functional stability in these taxa.

Gerlach, J. 1999. Distinctive neural bones in *Dipsochelys* giant tortoises: Structural and taxonomic characters. J. Morphol. 240:33–38.

Correspondence to: Justin Gerlach, 53 River Lane, Cambridge CB5 8HP, United Kingdom; e-mail: gerlach@bogo.co.uk.

Dwarf Chameleon Morphology: Evidence for Species Validity

The taxonomic status of the dwarf chameleons (*Brookesia*) of Madagascar has been the subject of several recent studies, many of which have questioned the validity of several species. Because it had been suggested that *B. tuberculata* and *B. peyrierasi* are synonyms of *B. minima,* Glaw et al. examined the external morphology, particularly the hemipenial structure, of these three taxa. They found several morphologies that differ among the taxa and suggest that each should be considered a distinct species. The authors also discuss several biogeographic considerations for these taxa.

GLAW, F., M. VENCES, T. ZIEGLER, W. BÖHME, AND J. KÖHLER. 1999. Specific distinctness and biogeography of the dwarf chameleons *Brookesia minima, B. peyrierasi* and *B. tuberculata* (Reptilia: Chamaeleonidae): Evidence from hemipenial and external morphology. J. Zool. Lond. 247:225–238.

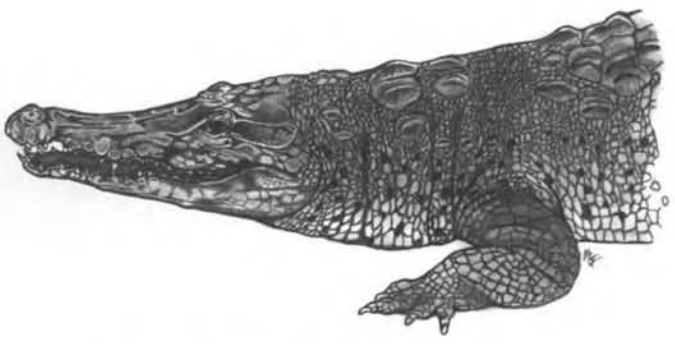
Correspondence to: Frank Glaw, Zoologische Staatssammlung, Münchhausenstrasse 21, D-81247 München, Germany; e-mail: uzs13b@uni-bonn.de.

Mass Amphibian Mortality Linked to Fungus?

Global interest in the decline of amphibian populations has sparked numerous studies geared toward identifying factors responsible for reduction in population numbers. Of particular concern are unhealthy populations that are located in protected areas, because factors causing their decline may be global in nature. Lips monitored a community of amphibians from the Reserva Forestal Fortuna, a protected forest in western Panamá. Through surveys of terrestrial amphibians conducted over a four-year period, she found declines in the number and diversity of amphibians in the area. While conducting stream surveys, she found numerous dead or dying frogs, all of which had high levels of a fungal infection. She also found that a high percentage of tadpoles living in these streams had severe developmental abnormalities. She suggests that the severe population declines of amphibians in western Panamá (and potentially around the world) are caused proximally by a highly contagious fungal infection, but that there are most likely environmental factors working in synergy to precipitate the mortality.

LIPS, K. R. 1999. Mass mortality and population declines of anurans at an upland site in western Panama. Conserv. Biol. 13:117–125.

Correspondence to: Karen R. Lips, Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901-6501, USA; e-mail: klips@zoology.siu.edu.



Crocodylus acutus. Illustration by Michael Frick.

OBITUARIES

Biographical Sketch of Miguel Alvarez del Toro (Don Miguel): 1917–1996

OSCAR A. FLORES-VILLELA
Museo de Zoología, Facultad de Ciencias, UNAM
Apartado Postal 70-399, México, D.F. 04510, México
e-mail: ofv@hp.fciencias.unam.mx

and

WENDY L. HODGES
Department of Zoology, University of Texas at Austin
Austin, Texas 78712, USA



The herpetological community primarily associates the name Miguel Alvarez del Toro with the famous book "Los Reptiles de Chiapas" published in three editions (1960, 1972, and 1982), and with the zoological park of Tuxtla Gutiérrez, Chiapas, now known as ZOOMAT "Zoológico Regional Miguel Alvarez del Toro," in his honor. But "Don Miguel," as he was known to most of us who had the honor to meet him, was also dedicated to the endless battle of conservation of the wilderness of Chiapas.

Miguel Alvarez del Toro was born in the city of Colima, capital city of the state with the same name, on August 23, 1917. He was an avid collector and observer during his childhood in Colima. In 1932, his family moved to Mexico City where he finished high school and later got his first jobs in natural history. Although his formal education ended at the high school level, his self-taught natural and zoological expertise later earned him honorary doctorates from the Universidad de Chapingo (1992) and the Universidad Autónoma de Chiapas (1993).

At the age of 21, Don Miguel collected birds for the Academy of Natural Sciences of Philadelphia from areas surrounding Mexico City. From 1939 to 1940 he was a taxidermist ("Técnico preparador") for the "Museo de Flora y Fauna, dependiente del Departamento Autónomo Forestal y de Caza y Pesca" in Mexico City. He became subdirector of the same museum in 1940 and remained there until 1941.

In 1942, he moved to Chiapas and accepted the position "Zoólogo General" of the "Departmento de Viveros Tropicales y Museo de Historia Natural," currently known as the "Instituto de Historia Natural." He was appointed director two years later after the premature death of the former director, and he remained in that position until his death in 1996.

Although Alvarez del Toro began as an ornithologist, his expertise extended into other fields of zoology such as mammalogy, arachnology, and herpetology. He was also a pioneer of conservation biology, and his reputation in this field earned him worldwide recognition. He received the Alfonso L. Herrera medal for merit in ecology and conservation (1985), the Paul Getty award for conservation of nature (1989), membership on the UNEP honor roll for

environmental achievement (1992), the national forestry and wildlife merit prize from the secretary of agriculture and water resources of México (1993), and the national merit prize in ecology from the secretary of ecology and social development of México (1994), among numerous other recognitions and achievements.

Don Miguel was a prolific writer, writing for the layman as well as for the scientific community. His literary works include nine books, over 70 scientific and popular publications, and countless newspaper articles. His contributions to the herpetological literature include 15 scientific manuscripts (see Appendix 1) and three books, "Los Animales Silvestres de Chiapas" (1952), "Los Reptiles de Chiapas" (1960, 1972, and 1982), and "Los Crocodylia de México" (1974). In 1985, he wrote his memoirs, "¡Asi era Chiapas!"

In recognition of his work, six species and four subspecies bear his name:

Diaethria mixteca alvarezi (Insecta)
Dismorphia crisia alvarezi (Insecta)
Pulex alvarezi (Insecta)
Troglopedetes toroi (Insecta)
Piranga bidentata alvarezi (Aves)
Anolis alvarezdeltoroi (Reptilia)
Coniophanes alvarezi (Reptilia)
Lepidophyma alvarezi (Reptilia)
Heloderma horridum alvarezi (Reptilia)
Nototriton alvarezdeltoroi (Reptilia)

Probably his most important work was "Los Reptiles de Chiapas," a book published in three editions (a fourth edition has been in press for several years). This may be the most important work in herpetology ever published by a Mexican national and has been the standard reference on reptiles of southern México. It contains numerous observations on the natural history of species inhabiting Chiapas, the majority of them original. This book stands as a testament to his skillful and detailed observations in the field.

Alvarez del Toro also published "Los Crocodylia de México," the product of his efforts and careful studies to preserve the crocodilian fauna of México. This project was funded by the WWF and CONACyT (Consejo Nacional de Ciencia y Tecnología), and was partially conducted at the zoo in Tuxtla Gutiérrez.

The zoo at Tuxtla Gutiérrez was another example of his dedication to nature, conservation, and education. He was the director of the zoo for 52 years. His objective was to teach people about their immediate surroundings, instilling a sense of pride and value in nature that would prompt them to actively support conservation in Chiapas. In 1980, the zoo was moved to a new location, "El Zapotal," a tropical forest very close to Tuxtla Gutiérrez. In this environment, he created a zoo unique among all zoos in the world by exhibiting only native animals of Chiapas, both vertebrates and invertebrates.

Don Miguel was instrumental in the design of a system of protected areas in Chiapas, some of which are now managed by the Instituto de Historia Natural. His desire was to preserve at least a sample of all the natural habitats of the state. Thanks to his efforts, Chiapas has more protected zones with the highest cumulative protected area than any other state in México.

For all of us who had the pleasure to know Don Miguel, he was a leading figure, an example to follow, and in many respects a true mentor. When he died at the age of 79 on the second of August, 1996, in Chiapas, the world lost a superb naturalist, a great conservationist, and a generous human being. His last desire was that his ashes be dispersed in La Selva del Ocote.

Acknowledgments.—We extend our appreciation to Becky and Hebe Alvarez Rincon for providing information about their father. Alfredo Cuaron and Aldolfo Navarro sent proofs of their articles. We thank Kraig Adler for providing the photograph of Don Miguel.

APPENDIX 1
Publications of Miguel Alvarez del Toro

1952. Los Animales Silvestres de Chiapas. Gobierno del Estado de Chiapas. Tuxtla Gutiérrez, Chiapas. 247 pp.
1956. Notulae herpetologicae chiapasiae I. Herpetologica 12(1):3–17. (in co-authorship with H. M. Smith).
1958. Notulae herpetologicae chiapasiae II. Herpetologica 14(1):15–17. (in co-authorship with H. M. Smith).
1959. Reptiles venenosos de Chiapas (falsos y verdaderos). ICACH (2):10–22.
1960. Los Reptiles de Chiapas. Instituto Zoológico del Estado/Gobierno del Estado de Chiapas/ICACH. México. 204 pp. (1973 second edition, 1982 third edition).
1962. Notulae herpetologicae chiapasiae III. Herpetologica 18(2):101–107. (in co-authorship with H. M. Smith).
1963. Notulae herpetologicae chiapasiae IV. Herpetologica 19(2):100–105. (in co-authorship with H. M. Smith).
1969. Breeding the spectacled caiman, *Caiman crocodilus*, at Tuxtla Gutiérrez Zoo. International Zoo Yearbook 9:35–36.
1971. Centro de repoblación del cocodrilo de pantano (*Crocodylus moreletii*). Revista ICACH, Segunda Época 2/3:15–17.
1972. Trabajos para la protección de los cocodrilianos en Chiapas. *In* E. Beltrán et al. (eds.), Aspectos Internacionales de los Recursos Renovables de México. IMERNAR. 87–95.
1972. The WWF project on crocodiles in Chiapas. 37th North American Wildlife Conference. Wildlife Management Institute, pp. 81–86.
1973. Krokodile vons aussterben bedroht! UMSCHAU 73(20):629–630.
1974. Los Crocodylia de México (estudio comparativo). IMERNAR. México, D.F. 70 pp.
1975. Morelet´s crocodile. Wildlife Conservation Yearbook 1975:88–91.
1977. A new troglodytic lizard (Reptilia, Lacertilia, Xantusiidae) from Mexico. Journal of Herpetology 11(1):37–40. (in co-authorship with H. M. Smith).
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Joseph Randle Bailey
1913–1998

ROGER CONANT
Department of Biology, University of New Mexico
Albuquerque, New Mexico 87131, USA

The death on September 18, 1998, of Joseph Randle "Joe" Bailey ended the career of a distinguished scholar and naturalist who published on all five of the principal groups of vertebrates. His major interest, however, was herpetology, a subject he pursued chiefly in North Carolina and Brazil.

Joe was born September 17, 1913, in Fairmont, West Virginia. His father's name was the same as his, his mother was Elizabeth Weston Maclaren. There was another son, Reeve Maclaren Bailey, who was two years older than Joe. The elder Joseph was killed in 1915, and Joe's mother raised the two boys at Perrysburg, Ohio, but later moved to Toledo where high school facilities were available. Both young men moved on to and graduated from the University of Michigan with Bachelor's degrees.



Joseph R. Bailey, Ann Arbor, Michigan, 1940. Photograph courtesy of Kraig Adler.

Joe's early interest in ornithology was diverted in large part to herpetology by Helen T. Gaige who was in charge of the Division of Amphibians and Reptiles at the University's Museum of Zoology. In the spring of 1936, Joe met Emmett Reid Dunn when the American Society of Ichthyologists and Herpetologists met in Ann Arbor. Dunn, in appreciation of Joe's interest and enthusiasm, invited him to pursue a Master's degree at Haverford College, for which Joe received a fellowship. Under Dunn's influence, Joe became interested in plethodontid salamanders on which he later published, and he co-authored a paper with Dunn on snakes of the Canal Zone and Darien.

After receiving his Master's, Joe returned to the University of Michigan, from which he received his Ph.D. in 1940. During the summers, in collaboration with James A. Oliver, he worked in New Hampshire on a survey of the Connecticut River Watershed, and they published reports on the amphibians and reptiles and on the fishes in two separate contributions.

Joe then decided he would like to work on snakes of the Neotropics, and he was successful in obtaining an International Exchange Fellowship to Brazil for the period of 1940–1942, the first of four sponsored sessions of work in the largest country in South America. He quickly absorbed Portuguese. Successively, he became a Guggenheim Memorial Foundation Fellow (1953–1954), a Fulbright Lecturer (1961) at the University of São Paulo where he was required to address classes in Portuguese, and a Duke Endowment Grant to South America (1966). He published several papers on Brazilian herpetology alone or with Antenor de Carvalho.

The entrance of the United States into World War II occurred while Joe was in Brazil. He asked the American Embassy what he should do, and he was told to continue his work. When he returned to the States in 1942, he was drafted into the Army Air Corps and was promptly sent back to Brazil, probably because of his familiarity with the language. He remained for a year as a member of a photo mapping squadron. After attending Officers Training School in Georgia, he was dispatched to Hawaii where he was stationed as an Aviation Physiologist until he received he discharge in June, 1946.

Joe returned to Ann Arbor to work at the University Museum. There he met Dorothy "Mike" O'Donnell, who had both a Bachelor's and Master's from Michigan. She was a skilled cartographer and illustrator. She and Joe were married on September 7, 1946, and they became a pair-bonded and inseparable couple. She never became as fluent in Portuguese as her husband, but their daughter, Patricia, even yet visits Brazil frequently in a professional capacity. A son, Robert "Mickey," is in business in North Carolina.

Joe applied for a faculty position at Duke University about the time of his marriage. He was successful, and the Baileys moved to Durham, North Carolina, which became their permanent home. Foreign travel was not over yet, however. He made his later trips to Brazil and, during 1970–1971, Joe was a Senior Scholar (Fulbright) Visiting Professor at James Cook University in Australia. Joe became a full professor at Duke in 1965 and continued in that position until he retired in 1983. He was Curator of the vertebrate collections for 20 years. He worked extensively on the wildlife of North Carolina, and for two summers he was the leader of groups that surveyed the fishes of the mountains.

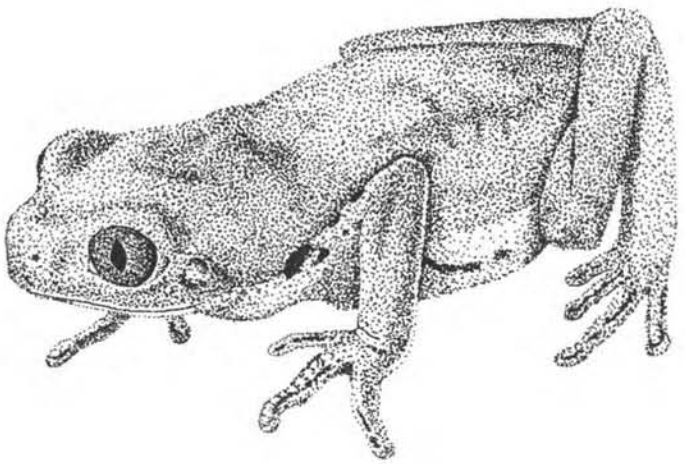
He was active in several organizations. Among them he served as president of the ASIH in 1972 and president of the southeastern division of the same organization in 1958–1959. He was also vice-president of the Highlands Biological Station during 1976–1978.

After retirement Joe kept an office and laboratory at Duke to continue his studies on South American snakes and the herpetology of his home state. He was one of a many-authored team that produced a popular work on the "Amphibians and Reptiles of the Carolinas and Virginia." His career was cut short by a debilitating stroke on November 1, 1995, that he had to endure until his death in 1998.

Joseph R. Bailey and his brother, Reeve, were the first friends I made when I, as a callow youth of 19, took my first professional job as Curator of Reptiles at the Toledo Zoo. We saw each other frequently, and they often accompanied me on field trips to various parts of Ohio as, on my days off, I sought to gather material for my "Reptiles of Ohio."

After I transferred to the Philadelphia Zoo in 1935 and Joe soon went to nearby Haverford College, we saw each other several times. Afterward our meetings were few and intermittent. I had the pleasure of nominating Joe for President of the ASIH. I fear that because of my own research on the water snakes of the Outer Banks, I may have been partially responsible for his selecting Moorehead City, North Carolina, when he served as the local chairman for the 1964 ASIH meeting. I was quite anxious to see Mullet Pond on the nearby Shackleford Banks to which he arranged for overwater transportation for several others and me. None who attended that ASIH meeting will ever forget our headquarters, the Biltmore-Moorehead City Hotel, manned by an inexperienced staff, and during which the ancient structure gradually fell apart in hilarious fashion.

With the death of Joe Bailey, I have lost an esteemed friend and one who had the great respect of his contemporaries.



Phyllomedusa hypocondrialis. Paraguay. Illustration by Dan Erickson.

ARTICLES

Use of Bomb Crater Ponds by Frogs in Laos

BRYAN L. STUART*
and
PETER DAVIDSON
Wildlife Conservation Society Lao Program
P.O. Box 6712, Vientiane, Lao PDR
e-mail: wcslao@loxinfo.co.th

**Current address: Department of Zoology, Box 7617*
North Carolina State University, Raleigh, North Carolina 27695-7617, USA
e-mail: blstuart@unity.ncsu.edu

The Ho Chi Minh Trail used by North Vietnamese and Pathet Lao forces during the Indochinese Conflict (1961–1975) passed through the limestone karst region in east-central Laos (Khammouan Province) that is presently classified as Hin Namno National Biodiversity Conservation Area (NBCA) (Timmins and Khounboline 1996). Aerial bombing of the region during the conflict has left many large craters that today hold water even into the dry season (November–April) (Fig. 1).

Amphibians are known to have colonized a wide variety of human-made sources of water, such as rain and drainage catchments, windmill wells (Burkett and Thompson 1994), rice paddies and their associated concrete ditches (Fujioka and Lane 1997), reservoirs (Boniecki 1996), irrigation canals (Schneider 1997), road-ruts (Adams and Lacki 1993), and ponds at former mine sites (Lacki et al. 1992; Turner and Fowler 1981). D. R. Karns (pers. comm.) found heavy use by both larval and adult salamanders and frogs of crater ponds created by exploded ordnance at a military test site (Jefferson Proving Ground, Indiana, USA). We report here on the use by frogs of the artificial ponds at the bottom of bomb craters formed during wartime in Laos.

Twenty-two craters along a one kilometer stretch of road (17°29.82'N 105°42.41'E to 17°30.09'N 105°42.68'E) slightly west of the Hin Namno NBCA boundary were sampled for presence of amphibians during the dry season in mid-Februrary 1998. The craters were surrounded by secondary growth and scrub, and were within 1 km of large limestone karst formations. Crater ponds were actively searched at night for post-metamorphic frogs. Ten dips were taken with a hand-net at the edge of each pond to standardize detection of amphibian larvae and other aquatic organisms.



FIG. 1. Artificial pond formed by exploded ordnance during the Indochinese Conflict (1961–1975) near the Ho Chi Minh Trail in Khammouan Province, Laos. Photograph by C. M. Francis.

The craters ranged from 20 to 40 m in diameter and from 3 to 5 m in depth, as measured from the surface of the ground. Eleven of the twenty-two craters (50%) contained standing water at the time of sampling. Cracked mud in the bottom of all the dry craters suggested they held water at wetter times of the year. The maximum depth of water in the wet craters ranged from 0.1 to 1.2 m (mean = 0.59, SE = 0.11). The estimated surface area of water in the craters varied from 2 to 250 m^2 (mean = 103.57, SE = 27.91).

No frogs were detected in any of the dry craters. However, larval or adult frogs were detected in all but one of the wet craters (90.9%). Densities of post-metamorphic frogs in the ponds ranged from 0 to 16 (mean = 4.72, SE = 1.43). Larvae were detected in two of the eleven wet craters (18.2%).

Four species of ranid frogs were found in the crater ponds. These were *Hoplobatrachus rugulosa, Rana erythraea, R. limnocharis*, and *Occidozyga martensii*. Additionally, *Bufo melanostictus* and *Microhyla ornata* were found within five meters of four of the wet craters (36.4%), and the larvae collected during sampling belonged to the former species. All of these frog species have wide geographic ranges and are typical of disturbed areas, including agricultural lands and near human habitation.

Many of the wet craters resembled permanent pond communities. Aquatic vegetation grew in nine of the craters (81.8%), sometimes quite densely. The presence of totally aquatic animal species in the ponds suggested that seasonal flooding of the Xe Bang Fai River, located approximately 0.3 km away at the nearest point from the sampling area, at least occasionally reaches these craters. Specifically, three different species of small fish and an eel were observed in seven of the wet craters (63.6%), and prawns in four of the wet craters (36.4%). Aquatic invertebrates including snails, leeches, larval odonates, heteropterans, and coleopterans were also present.

The ponds appeared to be heavily exploited for food by local people, based on the high density of people seen cast-netting the ponds during the day. This includes the collection of frogs, as two local people that were seen cast-netting a bomb crater pond for small fishes had also harvested an adult *Hoplobatrachus rugulosa*. Immigration of frogs and fish during floodings may be preventing the extirpation of these populations in the ponds, although R. Tizard (pers. comm.) reported that the ponds were sometimes stocked with fish by local people. Regardless of the harvesting, the permanence of the artificial ponds formed by exploded ordnance has provided a suitable environment in which at least six species of frogs live or reproduce.

Acknowledgments.—This work was conducted during an amphibian and reptile survey of Hin Namno NBCA, sponsored by the Wildlife Conservation Society Lao Program. We thank C. M. Francis for providing the photograph and to D. R. Karns for unpublished data.

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Does the Water Dragon, *Physignathus lesueurii* (Gray 1831), Occur in New Guinea?

GREGORY J. WATKINS-COLWELL
Department of Biological Sciences, Sacred Heart University
Fairfield, Connecticut 06432, USA
e-mail: watkinsg@sacredheart.edu

and

GREG JOHNSTON
Mitrani Centre for Desert Ecology, Blaustein Institute for Desert Research
Ben-Gurion University of the Negev, Sede Boqer 84990, Israel
e-mail: gregj@bgumail.bgu.ac.il

The Australian water dragon, *Physignathus lesueurii* (Gray 1831), is a large acrodontan lizard which occurs in eastern Australia and has been reported from western New Guinea (Fig. 1). The species appears to be absent from eastern New Guinea (Allison 1982). This unusual disjunct distribution has been widely accepted (e.g., Allison 1982, 1996; Cogger, 1995; Harrison 1928; Moody 1980; Welch et al. 1990; Whitaker et al. 1982), and has long been the subject of comment (Covacevich et al. 1990; Harrison 1928).

The existence of *P. lesueurii* in western New Guinea was first reported by de Rooij (1915) and was based on a single specimen in the Rijksmuseum van Natuurlijke Historie in Leiden in the Netherlands (RMNH 5462). The data associated with this specimen show that it was collected from the Arfak Mountains in what is now the Indonesian state of Irian Jaya. However, there have been no further specimens of *P. lesueurii* from New Guinea reported in the literature. All published reports of *P. lesueurii* in New Guinea appear to be based on De Rooij's (1915) account of this single specimen.

We have searched for additional specimens of *Physignathus lesueurii* from New Guinea in the following institutions: Australian Museum (AM); South Australian Museum (SAM); Northern Territory Museum of Arts and Sciences (NTM); Bernice P. Bishop Museum (BPBM); National Museum and Art Gallery of Papua New Guinea (PNGM); University of Papua and New Guinea (UPNG); University of Michigan Museum of Zoology (UMMZ); Field Museum of Natural History (FMNH); Carnegie Museum of Natural History (CM); California Academy of Sciences (CAS-SU and CAS); American Museum of Natural History (AMNH); Smithsonian Museum of Natural History (USNM); University of Illinois Museum of Natural History (UIMNH); Museum of Comparative Zoology (MCZ); Rijksmuseum van Natuurlijke Historie (RMNH). Although these collections contain over 300 additional specimens of the *P. lesueurii*, none was from New Guinea.

The Leiden specimen (RMNH 5462) is correctly identified as *P. lesueurii* (Fig. 2). However, all other specimens collected from New Guinea and identified as *P. lesueurii* (N = 15) were incorrectly assigned to this species. Fourteen of these belonged to the genus *Hypsilurus* (we follow the taxonomy of Moody 1980 after Cogger 1995). The other misidentified specimen (USNM 101095) was a *Hydrosaurus amboinensis* from Idi Falls on the Mamberamo River in the Van Rees Mountains of Irian Jaya.

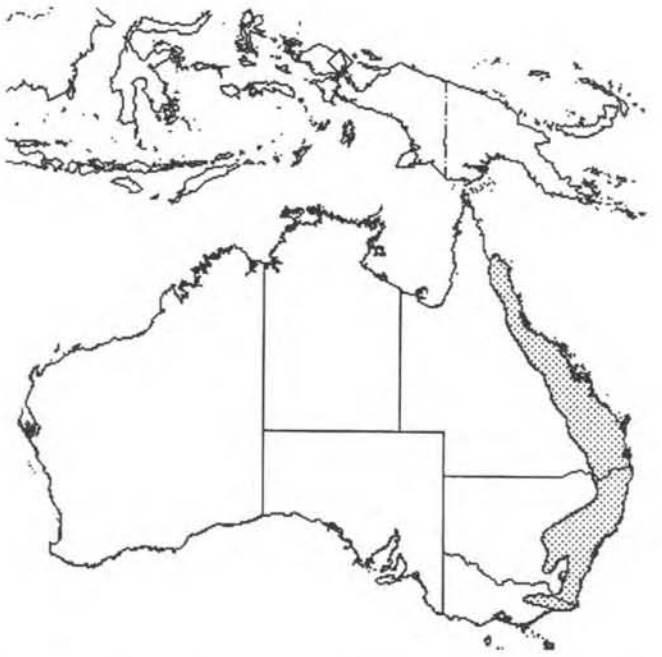


FIG. 1. The reported distribution of *Physignathus lesueurii* in Australia (following Cogger 1995) and New Guinea. The diamond indicates the location from which RMNH 5462 was reputedly collected.

Many museums had specimens of *Lophognathus temporalis* listed as *Physignathus temporalis* (following Worrell 1963; see Cogger et al. 1983 for a full synonymy of *L. temporalis*). This unfortunate artifact of taxonomic history adds confusion to the question of whether *Physignathus lesueurii* occurs in New Guinea. The two species are quite different in external morphology (see photos in Cogger 1995) and are no longer thought to be closely related (Baverstock and Donellan 1990; Cogger and Lindner 1974). The numerous specimens labeled "*Physignathus temporalis*" are not *Physignathus* at all, and provide no evidence for the existence of *P. lesueurii* in New Guinea.

Thus, the Leiden specimen of *Physignathus lesueurii* remains the only evidence we could find that this species occurs in New Guinea. Furthermore the locality data accompanying it may be suspect. RMNH 5462 was purchased from a specimen dealer called "Mulie" in 1871 (Marinus Hoogmoed, pers. comm.), and the locality data associated with the specimen may be incorrect. This specimen may actually have been collected in Australia and mislabeled prior to being purchased by the RMNH.

This issue of the occurrence of *P. leseuerii* in New Guinea is not only of academic interest. The reported occurrence of this species in New Guinea offers an opportunity for the species to be collected in Australia (where it is legally protected) and exported through New Guinea, for the exotic pet trade. This trade, although illegal, is likely of no direct consequence to the conservation status of *P. lesueurii* itself. It is abundant in large areas of eastern Australia (Fig. 1). However, the trade in *P. lesueurii* through Indonesia provides an opportunity for the illicit traffic of other, similar species (e.g., *Hypsilurus* spp. and *Hydrosaurus amboinensis*) whose conservation status is less certain, and which are commonly misidentified as *P. leseuerii*.



FIG. 2. Dorsal view of RMNH 5462. An adult male *Physignathus lesueurii*, reportedly collected in the Arfak Mountains of New Guinea. It was purchased in 1871 from a specimen dealer. The locality data may be in error. (Photograph by Mieke Van Engelen).

In conclusion, we recommend that *Physignathus lesueurii* be considered absent from the herpetofauna of New Guinea until additional specimens are collected. The locality data for the only confirmed specimen (RMNH 5462) reported as coming from New Guinea should be considered suspect as the specimen may have been collected in Australia. *Physignathus leseuerii* is a large, highly visible species. It is unusual that such an organism should not be collected in New Guinea for over a century. It is more likely that the species does not occur there, and that all unvouchered reports are actually of similar-looking species (*Hypsilurus* spp. or *Hydrosaurus amboinensis*).

Acknowledgments.—We thank the curatorial personnel associated with herpetology collections at AMS, SAMA, NTM, BPBM, PNGM, UPNG, UMMZ, FMNH, CM, CAS-SU, CAS, AMNH, USNM, UIMNH, MCZ, and RMNH for cooperation. Marinus S. Hoogmoed provided information about RMNH 5462. Thanks to Aaron M. Bauer for reviewing an earlier draft of the manuscript. This paper was written while GRJ held a Kreitman postdoctoral fellowship in the Department of Life Sciences, Ben Gurion University of the Negev. This is publication no. 264 of the Mitrani Centre for Desert Ecology.

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Phrynosoma hernandesi: Correct Spelling

HOBART M. SMITH
EPO Biology, University of Colorado
Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

KRAIG ADLER
Division of Biological Sciences, Seeley G. Mudd Hall
Cornell University, Ithaca, New York 14853-2702, USA

DAVID CHISZAR
Department of Psychology, University of Colorado
Boulder, Colorado 80309-0345, USA
e-mail: chiszar@clipr.colorado.edu

and
FRANK VAN BREUKELEN
EPO Biology, University of Colorado
Boulder, 80309-0334, USA
e-mail: vanbreuk@colorado.edu

Until recently the nominal species *Phrynosoma (Tapaya) hernandesi* Girard (1858:395; *Tapaya* Cuvier was explicitly adopted as a subgenus, as stated p. 394) has always been a name of little significance in herpetology, primarily because it existed throughout most of that time under a cloud of ambiguity. In a few works it was accepted as the name for a valid species, although not after

about 1917 (Stejneger and Barbour 1917). In recent years it has commonly been regarded as an invalid junior synonym of *Agama douglasii* Bell, 1828 (e.g., Hammerson 1986; Stebbins 1985; Zamudio et al. 1997; see Hammerson and Smith 1991, for spelling, often wrongly rendered *douglassii*, another original spelling). At earlier times it was often recognized as a weakly differentiated subspecies of *Phrynosoma douglasi* (e.g., Van Denburgh 1922, and Reeve 1952; the ending with a single *-i* is a permissible variant under the 1999 edition of the International Code of Zoological Nomenclature [hereinafter the "Code"], following the decision of the 1990 meeting of the International Commission on Zoological Nomenclature; see Savage 1990:56).

The mtDNA study by Zamudio et al. (1997), however, elevated Girard's name in both rank and importance by eliminating it from synonymy with *P. douglasi*, which they concluded consists only of the populations in northwestern United States and adjacent Canada that were formerly often regarded as constituting the nominotypical subspecies of the species. Girard's name is the oldest of those applied to the other populations of the species as formerly recognized, in which Zamudio et al. (1997) could find no basis for acceptance of subspecies.

Because Girard's name now appears to be firmly established for a widely distributed and frequently cited species of western United States and adjacent Mexico, the spelling of that name merits attention.

The question of spelling arises because Girard, clearly honoring Francisco Hernández (even though he did not explicitly so state), spelled the new patronym *hernandesi*. He was obviously conscious of Hernández' great work on the biota of Mexico (Hernández 1648), because he cited it in the synonymy of *P. (T.) orbiculare*, to which his description of *hernandesi* referred on the same page.

It is true that in the *P. (T.) orbiculare* synonymy Girard abbreviated all polysyllabic author names ("Bibr., Cuv., Daud., Dum., Gravenh., Grd., Griff., Hernand., Stansb., Wagl., Wiegm."), with one exception (Beechey), spelling in full only that name and those of a single syllable (Gray, Oken, Schinz, Voigt). Girard nevertheless undoubtedly knew the proper spelling of Hernández' name, even though it was not spelled out in full; he was a meticulous worker. That leaves the question of why he spelled the specific name with an "s" instead of a "z".

That the spelling *hernandesi* was a lapsus, even though it was used at least six times in Girard's (1858) thorough review of the entire genus *Phrynosoma*, was apparently immediately concluded by Baird (1859), who was the first to change it to *hernandezi* (he also added an extra terminal *-i*). Van Denburgh (1922:382) noted that Cope (1875), Yarrow (1875, 1883), McLain (1899), and Stone (1911) also used Baird's spelling, as did Smith and Smith (1976, 1993) and, upon the erroneous advice of one of us (HMS), Zamudio et al. (1997). Most others (many dozens) retained Girard's spelling, anchored by the six editions of the North American herpetological checklists beginning with Stejneger and Barbour (1917).

A strong basis for the validity of Baird's spelling is the consistency of spelling of the name Hernández, which is almost as common in Spanish-speaking countries as is Smith in English-speaking ones. For example, the National Union Catalog of Pre-1956 Imprints cites approximately 1000(!) different authors under the name Hernández, and only one under the name Hernandes (the latter appears on an 1870 publication in Paris). Similarly, the 4th, 1976 edition of the Diccionario Porrúa de Historia, Biografía y Geografía de México lists 43 persons under the name Hernández, none under Hernandes. By far the most famous of all, biologically, is of course Francisco Hernández, Mexico's first published naturalist, and still one of its most important and revered ones.

Girard's choice of spelling appears to have been deliberate and a product of a knowledge of classical Latin that was common at that time but is now rare. In classical Latin the letter "z" does not exist, nor do the letters "y" and "w". By consensus, based on commonality of sound or derivation, "s" substitutes for "z", "i" or "j" for "y", and "v" for "w", when the missing letters need to be represented. Therefore the classical Latin letters "i" (or "j"), "s" and "v" represent not only themselves per se, but under certain circumstances the foreign letters "y", "z" and "w", respectively.

On those grounds Girard chose the latinized spelling *P. hernandesi* in honoring Hernandez, and similarly Schmidt chose the spelling *Uta gadovi* to honor Gadow, and Cope *Sceloporus jarrovii* to honor Yarrow. Although it does not superficially so appear, in each case the original spelling actually was retained, but it was expressed by the customary substitute letters.

At least three nominal taxa other than Girard's were named for Hernández between 1831 and 1857: *Chamaeleopsis hernandesii* Wiegmann, 1831 (= *Corytophanes hernandesi*), *Heloderma hernandesii* Wiegmann, 1834 (= *H. h. horridum*), and *Iguana hernandesii* Jan, 1857 (a nomen nudum); in all, "s" appears instead of "z" in the original usage.

All of the examples cited appear to have been created deliberately by choice of their authors, on grounds of latinization. The Code requires maintenance of the original spellings in these cases, including Girard's, because it was obvious that the adopted spelling was deliberate, not a lapsus as required under Arts. 32 and 33 of the Code for correction of an incorrect original spelling. It is true that, at least under the current (1985) Code, eponyms do not necessarily have to be latinized, although they usually were in the past. Thus the spellings *yarrowi*, *gadowi*, *hernandezi*, etc., would be acceptable under the 1985 Code if they were proposed today, but choice of appropriate substitute letters in the past cannot be reversed, under the Code.

It is our conclusion, therefore, that under the Code the correct spelling of the name in question is *P. hernandesi*, the classical Latin equivalent of *P. hernandezi*. It should be noted also that the name *hernandesi* should be pronounced with the accent on the antepenultimate syllable, consistent with the pronunciation of Hernández' name. Written accents on scientific names are not permitted by the Code.

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Life History Attributes of a Rare Neotropical Salamander, *Nototriton picadoi* (Plethodontidae: Bolitoglossini)

RICHARD C. BRUCE
Department of Biology, Western Carolina University
Cullowhee, North Carolina 28723, USA
e-mail: bruce@wcu.edu

Nototriton picadoi is a diminutive, arboreal lungless salamander of Costa Rican rain forests. Its taxonomic history is complex; populations currently recognized as *N. picadoi* are known from a few localities at the northwestern end of the Cordillera de Talamanca (Good and Wake 1993). The species is a habitat specialist in moss; most specimens have been taken in clumps of moss on tree trunks and limbs, and moss also serves as nesting sites (Bruce 1998; Good and Wake 1993). These authors noted that egg clutches are unattended by the female parent, as is probably the case in other species of *Nototriton* (Good and Wake 1993; Jockusch and García-París 1998; McCranie and Wilson 1992). This is an unusual feature in plethodontids, where the ancestral condition is female parental attendance at egg clutches (Jockusch and Mahoney 1997).

The current study was undertaken to further define the life history of *Nototriton picadoi*, for comparison with other species of *Nototriton* and other neotropical bolitoglossine salamanders. The field work was conducted in Parque Nacional Tapantí, in the watershed of the Rio Orosi, on the Caribbean slope of the Cordillera de Talamanca, Cartago Province, Costa Rica. Tapantí is an area of premontane rain forest featuring a relatively open canopy with medium to tall trees, dense understory, nearly continuous ground layer, and a profusion of epiphytic bromeliads, orchids, ferns, and mosses (Sawyer and Lindsey 1971). Mosses are especially abundant, often covering extensive areas of the surfaces of trees, shrubs, and lianas. Rainfall is about 3300 mm annually at the official weather station at 1200 m elevation, but exceeds 6000 mm in the higher reaches of the watershed (Coen 1983). Although there is a modest dry season from January through April, rainfall is relatively high (≥ 100 mm) even in the driest month (March). The heavy rainfall and steep slopes result in unstable soil conditions; frequent treefalls create openings that quickly fill with dense tangles of large herbs, vines, and saplings. The lush vegetation and high rainfall would seem to favor large salamander populations, but the several species of *Bolitoglossa, Nototriton*, and *Oedipina* that occur in Tapantí are in fact quite rare (Wake 1987).

I visited Tapantí for periods of several days on each of nine occasions between September 1994 and January 1999, in various months, except for the drier period between mid-January and May. Approximately 270 person-hours were spent searching for *N. picadoi* at Tapantí. Searches were made in daytime, mainly by opening clumps and mats of mosses growing on the ground and on the surfaces of trees, shrubs, and lianas, as high as a person could reach, and occasionally pulling smaller dead trees to the ground to inspect mosses occurring at greater heights. In addition to finding egg clutches, as described herein and elsewhere (Bruce 1998), I located 38 individuals only of *N. picadoi* during the course of the lengthy sampling period. Three were found in moss mats on the ground, and the remaining 35 were taken above ground, to about 2.5 m. All but one of the latter were taken in clumps of moss; the exception was found in the root mass and soil at the base of a bromeliad. Salamanders were found on trunks of trees of various sizes, on horizontal logs, and frequently on small vertical and horizontal branches, and on dead sticks. Several kinds of mosses were used as habitat, but were not identified.

The specimens were preserved by anesthetization in MS-222, fixation in 10% formalin, and eventual transfer to 70% ethyl alcohol. Following preservation, each specimen was measured for snout-vent length (SVL) from the tip of the snout to the posterior end of the cloacal slit to the nearest 0.1 mm. Specimens > 15 mm SVL were then dissected to determine sex and reproductive status. In males, the absence or presence of a mental gland was noted, and the size and condition of the vasa deferentia and testes were determined. Squashes of the vasa deferentia and testes were examined at 100X for the presence of sperm. In females, the diameters and degree of convolution of the oviducts were recorded, the ovaries were examined for the presence of yolked follicles, and the number and sizes of the latter were determined.

Of eight individuals ≤ 15 mm SVL, three (8–10 mm) were similar in size to hatchlings obtained in the laboratory from field-collected egg clutches (Bruce 1998). They were collected in August and January, within the hatching period estimated in the earlier study. Five larger unsexed juveniles (13–15 mm) were collected in June and January. The low frequency of small salamanders in the total sample may reflect the greater difficulty of locating smaller *Nototriton* in the rhizoid tangles of the moss mats.

For males, three individuals 18–22 mm were scored as immature based on the absence of a mental gland, thin and straight vasa deferentia, small testes, and the absence of sperm in the vasa and testes. Ten other males, 20–29 mm, were considered mature. Thus it appears that males mature at 20–22 mm SVL. In mature males the testes were large, white, either club-shaped or elongate, and had prominent ampullae. The vasa were white or gray, with a scattering of brown pigment, and usually showed some degree of

coiling. None of the three smallest mature individuals (20–22 mm), collected in June (1) and August (2), had an obvious mental gland; in each the vasa deferentia were empty, but the posterior ampullae of the testes contained numerous bundles of sperm. I concluded that all three were undergoing spermatogenesis for the first time. In seven larger males (24–29 mm) a mental gland was present, though not prominent, as a darker, shield-shaped area on the throat just behind the lower jaw. Four of these males (26–29 mm), collected in July (1), September (1), and January (2) were in obvious breeding condition, having swollen, coiled vasa deferentia packed with sperm. The other three, taken in September (2) and January (1), had empty vasa. Although these data shed little light on whether males reproduce on a seasonal basis in *N. picadoi*, they do suggest that courtship and mating occur over an extended period of the annual cycle.

Among females, four individuals 17–21 mm were obviously immature, having thin, straight oviducts less than 0.1 mm in diameter, and ovaries with small, whitish, translucent follicles no greater than 0.3 mm diameter. The remaining 13 females, 23–33 mm, were all scored as mature on the basis of having swollen, convoluted oviducts (≥ 0.5 mm) and ovaries with enlarged, yolky follicles. In only two females did the follicles approach the sizes of eggs seen in natural clutches; one such female, 27 mm, collected in mid August, had six yolked follicles enlarged to 1.7–2.3 mm diameter. Her ovarian complement fell within the range of clutch sizes (1–11) observed in the field (see below). In the other individual, the largest in the sample at nearly 33 mm, taken in early January, the 12 yolked follicles were smaller (1.1–1.6 mm), but formed a discrete class separate from the tiny, non-yolked follicles. In other females the yolked follicles were more variable in size, and thus were difficult to assign to the class of follicles destined for the next clutch. However, in none of these females could more than 11 yolked follicles be counted. A number of females had several orange bodies in the ovaries, which presumably represented atretic follicles. These data suggest that females deposit most of their yolked follicles at one time in a single nest, with the remainder undergoing atresia in the ovaries. It is not known whether oviposition occurs on an annual cycle in this species.

TABLE 1. Body sizes of sexually mature *Nototriton picadoi* from Tapantí.

		Snout-vent length (mm)			
Sex	N	Size at maturation	Range	Mean	SD
Male	10	20–22	20.3–29.0	25.3	3.11
Female	13	≈ 23	23.1–32.6	28.3	3.36

The results suggest that females mature at slightly larger sizes, grow to larger sizes, and average larger than males (Table 1). Six of 13 mature females exceeded the largest male in SVL. The difference in mean size between the sexes was marginally significant at $\alpha = 0.05$ ($t = 2.184$, $df = 21$, $P = 0.040$). Thus, the trend is in the direction of female-biased sexual size dimorphism, which is the general pattern in neotropical bolitoglossine salamanders (Bruce 1999).

In the latter part of the field study, additional data on egg laying and nests were collected which supplemented and reinforced earlier observations (Bruce 1998). Two clutches containing late embryos taken on 27 and 28 July 1998 had 4 and 11 eggs, respectively. Both were taken in moss, and in neither case was an attending female present. The clutches were returned to the laboratory, and maintained in the moss in which they were found at temperatures similar to those recorded in the field (≈ 20°C). The four embryos of the first clutch hatched on 13–14 August (SVL: mean = 7.9 mm, SD = 0.24), while 10 of 11 embryos of the second clutch survived, to hatch on 18–20 August (SVL: mean = 7.6 mm, SD = 0.24). On 6 January 1999 I found a cluster of six empty egg capsules of *N. picadoi* in a clump of moss on a stump about 0.5 m above the forest floor. A juvenile (13 mm) was found in moss within 10–15 cm of the egg capsules. These newer data confirm the pattern reported earlier (Bruce 1998) of (1) oviposition, embryonic development, and hatching throughout much of the wet season, (2) the presence of discarded egg capsules in the latter part of the wet season (August–early January), and (3) non-attendance of clutches by the female parent.

Nototriton is one of only three or four genera of plethodontid salamanders in which females do not attend their egg clutches (Jockusch and Mahoney 1997). Within *Nototriton* this behavior is best documented in *N. picadoi* (Bruce 1998). In North American genera where parental care is lacking or reduced, namely in *Batrachoseps* and *Hemidactylium*, the loss of parental care is sometimes associated with communal nesting (Breitenbach 1982; Harris et al. 1995; Jockusch and Mahoney 1997). In *Nototriton* this may also be true of *N. barbouri* in Honduras (McCranie and Wilson 1992). However, there is no evidence of communal nesting in Costa Rican species of *Nototriton* (Good and Wake 1993). In the present study, numbers of yolked ovarian follicles could not be used to reliably estimate clutch size, because most of the few mature females exhibited partial vitellogenesis only. Nevertheless, counts of yolked follicles were similar to numbers observed in field clutches of eggs and in clusters of empty capsules of recently-hatched eggs, as reported herein and earlier (Bruce 1998), indicating that *N. picadoi* probably does not engage in communal nesting.

The data on egg clutches in this and the previous study (Bruce 1998) suggest that oviposition may be seasonal in *N. picadoi*, beginning early in the wet season (May), continuing for several months, followed by hatching of the eggs from August through December. The dissection data on adult females are too limited to either reinforce or refute this conclusion. McDiarmid and Worthington (1970) postulated that in neotropical bolitoglossines, in species living in areas having pronounced wet-dry seasonality, oviposition occurs in the dry season, with hatching following at the start of the wet season several months later; whereas in species occurring in regions lacking a dry season, oviposition may occur in any month. Given the generally wet climate of Tapantí and the brevity of the dry season, it appears that environmental conditions could support year-round reproduction by *N. picadoi* and other salamanders.

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RECENT POPULATION CHANGES

Conservation Status of the Northern Cricket Frog (*Acris crepitans*) in Colorado and Adjacent Areas at the Northwestern Extent of the Range

GEOFFREY A. HAMMERSON
The Nature Conservancy, 201 Devonshire Street
Boston, Massachusetts 02110, USA
email: ghammerson@aol.com

and

LAUREN J. LIVO
EPO Biology, University of Colorado
Boulder, CO 80309-0334, USA
email: ljlivo@aol.com

The northern cricket frog (*Acris crepitans*) is a small hylid with an historical range extending as far west as eastern New Mexico (Degenhardt et al. 1996) and eastern Colorado (Hammerson 1982). Its presence in Colorado was first documented by Ellis and Henderson (1913), who reported the collection of two juveniles (UCM 195) from the North Fork Republican River drainage at Wray, Yuma County, on 26 October 1912. The next Yuma County record comprised nine individuals collected 3.2 km E Wray on 10 July 1948 (UCM 3235–3243). The known range in that area was enlarged slightly by a specimen collected 8 km E Wray on 9 July 1955 (UCM 10233). A specimen collected in the South Fork Republican River drainage at Bonny Reservoir on 17 May 1958 (UCM 10875) and 12 specimens collected from 3.2 km E Wray on the following day (UCM 10861–10874) provided further documentation of the range in Yuma County. *Acris crepitans* evidently remained fairly widespread in this area through the 1960s, evidenced by a specimen from Wray on 23 July 1965 (KU 98094), two from downstream from Bonny Reservoir, eight from west of Stalker Lake (North Fork Republican River), and two from 8.8 km E Eckley (North Fork Republican River), all collected on 8 October 1967 (KU 125062–125071, 125073–125074).

The 1967 specimens include the last known *A. crepitans* observed from the South Fork Republican River drainage in Colorado. However, the species persisted in the North Fork Republican River in Yuma County through the late 1970s, based on records from our field notes: 4 km E Wray, 10 observed, 7 September 1975; 6.4 km E Wray, 4 June 1977; 5.8 km E Wray, 10 June 1977; 3.2 km W Wray, Stalker Lake, one calling, 18 June 1978; 6.4 km E Wray, five adults observed on 15 July 1979 and 10 adults and juveniles observed on 20 September 1979. A single specimen (UNSM 7792) was collected 4.8 km E Wray on 8 July 1977.

Occurrences in the South Platte River drainage in Colorado are few and questionable. Burnett (1926) reported that a specimen was found at the entrance of a prairie dog burrow near Briggsdale, Weld County, on 27 May 1922; the specimen (number 4843), no longer in existence, was deposited in the collection of the Colorado Agriculture College (now the University of Northern Colorado). This record may be based on a misidentified *Pseudacris triseriata*, which the senior author has observed in exactly the same circumstances in the same area, but Burnett's report included records of *Pseudacris*, suggesting that he was able to distinguish the two species. A record from the southern half of Weld County, mapped by Hammerson (1982), is based on an unpublished species list by an experienced herpetologist, but no documentation of the occurrence is available, and our searches in the area at the time of the report and later yielded no observations of this species. A record of *A. crepitans* from Morgan County (Fitzgerald 1978; Hammerson 1982) is based on specimens we examined in the collection of the University of Northern Colorado in Greeley around 1980. One container included a mixed collection of several *Pseudacris triseriata* with several *Acris crepitans*, plus a label with the data, "Narrows Reservoir site, 21 June 1971." None of the specimens was individually tagged with collection data. One additional specimen in the South Platte River drainage, from Varsity Lake on the University of Colorado campus in Boulder (25 July 1957, UCM 10232), was obtained from a short-lived introduced population that subsequently was extirpated when the lake was drained (T. P. Maslin, pers. comm., 1978; Livo et al. 1998).

Several field surveys by us at the historical localities in Colorado and in other areas of apparently suitable habitat in Yuma County in the 1980s and 1990s (at least one field survey in 10 of 18 years) yielded no additional observations of *A. crepitans*. In Weld and Morgan counties, we made incidental surveys from the late 1970s through 1997. Several searches along Crow Creek near Briggsdale from the 1970s to the 1990s yielded no observations of *A. crepitans*. Recent amphibian surveys in the Pawnee National Grassland (the vicinity of the Briggsdale record), conducted by the Colorado Division of Wildlife, also failed to reveal any extant populations (Ken Kehmeier, Colorado Division of Wildlife, pers. comm.). Our recent surveys along the South Platte River in southern Weld and Morgan counties also yielded no observations of this frog.

Little is known of the current status of *A. crepitans* in other areas in the northwestern portion of its range. In western Nebraska, Lynch (1985) mapped this anuran along the North Fork Republican River contiguous with Colorado. John Iverson collected nine specimens about 30 km east of the Colorado border along the North Fork Re-

publican River near Parks in Dundy County, Nebraska, in 1977 (UNSM 7793–7801), but all other records of *A. crepitans* in the University of Nebraska State Museum from the lower 200 km of the Republican River system in Nebraska are from 1938, 1947, 1973, and 1974. In the South Platte River drainage, Ballinger et al. (1979) found *A. crepitans* no farther west than North Platte, Lincoln County, during their 1975–1978 field surveys. Jones et al. (1981) did not encounter *A. crepitans* at Mormon Island Preserve along the Platte River in central Nebraska but reported that previously the species rarely had been found near that area. Corn et al. (1995) observed a population of *A. crepitans* next to the Niobrara River near Valentine in north-central Nebraska in 1991 (also mapped there by Hudson 1942 and Lynch 1985).

Acris crepitans was common in extreme western Kansas in Wallace County between 1978 and 1980 at about 39°N latitude in 1979 and 1980 when Gorman (1986) collected 91 from three localities. Most KU records for Kansas localities west of 100 degrees longitude are from before 1980. Two individuals were observed at separate localities in Morton County in extreme southwest Kansas in 1978 (Collins and Collins 1991). However, more recent records, each based on single individuals, exist for Greeley (1991, KU 218847), Wichita (1991, KU 218848), and Grant (1992, KU 220758) counties. *Acris crepitans* was observed along the South Fork Republican River in Cheyenne County in 1996 and Smoky Hill River drainage in Sherman County in 1997 (Stan Roth, pers. comm.). This anuran remains common in central and eastern Kansas (Busby and Parmelee 1996; Busby et al. 1996; Collins 1993).

The distribution and status of *A. crepitans* in western Oklahoma are not well known, although *Acris* appears to remain abundant in the central part of the state (J. Caldwell, pers. comm.). Recent vertebrate surveys in the panhandle region of western Oklahoma did not result in any observations of this species (Mark Lomolino, pers. comm.); however, these surveys did not concentrate on amphibian habitats. The only *Acris* records from the Oklahoma panhandle in the Oklahoma Museum of Natural History date from 1933 and are more the 150 km east of the Colorado border.

In summary, *A. crepitans* was fairly common in the Republican River drainage in Colorado through at least the late 1970s, and it may have occurred in the Platte River drainage in Weld and Morgan counties through at least the early 1970s. Subsequent surveys indicate that the species has declined in distribution in Colorado. Conspicuous breeding calls make this species easy to locate, so it is unlikely that the frog still occurs in the recently surveyed locations within the historical range. It is notable that, since 1995, we have observed in Colorado all of the state's other species of amphibians, including species with erratic activity and restricted distributions in the state such as the Great Plains narrowmouth toad (*Gastrophryne olivacea*) and Couch's spadefoot (*Scaphiopus couchii*) and others (e.g., *Bufo boreas* and *Rana pipiens*) that have experienced declines in distribution and abundance in mountainous areas of the state (Corn et al. 1989). In eastern Colorado, suitable habitat for *A. crepitans* exists primarily or exclusively along major streams, and we were able to access these areas by public roads in several locations. Hence existing data indicate that *A. crepitans* is extirpated or extremely localized at best in Colorado. Existing information for the contiguous portions of adjacent states suggests that the species is scarce there as well but extant in at least a few locations in western Kansas.

What accounts for the decline of *A. crepitans* in Colorado? Its continued presence within a few kilometers of the Colorado border in Cheyenne County, Kansas, suggests the possibility of a temporary contraction in the range. Regan (1972) suggested "general aridity, especially in the southwestern part of the study area; wave action around man-made reservoirs; and winterkill due to frost penetration" as potential limiting factors for *A. crepitans* in the western margins of the range. However, we know of no particular climatological events that we can associate with the decline of *Acris* in western Colorado. For example, *A. crepitans* remained common near Wray, Colorado, after the exceptionally cold winter of 1978–1979 when the average temperature in January in northeastern Colorado was 6.8°C below the median—the coldest January during the period 1961–1996 (NOAA-CIRES Climate Diagnostics Center). Exceptional drought conditions did not occur in northeastern Colorado after 1979.

Among anthropogenic factors that may have reduced or eliminated *A. crepitans* populations, habitat change, establishment of exotic species, and chemical contaminants warrant consideration. Over the past two decades some changes in the habitat of *A. crepitans* have occurred in Colorado, such as the lining of some irrigation ditches with concrete, but the extent of primary breeding habitat (ponds with shallow, marshy edges) seems not to have changed much. One Yuma County pond formerly inhabited by *Acris* appeared to have an increased amount of tall, thick vegetation where previously it was open and sunny at the pond edge, but an adequate evaluation of habitat changes in relation to the frog decline is not possible. Land use within the historical range apparently has remained relatively stable in recent decades.

The non-native bullfrog (*Rana catesbeiana*) is a well-known predator on small frogs (Bury and Whelan 1984), including *A. crepitans* (Lewis 1962; Perrill and Magier 1988; Tyler 1978). *Rana catesbeiana* is now abundant within the historical range of *Acris* in Colorado, but it was present at least as early as the 1940s and 1950s (UCM specimens) and may have been abundant in the vicinity of Bonny Reservoir by the early 1950s (Anonymous 1954), so it is difficult to attribute the decline of *A. crepitans* after the 1970s to the impact of *R. catesbeiana*. Also, the two species coexist over much of their ranges in central and eastern North America.

Chemicals associated with agricultural activity in the historical range of *Acris* in Colorado could have caused a decline through excessive mortality in adults and/or embryos, but again lack of sufficient information prevents an adequate evaluation of this possibility. At present, the decline is inexplicable but parallels a similar puzzling decline observed in the Midwest, where the species has largely disappeared from the northern portion of its range in the southern Great Lakes region (e.g., Harding 1997; Jung 1993; Lannoo 1998; Lannoo et al. 1994; Ludwig et al. 1992; Oldham and Campbell 1990; Weller and Green 1997; Vogt 1981). Factors responsible for the decline in the Midwest remain speculative, but the authors just cited mentioned pollution of water by pesticides and/or other chemicals deriving from agricultural sources, vegetation succession, climatic fluctuations (e.g., drought), predation by exotic and native species, and/or competition from other frog species, coupled with the frog's short life span and associated vulnerability to short-term phenomena, as possibly significant. However, further study is needed before any reliable conclusions can be reached on the cause(s) of the decline of *A. crepitans* in the northern and northwestern margins of its range. The species remains common in much of the southcentral and southeastern United States.

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TECHNIQUES

Laundry Detergent Effectively Preserves Amphibian and Reptile Blood and Tissue for DNA Isolation

ULRICH KUCH*
Zentrum der Rechtsmedizin, Johann Wolfgang Goethe-Universität
Kennedyallee 104, 60596 Frankfurt am Main, FRG
e-mail: kuch@stud.uni-frankfurt.de

MARKUS PFENNINGER
Abteilung Ökologie und Evolution
Zoologisches Institut der Johann Wolfgang Goethe-Universität
Siesmayerstr. 70, 60054 Frankfurt am Main, FRG

and

ANDREAS BAHL
Abteilung Ökologie und Evolution
Zoologisches Institut der Johann Wolfgang Goethe-Universität
Siesmayerstr. 70, 60054 Frankfurt am Main, FRG

** Author to whom correspondence should be sent.*

Molecular techniques have become invaluable tools in numerous fields of herpetology. The fact that only very small quantities of blood or tissue are needed for these analyses usually allows researchers to continue studies of the live animals after sample collection, and is of special importance if rare or endangered species are involved. Several methods of collecting and storing samples for DNA analysis are currently employed in the field (Dessauer and Hafner 1984; Dessauer et al. 1990). If refrigeration is not possible, blood and tissue samples are usually stored in ethanol, lysis buffers containing sodium dodecyl sulfate, a saturated salt solution, or anticoagulant preservative solution (Arctander 1988).

Using different commercially available laundry detergents (Persil Megaperls®, Persil Supra® Liquid, Frosch®) we previously extracted high molecular weight DNA from several types of tissue (human, lizard, snail, tobacco plant), and obtained a quality and yield of isolated DNA equal to that from conventional DNA isolation methods (Bahl and Pfenninger 1996). The extracted DNA was suitable as template for Polymerase Chain Reaction (PCR) and digestible with restriction enzymes. Furthermore, high molecular weight DNA could be isolated from Wall Lizard (*Podarcis muralis*) tissue after 14 d of incubation (37°C) with the laundry detergent-

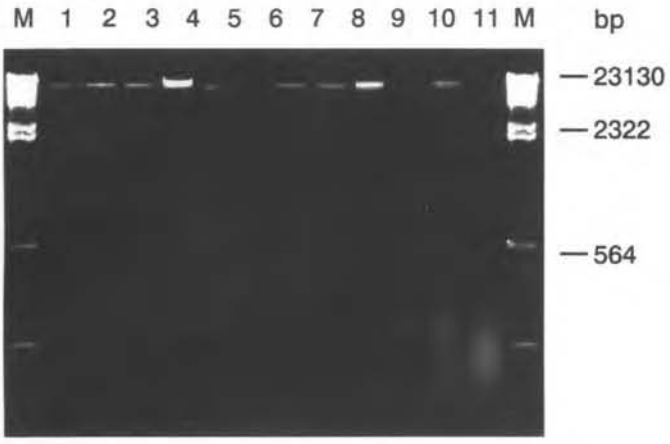


FIG. 1. DNA isolated after different storage procedures. Lane assignment: 1–4, from snake blood after 4 weeks incubation in laundry detergent; 5, from snake blood extracted with laundry detergent after 4 weeks incubation in 90% ethanol; 6–7, from snake tail tip tissue treated with laundry detergent and Hom II buffer, respectively; 8–9, same as 6-7, isolated after 14 d incubation; 10–11, from toad toe-clips extracted with laundry detergent, after 14 d incubation in laundry detergent (10) and 70% ethanol (11); M, l/Hind III marker (MBI Fermentas).

mixture, but not after incubation with a conventionally used DNA extraction buffer (Bahl and Pfenninger 1996). Considering the potential value that this method may have for workers in the field, we were interested to find out whether these results could be reproduced using a wider variety of amphibian and reptile samples, and if the new method could effectively preserve samples collected for DNA analysis and kept at ambient temperatures during field work in a tropical country. Storage of blood and tissue samples in ethanol and a conventional buffer was tested under the same conditions.

Blood samples were taken by cardiac puncture from a euthanized Java Krait, *Bungarus javanicus*. Reptile tissue samples were collected from the tail tip of a captive Many-Banded Krait, *Bungarus m. multicinctus*. This specimen died of multiple parasitoses and sepsis and had been frozen at –20°C immediately after death. Forty-nine millimeters of the total 99 mm tail were cut and nine cross-cut pieces of 42–57 mg were produced. Amphibian toe-clips were obtained from a previously frozen (–20°C) Common Toad, *Bufo b. bufo*.

The conventional DNA extraction buffer herein named Hom II was prepared according to a standard protocol (Sambrook et al. 1989). The commercially available laundry detergent Persil Megaperls® (Henkel Waschmittel KGaA, Düsseldorf, Germany) was suspended to 10% (w/v) in deionized water. Blood samples (0.1–0.5 ml) were transferred to screw top cryovials containing 2 ml of the laundry detergent suspension. Equal blood volumes were stored in 2 ml 90% ethanol. After manually shaking the samples for 30 sec to mix the blood and the laundry detergent suspension, they were kept at ambient temperatures (26–32°C) during four weeks of field work. After this period the samples were frozen at –20°C. Snake tail tissue, in 42–57 mg sections, was transferred to screw top cryovials containing either 2 ml laundry detergent suspension or 2 ml Hom II buffer. Some snake tail tissue samples were frozen immediately at –20°C until DNA isolation, whereas the rest was incubated 14 d at 37°C. Fifty milligrams of amphibian tissue per sample were incubated 14 d at 37°C in 2 ml laundry detergent suspension or 70% ethanol. All fresh tissue (previously frozen in laundry detergent or the conventional buffer) was crude homogenized manually for 30–60 sec with a micropestle 1–2 h before extraction. Twenty microliters proteinase K (10 mg/ml) was then added to the samples to be extracted with Hom II buffer, followed by 2 h incubation at 37°C. Prior to DNA extraction, proteinase K was also added to the samples that had been stored 14 d in Hom II buffer, followed by 12 h incubation at 37°C. To process the ethanol samples the supernatant ethanol was removed and the samples were air dried for 30–60 min at room temperature. Two milliliters laundry detergent suspension or Hom II buffer was added and the samples were processed as above. The DNA was isolated using a standard phenol/chloroform-isoamyl alcohol method (Sambrook et al. 1989). Ethidium bromide fluorescence after gel electrophoresis was used to estimate the integrity and yield of the isolated DNA. The degree of purity of the isolated DNA samples was calculated using the ratio of their spectrophotometric absorptions at 260 and 280 nm, which indicate concentrations of nucleic acids and proteins, respectively.

High molecular weight DNA could be isolated from all samples (Fig. 1, Table 1). No low molecular weight degradation products were observed in DNA samples from snake blood that had been preserved in laundry detergent over a period of four weeks at 26–32°C (Fig. 1, lanes 1–4). All samples preserved in 70% or 90% ethanol contained some degradation products, as did tissue samples under all preservation methods. Fresh snake tail tip tissue yielded more DNA if treated with laundry detergent, but a higher $A_{260/280}$ ratio was achieved by the conventional (Hom II buffer and proteinase K) extraction (Table 1). This might be due to adjuvants contained in the laundry detergent. Incubation of amphibian toe-clips in laundry detergent resulted in fewer degradation products than ethanol storage (Fig. 1, lanes 10–11). No DNA could be detected in the negative controls (extraction from laundry detergent without blood or tissue; data not shown). The DNA isolated from samples which had been incubated (26–37°C) in Persil Megaperls® laundry detergent for two to four weeks was digestible by a restriction enzyme (data not shown), and suitable as a template for PCR (Fig. 2).

Although DNA could be isolated from all samples, differences in quantity and quality were obvious. The best results (high quantity of high molecular weight DNA and no visible amount of degradation products) were obtained from snake blood that had been preserved in laundry detergent. Most commercial washing powders contain a mixture of detergents designed for removal of organic

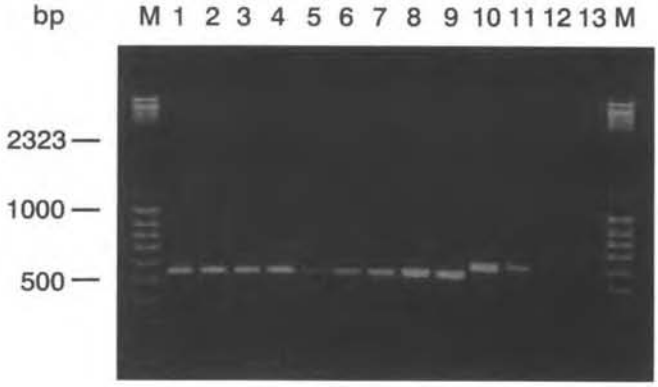


FIG. 2. A 1.4% agarose gel showing PCR amplification products of a 550 base pair fragment of the mitochondrial 16S gene using 3 ng DNA from the samples in Fig. 1. See Fig. 1 for assignment of lanes 1–11, 12–13, water; M, mix of 100 base pair ladder and l/Bst II marker (MBI Fermentas).

TABLE 1. DNA isolation protocols and spectrophotometrically estimated purity and yield.

Species	Material	Incubation	Extraction	Mean DNA Yield ± SD	Range	N	A_{260}/A_{280} Ratio
Bungarus javanicus	Blood	4 weeks, laundry detergent, 26–32°C	Laundry detergent	125 ± 89 µg from 0.1–0.5 ml	43–294 µg	5	1.60–1.87
		4 weeks, 90% ethanol, 26–32°C	Laundry detergent	149 ± 84 µg from 0.1–0.5 ml	65–233 µg	2	1.62–1.81
Bungarus multicinctus	Tail tip	— (fresh)	Laundry detergent	1.3 ± 0.1 µg/mg	1.2–1.4 µg/mg	2	1.38–1.47
		— (fresh)	Hom II buffer	0.5 ± 0.1 µg/mg	0.4-0.6 µg/mg	2	1.80–2.00
		14 d, laundry detergent, 37°C	Laundry detergent	1.1 ± 0.4 µg/mg	0.8-1.5 µg/mg	2	1.31–2.06
		14 d, Hom II buffer, 37°C	Hom II buffer	1.0 ± 0.1 µg/mg	1.0-1.1 µg/mg	2	1.32–1.87
		14 d, 70% ethanol, 37°C	Hom II buffer	0.5 ± 0.3 µg/mg	0.2–0.7 µg/mg	2	1.87–2.50
Bufo bufo	Toe clips	14 d, laundry detergent, 37°C	Laundry detergent	2.7 ± 1.1 µg/mg	1.5–3.8 µg/mg	2	1.41–1.51
		14 d, 70% ethanol, 37°C	Laundry detergent	3.5 ± 0.1 µg/mg	3.5–3.6 µg/mg	2	1.28–1.31

material, enzymes (e.g., proteases, lipases), and chelating complexes (e.g., EDTA), just like most of the conventional buffers for the isolation of genomic DNA. Being a single-cell suspension, blood is quickly and easily digested by the laundry detergent while the digestion of tissue samples appears to be slower. Similarly, passive ethanol diffusion into tissue appears to require more time. Although all tissue preservation techniques we tested yielded amounts of high molecular DNA that are sufficient for analysis, autolytic processes as evinced by DNase activity and resulting degradation products occurred in every tissue sample. Furthermore, the sampling of blood is less harmful for most studied animals than the collection of tissue, and guarantees the availability of undamaged specimens for morphological studies.

In studies of amphibian populations toe-clipping is a frequently used, semi-permanent marking method (ASIH et al. 1987; Donnelly et al. 1994; Ferner 1979). Usually, the toes are discarded after amputation. Gonser and Collura (1996) presented evidence that this tissue is a readily available source of genetic material, and urged that toe-clips should therefore be collected rather than wasted. Our observations on *Bufo bufo* toe-clips confirm their findings, and show that high molecular DNA can be isolated from amphibian tissue by laundry detergent too, even after prolonged incubation at high temperatures.

In a laboratory setting, laundry detergent has proven a rapid and uncomplicated storage method for recovering large quantities of genomic DNA. For applications which require a very high purity an additional extraction with phenol or conventional extraction methods may be needed.

With respect to field work in remote areas, laundry detergent has several advantages over freezing, ethanol, and the conventional buffer systems. Laundry detergent has a low dry weight, can be suspended with clean drinking water, is not flammable, and is not subject to legal restrictions. Unlike many conventional buffer systems, laundry detergent is inexpensive and widely available. Due to these characteristics and its ability to preserve blood and tissue samples under field conditions while providing the first steps of DNA extraction at the same time, it may be of interest not only for laboratory use but especially for herpetologists in the field.

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A Method to Study the Development of the Dentition in Pleurodont Reptiles

SERGIO R. P. LINE
Department of Morphology
Faculdade de Odontologia de Piracicaba-UNICAMP
13414-018 Piracicaba, São Paulo, Brazil
e-mail: serglin@fop.unicamp.br

Studies regarding the development of the dentition in reptiles are usually performed in decalcified tissue sections (Slavkin et al. 1984; Weill and Tassin 1970; Westergaard and Ferguson 1990). These studies are limited to the observation of few sections in a tooth, and are mainly focused on the cellular aspects of development, as enamel matrix is lost during decalcification procedure. In this paper we describe a simple procedure using scanning electron microscopy (SEM) and histochemistry to study the dentition development in whole mounts of tooth germs.

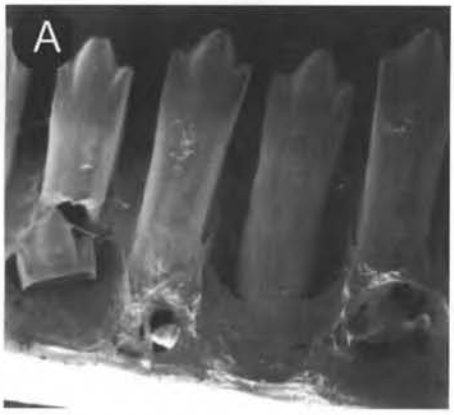


FIG. 1a. SEM image of macerated jaw. Note the presence of three small tooth germs which are inducing the resorption of the functional tooth. X 50.

Three specimens of the iguanid lizard *Tropidurus torquatus* (Vanzolini et al. 1980) were captured and killed by ether inhalation. After decapitation, the heads were macerated for 30 days in a 4% $CaCO_3$ solution at room temperature. After maceration, specimens were boiled in distilled water for 30 min, and the soft tissue was carefully removed under a binocular microscope. To prepare specimens for SEM, tooth germ-bearing bones were air dried and mounted intact on metal stubs. The material was coated with gold using a Balzers MED 010 sputter coater and examined in a Zeiss DSM 900 scanning microscope. For the histochemical analysis, tooth germs were stained with 0.05% Coomassie Brilliant Blue R-250 (Sigma Chemical Corporation, USA) diluted in a 50% methanol, 5% acetic acid solution (Pearse 1985).

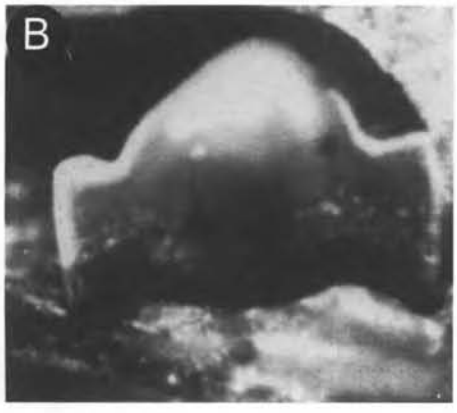


FIG. 1b. Enlarged SEM of a tooth germ. The corrugated surface of the tooth germ reflects large amounts of water loss from the organic matrix (Robinson et al. 1978). Details of the numerous resorption lacunae in the dentin of the functional teeth are also observed. X 140.

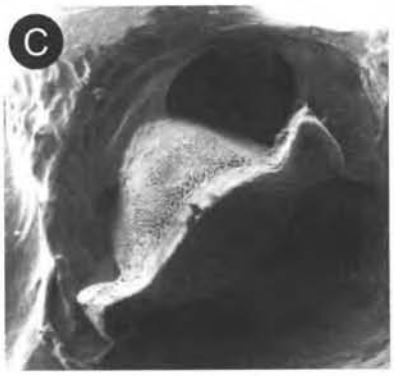


FIG 1c. Coomassie Brilliant Blue staining of a tooth germ. Note that the tip of the tooth germ is not stained, indicating that in this region the organic matrix was already replaced by a mineralized enamel. X 170.

Like in most reptiles, the teeth of the *T. torquatus* are continuously replaced throughout life. This is evidenced by the presence of multiple tooth germs in distinct stages of development (Fig. 1a). This lizard has a pleurodont type of tooth attachment, in which the tooth is attached to the inner margin of the bone jaw (Gaengler and Metzler 1991).

The maceration procedure preserves much of the organic matrix and allows the histochemical staining of the iguanid lizard tooth germs (Fig. 1b). The method described in this paper allows us to directly observe morphological details of odontogenesis (Fig. 1c), as well as the sequence and pattern of tooth formation in pleurodont reptiles and amphibians, and possibly in animals with other type of tooth attachment. This methodology can be used in carcasses of animals that have been dead for several weeks, and is especially useful for the observation of the tooth development in tiny animals, whose tooth germs can have a transverse diameter smaller than 0.1 mm.

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The Harmonic Direction Finder: A New Method for Tracking Movements of Small Snakes

CHRISTIAN ENGELSTOFT
Department of Biology, University of Victoria
Victoria, British Columbia, Canada V8W 3N5
e-mail: alula@islandnet.com

KRISTIINA OVASKA
Department of Forest Sciences, University of British Columbia
Vancouver, British Columbia, Canada V6T 1Z4
e-mail (KO): kovaska@jdmicro.com

and
NEIL HONKANEN
Department of Physics and Astronomy, University of Victoria
Victoria, British Columbia, Canada V8W 3P6
e-mail (NH): honkanen@uvic.ca

The harmonic radar (Riley et al. 1996, 1998) and harmonic direction finder techniques (Lövei et al. 1997; Mascanzoni and Wallin 1986, Roland et al. 1996; Wallin and Ekbom 1988) provide new possibilities for tracking small animals. The techniques are based on the principle that a tag (diode and antenna) attached to an animal converts incoming radio signals to a harmonic frequency of the original, broadcast wavelength, and re-radiates at this harmonic frequency. Thus, the returned signal differs from reflections from other objects and vegetation, and the tag can be detected. Because the tag does not need a power source, it can be exceedingly small, weighing as little as 0.4 mg (Roland et al. 1996). High-power scanning harmonic radars (which provide information on both the direction and range) are suitable for recording the dynamic trajectories of low-flying animals (particularly insects) over ranges of hundreds of meters, whereas the hand-held harmonic direction finders (which provide information on only direction) are more suited to the location of stationary or slowly moving targets that can be followed on foot.

The harmonic direction finder has been previously used to follow the movements of carabid beetles (Hockmann et al. 1989, Lövei et al. 1997, Mascanzoni and Wallin 1986, Wallin and Ekbom 1988), snails (Lövei et al. 1997), and a variety of flying insects (Roland et. al 1996). We are aware of only one published report on its use on vertebrates. As part of a study of spatial ecology of the Broad-headed Snake, *Hoplocephalus bungaroides*, in Australia, Webb and Shine (1997) augmented their radio-telemetry data by using the harmonic direction finder to follow movements of juvenile snakes with snout-vent length (SVL) < 35 cm. However, they did not specifically address the harmonic direction finder methodology, including its efficacy for use on snakes. The tags we describe are considerable lighter than those used by Webb and Shine (0.004 g versus 0.25-0.41g) and therefore have potential for tracking smaller animals. Here we present our adaptation of the technique for use on the Sharp-tailed Snake, *Contia tenuis*, including tag assembly, tag implantation, and field trials on tracking a small number of snakes. We also discuss problems that we encountered in our field trials. Our hope is that this information will stimulate others into further developing the method for use on vertebrates that are too small for conventional radio-tracking.

Due to the cryptic habits of *C. tenuis*, very little is known of its life history, behavior, and habitat use. In British Columbia, *C. tenuis* is extremely rare and on the provincial Red List of species at risk. Thus, information on its natural history, including movement patterns, is highly desirable for management and conservation purposes. The small size and slender body form of the snakes preclude the use of conventional radio-telemetry (SVL of adults typically < 30 cm, weight < 8 g, body diameter < 0.5 cm).

Tags and their assembly.—For tags, we used a high-frequency Schottky diode (Hewlett-Packard HP5316; detection frequency range: 1 to 26 GHz, capacitance: 0.10pF at 0V, voltage sensitivity: 6.6mV/μW) mounted in the center of a filamentous antenna (Roland et al. 1996). Characteristics necessary for a diode to function with a harmonic direction finder transceiver unit include an ability to operate in the GHz range of frequencies, a high sensitivity to detect weak signals, and a very low noise figure. To increase the strength of the tag suitable for use on snakes, we first soldered the two leads of the diode onto a small (0.1 x 0.4 mm) substrate made of a flexible, printed circuit board material (Kapton™, a polymide-based dielectric film, which is copper-clad and then etched). A copper plate (or lead) is imbedded to each end of the substrate. The substrate provided support for the diode and its fragile gold leads. We then soldered an antenna (0.079 mm or 40 gauge, enameled copper wire) onto each end of the substrate (Fig. 1).

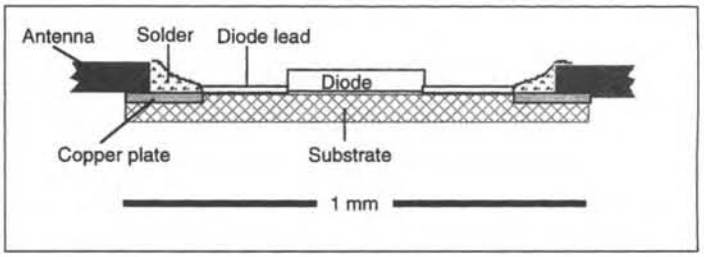


FIG. 1. Diagram of the tag implanted in *Contia tenuis*.

We assembled the tags under a dissecting microscope using a commercially available soldering station (Pace Sensa Temp®) and a 0.4 mm (1/64") diameter soldering bit. As the detection distance increases with antenna length, we used the longest antenna that could be implanted in the snakes (ca. 7 cm in total length). We dipped the tag (diode and antenna) into a presumably inert commercial plastic

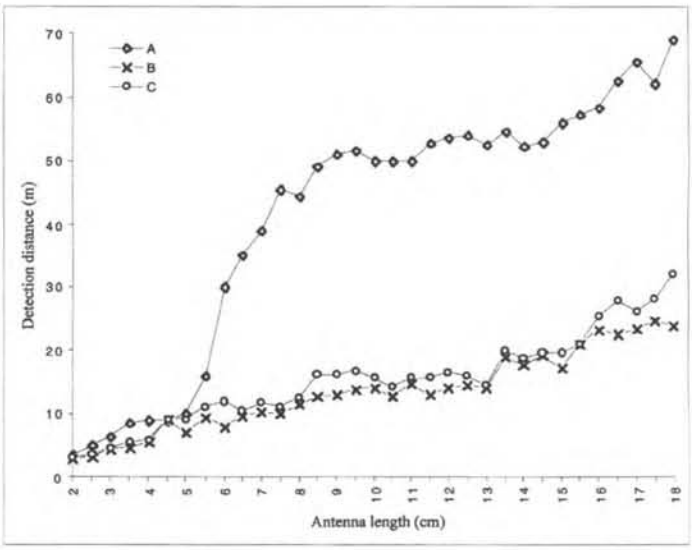


FIG. 2. Maximum detection range of a tag in relation to antenna length. A) Tag 80 cm above ground, transceiver at chest height (100 cm above ground; ◊). B) tag on ground, transceiver at chest height (100 cm above ground; O). C) tag on ground, transceiver above the observer's head (220 cm above ground; X).

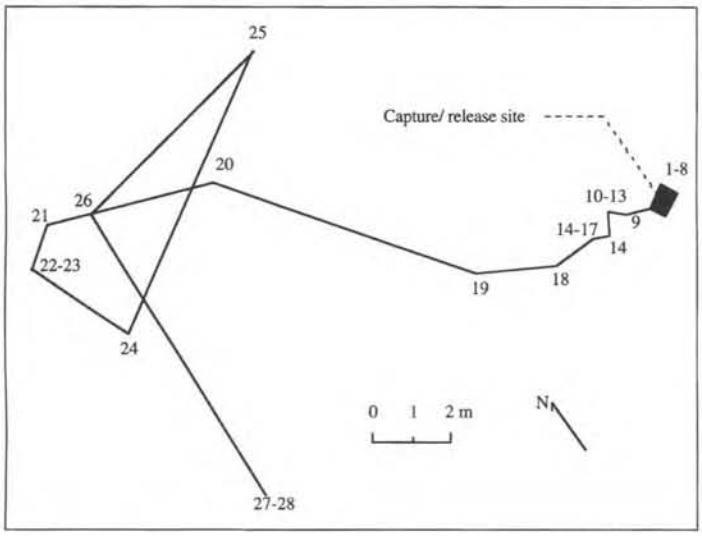


FIG. 3. Movements of an individual *C. tenuis* (# 3) during the night of its release on 11 September 1997. Numbers indicate detection locations.

mixture used for coating tool handles (Plasti Dip®, PDI, Inc. P.O. Box 130, Circle Pines, Minnesota 55014, USA); this potting material has been previously used for coating implanted radio-transmitters used for frogs and snakes (Jansen 1982, Macartney 1985). The total weight of the plastic-coated tag was ca. 4 mg. Webb and Shine (1997) placed tags used for *H. bungaroides* inside flexible, medical-grade silicon tubes.

Detection range.—To determine the relationship between antenna length and detection range, we incrementally shortened an antenna that was initially 18 cm in total length to 2 cm by snipping off 0.5 cm at a time from alternating ends of the tag. After each cut, we measured the maximum detection distance with a portable transceiver unit (RECCO4). The unit transmits a continuous signal at 917 MHz at 4–5 W and receives at 1834 MHz. The incoming wavelengths are translated into an auditory signal to permit tag detection. A Yagi antenna is built into the transceiver unit. We measured the detection distance (A) when the tag was 80 cm above the ground and the transceiver unit was held at chest height (100 cm above the ground), (B) when the tag was on the ground and the transceiver at chest height, and (C) when the tag was on the ground and the transceiver was held above the observer's head (at ca. 220 cm above the ground). In all trials the antenna was horizontal and perpendicular to the line of sight between the tag and transceiver; an antenna end-on to the transceiver cannot be detected (Lövei et al. 1997). We carried out the experiment in an open field where the path between the transceiver and the tag was unobstructed by vegetation.

For antenna lengths greater than 5 cm, the maximum detection distance of a tag raised above the ground was dramatically greater than that of a tag on the ground (Fig. 2). For a tag on the ground, the detection distance decreased steadily with decreasing antenna length. The maximum, unobstructed detection distance of a tag with a 7 cm long antenna, which we used on the snakes, was ca. 12 m when the tag was on the ground. The position of the transceiver unit (at chest height or above the observer's head) had little effect on the detection distance.

Attaching tags to snakes.—Initially, we attempted to attach the tag externally on the dorsum of the snakes by glueing it with SkinBond®, a surgical glue that remains flexible when dry. While tags glued onto four juvenile *Thamnophis ordinoides* (20–25 cm in SVL) remained in place for 7–20 days in captivity, the glue did not adhere properly to *C. tenuis*, presumably due to its smoother, unkeeled scales. Because of the failure of the glue, we decided to attempt subcutaneous attachment. Webb and Shine (1997) implanted tags used on *H. bungaroides* into the body cavity with methods used for radio-transmitter implantation. Our smaller tags allowed subcutaneous implantation.

We first anaesthetized a snake with Metophane® (2% Lidocaine was used for the first two *T. ordinoides*), and then inserted a catheter (11 cm long, gauge 22 [0.85 mm], Monoject® 220, 22 x 3.5) for the length of the tag (7 cm) under the skin. After removing the center rod of the catheter, we inserted a stiff lead wire attached to the tag through the catheter and then slowly removed the catheter while holding onto the lead wire. By pulling the lead wire, we placed the tag in the desired position under the skin. We then removed the lead wire, cut the antenna to appropriate length, and closed the two incisions with SkinBond®.

We implanted tags in four *Contia tenuis* (155–253 mm SVL) and five juvenile *Thamnophis ordinoides* (200–250 mm SVL). Apart from one fatality (the first *T. ordinoides* treated), which probably resulted from holding the snake too tight during the procedure, all snakes recovered and their movements appeared normal 4–6 days after the operation. We kept all four *T. ordinoides* in captivity to investigate signal retention. During the first three months, one *T. ordinoides* died in captivity, apparently from unrelated causes. The remaining three snakes retained functional tags for at least three months. We noted no obvious effects of the tags on feeding, shedding, or growth. We held the four tagged *C. tenuis* in the laboratory for 5–8 days after the procedure to allow for recuperation. We then released the snakes, one at a time, at their original capture locations as part of field trials.

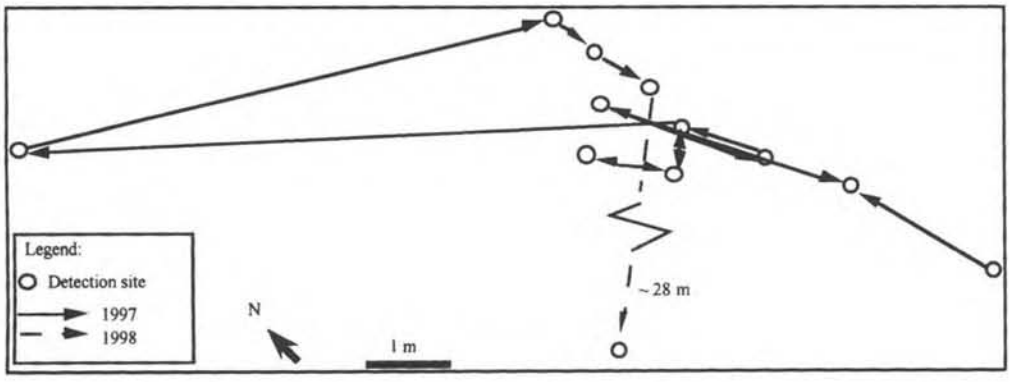


FIG. 4. Movements of an individual *C. tenuis* (# 3) from 12 September 1997 to 20 April 1998. The snake was found a total of 57 times during this period (52 times in fall and 5 times in spring) at the indicated locations. Double-headed arrows indicate movements back and forth between same locations.

Field trials.—We released three *C. tenuis* on North Pender Island (26 August 1997, 11 September 1997, 19 March 1998) and one on Saltspring Island (30 September 1997), British Columbia. The study site on Saltspring was ca. 0.15 ha and that on North Pender ca. 0.75 ha. To examine the feasibility of tracking tagged snakes, we followed the snakes throughout the night of their release, recording locations hourly or more often. For example, Snake #3 (a female) was

released at 1632 h and began to move at 2002 h. We located the snake 28 times during the first night, when it moved a total distance of 44 m (Fig. 3). During each check, we were able to pinpoint the position of the signal to within ca. 15 cm, but only once (at 0219 h) did we visually locate the snake; it traveled mostly under the surface.

After the first night, we were unable to relocate two of the four released snakes. The snakes presumably moved out of the study areas. However, we were able to track the remaining two tagged snakes for several months. From 11 September to 11 November 1997, we located Snake #3 52 times (excluding locations during the first night of release; Fig. 4). The snake spent five days (6 detections) within a log and an adjacent stump, which were in advanced stages of decay. It spent three days (11 detections) under a rock. The remaining 34 detections were at underground locations not associated with surface rocks or logs. During the two-month period, we searched for the snake an additional 17 times without success. In winter, the snake presumably hibernated underground at depths beyond signal detection (i.e., deeper than 20–30 cm). We located this snake again on 21 March 1998, and visually confirmed its identity. We located the snake five times in the same location in the following three weeks using the harmonic direction finder (until 7 April). The distance between two farthest locations was 39 m between September 1997 and April 1998. On 20 October 1998 (about 13 months after tagging), the snake was captured but emitted no signal; most likely, the connection between the antenna and the diode had become detached.

We located Snake #21 three times between 13 March and 20 April 1998 with the harmonic direction finder (excluding locations during the night after its release). One location was under a rock and two were under a downed log. The distance between two farthest captures was 93 m.

The most desirable features of the harmonic direction finder are the small size and relatively long functional life of the tag. In theory, a tagged animal is marked for life, but mechanical wear and tear can shorten tag life, as we documented for one snake. One of our tags lasted at least 208 days in the field, considerably longer than the 8–21 days of battery life for the smallest available radio-transmitters.

Limitations of the technique included short detection range, false signals, and lack of individual recognition. Because the tagged snakes spent most of their time underground, the detection range in the field was < 5 m and often only 1–2 m, a distance considerably shorter than the maximum, unobstructed detection distance of 12 m that we recorded for a tag with a 7 cm long antenna in an open field. Thus, it was necessary to search for snakes by thoroughly scanning the study sites from different directions and with the transceiver close to the ground. The coiling behavior of the snakes and the sigmoidal shape assumed by the antenna of at least one snake, presumably due to muscular activity, probably also contributed to a decrease in the detection distance. A transmitter unit with a stronger, pulsed signal would be desirable, but we are aware of no commercially available sources for such units. Because of its short detection distance, the harmonic direction finder is best suited for detecting relatively short movements. Webb and Shine (1997) obtained movement data for four juvenile *H. bungaroides* in the field. Most movements were < 110 m, but movements up to 250 m were detected.

At our disturbed study sites, various human-made objects, such as metal fencing, concrete with embedded wire mesh, and discarded cans and aluminum wrapping, as well as some iron-bearing rocks, generated false signals (see Lövei et al. 1997 for other sources of false signals). Therefore, before releasing tagged snakes, we examined the study areas with the transceiver and either removed objects emitting false signals or marked them with flags. To identify individual snakes, we tagged only a few snakes per site and verified their identity during visual encounters whenever possible; often, however, digging up the snakes would have resulted in considerable damage to the microhabitats, for example, when the snakes were inside decaying logs. Because known sites with *C. tenuis* are few and restricted in area in British Columbia, the number of individuals that can be potentially tracked without confusion is limited.

Regardless of its short-comings, the field trials showed that the harmonic direction finder can be used to obtain data on movements and habitat use of *C. tenuis*, information that otherwise would not be possible to obtain. With further development of both tags and the transceiver unit, the method holds promise for tracking movements of a variety of small animals.

Costs and permits.—The transceiver unit costs US $6,400 (from RECCO AB, Box 4028, S-181 04 Lidingö, Sweden; e-mail: Recco@recco.se). The diodes cost about US $4.00 each (from Penstock RF/Microwave Distribution Penstock, now AtNet, 520 Mercury Drive, Sunnyvale, California 94086-4060, USA).

Because of its novelty, regulations for the operation of the harmonic direction finder were not well defined in British Columbia at the time of our study and were dealt with on a case by case basis. We suggest that potential users check with their regional regulatory agencies for possible rules and regulations governing the operation of the device.

Criteria for using the harmonic direction finder.—The following questions should be considered before embarking on the use of the harmonic direction finder: (1) Does the target animal move within a relatively small area (e.g., within < 1 ha)? The method is not suitable for detecting long movements. Flying or climbing animals, however, can be detected farther away than animals that are underground or submerged in water. (2) Are there funds available for tag development and assembly? At present, tags are not commercially available and need to be assembled by researchers. Different tag configurations and attachment methods might need to be developed for particular species. (3) Are there objects in the study area that result in false signals? Whereas isolated signal-emitting objects can be identified, widely dispersed contaminants, such as certain metal-bearing rocks, may render the method unsuitable in particular areas. (4) Is individual recognition required? At present, the tags do not allow for individual recognition, and individuals must be identified visually or through other means when located. Passive interrogative transponders (pit tags) might allow individual identification without handling snakes once they have been located using the harmonic direction finder. Alternatively, tracking can be carried out either sequentially or at widely spaced locations.

Acknowledgments.—This work was conducted as part of an ecological study of *Contia tenuis*, for the Ministry of Environment, Lands and Parks, Vancouver Island Regional Office, with funding from Forest Renewal British Columbia. We thank Trudy Chatwin and Susan Holroyd for encouraging us to pursue testing the harmonic direction finder. Malcolm Macartney helped us in developing tag implantation procedures. John Crawford tirelessly assisted us with locating tagged snakes in the field. Sylvia and Kevin O'Reilly, Don Williams, John Crawford, Fred Franke, and Vince and Sandra Knight generously allowed us to track snakes on their properties. We thank Megan O'Shea for sharing ideas on the harmonic direction finder and Joe Riley for his extremely useful comments on an earlier version of this paper. We also thank Daryl Karns, Steve Beaupré, and Howard K. Reinert for their comments that greatly improved this paper.

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HERPETOLOGICAL HUSBANDRY

Cage Design for "Hard to Handle" Venomous Snakes

R. MARK WATERS
Department of Ecology and Evolutionary Biology
The University of Tennessee, Knoxville, Tennessee 37919, USA
e-mail: rmwaters@utk.edu

DONNA G. LAYNE*
and
GORDON M. BURGHARDT
Department of Psychology
The University of Tennessee, Knoxville, Tennessee 37919, USA
e-mail (GMB): gburghar@utk.edu

**Present address: Department of Biological Sciences*
Kent State University, Kent, Ohio 44242, USA
e-mail:dlayne1@kent.edu

Venomous snakes present unique husbandry problems to the researcher keeping them in the laboratory. In addition to providing a suitable environment for the snakes, the keepers must ensure the safety of those persons who study and care for the snakes. Researchers may also be required by their institutions to follow established guidelines for animal care and welfare (e.g., UFAW 1987; National Research Council 1996), despite the fact that such guidelines focus mainly on avian and mammalian species and provide little guidance for keeping snakes (Greene et al. 1997). Many institutions are also voluntary members of regulatory bodies, such as the American Association for the Accreditation of Laboratory Animal Care (AAALAC), which carry out compliance inspections. Thus, laboratory caging must meet both safety and animal care requirements. In recent years, the number of commercial cage designs for reptiles has proliferated. These vary from simple, modified aquaria to elaborate polycarbonate (e.g., Plexiglas®) vivaria. However, most of these cages are intended for non-venomous reptiles. Cages designed specifically for housing venomous snakes are generally lacking, so the keeper usually has to modify an existing cage.

In 1993 we began behavioral studies in the laboratory with neonate and juvenile habu (*Trimeresurus flavoviridis*: Crotalinae). Initially, we housed the snakes individually in modified 57 L glass aquaria with sliding, lockable tops, and manipulated the snakes using a standard snake hook. Although our initial research on young snakes was productive (Waters et al. 1996), we found that, as the snakes grew, our caging and method of animal transfer became unsuitable and potentially dangerous. We found that many specimens did not sit on the hook passively, but instead used the hook as a branch, and climbed toward the handler. Efforts to prevent this behavior agitated the snakes and made them difficult to control safely. Therefore we looked for a new cage system that: a) limited the need to handle snakes using a hook, b) provided an environment that reduced stress on the snakes and allowed normal behavior to be observed, c) met the standards for animal care required by AAALAC, and d) maximized the limited space available in our laboratory.

Of the existing caging options we examined, none provided a design that would accommodate all of our needs. Zoos provide examples of well-designed housing for venomous snakes (e.g., Frye 1991, Fig. 2-21). Unfortunately such housing is frequently very large and not easily adapted for laboratory use. Two published accounts describe well-designed cages. Mason et al. (1991) described a cage design for arboreal snakes (specifically *Boiga irregularis*) that met all animal care and welfare requirements. Unfortunately it does not easily accommodate snakes that seek seclusion in a visually isolated retreat. Coote's (1985) design for housing colubrid snakes provided a shelter by using a drawer beneath the main cage. The drawer had a fixed open top making it unsuitable for venomous snakes. In addition, the cage was constructed of wood, which if not completely sealed, does not meet AAALAC guidelines. With these and other designs in mind, we developed a cage that met all of our requirements. We have outlined the design in broad terms, and discuss the features of the design rather than merely providing a blueprint. Interested persons may wish to apply these features when constructing cages for their specific study animal.

Materials.—All elements of the cage are constructed from materials that meet AAALAC guidelines. The main body of the cage is constructed from clear Lexan® polycarbonate panels (6.35 mm thick) and stainless steel hardware. Panels are held together with steel screws. We chose screws, rather than a commercial bonding agent, to facilitate replacement of individual panels if they are damaged. The Lexan® panels tolerate an industrial cage washer that cleans at high temperatures. The hide boxes are not constructed from Lexan® because it was not available in the colors that we wanted. Instead we used acrylic of the same thickness. A complete list of materials is available on request.

Main Cage.—The cage is a 61 x 61 x 40.5 cm box divided into three permanent spaces: a large, upper living space, and two smaller, lower retreats. A hide box is inserted into each of the lower retreats. The living space can be divided into halves by a removable opaque divider (Fig. 1, Element A; Fig. 2). We find this flexibility useful when dealing with different sizes of snakes. Snakes are able to move freely between the living space and hide box via a round, 6.4 cm opening in the floor (Fig. 1, Element G). The openings in the hide box and living space can be independently closed using stainless steel plates that slide under (Fig. 1, Element H) or over (Fig. 1, Element I) the holes, respectively. The plates are secured in place with plastic thumbscrews.

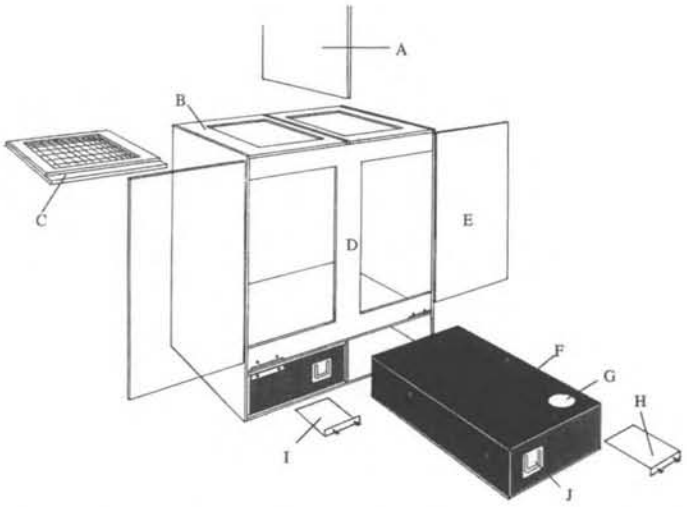


FIG. 1. Schematic diagram of venomous snake cage. A) opaque divider; B) protective top panels; C) lid; D) protective front panel; E) front door; F) hide box; G) opening for snakes to exit box; H) stainless steel sliding plate for hide box; I) stainless steel sliding plate for main cage; J) handle for removing hide box from main cage.

The front of the living space is an **I**-shaped panel (Fig. 1, Element D). This feature serves two purposes: it provides structural support while leaving openings for front access, and it forms a modest vertical barrier (5.1 cm high) to snakes moving forward along the ground. Similarly, the top panels (Fig. 1, Element B) form a lip around the top of the cage to restrict vertical exits when the lids are open.

The front doors (Fig. 1, Element E) are hung with stainless steel piano hinges and close over the **I**-shaped panel. When closed, the doors are secured using padlock hardware that is screwed to the doors and the **I**-shaped panel. In addition, each door has two nylon thumbscrews (top and bottom of distal end of door) that are threaded into the **I**-shaped panel (Fig. 2) to prevent the door from bowing out at the edges.

Each cage lid is constructed from two Lexan® frames with 3.2 mm stainless steel mesh sandwiched between them (Fig. 1, Element C). The mesh ensures adequate ventilation, but can be replaced with a solid panel for those species having high humidity requirements. The cage lids are also hung using stainless steel hinges (Fig. 2). When closed the left and right lids are secured together with a padlock. As with the doors, each lid has two nylon thumb screws which secure the lid to the underlying panel.

Hide Boxes.—The hide boxes are the most important feature of this design because they enable the keeper to avoid direct contact with the snakes. With sliding gates closed, each box may be moved into any other cage and can be weighed with the snake in it.

Each hide box (Fig. 1, Element F) is 39.4 x 58.4 x 8.6 cm. The top, bottom, and sides are constructed of black opaque acrylic to provide a dark retreat. The front and back panels are constructed of dark red transparent acrylic. The red tinted panels provide a measure of visual isolation while permitting the keeper to check the condition and behavior of the snakes in the hide box. An opening (Fig. 1, Element G) allows the snake to exit the hide box and enter the living space. In the face of the front panel there is a recessed handle (Fig. 1, Element J). The rear panel is removable and secured in place with thumbscrews. Snakes readily enter the hide box when disturbed.

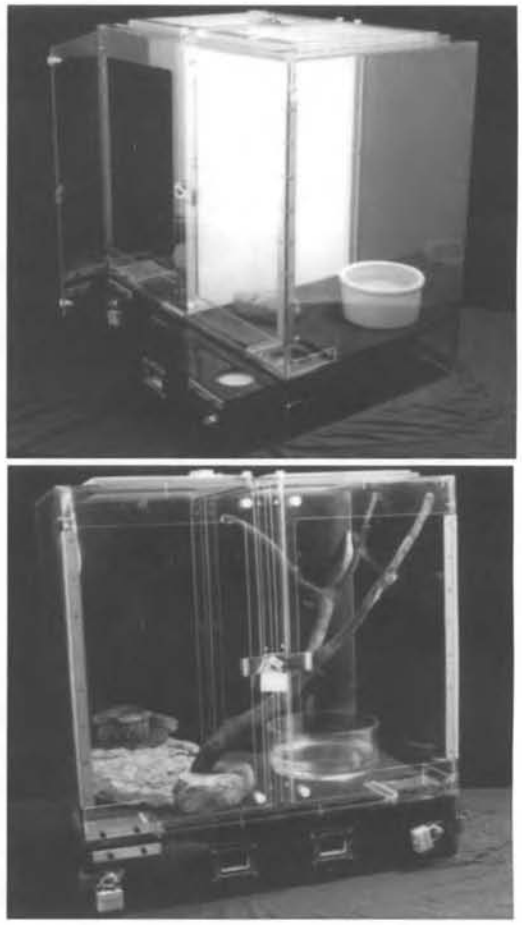


FIG. 2. Photographs of the cage with (a) partition in place; (b) without partition and habu in living space.

We have used this design for three years to house all our venomous snakes (*Trimeresurus flavoviridis, T. elegans*, and *Agkistrodon contortrix*) and have needed to use a snake hook (direct contact) rarely. The hook is occasionally used to encourage snakes to go into their hide box when the living space needs cleaning. If a snake needs to be removed from the hide box, the back panel of the box can be opened and the snake gently lifted out and into the upper living space. We find that the snakes adapt well to the cage and make use of both the living space and hide box. The habu is primarily nocturnal (Koba 1971) and therefore makes greatest use of the living space when the room is dark (Waters et al. 1998). We shifted the light/dark cycle so that the room becomes dark at noon. The mornings can then be used for servicing the cage while the snakes are secured in their hide boxes.

We are in the process of adapting the hide box so veterinarians may use it when treating snakes that become ill. This is usually the only time when the snakes need to be handled directly. One design will incorporate a squeeze box apparatus, while another will be adapted as an induction chamber for anesthesia with inhalation anesthetics.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 30, Number 1 (March 1999).

CAUDATA

NOTOPHTHALMUS PERSTRIATUS (Striped Newt). **COLORATION**. Occurrence of albinos has been reported for numerous species of salamanders (Dyrkacz 1981. SSAR Herp. Circ. 11. 31 pp.). Here we report observations of four albino striped newts encountered over a three-year period at One Shot Pond, a seasonally-ponded isolated wetland located on the Katharine Ordway Preserve-Carl Swisher Memorial Sanctuary, Putnam Co. Florida, USA. This is the first published account of albinism for *Notophthalmus perstriatus* and apparently the first for the genus *Notophthalmus*.

The first albino observed was a larva captured by dip net on 11 July 1995. This animal lacked normal integumentary pigmentation (Fig. 1) but had a yellowish cast throughout its body. Shiny bluish flecks were present along the dorsal and ventral margins of the tail fin (these appear as white spots in Fig. 1). The eyes appeared to be normally pigmented. Using the terminology of Dyrkacz (*op. cit.*), this animal is described as leucistic with xanthophores. The larva was maintained in captivity until its death on 6 August 1995 at which time it measured 23 mm SVL. We were unable to determine its sex. Although its tail fin and gills had atrophied considerably, it failed to complete metamorphosis. The specimen and a color slide of it in life were deposited in the Florida Museum of Natural History, University of Florida (UF102170). A second larva closely resembling the above was collected by dip net on 17 August 1996 (UF111290, sex unknown, SVL = 21 mm, TL = 43 mm).



FIG. 1. Albino (leucistic with xanthophores) *Notophthalmus perstriatus* larva from One Shot Pond, Putnam Co., Florida. Photo by Barry Mansell.

Two leucistic efts were also captured at One Shot Pond. The first was caught on 8 November 1996 in a bucket trap at a drift fence 60 m from the pond (UF111291, sex unknown, SVL = 20 mm). The second eft (UF 111292, female, SVL = 22 mm, 0.2 g) was captured on 2 December 1997 in a bucket trap on the inside of a drift fence that encircled the pond. Based on the presence of gill buds, it had recently metamorphosed and was moving into the uplands. Both efts lacked integumentary pigmentation although the eyes appeared normal. The stripes, which are characteristic in transformed individuals of *N. perstriatus*, were visible as distinct light lines. Both efts are described as leucistic with xanthophores (Dyrkacz, *op. cit.*).

We have conducted regular sampling in One Shot Pond since July 1995, usually examining about 50 individuals each month. Since October 1996, we individually marked more than 4000 striped newts caught in pitfalls at the drift fence that encircled the pond. We also have observed hundreds of striped newts at numerous breeding ponds throughout the geographic range of the species; however, these four individuals are the only *N. perstriatus* we have encountered with abnormal pigmentation. Additionally, in over 2500 captures at a breeding in north-central Florida, as well as numerous individuals observed throughout the species range in Georgia, USA, Dodd never encountered an albino striped newt (C. K. Dodd, Jr., pers. comm.).

We thank C. Kenneth Dodd, Jr., Richard D. "Bubba" Owen, and Dale A. Johnson for reviewing earlier drafts of this note. Barry Mansell took the photograph in Fig. 1.

Submitted by **STEVE A. JOHNSON**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA, and **RICHARD FRANZ**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA.

PLETHODON DUNNI (Dunn's Salamander). **REPRODUCTION**. Only a single nest of *Plethodon dunni* has been reported (Dumas 1955. Copeia 1955:65). On 27 May 1997, a second nest was discovered at Keel Mountain, Linn County, Oregon, USA (T12N R1E Sec 13). The nest contained an adult coiled around 12 eggs and was located in a cavity in a decay class 5 log (Maser et al. 1979. *In* Thomas (ed.), Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington, pp. 78–95. USDA For. Serv. Agric. Hndbk. 553.) near the upper surface of the log under loose wood. The log was on a 0.5 m high cut-bank ca. 0.2 m from a small, first-order perennial stream. Habitat at the site was characterized by ca. 40 yr old Douglas fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*), naturally regenerated after logging, with an understory of sword fern (*Polystichium minutum*), Oregon grape (*Berberis nervosa*), and huckleberry (*Vaccinium parvifolium*). Large decayed downed wood was

abundant due to apparent "high-grading" and/or snag-felling during previous timber management activities; log decay classes 4 and 5 were the most abundant at the site (S. Chan, USFS pers. comm.). A thick layer of bryophytes covered a large portion of the downed wood and forest floor.

Funding was provided to DHO by the USDA Forest Service, National Forest System and the Pacific Northwest Research Station. For assistance in study implementation and coordination, we are grateful to Charley Thompson (Portland, BLM), John Tappeiner (Biological Resources Division, U.S. Geological Survey), and Kerry Murphy (Salem District, BLM).

Submitted by **RICHARD S. NAUMAN, DEANNA H. OLSON, LORETTA L. ELLENBURG**, and **BRUCE P. HANSEN**. Aquatic-Land Interactions Research Program, USDA Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, Oregon 97331, USA.

ANURA

ACRIS CREPITANS (Northern Cricket Frog). **DEATH FEIGNING**. During October 1990, 89 juvenile *Acris crepitans* (20–27 mm SVL) were collected in southwest Normal, Illinois, USA. They were housed in plastic shoeboxes, filled with ca. 1 cm water and tilted to provide an aquatic and terrestrial environment. In captivity, 17 of these frogs displayed death feigning when they were roughly handled or restrained, although this behavior was not displayed as frequently when captured in the wild (pers. obs.). The apparent higher display frequency may be a result of stress levels experienced in captivity, as they were held captive for 2–3 weeks prior to release. When displaying this behavior, a frog would position all limbs in their normal resting position but raised from the substrate so the frog was resting on its venter. The medial digits of the forelimbs were positioned against the tympanum. The hind legs were similarly raised with the femoral portions of the limbs held against the lateral flanks of the abdomen. If released, a frog displaying this behavior would remain in this position for a few seconds, even when turned on its back. Afterwards it would right itself and quickly leap away from the observer. This behavior somewhat resembles the unken reflex displayed by highly toxic frogs such as *Bombina orientalis*. In the unken reflex, a toxic frog will raise its pectoral and pelvic regions from the ground and balance on its ventral surface. In the death feigning behavior, *A. crepitans* only positions its limbs, the pectoral and pelvic regions remain in their usual position, thus causing the chin to rest on the ground as if the frog were crouching. This appears to be the first report of death feigning in *A. crepitans*.

Submitted by **MALCOLM L. McCALLUM**, Department of Biology, Health, and Physical Education, Belleville Area College, 2500 Carlyle Avenue, Belleville, Illinois 62223, USA.

BUFO ALVARIUS (Colorado River Toad). **HABITAT**. *Bufo alvarius* has been reported to occur from elevations of 1250–1387 m in New Mexico (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. 431 pp.). Range-wide elevation has been reported between 0–1610 m (Stebbins 1985. A Field Guide to Western Amphibians and Reptiles. 2nd ed. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.) and 0–1615 m (Cole 1962. Herpetologica 18:172–175; Fouquette 1970. Cat. Am. Amphib. Rept. 93:1–4). Degenhardt et al. (*op. cit.*) described the habitat as "desert shrub characterized by broad flat expanses of creosotebrush and mesquite, in rocky riparian zones grown to cottonwood and sycamore, in muddy stock ponds". Stebbins (*op. cit.*) described range-wide habitat as "arid mesquite-creosotebush lowlands and arid grasslands into the oak-sycamore-walnut groves (plant community) in mountain canyons" and noted that the species "enters tropical thorn forest in Mexico." Fouquette (*op. cit.*) described the occurrence "in desert, but also in grassland and lower oak-woodland" of the Lower and Upper Sonoran life zones. Cole (*op. cit.*) listed 13 specimens collected in San Simon and San Bernardino Valleys as well as a specimen from the Peloncillo Mountains "200 yards E of the Arizona-New Mexico State Line on Geronimo Trail" in "an open meadow surrounded by pine-oak-juniper forest" (R.W. Axtell, pers. comm.). Presently, this site in Cottonwood Canyon is a mosaic of encinal woodland and savanna, with Mexican pinyon (*Pinus cembroides*) and alligator bark juniper (*Juniperus deppeana*) occurring throughout.

During the summers of 1997 and 1998, we observed six *B. alvarius* at elevations above 1685 m in Clanton Draw (NM) of the Peloncillo Mountains. These specimens were found in pine-oak woodlands characterized by high densities of Chihuahua pine (*Pinus leiophylla*), Mexican pinyon, alligator bark juniper, and various oaks (*Quercus* spp.). On 9 August 1998 a single specimen (Arizona State University ASU 30937) was collected at 1763 m in Cottonwood Canyon (NM) on a steep (>30°) rocky slope dominated by native grasses. Our observation of multiple individuals over two years, in addition to Cole's (*op. cit.*) 1961 specimen, indicate an adult population of *B. alvarius* occupies this rugged Madrean community bounded by grasslands and Chihuahuan desert scrub.

Submitted by **ANDREW T. HOLYCROSS** and **BRIAN G. FEDORKO**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA, and **OCKERT FOURIE**, University of Toronto, Department of Medical Biophysics, 1 King's College Circle, Toronto, Ontario M5S 1A8, Canada.

BUFO AMERICANUS (American Toad). **DEPTH RECORD**. On 19 June 1997 while SCUBA diving in the Connecticut River we captured two *Bufo americanus* tadpoles at a depth of 8 m. The dive site was near the confluence of Pine Meadow Brook and the Connecticut River, ca. 42°42'34"N, 72°26'14"W in the town of Northfield, Franklin County, Massachusetts, USA. The river bottom dropped steeply to 1 m and then gently to a maximum of 10 m. The bottom was a continuous bed of live mussels overlaying dead mussel shell and fist-sized rocks. The flow regime is variable on a diel basis due to an upstream power plant pumping station, with the current ranging from 0–2.5 knots. The two tadpoles, which had not started to transform, were found at a depth of 8 m while we were turning rocks and shells. We identified the tadpoles as *Bufo* sp. because of their distinctive coloration and size. The species, *B. americanus*, was inferred because the only other toad occurring in the area, *B. woodhousii fowleri*, breeds later in the year (Degraaf and Rudis 1983. Amphibians and Reptiles of New England: Habitats and Natural History. Univ. Massachusetts Press. Amherst. 85 pp.). In 1997, due to a cool and prolonged spring season, local *B. americanus* did not breed until mid-May with *B. woodhousii fowleri* delaying reproduction until June (TFT, pers. obs.). Typically, *B. americanus* breed in ponds and still, shallow water (Klemmens 1993. Amphibians and Reptiles of Connecticut and Adjacent Regions. State Geological and Natural History Survey of Connecticut. Bull. 112 xii+318 pp.). They also breed in local streams and rivers. This is the first report of a toad tadpole in deep and relatively fast flowing water. It is probable that eggs or tadpoles were washed into the river and settled in this vicinity as *B. americanus* have not been reported to breed in the river itself. The shells and rocks provide a still water microhabitat until transformation.

Submitted by **ALAN M. RICHMOND, THOMAS F. TYNING**, and **ADAM P. SUMMERS**, Organismic and Evolutionary Biology, University of Massachusetts at Amherst, Amherst, Massachusetts 01003-5810, USA.

BUFO BOREAS (Boreal Toad). **PREDATION**. Numerous predators of *Bufo boreas* adults and tadpoles have been reported in the literature. In 1994 and 1995, one of us (JPG) examined the stomach contents of 154 brook trout (*Salvelinus fontinalis*) from a boreal toad breeding site containing numerous tadpoles in Chaffee County, Colorado, USA. Most guts contained chironomid pupae and larvae, but none contained any tadpoles. Ten 150-mm greenback cutthroat trout (*Oncorhynchus clarki*) coexisted in a 3.7-m long hatchery trough with eight *B. boreas* tadpoles for 48 days and did not consume or injure any tadpoles. These observations suggest that these salmonids do not routinely consume boreal toad tadpoles.

When offered 200 boreal toad tadpoles, four captive mallards (*Anas platyrhynchos*) consumed the tadpoles in less than one minute. In Chaffee County, mallards have been observed at boreal toad breeding sites apparently consuming tadpoles (C. Fetkavich, pers. comm.). Medium and large odonate larvae consumed boreal toad tadpoles in laboratory trials, but we did not observe predation by odonate larvae at boreal toad breeding sites. We frequently observed spotted sandpipers (*Actitis macularia*) consuming toadlets in the Woods Creek drainage, Clear Creek County. Most predation occurred in August, when the toadlets were metamorphosing. During one observation on 9 August 1995, a spotted sandpiper ate 21 newly metamorphosed toadlets in approximately 30 seconds. Most of the toadlets were on the shore, but a few were in shallow water. At one site where dropping water levels exposed >1 m of unvegetated shore, the sandpipers walked parallel to the shoreline, picking up toadlets as they progressed. Also in August, American robins (*Turdus migratorius*) were observed eating tadpoles from the shallow portions of a boreal toad breeding pool. One robin ate six tadpoles in a one-minute period.

We also observed predation on adult boreal toads by red fox (*Vulpes vulpes*) and raccoon (*Procyon lotor*). Beginning in late June 1998, and continuing through July, raccoon tracks were found at three breeding ponds at or near the stripped-off skins of at least six adult toads, including three toads that had been equipped with radio transmitters. The skins were discarded in shallow water. A toad carcass was found near fox tracks, with no other mammal or bird tracks in the vicinity. In contrast to raccoon predation, the body parts appeared chewed rather than peeled away and were on the ground rather than underwater. In 1998, late June and early July were particularly dry, which may have concentrated both the toads and these mammalian predators, as we observed no such predation in the previous years (1995–1997) at this site. In addition, in 1998 a domestic dog tore the abdomen of an adult female toad, which died from the wound.

Funding for this work was provided by Great Outdoors Colorado through the Colorado Division of Wildlife. We thank Anne Beierle, Environmental Coordinator, and the Climax Molybdenum Company for facilitating research activities. Bud Stiles assisted with the field work.

Submitted by **MARK S. JONES** and **JOHN P. GOETTL**, Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526, USA, and **LAUREN J. LIVO**, Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526, USA, and EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

DENDROBATES AURATUS (Green Poison Frog). **PREDATION**. Predation on members of the genus *Dendrobates* is apparently rare, perhaps due to the presence of highly toxic alkaloids in their skin (Myers and Daly 1983. Sci. Am. 248:120–133). Here, I report observations of predation on *Dendrobates auratus* by the tarantula *Sericopelma rubronitens* on Toboga Island, Panama.

On 5 June 1985, I observed an adult *S. rubronitens* rush out of its burrow, capture a passing female *D. auratus* in its mandibles, and retreat back into its burrow. Apparently this spider was not hungry or was repelled by the frog's toxins as the frog left the burrow after ca. two minutes. The frog left the burrow slowly, hopping at a normal pace. Presumably the tarantula could have retrieved the frog if it had simply escaped. Examination revealed the frog was unscathed except for two parallel scratches in the skin on the right side, apparently from the fangs of the tarantula.

On 20 June 1985, I observed a courting male and female *D. auratus* as they passed by a rock under which a tarantula had a burrow. The spider rushed out, captured the male, and returned into its burrow. After one hour the spider was captured, examined, and found to be clutching the frog in its mandibles The frog was dead although the cause of death was not obvious, and it was not apparent that the tarantula had been attempting to consume the frog.

At a later date, I captured a *D. auratus*, tied a length of fishing line around its waist, and presented it to a foraging tarantula I had observed earlier. The spider immediately grabbed the frog in its mandibles and retreated under a rock. I allowed the spider to remain in this position for 2.5 h and then retrieved the frog. Examination of the corpse revealed two puncture marks in the upper venter, near the left foreleg. The frog's body on the left side was deformed and the internal tissues were dissolved and partially removed. Hence, it appeared the tarantula had injected the frog with digestive fluids and was in the process of removing the liquefied tissues.

The tarantula was kept in a terrarium for two days and showed no obvious ill effects from partially consuming the poison frog. Apparently *S. rubronitens* does prey on *D. auratus*, although the first observation of capture and subsequent release of a female suggests *D. auratus* may not be a preferred prey item.

I thank A. S. Rand and the administrative staff of the Smithsonian Tropical Research Institute for advice and assistance.

Submitted by **KYLE SUMMERS**, Department of Biology, East Carolina University, Greenville, North Carolina 27858, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad). **AGGREGATION WITH TARANTULA**. Blair (Copeia 1936:115) was the first to call attention to the tarantula *Aphonopelma hentzii* sharing its burrows with *Gastrophryne olivacea*, citing that up to nine of the toads were found in an individual burrow. In a presentation at the 1991 SSAR meeting I elaborated on the nature of this association, offering evidence that the tarantulas indeed would not attack *G. olivacea* or *G. carolinensis* but would attack and eat the frog, *Acris crepitans*.

On 14 April 1998 at a site in Wagoner County, Oklahoma, USA, I found several tarantulas under flat stones, some sharing the burrow with toads, others not. Under one stone I found 22 *G. olivacea* with a female tarantula. When uncovered, all of the animals attempted to rush into the burrow, the crush being so great that the animals literally plugged the burrow and could not force their way through the entrance. Because the toads must journey up to several hundred meters to reach their breeding sites, experiments are in progress to determine if individual toads return to the same burrows after the mating season.

Submitted by **HAROLD A. DUNDEE,** Tulane University Museum of Natural History, Belle Chasse, Louisiana 70037-3098, USA; e-mail: dundee@museum.tulane.edu.

LEPTODACTYLUS CHAQUENSIS (NCN). **DIET.** *Leptodactylus chaquensis* is a common frog in the Chacoan region of Argentina, where it is found in the eastern foothills of the Andean system (Jujuy, Salta, and Tucuman) up to the central marshes of Corrientes (Ibera swamps), the Entre Rios, and Santa Fe Province (Cei 1980. Amphibians of Argentina. Monitore Zoologico Italiano (NS). Monogr 2, 609 pp.). Nine individuals were collected during the following periods: April–June 1996 (one male 74.5 mm SVL; two females 52.1 and 52.3 mm SVL), October 1996 (two females 54.4 and 75.8 mm SVL), and January 1997 (two males 68.1 and 47.6mm SVL; two females 61.5 and 64.7 mm SVL). All specimens were collected 15 km northeast of Corrientes (27°28'S, 58°50'W) Corrientes, Argentina. *Leptodactylus chaquensis* is a nocturnal, active forager. Table 1 summarizes data collected during this study.

I thank Arturo I. Kehr for suggestions on field and laboratory methods and for reviewing a draft of this manuscript.

TABLE 1. Prey consumed by *Leptodactylus chaquensis* (N = 9) from Corrientes, Argentina.

Items	N	% Total	Vol (cm^3)	% Vol.	Freq.
ARACHNIDA					
Araneae	1	1.9	0.006	0.1	1
INSECTA					
Coleoptera	13	25.0	1.95	38.6	6
Orthropoda	5	9.6	2.16	42.7	5
Diptera	2	3.8	0.0003	0.1	1
Homoptera	2	3.8	0.039	0.8	1
Hemiptera	1	1.9	0.19	3.8	2
Hymenoptera (ants)	14	26.9	0.032	0.6	1
Hymenoptera (excl. ants)	2	3.8	0.37	7.3	2
Isoptera	9	17.3	0.03	0.6	3
Larva	1	1.9	0.001	0.2	1
MOLLUSCA					
Hirudineae	1	1.9	0.12	2.4	1
VERTEBRATA					
Amphibia	1	1.9	0.15	3.0	1
TOTAL	52	100	5.05	100	

Submitted by **MARTA I. DURE**, Centro de Ecología Aplicada del Litoral (CECOAL-CONICET), C.C. 291, (3400) Corrientes, Argentina.

LITHODYTES LINEATUS (Ant Frog). **COLORATION.** The leptodactylid frog *Lithodytes lineatus* occurs in eastern Peru, Ecuador, Colombia, Bolivia, Brazil, southern Venezuela to the Guianas, and on the island of Trinidad (Frost 1985. Amphibian Species of the World. Allen Press, Inc. and Assoc. Systematics Collections. Lawrence, Kansas. v + 732 pp.; Cochran and Goin 1970. Frogs of Colombia. Smithsonian Inst. Press. 655 pp.; Murphy 1997. Amphibians and Reptiles of Trinidad and Tobago. Krieger Publishing, Malabar, Florida. 245 pp.).

Normal coloration for *L. lineatus* consists of a black dorsum and a pair of wide yellow to golden tan dorsolateral stripes extending from the snout to nearly the groin. The dorsal surface of the limbs is black to brown with black or dark brown bars; red spots are present in the groin. The flanks are black and the venter is normally grayish brown (Duellman 1978. The Biology of an Equatorial Herpetofauna. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 65. 352 pp.; Rodriguez and Duellman. 1994. Guide to the Frogs of the Iquitos Region, Amazonian Peru. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 22. 106 pp.).

On 6 July 1998, an aberrant adult *L. lineatus* (ca. 35 mm SVL; Univ. Texas at Arlington (UTA) Slide 24363) was photographed and released in the riparian forest at Quebrada Ungurawe in the vicinity of Monteverde, Rió Tigre, Loreto, Peru (W. Lamar, pers. comm.). The specimen lacked all black pigment and was a uniform pale brown (flesh color by night). The dorsolateral stripes on the back were a weaker yellow, but the red markings in the groin appeared normal. The bars occurring on the dorsal surface of the limbs were yellow, and the ventral surface was pale gray to white.

Hypomelanism has been documented in anurans (Bechtel 1995. Reptile and Amphibian Variants: Colors, Patterns, and Scales. Krieger Publishing, Malabar, Florida. 206 pp.); however, this is the first report of hypomelanism in *L.lineatus*.

Submitted by **MATTHEW J. RUSSELL**, Department of Biology, University of Texas at Arlington, Box 19498, Arlington, Texas 76019, USA.

PHYLLOMEDUSA HYPOCONDRIALIS (NCN). **DIET.** Although many aspects of the ecology of *Phyllomedusa hypocondrialis* were discussed by Cei (1980. Amphibians of Argentina. Monitore Zoologico Italiano (NS). Monogr. 2, 609 pp.), the diet has not been investigated. Nine individuals were collected during the following periods: 7 February 1996 (two males; 28.2 and 31.0 mm SVL), October–November 1996 (five males; mean = 31.2 ± 0.06 mm SVL), and January 1997 (two males; 29.9 and 32.0 mm SVL). All specimens were collected 15 km northeast of Corrientes (27°28'S, 58°50'W), Corrientes, Argentina. *Phyllomedusa hypocondrialis* is a sit-and-wait predator. Table 1 summarizes data collected during this study.

I thank Arturo I. Kehr for suggestions on field and laboratory methods and for reviewing a draft of this manuscript.

TABLE 1. Prey consumed by *Phyllomedusa hypocondrialis* (N = 9) from Corrientes, Argentina.

Items	N	% Total	Vol (cm^3)	% Vol.	Freq.
ARACHNIDA					
Araneae	1	2.6	0.003	1	1
INSECTA					
Hymenoptera (ants)	1	2.6	0.0005	0.2	1
Hymenoptera (excl. ants)	2	5.3	0.078	26.1	2
Diptera	29	76.3	0.18	58.1	7
Homoptera	4	10.5	0.051	16.4	1
Orthoptera	1	2.6	0.003	1	1
TOTAL	38	100	0.31	100	

Submitted by **MARTA I. DURE**, Centro de Ecología Aplicada del Litoral (CECOAL-CONICET), C.C. 291, (3400) Corrientes, Argentina.

PHYSALAEMUS PUSTULOSUS (Túngara Frog). **PREDATION.** Although primarily nocturnal, *Physalaemus pustulosus* are active during the day on Toboga Island, Republic of Panama. *Physalaemus pustulosus* were heard calling, observed mating, and seen moving about the forest throughout the day (0700–1800 h, May–June 1998). On 15 June 1998 at 1030 h, we observed an adult *P. pustulosus* being attacked and dragged into a crevice under a boulder by an adult female tarantula, *Sericopelma rubronitens*. Toboga Island has a large population of tarantulas, with adult females (>100 mm in body length) encountered frequently (diurnal censusing yielded approximately 1 spider per 2 m^2).

To examine if *P. pustulosus* were being consumed by *S. rubronitens*, a thread was tied around a live frog's waist and the frog was placed on the leaf litter near a foraging tarantula. The spider pounced on the frog as soon it tried to hop away. The tarantula briefly handled the frog before inserting its fangs, and then carried the frog under a rock overhang. After 3 h, the tarantula was seen moving away from the overhang. The *P. pustulosus* was retrieved for examination and found to be flaccid with most of its tissues digested and removed. The frog's skin was intact except for the area under the left forelimb where the tarantula's fangs had been inserted. The carcass was surrounded by a thin veil of spider silk.

Unlike the majority of *P. pustulosus* predators, which locate the frogs through orientation to calls (Ryan 1985. The Túngara Frog. The University of Chicago Press, Chicago, Illinois. 230 pp.), these tarantulas use vibrational cues to locate prey. The spiders therefore present a threat to *P. pustulosus* during movement to and from breeding ponds. As both these spiders and frogs are more active at night, the incidence of tarantula predation on *P. pustulosus* is probably frequent on Toboga.

Submitted by **HEATHER M. GRAY**, and **DAVID M. GREEN** Redpath Museum, McGill University, 859 Sherbrooke Street West, Montreal, Quebec H3A 2K6, Canada, and **M. JASON PETERS**, Department of Biology, La Sierra University, Riverside, California 92515, USA.

RANA CASCADAE (Cascade Frog). **PREDATION**. On 11 September 1996, we released a male *Rana cascadae* (35 mm SVL) in Long Lake, Klamath County, Oregon, USA (T35S R5E Sec 27). It was immediately seized by a large (38 mm TL) giant water bug (*Lethocerus* sp.) which was concealed in the silty lake bottom. The frog was retrieved within 30 s from the water bug and was suffering paralysis throughout its body. The frog was breathing but all limbs were limp and no response to touch was observed. After ca. 10 min. the frog began to regain use of its limbs and was released. Giant water bugs are known predators of anuran larvae (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill Book Co., New York. 670 pp.) and in laboratory experiments giant water bugs readily fed on *R. cascadae* tadpoles (Peterson and Blaustein 1992. Copeia 1992:577–584). We know of no previously published records of giant water bugs preying on adult frogs.

Submitted by **RICHARD S. NAUMAN**[1] and **YVONNE DETTLAFF**[2], Chiloquin Ranger District, Winema National Forest, 38500 Hwy 97 North, Chiloquin, Oregon 97624, USA. [1]Present Address: PNW Research Station, USDA Forest Service, 3200 SW Jefferson Way, Corvallis, Oregon 97331, USA. [2]Present Address: USDA Forest Service, 2020 Toketee Ranger Station, Idelyld Park, Oregon 97447, USA.

RANA LUTEIVENTRIS (Columbia Spotted Frog). **CANNIBALISM**. Intraspecific predation is well documented in ranid frogs (Crump 1992. *In* Elgar and Crespi [eds.], Cannibalism: Ecology and Evolution Among Diverse Taxa, pp. 256–276. Oxford Univ. Press, New York), but is infrequently reported among ranid species in western North America. Despite several dietary studies of *R. luteiventris* (Turner 1959. Am. Midl. Nat. 61:403–413; Miller 1978. Northwest Sci. 52:243–249; Whitaker et al. 1983. Northwest Sci. 57:147–154), cannibalism has not been documented. However, intraspecific predation has been observed in Oregon spotted frogs (*R. pretiosa*) (M. P. Hayes, pers. comm.) and may be more prevalent than generally recognized. Herein, I report intraspecific predation of a metamorphosing juvenile by an adult *R. luteiventris*.

During a 5 September 1997 amphibian survey in a high-elevation (2484 m) lake, I observed an adult female *R. luteiventris* (ca. 75 mm SVL) consuming a metamorphosing conspecific (ca. 25 mm SVL; Gosner stage 42–43). The adult female was captured, with the metamorphosing frog in her mouth, along the marshy shoreline of a small (0.2 ha), unnamed lake (UTM Zone 11, E688900, N4998200) in the Bighorn Crags of the Frank Church-River of No Return Wilderness, Lemhi County, Idaho, USA.

Adult anurans do not appear to distinguish conspecifics from other prey (Duellman and Trueb 1986. Biology of Amphibians, John Hopkins University Press, Baltimore, p. 246). Therefore, cannibalism on juveniles by adults may simply represent utilization of an available food source. In the short, ice-free season of oligotrophic, high-elevation lakes, the consumption of abundant metamorphosing juvenile frogs by conspecific adults may be an important nutrient-rich food source for *R. luteiventris*. Intraspecific predation has been shown to increase nutrition and growth compared to other food sources (Crump 1990. Copeia 1990:560–564; Lannoo 1989. Can. J. Zool. 67:1911–1914; Wildy et al. 1998. J. Herpetol. 32:286–289). This may be particularly important in high-elevation lakes that typically have low productivity.

I thank Marc P. Hayes, John Lee, Charles R. Peterson, Dave Ross, and Elena Velasquez for commenting on an earlier version of this note, and Peter Ritson for his assistance with this observation.

Submitted by **DAVID S. PILLIOD**, Herpetology Laboratory, Department of Biological Sciences, Idaho State University, Pocatello, Idaho 83209-8007, USA.

RANA SPHENOCEPHALA (Southern Leopard Frog). **REPRODUCTION (FALL BREEDING).** In the southern portion of its range, *Rana sphenocephala* is known to breed during every month of the year (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agri. Exp. Station. Auburn, Alabama. 347 pp.; Dundee and Rossman 1991. The Amphibians and Reptiles of Louisiana. Louisiana State University Press. Baton Rouge, Louisiana. 300 pp.). Caldwell (1986. Copeia 1986:249–253), however, reported that even in these areas, breeding occurred in two primary time periods; early fall and winter. Smith (1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Sur. Bull., 28[1]. Illinois Natural History Survey Division, Urbana, Illinois. 298 pp.) reported that the breeding season for *R. sphenocephala* in Illinois is March and April and that transforming frogs can be found in June and July. Wright and Wright (1949. Handbook of Frogs and Toads, 3rd ed. Comstock Publ., Ithaca, New York. 640 pp.) observed ten *R. sphenocephala* egg complements south of Olney, Richland County, Illinois on 11 September 1929.

This note supports the Wrights' observation of fall breeding in *R. sphenocephala* in Illinois. Newly hatched tadpoles and egg masses were observed on 30 September 1996 in a recently filled, rainwater pond located 5.5 km E Ullin, 0.5 km S Cache River, E side Cache Chapel Road, Pulaski County, Illinois, USA (T14S R1E NW 1/4 Sec. 21; UTM Zone 16: N4127970m, E312475m).

Tadpoles were brought back to the laboratory and raised through metamorphosis to verify identification. In March 1997, 18 tadpoles successfully metamorphosed and positive identifications were made. Six metamorphs were vouchered in April (Illinois Natural History Survey 12981–12986); the remainder were released on 4 July 1997 at the site of capture. At the time of release, hundreds of *R. sphenocephala* tadpoles and metamorphs were observed. Because the hydrology of the pond is unknown from October 1996 to July 1997, we do not know if these tadpoles and metamorphs represent progeny of Fall 1996, Spring 1997, or both.

The range of the southern leopard frog in Illinois extends into the northern third of the state. The Wrights' Richland County and our Pulaski County observations fall within the southern third of the state. It is not known if fall breeding occurs near the northernmost edge of the range of *R. sphenocephala* in Illinois.

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

RANA SYLVATICA (Wood Frog). **COLORATION**. An albino *Rana sylvatica* tadpole was collected in St. Croix County, Wisconsin, USA, during Spring 1996. Several albino tadpoles were also observed in the area. The tadpole was raised in captivity and has reached 50 mm SVL as an adult. The specimen is being kept alive at the J. F. Bell Museum of Natural History and will be added to the vertebrate collection upon its death. The frog is ivory yellow with a pinkish mask. This is the first report of albinism in *R. sylvatica*.

Submitted by **DON LUCE**, J. F. Bell Museum of Natural History, 10 Church Street SE, Minneapolis, Minnesota 55455, USA, and **JOHN J. MORIARTY**, Hennepin Parks, 3800 County Road 24, Maple Plain, Minnesota 55359, USA.

RANA SYLVATICA (Wood Frog). **PREDATION**. On 26 May 1998 while electrofishing along the north shoreline of Pigeon Lake at the Pigeon Lake Field Station, Bayfield County, Wisconsin, USA (T45N R8W Sec 26), I collected a juvenile largemouth bass (*Micropterus salmoides*), 112 mm TL, that had captured a *Rana sylvatica* (29 mm SUL). The frog had been swallowed hind feet first up to the insertion of the forelimbs, and was still alive (largemouth bass often capture prey that are too large to swallow in one gulp and swim with them partially swallowed as digestion proceeds). Although largemouth bass are well known to prey on frogs (e.g., Cochran 1982. Herpetol. Rev. 13:45–46), fish were not included among the predators of wood frogs listed in recent field guides to the herpetofauna of the upper Midwest (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Public Museum. 205 pp.; Oldfield and Moriarty 1994. Amphibians and Reptiles Native to Minnesota. Univ. Minnesota Press. 237 pp.; Harding 1997. Amphibians and Reptiles of the Great Lakes Region. Univ. Michigan Press. 378 pp.). Presumably this reflects the wood frog's tendency to inhabit terrestrial environments and to breed in temporary fishless ponds. Relatively high water levels in Pigeon Lake in 1998 may have brought wood frogs and largemouth bass into closer proximity that usual by flooding areas of woody shoreline vegetation.

Submitted by **PHILIP A. COCHRAN**, Division of Natural Sciences, St. Norbert College, DePere, Wisconsin 54115, USA.

SCAPHIOPUS HOLBROOKI HURTERII (Hurter's Spadefoot). **PREDATION**. Recently metamorphosed Hurter's spadefoots were found in 25 samples during a crop analysis of 1767 northern bobwhites (*Colinus virginianus*) harvested between December 1995 and February 1996 from near Encino, Brooks County, Texas, USA. Three specimens (mean SVL = 16.6 mm) were deposited in the Texas Cooperative Wildlife Collection, Texas A&M University, College Station (TCWC 80162–164).

Although *Scaphiopus* spp. have been described as producing odors that are disagreeable to humans (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians. Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.), there are no experimental data on the effects of these odors or secretions on potential predators (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill Book Co., New York. 670 pp.).

Scaphiopus spp. migrate en masse at metamorphosis (Neill 1957. Herpetologica 13:185–187). Neill (*op. cit.*) observed mockingbirds and jays in the vicinity of a *Scaphiopus* mass migration but did not observe any predation by these birds. We suspect that predation by northern bobwhite on spadefoots is rare and limited to those times when coveys of quail fortuitously encounter mass migrations of metamorphosing spadefoots. However, because northern bobwhite coveys can contain as many as 16 adults (Lehmann 1984. Bobwhites in the Rio Grande Plain of Texas. Texas A&M Univ. Press, College Station. 371 pp.) and consume as many as 10 toadlets per individual (this study), these rare predation events may be locally important in spadefoot population dynamics.

Submitted by **MICHAEL J. McCOID**[1], **FRED S. GUTHERY**[2], **STEVE KOPP**[3], Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&M University, Kingsville, Texas 78363, USA, and **RONNIE HOWARD**, San Tomas Hunting Club, Box 94, Encino, Texas 78353, USA. [1]Present Address: Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA. [2]Present Address: Department of Forestry, Oklahoma State University, Stillwater, Oklahoma 74078, USA. [3]Present Address: 25100 Hwy. 441 North, Okeechobee, Florida 34972, USA.

TESTUDINES

CHRYSEMYS PICTA BELLII (Western Painted Turtle). **EARLY EMERGENCE**. On 7 April 1997, a hatchling *Chrysemys picta bellii* (James Ford Bell Museum of Natural History 13513) was found dead on a road in Shoreview, Ramsey County, Minnesota, USA. This was within a week of snowmelt. The winter of 1996–97 was one of early and heavy snow. This snow kept the ground from freezing. Once the snow melted the soil warmed up quickly, but was still not above 10°C when the hatchling was found. The temperature for the week of 1–7 April 1997 averaged 10°C with a high of 21°C, which was 5°C above normal. The month as a whole was 2°C below normal. Overwintering *C. picta bellii* hatchlings normally emerge in late May to early June. This is the earliest known emergence for this species at this latitude (Oldfield and Moriarty 1994. Amphibians and Reptiles Native to Minnesota. University of Minnesota Press, Minneapolis, Minnesota. 237 pp.).

Submitted by **JOHN J. MORIARTY**, Hennepin Parks, 3800 County Road 24, Maple Plain, Minnesota 55359, USA.

CHRYSEMYS PICTA BELLII (Western Painted Turtle). **HATCHLING EMERGENCE.** *Chrysemys picta bellii* in British

Columbia is at the extreme northwestern edge of its range. Females are known to lay multiple clutches of eggs at more southerly locations, but produce at most one clutch per year in British Columbia (Gregory and Campbell 1984. The Reptiles of British Columbia. British Columbia Provincial Museum, Victoria, British Columbia. 102 pp.). In northern populations, eggs hatch in late summer, hatchlings overwinter in the nest and emerge the following spring (St. Clair and Gregory 1990. Copeia 1990:1083–1089). Hatchlings have well-developed freeze tolerance, and can endure periods of freezing temperatures in the nest (Rubinsky et al. 1994. Am. J. Physiol. 267:R1078–R1088). There have been no previously published reports of viable hatchlings emerging from the nest in the fall in British Columbia, although St. Clair and Gregory (*op. cit.*) found a dead hatchling on the ground by a nest in September 1988.

On 18 September 1998, in the Creston Valley Wildlife Management Area, British Columbia, Canada (49°12'N, 116°38'W) we found the opening of a turtle nest. It was a small hole (ca. 5 cm across) in a dirt road leading down to the Kootenay River on a southwest-facing slope, about 20 m from the water. The opening to the nest did not appear to have been dug out by a predator. There were pieces of shell and two partly opened eggs with dried yolk in them on top of the rocks inside the hole; when these were removed, we could see a small turtle inside the hole, partly buried in the dirt and pebbles. It had been raining off and on all day, the first significant rain in over a week, and the air temperature was 20°C. As the rain began again, the turtle started to move around in the hole, and eventually dug itself out and climbed out of the hole. It had an egg tooth, and its carapace was about 3 cm long. The turtle immediately moved to the nearest vegetation at the side of the road. Meanwhile, a second hatchling appeared at the opening, moved uphill a short distance, then turned and went into the vegetation. Turtle breeding in Creston was about two weeks early in 1998 (pers. obs.); the fall hatchling found by St. Clair and Gregory (*op. cit.*) was from the first nest observed the previous mating season. Therefore, it is possible that an atypically long growing season may allow hatchlings to leave the nest before winter.

Submitted by **HEATHER L. WAYE**, 2927 Cedar Hill Road, Victoria, British Columbia, Canada V8T 3H8 (e-mail: hlwaye@islandnet.com), and **CAMERON GILLIES**, Box 245 Windermere, British Columbia, Canada V0B 2L0.

PSEUDEMYS FLORIDANA PENINSULARIS (Peninsula Cooter) and ***P. NELSONI*** (Florida Redbelly Turtle). **MUTUALISM**. For turtles that ambush their prey, an algae-covered carapace may provide camouflage from predators and prey (Neill and Allen 1954. Ecology 35:581–584). However, algal growth on the carapace could be pathological if, for example, the algae spread to the skin (Neill and Allen, *op. cit.*). Turtles can remove algae from their carapace by basking and shedding (Neill and Allen, *op. cit.*), biting algae off of their own shells (Reilly 1983. Herpetol. Rev. 14:76), and by biting algae off of conspecifics (Meshaka 1988. Herpetol. Rev. 19:88). Here, we report individuals of two different species of turtles removing algae from each other, an interaction that approaches interspecific mutual grooming.

On 11 May 1996 at 1445 h we watched a male *Pseudemys nelsoni* eating algae from the carapace of a female *P. floridana peninsularis* in Taylor Slough at Anhinga Trail, Everglades National Park, Dade County, Florida, USA. For six minutes, we observed the male removing algae from the rear of the female's carapace. During this time, the female's head was above water and she moved only passively from the actions of the male. Our observations ended when the actions of the male moved both turtles behind vegetation. We do not know how long this interaction had been taking place; however, there was a mosaic of freshly cleared patches on the pleurals of the female's carapace, suggesting that the male had been foraging for some time prior to our arrival.

On 27 May 1996 from 1010 to 1100 h, also at Anhinga Trail, WEM watched a female *P. f. peninsularis* feeding on the algae from the carapace of a female *P. nelsoni*. With each bite, the *P. f. peninsularis* would use her forefeet to push herself from the other turtle, removing algae in the process. The *P. nelsoni* made no attempt to avoid the *P. f. peninsularis*. At 1100 h, a second female *P. nelsoni* arrived along with a male *P. nelsoni*. The shells of both of these turtles were covered with algae. The *P. f. peninsularis* and male *P. nelsoni* foraged on the carapace of the second *P. nelsoni* female until 1105 h, after which the second female *P. nelsoni* swam away. At 1115 h, the original *P. nelsoni* female swam 0.5 m from shore, where she had been feeding on aquatic plants, to the female *P. f. peninsularis* and each fed from the other's carapace. From 1117 to 1123 h the male *P. nelsoni*, having found and swam around both turtles, positioned himself on top of the female *P. nelsoni*, vibrating his forefeet over her head in courtship. Throughout courtship attempts, the *P. f. peninsularis* alternately foraged on the rear of both turtles, often pulling the male from the female *P. nelsoni*. The male repeatedly moved above the female after these disruptions. At 1123 h, the *P. f. peninsularis* swam away from the courting pair of *P. nelsoni*.

As suggested for intraspecific algal grazing (Meshaka, *op. cit.*), this interspecific grazing behavior is suggestive of mutualism, whereby one individual receives nutrition and the other is relieved of a potential burden. Although basking sites were plentiful at this site, the carapaces of turtles of both species were covered with algae, perhaps because of the high pH, temperature, and eutrophication of the slough. Because of these conditions, the rate of algal growth on turtle carapaces might exceed that which can be removed during normal basking or shedding. Thus, it is possible that mutual algal grazing in these two species is adaptive. We thank James L. Dobie for commenting on this manuscript.

Submitted by **WALTER E. MESHAKA, JR.**, Everglades Regional Collections Center, Everglades National Park, 40001 SR-9336, Homestead, Florida 33034-6733, USA (e-mail: walter_meshaka@nps.gov), and **MARK DEYRUP**, Archbold Biological Station, P.O. Box 2057, Lake Placid, Florida 33862, USA.

TERRAPENE CAROLINA CAROLINA (Eastern Box Turtle). **DIET**. *Terrapene carolina* is regarded as omnivorous, eating a wide variety of plant and animal foods. Reptiles documented as food items, typically as carrion, include lizards (*Phrynosoma*), turtle eggs (*Chelydra*), and snakes (*Carphophis*, *Coluber*, *Storeria*, *Thamnophis*) (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institutional Press, Washington, D.C. 578 pp). On 20 August 1998, in Monroe County, Georgia, USA, I observed an adult male *T. carolina carolina* eating the entrails of a road-killed juvenile *Agkistrodon contortrix*. As I approached, rather than retracting its head into its shell, the turtle bit down firmly on the snake and carried it off the road and away from me. I know of no other reported observations of box turtles consuming road-killed venomous snakes.

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA (e-mail: john_jensen@mail.dnr.state.ga.us).

TERRAPENE ORNATA LUTEOLA (Desert Box Turtle). **HOMING BEHAVIOR.** Many turtle species seem to exhibit homing behavior and can return to their home range after being displaced up to several km away (Cagle 1944. Misc. Publ., Mus. Zool., Univ. Michigan 61:1–37; Gibbons and Smith 1968. Herpetologica 24:331–333). Box turtles (*Terrapene* spp.) have shown some tendency to exhibit homing behavior when experimentally moved. Eastern box turtles (*T. carolina*) have been able to return to their home range when displaced up to 1.2 km (Nichols 1939. Copeia 1939:125–127; Posey 1979. Bull. Maryland Herpetol. Soc. 15:139–140), but did not return when displaced greater than 1.6 km (Nichols 1939, *op. cit.*; Posey 1979, *op. cit.*; Schwartz and Schwartz 1974. Missouri Dept. Conserv. Terr. Ser. 5:1–28). Ornate box turtles (*T. o. ornata*) have shown the ability to return to their home range from up to 2.8 km away (Metcalf and Metcalf 1970. Trans. Kansas Acad. Sci. 73:96–117; Metcalf and Metcalf 1978. J. Herpetol. 12:411–412). We found a desert box turtle (*T. ornata luteola*) that appears to have returned over 9 km to its home range after accidentally being displaced.

We have been studying a population of *Terrapene ornata luteola* at the Sevilleta National Wildlife Refuge, 85 km south of Albuquerque, New Mexico, USA, since 1986. Turtles have been found while driving dirt roads (Nieuwolt 1996. Herpetologica 52:487–495). When encountered, turtles were marked by filing scutes (Cagle 1939. Copeia 1939:170–173) and most were put into a container for transport back to facilities where additional data were recorded. Turtles were returned to the site of capture and released within 1–7 d. Besides turtles that we found, we occasionally received unmarked turtles from others working in the area. Location data always accompanied these turtles. However, field notes and data sheets indicate that one turtle probably was not returned to its point of capture. On 20 September 1986, we received an adult female (116 mm CL, 373 g). After processing, we returned her the next day to what we understood to be her capture location near the northern end of our study site. We did not capture her again until 14 July 1988, when we found her 9.15 km south of the site where she had been released. This turtle was recaptured 18 times during 1990–1992. Each capture was within a well-defined area 8.10–8.75 km from her original release site. Because this adult female made one long-distance move and then settled into a fixed area, we feel certain that she returned to her original home range after accidentally being displaced in 1986.

Submitted by **DAVID J. GERMANO**, Department of Biology, California State University, Bakersfield, California, 93311, USA (e-mail: Dgermano@csubak.edu), and **PIMMY M. NIEUWOLT-DACANAY**, Department of Biology/314, University of Nevada, Reno, 89557, USA.

LACERTILIA

ABRONIA MIXTECA (NCN). **REPRODUCTION.** The anguid lizard *Abronia mixteca* is known only from seven pine-oak forested localities in the Sierra Madre Occidental of the Mexican states of Guerrero and Oaxaca (Bogert and Porter 1967. Amer. Mus. Novitates 2279:1–21; Campbell and Frost 1993. Bull. Amer. Mus. Nat. Hist. 216:1–121). Little is known about its reproduction. Herein we report observations of reproduction in captive individuals.

On 29 July 1995 at 1100 h an adult male (WSB 716-1, 115 mm SVL, 130 mm TL) was collected near the type locality at El Tejocote, Oaxaca (17°56'14"N, 97°33'03"W), elev. 2286–2400 m. The next day an adult female (WSB 716-2, 100 mm SVL, 125 mm TL) was collected in a disturbed oak forest at km 156.5 on the Tehuacán-Oaxaca Federal Hwy. 135 (17°36'83"N, 97°19'58"W), elev. 2287 m.

In the laboratory the specimens were housed together in a glass terrarium (70 x 50 x 50 cm). On 1 August 1998 at 0800 h the pair was found mating, the male grasping the female on the temporal region, and their tails loosely intertwined, as described by Campbell and Frost (*op. cit.*) for *Abronia lythrochila*. The lizards did not disengage until about 1600 h. Afterwards, the pair continued to be housed together. On 26 February 1996, seven months (210 days) after copulation, the female gave birth to seven live young (mean SVL 35.57 mm, SD 0.53, range 35–36 mm; mean TL 42 mm, SD 1.29, range 40–44 mm; mean mass 0.81 g, SD 0.069, range 0.7–0.9 g). The neonates were pale golden yellow with 5–6 black bands on the body, which were not continuous, but formed by a series of irregular black spots. There were 12–14 black rings on the tail, and the head had some black markings. The color pattern of the young differed from that of adults, which were bright light green dorsally with some irregular, black blotches on the body and tail.

The litter size is within the range for that of other anguids (range 1–12 young). Our observations suggest that *A. mixteca* mates during the summer and the offspring are born in the spring.

We thank Mario Mancilla and W. C. Sherbrooke for assistance in the field. W. C. Sherbrooke also provided financial support for the field work. We thank Ubaldo Guzmán for assistance in the lab.

Submitted by **WALTER SCHMIDT BALLARDO**, Museo de Zoología, Facultad de Ciencias, UNAM, Apdo. Postal 70-399, México D.F. 04510, México, and **FERNANDO MENDOZA-QUIJANO**, Instituto Tecnológico Agropecuario No. 6, Km. 5.5 Carr. Huejutla-Chalahuiyapa, Apdo. Postal 94 C.P. 43000, Huejutla, Hidalgo, México.

ANOLIS CASILDAE (NCN). **FORAGING.** *Anolis casildae* is a large anoline species recently described from Panama (Arosemena et al. 1991. Rev. Biol. Trop. 39:255–262), and for which nothing is known of its natural history. On 23 November 1997, while collecting this species in western Panama, Provincia de Chiriquí, I observed a large (108 mm SVL, 23.0 g mass, CRE 7665, University of Miami) male *A. casildae* leap from the ground to a sapling (2 cm diam) and perch ca. 0.5 m above the ground. While perching head-up on this sapling, the lizard began to consume a large green katydid (Orthoptera). Subsequently, the lizard was captured and found to be missing its left forearm. The distal portion of the remaining arm fragment was scarred but well healed, with a tiny bone fragment protruding from the tip. The injury may have been the result of a predation attempt. The missing forelimb appeared to have little effect on locomotion, as the anole captured the katydid with little difficulty, moved easily to the sapling to feed, and even managed to escape and evade capture for several minutes in the dorm room of the field station.

I thank the Smithsonian Tropical Research Institute for help with all aspects of collecting in Panama. I also thank Stan Rand, Roberto Ibañez, and the Herpetological Circle for encouragment and help while in Panama. This work was supported by a Tropical Biology Fellowship from the Department of Biology, University of Miami.

Submitted by **KIRSTEN E. NICHOLSON**, Department of Biology, University of Miami, Coral Gables, Florida 33124, USA.

CNEMIDOPHORUS SEXLINEATUS (Six-lined Racerunner). **ACTIVITY.** As is typical for *Cnemidophorus* species, *C. sexlineatus* is a highly active heliotherm that narrowly maintains a relatively high body temperature during a restricted activity period (Bogert 1949. Evolution 3:195–211; Fitch 1958. Univ. Kansas Publ. Mus.

Nat. Hist. 11:11–62; Hardy 1962. Univ. Kansas Sci. Bull. 43:1–73; Paulissen 1988. J. Herpetol. 22:473–476). Although *C. sexlineatus* has a wide geographic distribution in North America extending from New Jersey to Florida west to southern North Dakota and eastern New Mexico (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts, 450 pp.), activity periods and field body temperatures have been reported for relatively few populations (Florida, Bogert, *op. cit.*; Kansas, Fitch, *op. cit.*, Hardy, *op. cit.*; Oklahoma, Carpenter 1960. Proc. Oklahoma Acad. Sci. 41:72–77.; Paulissen, *op. cit.*). Here we document diel activity and body temperatures of *C. sexlineatus* from a population occupying a 400 m stretch of active railway trackbed in Searcy, White Co., Arkansas, USA.

On each of seven days between 28 July and 8 September 1985, one of us (RER) censused the active lizards on the study area every two hours from 0600 to 2000 h by slowly walking its length one time and recording all active *C. sexlineatus* observed by sex and age class (juvenile vs. adult). In addition, lizards were captured using a fishing pole with an attached 0.5 m length of monofilament line and a small hook baited with a cricket. We immediately measured each captured lizard's cloacal temperature with a Schulteis thermometer, and then sexed, measured (SVL), and released it at the site of capture. Air and soil surface temperatures were recorded at the onset of each census.

A total of only three lizards was observed on two overcast, rainy days when maximum soil surface temperatures reached only 26.4° and 29.2°C, respectively. On five cloudy or clear days, when maximum soil temperatures reached 41.2–52.0°C, a total of 203 lizard observations was made. Over these five days, no lizards were observed at either 0600 or 2000 h and only two lizards were observed at 0800 h and 10 lizards at 1800 h. Most lizards (94.1%) were active between 1000 and 1600 h when an average of 47.8 (SD = 13.0) lizards were observed at each census time (data pooled over five days). Mean activity temperature (Pough and Gans 1982. *In* C. Gans, ed., Biology of the Reptilia, Physiology C, Vol. 12, pp. 17–23. Academic Press, New York), calculated from body temperatures of 53 active lizards, was 40.7°C (SD = 0.20, range 36.9–42.8). Mean activity temperatures did not differ among juveniles (mean = 40.6°C, SE = 1.03), males (mean = 40.7°C, SE = 0.30) or females (mean = 40.7°C, SE = 0.28) (ANOVA, $F_{2, 50} = 0.006$, $P>0.99$).

Diel activity of *C. sexlineatus* at this locality was unimodal and restricted to the warmer parts of clear or partly cloudy days. Body temperature during activity was characterized by a relatively high mean and low variance (CV = 0.49%). These results are similar to those documented for the thermophilic *C. sexlineatus* in other parts of its range and reflect adaptations resulting in restricted activity times for *Cnemidophorus* spp. in general (Lowe 1991. *In* J. W. Wright and L. J. Vitt [eds.], Biology of Whiptail Lizards [Genus *Cnemidophorus*], pp. 1–25. Oklahoma Mus. Nat. Hist. Norman).

Submitted by **RANDY E. RANSOM** and **MICHAEL V. PLUMMER**, Department of Biology, Box 12251, Harding University, Searcy, Arkansas 72149, USA. Current address (RER): 1402 North Pierce E6, Little Rock, Arkansas 72207, USA.

EUMECES LATICEPS (Broad-headed Skink). **FORAGING BEHAVIOR.** On 22 May 1995 at 1200 h, two adult *Eumeces laticeps* were observed in a tree at the Village Creek Historical Park in Arlington, Texas, USA. Both were chasing hackberry butterflies (*Asterocampa celtis*), which were feeding on resins from an American elm (*Ulmus americanus*). The skinks were about 2.5 m above the ground. They made numerous attempts to capture the butterflies as they landed on the tree. After several failed attempts, one of the lizards waited until a butterfly flew past. The skink then leaped from its perch and narrowly missed a mid-flight capture of the butterfly. The lizard returned to its original perch site and made a second attempt to capture its prey in the same manner. *Eumeces laticeps* has been described as the most arboreal skink in North America (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **CARL J. FRANKLIN**, Department of Herpetology, Dallas Zoo, 635 South R. L. Thornton Freeway (I-35), Dallas, Texas 75203, USA.

LEIOSAURUS BELLI (NCN). **CLUTCH.** Data on the natural history of *Leiosaurus belli* (Polychridae) are scarce (Cei 1986. Reptiles del Centro, Centro Oeste y Sur de la Argentina, Mon. IV, 527 pp.). On 15 January 1993 two female *L. belli* were collected by FD'H in maritime sand dunes near Las Grutas beach, 18 km SW San Antonio Oeste (40°44'S, 64°57'W, San Antonio Department, Río Negro Province, southeastern Argentina. The lizards were maintained in a glass terrarium with sand substrate. On 18 January 1993, one female (102 mm SVL, 210 mm TL, not weighed) oviposited 15 white eggs (mean = 15.3 mm x 8.8 mm) in 30 minutes. Four days later, the other female (96 mm SVL, 195 mm TL, not weighed) oviposited 11 white eggs (mean = 14.2 mm x 8.8 mm) in 30 minutes. Both clutches were placed in a small container with sand and moist humus until their arrival in the laboratory. Upon arrival the eggs were discarded, as they appeared to be in bad condition. This is the first report on clutch size in *L. belli*. Nothing is known of the reproductive behavior of this species in the wild.

Submitted by **LUCIANO JAVIER AVILA**, CRILAR-CONICET, Mendoza y Entre Ríos s/n, 5301, Anillaco, La Rioja, Argentina, and **FEDERICO D'HERVÉ,** Instituto Superior de Formación Docente de Villa Regina, Alem 250, 3816, Villa Regina, Río Negro, Argentina.

LEPIDOPHYMA LOWEI (Lowe's Tropical Night Lizard). **REPRODUCTION**. No previously published reproductive data are available for *Lepidophyma lowei* (Bezy and Camarillo 1997. Contrib. Sci. 465:1–8). A female *L. lowei* collected at the type locality on 7 April 1991 was maintained in captivity and gave birth to four offspring on 27–29 April 1991: 27 April at 1500 h; 28 April at 1200–1400 h and at 2030–2120 h; and 29 April (time unknown). The extraembryonic membranes were not present and may have been eaten by the mother. No dead newborns or undeveloped eggs were observed. The female had a SVL of 60 mm, and weighed 5.50 g before and 3.32 g after parturition. The newborns weighed 0.29 g, 0.32 g, 0.33 g, and 0.31 g in order of birth.

These observations document viviparity in an additional species of xantusiid lizard and indicate that *Lepidophyma lowei* has a smaller litter size than most other members of the genus (Aguilar Cortes et al. 1990. Southwest. Nat. 35:373–374). The specimens were deposited in the Colección Herpetológica, Escuela Nacional de Estudios Profesionales Iztacala (ENEPI 3804-07).

Submitted by **JOSÉ L. CAMARILLO R.**, Herpetología, Proyecto Conservación y Mejoramiento del Ambiente, Escuela Nacional de Estudios Profesionales Iztacala, UNAM, A.P. 314, Tlalnepantla, Estado de México, México.

PHYMATURUS PATAGONICUS (Argentine Chuckwalla). **FACULTATIVE PARTHENOGENESIS.** In April 1991, BG purchased an adult *P. patagonicus,* which, although not measured at the time of purchase, measured 17 cm total length on 20 June 1998. It was kept alone in captivity from the time it was purchased. On or about 5 May 1998, the lizard produced a single, female offspring, which is still alive, and measured 9.5 cm total length on 20 June 1998 (Fig. 1). On 27 May 1998 a stillborn female (ca. 7 cm total length, 57 mm SVL) was assist-delivered, apparently fully-developed. It expired, however, presumably from the inability of the mother to extrude it. Sex of both neonates was determined by the absence of well-defined preanal pores.

The dead neonate was referred to the *Phymaturus patagonicus* complex of viviparous, herbivorous lizards from Argentina, by Richard Etheridge, who also recalled that Lamborot and Navarro-Suárez (1984. Herpetologica 40:258–264) karyotyped the congeneric *P. palluma*. That study revealed that males are the heterogametic sex, with 32+3 chromosomes (autosomes + genosomes), including a Y chromosome; females have 32+4 chromosomes, and lack a Y chromosome. Assuming that *P. patagonicus* is similar to *P. palluma*, we suggest that, in the absence of cytological proof, the two offspring, both being female, could have been produced by facultative parthenogenesis. The only alternative explanation is sperm retention (amphigonia retardata), which is unlikely for a period of seven years; the longest record of sperm retention in reptiles was reported by Haines (1940. Copeia 116–118), who observed fertile eggs (none of which hatched) laid by a *Leptodeira septentrionalis polysticta* after five years of isolation.

Facultative parthenogenesis has been shown to occur in snakes by Schuett et al. (1998. Herpetol. Nat. Hist. 5:1–10), who also note evidence of occurrence in lizards of the genera *Basiliscus* and *Iguana*. Herein we add another genus and family (Tropiduridae) to the list of probabilities.

Thanks to Richard Etheridge for identification and assistance with the literature.



FIG. 1. Mother and daughter *Phymaturus patagonicus*.

Submitted by **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA, **TILLIE GINGERY**, P.O. Box 225, Granby, Colorado 80446, USA, **BRETT GINGERY**, P.O. Box 780, Tabernash, Colorado 80478, USA, and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

SCELOPORUS UNDULATUS ELONGATUS (Northern Plateau Lizard). **EGG LAYING**. Very little is known about the life history and ecology of *Sceloporus undulatus elongatus* in Wyoming, the northern distribution limit for the subspecies (Baxter and Stone 1980. Amphibians and Reptiles of Wyoming. Wyoming Game and Fish Department). Previously I have reported mating behavior (Ashton 1998. Herpetol. Rev. 29:102) of this subspecies in Wyoming. Here I describe egg laying behavior, observed ca. 70 km (by air) SW of Rock Springs, Flaming Gorge National Recreation Area, Sweetwater Co., Wyoming, USA.

On 12 June 1998, from 1145 h to 1200 h, I observed an adult female *S. u. elongatus* (76.0 mm SVL, 96.0 mm tail length, 10.0 g mass post-partum). At 1145 h her anterior body was exposed while her posterior was under a small rock. She was not making any movements at this time. Then at 1150 h she moved most of her body out from under the rock and began digging with her hind limbs, pushing dirt over the eggs that she had just laid. She finished covering the eggs with dirt at 1200 h, at which time I captured her. She had distinct lateral folds, verifying that she had just laid eggs. I palpated her and did not detect any more eggs within her body cavity.

Submitted by **KYLE G. ASHTON**, Department of EPO Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA.

UROSAURUS MICROSCUTATUS (Small-scaled Lizard). **ENDOPARASITES**. *Urosaurus microscutatus* occurs from Imperial and San Diego Counties, California south to the vicinity of El Medaño, Baja California (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. 2nd ed., Houghton Mifflin Co., Boston, Massachusetts. 336 pp.). There are no reports of endoparasites from this species. This note reports helminths from *U. microscutatus* from southern California.

Ten male *U. microscutatus* (mean SVL = 45.0 mm ± 2.5 SD, range 41–48) collected in 1953, 1956–57, 1966, 1972–1973, and 1997, were borrowed from the Natural History Museum of Los Angeles County (LACM 97828–97830, 97832, 97834, 122066, 123398–12399) and San Diego State University (SDSU 3772–3773). Nine were from San Diego County; one was from Imperial County. The lizards had been fixed in 10% formalin and preserved in 70% ethanol (LACM) or 55% isopropanol (SDSU). The body cavity was opened by a longitudinal incision. The esophagus, stomach, small and large intestine were removed and examined with a dissecting microscope. The body cavity and liver were also examined. One ten-segment strobila of a cestode was found in the small intestine. It was stained with hematoxylin, mounted in balsam and identified as *Oochoristica* sp. The immaturity of the specimen prevented assignment to a species. Two species of nematodes were found in the large intestine and identified using a glycerol wet mount: *Spauligodon giganticus* and *Strongyluris rubra*. *Urosaurus microscutatus* is a new host record for these helminths.

Prevalence (number infected individuals divided by number of indiviuals examined) was 10% for *Oochoristica* sp.; 20% for *Spauligodon giganticus* (11 and 5 nematodes in 2 lizards); 10% for *Strongyluris rubra* (9 nematodes in 1izard). Helminths were deposited in the U.S. National Parasite Collection, Beltsville, Maryland: *Oochoristica* sp. USNPC 87999; *Spauligodon giganticus* USNPC 88000; *Strongyluris rubra* USNPC 88001. The related species *Urosaurus graciosus* from Los Angeles County, California (Goldberg et al. 1993. Bull. South. California Acad. Sci. 92:43–51) was found to harbor *Oochoristica* sp. and a single third stage larva, *Physaloptera* sp. *Urosaurus ornatus* from New Mexico harbored the cestodes, *Mesocestoides* sp. and *Oochoristica* sp., the nematodes *Spauligodon giganticus* and *Physaloptera* sp. (third stage larvae); *U. ornatus* from Arizona harbored *S. giganticus* (Goldberg et al. 1993. J. Helm. Soc. Washington 60:118–121.

We thank Robert L. Bezy (Natural History Museum of Los Angeles County) and Tod Reeder (San Diego State University) for permission to examine *U. microscutatus*.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, and **HAY CHEAM**, Department of Biology, Whittier College, Whittier, California 90608, USA.

SERPENTES

BITIS NASICORNIS (Rhinoceros Viper). **DERMATOPHAGY.** Dermatophagy by captive snakes is well documented (Weldon et al. 1993. J. Herpetol. 27:219–228, and references therein). Although I was unable to locate any literature regarding this behavior in rhinoceros vipers (*Bitis nasicornis*), I did find one account of shed skin consumption in another viperid, *Bitis arietans* (Haagner 1991. The Naturalist 35:32–33). It has been suggested that this behavior may be coincidental or related to reptile-eating in snakes (Groves and Groves 1972, Herpetologica 28:45–46). Other authors have speculated that dermatophagy in snakes may be used to eliminate evidence of the animal's location (Weldon et. al. 1993, *op. cit.*).

On 6 April 1998, I observed a three year old captive-born *Bitis nasicornis* (SVL = 737 mm; TL = 876 mm) in ecdysis at 0945 h. Approximately four minutes lapsed until the snake completed half of the shedding process. At this point, the animal removed the dead skin from its body and began consuming it. The snake then completed ecdysis, but it did not consume the remaining skin.

This specimen was housed in a plastic enclosure (90.8 x 44.5 x 44.5 cm) with a hide box, water bowl, and slabs of cork bark. It was misted twice weekly and fed a diet of adult mice (*Mus musculus*) once a week. No subsequent observations of this behavior have been made.

I thank members of the Dallas Zoo's Department of Herpetology for help with the preparation of this note.

Submitted by **MATTHEW J. RUSSELL**, Department of Reptiles and Amphibians, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA; e-mail: porthidium@aol.com. Present address: Department of Biology, University of Texas at Arlington, Box 19498, Arlington, Texas 76019-0498, USA.

CHIRONIUS FLAVOLINEATUS (NCN)**. COURTSHIP**. The reproductive behavior of Neotropical snakes in the wild is poorly documented. Here, we report courtship involving one adult female *Chironius flavolineatus* (SVL 875 mm, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, MZUFV 943), and six adult males (SVL 700–790 mm, MZUFV 944–946 and Museu Nacional, Universidade Federal do Rio de Janeiro, MNRJ 6453–6455). The animals were found on the ground, at 1800 h on 8 October 1997 in gallery forest (15°09'S, 44°08'W) close to the Mocambinho River, Jaíba, Minas Gerais, Brazil. The snakes were found during the tactile-chase phase of courtship (Gillingham 1986. *In* Seigel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 184–209. McGraw Hill, New York). At any time, two males were in close contact with the female; the remaining males were perched on the ground or in low bushes nearby (Fig. 1). From time to time, males would trade places, so that each male spent time in direct contact with the female and perched nearby. Typically, a male in direct contact with the female would be interrupted by another male that would pull the former out of position. Despite these displacements, males did not engage in combat or any other aggressive behavior. After 30 minutes of observation, we interrupted this behavior because the female appeared stressed and tried to escape. During the observation, we noted the following behaviors: dorsal body looping, chin rubbing, and dorsal advance (Gillingham, *op. cit.*). The latter phases of the courtship act (tactile-alignment, intromission, and coitus) were not observed.

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FIG. 1. Courtship in *Chironius flavolineatus*, showing two males in direct contact with the female, while two other males wait in the background.

Submitted by **RENATO N. FEIO**, **PATRÍCIA S. SANTOS**, Museu de Zoologia, Departamento de Biologia Animal, Universidade Federal de Viçosa, 36571000 Viçosa, Minas Gerais, Brazil, **RONALDO FERNANDES**, and **THAIS S. DE FREITAS,** Departamento de Vertebrados, Museu Nacional, 20940.040, Rio de Janeiro, RJ, Brazil.

CHIRONIUS MULTIVENTRIS FOVEATUS (NCN). **PREY.** Existing data on the diet of the colubrid *Chironius multiventris* suggest that, like other members of the genus, it feeds mainly on anurans (especially hylids and leptodactylids; e.g., Cunha and Nascimento 1993. Bol. Mus. Paraense Emílio Goeldi 9:1–191; Dixon et al. 1993. Revision of the Neotropical Snake Genus *Chironius* Fitzinger. Monografie XII, Museo Regionale di Scienze Naturali Torino. 279 pp.). The Atlantic Rainforest subspecies, *C. m. foveatus*, has been reported to prey on the hylids *Osteocephalus langsdorffi* and *Hyla* cf. *hylax* (Marques 1998. Composição Faunística, História Natural e Ecologia de Serpentes da Mata Atlântica, na Região da Estação Ecológica Juréia-Itatins, São Paulo, SP. Ph.D. Dissertation. Univ. de São Paulo. 135 pp.). Hylids of the genera *Hyla* and *Phrynohyas* and leptodactylids of the genera *Leptodactylus* and *Eleutherodactylus*, as well as lizards (genera *Ameiva*, *Anolis* and *Polychrus*) have also been reported as prey of other subspecies of *C. multiventris* (Cunha and Nascimento 1993, *op. cit.*; Dixon et al. 1993, *op. cit.*). Here we report the stomach contents of a specimen of *C. m. foveatus*, a subspecies whose natural history is still largely unknown (Dixon et al. 1993, *op. cit.*).

On 8 December 1996 at 0948 h, on an overcast rainy day, an adult male *C. m. foveatus* (129 cm SVL) was captured by CFDR in an undisturbed Atlantic Rainforest area (ca. 240 m elevation) on the coastal island of Ilha Grande (23°15'S; 44°15'W), near Vila Dios

Rios. The snake, which was moving over large boulders near a subterranean stream (width ca. 5 m), had a slight bulge in its abdomen. Upon dissection and examination of the snake's stomach contents, we found a partially digested, egg-laden female *Hyla circumdata* (Hylidae), the partially digested right hind foot of an adult *Proceratophrys appendiculata* (Leptodactylidae), and numerous insect remains (almost certainly secondary ingestions, originally in the frogs' stomachs). The *H. circumdata* (75 mm SVL) had been ingested head first and the head and trunk were already much digested, though the hind legs were almost intact.

This report confirms the tendency of *C. multiventris* to prey mainly on hylids and leptodactylids and adds a new anuran genus (*Proceratophrys*) and two new species to its diet. The snake (along with stomach contents) was deposited at the Museu Nacional do Rio de Janeiro (MNRJ 6717).

We thank José P. Pombal, Jr., Renato N. Feio, and Marcelo F. Nápoli for identifying the frog remains, and Thais S. de Freitas for confirming the identification of the snake and for her help in taking the measurements. CFDR (Process # 300819/94-3), DV (Process # 143607/98-7), and MVS (Process # 301117/95-0) benefitted from research grants from the Conselho Nacional do Desesnvolvimento Científico e Tecnológico (CNPq).

Submitted by **CARLOS FREDERICO DUARTE ROCHA, DAVOR VRCIBRADIC*,** and **MONIQUE VAN SLUYS**, Setor de Ecologia, Departamento de Biologia Animal e Vegetal, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-019, Rio de Janeiro, RJ, Brazil (e-mail [CFDR]: cfdrocha@uerj.br). *Present address: Post-Graduation Program in Ecology, Universidade Estadual de Campinas, C.P. 6109, 13083-970, Campinas, SP, Brazil.

CROTALUS WILLARDI (Ridgenose Rattlesnake). **MAXIMUM LENGTH**. Stebbins (1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin, Boston, Massachusetts. 336 pp.) reported *Crotalus willardi* reaches 640 mm total length (TL). Lowe et al. (1986. The Venomous Reptiles of Arizona. Arizona Game and Fish Department, Phoenix, Arizona. 115 pp.) reported an upper adult size of ca. 610 mm TL (reported as "exceptionally 24 inches"). Boundy (1995. Bull. Chicago Herpetol. Soc. 306:109–122) reported the maximum length as 641 mm TL based on a specimen of *C. w. obscurus* at the University of New Mexico (MSB 13715) originally reported by Harris and Simmons (1976. Bull. Maryland Herpetol. Soc. 12:1–22). In captivity, *C. willardi* has reached 670 mm TL (Campbell and Lamar 1989. The Venomous Reptiles of Latin America. Comstock Publishing Associates, Ithaca, New York. 425 pp.).

On 23 Sept 1994, we collected an adult male *C. w. obscurus* near the summit of Indian Peak (2585 m) in the Animas Mountains, Hidalgo County, New Mexico. The specimen's mass was 218 g (209 g after defecating) and it measured 668 mm TL (601 mm SVL). This is the largest wild-caught *C. willardi* reported. Since 1994, three additional males exceeding 640 mm TL have been observed on Animas Mountain including: 645 mm on 16 July 1997, 649 mm on 8 October 1996, and 649 mm 7 October 1998.

Submitted by **KIRK A. KEEGAN**, Department of Radiology, University of California, San Francisco, 350 Parnassus, Suite 908, San Francisco, California 94117, USA, **ROBERT N. REED**, Department of Zoology, Auburn University, Auburn, Alabama 36849-5414, USA, **ANDREW T. HOLYCROSS**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501, USA (e-mail: holycow@asu.edu), and **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

ELAPHE GUTTATA GUTTATA (Corn Snake). **AGONISTIC INTERACTIONS WITH POTENTIAL PREY.** Maternal aggression towards conspecifics functions to prevent infanticide in *Peromyscus leucopus* (Wolff 1985. J. Mammal. 33:117–123). I have observed this aggression to also be directed towards neonate corn snakes (*Elaphe guttata*) that pose a similar threat to a mother mouse's offspring. In October 1995, the carcass of a captive neonate corn snake that had escaped from its container was found in an adjacent room in the Bowling Green State University Animal Care Facility in a laboratory mouse container housing a female *P. leucopus* and her young. The body of the snake was badly mangled and had numerous bite marks along its length. This incident demonstrated that lactating white-footed mice will react aggressively towards smaller snakes, and indeed are capable of killing them.

To further examine the agonistic interactions between corn snakes and white-footed mice, I conducted controlled arena studies individually pairing six neonate corn snakes (SVL 220–252 mm) with either a lactating *P. leucopus* and her young (two trials), an adult male *P. leucopus* (two trials), or adult female *P. leucopus* (two trials). All of the snakes had been purchased from a supplier, and the mice were wild-caught near Bowling Green, Ohio. The snake and mouse were placed together in a laboratory mouse container (30 x 21 x 13 cm) covered with clear plexiglas, and the container placed on the floor beneath a video camera. A gap between the plexiglas and the container allowed the snake to escape the arena at any point during the trial. Three of the four snakes paired with adult male or female mice attempted to strike the mouse, even though it was far too large to be successfully ingested by the snake. In all instances, the mouse dodged the strike, fled to the opposite side of the container, and never retaliated against the snake. In one of the two trials pairing a neonate snake and a lactating mouse and her young, the snake attempted to strike at the mother and her offspring, but was quickly attacked and bitten by the mother. The trial was immediately terminated, but even in this short exchange the snake suffered a bleeding cut on its ventral side. The snakes and mice used in these tests suffered no permanent harm, and all were healthy afterwards.

It is not known if lactating white-footed mice will react similarly to smaller, foraging corn snakes in the wild, but these observations suggest maternal aggression may influence prey choice in small corn snakes. Although neonate corn snakes will readily eat baby mice in captivity, the diet of wild snakes of the same size consists primarily of lizards and caterpillars, with a shift to predominantly rodent prey with increasing snake size (Hamilton and Pollack 1956. Ecology 37:519–526). If maternal aggression functions to prevent neonate snakes from preying upon baby *P. leucopus* mice in the wild, then ontogenetic diet shifts in snakes may not only be a function of increasing gape size (Mushinsky et al. 1982. Ecology 63:1624–1629), but could also be due to agonistic interactions with potential prey.

Submitted by **MATTHEW M. LAPOSATA**, Department of Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43403, USA. Present address: Department of Biology, The Pennsylvania State University, University Park, Pennsylvania 16802, USA (e-mail: mml146@psu.edu).

ELAPHE OBSOLETA SPILOIDES (Gray Rat Snake). **REPRODUCTION**. Female *Elaphe obsoleta obsoleta* have

clutches of 6–44 eggs, but clutches exceeding 24 eggs are rare (Fitch 1963. Copeia 1963:649–658; Wright and Wright 1957. Handbook of Snakes of the United States and Canada. Cornell Univ. Press, Ithaca, New York. 561 pp.). Although information concerning clutch size and husbandry is available for captive *E. o. spiloides* (Merker and Merker 1995. Reptiles 3:56–75; Staszko and Walls 1994. Rat Snakes. TFH Publications, Neptune City, New Jersey. 208 pp), little is known about the reproductive biology of wild individuals of this subspecies. I report the clutch size of *E. o. spiloides* in Shelby County, Tennessee, USA, at the northwestern extreme of their range (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). During 1994–1997, two clutches were obtained from females that were gravid when collected in the field, and one clutch was discovered in a rotting tree stump. Mass (± 0.5 g) and SVL (± 0.5 cm) were recorded for each female at the time of collection. One female (772.7 g, 124.5 cm) laid 19 eggs and weighed 523.2 g following oviposition. The other female (716.5 g, 122.0 cm) laid eight eggs and weighed 583.4 g following oviposition. Eggs were weighed within 5 h of oviposition; individual egg mass ranged from 10.12–21.74 g (mean ± SE = 13.51 ± 0.68). Relative clutch mass (Shine 1980. Oecologia 46:92–100) averaged 33.42 ± 8.37%.

The clutch found in the tree stump contained eight eggs positioned ca. 75 cm above ground level in a tree stump measuring 25 cm in basal diameter. Activity by a colony of carpenter ants (*Camponotus* sp.) higher in the stump had encased the snake eggs in a layer of decaying wood grains.

Following either collection or oviposition, eggs were incubated at 26–28°C in plastic boxes containing a 1:2 water:vermiculite (by mass) substrate. Eggs hatched between 30 August and 24 September following an incubation period of 60–62 days. Eleven of the 41 eggs (26.8%) failed to hatch or produced still-born embryos following pipping. The sex ratio of the surviving neonates was 1:1.22 female:male.

I thank Tom Norman, Jr. and Dave Frederick for assistance in the field, and Bill Gutzke for comments on the manuscript.

Submitted by **STEPHEN J. MULLIN**, Department of Biology, University of Memphis, Memphis, Tennessee 38152-6080, USA. Present address: Department of Biology, University of Central Arkansas, Conway, Arkansas 72035, USA; (e-mail: smullin@mail.uca.edu).

EUNECTES MURINUS (Green Anaconda). **CAIMAN PREDATION**. The green anaconda (*Eunectes murinus*) and the spectacled caiman (*Caiman crocodilus*) are two large predators that use very similar habitats in the seasonally flooded savannas of South America. Predation of caimans by anacondas has been reported (Wehekind 1955. Brit. J. Herpetol. 2:9–13) and appears to occur often in the llanos (Rivas, unpubl. data). Predation by *Caiman sclerops* on *Eunectes notaeus* has been reported (Medem 1983. Los Crocodylia de Suramerica II. Editorial Carrera, Bogota, Colombia. 270 pp.); however, there are no reports of predation by caiman on the larger *E. murinus*. During a seven-year study of the behavioral ecology of the anaconda in the Venezuelan Llanos, we observed spectacled caimans preying on *E. murinus* on three occasions.

On 25 May 1996 we discovered a large caiman (SVL >90 cm) firmly gripping the head of a radio-implanted female anaconda (494 cm total length, 29 kg), who in turn had wrapped herself around the caiman's head and neck. After ca. 15 min. the snake relaxed her coils, apparently losing the struggle with the caiman. When the snake stopped struggling, we interrupted the event to recover the transmitter. Because this snake had been found severely wounded two months before this observation, it is likely that she was not in top physical shape, and this may have played some role in the attack.

Another observation took place on 29 April 1996 in a roadside channel covered partially by water hyacinth (*Eichhornia*). A caiman (SVL >90 cm) was on the left side of the anaconda, gripping it by the anterior 1/5 of its body. The snake had thrown a loop over the dorsal surface of the caiman and wrapped its posterior body and tail around the caiman's left hind leg. The snake, although much smaller than the caiman, was wrapped so tightly around the hind leg that the head of the caiman was pulled towards its hindquarters. The snake periodically tightened its loop, causing the caiman to flip over to the right and under the water. The caiman repeatedly attempted to drag the snake out of the water, but each time the anaconda managed to flip the caiman and pull it back under water. The wrestling match continued for five hours, often punctuated by both animals submerging for periods of 10–15 min. Finally, as the light faded (1900 h), we saw an unidentified caiman of similar size leaving the area with no snake in its mouth. Five days later we found a dead male anaconda (247 cm total length, 5.5 kg), with wounds from a caiman bite on the anterior 1/5 of its body. The wounds suggest a caiman with estimated measurements of 121 cm SVL, 43 kg mass, and 29.5 cm skull length (Thorbjarnarson, unpubl. data). The snake showed no signs of decomposition, indicating a recent death. We surmise that the snake escaped from the caiman but subsequently died from its wounds. Judging by the relationship of masses, we believe that it was the caiman trying to eat the snake and not vice-versa.

The last observation (19 March 1997) also involved a large caiman (SVL >90 cm) attacking a small female anaconda (152 cm total length, 1.7 kg). The caiman was in a small roadside pool with the snake in its mouth. Upon our approach, the caiman dropped the seriously wounded female anaconda. Although the snake survived, we consider this a predation event because the snake was not struggling when we arrived and thus would not have survived without our intervention.

In total, we have found twelve dead anacondas (six males and six females) during the study. Based on our observations and examination of the anacondas (presence of deep circular bite marks matching the size and position of caiman teeth), we determined that all six males and two of the females were killed by spectacled caimans. Interactions between these two sympatric reptiles seem to be quite common.

We are in debt to M. Quero and P Azuaje for their cooperation with the project. W. Holmstrom helped in the data collection and P. Calle was great help in the implantation of the transmitters. We also thank P. Andreadis and G. M. Burghardt for editorial comments on early versions of the manuscript. This research was possible thanks to grants from The Wildlife Conservation Society, The National Geographic Society, CITES, and the Venezuela Fish and Wildlife Service (Profauna). We thank COVEGAN for allowing us to work on their ranch and for all their cooperation with this project.

Submitted by **JESUS A. RIVAS**, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville Tennessee 37996-0900, USA (e-mail: jrivas@utk.edu), **JOHN B. THORBJARNARSON**, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460-1099, USA, **MARÍA C. MUÑOZ**, Graduate Program in Ecology, Departamento de Biología de Organismos, Universidad Simón Bolívar, Caracas, Venezuela, and **RENÉE Y. OWENS**, World Society for the Protection of Animals, 29 Perkins Street, P.O. Box 190, Boston Massachusetts 02130, USA.

IMANTODES CENCHOA (Chunk-headed Toad Snake). **AGGREGATION.** Aggregation is a poorly known behavior in snakes. Here we report an aggregation of *Imantodes cenchoa* in the southeastern Peruvian rainforest (Zona Reservada Tambopata-Candamo, Madre de Dios, Perú, 12°51'10"S, 69°21'57"W). On 21 May 1998 at ca. 2000 h, six individual *I. cenchoa* (4 male, 2 female) were observed actively moving in a single plant 1.5–2.5 m above the ground. All individuals were captured by hand, weighed, and measured. The females measured 63.0 cm SVL, 13.5 g; and 71.1 cm SVL, 16.5 g. The males measured 79.2 cm SVL, 20.5 g; 70.2 cm SVL, 16.0 g; 70.9 cm SVL, 20.0 g; and 78.0 cm SVL, 18.0 g. All individuals were adults and neither of the females was gravid. The snakes were subsequently released at the point of capture. We found no obvious purpose for this aggregation.

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Submitted by **TIFFANY M. DOAN*** and **WILFREDO ARIZABAL ARRIAGA***, TReeS-RAMOS, Casilla 28, Puerto Maldonado, Madre de Dios, Perú. *Present address: Urb. Los Angeles E-1, Cusco, Perú (e-mail: tiffperu@yahoo.com).

LEPTODEIRA ANNULATA (Culebra Desteñida, Banded Cat-eyed Snake). **DIET**. Colubrids are known to take a wide range of food items, including carrion such as fish (Norton 1993. Herpetol. Rev. 29:34) and frogs (Bedford 1991. Herpetofauna 21:35–36).

Leptodeira annulata is a medium-sized, nocturnal, colubrid snake with a maximum recorded total length of 870 mm (Wilson and Meyer 1985. The Snakes of Honduras. 2nd. ed. Milwaukee Publ. Mus. Publ., Biol. & Geol. No. 6, 159 pp.). This snake feeds on lizards, salamanders, and frogs (Alvarez del Toro 1982. Los Reptiles de Chiapas. 3d ed. Instituto Zoológico del Estado, Tuxtla Gutiérrez, México. 178 pp.). On 11 November 1997 (2250 h) we observed a *L. annulata* (SVL 459 mm) eating a road-killed frog from the gravel road surface in Palo Verde National Park, Guanacaste Province, NW Costa Rica (10°21'N, 85°2'W). The snake was deposited in the Museo de Zoología Universidad de Costa Rica (MZUCR 13629). The frog was in an advanced stage of decomposition, with a strong rotten smell. The snake was peeling the squashed frog from the mud, and subsequent dissection of the snake showed that it had consumed some of the remains. It had rained from 2130 h to 2200 h, and frog activity was high in the area where we found the snake. All the frogs we observed (at least 10 individuals) on the road during the 15 min. prior to the observation were *Rana vaillanti*. Because of similarities in size, we infer that the dead frog may have been another *R. vaillanti.*

These observations were conducted during a field trip of the Zoology II course of the School of Biology, University of Costa Rica. I acknowledge the enthusiasm of my students on this field trip. I thank Gerardo Chaves for the verification of the identification of the snake and frogs, and M. I. Di Mare and W. Eberhard for their suggestions on the ms.

Submitted by **JOSE M. MORA**, Escuela de Biología, Universidad de Costa Rica, San José, Costa Rica (e-mail: jmmora@cariari.ucr.ac.cr).

MORELIA AMETHISTINA (Australian Scrub Python). **MALE-MALE COMBAT**. There is considerable diversity among snake species in terms of whether or not males engage in physical combat during the breeding season; and if they do, whether or not the combat bouts involve biting as well as "wrestling" (Shine 1994. Copeia 1994:326–346). Australian pythons of the genus *Morelia* are of particular interest because they include the only recorded case of intraspecific variation in the occurrence of male-male combat. Males display vigorous combat in some populations of *M. spilota*, but not in others (Shine and Fitzgerald 1995. Oecologia 103:490–498). Because the same phenomenon might occur in other *Morelia*, we need records of snake behavior from throughout the range of all species. Combat has been reported in captive specimens of *M. amethistina* (Ross and Marzec 1990. The Reproductive Biology of Pythons and Boas. Institute for Herpetological Research, Stanford, California. 270 pp.), but without detail. Khorzov et al (1995. Russian J. Herpetol. 2:69–70) noted that males of the Indonesian subspecies (*M. a. amethistina*) may bite each other and cause severe injury. Scars on adult male *M. amethistina* in the field in northern Queensland have been interpreted as evidence of male-male combat (Anonymous 1993. Chondro 1:11–12).

One of us (LS) observed and photographed combat between two large scrub pythons one morning (1015 h) in early July 1997, in tropical Queensland (on the outskirts of the town of Gordonvale, near the Mulgrave River). Scrub pythons (*M. a. kinghorni*) regularly inhabit the ceilings of a farmhouse and adjacent shed, especially during winter. Alerted by the sound of items falling from the rafters of the shed, LS found two large (ca. 4.5 m) scrub pythons intertwined, having fallen from the rafters above. The snakes wrestled with each other for ca. 30 min., moving out of the shed and across the adjacent garden area. The posture adopted was similar to that depicted in photographs of male *M. spilota* in combat (see Shine and Fitzgerald, *op. cit.*; and Greer 1998. The Biology and Evolution of Australian Snakes. Surrey-Beatty, Sydney, New South Wales. 358 pp.); the posterior bodies were entwined and the heads of both snakes raised up to 1 m above the ground. One snake repeatedly bit the forebody of the other animal, leaving deep lacerations. The snakes were very similar in size; we infer that both were males. One of the snakes eventually moved away into thick bush; the other (with open wounds from the bites it had received) climbed to the roof of the house, and then to the rafters of the shed where the bout had commenced. Another scrub python (4 m long, without scars, and thus inferred to be female) was coiled among these rafters throughout the combat episode.

This appears to be the first report of male-male combat in free-ranging scrub pythons. Our observations suggest that combat takes the same form in these giant snakes as in other large python species, including other *Morelia* (for a review, see Shine 1994, *op. cit.*). However, our report also provides another example of a puzzling phenomenon first reported for populations of *M. spilota* from northeastern New South Wales (Shine and Fitzgerald, *op. cit.*): the co-occurrence of male-male combat and large mating aggregations within single taxa. Scrub pythons gather in considerable numbers in open areas during the winter mating season in northeastern Queensland, and male-male tolerance rather than aggression has been reported under these circumstances (see page 72 in Shine 1991. Australian Snakes. Reed Books, Sydney, New South Wales. 223 pp. for a photograph of multiple snakes in close proximity). The fact that males tolerate each other sometimes, but battle vigorously at other times, suggests that the reproductive "tactics" of male pythons may be more flexible than has hitherto been assumed.

Submitted by **LYN SUES**, P.O. Box 38, Gordonvale, Queensland 4865, Australia, and **RICHARD SHINE**, Biological Sciences A08, University of Sydney, NSW 2006, Australia (e-mail: rics@bio.usyd.edu.au).

MORELIA SPILOTA (Australian Carpet Python) **CAUDAL LURING**. Snakes of several phylogenetic lineages utilize caudal

luring to attract prey. Caudal luring involves a snake waving its tail tip such that it resembles a live worm or insect, inducing the potential prey item to approach the snake (Heatwole and Davidson 1976. Herpetologica 32:332–336). Caudal luring appears to be most common in "ambush" predators, such as viperids, boids, and pythonids (Strimple 1995. Litteratura Serpentium 15:74–77). Caudal luring seems to be elicited more easily in juveniles than in conspecific adult snakes (Allen 1949. Copeia 1949:225–226; Rabatsky and Farrell 1996. J. Herpetol. 30:558–561).

Among pythons, caudal luring has been reported in two Australian species: the highly arboreal *Morelia viridis* (Greene and Campbell 1982. Herpetologica 28:32–34) and the semifossorial *Aspidites ramsayi* (Wilson and Knowles 1988. Australia's Reptiles: A Photographic Reference to the Terrestrial Reptiles of Australia. Collins, Sydney. 447 pp.). We can now add another species to this list. We observed and filmed caudal luring in a young (49-day-old) *Morelia spilota mcdowelli* (coastal carpet python) hatched in captivity. The snake's parents were collected near the town of Bellingen on the northern coast of New South Wales, in eastern Australia. While filming for a documentary on python biology on 2 March 1996, one of us (PS) placed a green tree frog (*Litoria caerulea*) in a hexagonal cage (90 cm across) that contained two hatchling pythons. One snake that was loosely coiled on branches several cm above the ground immediately oriented towards the frog and began twitching its tail-tip rapidly. The tail-tip was vibrated a total of 23 times over the course of the next several hours. The first 17 of these vibrations occurred with the tail held >2 cm above the head. The snake then raised its tail above the head and completed six more vibrations.

We used frame-by-frame analysis of the film to quantify several attributes of the tail-flicks exhibited. All of the tail-flicks initiated from beneath the snake's head were horizontal, whereas the tail-tip moved vertically in four of the six "above-head" tail-flicks. These proportions differed significantly ($c^2 = 9.47$, 1 df, $P < 0.003$ with Yate's correction). "Above-head" versus "below-head" flicks did not differ significantly in terms of the arc over which the tail-tip travelled on each tail-flick (respective means ± SD = 91.3 ± 62.5° vs. 77.9 ± 33.4°, ANOVA $F_{1,21} = 0.39$, $P = 0.54$), the total duration of the flick (1.09 ± 0.32 s vs. 0.78 ± 0.34 s, ANOVA $F_{1,21} = 2.90$, $P = 0.10$) or the delay between successive flicks (2.08 ± 2.32 s vs. 1.48 ± 0.64 s, ANOVA $F_{1,21} = 0.87$, $P = 0.37$). However, above-head flicks involved a much greater proportion of the total tail length (27.5 ± 2.9% versus 15.3 ± 8.1%, ANOVA $F_{1,21} = 8.24$, $P < 0.01$). The frog showed no overt response to the snake's behavior, but was later seized and consumed by the snake. Part of this film sequence was included in the completed film ("Python, The Sly Strangler." Roger Whittaker Films Pty Ltd.).

The caudal luring exhibited by this young carpet python was very similar to that seen in other snakes that exhibit caudal luring, including elapids (Carpenter et al. 1978. J. Herpetol. 12:574–577) and viperids (Heatwole and Davidson, *op. cit.*) as well as other pythonids (Rabatsky and Farrell, *op. cit.*). The potential selective advantage of this behavior to cryptic "sit-and-wait" predators is obvious: it may substantially increase the number of potential prey items that approach the snake closely enough to be seized. Juvenile carpet pythons have a diverse diet, although anurans appear to be taken only rarely (Shine and Slip 1990. Herpetologica 46:283–290; Shine and Fitzgerald 1996. Biol. Conserv. 76:113–122). The most surprising aspect of our report is that this distinctive behavior has not been reported previously, because the species involved is abundant, widely-distributed, well-studied in the field and commonly maintained and bred in captivity (Barker and Barker 1994. Pythons of the World. Volume 1, Australia. Advanced Vivarium Systems, Lakeside, California. 171 pp.).

Submitted by **PHIL SIMON**, RMB Darkwood Road, Thora, NSW 2454 Australia, **ROGER WHITTAKER**, The Stonehouse, Clavering Road, Seaforth, Sydney NSW 2092 Australia, and **RICHARD SHINE**, Biological Sciences A08, The University of Sydney, NSW 2006 Australia (e-mail: rics@bio.usyd.edu.au).

NERODIA TAXISPILOTA (Brown Water Snake). **FEEDING BEHAVIOR**. *Nerodia taxispilota* is known to feed on a variety of fish species that collectively occupy all levels of the water column (Camp et al. 1980. J. Herpetol. 14:301–304; Mills and Hudson 1995. Herpetol. Rev. 26:149). Carr (1940. Univ. Florida Publ. Biol. Sci. Ser. 3:1–118) regarded *N. taxispilota* as probably the fastest swimmer among Florida water snakes, and Camp et al. (1980, *op. cit.*) proposed that speed may allow *N. taxispilota* to capture fish more easily than other *Nerodia*. Here we report an individual *N. taxispilota* hunting fast-swimming, open-water fishes in a ambush fashion.

On 22 April 1998 at 1530 h, a *Nerodia taxispilota*, ca. 1 m total length, was observed for 15 min as it attempted to ambush fish in the Hillsborough River, Hillsborough County, Florida, USA. The snake's tail was anchored to a mat of aquatic vegetation, while its anterior half was extended horizontally from the vegetation. The surface of the water was ca. 10 cm above the snake and the overall depth of the water was 1.5 m. The snake was 5 m from the shoreline and within 2 m of several cypress trees.

Twenty-two fish of the genus *Lepomis* (sunfish) were swimming near and around the snake's head, in some cases within 2–3 cm. The snake's underwater tongue flicks occurred at a rate of 10–12 per minute during five minutes of counting. The snake surfaced for air twice during the observation. On three separate occasions, when the fish swam within 1 cm of the snake's head, the snake struck open-mouthed and made three swift side swipes at the fish. Although no captures were observed, an object approximately the size of a sunfish could be seen moving posteriorly inside the snake's neck, probably indicating recently ingested prey.

Our observation suggests that *N. taxispilota* need not be a fast swimmer to capture fish, and that *N. taxispilota* sometimes hunts fast-swimming, open-water fishes using an ambush strategy.

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Submitted by **RICHARD D. REAMS**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA (e-mail: hylareams@aol.com), and **ANN M. STEVENS**, Department of Mammalogy, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA.

PSEUSTES SULPHUREUS SULPHUREUS (Papa-Ovo). **DIET**. On 5 September 1998, a specimen of *Pseustes sulphureus sulphureus* was collected in the National Forest of Caxiuanã, Melgaço, Pará State, Brazil. The specimen was captured on the roof of a house after it had eaten a bat, ca. 0300 h. This snake was deposited in the Museu Paraense Emílio Goeldi, Brazil (MPEG 19408). When we examined the stomach of the snake, we found the bat, an adult male *Molossus mollosus* (MPEG 26338). The literature suggests that *P. sulphureus* eats mainly rodents, wild birds, and young domestic animals (Beebe 1946. Zoologica, Chicago, 31[1-3]:11–52; Cunha and Nascimento 1993. Bol. Mus. Para. Emílio Goeldi 9:92–93). We believe that this is the first record of *P. sulphureus* eating a bat.

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Submitted by **NELSON RUFINO**, Fundação Centro de Referência em Educação Ambiental Escola Bosque Professor

Eidorfe Moreira, Av. Nossa Senhora da Conceição s/n, Outeiro, Belem, Para, Brazil (e-mail: rufino@interconect.com.br), and **JOSÉ A. R. BERNARDI**, Museu Paraense Emílio Goeldi, Caixa Postal 399, CEP: 66040-170, Belem, Para, Brazil.

SPILOTES PULLATUS (Tiger Ratsnake). **PREY**. Few data are available on the feeding habits of *Spilotes pullatus* (Colubridae) in the wild. On 10 February 1998 (1100 h) at Volcán Mombacho (ca. 1 km SW of Cutirre, 11°49.67'N, 85°56.37'W, 390 m elevation), Departamento de Granada, Nicaragua, we discovered an adult male *S. pullatus* trying to swallow a juvenile Mexican porcupine (*Sphiggerus mexicanus*) (Fig. 1). The locality is at the edge of a coffee plantation close to a forest. Immediately after we found the snake, it started to regurgitate its prey. Both the snake and the porcupine were preserved and deposited in the collection of the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt, Germany (SMF). The snake (SMF 78370) had a SVL of 160 cm and a tail length (TL) of 57.5 cm. The porcupine (SMF 86959) measured 165 mm SVL, 177 TL and 40 mm hind foot length. The oral cavity as well as parts of body and tail of the snake were spiked with numerous porcupine spines.

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FIG. 1. *Spilotes pullatus* trying to swallow a juvenile *Sphiggerus mexicanus* (Volcán Mombacho, Nicaragua).

Submitted by **GUNTHER KöHLER** and **ROBERT SEIPP**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt, Germany (e-mail [GK]): gkoehler@sng.uni-frankfurt.de).

THAMNOPHIS ELEGANS VAGRANS (Wandering Garter Snake). **MATING**. The timing of mating in garter snakes is often linked to spring emergence from hibernacula, which may facilitate scramble competition among males for mates (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. University of Oklahoma Press, Norman, Oklahoma. 332 pp.). Here I report observations of spring mating behavior in *Thamnophis elegans vagrans* from a denning area 32 km N of Craig, Moffat Co., Colorado, USA.

On 10 May 1998 at 1400 h I found two *T. e. vagrans* courting in the dirt between sagebrush ca. 10 m from the denning area. The female was 53.5 cm SVL, 69.5 cm total length; the male was 47.5 cm SVL, 63.0 cm total length. Then, at 1600 h I observed three *T. e. vagrans* intertwined at the denning area. I was unable to capture the three snakes to verify sex; however, this behavior is similar to the scramble competition involving one female and multiple males that has been noted at den sites in spring for other populations of *Thamnophis* (Rossman et al., *op. cit.*).

Submitted by **KYLE G. ASHTON**, Department of E.P.O. Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA (e-mail: ashtonk@colorado.edu).

THAMNOPHIS SAURITUS SAURITUS (Eastern Ribbon Snake). **HIBERNACULUM**. Although information regarding common garter snake (*Thamnophis sirtalis*) hibernacula is relatively abundant (Aleksiuk 1977. Herpetologica 33:98–101; Carpenter 1953. Ecology 34:74–80), such data for the congeneric eastern ribbon snake (*T. sauritus sauritus*) are relatively scarce. Most data available on hibernaculum use by *T. sauritus* are summarized in Ernst and Barbour (1989. Snakes of Eastern North America. George Mason Univ. Press, Fairfax, Virginia, 282 pp.), who reported use of vole tunnels, crayfish burrows, ant mounds, and possibly muskrat (*Ondatra zibethica*) lodges and bank burrows.

On 5 January 1998 amidst a week of unseasonably warm weather, five *T. s. sauritus* were observed at 1245 h on and around a large fallen beech tree (*Fagus grandifolia*) at Mason Neck National Wildlife Refuge, Fairfax County, Virginia, USA. The upturned root base of the tree was situated on a south-facing bank at the northern edge of a permanent tidal marsh with the trunk extending into the marsh. The fallen tree measured ca. 24 m in length and 86 cm in diameter at breast height. The mass of roots and attached soil at the base was 3.5 m in diameter and 98 cm thick. Electronic data loggers placed in the general area to record air temperature at 30 min. intervals indicated that air temperatures had not dipped below freezing the previous two nights, daytime highs had exceeded 16.5°C the previous two days, and mean daily temperatures had exceeded freezing the previous three days. The area surrounding the tree was scrutinized for other possible hibernation sites. None were found, and no snakes other than those around the tree base were found on 5 January.

Of the five *T. s. sauritus* seen on that day, two males were captured. The first (SVL 47.0 cm, mass 37.5 g) had a cloacal temperature of 29.0°C. The second (SVL 43.0 cm, mass 26.0 g) had a cloacal temperature of 26.0°C. The air temperature at the time of the captures was 22.0°C. Two other individuals were entwined on the sunlit bank near the base of the tree, with one exhibiting stimulatory courtship undulations.

We concluded that the ribbon snakes had been overwintering in tunnels, probably created by small mammals, within the tree's upturned root/soil base. The thickness of the root/soil base seemed sufficient to insulate snakes near its center from freezing temperatures. Additionally, the position and southern orientation of the tree base permitted exposure to sunlight at low angles of incidence during most of the winter daylight hours, providing further thermal buffering from frost. This condition is also likely to raise the body temperatures of snakes hibernating within the tree base to the activity threshold more quickly than those hibernating in adjacent soil, resulting in earlier emergence and providing them with an advance choice of amphibian prey.

Submitted by **KERRY A. HANSKNECHT**, **TERRY R. CREQUE**, and **CARL H. ERNST**, Department of Biology, George Mason University, Fairfax, Virginia 22020-4444, USA; e-mail (CHE): cernst@gmu.edu.

HERPETOLOGICAL HUSBANDRY

Notes on the Captive Reproductive Behavior of the Asiatic Four-lined Skink, *Eumeces quadrilineatus*

AKIKO HOSONO
and
TSUTOMU HIKIDA
Department of Zoology, Graduate School of Science, Kyoto University, Kitashirakawa, Sakyo, Kyoto 606-8502 Japan
e-mail (AH): akiko@zoo.zool.kyoto-u.ac.jp

Eumeces quadrilineatus ranges through southern China, Vietnam, Cambodia, and Thailand (Taylor 1935). It has been grouped with the American four-lined forms (*E. gilberti, E. lagunensis,* and *E. skiltonianus*) as the *E. skiltonianus* Species Group (Lieb 1985). Tanner (1957) observed reproduction of *E. skiltonianus* and presented data for the number of eggs per clutch, egg size, and hatchling size in that species. Based on counts of oviducal eggs, Punzo (1982) reported clutch sizes for *E. gilberti* and *E. skiltonianus*. However, there are no published accounts of reproduction in *E. quadrilineatus*. This report, based on captive observations, is the first published information regarding the reproductive traits of this species.

Two females, collected from Cheung Chau Island, Hong Kong, on 25 April 1997, were brought back to our laboratory, labelled #1 and #2, and set up individually in small, round, plastic cages (10 cm [length] x 6 cm [height]) with paper substrate and a water bowl. On 14 May 1997, Female #1 laid one egg with a soft yellowish-white shell, to which she paid no attention. Female #1 and the egg were transferred to a larger transparent plastic rectangular cage (20 cm [length] x 13 cm [width] x 13 cm [height]). Female #2 was also moved to a cage of the same size. Each cage was furnished with 5 cm of soil, a broken flowerpot for shelter, and a water bowl. The soil was moistened with water spray every third or fourth day. Ambient room temperature varied between 23°C and 25°C throughout the observation.

TABLE 1. Measurements (in mm and g) of the females and hatchlings of *Eumeces quadrilineatus*, taken immediately after hatchling. SVL = snout–vent length, HL = head length, HW = head width, TL = tail length, and BM = body mass.

	SVL	HL	HW	TL	BM
Female #1	74.8	13.8	7.8	75	5.02
Female #2	73.2	13.7	7.8	55	5.07
Hatchling #1	25.9	6.3	3.6	36	0.33
Hatchling #2	24.6	5.6	3.7	34	0.30
Hatchling #3	25.1	6.6	3.6	33	0.30
Hatchling #4	24.9	6.5	3.8	35	0.32
Hatchling means	25.1	6.3	3.7	34.5	0.31

Female #1 tunneled from under the shelter to the bottom of the soil and laid a second egg on 17 May. The first egg laid by this female remained on the soil surface and failed to hatch. Female #2 also dug a tunnel and laid three eggs on 18 May. Neither female accepted mealworms or crickets offered as food.

Observations of both females and their eggs were made through the transparent floor of the cages, or by carefully removing the shelters. Both females used their bodies to surround their eggs throughout incubation. Although they occasionally shifted their position within the tunnels, they remained under the soil and never appeared on the surface until their eggs hatched (see below).

When Female #1 was observed outside her tunnel on 27 June, we examined her egg and found a hatchling (Hatchling #1). Female #2 emerged from the soil on 8 July, whereupon we excavated three hatchlings (Hatchlings #2, 3, and 4), while Hatchling #4 was just struggling to extricate itself from its egg. Assuming that the females emerged upon the hatching of their eggs, as is the case of other congeneric species (e.g., *E. elegans*: Kato and Ota 1994), the incubation period of the second egg of Female #1 should be 41 days; the three eggs of Female #2 hatched in 51 days.

Various measurements of adult females and hatchlings are presented in Table 1. Although hatchlings were maintained in the enclosures in which they hatched, all died within three days.

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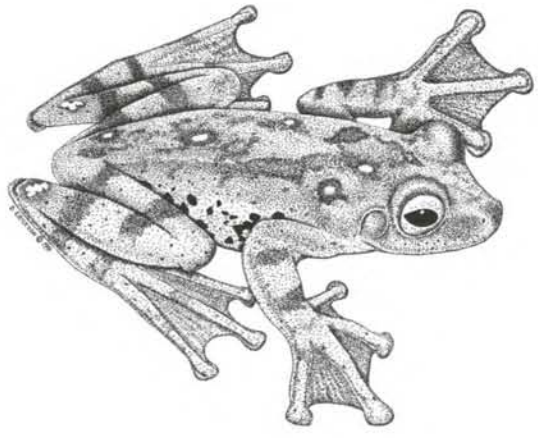
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Rhacophorus pardalis. Illustration by Dan Erickson.

NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their note (e.g., Reproduction, Morphology, Habitat, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send three copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover): J. Brian Hauge (lizards, amphisbaenians, crocodilians, *Sphenodon*); Charles W. Painter (amphibians); or Paul A. Stone (snakes, turtles). Authors are requested to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a text-only version of the file.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1997. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 4th ed., Herp. Circ. 25:1–40; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

AMBYSTOMA GRACILE (Northwestern Salamander). **MAXIMUM SIZE.** On 10 February 1998, a neotenic female *Ambystoma gracile* was collected from a wetland bisected by 36th Avenue (T18N R2W NE 1/4 Sec 5), 43 m elev., west Olympia, Thurston Co., Washington, USA. As measured alive (chlorotone anesthetized), the specimen was 106 mm SVL (from tip of snout to anterior end of vent), 228 mm TL (Univ. Michigan FS05406). Leonard et al. (1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, Washington. 168 pp.) reported the maximum size for neotenic *A. gracile* as ca. 85 mm SVL and 185 mm TL. Nussbaum et al. (1983. Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press, Moscow. 332 pp.) reported paedogenetic larvae ranging from ca. 65–105 mm SVL, with the largest individuals being females.

We thank William P. Leonard for confirming the species identification. Funding was provided by the City of Olympia, Department of Planning and Development, Olympia, Washington.

Submitted by **CRIS HAGEN**, 708 Division Street NW, Olympia, Washington 98502, USA, and **CHRISTOPHER R. WILSON**, 4914 Sunset Drive NW, Olympia, Washington 98502, USA.

ANURA

ATELOPUS ZETEKI (Panamanian Golden Frog). **ATTEMPTED PREDATION.** The Panamanian golden frog, *Atelopus zeteki*, is a bufonid found in mid-elevation cloudforests of western-central Panama. The brilliant yellow-orange coloration and high skin toxicity of this frog has made it a prime example of an aposematic species (Duellman and Trueb 1986. Biology of Amphibians. McGraw Hill, New York. 670 pp.). Although snake predation on highly toxic amphibians has been well documented (Noble 1931. The Biology of the Amphibia. McGraw Hill, New York. 577 pp.; Myers et al. 1978. Bull. Am. Mus. Nat. Hist. 161:309-365), there are no records of predation by any species on *A. zeteki*. The following is a description of anti-predator behavior directed at snakes by this frog.

During field studies on this species at Parque Nacional Altos de Campana, Provincia de Panamá in June 1996, an aluminum pole (13 mm diam) was presented by EDL and TEH to three male *A. zeteki* sitting along a stream bank ca. 1 m from the water. All three males showed a dramatic response to this stimulus. Each frog immediately scrambled across the substrate from his original position, dove under water, and remained on the stream floor for up to 12 minutes. This response is in sharp contrast to the slow ambling observed when this species is disturbed by human observers. The marked response to the aluminum pole suggests that the animals were perceiving a potential snake predator.

On 5 December 1997, while making observations on a male *A. zeteki*, EDL and DDB witnessed a predation attempt by an adult snake (ca. 130 cm SVL; genus *Dendrophidion*). Our vantage point was the top of a waterfall looking down on the event and the animals. Our presence appeared to be undetected by the frog and the snake. The interaction was videotaped at 10X magnification on an 8 mm Nikon VN360. Before the encounter, the snake appeared to be actively foraging at the base of the waterfall in the vicinity of the golden frog, which was visible on top of a rock at the stream's edge. The snake was examining rock crevices above and below the water line. When the snake was ca. 10 cm from the frog, the frog moved slightly and the snake struck at the frog. The strike just missed the frog and it rapidly hopped to another rock two feet away from the snake and away from the stream. Then, the frog remained motionless while the snake searched in the immediate vicinity, without finding the frog. Ten minutes later, the snake climbed to a low branch overlooking the area, and remained motionless. At this point, we tried to catch the snake, but failed. Video identification of the genus was confirmed by Roberto Ibáñez of the Smithsonian Tropical Research Institute, Balboa, Panama. The *Dendrophidion* species present at Campana Heights are all very similar in appearance and include *D. nuchalis*, *D. percarinatum*, and *D. vinitor*.

We are grateful for the assistance of A. Stanley Rand, Roberto Ibáñez, César Jamarillo, Frank Solís, and Alberto Castillo. Financial support in part was provided through a Smithsonian Tropical Research Institute short-term graduate fellowship, a Columbus Zoological Park Conservation Fund Grant, a Grant-In-Aid-Of-Research award through Sigma Xi, The Scientific Research Society, and a Graduate School Alumni Research Award through The Ohio State University awarded to EDL.

Submitted by **ERIK D. LINDQUIST**, Department of Biology, Indiana University, 269 Jordan Hall, Bloomington, Indiana 47405, USA (e-mail: elindquist@bio.indiana.edu), **THOMAS E. HETHERINGTON**, Department of Zoology, The Ohio State University, 1735 Neil Ave., Columbus, Ohio 43210, USA (e-mail: hetherington.1@osu.edu), and **DANIEL D. BADGLEY**, Columbus Zoological Park, 9990 Riverside Drive, Box 400, Powell, Ohio 43065, USA (e-mail: dbadgley@colszoo.org).

BUFO MARINUS (Cane Toad). **ENDOPARASITES.** *Bufo marinus* was introduced into Guam from Hawaii in 1937 (Easteal

1981. Biol. J. Linn. Soc. 16:93–113). Herein we report on the helminths from a sample of 27 *B. marinus* (mean SVL 78 mm ± 15.4 SD, range 59–130 mm) collected during 1967, 1971, and 1976–97 from Guam, Mariana Islands. Toads were originally fixed in 10% formalin, later preserved in 70% ethanol, and deposited in the Natural History Museum of Los Angeles County (LACM 144222–144248). The body cavity was opened and the gastrointestinal tract was excised by cutting across the esophagus and rectum. The esophagus, stomach, small intestines, and large intestines were slit longitudinally and examined separately under a dissecting microscope. Each nematode was removed, placed in a drop of glycerol on a glass slide and identified. Trematodes were stained with hematoxylin, mounted in balsam and identified. Two helminths were present: the trematode, *Mesocoelium monas* (Rudolphi 1819), prevalence 52% (13/27); (number infected individuals divided by number of individuals examined) mean intensity 69.6 ± 90.6, range 1–300 (mean number parasites per infected host) and the nematode, *Rhabdias multiproles* Yuen 1965, prevalence 22% (6/27), mean intensity 10.3 ± 8.0, range 1–19. Helminths were deposited in the U.S. National Parasite Museum, Beltsville, Maryland as *Mesocoelium monas* (87755) and *Rhabdias multiproles* (87756). *Bufo marinus* is a new host record for *R. multiproles*.

We thank Richard D. Krizman for providing the sample of *B. marinus*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, and **SONIA HERNANDEZ**, Department of Biology, Whittier College, Whittier, California 90608, USA.

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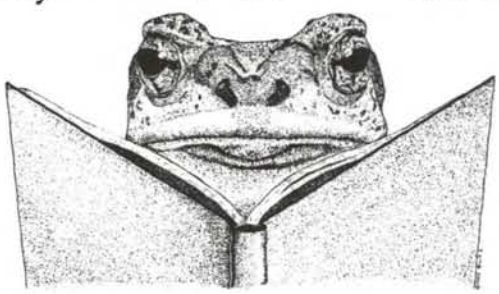
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PSEUDACRIS TRISERIATA (Western Chorus Frog). **REPRODUCTION**. Few details on characteristics of chorus frog egg masses are published. Reported ranges of the number of eggs per cluster fall are 5–176 (Ruthven et al. 1928. The Herpetology of Michigan. Univ. Michigan Handbook Series. No. 3. ix + 229 pp.; Walker 1946. The Amphibians of Ohio. Part I. The Frogs and Toads. Ohio State Museum of Science. Bull. 1, No. 3. 1–109; Logier 1952. The Frogs, Toads and Salamanders of Eastern Canada. Clarke Irwin, Toronto. xii + 127 pp.; Vogt 1981. Natural History of Reptiles and Amphibians of Wisconsin. Milwaukee Public Museum. 205 pp.; Dundee and Rossman 1989. The Amphibians and Reptiles of Louisiana. Louisiana State Univ. Press. Baton Rouge. xi + 300 pp.). Vogt (*op. cit.*) reported that egg masses surround grass stems or twigs 7.5–20 cm below the water surface.

We observed recently deposited egg masses in a temporary pond (ca. 1.5 m maximum depth, 30 m^2 area), in savanna habitat at the Ojibway Prairie complex in Windsor, Ontario, Canada (42°25'N, 83°0'N) in late March 1996 (N = 32) and 1997 (N = 36), and early April 1998 (N = 127). Most masses were attached to dead grass stems (e.g., *Phragmites communis*), but some were attached to twigs (*Populus deltoides*, *Quercus palustris*, *Crataegus* spp.) at a mean ± SE water depth (to top of mass) of 11.8 ± 0.56 cm (range 0.5–37 cm). The mean ± SE number of eggs per mass was 63 ± 5.2 (N = 32, range 18–140).

Mean water depth (to top of mass) differed significantly among years (ANOVA, F2, 192 = 133.6, P<0.001) with depth in 1998 (15.8 ± 0.61 cm) being greater than either 1996 (5.3 ± 0.43 cm) or 1997 (3.7 ± 0.38 cm) (Ps<0.001). Differences in depth among years appeared to be related to the amounts of infiltration and/or runoff resulting from precipitation during or after oviposition. In 1998, 41 mm of rain fell in a 24 h period at the site three days prior to our visit. The pond nearly crested its bank and the water depth covering the egg masses increased. The mean depths for 1996 and 1997 would be closer to the actual oviposition depths selected by *P. triseriata* judging by our observations of amplexing pairs. Changing water levels after oviposition would potentially influence larval success by affecting desiccation stress and/or UV-B penetration.

Submitted by **STEPHEN J. HECNAR**, Department of Zoology, University of Guelph, Guelph, Ontario N1G 2W1, Canada, and **DARLENE R. HECNAR**, 74 Janefield Ave, Suite 50, Guelph, Ontario N1G 2L6, Canada.

SCINAX ELAEOCHROA (NCN). **PREDATION**. *Scinax elaeochroa* occurs through the Caribbean lowlands from Nicaragua to western Panama, and in the Pacific lowlands of the Golfo Dulce regions in Costa Rica and Panama (Frost 1985. Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). On 7 July 1997 at ca. 2300 h, we observed several amplectant pairs of *S. elaeochroa* in a research swamp at La Selva Biological Station, 32 m elev., Heredia Prov., Costa Rica. At 2330 h a male cat-eyed snake (*Leptodeira septentrionalis*), which obviously contained a prey item, was captured near the edge of the swamp.

A sexual pair of *S. elaeochroa*, which had been consumed head first, were palpated from the digestive tract of the *L. septentrionalis*. Although dead, the frogs were still in an amplectant position. After observing several pairs of *S. elaeochroa*, it was noted that the males typically situated their heads around the mid to upper dorsum of the female during amplexus. It would be difficult, if not impossible, for an adult *L. septentrionalis* to restrain both frogs upon first strike. Therefore, it appeared that despite the instant threat of predation the male *S. elaeochroa* did not release his grasp from the female when the snake began feeding.

Submitted by **MATTHEW J. RUSSELL**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thorton Freeway, Dallas, Texas 75203, USA, **MAURA AMPLE**, Department of Biology, Indiana University, Bloomington, Indiana 47405, USA, and **ANN STRIEBY**, Department of Biology, California State University, 18111 Nordhoff Street, Northridge, California 91330, USA.

CROCODYLIA

CAIMAN LATIROSTRIS (Broad-snouted Caiman). **BEHAVIOR.** Tail display is relatively common in vertebrates, but is expressed most dramatically and variably in reptiles. Tail display has been described as an aggressive social behavior in adult males of *Caiman crocodilus crocodilus* during the reproductive period, occurring prior to frontal attack (Azarzaguena 1983. Doñana Acta Vert. 10[3]:1–136). During this display the animal keeps its head and distal portion of the tail arched above the surface of the water. Some head movement may be associated, but this is infrequent.

The same aggressive tail display was directed at me on many occasions by adult (SVL ≥ 75 cm), captive broad-snouted caimans (*C. latirostris*) of both sexes. The display differed in that, after arching their tails above the water, the caimans slowly moved their bodies approximately 45° in relation to the observer, then rotated back to the original frontal position, prior to attack. Frontal attacks would be expected to be faster and more efficient that lateral ones, during which animals would be more vulnerable to counterattack on their flanks. Why, then, does *C. latirostris* apparently compromise its efficiency by turning prior to attack?

One hypothesis is that this position may allow utilization of the tail during attack, but this has never been observed, other than in tail splashing prior to approaching an opponent. Oblique or lateral attacks have never been described. Another possibility may be that the tail acts to distract the opponent from the animal's main weapon, its mouth. If this is true, however, it does not explain why the animal does not rotate a full 90°, which would theoretically maximize the efficiency of the distractive behavior by placing the head and mouth as close to the opponent as the tail.

Perhaps two opposing selective pressures are acting on the same behavior. A frontal position relative to the opponent would favor the attack itself, but would minimize the effect of distractive tail movements. A perpendicular position would maximize distractive effects, but would reduce attack efficiency, as the animal would have to rotate 90° back to the frontal position before attacking. The observed behavior in *C. latirostris* could be the geometric resolution of these two apparently equal selective pressures.

Considering caiman head and tail morphology, tail distractive behavior may be visually efficient only when an opponent's eyes are at water level. It is doubtful that this behavior is part of an elaborate feeding strategy, as caimans are known to be opportunistic predators, and it is unlikely that they developed such complex behavior that would only be of benefit in pursuit of specific prey. Adult crocodilians have almost no natural predators besides humans, and, because tail display in caimans is exhibited only by adults, this behavior is apparently not related to predator defense. By exclusion, the most likely use of tail distractive behavior in caimans is in intraspecific social interactions. Tail displays described by Ayarzaguena (in lit.) for *C. crocodilus crocodilus* dur-

ing reproductive season seem to corroborate this hypothesis.

Submitted by **LUCIANO M. VERDADE**, Departamento de Zootecnia/ESALQ, Universidade de São Paulo, C.P. 09 Piracicaba, São Paulo 13418-900, Brazil.

TESTUDINES

CHELYDRA SERPENTINA (Common Snapping Turtle). **AGGRESSION**. There is an on-going debate about the existence of territoriality in the common snapping turtle (*Chelydra serpentina*). Some researchers have found extensive home range overlap among males (Galbraith et al. 1987. Can. J. Zool. 65:2623–2629), and no evidence of territoriality or aggression (Obbard and Brooks. 1981. Copeia 1981:630–637). Others believe that snapping turtles frequently exhibit intraspecific aggression by defending feeding areas or more simply their immediate surroundings (Kiviat 1980. Trans. Northeast Sect. Wildl. Soc. 37:158–168).

On 28 July 1996, we observed *Chelydra serpentina* biting at the sides of a turtle trap in Grafton Lake, Kejimkujik National Park, Nova Scotia, Canada. Based on their large size, we assumed that both turtles were adult males. For 10 min the turtles chewed at different parts of the trap; each apparently unaware of the other. Both turtles submerged and resurfaced periodically until, at one point they surfaced facing each other ca. 30–40 cm apart. At this point, there was a short (ca. 45 sec) but violent confrontation, with carapaces raised out of the water several times. At the fight's conclusion, one turtle remained near the trap and the second turtle surfaced ca. 40 m from the trap. On inspection the trap was found to contain a live common sucker (*Catostomus commersoni*).

This behavior was similar to an observation made the previous day while radio-tracking two adult males in another part of the lake. For over an hour, the two turtles moved closer to one another, until at one point they were 0.75 m apart. Subsequent tracking five min later revealed that one turtle was still at the site while the other had moved ca. 35 m away. Our unpublished data suggest that snapping turtles, during this time of day (1200 h), generally do not move long distances in such short periods of time. As a result, we suspect that this sudden movement was the result of a confrontation between the two turtles.

These two observations indicate that aggression between snapping turtles does occur. More data are needed before conclusions about the presence/absence of territoriality in this species can be made.

We thank the many participants in the Grafton Watershed Ecological Restoration Monitoring Project, and the staff of Kejimkujik National Park. Support was provided by the Ecosystem Monitoring Fund (Parks Canada) and the Acadia Centre for Wildlife and Conservation Biology.

Submitted by **DONNA D. HURLBURT**, **STEPHEN MOCKFORD**, and **THOMAS B. HERMAN**, Centre for Wildlife and Conservation Biology, Acadia University, Wolfville, Nova Scotia, Canada BOP 1XO; e-mail (TBH): tom.herman@acadiau.ca.

CLEMMYS MUHLENBERGII (Bog Turtle). **OVIPOSITION SITE**. Most *Clemmys muhlenberii* nesting sites have been located within elevated sedge tussocks or sphagnum moss above the water line. However, documented oviposition sites also include the soft soil above springs, adjacent pastures, and the sides of railroad embankments (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, DC. 578 pp.). On 21 July 1997, a clutch of three eggs (length x width = 30.81 mm x 15.88 mm, 31.42 mm x 15.97 mm, 30.19 mm x 15.85 mm), presumed to be *C. muhlenbergii*, was found ca. 6 cm deep in the top of a rotten, unidentifiable, hardwood stump. The stump, which was partially covered by mosses and poison ivy (*Toxicodendron radicans*), stood ca. 45 cm above the ground and was ca. 35 cm in diameter. All three eggs were collected and incubated at home by one of us (KMF). On 27 August 1997, one of the eggs hatched, confirming their identity as *C. muhlenbergii*. We believe this is the first reported use of a stump for nesting by *C. muhlenbergii*. The remaining two eggs never fully developed and began to rot. The surviving hatchling (30.19 mm CL, 34.41 mm CW; UGAMNH 44225 photo voucher) was released 28 March 1998 at the site of collection.

The collection site, Wolf Creek Bog (Chattahoochee National Forest, Union County, Georgia, USA), was first confirmed to be inhabited by *C. muhlenbergii* in 1979 (Hale and Harris 1980. Herpetol. Rev. 11:14). This bog site has been slowly succeeding to a more closed canopied hardwood forest. As a result, there is increasingly limited sedge and sphagnum moss areas in which to nest, potentially forcing *C. muhlenbergii* at this site to seek alternative oviposition areas. U.S. Forest Service personnel have begun management to reduce the hardwood encroachment and thus open up the canopy. This represents the first recorded nesting of *C. muhlenbergii* in Georgia.

We thank Jim and Cindy Wentworth of the U.S. Forest Service for their dedication to bog turtle conservation within the Chattahoochee National Forest.

Submitted by **KENNETH M. FAHEY**, 439 Pinewood Drive West, Dahlonega, Georgia 30533, USA, and **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA (e-mail: john_jensen@mail.dnr.state.ga.us).

DERMOCHELYS CORIACEA (Leatherback Sea Turtle). **ACCIDENTAL CAPTURE**. Records of *Dermochelys coriacea* on the Brazilian coast are rare (Bellini and Sanches 1998. Marine Turtle Newsltr. 79:22; Menezes 1972. Arq. Ciênc. Mar. 12:17–20; Moreno et al. 1994. Anais do II Encontro Sobre Coordenação de Pesquisa e Manejo da Franciscana. Ed. da FURG, Florianópolis, Brasil. 88 pp.). Two leatherback turtles were accidentally caught during fishery prospection near Saint Paul's Rocks, using a 28,000 m oceanic longline with 600 hooks baited with Brazilian sardines (*Sardinella brasiliensis*). A dead juvenile *D. coriacea* of undetermined sex was boarded on 18 October 1996. It measured 40 cm CCL (curved carapace length) and was caught at 180 m depth (00°46'S, 33°18'W). The specimen was photographed onboard and soon thrown overboard. A living adult (CCL = 180 cm) was caught on 19 October 1996. It was probably a female, based on the absence of a long tail, and was at 130 m depth (01°40'S, 33°36'W). The latter, while being boarded, showed a behavior similar to that described by Engrid et al. (1992. Herpetol. Rev. 23:70–71), swimming in wandering movements (zigzag) on its backside. Due to its great size, it could not be boarded, but was instead photographed in the water and released. Color slides of this turtle are on file in the Museu de História Natural, Universidade Estadual de Campinas (no catalog number). These are the northernmost records of the leatherback sea turtle in the Western South Atlantic. Apparently, sea turtle captures in this type of fishery are more common than reported. Artisanal fishermen from the Praia de Itapoã, Salvador, Bahia State (pers. comm. to C. L. S. Sampaio) and from several sites of southern Espirito Santo state (pers. comm. to J. L. Gasparini) report frequent captures of *D. coriacea.*

Many thanks to Ellen Wang and Sérgio R. Floeter for the English version, I. Sazima and J. L. Gasparini for comments on the manuscript, Renato B. Paglerani for colors slides and information about accidental captures, and CNPq for financial support.

Submitted by **CLÁUDIO LUIS S. SAMPAIO**, Universidade Federal da Bahia, Instituto de Biologia, Campus Universitário de Ondina, CEP 40.170-110, Salvador, Bahia, Brazil. Present address: Av. Sete de setembro, 2141/101, Edf. Caiçara, CEP 40.080-002, Salvador, Bahia, Brazil; e-mail: sampaio@ufba.br.

GOPHERUS AGASSIZII (Desert Tortoise). **PREDATION.** A variety of predators, most notably coyotes (*Canis latrans*) and common ravens (*Corvus corax*), have been reported to prey on hatchling desert tortoises, *Gopherus agassizii* (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 578 pp.). Here, we report an observation of a hatchling tortoise, fitted with a radiotransmitter, that was preyed upon by native fire ants (*Solenopsis* sp.) in the eastern Mojave Desert at Yucca Mountain, Nevada (36°50'N, 116°25'E). On 27 August 1993, we found a live, 5 day-old *G. agassizii* (45 mm carapace length) with the eyes, chin, and parts of the head and legs being eaten by ants. The tortoise was lethargic and responded little when touched. The ants were removed, and the tortoise was released near the site of capture. When relocated the next day, the tortoise was dead. This specimen was deposited at University of California at Berkeley, Museum of Vertebrate Zoology (MVZ 223521). Eight of 74 other radiomarked hatchlings (aged 3–7 days) that we monitored during 1992–1994 were found dead with fire ants scavenging the carcasses. We do not know if the ants preyed on these tortoises or if the ants were simply scavenging the carcasses. Five of these specimens were deposited at MVZ (223522, 223524, 223532, 223535–36). Although imported fire ants (*S. invicta*) have long been known to kill hatchling gopher tortoises, *G. polyphemus* (Mount 1981. J. Alabama Acad. Sci. 52:71–78), native fire ants have not been implicated previously as predators of desert tortoises.

Tortoises were handled under permits PRT-683011 and PRT-781234 from the U.S. Fish and Wildlife Service, and S-0446, S-1595, S-3108, S-5041, S-6941, and S-9060 from the Nevada Division of Wildlife. This research was supported and managed by the U.S. Department of Energy, Yucca Mountain Site Characterization Office, as part of the Civilian Radioactive Waste Management Program under contracts DE-AC08-88NV1067, DE-AC08-93NV11267, DE-ACO1-91RW00134, and DE-ACO8-91RW00134.

Submitted by **JAMES L. BOONE**, **DANNY L. RAKESTRAW**, and **KURT R. RAUTENSTRAUCH**, Science Applications International Corporation (SAIC), 1180 Town Center Drive, Las Vegas, Nevada 89134, USA (e-mail for JLB: jim_boone@ymp.gov).

GOPHERUS POLYPHEMUS (Gopher Tortoise). **SCAVENGING.** *Gopherus polyphemus* is an obligate grazer (Garner and Landers 1981. Proc. Conf. Southeast Assoc. Fish Wildl. Agencies 35:120–134; Macdonald and Mushinsky 1988. Herpetologica 44:345–353). Reports of carnivorous scavenging by this species are extremely rare (Garner and Landers, *op. cit.*; Anderson and Herrington 1992. Herpetol. Rev. 23:59). At 1400 h on 3 September 1997, DRJ observed a small adult or subadult gopher tortoise (15 annuli, CL 178 mm, PL 173 mm) scavenging the dry, flattened carcass of a great-horned owl (*Bubo virginianus*) on the edge of Georgia highway 33, 20 km north of Sylvester, Worth County, Georgia, USA. The activity took place in full sun at 33°C, with the tortoise ignoring occasional passing traffic. When handled, the tortoise voided a brownish urine. A voucher slide (UF 113440) has been deposited in the photographic archive of the Herpetology Collection, Florida Museum of Natural History.

In June 1992, TEO observed a juvenile gopher tortoise (130 mm CL) energetically consuming the dried remains of a road-killed armadillo (*Dasypus novemcinctus*) on US highway 19 in Citrus County, Florida, USA, near Crystal River. Old field and native upland pine habitats occurred at both the Georgia and Florida sites.

Scavenging of dried vertebrate remains may facilitate acquisition of minerals, such as calcium and phosphate, that often are poorly represented in the leached, sandy soils typically occupied by this herbivorous turtle (Garner and Landers, *op. cit.*). Our observations underscore the use of this foraging component by demographic groups other than mature females, the group emphasize by Garner and Landers (*op cit.*). In addition to the tortoise's propensity for living along roadsides, which facilitates its collection by humans for food or pets, feeding upon road-killed vertebrates may contribute directly to mortality (from automobile impact) of this already declining species.

We thank Todd Engstrom for identification of the owl carcass.

Submitted by **DALE R. JACKSON**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA (e-mail: djlcmlcm@aol.com), and **THOMAS E. OSTERTAG**, Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana 70402, USA.

TERRAPENE ORNATA LUTEOLA (Desert Box Turtle). **ATTEMPTED PREDATION.** A wide variety of predators, including birds, are known or suspected of eating eggs or young of turtles (Legler 1960. Univ. Kansas Publ., Mus. Nat. Hist. 11:527–669; Walley 1993. Herpetol. Rev. 24:148–149; Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, DC. 578 pp.). Predation on adults is less common, although large mammals like coyotes (*Canis latrans*), raccoons (*Procyon lotor*), and skunks (several species) might be capable of killing adults of some species (Harding 1997. Amphibians and



FIG. 1. Photograph taken October 1988 indicating shell damage on a female *Terrapene ornata luteola* inflicted by a turkey vulture (*Carthartes aura*).



FIG. 2. New epidermal material covering the damaged shell in July 1998.

Reptiles of the Great Lakes Region. The University of Michigan Press, Ann Arbor. 378 pp.). Birds are rarely considered predators of adult turtles, although two gulls (*Larus* sp.) attacked an adult *Malaclemys t. terrapin* (Watkins-Colwell and Black 1997. Herpetol. Rev. 28:87–88) and severely damaged the turtle's limbs.

On 3 October 1988 at 1826 h, I saw a turkey vulture (*Carthartes aura*) standing on an adult *Terrapene ornata luteola* on a dirt road in the Sevilleta National Wildlife Refuge, ca. 85 km south of Albuquerque, New Mexico, USA. From a distance I could see the vulture using its beak on the carapace of the turtle. I watched the interaction for ca. 1 min before driving up to the pair. As I drove up, the bird flew off. The turtle had both ends of its plastron shut tightly. The turtle was a female (128 mm carapace length, 480 g) that I had marked in August 1987. At that time, there was no damage to the carapace of the turtle. The carapace was now damaged, and judging from the behavior of the vulture and the fresh appearance of the damage, it seems likely that the damage was caused by the vulture. The vulture had apparently scraped off epidermal lamellae down to bone in one contiguous area on the right front of the carapace (Fig. 1). Although bone was exposed, the turtle did not seem to be seriously injured otherwise. Florida box turtles (*T. carolina bauri*) can survive extensive loss of epidermal material due to fire (Dodd 1997. Herpetol. Nat. Hist. 5:66–72). I do not know how much more damage could have been inflicted on the turtle if the vulture had not flown off when I approached.

I found the turtle again on 9 July 1998 while resurveying the population on the Sevilleta NWR. The damaged area of the shell had completely healed over with new epidermal material (Fig. 2). In addition, this female was carrying two eggs, a further indication of no lasting harm due to the attack.

Submitted by **DAVID J. GERMANO**, Department of Biology, California State University, Bakersfield, California 93311, USA (e-mail: Dgermano@csubak.edu).

LACERTILIA

GALLOTIA SIMONYI MACHADOI (Hierro Giant Lizard). **UNDESCRIBED BEHAVIOR.** The Hierro giant lizard is a diurnal, heliothermic, large lacertid (≤ 226 mm SVL) presently threatened with extinction, as the only remaining population, about 1600 individuals (Rodríguez-Domínguez, unpubl. data), is located in the small overhang of a cliff in the northeastern part of El Hierro Island (Canary Islands). Information regarding reproduction of the species is limited (Rodríguez-Domínguez and Molina-Borja 1998. J. Herpetol. 32:498–504).

The Canary government keeps 57 adult lizards in captivity, six of them captured from the natural habitat, at the Recovery Center for the Hierro giant lizard; they have been the progenitors for a breeding program that began in 1985. Here I report on previously unknown homosexual behavior between males, long-term sperm storage by females, and of the presence of coagulated material on the hemipenes and cloacas of some males and females. None of these features has been previously reported for *Gallotia*.

Observations were made through a blind in a large outdoor terrarium; the observer was 2–7 m from the animals. On 16 July 1997, I introduced four males of similar sizes and allowed them to interact freely. The largest male (226 mm SVL, 357 g mass), throat inflated and performing headbobs, approached another male (207 mm SVL, 288 g mass). The larger male bit the other's neck skin and attempted to insert one of his hemipenes into the other's vent. During that time, the second male struggled and exhibited nervous, vertical head shakings. Finally, the dominant male rubbed the other's back with his hemipenis. The lizards then became aware of the observer's presence and immediately separated and retreated. I saw remains of small stones in the center of the hemipenis's lobe that certified that the organs were everted.

On the other hand, I observed successful hatching of eggs laid by females that had been maintained in terraria without males for one year, indicating that *Gallotia simonyi* females may store living sperm and that fertilization need not immediately follow copulation. These females (N = 10) were born in captivity (mean SVL 184.9 mm, SD 1.9, range 165–192 mm), and included one six-year-old, one eight-year-old, and seven nine-year-old individuals. Clutches were produced from 25 June to 15 July 1997 (mean clutch size 4.11, SD 0.86); however, out of 37 eggs, only five live young hatched, one of which had a malformed backbone and an occluded eye.

During the reproductive period, four males exhibited a coagulated white secretion in the center of one or both lobes of the hemipenes. This material also was observed in the cloacas of two females. Although its appearance is very similar to the mating plugs that have been described in females of some snakes (Devine 1977. Nature 267:345–346), I cannot presently tell if this material has the same composition and function, i.e., to discourage copulation by other males.

I thank Miguel Molina-Borja from the Dpto. de Biología Animal, Facultad de Biología, Universidad de La Laguna (Tererife) and an anonymous reviewer for reviewing the original manuscript.

Submitted by **MIGUEL ANGEL RODRÍGUEZ-DOMÍNGUEZ**, Centro de Reproducción del Lagarto Gigante de El Hierro, Frontera 38911, El Hierro, Canary Islands, Spain (e-mail: marodri@iic.vanaga.es).

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). **PREDATION**. On 1 September 1997 we collected a young *Hemidactylus turcicus* (0.45 g, 27.8 mm SVL, 34.8 mm TL; UTA R-43562) and an adult female comb-footed spider *Tidarren sisyphoides* (6.9 mm cephalothorax and abdomen length) in its web. The web was discovered on the bottom of an office table within the Bird and Reptile Building at the Dallas Zoo, Dallas County, Texas, USA. The web also contained five spider egg cases, four of which were empty and one that was hatching. When found, the spider was actively feeding on the tip of the mandible of the gecko but retreated when disturbed. The Theridiidae, or comb-footed spiders, build irregular webs and cast viscous silk over their prey. They are known to prey on small lizards (Blondheim and Werner 1989. Brit. Herpetol. Soc. Bull. 30:26–28; McCormick

and Polis 1982. Biol. Rev. 57:29–58; Welter and Fauth 1996. Herpetol. Rev. 27:79) and to subdue prey many times their own size.

Submitted by **DAVID T. ROBERTS** and **RUSTON W. HARTDEGEN**, Dallas Zoo, Department of Herpetology, 650 South R.L. Thornton Freeway, Dallas, Texas 75203-2996, USA, and **DANIEL FORMANOWICZ**, Department of Biology, University of Texas at Arlington, Box 19498, Arlington, Texas, 76019, USA.

LACERTA LEPIDA (Ocellated Lizard). **NECROPHAGIA and OOPHAGIA**. Necrophagia and the consumption of bird eggs are known among large saurian species; however we have found only one explicit reference indicating necrophagia in *Lacerta lepida* (Calderón 1977. Doñana, Act. Vert. 4:61–126) and another implicit one (Hódar et al. 1996. J. Arid Env. 33:95–107). Oophagia in this species has been documented in analyses of the digestive tract and feces (Calderón 1977. *op. cit.*), but as *L. lepida* does not normally ingest eggshells (De Juana and De Juana 1982. Doñana, Act. Vert. 9:374–375), evidence of oophagia may have been overlooked.

On 15 May 1986, at 1300 h, near Constantina (Seville, Spain, UTM 30s TG6995), we observed an adult male *L. lepida* devouring vitellogenic follicles and fat bodies of a recently-roadkilled female conspecific. On 29 May 1986 at 1730 h near the Sanctuary of the Virgen de la Cabeza (Jaén, UTM 30s VH1126), and again on 5 July 1986 at 1010 h in El Dornajo (Granada, UTM30s VG6108), we found an adult *L. lepida* feeding on an adult male Montpellier snake, *Malpolon monspessulanus* (SVL of male 1250 mm, of female 602 mm, respectively), also recently roadkilled. On 20 March 1987 in Tobazo (Jaén, UTM 30s VG0956), we found a roadkilled adult male *L. lepida* with the remains of a female ladder snake, *Elaphe scalaris* (860 mm SVL), in its mouth.

On the sandy escarpment of the palaeocanal of the River Guadalete (C·diz, UTM 30s TF6584), was a small nesting colony of bee-eaters (*Merops apiaster*) with 11 occupied nests. On 6 May 1997 at 1800 h we saw an adult female *L. lepida* emerge from one of the nests with an egg in its jaws. At the entrance of the nest hole, the lizard broke open the egg, devoured the contents and discarded the shell. The lizard re-entered the nest hole, emerged with another egg and repeated the action. Afterwards, the lizard moved over the escarpment and entered a second nest, and this time emerged with a recently-hatched Bee-eater chick; at the entrance of the nest the chick was rapidly swallowed. After ingesting another egg from a third nest, the lizard fled.

Submitted by **JUAN M. PLEGUEZUELOS, SANTIAGO HONRUBIA**, Departamento de Biología Animal y Ecología, Facultad de Ciencias, Universidad de Granada, 18071 Granada, Spain (e-mail: juanple@goliat.ugr.es), and **JOSÉ A. MATEO**, Estación Biológica de Doñana, Avenida María Luisa s/n, 41013 Sevilla, Spain.

SCELOPORUS OCCIDENTALIS LONGIPES (Great Basin Fence Lizard). **PREDATION**. Although birds such as raptors, corvids, cuckoos, and shrikes are well-known predators of reptiles (Terres 1991. The Audubon Society Encyclopedia of North American Birds. Wings Books, New York. 1109 pp.), observations of predation in the wild are relatively scarce. On 23 February 1998, at east Lake Hodges, San Diego County, California, USA (33°03'45"N, 117°03'45"W; elev. 98 m), we observed an adult male great-tailed grackle (*Quiscalus mexicanus*) attack and consume two adult male *Sceloporus occidentalis longipes*. The grackle was perched near shore, searching for prey on a floating western cottonwood (*Populus fremontii*) branch when the first lizard was seized at 0830 h. The lizard was carried about 10 m to a small stand of cat-tail (*Typha angustifolia*) and willow (*Salix* sp.), where the tail and visceral contents were consumed first, followed by the remainder of the lizard's body. Shortly thereafter, at the same feeding site, the grackle seized a second lizard in a clump of dead cat-tails, flew about 50 m to a cottonwood, and again consumed tail and viscera first, followed by head and body.

The winter 1997–98 flooding of Lake Hodges and surrounding riparian woodland has displaced *S. o. longipes* to tree perches and floating vegetation (C. Mahrdt, pers. obs.), greatly exposing this species to avian predators. Although natural predators of *S. occidentalis* include birds and several colubrid snakes (Bell and Price 1996. Cat. Amer. Amphib. Rept. 631.1–631.17; Fitch 1940. Univ. California Publ. Zool. 44:151–172), apparently this is the first reported observation of a great-tailed grackle preying on a western fence lizard.

We thank Kent Beaman for his comments and review of the manuscript.

Submitted by **CLARK R. MAHRDT**, Herpetology Department, San Diego Natural History Museum, P.O. Box 1390, San Diego, California 92112, USA, and **RICHARD L. BARBER**, Palomar Audubon Society, 15569 Walton Heath Row, San Diego, California, USA.

SCELOPORUS VIRGATUS (Striped Plateau Lizard). **PREY**. Although *Sceloporus virgatus* is a relatively well-studied lizard, little is known about its diet beyond that fact that it is insectivorous. I report an attempted predation event by *S. virgatus* on a potentially dangerous prey item, a centipede (species unknown), in a wooded area of a study site in the Chiricahua Mountains (1600 m elev.), approximately 2.5 km SW Southwestern Research Station, Portal, Cochise County, Arizona, USA (see Smith 1996. Amer. Midl. Nat. 135:68–80). On 7 June 1993 I observed a female *S. virgatus* (SVL 53 mm) attack and attempt to consume a relatively large centipede (30–40 mm). The predation attempt by the lizard was unsuccessful, and involved a highly violent interaction, ending when the female released the centipede. The latter subsequently escaped.

Submitted by **GEOFFREY R. SMITH**, Department of Biology, William Jewell College, 500 College Hill, Liberty, Missouri 64068, USA.

TUPINAMBIS MERIANAE (Common Tegu). **ACTIVITY.** Although the genus *Tupinambis* is widely distributed in South America east of the Andes, with species occurring along many ecosystems (Ávila-Pires 1995. Lizards of Brazilian Amazonia [Reptilia: Squamata]. Nationaal Natuurhistorisch Museum, Leiden, The Netherlands. 706 pp.), information on their activity based on field data is scarce. *Tupinambis merianae* occurs in many Brazilian environments such as cerrado, caatinga, and the Atlantic forest. In an area of Atlantic Rainforest at Ilha Grande (23°11'S, 44°12'W), Rio de Janeiro, southeastern Brazil, *T. merianae* is the most abundant species of lizard. Field work was carried out at two sites, (1) a relatively undisturbed forest and, (2) a 30-yr-old regenerated forest. During transects carried out at both sites between January and December 1996, it was common to see and hear active individuals of *T. merianae* foraging and basking, mainly at sunny patches in the forest. The transects were always done between 0700 h and 1700 h. Each time we detected a lizard, we recorded the date and time. The lizards were active between

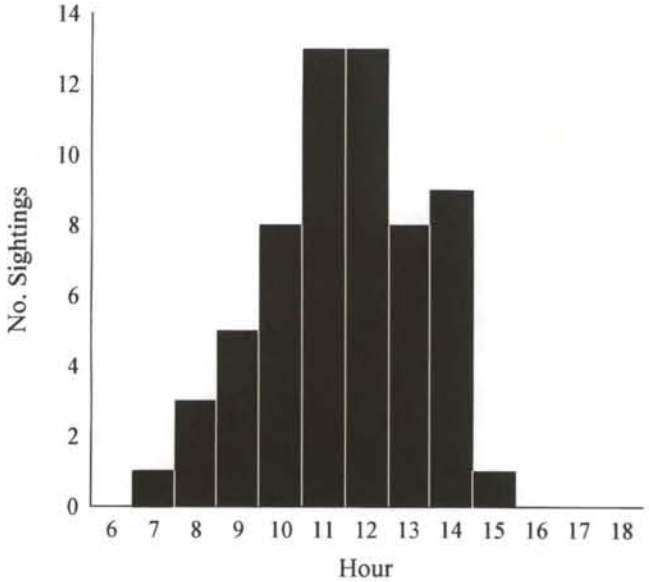


FIG. 1. Daily activity of *Tupinambis merianae* in the Atlantia rainforest of Ilha Grande, Rio de Janeiro, between January and December, 1996.

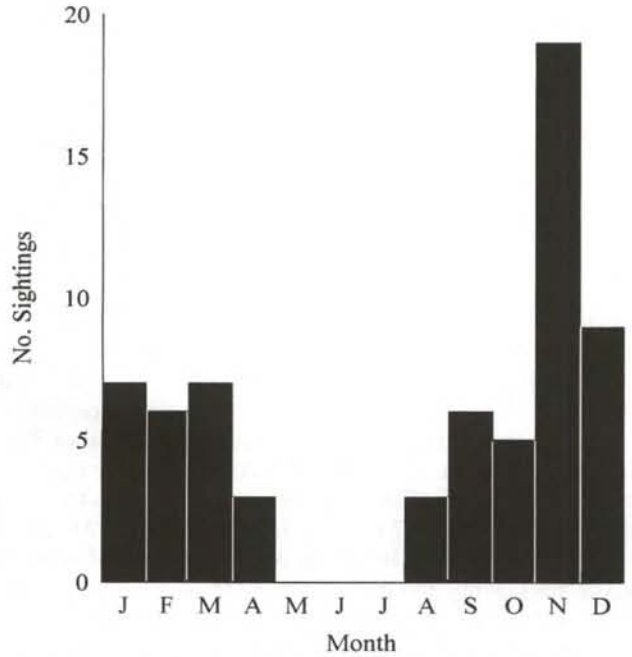


FIG. 2. Number of active *Tupinambis merianae* each month.

0700 h and 1500 h. Daily activity was unimodal, being highest during the hottest period of the day (1100–1300 h, Fig. 1). Yearly activity peaked during November; there was a period of aestivation between May and July (Fig. 2). This pattern of activity is similar to that of *T. teguixin*, at Serra do Japi, an area of Atlantic Rainforest in the State of São Paulo (Sazima and Haddad 1994. *In* Morellato (ed.), História Natural da Serra do Japi, pp. 212–236. EDUNICAMP/FAPESP, Campinas, São Paulo, Brazil). It is also similar to that of two Argentinian species, *T. teguixin* and *T. rufescens*, which overwinter in burrows and become active in September and October (Fitzgerald et al. 1991. *In* Robinson and Redford [eds.], Neotropical Wildlife: Use and Conservation, pp. 303–316. University of Chicago Press, Chicago, Illinois). These species also have a peak of activity during the spring, mainly during November and December (Fitzgerald et al. 1994. Interciencia 19:166–170).

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Submitted by **MONIQUE VAN SLUYS** (e-mail: vansluys@uerj.br) and **CARLOS FREDERICO DUARTE ROCHA**, Setor de Ecologia, Instituto de Biologia Roberto Alcántara Gomes, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier 524, Maracaná, Rio de Janeiro, 20550-013, Rio de Janeiro, Brazil.

SERPENTES

CLELIA CLELIA (Mussurana). **ATTEMPTED PREDATION.** *Clelia clelia* is a rear-fanged colubrid found at low to moderate elevations from southern Mexico to Argentina. It occurs in all but the driest lowland areas of Costa Rica. Ophiophagy has been well documented in this species, but few observations have been made in the wild (Scott 1983. *In* D.H. Janzen [ed.], Costa Rican Natural History, pp. 392. University of Chicago Press, Chicago, Illinois.).

On 8 July 1997 at 0130 h, we discovered a juvenile *C. clelia* attempting to eat a subadult *Leptodeira septentrionalis* (cat-eyed snake). This observation was made near the edge of a research trail at the La Selva Biological Station, Heredia Province, Costa Rica (32 m elev.). Photographs were taken immediately and 12 minutes of observation followed (Fig. 1). During this time, we sat on the trail with our flashlights dimmed ca. 3 m from the location of the snakes. The *C. clelia* was successively biting at the nuchal region of the *L. septentrionalis* while constricting the anterior and midbody with four tight coils. After 12 minutes, the *C. clelia* aborted the attempted predation and retreated. Surprisingly, despite probable envenomation and suffocation, the *L. septentrionalis* was not immobilized and made a rapid escape. Due to its swift retreat, we could not capture the *L. septentrionalis* for measurements. However, it can be safely stated that the *L. septentrionalis* was greater in length than the *C. clelia*, but not in circumference. The *C. clelia* measured 61.9 cm SVL, 74.9 cm total length, and weighed 68.8 g.

Submitted by **MATTHEW J. RUSSELL**, Department of Herpetology, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA, **MAURA MAPLE**, Department of Biology, Indiana University, Bloomington, Indiana 47405, USA, and **ANN**



FIG. 1. Attempted predation of a sub-adult *Leptodeira septentrionalis* by a juvenile *Clelia clelia*.

STRIEBY, Department of Biology, California State University, 18111 Nordhoff Street, Northridge, California 91330, USA.

CROTALUS ATROX (Western Diamondback Rattlesnake). **MORPHOLOGY**. Klauber (1972. Rattlesnakes. Their Habits, Life Histories, and Influence on Mankind. Univ. California Press, Berkeley, California. 740 pp.) reported the congenital absence of rattles in three species of rattlesnakes, *Crotalus cerastes*, *C. horridus*, and *C. pricei*. A rattleless form of *C. ruber lorenzoensis* is well established in the population on Isla San Lorenzo del Sur, and *C. catalinensis* has no rattles other than the proximal segment (Campbell and Lamar. 1989. The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp.). A captive rattleless *C. v. viridis* gave birth to a single rattleless neonate in a brood of 12 (H. M. Smith, pers. comm.).

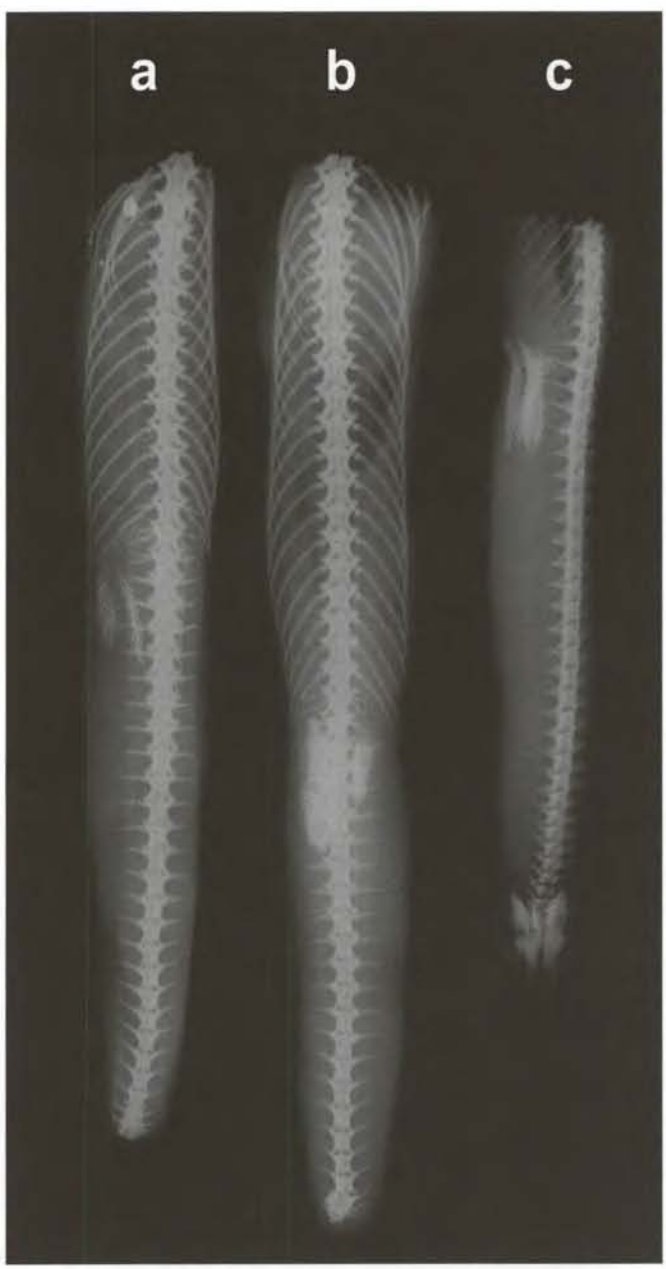


FIG. 1. Radiograph of three *Crotalus atrox*, showing normal tail (left) and congenital absence (middle, right) of rattle segments. All specimens from Eddy Co., New Mexico.

While conducting studies at the 8th annual Rattlesnake Extravaganza in Alamogordo, New Mexico, USA, during April 1995, CWP and LAF obtained two rattleless *C. atrox*. These specimens were collected from a den near Artesia, Eddy Co., New Mexico, on an unspecified date in April 1995. The hunter (anonymous) indicated he had observed other rattleless *C. atrox* in the same area.

The posterior 15 cm of each specimen was removed, X-rayed, and compared with a specimen possessing normal rattles (Fig. 1). The abnormal specimens were examined grossly for evidence of injury and corresponding scar tissue. The radiograph and gross exam revealed no evidence of scar tissue or previous injury, so we conclude that this condition was congenital rather than the result of an injury or removal of the rattles by trophy hunters. This is the first report of this rattleless condition in *C. atrox*. The specimens (MSB 60386-388) are accessioned into the Division of Herpetology, Museum of Southwestern Biology, University of New Mexico.

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, 87504, USA (e-mail: cwpaint@unm.edu), **LEE A. FITZGERALD**, Texas A & M University, Department Wildlife and Fisheries Sciences, College Station, Texas, 77843-2258, USA, and **MARK L. HEINRICH**, Carlsbad Animal Clinic, 103 East Blodgett, Carlsbad, New Mexico 88220, USA.

CROTALUS LEPIDUS (Rock Rattlesnake), ***CROTALUS MOLOSSUS*** (Blacktail Rattlesnake), ***CROTALUS PRICEI*** (Twin-spotted Rattlesnake), ***CROTALUS TIGRIS*** (Tiger Rattlesnake). **ENDOPARASITES.** There are, to our knowledge, no reports of endoparasites for *Crotalus lepidus, C. pricei* or *C. tigris*. There is one report of a nematode, *Kalicephalus inermis* in *C. molossus* from México (Prado Vera 1971. Thesis, Univ. Nac. Auton. México, D. F. 102 pp.). The purpose of this note is to report the presence of larval tapeworms (cestodes) in *C. molossus* and *C. pricei* and larval spiny-headed worms (acanthocephalans) in *C. lepidus* and *C. tigris*. The body cavities of a total of 55 *C. lepidus* from Arizona, Texas and México, 129 *C. molossus* from Arizona, New Mexico, Texas and México, 40 *C. pricei* from Arizona and México and 117 *C. tigris* from Arizona and México in the herpetology collections of the Natural History Museum of Los Angeles County and the University of Arizona were examined for helminths. A mid-ventral incision was made in the body wall, and organ surfaces and mesenteries in the posterior portion of the body cavity were visually checked for helminths. Oblong whitish bodies, approximately 1 by 3 mm were occasionally seen. These proved upon microscopic examination to be oligacanthorhynchid acanthocephalan cystacanths in *C. lepidus* and *C. tigris*, and tetrathyridia of *Mesocestoides* sp. in *C. molossus* and *C. pricei*. Prevalence of infection (infected snakes/sample examined x 100) was 5% each for oligacanthorhynchid cystacanths in *C. lepidus* and *C. tigris* and 2% and 5% for tetrathyridia of *Mesocestoides* sp. in *C. molossus* and *C. pricei*, respectively. Specimens were deposited in the U.S. National Parasite Collection, Beltsville, MD: oligacanthorhynchid cystacanths, *C. lepidus* (87642), *C. tigris* (87643); tetrathyridia of *Mesocestoides* sp., *C. molossus* (87644), *C. pricei* (87645).

Oligacanthorhynchid cystacanths have been found in other North American crotalids, *Crotalus atrox* and *C. scutulatus* (Bolette 1997. J. Parasitol. 83:751–752; Bolette 1997. Southwest. Nat. 42:232–236). Tetrathyridia of *Mesocestoides* sp. have been reported *C. atrox* and *C. viridis* (Bolette 1997. J. Parasitol. 83:751–

752; Mankau and Widmer 1977. Jap. J. Parasitol. 26:256–259). Rattlesnakes are believed to be paratenic hosts (Bolette *op. cit.*). The presence of oligacanthorhynchid cystacanths in *C. lepidus* and *C. tigris*, and tetrathyridia of *Mesocestoides* sp. in *C. molossus* and *C. pricei* are new host records and represent the first records of helminths in *C. lepidus, C. pricei* and *C. tigris*.

We thank Robert L. Bezy (Natural History Museum of Los Angeles County) and Charles H. Lowe (University of Arizona) for permission to examine *Crotalus lepidus, C. molossus, C. pricei* and *C. tigris* for helminths.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA, e-mail: sgoldberg@whittier.edu, and **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA; e-mail: cxb13@psu.edu.

CROTALUS MOLOSSUS MOLOSSUS (Northern Blacktail Rattlesnake). **BROOD DEFENSE.** An adult *Crotalus molossus molossus* was encountered near Tanque Verde Creek, Reddington Pass, Pima County, Arizona, USA, on a morning in early September 1984 (ca. 8 September). It was crawling toward me while rattling at 5 m distance, and when I stopped, the snake stopped 3 m away. After about 10–15 s, it returned in the direction from which it had crawled, traveling 4 m to an opening at the base of a massive rock outcrop, where it coiled. After a pause of ca. one minute, I approached to within 5 m and the snake again crawled toward me while rattling. When I stopped, the snake stopped about 2 m away, and after 5–10 s, it returned to the same opening at the base of the outcrop. On approach to 1.5 m from the opening, up to five newborn young were seen near the adult and although the adult did not advance again, it did rattle briefly. After a few minutes, one of the young crawled out of the refuge opening in front of the adult. The adult moved forward until it was resting on top of the young. The young struggled free and both returned to the opening. The posterior body and tail of the adult were notably thin, and the tail was proportionally short indicating a female. The young had a bluish cast and opaque pre-buttons, but the eyes were clear. The following day the adult and three or four young were present, but did not react to my presence. The next day there were two young and a shed skin with the adult, and on the fourth day neither the adult nor young were present. Later the opening under the overhang was found to extend horizontally at least 1.3 m.

Initially the refuge was approached directly with considerable commotion and twice the snake appeared to exhibit defensive behavior as I moved in its direction. This behavior was not observed on subsequent, stealthier visits. There are numerous accounts of pit vipers remaining with their young or eggs (Greene 1997. Snakes, the Evolution of Mystery in Nature. Univ. California Press, Berkeley, California. 288 pp.), but brood defense has only been reported for *Agkistrodon piscivorus conanti* (Walters and Card 1996. Herpetol. Rev. 27:203).

I thank Jillian Cowles, Harry Greene and David Hardy, Sr., for comments on the manuscript.

Submitted by **WILLIAM SAVARY**, Department of Facilities Management, University of Arizona, Tucson, Arizona 85721, USA.

CROTALUS VIRIDIS LUTOSUS (Great Basin Rattlesnake). **MORTALITY.** Although rodents have been reported as enemies of rattlesnakes, especially in laboratory or enclosed situations (Klauber 1972. Rattlesnakes. Univ. California Press, Berkeley. 1536 pp.), documentation of interactions in nature is uncommon. Here, we 1) relate the mortality and possible predation of two *Crotalus viridis lutosus* to environmental temperature and condition of snakes at a natural hibernaculum, and 2) note the specific targeting of venom glands by a predator/scavenger. This observation was made at a large snake hibernaculum in Butte Co., Idaho, USA, on the property of the Idaho National Engineering and Environmental Laboratory.



FIG. 1. Body of *Crotalus viridis* showing extensive tissue loss. Note injury to the right venom gland and teeth marks on transmitter.

As part of a hibernation project on *C. v. lutosus*, we surgically implanted radiotransmitters (8–9 g) into seven adult female snakes and released them at their hibernaculum within one week. On 25 October 1991 we released the last two snakes: #349 (SVL = 77 cm, mass = 339 g) and #365 (SVL = 76 cm, mass = 321 g). On 4 November 1991, all seven radio-equipped snakes were underground within the hibernaculum and presumed alive. On 6 November, rattlesnakes #349 and #365 were found dead and mutilated at two different openings of the hibernaculum. Both snakes possessed injuries to the body; one had minor skin lacerations but the other suffered considerable tissue loss (Fig. 1). Most notable,

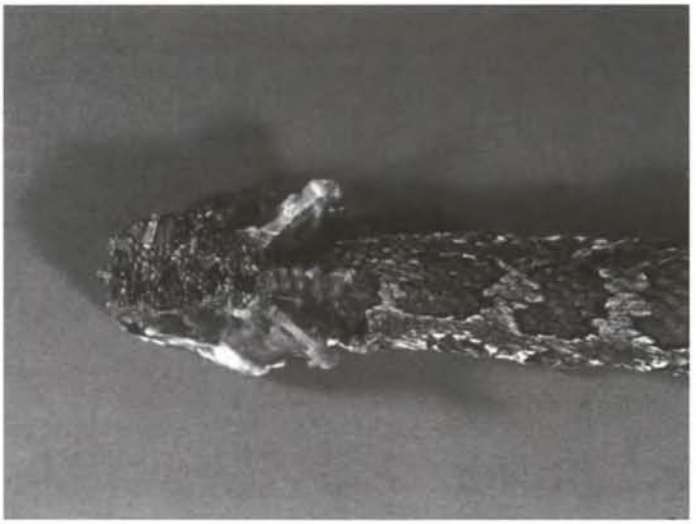


FIG. 2. Head of *Crotalus viridis* missing venom glands.

were the injuries to the lateral, posterior areas of the head, where the venom glands are located (Fig. 2). Both venom glands of one snake and one of the other were completely missing. Examination of the injuries and bite marks on one radiotransmitter suggested that the predator/scavenger was a rodent. The only likely rodent predator of rattlesnakes in this area is the bushy-tailed woodrat (*Neotoma cinerea*), a species commonly associated with this hibernaculum.

We suspect these two snakes were remaining active and basking near the entrances to the hibernaculum to promote healing of the suture site. Although we maintained the postsurgical snakes at warm temperatures for five days, healing may have been incomplete. Unfortunately, the weather worsened shortly after the snakes were released and remained relatively cool, allowing little time for the snakes to bask and maintain warm body temperatures. From release date until their death, operative snake body temperatures (measured with a datalogger and painted copper models) only rose above 20°C a total of 8.5 h. These reduced temperatures may have delayed healing and resulted in suboptimal locomotory and defensive performances (Peterson et al. 1993, *In* Seigel and Collins (eds.), Snakes: Ecology and Behavior, pp. 241–314. McGraw-Hill, New York), thereby increasing the snakes' vulnerability to predators. Halpin (1983. Am. Midl. Nat. 109:50–54) suggested that cool environmental temperatures may have facilitated a predation event on *Coluber* by prairie dogs (*Cynomys ludovicianus*), and Rowe and Owings (1990. Ethology 86:237–249) have suggested that ground squirrels can assess the risk of attacking a rattlesnake by detecting whether a snake is warm or not. Alternatively, the snakes may have died from other causes and been scavenged by rodents. Regardless of the mode of death, venom glands were specifically selected for consumption. We know of no other case where rodents have targeted snake venom glands. However, a possibly related observation involves wasps exhibiting specific attraction to the venom glands of freshly dead *C. viridis* on two separate occasions (Brent Charland, pers. comm.).

Submitted by **VINCENT A. COBB**, Department of Biology, Northeastern State University, Tahlequah, Oklahoma 74464, USA (e-mail: cobbva@cherokee.nsuok.edu); and **CHARLES R. PETERSON**, Department of Biological Sciences, Idaho State University, Pocatello, 83209, USA (e-mail: petechar@isu.edu).

ELAPHE FLAVIRUFA (Tropical Rat Snake). **PREDATION and DIET.** The only available record of the food habits of *Elaphe flavirufa* concerns the remains of an unidentified bird in the stomach of a snake collected in Mexico (Lee. 1996. The Amphibians and Reptiles of the Yucatán Peninsula. Cornell University Press, Ithaca, New York. 500 pp.). Here, we report a juvenile *E. flavirufa* feeding on two species of bats. On 20 July 1997 at ca. 2010 h, we observed a juvenile *E. flavirufa* (375 mm SVL; 472 mm total length; 22 g mass) on a wooden rafter (279 cm above the ground) in a thatched structure at the Lamanai Field Research Center, Indian Church Village, Orange Walk District, Belize. The snake was being attacked by two unidentified rodents, one of which seized the snake just behind the head and eventually killed it. A struggle then ensued between the two rodents over the dead snake, and shortly after the snake was dropped to the ground. The snake was collected, and subsequent examination of stomach contents revealed a black-winged little yellow bat (*Rhogeessa tumida*) and a little brown bat (*Myotis* spp.), both of which had been swallowed head-first. Frequently we observed bats roosting on the walls and ceiling of the thatched structure, and we suspect the bats in this instance may have been captured and eaten while roosting. The snake was deposited in the Campbell Museum (CUSC 1444), Clemson University, Clemson, South Carolina. The bats will be deposited in the American Museum of Natural History.

We are grateful to Bruce Miller for identifying the bats, Mark and Monique Howells for logistic support and accommodations at Lamanai Field Research Center/Lamanai Outpost Lodge, and Travis Crabtree for reviewing this manuscript.

Submitted by **THOMAS R. RAINWATER***, Lamanai Field Research Center, P.O. Box 63, Orange Walk, Belize, and **STEVEN G. PLATT**, Wildlife Conservation Society, Lamanai Field Research Center, P.O. Box 63, Orange Walk, Belize. * Present address: The Insitute of Environmental and Human Health, Department of Biological Sciences, Texas Tech University, 1207 Gilbert Drive, Lubbock, Texas 79416, USA.

LANGAHA MADAGASCARIENSIS (Leaf-nosed Snake). **REPRODUCTION**. On 10 September 1997, a wild collected, gravid *Langaha madagascariensis*was acquired by the Dallas Zoo's Department of Herpetology. On 2 October 1997, this specimen oviposited five eggs beneath a two-inch layer of sphagnum moss, which was used as a substrate in the specimen's enclosure. The eggs were measured (length [mean ± SD] = 24.4 ± 0.11 mm; width = 11.5 ± 0.08 mm). The eggs were incubated in a 1:1 mixture of vermiculite and water. Incubation temperature fluctuated from 24 to 27°C. Five neonates (125.6 ± 0.47 mm SVL; 1.5 ± 0.04 g) hatched after an incubation period of 81 days. Although human intrusion may have affected some of the data presented here, I believe this observation is noteworthy because nothing is known concerning the reproduction of this species in the wild.

My thanks to the staff of the Dallas Zoo Department of Herpetology for helpful comments and review of this manuscript.

Sumitted by **RICHARD D. REAMS**, Dallas Zoo Department of Herpetology, 650 R.L. Thornton Highway, Dallas, Texas 75203, USA.

LEPTODEIRA ANNULATA (False Mapanare, Banded Cat-Eyed Snake). **PREDATION**. Natural predation upon snakes by insects is rarely observed or photographically documented, and most reported cases involve mantid or water bug predators (Greene 1988. *In*: Gans and Huey (eds.), Biology of the Reptilia, Vol. 16, Ecology B. pp. 1–152. Alan R. Liss, New York); cases involving other insects are exceptional and occasionally remarkable (e.g., *Formica* ants; Graves 1989. Herpetol. Rev. 20:71). A group of students and one of us (ALM) observed predation upon a juvenile *Leptodeira annulata* (ca. 24 cm total length) by a carabid beetle (*Enceladus gigas* Bonelli, Tribe Siagonini; ca. 4 cm total length) at 2100 h on a blacktop road in northern Venezuela (Estado Guarico, 9 km ESE Paso Real) on 25 June 1997. The road traverses a xeric area with disturbed grassland and open bushy vegetational communities on gently rolling hills.

The snake had apparently just been captured when discovered as it was writhing rapidly and attempting to escape, and no exposed tissue or blood were evident at the site of the beetle's grasp, which was about 4 cm posterior to the snake's head. The snake did not attempt to bite the beetle. Within 1.5 min, the snake was immobilized, and its body was nearly severed at the point of attack, with lung tissue protruding from the incision (Fig. 1).

The freqency and significance of predation upon snakes by beetles are unknown. Larochelle (1990. The Food of Carabid Beetles [Coleoptera: Carabidae, including Cicindelinae], Fabreries, Suppl. 5, Association des Entmologistes Amateurs du

Quebec, Quebec. 132 pp.) compiled from the scientific literature a list of dietary items utilized by 1054 species of Carabidae, and snakes were absent. There is a detailed case of natural predation by a diving beetle larva (*Dytiscus*: Dytiscidae) upon a juvenile garter snake (*Thamnophis elegans*) reported by Drummond and Wolfe (1981, Coleopterists Bull. 35:121–124). This attack was similar to the one reported here in that both occurred near the snake's head, perhaps because it is a vulnerable area appropriate for a quick kill and/or to decrease the chance of being bitten by the snake.



FIG. 1. Juvenile *Leptodeira annulata* ca. 1.5 min. after capture by a carabid beetle (*Enceladus gigas*). The snake's body is almost completely severed at the site of the beetle's grasp.

Submitted by **ALLAN L. MARKEZICH**, Department of Natural Sciences and Engineering, Black Hawk College, Moline, Illinois 61265-5899, USA (e-mail: markezicha@bhc1.bhc.edu), and **PHILIP PARRILLO,** Insect Division, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Illinois 60605-2496, USA.

NERODIA ERYTHROGASTER (Plain-bellied Water Snake). **SIZE.** The record total lengths (SVL + tail length) for subspecies of *Nerodia erythrogaster* given in Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.) are 157.5 cm (*N. e. erythrogaster*), 149.9 cm (*N. e. flavigaster*), and 147.3 cm (*N. e. transversa*).

Here I report a female *N. e. flavigaster* (ALA 65-3860 in the Alabama Museum of Natural History) with a total length of 163.6 cm (131.9 cm SVL + 31.7 cm tail length). Approximately 1 cm of the tail is missing. The specimen is preserved in alcohol and was unable to be stretched in the manner of a live or freshly dead specimen. I captured this snake on the night of 16 April 1960, while it was swimming at Springhill Lake, Tuscaloosa Co., Alabama, USA. Accompanying me on the field trip were Gay M. Lake, Jr., Roy E. Smith, and William Gandrud. The specimen was preserved the following day by Shirley Whitt.

I thank Charles Lydeard (Curator of Herpetology, University of Alabama) for assistance in measuring the specimen. Michael E. Dorcas commented on the manuscript. Manuscript preparation was supported by Financial Assistance Award Number DE-FC09-96SR18546 from the U.S. Department of Energy to The University of Georgia Research Foundation.

Submitted by **J. WHITFIELD GIBBONS**, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

NERODIA FLORIDANA (Florida Green Watersnake). **REPRODUCTION**. Large broods of *Nerodia floridana* are not uncommon, averaging 20–30 offspring (Tennant 1997. A Field Guide to Snakes of Florida. Gulf Publishing Co., Houston, Texas. 257 pp.), with a record litter size of 101 reported from Polk Co., Florida (Telford 1948. Herpetologica 4:184).

On 6 July 1997, a *N. floridana* was found in Orlando, Orange County, Florida, USA (28°32' 56"N, 81°19'08"W), on the edge of Lake Barton in a residential yard. The resident, mistaking the snake for an *Agkistrodon piscivorus* (Florida cottonmouth), killed it with a shovel. On 10 July 1997, the resident called one of us (FMM) to retrieve the snake, which had been kept in a cooler of ice. The snake was in good condition except for a small wound ca. 20 cm from the cloaca. After further investigation, the snake was found to have been gravid and four fully-developed snakes were removed from the wound.

The specimen was kept in a freezer and later transferred to the Florida Museum of Natural History on 8 August 1997. Subsequent examination revealed that the snake contained an additional 128 fully developed embryos, of which only one showed any external deformities (the ventral side of this snake was folded on itself and fused for the anterior two-thirds of its length). Pertinent data for 128 embryos is: length (mean ± SD = 257 ± 13 mm; range = 170–280 mm); SVL (192 ± 10 mm; 125–211 mm); and mass (10.0 ± 1.3 g; 2.4–11.7 g). The adult female measured 175.0 cm total length (135.0 cm SVL) only 13.0 cm short of the record total length for this species (Conant and Collins 1991. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Female mass without embryos was 2835 g. The total mass of the embryos (1274 g) represents 45% of the adult's mass (without embryos). The adult and 128 offspring were deposited in the collection of the Florida Museum of Natural History at the University of Florida (UF 109763). The identification was verified by R. Franz of the Florida Museum of Natural History.

To our knowledge, this is the largest litter size (132) recorded for any member of the family Colubridae and second only to a record litter for all snakes of 156 for *Bitis arietans* (Branch 1978. The Snake 9:67–86)

We thank Nick Wray and Mike Talbot for assistance measuring and preserving this large brood. We also thank Dick Franz, Jonathan Campbell, and Ron Gutberlet for assistance in preparing this note.

Submitted by **KENNETH P. WRAY**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA, and **FLAVIO M. MORRISSIEY**, Curator of Zoological Services, 14501 South Orange Blossom Trail US 441, Gatorland, Orlando, Florida 32837, USA.

RHADINAEA BOGERTORUM (Oaxacan Graceful Brown Snake). **CLUTCH SIZE**. Despite extensive studies of reproduction in reptiles (Fitch 1970. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 52:1–247) and a monograph of the genus *Rhadinaea* (Myers 1974. Bull. Amer. Nat. Hist. 153:1–256), no data exist on reproduction in *Rhadinaea bogertorum*. Two gravid females were found in the Comaltepec municipality, Oaxaca, México. The first specimen (SVL 330 mm, tail length [TL] 88 mm, mass 10.4 g) was found on 31 March 1988 by Efraín Hernández and deposited in

Museo de Zoología Facultad de Ciencias (MZFC 4518), and the second specimen (SVL 348 mm, TL 126 mm, mass 18.5 g) was collected by Leo Schibli on 8 October 1994 and deposited in Colección de Herpetología del Instituto de Biología (IBH 11280). The first female had 9 non-vitellogenic follicles (volume [mean ± SE (range)] = 2.59 ± 0.47 mm^3 [0.58–5.43 mm^3]) and 2 oviductal eggs; mass = 0.325 ± 0.0135 g [0.312–0.339 g]). Relative clutch mass (RCM) was 0.069 g. The second female had 12 non-vitellogenic follicles (volume = 3.85 ± 0.81 [0.627–8.34 mm^3]), and 7 vitellogenic follicles (volume = 74.1 ± 5.87 [50.9–93.7 mm^3]). These data support the idea that species of *Rhadinaea* have a relatively small clutch size (Fitch 1970, *op. cit.*).

Submitted by **AURELIO RAMÍREZ-BAUTISTA**, and **MARIO MANCILLA MORENO**, Departamento de Zoología, Instituto de Biología, UNAM, A.P. 70-153, C. U., C.P. 04510, México 20, Distrito Federal, México.

THAMNOPHIS ELEGANS VAGRANS (Wandering Garter Snake). **DIET**. The diet of *Thamnophis elegans* has been extensively studied in many portions of its range (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman, Oklahoma. 332 pp., and references therein). On 31 July 1992 in the Jemez Mountains near Alamo Canyon, ca. 14 air km SW of Los Alamos (T18N R5E SE1/4 Sec. 9), Sandoval County, New Mexico, USA, CWP and MJA collected an adult *T. elegans* (279 mm SVL) that contained an adult Jemez Mountains salamander, *Plethodon neomexicanus* (ca. 59.8 mm SVL). The salamander was eaten tail first and the tail was completely digested up to the vent. These specimens are cataloged in the University of New Mexico Museum of Southwestern Biology as MSB 55407 (*T. elegans*) and MSB 55408 (*P. neomexicanus*).

On 20 July 1986 in the Sacramento Mountains, Water Canyon at the mouth of Telephone Canyon, ca 15.5 air km S of Cloudcroft (T17S R11E SE1/4 Sec. 24), Otero County, New Mexico, NJS and CWP collected an adult *T. elegans* (ca. 230 mm SVL) that contained an unidentified slug and a small Sacramento mountain salamander, *Aneides hardii* (30 mm SVL). The *T. elegans* is MSB 47339; the *A. hardii* was not cataloged. This is the first report of these New Mexico endemic plethodontid salamanders in the diet of *T. elegans*.

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, e-mail: cwpaint@unm.edu; **NORMAN J. SCOTT, Jr.**, U.S. Geological Survey, Piedras Blancas Research Station, P.O. Box 70, San Simeon, California 93452-0700, USA, e-mail: norman_scott@usgs.gov; and **MARILYN J. ALTENBACH**, New Mexico Natural Heritage Program, 851 University Blvd., Suite 101, Albuquerque, New Mexico 87131, USA; e-mail: altenbac@sevilleta.unm.edu.

UROTHECA (PLIOCERCUS) ELAPOIDES (False Coral Snake). **REPRODUCTION and DIEL ACTIVITY.** A female *Urotheca elapoides* (374 mm SVL) was collected on 12 January 1991 from Cuxta Bani, upper Raspaculo river, Maya Mountains, Belize, and deposited in The Natural History Museum, London (BMNH 1996.441). This snake was examined for signs of reproductive activity and found to contain five well-formed oviductal eggs. Egg sizes ranged from 18.5 x 6.5 mm to 21.5 x 8.0 mm, and averaged 20.2 x 7.5 mm.

Clutch size in this specimen falls within the range reported for *U. elapoides* (5–8 eggs) by Martin (1958. Misc. Publ. Mus. Zool. Univ. Michigan 101:1–102). The timing of reproduction, however, is unusual. Clutch deposition in specimens from Mexico (Greene 1969. J. Herpetol. 3:27–31; Martin, *op. cit.*) and El Salvador (Mertens 1952. Abh. Senckenb. Naturforsch. Ges. 487:1–120) has occurred during June–August, suggesting the summer wet season as the time of egg-laying in this species. The Belize snake was found gravid at the opposite time of year and, assuming that oviposition was imminent, the hatchlings would have almost certainly emerged during the local February–May dry season. This seems curious for a species that inhabits damp leaf litter and feeds largely on salamanders. Certain salamanders, however, may be reproductively active during the dry season; in neighboring El Petén, Guatemala, Duellman (1963. Univ. Kansas Mus. Nat. Hist. Publ. 15:205–249) found two species of salamanders (*Bolitoglossa doefleni* and *B. mulleri*) with eggs in February and March.

BMNH 1996.441 was found moving through wet leaf litter during the day (1530 h). Two other *U. elapoides* in Belize were observed foraging within a few m of each other on 26 May 1994 at 0800 h (vicinity of Ceibo Grande, Cayo District, pers. obs.), and there are two specimens from Toledo District in the Smithsonian collection (USNM 319776 and 319777; Union Camp, Columbia River Forest Reserve) also collected by day (5 and 7 April 1992). These observations concur with Smith and Chiszar's (1996. Species-Group Taxa of the False Coral Snake Genus *Pliocercus*. Ramus Publishing Inc., Pottsville, Pennsylvania. 112 pp.) assertion that *U. elapoides* is fundamentally diurnal in habits. Coincidental observations of the sympatric coral snakes *Micrurus diastema* and *M. hippocrepis* in Belize, which *Urotheca* appears to mimic, indicate that these species are also at least partly diurnal (pers. obs.).

The specimen was collected under authority of Ministry of Natural Resources (Belize) permits M/127/9/91(26) and 000159.

Submitted by **PETER J. STAFFORD**, Department of Botany, The Natural History Museum (BMNH), Cromwell Road, London SW7 5BD, UK.

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins 1997. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*. Fourth Edition. SSAR Herpetol. Circ. 25:1–40; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish.* Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al. 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology,* Copeia 1985[3]:802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen *only* when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large

turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*) to make sure you are not duplicating a previously published record.

Please submit any geographic distribution records in the **standard format only** to one of the Section Co-editors: Joseph T. Collins (USA & Canadian records only), Museum of Natural History—Dyche Hall, The University of Kansas, Lawrence, Kansas 66045–2454, USA; Jerry D. Johnson (México and Central America, including the Caribbean islands), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA; Hidetoshi Ota (all Old World records), Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-01, Japan; or Gustavo J. Scrocchi (South American records), Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina. Short manuscripts are strongly discouraged, and are only acceptable when data cannot be presented adequately in the standard format. **Submissions by e-mail are encouraged where possible**. Refer to inside front cover for e-mail addresses of section editors.

Recommended citation for new distribution records appearing in this section is: Marques, O. A. V., and G. Puorto. 1996. Geographic Distribution. *Chironius laevicollis*. Herpetol. Rev. 27:212.

CAUDATA

AMBYSTOMA TIGRINUM (Eastern Tiger Salamander). USA: WISCONSIN: MARQUETTE CO: 3.2 km W Wisconsin Rt. 22 on Co. Rt. J, ca. 8 km N Montello, SW1/4 of NW1/4 Sec. 17, T16N, R10E. 17 October 1998. William S. Brooks. MPM 30316. Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus. 1–87). Fills range gap ca. 15 km from nearest records mapped by Vogt (Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus. 205 pp.) and represents one of only seven localities for which records are available for Natural Division 4b, characterized by oak savanna, oak forest, and prairie; sandy loams; nearly level outwash plains and rolling moraine (Hole and Germain 1994, Natural Divisions of Wisconsin. Publ. Wisconsin Dept. Natural Res., Madison; Wisconsin Herp Atlas, Milwaukee Public Museum, unpubl. data). Lends credibility to only other reported observation in Marquette County by Lou Balaban from Sec. 11, T14N, R08E, in 1985 (Wisconsin Herp Atlas, *op. cit.*).

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA

NOTOPHTHALMUS PERSTRIATUS (Striped Newt). USA: GEORGIA: LIBERTY CO: Fort Stewart Military Reservation, ca. 5.4 air km NNE jct. Ga. Rt. 144/Fort Stewart Road 34 (ca. 1.4 km NW Bethel Cemetery), 31°59'02"N, 81°47'14"W. 10 January 1995. Aubrey E. Davis, Jr. SOCM 100. Verified by Robert A. Moulis. Adult dipnetted from 1.2 ha isolated cypress pond within longleaf pine (*Pinus palustris*)/wiregrass (*Aristida beyrichiana*) sandhill habitat. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712). Adults were also observed at this site on 10 February 1998 (3 females) and 21 May 1998 (1 male); larval striped newts were collected here 21 May 1998 (D. Stevenson, unpubl. data).

Submitted by **DIRK J. STEVENSON**, Directorate of Public Works, Fort Stewart Fish and Wildlife Branch, 1557 Frank Cochran Drive, Fort Stewart, Georgia 31314, USA, and **AUBREY E. DAVIS, JR.**, Jacksonville State University, Biology Department, 108 Ayers Hall, Jacksonville, Alabama 36265, USA.

PSEUDOEURYCEA SCANDENS (Tamaulipan False Brook Salamander). MÉXICO: QUERÉTARO: 3.5 km SW El Lobo, elev. ca. 1800 m. 6 August 1969. Madge R. Minton. Minton Herpetological Collection 1108; 8 km SW Pinal de Amoles, elev. ca. 2680 m. 7 August 1969. Madge and Sherman Minton. Minton Herpetological Collection 1110; ca. 3 km N Pinal de Amoles, elev. ca 2620 m. 1 August 1987. Sherman Minton. Color slides U223–U224, Indiana State Museum. Verified by Ernest A. Liner and James R. Dixon. First records for state of Querétaro. Extends range southward about 200 km.

Submitted by **SHERMAN A. MINTON**, 4840 East 77th Street, Indianapolis, Indiana 46250, USA.

ANURA

AGALYCHNIS CALCARIFER. HONDURAS: GRACIAS A DIOS: near Baltiltuk (15°51'N, 84°45'W) at edge of trail alongside Río Plátano, 30 m elev. 9 July 1992. G. A. Cruz Díaz. UNAH 2808. Verified by M. R. Espinal. First record for country; extends range ca. 540 airline km N Río San Juan, Departamento de Río San Juan, Nicaragua (Caldwell "1994" [1995], Herpetol. Nat. Hist. 2[2]:57–66).

Submitted by **GUSTAVO A. CRUZ DÍAZ**, Departamento de Biología, Universidad Nacional Autónoma de Honduras, Tegucigalpa, Francisco Morazán, Honduras, and **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.

CENTROLENE PROSOBLEPON. HONDURAS: OLANCHO: La Chorrera (15°00'N, 85°56'W), Sierra de Agalta, 1100 m elev. G. A. Cruz Díaz. UNAH 2570 (12 August 1991), UNAH 2613–15 (15 August 1991), UNAH 3041 (May 1992). All verified by M. R. Espinal. GRACIAS A DIOS: Baltiltuk (15°51'N, 84°45'W) along Río Plátano and a tributary, 30 m elev. G. A. Cruz Díaz. UNAH 3103-05 (11 August 1992), UNAH 3113 (14 August 1992). All verified by M. R. Espinal. First records for country with locality data; extend range ca. 210 airline km N and ca. 325 airline km NNE, respectively, of Selva Negra region, Departamento de Matagalpa, Nicaragua (Köhler 1998, Natur und Mus. 128:163–170).

Submitted by **GUSTAVO A. CRUZ DÍAZ**, Departamento de Biología, Universidad Nacional Autónoma de Honduras, Tegucigalpa, Francisco Morazán, Honduras, and **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). GEORGIA: CHATHAM CO: private residence on Screven Avenue (32°03'35"N, 84°47'50"W). 31 July 1998. Janet Habas. University of Georgia Museum of Natural History (UGAMNH 40135–37. Verified by M. E. McGhee. First state record for this exotic species. Eggs, froglets, and adults collected from outdoor flower pots.

Submitted by **BRADFORD WINN**, Georgia Department of Natural Resources, Nongame Endangered Wildlife Program, One Conservation Way, Brunswick, Georgia 31520, USA, and **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029,USA (e-mail: john_jensen@mail.dnr.state.ga.us), and **STEVE JOHNSON**, Department of Wildlife Ecology and Conservation, University of Florida, 303 Newins Ziegler Hall, Gainesville, Florida 32611-0430, USA (e-mail: tadpole@ufl.edu).

HYLA ANCEPS. BRAZIL: MINAS GERAIS: IPATINGA MUNICIPALITY: Fazenda Macedônia (19°28'S, 42°32'W, elev. 240 m). December 1992. L. B. Nascimento and T. A. M. Balstaedt. Museu de Ciéncias Naturais, Pontifícia Universidade Católica de Minas

Gerais (MCN-AM 1220–23). MARLIÉRIA MUNICIPALITY: Parque Estadual do Rio Doce (19°42'S, 42°36'W, elev. 536 m). November 1996. R. N. Feio. Museu de Zoologia João Moojen de Oliveira, Universidade Federal de ViÁosa (MZUFV 2767–68), and October 1997. R. N. Feio (MZUFV 3335–36). AIMORÉS MUNICIPALITY (19°29'S, 41°03'W, elev. 80 m). March 1997. L. B. Nascimento and M. A. V. N. Menezes (MCN-AM 1328–29). All verified by U. Caramaschi and J. P. Pombal, Jr. Published distribution of the species is the lowlands of the state of Rio de Janeiro (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.) and the state of Espírito Santo (Haddad et al. Herpetol. Rev. 26:207) in southeastern Brazil. First state record.

Submitted by **LUCIANA BARRETO NASCIMENTO**, Departamento de Ciéncias Biológicas, Pontifícia Universidade Católica de Minas Gerais, 30.535-610 Belo Horizonte, Minas Gerais, Brazil, and **RENATO NEVES FEIO**, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, 36.571-000 Viçosa, Minas Gerais, Brazil.

HYLA CINEREA (Green Treefrog) USA: TEXAS: LEE CO: 3 km (by road) NE jct. FM 1697 on Lee Co. Road 124 (30°19'04.8"N, 96°44'33.8"W). 12 September 1998. Toby J. Hibbitts and John H. Malone. TCWC 80499–500. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA and **JOHN H. MALONE**, Herpetological Independent Study Group, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

HYLA ELEGANS. BRAZIL: MINAS GERAIS: GUANHÃES MUNICIPALITY (18°46'S, 42°55'W, elev. 777 m). September 1992. L. B. Nascimento and T. A. M. Balstaedt. Museu de Ciéncias Naturais, Pontifícia Universidade Católica de Minas Gerais (MCN-AM 983–86). AIMORÉS MUNICIPALITY (19°29'S, 41°03'W, elev. 80 m). March 1997. L. B. Nascimento and M. A. V. N. Menezes (MCN-AM 1271–73). MARLIÉRIA MUNICIPALITY: Parque Estadual do Rio Doce (19°42'S, 42°36'W, elev. 536 m). October 1997. R. N. Feio, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa (MZUFV 3412–16). These localities are in the Atlantic Rain Forest Domain. CAETÉ MUNICIPALITY: Lagoa do Cabral (20°00'S, 43°40'W, elev. 945 m). November 1991. L. B. Nascimento and R. N. Feio (MCN-AM 784–85). SÃO GONÇALO DO RIO ABAIXO MUNICIPALITY: Estação Proteção e Desenvolvimento Ambiental de Peti (19°49'S, 43°21'W, elev. 627 m). December 1989. L. B. Nascimento (MCN-AM 235). MARIANA MUNICIPALITY (20°22'S, 43°24'W, elev. 712 m). January 1993. R. N. Feio (MZUFV 913, 915, 917). These localities are in the trasition Atlantic Forest—Cerrado Domains. ARAÇUAÍ MUNICIPALITY (16°50'S, 42°04'W, elev. 307 m). May 1990. L. B. Nascimento and J. B. Isaac Jr. (MCN-AM 380). This locality is in the Caatinga Domain. All verified by U. Caramaschi and J. P. Pombal, Jr. Published distribution for the species is Atlantic forests from Bahia to the state of São Paulo, Brazil (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.) from sea level to an elev. of 800 m (Lutz 1973, Brazilian Species of *Hyla*. Univ. Texas Press. 260 pp.). First record for state of Minas Gerais.

Submitted by **LUCIANA BARRETO NASCIMENTO**, Departamento de Ciéncias Biológicas, Pontifícia Universidade Católica de Minas Gerais, 30.535-610 Belo Horizonte, Minas Gerais, Brazil, and **RENATO NEVES FEIO**, Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, 36.571-000 Viçosa, Minas Gerais, Brazil.

LITHODYTES LINEATUS (Sapito Lineado). VENEZUELA: ESTADO TÁCHIRA: Las Cuevas, Valle del Río Doradas, 550 m elev. J. Péfaur and R. Pérez. 14 February 1985. Colección de Vertebrados, Facultad de Ciencias, Universidad de los Andes, Mérida, Venezuela (CVULA IV-3652). Constitutes the only record in the country outside of the Guianan Shield in the states of Amazonas and Bolivar; more than 850 km to the NW of a nearer record in Venezuela, the High River Cunucunuma (Ginés 1959, Mem. Soc, Cien. Nat. La Salle 19[53]:85–146.). Lynch (1979. *In* W. E. Duellman (ed.). The South American Herpetofauna: Its Origin, Evolution and Dispersal, pp. 189–215. Mus. Nat. Hist. Univ. Kansas Monogr. No. 7.) showed a general distribution map for the species, where localities of the Andean piedmont are noted in Peru, Ecuador, and Colombia. First report for the Estado Táchira and for western Venezuela. Río Doradas valley constitutes the only place in the western region of the country with the presence of Amazonian elements.

Submitted by **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

ODONTOPHRYNUS AMERICANUS (Common Lesser Escuerzo). ARGENTINA: CORDOBA: Barreto (63°18'20"W, 33°20'43"S), Km 148, Ruta provincial N°4, 153 m. A. L. Martino. Laboratorio de Ecología, Facultad de Ciencias Exactas Físico-Químicas y Naturales, Universidad Nacional de Río Cuarto, Argentina (UNRC-ECO 609–612, 1 December 1998; UNRC-ECO 627–628, 15 October 1992; and UNRC-ECO 629–630, 15 October 1993). All verified by R. Martori. Males SVL 45–47 mm; females 35–36 mm. Males were calling in temporary pond; females were captured using pit traps.

Submitted by **ADOLFO L. MARTINO**, **NANCY E. SALAS**, and **ISMAEL E. DI TADA**, Ecología, Departamento de Ciencias Naturales, Facultad de Ciencias Exactas, Físico-Químicas y Naturales, Universidad Nacional de Río Cuarto, Km 601, Ruta Nacional N°36, (5800) Río Cuarto, Córdoba, Argentina (e-mail [ALM]: amartino@exa.unrc.edu.ar).

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog) USA: FLORIDA: VOLUSIA CO: New Smyrna Beach, Bouchelle Island on N side of S causway (Rt. A1A). 13 August 1996. UF 115254. Verified by Arthur C. Echternacht. New county record; extends the northern range of this non-native species on the E coast of Florida by ca. 120 km from a coastal Brevard County record (Meshaka 1996, Herpetol. Rev. 27:37–40), and ca. 40 km NE of four unpublished museum records from Seminole County near Sanford in 1993 (UF 87341–44; David Auth, pers. comm.). One male was collected from the crotch of a cabbage palm leaf (Sabal palmetto) on the E shore of the island. Three others (two males, one female) were observed in palms on the island, which is being developed as a residential community. During summer 1996 and 1997, isolated males were occasionally heard calling at night in and around New Smyrna Beach, a quaint coastal town with rapidly increasing residential and commercial development. As indicated by Meshaka (*op. cit.*), the use of imported palms and other landscaping plants from south Florida will likely result in the establishment of additional breeding populations in this county and additional north Florida counties.

Submitted by **TODD CAMPBELL**, Department of Ecology and Evolutionary Biology, 569 Dabney Hall, University of Ten-

nessee, Knoxville, Tennessee 37996, USA (e-mail: lizardman@utk.edu).

PSEUDACRIS CLARKII (Spotted Chorus Frog) USA: TEXAS: FREESTONE CO: Richland Creek Wildlife Management Area, North Unit, near Jct US Rt. 287 and FM 488. 16 March 1998. Toby J. Hibbitts. TCWC 80124. Verified by James R. Dixon. Specimen collected during biodiversity inventory conducted on the Richland Creek WMA. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

SYNAPTURANUS MIRANDARIBEIROI (Sapito Apuntado de Miranda Ribeiro). VENEZUELA: ESTADO BOLÍVAR. East slopes of Cerro Santa Rosa, Serranía del Supamo (06°37'N, 62°27'W). Jun 1990. F. Mendoza. Museo de Ciencias Naturales, Caracas, (MCNC 8080). Verified by O. Fuentes. First country record and the northernmost for the species. Reported by Nelson and Lescure (1975. Herpetologica 31:389–397) from some localities in Guyana, French Guyana, Surinam, and Brazil, and by Pyburn (1975. Herpetologica 31:439-443) from SE Colombia.

Submitted by **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apto Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve) and **CHARLES BREWER-CARÍAS**, P.O. Box 90214 El Hatillo, 1083-A Caracas, Venezuela (e-mail: brewerch@ven.net).

SYRRHOPHUS CYSTIGNATHOIDES (Rio Grande Chirping Frog). USA: TEXAS: WALKER CO: Huntsville. 16, 19, 22 April 1998. New county record from three new localities; extends geographic range ca. 120.8 km N Houston (Harris County). Frogs were found in rocky refuges within small intermittent streams (Localities: 30°42'11"N, 95°31'59"W; 30°42'14"N, 95°33'1"W; and 30°42'53"N, 95°33'7"W). Sam Houston State Vertebrate Museum (SHSVM 0001-98, 0002-98, and 0003-98). Specimens verified by J. P. Caldwell, R. D. Durtsche, and L. J. Vitt.

Submitted by **WILLIAM I. LUTTERSCHMIDT** and **MONTE L. THIES**, Department of Biological Sciences, Sam Houston State University, Huntsville, Texas 77341, USA.

TESTUDINES

APALONE FEROX (Florida Softshell). USA: GEORGIA: LIBERTY CO: Fort Stewart Military Reservation: Fort Stewart Road 129, 3.2 km NW jct. with Georgia Rt. 119. 12 June 1998. Brian J. Platt, Mark Bradford. SOCM 1319 (photo). Verified by Robert A. Moulis. Adult found AOR crossing road near unnamed blackwater stream (tributary of Canoochee Creek). New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **DIRK J. STEVENSON** and **BRIAN J. PLATT**, Directorate of Public Works, Fort Stewart Fish and Wildlife Branch, 1557 Frank Cochran Drive, Fort Stewart, Georgia 31314, USA.

EMYDOIDEA BLANDINGII (Blanding's Turtle). USA: ILLINOIS: JASPER CO: Prairie Ridge State Natural Area. 187 m south of Co. Rd. 500N and 248 m west of Co. Rd. 1000E (NE 1/4, SW 1/4, Sec. 34, T6N, R9E). 4 May 1998. W. E. Louis. Illinois Natural History Survey (INHS photo vouchers 1998-10 and 1998-11). Verified by M. J. Dreslik. Recently added to the Illinois threatened species list; new county record, extending the historical Illinois range south (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. His. Surv. Bull. 298 pp.).

Submitted by **DANIEL J. OLSON** and **WADE E. LOUIS**, Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, Illinois 61801, USA.

GEOCHELONE CARBONARIA (Red-footed Tortoise). BRAZIL: PARÁ: Ilha do Marajó, Anajás (01°07'24.9"S, 49°34' 45.3" W). 22 January 1998. T. L. Pinto. Verified by U. Galatti. Museu Paraense Emílio Goeldi (MPEG 277). First record of this species on Marajó Island in the Amazonia region (Nascimento, Ávila Pires, Santos and Lima 1991, Bol. Mus. Para. Emílio Goeldi, sér. Zool. Belém 7:25–41; Pritchard and Trebbau 1984, The Turtles of Venezuela. Publ. SSAR, Miami University, Oxford, Ohio. 403 pp.).

Submitted by **GABRIEL SILVA PINTO**, Museu Paraense Emílio Goeldi, Departamento de Zoologia, Caixa Postal 399, Belém, Pará, Brazil, and **RUBENS NOBUO YUKI**, Faculdades Integradas do Tapajós, Rua Rosa Vermelha, 335, Aeroporto Velho, Santarém Pará, CEP: 68010-200, Brazil.

STERNOTHERUS ODORATUS (Common Musk Turtle). USA: ILLINOIS: JASPER CO: Prairie Ridge State Natural Area. 210 meters south of Co. Rd 500N and 274 meters west of Co. Rd. 1000E (NE 1/4, SW 1/4, Sec. 34, T6N, R9E). 18 May 1998. D. J. Olson. Illinois Natural History Survey (INHS Photo vouchers 1998-12 and 1998-13). Verified by M. J. Dreslik. New county record; fills in the expected distribution (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. His. Surv. Bull. 298 pp.).

Submitted by **DANIEL J. OLSON**, Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, Illinois 61801, USA.

LACERTILIA

ANOLIS DISTICHUS (Bark Anole). USA: FLORIDA: BROWARD CO: Plantation. 11 July 1998. A. T. Reppas, K. L. Krysko, C. L. Sonberg, and R. H. Robins. Florida Museum of Natural History, University of Florida (UF 114327–329). Verified by F. Wayne King. New county record; indicates this non-indigenous species is expanding its range northward.

Submitted by **ANTHONY T. REPPAS**, Department of Interdisciplinary Studies and Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA, **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation and Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (e-mail: kenneyk@flmnh.ufl.edu), **CARYN L. SONBERG**, Department of Education, University of Florida, Gainesville, Florida 32611, USA, and **R. H. ROBINS**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA (e-mail: rhrobins@flmnh.ufl.edu).

ELGARIA COERULEA (Northern Alligator Lizard). USA: NEVADA: DOUGLAS CO: Humboldt-Toiyabe National Forest, Spooner Summit, Rt. 50, unnamed National Forest Service road near a maintenance station, adult DOR with a broken tail (39°05'58"N, 119°54'25W), 2133 m elev. 12 November 1990. H. R. Panik. UNR 6949; Montreal Canyon, Humboldt-Toiyabe National Forest, ca. 0.4 km E on unnamed National Forest Service road, 1.3 km W jct. Rts. 28 and 50 (39°05'12"N, 119°54'12"W) 2152 m elev. Adult male found under a small cross-section of a pine log along a S-

facing slope in an aspen/pine forest. 12 August 1998. R. E. Espinoza, C. A. Carreño, A. R. Henderson, and R. W. Van Heest. UNR 6950. Both verified by J. Vindum. New county records; extends the range ca. 4.4 km SW (airline) from the closest reported locality at Clear Creek, Carson City (Vindum and Arnold 1997, Herpetol. Rev. 28:100). The database of the Nevada Natural Heritage Program also contains an unvouchered record for *E. coerulea* from a residential area in the city of Sparks (Washoe County, Nevada). Given the distance from other known populations in Nevada (e.g., 49.3 km NNE of Clear Creek), the lack of chief habitat requirements (Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Houghton Mifflin, Boston, Massachusetts. 336 pp.), and the absence of records for this species from this densely populated area, we suspect the Sparks record is the result of a released or escaped individual rather than a naturally occurring population.

Submitted by **ROBERT E. ESPINOZA**, Biological Resources Research Center, and Ecology, Evolution and Conservation Biology, MS 314, University of Nevada, Reno, Reno, Nevada 89557, USA, **CARRIE A. CARREÑO**, Nevada Natural Heritage Program, 1550 East College Parkway, Suite 145, Carson City, Nevada 89706-7921, USA, and **RONALD W. VAN HEEST**, Biological Resources Research Center, University of Nevada, Reno, Reno, Nevada 89557, USA.

ENYALIOIDES HETEROLEPIS. PANAMÁ: PROVINCIA DE COCLÉ: Parque Nacional Omar Torrijos H., ca. 10 km N El Copé, headwaters of Río Guaybal, behind main park refugio on dirt road, ca. 600 m elev. 14 January 1998. Karen R. Lips. Fluid Vertebrate Collection, Southern Illinois University, SIUC R-3140 (photo). Verified by Robert Ibañez and Cesar Jaramillo. Adult male captured at night while sleeping on 1 m high stump along riverbank. Second capture was of juvenile sleeping ca. 1.5m over ground on sapling along trail ca. 100 m above same stream on 6 June 1998. New locality extends geographic range ca. 110 km west from Parque Nacional Soberanía, Panamá (Nicholson 1998, Herpetol. Rev. 29:174). New province record.

Submitted by **KAREN R. LIPS**, Department of Zoology, Southern Illinois University, Carbondale, Illinois, 62901-6501, USA.

EUMECES EGREGIUS SIMILIS (Northern Mole Skink). USA: GEORGIA: Candler Co: R. G. Daniels Preserve (The Nature Conservancy), ca. 5.8 km SE Metter. 8 March 1997. Dirk J. Stevenson and Beth A. Willis. SOCM 304. Verified by Robert A. Moulis. Adult found under debris in longleaf pine (*Pinus palustris*)/turkey oak (*Quercus laevis*)/wiregrass (*Aristida beyrichiana*) sandhill. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **DIRK J. STEVENSON** and **BETH A. WILLIS**, Directorate of Public Works, Fort Stewart Fish and Wildlife Branch, 1557 Frank Cochran Drive, Fort Stewart, Georgia 31314, USA.

EUMECES GILBERTI RUBRICAUDATUS (Western Redtail Skink). USA: NEVADA: Nye Co: Nevada Test Site, Midway Valley on the E flank of Yucca Mountain, ca. 1130 m elev. (36°50'20"N; 116°26'15"W). 24 May 1995. C. L. Sowell and A. M. Ambos. BYU 46485. Verified by Jack W. Sites, Jr. Adult male (SVL = 79; TL = 120; 10.5 g); fills a distributional gap between Pahute Mesa (Medica et al. 1990, Herpetol. Rev. 21:40) and Grapevine Peak (Rogers and Fitch 1947, Univ. California Publ. Zool. 48:169–220). Specimen was collected in creosotebush (*Larrea tridentata*) bajada habitat which was drier and lower in elevation than would be expected for the species in this region (Banta 1962, Herpetologica 18:129–130). This was the only *E. gilberti* captured in this area during 6336 trap-days (24 h/d) of pitfall and funnel trapping and ca. 1000 person-days (4 h/d) of noosing conducted from 1991 to 1995.

Submitted by **JAMES L. BOONE** and **CHRIS L. SOWELL**, SAIC, 1261 Town Center Drive, Las Vegas, Nevada 89134, USA.

EUMECES TETRAGRAMMUS (Four-lined Skink). USA: ARIZONA: Cochise Co: Peloncillo Mountains, S Fork Skeleton Canyon, 1649 m elev. (31°31.41'N, 109°03.75'W). 9 August 1998. Andreas Noellert. Arizona State University (ASU 30936). Verified by Joseph T. Collins. First specimen from Arizona side of mountain range. (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. 431 pp.).

Submitted by **ANDY HOLYCROSS** and **BRIAN FEDORKO**, Biology Department, Arizona State University, Tempe, Arizona 85287-1501.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: FLORIDA: Levy Co: Cedar Key, concrete block wall of the public restroom at the City Park adjacent to the Cedar Cove Hotel, NW1/4 Sec. 32, T15S, R13E. 26 August 1997. Ryan C. Means and Guy H. Means. Florida Museum of Natural History, Gainesville, Florida (UF 112976). Verified by David Auth. Populations are known from Apalachicola in the Florida panhandle (Means 1996, Herpetol. Rev. 27:152) and Tampa in peninsular Florida (Nelson and Carey 1993, Northeast Gulf Sci. 13:53–58). New county record; helps close the gap in the Floridian Gulf Coastal distribution of this species.

Submitted by **RYAN C. MEANS**, Coastal Plains Institute and Land Conservancy, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

LEPIDODACTYLUS LUGUBRIS (Mourning Gecko). MALDIVES: SOUTH MALE ATOLL: Vadoo (4°07'N, 73°27'E). 6 September 1998. Akira Kikukawa. Zoological Collection of Kyoto University (KUZ 47850). Verified by Hidetoshi Ota. First record for the Maldive Islands. Fills the distributional gap between India (Das 1996, Biogeography of the Reptiles of South Asia. Krieger Publ., Malabar, Florida) and the Chagos Archipelago (Barnett and Emms 1997, British Herpetol. Soc. Bull. 59:6–12). A few other individuals were also observed. Species appears to be rare compared to *Hemidactylus frenatus,* which is already known from the Maldives (Moutou 1985, C. R. Soc. Biogeogr. 61:101–109).

Submitted by **AKIRA KIKUKAWA**, Vadoo Diving Paradise, South Male Atoll, P.O. Box 20159, Republic of Maldives.

LEPOSOMA OSVALDOI. BRAZIL: AMAZONAS: Município de Borba, Santa Bárbara, left bank of Rio Canumó. 9 June 1994. M. S. Hoogmoed. MPEG 16965. Verified by Rubens Nobuo Yuki. First record for the state of Amazonas. Previously known only in the state of Rondónia (Ávila-Pires 1995, Lizards of Brazilian Amazonia [Reptilia: Squamata]. Zoologische Verhandelingen 299:1–706).

Submitted by **GABRIEL SILVA PINTO**, Museu Paraense Emílio Goeldi, Departamento de Zoologia—DZO, Caixa Postal 399, CEP 66040-170, Belém, Pará, Brazil.

PODARCIS ERHARDII (Erhard's Wall Lizard) EUROPE: GREECE: DODECANECE: Pergousa (36°35'E, 27°02'N) and Pachia (36°34'E, 27°04'N) islets west of Nisyros Island. 19 February 1993. Collected by the authors. Museum of Natural His-

tory, University of Crete, Greece, MNHUC E98–E103 (Pergousa) and MNHUC E118–E124 (Pachia). Verified by B. Chondropoulos. First observation of *Podarcis erhardii* east of Middle Aegean Gap. Nearby islands of Nisyros and Gyali, although in close proximity, are characterized by an eastern herpetofauna, where *P. erhardii* is replaced by *Ophisops elegans*.

Submitted by **EFSTRATIOS D. VALAKOS** and **PANAGIOTA MARAGOU**, University of Athens, Department of Biology, Section of Animal & Human Physiology, GR-15784 Panepistimioupolis, Athens, Greece, and **MOYSIS MYLONAS** University of Crete, Department of Biology, P.O. Box 1470, GR 711 10 Iraklio, Greece.

SERPENTES

ATRACTUS TORQUATUS. (Culebra Terrera Roja; Red Burrowing Snake). VENEZUELA: ESTADO BOLÍVAR: Cerro Santa Rosa, 100 km SSE El Manteco, 300 m elev. June 1994. F. García. Museo de Ciencias Naturales, Caracas (MCNC-8034). Verified by L. F. Navarrete. Species was reported for the first time in Venezuela by McDiarmid and Paolillo (1988. *In* Brewer-Carías 1988, Cerro de la Neblina, Resultados de la Expedición 1983–1987. FUDECI, Caracas) from the lower Baría River at the S edge of the country in the state of Amazonas, and noted that the specimen was to be housed in the American Museum of Natural History of New York (no catalogue number given). We report here the first vouchered specimen of this species deposited in a Venezuelan museum, constituting the first locality in the state of Bolivar and extending the distribution of this taxon in the country 800 km to the NE. The presence of this snake in Venezuela is not surprising, as it is distributed through all north Amazonian countries (Hoogmoed 1980, Zool. Verhan., Leiden 175:1–47; Martins and Oliveira 1993, Zool. Meded. Leiden 67[2]:21–40).

Submitted by **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve), **CHARLES BREWER-CARÍAS**, P.O. Box 90214, El Hatillo, 1083-A Caracas, Venezuela (e-mail: brewerch@ven.net), and **OSWALDO FUENTES**, Instituto de Medicina Tropical-Serpentarium. Apartado Postal 47423, Caracas 1041, Venezuela (e-mail: ofuentes@tyto.ciens.ucv.ve).

BOTHROPS MOOJENI (Brazilian Lancehead). PARAGUAY: DEPARTAMENTO CANINDEYU: Reserva Natural del Bosque de Mbaracayú, "Caseta Lagunita," 24°08'04"S, 55°25'38"W. 6 April 1995. E. Buongermini P., R. Palacios, and U. Svensson. Museo Nacional de Historia Natural del Paraguay (MNHNP 6831). Verified by Marta Motte. First confirmed record for the Oriental Region of Paraguay. One male collected in an abandoned house. Species was mentioned as of probable occurrence in eastern Paraguay based on a photograph (Campbell and Lamar 1989, The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp).

Submitted by **EMILIO BUONGERMINI P.**, Museo Nacional de Historia Natural del Paraguay, Sección de Herpetología, Caballero 1060, Asunción, Paraguay, CP 1324 (e-mail: subtropy@infonet.com.py) and **TOMAS WALLER**, Zavalía 2090 3°B, Buenos Aires, Argentina, CP 1428.

DENDROPHIDION DENDROPHIS. BRAZIL: ALAGOAS: Maceió (9°40'S, 35°43'W), Rio Largo (9°30'S, 35°50'W) and Muricí (9°14'S, 35°48'W) in small patches of Atlantic Forest. February 1993–September 1995. E. M. X. Freire. Museu de História Natural, Universidade Federal de Alagoas (MUFAL 327, 429, 1779, 2060, 2245). Verified by R. Fernandes. First record for the northeastern region of Brazil; extends range ca. 1500 km SE of Belém, Pará, Brazil (Cunha and Nascimento 1978, Publ. Avuls. Mus. Par. Emélio Goeldi 31:67–68).

Submitted by **ELIZA MARIA XAVIER FREIRE**, Departamento de Zoologia e Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade, 452, Maceió, Alagoas, 57021-090, Brazil, and Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

ELAPHE GUTTATA (Corn Snake). USA: TEXAS: Lee Co: 6.4 km (by road) SW jct. Co. Rd. 123 and FM 141 on FM 141. 17 October 1998. John H. Malone. TCWC 81639. Verified by James R. Dixon. County record; fills distribution gap between Bastrop and Burleson counties. (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp; Dixon 1996, Ten year supplement to Texas herpetological county records published in Amphibians and Reptiles of Texas, 1987. Texas Herpetol. Soc. Spec. Publ. No. 2).

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA, and **THAD J. WILLIAMS**, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA.

ERYTHROLAMPRUS PSEUDOCORALLUS. (Falsa Coral de Maracaibo, Maracaibo's False Coral Snake). VENEZUELA: ESTADO AMAZONAS: Gavilán, a small indigenous village 30 km ENE of Puerto Ayacucho. 3 January 1990. Collected by Piaroa Indians. Museo de Ciencias Naturales, Caracas (MCNC 7676). Verified by O. Álvarez. *Erythrolamprus pseudocorallus* had been recorded previously in the Maracaibo Basin in the states of Zulia and Merida, and was thought to be endemic to this region (Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela. Ediciones de la Biblioteca, Universidad Central de Venezuela Caracas. 360 pp.). First report of the species outside of the Maracaibo Basin, about 600 km to the SE; demonstrates a much wider distribution in the country and that the endemicity of the species is invalid for the Maracaibo Basin. Rodríguez-Acosta and Fuentes (1995–96 Terra 11–12[20–21]:77–84) mention the presence of this species in Amazonas, but without further explanation.

Submitted by **OSWALDO FUENTES,** Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041, Venezuela (e-mail: ofuentes@tyto.ciens.ucv.ve) and **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI. Apto Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

FARANCIA ABACURA REINWARDTII (Western Mud Snake). USA: TEXAS: Fort Bend Co: Brazos Bend State Park, 26.1 km (by air) ESE Rosenberg. 19 September 1998. John H. Malone. TCWC 81641. Verified by James R. Dixon. First live specimen documented from Fort Bend Co. (previous record was based on a fossil specimen; Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp; Dixon 1996, Ten year supplement to Texas herpetological county records published in Amphibians and Reptiles of Texas, 1987. Texas Herpetol. Soc. Spec. Publ. No. 2). Specimen collected under the authority of State Park Scientific Study Permit 60-98.

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas A&M University, Department of Wild-

life and Fisheries Sciences, College Station, Texas 77843, USA, **DAVID HEINICKE**, Brazos Bend State Park, 21901 FM 762, Needville, Texas 77461, USA, and **DON WINSOR**, Brazos Bend State Park Volunteer Organization, Brazos Bend State Park, 21901 FM 762, Needville, Texas 77461, USA.

HETERODON SIMUS (Southern Hognose Snake). USA: GEORGIA: TATTNALL CO: Big Hammock Natural Area Preserve (Georgia Department of Natural Resources), ca. 6.9 km SSW Five Points. 2 August 1998. Dirk J. Stevenson. SOCM 1321A-1321D (photos). Verified by Robert A. Moulis. Male (SVL 322 mm, TL 403 mm) found in xeric longleaf pine (*Pinus palustris*)/turkey oak (*Quercus laevis*) sandhill habitat. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712).

Submitted by **DIRK J. STEVENSON**, Directorate of Public Works, Fort Stewart Fish and Wildlife Branch, 1557 Frank Cochran Drive, Fort Stewart, Georgia 31314, USA.

HYDRODYNASTES GIGAS (Surucucu do Pantanal). BRAZIL: RONDÔNIA: MUNICIPALITY OF PIMENTA BUENO: Asa Branca Farm (ca. 11°46'S, 61°20'W). November 1993. P. Jochen. Museu de História Natural Capão da Imbuia, Curitiba (MHNCI 7083). Verified by S. A. A. Morato. Dry skin; nearly 300 cm TL. First record for the state of Rondônia (Jorge-da-Silva 1993, Herpetol. Nat. Hist. 1:37–86). Extends range to NW Brazil. Specimen is the maximum size reported for the species (Dowling and Gibson 1970, Herpetol. Rev. 2:37–38).

Submitted by **PAULO SÉRGIO BERNARDE** and **JULIO CESAR DE MOURA-LEITE**, Curso de Pós-Graduação em Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil, and Laboratório de Herpetologia, Museu de História Natural Capão da Imbuia, Depto. De Zoológico (SMMA/PMC), Rua Prof. Benedito Conceição, 407-82810-080 Curitiba, Paraná, Brazil.

LAMPROPELTIS TRIANGULUM CELAENOPS (New Mexico Milk Snake) USA: TEXAS: WINKLER CO: DOR, 17.5 km (by road) E Kermit on Texas Rt. 302 (31°52'41.9"N, 102°55'19.6"W). 6 August 1998. Toby J. Hibbitts. TCWC 80002. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

LEPTOTYPHLOPS DULCIS DULCIS (Texas Blind Snake) USA: TEXAS: LA SALLE CO: 1.3 km (by road) S jct. Texas Rt. 72 on Texas Rt. 97 (28°29'10.4"N, 98°48'10.8"W). 16 August 1998. Toby J. Hibbitts. TCWC 79977. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

LIOPHIS MARYELLENAE. BRAZIL: BAHIA: Ibicoara (13°25'S, 41°17'W). 18 February 1989. Collected at nightfall while moving on the top of a "campo rupestre" (savanna of altitude rocky field). CZGB 568; Iramaia (13°18'S, 41°17'W). 21 February 1989. CZGB 570. Both collected by António J. S. Argôlo, Binael Santos, and Robson Nunes; both verified by Ronaldo Fernandes. These localities are situated between 600 m and 1040 m elevation; extends range over 500 km E from the unique previous record in the state of Bahia (Dixon 1985, Proc. Biol. Soc. Washington 98[2]:299.).

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil, and Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilhéus-Itabuna, CEP 45600-000, Ilhéus, Bahia, Brazil.

LIOPHIS POECILOGYRUS. VENEZUELA: ESTADO BOLÍVAR: El Palmar, 60 km E Upata. 1 February 1994. A. Hernández. Museo de Ciencias Naturales, Caracas (MCNC 8036). Verified by D. Briceño; Estación CVG Los Pijiguaos. February 1998. L. Andreani. (MCNC 7893). Verified by L. F. Navarrete. Sabanas de El Manteco, 20 km S El Manteco. March 1995. A. Hernández. (MCNC 8036). Verified by L. F. Navarrete. Dixon (1989 Smithsonian Herpetol. Infor. Serv. 79) pointed out the presence of this species in Venezuela. Dixon and Markezich (1992 Texas J. Sci. 44:131–166) clearly indicated the presence of this taxon in the state of Bolivar, Venezuela on their map (p. 136, two localities), but they did not mention vouchered specimens. We herein provide the first vouchers with precise localities in Venezuela.

Submitted by **OSWALDO FUENTES**, Instituto de Medicina Tropical-Serpentarium, Apartado Postal 47423, Caracas 1041, Venezuela (e-mail: ofuentes@tyto.ciens.ucv.ve) and **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

LIOPHIS SAGITTIFER MODESTUS. ARGENTINA: SANTA FE PROVINCE: Vera Department: Margarita (29°42'S; 60°13'W). 21 November 1972. A. Barrio. Herpetological collection of former Centro Nacional de Iología, now located in the Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina (CENAI 3299, a male 268 mm SVL, 87 mm TL). Verified by G. Couturier. First record for Santa Fe province, extends range ca. 250 km air line E from nearest known population in Santiago del Estero province (Cei 1993, Mus. Reg. Sci. Nat. Torino Monogr. 14:609–610; Dixon 1989, Smithsonian Herpetol. Infor. Serv. 79:22–23; Dixon and Thomas 1982, Herpetologica 38:389–395).

Submitted by **VANESA ARZAMENDIA** and **ALEJANDRO R. GIRAUDO**, FAFODOC, Universidad Nacional del Litoral and Instituto Nacional de Limnología, INALI, CONICET, José Macia 1933, 3016 Santo Tomé, Santa Fe, Argentina

MASTICOPHIS BILINEATUS (Sonoran Whipsnake) USA: NEW MEXICO: CATRON CO: DOR, S side of Pleasanton on US Rt. 180 (33°17'03.1"N, 108°52'41.5"W). 4 August 1998. Toby J. Hibbitts and Terry L. Hibbitts. TCWC 80000. Verified by James R. Dixon. This record extends the range ca. 54 km ENE of Eagle Creek, Greenlee County, Arizona (CM 71184, 70746). Another record exists from the Gila River, Greenlee County, Arizona (CM 71425). This record may be closer to the specimen that we collected, but the data are not precise enough to determine the exact locality (Camper and Dixon 1994, Ann. Carnegie Mus. 63[1]:1–48.). In New Mexico, this species was previously known only from western Hidalgo County (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico, Univ. New Mexico Press, Albuquerque. xix + 431 pp.)

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA and **TERRY L. HIBBITTS,** 602 Hilltop Circle, Wylie, Texas 75098, USA.

OXYRHOPUS FORMOSUS. VENEZUELA: ESTADO BOLÍVAR: Javillal, Río Caura. 5 October 1993. Colected by Panare indians. Museo de Ciencias Naturales, Caracas (MCNC-8035). Verified by O. Fuentes. Species has a wide distribution in South America east of the Andes and north of 20°S latitude (Peters and Orejas-Miranda 1986, Catalogue of Neotropical Squamata. Part I. Snakes. Smithsonian Inst. Press, Washington). First citation of the species in Venezuela was by McDiarmid and Paolillo (1988. *In* Brewer Carías (ed.), Cerro de la Neblina, Resultados de la Expedición 1983–1987. FUDECI, Caracas) from Río Baría, Estado Amazonas. Our example was found 750 km NNE of the previous known locality and provides evidence that the distribution of *Oxyrhopus formosus* in Venezuela includes all lowlands of the Guianan Shield.

Submitted by **RENATO MATTEI** and **CÉSAR LUIS BARRIO**, Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales, FUDECI, Apartado Postal 185, Caracas 1010-A, Venezuela (e-mail: fudeci@reacciun.ve).

OXYRHOPUS GUIBEI (False Coral Snake). BRAZIL: ALAGOAS: Muricí (9°14'S, 35°48'W) and Rio Largo (9°30'S, 35°50'W) in small patches of Atlantic Forest. September–October 1995. E. M. X. Freire. Museu de História Natural, Universidade Federal de Alagoas (MUFAL 1390, 1561, 1825), and Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ 6724–25). Verified by U. Caramaschi. First record for the Northeastern Region of Brazil; extends range ca. 1000 km NE of Minas Gerais, Brazil (Zaher and Caramaschi 1992, Bull. Mus. natl. Hist. nat. 4, Sér. 14:805–827).

Submitted by **ELIZA MARIA XAVIER FREIRE**, Departamento de Zoologia e Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade, 452, Maceió, Alagoas, 57021-090, Brazil, and Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

PHILODRYAS BARONI (Baron's Racer). ARGENTINA: SANTA FE PROVINCE: 9 de Julio Department: Pozo Borrado (28°56'S, 61°44'W). 19 February 1969. M. Mendoza. Herpetological collection of former Centro Nacional de Iología, now located in the Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina (CENAI 2762, a female 1230 mm SVL). Verified by A. Giraudo. First record for Santa Fe province; extends range ca. 150 km airline E from nearest known population in Santiago del Estero province (Cei 1993, Mus. Reg. Sci. Nat. Torino Monogr. 14:632–635). Species previously known from Tucumán, Salta, Catamarca, Córdoba, Chaco, and Santiago del Estero provinces in Argentina (Cei 1993, *op. cit.*; Williams and Francini 1991, Boll. Mus. Reg. Sci. Nat. Torino 9:74).

Submitted by **VANESA ARZAMENDIA**, FAFODOC, Universidad Nacional del Litoral and Instituto Nacional de Limnología, INALI, CONICET, José Macia 1933, 3016 Santo Tomé, Santa Fe, Argentina.

PHILODRYAS LIVIDA. BRAZIL: GOIÁS: Municipality of Mineiros, Pargue Nacional das Emas (18°20'S, 53°00'W, 760–880 m elev.). 26 July 1997. M. B. Ramos Neto. (Instituto Butantan, São Paulo, Brazil, IB 57338). Verified by F. L. Franco. Species is known from 19 specimens from twelve localities in the states of São Paulo and Mato Grosso do Sul (Thomas and Fernandes 1996, Herpetologica 52:271–275). Formerly known as *Platyinion lividum* Amaral (1923); has been recently placed in the genus *Philodryas* Wagler (1830) by Thomas and Fernandes (1996, *op. cit.*). First state record; extends range about 150 km northward.

Submitted by **PAULA H. VALDUJO** and **CRISTIANO NOGUEIRA**, Seção de Herpetologia, Instituto Butantan. Avenida Vital Brasil, 1500, CEP 05503-900, São Paulo, São Paulo, Brazil and Departamento de Ecologia Geral, Instituto de Biociências, Universidade de São Paulo, Caixa Postal 11461, CEP 05422-970, São Paulo, São Paulo, Brazil.

SONORA SEMIANNULATA (Ground Snake). USA: ARIZONA: Coconino Co: Wupatki National Monument. 9 June 1951. Pierson. University of Arizona Herpetology Collection (UAZ 26371–72). Verified by George Bradley. First Arizona records north of the Mogollon Rim outside of the Inner Gorge of the Grand Canyon, and first record for the Little Colorado River basin. Extends range ca. 80 km SE of nearest records in Grand Canyon National Park, and ca. 115 km NNE of nearest populations in Yavapai County (Fowlie 1965, The Snakes of Arizona. McGraw Hill, New York. 164 pp.; Frost 1983, Cat. Am. Amphib. Rept. 333:1–4). This record suggests the species could be found almost anywhere in the southern Colorado Plateau region of NE Arizona, NW New Mexico, SE Utah, and SW Colorado.

Submitted by **TREVOR PERSONS**, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Colorado Plateau Field Station, Northern Arizona University, P.O. Box 5614, Flagstaff, Arizona, 86011-5614, USA.

TAENIOPHALLUS BREVIROSTRIS. BRAZIL: ACRE: PORTO WALTER: Igarapí São Luiz (8°50'17"S 72°54'23"W). D. Oren, F. S. Braga and D. Pimentel. 24 April 1996. Departamento de Zoologia, Museu Paraense Emílio Goeldi. MPEG 19031. Verified by Ulisses Galatti. First record for the state of Acre (Myers 1974, Bull. Am. Mus. Nat. Hist. 153[1]:1–262; Cunha and Nascimento 1978, Pub. Avulsas Mus. Goeldi 31:1–218; Cunha and Nascimento 1993, Bol. Mus. Para. Emílio Goeldi, Sér. Zool. 9[1]:1–191 [= *Rhadinaea brevirostris*]; Di-Bernardo 1992, Comun. Mus. Ciénc. Tecnol. PUCRS, sér. zool. 5[13]:225–256; Silva-Jr. 1993, Herpetol. Nat. Hist. 1:37–86) [= *Echinanthera brevirostris*]).

Submitted by **RUBENS NOBUO YUKI**, Departamento de Zoologia, Museu Paraense Emílio Goeldi, CP 399, Cep: 66040-170, Belém, Pará, Brazil.

TANTLLITA LINTONI (Linton's Dwarf Short-tail Snake). NICARAGUA: JINOTEGA: Reserva Biosfera BOSAWAS, ca. 3 km S Ayapal at Río Curinwas, 200 m elev. (12°46.62'N, 85°23.17'W). 14 February 1998. G. Köhler. Forschungsinstitut und Naturmuseum Senckenberg (SMF 78606). Verified by L. D. Wilson. First record for Nicaragua; extends range ca. 250 airline km SE of record from mountains above Corozal, Departamento Atlántida, Honduras (Wilson and Meyer 1985, The Snakes of Honduras. 2nd Edition. Publ. Milwaukee Publ. Mus. 150 pp.).

Submitted by **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany.

TROPIDODRYAS SERRA. BRAZIL: BAHIA: Santa Cruz Cabrália: Estação Ecológica do Pau Brasil (CEPLAC/ESPAB) (15°40'S 38°58'W) 0-100 m elev. 3 May 1995. Laurindo Xavier and António Cosme. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau (CZGB 3698). Verified by Ronaldo Fernandes. Specimen was found during the morning on the ground on the border of a primary forest. Species is found in northeastern, central, and southeastern Brazil (Amaral 1978, Serpentes do Brasil, Melhoramentos/ Universidade de São Paulo, 2 ed. São Paulo. 246 pp.). Two specimens already known from Bahia have

no specific locality (Thomas and Dixon 1977, Pearce-Sellards Ser. Texas Mem. Mus. 27:1–20). According to these authors, the specimen referred to *T. serra* by Günther (1861, Proc. Zool. Soc. London 12–18) may be *T. striaticeps*. This individual had been found in Ilhéus (14°47'S, 39°03'W), 0–50 m elev. However, despite twelve years collecting in this region, the species has never been found there (Argolo, pers. obs.). To the contrary, *T. striaticeps* occurs 160 km west, at localities that are at least 640 m above sea level (Argôlo, pers. obs.). These data suggest that the specimen reported by Günther (*op. cit.*) could in fact be *T. serra*. The record from Santa Cruz Cabrália confirms the occurrence of *T. serra* in the state of Bahia, where the species is, apparently, rare.

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil, and Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilhéus-Itabuna, CEP 45600-000, Ilhéus, Bahia, Brazil.

TROPIDODRYAS STRIATICEPS. BRAZIL: BAHIA: Barra do Choça (14°52'S, 40°39'W): Recanto da Adriana farm. 24 September–21 December 1997. J. O. Ruas. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau/CEPLAC (CZGB 6237–38); 1 January–28 February 1998. J. O. Ruas. CZGB 6508; 1 March–7 April 1998. J. O. Ruas. CZGB 6588, 6590; Juritî farm. 1 April–2 May 1988. P. A. Souza. CZGB 7077; 3 May–11 July 1998. P. A. Souza. CZGB 7440; Ribeirão do Largo (15°28'S, 40°45'W); Boa Sorte farm. 1 January–28 February 1998. Collector unknown. CZGB 6419; 1 April–3 May 1998. Collector unknown. CZGB 7082. All verified by Ronaldo Fernandes. All localities are situated between 640 and 860 m above sea level and harbour deciduous and semideciduous seasonal Atlantic rainforests as well as evergreen Atlantic rainforest. First records to the Brazilian northeast; extend range ca 500 km N from the previous known limit (Thomas and Dixon 1977, Pearce-Sellards Ser. Texas Mem. Mus. 27:1–20).

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil, and Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilhéus-Itabuna, CEP 45600-000, Ilhéus, Bahia, Brazil.

VIRGINIA VALERIAE (Smooth Earth Snake). USA: TEXAS: Nacogdoches Co: A decapitated *Virginia valeriae* and a *Coluber constrictor* were regurgitated by an adult *Micrurus* captured on Melwood Circle in Nacogdoches, Texas, on 10 October 1997. The specimen of *Virginia valeriae* is a new county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Press, College Station. 434 pp.). J. Howard Williamson. TCWC 81519. Verified by James R. Dixon.

Submitted by **DANIEL SAENZ, CHRISTOPHER S. COLLINS, TONI TREES,** and **J. HOWARD WILLIAMSON,** Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA.

WAGLEROPHIS MERREMII (Boipeva). BRAZIL: RONDÔNIA: Municipality of Vilhena (12°44'26"S, 60°08'45"W, elev. 600 m). December 1993. D. do R. Benedini. Museu de História Natural Capão da Imbuia, Curitiba (MHNCI.7401). Verified by S. A. A. Morato. Young male; 235 mm TL. Species is known from some Amazonian localities (Gasc and Rodrigues 1980, Bull. Mus. Natl. Hist. Nat. Paris 4e Ser. 2[2]:559–598; Chippaux 1986, Les Serpents de la Guyane Française, Paris, Coll. Faune Tropicale 27:165 pp.), but this is the first record for the state of Rondônia (Jorge-da-Silva 1993, Herpetol. Nat. Hist. 1:37–86). Extends range to NW Brazil. Vilhena region is characterized by the contact between "Cerrado" (open arboreal savanna) and "Floresta Estacional Semidecidual" (semideciduous forest) formations (Brasil, Fundação IBGE 1988, Mapa da Vegetação do Brasil).

Submitted by **JULIO CESAR DE MOURA-LEITE** and **PAULO SÉRGIO BERNARDE**, Curso de Pós-Graduação em Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil, and Laboratório de Herpetologia, Museu de História Natural Capão da Imbuia, Departamento de Zoológico (SMMA/PMC), Rua Prof. Benedito Conceição, 407 - 82810-080 Curitiba, Paraná, Brazil.

XENODON NEUWIEDII. BRAZIL: BAHIA: Barra do Choça (14°52'S, 40°39'W), Juritî farm. January–February 1998. P. A. Souza. Coleção Zoológica Gregório Bondar of the Centro de Pesquisas do Cacau/CEPLAC (CZGB 6435); February–April 1998. P. A. Souza. CZGB 7025; April–2 May 1998. P. A. Souza. CZGB 7075; 12 July–26 September 1998. P. A. Souza. CZGB 7650-51; Recanto da Adriana farm (14°57'S, 40°33'W). March-April 1998. J. O. Ruas. CZGB 6580–82; 7 April-12 June 1998. J. O. Ruas. CZGB 7191; 12 June–11 July 1998. J. O. Ruas. CZGB 7455. All verified by Ronaldo Fernandes. All individuals were found at coffee farms, up to 800 m elevation and with remnants of deciduous and semideciduous mesophytic Atlantic rainforests. Northermost record of species in Brazil, where it has been reported only from the central, southeast, and southern sections (Peters and Orejas-Miranda 1970, Bull. U.S. Nat. Mus. 297:133).

Submitted by **ANTÔNIO JORGE SUZART ARGÔLO**, Universidade Estadual de Santa Cruz—UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil, and Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilhéus-Itabuna, CEP 45600-000, Ilhéus, Bahia, Brazil.

New Records of Amphibians from Parque Estadual do Rio Doce, State of Minas Gerais, Brazil

RENATO N. FEIO
PATRÍCIA S. SANTOS
Museu de Zoologia João Moojen de Oliveira
Departamento de Biologia Animal
Universidade Federal de Viçosa, 36.571-000, Viçosa, MG, Brazil
e-mail (RNF): rfeio@mail.ufv.br

and

ULISSES CARAMASCHI
Departamento de Vertebrados, Museu Nacional - Quinta da Boa Vista
Universidade Federal do Rio de Janeiro, 20.940-040, Rio de Janeiro, RJ, Brazil
e-mail: ulisses@acd.ufrj.br

During the last ten years, several collections and studies of anurans in the Parque Estadual do Rio Doce (19°48' and 19°29'S, 42°38' and 42°28'W), in southeastern part of the state of Minas Gerais, Brazil, have been conducted by us, resulting in new records of distribution of some species. All of them are typical of the east coast of Brazil and are known only from this region (Frost 1985). The Parque Estadual do Rio Doce represents the first recordings of this species in Minas Gerais territory and the most inland registered in Brazil, amplifying significantly the distribution of these species. All records are based on specimens deposited in the herpetological collections of the Museu de Zoologia João Moojen de Oliveira (MZUFV) at Universidade Federal de Viçosa, Viçosa, Minas Gerais, and Museu Nacional, in Rio de Janeiro

(MNRJ). The identifications are verified by J. P. Pombal Jr. (Curator, MNRJ).

Aparasphenodon brunoi. Marliéria Municipality: Parque Estadual do Rio Doce, Porto Capim. 10 October 1992. R. N. Feio, L. G. Cotta and L. W. F. Assad. MZUFV 714; Marliéria Municipality: 13 January 1994. R. N. Feio. MZUFV 1551–52; 5 December 1995. R. N. Feio, U. M. L. Braga and H. C. Wiederhecker. MZUFV 2630; 23 November 1996. R. N. Feio and P. S. Santos. MZUFV 2761–2762, MNRJ 20873.

Sphaenorhynchus prasinus. Marliéria Municipality: Parque Estadual do Rio Doce. 13 January 1994. R. N. Feio. MZUFV 1553-54; 5 December 1995. R. N. Feio, H. C. Wiederhecker and U. M. L. Braga. MZUFV 2631-2633, MNRJ 20874-20875.

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Railway-Aided Dispersal of an Introduced *Podarcis muralis* Population

STANLEY E. HEDEEN
Department of Biology, Xavier University
Cincinnati, Ohio 45207, USA
e-mail: hedeen@xavier.xu.edu

and

DAVID L. HEDEEN
Department of Entomology and Applied Ecology, University of Delaware
Newark, Delaware 19717, USA
e-mail: hedeen@udel.edu

The European wall lizard, *Podarcis muralis*, is native to southern and central Europe and northwestern Asia Minor. Within its geographical range, the species frequents rock faces, sparse woodlands, and landscapes modified by human habitation. Hospitable urban habitats include debris piles of stones and brush, unmortared brick and fieldstone walls, and rock ballast and splintered wooden ties in railroad right-of-ways (Arnold and Burton 1978; Hedeen 1984; Street 1979).

Several thousand *Podarcis muralis* occupy these urban habitats within the metropolitan area of Cincinnati, Ohio, USA (Kwiat and Gist 1987; Brown et al. 1995). The animals are the descendants of two lizards that were deliberately introduced from Italy in 1951 (Hedeen 1984; Vigle 1977). The purpose of this note is to report on the dispersal of this population.

The range expansion of an introduced species is by two modes: diffusion and jump-dispersal (Pielou 1979). Diffusion is a population's gradual spread over a period of several generations. Jump-dispersal is the rapid movement of individual organisms over large distances, followed by the establishment of satellite populations at the destinations. The two modes have been combined during the range expansions of many introduced plant (Baker 1986), insect (Simberloff 1986), and fish (Ehrlich 1986) species.

Jump-dispersal of introduced *Podarcis muralis* occurred as humans captured lizards from the area of colonization and established satellite populations in Ohio (Hedeen 1988) and Kentucky (Draud and Ferner 1994). The major mode of spread, however, has been by diffusion from the release site of the two founding lizards in a backyard between Melville Lane and Torrence Court. The founders' descendants have dispersed in all directions into the surrounding area, causing the neighborhood to become known as Lizard Hill.

At a distance of 400 m south of the original release site, the spreading population reached a northern bend of an east-west railroad right-of-way. From this bend between Lewis Street and Waterloo Avenue, the population diffused at least 1.0 km west along the railroad tracks toward downtown Cincinnati. However, by 1997, the lizards' western limit along the tracks had shrunk to a point 200 m west of the bend. The factors causing this range shrinkage are unknown.

The population also spread along the railroad tracks east from the bend, reaching a distance of at least 5.6 km by 1977. At a junction 6.9 km east of the bend, the lizards encountered tracks running north that split from the tracks continuing east. By 1997, the growing population had spread from the junction 2.5 km along each set of tracks, reflecting a uniform rate of dispersal along each roadbed.

The lizards diffused from the right-of-way into adjacent residential and commercial districts. In 1997, the greatest known distance of lizards from the railroad tracks was 2.4 km. The population's diffusion through residential and commercial areas has been comparatively slow, since hospitable habitats are separated by inhospitable habitats such as streets, parking lots, lawns, and dense stands of trees. Population spread has been more rapid along the continuous hospitable terrain provided by the railway's rock ballast and wooden ties.

Railroad right-of-ways limit the range expansion of some animals (Hengeveld 1989), but serve as favorable habitat corridors that accelerate the dispersal of other animals (Johnson and Choromanski-Norris 1992) as well as plants (Foy et al. 1983). Railway routes have aided the dispersal of *Podarcis muralis* in the Cincinnati area.

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New Missouri Amphibian and Reptile Distribution Records from a Catalogued College Teaching Collection

GEOFFREY R. SMITH
and
LINDA D. JOHNSON
Department of Biology, William Jewell College
500 College Hill, Liberty, Missouri 64068, USA
e-mail (GRS): smithg@william.jewell.edu

Although the distributions of many Missouri amphibians and reptiles are well known and well documented throughout the state, many other species have potentially widespread distributions throughout the state but are poorly documented, particularly around the edges of their expected distributions (see Johnson 1987; Powell and Daniel 1997). One region of relatively poor documentation includes the counties just north of the Missouri River (see maps in Johnson 1987; see also Powell and Daniel 1997). These counties often form the northern border of expected distributions of many species, perhaps because of the natural barrier of the Missouri River.

Here we document several new county records for amphibians and reptiles in Missouri, with many of these records coming from counties immediately north of the Missouri River. These records were obtained from the teaching collection of William Jewell College (WJCTC). All records confirmed by J. E. Rettig.

ANURA

Bufo woodhousii fowleri (Fowler's Toad). Camden Co: Sec. 29, T38N, R17W. 18 May 1962. I. Hirano. WJCTC 6302. New county record from a zone of potential intergradation between *B. woodhousii woodhousii* and *B. woodhousii fowleri* (see Johnson, 1987).

Hyla versicolor/chryscocelis Complex (Gray Treefrog). Clay Co: Liberty, Cemetary at William Jewell College, Sec. 8, T51N, R31W. 23 May 1967. C. Smith. WJCTC 1737. New county record for complex (i.e., neither *H. versicolor* nor *H. chryscocelis* have been documented in this county).

Rana areolata (Crawfish Frog). Jasper Co: on Hwy. 171. 5 May 1962. M. Armstrong. WJCTC 821. New county record, filling gap in distribution.

Rana blairi (Plains Leopard Frog). Clay Co: Liberty near bridge over Missouri River, Sec. 18, T54N, R30W. 5 May 1962. G. Newton. WJCTC 6184. New county record.

LACERTILIA

Cnemidophorus sexlineatus (Six-lined Racerunner). Clay Co: Shoal Creek at Wabash RR. 5 July 1950. L. J. Gier. WJCTC 1591. New county record at N edge of expected distribution in Missouri. Clinton Co: Hufft Farm, Sec. 17, T54N, R30W. 5 May 1962. G. Netwon. WJCTC 6196. New county record at extreme N edge of expected distribution in Missouri.

Eumeces fasciatus (Five-lined Skink). Morgan Co: Sec. 9, T40N R18W. 21 April 1962. A. Miller. WJCTC 6256. New county record, filling hole in Missouri distribution.

Scincella lateralis (Ground Skink). Clay Co: on mud bank along stream, Sec. 34, T52N, R31W. 13 May 1967. F. Johannsen. WJCTC 1729. New county record, extends documented range in Missouri NE by > 40 km.

SERPENTES

Carphophis amoenus vermis (Western Worm Snake). Clay Co: under rock in field, Sec. 34, T52N, R31W. 13 May 1967. F. Johannsen. WJCTC 1707. New county record, filling hole in Missouri distribution.

Heterodon platirhinos (Eastern Hognose Snake): Hickory Co: Pomme de Terre Lake, Sec. 35, T37N, R22W. 3 May 1964. A. Lewis. WJCTC 1228. New county record, filling hole in center of Missouri distribution.

Nerodia erythrogaster transversa (Blotched Water Snake). Clay Co: Cooley Lake, SE 1/2 SE 1/4 Sec 2 T51N R30W. 1968. J. Littleford. WJCTC 1839. New county record.

Nerodia rhombifer (Diamondback Water Snake). Clay Co: By old Missouri River channel, Sec. 28, T51N, R31W. 15 May 1965. J. Bean. WJCTC 1464. New county record.

Opheodrys aestivus (Rough Green Snake). Hickory Co: Pomme de Terre Lake, Sec. 35, T37N, R22W. 3 May 1964. M. Wood. WJCTC 1236. New county record, filling hole in Missouri distribution.

Thamnophis proximus (Western Ribbon Snake). Clay Co: Cooley Lake, Sec 2, T51N, R30W. 20 May 1967. G. Beets. WJCTC 1711. New county record.

Thamnophis radix radix (Eastern Plains Garter Snake). Clay Co: near old Missouri River Channel, Sec 28, T51N, R31W. 8 May 1965. J. Bean. WJCTC 1470. New county record.

Tropidoclonion lineatum (Lined Snake). Ray Co: Sec. 32, T53N, R29W. 29 April 1962. J. Eddington. WJCTC 6341. New county record.

In addition to the information provided on amphibian and reptile distributions, these records point out the value of small college teaching collections. Many small colleges have collections of vertebrates (and invertebrates) for use in the classroom or in laboratories which are often the result of the efforts of broadly trained natural historians who worked at these small colleges during the middle part of the 20th century. If records have been kept and specimens properly labeled and preserved, such collections may contain a wealth of distributional data, as well as historical information useful for assessing population persistence. These collections may also come from relatively uncollected areas. For example, the WJCTC increased the known county records for reptiles in Clay County by 35% (from 20 to 27). Thus we suggest herpetologists at small colleges examine their teaching collections for possible distribution records.

Acknowledgments.—This note is dedicated to all the excellent natural historians who have taught at small colleges over the years, and in particular C. Newlon of William Jewell College, and J. B. Cope and the late G. Ward of Earlham College, for their influence on one or both of us. J. Rettig made helpful comments on an earlier version of this manuscript.

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BOOK REVIEWS

A Field Guide to Reptiles and Amphibians of Eastern and Central North America, by Roger Conant and Joseph T. Collins. 1998. Houghton Mifflin Company, Boston and New York. Peterson Field Guide Series. Third edition, expanded. xviii + 616 pp., 48 color plates, 101 color photographs, 333 maps. Softcover US $20.00. ISBN 0-395-90452-8.

ROBERT POWELL
Department of Natural Sciences, Avila College
Kansas City, Missouri 64145, USA
e-mail: powellr@mail.avila.edu

The Peterson Field Guides to North American amphibians and reptiles are modern classics responsible for introducing many individuals to herpetology. They remain the most useful tools a herpetologically inclined person can take into the field. High quality illustrations indicating diagnostic characters, accurate maps, and cogent descriptions render these volumes superior to their competitors. All of the relevant features, good and bad, of the third edition of the "eastern" guide were discussed in detailed reviews by Mitchell (1992) and Good (1992), and I am not inclined to repetition. However, the recent publication of an "expanded" third edition warrants comment.

Although the description of new species, new introductions into the region, nomenclatural changes, and reevaluations of the status of subspecies since the publication of the original third edition in 1991 might suggest a need for a fourth edition, neither the text nor the plates have been changed. Consequently, the content is nearly a decade out of date (the "western" guide by Robert Stebbins is even more critically in need of revision). What has been altered in this expanded edition is the appearance and size of the book. This has resulted primarily from incorporating over 100 color photographs of selected taxa (credited on pages 595–596) and, to a lesser extent, the reorganization of the volume. Whether these changes were warranted or necessary is largely a matter of taste, as both positives and negatives accrued as a result.

On the positive side of the ledger, the book is much more attractive. Because one of the major groups at which the volume is directed consists of "amateurs," who are most likely to be influenced by appearance, this may have been the major motivation for the expansion. Nevertheless, glossy paper throughout, extensive use of color (including headers, frontice pieces, and maps), and generally high quality (some quite exquisite) photographs will be appreciated by even the most jaded "professional." Also positive was the relocation of the maps from the back of the book to close proximity of the relevant text. Although this precludes an easy comparison of ranges facilitated by the older format, most users will appreciate not having to flip between text and maps.

On the downside, the book has grown to an extent to which it is no longer easily carried in the field, presumably where it is to be most frequently used. Because color photographs, admittedly attractive, are provided for only some taxa, they contribute considerably less to the diagnosis of animals than the plates, which are still grouped, albeit now in the front of the book. Also, the relocation of the maps has caused many of them to be downsized, often to a degree where detail is lost and, as a result, a loss of utility is experienced. Amphibians and reptiles, unlike birds and even mammals, are relatively sedentary, so accurate maps are possible and frequently important, as geographic origin is critical for the proper identification of many taxa (this will become even more of a factor with a fourth edition which will include even more cryptic forms not otherwise easily distinguishable).

Was this expansion necessary? No, except as a marketing device. Instead, the publisher invested considerable time and money, when only a little more would have truly improved the product. Not only could a fourth edition have incorporated the cosmetic changes made herein, the composition of the regional herpetofauna, the taxonomy, and the distributions would have been current. Some concerns raised by previous reviewers (e.g., treatment of subspecies, common names, and the missed opportunity to educate users regarding the dynamic nature of systematics at all levels by including a few citations and explanatory remarks) could have been addressed. The size issue might be avoided by producing separate volumes on amphibians and reptiles, allowing all taxa to be illustrated with photographs and maps to be larger. Also, the omission in some maps of extralimital regions (e.g., the West Indies and large portions of México) would allow those portions of the range in the United States to be enlarged and imbued with greater detail. In addition, with the use of glossy paper throughout, plates could be inserted individually near maps and text, enhancing the utility of the book immensely.

Should you run to the nearest bookstore and buy one? Maybe. Make the effort only if you don't have an intact copy of the 1991 publication. However, if your copy is falling apart or you never got around to buying one, and in spite of my critical remarks, you will not find at any price a more useful, accurate, and attractive volume for identifying amphibians and reptiles in the eastern and central United States and Canada.

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The Bone Sharp. The Life of Edward Drinker Cope, by Jane Pierce Davidson. 1997. Academy of Natural Sciences of Philadelphia Special Publication No. 17, Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, Pennsylvania 19103-1195, USA. 237 pp., black and white portrait + 10 illustrations. Softcover, US $25.00. ISBN 0-910006-53-9.

C. KENNETH DODD, JR.
U.S. Geological Survey, Florida Caribbean Science Center
7920 N.W. 71st Street, Gainesville, Florida 32653, USA
e-mail: Ken_Dodd@usgs.gov

In his lifetime, Edward Drinker Cope sparked intensive debate involving both style and substance. He will always be remembered for his voluminous contributions to herpetology (Adler 1989), paleontology, ichthyology, and other scientific disciplines. Less known, and perhaps with good reason, are his views on women (he opposed suffrage and thought women incapable of directing their affairs without masculine guidance), questions of race (he was clearly a white supremacist), his neo-Lamarckian approach to evolution, and his financial failures. As the namesake of the journal *Copeia*, we are reminded of him every time we consult its pages. His ego was immense and self-serving, his energy and knowledge unbounded, his ability to carry a grudge legendary, and his devotion to his daughter unquestioned, despite a long separation from his wife. With such a complex, prolific, and important figure in late 19th Century science, it is surprising perhaps that more has not been written about him. Davidson's book, issued on the centennial of his death, both assists and falls short of helping bring his persona to light.

The book is composed of eight chapters. The first four chapters trace Cope's early life and professional development (Cope's Early Life, The 1860s, Field Research in the 1870s and 1880s,Wading in the Marshiana: the Cope-Marsh War). The second four chapters are meant to provide a personal glimpse of Cope and how he was perceived by his family, friends and colleagues (Cope's Life with his Wife and Daughter, Cope's Contemporaries on Cope, What Happened at the End, Cope on Human Evolution, Society, and Religion). The book contains three appendices tracing the Cope family genealogy, the Cope-Hayden correspondence, and a glossary of important persons in Cope's life. As interesting as the text may be, I often found the Notes, comprising 28 pages of small type text, to be far more engrossing. Much of this information should have been included in the main body of the text. One cannot read the text without often referring to the Notes.

Davidson clearly conducted an exhaustive amount of background research in delving into Cope's life. Much of this information is contained in the archives of the Academy of Natural Sciences and the American Museum of Natural History. She read so much of Cope's writing that she was able to discern differences in the pattern of his scrawl, to note that the handwriting became even more illegible the more excited or agitated he became. Interpretation is a difficult art, however, and although I found myself in agreement with many of her interpretations (such as the origin of the Cope-Marsh feud and Cope's manipulation of his father), other explanations are possible for some of his more erratic behavior and obsessions. For example, no matter how hard I tried, I could not accept Davidson's assertion of Cope's affair with 'Miss Collins' in South Dakota or some of the other women mentioned, at least based on the evidence presented. Cope seems to have been, by accounts, quite unfaithful to his wife, but with whom he dallied and when probably cannot be ascertained without much more solid information.

Davidson's stated objective was "to present Edward Cope as a real human being," and that she has done. Cope comes across as an individual so taken with his self-orchestrated role in life and superiority to those around him that one imagines he would have been quite insufferable (p. 143: "To put it in a simplistic manner, he did precisely what he wanted to do at all times during his life. The only consideration he gave the opinions which others might have had of his actions involved how those opinions might be used to further his aims, or conversely, impede his intentions"). Davidson offers sometimes insightful, if purely speculative, explanations for his behavior, as further on page 143 she discusses how his excessive self-obsession might have been interpreted by Cope as his birthright for being incredibly bright. On the other hand, his behavior may reflect a bipolar personality bordering on the paranoid schizophrenic—entertaining all the while, but not a person to be on the wrong side of.

In his early years, Cope seems to have mastered the art of telling others what they wanted to hear while expressing his true feelings between-the-lines. This trait served him well as he grew up (first in dealing with his father and later with his wife, especially concerning his Quaker beliefs), but with financial and professional independence, his outspoken character emerged to public view. Clearly, he was obsessed with paleontology and natural science, and nothing would have stopped him from pursuing his studies, not his father, farming, rivals, his financial disasters, Indian wars, or finally, his failing health. In some individuals, this forcefulness might have been termed passion, but passion seems too tame a word for the forces that drove Cope. That he died because, in part, he medicated himself (with formalin and belladonna) for a condition (a chronic urogenital problem, not syphilis as often whispered) that might have been treatable by surgery shows the intense level of his inflated self-reliance.

Cope, of course, was the 'Master Naturalist' which formed the basis for a flattering biography long after Cope's death (Osborn 1931). Although written from an obviously admiring point-of-view, *Cope: Master Naturalist* is a fascinating book because it reproduces so many of Cope's direct words (although sometimes carefully edited, as Davidson notes), something we miss in Davidson's work to a large degree. Davidson prefers to let others judge Cope's scientific contributions, and even treads rather lightly on the Cope-Marsh feud. Cope was an extremely nasty character on the attack, and often played fast and loose with the facts. The hysteria and orchestration of the charges against Marsh (a complex and egocentric character in his own right) and John Wesley Powell accentuate a view of Cope as paranoid. Although Davidson does not reproduce or footnote the dramatic January 1890 *New York Herald* headlines attacking Marsh and the U.S. Geological Survey, they add considerable weight to an unflattering view of Cope and his agenda. One wonders after reading the actual correspondence and headlines how Cope could have been taken seriously. But then, such attacks had little to do with science by the time they got into the hands of know-nothing anti-science Congressmen from Alabama and the West (Stegner 1954). In this respect, Cope's legacy on Congressional support for scientific inquiry had long lasting and dramatically detrimental effects, quite the opposite of what he might have liked.

The last few chapters of Davidson's important biography deal with Cope's relationship with others, especially his wife, daughter, other women, and his views on society. Davidson reveals that Cope and his wife had a strained relationship, especially in the end when she left him (something overlooked in other Cope biographies I have read). He clearly loved his daughter, and strove for her to have a rigorous education, something unusual for his

time, while at the same time advocating an inferior role for women in society. Cope was a ladies man, and despite the pious letters reprinted by Osborn (1931), apparently had no qualms about breaking his conventional marriage bonds. His views on blacks were strong and racist, even for his time, and although he probably objected, his views were used by racists of his day in their drive to assert scientific support for rather outrageous assertions of the biological inferiority of Africans and those of other cultures. And speaking of outrageous, the various terms he coined to cloak his neo-Lamarkian views on evolution (e.g., bathmogenesis, ergogenesis, mnemogenesis; see Osborn 1931) would do a present day cladist proud. Davidson delves into each of these topics in great detail. Reading these chapters can throw a rather wet rag on Cope's shining personality to those of us who grew up with his image as "Master Naturalist." I enjoyed Davidson's debunking of the syphilis myth, but wonder why she didn't ask a specialist whether Cope died from the drugs or the unnamed urogenital condition. One more paragraph could have been enlightening.

Although I greatly enjoyed reading Davidson's account and comparing her version of events and interpretation with other accounts, the book is not without flaws. Some of the chapters would have been better with more information presented in the text instead of the Notes. The end of the book is abrupt. It is as if Chapter 8 ended, and the final two paragraphs were added as an after-thought to close it out. Surely, a more complete ending or summary could have been written. I certainly disagree with Davidson's portrayal of Cope's brushes with Powell and the Geological Survey as of minor importance. Quite the contrary, his attacks had long-lasting effects, very carefully discussed by Stegner (1954), a source curiously overlooked by Davidson. Powell (and rational science in the West) was not a casualty of standing too close to Marsh, but a direct target of Cope's vendetta. I was surprised at Davidson's fascination with a postcard from "a Professor K. Mitsukuri, who was evidently (sic) a biologist or even a paleontologist from Tokyo Imperial University..." In fact, Professor Mitsukuri was a well-known developmental biologist who published important papers on the early development of the eggs of turtles. It does not seem surprising that he would contact Cope concerning papers on the phylogeny of vertebrates. And finally, Davidson washes over more recent developments in the saga of Professor Cope, such as his wild west tour in 1892 and his designation as type specimen for *Homo sapiens* (see Psihoyos and Knoebber 1994). However, she points out the lack of credible evidence to Psihoyos and Knoebber's (1994) assertion that Cope's skeleton showed signs of syphilis.

Finally, the book suffers from the lack of an index and the great number of grammatical errors or omissions. It is very difficult to locate topics or information in the text and notes without an index. There simply is no excuse for the large number of textual errors, which detract considerably from its readability. My copy is filled with circles where I found missing words or phrases, or where the text just doesn't make sense. The book could have used some proper editing. If a book is sloppy in editing, is the scholarship equally sloppy? I certainly hope not, as this book long will be cited as an authoritative work on Professor Cope.

Ultimately, *The Bone Sharp* is not the definitive biography of Edward Drinker Cope. Its interpretations need to be read in conjunction with his own words (see Osborn 1931, for instance) and with other biographies and historical treatises (e.g., Stegner 1954; Plate 1964; references provided by Davidson). Only then can the real complexity of E. D. Cope, the man, be understood separately from the scientist. Cope made important and long lasting contributions to natural science, but the man himself was difficult, contradictory, and often arrogant. As Davidson states, "He was a man enviable for his wealth, charm, intelligence and good looks, but he was a man one could not always understand or respect." *The Bone Sharp* presents a remarkable insight into Cope's personality and, although I am sure it will be much debated among science scholars, it is an important contribution. I highly recommend it.

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INDRANEIL DAS

Institute of Biodiversity and Environmental Conservation
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak, East Malaysia
e-mail: idas@mailhost.unimas.my

Thirteen years ago, the Zoological Survey of India (hereafter, ZSI) published, as part of its *Handbook* series, a work on the Indian Testudines, authored by Binoy Krishna Tikader (formerly Director, ZSI, now deceased) and Ramesh Chandra Sharma (formerly Officer-in-Charge, Desert Regional Station, ZSI at Jodhpur, now retired). The work of Tikader and Sharma (1985), at present out of print, contained serious errors of omission and commission. Now, the ZSI has thought fit to ask the second author to revise the *Fauna of (British) India* series on reptiles.

The introductory chapters of the first of the three volumes, covering Testudines and Crocodylia, are an indication of what is to come. It contains, in poor grammar, a general introduction, sections on progress in herpetology in India and "adjoining countries," phylogeny (which contains some vague remarks on "stem reptiles" as well as the origin of turtles, which the author firmly states "emerged from the early cotylosaurs"), distribution, and zoogeography (too long-winded for this reviewer), affinities of the reptiles of India, characteristics of Class Reptilia (generally agreed to be polyphyletic), leading to the definitions of the Order Testudines and accounts of each of the families that occur in the region.

Each species account comprises a suggested English name, the scientific name considered valid by the author, a synonymy (copied from Smith 1931, errors and all), a description written in an nonscientific style (e.g., "This is a gigantic, flat, soft-shelled species..."; p. 130), distribution (mostly from Smith 1931), habits and habitat, and conservation status. The last two categories contain most (unintentionally) amusing notes that more often than not hark back to Victorian times.

Although the author notes that knowledge on the fauna has increased substantially since the last treatment by Smith (1931), the present work omits many important papers and books published in the post-Independence period, including those on turtle and crocodile distribution and natural history. The fact that the author himself has published not a single paper on the subject is a pointer, and most of the references appear to have been derived from the earlier *Handbook*, which, in turn, were culled from Pritchard (1979) and Groombridge and Wright (1982), for the references from the last 30 years. Consequently, there are no references from the mid-1980s onwards.

Like Smith (1931), this work covers the entire mainland of southeastern Asia, besides the Indian Subcontinent, despite the fact that the author has no field experience outside of India. Much of the text has been copied, sometimes verbatim, from existing works, and when it is original, frequently introduces new errors. For instance, on p. 80, Sharma misinforms us of the distribution of *Melanochelys tricarinata*, indicating that it is found only in Bihar, Bengal, and Assam. Studies in the last 10 years have shown that the range of this species is about twice as large. Likewise, for perhaps India's rarest turtle, *Kachuga sylhetensis* (pp. 100–101), the distribution as known today is larger than "Garo, Khasi and Naga Hills." On the other hand, some species, such as *Aspideretes leithii* (pp. 137–138) have been stated to have larger ranges than recognized by reliable authorities. More seriously, several turtle species are shown as absent from India, including *Cuora amboinensis, Morenia petersi*, and *Pelochelys cantorii* (listed as *P. bibroni*; see Webb 1995 for the valid name of the taxon from the region), all known to occur in the country (see for instance, Das 1991; 1995). The common English names are not those suggested in Iverson (1992), but rather have been manufactured by the author, with disastrous results: Travancore vegetable-eating turtle for *Melanochelys trijuga coronata* (these turtles are omnivorous); Garo and Khasi Hills tortoise for *Cyclemys dentata* (Asian leaf turtle is more commonly used for this widespread turtle); and Assam freshwater tortoise for *Pyxidea mouhotii* (the keeled box turtle, which is terrestrial).

Readers are spared the poor quality color and black-and-white plates of preserved and misidentified species that characterized the *Handbook*, although most of the line art has been taken from that work. Of the new additions, some of the oddest depict crocodilians with scale markers in mm!

Taxonomic decisions are either poor or the author had no recent literature at hand on the nomenclature of the turtles of the world (see for instance, Iverson 1992). Thus, he refers all Indian testudinids to *Geochelone* (contra Crumly 1984; 1985) all trionychines to *Trionyx* (inspite of the convincing results from the phylogenetic analysis of Meylan 1987), and the batagurids to Emydidae (contrary to Hirayama 1984 and Gaffney and Meylan 1988). The subspecies concept of *Lissemys punctata*, as given in Smith (1931) is followed, despite the findings of Webb (1980; 1982) on the occupancy of names in these turtles, and the "Travancore tortoise" is noted as *travancorica* (rather than *forstenii*, as suggested by Hoogmoed and Crumly 1984). The important works of Moll (1986, 1987) on the taxonomy of the genus *Kachuga* are also ignored, as is new information on the biology and morphology of *Aspideretes nigricans*, reported by Ahsan and Haque (1991) and Ahsan and Saeed (1989). Indeed, the systematic and distributional information on Indian turtles are considerably more refined than during the time of M. A. Smith, thanks to the research of Bhupathy (1994, 1995), Bhupathy and Choudhury (1994, 1995), Frazier (1986, 1992), Frazier and Das (1994), Groombridge et al. (1983), Moll (1986, 1987), Moll et al. (1986), Moll and Vijaya (1986), Vijaya (1982, 1983), and many other workers, although this is not evident from this volume. For the Indian crocodiles, several Ph.D. theses have explored questions on ecology, although only the more popular articles are listed. The dangers of using the present work for formulating conservation plans are obvious.

The glossary provides some entertainment for those with time: "juxtaposed—placed in opposition to not imbricate"; "beak—the horny covering of the jaws assuming the shape of bird's beak"; "kinesis—fee movement between the bones or bony structure"; and finally, my favorite, "ossicle—a little bone." Many names of geographical localities are dated—Celebes, Foochow, Burma, Hainan, USSR—to give a few examples.

There are numerous false and misleading statements, including "the flesh [of *Amyda cartilaginea*] is not considered much suitable for human consumption" (p. 141), reference to *Aspideretes hurum* as endangered (p. 139), hatchling predation of *Crocodylus palustris* by herons and storks as a cause for their endangerment (p. 152), and so on. In general, the poor grammar and editing makes it difficult to distinguish typographical errors from other awkward phrases and expressions. An obvious one, of course, is Crocodylia, which has been misspelled Crocodilia even on the first page of the book. The spelling of this Order has clearly troubled the author, as the incorrect version appears not only at the start of the section on crocodilians (p. 141), but also as a running head throughout (p. 141 et seq.). Most annoying is the fact that several species names are consistently misspelled, according to the ICZN Code: *Hardella thurgi* for *Hardella thurjii* (p. 92), *Kachuga smithi* for *Kachuga smithii* (p. 95), and *Testudo horsfieldi* for *Testudo horsfieldii* (pp. 122–123). Interestingly, the titles on the dust jacket and spine are slightly different *(Fauna of India. Reptilia. Testudines and Crocodilians. Volume: I).*

In summary, this is neither a popular work nor a technical synopsis of the subject. It does not provide accurate information, nor is it aesthetically pleasing (no color photographs, an ancient font type, printing sometimes showing through on the opposite page, every scute of every turtle illustrated bears a name tag!). It has an incomplete bibliography, which would falsely suggest to the ininitiated that not much is known about the southern (and because of the coverage of this work, southeast) Asian turtle fauna. The Foreword by the Director, ZSI (p. iii) makes it abundantly clear that works like these will continue to be used for "formulating proper conservation strategies for ... protection," which confirms our worst fears.

The information presented has evidently been gleaned almost exclusively from three sources: Smith (1931), Pritchard (1979), and Groombridge and Wright (1983). Thus, if you have these works, you will save shelf space by not purchasing the latest work of Sharma. One now awaits with considerable trepidation the companion volumes on lizards and snakes in the *Fauna of India* series.

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Ladies in the Laboratory? American and British Women in Science, 1800–1900, by Mary R. S. Creese. 1998. 452 pp, illustrated; cloth; ISBN 0-8108-3287-9. Scarecrow Press, Inc., US $98.00.

GEORGE R. PISANI

Biological Sciences, University of Kansas, Lawrence, Kansas 66045, USA
e-mail: gpisani@falcon.cc.ukans.edu

The publisher's announcement of this exceptionally thorough reference states that it is "a systematic survey and comparison of the work of 19th-century American and British women in scientific research"; it also remarks "this well-organized blend of individual life stories and quantitative information presents [a] broad and methodical coverage on a hitherto unprecedented scale." The publisher's hyperbole is quite accurate! Mary Creese has written over 20 articles on women scientists since 1990; this is her most ambitious undertaking. Her spouse Tom collaborated on some of her other works, and on this book. It includes a 58-page bibliography of the works published in journals by the scientists chronicled; these were gleaned from *Catalogue of Scientific Papers, 1800–1900* (The Royal Society, London).

The book outlines the work of 680 women scientists grouped in the major categories of Life Sciences (7 chapters), Math and Physical Sciences (5 chapters), and Social Sciences (4 chapters); the chapters represent topical subdivisions of these major categories. The number of women featured is especially noteworthy as the time period selected was one of intensely rigid views of the societal roles women were expected to play; science was not eminent among these. This statement is not at all intended to suggest that this situation materially improved over the succeeding 75 years, but most certainly those women profiled in this thorough work must be considered pioneers in the process of challenging role-barriers. Creese in fact remarks (pp. ix, xi) that "...by far the greater number [of these scientists] were active during the last two decades of the century, the time when the first of the university-trained women (in many respects a most remarkable group) were beginning their careers." Certainly this trend applies to those in herpetology.

The balance between dry, factual accounting and interesting reading in a work of this sort is difficult to maintain; indeed, the author acknowledges her goal to position the book between biobibliographies (more narrowly focussed on particular disciplines or persons) and broad historical surveys (which usually fail to pay sufficiently close attention to how the subjects came to enter particular fields, and what they accomplished). The resultant text contains pleasant diversions from its encyclopedic cataloguing to explore the personal lives, motivations, mentoring and personalities of many of the scientists listed.

Given the rigid views of the day, I found it interesting that several of the scientists profiled in the section "Museum Taxonomists to Morphologists and Embryologists" were afforded early recognition and assistance in their chosen fields by some eminent contemporary male scientists like Spencer F. Baird (USNM) and David Starr Jordan (University of Indiana). Bolstered by Jordan's encouragement and research support, Rosa Smith became the first woman to join the San Diego Society of Natural History, and in

1887 was appointed jointly (with H. F. Lorquin) Curator of Fishes and Reptiles at the California Academy of Sciences. Also in that section we find:

- Mary Bowers (Wellesley College), who conducted meticulous and extensive neuroanatomical studies of *Eurycea bislineata* (then *Spelerpes bislineatus*), and histological studies of *Bufo terrestris* (then *B. lentiginosus*).
- Anne Bowers and Inez Whipple Wilder (Smith College)—respiratory anatomy of *Desmognathus*.
- Gertrude Crotty (University of Kansas and Radcliffe College)—turtle embryology.
- Julia Platt (whose relatively brief but noteworthy career spanned several institutions—a story worth reading in itself!)—amphibian (especially *Necturus*) osteogenesis.
- Catherine Hopley (Gardens of the Zoological Society of London)—anatomical and popular works on snakes, reptiles in general, and amphibians, as well as a number of short entomological studies.
- Lilian Sheldon and Alice Johnson (Bathurst College)—amphibian embryology.

This is not a book one sits down and reads like a novel or biography. It is a reference work, and will be most useful (indeed indispensible) to persons interested in the history of science and women's studies. Additionally, it will be an essential reference for herpetologists offering courses and seminars concerning Women in Science. Though costly, the excellent workmanship evident in its production, its level of scholarship, and the numerous charts comparing the distributions of authors and papers within fields and between countries return a wealth of information for the expense.

PUBLICATIONS RECEIVED

Sounds of North American Frogs, the Biological Significance of Voice in Frogs [Compact Disc], by Charles M. Bogert. 1998. Smithsonian Folkways Recordings, 955 L'Enfant Plaza, SW, Suite 7300, MRC 953, Washington, D.C. 20560, USA. Compact Disc + 40 pp. accompanying booklet. US $14.00.

This is a reissue of Bogert's classic 1958 series of frog recordings. Fifty-seven taxa are represented in the 92 tracks, featuring anurans from across North America. In addition to updated track notes, the associated booklet contains the text of the essay "The Biological Significance of Voice in Frogs," written by Bogert at the time of the original release, as well as a new introduction by Richard G. Zweifel, and biographical sketch of the late Charles M. Bogert. Bogert himself narrated the tracks, which present a variety of advertisement calls, as well as other vocalizations. This reissue makes this pioneering work available on CD for the first time and will serve to remind herpetologists, especially those too young to remember the original release of the album, of the historical significance of Bogert's work in the field of animal sound study.

Monitoring Vertebrate Populations, by William L. Thompson, Gary C. White, and Charles Gowan. 1998. Academic Press, Inc., 525 B Street, Suite 1900, San Diego, California 92101-4495, USA. xv + 365 pp. Hardcover. US $64.95. ISBN 0-12-688960-0.

This book is designed as a guide for biologists and managers who require information about survey design for the purposes of estimating population size. As such it will prove valuable to those involved in monitoring amphibian and reptile populations, especially those under threat or presumed to be declining. The book deals with issues of plot design, sampling design, enumeration methods, distribution and density assessment, and trend detection. Separate chapters deal with specific examples relevant to each major vertebrate group, including amphibians and reptiles. A dichotomous key to enumeration methods provides guidance as to the type of techniques appropriate to differing sets of survey aims and population characteristic assumptions.

Herpetological Bibliography of Indonesia, by Indraneil Das. 1998. Krieger Publishing Company, Krieger Drive, Malabar, Florida 32950, USA. 92 pp. Hardcover. US $22.50. ISBN 1-57524-026-2.

This bibliography lists the citations for approximately 1700 publications dealing with the amphibians and reptiles of the Indo-Malayan Archipelago. The area covered includes most of Indonesia (excluding Irian Jaya and associated smaller islands), as well as the Andaman and Nicobar Islands (India and Myanmar), Sarwak and Sabah (Malaysia), and Palawan and the islands of the Sunda Shelf (Philippines). The references, which include citations in at least 14 languages, extend from the 18th Century to 1997. Systematic, faunal, and natural history publications make up the bulk of the citations, although papers on other topics are also included. Although extensive bibliographies are available for some groups of the herpetofauna in some regions of the Indo-Malayan Archipelago, this small book provides the first comprehensive set of citations. Of particular interest are many citations from southeast Asian journals not widely known to herpetologists outside the region.

Interpretive Atlas of Texas Lizards, by Ralph W. Axtell. 1986–1998, *et. seq*. Privately published by and available from the author (Ralph W. Axtell, 2814 Rock Hill Road, East Alton, Illinois 62024, USA). Individual accounts available separately. Cost: US $0.10/page + postage and handling.

The most recent installment (number 18) in this series is *Holbrookia maculata*, the lesser earless lizard. This account totals 11 pages in addition to a detailed range map representing over 350 localities and ca. 1150 specimens. Axtell provides an in-depth discussion of distribution in Texas, along with current taxonomy, geographic variation, conservation status, and suggestions for future work.

ERRATUM

A recent Natural History Note on the diet of *Lepidochelys kempi* (Frick and Mason 1998. Herpetol. Rev. 29[3]:166–168) contains two errors. First, the third entry in Table 1, an adult female (63.5 cm CCL), was actually stranded on 8 June 1993, not 8 July 1993. Second, this same turtle appears in an earlier note (Frick 1997. Herpetol. Rev. 28[3]:149). This specimen's inclusion in Table 1 of the more recent note should have included a citation of the earlier publication.

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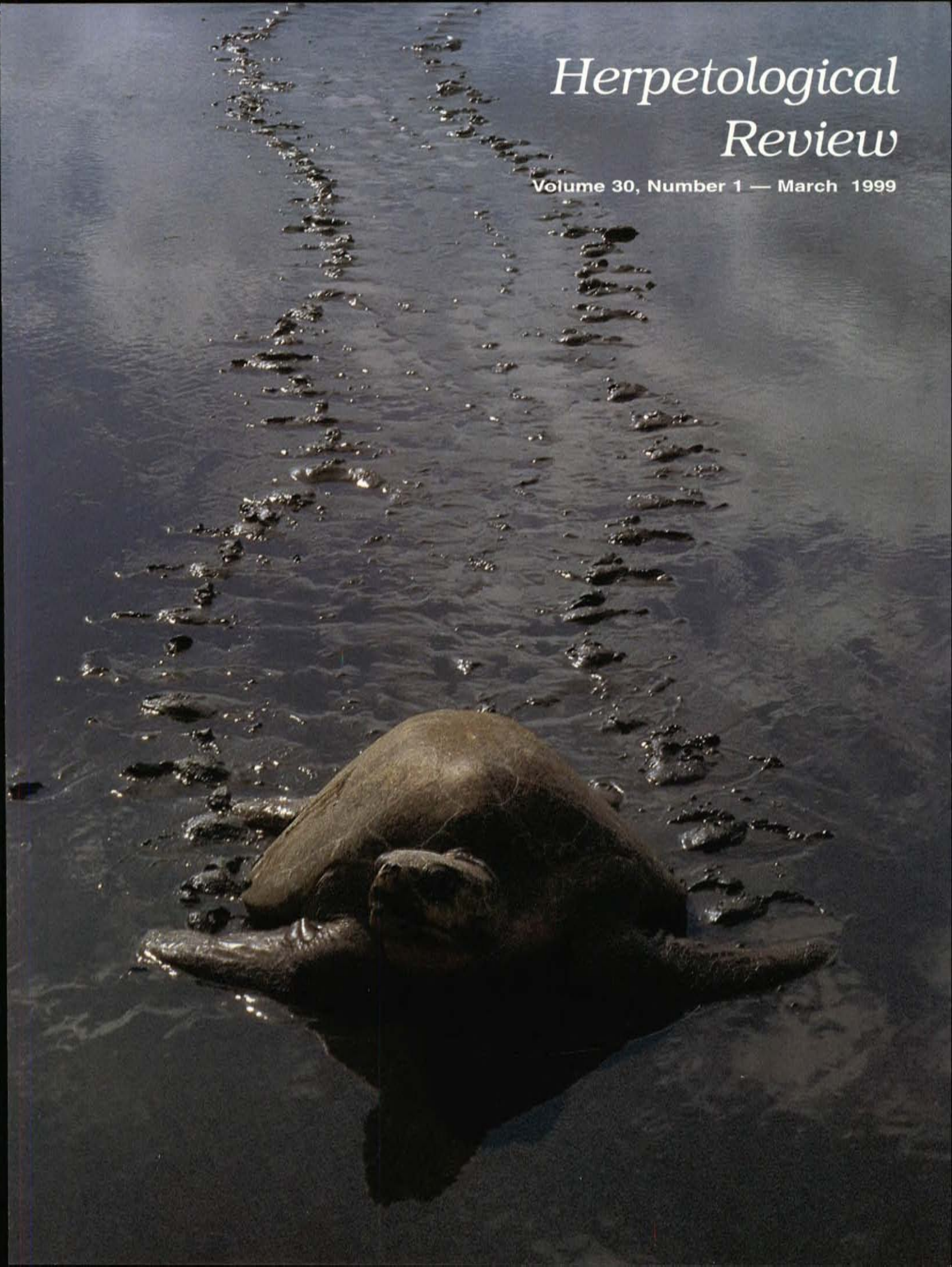
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Herpetological Review

Volume 30, Number 1 — March 1999

SSAR Officers (1999)

President
VICTOR H. HUTCHISON
Department of Zoology
University of Oklahoma
Norman, Oklahoma 73019, USA

President-elect
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124

Secretary
ELLEN J. CENSKY
Connecticut State Museum of
Natural History
University of Connecticut, U-23
Storrs, Connecticut 06269-3023, USA

Treasurer/Publications Secretary
ROBERT D. ALDRIDGE
Department of Biology
Saint Louis University
3507 Laclede Avenue
St. Louis, Missouri 63103-2010, USA
e-mail: ssar@sluvca.slu.edu

Immediate Past President
DARREL R. FROST
American Museum of Natural History
Central Park West at 79th Street
New York, New York 10024, USA

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SSAR Editors

Journal of Herpetology
RICHARD A. SEIGEL, Editor
Department of Biological Sciences
Southeastern Louisiana University
SLU 814
Hammond, Louisiana 70402, USA

WILLIAM S. PARKER, Managing Editor
Division of Science and Mathematics
Mississippi University for Women
Columbus, Mississippi 39701, USA

Contributions to Herpetology* and *Facsimile Reprints in Herpetology
KRAIG ADLER, Editor
Section of Neurobiology & Behavior
Cornell University
Ithaca, New York 14853, USA

Herpetological Circulars
JOHN J. MORIARTY, Editor
3261 Victoria Street
Shoreview, Minnesota 55126, USA

Catalogue of American Amphibians and Reptiles
ROBERT POWELL, Editor
Department of Natural Sciences
Avila College
Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(559) 323-7170 tel.; (559) 299-0161 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
208 South Great Road
Lincoln, Massachusetts 01773, USA
e-mail: ttyning@massaudubon.org

Associate Editors

DANIEL D. BECK
Central Washington University
e-mail: beckd@cwu.edu

JEFFREY LOVICH
U.S. Geological Survey
e-mail: jeffrey_lovich@usgs.gov

SHARYN B. MARKS
Humboldt State University
e-mail: sbm1@axe.humboldt.edu

BRIAN W. BOWEN
University of Florida
e-mail: bowen@gnv.ifas.ufl.edu

JOSEPH R. MENDELSON III
Utah State University
e-mail: sapo@bioserver.vsb.usu.edu

DARYL R. KARNS
Hanover College
e-mail: karns@hanover.edu

DEANNA H. OLSON
USDA Forestry Science Lab
e-mail: olsond@ccmail.orst.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

Current Research
ANNE M. MAGLIA
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: magliaa@falcon.cc.ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: soniak@unt.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biology
Indiana University
Bloomington, Indiana 47405, USA
e-mail: jdemuth@bio.indiana.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L. Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
e-mail: jbh10@psu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@ucok.edu

Editor-at-Large: *Adam P. Summers*
Copy Editors: *Jeff Parmelee, Jenny Pramuk, Martin J. Rosenberg, Amy Sproston*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

WWW: http://falcon.cc.ukans.edu/~gpisani/SSAR.html



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1999 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$50; Student membership $30; Family membership $60. Institutional subscription $95. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $30. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $25.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

1999 — Pennsylvania State University, University Park, Pennsylvania, USA, 24–30 June (Jay Stauffer, Chair).
2000 — Universidad Autónoma de Baja California Sur, La Paz, BCS, México, 14–20 June 2000 (Carlos Villavicencio, Chair).

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES
1999 ANNUAL MEETING
together with
AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS
and
THE HERPETOLOGISTS' LEAGUE

24 – 30 June 1999
The Pennsylvania State University, State College, Pennsylvania, USA

Keynote Address: "HERPETOLOGIST IN THE MIST: MY LIFE AMONG THE GUERILLAS," by Jonathan A. Campbell, The Herpetologists' League Distinguished Herpetologist (University of Texas at Arlington).

Symposium: "VARIATION IN LIZARD SOCIAL BEHAVIOR: INDIVIDUALS, POPULATIONS, AND SPECIES."*Organizers:* J. Kelly McCoy, Biology Department, Angelo State University, San Angelo, Texas 76909, USA; e-mail: kelly.mccoy@angelo.edu; Stanley F. Fox, Zoology Department, Oklahoma State University, Stillwater, Oklahoma 74078, USA; e-mail: foxstan@okstate.okway.edu; and Troy A. Baird, Biology Department, University of Central Oklahoma, Edmond, Oklahoma 73034; e-mail: tbaird@aix1.ucok.edu.

Symposium: "LIZARD SYSTEMATICS AND EVOLUTIONARY BIOLOGY FOR THE NEXT MILLENNIUM: A SYMPOSIUM HONORING THE LIFE WORK OF RICHARD ETHERIDGE." *Organizers*: Robert E. Espinoza, Ecology, Evolution & Conservation Biology, MS 314, University of Nevada, Reno, Nevada 89557, USA; e-mail: espin_r@unr.edu; and L. Lee Grismer, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA; e-mail: lgrismer@lasierra.edu.

Symposium: "AN *ANOLIS* SYMPOSIUM." *Organizers:* Manuel Leal and Jonathan B. Losos, Department of Biology, Washington University, St. Louis, Missouri 63130, USA (e-mail: mleal@biodec.wustl.edu and losos@biodec.wustl.edu); and Robert Powell, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145-1698, USA (e-mail: powellr@mail.avila.edu).

SSAR Conservation Forum: "BIOLOGY AND CONSERVATION OF TURTLES IN THE GENUS *CLEMMYS*." *Organizers:* Sheila Tuttle (e-mail: stuttle@skidmore.edu) or James Harding (e-mail: hardingj@pilot.msu.edu).

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day throughout the conference.

Student Paper Awards: Seibert Prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the September 1998 issue of *HR* for details.

Student Travel Grants: Ten travel grants of US $200 each will be available for SSAR student members. Refer to the December 1998 issue of *HR* for details.

Multimedia Presentations: "HERPETOLOGY OF THE WEST" and "AMPHIBIANS OF THE APPALACHIANS" by David Dennis and Eric Juterbock; "HERPETOLOGICAL NAMESAKES" by Kraig Adler and David Dennis.

Social Activities: General Reception at the Penn Stater Conference Center, SSAR Auction, Barbecue, Graduate Student Reception, ASIH Banquet, and Frameable Art Silent Auction.

Field Trips: Carnegie Museums of Art & Natural History, Fallingwater, National Aquarium, New Jersey State Aquarium and Academy of Natural Sciences, Philadelphia Zoo and Academy of Natural Sciences.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Costs: Pre-registration US $235 regular, US $133 student, US $95 accompanying person. After April 23, 1999, costs are US $280 regular, US $185 student.

Further Details: Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of SSAR in December 1998. Overseas members wishing to receive this information may do so by contacting Janet Patterson, Senior Conference Planner, The Pennsylvania State University, 225 The Penn Stater Conference Center Hotel, University Park, Pennsylvania 16802-7002; tel. 814-863-5100; e-mail: ASIH99@cde.psu.edu. For information concerning program content, please contact: Jay Stauffer, School of Forest Resources, The Pennsylvania State University, 2C Ferguson Building, University Park, Pennsylvania 16802, USA; tel. 814-863-0645; e-mail: vc5@psu.edu. Please visit the meeting web site at http://www.outreach.psu.edu/C&I/ASIH/ for additional and updated information.

About Our Cover: *Lepidochelys olivacea*

A quirk of nature has created an oasis of sorts on the Pacific Coast at Playa Nancite, a beach in Santa Rosa National Park, Guanacaste Province, Costa Rica. Craggy rocks and thornscrub conspire to form an abrupt and forbidding barrier to the leeward side, while shuddering breakers discourage approach from the sea at Nancite. It is one of the few secret places where earth and ocean meet, and it hosts a spectacular, world-class display of wildlife: the great *arribadas* (nesting aggregations) of the most diminutive and numerous of all sea turtles—the *Lora* or Olive Ridley (*Lepidochelys olivacea*). Synchronous, massive swarms of turtles churn the smooth sand into tangles of serrate tracks during really big *arribadas*, a phenomenon known to occur on only five beaches around the world. Nancite is unique among them in that it is totally protected, by nature and by humans, making it the most significant of all marine turtle rookeries.

Theories abound as to why *Loras* alone among sea turtles nest this way. Perhaps it is to satiate their many predators—stealthy coatis, raccoons, and coyotes, lumbering spiny-tail iguanas, and skittering ghost crabs—by providing them with a surfeit of food, thus assuring survival for a critical few. Although the Nancite *arribadas* are more-or-less monthly, their occurrence is not entirely predictable, and we still do not understand the suite of prerequisites that precipitates their onset. From July through December, for up to a week around each third-quarter moon, *Loras* converge on Nancite in unprecedented numbers. As many as 8,000 turtles at a time clamber through the nearshore waters, bathed like fire opals in ghostly cascades of glitter as their struggles disturb the bioluminescent plankton in the surf. When this chelonian Woodstock is over, as many as 150,000 *Loras* may have left their eggs and efforts on the beach at Nancite. It is one of the earth's greatest and most unheralded events.

Sometimes, when the *arribada* is particularly large, emergence may begin in early afternoon, and the fortunate person present will witness a spectacle usually reserved for the darkness. On 20 November 1997, **Alejandro Solórzano**, a prominent Costa Rican herpetologist and Director of its National Serpentarium, was there. As the early arrivals splashed towards land, Solórzano photographed this *Lora* with a Canon EOS ELAN using a Canon 35–105mm zoom lens and Fuji Provia 100 film exposed at f/16 for 1/60th of a second. Alejandro's articles and photos have made him well-known to those interested in Central American natural history. His book, "Las Serpientes de Costa Rica: Gúia General de Identificación," featuring illustrations by Michael and Patricia Fogden, Louis W. Porras, and William W. Lamar, is being published by the Universidad de Costa Rica.

Separation and imaging of Solórzano's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

SSAR Election Results

Results of the recent SSAR election are as follows:

President-elect (to serve as President for 2000) ..... *Julian C. Lee*

Secretary ..... *Ellen Censky (unopposed).*

Treasurer ..... *Robert Aldridge (unopposed).*

Directors ..... *Maureen Donnelly and Akira Mori.*

New Editor for SSAR Herpetological Circulars

John Moriarty has been appointed as Editor for the SSAR Herpetological Circulars, succeeding Joseph T. Collins. Individuals wishing to discuss possible projects for publication in this series should contact Moriarty at the postal address on the inside front cover or by e-mail at frogs@tc.umn.edu.

Proposed Amendment to the SSAR Bylaws

Members of the Society for the Study of Amphibians and Reptiles are hereby notified of a proposal approved by the SSAR Board of Directors to amend the following article of SSAR Bylaws to extend the term of office for several officers from one year to two or three years (dependent on position):

Article ll. Section 3 currently reads: "The terms of office for the President, President-elect, Secretary, Treasurer, Publications Secretary, and Immediate Past President shall be for one year; those for Directors shall be for three years (with election to provide for staggered terms so that no more than two Directors shall be elected in any one year)."

If amended, it will read: "The terms of office for the President, President-elect and Immediate Past President shall be for two years; those for Secretary, Treasurer, Publications Secretary and Directors shall be for three years (with election to provide for staggered terms so that no more than two Directors shall be elected in any one year)."

These proposed amendments will be on the agenda for discussion at the 1999 general business meeting at Penn State University on Sunday, 27 June at 1500–1630 h. A ballot on the amendments will be submitted by mail to the SSAR membership after the annual meeting at Penn State. The new terms would take effect in 2001 for those persons elected by mail ballot during 2000.

HR Staff Changes

The end of 1998 brought about several changes in the composition of the *HR* staff. Kathryn Vaughan has stepped down as Section Editor for Natural History Notes. This vacancy has been filled by Brian Hauge (Pennsylvania State University, Hazelton). Associate Editor Hal Avery has resigned, and has been replaced by Joe Mendelson (Utah State University). Liz Johnson, *HR*'s longtime ad manager, has resigned her position. On behalf of SSAR,

the editors thank Kathryn, Hal, and Liz for their service to the society and their colleagues.

Items Needed for SSAR Auction at Penn State

The SSAR Auction will once again be conducted during the annual meeting at Pennsylvania State University in June 1999. All proceeds from the auction go to the SSAR treasury, and help to continue the production of the diverse publications and services for which SSAR is known. Items of value, as well as those that lend themselves to humor, are always welcome. Following in the footsteps of Joe Collins and Darrel Frost, Dave Morafka will try his hand at removing large quantities of cash from auction participants through the judicious use of beer and plastic. Auction items may be brought directly to the meeting, or sent in advance to: *Janet Patterson, Conferences and Institutes, The Pennsylvania State University, 255 Penn Stater Conference Center Hotel, University Park, Pennsylvania 16802-7005, USA.*

Publications Needed for SSAR Graduate Student Reprint & Book Scavenge

Reprints and other publications are needed for the 1999 SSAR student reprint scavenge at Penn State. The graduate student social is greatly enhanced by the opportunity for students to acquire various herpetological literature. Now would be a good time to disseminate those extra reprints you have cluttering your office. Anyone wishing to donate items in advance may send them to: *Janet Patterson, Conferences and Institutes, The Pennsylvania State University, 255 Penn Stater Conference Center Hotel, University Park, Pennsylvania 16802-7005, USA.*

NEWSNOTES

Southwestern Research Station Positions And Grants For 1999

VOLUNTEERS—Approximately 30 volunteer positions are open in 1999 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 14 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 1999. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin March 14, 1999, through September 1999. Five-day week; salary $235/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

Ernest A. Liner Scientific Collection

The Department of Herpetology, American Museum of Natural History, is pleased to announce that Dr. Ernest A. Liner of Houma, Louisiana (USA), has transferred his important scientific collection of amphibians and reptiles to our care. Accessioning this large collection will take time, but individuals who have questions about these specimens may inquire among Drs. Linda Ford, Darrel Frost, or C. J. Cole at the Department of Herpetology, AMNH, Central Park West at 79th Street, New York, New York 10024-5192, USA.

If you have an outstanding loan of specimens from the Liner Collection, please contact us immediately so that we can prepare updated invoices to reflect the transfer of the collection. If you are ready to publish on certain specimens, please contact us for AMNH catalog numbers for publication. Also, if you are ready to return specimens that are on loan to you, please return them directly to the AMNH after notifying us that the specimens are being sent. Please use e-mail specifically for these communications; addresses are lford or frost or cole@amnh.org.

Osteology Collection of Dr. Richard Etheridge

The Department of Herpetology, American Museum of Natural History, is pleased to announce that Dr. Richard Etheridge, San Diego, has transferred to the AMNH the major part of his osteological collection of amphibians and reptiles. Accessioning this large collection will take time, but inquiries for access should be directed to either Dr. Darrel Frost, Dr. Charles J. Cole, or Dr. Linda Ford at the Department of Herpetology, AMNH, Central Park West at 79th Street, New York, New York 10024-5192, USA.

Announcement: A Forum on the Biology and Conservation of Turtles in the Genus *Clemmys*

This forum, under the auspices of the SSAR Conservation Committee, will take place at Pennsylvania State University during the joint meeting of the ASIH, HL, and SSAR, 24–30 June 1999. The genus *Clemmys* presently includes four semi-aquatic species of North American turtles which, as a group, display varying degrees of habitat specialization as well as many unique behavioral and morphological adaptations. In addition, all have experienced significant recent population declines, and present an urgent challenge to researchers and wildlife managers to devise workable management strategies. This forum will include spoken and poster presentations from a wide spectrum of chelonian biologists and conservationists. Topics will range from basic biology (including population ecology, behavior, reproduction, and systematics) to reports on exploitation and protective legislation. The paper presentations will be followed by an open discussion session on the management implications of present knowledge, and possible directions for future research and conservation efforts.

For information on this event please contact the SSAR Conservation Committee (Michael Klemens, Chair; e-mail: mwklemens@aol.com) or organizers Sheila Tuttle (tel. 518-580-5073; e-mail: stuttle@skidmore.edu) or James Harding (tel. 517-353-7978; e-mail: hardingj@pilot.msu.edu). A tentative list of participants and titles is available on the Penn State meeting web site (www.outreach.psu.edu/C&I/ASIH/).

Fellowship in Herpetology: Prehensile-tailed Skink Project

The Philadelphia Zoo is seeking a qualified candidate for a fellowship in herpetology. The fellowship will be focused on obtaining a detailed morphometric analysis of the Zoo's prehensile-tailed skink (*Corucia zebrata*) captive population. For further information about the project, please contact Curator and Veterinarian of Amphibians and Reptiles, Dr. Kevin Wright (tel. 215/243-5373; e-mail: wright.kevin@phillyzoo.org). The qualified candidate should hold a bachelor's degree in the life sciences and be pursuing an advanced degree in herpetology or veterinary medicine. The duration of the fellowship is three months or one semester, and pays a stipend of US $1,500/month. Qualified candidates should submit a letter of intent, a curriculum vitae, and two letters of reference to Human Resources, Attention: Herpetology Fellowship, Philadelphia Zoological Garden, 3400 West Girard Avenue, Philadelphia, Pennsylvania 19104, USA. All applications must be received by 1 May 1998.

Collins Award Winner Announced

On 7 November 1998 at the Silver Anniversary Meeting of the Kansas Herpetological Society, Travis W. Taggart, first-year doctoral student at the KU Medical Center in Kansas City, was chosen as the first recipient of the Suzanne L. & Joseph T. Collins Award for Excellence in Kansas Herpetology. Taggart received his undergraduate degree at Fort Hays State University, a Masters Degree from Southeast Louisiana State University in Hammond, and is currently enrolled at the KU Medical Center in pursuit of a doctoral degree in molecular biology. At the banquet, James L. Knight, formerly of Salina and now with the South Carolina State Museum, representing The Center for North American Amphibians and Reptiles, joined KHS President John Lokke in presenting Taggart with a commemorative plaque and a check for US $1000.

The Collins Award is the largest biological award given annually in Kansas, and one of the largest awards given for research on reptiles and amphibians worldwide. Recipients of The Collins Award are selected from among those scientific presentations and papers that were given or published in the preceding two years (1996 and 1997). The award-winning paper published by Taggart in 1997 in KHS Newsletter 109 was entitled "Status of *Bufo debilis* (Anura: Bufonidae) in Kansas."

As provided for in the conditions of the award, at next year's meeting of the KHS in Pratt, Kansas, The Collins Award will be given for the best photograph of a native Kansas amphibian or reptile by a KHS member. The award alternates each year, with scientific research honored in even-numbered years, and photography in odd-numbered years.

Lani Burress, of Emporia State University, was honored with the Howard Kay Gloyd-Edward Harrison Taylor Scholarship for 1998, while Hank Guarisco, of Lawrence, and Kelly J. Irwin, formerly of Topeka and now with the University of Georgia Museum of Natural History, were the recipients of The Bronze Salamander Award, given for distinguished service to the Society, and Joseph T. Collins was installed as the fifth Distinguished Life Member of the KHS, joining Robert F. Clarke (Emporia State University), Henry S. Fitch (University of Kansas), Dwight R. Platt (Bethel College), and Hobart M. Smith (University of Colorado).

Carnegie Museum of Natural History-Collection Study Grants in Herpetology

The Carnegie Museum of Natural History is pleased to announce a grant to support herpetological research by graduate students and foreign scientists. The grant is intended to defray costs of transportation and lodging associated with visiting and using the collection. The Carnegie's herpetological collection contains more than 194,000 preserved specimens, including one of the largest collections of turtles and extensive holdings from the West Indies, Mexico, South America, Spain, Africa, India, and the Phillipines. Applicants should send the following, in duplicate: (1) a description of the proposed research (including its significance and the justification for visiting the Carnegie), not to exceed two pages, (2) literature cited, (3) budget, and (4) CV. Students should also arrange for two letters of recommendation to be sent. Awards will be made twice a year. Deadlines for application materials are 15 April and 15 November. Send applications to Collection Study Grants in Herpetology, Section of Amphibians and Reptiles, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213-4080, USA. For more information contact John J. Wiens (e-mail: wiensj@clpgh.org; tel: 412-622-5520; fax: 412-622-8837).

Publication Correction

In the recently published "A Key to Amphibians and Reptiles of the Continental United States and Canada," (University Press of Kansas, 1998), there is a significant transposition on page 99, left column, couplet 1. The correct couplet follows, and will be corrected in the forthcoming second printing:

1a. Ventral scales not transversely elongated (Fig. 205); eyes covered by scales 2
1b. Ventral scales transversely elongated (if barely larger than dorsal scales, divided into two rows with a midventral sulcus) (Fig. 205); eyes not covered by scales 3

MEETINGS

Meetings Calendar

13–17 May 1999—Fourth International Symposium on Isolated Vertebrate Communities in the Tropics, Bonn, Germany. Hosted by the Zoologisches Forschungsinstitut und Museum Alexander Koenig. To receive announcements and to obtain further information, please contact: Prof. Dr. W. Böhme, Adenauerallee 160, 53113 Bonn, Germany; tel. +49 228 91 22 250, fax ++49 228 216 979, e-mail: r.hutterer.zfmk@uni-bonn.de.

24–30 June 1999—42nd Annual Meeting, Society for the Study of Amphibians and Reptiles, together with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists, State College, Pennsylvania, USA. (*Refer to meeting announcement on page 1 of this issue*).

6–10 September 1999—10th Ordinary General Meeting of the Societas Europaea Herpetologica, Natural History Museum of Crete (University of Crete), Irakleio, Crete (Greece). Deadline for abstracts and fees 31 May 1999. Contact: Natural History Museum of Crete, University of Crete, Knosou Av, 71409, Irakleio, Crete. Tel./fax +30 81 324 366; e-mail: nhmc_vtb@cc.uch.gr.

2–4 October 1999—Australian Herpetological Society, 50th Anniversary Conference on Captive Husbandry and Conservation of Reptiles, Sydney, Australia. (*Refer to detailed information below*).

5–9 October 1999—The Sixth Annual Conference of the Association of Reptilian and Amphibian Veterninarians, Columbus, Ohio, USA. For conference registration information contact: Wilbur Amand, VMD, PO Box 605, Chester Heights, Pennsylvania 19017, USA; fax: 610-892-4813.

8–11 October 1999—Second Symposium on the Status and Conservation of Florida Turtles, Eckerd College, St. Petersburg, Florida, USA. Contact: Gopher Tortoise Council, c/o George L. Heinrich, 1223 Alhambra Way S., St. Petersburg, Florida 33705-4620, USA; tel. (813) 865-6255; e-mail: highpine@gte.net.

12–17 December 1999—5th Latin American Congress of Herpetology, University of Uruguay, Montivideo, Uruguay. Abstract deadline 30 June 1999. For registration and information contact: Lic. José A. Langone, Secretario Ejecutivo V CLAH, Museo Nacional de Historia Natural, CC 399, 11000 Montivideo, Uruguay (e-mail: vclah@fcien.edu.uy). Within the U.S. or Canada, contact: Dr. Rafael de Sá, Department of Biology, University of Richmond, Richmond, Virginia 23173, USA (e-mail: rdesa@richmond.edu). Web site: http://zvert.fcien.edu.uy/clh.

Australian Herpetological Society 50th Anniversary Meeting

The Australian Herpetological Society will celebrate its 50th anniversary by hosting the Conference on Captive Husbandry and Conservation of Reptiles on 2–4 October 1999 in Sydney. Keynote speakers will be David Barker and Harold Cogger. The Conference will be open to anyone with a general interest in reptiles and amphibians, and invitations will also be extended to wildlife authorities, zoos, and museums. The general theme will be on captive maintenance and breeding and the role of amateurs, although interested participants are welcome to present papers of general interest. The first two days will include the presentation of papers while the third day will be a tour of a local zoological facility with a barbeque lunch. Other likely events are a conference dinner, post-conference field trip, photo competition, and more. For additional information contact Daniel Holloway (email: ozherps@zip.com.au) or visit the Society's web page (www.ozherps.zipworld.com.au).

OBITUARIES

James F. Lynch (1942–1998)

LINDA McCANN LYNCH
Smithsonian Environmental Research Center
P.O. Box 28, Edgewater, Maryland 21037, USA

James F. Lynch, Smithsonian Research Scientist, lost a long battle with cancer on 26 March 1998. He died at his home in Shady Side, Maryland, USA. Despite the difficulties of his illness, he carried out fieldwork in Texas only three weeks before he died. Over the past year, he produced several new papers and manuscripts and sustained an active correspondence with colleagues around the world.

Jim Lynch was a man with a great love of life and a large appetite for its many aspects. He was a productive scientist, a willing teacher, a talented artist, a gifted musician, and a generous friend.

Jim was born in Boston, Massachusetts in November 1942. He went to Harvard College, graduating cum laude in 1964 with a B.A. in geology. He was a man of many facets. To help put himself through school, he sang professionally with a group aptly named "The Lynch Mob." He also rowed during this period, and made the decision to concentrate on science rather than train as a member of the American Olympic rowing squad.

From Harvard, Jim moved to the University of California at Berkeley to pursue his Ph.D. It was at this stage that he underwent a major change in research direction. During his first two years at Berkeley he was a graduate student in Geology. After a summer geology work experience in a mine in Montana, he switched his major to Zoology, graduating in 1974. His thesis was titled "Ontogenetic and geographic variation in the morphology and ecology of the black salamander, *Aneides flavipunctatus*."

Jim then joined the Smithsonian Environmental Research Center in Edgewater, Maryland, as a research scientist. During his 24 years with the Smithsonian Institution, he conducted research in ecology, systematics, island biogeography, habitat reduction and fragmentation, and animal-plant interactions. Jim's conservation research in Central America and Mexico spanned over 30 years, from documenting the distribution of salamander populations in Guatemala to examining impacts of habitat fragmentation in Yucatan bird populations. Most recently, he initiated a project to monitor bird populations in the Laikipia District of Kenya, comparing avian communities in a variety of humanly impacted areas. Over the course of his career, he worked on amphibians,

birds, mammals, reptiles, and ants, and conducted research over an enormous range of the world, including North, Central, and South America, Australia, and East Africa, in addition to many parts of the United States.

Jim produced over 60 scientific publications. He was actively involved in many professional societies, advisory committees, and non-profit organizations. A regular reviewer for many international journals, he was an enthusiastic collaborator with scientists from all over the world.

In an attempt to support new scientists working in Conservation Biology, a fund has been set up in Jim's honor through the Smithsonian Environmental Research Center. The James F. Lynch Conservation Biology Fund will assist students and researchers working in Central America and East Africa, including students native to these areas. The goal is to build this fund into an endowment that will continue to help conservation biologists for years to come. Contributions and inquiries may be made to the James F. Lynch Conservation Biology Fund, c/o Jeanine Robert, Smithsonian Environmental Research Center, P.O. Box 28, Edgewater, Maryland 21037, USA. The first award for this fund will be made in 1999.

Benjamin Edward Dial (1944–1998)

HARRY W. GREENE
Section of Ecology and Systematics, Cornell University
Ithaca, New York 14853-2701, USA
e-mail: hwg5@cornell.edu

I first met Ben Dial at an amateur naturalists gathering in 1962, as he finished high school in Dallas and I began my senior year in Fort Worth. We were pals ever since those days in the Strecker Society, through lots of thick and a fair amount of thin, both of us fascinated by herpetology, music, people, and nature. Ben learned last August that his thyroid cancer, perhaps facilitated by years of daily immunosuppressants, had metastasized and was untreatable; he died at home on the afternoon of November 5th, accompanied by me, his dear friend Sue Lamoureux, and a hospice nurse.

As much as Ben and I both later came to love teaching, we were woefully mediocre undergraduates (all too easily distracted by newfound independence) and our professional paths were correspondingly indirect. He attended Texas A & M University in two bouts, interrupted by a few years of southern California surfing and work as a Houston zoo keeper, and finally received a B.S. in 1972. Ben received a masters from Texas A & M in 1975, with a thesis on geographic variation in *Coleonyx* supervised by James R. Dixon; he earned a Ph.D. from North Texas State University in 1981, with a dissertation on life history evolution in geckos supervised by Lloyd C. Fitzpatrick. Ben taught briefly at Texas A & M, then came to Chapman University as an assistant professor in 1984; he achieved tenure at Chapman in 1990, and was promoted to full professor in the spring of 1998.

Ben's scholarly contributions were primarily in physiological and behavioral ecology. He published about 20 scientific papers and book chapters, the first at age 17 (Dial 1961), and one chapter from his dissertation (Dial and Fitzpatrick 1983) was warmly praised by Stephen Jay Gould in a *Natural History* magazine column. After graduate school Ben turned to behavioral energetics, and conducted innovative research on the hatchling frenzy of baby sea turtles (Dial 1987) and limbless locomotion in reptiles (Dial et al. 1987). Recent publications include one of the first to analyze physiological ecology in the context of phylogeny and biogeography (Dial and Grismer 1992), as well as a clever study of chemoreception and buccal pulsing in geckos (Dial and Schwenk 1996). Ben's last manuscript was completed just days before he died, and when published will significantly advance our understanding of feeding energetics in snakes (I have reprints of most of his papers for distribution). Ben loved seeing and thinking about nature in the field, and perhaps the most insightful and lasting aspects of his scientific work stem from that perspective.

Ben earned two Distinguished Graduate Student Awards at Texas A & M University, and the Faculty Merit Award, two Hua-Cheng Faculty Fellowships, and a Research Excellence Award at Chapman University. His teaching evaluations were the best I've ever seen for anyone, anywhere, although by all accounts he was a hard task master and very tough grader. Ben was well organized, passionately interested in biology, thought it was really important to get things right, and truly liked people, especially young people. He delighted in devising tricks to capture students' attention, and especially to make them think. His colleague Michael Griffin told me that Ben sometimes set an upturned box next to jars of charcoal, salt, and water on the lectern, then began explaining that life was nothing more than a few simple chemicals. While students were still wondering what was going on, he suddenly lifted the box and exposed a Desert Iguana! No doubt many Chapman alumni—hopefully now influential lawyers, bankers, and so forth—will never forget the lesson of that beautiful and very lively lizard.

Two events are essential to understanding Ben and his impact on others. In about 1981, he befriended retired Texas businessman H. Erle Rawlins Jr., and from the transplant until Erle's death in 1995 (at the age of 87), they set an incredible example for anyone anxious about infirmities and aging. Late in 1985 Ben experienced shortness of breath and was diagnosed with myocarditis. After a year-long convalescence, during which his strength further declined, he was accepted in the transplant program at Stanford and received a new heart on March 21, 1987. Ben was an ideal patient because he carefully followed all medical instructions, yet resolutely lived as nearly as possible a normal life, despite various potential impediments. Seemingly oblivious to facial swelling and other drug side effects that would have severely threatened the vanity of some of us, he gave riveting public lectures on the surgery and its impact on his life (one talk was titled "I left my heart in San Francisco"). In the years following the transplant Ben and Erle explored the length of Baja California by car, and they conquered the difficult road to Batopilas, in the bottom of Mexico's Barranca del Cobre. They led memorable excursions for Chapman University students and alumni to Costa Rica and the Galapagos Islands, and laughed about once having driven the 6,000 mile "southern route" from Dallas to Orange County by way of Tikal, Guatemala.

As much as he loved the Southwest and Mexico, Ben was endlessly nostalgic about California and popular music. A movie version of his life would have to be filmed in La-La Land, with soundtrack by the Eagles and Fleetwood Mac. Although Ben frequently railed at widespread onslaughts against nature in Orange County, whenever I'd say something critical of the traffic, the smog, and so forth, he would start bragging about Brown Pelicans at Boca Chica Wetlands, near his condo. Ben found my upcoming move to New York unfathomable because, whatever the lure of exotic *travel*, he just couldn't imagine actually *living* anywhere other than California. And as for rock-and-roll, Janalee P. Caldwell wrote me that "Once when he visited us in Topanga, Ben and

Laurie [Vitt] started reminiscing about songs from the 60's and 70's; he knew all the lyrics to every song and Laurie could play the melodies. Probably every song from that era was sung that day!"

I don't want to obscure my friend's humanity with one-sided praise, especially since Ben laughed readily at his own foibles. He was zealously private in some respects, phenomenally picky, and even downright quirky about certain things; he could be irritatingly stubborn and judgmental. Ben was impossible to pigeon-hole politically, since his opinions spanned the reactionary to radical spectrum. Meals with him often veered into debates, whether or not anyone else really *wanted* to argue—usually about the environment, medicine, religion, or some other aspect of our human predicament. Ben disliked bullies and stuffed shirts, and he sometimes went out of his way to confront those he perceived, rightly or wrongly, as acting that way. Those things said though, for most of his associates, Ben was impossible not to like.

Ben left me several items on a computer disk that say a lot about him, including a list of "Some of my favorites: I love the music of Buffalo Springfield, the Byrds, Neil Young, 10,000 Maniacs, Eric Clapton, and Don Henley; the paintings of Georgia O'Keefe and Vincent Van Gogh; and the words of Robinson Jeffers, David Quamman, John McPhee, and Barry Lopez. I love soapberries collected in the fall and then back-lit, really weathered wood, green-glass insulators that are old enough to have a patina, the smell of wet Creosote Bushes, the colors of a Madrone, the antics of Desert Iguanas, everything about Gray-banded Kingsnakes, the fire-pit at Nepenthe, the cathedral at Chartres, the zócolo at San Miguel de Allende, the Study Butte Store in Big Bend, and the desert, any desert." Ben also loved Chapman University. He was proud of his students and colleagues, and he was extremely grateful for the support they provided in so many ways during his illnesses. Memorial donations can be sent to the Chair, Natural and Applied Sciences Division, Chapman University, Orange, California 92866, USA, where an undergraduate prize in biology has been established in honor of Ben and Erle.

I know from our conversations during his last few weeks that Ben was totally at peace with impending death, and that he wanted us to celebrate collective good fortunes rather than mourn his passing. Besides a legacy of inspired undergraduates and formal scientific accomplishments, Ben Dial left the unusual example of his profound joy, in the face of substantial physical hardships, for those things and places and creatures and people that he cared about. Ben once told me that the years since the heart transplant were by far his best, because since then he "always took time to smell the flowers." A common response of his friends, colleagues, and students to news of Ben's passing was how deeply important, how personally strengthening his example had been to them. The computer document he left me ends with this: "Here's my advice for young people, borrowed from Joseph Campbell's *The Power of Myth*. If you are after happiness, it works: 'Follow your bliss.'"

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GREENE, H. W., AND B. E. DIAL. 1966. Brooding behavior by female Texas alligator lizards. Herpetologica 22:303.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Social Monogamy and Paternity in *Tiliqua rugosa*

In this study, the authors investigate the social monogamy and paternity of *Tiliqua rugosa* by radio tacking 55 adult female and 39 adult male lizards during their spring activity period, for a

period from 1–5 years. The results of the radiotelemetry portion of this study indicate that social monogamy is the normal state for females, and seems to be the common pattern for males (18% of adult males showed polygyny). To investigate paternity of offspring, 21 gravid females were removed to the laboratory, where they gave birth to 42 offspring. Genotypes of five polymorphic microsatellite DNA loci were determined for the females, their male partners, and all offspring. Nineteen percent of the litters showed signs of extra-pair fertilization. A discussion of social monogamy and extra-pair mating is presented and the results of this study seem to support the hypothesis that social monogamy within a season results from male *T. rugosa* guarding female partners, and that males are constrained to monogamy because they cannot successfully defend multiple females. Eighty percent of the males in this study that were found to be socially monogamous were shown to have fathered all the young of their female partner.

BULL, C. M., S. J. B. COOPER, AND B. C. BAGHURST. 1998. Social monogamy and extra-pair fertilization in an Australian lizard, *Tiliqua rugosa*. Behavioral Ecology and Sociobiology 44(1):63–72.

Correspondence to: C. M. Bull, School of Biological Sciences, Flinders University of South Australia, GPO Box 2100, Adelaide, SA 5001, Australia; e-mail: michael.bull@cc.flinders.edu.au.

Homeward Orientation in *Tiliqua rugosa*

Tiliqua rugosa is a monogamous skink that exhibits high pair fidelity. This study indicates differences between and among sexes in homeward orientation performance when males and females were displaced during three phases of the spring activity period (i.e., pre-pairing, during pairing or mating, and post-pairing periods). The author found all groups to be significantly oriented homewards during all periods, with the exception of post-pairing males; males were significantly better homeward oriented than females during the pairing period. Differences in homing motivation between the sexes are discussed.

FREAKE, M. J. 1998. Variation in homeward orientation performance in the sleepy lizard (*Tiliqua rugosa*): effects of sex and reproductive period. Behavioral Ecology and Sociobiology 43(4/5):339–344.

Correspondence to: M. J. Freake, Department of Biology, Jordan Hall, Indiana University, Bloomington, Indiana 47405, USA; e-mail: mfreake@sunflower.bio.indiana.edu.

Phenotypic Plasticity in *Rana sylvatica*

The authors discuss hypotheses of phenotypic plasticity and comment on two major assumptions that accompany them. The first assumption is that plasticity improves the fitness of individuals and the second is that it evolved in response to selection imposed in heterogeneous environments. Though the authors agree that the second assumption is difficult to test, they state that it can be tested in a general form by determining whether natural selection currently acts to maintain phenotypic plasticity. In this study, the authors examined several plastic morphological traits in larval wood frogs (*Rana sylvatica*). Larval *R. sylvatica* were selected to be reared either in the presence of predators (dragonfly larvae [*Anax*] confined within cages to prevent actual predation), or in predator-free artificial ponds. Results show dramatic differences in size and shape between conditioning treatments, with the predator-reared larvae having relatively shorter bodies with deeper tails. Tests of mortality of predator-exposed larvae and predator-free larvae to *Anax* larvae also was examined and mortality was found to be greatest among larvae with relatively short, shallow tails and narrow tail musculature (i.e., those anuran larvae that were reared in predator-free ponds). According to the authors, their results indicate that morphological plasticity in larval wood frogs is promoted by selection and that they support the hypothesis that plasticity represents an adaptation to variable predator environments.

VAN BUSKIRK, J., AND R. A. RELYEA. 1998. Selection for phentoypic plasticity in *Rana sylvatica* tadpoles. Biological Journal of the Linnean Society 65(3):301–328.

Correspondence to: J. Van Buskirk, Institution of Zoology, University of Zürich, CH-8057 Zürich, Switzerland; e-mail: jvb@zool.unizh.ch.

Effects of Autotomy on Movement Patterns in *Psammodromus algirus*

Eleven adult lizards (*Psammodromus algirus*) (6 male, 5 female) were captured and taken to the author's laboratory to evaluate the costs and effects of caudal autotomy (i.e., loss of all but the proximal 2 cm of their tails) on escape performance before and after tail loss. The authors indicate that a control group of tailed lizards also was studied to determine the repeatability of locomotor patterns between trials. The authors found that tail loss had a significant effect on movement patterns as tailless lizards exhibited significantly slower speeds during bursts of locomotion and the distances traveled within these bursts were significantly reduced. They also found that pausing time increased and overall speeds dropped even greater than burst speeds. Loss of the tails also had the effect of decreasing main stride and significantly shortened escape distances. As there are many lizards that employ caudal autotomy as a defensive strategy, these results have relevance for the ecology and fitness of lizards that exhibit autotomy.

MARTIN, J., AND R. A. AVERY. 1998. Effects of tail loss on the movement patterns of the lizard, *Psammodromus algirus*. Functional Ecology 12(5):794–802.

Correspondence to: J. Martin, Departamento de Ecología Evolutiva, Museo Nactional de Ciencias Naturales, CSIC, José Gutiérrez Abascal 2, 28006, Madrid, Spain.

Response of *Ambystoma talpoideum* to Clearcutting

The authors comment on the impact of forest management practices on amphibian populations and the attention that this topic has received over the past decade. They note that measured responses of amphibians to these changes only include comparisons of species diversity indices and population counts, thus lacking true spatial and temporal controls. In this experimental approach to test for differences in fecundity, growth rate, age at maturity, and whole-body storage lipids among individual *Ambystoma talpoideum*, 640 recently metamorphosed *A. talpoideum* were assigned randomly to four 100 m^2 field enclosures built in two habitats (recently clearcut patches and 40 yr old pine forests). After approximately six months of exposure to these habitats, the authors found no significant differences between habitats for number of recaptured salamanders, final body mass, final body length, percent whole-body storage lipid, clutch size, or percent storage lipid of eggs. Their results may suggest that

habitat modification of this sort (clearcutting) may not detrimentally effect newly metamorphosed *A. talpoideum*. The authors also discuss the inherent complexities in establishing the causal links between habitat management and effects on amphibians.

CHAZAL, A. C., AND P. H. NIEWIAROWSKI. 1998. Responses of mole salamanders to clearcutting: using field experiments in forest management. Ecological Applications 8(4):1133–1143.

Correspondence to: A. C. Chazal, Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia 23219–3634, USA.

Population Differences in Lizard Communicative Display

The authors describe the differences in the push-up displays produced by several populations of sagebrush lizards, *Sceloporus graciosus*, in Coyote Butte, Oregon (two populations) and Red Butte, Utah (one population). Lizards were observed during peak activity periods (0900–1200 h and 1400–1700 h) and care was taken not to bias data with pseudoreplication; however, the authors acknowledge that observations may be biased toward more active individuals. Results of this study indicate that the three populations studied differ in display body posture, number of legs extended to produce the up-and-down motion of display, and the number of headbobs produced in all three segments of the display (broadcast, courtship, and agonistic), and that push-up displays are undergoing far more rapid change than previously thought.

MARTINS, E. P., A. N. BISSELL, AND K. K. MORGAN. 1998. Population differences in a lizard communicative display: evidence for rapid change in structure and function. Animal Behaviour 56(5):1113–1119.

Correspondence to: E. P. Martins, Department of Biology, University of Oregon, Eugene, Oregon 97403, USA; e-mail: emartins@evolution.uoregon.edu.

Structure, Function, and Evolution of the Oviducts of Squamates

The author discusses the diversity exhibited among extant squamates in the function of oviducts for fertilization, sperm storage, egg transport, eggshell deposition, maintenance of the early embryo, and the expulsion of the egg or fetus. Data from dissections of 30 genera, as well as data from literature, indicate seven macroscopic features by which squamate oviducts vary: extent and nature of regional differentiation; vascular supply; topographic asymmetry; number of oviducts; vaginal pouches; and relative positions of the cloaca. Specializations of the uterus are discussed and described for viviparous squamates, and include a discussion of specilizations for nutrient provision to the fetus. Results of a cladistic analysis of these data suggest that oviductal features in reptiles reflect evolutionary convergence and secondary simplification, rather than a unidirectional trend toward increased specialization.

BLACKBURN, D. G. 1998. Structure, function, and evolution of the oviducts of squamate reptiles, with special reference to viviparity and placentation. The Journal of Experimental Zoology 282(4/5):560–617.

Correspondence to: Daniel G. Blackburn, Department of Biology, Trinity College, Hartford, Connecticut 06106, USA; e-mail: daniel.blackburn@trincoll.edu.

Mechanics of Lung Ventilation in *Ambystoma tigrinum*

X-ray video and pressure measurements from the body and buccal cavities of the aquatic, larval *Ambystoma tigrinum* demonstrate that this salamander inspires by a two-stroke buccal pump, and that they exhale by actively contracting the hypaxial musculature. The author describes the mechanics of inhalation and employed electromyography to indicate duration and highest-amplitude activity for various muscles during the process of exhalation.

BRAINERD, E. L. 1998. Mechanics of lung ventilation in a larval salamander *Ambystoma tigrinum*. The Journal of Experimental Biology 201(20):2891–2901.

Correspondence to: Elizabeth L. Brainerd, Department of Biology and Program in Organismic and Evolutionary Biology, Morrill South, University of Massachusetts, Amherst, Massachusetts 01003-5810, USA; e-mail: brainerd@bio.umass.edu.

Correlations of Morphology, Ecology, and Evolution in Australian Suctorial Tadpoles

Suctorial anuran larvae use their highly specialized oral disks to adhere to the substrate in fast-flowing waters. Suctorial *Litoria nannotis*, *L. rheocola*, and *Nyctimystes dayi* were compared to pond-type larvae of *L. caerulea*, *L. genimaculata*, and *L. xanthomera*, as well as several other taxa from literature, to explore the diversity of cranial musculoskeletal structures to determine shared characters among taxa, irrespective of their phylogenetic position (suctorial tadpoles have evolved independently several times). Many chondrocranial and muscular characters are discussed and the authors conclude by stating that convergent evolution of many features shared among these taxa suggest that they are causally associated with the suctorial mode of larval life.

HAAS, A., AND S. J. RICHARDS. 1998. Correlations of cranial morphology, ecology, and evolution in Australian suctorial tadpoles of the genera *Litoria* and *Nyctimystes* (Amphibia: Anura: Hylidae: Pelodryadinae). Journal of Morphology 238(2):109–141.

Correspondence to: Alexander Haas, Institut für Spezielle Zoologie und Evolutionsbiologie, Friedrich-Schiller-Universität Jena, Erbertstr. 1, D-07743 Jena, Germany; e-mail: b5haal@rz.uni-jena.de.



Acris crepitans. USA: Missouri: Taney Co. Illustration by Dan Erickson.

Roger Conant to Turn 90 on May 6

RAYMOND J. NOVOTNY
Ford Nature Center, Mill Creek MetroParks
840 Old Furnace Road, Youngstown, Ohio 44511, USA
e-mail: raynovotny@yahoo.com



At the Toledo Zoo, holding a large *Elaphe obsoleta lindheimeri* (ca. 1931). Photograph courtesy of K. Adler.

This writer is perhaps like many of you—one of the thousands of people fortunate enough to know Roger Conant. We know him through his books, his letters, or his friendship. Join with SSAR now to wish him a "Happy 90th Birthday" and reflect on a few of the highlights of his long, productive, and inspirational life.

Dr. Conant was born in Mamaroneck, New York on May 6, 1909, the only child of Charles and Clara Conant. At age twelve, when many youngsters are developing an interest in the creatures that hop, crawl, and slither, he tragically lost his father. His grandparents and other relatives helped his mother raise him. Fortunately, Roger, a good student not afraid of work, thrived. An Eagle Scout before age 15, he credits his experiences at Boy Scout camp, especially the capture of a copperhead, as the beginning of a lifelong devotion to herpetology.



Curator of Reptiles, Toledo Zoological Park (1930 or 1931). Photograph by H. K. Gloyd, courtesy of K. Adler.

Roger graduated from high school two years early and sought work in the zoo world and advice from luminaries such as Raymond Ditmars. A stint at the privately owned Twin Brook Zoo in New Jersey gave him his start and his direction. While not yet 20 years old, after two years of biology at the University of Pennsylvania, he secured a position at the Toledo Zoological Park in Ohio.

It would be difficult to underestimate the importance of his six years in Toledo for there he received his professional zoo training and exposure to academic herpetology. Beginning as curator of reptiles, he rose to the rank of general curator, in charge of the entire zoo. He took full advantage of opportunities at the University of Michigan in nearby Ann Arbor, with its faculty such as Alexander Ruthven and Frank Blanchard. It was at this time that Roger met Howard K. Gloyd, a UM graduate student who would become his lifelong friend and colleague.



Preserving a DOR *Lampropeltis getula*, Delmarva Peninsula, Delware (May 1936). Photograph courtesy of K. Adler.

Inspired by Ruthven's "Herpetology of Michigan," Roger decided to produce a similar study of Ohio. Despite the financial problems of the Great Depression, Roger and his young enthusiastic helpers criss-crossed the state and surveyed 86 of Ohio's 88 counties. Nine years after its inception, his study was published by the *American Midland Naturalist* as "The Reptiles of Ohio." This marked the first milestone of his impeccable reputation as a herpetologist.



Collecting water snakes in the Mississippi Delta, Louisiana (March 1948). Photograph courtesy of K. Adler.

Unfortunately, a difficult political situation in Toledo forced Roger to seek a new position and in 1935 he moved closer to home to Philadelphia, to the "Nation's First Zoo." He would spend the next 38 years there, beginning as Curator of Reptiles and retiring as Director. Although he was very busy during the workday overseeing the collections, promoting the zoo, and producing publications, he found the energy to continue to work on herpetological projects during his "off" time.

In 1951, Roger Tory Peterson approached Roger with an offer of a lifetime, the authorship of the Peterson field guide on reptiles and amphibians. For most of the 1950s, Roger and his wife Isabelle worked on this project, with Isabelle quitting her job in order to better contribute her photographic talent in addition to her loving support. This enormous project required the Conants to travel hundreds of miles to collect and photograph specimens. Thankfully, they received assistance from many interested herpetologists and naturalists across the country. Their commitment was rewarded by the universal acclaim given to the book after publication in 1958. The field guide has since been expanded and revised twice, in 1973 and 1991; the third edition was expanded in 1998. The combined editions are considered to be the most widely used books in herpetology and have sold over half a million copies.

Shortly before his retirement from the Philadelphia Zoo, the University of Colorado awarded him an honorary Doctor of Science degree. In 1973, he and Isabelle moved to Albuquerque and he was given a courtesy appointment as Adjunct Professor of Biology at the University of New Mexico. Unfortunately, Isabelle was stricken with cancer and passed away just three years later. Grief-stricken, he went to visit Howard Gloyd in Tucson, Arizona, who was also terminally ill. Roger promised to finish the monograph on the snake genus *Agkistrodon* that they had planned in the 1930s and worked on intermittently since.



The Conants working in the field, Durango, México (September 1960). Photograph courtesy of K. Adler.



The Conants demonstrating their technique in obtaining photographs for use in their Field Guide (middle to late 1960s). Photograph courtesy of K. Adler.

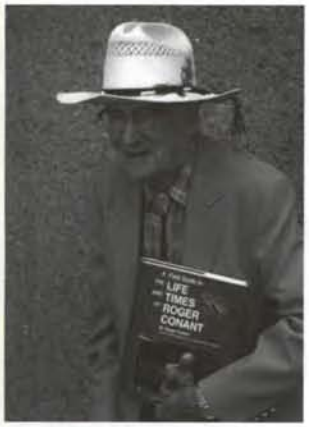
Perhaps to assuage the pain he felt over his personal losses, he plunged himself into the daunting task. In 1990, SSAR published the book and it was immediately hailed as a classic by reviewers.

Roger's resume goes on for pages so here is just a sample. He has served as the President of the American Society of Ichthyologists and Herpetologists and he also was the unofficial adviser to the SSAR's predecessor, The Ohio Herpetological Society. Ten years ago, the American Association of Zoological Parks and Aquariums bestowed upon him its highest award, the R. Marlin Perkins Award. More recently, in 1995, the Roger Tory Peterson Institute of Natural History chose him for its Nature Educator of the Year Award. The following year, the Cleveland Museum of Natural History honored him with its David S. Ingalls, Jr. Award of Excellence.



Examining an *Agkistrodon contortrix*, Herpetology Range, Museum of Southwestern Biology, University of New Mexico (ca. 1982). Photograph courtesy of K. Adler.

Roger recently published his massive autobiography, "A Field Guide to the Life and Times of Roger Conant." The 500+ pages of this well-written and illustrated book document his life so far. It also serves as a history of twentieth century US herpetology, perhaps the only one we'll ever have. Although Roger will soon turn 90 we should not necessarily expect that his contributions and adventures are finished, for his family is known for its longevity. Just last fall he and his wife Kathryn Gloyd (Howard's widow) traveled again to South America and he now is completing a scientific paper on Mexican garter snakes.



Roger Conant with his recently issued autobiography. Photograph by R. Andrew Odum, Toledo Zoological Society.

Dr. Conant's support and encouragement of others is legendary. I first wrote to him when I was just barely a teenager and was amazed when he wrote back with a personal note, not a form letter. It has been almost 30 years since and we still keep in touch. I suppose in some ways he serves as a surrogate grandfather. No doubt many others have had similar stories.

With his abilities and focus, Roger Conant could have succeeded in any number of life pursuits. Those of us interested in amphibians and reptiles should be thankful that he shared our passion for these animals and shared himself with us for all these many years.

LETTERS TO THE EDITOR

Notes on the Type Series of *Oxybelis wilsoni* Villa and McCranie

JAMES R. McCRANIE
10770 SW 164th Street, Miami, Florida 33157–2933, USA

Oxybelis wilsoni was recently described from Isla de Roatán, Islas de la Bahía, Honduras, by Villa and McCranie (1995). However, that paper contains numerous errors, due to inattention by the senior author to both the junior author's corrected versions of the manuscript and to the proofs. Nowhere are these errors more apparent than in the list of paratypes.

The list of paratypes begins with the inaccurate statement "Twenty-three males and 16 females ..." (Villa and McCranie, 1995:297). This statement is then followed by a list of 14 specimens in various museums (including the nonexistent number AMNH 00000). Following this list is the statement "In addition to these, we have donated 23 specimens to several museums for which we kdo [sic] not have accession numbers yet ...." This latter statement is erroneous on two counts. First there were not 62 specimens of *O. wilsoni* available to the authors as implied (data from 24 males and 18 females were used) and secondly, the statement is entirely untrue. In fact, at the time the description of *O. wilsoni* was published, apparently no specimens had been donated to museums. The word apparently is used because all efforts by McCranie to learn of the whereabouts of this material from Villa proved unsuccessful (all specimens collected by McCranie and Villa were entrusted to Villa to distribute to various museums). Additionally, personnel of two museums assigned numbers to specimens of *O. wilsoni* that Villa promised to send them (TCWC 67203–04; USNM 318010–12). As of this writing, these specimens have yet to be deposited in these collections, nor have efforts by personnel of these two institutions to secure this material from Villa been successful (R. K. Vaughan, pers. comm. 28 April 1998; G. R. Zug, pers. commun. 10 April 1998). This is especially troublesome because USNM 318010 was designated as the holotype and TCWC 67204 the allotype of *O. wilsoni*. Because Villa has not responded to correspondence, it is not possible to ascertain if this material is lost or is still in Villa's possession.

In late March of 1998, W. R. Courtenay, Jr., of Florida Atlantic University (FAU), found eight specimens of *O. wilsoni* in a room at FAU formerly occupied by Villa. Courtenay had earlier found several specimens that Villa had borrowed and that were designated as paratypes of *O. wilsoni* and returned these to their respective museums (LSUMZ 21768, 22365, 22374, 22398; TCWC 21914). The eight most recent specimens found by Courtenay were sent to L. D. Wilson, who gave them to me. This material was then deposited in several museum collections. As data for these specimens were used in the variation of the paratypes section in the description of *O. wilsoni*, these specimens should be considered part of the paratypic series (two, LDW 9170, 9196, were specifically mentioned in the section on variation in the paratypes). Pertinent data for this material are as follows (institutional acronyms follow those of Leviton et al., 1985): AMNH R-143507–08 (the latter formerly LDW 9170), TCWC 79732, Rocky Point near Santa Elena (town) on east end of Isla de Roatán, Honduras; TCWC 79731, USNM 521995 (the latter specimen was dehy-

drated when found by Courtenay), between West End and Sandy Bay, Isla de Roatán, Honduras; USNM 318011–12, 521996 (the latter formerly LDW 9196), near Coxen Hole, Isla de Roatán, Honduras. The numbers USNM 318011–12 were included in the list of paratypes by Villa and McCranie (1995) without locality data, and until now, without actual specimens tagged with these numbers.

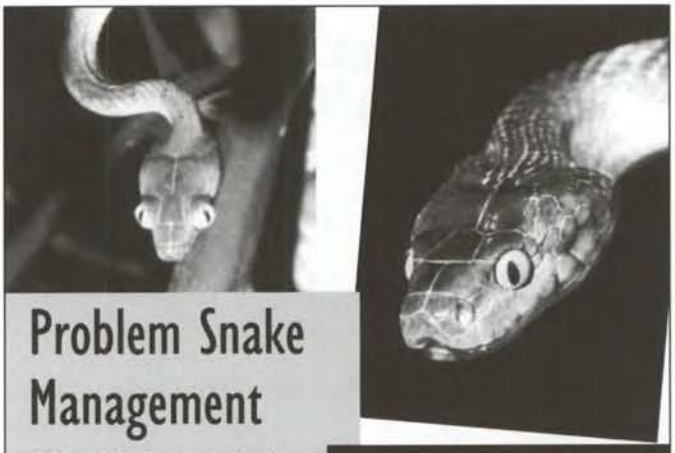
As previously mentioned, the whereabouts of the holotype and allotype of *O. wilsoni* are unknown. Hopefully, Villa will soon realize his responsibility and send these specimens (if still extant) to their promised institutions. It is also to be hoped that Villa will donate the additional paratypes to an institutional collection as well.

Acknowledgments.—I thank W. R. Courtenay, Jr. for his efforts to locate specimens at FAU and L. D. Wilson for assistance with the specimens located by Courtenay and for reading an early draft of this manuscript. Wilson also sent several unanswered letters to Villa concerning the *O. wilsoni* and other material. I also thank the following people for answering my inquiries concerning the type series of *O. wilsoni*: C. J. Cole and L. S. Ford (AMNH); A. Resetar (FMNH); F. T. Burbrink (LSUMZ); R. K. Vaughan (TCWC); D. L. Auth (UF); and G. R. Zug (USNM).

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Problem Snake Management

The Habu and the Brown Treesnake

EDITED BY
GORDON H. RODDA,
YOSHIO SAWAI,
DAVID CHISZAR, AND
HIROSHI TANAKA

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POINTS OF VIEW

Perils of Permits: Procedures and Pitfalls

WILLIAM E. DUELLMAN
Natural History Museum and Biodiversity Research Center
The University of Kansas, Lawrence, Kansas 66045-2454, USA
e-mail: duellman@kuhub.cc.ukans.edu

Permits to collect, permits to export, and permits to import have become an absolutely obligatory part of our lives. It makes no difference whether you are going to collect in the next county, the next state, or in some distant part of the world, almost without exception permits are required. The degree to which permits are required for collecting is indicative of the value ascribed to wildlife, which is a good thing for conservation of biodiversity.

Herein, I provide information and suggestions pertaining to the collection of scientific specimens in, and exportation from, foreign countries and their importation into the United States. A thorough summary of state regulations in the U.S. was provided by Levell (1997). My remarks are based on many years of collecting on four continents and focus on procedures for obtaining permits for preserved specimens—newly collected specimens, as well as those being loaned to, borrowed from, or exchanged with other institutions.

COLLECTING PERMITS

Each country has its unique set of regulations regarding the collection of scientific specimens. In some countries, such as the U.S. and Australia, each state has its own laws, and in some other countries, different regulations may pertain to certain parts of the country. Likewise, collecting in national (and sometimes state or provincial) parks and reserves commonly requires an additional permit. Obtaining these permits requires advanced planning, often many months in advance. It must be remembered that in-country biologists have to abide by the same regulations.

Many headaches and frustrations may be avoided by collaborating with a reputable colleague in the country to be visited. Many countries require that requests for collecting permits be made through a recognized institution or organization in the country, and a few countries (e.g., Brazil) require that special visas be obtained from a consular office. Such official requests may necessitate the inclusion of any combination of the following: names, nationalities, and photocopies of photo pages of passports; inclusive dates of proposed collecting; areas to be visited (sometimes quite specific); research proposal outlining the specific needs for specimens and the scientific significance of the project; numbers of specimens to be obtained and how they are to be collected and prepared; institutions in which specimens are to be deposited; and perhaps an application fee. (If the permit is not issued, you should not anticipate that the application fee will be refunded.) In non-English-speaking countries, the application should be written in the native language. It is not uncommon for the applicant to have to agree to take one or more in-country biologists in the field at the applicant's expense. Some countries require the applicant to present one or more lectures. Furthermore, copies of field catalogues, a report on the field studies, copies of photographs, and copies of all publications resulting from the field work may be required. Such collaboration provides the opportunity for working with scientists and training of students in the host country on their own biotas, thereby fostering their biodiversity

infrastructure and promoting local awareness of biodiversity and conservation.

Although in a few countries (e.g., Brazil and Costa Rica), provision of scientific permits is handled by an office staffed with knowledgeable biologists, most offices are within major government ministries, most commonly the Ministry of Agriculture or its equivalent. Personnel therein may include a zoologist, but more commonly they are agronomists or foresters by training, and sometimes they are simply political appointees having no background in biology. Generally, their mandate is to conserve the natural resources of the country, and most of their dealings are with commercial interests. Thus, a biologist who wishes to collect animals is challenging their mandate; it is up to the biologist to convince the officials of the necessity of documenting their national biota so that effective conservation measures can be undertaken. The herpetofauna in many parts of the world is poorly known; consequently, series of specimens are needed for systematic studies. Officials who issue permits are not systematists; they must be convinced of the necessity for collecting numerous individuals of many species. Perhaps in the not too distant future these offices will be staffed with personnel who have had the benefit of proper training provided by international collaboration.

Practically all of us who have dealt with such bureaucrats can document a variety of experiences. Some personal examples include: Before I took a group of students (US and nationals) into a previously unstudied area, an official in the permit office requested a list of the species and the number of individuals of each that we intended to collect; only after a lengthy explanation and my requesting her to provide me with a list of the names of persons working in an office building visible from her window did she understand the inappropriateness of her request. Another application was for the documentation of the herpetofauna at six sites; the office wanted to issue a permit for the collection of no more than four individuals of each species! Again, there is a need for education.

Making sure that the permit is correct before carrying out field work can save headaches. In one permit issued to me, the provinces in which we had permission to collect were listed. Upon being handed the permit, I noted that one requested province had been omitted, but I was told that the oversight was not important and not to worry. Upon my return to the capital with my collection and report of field activities, I was severely chastised for collecting in a province not listed on the permit. The person who told me that the oversight was not important could not be found! Once the Director of national parks passed through a field camp where intensive studies were underway on the flora and fauna; the director strongly encouraged us to send some of our team down river to make collections in a newly designated reserve. We did so at considerable expense and discomfort. Upon returning to the capital, we were informed by another official that we did not have permission to collect in the reserve, and the collections were confiscated. Of course, the Director of national parks was out of town. While working with colleagues from South Australia, we collected in Western Australia and returned to South Australia with the specimens. Officials in Western Australia were incensed; our permit was to "take," not "take out." The lesson is: Have everything in writing and be sure that the documents are correct and have all of the necessary signatures and seals.

Many countries require that a percentage of specimens be deposited in an institution in the country, and some countries (e.g., Brazil and Peru) require that all holotypes be deposited in such collections. Formerly, officials in some countries requested that a "synoptic collection" be left in the country. It was not uncommon for collectors to leave many specimens of common species and depart with the "goodies." Understandably, this probably was standard operating procedure in countries that had no herpetologists or herpetological collections. Nowadays, many such countries have trained, active scientists studying their herpetofaunas and maintaining scientific collections. If deposition of specimens in the host country is required, the most effective means of achieving this is to have an interinstitutional agreement that clearly documents the disposition of specimens, including percentage of specimens, division of taxa (and uniques), and disposition of types. Moreover, are the specimens to be left in the host country or returned after study? Obviously, such agreements should conform to the laws of the country, and it is best to have agreements approved by the office that issues permits.

Exportation of Specimens

Once field work has been finished, it is frequently necessary to spend several days in the capital city in order to obtain export permits. This usually is accomplished at the same agency that issued the collecting permit. Depending on the country, various kinds of information must be provided. Minimally, this will consist of a list of species and numbers of specimens of each, as well as the name of the person exporting the specimens and the institution in the U.S. where the specimens will be deposited. It is a good idea to have copies of your institutional import permit issued by the U.S. Fish & Wildlife Service (USFWS). At the time of applying for the export permit, it is necessary to have a document from the institution in the host country showing that all obligations regarding disposition of specimens and data have been fulfilled. Furthermore, additional costs may be entailed. For example, Cameroon charges a "kill tax" on each specimen; this is a spinoff from big-game hunting.

In addition to laws of a given nation, permit offices in all but a few nonsignatory countries theoretically abide by the regulations of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Species listed on CITES Appendix I can be exported (and imported) only with special permits, often from both countries. If such species are important to your research, it is imperative that you have the special permits. On the other hand, species listed on CITES Appendix II can be exported (and imported) with proper permits. Some foreign officials insist on using the official CITES exportation form for all species, whether or not they are listed by CITES.

In recent years, herpetologists have been collecting tissues for molecular studies. Whether such tissues are in liquid nitrogen or special liquid preservatives, it usually is necessary to have special permission for their exportation. With the increasing emphasis on pharmaceuticals from exotic plants and animals, nations around the world have increasing concern about their "genetic resources" and potential financial gain from commercial products derived therefrom. Thus, it may be necessary to sign restrictive documents.

All of these procedures may require what seems to be an inordinate amount of time; delays should be expected. Despite the fact that a neat, typewritten list of specimens was provided to the permit office, usually instead of an export permit with the list bearing appropriate official stamps being appended to the permit, everything may be retyped (with numerous errors) with faint carbon copies. Permits usually must be signed by a series of increasingly superior officials. Thus, once the permit has been prepared, several days may elapse before the last bureaucrat signs the permit.

A note of caution: Beware of dealing with individuals who act as brokers or who are representatives of nongovernmental agencies. Some of these persons might be very helpful, but other unscrupulous individuals charge substantial fees for their "services" and provide bogus documents. Also, from bitter experience, I learned that internal politics can cause grief. After having a reasonably good working relationship with an institution in a Latin American country for several years, a representative of a nongovernmental agency in that country coordinating a large collecting trip made a unilateral decision to have specimens deposited in another institution. Upon learning of this, the first institution pressured the government agency to negate the collecting permit and caused a delay of nearly one year in the issuance of the export permit.

Once the permit (and several copies thereof) is in hand, most of the procedure may be over. It is recommended that you transport your collection with you. If you are driving to the U.S. from a Central American country, you cannot transport specimens through Mexico to the U.S. without obtaining a permit from Mexico. Traveling by air may be less difficult, except for the costs of excess baggage and real, or perceived, problems with containers, especially a liquid nitrogen canister. However, it is possible that customs officials at the airport of departure will demand documentation for (and even inspection of) specimens. Enforcement of environmental and wildlife laws is a luxury that most nations can ill-afford. Thus, you may encounter officials who do not understand the legalities of your undertaking. This sometimes results in problems at airports.

If the specimens are being shipped via air or sea cargo, it is necessary to have a customs broker in the host country. The customs broker will need to have copies of the export and import permits, completed and signed USFWS declaration documents (Form 3-177), and name and address of a customs broker at a designated port of entry in the U.S. (see below.) If more than one container is being shipped, each container should be addressed properly and noted sequentially (e.g., 1 of 3 containers). A manila envelope containing copies of all documents should be securely fixed to the first container. Ideally, you should not depart the foreign country until the shipment has been fully taken care of and you have in hand a bill of lading. Otherwise, have a responsible colleague deal with the broker.

Laws in some countries require different documents for international shipments. For example, in order to ship specimens from Chile, a certificate from a veterinarian was necessary; the veterinarian to whom I took a container of preserved specimens opened the container, got a whiff of formalin, and with a very perplexed look on his face signed the document. As soon as possible, inform the intended customs broker in the U.S. of the scheduled time of arrival. Because of the time involved in seeing that a shipment is on its way and because of the fees charged by the broker, it usually is less expensive to carry the collection with you as excess baggage, unless the collection is extremely bulky or heavy.

Importation into the United States

There are only 14 designated ports of entry for importation of wildlife into the U.S.—Atlanta, Baltimore, Boston, Chicago, Dallas/Ft. Worth, Honolulu, Los Angeles, Miami, New Orleans, New York, Newark, Portland, San Francisco, Seattle. An Exception to Designated Port Permit may be requested from the appropriate USFWS Law Enforcement Regional Office—Portland, Oregon (503-231-6125); Albuquerque, New Mexico (505-248-7889), Fort Snelling, Minnesota (712-725-3530); Atlanta, Georgia (404-679-7057); Hadley, Massachusetts (413-253-8274); Denver, Colorado (303-236-7540); Anchorage, Alaska (907-786-3311). However, with an export permit from Mexico, specimens can be imported at the following border crossings—Brownsville, El Paso, Laredo, Nogales, and Tijuana.

Every person entering the U.S. must fill out a Customs Declaration Form, which includes a question about carrying animals or parts thereof; if you have any specimens, you are legally bound to answer "yes." Upon seeing that you have declared that you have animals, the customs inspector usually will ask what you have and then send you and your luggage to the inspector from the U.S. Department of Agriculture. Show the agricultural inspector the import permit and Form 3-177 with an attached list of species. The inspector nearly always will ask if any of the specimens are alive. At this point, any one of several things may happen: (1) The inspector may say that agriculture has no interest in these and approve your passage. (2) The inspector may agree to sign and stamp the importation documents and keep two copies to be forwarded to the USFWS. (3) Most correctly, the inspector will require your importation to be approved by an inspector from the USFWS. Often, a USFWS inspector is not present in the customs area; thus, the USFWS office must be called. In some cases, the matter can be handled over the telephone, and the USFWS records the institution where the material will be available for inspection, requests that the importation documents be mailed to their office, and will inform the agricultural inspector to approve passage. In other cases, the USFWS will send an inspector to the port of entry; this may result in your waiting for an hour or more. Upon his arrival, the inspector may do nothing more than review the documents and ask a few questions or carefully check every name against CITES lists and ask to see certain specimens. If the documents are not in order, the specimens may be confiscated.

In order to expedite the process at the port of entry, it is desirable to make previous arrangements with the USFWS at that port. These consist of providing the USFWS office there with the date and time of arrival and copies of import and export permits, Form 3-177 and a list of specimens. This usually cannot be done until shortly before you leave the foreign country, so it will be necessary to fax the documents. However, after going to the expense of faxing the documents, you cannot necessarily expect an inspector from the USFWS to be present when you arrive in the US.

If your specimens were not inspected at the port of entry and Form 3-177 was not signed by an inspector from the USFWS, you should notify your USFWS Law Enforcement Regional Office by sending a set of documents and informing the office of the location and availability of the specimens for inspection. There is an exception for the reporting after the fact that is available to "accredited scientists or scientific institutions" for the importation of "dead, preserved, dried or embedded scientific specimens or parts thereof" without initially filing Form 3-177. However, this form must be submitted within 180 days of the importation and must include taxonomic identifications of the specimens and their country of origin, together with a copy of the export permit from the country of origin.

The importation of frozen tissues of birds, as well as skinned study specimens not in fluid preservatives, requires a permit from the Animal and Plant Health Inspection Office (APHIS). APHIS regulates the importation of all "animal-origin materials" that could represent a disease risk to U.S. livestock and the importation and transportation of infectious organisms and vectors of disease agents, including not only animal products and byproducts but also biological materials that contain, or have been in contact with, certain organisms and animal materials (including cell cultures).

Although Agricultural Inspectors at a port of entry may pay special attention to frozen tissues, the APHIS regulations do not apply to amphibians and reptiles. Permits are issued to institutions approved by APHIS of the U.S. Department of Agriculture; inspection of storage facilities of such tissues is made periodically by officials from APHIS. Up-to-date information and application forms can be obtained electronically >http://www.aphis.usda.gov<.

In cases where specimens are shipped from a foreign country to a designated port of entry (or non-designated port with the prior Exception to Designated Port Permit), copies of all documents should be in the hands of the customs broker at the time of arrival of the shipment. Such shipments are subject to inspection at the port of entry, or they may be shipped in bond to your institution, where they may be inspected by a local agent of the USFWS.

Although many wildlife regulations and statutes seem to be overly complicated, they are the result of international treaties and agreements and must be followed. Minimally, every scientist involved with the importation and exportation of scientific specimens should be familiar with the U.S. Endangered Species Act (ESA), which is the U.S. statute that fulfills our obligations under the CITES Treaty. Full information about these regulations may be obtained from the Code of Federal Regulations. See especially 50 CFR, parts 13, 14, 16, 17, 18 and 23. The regulations are available electronically: >http://www.access.gpo.gov/nara/cfr/index.html<. Also see Digest of Federal Laws of Interest to the U.S. Fish and Wildlife Service: >http://www.fws.gov<. Information on CITES can be obtained electronically: >http://www.wcmc.org.uk:80/cites<. The CITES Appendices with the listing of controlled species and a listing of institutions can be accessed: >http://www.unep.ch/cites.html<. Also, essays and material on regulations included in Anonymous (1997) are useful.

International Loans, Exchanges, and Gifts

By strict letter of the law, all importation and exportation of wildlife must be documented for, and approved by, the USFWS. These regulations apply to specimens temporarily imported as a loan. Thus, if specimens are borrowed from a foreign institution, they must be documented as being exported and imported legally; moreover, if the species is listed by CITES, the CITES permit from the foreign country is required. For example, at The University of Kansas, we fill out Form 3-177 and attach a copy of the loan invoice from the foreign institution for a loan to us. When the specimens are returned, we fill out Form 3-177 and attach a copy of our shipping invoice. If specimens are loaned to, or exchanged with, a foreign institution, the same procedures are followed. Semiannually, all such documents are sent to the regional office of the USFWS.

Sometimes an institution receives specimens as an unsolicited gift from a person in a foreign country. Notification of such receipt should be sent to the local office of the USFWS. An attempt should be made to obtain the necessary permits from the person who sent the specimens. If no permits are forthcoming, the USFWS should be requested to rule on the status of the specimens. Once that is done, one of three things may happen:

- If the only problem involved is that of the filing of Form 3-177, the USFWS normally will allow you to file the form after the fact, because the material was an unsolicited gift.
- If the specimens required an export permit or other documentation from the country of origin, you should request, or ask the sender to request, an after-the-fact permit from the appropriate office in the country of origin.
- If you are not interested in keeping the specimens or the foreign government will not issue an after-the-fact permit, the USFWS will either allow the specimens to be returned to the sender or the items will be seized by the USFWS. Seizures of such material normally are settled with their abandonment by the receiver.

During an investigation, the USFWS may sequester all specimens under investigation. Upon the completion of an investigation, the specimens may be returned to the collection, confiscated, or returned to the country of origin.

Institutional Responsibilities

Collections in natural history museums are acquired by field collecting, exchange, gift, purchase, bequest, contract, abandonment, or other means. It is the responsibility of the institution to insure that all accessioned specimens were acquired legally. Because accessioning of material into the museum initiates ownership and legal responsibility, specimens should not be accessioned until all proper documentation is in order. If not already in place, formal policy and guidelines for the accessioning of specimens should be established in every natural history museum. As a model for aiding in compliance with accession policies, I present herein the accession checklist adopted by the Natural History Museum at the University of Kansas in April 1996.

Receipt of specimens previously catalogued in another museum (by donation, gift, exchange, abandonment, or purchase):

- Transmittal form or letter from appropriate authority at the institution of origin
- Signed Deed of Transfer form
- Export permit (if from a non-US institution)
- Import permit (if from non-US institution)
- CITES permits if transaction involves CITES-listed species
- APHIS certification (if applicable)

Receipt of specimens not previously catalogued in another museum (field work, gift, exchange, purchase, donation, bequest, or contract):

- Original or copy of collecting permit(s)
- Original or copy of export permit (if from foreign country)
- Signed Deed of Transfer form
- Current USFWS permit on file
- Copy of USFWS Form 3-177 (if from foreign country)
- CITES permits (if transaction involves CITES-listed species)
- Antarctic Conservation Act permit (if applicable)
- Bald Eagle Protection Act permit (if applicable)
- Bureau of Land Management permit (if applicable)
- Controlled Substances Act permit (if applicable)
- Feather Import Quota permit (if applicable)
- Federal Noxious Weed Act permit (if applicable)
- Fur Seal Act permit (if applicable)
- Marine Mammal Protection Act permit (if applicable)
- Migratory Bird Treaty Act permit (if applicable)
- Plant Pest Act permit (if applicable)
- Plant Quarantine Act permit (if applicable)
- State collecting permit (if applicable)
- USFWS Salvage permit (if applicable)
- APHIS certification (if applicable)
- Original or copy of field notes for specimens in accession
- Originals or copies of any correspondence relating to accession

The Deed of Transfer includes a description of the accession and a signed and dated agreement: "I hereby acknowledge that I have read the terms of acceptance of this accession, and that to the best of my knowledge, the specimens and/or objects comprising this accession were obtained legally."

Personal Responsibilities

Regardless of one's opinion or assurances from others, ultimately it is the individual's responsibility to know and abide by the laws and regulations of the country in which you are collecting specimens. Also, it is the individual's responsibility to know and abide by the laws and regulations of the U.S. and how your collection must be documented prior to importation. Anything less will expose the individual and the institution to possible criminal or civil penalties.

I have had the misfortune of being subjected to a Federal investigation. As a curator in the Division of Herpetology in the Natural History Museum at The University of Kansas, I collected thousands of specimens of amphibians and reptiles in various parts of the world. I thought that I was fairly knowledgeable about the wildlife laws and regulations of the U.S. and the foreign countries in which I was collecting. Unfortunately, I became lax in my observance of these laws and grew to depend too much on others to assist me in the tedious job of obtaining foreign permits and doing the required paperwork. My lack of foresight and negligence eventually contributed to a Federal investigation of me and The University of Kansas. The investigation dealt with five collections of amphibians and reptiles that I imported into the U.S. and one unsolicited collection that I received from a colleague. These six collections were imported into the U.S. between the years 1991 and 1994 without the required foreign permits and without declaring the items once they entered the U.S.. I did work with the USFWS on one of those importations in trying to obtain the required export permits after the fact. However, my lack of concern for the requirements of Federal wildlife laws of which I was aware led to eventual enforcement action against me. I was fined a substantial civil penalty (many thousands of dollars), was restricted from any collecting activities for one year, and was required to submit this paper in an effort to prevent others from making the same mistakes that I made. This investigation also resulted in a great deal of embarrassment and scrutiny of myself and The University of Kansas. Although I was acting as an agent of The University of Kansas and the specimens were deposited in that institution, the University placed all responsibility on me.

Thus, I encourage anyone involved with the collection of foreign scientific specimens for eventual importation into the U.S. to know and abide by the laws before acting. Do not depend on other individuals or your institution to assume those responsibilities. Educate yourself on the legal way to conduct your collecting and research activities. The laws are in place for purposes of biological conservation and must be observed if scientific collecting is to be a respected and continuing practice.

Laws and the Future of Scientific Collecting

In well-meaning efforts to protect species and certain populations, international organizations and governments throughout the world have enacted a bewildering array of regulations that commonly restrict scientific activities that are essential to secure the very information that might be useful in determining how to protect threatened species. Yet habitat destruction and wanton slaughter of animals continues. How many of us have returned to a formerly pristine forest only to find it cleared? How many of us have seen a person kill a rare snake but not be able to preserve the specimen for science because we had no permit?

We are all aware of species of amphibians and reptiles that are threatened or endangered, as we are aware of rapidly declining populations of amphibians. These so-called threatened and endangered species are listed in different places by different organizations; the listings do not necessarily coincide. Anyone using these lists needs to realize the different purposes of these lists and the legal requirements facing anyone conducting scientific collecting of these species.

A comparison of the three most common up-to-date lists of amphibians (ESA, CITES, and IUCN) reveals that only four species are common to the three lists (Duellman, 1999). The reason is that these lists have different purposes. The list generated by the Endangered Species Act, U. S. contains all of the federally listed endangered species of animals and plants. The species listed therein are protected under federal laws and regulations and can be imported into, or exported from, the U.S. only with a permit for scientific purposes obtained beforehand from the USFWS. The Convention on the International Trade in Endangered Species (CITES) has a list of species that are in peril of becoming endangered or threatened because of exploitation through international trade. Although these species can be imported into the U.S., their importation requires permits from the exporting country and sometimes from the U.S., as in the case of species listed on Appendix I. The list provided by the International Union for the Conservation of Nature (IUCN) is in place to help ensure that trade in wildlife is maintained at sustainable levels and in accordance with domestic and international laws and agreements. In many cases (e.g., dendrobatid frogs), listing by CITES has not curtailed traffic, because of commercial interests (Gorzula, 1996). International importation and exportation by the pet trade is in orders of magnitude greater than that by scientific institutions. Lobbying efforts by organizations such as the Pet Industry Joint Advisory Council are far more influential than any organization representing biologists studying biodiversity. These and other issues were addressed thoughtfully and eloquently by Campbell and Frost (1994).

In order to gather essential data on biodiversity, scientific collecting needs to be encouraged, and scientific collectors need to become thoroughly educated on the laws regulating their activities. Scientists need to take an active role in working with governments to establish regulations. In fact, scientists recently had the opportunity on the development of policy for the use of permits as conservation tools (Federal Register Notice, Vol. 63, No. 153, August 10, 1998). Moreover, biologists, especially systematists, need to educate the public and governments on the necessity of continued scientific collecting.

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THE LIZARDS OF IRAN

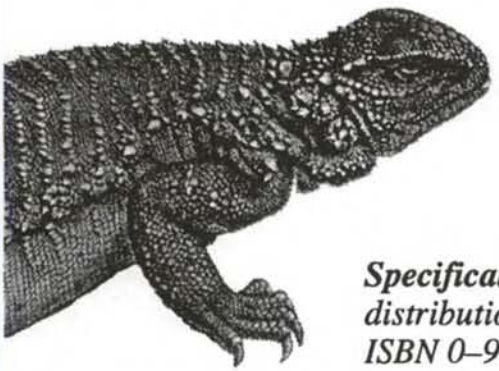
by Steven C. Anderson

CALIFORNIA ACADEMY OF SCIENCES AND UNIVERSITY OF THE PACIFIC



IRAN IS A LARGE AND STRATEGICALLY LOCATED country, but few synthetic studies of its herpetofauna have been published. Steven C. Anderson has conducted extensive field work in Iran, beginning in 1958, and has spent a lifetime studying its herpetofauna, a subject on which he is a recognized authority. The lizard fauna of Iran is quite diverse and includes representatives of eight families: Agamidae (20 species), Anguidae (2), Eublepharidae (3), Gekkonidae (39), Lacertidae (42), Scincidae (14), Uromastycidae (3), and Varanidae (2).

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ARTICLES

Habitat Characteristics of Sympatric Gilbert's and Western Skinks

MICHAEL L. MORRISON[1]
PAUL A. AIGNER[2]
LISA A. NORDSTROM[3]
and
LINNEA S. HALL[1]
Department of Environmental Science, Policy, and Management
University of California, Berkeley, California 94720, USA

[1]*Present address: Department of Biological Sciences, California State University, Sacramento, California 95819, USA*
e-mail: wildmlm@worldnet.att.net
[2]*Present address: Department of Biology, University of California Riverside, California 92521, USA*
[3]*Present address: Department of Fisheries and Wildlife, Utah State University Logan, Utah 84322, USA*

Two closely related skink (*Eumeces*) species have been recorded in the Inyo and White mountains of eastern California. Gilbert's skinks (*E. gilberti*) occur in both ranges around springs and streams between 1200 and 2400 m, and away from water between 1800 and 2400 m (Macey and Papenfuss 1991). Until 1991, only a single western skink (*E. skiltonianus*) was recorded in the Inyo-White range, although it has been presumed to be a high-elevation species inhabiting the pinyon-juniper (*Pinus-Juniperus*) woodlands of the White Mountains between 2100 and 3000 m (Macey and Papenfuss 1991). The distribution of both species in the Great Basin is likely influenced by the desiccation of the region since the last Pluvial period of the Pleistocene (Banta 1962). Where the two species come in contact, *E. gilberti* apparently occupies lower elevations and more arid conditions (Rodgers and Fitch 1947; Tanner 1957).

Little is known about these species in areas of sympatry. Furthermore, habitat use by the species has only been anecdotally described for most of their range. Both species seem to have similar preferences for open, rocky areas with scattered vegetative cover (e.g., Rodgers and Fitch 1947; Tanner 1957, 1988). The purpose of our study was to describe the microhabitat relationships of these skinks in a zone of sympatry in the Inyo-White mountains, Inyo County, eastern California.

The Inyo-White mountains, ranging from 1500 to 4200 m in elevation, lie along the California-Nevada border, parallel to and east of the Sierra Nevada Mountains. The environment is arid with warm, dry summers. Snow cover and rainfall usually last from November through May, and scattered thunderstorms occur in late summer (see Morton et al. 1995 for details). We worked in the pinyon-juniper (*Pinus monophylla-Juniperus osteosperma*) woodland. The understory was composed of scattered individual trees and small patches of only a few shrub species, most commonly sagebrush (*Artemisia nova* and *A. tridentata*) and bitterbrush (*Purshia tridentata* and *P. glandulosa*). The grass-forb layer was sparse and the ground cover was bare soil or rocks (Hall 1992; Lloyd and Mitchell 1973).

We established three trapping grids as representative of the pinyon-juniper vegetation in which the skinks were thought to be sympatric: "Pinyon" (T7S, R35E, sec. 29; 2100 m elevation) and "Cedar" (T7S, R35E, sec. 32; 2200 m elevation) were about 1.5 km apart, and "Westgard" (T8S, R35E, sec. 9; 1900 m elevation) was about 7 km from the other two. Grids were >300 m from a road. Each grid consisted of 41 pitfall traps (without drift fences) arranged in a 200 x 200 m (4 ha) area. We established nine parallel trap lines with traps placed at 25-m intervals. Traps were constructed of two no. 10 cans taped together (the bottom of one can was removed), with small (1–2 mm) drain holes punched in the bottom. A 30 x 30-cm piece of plywood was raised about 4 cm above each trap to provide shade (Corn 1994).

Traps were opened during the first week of May and closed during the last week of September for a total of about 5300 trap days per grid per year, from 1989 to 1991 (48,000 total trap days for the study). Traps were examined at least every two days. All captures were identified as to species, sex, and age, and a single hind toe—unique to each year of study—was clipped to facilitate determination of the number of animals captured. Animals were released >2 m from the trap. Identification of animals, including juveniles, was made following Macey and Papenfuss (1991). Morrison and Hall (in press) reported other, non-skink species captured.

To describe the joint distribution of animals on each grid we calculated the percent of traps occupied by at least one individual of both species in the same year, and in different years. The sample size of available traps (denominator in the calculation) was the number of different traps occupied by either species within or across all years, respectively.

We established 10-m-radius plots centered on each trap location to characterize the macrohabitat conditions surrounding a trap. Within each plot we determined the slope, aspect, and slope position (on a scale of 0.0–1.0, where 0 = bottom, 0.5 = mid slope, and 1.0 = ridge top); and counted snags (≥1.5 m tall), stumps (<1.5 m tall), and pinyon and juniper trees by height class (1.5–3, >3–6, >6 m). We also established a transect bisecting the 10-m-radius plot, and at 1-m-intervals along this transect, recorded the presence of habitat features that intercepted an imaginary line extending vertically above the ground. Features recorded included type of ground cover (e.g., bare ground, sand, gravel, and litter), dead and down woody cover, and the presence of each plant species within three height classes (given above).

We used one-way analysis of variance (ANOVA) and Tukey's multiple comparison tests to compare habitat use between the two skink species and the abundance of the habitat features on the study plots. Variances were equal across groups. Too few animals were captured for analyses by individual grids, or for the use of multivariate statistics (Morrison et al. 1992:329–330). We reduced the data set for presentation by conducting simple correlations among all variables and retaining one of each pair of variables with an $r > 0.4$ ($P < 0.05$); the variable retained had the lowest t-value of the pair. All analyses were conducted using SPSS-PC software.

Over all three years we captured 26 *Eumeces gilberti*, five of which were recaptures; 88% were adults and 12% were juveniles. Animals were captured between 25 May and 18 September. We captured 29 *E. skiltonianus*, one of which was a recapture; 52% were adults and 48% were juveniles. Animals were captured between 7 May and 19 September. *Eumeces skiltonianus* was more numerous on the Pinyon (5 *E. gilberti* and 11 *E. skiltonianus*) and Cedar (11 *E. gilberti* and 15 *E. skiltonianus*) grids, and *E. gilberti* were more numerous (10 animals) than *E. skiltonianus* (3 animals) on Westgard.

There was no overlap in trap use by the species in the same trap in the same year on Pinyon (0 of 10 potential traps); however, 9.5% (2 of 21) of the traps on Cedar, and 22.2% (2 of 9) on

TABLE 1. Habitat characteristics of trap sites used by *E. gilbeti* and *E. skiltonianus*, and the abundance of those characteristics, in the Inyo-White mountains, California, 1989–1991 (sample sizes in parentheses). Means with different letters were significantly different ($P < 0.05$), and those with letters in parentheses were nearly significant (i.e., $P < 0.1$), using Tukey's multiple comparison tests. All variables are percent cover except slope position (0 = bottom, 0.5 = mid slope, 1 = ridge). Only variables with mean values of ≥5% cover are presented.

Characteristic	*E. gilberti* (19) mean	SD	*E. skiltonianus* (23) mean	SD	Abundance (123) mean	SD	P[a]
Slope position	0.12B	0.06	0.66A	0.28	0.50A	0.35	<0.001
Slope (degrees)	13	7.1	15	10.0	15	7.0	0.550
Coarse gravel	50(A)	21.3	46(A)	23.3	58(B)	26.4	0.075
Large stones	8	9.8	6	5.5	5	7.7	0.209
Grass	6	5.1	5	5.7	4	5.4	0.332
Juniper litter	1(A)	4.1	1(A)	4.6	6(B)	11.7	0.056
Shrub litter	13A	11.0	12AB	10.7	7B	8.8	0.014
Total juniper trees	7	11.1	4	6.7	9	12.2	0.133
Total pinyon trees	30	16.5	33	22.3	26	19.0	0.316
Down wood	7	5.9	6	6.8	6	7.1	0.794

[a] Analysis of variance.

Westgard captured both species. Animals caught in the same trap but in different years were 7.7% (1 of 13) on Pinyon, 23.5% (4 of 17) on Cedar, and 25% (1 of 4) on Westgard.

Traps used by *E. gilberti* and *E. skiltonianus* had similar habitat characteristics, with slope position of capture sites being the only variable that was significantly different between species (Table 1). The similarity in habitat use by these species occurred despite considerable variability in habitat characteristics available to them. *Eumeces gilberti* were captured near the bottom of slopes, whereas *E. skiltonianus* were captured just above mid-slope. As slope position of traps increased, the cover of small juniper and coarse gravel decreased (r = -0.3 to -0.4, $P < 0.01$); whereas the cover of pinyon trees and large rocks increased (r = 0.2–0.3, $P < 0.05$). Thus, lower slopes were more open—and thus perhaps warmer—than the more shaded and protected mid-slopes. Relative to the abundance of habitat characteristics, both skink species were captured in locations of relatively greater shrub litter (Tukey's $P < 0.1$ for *E. skiltonianus*), less juniper litter, and less coarse gravel (Table 1). The use of deep litter for burrowing is typical of these species (e.g., Macey and Papenfuss 1991; Rodgers and Fitch 1947). Locations with a high proportion of juniper tend to have little litter cover and are sparsely vegetated (pers. obs.).

Eumeces gilberti were captured more frequently than *E. skiltonianus* on the Westgard grid, which was the lowest elevation grid and was relatively more open and had a high proportion of juniper trees (Morrison and Hall, in press). In contrast, *E. skiltonianus* outnumbered *E. gilberti* on the Pinyon and Cedar grids, which were more mesic due to an extensive cover of pinyon trees and a more easterly aspect (Morrison and Hall, in press). Banta (1962) speculated that *Eumeces* was more widespread in the Great Basin during the wetter, Pluvial periods of the Pleistocene. Further, he thought that *E. gilberti* was more capable of existing at lower elevations and in more arid environments than *E. skiltonianus*, which is restricted to higher elevations in southern mountains. Similarly, Rodgers and Fitch (1947) described *E. skiltonianus* as spotty in occurrence and restricted to cooler, higher areas in the Great Basin (see also Tanner 1957). Macey and Papenfuss (1991) speculated that *E. skiltonianus* was not found below 2100 m in the Inyo-White mountains. In contrast, they felt that *E. gilberti* occurred across a wider elevational range, from 1200 to 2400 m. Thus, our field sampling supported the basic relationships proposed by Banta (1962) and Macey and Papenfuss (1991). In addition, our results indicate that *E. gilberti* and *E. skiltonianus*, while broadly overlapping on the landscape level, tend to separate by microhabitat features (e.g., slope position, tree density) that may reflect microclimate conditions within their area of sympatry in the Inyo-White mountains.

A potential weakness of our study was the use of a single sampling method to assess skink abundance and habitat use. We could not conduct visual encounter surveys (Crump and Scott 1994) because our grids were part of a long-term study of small mammal ecology, and we wanted to minimize site disturbance. However, we also found both skink species to be rare during visual encounter surveys in other locations in the pinyon-juniper woodland (see Morrison and Hall, in press).

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The "Spring Lizard" Bait Industry in the State of Georgia, USA

JOHN B. JENSEN
Georgia Department of Natural Resources
Nongame-Endangered Wildlife Program
116 Rum Creek Drive, Forsyth, Georgia 31029, USA
e-mail: john_jensen@mail.dnr.state.ga.us

and

CHUCK WATERS
Georgia Department of Natural Resources, Game Management Section
2150 Dawsonville Highway, Gainesville, Georgia 30501, USA

The term "spring lizard" is a colloquialism used by residents of the Appalachian Mountain region and refers to salamanders sold as bait for fishing. Obviously, this contradictory synonymy can create confusion for fishermen and bait dealers when communicating with biologists and wildlife agency personnel, and vice versa. Nowhere is this more apparent than within the arena of wildlife law and regulation. Although collection and personal bait use of all salamanders not listed as endangered, threatened, or in need of management is permitted in the state, Tennessee law (TN WRCR 1660-1-17-.01B) allows for the sale (as bait) of only "dusky salamanders, *Desmognathus fuscus*" (Levell 1997). However, casual surveys of eastern Tennessee bait shops advertising "spring lizards" found at least seven other salamander species being sold, including *Desmognathus quadramaculatus* (P. Wyatt, pers. comm.), which is further protected as a species "In Need of Management" (Levell 1997). Georgia law (O.C.G.A. 27-1-28) lists "spring lizards," as one of fourteen groups of nongame wildlife exempt from any type of protection. The Georgia Department of Natural Resources does not interpret this portion of the law as including true lizards (Sauria) or salamanders other than *Desmognathus* spp., however the absence of a "spring lizard" definition may create a legal loophole providing little enforcement power for the protection of true lizards or non-desmognathine salamander species. Only those salamander species state-listed as endangered, threatened, or rare (*Ambystoma cingulatum, Amphiuma pholeter, Aneides aeneus, Cryptobranchus alleganiensis, Haideotriton wallacei, Notophthalmus perstriatus,* and *Plethodon petraeus*) are ensured legal protection. No species of lizards are currently listed as endangered, threatened, or rare.

In an effort to determine which species of salamanders are typically sold as bait in Georgia, and therefore provide a better definition of what should be considered legally commercialized species of bait salamanders, spring lizard bait boxes of nine shops in the north Georgia mountains (including Fannin, Forsyth, Habersham, Hall, Rabun, Towns, and Whitfield counties) were inventoried. Further, bait dealers were casually interviewed on various aspects of the spring lizard industry to gain a better understanding of its potential impacts. Visits were made on 29 May 1997 and 9 April 1998. Every salamander in each bait box was systematically identified and enumerated. Individual salamanders of uncertain species were purchased and mailed alive to qualified biologists for accurate identification.

Two species, *Desmognathus monticola* and *D. quadramaculatus*, accounted for more than 95% of all salamanders inventoried, though a total of seven species was encountered (Table 1). Bait dealers and fishermen recognize *D. monticola* and *D. quadramaculatus* as different species, referring to them as "light bellies" and "black bellies," respectively. Many fishermen prefer *D. monticola* over *D. quadramaculatus,* reporting them to be more active on the hook and to live longer.

Of the three other species of dusky salamanders encountered, *D. santeetlah* is of greatest interest. Presently, this species is known to occur only in North Carolina and Tennessee. Its discovery at a Georgia bait shop suggests that either the species ranges further south than currently known, or more likely, spring lizard collectors travel greater distances to sell their catch than would be expected. If indeed the *D. santeetlah* specimen came from within its known range, it was quite possibly collected illegally as the vast majority of its range falls within the Great Smoky Mountains National Park and adjacent National Forest lands.

Only two species of non-desmognathine salamanders, *Pseudotriton ruber* and *Gyrinophilus porphyriticus,* were found. These two species are marketed as "red dogs," and apparently are highly sought after by fishermen. Though not found during this survey, larval *Ambystoma tigrinum* are occasionally available at Georgia bait shops, where they are marketed as "mud puppies" or "waterdogs" rather than spring lizards (J. Ozier, pers. comm.). Non-desmognathine salamanders found in Tennessee bait shops included *G. porphyriticus, Notophthalmus viridescens, Plethodon serratus, Pseudotriton montanus,* and *P. ruber* (P. Wyatt, pers. comm.).

TABLE 1. Number of salamanders, by species, encountered at nine bait shops in northern Georgia, 29 May 1997 and 9 April 1998.

Species	Total no. of individuals	Percentage
Desmognathus fuscus	25	2%
D. monticola	686	67%
D. cf. *ochrophaeus*	1	<1%
D. quadramaculatus	310	30%
D. santeetlah	1	<1%
Gyrinophilus porphyriticus	1	<1%
Pseudotriton ruber	2	<1%

The sale of spring lizards is very seasonal, with most dealers offering them only during early spring and, occasionally, late fall. Spring lizards are mainly used to catch various species of bass, primarily from large reservoirs and other impoundments. Once late spring arrives and water temperatures begin to warm in these lentic bodies, spring lizards reportedly do not live long enough on the hook to be of much fishing value. During winter, collectors are not successful at finding enough spring lizards to continue pursuit and sale of them.

Most bait dealers sell spring lizards for US $4–$6/dozen after purchasing them for around US $2/dozen from individual collectors. "Red dogs" are usually sold individually and often are more expensive. One bait shop owner informed us that he typically buys four or five dozen spring lizards at a time and may purchase up to 120 dozen each year. In some areas of south and central Georgia, fishermen have north Georgia bait dealers or collectors send shipments of live spring lizards (E. Williams, pers. comm.). The presence of isolated colonies of *D. quadramaculatus* in south and central Georgia may be a result of the release of specimens distributed in this manner (Conant 1975).

There are several collecting methods employed, one of which is particularly disturbing. This method involves pouring liquid bleach into small streams, which apparently "shocks" the salamanders out from hiding. Collectors then easily grab up all the stunned animals and quickly wash them off. Obviously, this method likely creates a significantly negative impact on all the aquatic fauna and flora found in the streams where it is used. This method may impact populations of rare species, such as *Cryptobranchus alleganiensis* and several species of fish. Encouragingly, most bait dealers are very much opposed to this since spring lizards collected in this manner rarely live more than a couple of days. Several dealers informed us that one can occasionally smell the bleach on the spring lizards and that they often have "foggy" eyes. Individuals who collect spring lizards in this fashion will likely be "weaned-out" of this industry since dealers will not give them follow-up business. However, individuals who collect their own bait for a day of fishing may continue employing this method because it is fast, effective, and the animals should live, at least, through the day.

Another method practiced by some individuals involves stream diversion (M. Harris, pers. comm.). Small streams that run under unpaved roads can be diverted by placing a plywood board in front of the culvert, which backs up the water upstream from the road crossing. Once the water rises to the road level, ideally it then begins flowing down the tire-ruts of the road and away from the stream channel. Downstream from the culvert, the stream-bed is then exposed making it much easier to collect salamanders from under rocks. Others simply collect spring lizards by rolling rocks and logs in or adjacent to small streams and seeps, without the aid of stream diversion. Though none of the dealers we spoke with mentioned other collecting techniques, Camp and Lovell (1989) reported the use of a "fishing pole" equipped with an earthworm-baited hook for effectively capturing *D. quadramaculatus*. All methods reported involve collecting in or immediately adjacent to small streams, which may account for the encounter of only one *D.* cf. *ochrophaeus*. This species is noted for being more terrestrial and often living considerably further from water than most other *Desmognathus* spp. (Bishop 1943).

There are almost certainly additional species of salamanders that turn up from time to time in Georgia bait shops and additional collecting techniques are surely practiced. However, this study should provide the framework for applying more scientifically-based knowledge to laws and regulations involving bait salamanders in Georgia.

Acknowledgments.—Floyd Scott and Stephen Tilley confirmed the identity of several individual salamanders that puzzled us. We especially want to thank the owners and personnel at Crestview Grocery, Shady Rest Bait Shop, Field Stone Marina, Lakewood Bait and Tackle, Grant's Sporting Goods, Wahoo Trading Post, Hammonds Bait Shop, Wee Willy's No. 4, Wren's Bait and Tackle, and Freddy's Quick Service for their assistance with this inventory. Law enforcement officers with the GDNR provided information on bait shops that sold "spring lizards." The manuscript was improved through editorial comments provided by Mike Harris and E. J. Williams.

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Eleutherodactylus Frog Introductions to Hawaii

FRED KRAUS
Department of Land and Natural Resources, 1151 Punchbowl Street Room 325, Honolulu, Hawaii 96813, USA

EARL W. CAMPBELL
USDA National Wildlife Research Center, Box 10880, Hilo, Hawaii 96721, USA

ALLEN ALLISON
Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii 96817, USA

and

THANE PRATT
USGS-Biological Resources Division, P.O. Box 44 Hawaii National Park, Hawaii 96785, USA

As an oceanic archipelago isolated from continental source areas, Hawaii lacks native terrestrial reptiles and amphibians. Polynesians apparently introduced seven gecko and skink species after discovering the islands approximately 1500 years ago, and another 15 reptiles and five frogs have been introduced in the last century and a half (McKeown 1996). The Polynesian introductions are probably inadvertent because the species involved are known stowaway dispersers (Gibbons 1985; Dye and Steadman 1990). In contrast, most of the herpetological introductions since European contact with Hawaii have been intentional. Several frog species were released for biocontrol of insects (e.g., *Dendrobates auratus*, *Bufo marinus*, *Rana rugosa*, Bryan 1932; Oliver and Shaw 1953), and most of the remaining species are released or escaped pets (e.g., *Phelsuma* spp., *Chamaeleo jacksonii*, *Iguana iguana*, McKeown 1996). Government-approved releases have not occurred for many years, but the rate of establishment of new species has increased in the past few decades because of the importation and subsequent release of pets.

We report the recent establishment in Hawaii of three new species of frogs native to the Caribbean: *Eleutherodactylus coqui*, *E. martinicensis*, and *E. planirostris*. Several Antillean *Eleutherodactylus* species have been introduced outside their natural ranges (Table 1) by hitchhiking with nursery plants, but these represent the first reports of establishment of the genus outside the general Caribbean region. *Eleutherodactylus coqui* recently

has been reported from Hawaii in the hobbyist literature (R. Campbell 1996; McKeown 1998), but either vouchered specimens were not provided and identification was unconfirmed (R. Campbell 1996) or claims as to identity and distribution included inaccuracies because they were based on erroneous assumptions and second-hand information from newspaper articles (McKeown 1998). McKeown (1998) did provide one vouchered specimen of *E. coqui* (USNM 515162, identified by R. Crombie, unexamined by us), although the locality data he provided are vague (USNM database records, R. Crombie, pers. comm.). We provide accurate locations for *Eleutherodactylus* species currently known to be introduced to Hawaii and, to the extent possible, information on the methods and rate of spread of these species, their habitat associations in Hawaii, their potential environmental impact in the state, and alternatives for management.

Eleutherodactylus coqui is documented with voucher material from three locations on Maui and five locations on Hawaii Is. (Fig. 1). One Hawaii Is. site and one Maui site are outdoor commercial plant nurseries. One Maui site is a resort hotel with grounds that are planted with horticultural species obtained from nearby nurseries. Two sites on Hawaii Is. and one on Maui are located in residential areas, at least one of which has considerable plantings of nursery material. The last two sites, both on Hawaii Is., are located in ornamental vegetation in a public park and in native forest, respectively. Frogs in the latter site probably originated from ornamental plantings at a nearby residence. The known elevational range of this species in Hawaii is 40–430 m. Populations seem to vary from a few calling individuals at the resort to several thousand individuals at the nursery on Hawaii Island, but all populations appear to be established and expanding, based on discussions with landowners or nearby residents. Population estimates at the Hawaii Is. nursery were based on collecting 105 frogs from an approximately $50m^2$ area in 50 minutes of casual nighttime collecting during very dry conditions lacking calling frogs, and extrapolating across the acreage known to have calling frogs. Virtually all of these captured frogs were adults. This density is approximately ten times that reported for *E. coqui* in unmanipulated native rainforest in Puerto Rico (Turner and Gist 1970, referenced as "*E. portoricensis*"; Stewart and Pough 1983). Although these frogs probably do not occur at this density uniformly throughout the nursery, it illustrates the large numbers and densities that have built up over the relatively short period of time (ca. 5 years) since the first calling frog was noticed.

Eleutherodactylus martinicensis is documented with preserved material from both a nursery at Kokomo, Maui (430 m elev.), which also has *E. coqui* (Fig. 1), and from a residence in Omaopio (~670 m elev.). The former apparently is an established population; the latter may only represent a translocation of a few calling individuals. The numbers of frogs at the nursery was not assessed because the call of this species is readily masked by syntopic calling *E. coqui*.

Eleutherodactylus planirostris is documented from three sites on Hawaii Is., all of which are at or adjacent to commercial plant nurseries, and one residential site on Oahu (Fig. 1). All are established populations. Elevations of sites are low, ranging from 60–190 m. In Jamaica, where this species also has invaded, it can occur up to 610 m elevation (Schwartz and Fowler 1973). Due to this species' cryptic habits and weak call, we did not estimate population sizes at any of the locations, but we routinely collected scores of individuals at night by walking the roadside grass margins at the Pahoa site. This site is adjacent to extensive ohia forests on 'a'a lava, suggesting that frogs also may occur in the native forest, as they do elsewhere where the species has invaded (Goin 1947; FK, pers. obs.).

Maui has the greatest number of reported locations with *Eleutherodactylus*. Radio public service announcements broadcasting the call of *E. coqui* and asking the public to report encounters with these animals have been playing on Maui since May 1998. This has resulted in our receiving additional reports of calling frogs from Honokowai, Ka'anapali, Kula, Ulumalua, Wailea, and Wailuku (Fig. 1). These are probably *E. coqui*, *E. martinicensis*, or mixed choruses of the two, given that they are the only two species known from the island, their calls are similar, and most reports have been in response to the broadcast calls. Most unverified sites are at resort hotels or from residential areas. Hotels from which frogs are reported are near sea level on the dry, leeward side of Maui. However, each is thickly planted with horticultural material and watered frequently, apparently providing sufficient moisture for frogs to thrive.

The route of entry of these frogs into Hawaii clearly appears associated with horticultural trade. The largest known populations of *Eleutherodactylus* in the State are found at active nurseries and their immediate surroundings. This is not surprising, given the propensity of each of these species to travel in greenhouse materials (Barbour 1930; Goin 1944; Gorzula 1989; Günther 1895; Lescure and Marty 1996) and the direct developmental mode of each. Although it is possible that each species has invaded the State more than once, we have no way to test this. Most populations appear to be the result of intra-state transport of frogs from infected nurseries to residential or resort sites landscaped with nursery materials. In at least two instances, calling frogs appeared after the purchase and installment of bromeliads for landscaping purposes. In one instance, bromeliads obtained from the Maui nursery with a large population of *E. coqui* and *E. martinicensis* were planted on 19 December 1996, and the first calling frogs (*E. coqui* only) at that residence were heard on 4 January 1997. However, we doubt bromeliads always are involved as vectors in the transport of these frogs. At the nurseries we have visited, *E. coqui* is common on palms, bamboo, *Dracaena*, and among unused pots and pallets. The nurseries around which *E. planirostris* is abundant specialize in raising *Dracaena*.

A second means by which *Eleutherodactylus* frogs may have dispersed in Hawaii is by intentional transport to establish new populations. In at least one case, a nursery owner with a conspicuous population of calling frogs allowed individuals inter-

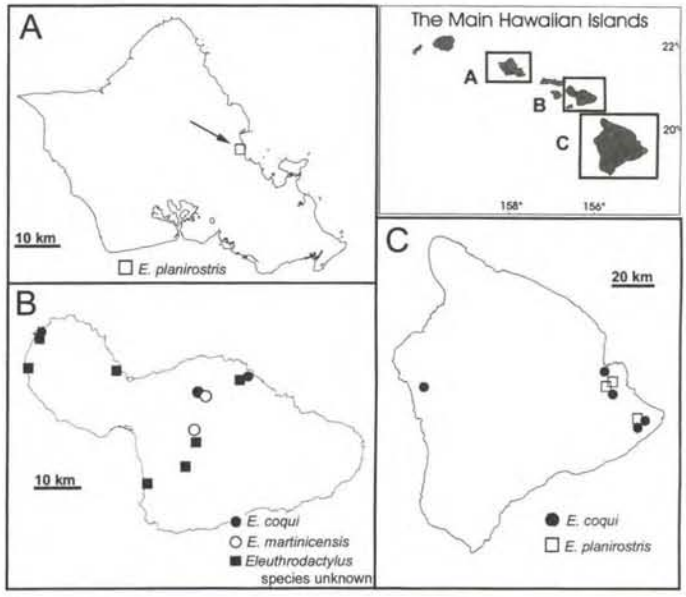


FIG. 1. Map of the Hawaiian Islands showing known localities of *Eleutherodactylus* on A) Oahu, B) Maui, and C) Hawaii Island.

TABLE 1. Introduced populations of Caribbean *Eleutherodactylus*.

Species	Location	Reference
E. antillensis	Panama	DeSousa et al. 1989
E. coqui	US: Florida	Austin and Schwartz 1975; Dalrymple 1994
	US: Hawaii	this paper
	US: Louisiana	Conant & Collins 1991; Schwartz & Henderson 1991
	Virgin Islands	MacLean 1982
E. gossei	Bermuda	Pope 1917; Wingate 1965
E. johnstonei	Anguilla	Censky 1989
	Bequia	Lazell & Sinclair 1990
	Bermuda	Pope 1917; Wingate 1965
	Curaçao	Hardy & Harris 1979
	Dominica	Kaiser & Wagenseil 1995[1]
	England: Kew Gardens	Günther 1895
	French Guiana	Lescure & Marty 1996
	Guadeloupe	Hardy & Harris 1979; Henderson et al. 1992
	Guyana: Georgetown	Hardy & Harris 1979; Bourne 1997
	Jamaica	Barbour 1910a; Dunn 1926; Perkins 1942
	Marie-Galante	Henderson et al. 1992
	Martinique	Lescure 1966
	Mustique	Henderson et al. 1992
	Panamá: Panamá City	Ibáñez & Rand 1990
	Trinidad	Kenny 1980[2]
	Venezuela	Hardy & Harris 1979; Gorzula 1989
E. martinicensis	St. Barts	Kaiser 1992
	US: Hawaii	this paper
E. planirostris	Caicos Islands	Schwartz & Henderson 1991
	Grenada	R. Crombie, pers. comm.
	Jamaica	Lynn 1937, 1940; Lynn & Dent 1943
	México: Veracruz	Schwartz 1974
	US: Alabama	Carey 1982
	US: Florida	Cope 1863; Barbour 1910b; Goin 1947; Conant & Collins 1991
	US: Hawaii	this paper
	US: Louisiana	Plotkin & Atkinson 1979; Dundee & Rossman 1989; Dundee 1994; Platt & Fontenot 1995; Williams & Wygoda 1997
Eleutherodactylus sp.[3]	Union Island	Henderson et al. 1992

[1] Not Kaiser (1992), as erroneously cited by Kaiser and Hardy (1994).
[2] Described by Kenny (1980) as *E. martinicensis*; referred to by Kaiser and Hardy (1994) and Kaiser and Wagenseil (1995) as *E. johnstonei*.
[3] Not *E. johnstonei*, as apparently erroneously cited by Kaiser and Hardy (1994) and Kaiser and Wagenseil (1995).

ested in establishing frogs at their residences to capture frogs from his property. We have been unable to confirm whether these intentional introductions have been successful, but the apparent ease of accidental establishment suggests this could be a viable route of range expansion for the frogs.

Of the three species discussed here, only *E. coqui* has been well-studied in its native range. It lays 4–6 clutches/yr, each with 16–41(mean = 28) eggs/clutch (Townsend and Stewart 1994). Generation time is approximately eight months (deduced from information provided in Townsend et al. 1984; Townsend and Stewart 1994; Turner and Gist 1970). We have received anecdotal reports indicating that population expansion of *E. coqui* at two sites has been rapid and in accordance with expectations based on this prior ecological knowledge. The owners of the large Hawaii Is.nursery reported to us that they initially had a single calling frog in 1992 or 1993, that there were several more calling the next year, and hundreds calling after two years. This is the earliest record of invasion that we have been able to discover so far. As noted above, our estimate is that many thousands of frogs are now calling from several acres at this site. In the instance of the bromeliad shipment noted earlier, landowners heard a single calling frog on 4 January 1997. They then left the State for six months. Upon their return in September, 1997, a few dozen individuals were calling around their residence. Approximately 25–30 calling males were removed from this site between 7 November and 6 December, 1997. These examples illustrate the short time required for *E. coqui* to expand in numbers from a small inoculum of individuals.

Most alien *Eleutherodactylus* species have become introduced to regions relatively near their native ranges that already contained a native frog fauna (Table 1) and, hence, these introductions have not introduced novel ecological challenges to the native fauna. The situation in Hawaii is different because of the original absence of reptiles and amphibians, and leads to concern about the ecological ramifications of introducing these animals to Hawaii or other herpetologically depauperate islands of the Pacific Ocean.

Of primary concern is that the elevational range tolerated by *E. coqui* (Schwartz and Henderson 1991) may allow it to invade native rainforest and mesic forest in Hawaii. In their native Puerto Rico, *E. coqui* can occur at densities greater than 20,000 animals/ha and crop an average of 114,000 prey/night/ha (Stewart 1995; Stewart and Pough 1983). We have seen no reason to expect lesser densities in Hawaiian settings and have evidence that they can match or exceed this. Should *E. coqui* invade native forest, consequent effects on native communities may be substantial: 1) they may exert a tremendous predation pressure on a wide array of native arthropods, primarily insects and spiders, many of which are already stressed to the edge of extinction due to the establishment of other alien predators and parasitoids (Cole et al. 1992; Gagné and Howarth 1985; Gillespie and Reimer 1993; Howarth 1985, 1990); 2) from this, one may expect a resulting indirect negative effect on native forest birds, the majority of which are partially or completely insectivorous (Munro 1944; Perkins 1903; Scott et al. 1986); 3) this rending of the native food web may result in the frogs serving as nutrient sinks (cf. Burton and Likens 1975) in the communities into which they insert themselves or, more likely, serving to enhance already large populations of introduced predators, such as rats and mongooses, which in turn will further increase predation pressure on native birds, a dynamic documented for alien predators elsewhere (E. Campbell 1996; Rodda et al. 1997) and suspected to occur for other taxa in Hawaii (Howarth 1985; Tomich 1986, p. 95). *E. martinicensis* may have a similar effect because its ecology seems similar in most respects to that of *E. coqui*. *Eleutherodactylus planirostris* should have less effect in this regard because it: 1) is currently restricted to relatively low elevations, which retain fewer native arthropods; 2) forages in leaf litter and on the ground surface instead of in tree canopies, reducing potential competition with birds; and 3) will probably not occur at most elevations dominated by native insects or birds.

From a more anthropocentric viewpoint, *E. coqui* and *E. martinicensis* are becoming nuisance species because of their loud calls and ability to live in the horticultural plantings around human dwellings. Several reports from Maui have come to our attention as complaints from residents whose sleep is disturbed by calling frogs. This has been a consequence of *Eleutherodactylus* introductions elsewhere as well (Lescure and Marty 1996; Pope 1917). Complaints from visitors at Maui hotels also have been lodged with resort managers, and at least one hotel has consulted with a pest control professional. In another instance, residents have vowed to move from Hawaii if the calling frogs on their property could not be eliminated. We expect these complaints to increase with time, unless introductions become actively managed. *E. planirostris* may be a lesser problem in this regard because of its less conspicuous call, although the one reported locality for this species on Oahu came to our attention because of dissatisfaction with the frogs' noise. A preliminary effort to investigate whether *E. coqui* transports plant nematode eggs on their skins has met with inconclusive results, but this ability would have potentially important consequences for nursery owners.

Most, and possibly all, populations of *E. coqui* and *E. martinicensis* are susceptible to eradication because numbers are still low at most sites and because males can readily be targeted for removal, thereby halting reproduction. Hand-capture, however, is inefficient, and efforts will soon be made to begin registration with the U.S. Environmental Protection Agency of a weak detergent solution for localized use in killing frogs. However, such efforts will be pointless until such time as relevant State officials actively pursue a program to ensure nursery material imported into Hawaii or offered for sale in-state is free of frogs or their eggs. This is difficult because of the magnitude of the ornamental plant trade in Hawaii, but can probably be achieved when nursery owners understand the potential problems the frogs may create for them. Public education of the threats posed by these frogs is ongoing in the form of public service announcements, fact sheets, and public talks, but is currently insufficient to meet the need for outreach to nursery owners, hotel managers, and agricultural officials, whose active support is necessary to control these frogs in Hawaii.

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Specimens Examined—*E. coqui*: HI: Hawaii Is.: NE of Huina Rd., Kurtistown (USNM 518648–64); Ka'iulani St., Hilo (BPBM 13296–97); Nahoa Rd., Leilani Estates, Puna District (BPBM 13751–52); Lava Tree State Park (BPBM 13753–54; Holualoa (BPBM 13750); Maui: Kapalua Bay Hotel, Kapalua (BPBM 13457); Kokomo Rd., Kokomo (BPBM 13459); Huelo (BPBM 13460). *E. martinicensis*: HI: Maui: Pea Place, Oma'opio (BPBM 13291); Kokomo Rd., Kokomo (BPBM 13292–95). *E. planirostris*: HI: Hawaii Is.: Auina Rd., Pahoa (USNM 518665–703, 518707–20, BPBM 13298–319); Kealakai St., Pana'ewa (USNM 518704–06, BPBM 13355); Oahu: Kaimalolo Rd., Waiahole (BPBM 13724–13729).

Unvouchered Records—*Eleutherodactylus* sp. (either *E. coqui* or *E. martinicensis*). HI: Maui: Hyatt Hotel, Ka'anapali; Lower Honoapi'ilani Hwy., Napili; Maui Inter-continental Hotel, Wailea; High St., Wailuku. *E. planirostris*. HI: Hawaii Is.: University of Hawaii Agriculture Experimental Station off Stainback Hwy.

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An Enteric Parasite Survey of Neotropical Herpetofauna

RUSTON W. HARTDEGEN
MATTHEW J. RUSSELL
Department of Herpetology, Dallas Zoo
650 South R.L. Thornton Freeway
Dallas, Texas 75203, USA
e-mail (RWH): rustonh@sprintmail.com

and
RITA BUICE
Department of Veterinary Medicine, Dallas Zoo
650 South R.L. Thornton Freeway
Dallas, Texas 75203, USA

Between 1 June 1996 and 21 June 1996, reptiles and amphibians were collected at La Selva Biological Research Station in Heredia Province, Costa Rica. Fecal samples were obtained and analyzed to document naturally occurring enteric parasite infections. Due to time and funding constraints, parasites were only identified to the generic level. Ninety-three animals were collected during the 126 h collection period (mean = 6 h per 24 h period).

All animals were held for no more than 48 h. Fecal samples were collected either from the specimen holding enclosure or manually expressed from the rectum. Animals were then released within 100 m of the original capture site. Sixty-four fecal samples from 23 species of reptiles and 12 species of amphibians were obtained. Fecal samples were collected in flotation cups (Fecalyzer, Evsco Pharamaceuticals, Buena, New Jersey) and refrigerated (<10 h) until examination.

TABLE 1. Parasite infection rates determined by fecal examinations of 35 species of reptiles and amphibians from Costa Rica.

Species	No. examined	No. infected
Snakes		
Bothrops asper	2	1
Chironius grandisquamis	1	0
Dendrophidion percarinatum	1	1
Imantodes cenchoa	5	4
Imantodes inornatus	1	1
Lampropeltis triangulum	1	0
Leptodeira annulata	2	2
Leptophis depressirostris	1	1
Micrurus nigrocinctus	1	0
Porthidium nasutum	1	1
Sibon nebulata	1	1
Lizards		
Ameiva festiva	2	2
Lepidoblepharis xanthostigma	1	1
Norops biporcatus	1	1
Norops capito	1	1
Norops carpenteri	3	3
Norops humilis	7	6
Norops lemurinus	4	4
Norops limifrons	1	1
Norops oxylophus	1	1
Norops pentaprion	1	1
Turtles		
Kinosternon leucostomum	1	1
Rhinoclemmys annulata	1	1
Total for Reptiles	41	35 (85%)
Frogs		
Agalychnis calcarifer	1	1
Bufo haematiticus	1	1
Bufo melanochloris	1	1
Dendrobates pumilio	5	3
Eleutherodactylus bransfordii	4	4
Eleutherodactylus crassidigitus	2	2
Eleutherodactylus fitzingeri	1	1
Gastrophyrne pictiventris	1	1
Hyla ebraccata	1	0
Leptodactylus pentadactylus	3	2
Scinax elaeochroa	1	1
Smilisca baudinii	2	1
Total for Amphibians	23	18 (78%)

Semi-quantitative fecal analyses were performed using direct smear and flotation methods (Bowman 1995; McCurnin 1994). Direct smears were examined under saline and/or Dobell & O'Connor iodine solutions (Becton Dickinson and Company, Cockeysville, Maryland). Flotations were performed in zinc sulfate solution (Vetus/Burns Veterinary Supply, Rockville Center, New York). Using a binocular (10x) light microscope, parasites were identified and quantified under 100x and 400x magnifications.

TABLE 2. Positive fecal results for 20 species of reptiles and 11 species of amphibians. Levels of infection are based on the following densities, as determined by a low power field (LPF; magnification of 100x) examination: 1+ = 1–2 eggs/LPF; 2+ = 3–5 eggs/LPF; 3+ = 6–8 eggs/LPF; 4+ = >10 eggs/LPF. <1 denotes parasite loads of rare/few.

Species	id no.	Parasite type	Level
Snakes			
Bothrops asper	2	trichomonads	2+
Dendrophidion percarinatum	1	*Isospora* sp.	2+
		Nematodes	<1
Imantodes cenchoa	1	*Isospora* sp.	4+
		trichomonads	1+
		Strongyloides	2+
	2	*Isospora* sp.	2+
		Strongyloides	2+
	3	*Isospora* sp.	4+
		nematodes	<1
	4	*Isospora* sp.	4+
Imantodes inornatus	1	strongyles	<1
		Strongyloides	3+
Leptodeira annulata	1	*Isospora* sp.	1+
		strongyles	<1
	2	*Eimeria* sp.	1+
		Isospora sp.	2+
Leptophis depressirostris	1	ciliates	1+
Porthidium nasutum	1	trichomonads	3+
Sibon nebulata	1	acanthocephalans	4+
		Isospora sp.	1+
		strongyles	1+
		trichomonads	4+
Lizards			
Ameiva festiva	1	*Isospora* sp.	<1
		trichomonads	4+
	2	*Isospora* sp.	3+
Lepidoblepharis xanthostigma	1	*Isospora* sp.	1+
Norops biporcatus	1	nematodes	<1
Norops capito	1	*Eimeria* sp.	1+
		strongyles	2+
Norops carpenteri	1	*Isospora* sp.	1+
	2	*Eimeria* sp.	3+

		strongyles	2+
		trichomonads	<1
	3	*Isospora* sp.	2+
Norops humilis	1	*Eimeria* sp.	1+
	2	*Isospora* sp.	1+
	3	*Eimeria* sp.	<1
		strongyles	2+
	4	trichomonads	<1
	5	trichomonads	1+
		strongyles	1+
	6	*Isospora* sp.	<1
		strongyles	<1
Norops lemurinus	1	*Eimeria* sp.	1+
	2	*Strongyloides*	<1
		trichomonads	4+
	3	trichomonads	1+
	4	*Isospora* sp.	<1
Norops limifrons	1	*Eimeria* sp.	2+
		nematodes	1+
Norops oxylophus	1	*Eimeria* sp.	1+
		nematodes	<1
		strongyles	<1
		trichomonads	1+
Norops pentaprion	1	*Eimeria* sp.	4+
		oxyurids	2+
Turtles			
Kinosternon leucostomum	1	ciliates	<1
		Isospora sp.	<1
		trematodes	<1
Rhinoclemmys annulata	1	ciliates	1+
		Isospora sp.	<1
		trichomonads	<1
Frogs			
Agalychnis calcarifer	1	trichomonads	1+
Bufo haematiticus	1	*Strongyloides*	1+
Bufo melanochloris	1	strongyles	2+
		trichomonads	<1
Dendrobates pumilio	1	strongyles	1+
	2	*Strongyloides*	<1
	3	strongyles	1+
Eleutherodactylus bransfordii	1	trichomonads	<1
	2	*Isospora* sp.	2+
		strongyles	3+
		ciliates	<1
	3	strongyles	<1
	4	*Isospora* sp.	1+
Eleutherodactylus crassidigitus	1	*Isospora* sp.	<1
		nematodes	<1
	2	*Strongyloides*	1+
Eleutherodactylus fitzingeri	1	*Isospora* sp.	2+
		strongyles	<1
		trichomonads	<1
Gastrophryne pictiventris	1	strongyles	1+
		trichomonads	<1
Leptodactylus pentadactylus	1	*Strongyloides*	<1
	2	ciliates	<1
		Strongyloides	2+
		trichomonads	1+
Scinax elaeochroa	1	*Isospora* sp.	<1
		trichomonads	<1
Smilisca baudinii	1	trichomonads	<1

Enteric parasites were found in 85% of reptile and 78% of amphibian fecal samples (Table 1). Parasites found in reptile feces included trichomonads (34% of samples with parasites), strongyles (26%), and coccidia (74%) (Table 2). *Isospora* sp. coccidia (Bovee and Telford 1965; Reichenbach-Klinke and Elkans 1965) were found in 51%, while *Eimeria* sp. (Bovee and Telford 1965; Reichenbach-Klinke and Elkans 1965) were found in 26% of the total number of samples with parasites. The mean rate of infection (excluding infections of <1) in reptile samples was 2.02 (SD = ± 1.18). The most common enteric parasites in amphibian fecal samples were trichomonads (49%), strongyles (39%), *Isospora* sp. (28%), and *Strongyloides* (28%) (Table 2). The mean rate of infection (excluding infections <1) in amphibian samples was 1.46 (SD = ± 0.63). Concurrent enteric parasite infections were found in 49% of reptile fecals and 30% of amphibian samples (Table 3). Relative levels of infection were low.

TABLE 3. Concurrent parasitic infection rates in Costa Rican herpetofauna.

No. parasite types	No. infections	% infection
Reptiles		
2	13	32
3	5	12
4	2	5
Total	20	49
Amphibians		
2	4	17
3	3	13
4	0	0
Total	7	30

Several factors are known to affect levels of parasite infection intensity (Aho 1990). Some data representing Central and South American reptile parasite levels in the wild are available (Chitwood 1938; Goldberg and Bursey 1992; Lainson 1968; Upton et al. 1989; Van Sluys et al. 1994, 1997). Comparisons of parasite levels between wild populations and captive groups have been documented with some species (Baker et al. 1996). However, no data were found to compare to enteric parasite levels in reptiles and amphibians recently imported from Costa Rica.

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TECHNIQUES

Enclosure Design for Ecotoxicological Studies of Terrestrial Salamanders

MATTHEW M. LAPOSATA*
and
WILLIAM A. DUNSON
Department of Biology, 208 Mueller Laboratory
The Pennsylvania State University, University Park, Pennsylvania 16802, USA
e-mail (MML): mml146@psu.edu
e-mail: (WAD): bdunson@semtribe.com

**Author to whom correspondence should be addressed*

Amphibians have been proposed as bioindicators for various anthropogenic stresses on ecosystems (Cooke 1981; Dunson et al. 1992; Hall and Mulhearn 1984). Amphibians are likely to be more susceptible to pollutants and habitat alterations than other vertebrates due to complex life cycles that expose them to pollutants in both aquatic and terrestrial habitats, permeable eggs/gills/skin that exchange materials freely with their surroundings, and intimate contacts with polluted soils or sediments for long periods when estivating or overwintering (Dunson et al. 1992). Terrestrial salamanders are an abundant component of northeastern forest ecosystems, with their total biomass exceeding that of breeding birds and mammals (Burton and Likens 1975; Hairston 1987). Salamander physiological functions and water and cation levels in body tissues are affected by alterations in soil pH (Frisbie and Wyman 1995; Wyman and Hawksley-Lescault 1987) and soil moisture (Heatwole and Lim 1961). Salamanders occupy intermediate positions in forest trophic webs (Hairston 1987; Pough et al. 1987), and impacts on them could directly affect adjacent trophic levels. Their sensitivity to abiotic conditions, abundance in forests, and trophic position make salamanders a potentially effective bioindicator of anthropogenic stresses on terrestrial ecosystems.

An integral component in assessing human impacts on amphibians involves *in-situ* enclosures of animals in areas affected to varying degrees. A variety of aquatic enclosures exist for amphibian eggs and larvae (Harris and Bogart 1997; Sadinski and Dunson 1992), but there are few designs for terrestrial salamanders. Terrestrial enclosures for salamanders should ideally meet several criteria if they are to be used effectively in ecotoxicological studies. First, they should be inexpensive, easy to construct, easily installed, durable, and portable. These features enable multiple replicate enclosures to be transported to remote field sites. Second, an ideal enclosure design would be adaptable for use with many salamander species, having differing habitat and space requirements. Finally, the soils within the enclosure should mimic the ambient abiotic and biotic conditions of the study site, and provide the enclosed salamander with the microhabitats normally utilized by that species under natural conditions. In this paper, we review several enclosure designs for terrestrial salamanders from the literature, and present a new design that is inexpensive, portable, adaptable, and has proven to be useful in assessing the effects of anthropogenic soil alterations on terrestrial salamanders.

Several existing terrestrial salamander enclosure designs fail to meet all of the criteria listed above, and so would be inappropriate for ecotoxicological studies involving terrestrial salamanders. Pechmann (1995) enclosed salamanders in large (225 m^2) tracts of terrestrial habitat surrounded with aluminum drift fencing, and recaptured them as they migrated to a nearby pond to breed. Although this method is flexible in meeting the space and habitat requirements of different species, the fencing can be labor-intensive to install, limiting the number of replicate sites that could be utilized. Additionally, this design does not allow for easy recapture of the enclosed animals outside of the breeding season, making it unsuitable for studies examining the physiological reactions of individual salamanders to differing abiotic soil conditions. Wyman (1998) used 1.2 m x 2.5 m (3 m^2) enclosures composed of wooden frames covered with mesh screening to investigate the effects of salamander predation on soil invertebrates and leaf litter decomposition rates. As with Pechmann's (1995) design, the enclosed salamanders are afforded sufficient space within these enclosures, but their large size would make them difficult to transport to remote field sites. Frisbie and Wyman (1995) constructed enclosures for *Plethodon cinereus* by removing the bottoms of 5 gallon polyethylene buckets and then forcing the bucket approximately 15 cm into the soil. These enclosures are inexpensive, portable, and easily installed, but they provide little surface area (0.051 m^2) and limit the variety of microhabitats available to the enclosed salamander.

Our design, modified from Frisbie and Wyman's (1995), includes the advantages of greater area and microhabitat complexity within the enclosure. We use large plastic plant pots (38 cm diam) as enclosures, although this method could be used with any size container. The enclosures are constructed by removing the bottom of the container with a hacksaw or reciprocating saw, creating a tapering cylinder (38 cm pot: volume = 0.0282 m^3 and surface area = 0.1134 m^2). The enclosures are installed by first placing the inverted enclosure on the soil, and tracing its outline on the soil surface. All leaf litter within the inverted enclosure is collected and saved. The soil around the outline is then excavated to a depth of 25–30 cm with a shovel, the organic and mineral soils removed, and placed in separate containers. The enclosure is placed in the hole, tapered side down, until the lower edge of the top lip of the enclosure is flush with the soil surface. The soil layers (mineral and organic) are then backfilled inside and outside the enclosure to their corresponding levels in the surrounding soil. Next, a 25 mm diameter PVC pipe is hammered into the center of the soil within the enclosure at a 45° angle and then removed to create an artificial mammal burrow within the enclosure approximately 25 cm long. Many species of terrestrial salamanders, particularly in the genus *Ambystoma*, are frequently found in mammal burrows in the soil (Douglas and Monroe 1981; Madison 1997; Madison and Farrand 1998; Semlitsch 1981; Williams 1973), and some of these species do not actively burrow (Semlitsch 1983). The inclusion of an artificial burrow within the

enclosure allows the salamander access to the upper soil layers that they would normally occupy. After creating the artificial burrow, the leaf litter is replaced inside the enclosure. The enclosure is then left in the soil for a minimum of 14 days to allow time for the abiotic soil conditions within the enclosure to approximate those of the surrounding soil. An individual salamander can then be placed in the enclosure, and the enclosure covered with a 58 x 58 cm piece of 1 mm fiberglass mesh screening or plastic utility screening (if larger mesh sizes are desired), secured to the enclosure with a 91.5 cm (36 in.) bungee cord (Fig. 1). At the conclusion of the experiment, the salamander can be collected directly from the enclosure if it is in the leaf litter or in the artificial burrow, or the enclosure can be searched by hand if the salamander's location is not immediately apparent. If the soil is sufficiently moist, the entire enclosure can be lifted out of the soil and its contents dumped into a large container where it can be searched.

This enclosure was originally designed for use with salamanders in the genus *Ambystoma*, but it can be modified to meet the habitat and surface area requirements of any salamander species simply by changing the size of the container used to create the enclosure. *Ambystoma* salamander home range sizes show considerable intra- and inter-specific variation, ranging from a few dozen square centimeters to over 200 m^2 (Kleeberger and Werner 1983; Semlitsch 1981; Williams 1973). Further, some species spend a vast majority of their time in several considerably smaller "activity centers" within their home range, and so may require even less area than the home range sizes for that species would suggest (Semlitsch 1981). The flexibility of this enclosure design allows the user to balance surface area requirements with logistical constraints, and to include within the enclosure any microhabitats (simulated mammal burrows, leaf litter, decaying logs) utilized by the species being examined.

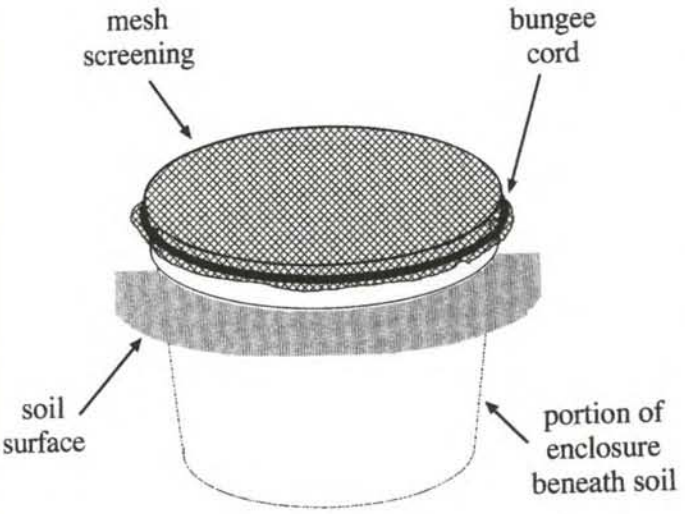


FIG. 1. Enclosure for terrestrial salamanders as installed in the soil.

We have used this enclosure design to examine the responses of juvenile *A. jeffersonianum* to soils altered by wastewater effluent irrigation, acidic deposition, and deforestation in central Pennsylvania, USA. In one study (Laposata and Dunson, in prep.), 40 juvenile *A. jeffersonianum* were individually enclosed for 28 days in clearcuts and adjacent forests in two regions in central Pennsylvania that received differing amounts of acidic atmospheric deposition. Abiotic soil conditions differed among the sites; sites in the region with higher deposition had lower soil pH than sites in the lower deposition region, and clearcuts had lower soil moisture levels than adjacent forests. Since the enclosure could prohibit soil invertebrates from entering the enclosure, the animals were fed red worms (*Lumbricus rubellus*) once weekly to insure that food was not limiting. At the conclusion of the experiment, salamander growth rates and body sodium concentrations were significantly lower in the region with higher deposition levels, and animals enclosed in clearcuts showed lower body water concentrations than those in forested sites. These results are consistent with laboratory studies in which salamanders were exposed to low pH substrates (Horne and Dunson 1994; Wyman and Hawksley-Lescault 1987) or low soil moisture levels (Heatwole and Lim 1961).

This enclosure method also was used to evaluate the impacts of the spray irrigation of treated wastewater effluent on *A. jeffersonianum* (Laposata 1998). Twenty salamanders were enclosed in irrigated and unirrigated areas for 35 days, and growth, body water concentration, and body concentrations of Na, K, Ca, and Mg compared in the two areas. No significant differences in any of the physiological parameters were detected in animals enclosed in irrigated and unirrigated areas, suggesting that wastewater effluent irrigation is not acutely toxic to terrestrial salamanders under natural conditions.

In both studies, soil temperature, moisture, and pH were compared inside the enclosure and at a randomly determined locations 1 m from the enclosure on the first (14 days after installation) and the last (28 or 35 days after the salamander was placed inside) day of each experiment to determine if soil conditions were altered within the enclosure. These soil conditions inside and outside the enclosures did not vary significantly at the start or conclusion of the experiment in either study, indicating salamanders within the enclosures were exposed to pH, moisture, and temperature levels like those in the surrounding soil (Laposata 1998; Laposata and Dunson, in prep.).

In these two studies, we enclosed a total of 60 salamanders in various habitats with greatly differing abiotic and biotic characteristics. Survival rates of the enclosed salamanders for each experiment were 100%, and three (5%) salamanders escaped from the enclosure or were unable to be located at the conclusion of the experiment. All three of the escapes were in forested sites with sandy soils, and the salamanders may have been able to burrow through the soil and escape through the open bottom of the enclosure. After these initial experiments, we modified our design to reduce the probability of escape. Prior to installation in the soil, we covered the bottom of the enclosure with a 58 x 58 cm piece of 1 mm fiberglass mesh screening, secured it with a bungee cord, and attached 4–5 large metal binder clips over the enclosure's bottom edge to hold the bungee cord in place. This modification caged the bottom of the enclosure as well as the top, and preliminary tests with this new design revealed no escapes of 20 enclosed animals over a 21 day period in the same soils in which the previous escapes occurred (Laposata and Dunson, unpubl. data).

The enclosures described in this paper are inexpensive (< US $5.00 each), simply constructed, easily installed, durable, and portable. Salamanders exposed to soils with differing abiotic conditions in these enclosures can experience measurable alterations in physiological parameters. This enclosure method could be used to evaluate a wide variety of natural and anthropogenic stresses on terrestrial salamanders, and facilitate their use as bioindicators of human impacts on terrestrial ecosystems.

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The Accuracy of Estimating Eggs in Anuran Egg Masses Using Weight or Volume Measurements

J. KIRWIN WERNER
JOSEPH WEASELHEAD
and
TRUMAN PLUMMER
Salish Kootenai College
P.O. Box 117, Pablo, Montana 59855, USA
e-mail (JKW): jkw@ronan.net

To document amphibian mortality in early life history stages, it is important to know the number of eggs oviposited. Indirect methods such as weight or volume displacement have become more common (Corn and Livo 1989; Cuellar 1994) because counting all eggs in masses of hundreds to thousands is impractical. Weight or volume displacement should produce similar results with careful sampling. We tested this assumption using spring scales and volumetric flasks, and examined the error associated with these methods.

Egg masses were weighed in a half-gallon plastic bucket using an Ohaus 2000 g spring scale; samples were weighed in a 50 cc plastic vial with a wire handle using a Pesola 100 g spring scale. Egg mass volumes were measured in a 2500 cc flask with ~1000 cc of water and samples in a 50 cc graduated cylinder with ~10 cc of water.

Thirty egg masses of *Rana luteiventris* were taken from a series of ponds located on the Flathead Indian Reservation in western Montana, USA. Based on daily visits to the ponds, the eggs were 3–12 days old when analyzed. Although we made no attempt to stage the eggs, we categorized the mass as being Type I (N = 13 masses) if the matrix was relatively solid and the eggs small and circular or Type II (N = 17 masses) if the matrix was more soft and some eggs were beginning to elongate into the neurula stage.

After a mass was weighed and the volume determined, 10 samples of 10–40 eggs each were separated from the mass, counted, and the volume and weight recorded. The total number

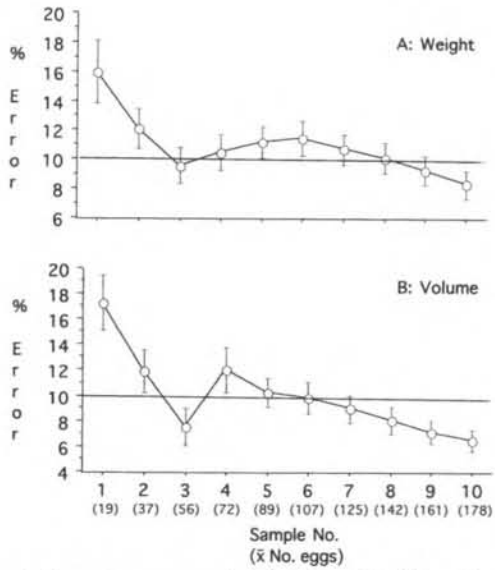


FIG. 1. Percent error associated with weight (A) and volume (B) estimates of egg mass number. Vertical lines represent one standard error. The horizontal line represents a 10% error. Number in parenthesis (x-axis label) is the mean number of eggs used in the sample; the mean number of eggs for all masses was 1035.

of eggs in the mass was determined by counting the remaining eggs.

For the first sample, the mean weight and volume of a single egg was estimated by dividing weight and volume of the sample by number of eggs in the sample. An estimate of the total number of eggs in the mass was made by dividing the total weight or volume of the mass by the mean weight or volume of an individual egg. The mean error was computed as: $E = (N_{estimated} - N_{counted}) / N_{estimated}$ (Corn and Livo 1984).

TABLE 1. Unpaired t-tests comparing weight vs. volume errors for samples 1, 3, and 10. T-tests are included for weight vs. weight and volume vs. volume errors for Type I and II egg masses.

Sample	Mean Diff.	DF	t-value	p-value
Weight vs. Volume Errors (N = 30 masses)				
1	0.013	58	0.43	0.67
3	0.005	58	0.29	0.77
10	-0.018	58	-0.43	0.16
Weight Errors: Type I vs. Type II masses				
1	0.066	28	1.54	0.13
3	0.030	28	1.24	0.22
10	0.003	28	0.01	0.99
Volume Errors: Type I vs. Type II masses				
1	0.021	28	0.47	0.64
3	0.023	28	0.85	0.40
10	0.025	28	1.62	0.12

In order to see how accuracy improved by increasing egg count, data from the first sample was combined with the second sample of 10–40 eggs and a new estimate was made. Data from the first and second samples were subsequently combined with a third sample and so on through 10 samples.

Egg count accuracy steadily improved through the first three samples (Fig. 1). Using absolute error values, regardless of whether they were over or under estimates, one sample of 10–40 eggs (1.8% of the mass) produced a mean error of 16% (range 1–37%); the error associated with volume determinations was 17% (range 2–42%). The mean error for both weight and volume dropped to 10% (range 0–28%) using three samples with a total of 41–80 eggs (5.4% of the mass). Further increases in sample size produced a slight increase in error and then a steady decrease (Fig. 1, e.g., range 0–17% using 10 samples). Errors below 10% were achieved with weight determinations in the 9th sample (161 eggs, range 137–230) and in the 6th sample (107 eggs, range 85–132) with volume determinations.

Mean errors for weight and volume estimations were not different at any sample size (Table 1). However, weight measurements consistently produced overestimates that were significantly different from a 1:1 over-under ratio (Table 2). Volume estimates approximated a 1:1 over-under ratio. Further, the mean errors for weight were different from zero in all samples whereas volume errors were not. Corn and Livo (1984) suggested that if the mean error was significantly different from zero, the estimate be adjusted by the mean error ($N_{adjusted} = (1 - E) \times N_{estimated}$).

Comparisons between Type I (early stage) and Type II (later stage) egg masses did not produce differences in either weight or volume errors (Table 1). Type II egg masses required more care in handling because of the sticky and loose nature of the mass.

TABLE 2. Chi-Square tests of over and under estimates for weight and volume determinations (samples 1, 3, and 10). T-tests for differences of the mean errors from zero.

	Sample	# Over Estimates	# Under Estimates	Chi-Square	Diff. from zero t-value
Weight	1	21	9	4.80[1]	4.16[2]
	3	23	7	8.53[1]	4.47[2]
	10	23	7	8.53[1]	5.13[2]
Volume	1	17	13	0.53	1.46
	3	13	17	0.53	-0.99
	10	14	16	0.13	-0.60

[1] = Significant at the $P < 0.05$ level or [2] = at the $P < 0.01$ level.

In summary, one sample of 10–40 eggs from a mass of approximately 1000 eggs produced substantial errors, in some instances as high as 42%. Increasing the sample size to 5% or more of the mass resulted in a mean error of about 10% (range 0–27%), which would seem acceptable for this type of equipment and field situation. Corn and Livo (1984) derived their data based on counting 5–10% of the mass. Although there were no significant differences between weight and volume estimates, the frequent overestimates observed with weight, and the fact that errors for weight determinations decreased slower than volume errors (Fig. 1), would suggest that volume determination was the better method. The overestimates with weight may reflect both the inaccuracy of the Ohaus scale and/or a tendency to add water to samples displaced in and out of a water medium. Trying to remove excess water by blotting egg masses is impractical, but a more accurate spring or digital scale would probably improve results. Although the age of the mass was not critical in the estimations, the older the mass, the more difficult it became to separate and count individual eggs. Because newly laid egg masses swell considerably in the first 24 h, the optimum time for making estimates is probably 2–5 days following egg laying.

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A Technique for Sexing Red-Backed Salamanders (*Plethodon cinereus*)

VANESSA S. QUINN*
and
BRENT M. GRAVES
Department of Biology, Northern Michigan University
Marquette, Michigan 49855, USA

**Present address: Department of Life Science, Indiana State University, Terre Haute, Indiana 47809, USA*
e-mail: LSVQUINN@SCIFAC.INDSTATE.EDU
e-mail: BGRAVES@NMU.EDU

Red-backed salamanders (*Plethodon cinereus*) have been used as a model species for several investigations, including behavioral differences between males and females (Mathis et al. 1996). A difficulty in this regard is that techniques have not been established to determine sex using external characteristics for this species. The overlap in snout-vent length (SVL) ranges (e.g., males: 32–49 mm; females: 34–48 mm; Sayler 1966) demonstrates the inadequacy of a sexing technique based on SVL. Mental glands are sexually dimorphic during the mating season (fall and spring; pers. obs.). However, only sexually active males can be distinguished by the presence of enlarged glands, while females and sexually inactive males cannot be discriminated. In mature females, eggs may be visible in the abdomen, yet again, this technique is not adequate for distinguishing non-gravid females. Although these methods have been used to externally sex red-backed salamanders, no studies have been done to confirm their accuracy in this species, which requires internal investigation. In this paper we describe a new technique, confirmed via internal investigation, that may effectively allow for the external sexing of adults. We report a sexually dimorphic character, the distance between nares at the tip of the snout (inter-nares distance; IND), from Michigan populations.

In 1996, we collected 95 adult red-backed salamanders from Alger and Marquette counties, Michigan, USA. We preserved each individual in a 10% formalin solution and measured the distance between nares, at the tip of the snout, to the nearest 0.01 mm. We also measured SVL, to the nearest 0.01 mm, from the tip of the snout to the posterior portion of the vent using calipers. After measuring external characteristics, we dissected each individual. Adult males were sexed on the basis of pigmentation of the testes and vasa deferentia, while adult females were sexed on the basis of enlarged oviducts (Sayler 1966). Snout-vent length and IND of females and males were compared using t-tests. Both variables were first log-transformed to meet parametric assumptions. In 1998, we collected three adult males and three adult females from Clark Co., Illinois. Individuals from the Clark population were cooled on ice before measuring to determine if this technique would be of value in the field, as well as on preserved animals. These animals were not dissected, and therefore, not included in the data set.

From dissections, 55 males and 40 females were identified. The IND of males (mean = 0.27, SE = 0.04 mm) was significantly greater than the IND of females (mean = 0.19, SE = 0.05 mm; $T = 11.942$; $df = 93$; $P = 0.001$). The ranges of IND for males was 0.22–0.33 mm while, female IND ranges from 0.13–0.23 mm. Range overlap occurred among few animals (2 males and 2 females had IND = 0.22; 1 male, IND = 0.21; 1 female, IND = 0.23). Mean SVL did not differ between males and females ($T = 1.174$; $df = 93$; $P = 0.244$).

This report validates the use of IND as a sexing tool. In the field, cooling salamanders on ice allows the measurement of IND and SVL. Additionally, this is a tool that will allow the sexing of preserved specimens, without requiring dissection. Sexual dimorphism in this character has not been reported previously, thus, it is important to confirm the utility of this technique and the pattern of sexual dimorphism in other populations of *P. cinereus*, as well as other plethodontid salamanders. An understanding of patterns of sexual dimorphism in such characteristics in relation to ecological and taxonomic variation may shed light on the potential functional significance of sexually dimorphic characteristics.

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Individual Identification of Captive Mexican Caecilians (*Dermophis mexicanus*)

KEVIN M. WRIGHT
and
TANYA MINOTT
Department of Herpetology, Philadelphia Zoological Garden
3400 West Girard Avenue, Philadelphia, Pennsylvania 19104, USA
e-mail (KMW): Kwright_pzg@compuserve.com

Most species of terrestrial caecilians lack obvious identification patterns making it difficult to distinguish individual animals. We have noted that the pattern of annuli (permanent skin folds sometimes called grooves or rings) is distinct for different individuals of *Dermophis mexicanus* held in captivity at the Philadelphia Zoo. Identification consists of noting which annuli are incomplete, broken, or bent. Photographs of the dorsal and ventral pattern can be made, but obtaining the photographs can be difficult and costly. An easy alternative to using photographs for identification is to obtain only the ventral pattern of the annuli by photocopying the caecilian while it lies in a transparent-bottomed container such as a clear plastic shoebox or a glass-bottomed aquarium. A light colored damp towel can be laid on top of the caecilian to reduce its movements during the photocopying and to provide a high-contrast background. A high-speed photocopier should be used to reduce the length of light exposure time required.

Although *Dermophis mexicanus* do have light-dark discrimination (M. Wake, pers. comm.), the risk of retinal injury from brief exposure to the photocopier's light is assumed to be minimal. The bright light and heat associated with photocopying may be distressing to some animals, especially if the light exposure exceeds 2–3 seconds, so we have restricted photocopy attempts to one or two per caecilian. No untoward effects of the photocopying process have been noted in any of the caecilians in the months to years following the procedure. The photocopy of the ventral pattern can then be analyzed for obvious characteristics

that are annotated to facilitate re-identification of the caecilian at a later date.

Although this method of identification has worked well for the small sample size (N = 17 as of 31 December 1997) of *Dermophis mexicanus* held at the Philadelphia Zoo, similar annular disjunctions may not be present in all specimens of a given population of this species (M. Wake, pers. comm.). In addition, the annular disjunctions may not be present in other species, especially those that lack secondary or tertiary annuli (M. Wake, pers. comm.). Other methods of identification, such as permanently implanted transponders, may be necessary to identify living specimens over long periods of time.

Effects of Marking *Uta stansburiana* (Sauria: Phrynosomatidae) with Xylene-based Paint

JAMES L. BOONE
and
ELIZABETH A. LARUE
Nevada State Museum
700 Twin Lakes Drive, Las Vegas, Nevada 89107, USA
e-mail: jlboone @ aol.com

Population biologists often rely on marks to identify individual animals (Nietfeld et al. 1994). For many years, herpetologists have marked reptiles with toe-clips, scale-clips, and paint (Ferner 1979), and although any marks potentially affect animals, generally these have been shown not to affect survival or other biological processes (e.g., Brown and Parker 1976; Jones and Ferguson 1980; Weatherhead et al. 1995). As technologies change, new methods of marking appear. Some new methods obviously require testing before one can be sure that the method does not adversely affect the target animal (e.g., glass beads, Fisher and Muth 1989; radioactive tags, Pendleton 1956; PIT tags, Prior and Weatherhead 1996).

One example of a new method entering use without being tested was a modification of standard painting techniques. Herpetologists have long used model paint (e.g., Testor Corporation paints) to mark lizards and snakes without adverse effects (e.g., Jones and Ferguson 1980). However, using model paint in the field can be messy and may require researchers to carry and use paint thinner, leading one to look for more convenient methods. Some researchers have used fingernail polish, while others have found quick-drying Faber-Castel™ paint-pens more convenient for marking reptiles than either model paint or fingernail polish. The carrier in these paint-pens, however, is xylene, and xylene has well-known toxic effects on animals (d'Azevedo et al. 1996; Rana and Kumar 1997). One might assume that marking a reptile with a small amount of paint would result in a negligible dose of xylene, especially in hot, arid environments where the paint dries almost immediately. Based on this assumption, one might conclude that using paint-pens would not affect lizard behavior, survival, or other demographic parameters. However, no one has tested this assumption.

We conducted a pilot study to test the null hypothesis that xylene-based paint-pens have no adverse effect on the survival of side-blotched lizards (*Uta stansburiana*), a small insectivorous lizard that is common in the western USA and northern Mexico. We captured 35 *U. stansburiana* (18 female; 17 male; 19 adults, snout–vent length, SVL > 39 mm; 16 juveniles, SVL ≤ 39 mm) from five locations around southern Nevada (October, 1996 through October, 1997). We held the lizards in a lab and housed them on sand and gravel in individual 2-liter jars. We exposed the lizards to ambient light and provided full-spectrum lamps for heat during daylight hours. Daily ambient temperatures in the lab ranged from about 13–27°C. Before marking the lizards, we kept them in captivity for 2–3 days to ensure that no animals died immediately after capture.

We painted 21 lizards and used 14 as unpainted controls. We painted lizards in a manner similar to how *U. stansburiana* had been marked during a previous mark-recapture study (Boone et al. 1998). We placed a spot of paint on the dorsum (diameter ≤ 1 cm, less than the width of the dorsal surface) generally every 3–4 days until each lizard had been painted four times. This simulated four capture-recapture events over two weeks using a different color of paint specific to each day of sampling. In the field, large spots (i.e., the width of the dorsum) were used so that the paint color could be seen from a distance. Each successive spot of paint was placed on top of the previous spots. We recorded mortality and sleeping behavior (i.e., spending the night above or below ground) for two weeks.

Of the 21 painted lizards, five died (four juveniles, one adult; 24%), all of which had been painted at least twice. No unpainted lizards died. While the sample size was small, the result was statistically significant ($G_{adj} = 5.408$, $P = 0.02$). Sleeping behavior also changed. When first brought into the lab, all lizards burrowed into the substrate and spent every night underground. During the remainder of the study, most unmarked lizards continued to burrow underground almost every night (Table 1). By contrast, 8 of 11 (73%; $P = 0.06$) painted juveniles, and 2 of 10 painted adults (20%; $P = 0.62$), switched sleeping location and spent almost every night aboveground (Table 1).

When first applied, the paint sometimes appeared to irritate the lizards: they sometimes gaped, some exhibited dorso-ventral flattening as if a weight had been placed on their back, and a few

TABLE 1. Frequency at which 35 *Uta stansburiana* from the southern Nevada region spent the night above or below ground after having been marked, or not-marked, with xylene-based paint-pens. Data were summarized for all lizards, for juveniles (SVL ≤ 39 mm), and for adults (SVL > 39 mm).

	All Lizards		Juvenile		Adult	
Sleeping Position	Marked	Not-marked	Marked	Not-marked	Marked	Not-marked
Above Ground	10	2	8	1	2	1
Below Ground	11	12	3	4	8	8

flexed their bodies 45–60° backwards lifting their front legs off the ground or pressing their front legs against the side of their jar. Some of the painted lizards became lethargic. There seemed to be a dose-response relationship. More smaller lizards than larger lizards showed negative responses to the paint, and the lizards that showed a negative response often did so after their second paint treatment.

Not all samples gave the same result. A group of five lizards (SVL = 42–47 mm) captured south of Las Vegas never exhibited any negative reactions (three marked, two unmarked). In contrast, from a group of nine lizards caught west of Las Vegas, four (SVL = 37–45 mm) of five painted lizards exhibited negative reactions, and the lizard that did not show a response (SVL = 52 mm) was the largest of these five.

The xylene-based paint used in this study was associated with the death of some lizards; it was also associated with altered behavior in others that could affect survival. If lizards in the field failed to seek cover at night, they may be subjected to increased predation or stressed by exposure to low temperatures.

Our observations suggest that *Uta stansburiana* experiences a dose-related, adverse effect from this marking technique. Although small amounts of paint may not affect these lizards, it appears that xylene-based paints can introduce unnecessary bias into field experiments, and therefore field biologists should avoid using these paints for marking lizards or other animals. An important point is to beware of new methods in the guise of old ones, and to carefully examine new techniques and procedures before assuming they are the same as the old favorites.

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An Alternative Anesthesia for Amphibians: Ventral Application of Benzocaine

MEGAN H. CHEN
e-mail: mchen02@fiu.edu

and

CHRISTY A. COMBS
e-mail: ccombs01@fiu.edu
Department of Biological Sciences, Florida International University
Miami, Florida 33199, USA

Benzocaine as "a convenient killing agent for amphibians" was first reported by Altig (1980) and then described by McDiarmid (1994). Altig placed a small dose of benzocaine-containing gel (e.g., Orajel® regular, 7.5% benzocaine) on a frog's head to kill it. Orajel® is a product that can be obtained easily at any pharmacy. We modified this technique by gently rubbing benzocaine (Orajel® regular, 7.5% benzocaine or Orajel® extra strength, 20% benzocaine) on the animal's ventral surface instead of its head. For anurans, benzocaine can be applied to the pelvic patch area rather than the entire venter. Benzocaine applied to the venter was absorbed faster than when applied to the head.

Hyla cinerea individuals were euthanized using both head and pelvic patch application methods. Individuals with pelvic patch applications died approximately 5–10 times faster than individuals with head applications. For anurans, the amount of Orajel® was proportional to body size: smaller species (less than or equal to 6 g wet weight) needed only a 10 mm diameter dollop (approximately 0.1 g) of gel, while larger species (greater than 6 g wet weight) needed a 25 mm diameter dollop (approximately 0.3 g) of gel. One salamander species (*Eurycea quadridigitata*) was also tested. Individuals required a 5 mm diameter dollop (approximately 0.05 g) of gel. We did not test Orajel® on caecilians.

Once benzocaine was applied, the animals were placed in a plastic bag. Individuals appeared completely relaxed and death occurred within 5 min for anurans and less than 1 min for *E. quadridigitata* (M. A. Donnelly, pers. comm.). Benzocaine gel application enabled individuals to be positioned easily as scientific specimens and only small amounts of skin toxins appeared to be released. A second application was necessary for a few individuals greater than 60 g wet weight (e.g., *Phyllomedusa bicolor, Bufo marinus, B.guttatus, Leptodactylus bolivianus, L. knudseni, L. rhodomystax,* and *L. mystaceus*). We were able to euthanize 50 individuals weighing 0.8–5 g using approximately one tube of Orajel® (7.08 g).

This methodology worked successfully for over 1500 individuals from both temperate and tropical anuran families including Hylidae, Microhylidae, Bufonidae, Leptodactylidae, Dendrobatidae, Centrolenidae, and Pipidae. Only one species (*Leptodactylus petersi*) consistently needed more than two applications of benzocaine for successful euthanasia. This was not a leptodactylid trait as other species in the family (*L. mytaceus, L. bolivianus, L. knudseni, L. rhodomystax, Ceratophrys cornata,* and *Adenomera andreae*) did not need more than two applications of Orajel®.

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seasonal staff at BBNWR whose perserverance and dedication has made our efforts successful. We owe a special debt of gratitude for the technical support provided by K. A. Phelps. BBNWR field personnel were partially supported by the U.S. Army Corps of Engineers, Norfolk, Virginia. We thank J. Geiger, D. Stewart, and J. Robinette for helpful comments on earlier drafts of the manuscript.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 29, Number 1 (March 1998).

CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). **ALBINISIM**. Herein we report three partially albino *Ambystoma opacum* larvae. Two were discovered from the same vernal pool in Tiverton, Newport County, Rhode Island, USA (BD, JB) during 1988. A third specimen was found during March 1997 from a vernal pool in Lyme, Connecticut, USA (HG).

On 31 March 1988, an albino *A. opacum* larva (46 mm TL) was captured in 16.5 cm of water at 1535 h. The ambient temperature was 13.5°C; water temperature was 12°C. A second albino larva (50 mm TL) was captured on 6 May 1988 in 30.5 cm of water at 1200 h; ambient temperature and water temperature were 15.5°C and 14.5°C. This specimen was photographed at the capture site and released.

The coloration of both living animals appeared identical. Alive, the larval integuments were transparent with a yellowish cast; eyes appeared normally pigmented except that the pupils were pink, and the visceral organs, major blood vessels, and developing cranium were clearly visible through the integument. The external gills were flushed orange-red from blood. Preserved, the first larva appeared chalky-white with a slight hint of its former yellowish cast. This animal was catalogued in the American Museum of Natural History (AMNH 130240). Using definitions from Harris (1970. Bull. Maryland Herpetol. Soc. 6:21–22), both specimens were partial albinos, possessing integumentary xanthophores and orbital melanophores.

On 27 March 1997, another albino *A. opacum* larva was discovered in a vernal pool in Lyme, Connecticut. The coloration of this specimen was similar to that of the Tiverton larvae except the gills were yellowish and showed no red coloration from its blood, the eyes were slightly darker yellow than the integument, and most of the tail musculature was devoid of color and appeared white. The animal was placed in a jar, photographed, and returned to the pool. Color slides of this larva were sent to AMNH.

Albinism in *A. opacum* has been documented twice previously, once from Maryland (Harris, *op. cit.*) and once from Mississippi (Dyrkacz 1981. SSAR Herpetol. Circ. No. 11). To our knowledge, this is the first documentation of albinism for *A. opacum* in New England.

We thank Dr. Wang Yong and Charles W. Painter for their comments on this manuscript.

Submitted by **BOB DEEGAN**, 97 Raymond Street, Fairhaven, Massachusetts 02719, USA, **JOHN BERKHOLTZ**, Franklin Park Zoo, Children's Zoo, 1 Franklin Park Road, Boston, Massachusetts 02121, USA, and **HANK GOLET**, 5-1 Binney Road, Old Lyme, Connecticut 06371, USA.

GYRINOPHILUS PORPHYRITICUS (Spring Salamander). **COLORATION**. Although many *Gyrinophilus porphyriticus* spend much time underground, making use of subterranean springs and caves (Bishop 1947. Handbook of Salamanders. Comstock, Ithaca, New York. 535 pp), albinism has been reported in only one population (Brandon and Rutherford 1967. Am. Midl. Nat. 78:537–540; Dyrkacz 1981. SSAR Herp. Circ. 11). On 1 May 1997 in Chenango County, New York, USA, we found an albino (leucistic) larval *G. porphyriticus* (66 mm SVL, 50 mm TL) at the emergence of an underground spring ca. 550 m elev. The individual had a completely pigmentless integument, gills pink with hemoglobin, and normally pigmented eyes. A total of 15 larvae and adults, all normally pigmented, were found at the same site over a 15 day period. The specimen is deposited in the SUNY Cortland Bowers Natural History Museum (97-101PKD).

Submitted by **CARMEN FERRIERO**, **SCOTT MILLER**, **MATTHEW CHAPMAN**, and **PETER K. DUCEY**, Department of Biological Sciences, State University of New York at Cortland, Cortland, New York, 13045 USA.

PLETHODON HUBRICHTI (Peaks of Otter Salamander). **ALBINISM**. Albinistic and leucistic salamanders in the genus *Plethodon* have been recorded for *P. cinereus* (Harris 1968. Bull. Maryland Herpetol. Soc. 4:57–60; Pauley 1974. Redstart 41:104), *P. dorsalis* (Thurow 1955. Copeia 1955:62–63), *P. glutinosus* (Piatt 1931. Copeia 1931:29), and *P grobmani* (reported as *P. glutinosus*, Highton 1956. Copeia 1956:75–93).

On 26 May 1996, we found a leucistic, gravid, adult female *P. hubrichti* (53 mm SVL, 111 mm total length, 1.9 g) in the George Washington and Jefferson National Forest, 960 m, 7.0 km SE Arcadia (79°33'55", 37°29'38"), Botetourt County, Virginia, USA (Fig. 1). Integumentary pigment was completely lacking, although she had normally pigmented eyes. She was found in a six-year-old clearcut of striped maple (*Acer pennsylvanicum*) and red oak (*Quercus ruber*) saplings. We maintained the female in captivity to obtain reproductive data but despite efforts to induce feeding, she died about 10 weeks after capture. This is the first record of the leucistic phase of albinism in this endemic Blue Ridge Mountains species. The specimen is catalogued in the Virginia Museum of Natural History (VMNH 8086).



FIG. 1. Leucistic albino *Plethodon hubrichti*.

Submitted by **MICHAEL S. HAYSLETT**, 923 Euclid Avenue, Lynchburg, Virginia 24501, USA, **GORDON L. WILSON**, Department of Biology, Liberty University, Lynchburg, Virginia 24506, USA, and **JOSEPH C. MITCHELL**, Department of Biology and School of Continuing Studies, University of Richmond, Richmond, Virginia 23173, USA.

TARICHA TOROSA TOROSA (Coast Range Newt). **PREDATION**. On 20 July 1996 at the Santa Rosa Plateau Ecological Reserve, Riverside County, California, USA, we obtained a 194 mm SVL adult male bullfrog (*Rana catesbeiana*). Examination of its stomach contents revealed two predaceous water beetles (Dytiscidae) and a recently ingested, 76 mm SVL, adult male, *T. t. torosa*. The newt was deposited at the California Academy of Sciences (CAS 203181).

From 30 June–23 September 1997 at Ledson Marsh, Annadel State Park, Sonoma County, California, 3 adult and 2 larval *T. t. torosa* were flushed from the stomachs of an adult male and 3 adult female *R. catesbeiana* 183, 180, 141, and 122 mm SVL. In all cases, the skin of the adult newts had been digested. Other prey items included 3 subadult Pacific treefrogs (*Hyla regilla*) and one dragonfly nymph (Aeshnidae).

Bullfrogs have been poisoned by ingesting northern rough-skinned newts (*Taricha granulosa granulosa*) in Oregon under both experimental and wild conditions (Brodie 1968. Copeia 1968:307–313). These observations presumed that since bullfrogs were recently introduced into the American West and did not co-evolve with Pacific newts (*Taricha* spp.), they have not had sufficient time to develop any resistance to the potent toxins found in all life stages of *Taricha*. Our observations provide evidence that adult bullfrogs consume both larval and adult *T. t. torosa* in the wild, and naturalized bullfrogs may indeed have acquired some resistance to tetrodotoxin.

Our thanks to Robin Wills, Scott Principil, and Gary Bell for assistance in the field, and to Galen B. Rathbun and Norman J. Scott, Jr. for reviewing the manuscript. Permission to collect specimens was granted under California Department of Fish and Game permits issued to the authors. The Nature Conservancy allowed the use of facilities on the Santa Rosa Plateau Ecological Reserve.

Submitted by **MARK R. JENNINGS**, U.S. Geological Survey, Biological Resources Division, California Science Center, Piedras Blancas Field Station, P.O. Box 70, San Simeon, California 93452-0070, USA, and Research Associate, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-9961, USA; and **DAVID COOK**, Biology Department, Sonoma State University, 1801 E. Cotati Avenue, Rohnert Park, California 94928-3613, USA.

TARICHA TOROSA (California Newt). **PREDATION**. Members of the genus *Taricha* are known to contain toxic skin secretions and terrestrial forms have few predators (Stebbins and Cohen 1995. A Natural History of Amphibians. Princeton Univ. Press. Princeton, New Jersey. 316 pp).

On 15 July 1997 at 1500 h along a first order stream in the Santa Monica Mountains, Los Angeles County, California, USA, we found a ringneck snake (*Diadophis punctatus* 48 cm TL, 40 cm SVL) swallowing a *T. torosa* (7.8 cm TL, 3.8 cm SVL). The head and forelimbs of the newt were entirely consumed with only the hindlimbs and tail protruding. When we picked up the snake it was lethargic and did not attempt to move. We were unsure if the snake's behavior was defensive or a reaction to the newt toxins. The snake was collected and returned to the laboratory where it remained lethargic. The next morning (15 h later) the snake had regurgitated the newt. The snake's behavior appeared normal and the newt was dead. Based on these observations it is unclear if *T. torosa* are a regular part of the diet of *D. punctatus*. However, *D. punctatus* apparently attack *T. torosa* and a percentage of these attacks likely result in mortality for the newts either because of consumption or capture.

Submitted buy **LEE B. KATS, JEFF A. GOODSELL, NICOLE MATTHEWS, CATHY BAHN**, Natural Science Division, Pepperdine University, Malibu, California 90263, USA, and **ANDREW R. BLAUSTEIN**, Zoology Department, Oregon State University, Corvallis, Oregon 97331, USA.

ANURA

HYLA AVIVOCA (Bird-voiced Treefrog). **AMPLEXUS and OVIPOSITION**. Compared to most other North American *Hyla*, little is known about the life history of *Hyla avivoca*, with most data collected from chorusing males. The non-vocal females are seldom observed, and previously reported observations on oviposition (Hellman 1953. Publ. Res. Div. Ross Allen's Rept. Inst. 1:61–74; Trauth and Robinette 1990. Bull. Chicago Herpetol. Soc. 25:218–219; Volpe et al. 1961. Copeia 1961:340–349) were of females of amplexing pairs collected in the wild that later oviposited in the lab or in collecting containers. Herein I report observations of amplexus and oviposition in two pairs of *H. avivoca* in nature.

The first observation took place on 24 May 1997 at Bell Pond, Johnson Co., Illinois, USA (T13S R4E SW/4 Sec. 11). Air temperature was 20°C with light but steady rain. At 2211 h a female was observed approaching a male calling on a limb of a pumpkin ash (*Fraxinus tomentosa*) ca. 1.7 m above water and 3 cm from the trunk. The tree was in clear water 8 cm deep. The female ascended the tree and when she reached the male (at 2215 h) she reached out with one hand and touched him on a hind limb. The male immediately turned toward her, climbed onto her, and clutched her in axillary amplexus. As the male was mounting and for several minutes afterwards, he emitted a call that sounded like the breeding call, but which had a more "raspy" sound (possibly because he was unable to fully inflate his vocal sac). The pair remained on the perch until 2227 h when they descended the tree head first. At 2235 h when the pair reached the water, the female paused and remained still until 2241 h then she turned and oriented so that her head faced up the tree with her cloaca ca. 1 cm above the water. She then backed into the water until the posterior third of her body and half of the male's body were submerged. Oviposition began immediately. The female arched her back and released one or both hind limbs from their grip on the tree trunk and appeared to close both eyes each time a cluster of eggs was laid. The first cluster of six eggs sank slowly to the substrate. Additional clusters of 3–9 eggs were laid at 1–4 min intervals over the next 40 min and I estimated 150–180 eggs were laid. Most sank slowly to the pond substrate of dead leaves and formed one mass, but at least three clusters adhered to the trunk of the tree between the water surface and substrate. This observation ended at 2324 h with the pair still amplexed and ovipositing.

The second observation began at 2110 h on 3 July 1997 at Reevesville Swamp, Pope Co., Illinois, USA (T13S R5E NW/4 Sec 31). A female was observed ascending the stem of a reed (*Phragmites* sp.) near another on which a male was calling ca. 1.3 m above the water. She paused when the male stopped calling

and rapidly climbed the reed she was on, or moved closer when the male resumed calling. By 2117 h the female had reached the base of the leaf where the male was perched. When she stepped onto the leaf the male oriented toward her, then climbed onto her (head first) and clasped her in axillary amplexus. The male continued to call (though the calls sounded more raspy than before) until 2123 h. The pair remained in place until 2132 h when the observation was interrupted. By 2140 h the female had descended to within 0.3 m of the water and climbed onto a low buttonbush (*Cephalanthus occidentalis*) branch in contact with the reeds where amplexus began. The female continued to descend the branch until she reached the water at 2147 h. She continued on the branch until her body (behind the shoulders) was submerged (only the posterior third of the male was submerged). The water was fairly clear, ca. 0.2 m deep over a substrate of mud, and covered by a thick mat of duckweed (mostly *Lemna* sp.) thus making oviposition difficult to observe. At 2153 h the female released her hind limb grip, thrust her head and cloaca upwards, and deposited an egg cluster. This behavior was repeated four times by 2205 h when I attempted to determine if eggs were sinking by gently scooping up or pushing duckweed from behind the frogs. One cluster of three eggs adhered to the *Cephalanthus* branch, but no others were seen. I ended the observation at ca. 2210 h. During subsequent visits on 6 and 10 July, three and seven *H. avivoca* tadpoles were collected from well shaded water in the interior of the same *Phragmites* thicket. Despite repeated attempts, no *H. avivoca* tadpoles were seen in an adjacent sunlit pond with scattered cattail (*Typhus* sp.) and *Cephalanthus* stands (where *H. cinerea* and *Acris crepitans* tadpoles were abundant), nor in a shaded cypress (*Taxodium distichum*)-tupelo (*Nyssa aquatica*) swamp where many male *H. avivoca* were heard calling previously.

I thank R.A. Brandon for reading a draft of this manuscript.

Submitted **by MICHAEL REDMER**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901-6501, USA.

HYLA CHRYSOSCELIS (Gray Treefrog). **HIBERNACULA.** On 14 December 1996, ca. 15 km NE Fredericktown, Knox County, Ohio, USA, at a site composed predominantly of sugar maple (*Acer saccharum*), I unearthed a *Hyla chrysoscelis* from its apparent hibernaculum. This specimen was found 30.2 cm from the base of a sugar maple that was joined with another at its base. Both litter and soil were carefully raked out from the base of the tree in a circular fashion for one meter. Another *H. chrysoscelis* was discovered on the south side of the same tree 57 cm from the base. Leaf litter depth varied from 3.5–7 cm. The frogs were located 2.5 and 5.0 cm beneath the soil surface. Air temperature was ca. 4°C and the soil was not frozen. The leaf litter and soil around the base of eight additional trees were investigated in a similar manner and three more *H. chrysoscelis* were discovered. All were found in the soft, loose soil, but not in any of the numerous rodent tunnels at the bases of the trees. The total area examined was ca. 200 m^2.

In all cases the specimens were found in situations above the frostline. *Hyla chrysoscelis* is a freeze-tolerant species, known to survive temperatures less than 3°C and shows blood glucose concentration and dehydration levels that are similar to *H. versicolor* (Costanzo et al. 1992. Copeia 1992:565–569). Based upon this information it should not be surprising to find *H. chrysoscelis* during the winter months in shallow hibernacula as noted in this observation.

Submitted by **GARY BURKHOLDER**, Department of Biology, Mt. Vernon Nazarene College, Mt. Vernon, Ohio 43050, USA.

HYPEROLIUS TUBERILINGUIS (Tinker Reed Frog). **OVIPOSITION.** Nest building behavior in frogs appears to have evolved independently in at least five families: Rhacophoridae, Myobatrachidae, Leptodactylidae, Hylidae, and Hyperoliidae (Haddad et al. 1990. J. Herpetol. 24:225–226; Duellman and Trueb 1994. Biology of Amphibians, Johns Hopkins University Press, Baltimore, Maryland). Few reports describe the details of nest construction and few data exist on the breeding behavior of the largely African family Hyperoliidae. *Hyperolius tuberilinguis*, a widely distributed species throughout the eastern coastal plain from Kenya to KwaZulu-Natal, South Africa (Pallet and Passmore 1988. Bioacoustics 1:13–23), deposits its eggs in a nest constructed of egg jelly attached to emergent vegetation. Rose (1962. The Reptiles and Amphibians of Southern Africa, Maskew Miller, Cape Town) described the nest as "a mass of very sticky, crystal clear jelly attached to the stalks (of plants) about five inches above the water." Wager (1986. Frogs of South Africa. Delta Books, Craighall) and Poynton and Broadley (1987. Ann. Natal Mus. 28[1]:161–229) make similar observations but add that the size of the nest is ca. 35 x 50 mm. The process of oviposition and nest construction has not been observed (Passmore and Carruthers 1995. South African Frogs: a Complete Guide, Witwatersrand University Press / Southern Books, Johannesurg). Herein we report on the behavior associated with oviposition and nest construction in *H. tuberilinguis*.

On 10 February 1997, four amplexing pairs of *H. tuberilinguis* were observed at Wits Pond, Twinstreams Farm, Mtunzini, KwaZulu/Natal (28°51'S; 31°46'E), South Africa, between 2200 h and 0300 h. The first pair formed at ca. 2220 h, the second and third at ca. 2330 h. The fourth pair was not observed forming. Oviposition and nest construction were observed in two of these pairs. The first pair initiated oviposition by 2300 h on a leaf of *Hibiscus diversifolius* 210 mm above the water. The second pair deposited an egg mass at the base of an emergent *Typha capensis* 20 mm above the water.

Oviposition involved the pair positioning themselves heads up on the leaf. The female grasped the edges of the leaf with both fore- and hind-limbs. Males did not help with the grasping of the leaf. An initial egg mass was laid with only the male appearing to push the eggs against the leaf with his hind-limbs. Oviposition took 25 min. for the first pair and 23 min. for the second, with egg masses measuring 37 x 31 mm and 44 x 39 mm.

Both pairs left the egg masses when oviposition was complete and returned ca. 6–7 m to the water. One pair remained half-submerged in the water for 50 min, the second pair remained half-submerged for 65 min. Both pairs then returned to the previously laid egg masses. During this entire period the male and female remained in amplexus. Upon reaching the egg mass the pairs proceeded to deposit more egg jelly on the egg mass after a delay of three minutes for the first pair and two minutes for the second. The process of adding egg jelly lasted for 30–40 min. in both pairs. During this time no more eggs were deposited. Both the male and female spread the jelly over the egg mass using their hind-limbs. Only the female appeared to contribute to the production of the jelly. This procedure, of returning to the water and then to the egg mass to deposit more egg jelly, occurred twice in both pairs. The elapsed time from commencement of egg laying until completion of the nest was 190 min. for the first pair and 210 min. for the second. The completed egg masses measured 59

x 55 and 58 x 50 mm. The added egg jelly was clear and extremely viscous. It remained moist until the nest's degeneration, ca. 3 days later, and the subsequent emergence of the tadpoles. The construction of nests by *H. tuberilinguis* appears to be unique in this family. We know of no other published accounts of nest construction for members of the Hyperoliidae, specifically *Hyperolius*.

We thank the Foundation for Research Development for funding and Mondi Forests, South Africa for permission to work on their property.

Submitted by **MERVYN C. MASON** and **NEVILLE I. PASSMORE**, Communication and Behaviour Research Group, Department of Zoology, University of the Witwatersrand, Private Bag 3, P.O. WITS, Johannesburg, 2050, South Africa.

RANA CASCADAE (Cascades Frog). **PREDATION.** *Rana cascadae* is nearly extinct at its southernmost limit—Lassen Volcanic National Park and vicinity, northern California, USA (Fellers and Drost 1993. Biol. Conser. 65:177–181). About 150 km NW of the Lassen area, *R. cascadae* persists at some sites in the Shasta area (pers. obs.; Fellers and Drost, *op. cit.*). One of many hypotheses why amphibians have declined is that novel (non-native) predators harm populations through evolutionarily unprecedented predation (Hayes and Jennings 1986. J. Herpetol. 20:490–509). But little direct evidence exists documenting the presumed predation. Here I present an observation of *R. cascadae* predation that supports the novel predator hypothesis.

On 17 October 1992 I observed an adult *R. cascadae* (ca. 50 mm SVL) jump into Butte Creek at ca. 1765 m elevation on the northeast slope of Mount Shasta volcano. The frog remained motionless on the creek bottom for several seconds, but was seized and eaten by a brown trout (*Salmo trutta*; ca. 200 mm fork length [FL]) as the frog began to swim downstream.

This observation confirms that *S. trutta* will eat *R. cascadae* under natural conditions, and that fish predation threatens adult frogs as well as (presumably) tadpoles (Bradford 1989. Copeia 1989:775–778). Fish do not always decimate *R. cascadae* populations, however, as a simple predation hypothesis might suggest (see Jennings 1996. Status of Amphibians, Sierra Nevada Ecosystem Project: Final Report to Congress, Centers for Water and Wildland Resources, University of California, Davis). A reproductive population of *R. cascadae* persists at Gumboot Lake west of Mt. Shasta City despite the presence of a trout fishery at the lake (pers. obs.; Fellers and Drost, *op. cit.*). For more than 25 years, California Department of Fish and Game has repeatedly stocked ca. 180 mm FL rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*) into the lake for sport fishing.

I thank Matt Simons, Brad Shaffer, Michael Rode, and Mark Jennings for assistance. Research was funded in part by The California Nature Conservancy and University of California at Davis.

Submitted by **LEE H. SIMONS**. Shasta Natural History Foundation, 913 Shasta Avenue, Yreka, California 96097-3115, USA.

RANA CATESBEIANA (Bullfrog). **DIET**. *Rana catesbeiana* is known to prey upon a wide range of small vertebrates (Bury and Whelan 1984. U.S. Fish and Wildl. Serv. Publ. 155. U.S. Dept. Interior, Washington, D.C.). Herein I report predation on *Thamnophis atratus hydrophilus*, *Elgaria multicarinata*, *Sceloporus occidentalis*, and *Rana boylii*, species previously unreported as prey. Voucher specimens are catalogued into the California Academy of Sciences (CAS).

On 24 June 1997, I collected a male *R. catesbeiana* (134.1 mm SVL, 298.3 g, CAS 203708) in Cache Creek, Colusa County, California, USA (38°55'29"N, 122°19'54"W) that contained a *Thamnophis atratus hydrophilus* (392 mm SVL, 515 mm total length, 22.7 g, CAS 204236).

On 6 September 1997, I collected a female *R. catesbeiana* (80.7 mm SVL, 59.65 g, CAS 203709) in Bear Creek, Colusa County, California (38°03'24"N, 122°24'41"W) that contained a *Sceloporus occidentalis* (31 mm SVL, 1.5 g, CAS 204238).

On 13 May 1997, I collected a female *R. catesbeiana* (128.8 mm SVL, 288.9 g) in Davis Creek, Yolo County, California (38°53'36"N 122°22'01"W) that contained an *Elgaria multicarinata* (54.8 mm SVL, 2.28 g, with a 9.3 mm tail remnant, CAS 204237). The bullfrog was not retained.

Also on 13 May 1997 at the Davis Creek site, I observed a male *R. catesbeiana* (105 mm SVL, CAS 203633) at 2230 h behaving in a manner consistent with subduing and swallowing moving prey. I hand-grabbed the frog and as I squeezed it for a more secure grasp, the hind feet of another anuran protruded from its mouth. I grabbed the feet and pulled a female *Rana boylii* (45 mm SVL, CAS 203634) from the stomach of the *R. catesbeiana*. The *R. boylii* appeared unharmed and lived until preserved the next morning. The *R. catesbeiana* also contained the partially digested body of another *R. boylii* (CAS numbers pending).

Moyle (1973. Copeia 1973:18–22) inferred that predation by *R. catesbeiana* was a causal factor in the decline and/or disappearance of native ranid frogs, including *R. boylii*, in parts of California. However, he and subsequent authors (Hayes and Jennings 1986. J. Herpetol. 20:490–509; Kupferberg 1997. Ecology 78:1736–1751) who have examined the issue of competition between *R. catesbeiana* and *R. boylii*, offered no direct evidence of predation by *R. catesbeiana* in the field. It is notable that the *R. catesbeiana* that ate the *R. boylii* was smaller than most individuals from a series of adults collected in the watershed (mean = 128.3 mm SVL; range = 81.4–175.7 mm SVL; SD = 22.7 mm; N = 43); thus most adult *R. catesbeiana* present can be assumed capable of preying on *R. boylii*.

I thank Ray Krause of the Homestake Mine and Paul Elliott of the Payne Ranch for access to collecting sites, and Patrick Davis, Roger Hothem, Mark Jennings, and Norm Scott for help collecting specimens. Specimens were obtained under scientific collecting permits issued by the California Department of Fish and Game.

Submitted by **JOHN J. CRAYON**, U.S. Geological Survey, Biological Resources Division, California Science Center, Davis Field Station, c/o Wildlife, Fish, and Conservation Biology, University of California, Davis, California 95616–5224, USA.

ZACHAENUS PARVULUS (Leaf Frog)**. DEFENSIVE BEHAVIOR and COLOR PATTERN**. Certain leaf-litter leptodactylids (e.g., *Proceratophrys appendiculata*) and microhylids (e.g., *Stereocyclops incrassatus*) display a defensive behavior in which they flatten their body and become immobile, thus acquiring a leaf-like body shape. Together with cryptic coloration, this position should help prevent detection by visually oriented predators (Sazima 1978. Biotropica 10:158). Sazima (*op. cit.*) reported similar behavior by *Zachaenus parvulus*, a leptrodactylid frog endemic to the Atlantic Rainforest of SE Brazil. However, because of the restricted number of observations, he provided only scant details. Here we report field observations of the defensive behavior of *Z. parvulus* and include information on color pattern variation in living frogs.

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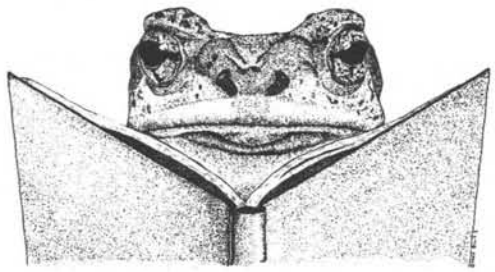
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These observations were made at the Atlantic Rainforest area of Ilha Grande (23°11'S, 44°12'W), an island in southern Rio de Janeiro State, southeastern Brazil. On several occasions (N = 14) we observed *Z. parvulus* display the following behavior: when disturbed they jumped 10–15 cm and, just after landing, remained immobile with the forelimbs and hindlimbs fully extended forward and backwards, the extended limbs remaining along the axis of the body with the body flattened against the ground. If touched, individuals remained immobile and maintained this posture even if overturned. This behavior, together with the color pattern, results in individuals resembling a fallen leaf. During another observation, one individual did not display this complete behavioral sequence but only flattened the body against the ground (MASA, pers. obs.).

Lutz (1944. Bol. Mus. Nac. Rio de Janeiro 17:1–66) provided the only information on the color pattern of *Z. parvulus* in life and reported the dorsal color could be greenish, yellowish, light-wine, or brown. Live individuals in the Ilha Grande population have considerable variation in dorsal color pattern. Of 17 individuals examined 6 (35.3%) were beige with dark-gray bands, 5 (29.4%) light gray, 3 (17.6%) orange, 2 (11.8%) dark-gray, and 1 (5.9%) light-green. Preserved individuals lose their original color after a few days in preservative (pers. obs.). The preferred microhabitat of *Z. parvulus* at Ilha Grande is under fallen tree trunks where various colored fungi are common.

We thank the Sub-Reitoria de Pós-Graduação e Pesquisa (SR-2) for partial funding and the people of the Centro de Estudos Ambientais e Desenvolvimento Sustentado of Campus Regional da Ilha Grande for logistical support. During this study CFDR, MVS, HGB, and MASA received research grants from the Conselho Nacional do Desenvolvimento Científico e Tecnológico - CNPq and DV received a graduate fellowship from Coordenação de Pessoal de Ensino Superior (CAPES).

Submitted by **CARLOS FREDERICO D. ROCHA, MONIQUE VAN SLUYS, HELENA G. BERGALLO, MARIA ALICE S. ALVES**, and **DAVOR VRCIBRADIC**, Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier 524, Maracanã, 20550-019, Rio de Janeiro, RJ, Brazil. e-mail (CFDR): cfdrocha@uerj.br.

TESTUDINES

APALONE SPINIFERA (Spiny Softshell) **REPRODUCTION.** Despite considerable data on reproduction in *Apalone spinifera* (reviewed by Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 578 pp.), Iverson (1992. Herpetol. Monogr. 6:25–42) was unable to determine relative clutch mass (RCM) for any species of Trionychidae without having to resort to an estimate. Moreover, he was able to estimate RCM only for the smooth softshell (*A. mutica*). The general absence of information on RCM reflects the difficulty in catching these wary turtles during their nesting forays.

On 10 June 1997, we captured a large female *A. spinifera* just after it had emerged from Stump Lake, a backwater of the Illinois River in Jersey County, Illinois, USA. Despite numerous observations of females at this and other sites, this was the only nesting individual we caught in four years of collecting. Because so little information exists on the relationship between female mass and clutch mass in the Trionychidae, we report details on the female and her clutch.

The female's carapace length was 402 mm measured to the nearest mm with calipers and her gravid mass was 5625 g determined to the nearest 25 g with a spring balance immediately after capture. After injection with oxytocin (Ewert and Legler 1978. Herpetologica 34:314–318), she oviposited 31 nearly spherical eggs over a three day span. The female was retained for another five days and then reinjected. However, she laid no additional eggs and was later released at the collecting site.

The eggs were weighed (nearest 0.01 g) and measured (nearest 0.1 mm) shortly after laying. Average egg mass (mean ± SD, [range]) was 7.92 ± 0.37 g (6.72–8.39 g) and average egg diameter was 24.1 ± 0.55 mm (22.7–25.0 mm). The entire clutch weighed 245.39 g. Relative clutch mass was 4.56% of maternal spent body mass when calculated using the method of Iverson and Smith (1993. Copeia 1993:1–21).

The value of RCM for this turtle was about half that estimated for *A. mutica* (9.03% of maternal spent body mass) by Iverson (*op. cit.*). However, the *A. spinifera* that we studied was much larger than the *A. mutica* (carapace length = ~211 mm, mass = ~819 g) Iverson used to estimate RCM. Iverson (*op. cit.*) found that larger species produce relatively lighter clutches and thus have lower values of RCM than smaller species.

Funding for DAW was provided by a summer internship from the Department of Zoology and Genetics, Iowa State University and by an Iowa State University research grant to F. J. Janzen. This work was partially supported by the Illinois Natural History Survey and the Upper Mississippi River System Long Term Resource Monitoring Program.

Submitted by **JOHN K. TUCKER**, Great Rivers Field Station, Illinois Natural History Survey, 4134 Alby Street, Alton, Illinois 62002, USA (e-mail: john_k_tucker@usgs.gov), and **DANIEL A. WARNER**, Department of Animal Ecology, Iowa State University, Ames, Iowa 50011, USA.

CARETTA CARETTA (Loggerhead Sea Turtle). **PREDATION.** Birds are well known predators of hatchling sea turtles (Dodd 1988. U.S. Fish Wildl. Serv. Biol. Rep. 88:1–110). On 26 August 1997, a Caretta Research Project team witnessed a great horned owl (*Bubo virginianus*) feeding upon *Caretta caretta* hatchlings at Wassaw National Wildlife Refuge, Georgia, USA. Weather conditions were clear and the air was warm (28°C) and humid. At 2103 h, hatchlings began to emerge from their nest chamber located in a self release hatchery. During this time, an adult *B.virginianus* flew down and began seizing *Caretta* hatchlings. After catching a hatchling, the owl would transfer the loggerhead from its talons into its mouth and fly to a nearby slash pine tree (*Pinus elliottii*) where it would eat the turtle. This process was repeated five times, and each turtle was seized before it emerged from the dune vegetation bordering the high water mark. By 2118 h, the surviving turtles from this nest had reached the sea and the owl had left the hatchery area. On 27 August 1997, between 2240–2300 h, four more *Caretta* hatchlings were caught and consumed by *B. virginianus* (presumably the same individual). The owl's feeding sequence mirrored the previous night's events.

Great horned owls commonly feed upon small reptiles (Ross 1989. Amphibians and Reptiles in the Diets of North American Raptors. Wisconsin Endangered Species Report No. 59). However, sea turtles have not been documented in the diet of *B. virginianus*. Additionally, these observations are of interest because they demonstrate predation in "protected" hatchery areas. The utilization of hatcheries as feeding territories has been documented for raccoons (*Procyon lotor*) and imported fire ants (*Solenopsis invicta*) but not for any type of avian predator (Dodd 1988, *op. cit.*; Moulis 1997. Chel. Biol. Cons. 2:433–436).

Submitted by **MICHAEL G. FRICK**, Caretta Research Project, P.O. Box 661, Tybee Island, Georgia 31328, USA; e-mail: Caretta05@aol.com.

CHELYDRA SERPENTINA (Common Snapping Turtle). **PREDATION.** Since its introduction into North America in the 1930's, the South American fire ant, *Solenopsis invicta*, has spread throughout the southeastern United States. Fire ants have been observed interfering with a nesting turtle (Whiting 1994. Herpetol. Rev. 25:25), and preying on tortoises (Landers et. al. 1980. Herpetologica 36:353–361), alligators, (Allen et al. 1997. J. Herpetol. 31:318–321) and other species of reptiles (Mount et al. 1981. J. Alabama Acad. Sci. 52:71–78). On 19 September 1992, I discovered a nest of *Chelydra serpentina* along the north shore of the Little Cahaba River, ca. 1.7 km upstream from its junction with the Cahaba River, in Jefferson Co., Alabama. Six dead hatchlings were found on or just below the surface of the nest. A large number of fire ants were on and among the hatchling snapping turtles. The nest did not appear to have been disturbed by a vertebrate predator as there was no excavation of soil at the site, and the turtles were intact with no visible injuries. All of the turtles had a prominent plastral yolk sac of an appropriate size for a hatchling, and otherwise appeared to have developed fully and normally. They appeared to have died shortly before their discovery since there was no noticeable odor or other evidence of decomposition. The presence of a large (>30 cm diameter) fire ant mound about 1 m from the nest indicates that the ants were in close proximity to the nest during a substantial segment of the incubation period. A number of empty eggshells and two intact infertile eggs were found at the site, indicating that some hatchlings may have successfully emerged from this nest. I thank Larry Zorns for companionship in the field.

Submitted by **J. STEVEN CONNERS**, Animal Science Department, Miami Metrozoo, 12400 SW 152nd Street, Miami, Florida 33177, USA.

ERETMOCHELYS IMBRICATA (Hawksbill). **PREDATION.** Necropsy of an immature female hawksbill, *Eretmochelys imbricata*, found stranded in the Florida Keys suggest that shark attack was the ultimate cause of death. The turtle had been found stranded at the furthest point south of Old Boca Chica Road on Boca Chica Key in Monroe County, Florida, USA (24°335'N, 81°412'W). It was stored frozen at the Department of Environmental Protection in St. Petersburg, Florida, until the necropsy in February 1997. The necropsy revealed that the turtle was an immature female (66.8 cm SCL). Upon dissection, deep wounds consistent with shark attack were observed. The tail and posterior marginal scutes along the right side of the carapace were missing as a result of the shark bite, and the right rear flipper was severed. Puncture marks from the attack also appeared on the left rear flipper. The bites of the shark penetrated the body cavity through the abdominal muscles. Shark bite marks on the posterior body portion suggest that the turtle may have been hiding under a coral shelf or attempting to flee its predator when attacked (e.g., Bustard 1983. *In* Harless and Morlock [eds.], Turtles: Perspectives and Research, pp. 234–235). The shark bites appeared to have led to an internal infection in the body cavity, evident from necrotic tissue found in the posterior third of the body. The infection of the tissues implies that the proximate cause of death of the animal was the persistant internal infection, rather than the shark attack itself.

Sharks are known predators of hawksbills, but their impact on hawksbill populations is unknown (Witzell 1983. FAO Fish. Sinop. 137, Rome, p. 77). Young (1992. Marine Turtle Newsletter 59:14) reports remains of a "dinner-plate" sized hawksbill found in the stomach of a tiger shark, *Galeocerado cuvier*, in the Miskito Keys. A juvenile hawksbill was recently found in the stomach of *G. cuvier* in the western Atlantic Ocean (Gasparini and Sazima 1995. Herpetol. Rev. 26:34). My observation is notable because of the large size of the attack victim and because the hawksbill appears to have died from the infection following the attack.

Submitted by **LAURA K. ESTEP**, Natural Sciences Collegium, Eckerd College, 4200 54th Avenue South, St. Petersburg, Florida, 33711, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). **DIET.** There are several reports of *Terrapene ornata* feeding on the carcasses of mammals (Metcalf and Metcalf 1970. Trans. Kansas Acad. Sci. 73:96–117), birds (Blair 1976. Southwest. Nat. 21:89–103), and even other box turtles (Legler 1960. Univ. Kansas Publ., Mus. Nat. Hist. 11:527–669). Here I report the first published observation of an ornate box turtle eating snake carrion. On 13 August 1997, between 1300 and 1400 h, a sudden thunderstorm moved through the area of Valentine National Wildlife Refuge in Cherry Co., Nebraska, USA. Immediately after the storm I was driving east on Hwy 16B spur from the refuge headquarters to Hwy 83, a 13 mile stretch, and I observed numerous DOR and live reptiles on the still wet pavement. In particular, I observed a *T. o. ornata* on the south side of the road chewing on the exposed viscera of a DOR *Thamnophis sirtalis parietalis*. I interrupted this scavening episode when I stopped the car and approached the scene in order to identify the carcass.

I thank Fredric J. Janzen, Brian E. Smith, and Carrie L. Milne for reviewing this note.

Submitted by **JASON J. KOLBE**, Department of Zoology and Genetics, Iowa State University, Ames, Iowa 50011, USA.

TRACHEMYS GAIGEAE (Big Bend Slider). **COURTSHIP BEHAVIOR**. Male courtship in *Trachemys gaigeae* has not been described in detail, although Ernst (1992, Cat. Amer. Amphib. Rept. 538:3) noted that it does not involve foreclaw titillation but rather pursuit from the rear and possible biting by the male. Herein we provide preliminary observations of courtship in captive *T. gaigeae*.

Adult *T. gaigeae* were collected in Socorro and Sierra counties, New Mexico, and Brewster Co., Texas, USA. Three males (137–163 mm straight-line carapace length, SCL) and two females (216 and 224 mm SCL) were maintained in an outdoor artificial pond (610 cm diam. x 78 cm deep) or were housed in pairs for 3–4 days at a time in an aquarium (61 x 37 x 31 cm) for close observation. Total observation time in both the pond and aquarium was ca. 40 h during 1996–97.

Typical pre-courtship behavior exhibited by males in the pond involved trailing of the female along the bottom and cloacal "sniffing." This was quickly followed by the male approaching the female from the front or side (or rarely from above or beneath) with his head and neck fully extended and oriented towards the head of the female. When their heads were <5 cm apart, the male would initiate a rapid, jerky nodding or bobbing motion of his head (2–3 nods/sec). The nodding motion was accompanied by a simultaneous, less-pronounced, side-to-side "wagging" head motion. This

head nodding was done with the mouth closed and without contact between the pair. Male biting or use of foreclaws was never seen during ca. 30 such encounters. Head nodding usually ceased if either turtle surfaced. However, on three occasions involving two different males in the aquarium, we observed the male continue his head-nodding motions up to the water surface as he accompanied a surfacing female. As the head of the male broke the surface, we observed that a thin jet of water was ejected from his nostrils. Although our observations of "nasal squirting" were limited, our impression is that it is directly related to head nodding, but is undetectable when the male is submerged (nasal squirting was never seen during non-courtship activities such as feeding near the surface). Females were generally unresponsive to courting males, although one female gaped and then bit at a persistent male. Males often attempted to mount quiescent females, usually following courtship, but no copulation was ever observed. Observations of head nodding and nasal squirting were made during April–May in the aquarium (water temperature = 20°C); head nodding alone was seen in the pond in January–February (water temperature = 9–15°C). Head nodding and nasal squirting have been previously reported as elements of courtship behavior in neotropical *Trachemys* spp. (Fritz 1990. Salamandra 26:221–245; Seidel and Fritz 1997. Herpetol. Rev. 28:70–72). Based on our observations of *T. gaigeae* and very similar observations by Fritz (1990, *op. cit.*) of "*T. ornata callirostris*," these behavioral elements appear to be analogous to foreclaw vibration in male *T. scripta* (sensu stricto). Additional studies of Mesoamerican sliders, especially those in which snout length is sexually dimorphic, may reveal similar courtship behaviors.

We thank M. E. Seidel and W. G. Degenhardt for loan of the Texas specimens and comments, and C. W. Painter for comments. The New Mexico Department of Game and Fish Share With Wildlife Program partially funded this work.

Submitted by **JAMES N. STUART** and **JENNIFER B. M. MIYASHIRO**, Museum of Southwestern Biology and Department of Education, University of New Mexico, Albuquerque, New Mexico 87131, USA; e-mail (JNS): StuartJN@unm.edu.

AMPHISBAENIA

BLANUS CINEREUS (Iberian Amphisbaenian). **DIET**. *Blanus cinereus* is an amphisbaenid, endemic to the Iberian Peninsula, that is often found in sandy, loose soils in Mediterranean type ecosystems (Barbadillo 1987. La Guía de Incafo de los Anfibios y Reptiles de la Península Ibérica, Islas Baleares y Canarias. Incafo, Madrid, 694 pp.; Salvador 1981. *In* W. Böhme [ed.], Handbuch der Reptilien und Amphibien Europas, pp. 227–289. Aula Verlag, Wiesbaden). Like other amphisbaenians, it has subterranean, secretive habits, and thus few data about its biology are available. In recent years, some studies have focused on the feeding habits of this species, reporting a diet consisting exclusively of small invertebrates, mainly adult and larval insects (max. prey size = 29.3 mm), in accordance with its small-medium size (up to 30 cm in total length) (Gil et al. 1993 J. Herpetol. 27:205–209; López et al. 1991. Herpetologica 47:210–218).

On 20 April 1996, at Navas del Rey (Province of Madrid, Spain), we observed, by lifting a stone, an adult *Blanus cinereus* (SVL = 162 mm) swallowing the tail of a juvenile Spanish wall lizard (*Podarcis hispanica*) (SVL = 39 mm). The *P. hispanica* was concealed in a small cavity in the ground, 21 cm away from the *B. cinereus*. Although the initial attack had not been observed, an examination of the juvenile *P. hispanica* revealed an injury to its left thigh. Thus, it is probable that the attack was initially directed to the lizard's hindlimb, resulting in subsequent tail autotomy. In any case, we can conclude that *Blanus cinereus* occasionally preys upon small vertebrates, our observations being the first record describing such predatory behavior.

Submitted by **LUIS J. BARBADILLO, IÑIGO MARTÍNEZ-SOLANO** and **DAVID G. VALDEMORO**. Departamento de Biología, Facultad de Ciencias, Universidad Autónoma, E-28049 Cantoblanco, Madrid, Spain.

LACERTILIA

ANOLIS CAROLINENSIS (Green Anole). **HERBIVORY.** On 13 September 1996 at Bienville Parish, Louisiana, USA (3 km E Kepler Creek Bridge), an *Anolis carolinensis* was observed feeding on a flower of an aster (Asteraceae). At 1030 h, the lizard bit the head of the flower. After 5 s, the lizard withdrew its head from the flower and licked its pollen-covered snout before resuming feeding. This behavior continued for 2 min, after which the lizard left the flower and was no longer observed. No insects were visible at the flower; apparently the lizard was consuming nectar or pollen. The consumption of nectar and pollen by *A. carolinensis* was noted by Bartlett (1995. Reptiles 2:48–65). Nectarivory by *A. carolinensis* from hummingbird feeders was reported by Liner (1996. Herpetol. Rev. 27:78). Nevertheless, consumption of nectar and pollen by this species remains a little known and seldom observed behavior.

Submitted by **JOHN G. HIMES**, Museum of Life Sciences, Louisiana State University in Shreveport, One University Place, Shreveport, Louisiana 71115-2399, USA.

ANOLIS CAROLINENSIS (Green Anole). **SAUROPHAGY.** On 16 September 1996, an *A. carolinensis* (ca. 55–65 mm SVL) was observed feeding on a dead *Sceloporus undulatus* (56 mm SVL). The sequence of events follows. At 0910 h, as the observer approached, an anole fled under a shrub. A dead *S. undulatus* was discovered on the ground <5 cm from the site where the anole had departed. The carcass was intact except for the lack of distal halves of the right fore and hindlimbs.

At 0915 h, the observer moved 10 m away from the *S. undulatus*, and the *A. carolinensis* returned to the carcass. The anole grasped one of the two limb stumps with its jaws and violently thrashed the carcass in the air for 2–3 s. After the thrashing, the anole released the carcass and swallowed, indicating that feeding was taking place. The thrashing and swallowing sequence took place repeatedly during 10 min of observation. Approximately 100 harvester ants (*Pogonomyrmex* spp.) were on the carcass as well, and thus the thrashing may have been an attempt to remove the ants as well as a piece of flesh.

At 1050 h, the anole was still feeding on the carcass. After 5 min, the anole fled under a shrub due to observer disturbance. At 1105 h, the anole had not returned and the carcass was examined. The proximal right fore and hindlimbs were nearly devoid of flesh.

The cause of death and limb amputation of the *S. undulatus* could not be determined. However, because it is unlikely that an *A. carolinensis* is capable of killing an adult *S. undulatus* and biting through its leg bones, it is probable that the cause of death and amputation of the limbs were unrelated to the anole.

Anolis carolinensis is known to consume large caterpillars of a size similar to small *S. undulatus* (T. Jenssen, pers. comm). However, I know of only one occurrence of natural saurophagy by *A. carolinensis* (on *A. sagrei*) (J. Losos, unpubl. data).

I thank Gregg Henderson for identifying the ants and Laurence M. Hardy for critiquing the manuscript.

Submitted by **JOHN G. HIMES**, Museum of Life Sciences, Louisiana State University in Shreveport, One University Place, Shreveport, Louisiana 71115-2399, USA.

ANOLIS CRISTATELLUS WILEYAE (Virgin Islands Crested Anole). **HERBIVORY.** On Guana Island, British Virgin Islands, at 0730 h on October 1997, we watched an adult female crested anole chewing and swallowing the bright yellow flower of *Tecoma stans*, a naturalized ornamental shrub native to Central America as far north as Texas. Lazell and Perry (Herpetol. Rev. 1997. 28:150) report frugivory in this species, but were misinformed about one plant that we reported the anoles to be eating, *Trichostigma octandra*. We take this opportunity to correct that identification to *Rivina humila* (Phytolaccaceae), "blood berry."

We are indebted to Dr. George Proctor for redetermining this species from a patch the anoles were eating in 1996. They were eating its berries from the same patch in 1997.

Submitted by **JAMES LAZELL** and **NUMI C. MITCHELL**, The Conservation Agency, 6 Swinburne St., Jamestown, Rhode Island 02835, USA.

CNEMIDOPHORUS HYPERYTHRUS (Orange-throated Whiptail) and ***CALLISAURUS DRACONOIDES*** (Zebra-tailed Lizard). **PREDATION and DIET**. Here, we report predation on *Callisaurus draconoides* by *Cnemidophorus hyperythrus*. On 1 July 1997, while conducting fieldwork at "El Comitán," 17 km N of La Paz, Baja California Sur, México, we observed a male *C. hyperythrus* capturing a lizard. We noosed the whiptail (65 mm SVL, 5.32 g) and identified its prey, a hatchling *C. draconoides*, which was still alive in the predator's mouth. *Cnemidophorus hyperythrus* feeds on termites, spiders and a variety of insects (Asplund 1967. Am. Midl. Nat. 77:462–475; Bostic 1966. Herpetologica 22:23–31). Galina (1994. Estudio comparativo de tres especies de lacertilios en un matorral desértico de la región del Cabo, Baja California Sur, México. Master's thesis, Universidad Nacional Autónoma de México, México City. 81 pp.) examined stomach contents of 126 *C. hyperythrus* collected at "El Comitán" during 1987 and found termites to be the main type of prey. In that study no lizards were registered as prey. However, a hatchling *Uta stansburiana* was found in the stomach of a *C. hyperythrus* from San Diego Co., California, USA (Berrian and Banta 1979. Bull. Maryland Herpetol. Soc. 15:61). Our observation confirms that small lizards form an occasional component of the diet of *C. hyperythrus*.

Submitted by **PATRICIA GALINA**, Centro de Investigaciones Biológicas del Noroeste, P.O. Box 128, La Paz, Baja California Sur, México, **CARMEN BLAZQUEZ**, Estación Biológica de Doñana, CSIC, Avda. De María Luisa, Pabellón del Perú, 41013 Sevilla, Spain, **JOSE P. VEIGA** and **ALFREDO SALVADOR**, Departamento de Ecología Evolutiva, Museo Nacional de Ciencias Naturales, CSIC, José Gutierrez Abascal 2, 28006 Madrid, Spain.

CNEMIDOPHORUS TIGRIS, UTA STANSBURIANA (Western Whiptail, Side-blotched Lizard). **ENDOPARASITES FROM MÉXICO.** Endoparasites have been reported from *Cnemidophorus tigris* and *Uta stansburiana* from the USA (Telford 1970. Am. Midl. Nat. 83:516–554; Goldberg et al. 1997. Great Basin Nat. 57:273–277). However, there are no reports of helminths from these lizards in México. The purpose of this note is to report the presence of the nematodes *Skrjabinoptera phrynosoma* and *Thubunaea ctenosauri* in *Cnemidophorus tigris* and *Uta stansburiana* from Chihuahua, México. *Cnemidophorus tigris* (N = 4) and *U. stansburiana* (N = 6) were collected 10 km N Laboratorio del Desierto, Mapimí Biosphere Reserve (26°50'N, 103°49'W), Chihuahua, México in 1990. Lizards were fixed in 10% formalin and preserved in 70% ethanol. They were deposited in the herpetology collection of the Instituto de Ecología, A.C., Centro Regional Durango, Durango, México. Upon dissection, nematodes were found in the stomachs of these lizards. Each nematode was placed in a drop of glycerol on a glass slide and identified. Prevalence (number infected individuals divided by number of individuals examined) of *S. phrynosoma* was 50% for *C. tigris* and 67% for *U. stansburiana;* prevalence of *T. ctenosauri* was 50% for *C. tigris* and 33% for *U. stansburiana.* Mean intensity (mean number parasites per infected host) for *S. phrynosoma* was 14.0 in *C. tigris* and 2.5 in *U. stansburiana;* for *T. ctenosauri,* 22.0 in *C. tigris* and 1.5 in *U. stansburiana.* Selected nematodes were placed in vials of alcohol and deposited in the U.S. National Parasite Collection, Beltsville, Maryland: *C. tigris* (*S. phrynosoma* USNPC 87782, *T. ctenosauri* USNPC 87783); *U. stansburiana* (*S. phrynosoma* USNPC 87784, *T. ctenosauri* USNPC 87785).

Skrjabinoptera phrynosoma was originally described (Ortlepp 1922. Proc. Zool. Soc. Lond. pp. 999–1107) from nematodes obtained from *Phrynosoma cornutum* and *P. solare* that died in the London Zoological Garden. It has been found in *C. tigris* in California (Telford 1970, *op. cit.*); however, *U. stansburiana* is a new host record. *Thubunaea ctenosauri* was originally described from *Ctenosaura pectinata* from Aguamilpa, Nayarit, México (Moravec et al. 1997. J. Helm. Soc. Washington 64[2]:240–247). *Cnemidophorus tigris* and *U. stansburiana* are new host records for *T. ctenosauri*.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, and **HECTOR GADSDEN ESPARZA,** Instituto de Ecologia, A.C., Centro Regional Durango, C.P. 34100, A.P. 632, Durango, Durango, México.

CRICOSAURA TYPICA (Cuban Night Lizard). **ENDOPARASITES.** *Cricosaura typica* is known only from Granma Province and Santiago de Cuba Province, Cuba (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies. Descriptions, Distributions, and Natural History. University of Florida Press, Gainesville. 720 pp.). *Skrjabinodon cricosaurae* was originally described from *Cricosaura typica* (Barus and Coy Otero 1974. Vest. Csk. Spol. Zool. 38[1]:1–12) and is the only helminth known for this host (Coy Otero and Barus 1979. Acta Sc. Nat. Brno 13[2]:1–43). The purpose of this note is to present prevalence and mean intensity data on *S. cricosaurae* in two *C. typica* populations. Twenty-one *C. typica* were collected in February and June 1996 in La Mula, Santiago de Cuba Province, Cuba; ten were collected in April 1996 from Alegría de Pío, Granma Province, Cuba. Lizards were originally fixed in 10% formalin and later preserved in 70% ethanol. The body cavity was opened and the gastrointestinal tract was excised by cutting across the esophagus and rectum. The esophagus, stomach, small intestines, and large intestines were slit longitudinally and examined separately under a dissecting microscope. Each nematode was removed and placed

in a drop of glycerol on a glass slide. Nematodes were identified from these temporary mounts; all were from the large intestine. Lizards were deposited in the herpetological collection of the Centro Oriental de Ecosistemas y Biodiversidad (BIOECO) in Santiago de Cuba, Cuba.

The prevalence (number of infected individuals divided by number of individuals examined) of *S. cricosaurae* (86%, 18/21) in *C. typica* from La Mula was higher than that (80%, 8/10) in *C. typica* from Alegría de Pío, although not significantly different (Chi-square = 0.16, $P > 0.05$). Also, the mean intensity (mean number parasites per infected host) was higher (5.3 ± 6.7 SD, range 1–28) in *C. typica* from La Mula than that (3.3 ± 4.3 SD, range 1–13) in *C. typica* from Alegría de Pío, but there was no significant difference (t-test = 0.93, $P > 0.05$).

We thank Angel Arias and Rolando Viña for assistance in collecting specimens. AFG thanks Israel and Felicia Méndez for hospitality in their house at La Mula.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, and **ANSEL FONG G.**, BIOECO, Museo de Historia Natural "Tomas Romay," Enramadas #601, Santiago de Cuba 90100, Cuba.

ELGARIA KINGII NOBILIS (Arizona Alligator Lizard). **COLORATION.** On 28 June 1995, along Turkey Creek in the Gila Wilderness Area, Grant County, New Mexico, RDJ collected a nearly-patternless *Elgaria kingii* (Fig. 1). The specimen is an adult female, 91 mm SVL and 89 mm tail (regenerated). In life, the dorsal and ventral coloration was solid olive-gray (color 42 in Smithe 1975. Naturalist's Color Guide. Amer. Mus. Nat. Hist., New York) with occasional black flecking laterally. Coloration of the labial scales was normal with contrasting, alternating, black and white scales. This is the first *E. kingii* reported with such abnormal coloration. It is catalogued in the Museum of Southwestern Biology at the University of New Mexico (MSB 59639).



FIG. 1. Nearly patternless female *Elgaria kingii* from Grant Co., New Mexico.

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **RANDY D. JENNINGS**, Department of Natural Sciences, Western New Mexico University, Silver City, New Mexico 88062, USA.

GALLOTIA CAESARIS (Hierro Canary Island Lizard). **UNUSUAL PREY.** Most lacertids are insectivorous, but there are notable exceptions in *Takydromus* spp. and some of the members of the genus *Gallotia*, which are herbivorous (Arnold 1989. Bull. Br. Mus. Nat. Hist. 55:209–257). These genera have a tricuspid/multicuspid dentition as an adaptation for feeding on plant material. In *Gallotia* spp. the adult diet consists predominantly of flowers, seeds, and fruits, except in *G. atlantica*, which is insectivorous (Molina 1991. Vieraea 20:1–9; Mateo and López-Jurado 1992. Biol. J. Linn. Soc. 46:39–48). However, the stomach contents of a specimen of *Gallotia caesaris* from El Hierro, Canary Island (SVL = 85 mm) included an undigested *Chalcides viridanus* (Scincidae) with a SVL of 57 mm. The presence of a skink as a prey item and its large size are very unusual not only for *Gallotia* spp., but for lacertids in general.

I thank Luis Felipe López-Jurado for donation of the specimen.

Submitted by **FABIOLA BARAHONA**, Department of Anatomy and Developmental Biology, Rockefeller Building, University College London, University Street, London WC1E 6JJ, United Kingdom.

HOLASPIS GUENTHERI LAEVIS (East African Fringe-tailed Forest Lizard). **REPRODUCTION**. Between October 1996 and March 1997, the Cologne Aquarium received 8 adult *Holaspis guentheri laevis* (5 males, 3 females). Locality data were given as Arusha, Tanzania, or Tanzania alone. Sex was determined by comparing the base of the tail (swollen in males) and femoral pores (better developed in males). Ventral body coloration was also found to be a sexually dimorphic character, with males having a bright orange belly; in females it is a faint gray-orange.

Initially, the lizards were housed in groups of multiple males and one female; however, males were soon found to be territorial and aggressive, and were subsequently housed in male/female pairs, or singly.

One pair produced a clutch of two eggs on 14 November 1996. After an incubation period of 54 days one egg hatched. Total length of the hatchling was 50 mm, SVL 25 mm, and mass 0.25 g. Coloration of the hatchling was identical to that of the adults, except for having a totally black ventral surface. Unfortunately, the specimen died one day after hatching. The same pair produced clutches consisting of one egg (on 22 December 1996 and 24 February 1997) and two eggs (5 April 1997). None of these eggs hatched. Clutches of two eggs in this species were reported by Dunger (1967. The Nigerian Field 32(2):117–131).

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Submitted by **HANS-WERNER HERRMANN**, Kölner Aquarium am Zoo, Riehler Str. 173, 50735 Köln, Germany.

IGUANA IGUANA (Green Iguana). **JUVENILE PREDATION.** Green iguanas have been reported to nest communally as an strategy to decrease predation by terrestrial vertebrates (Rand and Dugan 1983. Copeia 1983:705–711). Iguana nests may be preyed upon by several species (Rand and Robinson 1969. Herpetologica 25:172–174). Juveniles may suffer particularly high predation (Greene et al. 1978. J. Herpetol. 12:169–176.).

During the dry season (April–May) of 1988 the emergence of hatchlings in several breeding aggregations was documented at Hato Masaguaral, a cattle ranch in Guárico State, Venezuela (8°34'N, 67°35'W). While systematically patrolling the breeding

TABLE 1. Predators documented preying on iguanas or with iguana remains in the stomach. Numbers with an asterisk represent events where predators were seen chasing, stalking, or holding pieces of iguana tail. Frequencies marked with an "f" denote more than 10 predation events. *Piaya cayana* was observed on two occasions with unidentified lizard embryos in an advanced stage of development. Predation by *Crocodylus* occurred in outdoor enclosures.

	Size I	Size II	Size III
REPTILES			
Alligatoridae			
Caiman crocodilus		1	
Crocodilidae			
Crocodylus acutus		1	
Crocodylus intermedius		1	1
Boidae			
Eunectes murinus		2	1
Colubridae			
Chironus sp.		1*	
Teidae			
Ameiva ameiva	4	1	
Cnemidophorus sp.	1		
Tupinambis sp.	1*	1	
BIRDS			
Accipitridae			
Buteo albicaudatus	3		
Buteo magnirostris	6		
Buteogallus urubitinga	f	3	1, 1*
Elanoides fortiscatus	1		
Elanus leucurus	1		
Gampsonyx swainsonii	1		
Geranospizia caerulencens	1		
Heterospizia meridionalis	f		
Parabuteo unicintus	1	1	
Ardeidae			
Ardea cocoy		1	
Casmerodius albus	1		
Tigrisoma sp.	1		
Cuculidae			
Crotophaga ani	1*		
Crotophaga mayor	1		
Piaya cayana	2		
Falconidae			
Falco femoralis	f		
Falco sparverius	f		
Milvago chimachima	1		
Polyborus plancus	f		
Icteridae			
Icterus icterus	4		
Tyrannidae			
Pitangus sulphuratus	2*		
Tytonidae			
Tyto alba	1		
MAMMALS			
Canidae			
Canis familiaris			6
Cerdocyon thous	f	1	1
Cebidae			
Cebus nigrivitatus		1	1
Felidae			
Felis pardalis			1
Felis domesticus	f		
Procyonidae			
Procyon cancrivorus	1		

aggregations, incidents of predation on iguana hatchlings were recorded. Patrols were conducted 0800–0930 h and 1630–1800 h for a total of 51 h of observations in 17 days. Other incidental predation events also were recorded, along with stomach contents of road-killed predators on the highway. Prey were classified into three size categories, based upon estimated SVL: Size I <180 mm, Size II 180–239 mm, and Size III ≥240 mm (Rivas, unpubl.).

Table 1 lists species of vertebrates observed preying on iguanas, along with size class of prey and relative frequency of predation. Birds were the most frequent predators (22 species), followed by reptiles (eight species), and mammals (six species). Predation pressure by mammals could, however, be underestimated due to their secretive and nocturnal habits.

The period between the first and last egg hatched was 14 days. During this time, ca. 4800 hatchling iguanas emerged from 120 nests into a dune of ca. 8 ha. This synchrony of hatching produced an invasion of young iguanas into the area. High encounter rate may account for the high number of predation events we observed.

These data suggest that juvenile iguanas suffer heavy predation from birds. This may explain the cryptic behavior of juveniles in tree tops, where they remain motionless for long periods, synchronizing their movements with the canopy wind (Henderson 1974. Herpetologica 30:327–332), as well as the juveniles' habit of sleeping in burrows (Brust 1985. Amer. Zool. 25:7A).

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Submitted by **JESUS ANTONIO RIVAS**, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville Tennessee 37996-0900, USA, **CESAR RAMON MOLINA** and **TITO MANUEL AVILA**, Instituto de Zoología Tropical, Universidad Central de Venezuela, Caracas, Venezuela.

OPHISAURUS VENTRALIS (Eastern Glass Lizard). **NOCTURNAL ACTIVITY.** Glass lizards (*Ophisaurus*) are diurnal (Behler and King 1995. National Audubon Society Field Guide to North American Reptiles and Amphibians. Chanticleer Press, New York. 743 pp.), and to our knowledge there are no records of nocturnal activity. Here we report nocturnal activity in *O. ventralis* in the Apalachicola Lowlands of the Florida panhandle.

On 4 July 1997 at 2325 h, an *O. ventralis* was found AOR on SR 67, 1.2 mi. N NFR 107, Liberty Co., Florida, USA (UF Color Slide 109634). Earlier that day it rained continuously from ca. 1600–2000 h. Glass lizards are good burrowers and spend much of their time below ground (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed., Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). As a result, one explanation for this unusual nocturnal behavior might include the lizard retreating from extremely damp soil to drier habitat.

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA, e-mail: kenneyk@grove.ufl.edu, and **ANTHONY T. REPPAS**, Department of Interdisciplinary Studies, University of Florida, Gainesville, Florida 32611, USA.

TILIQUA RUGOSA (Sleepy Lizard). **MATING BEHAVIOR and NECROPHILIA.** Sleepy lizards are large (30 cm SVL), long-lived skinks from southern Australia. They form monogamous male-female pairs for up to 8 weeks before mating in late spring, and usually choose the same partners in successive years (Bull 1988. Behav. Ecol. Sociobiol. 23:45–49). Since 1992, we have been locating radio-tagged individuals daily during the pairing season (September–December) at a site near Mt. Mary in the mid-north of South Australia (33°55'S, 139°20'E). Adult mortality is very low (Bull 1995. Aust. J. Ecol. 20:393–402). However, on 28 October 1997, at 0930 h, a radio-tagged female was found dead. It appeared that, during the previous afternoon, her head became caught as she tried to crawl through tangled fencing wire, and, exposed to the afternoon sun, she died from hyperthermia. This female was first tagged in 1995 and had been recorded with the same male partner in each of the three years 1995–1997. That male partner was by the side of the dead female when she was discovered. We removed the female from the wire and placed her close by. That evening the male lizard refuged under a bush ca. 5 m from his mate. On 29 October 1997 at 0920 h the male was ca. 60 m from the female. The following observations of the male and his dead mate commenced at 1605 h on that day, when the female had probably been dead for 48 h. The male approached the female, moving towards her head. He walked directly up to her and stopped in a face-to-face position with her, ca. 10 cm from her snout. He remained in this position for 4 min. He then moved forward to within 3 cm of her and began tongue flicking towards her snout for a further 2 min. The male then remained stationary in the snout-to-snout position with the female for 6 min. before placing his snout under the snout of the female and tongue flicking again for 30 s. He then moved directly backwards 5–6 cm, then forwards in a small arc until he reached the left flank of the female. Once there he began gently nudging the female's side with his snout, while continuing to tongue flick. This continued for 1 min., after which the male moved toward the female's back leg, tongue flicking. The tongue flicking continued as the male moved forward again towards middle of the body. He then nudged the front leg, moved away 2–3 cm, walked to the female's back leg and once again tongue flicked this for ca. 15 s. The male then moved off and refuged under a bush 88 m away. The observed interaction between the male and his dead partner lasted 17 min. Six days later, the male was again observed ca. 10 m from the dead female.

We interpreted this interaction as a component of the pair bond that forms between male and female lizards during the spring, and an indication of the strength of the bond. The male still recognized cues from his partner, and remained with her, apparently attempting to elicit normal behavior from her, 48 h after her death. Live pairs use tongue flicking and chemical signals to maintain a close physical association over much of the spring (Bull et al. 1993. Herpetologica 49:294–300). There has been one previous observation in this species (Sharrad et al. 1995. W. Aust. Nat. 20:33–35) where a male was attempting to mate with a road-killed female, although the previous history of that pair was not known.

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Submitted by **TRAVIS L. HOW** and **C. MICHAEL BULL**, School of Biological Sciences, Flinders University, GPO Box 2100, Adelaide, South Australia 5001, Australia.

UMA EXSUL, UMA PARAPHYGAS (Fringe-toed Sand Lizard, Chihuahua Fringe-toed Lizard). **ENDOPARASITES.** The fringe-toed sand lizard, *Uma exsul,* is known only from Coahuila, México; the Chihuahua fringe-toed lizard, *Uma paraphygas* is known only from Coahuila and Chihuahua, México (Adest 1977. Copeia 1977:47–52). There are no reports of endoparasites from these hosts. The purpose of this note is to report the presence of the nematode *Skrjabinoptera phrynosoma* in *Uma exsul* and *U. paraphygas*. *Uma exsul* (N = 4) was collected 8 km S Emilano Zapata, Coahuila, México in 1992; *Uma paraphygas* (N = 6) was collected 10 km N Laboratorio del Desierto, Mapimí Biosphere Reserve, Chihuahua, México. Lizards were preserved in 10% formalin and later stored in 70% ethanol. They were deposited in the herpetology collection of the Instituto de Ecología, A.C., Centro Regional Durango, Durango, México. Nematodes were removed from the stomachs of these lizards. Each was placed in a drop of glycerol on a glass slide and identified as *Skrjabinoptera phrynosma.* Prevalence (number infected individuals divided by number of individuals examined) was 100% for both *U. exsul* and *U. paraphygas.* Mean intensity (mean number parasites per infected host) was 4.5 ± 2.7 SD, range = 1–7 for *U. exsul* and 7.5 ± 2.2 SD, range = 5–10. Selected specimens of *Skrjabinoptera phrynosoma* were placed in vials of ethanol and deposited in the U.S. National Parasite Collection, Beltsville, Maryland: *U. exsul* (USNPC 87650);*U. paraphygas* (USNPC 87649) and in Colección Nacional de Helmintos, Instituto de Biología de la Universidad Nacional Autónoma de México: *U. exsul* (CNHE 3202); *U. paraphygas* (CNHE 3203). *Skrjabinoptera phrynosoma* has previously been found in *U. notata* and *U. scoparia* from California (Telford 1970. Am. Midl. Nat. 83:516–554) and other species from México: *Phrynosoma braconnieri, P. taurus* (Goldberg and Bursey 1991. Southwest. Nat. 36:365–368), *P. douglasii, P. solare, Sceloporus spinosus* (Caballero 1937. Ann. Inst. Biol. Univ. Nac. Auton. Mex. 8[1– 2]:189–200) as well as 11 other North American lizard species (see Goldberg and Bursey, *op. cit.*) plus 14 lizard species from Cuba (see Baker 1987. Mem. Univ. Newfoundland, Occas. Pap. Biol. 11:1– 325). The finding of *S. phrynosoma* in *U. exsul* and *U. paraphygas* are new host records.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA, and **HECTOR GADSDEN ESPARZA,** Instituto de Ecología, A.C., Centro Regional Durango, C.P. 34100, A.P. 632, Durango, Durango, México.

VARANUS EXANTHEMATICUS (Bosc's Monitor). **PREDATION.** On 17 June 1997 at 1535 h we found a burrow in a field of cassava at Bui Camp (8°00'N, 2°15'W), close to Bui National Park, Ghana, that showed signs of use by a young Bosc's monitor (*Varanus exanthematicus*). When we returned at 0630 h the following morning there were signs that a snake had entered the burrow. The burrow was excavated and found to contain an African garter snake, *Elapsoidea guentheri* (602 mm SVL, 44 mm tail, 97 g without prey) that regurgitated a juvenile *V. exanthematicus* (199 mm SVL, 11 mm tail, 32 g). Although we have long suspected that snakes (particularly of the genus *Naja*) are important predators on young monitor lizards, this is the first direct proof of predation by snakes that we have found. Lenz (1995. Zur Biologie und Okologie des Nilwarans, *Varanus niloticus*, im Gambia, Westafrika. Mertensiella 5. 256 pp.) records predation on an adult *V. exanthematicus* by *Python sebae* in The Gambia.

Submitted by **DANIEL BENNETT**, Department of Zoology, University of Aberdeen, AB29 2TZ, Scotland, and **BRIAN BASUGLO**, Ghana Wildlife Department, Box M.239, Accra, Ghana.

SERPENTES

ARIZONA ELEGANS (Glossy Snake). **DIET.** On 21 June 1997, we excavated an adult female *Arizona elegans* (567 mm SVL, 93 mm TL, 87 g; Fig. 1) from a burrow in sandy soil of the shinnery oak (*Quercus havardii*) habitat 14.8 km S, 18 km W Hobbs, Lea County, New Mexico, USA (32°33.845'N, 103°19.395'W). This snake was maintained in a cooler until it was sacrificed and preserved on 23 June. Dissection of the stomach yielded an adult Ord's kangaroo rat (*Dipodomys ordii*) (124 mm body length, 67 g). Both the snake and prey were weighed and measured after being fixed in 10% formalin and stored in 55% isopropyl alcohol. The prey was 77% of the total weight of the snake. During the three days from the time of capture to the time the specimen was preserved, the girth of the snake became visibly smaller, suggesting the possibility of a larger prey/predator percentage. The snake and prey were deposited in the University of New Mexico Museum of Southwestern Biology, Division of Herpetology (MSB 60802).



FIG. 1. Adult female *Arizona elegans*, indicating relative size of ingested prey, an Ord's kangaroo rat.

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, Endangered Species Program, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **DON SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

CORONELLA GIRONDICA (Southern Smooth Snake). **DIET**. The ecology of European smooth snakes is poorly documented because of their secretive behavior. Of the two species, *Coronella girondica* is more saurophagous than *C. austriaca*. *Coronella girondica* preys mainly on lizards and juvenile snakes, but mammals and arthropods are occasionally taken (Agrimi and Luiselli 1994. Vie Milieu 44:203–210; Galán in press. *In* Ramos [ed.], Fauna Iberica. Vol. Reptiles. MNCN-CSIC, Madrid). Neither of the published works on the diet of *C. girondica* makes reference to predation on birds, which are occasionally taken by *C. austriaca*. (Rugiero et al. 1995. Herpetol. J. 5:316–318). During July 1996 in the Natural Park of Sanabria (Zamora Province, Spain; UTM: 29TPG813655) at an altitude of 1605 m and at dusk (1930 h), we observed an adult *C. girondica* in a dunnock (*Prunella modularis*) nest that had been constructed at the bottom of a shrub. In the snake's coils was a dunnock chick, which the snake was swallowing. After ten minutes the chick was finally devoured. Three other chicks remained in the nest while the parents flew nearby emitting cries of alarm. Smooth snakes may have a constraint on the size of their prey because they cannot unhinge the lower jaw, perhaps forcing the selection of small or elongated prey such as lizards (Dusej 1993. *In* Böhme [ed.], Handbuch der Reptilien und Amphibien Europa. Band 3/1. Schlangen [Serpentes], pp. 247–264. Aula Verlag, Wiesbaden). Our observation of a bird in the diet of *C. girondica* is the first recorded for this species and indicates that chicks or small birds can also be captured. We thank P. Galán and J. M. Pleguezuelos for their comments on the text.

Submitted by **MIGUEL LIZANA** and **JAVIER MORALES**. Departamento de Biología Animal, Universidad de Salamanca, E-37071 Salamanca, Spain (e-mail: Lizana@gugu.usal.es).

ELAPHE JANSENI (Celebes Black-tailed Ratsnake). **MAXIMUM SIZE.** Records indicate that *Elaphe janseni* commonly reaches a total length of 170–180 cm, and occasionally as much as 200 cm (Schulz 1996. A Monograph of the Colubrid Snakes of the Genus *Elaphe* Fitzinger. Koeltz Scientific Books, Havlickuv Brod, Czech Republic. 439 pp.). A female in the University of Colorado Museum of Natural History (UCM 59364), acquired from central Sulawesi, Indonesia, in November 1997, considerably exceeds those dimensions, measuring 237.4 cm total length (54.2 cm tail length). Although these measurements are impressive, Schulz (*op. cit.*) regards *Elaphe taeniura friesi* of Taiwan as the largest member of the genus, reaching a maximum length of 270 cm.

Submitted by **KAMURAN TEPEDELEN**, P.O. Box 19096, Boulder, Colorado 80308, USA (e-mail: kamuran@aol.com), and **HOBART M. SMITH**, EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA (e-mail: hsmith@colorado.edu).

EUNECTES MURINUS (Green Anaconda). **DIET.** The diet of *Eunectes notaeus* was described by Strussman (1994. Stud. Neotr. Fauna Envir. 28:157–168), but little is known about the food habits of *E. murinus* in the wild. During February 1996, during an ecological study of crab-eating foxes (*Cerdocyon thous*) in Emas National Park, central Brazil, a fox fitted with a radio-collar was eaten by an anaconda on the shore of the Rio Formoso. The snake stayed at the capture site for two days (as detected by telemetry data), then swam the 5 m-wide river and entered a gallery forest. We located this anaconda 30 days later, 200 m from the capture site, basking in a marsh. We captured and held the snake in an enclosure until the following day, when it regurgitated the collar and the remains of the fox. After regurgitating the fox remains, the snake measured 3.15 m (total length), 45 cm maximum circumference, and weighed 15 kg. The fox, when originally captured, weighed 7.5 kg. This is the second record of an anaconda preying on a crab-eating fox in the Park. On another occasion, A. M. da Cruz and park rangers observed an anaconda (ca. 4 m total length) eating a crab-eating fox on the bank of the Rio Formoso. In addition, two anecdotal observations of anacondas eating crab-eating foxes have been reported by local inhabitants on farmlands

that surround Emas National Park. Crab-eating foxes spend much time foraging in marsh habitats (Brady. 1979. *In* Eisenberg [ed.], Vertebrate Ecology in the Northern Neotropics, pp. 161–171. Smithsonian Inst. Press, Washington, D.C.), behavior which may expose them to frequent anaconda predation.

We thank José Alexandre F. Diniz Filho for reviewing the manuscript and Antonio Malheiros for additional information on anacondas in Emas National Park. This information was collected during a mammalian carnivore community study in Emas National Park. This research was supported by CENAP/IBAMA, Fundaÿão O Boticário, the Denver Zoo, the Memphis Zoo, and CAPES.

Submitted by **ANAH TEREZA A. JÁCOMO** and **LEANDRO SILVEIRA**, Universidade Federal de Goiás, Depto. Biologia Geral, ICB-I, Campus II Samambaia, Cx.P. 113, Goiânia-GO, 74 001-970, Brazil; e-mail (LS): lsilveira@persogo.com.br.

MASTIGODRYAS BIFOSSATUS (Jararaca do Banhado). **TAIL BREAKAGE.** In reptiles, partial loss of the tail may result from two distinct mechanisms: intravertebral rupture (involving both neural control and late tail regeneration), or intervertebral rupture (without neural involvement or tail regeneration). The former occurs widely in lizards (Etheridge 1967. Copeia 1967:699–721), whereas the latter is common in amphisbaenids (Gans 1978. Trans. Zool. Soc. Lond. 34:347–416) and snakes (Mendelson 1992. Herpetologica 48:448–455; Savage and Crother 1989. Zool. J. Linn. Soc. 95:335–362). Both types of tail autotomy may function as antipredator mechanisms (Henderson 1984. *In*: Seigel et al. [eds], Vertebrate Ecology and Systematics: A Tribute to Henry S. Fitch, pp. 185–194. Museum of Natural History, University of Kansas, Lawrence, Kansas; Mendelson, *op. cit.*).

Here we present data on frequencies and characteristics of tail breakage in 119 museum specimens of *Mastigodryas bifossatus* from diverse localities in Brazil. We examined both young and mature specimens of *M. bifossatus*, housed at Instituto Butantan (IB), São Paulo; Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP), Porto Alegre; Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul (MCN), Porto Alegre; and Linha de Pesquisa em Herpetologia da Pontifícia Universidade Católica do Rio Grande do Sul (LPH), Porto Alegre. For each specimen with a broken tail we recorded the number of remaining subcaudals (SC), sex, and snout-vent length (SVL).

Tail breakage in *M. bifossatus* occurred between SC 32 and 98. It was most common (33.3%) between SC 81 and 90, and rarest (3.7%) between SC 41 and 50. In females, the number of remaining subcaudals ranged from 32–93 (N = 24). For males, this range was 35–98 (N = 30). There were no sex-related differences in the ratio of broken to intact tails ($X^2 = 0.81$).

Among the 119 specimens, 46.7% showed tail loss. In specimens with intact tails, tail length was 31–41% of SVL in females (N = 15, SVL > 600 mm) and 34–44% of SVL in males (N = 16, SVL > 600 mm). For specimens with incomplete tails, tail length was 15–35% of SVL in females (N = 10, SVL > 600 mm), and 10–43% in males (N = 13, SVL > 600 mm). We conclude that *M. bifossatus* can be included among those species of snakes having a high frequency of broken tails. Despite high frequencies of tail breakage, well-defined breakage sites or sex-related breakage patterns are apparently lacking in this species.

We thank the following curators for allowing examination of material under their care: M. Di-Bernardo (MCP), M. Araújo-Leitão (MCN), G. Puorto and M. F. D. Furtado (IB). We also thank T. De Lema for incentive, and C. Strüssmann and J. Ragusa-Netto for important suggestions about the manuscript. Financial support was provided to VLF by the Fundação Coordenação de Aperfeiçoamento de nível Superior (CAPES - Brazilian Federal Government).

Submitted by **VANDA LÚCIA FERREIRA**, Universidade Federal do Mato Grosso do Sul, Centro Universitário de Corumbá (CEUC/DAM), Av. Rio Branco, 1270, Postal Box. 252, CEP 79304-020, Corumbá-MS, Brazil; e-mail: Vanda@music.pucrs.br; and **ARLETE BALLESTRIN OUTEIRAL**, Pontifícia Universidade Católica do Rio Grande do Sul, Museu de Ciências e Tecnologia, Linha de Pesquisa em Herpetologia, Av. Ipiranga 6681, Postal Box. 1429, CEP 90619-900, Porto Alegre-RS, Brazil; e-mail: Arlete@music.pucrs.br.

MICRURUS FRONTALIS (Coral Snake). **MALE COMBAT.** Combat rituals have been observed in numerous snake genera, including several elapids (Shine 1994. Copeia 1994:326–346). One explanation for such behavior is male-male competition for access to reproductive females (Bogert and Roth 1966. Amer. Mus. Novit. 2245:1–27; Kelleway 1982. Br. J. Herpetol. 6:225–230).

Micrurus frontalis is an elapid whose reproductive behavior is largely unknown. We report the first observation in the field of a combat ritual between two male *M. frontalis* (SVL = 875 and 836 mm). On 12 April 1994 (ca. 1230 h) in Santa Rita city (29°51'S, 51°16'W), Rio Grande do Sul, Brazil, the snakes were found sheltered under rocks. They were aligned horizontally with their bodies and tails interwined and their heads raised slightly (Fig. 1). The two males kept their heads side by side while moving foward and trying to hover over each other. When captured, one everted the hemipenis. Subsequently, these males were deposited in the Museum Collection of the Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul (MCN 11424, 11435).

In addition to our field observation, two captive males were twice observed engaging in a combat ritual in the same season. In every case, the postures were very similar to those of *Austrelapis superbus* (Shine and Allen 1980. Victorian Nat. 97:188–190), but different from those reported for other elapids. The horizontal interwining of the body without vertical posturing of the head and anterior trunk appears similar to the behavior of colubrids such as *Pituophis melanoleucus affinis* (Bogert and Roth, *op. cit.*).

We thank M. G. Salomão for helpful comments and revisions of the manuscript, O. A. V. Marques for fruitful discussions on the subject, and V. X. da Silva for preparing the illustration.



FIG. 1. Combat ritual between male *Micrurus frontalis*.

Submitted by **SELMA MARIA ALMEIDA-SANTOS**, Instituto Butantan, Av. Vital Brasil, 1500, CEP 05503-900, São Paulo, SP - Brazil, **LUIS FELIPE SCHMIDT DE AGUIAR** and **RAFAEL LUCCHESI BALESTRIN**, Núcleo de Ofiologia de Porto Alegre, Rua Salvador França, 1427, CEP 90690-000, Porto Alegre, RS - Brazil.

OPHEODRYS AESTIVUS (Rough Green Snake). **EGG PREDATION**. Since its introduction into North America in the 1930's, the South American fire ant, *Solenopsis invicta*, has spread throughout the southeastern United States. Fire ants have been documented to consume the eggs of the lizard, *Cnemidophorous sexlineatus* (Mount et al. 1981. J. Alabama Acad. Sci. 52:66–70). On 3 July 1994, a clutch of nine *Opheodrys aestivus* eggs was discovered beneath a piece of carpet in Leeds, Jefferson Co., Alabama. The eggs appeared normal in size, shape, and shell development and were slightly adherent. Three of the eggs were separated from the clutch and moved indoors for artificial incubation at 22–29°C. The other six were left undisturbed. The three artificially incubated eggs hatched on 10 August. By 12 August, fire ants had built a small mound on the undisturbed eggs, and at least four were oozing clear fluid from tiny punctures. By 23 August two eggs had collapsed and all were removed for examination/artificial incubation. By 29 August all the eggs but one had collapsed. This egg produced a viable hatchling on 30 August. It is probable that the fire ants were directly responsible for the failure of the five eggs to incubate properly. I thank Kurt Buhlmann for a valuable reference.

Submitted by **J. STEVEN CONNERS**, Animal Science Department, Miami Metrozoo, 12400 SW 152nd Street, Miami, Florida 33177, USA.

OXYBELIS FULGIDUS (Green Vine Snake or Bejucillo). **FEEDING.** On 6 June 1996 at ca. 1130 h we encountered an adult (ca. 1.7 m total length) *Oxybelis fulgidus* ca. 1.3 m above the forest floor in the dense understory of second growth forest in the Selva Verde private reserve, Chilamate, Heredia Province, Costa Rica. The snake was draped across three different small trees. It then moved horizontally for about 1 m, turned 180°, and descended at a 30° angle ca. 0.7 m before pausing. From this position the snake moved slowly at first, then rapidly forward and down ca. 0.5 m, striking a large (ca. 9.5 cm SVL) *Ameiva festiva festiva*. The snake seized the lizard by combining forward movement of its body with a rapid strike of its head. The struggling lizard was grasped across the body between the fore and hind legs. Next the snake moved its prey toward the back of its mouth using alternating movements of its upper and lower mandibles, probably envenoming the lizard at this time. During this process the snake moved from its extended downward position to a horizontal position. The alternating movements of the upper and lower mandibles continued, now positioning the lizard, which had stopped struggling, to be swallowed head first. After swallowing the lizard until only 2 cm of the tail protruded from the snake's mouth, it climbed a small tree to a branch that formed an acute angle with the trunk. It lifted its head and ca. 4 cm of its neck over the branch and began to move its body through the narrowest portion of the fork, which was too narrow to permit passage of the lump that was the lizard's body. In this way the lizard was pushed down the snake's esophagus. The snake pushed the bulge ca. 6 cm distally, then stopped moving. The lizard's tail was no longer visible in the snake's mouth. When we left 5 min later, the snake was still poised motionless in the fork of the tree. The observation is noteworthy in that the capture was unusually low (ca. 20 cm) for a species of *Oxybelis* (Henderson and Binder 1980. Milwaukee Publ. Mus. Contr. Biol. Geol. 37:1–38) and the snake appeared to use the tree fork to assist in swallowing the unusually large prey.

We thank Bryan L. Sharp and Gregory J. Colwell for assistance with identification of the snake and its prey. Bruce C. Jayne and A. John Gatz provided helpful comments on the manuscript.

Submitted by **JEFFREY L. NORRIS**, APDO 178-3006, Heredia, Costa Rica, and **EDWARD H. BURTT, JR.**, Department of Zoology, Ohio Wesleyan University, Delaware, Ohio 43015-2370, USA.

THAMNOPHIS MELANOGASTER CANESCENS (Mexican Black-Bellied Garter Snake). **LITTER SIZE**. On 22 July 1995, a gravid female *T. melanogaster canescens* was found in Lake Pátzcuaro (19°32'N and 101°43'W) in the state of Michoacán, México. This lake is 19.75 km in length and 2035 m in elevation. The pregnant snake was measured and weighed, and then its embryos were removed and were individually measured and weighed. The adult female measured 506 mm SVL, 136 mm tail length (TL), weighed 134.6 g, and contained 12 embryos. The measurements of the embryos were: mass (mean ± SE [range]) = 2.21 ± 0.083 (1.44–2.54); SVL = 118.3 ± 1.4 mm (108–128 mm); TL = 37.0 ± 0.8 mm (34–42 mm). This litter size is similar to other females (mean = 12.9 embryos) cited by Ford and Ball (1977. Herpetol. Rev. 8:118).

Submitted by **AURELIO RAMÍREZ-BAUTISTA**, and **MARIO MANCILLA MORENO**, Departamento de Zoología, Instituto de Biología, UNAM, A.P. 70-153, C. U., C.P. 04510, México 20, Distrito Federal, México; e-mail (AR): raurelio@servidor.unam.mx.

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GYMNOPHIONA

LUTKENOTYPHLUS BRASILIENSIS (São Paulo Caecilian). ARGENTINA: MISIONES: 25 de Mayo, Puerto Londero (27°23'S, 54°26'W). September 1947. M. J. Viana. Museo Argentino de Ciencias Naturales, Buenos Aires (MACN 9491). Verified by G. Carrizo. First record for country; extends range 165 km S from nearest previous record at Ciudad del Este, Itaipu, Paraguay (Nussbaum 1986, J. Herpetol. 20:441–444).

Submitted by **TAMARA HEER** and **LLAURA LANARI**, Museo Argentino de Ciencias Naturales, Sección de Herpetología, Avenida Angel Gallardo 470, Buenos Aires, Argentina (e-mail: frida298@yahoo.com).

CAUDATA

AMBYSTOMA CINGULATUM (Flatwoods Salamander). USA: GEORGIA: Miller Co: Willoughby Tract of Mayhaw Wildlife Management Area (31°13'N, 84°47'W). Exact location withheld due to the rarity of the species. 6 March 1998. John B. Jensen. University of Georgia Museum of Natural History (UGAMNH 40092). Verified by M. E. McGhee. First county record. Two larvae were captured in an isolated cypress (*Taxodium ascendens*) pond surrounded by longleaf pine (*Pinus palustris*)/wiregrass (*Aristida beyrichiana*) flatwoods.

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA (e-mail: john_jensen@mail.dnr.state.ga.us) and **STEVE A. JOHNSON**, Department of Wildlife Ecology and Conservation, University of Florida, 303 Newins-Ziegler Hall, Gainesville, Florida 32611-0430, USA (e-mail: tadpole@ufl.edu).

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: GEORGIA: White Co: Smithgall Woods Conservation Center, ca. 2 km ESE jct. of State Rt. Alt. 75 and State Rt. 348. 28 January 1998. John B. Jensen. UGAMNH 40061–63. Verified by M. E. McGhee. First county record and first Georgia record within the Blue Ridge physiographic province (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712). Many paedomorphic adults observed actively breeding in a woodland pool within the Dukes Creek floodplain.

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA (e-mail: john_jensen@mail.dnr.state.ga.us).

AMPHIUMA PHOLETER (One-toed Amphiuma). USA: MISSISSIPPI: Jackson Co: Mississippi Sandhill Crane National Wildlife Refuge: SE 1/4 of SE 1/4 Sec. 11, T7S, R8W, 0.2 km W of W boundary of Old Fort Bayou Mitigation Bank, 0.35 km S of I-10, ca. 1.72 km W of I-10 bridge spanning Old Fort Bayou. 14 March 1998. Peter S. Floyd, Sr. Mississippi Museum of Science Collection (MMNS 5409). Verified by D. Bruce Means. Specimen found dead and partly decomposed in a shallow stream bordered by longleaf and slash pine; mat of sphagnum moss present on bank above collection site. Stream drained into cypress tupelo gum swamp ca. 100 m downstream from collection site. Substrate in the stream and swamp is relatively firm and interlaced with roots. First record for the state of Mississippi and westernmost locality for the species (Means 1996, Cat. Am. Amphib. Rept. 622.1–622.2).

Submitted by **PETER S. FLOYD, SR., PETER S. FLOYD, JR.,** and **JONATHAN D. FLOYD**, Mississippi Museum of Natural Science, 111 North Jefferson Street, Jackson, Mississippi 39201, USA.

DICAMPTODON COPEI (Cope's Giant Salamander). USA: WASHINGTON: Skamania Co: Spring Creek National Fish Hatchery, 2 km W of White Salmon River (SW1/4 Sec. 22, T3N, R10E). On 29 March 1998, we collected one neotenic larva (UMMZ 222695–222696) in each of two unbaited minnow-traps set overnight in a spring-fed creek where it emerges from the base of a forested, talus slope. Verified by Lawrence L. C. Jones. Extends the known distribution ca. 25 km E in the Columbia River Gorge (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Press Idaho, Moscow. 332 pp.; McAllister 1995, Northwest Fauna 3:81–112).

Submitted by **WILLIAM P. LEONARD**, Washington Department of Ecology, P.O. Box 47775, Olympia, Washington 98504-7775, USA, **LAURA L. TODD**, U.S. Fish and Wildlife Service, 2600 SE 98th Avenue, Suite 100, Portland, Oregon 97266, USA, and **MEGAN A. LEONARD**, 223 Foote Street NW, Olympia, Washington 98502, USA.

ENSATINA ESCHSCHOLTZII (Ensatina). USA: WASHINGTON: Klickitat Co: NW 1/4, NW 1/4, Sec 20, T4N, R10E, 20 m W of road B-1600. 23 April 1998. Suzanne Grayson. UWBM Color Print 2293 (juvenile). Verified by Keith B. Aubry. One adult and one juvenile were found under surface objects in a Douglas-fir forest with a vine maple understory. First county record and first record of this species east of the Cascade Crest in Washington, as indicated by county lines (McAllister 1995, Northwest Fauna 3:81–112).

Submitted by **LAWRENCE L. C. JONES**, USDA Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, Washington 98512, USA, and **SUZANNE GRAYSON**, Washington Department of Natural Resources, 713 East Bowers Road, Ellensburg, Washington 98926, USA.

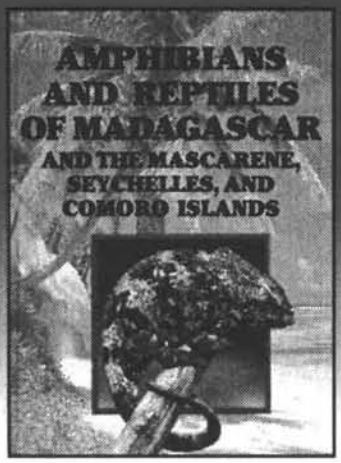
NOTOPHTHALMUS PERSTRIATUS (Striped Newt). USA: GEORGIA: Emanuel Co: Ohoopee Dunes Natural Area (Georgia Department of Natural Resources), ca. 8.2 km WNW Swainsboro (32°36'19"N, 82°25'04"). 24 August 1997. Dirk J. Stevenson and Beth A. Willis. UGAMNH 40086–89. Verified by M. E. McGhee. Larvae collected at isolated, 1.6 ha semi-permanent pond fringed with swamp blackgum (*Nyssa biflora*). Surrounding habitat represented by xeric longleaf pine (*Pinus palustris*)—turkey oak (*Quercus laevis*)—wiregrass (*Aristida beyrichiana*) sandhill. 24 January 1998. Mark A. Bailey, John B. Jensen, Alison J. McGhee, Dirk J. Stevenson, and Keith R. Tassin. UGAMNH 40090–91. Verified by M. E. McGhee. Sixteen adults, including nine perennibranch individuals, were captured (1 perennibranch adult and 1 metamorphic adult preserved). Females (N = 6) averaged 38 mm SVL (range 35–40 mm) and averaged 1.43 g in weight (range 1.19–1.58 g); males (N = 10) averaged 36 mm SVL (range 31–38 mm) and 1.14 g in weight (range 0.66–1.45 g). First vouchered records for this county, and extend known range ca. 48 km WSW of nearest known locality in Jenkins County, Georgia (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–

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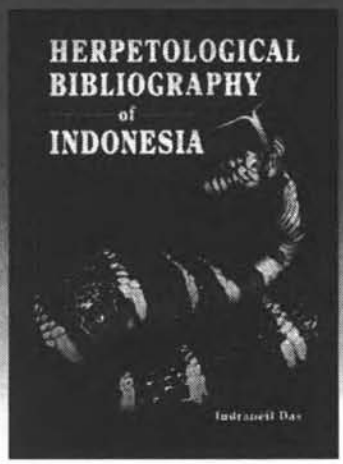
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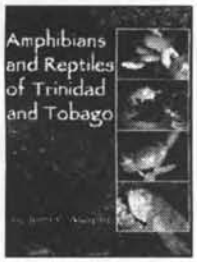
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712). Neill (1951, Ecology 32:764–766) mentioned collecting this species (as *Diemictylus perstriatus*) in Emanuel County, Georgia, but his observations were not supported by museum specimens. On both of the collection dates for our field work, specimens were taken by dipnetting in dense clumps of yellow-eyed grass (*Xyris* cf. *fimbriata*) growing near the pond margin.

Submitted by **DIRK J. STEVENSON**, Directorate of Public Works, Fort Stewart Fish and Wildlife Branch, 1557 Frank Cochran Drive, Fort Stewart, Georgia 31314, USA, **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA, and **KEITH R. TASSIN**, The Nature Conservancy, Altamaha River Bioreserve Office, P.O. Box 484, Darien, Georgia 31305, USA.

PLETHODON SERRATUS (Southern Redback Salamander). USA: GEORGIA: CLAYTON CO: Clayton County Water Authority Wetlands Center, 2755 Freeman Road, Hampton. Swamp located 100m SW jct. of Pate's Creek and Freeman Road. Two specimens found on hill between where Turkey Creek and Pate's Creek enter the wetland. 14 February 1998. Stacy Smith. SOCM 0813. Verified by John Jensen. New county record (Williamson and Moulis 1994, Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Spec. Pub. 3:1–712).

Submitted by **STACY N. SMITH**, Clayton County Water Authority Wetlands Center, 2755 Freeman Road, Hampton, Georgia 30228, USA.

ANURA

BUFO AMERICANUS CHARLESMITHI (Dwarf American Toad). USA: LOUISIANA: BIENVILLE PARISH: Ridge Road, 3.9 km E Louisiana Rt. 7. AOR. 16 May 1998. John G. Himes and Ty W. Bryan. Louisiana State University in Shreveport Museum of Life Science Collection (LSUS 6992). Verified by Laurence M. Hardy. First parish record (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **JOHN G. HIMES**, Department of Biological Sciences, Box 5018, University of Southern Mississippi, Hattiesburg, Mississippi 39406-5018, USA, and **TY W. BRYAN**, Division of Natural Science, Bossier Parish Community College, 2719 Airline Drive North, Bossier City, Louisiana 71111, USA.

BUFO FERNANDEZAE. ARGENTINA: CÓRDOBA: Barreto (33°20'43"S, 63°18'20"W), temporary pond at Km 148, Ruta Provincial No. 4., 153 m. 26 January 1995. A. L. Martino. Herpetologial Collection of Universidad Nacional de Río Cuarto, Ecología (UNRC-ECO 616–17); 28 January 1998 (in amplexus)—male 43.4 mm, female 46.5 mm, snout-vent length. UNRC-ECO 613–15. All verified by R. Martori. Species previously recorded in eastern part of Córdoba province as *Bufo granulosus fernandezae* (di Tada et al. 1976, Bol. Acad. Nac. Cs. Córdoba 51[3–4]:325–362) and as *Bufo fernandezae* (Cei 1980, Monitore Zool. Ital. N. S. Monog. No 2. 2609 pp.; Lavilla et al. 1992, Asoc. Herpetol. Argentina Serie Divulgación No. 7. 18 pp.; di Tada et al. 1996, pp. 191–213. *In* I. E. di Tada and E. H. Bucher (eds.). Ed. UNRC). Range extension.

Submitted by **ADOLFO L. MARTINO, NANCY E. SALAS**, and **ISMAEL E. DI TADA**, Ecología, Departamento de Ciencias Naturales, Facultad de Ciencias Exactas, Físico-Químicas y Naturales, Universidad Nacional de Río Cuarto, Km 601, Ruta Nacional No. 36, (5800) Río Cuarto, Córdoba, Argentina (e-mail: amartino@exa.unrc.edu.ar).

CTENOPHRYNE GEAYI (Brown Egg Frog). FRENCH GUIANA: COMMUNE DE ROURA: Crique Bagot, foot of the Kwata Mountain (4°32'N; 52°32'W, elev. 10 m). 5 January 1995. Philippe Kok. Institut royal des Sciences naturelles de Belgique (IRSNB 12731). Verified by G. Lenglet. New county record, previously known only from two localities in French Guiana—the Sinnamary River basin (commune de Saint-Elie) and 'Saut Emerillonî, upper Inini River (commune de Maripasoula) (de Massary and Lescure 1998, Revue fr. Aquariol. 25[1–2]:53–57). Extends range ca. 60 km airline SE from the easternmost known locality in French Guiana. Rare species probably due to its secretive habits; the specimen (34.4 mm SVL) was collected by day under dead leaves.

Submitted by **PHILIPPE KOK**, Laboratoire dí Herpétologie, Institut royal des Sciences naturelles de Belgique, 29 rue Vautier, B-1000 Bruxelles, Belgium.

ELEUTHERODACTYLUS LAURASTER (NCN). NICARAGUA: MATAGALPA: Selva Negra, 1300 m elev. (12°59"96'N, 85°54"55'W). March and August 1995, March and April 1996. G. Köhler. July and August 1997. P. Stoldt. Forschungsinstitut und Naturmuseum Senckenberg (SMF 77851, 77853–4, 77233–46, 78229–32). Verified by James R. McCranie. First records for Nicaragua; extends the range ca. 200 km south of the closest known locality in Honduras (Savage et al. 1996, Proc. Biol. Soc. Washington 109:366–372).

Submitted by **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany.

HYLA CINEREA (Green Treefrog). USA: TEXAS: ARKANSAS CO: Arkansas Wildlife Refuge. 12 April 1986. A. Chaney and party. TAIC 5666. Verified by Steve A. Smith. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **MICHAEL JAMES McCOID**, Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA.

HYLA PUNCTATA. BRAZIL: PARANÁ: Diamante do Norte Municipality (ca. 22°40'S, 53°00'W). 5 March 1998. P. S. Bernarde. Museu de História Natural, Universidade Estadual de Campinas (ZUEC 11507, adult male) and Museu de História Natural Capão da Imbuia, Curitiba (MHNCI 3243, adult male). Verified by Ariovaldo A. Giaretta. Original distribution was given as central and north Brazil, the chaco of Paraguay and Argentina, Amazon Basin, upper Orinoco Basin, Guianas, northern Colombia, and Trinidad (Frost 1995, Amphibian Species of the World. Version 2/95. Electronic manuscript, Herpetologists' League). First record for the state of Paraná; extends distribution to southern Brazil. Specimens were found calling in pond in an open area.

Submitted by **PAULO SÉRGIO BERNARDE**, Curso de Pós-Graduação em Zoologia, Departamento de Zoologia, Universidade Federal do Paraná, CP 19020, 81531-990, Curitiba-PR, Brazil; e-mail: bernarde@garoupa.bio.ufpr.br.

PSEUDACRIS CLARKII (Spotted Chorus Frog). USA: TEXAS: HAMILTON CO: Hico City Park. 10 April 1987. Bobby J. Schat. TAIC 5927 (3 specimens). Verified by Steve A. Smith. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **MICHAEL JAMES McCOID**, Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA.

RANA AREOLATA AREOLATA (Southern Crawfish Frog). USA: TEXAS: REFUGIO CO: 8.8 km E,& 24 km N Refugio (28°31'6"N, 97°11'43"W). 4 July 1998. James M. Mueller. TCWC 79735 (specimen in ethanol and tissues in Longmire's solution for DNA studies). Verified by James R. Dixon. Collected at 1215 h by hand in grassland prairie dominated by *Spartina spartinae* and *Paspalum* spp. growing on sandy loam soil. Specimen was observed in the open next to northern bobwhite (*Colinus virginianus*) nest one day following 3.5 cm of rain during an unusually dry summer. New county record; westward range extension of ca. 60 km (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES M. MUELLER**, Department of Range, Wildlife, and Fisheries Management, Texas Tech University, Lubbock, Texas 79409, USA.

RANA CATESBEIANA (Bullfrog) USA: COLORADO: CHEYENNE CO: pond on Rush Creek ca. 1.0 mile east of Lincoln County line (N 38 40.301, W 103 10.000). 1 adult taken, 3 juveniles sighted. 25 June 1998. UNC-MNH 1281. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **THERESA CHILDERS**, **ENOCH BERGMAN**, **JERRY D. MANZER**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

SYRRHOPHUS MARNOCKII (Cliff Chirping Frog). USA: TEXAS: BANDERA CO: Lost Maples State Natural Area, 8.0 rd km N Vanderpool on FM 187. 10 June 1998. John H. Malone. TCWC 79861–62. Verified by James R. Dixon. County record; fills distribution gap amongst Kendall, Kerr, Real, Medina, and Uvalde counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp; and Dixon 1996, Texas Herpetol. Soc. Spec. Publ. 2). Specimens were collected during a herpetofaunal inventory for the Texas Parks and Wildlife Department, June–August 1998. All specimens were collected under the authority of State Park Scientific Study Permit 32-98. *Syrrhophus marnockii* was found to be common throughout all canyonlands in the park.

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA.

TESTUDINES

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: TEXAS: POLK CO: crossing Rt. 190, 0.5 km E Menard Creek bridge and 8.6 km E of city limits of Livingston. 30 January 1998. Robert R. Fleet. Adult male. Verified by Lee Fitzgerald. SFAVM color slides 4892a–c. County record. (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **ROBERT R. FLEET** and **FRED C. RAINWATER**, Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA.

ERETMOCHELYS IMBRICATA (Hawksbill). USA: GEORGIA: CAMDEN CO: dead on beach north of Dungeness Crossing, Cumberland Island. 1 June 1998. Carol Ruckdeschel and C. Robert Shoop. Cumberland Island Museum 98.06.01.03. Verified by G. R. Zug. Adult female, 87.5 x 72 cm CCL x W. First specimen from Georgia, although range extends along the Atlantic coast to New England.

Submitted by **CAROL RUCKDESCHEL** and **C. ROBERT SHOOP**, Cumberland Island Museum, P.O. Box 796, St. Marys, Georgia 31558-0796, USA.

KINOSTERNON FLAVESCENS FLAVESCENS (Yellow Mud Turtle) USA: COLORADO: LINCOLN CO: AOR. Rt. 94, 5.2 mi W jct. County Road 43 (near a tributary of Rush Creek; N38 51.035, W103 22.228). 16 June 1998. UNC-MNH Photographs 28–29. Verified by Hobart M. Smith and David Chiszar. First County record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.). This specimen represents a range extension of ca. 65 miles NW from the closest known occurrence on the Arkansas River in Prowers County.

Submitted by **ENOCH BERGMAN**, **JERRY D. MANZER**, **THERESA CHILDERS**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

KINOSTERNON SCORPIOIDES (Scorpion Mud Turtle). BRAZIL: RORAIMA: 4°10'45"N, 61°0'46"W, Km 681 on the Boa Vista-Pacaraima Road. 16 August 1997. William E. Magnusson. Photograph digitalized on CD-ROM deposited in the Reptile Collection of the Instituto Nacional de Pesquisas da Amazónia, Manaus, Brazil (Registration Number 1523). Verified by Richard C. Vogt. Species has been recorded from widespread localities in South America, but the only previous record from the state of Roraima is from the Serra de Lua, ca. 180 km south of our record (Cabrera and Colantonio 1997, J. Herpetol. 31:507–513).

Submitted by **WILLIAM E. MAGNUSSON**, **ALBERTINA P. LIMA**, and **MARIA CARMOZINA DE ARAÚJO**, Coordenação de Pesquisas em Ecologia, Instituto Nacional de Pesquisas da Amazónia, CP 478, 69011-970 Manaus AM, Brazil.

LEPIDOCHELYS OLIVACEA (Pacific Ridley). USA: ALASKA: near Ketchikan, (55°20'N, 131°35'W). June 1991. Dry carapace (81 cm x 60 cm) on beach, confiscated by National Marine Fisheries Service (NMFS) Special Agent Jeff Passer, Sitka, Alaska. Verified by Karen L. Eckert. Carapace, photographs, and NMFS enforcement documents in herpetological collection of NMFS Auke Bay Laboratory (AB92-22), Juneau, Alaska. Other skeletal and soft parts missing at time of discovery, although some skin was still attached to the bones. It is not possible to determine the time or place of death, which may have occurred in Alaska or the carcass may have reached Alaska as flotsam from more southern regions of the eastern North Pacific Ocean. Alaska marine conditions during the late winter and spring of 1991 were slightly cooler than average.

This is the first confirmed *Lepidochelys olivacea* from Alaska and the northernmost record to date. Ketchikan is 913 km north of the previous northern record, Copalis Beach, Washington (Richardson 1997, Washington State Status Report, Olive Ridley Sea Turtle. Washington Dept. Fish & Wildlife, Olympia. 14 pp.). *Lepidochelys olivacea* is the fourth species of marine turtle recorded from Alaska waters.

Submitted by **BRUCE L. WING**, Auke Bay Laboratory, 11305 Glacier Highway, Juneau, Alaska 99801, USA, and **ROBERT PARKER HODGE**, 181 Raft Island, Gig Harbor, Washington 98335, USA.

LACERTILIA

ANOLIS BARKERI (Barker's Anole). MÉXICO: TABASCO: MUNICIPALITY OF HUIMANGUILLO, ca. 1 km W of Carlos A. Madrazo, dirt road to Pedregal River near the border of Veracruz (17°23'N, 93°40'W), 245 m. 25 March 1998. Fernando Mendoza Quijano and Ma. de los Angeles Sánchez Arriola. Colección Nacional de Anfibios y Reptiles, Instituto de Biología, UNAM, IBH 12396 (formerly TP 062, SVL = 45.8 mm, TL = 81.7 mm), a subadult male found in riparian vegetation. First record for state; extends range ca. 56 km NW from the closest known locality in Cascajal, Veracruz (Schmidt 1939, Publ. Field. Mus. Nat. Hist., Zool. Ser. 24[2]:7–9); MUNICIPALITY OF HUIMANGUILLO, ca. 3 km E of Carlos A. Madrazo (17°22'N, 93°39'W), 320 m. 26 March 1998. Fernando Mendoza Quijano. IBH 12397 (formerly TP 065, SVL = 79.2 mm, TL = 116 mm), an adult male found in cloud forest in ravine with small waterfall on leaf litter. Extends distribution at least some 57 km NW from former records in Cascajal, Veracruz. Both specimens verified by Adrian Nieto Montes de Oca.

Submitted by **VÍCTOR HUGO REYNOSO ROSALES, CLAUDIA S. VALDESPINO TORRES**, Colección Nacional de Anfibios y Reptiles, IBUNAM, Apartado Postal 70-153, C.P. 04510, México, Distrito Federal, México, and **FERNANDO MENDOZA QUIJANO**, Instituto Tecnológico Agropecuario No. 6, km 5.5 Carr. Huejutla-Chalahuiyapa, Apartado Postal 94, C.P. 43000, Huejutla de Reyes, Hidalgo, México.

ANOLIS CAROLINENSIS (Green Anole). USA: TEXAS: BANDERA CO: Lost Maples State Natural Area, 8.0 rd km N Vanderpool on FM 187. 4 June 1998. John H. Malone. TCWC 79908. Verified by James R. Dixon. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp; and Dixon 1996, Texas Herpetol. Soc. Spec. Publ. 2). Specimen was collected during a herpetofaunal inventory for the Texas Parks and Wildlife Department, June–August 1998. All specimens were collected under the authority of State Park Scientific Study Permit 32-98.

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA, and **WAYNE DAVIS**, Lost Maples State Natural Area, HCO1, Box 156, Vanderpool, Texas 78885, USA.

EUMECES LATICEPS (Broadhead Skink). USA: FLORIDA: HERNANDO CO: Chassahowitzka Wildlife Management Area, 28°38'33"N, 82°35'28"W. 10 July 1995. Kristin N. Wood. UF 109402. Verified by David L. Auth. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part 2: Lizards, Turtles and Crocodilians. Revised edition. Windward Publ., Miami. 191 pp.). Collected from a funnel trap in a hydric hammock.

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 23212 Lake Lindsey Road, Brooksville, Florida 34601, USA.

HEMIDACTYLUS MABOUIA (Tropical Gecko). USA: FLORIDA: BREVARD CO: I-95 between SR 406 and 405 in Titusville. 13 August 1998. Noah Anderson, Todd Campbell, Bridget Quinn. Louisiana State University Museum of Natural Science (LSU 80027–28). Verified by Brian Crother. New county record; extends range ca. 190 km NE of Glades County. One adult male (SVL = 64 mm) and one gravid female (SVL = 61 mm) collected from hotel walls. Sympatric with *H. turcicus*. Also, *H. garnotii* found in Titusville, but not present with either *H. turcicus* or *H. mabouia* (Meshaka et al. 1994, Herpetol. Rev. 25:165).

Submitted by **CHARLES D. CRISCIONE** and **NOAH J. ANDERSON**, Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana 70402-10736, USA, **TODD CAMPBELL**, Department of Ecology and Evolutionary Biology, University of Tennessee, 569 Dabney Hall, Knoxville, Tennessee 37996-1610, USA, and **BRIDGET QUINN**, 356 West Ogden Street, Girardville, Pennsylvania 17935, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: BANDERA CO: Lost Maples State Natural Area, 8.0 rd km N Vanderpool on FM 187. 4 June 1998. John H. Malone. TCWC 79911. Verified by James R. Dixon. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp; and Dixon 1996, Texas Herpetol. Soc. Spec. Publ. 2). Specimen was collected during a herpetofaunal inventory for the Texas Parks and Wildlife Department, June–August 1998. All specimens were collected under the authority of State Park Scientific Study Permit 32-98. *Hemidactylus turcicus* was found to be established at the campground bathroom and park maintenance area.

Submitted by **JOHN H. MALONE**, Herpetological Independent Study Group, Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, Texas 77843, USA.

MABUYA HEATHI. BRAZIL: BAHIA: ABROLHOS ARCHIPELAGO (17°58'S, 38°42'W), Sueste Island. 8 March 1995. G. F. Dutra and T. M. Guerra. Museu do Rio de Janeiro (MNRJ 6652–54); 13 April 1997. G. F. Dutra and D. Vrcibradic. MNRJ 6655–59; 15 April 1997. D. Vrcibradic. MNRJ 6660–62; Siriba Island. 17 April 1997. D. Vrcibradic. MNRJ 6663–64. All verified by Paulo E. Vanzolini. Also observed (but not collected) on Redonda Island by G. F. Dutra in 1995. The species is relatively abundant on the archipelago of Abrolhos (except on Santa Barbara, the largest of the four islands, where it is apparently absent), which lies ca. 70 km from the nearest continental coastline. According to previous published data on the distribution of this lizard (Vanzolini et al. 1980, Répteis das Caatingas. Academia Brasileira de Ciencias, Rio de Janeiro. 161 pp.; Peters and Donoso-Barros 1986, Catalogue of Neotropical Squamata. Part II. Lizards and Amphisbaenians. Bull. U.S. Natl. Mus. 297.293 pp.), it ranged from the state of Ceará (type locality Fortaleza, 3°48'S, 38°38'W) to near Salvador (12°50'S, 38°25'W) in Bahia. This is the first published insular record for the species.

Submitted by **GUILHERME FRAGA DUTRA** and **DAVOR VRCIBRADIC**, Pós-Graduação em Ecologia, Departamento de Zoologia, C. P. 6109, Universidade Estadual de Campinas, 13081-970 Campinas, São Paulo, Brazil. *Corresponding address for DV:* Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua S. Francisco Xavier, 524, Maracana, 20550-011, Rio de Janeiro, Rio de Janeiro, Brazil.

SERPENTES

ARIZONA ELEGANS ELEGANS (Kansas Glossy Snake) USA: COLORADO: PUEBLO CO: DOR. Pueblo Reservoir State Wildlife Area, southwest shore access road ~3 mi north of Highway 96 (N:38 16.509, W: 104 48.615). 8 August 1998. UNC-MNH 2235. Verified by Hobart M. Smith and David Chiszar. First County record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **ENOCH BERGMAN, MENAN BERGMAN, THERESA CHILDERS, JERRY D. MANZER**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

CROTALUS ATROX (Western Diamondback Rattlesnake). USA: NEW MEXICO: UNION CO: Jimmie Taylor Ranch at Goat Canyon, ca. 14 air mi S, 20 air mi W Clayton; Sec 5/6, T23N, R32E; 36°17.08'N 103°32.59'W. 3 August 1998. Fidel Vital. KU Color Slides 6564–65. Verified by J. E. Simmons. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

CROTALUS MOLOSSUS: (Blacktail Rattlesnake). USA: NEW MEXICO: TORRANCE CO: 9.6 mi N U.S. Rt. 60 on USFS Road 422; Priest Canyon, Manzano Mts., border between Secs. 20–21. T4N, R5E. 16 May 1998. Bruce Christman. University of New Mexico Museum of Southwestern Biology (MSB 61130). Verified by A. M. Snyder. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **BRUCE CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87205, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

DRYMARCHON CORAIS EREBENNUS (Texas Indigo Snake). USA: TEXAS: BROOKS CO: no specific locality, but catalogued data includes 'venado camp' which is probably a temporary hunting camp. August 1985. No specific collector. TAIC 5820. Verified by Steve A. Smith. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **MICHAEL JAMES McCOID**, Department of Biology, Campus Box 158, Texas A&M University, Kingsville, Texas 78363, USA.

EPICRATES CENCHRIA ALVAREZI (Argentine Rainbow Boa). BOLIVIA: SANTA CRUZ DE LA SIERRA: San Antonio del Parapetí. July 1986. B. Malkin. Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 33023). Verified by Gustavo Carrizo. First record for country.

Submitted by **TOMAS WALLER**, Zavalía 2090 3°B, Buenos Aires, Argentina, CP 1428 (e-mail: tomas@waller.com.ar) and **EMILIO BUONGERMINI P.**, Museo Nacional de Historia Natural del Paraguay, Sección de Herpetología, Caballero 1060, Asunción, Paraguay, CP 1324.

PITUOPHIS MELANOLEUCUS MUGITUS (Florida Pine Snake). USA: FLORIDA: HERNANDO CO: Chassahowitzka Wildlife Management Area, 28°37'03"N, 82°33'23"W. 20 June 1996. Kristin N. Wood. UF 109410. Verified by David L. Auth. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part 1: The Snakes. Revised edition. Windward Publ., Miami. 176 pp.). Collected from a funnel trap in mesic flatwoods.

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 23212 Lake Lindsey Road, Brooksville, Florida 34601, USA.

REGINA RIGIDA RIGIDA (Glossy Crayfish Snake). USA: FLORIDA: HERNANDO CO: Chassahowitzka Wildlife Management Area, 28°36'32"N, 82°35'58"W. 2 October 1997. Kristin N. Wood. UF 113925. Verified by David L. Auth. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part 1: The Snakes. Revised edition. Windward Publ., Miami. 176 pp.). Extends range south along Gulf Coast; collected from a funnel trap in a hydric hammock.

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 23212 Lake Lindsey Road, Brooksville, Florida 34601, USA.

RHADINAEA FLAVILATA (Pine Woods Snake). USA: FLORIDA: HERNANDO CO: Chinsegut Nature Center, 28°37'42"N, 82°21'26"W. 28 May 1996. Kristin N. Wood. UF 109409. Verified by David L. Auth. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part 1: The Snakes. Revised edition. Windward Publ., Miami. 176 pp.). Collected from a funnel trap in sandhill habitat.

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 23212 Lake Lindsey Road, Brooksville, Florida 34601, USA.

SIBON ANNULATUS (Ringed Slug-eater) NICARAGUA: JINOTEGA: Nature Reserve Bosawas: ca. 0.5 km S Pueblo Wiso, 13°59'90"N, 85°19'60"W, ca. 200 m elev. 16 February 1998. G. Köhler and R. Seipp. Forschungsinstitut und Naturmuseum Senckenberg (SMF 78369). Verified by James R. McCranie. First record for Nicaragua; extends the range ca. 400 km north of the closest known locality in Costa Rica (Savage and McDiarmid 1992, Copeia 1992:421–432).

Submitted by **GUNTHER KÖHLER** and **ROBERT SEIPP**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany.

STORERIA OCCIPITOMACULATA OBSCURA (Florida Redbelly Snake). USA: FLORIDA: HERNANDO CO: Chassahowitzka Wildlife Management Area, 28°36'32"N, 82°35'58"W. 27 July 1995. Kristin N. Wood. UF 109408. Verified by David L. Auth. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part 1: The Snakes. Revised edition. Windward Publ., Miami. 176 pp.). Collected from a funnel trap in a hydric hammock.

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 23212 Lake Lindsey Road, Brooksville, Florida 34601, USA.

THAMNOPHIS SIRTALIS (Common Garter Snake). USA: NEW MEXICO: CHAVES CO: Bitter Lake National Wildlife Refuge, funnel trap on gravel rd between Units 3 & 5; 16.5 air km NE Roswell (jct U.S. Rts. 380 & 285); NE1/4 Sec 9, T10S, R25E, 33°27'38.8" N 104°23'58.4" W. 25 April 1998. Gordon L. Warrick. University of New Mexico Museum of Southwestern Biology (MSB 61103). Verified by D. S. Sias. MSB 61103 is an adult male 365 mm SVL, 120 mm TL. On 24 May 1998 a gravid female 800 mm SVL, 190 mm TL was captured at the same site, photographed, and released (KU Color Slide11257–58). The specimens reported herein are the first to be collected outside of the Rio Grande drainage in New Mexico since those reported by Bundy (1951, Copeia 1951:314) and specimens reported to CWP as Ohio University Vertebrate Collection (OUCV 2640–41) collected during July 1950. Given that specimens had not been

discovered in this area for almost 50 years, the population of *T. sirtalis* in the Pecos River drainage was presumed likely extirpated (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **GORDON L. WARRICK** and **WILLIAM R. RADKE**, Bitter Lake National Wildlife Refuge, P.O. Box 7, Roswell, New Mexico 88202, USA.

Distribution Records and Life History Notes for Amphibians and Reptiles in Belize

STEVEN G. PLATT
Wildlife Conservation Society
c/o P.O. Box 346, Belmopan, Belize
e-mail: lamanai@btl.net

and

THOMAS R. RAINWATER
The Institute of Environmental and Human Health
Department of Biological Sciences, 1207 Gilbert Drive
Texas Tech University, Lubbock, Texas 79416, USA
e-mail: trainwat@ttacs.ttu.edu

The distributions of amphibians and reptiles in Belize have recently been reviewed and summarized in Lee (1996). We herein report additional records and life history data collected from 1993 to 1997. Records were determined based on comparisons with range maps and locality data presented in Lee (1996). Place names correspond to topographical maps issued by the Ordnance Survey, Southampton, England and obtained from the Department of Lands and Surveys, Belmopan, Belize. Voucher specimens or photographs are deposited in the Campbell Museum (CUSC), Clemson University, Clemson, South Carolina, USA.

Bufo marinus (Marine Toad). TURNEFFE ATOLL: Calabash Cay (17°17'N; 87°49'W). 25 February 1997. Steven G. Platt and Thomas R. Rainwater. Verified by Jacob A. Marlin. CUSC 1569. First record for Turneffe Atoll. Not previously reported from any offshore habitat in Belize.

Chelydra serpentina (Common Snapping Turtle). TOLEDO DISTRICT: Agua Caliente Swamp, ca. 2 km N Laguna Village (16°10'N; 88°58'W). 11 June 1997. Steven G. Platt and Thomas R. Rainwater. Verified by Jacob A. Marlin. CUSC 1438. Carapace (length = 39.0 cm) of an adult recently killed by fishermen. Previously recorded from only three sites in Belize, all within 20 km of Agua Caliente Swamp. According to locals *C. serpentina* is common in the swamp and regularly harvested for food. Hunting Cay in the Sapodilla Cay Group (16°07'N; 88°16'W). 7 December 1997. Captured by Belize Defense Force personnel and deposited in the Belize Zoo. Voucher photograph. Verified by Anthony Garel. CUSC 1559. First record from any offshore island in Belize. The nearest populations are on the mainland, ca. 60 km W of Hunting Cay. It is likely the turtle was transported to the island by humans. Hunting Cay is a small (ca. 0.5 km^2) mangrove island with no available freshwater habitat, and is unlikely to support a resident population of *C. serpentina*.

Claudius angustatus (Narrow-bridged Mud Turtle). ORANGE WALK DISTRICT: 3.4 km SE San Felipe Village on San Felipe to Indian Church Road (17°52'N; 88°45'W). 14 August 1993. Steven G. Platt. Verified by William E. Snyder. Voucher photograph. CUSC 1558. District record. Extends range ca. 50 km NE.

Crocodylus acutus (American Crocodile). AMBERGRIS CAY: San Pedro Lagoon, ca. 1.5 km N San Pedro (17°55'N; 87°58'W). 2 October 1996. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1468. Western shoreline, ca. 20 km NW of San Pedro (17°58'N; 87°58'W). 1 November 1996. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1474. Laguna Cantena, ca. 30 km NE of San Pedro (18°09'N; 87°51'W). 28 May 1997. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1476. BELIZE DISTRICT: Belize City, University College of Belize Campus, ca. 2 km E Northern Highway (17°30'N; 88°12'W). 14 January 1997. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1475. Cay Caulker, mangrove swamp adjacent to municipal airstrip, ca. 22 km NE Belize City (17°46'N; 88°02'W). 24 April 1997. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1449. Hicks Cay, northern shoreline, ca. 22 km N Belize City (17°41'N; 88°09'W). 19 July 1996. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1471. Long Cay, interior mangrove swamp, ca. 20 km NE Belize City (17°38'N; 88°04'W). 19 February 1997. Steven G. Platt and Thomas R. Rainwater. Verified by Travis Crabtree. Voucher photograph. CUSC 1472. Maps Cay, ca. 12 km W Belize City (17°30'N; 88°05'W). 27 January 1997. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1470. Northern River Lagoon, ca. 10 km E Maskall Village (17°53'N; 88°13'W). 24 October 1997. Steven G. Platt and Steven Brewer. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1447. Western Lagoon, ca. 6 km NW Gales Point Village (17°16'N; 88°20'W). 18 September 1997. Steven G. Platt. Verified by Jacob A. Marlin. Voucher photograph. CUSC 1469.

The distribution of *C. acutus* in Belize has long been uncertain owing to confusion with the sympatric Morelet's crocodile (*C. moreletii*), and the only previous records were from the Turneffe Atoll (Lee 1996). Our records extend the distribution north ca. 100 km to the Mexican border, and south ca. 120 km to Toledo District. Within this range *C. acutus* is expected on most offshore cays, but appears rare and confined to scattered localities on the coastal mainland. We found no evidence for the occurrence of *C. acutus* in any inland, freshwater habitats (Platt 1996).

Coniophanes schmidti (Schmidt's Striped Snake). ORANGE WALK DISTRICT: Lamanai Outpost Lodge, Indian Church Village (17°46'N; 88°40'W). 28 December 1997. Hong Liu and Steven G. Platt. Verified by Julian C. Lee. CUSC 1564. Previously known in Belize from two specimens collected in the Mountain Pine Ridge, Cayo District. This specimen represents a District record and extends the range ca. 70 km NE of the Mountain Pine Ridge. An intact bird egg was found in the stomach.

Crotalus durissus (Neotropical Rattlesnake). TOLEDO DISTRICT: Southern Highway, ca. 16 km NE Medina Bank Village (16°27'N; 88°37'W). 17 April 1997. Steven G. Platt. Verified by Jacob A. Marlin. CUSC 1440. Logging road ca. 7.1 km SE of Bladen River Bridge, Southern Highway (16°24'N; 88°38'W). 19 April 1997. Steven G. Platt. Verified by Jacob A. Marlin. CUSC 1441. Both specimens were DOR in extensive coastal pine savannas. A partially digested rodent (probably *Sigmodon hispidus*) was found in the stomach of CUSC 1440. These District records are the southernmost for Belize, and constitute a range extension of ca. 70 km S from populations in the Mountain Pine Ridge, Cayo District. BELIZE DISTRICT: ca. 5 km N of Democracia Village (17°22'N; 88°34'W). 21 October 1997. Steven G. Platt. Verified by Jacob A. Marlin. CUSC 1452.

Found in a recently (April 1997) burned pine savanna approximately 1.0 m from an armadillo burrow. Western Highway, ca. 6.4 km W of Hattieville (17°25'N; 88°24'W). 22 August 1997. Steven G. Platt. Verified by Jacob A. Marlin. CUSC 1450. Found in wet coastal savanna dominated by sedges and palms (*Paurotis* sp.). These specimens represent District records and constitute a range extension of ca. 60 km NE from populations in the Mountain Pine Ridge. ORANGE WALK DISTRICT: Lamanai Outpost Lodge, Indian Church Village (17°46'N; 88°40'W). 2 August 1997. Thomas R. Rainwater. Verified by Jacob A. Marlin. CUSC 1450. Extends distribution ca. 30 km SE of August Pine Ridge Village, the previous southernmost record outside of the Mountain Pine Ridge. The habitat at this site consists of second-growth hardwood forest and milpas in various stages of abandonment. Pine savanna is absent, contradicting Fugler's (1960) statement that *C. durissus* in Belize is restricted to savanna habitats. Although Lee (1996) speculated that *Bothrops asper* may competitively exclude *C. durissus* from forested habitats, both species occur at this locality (S. Platt and T. Rainwater, pers. obs.).

Ctenosaura similis (Spiny-tailed Iguana). TURNEFFE ATOLL: beach on Northern Cay (17°29'N; 87°47'W). 4 April 1997. Steven G. Platt and Thomas R. Rainwater. Verified by Jacob A. Marlin. CUSC 1448. First record for the Turneffe Atoll. Common on beach ridges and littoral forest throughout the atoll. Nearest populations are 40 km SE on Half Moon Cay, Lighthouse Atoll.

Leptophis mexicanus hoeversi (Mexican Green Tree Snake). TURNEFFE ATOLL: Calabash Cay (17°17'N; 87°49'W). 15 June 1995. Steven G. Platt. Verified by Jacob A. Marlin. CUSC 1546. Northern Cay (17°29'N; 87°47'W). 25 June 1997. Steven G. Platt. Verified by Jacob A. Marlin. CUSC 1435. *L. mexicanus* was previously reported in the Turneffe Atoll only from Big Cay Bokel (Henderson 1976). We found *L. mexicanus* common in littoral forests throughout the atoll, and both blue (1435) and green (1546) morphs were encountered. The blue morph has not been previously reported, and these individuals exhibit a bright blue dorsum devoid of any markings. Although mistakenly labeled as *Leptophis ahaetulla*, a photograph of both *L. mexicanus hoeversi* morphs collected by SGP on Calabash Cay appears in Garel and Matola (1996). Snakes were observed feeding on *Anolis sagrei*, which are abundant in the atoll.

Tantillita canula (Yucatan Dwarf Short-tailed Snake). ORANGE WALK DISTRICT: Lamanai Outpost Lodge, Indian Church Village (17°46'N; 88°40'W). 16 July 1997. Thomas R. Rainwater. Verified by Julian C. Lee. CUSC 1556. Snake found dead after application of pesticide to ornamental plants. This represents the fourth specimen from Belize. Two specimens were previously collected at Lamanai Archaeological Site, ca. 2 km N of Lamanai Outpost Lodge (Lee 1996).

Thamnophis marcianus (Checkered Garter Snake). ORANGE WALK DISTRICT: Lamanai Outpost Lodge, Indian Church Village (17°46'N; 88°40'W). 25 September 1997. Thomas R. Rainwater. Verified by Jacob A. Marlin. CUSC 1453. District record extending distribution ca. 30 km NW of previous range limit in the Belize District.

Acknowledgments.—Julian C. Lee and John B. Thorbjarnarson are thanked for reviewing early drafts of this manuscript. The assistance of Julian C. Lee, Jacob A. Marlin, Anthony Garel, Travis Crabtree, and William E. Snyder in verifying our identifications was most appreciated. We are grateful to Raphael Manzanero and Emil Cano, Conservation Division, Forest Department, Belmopan for issuing the necessary collecting, research, and export permits. Fieldwork in the Turneffe Atoll was assisted by Coral Cay Conservation and University College of Belize. Further assistance was provided by Hong Liu, Brenda Salgado, Mark and Monique Howells and Lamanai Outpost Lodge, Richard and Carol Foster, William Hasse, Matthew Miller, Bruce and Carolyn Miller, Richard Montanucci, and John Scavo. Stanlee Miller of the Campbell Museum assisted in the preparation and deposition of voucher material. Support for SGP was provided by Wildlife Conservation Society. TRR was supported by Lamanai Field Research Center.

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Distributional Records for Louisiana Amphibians

JEFF BOUNDY
Louisiana Department of Wildlife and Fisheries, P.O. Box 98,000
Baton Rouge, Louisiana 70898-9000, USA
e-mail: boundy_jj@wlf.la.state.us

The following Louisiana State University Museum of Natural Science (LSUMZ) specimens represent new parish records for Louisiana. Pertinence of records are based on distributional data provided by Dundee and Rossman (1989). Identification of specimens was verified by Douglas Rossman.

Ambystoma maculatum (Spotted Salamander). Richland Parish: 0.7 mi NE Rayville. Larry Wilson. LSUMZ 42531. 11 September 1965. Sabine Parish: Bayou Toro at LA 392. Jack Deshotels, Philip St. Romain, Mark Staton. LSUMZ 60050. 16 August 1973.

Ambystoma opacum (Marbled Salamander). Concordia Parish: 1 mi S Clayton. Larry Wilson, A. Romano. LSUMZ 25211–25213. 2 March 1965. St. Martin Parish: 4 mi N of I-10 on Whiskey Bay exit. Mike Kirton. LSUMZ 60312–13. 1 February 1975. West Baton Rouge Parish: 7–9 mi W Port Allen. D. May, E. Armstrong, Lawrence Binford, Burt Monroe, Jr. LSUMZ 6735–38. 14–25 February 1962. 6 mi N Port Allen. G. Schaefer. LSUMZ 17538. 4 April 1964. 6 mi E Rosedale. James Hebrard, John O'Neill. LSUMZ 17907, 18609. 22 February 1967.

Ambystoma talpoideum (Mole Salamander). Ascension Parish: 2.5 mi E, 0.8 mi S of Galvez. LSUMZ 59523. F. Marabella. December 1997.

Ambystoma texanum (Smallmouth Salamander). Iberia Parish: between Loreauville and Lake Fausse Pointe. Todd Lewis. LSUMZ 57534–35. March 1996. Vernon Parish: 1.9 mi N jct Louisiana 464 and Louisiana 111. Larry Wilson. LSUMZ 42240–41. 19 February 1966.

Amphiuma means (Two-toed Amphiuma). East Baton Rouge Parish: Camp Istrouma, Indian Mound. Jeff Boundy, Steve Shively. LSUMZ 59692–93. 17–19 June 1998.

Amphiuma tridactylum (Three-toed Amphiuma). Ascension Parish: 2.5 mi E, 0.8 mi S of Galvez. LSUMZ 59528. J. Boundy. 27 March 1998.

Desmognathus conanti (Spotted Dusky Salamander). Red River Parish: 10 mi NNE Coushatta on Louisiana 788. Larry Wilson. LSUMZ 28084. 18 December 1966.

Eurycea quadridigita (Dwarf Salamander). Iberville Parish: 6 mi WNW Rosedale. Larry Wilson. LSUMZ 51816. 31 December 1964.

Hemidactylium scutatum (Four-toed Salamander). Ascension Parish: 2.5 mi E, 0.8 mi S of Galvez. LSUMZ 59524. F. Marabella and J. Faggard. 17 March 1998.

Necturus maculosus (Common Mudpuppy). Evangeline Parish: 0.5 mi N Dossman at Bayou Cocodrie. Howard Dupre. LSUMZ 62954. 8 January 1976.

Notophthalmus viridescens (Eastern Newt). Madison Parish: 0.2 mi E Indian Lake on Spur Louisiana 577. LSUMZ 23947. 3.7 mi W U.S. 65 on Spur Louisiana 577. R. Van den Bold. LSUMZ 37785. 24 April 1971.

Plethodon kisatchie (Kisatchie Slimy Salamander). Catahoula Parish: tributary of Sugar Creek, T10N, R5E, NW quarter S21. Steve Shively. LSUMZ 58297. 19 March 1997.

Plethodon mississippi (Mississippi Slimy Salamander). Ascension Parish: 2.5 mi E, 0.8 mi S Galvez. Jeff Boundy, Frank Marabella. LSUMZ 58248. 18 February 1997. LSUMZ 58256. Frank Marabella. January 1997.

Siren intermedia (Lesser Siren). Ascension Parish: 2.5 mi E, 0.8 mi S Galvez. Frank Marabella. LSUMZ 58253. 16 February 1997. Iberville Parish: Nicholson Drive, ca. 11 mi SE Baton Rouge. Robert Claire. LSUMZ 37785. May 1979.

Eleutherodactylus planirostris (Greenhouse Frog). St. Bernard Parish: Louisiana 300, 1.5 mi E Louisiana 46 at Reggio. Steve Karsen. LSUMZ 59096. 1 November 1997. St. John the Baptist Parish: 100 Vicknair Place, east side of LaPlace. Steve Karsen, Jeff Boundy. LSUMZ 58208. 3 February 1997.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). East Carroll Parish: Transylvania, Mississippi River levee. Douglas Rossman. LSUMZ 23952–54. 24 April 1971.

Hyla avivoca (Bird-voiced Treefrog). Tensas Parish: Tensas Bayou at Fool River. Steve Shively. LSUMZ 57192–95. 27 July 1995.

Hyla cinerea (Green Treefrog). West Baton Rouge Parish: 6 mi W Port Allen. G. Schaefer. LSUMZ 15481–82. 4 April 1964. Rosedale Road. Larry Wilson, A. Romano. LSUMZ 15483, 51575. 7 April 1964. Louisiana 415 between Louisiana 76 and US 190. Larry Wilson. LSUMZ 41405. 2 March 1966. Rosedale Road. Larry Wilson. LSUMZ 41985. 2 March 1966. 5.0 mi S Port Allen, 0.5 mi W of Louisiana 1. Jeff Wilkinson. LSUMZ 49491–93. 14 February 1990. 4 mi E Rosedale. Edmund Keiser. LSUMZ 66316. 26 April 1965. Louisiana 76, near parish line. Edmund Keiser. LSUMZ 66325. 26 April 1965.

Hyla gratiosa (Barking Treefrog). West Feliciana Parish: 0.7 mi W Louisiana 66 on Highland Road, Sec. 89. Randy Vaeth, Jim McLean. LSUMZ 36929. 23 June 1978.

Pseudacris feriarum (Upland Chorus Frog). Ascension Parish: 2 mi E Geismar. E. Hastings. LSUMZ 6134. 15 February 1953.

Acknowledgments.—Thanks are due Harold Dundee for investigating several questionable records in the Tulane University collection.

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BOOK REVIEWS

Amphibians in Decline: Canadian Studies of a Global Problem, edited by David M. Green. 1997. Society for the Study of Amphibians and Reptiles. Herpetological Conservation 1. 338 pp. Softcover. US $39 + $3 shipping & handling. ISBN 0-916984-40-0.

JEAN-MARC HERO
School of Applied Science, Griffith University Gold Coast
PMB 50 Gold Coast MC, Queensland 4127, Australia
e-mail: M.Hero@eas.gu.edu.au

This comprehensive book is an impressive collection of individual papers covering the broad scope of current research (all papers include research post 1990) related to amphibian declines in Canada. It was a pleasure to read the book as the breadth of content and methodologies used gives the reader a complete overview of the extent of research involved in trying to understand the current status of Canadian amphibians. Unfortunately, this made me realize that the work over the past seven years is only the tip of the iceberg and an enormous amount of research is necessary to resolve this complex problem, involving many species and many potential causes (known and unknown).

As mentioned in the foreword, this book is a collection of papers on research developed and presented in isolation. Consequently, it is not a coordinated effort aimed at documenting and understanding amphibian declines at a national scale. This problem is also evident in other countries and may result partly from the geographical isolation of research institutes. Research should reflect a communal concern to resolve a national problem and should be coordinated at either a species or subject level. Wildlife managers should focus on determining the current status of populations, and research teams on resolving specific hypotheses to explain observed declines (i.e., natural population dynamics, disease, UV, radiation etc.) coordinated at a species level (rather than political boundaries). The message from this book is clear, the problem is immense and scientists must work together to examine specific hypotheses and replicate research among species and across latitudinal boundaries.

The first chapter presents a good example of the broad surveys needed to assess the factors influencing the distribution and abundance of amphibians. This study allows us to evaluate the biological factors determining species distributions (i.e., the presence/absence of fish), the stochastic nature of species distributions and, when replicated over many years, allows assessment of the status of species on a regional scale. This is exactly what is urgently needed to assess amphibian populations throughout the world. The following chapters (2–6) present intensive studies on the population dynamics of particular species at given localities, providing a basis for understanding amphibian population dynamics at the population level. Chapter 7 presents a fine example of metapopulation dynamics, and dispersal characteristics among populations. This information is crucial for managing species in fragmented landscapes. The broad survey result, presented in Chapter 8, provides a good example of using calling survey data (albeit for a single species) for rapid assessment of population numbers compared with historical data to determine population declines.

The potential role of conservation genetics is presented in Chapters 9, 10 and 28. Their application is clearly lacking from research to date and field ecologists should collaborate with

geneticists (for example, providing the toe-clips from population studies) to utilize the advantages of population genetics. In Chapters 11 (three papers), 12, 13 and 14, a variety of methods are used to assess the status of amphibian populations in particular provinces. Calling surveys are used to identify species-habitat relationships in agricultural landscapes in Chapter 15, and a good evaluation of the technique is presented in Chapter 16. The use of artificial covers for assessing salamander populations is evaluated in Chapters 17 and 18 and a method for sub-sampling aquatic frogs is presented in Chapter 19 (see discussion below). Potential impacts of forestry activities are described in Chapters 20 and 21, followed by an assessment of the potential impacts of global warming and increased UV radiation on amphibian populations in Chapter 22. The potential changes in amphibian populations at four ponds resulting from changes in water acidity is presented in Chapter 23. Experimental analyses of herbicides and pesticides on egg and larval survival are assessed in Chapter 24, followed by an assessment of agriculture on amphibian deformities (potentially related to herbicide/pesticide residues) in Chapter 25. The role of disease in amphibian declines is well reviewed in Chapter 26. Chapter 27 presents an alternative view on larval surveys and the use of chemical control for introduced species.

The final chapter provides a good overview of the problems associated with assessing amphibian populations and the important distinction between "population size" and "population numbers". The stochastic nature of amphibian populations makes the former difficult to interpret without long term data. The latter (as presented in Chapter 1) is more appropriate for rapid assessment of population status. Finally, a summary of the current status of each species (within each province) is presented in Appendix 1, a suitable basis for management and conservation agencies. The declines are generally attributed to direct anthropological causes yet declines are prevalent in western Canada where human populations are less concentrated.

The large number of authors with a wide range of experience make this book a significant contribution to our understanding of amphibian biology. Many provide excellent examples of methodology and experimental design, however the range of experience of the authors results in some papers lacking rigorous scientific integrity. As for any journal article the reader must consider the experimental design, the results obtained, and the limits on the conclusions reached. In several cases substantial results were overlooked in the discussion, or conclusions are presented without data to support them. One frequent limitation in experimental design results from surveying less than five populations (sometimes within a single waterbody) that may not represent broad patterns for a species. This may result from the limitations imposed by working with endangered species for which only a few sites may be available, but should be avoided whenever possible.

Surprisingly, this book contains little evidence of frog declines in Canada (although see Appendix 1 for species accounts) and no evidence of declines in any of the salamanders. Predicted causes for amphibian declines result from a complex suite of potential (habitat modification, pesticides and herbicide pollution, etc.), postulated (global climate change, disease, acid rain, etc.), and unexplained causes (Chapter 8).

These potential causes are most likely acting independently (although several factors may be acting at the same time) upon each species in each province. Observed declines are associated with habitat destruction, fragmentation and degradation (Appendix 1, however, see Chapter 8). Fortunately, appropriate management actions can be instigated (e.g., forestry regulations, planning urban and agricultural expansion) as political action is clearly the only way to mitigate these anthropogenic effects. The predicted influence of global warming and increased UV radiation on amphibian assemblages once again reminds us of the need for all countries to ensure they are doing everything possible to reduce the local emissions responsible for changing the global environment.

For biologists working on unexplained declines in relatively pristine areas (e.g., eastern Australia, the Rocky Mountains of North America, Central America, and the Andes or Atlantic Forest regions of South America) this volume provides little insight into determining the cause of these declines. Contrary to the conclusion of this book, I believe the fundamental cause of these declines may still be global, however I agree that the primary way of determining the cause of declines will ultimately depend on research at the local scale.

Reflections on several important points raised in this volume include:

1) The sheer amount of research needed is a daunting task and priorities based on rapid assessment are urgently required. A good initiative is presented by Kristiina Ovaska (Chapter 22). However, in her model, the conservation status for each species was included as an independent variable. To create a predictive model that will identify which species are susceptible to global change, current conservation status could be used as the dependent variable. The resulting model would identify the species characteristics which are significantly associated with population declines, also a list of species predicted to be most susceptible to the proposed global changes could be generated.

2) Large-scale surveys are required to document population declines (e.g., Chapters 1, 8, 12, 15, 16, 17, 18 and 28), however, surveys were often restricted to individual species or habitats (water bodies) and/or provincial-political boundaries. Determining species priorities will greatly assist this forbidding task.

3) The variety of methodologies presented provides useful techniques but each contains inherent biases that must be considered in their interpretation and hence application. Adequate surveying often requires species-specific survey techniques. For example, the survey methods in Chapter 1 only sampled species that reproduce in permanent ponds, calling surveys on road transects (Chapters 14–16) only detect vocal species from ponds and not stream-dwelling species, and the use of artificial covers is only effective for some species of salamanders and not others (Chapters 17 and 18). The transect survey method in Chapter 19 may be effective, however no comparison is made with alternative methods. Research on appropriate methodologies would be more productive if compared with alternative methods either in the same place at the same time, or with published results from other studies (e.g., Chapter 16). Alternatively, a single methodology could have been used to compare their efficiency at answering certain ecological questions.

4) Broad scale surveys are urgently required to determine the current status of all species at the "population number" scale (e.g., Chapter 1). Intensive mark-recapture studies provide important baseline data on how individual populations fluctuate (Chapters 2–6), however, they are of limited benefit as they rarely differentiate between immigration, emigration, birth, and mortality. The labor-intensive fieldwork required obtaining this detailed information on population dynamics limits the scope of these studies to a few sub-populations (at the pond or stream level). Sites of high abundance are usually chosen, and without adequate replication across the distribution of the species, these studies do not provide information at the species level. For example, the dynamics of a sub-population will not represent a species if it is a "sink" population. Subsequently, intensive mark and recapture

studies contribute little to our understanding of population declines. However as stated in the editor's final chapter, they will provide valuable information on the dynamics of amphibian populations that may be extremely useful in identifying the cause of a population decline.

Finally, I cannot agree with the conclusions of Chapter 27, supported in the final chapter by Green, suggesting that larval surveys are "largely inapplicable to monitoring the health or persistence of a population." First, there are no data presented to support this contention. The complex life-history of amphibians makes it difficult to pinpoint the most important life stage for population regulation (e.g., Chapter 5). Clearly combined survival at all stages (embryo, larval, juvenile, and adult) influence population size. Studies on population dynamics and regulation must consider all life-history stages.

Several papers presented in this book demonstrate the value of larval surveys (Chapter 1). In the study by Green (Chapter 5), the number of calling males in any year could not be related to the number in the previous year, suggesting that the adult population is regulated by larval recruitment. Unfortunately, larval abundance was not monitored in that study and the role of larval recruitment as a crucial stage in the life-history of this species could not be assessed. Clearly, to understand the "population demographics" of any amphibian species, both larval and adult populations must be considered.

Regarding the question of "population number" the presence of larvae represents the likelihood of reproductive success and hence would be a better indicator of population persistence than the presence of adults. While this may vary for a few ephemeral pond-breeding species (where larval mortality may reach 100 %), most species in Canada appear to breed in more permanent water bodies and larvae are present for extensive time periods (some overwintering). The results of Chapter 7 also demonstrated the value of larval surveys. In that study the presence of adults did not reflect reproductive success as only one pond produced metamorphs (i.e., source vs sink populations). This study demonstrates that the mobility of adults makes adult population estimates difficult to interpret (as mentioned above). Furthermore, tadpole surveys can be useful when searching for remaining populations of species that have significantly declined, particularly for species with a cryptic adult life stage (e.g., *Taudactylus* species in Australia).

Monitoring both larval and adult stages allows us to assess the relative importance of any water body to the success/survival of the species (Chapter 1). For "population number" long-term monitoring of any life-history stage can be surveyed and all are suitable as indices of population status. Larval surveys are often much easier to employ, and are not subject to the immediate climatic effects that limit the activity of adults to certain conditions or particular times of year.

In summary, the book is a credit to the editor, it has an ample scattering of black and white photos that allow overseas readers to visualize the species they are reading about and there are few typographical errors. Reading the book in its entirety provokes constructive thoughts on this global phenomenon and clearly provides insight into appropriate methodologies and direction for future research. The reasonable price and invaluable contents of this book make it a must for anyone interested in amphibian declines.

Amphibians of Iran, by M. Baloutch and H. G. Kami. 1995. Tehran University Publications (no. 2250), Tehran. Softcover, 177 pp. In Farsi (Persian), with Latin taxonomic names and authors' names in Roman type. Price not known.

STEVEN C. ANDERSON
Department of Biological Sciences, University of the Pacific
Stockton, California 95211, USA
and
Department of Herpetology, California Academy of Sciences
San Francisco, California 94118, USA
e-mail: asaccus@aol.com

Mohamad Baloutch of the University of Tehran is the dean of Iranian herpetologists and has introduced the current generation of Iranian students to field biology and natural history. Haji Gholi Kami is one of those former students, now at the University of Gorgan, who is working on amphibians. Their book has been created, apparently, primarily as a guide to amphibiology generally and to the Iranian amphibian fauna specifically for their students.

The first 65 pages cover the biology and taxonomy of amphibians worldwide, drawing information and illustrations from older standard sources, such as Dickerson, 1969, Goin et al. (1978), Porter (1972), Terentjev and Chernov (1949), Thorn (1969), and others. Topics covered include development and metamorphosis, temperature and hibernation, voice, habitat and biocoenosis, life cycles, food, behavior, reproduction, field and museum techniques and brief treatments of taxa, including orders, suborders, and families. Important biological and herpetological terms are followed by the English term in parentheses, presumably as an aid to students reading the Western literature, and one section is devoted to the definition of important terms of external anatomy used in the descriptions and keys.

The remainder of the book deals with the Iranian amphibian fauna and draws upon most of the important primary literature of Iranian and Southwest Asian amphibians as well as upon the experience of the authors. The species accounts include information on natural history, habitat, and distribution, as well as descriptions of the taxa. Keys to all taxonomic levels are included. The bibliography includes 17 titles in Farsi (in Arabic script) and 81 titles in Western languages (in Roman script).

Most of the errors that I noticed are due to typesetters unfamiliar with taxonomic conventions (e.g., capitalization, here and there, of specific and subspecific epithets). The photographs and some other illustrations have not printed well. The authors have followed Eiselt and Schmidtler (1973) and Anderson (1985) in including *Bufo arabicus* Heyden, 1827, as a subspecies of *Bufo viridis*, whereas Balletto et al. (1985) have shown that this name applies to a different toad of the Arabian peninsula (see also Leviton et al. 1992).

Of what interest is a book in Persian designed for Iranian students to readers of *Herpetological Review*, apart from herpetological bibliophiles who feel compelled to collect all such esoterica? For herpetologists interested in Southwest Asia the book provides a complete list of the Iranian amphibian fauna, but more important, the only existing spot distribution maps for each species (although names of localities are not provided). Thus, while I would hardly recommend that all herpetologists seek out this book, it should probably be in the collections of museum departments of herpetology and in the libraries of large research universities.

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Genitalstrukturen und Paarungsbiologie bei squamaten Reptilien, speziel den Platynota, mit Bemerkungen zur Systematik, by Thomas Ziegler and Wolfgang Böhme. 1997. *Mertensiella* 8 (Deutschen Gesellschaft für Herpetologie und Terrarienkunde). 210 pp. Softcover. DM 68- (approx. US $35), half price for DGHT members. ISBN 3-9801929-7-0.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

This monograph on squamate genital structure is the eighth in the *Mertensiella* series, published as a supplement to the more well-known (at least to North Americans) journal *Salamandra*. Previous issues in the series have included primarily edited works on Palearctic amphibians and reptiles and on varanid biology. This treatise expands on earlier work by the authors on the morphology of the hemipenes and the recently described and named hemiclitores of squamate reptiles, especially varanids and their relatives. It also examines the evolutionary and developmental implications of the copulatory organs and their relationship to mating.

The book begins by providing a historical overview of the study of genital morphology and an introduction to cloacal structure and function. The platynotan lizards are introduced with respect to paleontology, distribution, and general characteristics. The materials and methods section is especially valuable as it outlines methods for the preparation of the hemipenes, hemiclitores, and hemibacula. If inappropriately or incompletely everted, many of the structures of potential interest and systematic use may be obscured or uninterpretable. Significantly, it is possible to evert hemipenes of preserved material, allowing researchers to retrieve data from most museum specimens.

As part of their review of copulatory structures Ziegler and Böhme examined *Lanthanotus borneensis*, both living species of *Heloderma*, and 37 of 47 *Varanus* species. The male and female genital organs are described for each species and line drawings or photographs illustrate many of these structures, including the mineralized hemibacula and their female homologues, the hemibaubella. As Böhme has long argued, these structures, especially the hemipenes, are remarkably complex and provide a potential wealth of characters for both functional and phylogenetic analysis. In one of the more controversial interpretations of their study, the authors recognize female choice as the major factor involved with the evolution of such hemipenial complexity.

Hemiclitores are widespread in the Iguania, Gekkota, Amphisbaenia, Serpentes, and Scincomorpha, as well as the Anguimorpha. This will come as a surprise to many herpetologists and has some direct implications for reptile husbandry, as traditional methods of probing may incorrectly identify females with large hemiclitores as males. The female organs appear to represent rudimentary versions of the male genitals that are characterized by smaller size, a lack of a mineralized internal skeleton, and a simplified surface morphology. The authors include some developmental data to support this interpretation and also assess within taxon variability in both hemipenes and hemiclitores (it is minimal).

The authors document a general conservativeness across varanid lizards with respect to genital morphology, but have identified autapomorphies of these organs which they use to erect a new subgenus, *Soterosaurus*, for *Varanus salvator*. Although the value of recognizing such monotypic subgenera may be questioned, they have also identified other genital characters that appear to support the monophyly of previously recognized subgenera of monitors. Perhaps most importantly, features of squamate genitals appear to be useful in alpha systematic studies and may provide evidence of multiple taxa masquerading under a single name.

The monograph is illustrated by 117 figures and 14 pages of color plates. The majority of these illustrations are informative and contribute materially to the text, however some photographs of lizards *in copulo* are probably superfluous and one figure (Plate 1, Fig. E) appears to be missing and has been replaced by a duplicate of the figure intended for Plate 2, Fig. E. The bibliography includes over 400 references, including the majority of papers dealing with the structure, function, and development of the copulatory organs of squamates.

This contribution will be of considerable use to those interested in varanid biology, squamate reproductive morphology, and intersexual homology. However, all squamate systematists will find the techniques of hemipenial eversion valuable and most morphologists will be intrigued by the fact that the complexity of the hemiclitores and associated structures have gone unappreciated for so long. An English summary and bilingual figure captions should make the majority of this valuable work accessible to even non-German readers and the reasonable price (especially for DGHT members) makes this an affordable addition to most herpetological libraries.

Amphibians and Reptiles of the Great Lakes Region, by James H. Harding. 1997. University of Michigan Press, Ann Arbor. xvi +378 pp. Cloth US $42.50 (ISBN 0-472-09628-1) Paper US $19.95 (0-427-06628-5).

JOHN J. MORIARTY
Minnesota Frog Watch, 3800 County Road 24
Maple Plain, Minnesota 55359, USA
e-mail: frogs@tc.umn.edu

Amphibians and Reptiles of the Great Lakes Region is the newest addition to the Great Lakes Environment series from the University of Michigan Press. The series covers a variety of natural history topics dealing with the Great Lakes Basin. Like other books in the series, this book's emphasis is on the recognition and general distribution of all species of amphibians and reptiles in the region. This is a plus for using the book as part of the series, but has some limitations.

The book is organized into three sections: introduction, species accounts, and resources and references. The most unique part of the book is the introduction. In it, Harding details the effects of glaciation on the distribution, evolution, and life history of the amphibians and reptiles found in the region. This is the only book I have seen that explains this important part of ecological and evolutionary history in an easy-to-read manner.

The species accounts make up the majority of the book. The accounts cover all the species of the Great Lakes drainage including peripheral species such as the bog turtle, ravine salamander, slender glass lizard, and short-headed garter snake. The accounts are divided into: Description, Confusing Species, Distribution and Status, Habitat and Ecology, Reproduction and Growth, and Conservation. There is a range map and at least one color photo of each species.

The maps in the book are standardized with the rest of the books in the series; they are centered on the Great Lakes Basin, so most states are only partially covered. Wisconsin and Michigan are the only states that are completely included. The maps are not intended to be exact locality maps, but some of the maps are very imprecise, especially at the periphery. The green snake and Blanding's turtle mapped distributions, for example, are too wide ranging in Minnesota. The photos, however, are uniformly good and clearly show diagnostic features of each species.

The one aspect of the book with which I have the biggest problem is the lack of citations, a fault I have seen in some other recent herp guides. I understand this book is intended to be a general guide, but the back cover does state that this is an essential guide for the professional and private enthusiast. I found myself wanting to know where some of the facts came from. I was also a little concerned with the use of the terms "possibly," "probably," and "may" to describe longevity, size, and other natural history items. Unfortunately, these unsubstantiated "facts" may be cited by others. One example is in the Blanding's turtle account, in which Harding states "... it seems possible that a few individuals may reach the century mark." The oldest known *Emydoidea blandingii* has been reported at 77 years. I can see the day when Harding (1997) will be cited as the source for the longevity record for this species. Caution is in order in such matters.

The conservation section provides information on current threats to the species and some suggestions on how they can be corrected. This will be very useful for wildlife managers and conservation planners.

The last section of the book contains resources and references, including a complete bibliography. I would have liked to see the state herp books from the Great Lakes states in a separate listing or at least highlighted. The inclusion of state wildlife and conservation agency addresses is useful for persons interested in state conservation and regulation issues.

Amphibians and Reptiles of the Great Lakes Region is a good field guide for the region. Many of the states included in the Great Lakes drainage currently do not have an amphibian and reptile guide, and this book will be extremely useful in those areas. The generalist will find that the book will stand alone, while the professional will want, or need, to use it in conjunction with more detailed individual state sources of information. In either case it will be used extensively by herpetologists and conservationists in the Great Lakes Region.

Literature Cited

Brecke, B., and J. J. Moriarty. 1989. *Emydoidea blandingii*. Longevity. Herpetol. Rev. 20:53.

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Editor
ROBERT W. HANSEN
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Clovis, California 93611, USA
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Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: soniak@unt.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biology
Indiana University
Bloomington, Indiana 47405, USA
e-mail: jdemuth@bio.indiana.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cpainter@state.nm.us

Natural History Notes
J. BRIAN HAUGE
Pennsylvania State University
Hazelton Campus
Hazelton, Pennsylvania 18201, USA
e-mail: jbh10@psu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@aix1.ucok.edu

Editor-at-Large: *Adam P. Summers*
Copy Editors: *Jeff Parmelee, Jenny Pramuk, Martin J. Rosenberg, Amy Sproston*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

WWW: http://falcon.cc.ukans.edu/~gpisani/SSAR.html



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1998 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

1999 — Pennsylvania State University, University Park, Pennsylvania, USA, 24–30 June (Jay Stauffer, Chair).
2000 — Universidad Autónoma de Baja California Sur, La Paz, BCS, México, 14–20 June 2000 (Carlos Villavicencio, Chair).

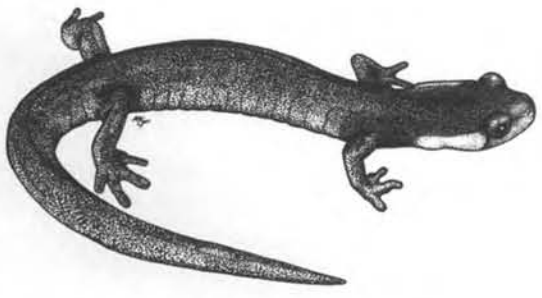
About Our Cover: *Plethodon jordani*

Although *Plethodon jordani* is one of the most abundant plethodontid salamanders in the Appalachian Mountains of the eastern U.S., its eggs have never been found in nature. Our cover apparently is the first published photograph depicting its embryos. The eggs were laid spontaneously in the Lynne Houck-Steve Arnold Herpetology Lab at Oregon State University by a female collected on Wayah Bald, Macon County, North Carolina. Of special interest is that although in nature the eggs of *P. jordani* are terrestrial, this clutch was successfully incubated in the lab under flowing water. The incubation technique is described fully by Bernardo and Arnold (Amphibia-Reptilia: in press).

The cover photo was taken by **Bill Leonard**, using a Nikon N90s body, Nikkor 200mm f/4 macro lens, Tamron 2X teleconverter, Nikon 3T close-up lens, a Nikon SB-26 flash, and recorded on Fuji Velvia film. The combination of optics used to make the photo permitted magnifications ranging from 1.5:1 to 3:1. The exposure was made at 1/250th of a second at f/16 with the camera's compensation dial set at +0.7. The camera was mounted on a tripod to maintain steady, sharp focus while the hand-held TTL flash was aimed at the embryos from about a 30° angle above the water's surface. The eggs were placed in a water-filled glass bowl and photographed from above. Jerod Sapp and Robert Storm assisted Bill in setting up the photo in the lab.

Bill Leonard lives in Olympia, Washington, where he works for the Washington Department of Ecology. Bill has lent his writing, editing, and photographic skills to several recent books, including *Amphibians of Washington and Oregon* (1993), *Reptiles of Washington and Oregon* (1995), *How to Photograph Reptiles and Amphibians* (1997), and *Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific Northwest* (1997). He is the managing editor of *Northwest Fauna*, an occasional monograph series published by the Society for Northwestern Vertebrate Biology, and a co-chair of the U.S. Pacific Northwest Working Group of the Declining Amphibian Populations Task Force.

Separation and imaging of Leonard's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.



Plethodon jordani. Illustration by Michael G. Frick.

SSAR BUSINESS

1998 Annual Meeting: Guelph, Ontario

The 41st annual meeting of SSAR occurred from 16 to 23 July 1998 in Guelph, Ontario, Canada. Once again this year, SSAR met jointly with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists on the campus of the University of Guelph. The University and the local committee, chaired by Jim Bogart, hosted over 1000 attendees. Most of the meeting's events took place on the campus. The meeting's unofficial opening, the SSAR Board of Directors annual meeting, took place on 16 July between 1430 and 1855 h. In attendance for all or most of the meeting were Elected Officers Darrel Frost, Vic Hutchison, Robert Aldridge, Ellen Censky, R. Wayne Van Devender, John Iverson, and Henry Mushinsky; Appointed officers Kraig Adler, Rich Seigel, Robert Hansen, Brian Crother, and Steve Corn; Committee Chair Dawn Wilson, Ken Dodd, Don Forester, and Julian Lee; Members-at-large Mo Donnelly, David Hardy, and John Moriarty. A summary of business conducted was presented at the Business Meeting (see below).

Presentations

The meeting officially opened at 0815 h on 17 July at War Memorial Hall with opening remarks and announcements by Jim Bogart followed by a welcome from the University's president. That was followed by Harry Greene's presentation of the ASIH Henry S. Fitch Award to A. Stanley Rand in recognition of his major contribution to herpetology. The HL Distinguished Herpetologist this year was Sharon Emerson who presented a talk entitled "The evolution of morphological novelties." And then there was a shark talk.

A total of 545 talks and 112 posters were presented in 65 oral presentation sessions and four poster sessions. There were eight symposia at the meetings this year, however, none of them was sponsored by SSAR. SSAR did host the Conservation Forum on 20 July and the topic this year was "CITES: Benefit or hinderance to the conservation of amphibians and reptiles." This Forum was organized by Ken Dodd and the Point-Counterpoint speakers were Michael Klemens, Brian Bowen, and Sue Lieberman.

Social Programs

In addition to the scholarly activities at the meetings, there was a wealth of social activities and special events in which to partake. The social activities were kicked off with the General Reception, held at the University Centre on 16 July. Fine edibles and liquid refreshments were served. Herpetologists and ichthyologists alike were entertained the next evening (17 July) by Bob Murphy, Leslie Lowcock, and Ross MacCulloch's encore performance of ROMMY, ROMMY II. The evening started with the stand-up comedy of David Green and continued with "The World's First Phylogenetic Rock Opera" performed by the aforementioned and their talented crew of graduate students, post docs, etc.

The Ontario Herpetological Society and the Department of Zoology, University of Guelph sponsored the exhibit "Living Amphibians and Reptiles of Ontario." Living representatives of most species from Ontario were on display throughout most of the meetings, providing a great opportunity for photography buffs.

The picnic was held on 20 July at Guelph Lake Conservation

area. As soon as the first steaks hit the grill, the beer began to flow. Dancing ensued soon after the food was eaten and continued until the last bus arrived to retrieve its passengers. On the last evening, 22 July, the more reserved Banquet was held at the University Centre.



Among the several hundred picnic attendees, Kraig Adler, Betty Taylor, and Doug Taylor listen to another of Jim Murphy's implausible, but true, tales of zoo life.

Two of the traditional SSAR activities, the auction and the multimedia show, had their problems. Dave Dennis and Eric Juterbock were on their way to the meetings with multimedia show in tow and ended up with van in tow. They were unable to complete the journey. Hence, the show did not go on. The auction came off without a glitch, but that was due to the quick action and quick wittedness of Darrel Frost. Joe Collins found himself in the hospital just a few days prior to the meeting and had to cancel as auctioneer. Darrel took up the call and according to many has missed his calling. Meeting host Jim Bogart—AKA "Beer Fairy"— dispensed tickets for beers and the auction, held at the Brass Taps on 21 July, was a great success, with over $3500 being raised. The Silent Auction was also successful with over 50 works of art donated. As usual, it ended with a bang with lots of bids coming in at the last minute. The amount raised by the Silent Auction for Student Travel Awards next year was $1400.

Business Meeting

President Darrel Frost called to order the 41st Annual Business Meeting of the SSAR at 1030 h in Axelrod Room 200 on the campus of the University of Guelph on Tuesday, 21 July. He reported on the upcoming meetings in 1999 at Penn State—another three-way meeting (with HL and ASIH)—and remarked on the unremarkable effort that we have made in trying to secure future meeting sites. He appointed Henry Mushinsky as chair of a committee to seek sites for future herpetology meetings. Frost also reported on the Joint Directory, stating that names of members from all three societies have been integrated and duplicates purged. He hoped that the directory would be completed by September, but noted that all three societies had not yet signed a Memorandum of Agreement towards its use and distribution. This would be done soon.

There were several people who were recognized for their services to the society. In addition, new appointments were announced. Ken Dodd was thanked for his untiring effort towards matters dealing with conservation. Dodd resigned as Chair of the Conservation Committee and Michael Klemens was appointed to that position. Julian Lee resigned from the Grants-in-Herpetology committee after four years as Chair and two years as a member of the committee. The society recognized his contributions over the years. Joseph Mendleson was appointed to Chair GIH. Julian was also thanked for his efforts as Associate Editor of *Journal of Herpetology*. Geoffrey Smith has been appointed to replace him. Dave Hardy was acknowledged for his job as elector, and was replaced by Christopher Raxworthy. Robin Andrews was thanked for chairing the Nominations Committee and Henry Mushinsky was appointed as the new chair. The membership expressed its gratitude to John Lynch for having served as CAAR section editor for Anura and as Associate Editor of JH. Hinrich Kaiser was appointed to the CAAR position and Eric Wild to JH. Lee Fitzgerald resigned and Hal Avery and Sharyn Marks were appointed as Associate Editors for *Herpetological Review*.

Treasurer Robert Aldridge reported that our membership remained steady at 2571 but that our expenditures had exceeded our income. This prompted the board to raise the dues by $10 for all members except students, to $95 for Institutional subscriptions, and to $25 for "HR only" category. He reported that the board had approved a 1999 budget of $208,310.

Secretary Censky reported much of the remaining business conducted at the Board Meeting. In addition to the aforementioned resignations and appointments to the *Journal of Herpetology*, Dirk Bauwens and Peter Ducey were added to the Editorial Board. The board authorized the placement of JH abstracts on the Allen Press web site with a link to the SSAR homepage. The cost of page charges for JH were lower in 1998 than in 1997, and Editor Seigel will continue to seek ways to reduce the costs of the journal. *Herpetological Review* editor Robert Hansen noted that during his tenure the number of pages per issue had doubled from 32 in 1991 to 64 today. He reported that the journal is doing well and he is also seeking ways to reduce costs.



Beer frenzy. Government regulations prevented the serving of beer at the Guelph Lake picnic when the crowd arrived and for some time afterwards. However, at the officially sanctioned moment, herpetologists and ichthyologists surged forward to quench their thirst.

The *Catalogue of American Amphibians and Reptiles* report to the board stated that there had been a delay in production of the 1997 accounts associated with shifting to a total in-house pro-



Godfather and Zen Master: Carl Gans and Richard Etheridge at the banquet.

duction. Because of the in-house production, expenditures were down. CAAR is back on track. Facsimiles editor Kraig Adler reported that two works will be published in 1998: "Contributions to the Herpetology of the Belgian Congo," by Karl P. Schmidt and G. K. Noble and "The Gigantic Land Tortoises of the Galapagos Archipelago," by John Van Denburgh. There was also one Contribution published in 1998: "Biology of the Reptilia, volume 19: Visceral Organs," edited by Carl Gans and Abbot Gaunt. Future publications include "Lizards of Iran," by S. C. Anderson; "Anatomy of the Salamander," by E.T.B. Francis; "Herpetofauna of New Caledonia and Surrounding Islands," by A. Bauer and R. Sadlier; "General Zoology: volume 3 Amphibia," by G. Shaw; "Amphibians of Honduras," by J. R. McCranie and L. D. Wilson; and "Herpetological Illustrations from the Spencer Library, University of Kansas," compiled by S. Haines. It was reported that *Herpetological Circulars* will publish "Venomous snakes: A Safety Guide for Keepers," by W. Altimari, and "Lineages of Zoo Herpetologists in the United States," by W. Card and J. B. Murphy. *Herpetological Conservation* has accepted a proposal from Michael Lambert for an edited volume of papers on ecotoxicology of amphibians and reptiles.



Always in search of new resolutions, Julian Lee brings his briefcase to the picnic, as Greg Pregill and Ellen Censky admire Julian's dedication to the Society.

Chair Brian Crother described the new structure of the Standard English and Scientific Names Committee. He stated that he had created sub-committees to handle each of the major taxonomic groups and that a manuscript should be ready this fall. In addition to standardized common names, this publication will include scientific names in debate and describe the nature of the debate. He stated that they will also publish a paper describing the goals of the committee.

Ken Dodd, Chair of the Conservation Committee, reported that the committee had produced a brochure on conserving amphibians and reptiles, and he thanked George Pisani for putting it on the Web. Hard copies are available from Mike Klemens or Dodd.

Julian Lee, Chair of the Grants-in-Herpetology Committee, reported that the program was thriving. There were 53 proposals received. The committee was composed of Julian, Anne Maglia, Joseph Mendelson, Janice Perry, and Kelly Zamudio.

Julian Lee also read proposed resolutions, which were then accepted by the membership. Resolutions are presented below.

The Kennedy Award Committee (Ken Marion, chair, Robin Andrews, Dave Duvall, Robert Gatten, and Terry Schwaner) reported that there were 15 manuscripts in competition this year and the winner was "The effects of reproductive mode and climate on reproductive success in the Australian Lizard, *Lerista bougainvillii*" by Carl Qualls.

The Student Travel Award Committee (Todd Esque, Roy Mark Waters, and Dustin Haines) presented 10 awards of $200 each. In addition, they secured several items for the silent auction at Guelph. Dawn Wilson has been appointed to oversee this committee. John Wiens, Chair of the Seibert Award Committee, reported that there were 34 presentations entered into competition. The judges included Brad Shaffer, Dawn Wilson, Steve Tilley, Steve Poe, Kelly Zamudio, and John Wiens. Chuck Crumly of Academic Press donated a book to the winner in each category and all honorable mentions.

Mike Tyler, representing the Executive Board of the World Congress of Herpetology, reported that the next World Congress will be in Sri Lanka, probably in the year 2001.

Nominations for election to SSAR office for 1999 were presented and accepted by the membership. President-elect: David Green and Julian Lee; Secretary: Ellen Censky; Treasurer: Robert Aldridge; Director (Class of 2001): Maureen Donnelly and Lee Fitzgerald; Director (non-US): Akira Mori and Richard Wassersug.

—Respectfully submitted by Ellen J. Censky, Secretary.

1998 Resolutions

Honoring David Wake

WHEREAS, David B. Wake has made many important contributions to our knowledge of evolutionary morphology, and of the systematics and ecology of salamanders; and

WHEREAS, David B. Wake has done much to elucidate the nature of global amphibian population decline, and to raise public awareness of this important issue; and

WHEREAS, David B. Wake was recently elected to membership in the National Academy of Sciences,

THEREFORE, be it
RESOLVED that the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for

the Study of Amphibians and Reptiles offer congratulations to David on the occasion of this high honor, richly deserved.

Declining Amphibians

WHEREAS, there is compelling evidence that, over the last 15 years, there have been unusual and substantial declines in abundance and numbers of populations of various species of amphibians in globally distributed geographic regions; and

WHEREAS, many of the declines are in protected areas or other places not affected by obvious degradation of habitats; and

WHEREAS, these factors are symptomatic of a general decline in environmental quality; and

WHEREAS, even where amphibian populations persist, there are factors that may place them at risk; and

WHEREAS, some patterns of amphibian population decline appear to be linked by causative factors; and

WHEREAS, declines can occur on multiple scales, in different phases of amphibian life cycles, and can impact species with differing ecology and behavior; and

WHEREAS, there is no obvious single common cause of these declines; and

WHEREAS, amphibian declines, including species extinctions, can be caused by multiple environmental factors, including habitat loss and alteration, global climate change, pathogens, parasites, various chemicals, ultraviolet radiation, invasive species, and stochastic events; and

WHEREAS, these factors may act alone, sequentially, or synergistically to impact amphibian populations; and

WHEREAS, to understand, mitigate, and preempt the impacts of these factors, a comprehensive, interdisciplinary research program must be undertaken; and

WHEREAS, this research program must be conducted in several regions around the globe, both in areas of known declines, and in areas where declines have not been documented; and

WHEREAS, this research must examine issues ranging from environmental quality of landscapes to the condition of individual animals,

THEREFORE, be it
RESOLVED, The American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and The Society for the Study of Amphibians and Reptiles call for the establishment of an interdisciplinary and collaborative research program, which will specify and quantify the direct and indirect factors affecting amphibian population dynamics; and be it

FURTHER RESOLVED that this program will include basic research and monitoring that will test hypotheses of causative factors and examine patterns of change through historical records, field-based correlative data, and controlled, multi-factorial experiments; and be it

FURTHER RESOLVED that interdisciplinary, incident response teams should be assembled in "hot spots" of amphibian decline to identify causative factors to facilitate the mitigation of these sudden declines; and be it

FURTHER RESOLVED that The American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and The Society for the Study of Amphibians and Reptiles call upon both public and private agencies and institutions to promote and support research, policies, and conservation measures that will ameliorate losses and declines of amphibian populations; and be it

FURTHER RESOLVED that this broad-based approach to the study of amphibian population dynamics will serve as a model for study of the global biodiversity crisis.

Commercial Collecting

WHEREAS, there is an unrelenting demand for the commercial collection of amphibians and reptiles, and

WHEREAS, natural populations of amphibians and reptiles must maintain a minimum critical density in order to prevent population collapse, and

WHEREAS, information on the persistence of natural populations of amphibians and reptiles is often unavailable, and

WHEREAS, natural populations of amphibians and reptiles have collapsed under the pressure of commercial collecting, and

WHEREAS, there exist state and national laws regulating scientific collecting, in order to prevent illegal activities and to protect wildlife, but commercial collecting in some states is virtually unregulated,

THEREFORE be it
RESOLVED that The American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and The Society for the Study of Amphibians and Reptiles encourage all appropriate wildlife agencies to work with ASIH, HL, SSAR and other scientific organizations to take appropriate measures to regulate commercial collecting in states where such collecting is allowed.

Thanks to Local Committee

WHEREAS, the 1,040 attendees at the meeting of the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles at The University of Guelph have enjoyed a stimulating, informative, and entertaining program of contributed papers, posters, symposia, and social events, and

WHEREAS, hosting such meetings involves an enormous expenditure of time, energy, and resources on the part of Local Committee members, and

WHEREAS, said Local Committee members have given selflessly of themselves in the service of our societies, and have done so with grace, good humor, and generosity of spirit, to the benefit of all attendees,

THEREFORE be it
RESOLVED, that we, the assembled members of the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles acknowledge our deep debt of gratitude to the University of Guelph, its administrators, and the following members of the Local Committee, and we extend to them our sincere thanks for their efforts on our behalf. Bob Sheath, Dean, College of Biological Sciences; Paul Hebert, Chair, Department of Zoology; Local Committee Members Jim Ballantine, Bill Beamish, Ronald J. Brooks, Steve Crawford, Roy Danzman, Sonia deRincion, Joshua Feltham, Moira Ferguson, Cyndy Forsyth, David Galbraith, Megan Harris, Tim Jennings, Lori Kirsh, Amy Lathrop, Angie Lightle, Heather Lynn, Steve Marks, Ian Mason, Tom Mason, Tana McDaniel, Clair Morris, Bob Murphy, David Noakes, Mike Rankin, Marie Rush, Leslie Rye, Ian Smith, Ildiko Somorjai, Don



Prepublication Announcement

VENOMOUS SNAKES: A SAFETY GUIDE FOR REPTILE KEEPERS

WILLIAM ALTIMARI

A New Herpetological Circular from the Society for the Study of Amphibians and Reptiles

HERPETOLOGICAL CIRCULAR NO. 26

This long-awaited publication contains a wealth of information about the habits, sizes, venom yields, symptoms of envenomation, and temperaments of 59 species of snakes of the families Elapidae and Viperidae. All of the species of snakes featured herein are currently represented in the herpetological collections of North American zoos, and this booklet makes vital information about them quickly available. Includes an Introduction as well as sections on Equipment and General Guidelines, followed by the Species Accounts, and ending with sections on Venoms and Conclusions. Contents and Literature Cited. iv + 24 pages. ISBN 0-916984-47-8. September 1998.

This SSAR publication partially financed and co-sponsored by
THE CENTER FOR NORTH AMERICAN AMPHIBIANS & REPTILES

Prices:	
Prepublication price *(SSAR members only)*	US $4.00
After 15 January 1999	US $6.00
Shipping:	
First copy	US $2.00
Subsequent copies	US $1.00

Send orders to: Dr. Robert D. Aldridge, Department of Biology, Saint Louis University, 3507 Laclede Ave., St. Louis, Missouri 63103-2010, USA. *Telephone* 314/977-3910; *fax* 314/977-3658; *e-mail*: ssar@sluvca.slu.edu. Make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks or by International Money Order. Orders may be charged to VISA or MASTERCARD (account number and expiration date must be provided). SSAR membership details and a complete list of Society publications can be obtained on request to Dr. Aldridge.

Stevens, Glenn Vander Kraak, and especially Jim Bogart, Chair of the Local Committee.

Non-Substantive Resolutions

WHEREAS, more ichthyologists and herpetologists are beginning to enter the 20th Century and are using computer technology more and more to produce slide extravaganzas, and

WHEREAS, certain herpetologists from the Royal Ontario Museum have resurrected ROMMY and raised it to new musical and theatrical heights, and

WHEREAS, with these influences it is expected that ASIH/HL/SSAR presentations will use music, theater, and computer technology more and more frequently to entertain while educating,

THEREFORE be it
RESOLVED that new Stoye award categories be devised to reflect:
Best special effects
Best sound track
Best vocal...

WHEREAS, it first seemed that the solution to having too little beer for the picnic was to refuse to serve those in attendance, and

WHEREAS, the arcane regulations imposed by various and sundry government agencies on beer drinking at the picnic has forever changed the meaning of "Excuse me, sir, may I hold that for you?" for one member whose need was more pressing than the line to the portolets allowed, and

WHEREAS, the Local Committee resolved any potential shortages by calling the Molson Rapid Response Team van at 1-800 MOLSON eh?

THEREFORE be it
RESOLVED that those in attendance at the picnic express their sincere appreciation to the Local Committee for working so hard to resolve the many obstacles imposed by the government on Canada's National Pastime, and be it

FURTHER RESOLVED that each U.S. delegate be sent home with a six pack of Coors Light so that the Local Committee needn't suffer the indignity of having so much undrinkable swill on their hands.

WHEREAS, the Guelph Local Committee has graciously commissioned the Canadian Treasury Department to print and distribute a special $10.00 banknote honoring American Herpetologist Dr. Craig Guyer,

THEREFORE be it
RESOLVED that at all future meetings of the ASIH, HL, and SSAR, similar commemorative legal tender be commissioned in honor of other prominent ichthyologists and herpetologists.

WHEREAS, even the thought of a dry campus strikes terror into the hearts of attendees of these meetings, and

WHEREAS, said delegates were greatly relieved to learn that the "wet" and"dry" containers around campus were not part of a campaign to alter their drinking habits but were instead a laudable recycling program, and

WHEREAS, many other aspects of these meetings have been conducted in an environmentally friendly manner, including but not limited to Ecorite cottontote bags, scrumptious vegetarian options at mealtime, beverage dispensers rather than canned or bottled drinks during breaks (including quality draught rather than bottled beer) and of course minimal use of airconditioning,

THEREFORE be it
RESOLVED that the attendees at these meetings commend the University of Guelph and the Local Committee for their efforts at conserving energy and natural resources.

WHEREAS, Richard Etheridge has been an early, if not founding, member of all three North American herpetological societies, and

WHEREAS, Richard Etheridge has faithfully served these three societies in various capacities for over four decades, this being the 50th meeting that he has attended, and

WHEREAS, despite his soft-spoken, humble, zen countenance, Richard Etheridge has been one of the most influential herpetologists of the past century, and

WHEREAS, Richard's dedication to herpetology has been nothing less than extraordinary and has included great personal sacrifices, including dating daughters of certain deceased herpetologists in order to acquire full reprint sets of said herpetologists' work, and

WHEREAS, Richard credits William Milstead with teaching him that "herpetology is more than keeping snakes in cages," and

WHEREAS, despite this advice, Richard has spent his adult life rendering various reptiles into skeletons which he keeps in cardboard boxes, and

WHEREAS, Richard Etheridge is the only herpetologist to be envenomated by a dead speckled rattlesnake, and

WHEREAS, Richard's research efforts have resulted in the frustration of curators world wide who were compelled to change jar labels for millions of specimens once considered to belong to the family "Iguanidae," and

WHEREAS, Richard worked at a university where only Masters degrees were awarded, and

WHEREAS, despite this limitation, Richard's students produced theses which often exceeded 500 pages, bound as two volumes, and

WHEREAS, said students are some of today's most widely respected and influential herpetologists, and

WHEREAS, Richard Etheridge recently retired from San Diego State University,

THEREFORE be it
RESOLVED that at next year's meeting at Penn State University, the three societies, its members, and especially his students and colleagues honor Dr. Richard Etheridge with a day-long symposium and nighttime "roast," and be it

FURTHER RESOLVED that from this day forward Richard be referred to as "The Godfather and Zen Master of Lizard Systematics."

WHEREAS, we ran out of beer at the social, and

WHEREAS, no beer was available at the barbecue, and

WHEREAS, the term microbrew does NOT refer to QUANTITY,

THEREFORE be it

RESOLVED that future Local Committees review the data gathered by the Local Committees in Austin, New Orleans, and Seattle showing that volume increases exponentially with surface area of the members.

Seibert Award Winners for 1998 Announced

The seventh annual Seibert Awards were presented at the 41st Annual Meeting of the SSAR in Guelph, 16–23 July 1998. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). In recognition of outstanding student presentations at the annual meetings, a single award was given in each of the following categories: Systematics (3 eligible presentations), Ecology/Evolution (17), Physiology/Morphology (4), and Conservation (7). All four awardees received a check for US $200 and a book from Academic Press.

The Winners.—Conservation: Martin Schlaepfer, Department of Natural Resources, Cornell University, "The effects of forest-pasture edges on the herpetofauna of Fila Cruces, Costa Rica." Ecology/Evolution: Richard Glor, Section of Ecology and Systematics, Cornell University, "Reptile diversity in a disturbed tropical forest landscape." Systematics: Anne Maglia, Natural History Museum and Department of Systematics and Ecology, University of Kansas, "Comparative osteology and phylogenetic relationships of the pelobatid frogs (Anura: Pelobatidae)." Physiology/Anatomy: Jason Irwin, Department of Zoology, Miami University, "Freeze avoidance and terrestrial overwintering in the northern cricket frog, *Acris crepitans*."

Honorable Mention.— Conservation: M. B. Kolozsvary, Department of Forestry and Natural Resources, Purdue University, "Amphibian species distribution patterns in an agriculturally-fragmented landscape." Ecology/Evolution: Sharon Downes, School of Biological Sciences, University of Sydney, "Do incubation-induced changes to a lizard's phenotype affect its vulnerability to predators?" Physiology/Anatomy: Philip Martin, Department of Biological Sciences, Ohio University, "Adaptation to life in estuarine environments in the northern water snake (*Nerodia sipedon*)."

The judges were: John Wiens, chair (Carnegie Museum of Natural History), Steven Poe (University of Texas, Austin), Brad Shaffer (University of California, Davis), Steve Tilley (Smith College), Dawn Wilson (University of Nevada, Reno), and Kelly Zamudio (University of California, Berkeley).

ASIH-HL-SSAR 1999 Meeting Update

Meetings organizers of the 1999 ASIH-HL-SSAR meetings at Penn State have changed deadlines related to abstract submission and modification as follows:

Abstract submission deadline for acceptance: 1 February 1999. Final abstract text may be changed until: 15 March 1999.

SSAR Student Travel Awards Call for Applications

Awards of US $200 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author (or co-author, see below) of a paper or poster to be

presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that states: he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Student Travel Awards Committee are excluded from applying for a travel award.

APPLICATIONS MUST BE POSTMARKED BY 15 MAY 1999. Award recipients will be notified by 1 June 1999 and award checks will be disbursed at the meeting. Direct requests for information to: *Lance D. McBrayer, Department of Biological Sciences, Ohio University, Athens, Ohio 45701, USA: Tel. (740) 593-2351; e-mail: lance.mcbrayer@ohio.edu.*

SSAR Student Awards Fund-raiser: 1998 Results and Call For 1999 Donations

Thanks to the many generous donations from several individuals to the 1998 silent auction in Guelph, the SSAR Student Travel Awards Committee (SSAR STAC) awarded ten US $200 travel grants to the following individuals: Christine Bridges, Sharon Downes, Kevin Jansen, Mark Jordan, Jason Kolbe, Matt Lovern, Philip Martin, Matthew Parris, Carol Spencer, and Nicole Valenzuela. The SSAR STAC wishes to thank all who donated items to the 1998 auction in Guelph. The fourth annual Frameable Art Silent Auction raised over $1300 for future student travel awards. On behalf of SSAR and the SSAR STAC Chairman, Todd Esque, thanks to all who helped, including Dustin Haines, Roy Mark Waters, Tana McDaniel, and the Guelph meeting organizers.

The SSAR STAC announces the Fifth Annual Frameable Art Silent Auction to be held at the 1999 SSAR meeting at Penn State. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *Lance D. McBrayer, Department of Biological Sciences, Ohio University, Athens, Ohio 45701, USA: Tel. (740) 593-2351; e-mail: lance.mcbrayer@ohio.edu.*

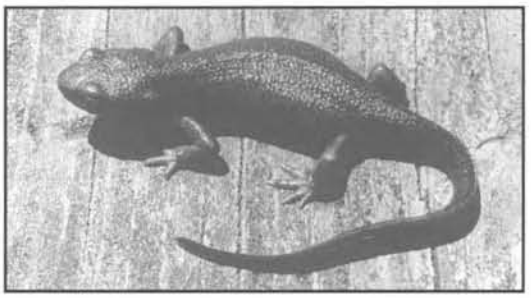
Grants-in-Herpetology Donations Sought

Financial contributions by SSAR members, institutions, and other benefactors support this program significantly and can increase the number and/or size of awards. Your tax-deductible (for U.S. residents) contribution to this program will directly benefit meritorious research and education in herpetology. Contact the Treasurer of SSAR for additional information on contributing to the Grants-in-Herpetology Program. If you are employed by an organization that will match donations made to nonprofit organizations, please notify your employer that you have made a donation to the Grants-in-Herpetology Program.

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NEWSNOTES

Herplit Database

The Herplit Database, maintained by Breck Bartholomew, consists of approximately 30,000 herpetological citations. These citations may be searched and specific citations selected and e-mailed to you (the citation, not the publication). This can be especially useful for persons doing literature searches. To access the site, go to: http://www.herplit.com/herplit.

Changes at Louisiana State University

Effective 19 December 1998, Douglas A. Rossman retired from his position as Curator of Amphibians and Reptiles in the Museum of Natural Science at Louisiana State University, a position he held for 35 1/2 years. He intends to continue his research in snake systematics and welcomes continued correspondence and reprint exchanges with colleagues working in this area.

Rossman's successor at LSU will be Jimmy A. McGuire, who assumes the post on 1 January 2000. During 1999, all loan requests and other correspondence pertaining to the collection of Amphibians and Reptiles should be directed to Frank T. Burbrink at the Museum of Natural Science, 119 Foster Hall, Louisiana State University, Baton Rouge, Louisiana 70803, USA. Tel. 225-388-3082, e-mail: fburbri@unix1.sncc.lsu.edu, Fax: 225-388-3075.

Adler Assumes New Role at Cornell

Kraig Adler, one of SSAR's founders and long-time professor of biology at Cornell University, has been named Vice Provost for Life Sciences, a position within the research administration. Adler will serve in his new role on a half-time basis and will continue his research and teaching activities within the Section of Neurobiology and Behavior. His new duties involve coordination of research activities in the life sciences and will help focus the university's attention on new areas of opportunity, such as genomics and biodiversity.

Southwestern Research Station Positions And Grants For 1999

VOLUNTEERS—Approximately 30 volunteer positions are open in 1999 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 14 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 1999. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin March 14, 1999, through September 1999. Five-day week; salary $235/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

MEETINGS

Meetings Calendar

2–6 March 1999—19th International Symposium on Sea Turtle Biology and Conservation, South Padre Island, Texas, USA. Contact Jane Provancha, Symposium Secretary, Aquatics Ecological Program, DYN-2, Kennedy Space Center, Florida 32899, USA; e-mail: Jane.Provancha-1@ksc.nasa.gov; Fax: (407) 853-2939.

15–16 March 1999—Conference: "Population Viability Analysis: Assessing Models for Recovering Endangered Species," San Diego, California, USA. *Further details below.*

13–17 May 1999—Fourth International Symposium on Isolated Vertebrate Communities in the Tropics, Bonn, Germany. Hosted by the Zoologisches Forschungsinstitut und Museum Alexander Koenig. To receive announcements and to obtain further information, please contact: Prof. Dr. W. Böhme, Adenauerallee 160, 53113 Bonn, Germany; tel. +49 228 91 22 250, fax ++49 228 216 979, e-mail: r.hutterer.zfmk@uni-bonn.de.

5–9 October 1999—The Sixth Annual Conference of the Association of Reptilian and Amphibian Veterninarians, Columbus, Ohio, USA. For Conference registration information contact: Wilbur Amand, VMD, PO Box 605, Chester Heights, Pennsylvania 19017, USA; fax: 610-892-4813.

8–11 October 1999—Second Symposium on the Status and Conservation of Florida Turtles, Eckerd College, St. Petersburg, Florida, USA. Contact: Gopher Tortoise Council, c/o George L. Heinrich, 1223 Alhambra Way S., St. Petersburg, Florida 33705-4620, USA; tel. (813) 865-6255; e-mail: highpine@gte.net.

12–17 December 1999—5th Latin American Congress of Herpetology, University of Uruguay, Montivideo, Uruguay. *Further details below.*

22nd Annual All Florida Herpetology Conference and First Annual Herpetology Education Institute

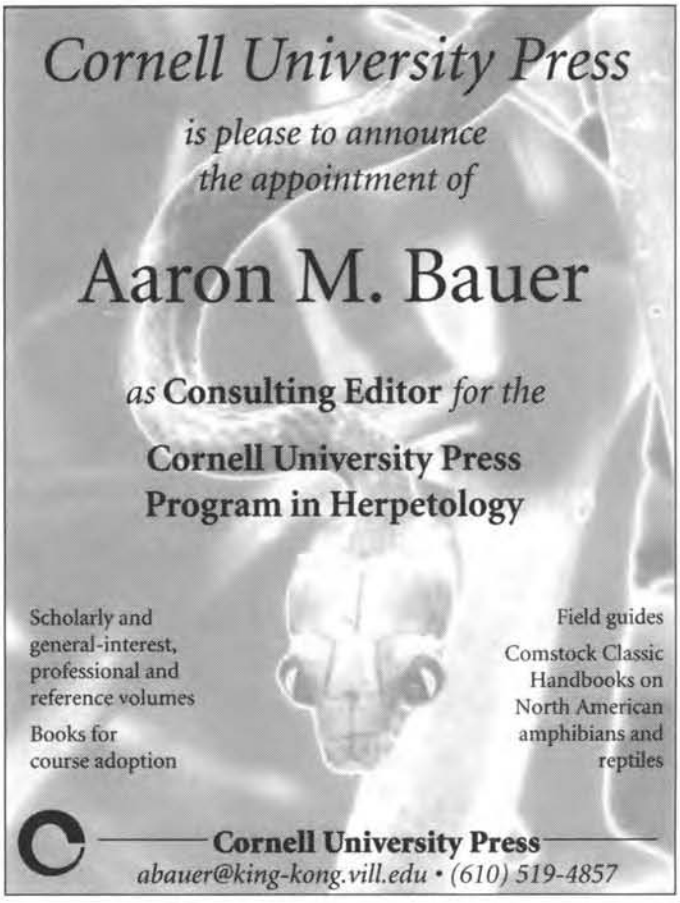
The 22nd Annual All Florida Herpetology Conference will be held 14–16 May 1999, in Gainesville, Florida, USA. This popular event traditionally has drawn over 400 participants and has now been expanded to three days and will be held at the Radisson Hotel to make room for the more than 600 amateur and professional herpetologists, breeders, veterinarians, and educators that are expected to participate. In addition to addressing issues of global importance such as disappearing amphibians, habitat conservation, and enforcement of protected species regulations, the All Florida Herp Conference will offer informative exhibits with live reptiles and amphibians, herp identification contests, multimedia presentations, and informational sessions. The Herpetology Education Institute on Friday and Sunday will feature hands-on workshops and field trips for all ages. The Conference and Institute are Co-sponsored by the Florida Museum of Natural History and the Gainesville Herp Society. Supporters this year are Ashton, Ashton & Associates, Inc. and the Jacksonville Zoo. For additional information, please contact either of the meeting co-chairs: Ray E. Ashton, Jr., Executive Director, Ashton, Ashton & Associates, Inc., 5745 SW 75th St. #331, Gainesville, Florida 32608, USA, tel. (352) 495-7433 or 495-7449, e-mail: Tortfarm2@aol.com; or Max Nickerson, Curator, Florida Museum of Natural History, P.O. Box 117800, Gainesville, Florida 32611, USA, tel. (352) 392-1721, e-mail: maxn@flmnh.ufl.edu.

5th Latin American Congress of Herpetology

The 5th Latin American Congress of Herpetology (5th CLAH) will be held at the University of Uruguay, Montevideo, Uruguay, 12–17 December 1999. The official languages of the 5th CLAH will be Portuguese and Spanish. However, English and other languages will be accepted in workshops, symposia, and poster presentations but will need to be accompanied by an abstract in one of the official languages. Deadline for Abstracts is 30 June 1999. For registration and additional information please contact Lic. José A. Langone, Secretario Ejecutivo V CLAH, Museo Nacional de Historia Natural, CC 399, 11000 Montevideo, Uruguay, e-mail: vclah@fcien.edu.uy. Additional information and updates will be posted at: http://zvert.fcien.edu.uy/clh. For further information and registration within the U.S. and Canada, please contact: Dr. Rafael de Sá, Department of Biology, University of Richmond, Richmond, Virgina, 23173, USA; e-mail: rdesa@richmond.edu.

Population Viability Conference

A conference entitled "Population Viability Analysis: Assessing Models for Recovering Endangered Species," sponsored by the University of California Berkeley and the Western Section of the Wildlife Society, will be held 15–16 March 1999 in San Diego, California, USA, at the Town and Country Hotel in Mission Valley. Population Viability Analysis (PVA) has become an important tool for assessing risks to endangered species, but has been criticized for the unrealistic ways that models have been applied in management and policy decisions. This conference will focus on issues in the development and application of demographic and genetic PVA models for conserving threatened and endangered species. Themes of conference sessions include conceptual issues in the development of PVA models, integrating theory and practice in the use of PVA, applications of PVA to conservation problems, and the future of PVA. The meeting will consist of presentations by invited speakers including M. Soulé, R. Lande, M. Gilpin, M. Boyce, B. Taylor, F. Allendorf, I. Hanski, S. Harrison, K. Ralls, D. Doak, S. Pimm, H. Possingham, R. Lacy, G. Belovsky, R. Waples, P. Hedrick, S. Haig, S. Beissinger, S. Mills, C. Walters, J. Walters, P. Wade, M. Shaffer, and D. McCullough. In addition, there will be sessions for contributed oral papers and posters. For information on the scientific program, contact Steven R. Beissinger (tel. 510-643-3038; e-mail: beis@nature.berkeley.edu) or Dale R. McCullough (tel. 510-642-8462; e-mail: mcculla@nature.berkeley.edu). For information on logistics and registration, contact William Hull (tel. 510-465-4962; e-mail: whull@cgbd.org) or visit the conference web site at http://www.cccweb.com/tws-west/pva.



LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. Please direct all communication to the section editor, Jeffery Demuth (postal and e-mail addresses on inside front cover).

USA: U.S. Fish and Wildlife Service: The USFWS proposes to reclassify the yacare caiman (*Caiman yacare*, also known as *Caiman crocodilus yacare*) from its present endangered status to threatened status under the Endangered Species Act. It is also proposed that the common caiman (*Caiman crocodilus crocodilus*) and the brown caiman (*Caiman crocodilus fuscus*) be listed as threatened due to similarity of appearance. The yacare caiman is native to Argentina, Brazil, Paraguay, and Bolivia, and the others occur in Mexico and Central and South America. All three taxa are listed under CITES Appendix II. A special rule is also proposed for these three species that would allow U.S. commerce in caiman skins and other parts and products under certain conditions. These conditions largely pertain to the implementation of a CITES resolution on the universal tagging of crocodilian skins. The proposals are intended to: (1) more accurately the reflect the status of the yacare caiman; (2) promote their conservation by ensuring proper management of the commercially harvested caiman species in the range countries and through implementation of trade controls; (3) relieve the burden on U.S. law enforcement personnel who must screen difficult to distinguish caiman products.

Further information may be obtained by contacting Dr. Susan Lieberman; Chief, Office of Scientific Authority; Room 750 Arlington Square; 4401 North Fairfax Drive; U.S. Fish and Wildlife Service, Arlington, Virginia 22203, USA; e-mail: Susan_Lieberman@mail.fws.gov. Comments from all interested parties should be received at the above address by 22 December 1998.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Asymmetric Competition in *Rana areolata* Larval Communities

Parris and Semlitsch examined larval performance of the northern crawfish frog *(Rana areolata circulosa)*, an anuran species of particular conservation concern, at low and high population densities and under conditions of interspecific competition, with two sympatric congeners (*R. blairi* and *R. sphenocephala*), in an array of replicated artificial ponds. Their results indicated that *R. areolata* larval performance was significantly reduced in terms of larval period length and body mass at metamorphosis when exposed to interspecific competition. The authors conclude that the impact of biotic community interactions may be just as important as the preservation of critical habitat in maintaining viable populations of rare anuran species.

PARRIS, M. J., and R. D. SEMLITSCH. 1998. Asymmetric competition in larval amphibian communities: conservation implications for the northern crawfish frog, *Rana areolata circulosa*. Oecologia 116:219–226.

Correspondence to: M. Parris, Division of Biological Sciences, 105 Tucker Hall, University of Missouri, Columbia, Missouri 65211-7400, USA; e-mail: c648571@showme.missouri.edu.

Effects of Silvicultural Edges on Amphibian Biodiversity

Demaynadier and Hunter studied the effects of forest edges on amphibian populations in Maine by sampling 14 species of amphibians living near the edges of various silviculture stands. Their results indicate that salamanders were more sensitive to even-aged harvest edge effects than anurans, and that the depth of edge effects were 25–35 m for the more sensitive species. Their results indicate that the effects of intensive forest management practices on amphibian communities extend beyond the boundary of the harvested stands.

DEMAYNADIER, P. G., and M. L. HUNTER, JR. 1998. Effects of silvicultural edges on the distribution and abundance of amphibians in Maine. Cons. Biol. 12:340–352.

Correspondence to: P. G. Demaynadier, Department of Wildlife Ecology, Nutting Hall, University of Maine, Orono, Maine 04469, USA; e-mail: demaynad@umenfa.maine.edu.

Salamanders Distribution and Canopy Cover

The impact of selective logging on redback salamander (*Plethodon cinereus*) populations was studied by Messere and Ducey. They collected salamanders from transects passing through forested areas and gaps one year after a harvest; they found no significant differences in the densities of salamanders in areas with different amounts of canopy cover. These results suggest that gaps formed by selective logging do not affect the distribution of redback salamanders one year after cutting.

MESSERE, M., AND P. K. DUCEY. 1998. Forest floor distribution of northern redback salamanders, *Plethodon cinereus,* in relation to canopy gaps: first years following selective logging. Forest Ecol. Manag. 107:319–324.

Correspondence to: P. K. Ducey, Dept. of Biological Sciences, State University of New York at Cortland, Cortland, New York, 13045, USA; e-mail: duceyp@cortland.edu.

Antipredator Behavior of Hatchling Snakes

To examine antipredator behaviors, the author tested the responses of hatchling pine snakes (*Pituophis melanoleucus*) to visual and vibratory stimuli. Hatchlings had been incubated at one of three temperature regimes (22–23, 27–28, or 32–33°C) and

were exposed to one of five conditions (four visual and one vibratory), testing for differences in response as a function of predator type and incubation temperature, as compared to the null hypothesis of no differences. Results indicate that emergence behavior, when undisturbed, was affected by incubation temperature, and predator type and incubation temperature affected antipredator behavior. The author found that hatchlings responded more protectively (withdrawal into tunnels) than defensively (striking), responded with less intensity to a vibration than to visual predator stimuli, responded with less intensity to a vibration than to visual predator stimuli, and required longer to respond to a head model without eyes than to all other predator types.

BURGER, J. 1998. Antipredator behaviour of hatchling snakes: effects of incubation temperature and simulated predators. Anim. Behav. 56:547–553.

Correspondence to: Joanna Burger, Biological Sciences, Rutgers University, 604 Allison Road, Piscataway, New Jersey 08854, USA; e-mail: burger@biology.rutgers.edu.

Growth Rate, Adult Body Size, and Sexual Maturity in Spotted Turtles

Employing 19 years of mark-recapture data, the authors examined growth rates, adult body size, and age and size at sexual maturity of a northern temperate population of *Clemmys guttata*. Results indicate that growth rates are inversely proportional to body size, there is high variation in individual growth rates, and there are no sexual differences with respect to growth rates. Although no sexual size dimorphism exists with respect to carapace length, females were found to have significantly longer plastrons than males. In general, sexual maturity was found to be reached at larger size and estimated age (both males and females) in these animals than in the more southerly conspecifics.

LITZGUS, J. D., AND R. J. K. BROOKS. 1998. Growth in a cold environment: body size and sexual maturity in a northern population of spotted turtles, *Clemmys guttata*. Can. J. Zool. 76(5):773–782.

Correspondence to: J. D. Litzgus, Department of Zoology, Miami University, Oxford, Ohio 45056, USA; e-mail: LitzguJD@miavxl.muohio.edu

Sex Determination and Sex Differentiation in Amphibians

The author presents two issues that typically have been treated separately in amphibian biology—sex determination and sex differentiation. The goal of this paper is to synthesize work on these two areas of research, to place them into an evolutionary framework, and explore the interactions between them. Comprehensive reviews of Genetic Sex Determination (GSD), Environmental Sex Determination, gonadal differentiation, the roles of steroid, thyroid, and pituitary hormones, and parthenogenisis are presented. In summary, the author finds that it is likely that all amphibians display GSD, but that external factors such as temperature, physical manipulations, and exogenous hormones can influence gonadal sex differentiation.

HAYES, T. B. 1998. Sex determination and primary sex differentiation in Amphibians: genetic and developmental mechanisms. Journal of Experimental Zoology 281(5):373–399.

Correspondence to: T. B. Hayes, Department of Integrative Biology, 3060 Valley Life Sciences Building, University of California, Berkeley, California 94720-3140, USA; e-mail: tyrone@socrates.berkeley.edu.

Phylogeny and Biogeography of Australian Elapids

The authors analyzed portions of the cytochrome b and 16S rRNA mitochondrial DNA genes from 19 of the 20 known Australian genera of the subfamily Hydrophiinae, as well as six of the seven Melanesian genera, a sea krait (*Laticauda*), and a true sea snake (*Hydrelaps*). Parsimony analyses led to several conclusions about these snakes: 1) the Melanesian elapids form sister groups to the Australian species, indicating that Australian radiation of these snakes came via Asia, rather than representing a relict of a Gondwanan radiation; 2) sea kraits and true sea snakes represent independent invasions of the marine environment; and 3) radiation of viviparous Australian elapids is much older than previously suggested. These analyses were unable to resolve relationships among the Australian snakes.

KEOGH, J. S., R. SHINE, AND S. DONNELLAN. 1998. Phylogenetic relationships of terrestrial Australo-Papuan elapid snakes (Subfamily Hydrophiinae) based on cytochrome b and 16S rRNA sequences. Mol. Phyl. Evol. 10(1):67–81.

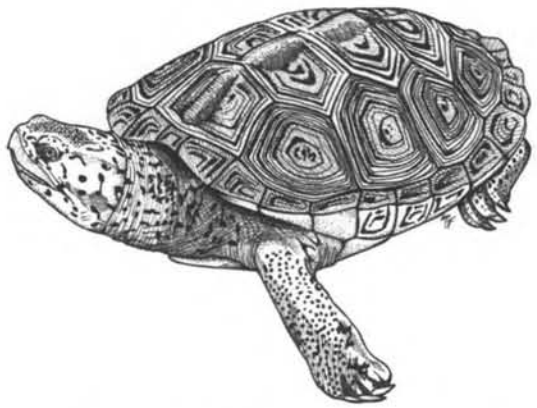
Correspondence to: J. S. Keogh, Division of Botany and Zoology, Australian National University, Canberra, ACT 0200, Australia.

Conservation Genetics of Mediterranean *Podarcis*

The authors sequenced and analyzed a fragment of the mitochondrial cytochrome b gene of the endemic and endangered lizard *Podarcis atrata* of the Columbretes Archipelago (Mediterranean Spain). The population genetic structure of these lizards was analyzed as a first step to identifying evolutionarily significant units (ESU) for developing appropriate conservation strategies. Their analyses suggest that *P. atrata* from Foradada and El Lobo represent ESUs. The authors also include a brief discussion of the possibility of gene flow, from the mainland to several of these islets, which may threaten the genetic diversity of existing populations.

CASTILLA, A. M., V. FERNÁNDEZ-PEDROSA, T. BACKELJAU, A. GONZÁLEZ, A. LATORRE, AND A. MOYA. 1998. Conservation genetics of insular *Podarcis* lizards using partial cytochrome b sequences. Mol. Ecol. 7(10):1407–1411.

Correspondence to: A. M. Castilla, Department of Biology, University of Antwerp (UIA), B-2610 Wilrijk, Belgium; e-mail: castilla@uia.ac.be.



Malaclemys terrapin (Diamondback Terrapin). Illustration by Michael G. Frick.

LETTERS TO THE EDITOR

Early Reptile Photography—A New Entry

KRAIG ADLER
Neurobiology and Behavior, Seeley G. Mudd Hall
Cornell University, Ithaca, New York 14853, USA
e-mail: kka4@cornell.edu

and

HAROLD G. COGGER
The Australian Museum, 6-8 College Street, P. O. Box A285
Sydney South, New South Wales 2000, Australia
e-mail: halc@amsg.austmus.oz.au

In the September 1998 issue of *Herpetological Review* (vol. 29, pp. 134–135), John Edwards has presented three interesting photographs, dated 1865, which he believes may be the oldest surviving portraits of living reptiles. (He mentions the photograph of a living tortoise dated 1864, but this image apparently is no longer extant.) We wish to present an earlier entry, and from a distant, and perhaps even surprising, place.

Gerard Krefft (1830–1881) was born in Germany and emigrated to Australia in 1852 (for biography, see Adler 1989, Contributions to the History of Herpetology. Soc. Study Amphib. Reptiles, Contr. Herpetol. 5:51). Among his many publications, he published the classic book, "The Snakes of Australia" (1869), and is justly regarded as the Father of Australian Herpetology. In 1864, he had the accompanying portrait made which, from the distinctive studio props, makes it clear that it was taken by the Sydney photographer, William Hetzer, who had arrived in 1850 to open a studio specializing in calotypes (a photographic method that superseded Daguerreotypes). The original photograph was discovered in an album of portraits collected by Albert Günther from his correspondents around the world, among whom Krefft was one of the most active. The album is now kept in the general library of the Natural History Museum in London. We thank the authorities at the museum, John Thackray and Vicky Street, for their assistance and permission to reproduce the photograph, which is handcolored in the original.



The live reptiles in the photograph are two diamond pythons (*Morelia s. spilotes*), an eastern blue-tongued lizard (*Tiliqua scincoides*) on the table beside the hat, and an eastern water dragon (*Physignathus lesueurii*) on Krefft's right knee. In the 1860s, Sydney had dozens of photographic studios and Hetzer may have been chosen by Krefft because he was a fellow German and, thus, with a common language, he was better able to communicate his wish to be photographed with living reptiles—something that may not have endeared Krefft to the average Sydney photographer of the day.

We await further entries in the contest to find the earliest photograph of a living reptile.

ARTICLES

Pressure/Immobilization as First Aid for Venomous Snakebite in the United States

DAVID L. HARDY, SR.
Research Consultant, Arizona Poison and Drug Information Center
P.O. Box 245079, Tucson, Arizona 85724-5079, USA
e-mail: dhardysr@theriver.com

and

SEAN P. BUSH
Department of Emergency Medicine
Loma Linda University School of Medicine
11234 Anderson Street, Loma Linda, California 92354, USA
e-mail: famensean@aol.com

The pressure/immobilization method (P/I) of first aid has been used for elapid snakebite in Australia for nearly 20 years (Sutherland et al. 1979). Recently, the use of P/I for pitviper bites in the United States has become a controversial topic of discussion, especially on the Internet. We begin with an overview of snakebite first aid in the United States, discuss the place for P/I in bites by different groups of venomous snakes, and finally, advance a conservative regime for first aid. Since most venomous snakebites in the U.S. are inflicted by native pitvipers, this is emphasized in our discussion. The increasing number of exotic venomous snakes in private collections across the country has led to more bites by foreign species, especially cobras, and the utility of P/I in this setting is addressed.

Various first aid measures have been recommended over the years for pitviper bite in the U.S., including incision and suction (Jackson 1927; Jackson and Harrison 1928; Seelex 1963), constricting bands (Glass 1976; Seelex 1963), local cooling (ice application) (Glass 1976, 1981), ice water immersion or cryotherapy (Stahnke 1953; Stahnke and McBride 1966), and electroshock (Guderian 1993; Guderian et al. 1986). Immobilization by splinting has been generally favored, while more recently, suction without incisions using The Extractor™ (Extractor) (Bronstein et al. 1985, 1986) has had qualified endorsement.

Current status of controversial first aid measures.—A literature survey of 1970–1979 included 17 papers offering conflicting advice on the use of incision and suction, tourniquets, ice or ice water, splinting, exertion, and killing or catching the snake (Stewart et al. 1981). More recently, the opinions of four experts in the U.S. concerning first aid for rattlesnake bite has been published (Forgey et al. 1994).

Laboratory evidence for effectiveness of incision and suction has been conflicting (Gennaro 1963; Ya and Perry 1960; Ya et al. 1961), while ice or cold application and electroshock have not held up to lab testing (Dart et al. 1988; Howe and Meisenheimer 1988; Johnson et al. 1987; Snyder et al. 1989; Stoud et al. 1989). Incisions (Glass 1976), tourniquets (Curry et al. 1985), and ice water immersion (McCollough and Gennaro 1963; McCollough et al. 1961) have caused injury. Extractor suction (Bronstein et al. 1985, 1986) and splinting do not appear to harm and may be effective. Although splinting is generally included in many protocols, its use may sequester venom at the local site (Richard Dart, M.D., pers. comm.), and with swelling, splint wrapping may become tighter than intended (Frank Walter, M.D., pers. comm.).

The problem of recommendations based on favorable laboratory results continues. Burgess et al. (1992), using a pig-leg model,

found that a regulated pressure band at 45 mmHg effectively lowered levels of systemic venom and a sudden rise in these levels did not occur upon release. Gomez and Dart (1995) were cautious in making a general recommendation for its use as first aid based on this study. Unfortunately, the public is not likely to understand or follow the guidelines needed to use this method effectively and safely. Use of a constriction band has been recently recommended on the basis that its potential benefits in retarding systemic absorption outweigh disadvantages (Norris 1995; Norris and Minton 1995).

In general, few measures have been evaluated in a clinical setting, but specific exceptions are tourniquets for Philippine cobra bite (Watt et al. 1988), and pressure-pad/wrapping/splinting for Russell's viper bite in Myanmar (Tun-Pe et al. 1995). Unfortunately, a study of the Extractor suction device for western diamondback rattlesnake bite at a rattlesnake round-up in Texas (Bronstein et al. 1986) has only been reported as a short abstract making this clinical study difficult to evaluate. It is possible that strong suction on tissues that have undergone rapid swelling could increase local damage (David Warrell, D.M., 1998, pers. comm.). The clinical use of P/I for pitviper bites has not been reported.

First aid did not improve the outcome of victims with pitviper envenomation in other studies. In a series of 225 rattlesnake bites treated in the Los Angeles County area, first aid (incision, suction, tourniquet, cryotherapy, or any combination) did not have a statistically significant effect on envenomation severity (Wingert and Chan 1988). First aid did not modify the course of 244 pitviper bites in Colombia (Otero et al. 1992), and it may have increased local necrosis and disability in a series from the western United States (Dart et al. 1989).

In the discussion that follows, we emphasize recommendations to the general public and include special situations intended for physicians, emergency medical technicians, zoo personnel, and herpetoculturists of venomous snakes.

Severity of pitviper bite in the U.S.—The majority of venomous snakebite victims suffer no long term sequelae. However, field management and hospital treatment may actually cause more injury than the snakebite (Curry et al. 1985; Dart and Gustafson 1991; Litovitz et al. 1991). The seriousness of pitviper bites in the U.S. varies among epidemiological studies, but the following is one breakdown: dry bites 25%, mild bites 25%, moderate bites 35%, severe bites 15%, and fatal bites less than 0.5% (some of these are preventable [Hardy 1986]). (The actual percentage of dry and mild bites may be significantly higher since many males with illegitimate [interactive] envenomation do not seek medical evaluation and are not part of hospital and poison center statistics.) If these percentages are representative, most victims do well without first aid and only a small percentage will suffer local necrosis and life threatening systemic toxicity.

The Australian pressure/immobilization method.—The pressure/immobilization method (P/I) is used in Australia for the field management of elapid snakebite (Sutherland and Coulter 1981; Sutherland et al. 1979). The entire extremity is wrapped firmly with an elastic bandage and immobilized using a splint. Activity of the victim is minimized as much as possible during evacuation (Edmondson 1979). The rationale is to confine the venom to the bite site and reduce systemic absorption until arrival at a medical facility. The extremity is unwrapped only after one or more intravenous lines are established, and antivenom and mechanical ventilation capability are at hand. If the patient shows signs of significant systemic venom absorption (paralysis, shock, or coagulopathy), treatment can be instituted without delay. Laboratory and clinical studies support the use of this method in bites by Australian elapid snakes (Fulde and Smith 1984; Murrell 1981; Pearn et al. 1981). The Monash Method of pressure pad/wrapping/splinting is considered similar to P/I in this discussion (Anker et al. 1982; Tun-Pe et al. 1995).

Recent studies in human subjects of simulated snake envenomation using a radio-active colloid (ersatz venom) were treated with immediate wrapping and splinting of upper or lower extremities (Howarth et al. 1994). These measures were effective for up to 145 min, but only with the subject at rest. Even with correct and effective wrapping and splinting, those who walked for 10–25 min showed systemic absorption. This was true even if the upper extremity was involved. However, no data or literature were cited to validate this model, e.g., comparison with labeled venom to see if transit rates are comparable (Walter 1995). Problems with application of P/I in the field and evaluation of its clinical effectiveness have been commented on by Currie (1993).

Advocating pressure/immobilization outside Australia.—Pressure/immobilization has been advocated for bites by Africa's venomous snakes, including viperines and cobras, whose venom can cause necrosis (Patterson 1987; Spawls and Branch 1995). However, Blaylock (1994) criticized P/I as ineffective when used for bites in southern Africa. Sutherland (1995) disagreed because evidence was anecdotal. Blaylock (1995) replied that when the times of onset and peak of illness with and without P/I were compared, P/I offered no obvious advantage.

Absorption of Indian cobra (*Naja naja*) venom was delayed by P/I in monkeys and its use as first aid in India was recommended by Sutherland et al. (1981). P/I has also been recommended for use in viperine bite in Italy (Torregiani et al. 1991).

Advocating pressure/immobilization for pitviper bite in the U.S.—Pressure/immobilization has been recommended for pitviper bite in the United States in publications (Anderson 1994; Grenard 1994, 1998; Rosenberg 1989; Sutherland and Coulter 1981) and on the Internet (Snakebite Emergency First-aid Information, May 1998: http://www.xmission.com/~gastown/herpmed/snbite.htm). Crotaline venoms can produce significant swelling and local necrosis; effects that might increase with the use of a compressive wrap (Currie 1993; Greenland and Hoffman 1982; Holstege et al. 1997; Russell 1982). Advocates argue the benefit of delaying severe systemic effects is worth any increase in local necrosis. Monkeys injected with *Crotalus adamanteus* venom and treated with P/I had significantly reduced systemic venom levels compared to controls (Sutherland and Coulter 1981). It has also been suggested that P/I could be of benefit by restricting necrosis to a limited area (Sutherland et al. 1981).

There are few laboratory studies in animals concerning P/I and pitviper venom. Use of P/I treatment in an envenomated rat tail model resulted in increased survival rates with elapid venoms, whereas local tissue damage was increased with viperid venoms (Straight and Glenn 1985).

Warrell (1993a,b; 1995a,b) has warned that advocacy of the use of P/I in bites by viperid and elapid snakes of Asia and Africa is premature. Similar admonitions for viperid bites have been issued by others as well (Holstege et al. 1997; Norris and Minton 1995; Sullivan et al. 1995). Alternately, if the bite is potentially life threatening, e.g., large or virulent snake, multiple bites, or a prolonged evacuation time, Minton and Norris (1995) suggest P/I might buy valuable time in a trade off with potential complications.

A prospective study of 23 patients envenomated by Russell's vipers (*Daboia russellii*) in Myanmar (Burma) and treated with rubber pad compression of the bite site and immobilization (Monash Method of Australia [Anker et al. 1982]) showed the

absorption of venom was retarded in 13 patients, and 15 showed increased venom antigen levels after release of the pad's pressure (Tun-Pe et al. 1995). There was no apparent increase in local venom effects. The authors suggested the possible increased incidence of local necrosis was less serious than potential fatal complications from systemic venom effects in the field.

Pressure/immobilization should not be recommended for pitviper bite.—Pressure/immobilization should not be recommended as first aid for pitviper bite in the United States for the following reasons:

1) Local necrosis may be increased by its use because of sequestration of venom at the bite site.

2) Correct application of P/I requires knowledge of the technique and the immediate availability of appropriate materials. As with constriction bands, improper wrapping with materials at hand, e.g., torn up clothing, is possible. The pressure generated is difficult to gauge, and if wrapped loosely, it will be ineffective and if tightly, it may become a tourniquet (Warrell 1995b). There appears to be confusion by some as to whether an elastic material should be used (crepe bandage in Australia, 'Ace' wrap and 'Coban' in the U.S.) or if it should be a non-elastic (gauze) material. The latter is clearly shown in one reference from South Africa (Patterson 1987), which is contrary to the original technique (Sutherland and Coulter 1981; Sutherland et al. 1979).

3) P/I may increase the likelihood that a compartment syndrome (elevated subfascial pressures which lead to irreversible damage of major nerves [Garfin et al. 1979; Mubarak and Hargins 1981]) might develop. Although this syndrome is an uncommon complication of envenomation, the additional pressure generated by P/I when added to already mild-to-moderately elevated compartment pressures associated with some envenomations may create a compartment syndrome with resultant tissue ischemia (Warrell 1995b).

4) If evacuation requires physical exertion, P/I may become ineffective (Howarth et al. 1994).

5) Pitviper venoms often produce the immediate onset of severe pain which could be aggravated by application of P/I, and has been observed to become intolerable (R. Dart, 1997, pers. comm.).

6) A snakebite victim who is alone may find P/I impossible to apply as recommended, especially if bitten on the dominant hand (Warrell 1995b, and pers. comm. 1998).

7) In some circumstances, implementation of P/I could unnecessarily delay transport to a medical facility.

Use of pressure/immobilization in the United States.—In the United States, P/I is indicated for bites by captive Australian elapids and for other exotic elapids whose venom is known not to produce local necrosis. It may not be appropriate for bites by *Naja mossambica* and *N. nigricollis*, African spitting cobras whose venoms produce local necrosis rather than skeletal muscle paralysis (Blaylock 1994; Warrell et al. 1976). As many Asian cobras, including *N. atra, N. kaouthia, N. naja*, and *Ophiophagus hannah,* also cause a significant incidence of local necrosis (Warrell 1995b), it may be difficult to know when this might be the determining factor in the use of P/I. However, most of these Asiatic species can also cause rapid death from respiratory paralysis, so retardation of venom absorption might have greater priority than worries about the extent of necrosis, unless one is near a medical facility. Because bites from captive snakes frequently occur at locations near medical facilities, P/I could be counter productive by delaying travel.

David Warrell (pers. comm. 1998) has suggested the following approach to this problem, "The practical issue is one of balancing risks of 1) early life threatening systemic envenoming against 2) exaggeration by P/I of severe local effects which could lead to permanent morbidity. In the case of black mamba bite the risk of 1) clearly outweighs the risk of 2) and P/I is recommended. In the case of African spitting cobra bites *(N. nigricollis, N. mossambica, N. pallida,* etc.) in which neurotoxicity has never been convincingly reported in human victims, 2) outweighs 1) and, I would consider that P/I is contraindicated. The Asian cobras produce mixed effects, varying from *N. philippinensis* which causes relatively little local envenoming but rapid severe neurotoxicity (P/I definitely recommended) to *N. siamensis* and *N. kaouthia,* where local necrosis is far more common than neurotoxicity."

Envenomation by eastern and Texas coral snakes (*Micrurus fulvius*) can cause delayed respiratory paralysis (Kitchens and Van Mierop 1987) without local necrosis, and P/I may be useful in this setting. It should be noted, however, that P/I has not been specifically studied for coral snake bites (Davidson and Eisner 1996).

Certain populations of at least 10 species of rattlesnakes have venom containing phospholipase A-2 (PLA2) and/or small basic peptide (SBP) toxins (Straight et al. 1991; Weinstein et al. 1985), and their distribution, even within subspecies, is highly variable on a regional basis. Whether P/I should be considered for their bites is debatable because identification of rattlesnakes in the wild with these highly toxic (PLA2/SBP) components is problematic. Mojave toxin is found in the venom of populations of the Mojave rattlesnake (*Crotalus s. scutulatus*) in the eastern and western parts of its distribution (Wilkinson et al. 1991). Venom from some populations of the timber rattlesnake (*C. horridus*) (= canebrake rattlesnake [*C. h. atricaudatus*]) contains canebrake toxin (Glenn et al. 1994, Straight et al. 1991) which may explain some severe bites in these areas by this species (Carroll et al. 1997). P/I may be useful on a case by case basis for individuals bitten while working with rattlesnakes having confirmed PLA2 venoms, although such an application has not been studied. However, the same arguments cited against use of P/I in pitviper envenomation apply to its use for these venoms.

Prospects for a resolution.—A prospective study of P/I in human victims of pitviper bite is unlikely due primarily to the inherent variability of injury and to a lesser extent the ethical issues involved. If P/I is used by victims of their own volition, the assembled data base from patients before and after unwrapping of the extremity at a medical facility could be meaningful. However, isolated reports of outcome are less likely to shed light on the problem.

First aid recommendation for venomous snakebite.—Prevalent first aid protocols suggested for pitviper bite in the U.S. (Gomez and Dart 1995; Hardy 1992; Holstege et al. 1997; Sullivan et al. 1995; Walter et al. 1998) have been modified to reflect the above discussion:

1) Go to medical facility without delay.
2) Remain calm.
3) Remove constrictive rings, jewelry, and clothing.
4) Use the *Extractor*™ if available and using it will not cause delay.

The following are not included: incisions, constriction bands, active splinting, local cooling, electroshock, or pressure/immobilization. Although the work of Leopold et al. (1957) supports the use of passive immobilization, we have omitted it because local effects were not addressed and there has been no clinical evaluation of this method.

For bites by captive Australian elapids, P/I should be applied if a medical facility is more than a few minutes away.

Summary.—Most field treatment for venomous snakebite ap-

pears to have minimal impact on outcome. Safe and expeditious transport to a medical facility is the most important component of any first aid protocol for venomous snakebite. Pressure/immobilization should not be a general recommendation for first aid in the United States since it may worsen the predominant injuries associated with most U.S. pitviper envenomation, and has not been shown to improve outcome or reduce mortality. Application of P/I has the potential to greatly increase pain associated with pitviper envenomaton. In addition, it may be improperly applied by lay persons and is difficult to apply by a lone victim. Circumstances may exist in which P/I may be beneficial in the U.S., such as exotic, non-necrotizing elapid envenomation. However, further study in terms of outcome is needed before P/I should be widely recommended to the general public as first aid for U.S. snake bites.

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Ontogenetic Effects on Prey Selection and Food Habits of Two Sympatric East Texas Ranids: the Southern Leopard Frog, *Rana sphenocephala*, and the Bronze Frog, *Rana clamitans clamitans*

J. M. FORSTNER
M. R. J. FORSTNER*
and
J. R. DIXON
Department of Wildlife and Fisheries
Texas A&M University, College Station, Texas 77843-2258, USA

** Current address and to whom all correspondence should be addressed:*
Florida Atlantic University, 2912 College Avenue
Davie, Florida 33314, USA
e-mail: forstner@fau.edu

Our study continues the documentation of amphibian feeding ecology through characterization of prey composition and temporal aspects of feeding for two frog species. The relationship between frog size and relative prey size and number are examined to provide a better understanding of fundamental feeding strategies. Anuran food habit studies are plentiful (Christian 1982; Donnelly 1991; Flowers and Graves 1995; Jenssen 1967; Kilby 1945; Kramek 1972; Labanick 1976; Stewart and Sandison 1972), but it is difficult to directly compare any of the studies because they vary greatly in taxonomic treatment, methodology, and geographic location. Nevertheless, some general conclusions can be drawn about anuran feeding behavior. Frogs are opportunistic feeders, choosing prey from any moving object that is of an appropriate size to be swallowed. Prey choice reflects both habitat and availability (Hedeen 1970; Jenssen and Klimstra 1966; Kramek 1972; Stewart and Sandison 1972) although some anurans may develop preferences (Sweetman 1944). Insects comprise the primary pool of prey items, and similar prey items are taken by similarly sized, sympatric species (Hedeen 1970). Studies have

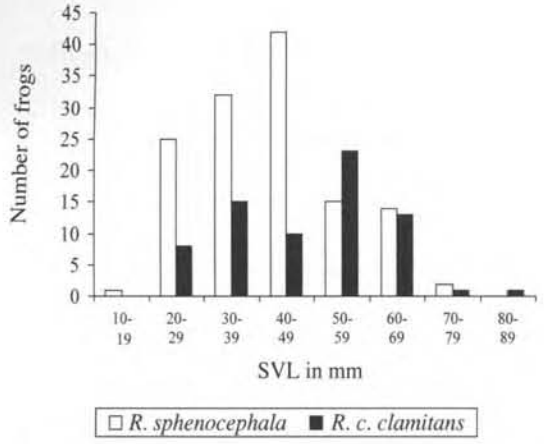


FIG. 1. Number of frogs per size class as defined by 10 mm increments of the SVL measurement.

investigated the existence of ontogenetic prey changes in anurans, testing the hypothesis that as a generalist predator grows, it will gradually switch from eating numerous, small prey items to eating fewer, larger prey items (Brooks 1964; Christian 1982; Donnelly 1991; Flowers and Graves 1995; Labanick 1976; Lima and Moreira 1993; Oplinger 1967).

The southern leopard frog, *Rana sphenocephala*, and the bronze frog, *Rana clamitans clamitans*, are similarly sized ranids found sympatrically in East Texas. The diets of these two frogs were categorized and the existence of ontogenetic prey change investigated by the correlation between the size of these frogs and the size of their prey. A second potential correlation between frog snout-vent length (SVL) and the number of prey items ingested was also tested.

Study Area.—The study site at the Forest Lake Wildlife and Forest Research Station is located four miles east of Spurger, Tyler County, Texas, USA. Owned and operated by the Temple-Inland Forest Products Corporation, it is adjacent to the Big Thicket National Preserve and consists of approximately 4050 ha of mixed pine and hardwood forests with 1620 ha of this land within the flood plain of the Neches River (Foley 1994). The area is characterized as a seasonally-flooded, bottomland-hardwood forest and is close to the western-most edge of distribution for both of these frogs (Dixon 1987).

Methods.—Frogs for this study were collected monthly from June 1995 to September 1995 coinciding with the peak emergence of recently metamorphosed frogs on site, as determined by Foley (1994). The frogs were collected from existing drift fence trap lines and manually from within the study site. Trap lines were opened 24 h prior to collection and frogs were placed into damp cloth bags for transport to the field station minimizing exposure to high temperatures and desiccation. Frogs awaiting processing were refrigerated at 14°C to slow digestion. SVL to the nearest mm was measured with vernier calipers and the weight of each frog recorded in grams using Pesola spring scales. Prey items were obtained by stomach-flushing based on the method of Legler and Sullivan (1979). We utilized a feline urinary catheter trimmed to an 8 cm length attached to a 5cc syringe. The frog's jaws were held open with a small piece of flexible 64 mm tubing for ease of handling and holding the oral cavity open. The disgorged prey items were frozen on site, then transferred to a 70% ethanol solution upon return to the laboratory. Frogs were placed in a cool, moist container and later released.

Recognizable prey items were identified to order (for insects) or to class (all other prey) using a dissecting microscope and available keys (Borror et al. 1981; Pennak 1978). Vegetation in the stomach contents was considered to be accidental "by-catch" (Hamilton 1948; Hedeen 1970; Jenssen and Klimstra 1966) and discarded. Prey items were measured using a plastic ruler to the nearest 0.5 mm. The volume of each measurable item was calculated using the formula for the volume of a cylinder ($\pi r^2 \times l$) because this shape most closely approximates that of the majority of prey items. A mean prey volume for each species, and for each size class of frog (defined as 10 mm increments in SVL) was calculated. Correlation between SVL and prey size was determined using a standard ANOVA. The SVL was also correlated with the number of prey items taken by each frog. All statistics were calculated by SPSS/PC+ version 4. 1 (1987).

Results.—Two hundred and two frogs were collected during the course of this study. Sampling success was fairly constant throughout June, July, and August (65, 52, and 73 respectively), but dropped sharply in September (12 individuals). The low number taken in September was caused by the onset of a drought which lasted 19 months. The number of frogs per size class is shown in Figure 1. Of the total number of frogs, 131 were *R. sphenocephala* ranging from 19 to 72 mm SVL and from 0. 7 to 40 g. Ninety-three of the 131 *R. sphenocephala* (71%) contained prey items with a mean of 2.1 items per frog (SE = 1.8, N = 194). Prey volumes ranged from 0.3925 to 1256 mm^3 with a mean of 70.78 mm^3 (SE = 171.6). *Rana sphenocephala* had a very high positive correlation between SVL and prey volume (F = 13.18; df = 1,134; P = 0.0004). The number of prey items ranged from 1–9 and was not significant when compared to SVL (F = 1.496; df = 1,87; P = 0.22).

TABLE 1. Percentage of prey item by taxonomic category for *R. sphenocephala* (R. s.) and *R. c. clamitans* (R. c. c.) and percentage of stomachs in which each prey category was found.

	% of Total Diet		% of Stomachs	
Prey Category	R. s.	R. c. c.	R. s.	R. c. c.
Araneae	20.5	14.78	0.27	0.32
Bivalvia	0.0	1.34	0.00	0.02
Chilopoda	2.7	2.68	0.06	0.07
Coleoptera	32.8	16.78	0.54	0.33
Dermaptera	0.5	1.34	0.01	0.03
Diplopoda	0.5	13.42	0.01	0.12
Diptera	1.1	2.68	0.02	0.05
Ephemeroptera	1.6	1.34	0.02	0.03
Gastropoda	9.2	15.44	0.15	0.18
Hemiptera	7.5	2.01	0.12	0.03
Hymenoptera	7.1	10.74	0.10	0.15
Lepidoptera	5.9	10.07	0.11	0.13
Neuroptera	0.5	1.34	0.02	0.02
Odonata	0.5	1.34	0.01	0.03
Orthoptera	8.6	3.36	0.20	0.08
Solofugae	0.5	0.00	0.01	0.00
Trichoptera	0.5	1.34	0.01	0.03
Sample size	152	136	93	60

The remaining seventy-one frogs were *R. c. clamitans* ranging in SVL from 24 to 82 mm and from 2.1 to 56 g. Sixty of the 71 frogs (84.5%) contained prey items with the mean number of items

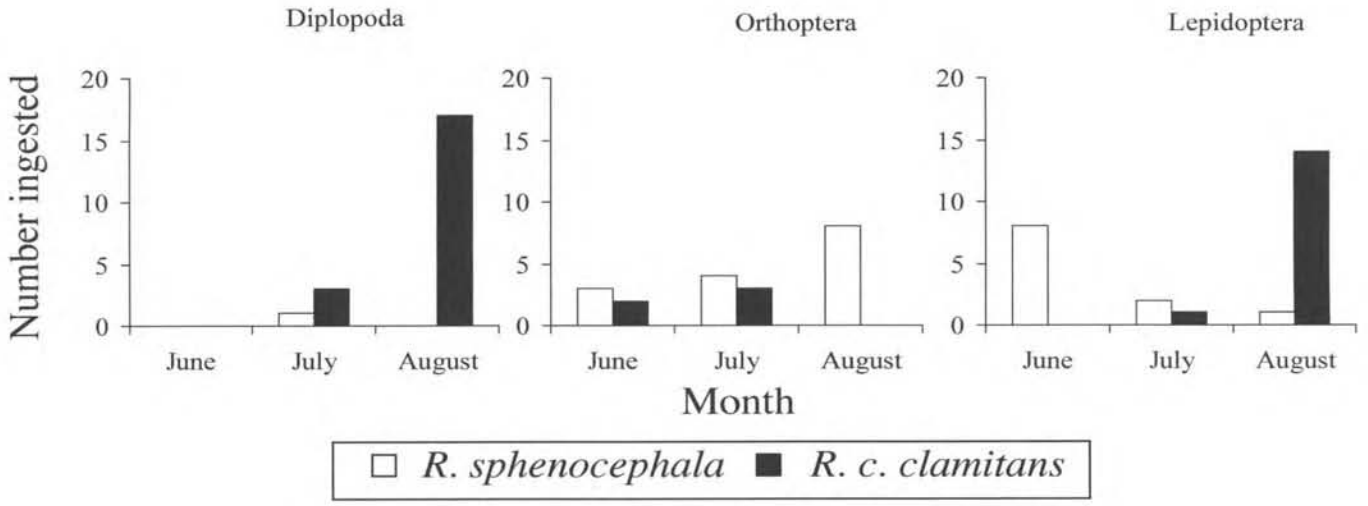


FIG. 2. Temporal variation in capture of Diplopoda, Orthoptera, and Lepidoptera by East Texas *Rana sphenocephala* and *R. c. clamitans* during June, July, and August 1995.

per frog equal to 2.5 (SE = 1.8, N = 152). Prey volumes in *R. c. clamitans* ranged from 0.19625 to 1962.5 mm^3 with a mean volume of 89.80 mm^3 (SE = 259.7). The largest size class of *R. c. clamitans* was represented by a single frog. The SVLs of the *R. c. clamitans* were positively correlated with prey volume (F = 4.7676; df = 1,144; P = 0. 03) while the number of prey items ingested, which ranged from 1–8, was not significant when compared to SVL (F = 0.7539; df = 1,57; P = 0.39).

Table 1 shows the percentage each prey category represents of the total diet and the percentage of stomachs in which each prey category was found for each species. The diets had a 60. 3% overlap; 202 items were the same out of a total of 335 recognizable prey items. Prey choices among both species consisted of six classes of invertebrates: Arachnida, Diplopoda, Chilopoda, Hexapoda, Gastropoda, and Pelecypoda. The class Hexapoda, which made up the majority of the prey, is represented by twelve orders. The most common prey items of both species were the orders Coleoptera, Araneae, and Gastropoda.

Discussion.—Several differences between prey choices are apparent when comparing the two frog species. Millipedes (Diplopoda) provide the strongest example; of the 21 millipedes eaten, 20 were taken by *R. c. clamitans*. The single specimen ingested by a *R. sphenocephala* was taken in June, while of the 20 taken by *R. c. clamitans*, 3 were ingested in July and the remaining 17 in August (Fig. 2). Of the 21 grasshoppers (Orthoptera) ingested, five were eaten by *R. c. clamitans* during June and July, while *R. sphenocephala* ate 16 over the course of the study (Fig. 2). Both of these orders provide examples of how microhabitat differences between these two species could be affecting dietary choices. *Rana sphenocephala*, like most orthopterans, is found in grassy, meadow-like areas while *R. c. clamitans* is found in moister, forested habitats corresponding to its higher rate of diplopodan ingestion. Lepidopterans, though commonly observed within the study site, appear to be more readily available in August (15 ingested) as compared to June (eight ingested) and July (three ingested) (Fig. 2).

As a final note on contents, none of the frogs in this study was found to have ingested their shed skins; the existence and importance of ingesting dead skin is debated in the general literature on anuran food habits. Nor were any vertebrates or crustaceans ingested as shown in other studies; however, this may be an artifact of sample size since both of these prey items were readily observed in the study environment.

Hamilton (1948) makes the important point that the "circumstances, season, and whims of the collector determine in large measure the recorded data of the food habits of vertebrates." This appears to be true as direct comparisons with previous studies were difficult, if not impossible. Results are reported in a variety of ways including the percentage each prey category represents of the total stomach volumes, and by the frequency each is found. The prey items are categorized by order, by family, by species, by life stage, or by habitat (terrestrial versus aquatic). We compared our results for *R. sphenocephala* to Kilby (1945). There were no directly comparable studies of *R. c. clamitans* so our results were compared to a study of *R. c. melanota* (the northern subspecies) by Jenssen and Klimstra (1966). The studies represent the distant points of the known ranges of these frogs and comparisons further support the notion of frogs as generalists. *Rana sphenocephala* had a 56% overlap in prey categories while *R. clamitans* overlapped by only 41.7%, suggesting the frogs are eating whatever prey items are available in their specific habitats rather than selecting specific quarry.

The results from our investigation support the hypothesis that larger individuals eat larger prey; however, the hypothesis that the number of prey items decreases as frog size increases was not supported. The patterns of temporal change detected in the prey base and comparisons with earlier studies further strengthens the paradigm of frogs as opportunistic feeders.

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Epibionts Associated with Nesting Loggerhead Sea Turtles (*Caretta caretta*) in Georgia, USA

MICHAEL G. FRICK
Caretta Research Project, PO Box 661, Tybee Island, Georgia 31328, USA
e-mail: Caretta05@aol.com

KRISTINA L. WILLIAMS
Caretta Research Project, 4405 Paulsen Street, Savannah, Georgia 31405, USA

and

MICHAEL ROBINSON
P.O. Box 21078, St. Simons Island, Georgia 31522, USA

Loggerhead sea turtles (*Caretta caretta*) are platforms for the colonization of various species of marine flora and fauna (Ernst et al. 1994). Unfortunately, much of the data on commensals and parasites associated with loggerheads is based on small sample sizes, dead turtles, and extremely broad areas of sampling (Dodd 1988). Not until Caine's (1986) research were any data available regarding loggerhead epibionts based on a large sample size of live turtles (N = 138) within the southeastern United States. Caine's (1986) study was conducted only in South Carolina and Florida, leaving a large gap for information on epibionts from *Caretta* along the Georgia coast. To our knowledge, there are only four studies which report epibionts from *Caretta* (Frazier et al. 1985, 1991, 1992; Sawyer et al. 1975). Furthermore, research conducted in Georgia can only include turtles from Camden County (Frazier et al. 1985, 1991, 1992), because Sawyer (1975) did not specify the localities from where his samples were taken.

We initiated a study to provide a comprehensive survey of the epibionts associated with nesting loggerheads in Georgia.We documented a total of 86 epibiotic species (Table 1), 76 of which had never been seen from *Caretta* in Georgia and 52 of which were unknown from loggerheads within the United States. Here, we report our data on loggerhead epibionts from five major nesting beaches in Georgia.

Our study sites were located on Blackbeard Island in McIntosh Co. (31°28.4'N, 81°13.1'W); Jekyll Island, Glynn Co. (31°03.9'N, 81°24.9'W); Little Cumberland Island, Camden Co. (30°57.2'N, 81°25.5'W); Little St. Simons Island, Glynn Co. (31°15.4'N, 81°17.2'W); and Wassaw Island, Chatham Co. (31°53.4'N, 80°58.4'W). All samples were collected during the 1997 nesting season from May to August. No samples were included from dead turtles because epibiont attachment may have occurred post-mortem and may not reflect the true nature of the observed relationship.

Sampling was conducted while the turtle was nesting or covering the nest site. All visible areas of the turtle were examined and sampled where epibiota were most prevalent. Standardization of collection sites on turtles was considered but not adopted as suggested by Caine (1986). Epibionts were collected by using a small putty knife and/or pair of forceps. Once collected, samples were placed in containers of 10% formalin or 70% isopropyl alcohol. Containers were marked with a number previously

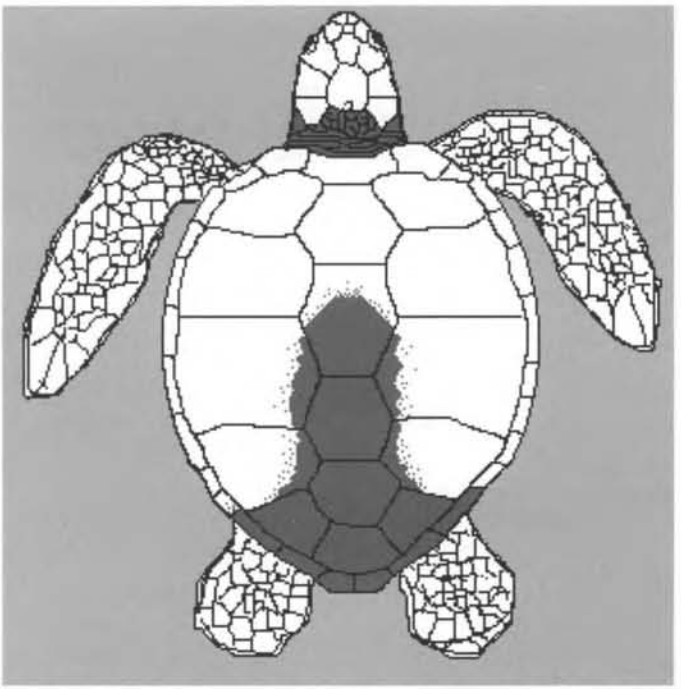


FIG. 1. Prevalent epibiont sites on nesting *Caretta caretta* in Georgia, USA. Shaded neck region represents attachment site for marine leeches, *Ozobranchus margoi*.

TABLE 1. Epibionts collected from *Caretta caretta* in Georgia, USA. Data are the number of turtles upon which the epibiont was found with the percent occurrence in parentheses; sample size (N) = 65 turtles. B = Blackbeard Island, J = Jekyll Island, LC = Little Cumberland Island, LS = Little St. Simons Island, W = Wassaw Island, and A = all localities surveyed.

Species	Common Name	Locality	Percentage
Porifera			
Cliona celata	boring sponge	W, LC, J	31 (47.7%)
Haliclona loosanoffi	eroded sponge	W, J	4 (6.2%)
Microciona prolifera	red beard sponge	J, LC	7 (10.8%)
Mycale americana	flabby sponge	W, LC, J	8 (12.3%)
Cnidaria			
Hydrozoa			
Halocordyle disticha	feather hydroid	W	9 (13.8%)
Hydractinia echinata	snail fur	A	65 (100%)
Obelia dichotoma	brown hydroid	J, LC	19 (29.2%)
Tubularia crocea	wildflower hydroid	A	13 (20%)
Anthozoa			
Aiptasia pallida	brown anemone	LC, W	2 (3.1%)
Anemonia sargassiensis	sargassum anemone	W, J, LC	5 (7.7%)
Bunodosoma cavernata	warty anemone	J	1 (1.5%)
Calliactus tricolor	hermit crab anemone	W, LC	17 (26.1%)
Halliplanella luciae	orange-striped anemone	J, LC	2 (3.1%)
Leptogorgia virgulata	sea whip	W	3 (4.6%)
Mollusca			
Gastropoda			
Chaetopleura apiculata	eastern beaded chiton	W	1 (1.5%)
Cratena pilata	ivory sea slug	A	6 (9.2%)
Crepidula fornicata	Atlantic slipper snail	W, LC	27 (41.5%)
Crepidula plana	white slipper snail	W, J	19 (29.2%)
Diadora cayenensis	cayenne keyhole limpet	J	2 (3.1%)
Doriopsilla pharpa	lemon drop sea slug	W, LC, J	7 (10.8%)
Doris verrucosa	sponge sea slug	W, J, LC	3 (4.6%)
Ischnochiton striolatus	false beaded chiton	LC	1 (1.5%)
Miesea evelina	translucent sea slug	J, LC	2 (3.1%)
Bivalvia			
Anadara ovalis	blood ark	W	12 (18.5%)
Anomia simplex	common jingle	J, LC	14 (22%)
Brachidontes exustus	scorched mussel	W	5 (7.7%)
Chione grus	grey pygmy venus	A	5 (7.7%)
Musculus lateralis	zig-zag mussel	A	10 (15.4%)
Ostrea equestris	horse oyster	J	13 (20%)
Rupellaria typica	Atlantic rock borer	W, LC	2 (3.1%)
Sphenia antillensis	soft shelled clam	LC	2 (3.1%)
Platyhelminthes			
Trematoda			
Oligaclado floridanus	variable flatworm	W	1 (1.5%)
Turbellaria			
Bdelloura candida	white flat worm	W, LC	4 (6.2%)
Annelida			
Hirudinea			
Ozobranchus margoi	marine turtle leech	W, J, LC	58 (89.2%)
Polychaeta			
Dorvillea sociabilis	millipede worm	A	12 (18.5%)
Filograna vulgaris	lacy feather worm	W	1 (1.5%)
Nereis falsa	false polychaete	J	3 (4.6%)
Podarke obscura	swift-footed worm	W, J	5 (7.7%)
Procerea fasciata	red, white and blue worm	W	1 (1.5%)
Sabellaria floridensis	Florida mason worm	W	2 (3.1%)
Sabellaria vulgaris	mason worm	LC	3 (4.6%)
Serpula vermicularis	fan worm	LC	7 (10.8%)

Syllis spongicola	sponge worm	W, J	2 (3.1%)
Arthropoda			
Crustacea			
Decapoda			
Lysmata wurdemanni	peppermint shrimp	W	9 (13.8%)
Cirripedia			
Family Lepadidae			
Lepas anatifera	large goose barnacle	W, J	2 (3.1%)
Lepas pectinata	small goose barnacle	W	1 (1.5%)
Family Balanidae			
Balanus amphitrite	acorn barnacle	A	65 (100%)
Balanus eburneus	ivory barnacle	W, J, B	13 (20%)
Family Corunulidae			
Chelonibia testudinaria	turtle barnacle	A	65 (100%)
Chelonibia caretta	turtle barnacle	A	65 (100%)
Chthamalus fragilis	fragile barnacle	A	42 (64.6%)
Chthamalus stellatus	star barnacle	W, J, LC	21 (32.3%)
Tanaidea			
Zeuxo robustus	robust tanaid	J, LC	6 (9.2%)
Amphipoda			
Ampithoe ramondi	Raymond's amphipod	W, J	2 (3.1%)
Caprella andreae	skeleton shrimp	A	65 (100%)
Caprella equilibria	skeleton shrimp	A	44 (67.7%)
Caprella penantis	skeleton shrimp	W, J, B	19 (29.2%)
Dulichiella appendiculata	bigclaw amphipod	W, J	24 (36.9%)
Elasmopus rapax	no common name	LC	3 (4.6%)
Erichthonius braziliensis	no common name	J	1 (1.5%)
Paracaprella tenuis	skeleton shrimp	W	6 (9.2%)
Podocerus cheloniae	no common name	J, LC	17 (26.2%)
Stenothoe minuta	no common name	J	3 (4.6%)
Isopoda			
Sphaeroma quadridentatum	marine roly-poly	W, J	31 (47.7%)
Cancrion carolinus	entonioscid isopod	W	4 (6.2%)
Brachyura			
Neopanope sayi	mud crab	J, LC	7 (10.8%)
Panopeus herbstii	Atlantic mud crab	W	8 (12.3%)
Planes minuta	gulf-weed crab	W	2 (3.1%)
Bryozoa			
Amathia distans	bushy bryozoan	LC, J	31 (47.7%)
Anguinella palmata	bushy bryozoan	W, LC	29 (44.7%)
Bugula neritina	bushy bryozoan	A	60 (92.3%)
Membranipora tenuis	white crust bryozoan	A	65 (100%)
Chordata			
Urochordata			
Aplidium constellatum	constellation tunicate	W, J	2 (3.1%)
Didemnum duplicatum	paintbrush tunicate	W	7 (10.8%)
Eudistoma carolinese	sandy lobed tunicate	A	42 (64.6%)
Molgula manhattensis	sea grape	W	5 (7.7%)
Perophora viridis	honeysuckle tunicate	W	1 (1.5%)
Algae			
Calothrix sp.	blue-green algae	W	19 (29.2%)
Ceramium sp.	red algae	LC, LS	2 (3.1%)
Cladophora sp.	green algae	W, LC, J	31 (47.7%)
Ectocarpus sp.	brown algae	A	60 (92.3%)
Enteromorpha sp.	green algae	W, J, LC	42 (64.6%)
Noctiluca sp.	dinoflagellate (fire water)	A	65 (100%)
Polysiphonia sp.	red algae	W, J	13 (20%)
unidentified green algae	single celled algae	A	65 (100%)
unidentified diatoms	diatoms	A	65 (100%)

assigned to data sheets which corresponded to each sampling attempt. Samples were only taken from tagged turtles and no turtle was sampled twice. Epibionts were sorted from the samples, counted, and identified.

Other data recorded at the time of sampling included turtle length and width, tag numbers, date, time, county, locations on the turtle where epibiota were most prevalent, and the locations on the turtle where epibionts were collected. Data sheets and samples were compiled in August and September 1997 and recorded into the Caretta Research Project/Wassaw National Wildlife Refuge database at the Savannah Science Museum.

The sites where epibionts were most prevalent corresponded to the posterior one-third of the carapace (Fig. 1). Marine turtle leeches (*Ozobranchus margoi*), however, were more common in the axial region of the turtles (Fig. 1). Also, while leeches preferred the aforementioned area, several turtles (N = 7, Wassaw Island) contained excessive loads of *O. margoi* within their ovipositors. Such obstructions of leeches were ultimately detached during egg deposition.

The relationship between marine turtles and their epibionts remains a poorly studied aspect of sea turtle natural history (Dodd 1988). The occurrence of particular epibiont species may ultimately help to clarify certain questions about sea turtle movements, habitat preference, juvenile and subadult activities, and many other aspects of their life history away from the nesting beaches (Caine 1986).

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The Distribution of Red-Spotted and Central Newts In Michigan

JAMES C. BALL
1083 Jewell Road, Milan, Michigan 48160, USA
e-mail: jball@ford.com

Newts have been found in many counties of Michigan since the turn of this century (Clark 1902; Ellis 1917; Evans 1915; Gaige 1915; Gibbs et al. 1905; Ruthven 1905, 1911a, 1911b; Ruthven et al. 1912; Thompson and Thompson 1912). Currently, there are four recognized subspecies of *Notophthalmus viridescens* (Collins 1997), two of which are found in Michigan (Conant and Collins 1991); the red-spotted newt (*N. v. viridescens*) and the central newt (*N. v. louisianensis*). The red-spotted newts were first described by Rafinesque (1820) followed by the description of the central newt by Wolterstorff (1914). Central newts are distinguished from red-spotted newts by their slightly smaller size, subtle differences in dorsal coloration, and the lack of black-bordered red spots (if any red spots are present they lack black borders or are incompletely bordered by black). Ruthven et al. (1928) published the first range map of the red-spotted newt in Michigan but did not distinguish between the two subspecies. To the best of my knowledge, the first range map of these two subspecies in Michigan was published by Bishop (1943). Bishop's map shows the central newt in approximately the western three-fourths of the state including the western portion of the Upper Peninsula while the red-spotted newt is found in the remaining eastern quarter of the Lower and Upper Peninsula of Michigan. In addition, Bishop's range map shows an area of intergradation between these two subspecies about one to two counties wide. Conant (1958) developed a range map that separated these two subspecies south of Saginaw Bay, but did not extend the line dividing them north of Saginaw Bay. The source of information for this map was based on museum collections and discussions with Charles F. Walker and other Michigan herpetologists (R. Conant, pers. comm.). Subsequent field guides have retained a range map very similar to that adopted by Conant in his 1958 field guide (Fig. 1; Conant and Collins 1991; Harding and Holman 1992). Recently, Harding (1997) described the red-spotted newt as residing in the drainage basin of Lake Erie and the central newt inhabiting the drainage basins of Lake Michigan and Lake Superior. Harding (1997) did not separate the subspecies in his range map for *Notophthalmus viridescens* but indicated that these two subspecies showed "a broad zone of intergradation across Michigan's Lower Peninsula and into Indiana: specimens from this area can display coloration intermediate between the two subspecies."

TABLE 1. Scores for spots and the degree of bordering by black pigment in central and red-spotted newts. See text for scoring protocol.

Location	N	Mean Spot Score ± 1 S.E.	Range	95% Confidence Interval of the Mean
Northwest Michigan	260	19.1 ± 1.0	1–77	17.2–21.1
Southeast Michigan	59	22.3 ± 2.1	1–61	18.2–26.4
Central Newts	36	8.7 ± 2.2	1–39	4.2–13.2
Red-spotted Newts	60	46.9 ± 2.7	11–120	41.5–52.2

In the Winter/Spring of 1997 I surveyed a breeding salamander population from vernal pools in a small (20 ha), isolated wooded area southeast of Ann Arbor, Michigan, and found newts with considerable variation in the number of red spots and the degree to which these spots were bordered in black. In fact, newts with no red spots and individuals with numerous black-bordered red spots were found in the same funnel trap. The newts in this population obviously are intergrades between the red-spotted newt and the central newt while the field guides at the time of this survey (Conant and Collins 1991; Harding and Holman 1992) indicated that these newts should have been primarily red-spotted newts. This led me to question the accuracy of range maps showing the distribution of these newts in Michigan. I examined museum specimens from the University of Michigan Museum of Zoology (UMMZ) and from the Michigan State University Museum (MSU); these two collections contain specimens from 55 of the 83 Michigan counties. A large number of newts from Livingston and Washtenaw counties are present in the UMMZ collection: inclusion of all the newts from these counties might seriously bias the analysis of the distribution of these newts in Michigan. Therefore, no more than 25 newts, randomly selected, from any county were used in this study. Adults and efts were examined from each county; larvae with gill structures present were not examined. Specimens were examined under a dissecting microscope and scored for the number of spots and the degree to which these spots were bordered by black pigment. A value of one was assigned to a newt that did not have any spots (a typical central newt). A numerical value was assigned to the following spot morphologies: a value of two was given to a spot with no black-borders, three was assigned to a spot with partial black-borders, and four was given to a spot with a complete black-border. Hence, a specimen with 20 complete black-bordered red spots (red-spotted newt) would be assigned a value of 80. In addition to the Michigan samples, newts from typical red-spotted newt localities (primarily Massachusetts and West Virginia; N = 60) and central newt localities (primarily Mississippi and Eastern Texas; N = 36) were also examined as control populations. Newts preserved in ethyl alcohol have lost their red pigmentation, but the spot area is much lighter than the surrounding integument and is easily discernible under a dissecting microscope. These data were analyzed using a one-way ANOVA with location as the factor and spot score as the variable (equal variance; Levene test; P = 0.1) and a Bonferroni post hoc test for multiple comparisons. Data were also analyzed using non-parametric methods and similar degrees of significance were found (statistics not shown). Data were analyzed using SPSS 7.5.2 statistical software.



FIG. 1. Distribution of central newts (A; *Notophthalmus viridescens louisianensis*) and red-spotted newts (B; *Notophthalmus viridescens viridescens*) in Michigan according to Conant and Collins (1991) and Harding and Holman (1992). Counties with open circles were included in this study.

TABLE 2. A Bonferroni post hoc pairwise comparison of the mean spot scores from different geographic locations. The mean differences between locations are presented to facilitate comparisons. Central newt specimens were from Mississippi and Texas; red-spotted newt specimens were from Massachusetts, West Virginia, New York, and Pennsylvania.

Location 1	Location 2	Mean Difference ± 1 S.E.	P-value
Northwest Michigan	Southeast Michigan	-3.2 ± 2.4	>0.99
Northwest Michigan	Central Newts	10.4 ± 2.9	0.003
Northwest Michigan	Red-spotted Newts	-27.8 ± 2.4	<0.001
Southeast Michigan	Central Newts	13.6 ± 3.5	0.001
Southeast Michigan	Red-spotted Newts	-24.6 ± 3.0	<0.001
Central Newts	Red-spotted Newts	-38.2 ± 3.5	<0.001

Geographical differences in spot scores of newts are shown in Table 1. A one-way ANOVA showed that there were significant differences in spot scores between locations ($F_{(3, 411)} = 55.5$; $P < 0.001$). A Bonferroni post hoc test for multiple comparisons of observed means is shown in Table 2. Two different Michigan populations were analyzed: newts from the west and northwest part of Michigan and the southeast section of the state (Fig. 1). There was no significant difference in spot scores from the southeast corner of Michigan (mean = 22.3; Table 2) compared to the newts from the west and northwest of Michigan (mean = 19.1). The northwest Michigan newts (mean = 19.1) scored significantly greater values than the central newts (mean = 8.7) and significantly smaller values than the red-spotted newts (mean = 46.9). Likewise, the southeastern Michigan newts (mean = 22.3) scored significantly greater values compared to central newts (mean = 8.7) and significantly smaller values than the red-spotted newts (mean = 46.9). As expected, central newts (mean = 8.7) scored significantly lower values than red-spotted newts (mean = 46.9). Because the mean spot scores for the Michigan newts were not significantly different from each area, the data from both regions were combined and the mean for the entire Michigan population was determined. The mean spot score for Michigan newts (mean = 19.7 ± 0.9) is closer to the score for central newts than it is for red-spotted newts (midpoint between red-spotted and central newt = 28). This suggests that Michigan newts are more similar to central newts than red-spotted newts.

These results suggest that all newts from Michigan are intergrades between these two subspecies and that the area of intergradation between these subspecies is likely to be on the order of states not counties. Minton (1972) came to a similar conclusion suggesting that "much of Indiana is a zone of intergradation" between these two subspecies. I recommend, therefore, that future range maps for these two subspecies of *Notophthalmus viridescens* show a wide range of intergradation that encompasses at least Michigan and possibly Indiana.

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A Bite from the Rear-Fanged Colubrid *Psammophis phillipsii*

PHIL SENTER*
Department of Biology, Box 97388, Baylor University
Waco, Texas 76798-7388, USA

**Present address: 473 Ruff Crossing, McGregor, Texas 76657, USA*

Although bites from most species of rear-fanged colubrid snakes are harmless to humans, the venom of a few species can be dangerously toxic. Bites from the rear-fanged colubrid genera *Dispholidus* and *Thelotornis* can be fatal (Broadley 1957), and bites from species of *Boiga* may cause severe symptoms (Fritts et al. 1994).

Significant symptoms have also been reported from bites of some species of *Psammophis*. Broadley (1959) reports that a bite from a large *P. sibilans sibilans* caused local swelling, which was gone in 48 h. Fitzsimons (1970) reports that a *P. s. sibilans* bite may cause "excruciating pain, swelling, nausea, cold sweats etc. for some days after a bite." Broadley (1983) reports that a *P. phillipsii* bite may cause "local pain, swelling, inflammation and nausea, which passes off within about 48 hours."

The taxonomic status of the aforementioned species and subspecies of *Psammophis* was revised by Broadley (1977). Unfortunately, as Spawls and Branch (1995) note, this opens to question the identity of each individual snake whose bite contributed to the published descriptions of bites from *Psammophis*. Broadley does not cite case histories in his 1983 publication, and the reader is not told whether the individual *Psammophis* whose bites contributed to the description therein, were identified before or after Broadley's (1977) revision of the genus. If researchers are to know which symptoms to expect from particular species of *Psammophis*, then new case histories need to be collected, and the snakes involved need to be identified per Broadley's (1977) revision.

On 7 January 1989, I sustained a bite from a 114 cm *Psammophis* that had been collected in Monrovia, Liberia. The snake was identified as *P. phillipsii* using Hallowell's (1844) original description of the species, Villiers (1950; as *P. sibilians phillipsii*), Hughes and Barry (1969), and Broadley (1977).

The snake bit the tip of my right index finger and chewed for 60 s before releasing its bite. I then lay down and propped up my right hand with pillows. By 5 min 30 s after the snake ceased to chew, the site of the bite exhibited swelling, a slight purple color, and a burning, stinging throb. An ice cube was applied to the proximal half of the finger 7 min 15 s after the snake released its bite. By 14 min after the bite, the entire finger was red, swollen, and difficult to bend. At 35 min post-bite, the ice was removed; burning persisted at the bite site. One hour and 30 min after the bite, the finger was still swollen, and pain persisted at the bite site. Nine hours after the bite, the finger had almost returned to normal size (it had been half again its usual diameter at the height of the swelling). Twenty-one hours after the bite, the finger had regained its usual size and color, but retained stiffness and soreness at the bite site and at the joints. No symptoms persisted after 48 h. The bite caused neither nausea nor cold sweats.

On 20 June 1986, I caught a 41 cm *P. phillipsii* in Yekepa, Nimba County, Liberia. The snake bit my fingers and chewed, presumably to facilitate venom injection. No noticeable symptoms resulted. However, the snake regurgitated a skink soon thereafter; it is possible that the snake had spent most or all of its venom on the skink, and had little or none left with which to envenomate me.

Acknowledgments.—I thank John Anderson for pointing out the large *P. phillipsii* to me at the American Cooperative School in Monrovia. Jayne Cawthon transported it home for me. I thank Len Laughridge for tape-recording and timing my comments on the progress of the symptoms, for providing the ice, and for the use of his dorm room during the recording of the symptoms.

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Prolonged Oviductal Egg Retention Arrests Embryonic Growth at Stage 34 in Captive *Calotes versicolor*

RAJKUMAR S. RADDER
BHAGYASHRI A. SHANBHAG*
and
SRINIVAS K. SAIDAPUR
Department of Zoology, Karnatak University, Dharwad 580 003 India

** Author to whom correspondence should be directed*

The retention of eggs in the oviduct in oviparous lizards is well documented (DeMarco 1993; Shine and Guillette 1988). During the period of egg retention, embryos continue to develop up to certain stages (modal embryo at oviposition is stage 30; N = 38 species) depending on the species (DeMarco 1993). When gravid lizards do not oviposit in captivity, they die because of stress and/or death of the embryos *in utero* (Doughty 1996; Muthukkaruppan et al. 1970). *Calotes versicolor* is a multiclutched, agamid lizard known to breed from May–October in Dharwad, India (Shanbhag and Prasad 1993a). Oviposition and hatching occurred at stages 27 and 42, respectively (staging scale according to Dufaure and Hubert 1961), in captive *C. versicolor* and the interval between successive stages was 2–4 days (Muthukkaruppan et al. 1970). Unreported was the number of days taken for oviposition in captive gravid females.

A previous study of captive *C. versicolor* has shown that following induction of ovulation using pregnant mare serum gonadotropin (PMSG), fertilization of eggs and normal development of the embryos occur in the absence of males, thereby suggesting utilization of sperm stored in the oviduct (Shanbhag and Prasad 1993b). Upon termination of the experiment after 15 days, examination of the eggs revealed embryos at stages 27–28, the stages at which oviposition is known to occur. The findings suggest that oviductal egg retention time in *C. versicolor* is about two weeks (Shanbhag and Prasad 1993b).

In our laboratory, we have undertaken reproductive studies of captive *C. versicolor*. We maintained 11 gravid females (SVL 9.2–11 cm; body mass 33–49 g) collected from areas around Dharwad, Karnataka, India (15°17'N 75°3'E) during May, the early part of the breeding season. The presence of oviductal eggs was confirmed by palpation of the abdomen. The lizards were kept in wire mesh cages (90 x 120 x 120 cm). Each cage had a sand bed of about 9 cm, a water dish, and a few bricks and dry sticks for shelter. Live cockroaches or grasshoppers were provided *ad libitum* on alternate days. Every morning the cage bed was inspected for oviposited eggs.

None of the 11 wild-collected gravid females laid eggs during the two weeks following their capture. Four of these were necropsied to assess the embryonic development of the oviductal eggs. Of these, one had eggs with embryos at stage 27, others had embryos of stages 28, 31, and 32, respectively. These observations suggest that each individual among these four lizards had ovulated at different times and therefore had embryos at different stages of development. The remaining seven lizards were autopsied after 32 (two lizards), 42 (three lizards), 52, and 78 (one each) days in captivity. All seven lizards had eggs with healthy embryos at stage 34. The adult females were healthy and active and displayed no signs of ill health. Three lizards even showed the preparation of a second clutch of eggs as evidenced by the presence of vitellogenic follicles in the ovary.

In *C. versicolor*, hatching occurs between 65–71 days when the eggs containing embryos with stage 27 are removed from oviducts and incubated at ambient temperature. It takes about 4–6 days for all the eggs in a clutch to hatch (unpubl. observations). The present study shows that captive *C. versicolor* can retain oviductal eggs for well over two months (78 days), a period approximating the time required for total embryonic development (oviductal egg retention period + duration of incubation before hatching), i.e. 80 ± 5 days. However, the development of embryos in retained eggs is arrested at stage 34. Previous studies have reported death of captive lizards that were unable to oviposit and in such cases the embryos were found in advanced, though unspecified, stages of development (Doughty 1996; Muthukkaruppan et al. 1970).

Egg retention in turtles is believed to be an adaptation that facilitates delayed nesting/oviposition when unfavorable environmental conditions prevail or when suitable nest sites are not available (Ewert 1985; see also Plotkin et al. 1997). The arrest of embryonic development at stage 34 in captive *C. versicolor* may be a strategy to overcome the increasing demands of the growing embryos on one hand and avoid possible mortality of the female holding oviductal eggs for long periods possibly due to the lack of suitable nesting sites.

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TECHNIQUES

Blood Sampling Techniques for Hatchling Cheloniid Sea Turtles

THANE WIBBELS*
Department of Biology, University of Alabama at Birmingham
1300 University Boulevard, Birmingham, Alabama 35294-1170, USA
e-mail: biof009@uabdpo.dpo.uab.edu

JOANNE HANSON
Department of Biology, University of Alabama at Birmingham
1300 University Boulevard, Birmingham, Alabama 35294-1170, USA

GEORGE BALAZS
National Marine Fisheries Service, Southwest Fisheries Science Center
Honolulu Laboratory, 2570 Dole Street
Honolulu, Hawaii 96822-2396, USA

ZANDY-MARIE HILLIS-STARR
National Park Service, Buck Island Reef National Monument
Christiansted, St. Croix, U.S. Virgin Islands 00820-4611, USA

and

BRENDALEE PHILLIPS
U.S. Geological Survey, Biological Resource Division
Buck Island Reef National Monument
Christiansted, St. Croix, U.S. Virgin Islands 00820-4611, USA

**To whom correspondence should be directed*

A variety of physiological and genetic studies has shown the utility of blood samples in sea turtle research (e.g., Bickam et al. 1980; Bowen 1995; Gross et al. 1995; Owens and Morris 1985; Wibbels et al. 1990). The endangered status of many sea turtle populations has prompted the development and use of nonlethal methods for obtaining blood samples over the past two decades (Bentley and Dunbar-Cooper 1980; Dutton 1996; Owens et al. 1978; Owens and Ruiz 1980). In past studies, blood has been sampled from a variety of vessels including the heart (Dozy et al. 1964; Frair 1977), the carotid artery (Berkson 1966), the dorsal cervical sinus (Owens et al. 1978; Owens and Ruiz 1980) and the rear flipper (Dutton 1996). Of these, the dorsal cervical sinus approach has proven to be reliable for obtaining blood from juveniles and adults, and is in widespread use. Owens et al. (1978) and Owens and Ruiz (1980) initially described the location of the dorsal cervical sinus (i.e., paired vessels running lateral to the spinal column along the dorsal aspect of the neck), but a detailed anatomical description of these vessels has not been reported. The ability to obtain blood from hatchling sea turtles has been reported in a few studies (Dutton 1996; Gross et al. 1995; Fitzsimmons 1996; Fitzsimmons et al. 1996), and sampling from the bilateral cervical sinus of hatchling *Caretta caretta* was described in one previous study (Bennet 1986). The availability of safe and reliable methods for obtaining hatchling blood samples would be of value to studies addressing subjects such as sex ratios and population genetics. The purpose of the current study is to provide a comprehensive evaluation and detailed description of safe and practical methods for obtaining blood samples from hatchling sea turtles. The study extends the findings of previous studies by 1) evaluating different sampling locations, 2) sampling from three different species of cheloniid sea turtles, 3) providing a detailed description of the methodology, and 4) evaluating sampling techniques both in the laboratory as well as on the nesting beach.

Blood Vessels Used for Sampling.—A variety of locations along the dorsal surface of the neck were examined in order to identify optimal sites for obtaining blood. Two optimal locations were identified (see detailed description of each below). Although cardiac puncture has been used to obtain blood from hatchlings in a previous study (Gross et al. 1995), it was not evaluated in the current study because it is more invasive than sampling from blood vessels in the neck.

Blood Sampling Equipment.—Blood samples were collected with 1 cc tuberculin syringes equipped with 1.3 cm, 25 gauge needles. The syringes were heparinized using a concentrated solution (3.2 mg per ml of sterile water) of sodium heparin (ovine, Sigma Chemical Co.). A volume of approximately 0.2 cc of the solution was taken into the syringe, allowed to coat the walls of the syringe, and was then expelled. Numerous syringes were heparinized in advance and then placed on ice until they were used later the same day. In the case of genetic/molecular studies, anticoagulants such as acid citrate dextrose solution B (ACD-B) or EDTA are preferred over heparin since they result in less DNA degradation (Dutton 1996; Gustafson et al. 1987).

Blood Sample Volume.—Due to the relatively small size of hatchlings, only a small amount of blood can be sampled safely. The blood volume of turtles has been estimated to be approximately 5–6% of body weight (Schmidt-Nielsen 1994; Thorson 1968). In general, a maximum of 10% of blood volume can be sampled safely. Therefore, the maximal amount of blood that can be taken safely can be estimated by multiplying the weight of a hatchling by a factor of approximately 0.005. As an example, in the case of a hatchling with a weight of 20 g, a maximum of 100 µl of blood should be sampled.

Blood Sample Processing.—For hormone studies, blood samples are transferred to 0.6 ml microcentrifuge tubes and spun at approximately 6000 RPM in a small microcentrifuge for 5 minutes. The plasma is decanted into separate 0.6 ml microcentrifuge tubes and frozen. For genetic/molecular studies, the cellular fraction (or the entire blood sample) can be placed on ice, frozen, or transferred to lysis buffer depending on the specific application (Dutton 1996; Gustafson et al. 1987).

Evaluation of Blood Sampling Techniques in the Field and in the Laboratory.—Blood sampling techniques were evaluated during four field studies and one laboratory study. A total of 845

hatchling blood samples were successfully collected: 80 from *Caretta caretta* from the Archie Carr National Wildlife Refuge (ACNWR), 197 from *C. caretta* from Hutchinson Island, Florida, 57 from *Chelonia mydas* from the French Frigate Shoals in the Hawaiian archipelago, 385 from *Eretmochelys imbricata* from Buck Island Reef National Monument, U.S. Virgin Islands, and 126 from *C. caretta* hatched in the laboratory from eggs collected at ACNWR. At several of these study sites, sampling was conducted on the nesting beach and samples were placed on ice until they could be processed. In the field studies, hatchlings were released after sampling and all appeared active. In the laboratory study, hatchlings were maintained in aquaria and observed for several days following sampling. No obvious change in activity levels was noted and no mortality was associated with the sampling.

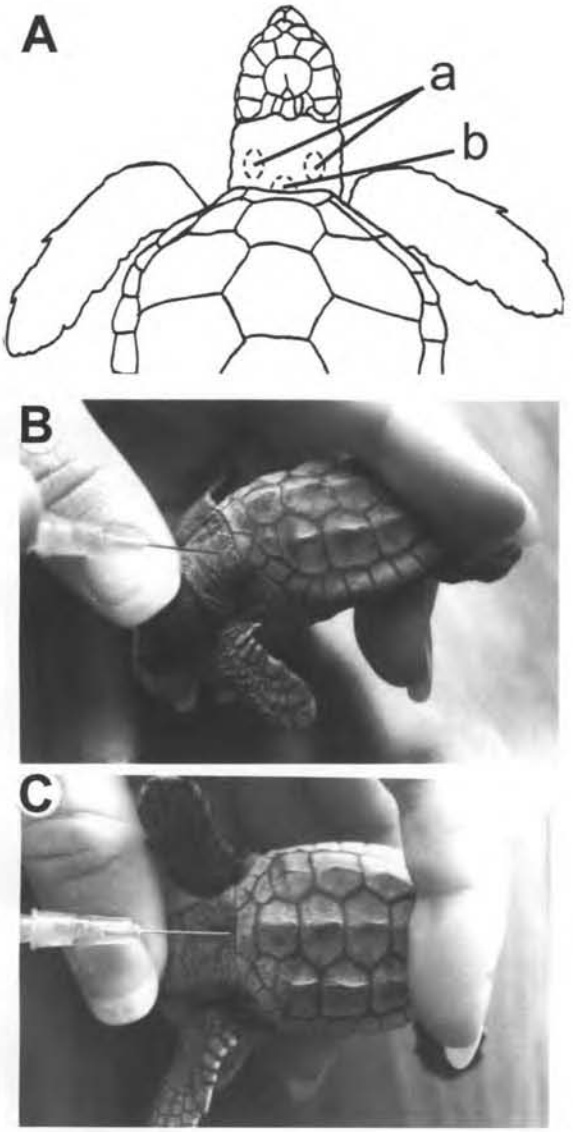


FIG. 1. Blood sampling techniques for hatchling sea turtles. A) Optimal sites for sampling blood. (a) Area for inserting needle to sample from dorsal cervical sinus. (b) Area for inserting needle to sample from alternate sampling location located under nuchal scute. B) Example of technique for sampling from dorsal cervical sinus. C) Example of technique for sampling from under the nuchal scute.

Blood samples were consistently obtained from two locations on the dorsal portion of the neck. The first was the dorsal cervical sinus (see sampling location "a" on Fig. 1A and Fig. 1B). These are a pair of blood vessels located lateral to the spinal cord on both sides of the neck (Owens et al. 1978). Additionally, a second blood sampling site was identified along the midline of the neck, just under the nuchal scute of the carapace (see sampling location "b" on Fig. 1A and see Fig. 1C). Both sampling locations were used successfully to obtain samples from *C. caretta* and *E. imbricata* hatchlings. The dorsal cervical sinus was used successfully to obtain samples from *C. mydas* hatchlings, but the second sampling site was not evaluated in this species. A detailed methodology for obtaining blood samples from both of these sampling locations is provided below.

In the laboratory we were able to obtain blood samples from 100% of the hatchlings (N = 126), although multiple sampling attempts were necessary for most hatchlings. In the field, it was desirable to collect more hatchlings than were needed for the blood sampling. In that way, blood sampling was usually attempted a maximum of two times for each hatchling (e.g., once from the left cervical sinus and once from the right cervical sinus). If no blood sample was obtained, the hatchling was released and sampling was attempted on a new hatchling. In general, a blood sample could be obtained from 2 of every 3 hatchlings using a maximum of two sampling attempts. Obtaining blood samples from hatchlings is more difficult than sampling from juveniles or adult sea turtles, but the diligent use of the techniques described below should allow one to successfully obtain blood samples from most hatchlings.

Detailed Description of Blood Sampling Methodology.—The neck of the hatchling should be swabbed with a disinfectant such as 70% ethanol and then allowed to dry. To position the turtle for sampling, the hatchling is held in one hand using the index and middle fingers (Fig. 1). The hatchling is positioned with its head pointed downward in an effort to fill blood sinuses in the neck. The thumb is used to slightly lower the head, thus extending the neck. Blood sampling from the dorsal cervical sinus is best accomplished by inserting the needle at a relatively steep angle (Fig. 1B), lateral to the midline of the neck and several millimeters from the carapace (see sampling location "a" on Fig. 1A). The needle is inserted approximately 0.25 to 0.5 cm into the neck and a slight upward pressure is placed on the syringe plunger to generate a vacuum. If no blood is obtained, the needle is pushed slightly deeper or withdrawn slightly, while maintaining a vacuum. It is apparent in some cases that the needle may be inserted in the correct location, but the sinus is temporarily collapsed. Even without moving the needle, blood flow can be intermittent, particularly in response to muscle contractions in the neck. Therefore, it is advantageous to hesitate for a short period before moving the needle position because of lack of blood flow. If blood is not obtained, the needle can be removed and then inserted in a similar location on the opposite side of the neck (i.e., switch from right to left cervical sinus or vice versa).

The second bleeding site is on the midline of the neck, just under the nuchal scute of the carapace (Fig. 1C; also see location "b" on Fig. 1A). The needle is inserted at a relatively shallow angle (Fig. 1C), at a depth of approximately 0.25 cm, and vacuum is applied as described previously. If blood is not obtained, the needle can be moved slightly inward or withdrawn slightly while maintaining a vacuum. Inserting the needle too deeply at this location should be avoided since it can result in the needle contacting the vertebrae. In general, this site was utilized when difficulty was encountered in obtaining blood from the dorsal cervical sinus.

Regardless of which sampling site is used, blood sampling is optimally accomplished when the surface of the hatchling's neck is dry. In that situation, blood coming to the surface after the needle is removed forms a bead that can be aspirated into the syringe. As much as 50 µl of blood can be obtained in this fashion, thus representing a significant volume of blood from a hatchling. Once an adequate amount of blood is obtained, the thumb is used to push the hatchling's head in a slightly upward position, thus compressing the dorsal portion of the neck and preventing blood loss after the sample is taken.

The results indicate that the techniques described above provide a safe and practical means of obtaining hatchling blood samples from at least three species of cheloniid sea turtles. These methods may be applicable to hatchlings of all sea turtle species, as previous blood sampling studies of adults and juveniles suggest the dorsal cervical sinus is a common feature of all sea turtles, including *Dermochelys coriacea* (Rostal et al. 1996). In fact, blood samples have been collected from the dorsal cervical sinus of *D. coriacea* hatchlings (D. Rostal, pers. comm.).

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Backpacks for Lizards: A Method For Attaching Radio Transmitters

JONATHAN Q. RICHMOND
Department of Biology 0116, University of California, San Diego
La Jolla, California 92093-0116, USA

Present address: Department of Biology, San Diego State University
San Diego, California 93281-4614, USA
e-mail: richmond@sunstroke.sdsu.edu

Radio telemetry provides a reliable method for studying various aspects of habitat use in horned lizards (Fisher and Muth 1995). Perhaps the most difficult aspect of utilizing radio telemetry in these small, cryptic lizards is finding a suffcient technique for attaching a radio transmitter. Fisher and Muth (1995) proposed a backpack design for attaching a radio transmitter to the flat-tailed horned lizard *Phrynosoma mcallii*. However, we experienced difficulty with this design in telemetry studies of a larger species, the coast horned lizard *Phrynosoma coronatum*. This difficulty stemmed from the construction and materials of the harness, designed for adult *P. mcallii* (62–81 mm SVL, Stebbins 1985; 11.0–25.0 g, Fisher and Muth 1995). Adult *P. coronatum* (62–100 mm SVL, Stebbins 1985; 21.0–53.0 g, N = 33, mean = 34.5 g, Suarez et. al., unpubl. data) easily destroyed the harness material through normal daily activity. To alleviate this problem, we constructed a harness similar to the Fisher and Muth design (1995). However, our backpack has fewer components, fewer attachment points, and provides a sturdier design for the larger *P. coronatum*.

A PD-2 transmitter with an external whip antenna (Holohil Systems Ltd.) was used in our study. The transmitter (including battery and investment acrylic) weighs 3.25–3.50 g, and is powered by a lithium camera battery (Li 75). Battery life ranges from 4.5 months to 6 months, and can be adjusted according to specific electronic configurations. Transmitter signals were received on an LA 12-Q portable radiotelemetry receiver with a three element Yagi antenna made by AVM Instrument Company Ltd.

The harness is constructed by taking an ordinary bicycle innertube and cutting it to resemble the letter "U" (Fig. 1A). The horizontal portion of the "U" forms the region of the harness where the transmitter is fastened, and is approximately 20 x 20 mm. The vertical portions of the "U" form the straps, and are approximately 3–4 mm wide and 80–100 mm long. These dimensions are easily adjusted to the size of the lizard. The harness weighs approximately 1.0 g without the transmitter attached.

Innertubes commonly are coated with a substance that prevents drying and cracking of the rubber, but it also interferes with gluing the transmitter to the rubber. The innertubing should be washed with soap and water to remove the protective coating. Exposure tests demonstrated that the washed material maintains its elasticity and construction throughout the life of the transmitter battery (4.5–6 months). The transmitter is attached to the backpack by lightly sanding the acrylic coating, then gluing (cyanoacrylic glue) one side of it to the 20 x 20 mm portion of the U-shaped backpack. The antenna should be pointing in the opposite direction of the straps since the straps are slung over the shoulders of the lizard.

Once the transmitter is fastened to the harness, several dabs of glue are placed on the underside of the 20 x 20 mm square. The entire pack is then placed on the lizard's back, making sure that the straps are pointing anteriorly (Fig. 1B). It is imperative, at least with horned lizards, to position the backpack such that the transmitter does not contact the occipital horns (at the rear of the head), yet is as far forward on the back as possible. If one were to draw a line perpendicular to the spine and even with the forelimbs, the front of the transmitter is positioned at this point. The straps are then placed over the shoulders, crossed on the chest, pulled through the axilla region of the opposite leg, and glued to the top of the 20 x 20 mm section of the backpack (Fig. 1C). Excess strap material is removed. Glue is applied between the straps where they cross on the venter, as well as a small dab between the crossed straps and the lizard's skin. This prevents the pack from shifting off the midline. The straps should not be pulled too tightly around the neck and shoulders. However, horned lizards commonly inflate the thorax and abdomen as a defense posture, so strap tension must compensate for this extra volume. Ideally, the straps should have a snug fit when the lizard's thorax is not inflated.

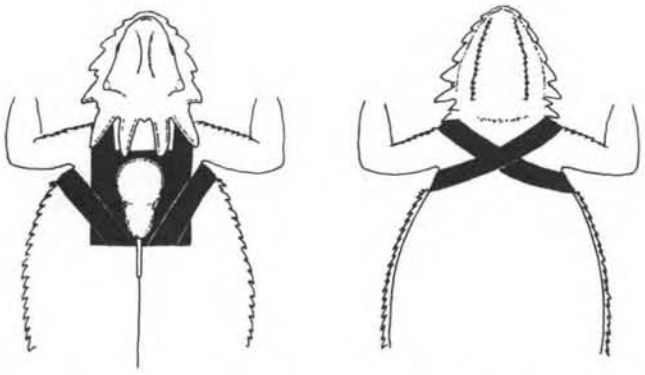


FIG. 1. (A) The U-shaped harness without the radio transmitter attached. (B) Dorsal view with the transmitter and harness attached to the lizard. (C) Ventral view with the shoulder straps crossing over on the chest.

Because horned lizards rely on crypsis to avoid predators (Pianka and Parker 1975), the backpack and transmitter were painted with acrylic paint to match the skin color of the lizard. Colors were easily mixed and matched in the field, and water can be used as a solvent as long as the paint is wet. The backpacks were painted after they were attached to the lizards because clean surfaces are required for proper glue adhesion. With age and wear, the camouflage paint and the backpack takes on a more cryptic appearance.

Horned lizards have remarkably mild dispositions; therefore, backpacks were easily assembled and attached to the lizards in the field. In most cases, *P. coronatum* resumed normal activity minutes after attaching a backpack. Feeding, locomotion, burying, and breeding appeared unaffected by the unit. The total mass of the backpack, about 4.5 g, constitutes as little as 12% of the total body mass in large adults. Oviductal clutches of female *P. coronatum* are reported as high as 24% of total body weight (Pianka and Parker 1975), thus our design weighs considerably less than a typical clutch of eggs. Of the 28 lizards fitted with this harness (April 1996–present), only one presumably detached from a lizard. All other backpacks remained attached for the duration of the transmitter battery life.

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Intracranial Stereotaxic Surgery on Reptiles with External Tympana

MICHAEL S. GRACE
Department of Biology, Gilmer Hall, University of Virginia
Charlottesville, Virginia 22903-2477, USA
e-mail: msg5y@virginia.edu

Stereotaxic positioning devices allow accurate mathematical placement of electrodes and similar devices for survival surgeries in inaccessible (for example intracranial) locations (see for example Feigenbaum 1985; Ruby et al. 1996). For accurate and precise animal positioning in stereotaxic surgery, the subject must be rigidly mounted in a standard manner. Reptiles with external tympana present difficulties with both of these problems. Small animal stereotaxes are designed for animals with ear canals; earbars inserted into ear canals provide two points in a 3-point mount, and with the toothbar, provide accurate lateral (square) positioning of the head. Reptiles such as iguanid lizards cannot accept earbars in the traditional manner without damage to the tympanic membranes. Therefore, these animals cannot be held rigidly in typical small animal stereotaxic devices. Because the position of rodent ear canals varies little among individuals of the same species, ear canals also provide a means for standardized positioning of the rodent head in the device. As such, it is difficult to standardize head position of reptiles with external tympana.

Greenberg (1982) presented in very limited fashion a method of mounting *Anolis carolinensis* in a small animal stereotax using elastomeric dental material as a bridge between earbars and the tympana. Here I describe in detail a modification of this method

that provides rigid, accurate, and precise positioning of reptiles in the stereotax. I also discuss methods of anesthesia, and provide a safe and acceptable method of anesthetizing iguanid lizards. I have successfully used these techniques for effective stereotaxic survival surgeries on numerous *Iguana iguana*.

A Kopf Model 900 small animal stereotax (David Kopf Instruments, Tujunga, California, USA) was used with a Kopf Model 960 electrode manipulator (Fig. 1). Both standard rat earbars (Kopf Model 957, tip angle approximately 20°) and optional 45° tip earbars (Kopf Model 955) were tested. Ultimately, 45° tip earbars were selected as standard, because the greater tip angle decreased chances of tympanic membrane perforation. Three major modifications were made to the stereotax: (1) a cushioned bite plate was mounted to the tooth bar, (2) the straight nose bar was bent into a 90° angle and cushioned, and (3) a vinyl polysiloxane cushion was added to the tips of the earbars.

The bite plate (Fig. 2) was made by cutting a "T" of sheet aluminum (1 mm thick), the base of which matched the width of the tooth bar. The plate was then coated (approximately 1 mm thick) with freshly-prepared vinyl polysiloxane dental impression material (Reprosil Type 1 high viscosity, Dentsply International, Milford, Delaware, USA). After the dental material cured, the coated plate was attached to the flat upper surface of the toothbar with two stainless steel screw-driven pipe clamps. The nosebar was also modified for iguana surgery by bending it into a 90° angle inverted "V", and then covering it with a tight-fitting length of Tygon tubing to form a cushion.

Dental impression material is also used to modify the stereotax earbars. Small batches of freshly prepared dental material are applied to the tips of the earbars. When the earbars are advanced toward the tympana and the dental material allowed to cured, the impression material conforms to the lizard's head contours, providing a rigid but harmless and easily removed attachment between the animal's head and the stereotax earbars.

With the modified stereotax, surgeries were performed on chemically-anesthetized animals. I tested ketamine HCl (100 mg/ml; Ketaset, Fort Dodge Laboratories, Ft. Dodge, Iowa, USA) as an anesthetic agent for *Iguana iguana*, and found that the effective dose was greatly lowered by administering to animals whose body temperature was 35–37°C. Under these conditions, 90 mg ketamine/kg body weight given subcutaneously, intramuscularly, or intraperitoneally effectively induced anesthesia (loss of righting reflex, and loss of flinch response to a pinch of lateral body skin). It should be noted, however, that ketamine injected subcutaneously may cause tissue damage in iguanid lizards. After subcutaneous injection, a deep blue color appeared around the injection site within one hour of injection, and lasted for at least two weeks.

Greenberg (1982) used hypothermia to immobilize *Anolis carolinensis* for placement of electrolytic lesions with the aid of a stereotax. Hypothermia has also been used by many others, but generally today is considered to be an ineffective anesthetic agent (Bennett 1996), immobilizing the subject but failing to prevent noxious sensory input. Hypothermia may also be damaging. For example, Northcutt and Butler (1974) reported retinal axon degeneration following experimental hypothermia in *Nerodia sipedon*. Even so, hypothermia continues to be used by some investigators (Tosini and Menaker 1995). In my preparations, Ketamine HCl (administered at 90 mg/kg to warmed *Iguana*) provided at least 30 minutes of complete anesthesia, allowing ample time for surgical setup and procedures.

When animals display full anesthesia, the upper jaw is placed flat onto the biteplate, and the angled nosebar clamped firmly

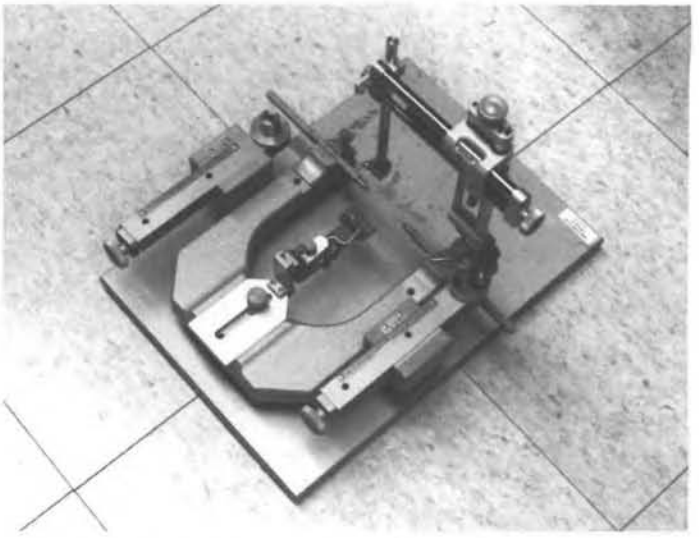


FIG. 1. The Kopf Model 900 small animal stereotax. Note the biteplate/nosebar apparatus in the center of the instrument. Electrode carrier(s) mounts to the positioning device lateral to the biteplate/nosebar apparatus.

down onto the bridge of the animal's rostrum. For accurate stereotaxic surgery, the animal's head must be square in the stereotax (the rostro-caudal axis of the head must be parallel to the longitudinal track of the electrode manipulator). To set this angle, 20° tip angle earbars are placed in the stereotax, and advanced equally to points near an identifiable feature on the animal's head (I use the anterior margin of the tympanum). The nosebar is loosened, and the animal's head angle set such that reference points are equidistant from each earbar tip. The nosebar is then re-tightened, and numeric position of the earbars is noted with their tips placed 1mm from the tympanic membranes.

Dental impression material base and catalyst are then mixed 1:1 for 30–45 seconds, and a small (approximately 6 mm diameter) sphere of material is applied to the tip of each earbar. Reprosil has a working life of approximately 2 minutes, so it must be prepared after the animal has been anesthetized and clamped onto the biteplate. The earbars are then slowly advanced toward the tympana until they have reached the previously determined



FIG. 2. Modified biteplate/nosebar apparatus (left) for reptile positioning, and original instrument (right) designed for rodents. Note that in the modified apparatus a cushioned biteplate (arrow) has been mounted to the toothbar, and the nosepiece has been bent into a 90° inverted "V" and cushioned with a length of tight fitting silastic tubing (arrowhead).

setpoint. The dental impression material is allowed to cure for approximately 6 minutes before beginning surgery. Reprosil contains toluene and methylene chloride, so repeated exposure of surgical subjects and personnel to uncured product should be avoided.

The modified stereotaxic procedure described here has been used successfully on *Iguana iguana*, SVL <7 cm to >25 cm, for precise and repeatable intracranial placement of electrodes for electrolytic lesioning. This stereotax will also accommodate animals much larger than those tested, and the modular nature of the modified Kopf system makes it extremely convenient and cost-effective for surgeries on multiple types of animals. I commonly perform surgeries on both iguanid lizards and rodents, using a single stereotax, two toothbar/nosebar pieces, and two sets of earbars. One toothbar/nosebar apparatus remains in unmodified form for rodents, while the other is modified for use on reptiles. The setup can be modified from rodent to reptile use in less than 1 minute by replacing the entire rodent toothbar apparatus with the modified biteplate apparatus, and replacing the two earbars. Reprosil dental impression material forms a cushion to prevent tooth damage on the biteplate. It can be cleaned easily, and also can be easily removed and reapplied if necessary. Reprosil also forms a rigid connection between earbars and the subject's head while preventing damage of external tympana. Following surgery it is easily and completely removed without harm to the animal.

Reptiles are important model systems for neurobiological investigation, particularly in comparative analyses (Foster et. al. 1994; Grace et al. 1996). My research group performs stereotaxic electrolytic surgery on *Iguana iguana* hypothalamus and forebrain with the goal of defining neural organization of the circadian timing system in vertebrate animals. The stereotaxic technique described here is useful for any intracranial survival surgery requiring accuracy and precision, and can be used directly on anapsid and many diapsid reptiles (but with snakes, for example, it is not possible to accurately position and attach earbars), as well as on anuran amphibians.

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Hypersensitivity of Some Lizards to Pilocarpine

BRYAN STUART[1]
W. JAMES CROOM, JR.[2]
and
HAROLD HEATWOLE[1]
[1]Department of Zoology, Box 7617
[2]Department of Poultry Science, Box 7608
North Carolina State University, Raleigh, North Carolina 27695, USA
e-mail (HH): harold_heatwole@ncsu.edu

A reliable method for collecting sufficient quantities of venom from the Duvernoy's gland of colubrid snakes was described by Rosenberg et al. (1985). Anesthetized snakes are intraperitoneally injected with a saline solution of pilocarpine HCl (5 mg/ml; Sigma Chem. Co., St. Louis, Missouri) at a dosage of 0.1–2.0 mg/100 g body weight. Pilocarpine is a parasympathomimetic muscarinic agonist that stimulates the discharge of secretory products from the lumen of salivary glands (Mahr et al. 1980). This method also was employed successfully by Stuart (1998) for collecting salivary and Duvernoy's secretions from 23 taxa in five families of snakes (dosage 2.0 mg/100 g body weight) and by Hill and Mackessy (1997) for collecting Duvernoy's secretions from 14 colubrid species (dosage 0.75 mg/100 g body weight). None of these authors reported adverse effects, except for Hill and Mackessy (pers. comm.) who noted mortality in a few specimens that were in poor body condition and not feeding prior to treatment; otherwise they injected pilocarpine into snakes without apparent harm. Both Rosenberg et al. (1985) and Stuart (1998) injected individuals repeatedly (up to ten times) without later complications such as weight loss or cessation of feeding.

The collection of large quantities of venom from the gila monster, *Heloderma suspectum*, and the beaded lizard, *H. horridum*, has been problematic. Similar to opisthoglyphous colubrid snake venoms that flow from one to three ducts of the Duvernoy's gland to the base of grooved maxillary teeth, the venom from the infralabial gland of *Heloderma* discharges from multiple ducts to the base of grooved teeth in the lower jaw. The method of collecting venom used by the Miami Serpentarium Laboratories (Punta Gorda, Florida) involves inducing a lizard to bite a neoprene rubber disc, turning the animal onto its back, and pipetting the secretions as they flow down the plate (N. Haast, pers. comm.). Stuart (1998) inserted flexible plastic tubing (15 cm long; 12 mm outer diam, 8 mm inner diam) over the front teeth of an adult *Heloderma suspectum* perpendicular to the longitudinal axis of the body. The lizard repeatedly compressed the tube with its jaws, and venom dripped from the front of the mouth onto a watchglass placed under the chin. Approximately one ml of venom was collected within ten minutes.

Loeb (1913) subcutaneously injected 21 adult *Heloderma suspectum* (body weight not reported) with 0.1 grain (= 6.48 mg) of pilocarpine. The pilocarpine increased the duration and quantity of the venom secreted by 3–4 fold compared to methods not using pilocarpine. Three animals died after being injected once per day for three successive days.

We injected intraperitoneally a healthy, young adult *Heloderma suspectum* weighing 650 g with 2.0 mg of pilocarpine HCl (Sigma)/100 g body weight, the same dosage used by Stuart (1998) for snakes. The animal was cooperative and was not anesthetized during the procedure. Within three minutes of injection, venom and saliva began flowing copiously from the lower jaw. Approximately one ml of fluid was pipetted from the mouth within five minutes of the initiation of secretion. After ample venom had

been collected for the intended analysis, the lizard was returned to its habitation; oral secretions flowed continuously from the lower jaw until the animal expired 18 h later.

Electrolytic imbalance after such prolonged secretion may have contributed to the death of this animal. Drowning on salivary secretions has been reported in a number of species injected with high doses of the muscarinic agonist slaframine (Hagler and Croom 1989), but was ruled out in *Heloderma* by a necropsy (NCSU Teaching Hospital Report #97-0124). However, approximately 10 ml of a slightly opaque fluid was found in the stomach, and was presumed to be venom and saliva that had been swallowed. Whether or not this fluid contributed to the death of the animal is unknown.

A greater number of trials would strengthen the present study. However, because of the conservational status of *Heloderma*, currently it is not feasible to test enough individuals to construct an LD_{50} curve for the effect of pilocarpine on this taxon. Nevertheless, it can be concluded that *Heloderma* is more sensitive to pilocarpine than are snakes. Assuming that Loeb (1913) used animals similar in size to the one of the present study, his *Heloderma* perished after three injections of half the dosage tolerated by snakes over ten consecutive doses (Stuart 1998). Also, the single *Heloderma* used in the present study succumbed to one injection of the dosage given to snakes; this animal was a young one and probably smaller than those used by Loeb.

Loeb (1913) mentioned one instance of administering 2.1 grains (= 136.08 mg) to eight *Heloderma* that presumably survived (data not reported). The dosages cannot be calculated exactly without body weights but assuming the body weight of his animals to be 650 g (the weight of our animal), this injection corresponds to 0.23 mg/kg, slightly more than ten times the dosage of pilocarpine that proved lethal in the present study. These discrepancies may be explained by Loeb (1913) using a lower purity of pilocarpine than that presently available. The pilocarpine used in the present study was >99% pure as tested by thin layer chromatography (Sigma Chem. Co., St. Louis, Missouri). Alternatively, methodological differences may have affected results. Loeb (1913) injected subcutaneously; we injected intraperitoneally.

To examine the effects on another species of lizard, a 900 g *Iguana iguana* was injected intraperitoneally with 2.0 mg pilocarpine/100 g body weight. Salivation began within three minutes. The animal became lethargic, convulsed, and perished 35 minutes later. However, subsequent injections of the same dosage of pilocarpine to four juvenile iguanas (47, 86, 97, and 270 g) stimulated salivation without obvious adverse effects.

It is unclear whether pilocarpine induces changes in the composition of venom (Weinstein and Kardong 1994). Rosenberg et al. (1985) found an increase in water content and a decrease in protein concentration of colubrid Duvernoy's secretions induced by pilocarpine compared to levels in secretions obtained by merely rinsing the oral membranes. They did not believe that there was much influence of the drug on the nature of the secretory proteins. Similarly, Marmary et al. (1987) did not find changes in protein composition of rodent parotid glands stimulated by pilocarpine. Fox and Loeb (1913) found that the drug induced zymogen degranulation of the duct cells of *Heloderma* venom glands in a manner similar to that reported for salivary glands. Loeb (1913) found that venom obtained with pilocarpine was as toxic in rats and guinea pigs as that obtained without pilocarpine. We found that the *Heloderma* venom obtained with pilocarpine was mixed with considerably more saliva than that obtained by the bite-collection methods described above, as evidenced by higher mucus content and significantly greater amylase activity (Stuart 1998). Although the secretions obtained by pilocarpine may be a better representation of the total oral secretions that coat prey that is being swallowed, contamination by saliva may confound precise analysis of the composition of the infralabial venom of *Heloderma*.

There are also interspecific differences in the effects of pilocarpine in mammals. Marmary et al. (1987) reported a 3–4 fold greater pilocarpine-induced salivary flow in mice than in rats. Similarly, cattle and sheep appear to differ in their responses to pilocarpine. Gurnsey et al. (1980) reported that cattle can sustain intramuscular injections of up to 2.0 mg pilocarpine/kg body weight, without their ad libitum intake of food being affected. For subcutaneous injections that threshold for sheep was only 0.4 mg pilocarpine/kg body weight (Bird et al. 1991). The mixed agonist properties of pilocarpine seem to induce different physiological responses even among closely related taxa, and, hence, may be tolerated by snakes but lethal to lizards. Studies concerning the pharmacological characterization of muscarinic receptors in non-mammalian species are not extensive (Jones and King 1995), and caution is advised when transferring protocols across taxa.

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RECENT POPULATION CHANGES

Slevin's Bunch Grass Lizard (*Sceloporus slevini*) Decimated on the Sonoita Plain, Arizona

HOBART M. SMITH
Department of Environmental, Population and Organismic Biology
University of Colorado, Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

DAVID CHISZAR
ADAM CHISZAR
Department of Psychology
University of Colorado, Boulder, Colorado 80309-0345, USA
e-mail (DC): chiszar@clipr.colorado.edu

DAVID L. AUTH
JOANNE AUTH
Florida Museum of Natural History
University of Florida, Gainesville, Florida 32611, USA
e-mail (DLA): dlauth@flmnh.ufl.edu

CLINT HENKE
11823 Eaton Way, Westminster, Colorado 80020, USA
e-mail: v1967ette@aol.com

CARL E. BOCK
JANE H. BOCK
JOHN A. RYBAK
Department of Environmental, Population and Organismic Biology
University of Colorado, Boulder, Colorado 80309-0334, USA
e-mail (CEB): carl.bock@colorado.edu

RICHARD L. HOLLAND
1855 Garland Lane, Boulder, Colorado 80304, USA
e-mail: hollanj@spot.colorado.edu

KEVIN BONINE
Department of Zoology, University of Wisconsin, Birge Hall
430 Lincoln Drive, Madison, Wisconsin 53706, USA
e-mail: kebonine@students.wisc.edu

and
GREGORY J. WATKINS-COLWELL
Department of Biology, Sacred Heart University
Fairfield, Connecticut 06432-1000, USA
e-mail: gjwc@aol.com

Slevin's bunch grass lizard (*Sceloporus slevini* fide Smith et al. 1996; formerly *S. scalaris slevini*) was first known in the United States from high altitudes. The earliest record for the country (Van Denburgh 1896:341), under the name of *Sceloporus scalaris*, was from 9500 ft in the Huachuca and Dragoon Mountains, and by 1922 (Van Denburgh 1922:268–273) the species still was known only from "above seven or eight thousand feet" in the Dragoon, Huachuca, and Santa Rita Mountains. By 1954 (Stebbins 1954:234–235) its known range had been extended to the Chiricahua Mountains, but still only above 8000 ft. By twelve years later (Stebbins 1966), however, the species had been recorded from "lowland" localities at "Empire Valley, 11 miles northeast of Sonoita, 4300 ft., Santa Cruz Co., Arizona, and upper Animas Valley, 10 mi. east of Cloverdale, 5200 ft., New Mexico."

In June 1987, RLH found the species to be very abundant at low altitude about the remains of a burned corral 3.3 mi. east of Elgin, on the Sonoita Plain (between the Huachuca and Santa Rita Mts.), Santa Cruz Co., Arizona, at 4800 ft. The lizards hid under small boards scattered widely on the ground, in lieu of their usual refuges of bunch grass, which was missing in that vicinity due to heavy grazing by cattle. As reported by Bock et al. (1990) and Smith et al. (1990), those authors also observed numerous *S. slevini* at the same place, and found it to be very common elsewhere on the Sonoita Plain, especially on the Audubon Research Ranch, ca. 8 km SSE of Elgin. Indeed, it was by far the most common lizard where grazing was limited or prevented completely. Much the same observations were repeated in July 1990, after the preceding publications appeared. Ballinger and Congdon (1996) have recorded the strongly deleterious effect of grazing on the same species in the nearby Chiricahua Mts.

In summary, it is an established fact that *S. slevini* occurred rather widely at least from about 1965 to recent times in grasslands at relatively low altitudes (4300–5400 ft.) in southeastern Arizona and southwestern New Mexico. Whether it was present at such altitudes before that time is not known.

In June and August 1997, a number of the authors walked a total of about 9 miles of grassland each month, half on the Audubon Research Ranch (5000–5200 ft. elev.), where no cattle grazing has occurred for three decades (since 1968), and half on adjacent grazed ranchland. In earlier years we would have seen several hundred *S. slevini* with that much search (Bock et al. 1990), but on these occasions none was seen. The burned corral debris east of Elgin, where both Smith and Holland had previously found the species to be abundant, no longer was inhabited by it, although there were a few *Cnemidophorus* much as before. On 12–13 September 1997, after grass cover became luxurious due to ample rainfall, CEB and JHB again thoroughly surveyed areas on the Research Ranch where the species was formerly abundant, and found none. The lizards therefore probably were not estivating during the dry months, because we would have expected them to become active after the 1997 rains and subsequent plant growth.

The apparent proximate cause for the essentially complete disappearance of the species at low altitudes was a severe drought persistent over the past two years (Fig. 1). Predation may be enhanced by the drought and the concurrent stunting of the bunch grass that serves as cover for the lizards, but that alone cannot be the cause, for the population at the burned corral west of Elgin would not be more exposed to predation during the drought than prior to it. Other lizards and snakes appeared subjectively to be somewhat reduced in number, but they seemed not to be severely affected. *Sceloporus slevini* has clearly been affected far more than any other observed reptile species.

Presumably the species survives at high altitudes with little if any attrition due to drought, inasmuch as the latter would be much attenuated or absent there. However, refugia exist even at lower altitudes, as observed by JAR, who on 23–29 March 1997 backpacked along trails through numerous habitats southeast from the town of Patagonia, Santa Cruz Co., Arizona, through the Canelo Hills and across the Huachuca Mts. to the Coronado National Memorial. He observed 18 *S. slevini* in three areas (~5 mi. E Patagonia; Redrock Canyon near the Canelo Hills; and Scotia Canyon on the west side of the Huachuca Mts.), mostly in ungrazed, grassy habitats in close proximity to water. Several were observed on grazed land, but always where thorn scrub protected the grass from being grazed, or where rocks or debris provided adequate cover. Away from these havens, no other *S. slevini* were seen.

The reason for the differential susceptibility of *S. slevini* to drought perhaps lies with its presumed adaptation as a species to relatively high altitudes. Since periodic extended droughts have no doubt occurred for centuries in the southwest, it is quite likely that the range of *S. slevini* ebbs and flows with them, recovering between episodes of severe drought by repopulation from refugia

scattered across the lowland range of the species. The former, wide-ranging population on the Sonoita Plain therefore may recover in the next few years from its present decimation. On the other hand, those lowland populations may well be more threatened by drought today than they might have been in earlier times, because of the combined impacts of drought and livestock grazing. Now so much of the original habitat is unsuitable because of grazing that (a) most of the refugia are gone, and (b) the populations are so small and fragmented that they are highly vulnerable to extirpation.

Such a scenario is, however, conjectural. The current fact is that *S. slevini* has a greatly reduced lowland population on the Sonoita Plain at the present time, and therefore is a species of concern that should be monitored over the next several years. The extent of decimation, if any, in adjacent areas remains to be determined. Termination of the drought may enhance recovery where losses have occurred.

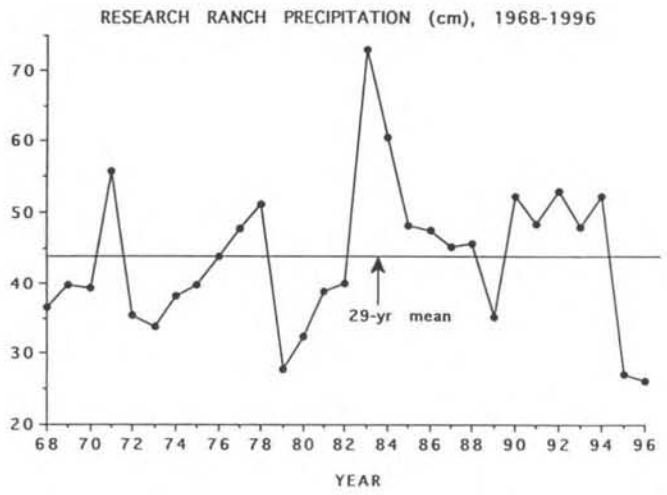


FIG. 1. Annual precipitation at the Research Ranch, Santa Cruz Co., Arizona, 1968–1996.

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HERPETOLOGICAL HUSBANDRY

A Safe, Easy-to-Use Tool for Assist-Feeding Small Reptiles and Amphibians

R. MICHAEL BURGER
Department of Herpetology, San Antonio Zoo
3903 North St. Mary's Street, San Antonio, Texas 78212, USA

Small reptiles and amphibians often can be difficult to manipulate during handling and attempts to assist feed or medicate orally. A technique often used to open the mouths of small lizards (*Anolis* spp., *Uroplatus* spp., etc.) involves tapping on their snouts. However, many diminutive squamates, anurans, and salamanders inevitably need an implement forced between their jaws in order to successfully open their mouths. Spatulas, credit cards, forceps, plastic spoons, plastic wedges cut from deli cups (Barker 1982; deVosjoli 1996) as well as other items all work to some degree depending on the size of the specimen involved. These items can be cumbersome because of size or dangerous due to sharp edges when dealing with extremely small animals.

A tool that has been successfully used in a wide range of neonate, small, or delicate reptiles and amphibians has been a plastic guitar pick. Relatively inexpensive and available at most music stores, the pick is available in several sizes, thicknesses, and compositions. The thin Fender® guitar pick (Fender Musical Instrument Corporation, Scottsdale, Arizona, USA) works particularly well and has smooth, tapered edges. The utility of a lightweight guitar pick allows one to hold a small animal in one hand, slowly insert the guitar pick with the other, and easily follow with a food item or medication tube without the risk of the guitar pick falling out due to its weight or cumbersome size. It does take practice (as is the case with almost any technique); once inserting the food item or tube, one must carefully excise or swipe the guitar pick away from the mouth. Because of the triangular shape of a guitar pick, swallowing the pick is impossible with an animal whose gape is less than the width of the pick. This tool has been used successfully with *Phyllomedusa hypochondrialis, Rhacophorus reinwardtii, Agalychnis callidryas, Ambystoma* sp., *Uroplatus henkeli, Atheris ceratophorus, Lampropeltis* spp., *Elaphe* spp., *Rhinocheilus lecontei, Spilotes pullatus, Calabaria reinhardtii, Tropidophis* sp., *Ungaliophis continentalis, Corallus caninus, C. hortulanus, Morelia viridis*, and *M. spilota variegata.*

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Age at First Reproduction in Captive *Caiman latirostris* (Broad-snouted Caiman)

LUCIANO M. VERDADE
and
FABIANNA SARKIS
Departamento de Zootecnia / ESALQ
Universidade de São Paulo, C.P. 09 Piracicaba, São Paulo 13418-900 Brazil
e-mail (LMV): lmv@carpa.ciagri.usp.br

Age at sexual maturity is one of the most important aspects of population dynamics. The longer individuals take to start breeding the longer the generation length and the slower the population rate of increase (Caughley 1977). However, there is little information about age at sexual maturity in crocodilians. Age at sexual maturity ranges from 2.5 years for *Crocodylus palustris* in captivity to possibly 35 years for *Crocodylus niloticus* in the wild (Ferguson 1985). Magnusson and Sanaiotti (1995) report that *Caiman crocodilus crocodilus* attains sexual maturity at 5–6 years of age in the Brazilian Amazon, but they note that growth rates vary among habitats and individuals. Moulton et al. (in press) suggest an asymptotic snout-vent length (SVL) of 87–107 cm, with an estimated age range of 8.6–15 years for *Caiman latirostris* female first reproduction in a mangrove habitat of southeastern Brazil.

This report documents the first production of second generation (F_2) broad-snouted caimans in captivity. Genealogy and other information about these animals is available in the Regional Studbook for the species (Verdade and Kassouf-Perina 1993). The broad-snouted caiman captive breeding program is maintained by the Department of Animal Sciences of the Escola Superior de Agricultura "Luiz de Queiroz," University of São Paulo, located in Piracicaba, São Paulo (22°42.557'S, 47°38.246'W). This region presents a tropical climate with wet summers and dry winters (Simielli 1993). Although temperatures can get below 10°C during the winter and above 30°C during the summer, monthly average temperatures range from 16.8°C in June to 24.7°C in February, with only four months (May–August) below 20°C (Ometto 1991).

The caimans were maintained under natural temperature conditions since they hatched. During the first six years of life they were maintained in walled pens of 64 m^2 (ca. 2.7–10.7 m^2 per individual) with a 60 cm deep cemented pool of ca. 24 m^2 (1.0–4.0 m^2 per individual). They were then transferred to and maintained in a fenced area of 120 m^2 (20–30 m^2 per individual) with a one-meter-deep cemented pool of ca. 30 m^2 (5–7.5 m^2 per individual). Nesting shelters, consisting of an approximately 4 m^2 partially walled area, adapted from Bustard (1975), were provided and successfully utilized by the females.

Age at first reproduction was approximately 10 years (Table 1). Clutch size ranged from 36 to 44 with an average of 40.25 eggs per clutch. Incubation period ranged from 85 to 89 days with an average of 86.5 days. Eggs were incubated as described by Verdade et al. (1992a) with hatching success of 40–86%, and averaging 67% (see Table 2 for a summary of reproduction). Hatchlings were raised as described by Verdade et al. (1992b), and presented a low mortality rate (0.75%) at seven days post-hatching.

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Table 1. Age at first reproduction of captive *Caiman latirostris*.

Animal	Sex	Date of birth	Date of reproduction*	Age at first reproduction	SVL (cm)**	M (kg)**
CL1	Male	28 February 1986	19 March 1996	10 years and 20 days	101.5	51.0
CL5	Female	01 April 1986	28 March 1996	9 years, 11 months, and 29 days	81.0	30.5
CL9	Female	01 April 1986	19 March 1996	9 years, 11 months, and 21 days	80.4	24.0
CL10	Female	01 April 1986	21 March 1996	10 years and 21 days	70.9	20.0
CL13	Female	01 April 1986	06 April 1996	10 years and 8 days	80.6	29.5

* Date when first siblings hatched
** October 1995

Table 2. Summary of reproduction of captive *Caiman latirostris*.

Female	Clutch size	No. of broken eggs	% broken eggs	No. of incubated eggs	No. of hatchlings	Incubation success	Incubation period (days)	Deaths (days 0–7)
CL5	44	15	34.09	29	19	65.52	86	1
CL9	44	5	11.36	39	28	71.79	85	
CL10	36	8	22.22	28	24	85.71	89	
CL13	37	12	32.43	25	10	40.00	86	2
average	40.25	10	24.69	30.25	20.25	66.94	86.5	0.75

Incubation temperature: 31 ± 1°C

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A New Technique for Artificially Incubating Loggerhead Sea Turtle Eggs

CHAD L. CROSS
Department of Biological Sciences, Old Dominion University
Norfolk, Virginia 23529-0266, USA

JOHN B. GALLEGOS
FLORENCE G. JAMES
and
SARA WILLIAMS
U.S. Fish and Wildlife Service, Back Bay National Wildlife Refuge
4005 Sandpiper Road, Virginia Beach, Virginia 23456-0286, USA

The loggerhead sea turtle (*Caretta caretta*) is a recurrent visitor to the southeastern coastline of Virginia (USA). Female loggerheads generally nest on a two to four year cycle, and construct from one to six nests during each breeding season (Dodd 1988; Ehrhart 1979). Nesting in southeastern Virginia usually occurs in June or July. The resulting eggs incubate for 60–65 days before hatching (Dodd 1988).

U.S. Fish and Wildlife Service personnel at Back Bay National Wildlife Refuge (BBNWR) in Virginia Beach, Virginia conduct daily patrols along a 16–24 km stretch of beach from mid-May through August. Because of very narrow beaches and large numbers of visitors, nest failure because of human and tidal impacts would be high; therefore, nests are excavated and removed to a remote area of BBNWR, placed in cylindrical, predator-proof cages (35.5 cm diam, 78.7 cm height) constructed of meshed hardware cloth over a wooden frame, and buried at the same depth as the original nest. This technique has worked satisfactorily for a number of years; however, the late production of nests in August (one in 1995, two in 1996) raised concern that allowing nests to remain in situ through October would result in low hatching success from low subsurface sand temperatures during the incubation period. We believed that mimicking the natural nest environment would be the best solution. Artificial nests allow eggs to be buried at a natural depth and provide space for an adequate amount of sand to be placed around the nest. The entire artificial nest must be transportable to a warmer environment.

We used a large, plastic tree planter pot for the artificial nesting chamber (67.3 cm deep, with a top diameter of 76.2 cm narrowing to 52.1 cm at bottom). Several holes were drilled through the pot sides and bottom to facilitate aeration and drainage. The pot was lined with burlap to stop loss of sand through holes.

The nesting chamber was easily transported to a nest site via an all-terrain vehicle equipped with a small trailer. The bottom of the pot was then lined with 15–20 cm of damp sand from the original nest. The predator-proof nest cage (described above), with intact nest inside, was excavated and placed into the pot using heavy rope or straps that were originally buried around and under the nest cage. The eggs themselves were not excavated or otherwise disturbed. The remainder of the pot was filled to within 8 cm of the top with moist sand from the nest cavity (Fig. 1). The nesting chamber was then towed back to an enclosed, heated building.

The temperature of the nesting chamber was kept at 27–29°C by maintaining the room temperature at ca. 25°C, and was supplemented by using 3–4 small hood 100-watt lamps clipped to the sides of the trailer. Nest temperatures at egg level were monitored daily with a deep soil probe. Lamp number and location can be adjusted to maintain desired temperatures.

This technique was successful for the three late nests at BBNWR during 1995 and 1996, with hatching success of 94%, 88%, and 42%. Hatchlings were released on the beach in order to imprint on the natal nesting site, then collected and transported out to the Gulf Stream where they were released. This technique should prove valuable to researchers and conservationists requiring an inexpensive, easily maintained artificial nesting chamber for incubating late-season eggs.



FIG. 1. Nesting chamber used to artificially incubate loggerhead eggs. The nest cage, straps used to lift the nest cage, thermomenter, and heat lamps are visible. See text for full description of the nesting chamber.

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seasonal staff at BBNWR whose perserverance and dedication has made our efforts successful. We owe a special debt of gratitude for the technical support provided by K. A. Phelps. BBNWR field personnel were partially supported by the U.S. Army Corps of Engineers, Norfolk, Virginia. We thank J. Geiger, D. Stewart, and J. Robinette for helpful comments on earlier drafts of the manuscript.

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NATURAL HISTORY NOTES

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CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). **ALBINISIM**. Herein we report three partially albino *Ambystoma opacum* larvae. Two were discovered from the same vernal pool in Tiverton, Newport County, Rhode Island, USA (BD, JB) during 1988. A third specimen was found during March 1997 from a vernal pool in Lyme, Connecticut, USA (HG).

On 31 March 1988, an albino *A. opacum* larva (46 mm TL) was captured in 16.5 cm of water at 1535 h. The ambient temperature was 13.5°C; water temperature was 12°C. A second albino larva (50 mm TL) was captured on 6 May 1988 in 30.5 cm of water at 1200 h; ambient temperature and water temperature were 15.5°C and 14.5°C. This specimen was photographed at the capture site and released.

The coloration of both living animals appeared identical. Alive, the larval integuments were transparent with a yellowish cast; eyes appeared normally pigmented except that the pupils were pink, and the visceral organs, major blood vessels, and developing cranium were clearly visible through the integument. The external gills were flushed orange-red from blood. Preserved, the first larva appeared chalky-white with a slight hint of its former yellowish cast. This animal was catalogued in the American Museum of Natural History (AMNH 130240). Using definitions from Harris (1970. Bull. Maryland Herpetol. Soc. 6:21–22), both specimens were partial albinos, possessing integumentary xanthophores and orbital melanophores.

On 27 March 1997, another albino *A. opacum* larva was discovered in a vernal pool in Lyme, Connecticut. The coloration of this specimen was similar to that of the Tiverton larvae except the gills were yellowish and showed no red coloration from its blood, the eyes were slightly darker yellow than the integument, and most of the tail musculature was devoid of color and appeared white. The animal was placed in a jar, photographed, and returned to the pool. Color slides of this larva were sent to AMNH.

Albinism in *A. opacum* has been documented twice previously, once from Maryland (Harris, *op. cit.*) and once from Mississippi (Dyrkacz 1981. SSAR Herpetol. Circ. No. 11). To our knowledge, this is the first documentation of albinism for *A. opacum* in New England.

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Submitted by **BOB DEEGAN**, 97 Raymond Street, Fairhaven, Massachusetts 02719, USA, **JOHN BERKHOLTZ**, Franklin Park Zoo, Children's Zoo, 1 Franklin Park Road, Boston, Massachusetts 02121, USA, and **HANK GOLET**, 5-1 Binney Road, Old Lyme, Connecticut 06371, USA.

GYRINOPHILUS PORPHYRITICUS (Spring Salamander). **COLORATION**. Although many *Gyrinophilus porphyriticus* spend much time underground, making use of subterranean springs and caves (Bishop 1947. Handbook of Salamanders. Comstock, Ithaca, New York. 535 pp), albinism has been reported in only one population (Brandon and Rutherford 1967. Am. Midl. Nat. 78:537–540; Dyrkacz 1981. SSAR Herp. Circ. 11). On 1 May 1997 in Chenango County, New York, USA, we found an albino (leucistic) larval *G. porphyriticus* (66 mm SVL, 50 mm TL) at the emergence of an underground spring ca. 550 m elev. The individual had a completely pigmentless integument, gills pink with hemoglobin, and normally pigmented eyes. A total of 15 larvae and adults, all normally pigmented, were found at the same site over a 15 day period. The specimen is deposited in the SUNY Cortland Bowers Natural History Museum (97-101PKD).

Submitted by **CARMEN FERRIERO**, **SCOTT MILLER**, **MATTHEW CHAPMAN**, and **PETER K. DUCEY**, Department of Biological Sciences, State University of New York at Cortland, Cortland, New York, 13045 USA.

PLETHODON HUBRICHTI (Peaks of Otter Salamander). **ALBINISM**. Albinistic and leucistic salamanders in the genus *Plethodon* have been recorded for *P. cinereus* (Harris 1968. Bull. Maryland Herpetol. Soc. 4:57–60; Pauley 1974. Redstart 41:104), *P. dorsalis* (Thurow 1955. Copeia 1955:62–63), *P. glutinosus* (Piatt 1931. Copeia 1931:29), and *P grobmani* (reported as *P. glutinosus*, Highton 1956. Copeia 1956:75–93).

On 26 May 1996, we found a leucistic, gravid, adult female *P. hubrichti* (53 mm SVL, 111 mm total length, 1.9 g) in the George Washington and Jefferson National Forest, 960 m, 7.0 km SE Arcadia (79°33'55", 37°29'38"), Botetourt County, Virginia, USA (Fig. 1). Integumentary pigment was completely lacking, although she had normally pigmented eyes. She was found in a six-year-old clearcut of striped maple (*Acer pennsylvanicum*) and red oak (*Quercus ruber*) saplings. We maintained the female in captivity to obtain reproductive data but despite efforts to induce feeding, she died about 10 weeks after capture. This is the first record of the leucistic phase of albinism in this endemic Blue Ridge Mountains species. The specimen is catalogued in the Virginia Museum of Natural History (VMNH 8086).



FIG. 1. Leucistic albino *Plethodon hubrichti*.

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AMBYSTOMA LATERALE (Blue-spotted Salamander). **COURTSHIP and EGG LAYING BEHAVIOR**. *Ambystoma laterale* is a spring breeder found from Nova Scotia to New England and throughout the Great Lakes region (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Public Museum, Milwaukee, Wisconsin. 205 pp.). Few studies on the courtship behavior of this species have been published (Arnold 1977. *In* D. H. Taylor and S. I. Guttman, eds., The Reproductive Biology of Amphibians, pp. 141–183. Plenum Press, New York). Observations on the courtship and egg laying behavior of *A. laterale* were conducted during March–April of 1991, 1992, and 1995 at an ephemeral pond in Waukesha Co., Wisconsin, USA. These observations confirm the pattern reported by Kumpf and Yeaton (1932. Amer. Mus. Novit. 546:1–7) and Storez (1969. J. Herpetol. 3:87–95) and provide additional observations on courtship.

Salamanders were collected in pitfall traps, or during nocturnal migration. In the laboratory, they were maintained at 15–20°C in a 37.9-liter aquarium containing moist soil and bark for cover. Salamanders were not segregated by sex. Courtship and egg laying observations were made in a 75.7-liter aquarium with a gravel substrate, plastic plants, twigs, leaves, and rocks to stimulate natural conditions during two weeks following capture. Approximately 25 cm of dechlorinated or pond water at 20°C was used for all the trials. Courtship and egg laying behaviors were observed under light and dark conditions using red and white light. Females were placed in the tank with either one or two males. The courtship description follows Salthe's (1967. Copeia 1967:100–117) division of salamander courtship into five stages: 1) awareness and overtures, 2) capture of female, 3) initiation of spermatophore deposition, 4) spermatophore deposition, and 5) insemination of female.

Five courtships were observed for *A. laterale* in the laboratory: three with one male and one female, one with two males and one female, and one with two females and one male. Courtship rituals were variable, but all had recognizable characteristics.

The first stage, awareness and overture was brief. The first awareness by the male of the female, or vice versa, seemed to be chemically dependent, as both sexes seemed to be tasting the water while moving about the tank. The nudging behavior that followed awareness became critical to the male's recognition of the sex of his partner. When a male approached another animal he would direct his snout to the side region between the fore and hind limbs. Simultaneously, the male would prod his snout against the other animal's side and/or cloacal region. This behavior was directed equally to both sexes when present but soon became more intense and directed solely toward the female. This short nudging process usually lasted 30–45 s and was followed by the second stage capture of the female.

Capture of the female began by the male amplexing with the female. Amplexing usually lasted 1–2 minutes. The capture of the female consisted of three parts as described by Storez (*op. cit.*). In the initial clasp the male was passive while the female moved about the tank. Following this passive phase, which lasted 10–30 s, the male began rubbing his chin from side to side over the female's snout. The second phase occurred when the male arched forward, released his grasp, and moved ahead of the female. He then turned and moved directly back over the female until his body was even with the female's tail. At this point, phase 3, the male turned once again and resumed his clasp of the female and resumed rubbing his chin against the female's snout. The male became very excited during the third phase, his rubbing became more intense, and he began to rub his cloaca against the female's back by undulating his tail from side to side.

The capture stage led to the spermatophore initiation and deposition stages. In these two stages, the male released the female and moved ahead of her, his body vibrating intensely. With the female behind him, the male held his hind legs straight out to either side, pressed his cloaca against the substrate, and released a spermatophore. Males were observed releasing 1–3 spermatophores per courtship and no females were observed picking up the spermatophores. Males would stop depositing spermatophores if the female stopped following the male or if the male got too far out in front of the female.

Other characteristics arose in the courtship when two males or two females were placed in the breeding tank with one member of the opposite sex. When two males were placed with one female the non-courting male was observed to interrupt the courtship at all stages by amplexing with the pair or dislodging the courting male. When two females were placed with a single male, the non-courted female would align herself parallel to the courted female. As the male proceeded with the capture of the female he became disoriented and switched partners, amplexing with the non-courted female.

One female deposited eggs two days after courtship was observed. Egg laying began at 2230 h and continued until 0317 h. The female was observed climbing up onto twigs and other vegetation in the tank. Once finding a suitable location the female pressed her cloaca against the vegetation and deposited clumps of 1–13 eggs. A total of 212 eggs were laid in 4.75 h, most of them being deposited singly. None of the eggs was fertile.

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Submitted by **MATTHEW G. BOLEK**, Department of Biology, Carroll College, Waukesha, Wisconsin 53816, USA. Present Address: Department of Biological Sciences, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin, 53201, USA; e-mail: bolek@csd.uwm.edu.

AMPHIUMA MEANS (Two-toed Amphiuma). **DIET**. On 19 August 1992, a recently drowned *Amphiuma means* (SVL 78.5 cm; TL 102 cm; mass with empty stomach 1350 g) was removed from a funnel trap in a cypress dome swamp in the Spring Creek Unit of Big Bend Wildlife Management Area, Taylor County, Florida, USA. While being preserved, the amphiuma regurgitated a crayfish and a *Regina rigida* (SVL 71.1 cm) that had been swallowed tail first. The snake was close to the record size (TL 79.7 cm) reported by Conant and Collins (1991. A Field Guide to Reptiles and Amphibians Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.), but its total length could not be determined because the tail was partially digested. The only other recorded predators of *R. rigida* are *Rana catesbeiana* (Hensley 1962. Herpetologica 18:141) and *Lampropeltis getula* (Viosca 1926. Copeia 1926:109).

Submitted by **KEVIN M. ENGE**, Florida Game and Fresh Water Fish Commission, Route 7, Box 3055, Quincy, Florida 32351, USA.

AMPHIUMA TRIDACTYLUM (Three-toed Amphiuma). **ECTOPARASITES**. On 19 February 1995, an adult female *Amphiuma tridactylum* was captured in a small roadside ditch in Hammond, Tangipahoa Parish, Louisiana, USA. Three leeches were collected from the *Amphiuma*. These were identified as *Placobdella montifera* (1 specimen) and *P. multilineata* (2 specimens) by Ron W. Davies and were deposited in his reference collection at Monash University, Melbourne, Australia. The keeled-back leech (*P. montifera*) is known to parasitize a number of fish species (Bere 1931. Trans. Wisconsin Acad. Sci. Arts Letters 26:437–440; Meyer 1946. Trans. Amer. Micros. Soc. 65:237–249; Davies 1973. Can. J. Zool. 51:531–545; Amin 1981. Trans. Amer. Micros. Soc. 100:42–51) and has been collected from frogs, toads, mussels, and snails (Mathers 1948. Proc. Iowa Acad. Sci. 55:397–421). However, there are no reports of parasitic interactions between *P. montifera* and *Amphiuma*. In addition, *P. montifera* has not been previously encountered in Louisiana (Sawyer 1972. Illinois Biol. Monogr. 46. Univ. Illinois Press, Chicago. 155 pp.). This is also the first report of an amphibian parasitized by *P. multilineata*. This leech has been collected from turtles (Forrester and Sawyer 1974. J. Parasitol. 60:673; Sawyer and Shelley 1976. J. Nat. Hist. 10:65–97; Stone 1976. Southwest. Nat. 20:575–576), as well as on American alligators from Tangipahoa Parish, Louisiana, and Florida (Forrester and Sawyer, *op. cit.*; Cherry and Ager 1982. J. Parasitol. 68:509–510; Brantley and Platt 1991. Herpetol. Rev. 22:4–5).

Submitted by **RAYMOND A. SAUMURE**, Department of Natural Resource Sciences, McGill University, 21111 Lakeshore Road, Ste-Anne-de-Bellevue, Québec, H9X 3V9, Canada, e-mail: clemmys@total.net, and **J. SEAN DOODY**, Applied Ecology Research Group, University of Canberra, P.O. Box 1, Belconnen, ACT 2616, Australia.

EURYCEA JUNALUSKA (Junaluska Salamander). **MORPHOLOGY**. Thirty *Eurycea junaluska* larvae were collected from the Cheoah River (Graham Co., North Carolina, USA) on 12 May 1995. Two of these individuals (37.1 and 25.6 mm SVL) were observed to have scoliosis of the spinal column. This condition did not appear to hinder locomotion in the field nor in the lab and was confirmed by radiography. Because of incomplete ossification of the larval skeleton, the radiographs are of poor quality, but they are sufficient to demonstrate the vertebral malformations. The specimens and a radiograph are deposited at the North Carolina State Museum (NCSM39536–37).

Spinal abnormalities have been reported in other salamanders (e.g., *Plethodon glutinosus*; Marvin 1995. Herpetol. Rev. 26:30), but I am unaware of a record of the condition in pre-metamorphic individuals. Based on the size distribution of larvae at Cheoah River (T. J. Ryan, unpubl.) and nearby Santeetlah Creek (Ryan 1998. J. Herpetol. 32: *in press*), the affected individuals are likely representatives of the 1993 and 1994 hatchling classes. The affected individuals are of a size representative of their cohorts, indicating that the condition has not negatively influenced growth. I have not observed this condition in any other *E. junaluska* larvae, despite examining more than 100 *E. junaluska* larvae from the Cheoah River, and over 300 others from populations in western North Carolina (Ryan 1997. Copeia 1997:210–215) from April 1994 to present. That the affected individuals were from successive cohorts in the same population may suggest the condition is environmentally induced due to conditions unique to the Cheoah River site or possibly due to a heritable factor.

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Submitted by **TRAVIS J. RYAN**, Savannah River Ecology Laboratory, P.O. Drawer E, Aiken, South Carolina 29802, USA.

PLETHODON IDAHOENSIS (Coeur d'Alene Salamander). **EGG MASS.** Although egg masses have been described for most western *Plethodon* no such description exists for *Plethodon idahoensis*. This salamander's secretive habits have prevented observation of its eggs in the wild (Lynch 1984. MS Thesis, Univ. Idaho, Moscow. 59 pp.). Herein we describe a clutch of eggs from a captive *P. idahoensis* obtained from the Kootenai River Valley, Lincoln County, Montana, USA during 1988. The eggs were discovered in an aquarium maintained in the Washington State University Department of Zoology and were laid during the week of 2–9 June 1989. Whether a female was in attendance is unknown. The egg mass (maximum dimension 21 mm) contained seven coherent, creamcolored eggs (mean = 5 mm; range 4.9–5.1 mm; SD = 0.07), each surrounded by two jelly capsules. There was no suspensory stalk; six of the eggs forming a single layer attached to paper toweling that lined the aquarium. This egg mass is similar to that described for the closely related *P. vandykei* (Jones 1989. Herpetol. Rev. 20:48). This egg mass has been deposited at the California Academy of Sciences (CAS 202842).

Submitted by **MICHELE D. LARSON** and **ALBERT G. WILSON, JR.**, Department of Life Sciences, Spokane Falls Community College, MS 3180, 3410 Fort Wright Drive, Spokane, Washington 99204, USA, and **JOHN H. LARSEN, JR.**, Department of Zoology, Washington State University, Pullman, Washington 99164, USA.

PSEUDOEURYCEA GALEANAE (Galeana False Brook Salamander). **HABITAT USE**. Salamanders of the genus *Pseudoeurycea* are generally found in forested areas under rocks, rotten wood, in caves, or less commonly inside epiphytic bromeliads (Wake and Lynch 1976. Nat. Hist. Mus., Los Angeles Co. Sci. Bull. 25:1-65). *Pseudoeurycea galeanae* is endemic to Nuevo León, México, and is reported from four localities (Johnson et al. 1982. Herpetol. Rev. 13:51; Taylor 1941. Proc. Biol. Soc. Washington 54:81).

We conducted a diurnal search on 23 May 1997 at Puerto de Cieneguillas, 6 km S Pablillo, Nuevo León, México (24°31'10"N, 99°58'58"W, ca. 2577 m elev.) where *P. galeanae* was previously located (E. Liner, unpubl. data). The general habitat was a mixed forest of *Pinus* sp. and *Quercus* sp. We found three adult specimens (GP 45–47) inside dead *Agave* sp. The salamanders were located at the insertion of the leaves with the rotten trunk, up to 40 cm above the ground. The leaves were very wet, and small amounts of water with rotten plant matter had accumulated at the juncture of the leaves and trunk. After 45 min of searching not a single specimen was found under rocks or logs. The salamanders were found in the ecotone between the forest and small pastures. At the time of our visit the first rains of the season had began, but the amount of rain was small and the soil was still dry under rocks and logs. It seems likely that the salamanders use the leaves of the *Agave* (especially the rotten ones) as a refuge for aestivation

and temporary microhabitat when the soil is still dry, in the same way that more tropical species (e.g., *P. scandens*, *P. nigromaculata*) use bromeliads. This is an unusual microhabitat for non-tropical bolitoglossine salamanders. The use of plants above ground as habitat is common among tropical species inhabiting humid zones, but is not reported in temperate, more xeric areas. *Pseudoeurycea galeanae* is apparently uncommon, but the paucity of records may be due to the use of a habitat not usually surveyed for bolitoglossine salamanders.

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Submitted by **GABRIELA PARRA-OLEA** and **MARIO GARCIA-PARIS**, Museum of Vertebrate Zoology and Department of Integrative Biology, University of California, Berkeley, California 94720, USA.

TARICHA GRANULOSA (Roughskin Newt). **BEHAVIOR.** On 6 May 1997 near Lake Cowichan, Vancouver Island, British Columbia, we observed a male *Taricha granulosa* in amplexus with a female *Ensatina eschscholtzii*. The pair was swimming in a small, temporal pool (ca. 2 m diameter and 50 cm deep), and the *T. granulosa* had the *E. eschscholtzii* firmly clasped in axillary amplexus. The salamanders separated when we picked them up for closer inspection. The *E. eschscholtzii* was extremely sluggish, suggesting that the amplexus had lasted for some time. The newt was in the smooth-skinned, breeding phase. The observation occurred between 1400-1500 h ca. 10 m from the shore of Lake Cowichan under the shaded canopy of Douglas fir *(Pseudotsuga menziesii)* and red cedar *(Tsuga heterophylla)*. Rain had fallen for several days, and conditions were favorable for salamander activity. The newt could have captured the terrestrial *E. eschscholtzii* along the edge of the pool and dragged it into the water. Alternatively, the *E. eschscholtzii* could have either fallen or ventured into the pool where the newt clasped it. On Vancouver Island, Guppy (1953. Victoria Nat. 10:25–27) found an *E. eschscholtzii* on the bottom of a small lake and suggested that *E. eschscholtzii* may occasionally venture into the water to rehydrate. Reports of indiscriminate clasping behavior involving salamanders are rare. To our knowledge, this is the first report of an interspecific amplexus between aquatic- and terrestrially-breeding salamanders.

Submitted by **CHRISTIAN ENGELSTOFT**, Alula Biological Consulting, 1967 Nicholas Road, Saanichton, British Columbia, Canada, V8M 1X8 (e-mail: alula@islandnet.com), and **KRISTINA OVASKA**, Renewable Resources Consulting Services Ltd., 214 Marine Technology Center, Sidney, British Columbia, Canada V8L SY8 (e-mail: kovaska@jdmicro.com).

ANURA

BUFO FERGUSONII (Ferguson's Toad). **ECOLOGY.** *Bufo fergusonii* Boulenger 1892, is a small (adult females to 46 mm SVL), terrestrial bufonid endemic to peninsular India. It also has been reported from Sri Lanka (Dutta. 1997. Amphibians of India and Sri Lanka [Checklist and Bibliography]. Odyssey Publ. House, Bhubaneswar. xiii + 342 + xxii pp.). Little is known of its ecology (Daniel 1963. J. Bombay Nat. Hist. Soc. 60:415–438; Rao 1915. Rec. Indian Mus. 11:31–38; Satyamurti 1967. Bull. Madras Govt. Mus. n.s. Nat. Hist. 7[2]:1–90). A series of eight breeding adults collected from the base of Pataravakkam Hill near Tiruvadisoolam (12°45'N, 80°04'E), Chengleput District, Tamil Nadu State, southeastern India, provided information on size, microhabitat, diet, and reproduction. Collections were made on 16 Nov 1997 between 1830–2040 h, after heavy showers that characterize the Northeast Monsoons in southeastern India. There were intermittent light showers during the period of collection.

Five gravid females measured 34.2–44.3 mm SVL (mean 40.84 ± 1.87 SE) and weighed 3.3–10.1 g (mean 7.04 ± 1.25 SE); three adult males measured 30.4–33.7 mm SVL (mean 31.53 ± 1.19 SE) and weighed 2.2–3.5 g (mean 2.9 ± 0.38 SE). All males had pale yellowish median subgular vocal sacs, but no nuptial pads. These specimens were taken from an undulating area dominated by scrub forest. All females and two males were found in wet grassy clearings among scrub and grassy puddles; one male was found floating on the surface of a ca. 0.3 m deep ephemeral pool with dense shore vegetation.

All toads contained food in their stomachs. Of the 20 prey items discovered, 17 (85%) were Formicidae, 2 (10%) Coleoptera, and 1 (5%) Hemiptera. Number of items in stomach samples ranged from 1–5 (mean 3.5; N = 8), and although females showed more prey items (1–5) than males (1–2), this difference was not statistically significant (paired *t*-test, $P < 0.05$). Prey length varied between 3.3–11.2 mm (mean 7.32 ± 1.37 SE; N = 5). Rao (*op. cit.*) mentioned that *B. fergusonii* is a termite specialist, avoiding ants, beetles, and earthworms.

All males had enlarged testes, and all females carried unpigmented eggs (0.08–0.1 mm diam). Clutch weight and relative clutch mass in five females ranged from 0.4–2.5 g (mean 1.50 ± 0.40 SE) and 0.08–0.27 (mean 0.21 ± 0.04 SE).

We thank Tharaq Andrews, Romaine Andrews and Kathryn Hawkswell for assistance in collection and Romaine Andrews for transport.

Submitted by **INDRANEIL DAS**, Institute of Biodiversity and Environmental Conservation (IBEC), Universiti Malaysia Sarawak (UNIMAS), 94300 Kota Samarahan, Sarawak, Malaysia; e-mail: idas@mailhost.unimas.my and **GERARD N. MARTIN**, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

DENDROBATES AURATUS (Black-and-Green Poison Dart Frog). **PREDATION.** At ca. 0930 h on 26 March 1995, an adult rufous motmot (*Baryphthengus marhi*) was observed in secondary lowland tropical forest located at Estacion Biologica La Suerte, near the town of Cariari in the Province of Limon, northeastern Costa Rica. The bird was ca. 25 m from a hiking trail and was perched on a bare branch in an exposed position ca. 3 m above ground. The lone individual was observed with binoculars for ca. 4 min. Another bird landed on the same branch and sat next to the original individual. The newly arrived motmot was grasping a *Dendrobates auratus* in its beak which it immediately fed to the original individual. In the field is difficult to distinguish male and female rufous motmots, however this behavior was interpreted as a male feeding the female as a courtship gesture. Both individuals had the diagnostic black mask on the breast and racquet-tails indicative of adult birds. The pair continued sitting on the branch for ca. 30 min., after which they flew off together into the forest. Neither individual appeared to suffer any ill effects from either grasping or consuming the *D. auratus* during this period.

Although this foraging behavior has not been documented in

the field, blue-crowned motmots (*Momotus momota*) inhabiting the rainforest exhibit at the National Aquarium in Baltimore have consumed *D. auratus* and several other species of poison dart frogs (C. Rowsom, pers. comm.).

I thank Tom LaDuke of East Stroudsburg University and Brent Graves of Northern Michigan University for their encouragement and assistance with this note.

Submitted by **TERRY L. MASTER,** Department of Biological Sciences, East Stroudsburg University, East Stroudsburg. Pennsylvania 18301, USA.

PHYSALAEMUS CENTRALIS (NCN). **MALE-MALE COMBAT.** The genus *Physalaemus* contains 37 species and is distributed throughout the Mexican lowlands to northern Argentina (Frost 1985. Amphibian Species of the World. Allen Press, Lawrence, Kansas, 732 pp.). The occurrence of male-male combat within the genus is only reported for *Physalaemus pustulosus* (Ryan 1985. The Túngara Frog: A Study in Sexual Selection and Communication. University of Chicago Press, Chicago, Illinois. 230 pp.) and *P. cuvieri* (Barreto and Andrade 1995. Amphibia-Reptilia 16:67–76).

Herein I report field observations of eight male-male combats in *Physalaemus centralis*, observed 20–21 November 1996 in temporary ponds at the Centro de Pesquisas e Treinamento em Aquicultura, near Cachoeira das Emas, municipality of Pirassununga (47°25'28"W; 21°59'52", 620 m), state of São Paulo, southeastern Brazil.

Males often called while floating in small puddles (ca. 5 cm diameter and 3 cm deep). In a typical encounter, the invader frog quietly and slowly approached the calling resident from behind. When the distance between the two males was less than 10 cm, the invader rapidly approached the resident, jumped underneath it, and using kicks, moved it out of the calling site. The resident would then quickly return to the site and jump on the invader, holding it in a venter-venter position. The two frogs rolled on the ground or in the water until separating. In all combat bouts observed, the winner was always the resident male. In eight observations, the loser returned five times to the original calling site and repeated the fight sequence two or three times. The combat bout terminated when the loser dispersed and the winner resumed calling. Combat bouts lasted from one to three minutes. No calls were heard during the interactions.

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Submitted by **CINTHIA AGUIRRE BRASILEIRO**, Curso de Pós-Graduação em Ecologia, Museu de História Natural, Instituto de Biologia, Caixa Postal 6109, Unicamp, 13083-970, Campinas, São Paulo, Brazil.

RANA AURORA DRAYTONII (California Red-legged Frog). **EGG PREDATION.** The designation of the California red-legged frog (*Rana aurora draytonii*) as Threatened by the U.S. Fish and Wildlife Service (Fed. Reg. 23 May 1996, 61[101]:25813–25833) has heightened concern about mortality from predation. Of special concern has been the potential impacts of the introduced bullfrog (*R. catesbeiana*) and exotic fishes on tadpoles and adults (reviewed in Fed. Reg. 2 Feb 1994, 59[22]:4888–4895). Virtually no information, however, has been published on predation of eggs in *R. a. draytonii*.

On 12 March 1997, at Lower Staub Pond (Swanton-Pacific Ranch, Scott Creek drainage, Santa Cruz County, California, USA), I found a 1 to 2-day-old red-legged frog egg mass. It was located at the surface of the water and was attached to the outer stems of a clump of *Juncus*. The water depth was about 25 cm.

I watched several newts (*Taricha* sp.) feeding on the eggs from 1620–1715 h. There were always 1–3 newts at the egg mass, and I estimated 6–8 individuals ate up to four eggs each during my observations.

During ingestion, each newt faced the egg mass and snapped up a single jelly-encased ovum with a short lunge. While the egg was grasped in the mouth, each newt shook its head violently back and forth 4–5 times in 2–4 bouts separated by about 2–3 s. The egg was dislodged from the mass by this shaking, and perhaps the jelly envelope was also removed. Swallowing motions followed the shaking. The forelegs were not used during ingestion.

After observing the feeding newts, I captured a female that had ingested two eggs, which were regurgitated in my hand. The eggs appeared to be without jelly envelopes. I dissected the newt, but found her digestive tract empty. On the afternoon of 11 March 1997, 5 Gee minnow traps (ca. 43 cm long, 2 cm diameter entrance, 6 mm mesh) were set about 2 m from shore along the perimeter of Lower Staub Pond. When the traps were checked mid-morning the next day, they yielded 46, 34, 30, 22, and 3 newts. These numbers corroborated my observations that the population of *Taricha* in the pond was large.

Egg and tadpole predation by native newts may be an important factor in *R. a. draytonii* population dynamics that should be considered along with other documented forms of predation.

I am grateful to Walter R. Mark, California Polytechnic State University, San Luis Obispo, for permission to work on the Swanton-Pacific Ranch. Assistance from Jae Able, Susan Christopher, Mark Jennings, Dawn Smith Reis, and Norm Scott, Jr., was also appreciated.

Submitted by **GALEN B. RATHBUN**, U.S. Geological Survey, Biological Resources Division, Piedras Blancas Research Station, San Simeon, California, USA 93452-0070; e-mail: galen_rathbun@usgs.gov.

XENOPUS LAEVIS (African Clawed Frog). **PREDATION.** Avian predation on *Xenopus laevis* has been documented in Africa but not in extralimital populations in the United States. Here we offer evidence of predation by birds in a recently discovered population of *X. laevis* in southern California.

On 21 May 1996, while examining black-crowned night heron (*Nycticorax nycticorax*) nests at Piute Ponds on Edwards Air Force Base, southwest of Rosamond Lake, Los Angeles Co., California (34°47'N, 118°7'W), RLH found a ca. 21-day old chick that regurgitated the partial carcass of *X. laevis*. The carcass was retained and the partial skeleton was deposited at the University of California, Davis (UCDMZ 12275). During a subsequent visit on 17 October 1996, JJC observed >10,000 adult and recently metamorphosed *X. laevis*. Eight recent metamorphs were collected and catalogued into the California Academy of Sciences (CAS 202468–475) .

To further document predation of *X. laevis,* JJC collected bird pellets from beneath a Fremont cottonwood (*Populus fremontii*) at the north edge of one of the ponds where the frogs were observed. This tree was the site of an active great blue heron (*Ardea herodias*) nest during May 1996. Based on skeletal characteris-

tics, 12 of 25 pellets contained the remains of *X. laevis* and 13 contained the remains of rodents or birds. Among those pellets containing frog remains, 10 contained skeletal elements from a single frog and two contained parts of two frogs.

In a Joshua tree (*Yucca brevifolia*) ca. 0.5 km from the first nest and 30 m south of the water's edge, was another great blue heron nest, which had also been active during May 1996. An examination of 16 pellets found under this nest yielded no frog bones. However, bones from a single *X. laevis* were found on the ground amid other bird and mammal bones and weathered pieces of pellets.

During a third trip on 21 December 1996, JJC examined ca. 250 pellets found under seven Joshua trees and two willow trees (*Salix* sp.) on the pond's perimeter. These contained the remains of 22 *X. laevis,* 12 of them singly in pellets and 10 of them in pellets containing two frogs. One pellet contained bird bone fragments mixed with *X. laevis* bones and another contained kangaroo rat (*Dipodomys* sp.) bones mixed with bones of two *X. laevis.*

Piute Ponds consist of ca. 80 h of flooded desert playa, with perennial open water and extensive cattail (*Typha angustifolia*) and bulrush (*Scirpus* spp.) marshes. Several species of wading birds, including great egrets (*Ardea alba*), great blue herons, black-crowned night herons, and snowy egrets (*Egretta thula*) are present year round. Ciconiiformes with similar feeding capabilities, including black-headed herons (*Ardea melanocephala*) [O'Connor 1984. Ostrich 55:221–222], yellow-billed egrets (*Egretta intermedia*) [Bates et al. 1992 Ostrich 63:44], hamerkops (*Scopus umbretta*) [Loveridge 1953. Bull. Mus. Comp. Zool. Harvard 110:325–406], and Marabou storks (*Leptoptilus crumeniferus*) [Kahl 1966. J. Zool. 148:289–311] are documented predators of *Xenopus* spp. in Africa. Thus, any Ciconiiformes at Piute Ponds are potential predators of *X. laevis.* However, without direct observation we cannot be certain which species other than black-crowned night herons produced the pellets containing the *X. laevis* bones.

We thank W. Deal and M. Hagen for permitting access to the site and M. Jennings and T. Custer for their review of this note. Specimens were collected under California Department of Fish and Game Scientific Collecting Permit #803046-03.

Submitted by **JOHN J. CRAYON** and **ROGER L. HOTHEM**, U.S. Geological Survey, Biological Resources Division, California Science Center, Davis Field Station c/o Wildlife, Fish, and Conservation Biology, University of California, Davis, California 95616-5224, USA.

GYMNOPHIONA

SIPHONOPS HARDYI (Hardy's Caecilian). **PREDATION.** On 11 September 1994 after a rainy night we collected a juvenile Maximilian's snake-necked turtle (*Hydromedusa maximiliani*; 105 mm straight-line carapace; 91 g) biting an "earthworm-like" prey at midbody. The turtle was discovered in a dammed portion of a hillside streamlet covered by coastal rain forest (Atlantic Forest) at the Sítio Três Marias, Municipality of Marechal Floriano, State of Espírito Santo, eastern Brazil (20°24'36"S, 40°49'26"W), ca. 680 m elevation. The prey was the small, subterranean, and poorly known caecilian *Siphonops hardyi* (163 mm TL, 4.5 g). This appears to be the first record of a turtle preying on a caecilian. It is possible that such predatory events are uncommon due to habitat segregation of the aquatic predator and its subterranean prey. The turtle and its prey are in the Coleção Zoológica da Universidade Federal do Espírito Santo (ZUFES 150391 and 140348).

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Submitted by **CLAUDIO ZAMPROGNO** and **MARIA DAS GRAÇAS F. ZAMPROGNO**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil. e-mail (CZ) czamprog @ server.npd.ufes.br.

CROCODYLIA

ALLIGATOR MISSISSIPPIENSIS (American Alligator) and ***GOPHERUS POLYPHEMUS*** (Gopher Tortoise). **COMMENSALISM.** During a gopher tortoise relocation project in Collier County, Florida, USA, an excavated tortoise burrow revealed a 76.2 cm *Alligator mississippiensis* sharing the burrow with an adult tortoise. The burrows being excavated were located in a saw palmetto (*Serenoa repens*) prairie, which exhibits higher elevations and drier conditions than most wooded habitats in Florida. The burrows were excavated during the first part of May 1996. This is the beginning of the rainy season in Florida, and most lakes and canals have very low water levels at this time. The nearest standing water, a 4.6 ha pond cypress (*Taxodium ascendens*) swamp, is ca. 430 m from the tortoise burrow.

Some of the more common and documented commensals known to utilize *G. polyphemus* burrows in southwest Florida include *Rana areolata* (Gopher Frog), *Drymarchon corais couperi* (Eastern Indigo Snake), and *Crotalus adamanteus* (Eastern Diamondback Rattlesnake). To my knowledge, this is the first observation of an *Alligator mississippiensis* sharing a burrow with *G. polyphemus.*

Submitted by **STEPHANIE M. VORIS**, Wilson, Miller, Barton & Peek, Inc., 3200 Bailey Lane, Suite 200, Naples, Florida 34105-8507, USA.

TESTUDINES

LEPIDOCHELYS KEMPI (Kemp's Ridley Sea Turtle). **DIET.** Adult *Lepidochelys kempi* diets have been well documented in the Gulf of Mexico (Marquez 1990. Food and Agriculture Organization Fisheries Synopsis: Sea Turtles of the World. No. 125, Vol. 11. Rome, FAO. 81 pp.). However, little is known about this turtle's feeding habits as a subadult or its feeding habits along Georgia's coast. Here, we report the stomach/gastrointestinal tract contents of 12 stranded, juvenile to adult-sized *Lepidochelys kempi* (Table 1). These collections were obtained from 1992 to 1997 from Wassaw Island, Georgia, USA (31°55'0"N, 80°56'0"W).

All stomach and gastrointestinal tract contents examined from *L. kempi* are considered to be relatively shallow water inhabitants ($\leq$ 25 m deep) (Ruppert and Fox. 1985. Shallow Water Marine Benthic Macroinvertebrates of South Carolina. University of South Carolina Press, Columbia. 330 pp.). This further supports the belief that *L. kempi* commonly inhabit and feed in shallow water environments.

We thank Robert A. Moulis, Kristina L. Williams, and Randy Isbister for their guidance and support on Wassaw NWR, and the Georgia Department of Natural Resources (Brad Winn, John Jensen, Mike Harris, and Steve Pete) and U.S. Fish and Wildlife Service (John Robinette, Sam Drake, Mark Musaus, Charles Warnock, and Jim Stockie) for supporting such investigations along the Georgia coast.

TABLE 1. Stomach/gastrointestinal tract contents of *Lepidochelys kempi* from Wassaw Island, Georgia, USA.

Date	CCL	Sex/Age Class	Contents	Common Name
06 September 1992	69.0 cm	Female / Adult	*Callinectes sapidus*	Blue Crab
			Libinia dubia	Spider Crab
			Nassarius obsoletta	Mud Snail
			Mennipe mercenaria	Stone Crab
			Stenocionops furcata	Decorator Crab
			2 chicken necks	
06 September 1992	63.5 cm	Female / Adult	*Callinectes sapidus*	Blue Crab
			Libinia dubia	Spider Crab
			Nassarius obsoletta	Mud Snail
08 July 1993	63.5 cm	Female / Adult	*Callinectes sapidus*	Blue Crab
			Libinia dubia	Spider Crab
			Malaclemys terrapin	Diamondback Terrapin
05 May 1994	31.5 cm	Female / Juvenile	*Beroe* sp.	Beroe's Comb Jelly
			Callinectes sapidus	Blue Crab
			Dinocardium robustum	Great Heart Cockle
			Divaricella quadrisulcata	Cross-hatched Lucine
			Nassarius obsoletta	Mud Snail
			Siliqua costata	Ribbed Mussel
			Ulva lactuca	Sea Lettuce
22 August 1994	30.0 cm	Female / Juvenile	*Callinectes sapidus*	Blue Crab
			Dinocardium robustum	Great Heart Cockle
			Sclerodactyla briareus	Hairy Sea Cucumber
			Squilla empusa	Mantis Shrimp
			Ulva lactuca	Sea Lettuce
			unidentified fish scraps	
17 September 1994	45.1 cm	Female / Subadult	*Beroe* sp.	Beroe's Comb Jelly
			Callinectes sapidus	Blue Crab
			Luidia clathrada	Slender Sea Star
			Menippe mercenaria	Stone Crab
			Nassarius obsoletta	Mud Snail
			Penaeus duorarum	Pink Shrimp
			Squilla empusa	Mantis Shrimp
05 June 1995	29.2 cm	Female / Juvenile	*Callinectes sapidus*	Blue Crab
			Menippe mercenaria	Stone Crab
			Nassarius obsoletta	Mud Snail
			Priontus carolinus	Northern Sea Robin
			Ulva lactuca	Sea Lettuce
16 August 1995	30.0 cm	Female / Juvenile	*Callinectes sapidus*	Blue Crab
			Libinia dubia	Spider Crab
			Menippe mercenaria	Stone Crab
			Nassarius obsoletta	Mud Snail
25 October 1995	40.0 cm	Female / Subadult	*Callinectes sapidus*	Blue Crab
			Menippe mercenaria	Stone Crab
			Nassarius obsoletta	Mud Snail
			Penaeus duorarum	Pink Shrimp
20 January 1996	57.7 cm	Female / Adult	*Callinectes sapidus*	Blue Crab
21 May 1996	32.5 cm	Female / Juvenile	*Callinectes sapidus*	Blue Crab
14 May 1997	55.2 cm	Female / Adult	*Argopecten gibbus*	Calico Scallop
			Astropecten articulatus	Margined Sea Star
			Busycon sinistrum	Lightning Whelk
			Callinectes sapidus	Blue Crab
			Conus stearnsi	Stearn's Cone
			Divaricella quadrisulcata	Cross-hatched Lucine
			Fasciolaria lilium	Banded Tulip
			Gymnachirus melas	Naked Sole
			Ulva lactuca	Sea Lettuce

Submitted by **MICHAEL G. FRICK** and **PERI A. MASON**, Savannah Science Museum, Caretta Research Project, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

LACERTILIA

CTENOSAURA SIMILIS (Ctenosaur, Garrobo, Iguana Negra). **BEHAVIOR.** Recently I observed a predation event involving a frog distress call that attracted a large ctenosaur, presumably by the opportunity to pirate a meal, allowing the frog to escape from its original predator (a colubrid snake). Although anecdotal, this observation is one of only a few examples in the herpetological literature of predator attraction to distress calls, and the second example of a selfish benefit to distress calling in an amphibian.

The Río Cabuyo, in the Lomas Barbudal Biological Reserve in Guanacaste, Costa Rica (10°30'N, 85°23' W), is a small river with a stable flow of ground water during the long dry season (December–May). The river bank has a narrow flood plain about 1–3 m wide leading from the water's edge to a steep embankment created by erosion during times of high water in the wet season. On the afternoon of 30 March 1993, a racer (*Coluber* [= *Masticophis*] *mentovarius*), about 1.5 m in total length, captured a large frog (species unknown) on the narrow flood plain near the water's edge. The frog, emitting a series of loud yelping sounds, was held firmly in the mouth of the snake with its forelimbs and head extending from the snake's mouth. Within about 5–10 s, a large ctenosaur (*Ctenosaura similis*), situated about 10 m beyond the embankment, advanced through the dry leaf litter on the forest floor to the cusp of the steep embankment, then quickly dropped the 2 m to the flood plain, and ran directly toward the frog and snake. Before the ctenosaur reached the frog and snake, the frog broke free from the snake's grasp. In two long leaps the frog jumped into the stream and was carried by the current to safety. It was not clear whether the snake voluntarily released the frog, or if the frog took advantage of the distraction caused by the abrupt appearance of the ctenosaur to struggle free. For about 5 min after the frog had escaped, the snake and ctenosaur searched the flood plain in the area where the frog had been captured, all the while maintaining a distance of at least 1–2 m from each other.

The topography of the embankment prevented the frog/snake interaction from being visible from the forest floor where the ctenosaur initiated its approach. The acoustic distress signal however, would have been clearly audible to the ctenosaur. This anecdote further supports the hypothesis that distress calls benefit the signal sender by attracting secondary predators that interfere with the primary predator, thereby creating an opportunity for escape.

Submitted by **BRIAN D. WISENDEN**, Department of Zoology, University of Western Ontario, London, Ontario, N6A 5B7, Canada. Present address: Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9, Canada.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard). **PREDATION.** In extreme northern Chihuahua, México, near its border with New Mexico, few thorn-bearing bushes are available in the dune habitat for use by verdugos (loggerhead shrikes, *Lanius ludovicianus*), which substitute barbed wire fences both as perches and as impaling devices on which prey are temporarily stored. Prey, ranging in size from grasshoppers to rufous-sided towhees, are known to have been impaled on barbed wire (Vander Wall 1990. Food Hoarding in Animals. University of Chicago Press, Chicago, Illinois). Although it is not surprising that verdugos prey upon *Phrynosoma cornutum*, we are unaware of reports of these lizards being impaled. Therefore, we offer the photograph in Fig. 1 (UCM 58818, 49 mm SVL), taken during a lizard survey on Rancho El Tule, Chihuahua, near the Mexico-New Mexico border (31°45'N, 107°13'W), 4 June 1997. A pair of *L. ludovicianus* was seen on this fence in the immediate vicinity of the impaled *P. cornutum*.



FIG. 1. *Phrynosoma cornutum* impaled on barbed wire by a verdugo (*Lanius ludovicianus*).

Submitted by **JULIO A. LEMOS ESPINAL**, Laboratorio de Conservacíon, CyMA, UIICSE, Escuela Nacional de Estudio Profesionales Iztacala, UNAM, Apartado Postal 314, Tlalnepantla, México, México, **DAVID CHISZAR,** Psychology, CB 345, University of Colorado, Boulder, Colorado 80309-0345, USA, **CLINT HENKE**, 11823 Eaton Way, Westminster, Colorado 80020, USA, and **HOBART M. SMITH,** EPO Biology, CB 334, University of Colorado, Boulder, Colorado 80309-0334, USA.

PHRYNOSOMA DOUGLASI (Short-horned Lizard). **REPRODUCTION.** *Phrynosoma douglasi* (= *P. hernandezi*; Zamudio et al. 1997. Syst. Biol. 46:284–305) is widespread in Wyoming, yet nothing is known about its reproductive biology in the state (Baxter and Stone. 1980. Amphibians and Reptiles in Wyoming. Wyoming Game and Fish Department). Here we report the date of parturition for a female *P. douglasi*, as well as offspring characteristics.

We collected a gravid female (70.0 mm SVL, 27.0 mm TL, 29.0 g mass) on 26 July 1997 near Flaming Gorge National Recreation Area, Sweetwater County, Wyoming, USA. She was brought back to a lab at the University of Colorado, Boulder, where she gave birth 6 August 1997 to 13 offspring (4 of which were stillborn). After birth, the female weighed 13.3 g and the total offspring mass was 11.2 g. Thus, the relative clutch mass (offspring mass/female mass) = 0.84. The sex ratio of the offspring was 9 males: 4 females (5 males: 4 females for the live offspring; all 4 stillborns were males); mean offspring mass = 0.86 g (mean

mass live offspring = 0.85; mean mass stillborn offspring = 0.87 g); mean offspring SVL = 23.8 mm (mean SVL live offspring = 24.1 mm; mean SVL stillborns = 23.3 mm). The female and her offspring were released 10 August 1997 at their capture site.

This clutch consisted of offspring of two different colors, pink and gray. Three out of four live females were gray, whereas four out of five live males were pink (stillborns could not be classified as either color, although they looked more pinkish). The function of this coloration, and whether the coloration differences are retained throughout life, are not known at this time. However, it is of interest that *Crotalus viridis concolor*, and possibly *Sceloporus undulatus elongatus*, at this same locality also show two color morphs (tan versus pink, and gray versus pink, respectively; pers. obs.). Thus, there may be an ecological factor that makes it advantageous for reptiles in this area to produce young of different colors.

Submitted by **KYLE G. ASHTON** and **KRISTI L. ASHTON**, Department of EPO Biology, Campus Box 334, University of Colorado, Boulder, Colorado, 80309, USA.

UNDERWOODISAURUS MILII (Thick-tailed Gecko). **CROSS PREDATION**. Observations of invertebrates feeding on vertebrates under natural conditions are rare. How et al. (1990. Rec. West. Aust. Mus. 14[4]:449–459) report centipedes to be a relatively common prey item for *U. milii* from Western Australia. We witnessed a scolopendromorph centipede (*Cormocephalus aurantiipes*, 94 mm) killing and partially consuming a subadult gecko (*Underwoodisaurus milii*, 80 mm SVL) on a granite outcrop in Victoria, Australia. Our observation suggests cross predation between centipedes and *U. milii*; that is, *U. milii* may alternately be prey or predator of centipedes (see also Bauer 1990. Herpetol. Rev. 21: 83–87; McCormick and Polis 1982. Biol. Rev. 57:29–58).

On 24 April 1997 at 1250 h we lifted a rock, disturbing a large *C. aurantiipes* (approx. 90 mm) attacking a subadult *U. milii*. The centipede's head was positioned, ventral side uppermost, underneath and to the left of the lower jaw of the gecko, which was held firmly by the centipede's telopodites (venom claws). The centipede's body passed under the gecko's head and down the right flank, its legs tightly gripping the gecko's body. The gecko's tail was not restrained, nor had it been autotomized. The centipede repeatedly stabbed the gecko's throat with its venom claws, drawing blood. We suspect that the gecko was injected with venom and paralyzed at this time (see Mendez et al. 1990. J. Morph. 206:303–312). The centipede used its mandibles and maxillae in tandem with the venom claws, and its antennae were active throughout.

The gecko struggled occasionally but appeared dead by 1300 h, at which time the centipede released its tight grip, then flipped the gecko to expose its ventral surface. While using the distal end of its body to pin the gecko securely to the substrate, the centipede opened the flesh of the gecko's throat with its venom claws and chewed with its mandibles and maxillae. The centipede released its prey at 1315 h, at which time we collected the gecko. It measured 41 mm SVL and 25 mm TL. We examined its wounds (the centipede had removed the flesh surrounding the lower jaw of the gecko) before replacing the gecko under the rock near the centipede. At 1415 h the centipede resumed feeding, this time on the hind leg. We continued our observations for an additional 15 min, during which time the centipede consumed all the flesh from the cloacal region of its prey. Observations ceased at 1430 h, at which time the centipede was consuming the area of the abdominal cavity. We returned on 13 May, to find the skeletal remains of the gecko under the same rock, but the centipede was no longer present.

It is likely that we initiated this predation event. An adjacent rock we had lifted previously had harbored a large *C. aurantiipes* that was no longer present upon subsequent inspection, and it may have moved under the rock with the *U. milii*. However, the efficiency with which the centipede dispatched and consumed the gecko, the abundance of both species in the study area, and the similarity of the shelter sites (exfoliated rock) suggest that this is not an unusual event.

Submitted by **MICHAEL KEARNEY**, Department of Ecology and Evolutionary Biology, Monash University, Victoria, 3168, Australia, and **SHARON DOWNES**, Biological Sciences, Building A08, University of Sydney, New South Wales, 2006, Australia.

SERPENTES

BOTHROPS AMMODYTOIDES (Yarará ñata, Patagonian Lancehead). **PREY**. *Bothrops ammodytoides* is a medium-sized (450–750 mm total length) lancehead that is endemic to Argentina. Available data indicate that *B. ammodytoides* feeds on lizards (Serie 1919. Physis 4:538–539) and rodents (Miranda et al. 1983. Guía de los Ofidios Bonaerenses. Asoc. Coop. Jard. Zool., La Plata. 71 pp.). An adult female *B. ammodytoides* (SVL ca. 550 mm, 300 g) was found at 1230 h on 11 January 1996 on a mountain trail, near a creek, in Río Seco Canyon, 5 km NW of Villa Larca, San Luis Province, Argentina. The snake was eating an adult *Odontophrynus occidentalis* (estimated mass = 20 g). When we captured the snake, it regurgitated the frog. The frog was deposited in the herpetological collection of the Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto (ZV-UNRC 3784), and the snake is being kept alive in the Instituto de Herpetologia, Fundacion Miguel Lillo, Tucumán. Although other *Bothrops* species include amphibians in their diets, this type of prey has not previously been recorded for *B. ammodytoides*.

Submitted by **LUCIANO JAVIER AVILA** and **MARIANA MORANDO**, Centro Regional de Investigaciones Cientificas y Tecnologicas de La Rioja (CRILAR) CONICET, Anillaco, La Rioja, Argentina.

BUNGARUS MULTICINCTUS (Many-banded Krait). **DIET**. While the ophiophagous habits of kraits (*Bungarus* spp.) generally are well recognized, several other prey types, especially fish, are commonly taken by some species (Mao 1970. Herpetologica 26:45–48). However, lizards apparently are rare in the diets of kraits in the wild, with only four cases of lizard prey in the 112 specimens of nine species of *Bungarus* for which data are available (Slowinski 1994. Herpetol. Rev. 25:51–53). Here I report on another case of lizard prey in wild *Bungarus*. A subadult *Bungarus multicinctus multicinctus* (total length ca. 52 cm) that had been chopped to pieces in Yangon, Myanmar (= Rangoon, Burma) was found to contain an unidentified, partly digested skink (total length > 11 cm). Prey mass was at least 22% of predator mass. Both specimens are deposited in the collection of the Senckenberg Museum (SMF 73341).

Submitted by **ULRICH KUCH**, Sektion Herpetologie, Forschungsinstitut Senckenberg, Senckenberganlage 25, D-60325 Frankfurt, Germany.

CONOPSIS NASUS (Largenose Earth Snake) **REPRODUCTION.** Insofar as known, *Conopsis* and the closely related *Toluca* are live- bearing. Greer (1966. Copeia 1966:371–373) found 22 gravid females in a series of 104 *C. nasus* collected at Alvarez, San Luis Potosí, México during October and November. The number of embryos in these females varied from one to six and the degree of development of the embryos varied from barely recognizable to almost full term. A female *C. nasus* (38 cm total length) collected in the city of Queretaro, México on 4 April 1997 aborted two embryos after an injury on 5 June and gave birth to four live and one dead snake on 19 June 1997. The young snakes were approximately 10 cm total length. One of us (SAM) has collected *Conopsis* of this size in Queretaro and Guanajuato during late July.

Submitted by **SHERMAN A. MINTON**, 4840 East 77th Street, Indianapolis, Indiana 46250, USA, **JAIME MALO CISNEROS**, Corregidora 141-A, Queretaro, Queretaro, México, and **BROOKS M. de CERVANTES**, 15 de Mayo, Queretaro, Queretaro 76000, México.

CORALLUS CROPANII (NCN). **HABITAT and DIET.** *Corallus cropanii* is known from a restricted area of the Atlantic Forest in southeastern Brazil (Henderson and Puorto 1993. Cat. Amer. Amphib. Rept. 575:1–2), and nothing is published on its biology (Henderson et al. 1995. Herpetol. Nat. Hist. 3:15–27). Here we report substrate use and gut contents of the holotype, housed in the collection of the Instituto Butantan in São Paulo (IB 15200). The snake was collected in 1953, about 1.5 m above ground in a tree (J. Santos, pers. comm. to JC in 1953). After collection it was maintained in captivity for one week. An arboreal tendency was obvious; the snake spent most of the week above the ground. In 1997 we dissected this specimen and in the hindgut we found hair of the brown four-eyed opussum, *Metachirus nudicaudatus* (Marmosidae). An arboreal habit and mammalian prey are recorded for *Corallus caninus* (Henderson 1993. Herpetol. Nat. Hist. 1:91–96), which is considered a sister species of *C. cropanii* (Kluge 1991. Misc. Publ. Mus. Zool. Michigan 178:1–58).

We thank I. Sazima for suggestions on the manuscript and K. G. Facure for the identification of the mammal prey.

Submitted by **OTAVIO A. V. MARQUES** and **JOAQUIM CAVALHEIRO** Laboratório de Herpetologia, Instituto Butantan. Av. Vital Brasil, 1500, CEP 05503-900, São Paulo, SP, Brazil.

CROTALUS VIRIDIS CONCOLOR (Midget Faded Rattlesnake). **DRINKING FROM SKIN.** Some agamid lizards and snakes have been observed drinking from their skin (Greene. 1997. Snakes: The Evolution of Mystery in Nature. University of California Press, Berkeley. 351 pp.; Schwenk and Greene. 1987. J. Herpetol. 21:134–139). Here we report a similar behavior in *Crotalus viridis concolor* in the Flaming Gorge National Recreation Area, Sweetwater Co., Wyoming, USA. On 18 July 1997 at ca. 1600 h we located an adult male *C. v. concolor* (56.0 cm SVL) that had a radiotransmitter implant. As it began to rain the snake emerged from its burrow and drank water that had gathered in a depression of a small (4 x 10 cm) rock. Then, the snake moved back to the burrow entrance and loosely coiled, with part of its coils exposed to rainfall. After rain drops had accumulated on the exposed portion of its body, the snake began drinking from its skin. It continued drinking intermittently for ten minutes.

We thank Alan de Queiroz for comments on the manuscript.

Submitted by **KYLE G. ASHTON** and **JAY JOHNSON**, Department of E.P.O. Biology, Campus Box 334, University of Colorado, Boulder, Colorado, 80309, USA.

GRAYIA CAESAR (African Banded Water Snake). **SEXUAL DIMORPHISM.** The rare and poorly-studied aquatic colubrid *Xenurophis caesar* Günther, 1863 was described on the basis of an adult female (BMNH 1946.1.6.38). *Grayia tholloni* Mocquard, 1897 seemed to bridge so well the gap between *X. caesar* on the one hand and *Grayia smithii* and *G. ornata* on the other hand that Mocquard (1897. Bull. Soc. Philom. Paris 8[9]:5–20) and later Boulenger (1901. Ann. Mus. Congo Belge. Zool. Sér. I Tome II, fasc. I:1–14) stated that these four species had to be placed in a single genus. While studying the relationships between these forms, we examined all 27 available specimens of *G. caesar* in the Muséum national d'Histoire naturelle (MNHN, Paris), Musée Royal de l'Afrique Centrale (MRAC, Tervuren), British Museum of Natural History (BMNH, London), and Institut Royal des Sciences naturelles de Belgique (IRSNB, Brussels): 16 females and 11 males whose sex was determined by tail dissection.

Four notable sexually dimorphic characters were revealed in *G. caesar:* anal scale state, number of white bands on body, number of ventral scales, and number of subcaudal scales. All males have an undivided anal, while all females but one (BMNH 1912.6.27.24) have a divided anal. This represents an original and new sexually dimorphic character among snakes. The males have fewer white bands on the body than females (males: mean ± SD = 24.0 ± 2.1, range = 21–28, N = 11; females: mean ± SD = 27.6 ± 1.5, range = 26–30, N = 16). This difference was statistically significant (Mann-Whitney U Test, $P \leq 0.05$). The bands are also present on the tail, which is rarely entire, as in many other aquatic snakes. Dowling's system (1951. Brit. J. Herpetol. 1:97–99) was used for counting ventrals. The number of ventrals ranges from 123 to 127 in males (125.0 ± 1.2, N = 11) and from 136 to 145 in females (139.8 ± 2.4, N = 16). Thus, ventral counts are non-overlapping (Mann-Whitney U, $P \leq 0.05$). The number of subcaudals in specimens with an entire tail ranges from 151 to 162 in males (157.5 ± 4.2, N = 6) and from 140 to 146 in females (143.3 ± 2.8, N = 4); thus, this character also separates the sexes ($P \leq 0.05$).

We thank C. McCarthy and B. Clarke (BMNH), and G. Lenglet (IRSNB) for reception in their museums, and A. Dubois, I. Ineich, and B. Hughes for constructive discussions. G. Josens provided working facilities at the Université Libre de Bruxelles.

Submitted by **OLIVIER PAUWELS**, Muséum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles et Amphibiens), 25 rue Cuvier, F-75005 Paris, France, **DANNY MEIRTE**, Musée Royal de l'Afrique Centrale, Vertebrate Section (Herpetology), Steenweg op Leuven, B-3080 Tervuren, Belgium, and **FRÉDÉRIC CHÉROT** (Grant F.R.I.A., contract F 3/5/5-FC-18256), Université Libre de Bruxelles, Laboratoire de Zoologie systématique et d'Ecologie animale, CP 160/13, 50 Av. F.-D. Roosevelt, B-1050 Brussels, Belgium.

PITUOPHIS MELANOLEUCUS DESERTICOLA (Great Basin Gopher Snake). **REGIONAL HETEROTHERMY.** On 3 July 1997 at 1230 h in the Flaming Gorge National Recreaation Area, Sweetwater Co., Wyoming, USA, I observed an adult female *P. m. deserticola* that was coiled loosely under the west side of a rock. The majority of its body was under the rock in the shade. However, a portion of its body (ca. 20–30 cm beginning ca. 50

cm from the head) was fully exposed to the sun. The snake had a noticeable bulge, indicating a prey item, in the region that was fully exposed to the sun. This female had been captured and measured (132 cm SVL; 573 g) on 22 June 1997. Neither then, nor when relocated on 25 June did the snake have a bulge in its body.

Regional heterothermy occurs when an organism maintains one region of its body at a different temperature than the rest of its body. This behavior has been observed in snakes that have recently eaten or are gravid (Greene 1997. Snakes: The Evolution of Mystery in Nature. University of California Press, Berkeley. 351 pp.). Regional heterothermy may increase digestive efficiency while reducing exposure to predators (Greene, *op. cit.*) and/or reducing metabolic rate. My observation is a possible example of regional heterothermy to aid digestion.

I thank Alan de Queiroz for comments and suggestions on this manuscript.

Submitted by **KYLE G. ASHTON**, Department of E.P.O. Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 29, Number 1 (March 1998).

CAUDATA

AMBYSTOMA TIGRINUM (Tiger Salamander). MÉXICO: AGUASCALIENTES: Asientos, Presa "El Llavero" (22°04'N, 102°05'W) in thorn shrub. 17 August 1980. Javier Espinosa and Joel Vázquez-Díaz. Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA [VA] 36–1, UAA [VA] 36–2, UAA [VA] 36–3, UAA [VA] 36-4, UAA [VA] 37), at Presa "Charcas Verdes," 2 km E of "La Tinajuela" (22°04'N, 101°55'W), 23 August 1989 (UAA [VA] 152), and at "La Tinajuela," 16 August 1993 (UAA [VA] 162). All verified by Mario Mancilla. First records for the state and range extension of 135 km NW of Guanajuato (Maldonado-Koerdell 1948, Mems. Revta. Soc. Cient. Antonio Alzate 56[2/3]:185–226).

Submitted by **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes. Centro Básico, Departamento de Biología. Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México; and **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México Distrito Federal 04510, México.

BATRACHOSEPS GABRIELI (San Gabriel Mountain Slender Salamander). USA: CALIFORNIA: Los Angeles Co: (all San Gabriel Mountains)—Cloudburst Canyon, ca. 0.95 SE of Falling Springs km (all distances reported as map km), 1145 m elev. 17 January 1997. R. H. Goodman, Jr. and S. K. Watanabe. MVZ 225952; Alpine Canyon, ca. 1.25 km SE of Falling Springs. 1109–1121 m elev. 17 January 1997. R. H. Goodman, Jr. and S. K. Watanabe. MVZ 225947–50; Area S of Alpine Canyon, ca. 1.26 km SE of Falling Springs, 1090 m elev. 20 January 1997. R. H. Goodman, Jr. and M. N. Pires. MVZ 225951; Cow Canyon, ca. 0.6 km SW of Mt. Baldy town, 1379 m elev. 7 February 1998. R. H. Goodman, Jr. and K. P. Condon. MVZ 228291; San Antonio Canyon, ca. 1.5 km SSW of Mt. Baldy town, 1155 m elev. 7 February 1998. R. H. Goodman, Jr. and K. P. Condon. MVZ 228292; San Bernardino Co: (all San Gabriel Mountains)—New county records: San Antonio Canyon, ca. 0.7 km S of Icehouse Canyon, 1451 m elev. 7 February 1998. R. H. Goodman, Jr. and K. P. Condon. MVZ 228303; North Fork Lytle Canyon, ca. 0.8 km NW of Lytle Creek town, 1231 m elev. 5 April 1998. R. H. Goodman, Jr. and M. N. Pires. MVZ 228297–98; Middle Fork Lytle Canyon, ca. 1.5 km S of Lytle Creek (town), 1097 m elev. 11 April 1998. R. H. Goodman, Jr. and Melinda Benton. MVZ 228299–301; South Fork Lytle Canyon, ca. 3 km S of Lytle Creek (town), 1050 m elev. 15 April 1998. R. H. Goodman, Jr. and Melinda Benton. MVZ 228302. All specimens verified by David B. Wake. *Batrachoseps gabrieli* is a recently described plethodontid known only from two locations on the cismontane side of the San Gabriel Mountains in Los Angeles County (Wake 1996, Contr. Sci. Los Angeles Co. Nat. Hist. Mus. 463:1–12). This report adds nine new localities, extending the range south and eastward into San Bernardino County.

Habitat associations for these new populations are similar to those described by Wake (1996, *op. cit.*) for the type locality, though lower in elevation. Most of the *B. gabrieli* were captured in and around talus with canyon live oak (*Quercus chrysolepis*), big cone spruce (*Pseudotsuga macrocarpa*), and chaparral components such as ceanothus (*Ceanothus* sp.), manzanita (*Arctostaphylos* sp.), and mountain mahogany (*Cercocarpus betuloides*) present.

Submitted by **ROBERT H. GOODMAN, JR., STUART K. WATANABE, KEITH P. CONDON,** and **MARCELO N. PIRES**, Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, California 91768, USA, and **MELINDA S. BENTON**, U.S. Forest Service-San Bernardino National Forest, Lytle Creek Ranger Station, 1209 Lytle Creek Road, Lytle Creek, California 92358, USA.

EURYCEA LONGICAUDA (Longtail Salamander). USA: ILLINOIS: Calhoun Co: 5.2 km SW Kampsville at Schumann Spring (NE 1/4 NW 1/4 Sec. 17, T9S, R2W; UTM Zone 15: N4349730m, E701545m). 13 October 1995. D. Webb. INHS 13513. Verified by Jeanne M. Serb. New county record.

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: ILLINOIS: LaSalle Co: Sec. 35, T34N, R1E. 14 April 1998. Photographed by Todd Bittner, verified by Scott R. Ballard. Three color slide photographs deposited in the Herpetology collection at Southern Illinois University at Carbondale, Catalog number H-5710. New county record; this state-threatened species was documented from a nature preserve, thus no specimens were collected. Four terrestrial individuals were observed, two from each of two subpopulations separated by 125 m and a natural barrier. Habitat is vernal ponds and mesic floodplain forest below sandstone cliffs adjacent to a high-quality stream. This new relict population is disjunct from other known relict populations in Illinois.

Submitted by **TONYA D. BITTNER**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA, and **R. TODD BITTNER**, Illinois Department of Natural Resources, Division of Natural Heritage, IVCC E. Campus Building 11, 815 North Orlando Smith Road, Oglesby, Illinois 61348-9691, USA.

NOTOPHTHALMUS VIRIDESCENS (Eastern Newt). USA: ILLINOIS: HARDIN CO: 1.6 km W Cave-In-Rock at the Herrin Club (Sec. 23, T12S, R9E; UTM Zone 16: N4146700m, E395000m). 12 October 1997. C. A. Phillips. INHS 13372. Verified by Jeanne M. Serb. New county record.

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

PLETHODON ELONGATUS (Del Norte Salamander). USA: CALIFORNIA: HUMBOLDT CO: Humboldt State University campus, Arcata [West 1/2 Sec. 28, T6N, R1E; (124°04'33"W, 40°52'38"N; UTM coordinates: 409350E, 4525470N, Datum: NAD27 CONUS; UTM Zone 10); average elevation of campus = ca. 60 m]. 6 May 1964. M. D. Be'aston. Humboldt State University Vertebrate Museum Collection (HSU 326, formerly A64-43). Verified by R. B. Bury. Extends northern coastal range ca. 54 km (33.3 mi) S from near Orick, Humboldt County (MVZ 44368–75, 56068, 81852–60) [Brodie 1970, Herpetologica 26:502; USDA Forest Service, Regional Ecosystem Office, Portland, Oregon, unpublished draft survey protocol with range map]; and ca. 1.6 km (ca. 1.0 mi) S and ca. 11.3 km (70 mi) W of the nearest southernmost coastal foothills record which is ca. "3.1 mi (ca 5.0 km) E of Blue Lake off Rt. 299" (MVZ 66531–34) (Brodie, *ibid.*; Norman and Schmidt, pers. observ.)].

Plethodon elongatus occurs farther south in inland Humboldt County (Jones and Raphael 1990, Herpetol. Rev. 21:37; Schmidt and Norman 1997, Herpetol. Rev. 28:206). However, no records exist as far south as the HSU 326 record on the northern California coast (Brodie, *ibid.*; L. Ollivier, pers. comm.; Schmidt and Norman, pers. observ.). The HSU collection catalog states that this "adult" (SVL = 45.2 mm, Norman, unpublished data) was "taken at night" (Norman, pers. observ.). No further specimens of *P. elongatus* have been documented from the area since the collection of HSU 326 and, because the campus has been heavily landscaped over the last three decades, the species may now be extirpated from the area (Ollivier and Norman, pers. observ., and Bury, pers. comm.).

No unpublished or published records filling the gap between the previous Orick records and HSU 326 exist in the Six Rivers National Forest database (Schmidt and Norman, pers. observ.). HSU 326 constitutes the first published record for the species south of the Mad River per se, the overall westernmost record for the county, and the southernmost coastal record for the species.

Submitted by **BRADFORD R. NORMAN**, 69 Midway Court, Arcata, California 95521, USA, and **GREGORY A. SCHMIDT**, Six Rivers National Forest, 1330 Bayshore Way, Eureka, California 95501, USA.

ANURA

ACRIS CREPITANS BLANCHARDI (Blanchard's Cricket Frog). USA: MINNESOTA: HENNEPIN CO: Bloomington, near the confluence of Nine Mile Creek and the Minnesota River (NW Sec. 28, T116N, R24W). 14 June 1998. Andrew Forbes, Delvin Jones, and John Moriarty. JFBM 13727. Verified by James Underhill. An additional 40–50 frogs heard calling. County record (Oldfield and Moriarty 1994, Amphibians and Reptiles Native to Minnesota. Univ. Minnesota Press, Minneapolis. 237 pp.). First report of this species from the state in the last 17 years.

Submitted by **JOHN J. MORIARTY**, Hennepin Parks, 3800 County Road 24, Maple Plain, Minnesota 55359, USA, **ANDREW FORBES**, 13416 Xerxes Avenue South, Burnsville, Minnesota 55337, USA, and **DELVIN JONES**, 4208 Kemrich Circle, Minnetonka, Minnesota 55345, USA.

ATELOPUS CRUCIGER. VENEZUELA ESTADO COJEDES: Cerro Azul, Fila La Blanquera, 1300 m elev. (09°57'50"N, 68°36'50"W). 26 February 1979. Alfredo Paolillo. Museo de Historia Natural La Salle (MHNLS 7519–29). Verified by Celsa Seóaris. First state record and southernmost record for the species (La Marca 1992, Cuad. Geog. 9, Univ. Los Andes, Mérida. 197 pp.). This species seems to have had a more continuous distribution in the Venezuelan coastal range in the past, but now there is enough evidence of decline to indicate that its populations are seriously threatened (La Marca and Reinthaler 1991, Herpetol. Review 22:125–128; La Marca 1995, Reptilian Magazine 3[8]:22–24; La Marca and Létters 1997, Herpetologia Bonnensis. Pp. 207–213).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado 1930, Caracas 1010-A, Venezuela.

COCHRANELLA PLUVIALIS. BOLIVIA: LA PAZ: Provincia Nor-Yungas, Cerro Uchumachi near Coroico (16°10'S, 67°42'W), 1950 m elev. 17 January 1998. Steffen Reichle. Verified by Wolfgang Böhme. Colección Boliviana de Fauna, La Paz (CBF 3302). Found at night in an area of disturbed cloud forest, together with another glassfrog species, *Hyalinobatrachium bergeri*. First record for Bolivia; southeastward range extension (airline) of ca. 550 km (Cannatella and Duellman 1982, Herpetologica 38:380–388).

Submitted by **JÖRN KÖHLER**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, 53113 Bonn, Germany, and **STEFFEN REICHLE**, Langwiesenstrasse 26, 70771 Leinfelden-Echterdingen, Germany.

FROSTIUS PERNAMBUCENSIS. BRAZIL: ALAGOAS: Murici Forest Reserve, Fazenda Bananeiras, 9°14'S, 35°48'W, 700 m elev. 16 July 1997. Eliza Freire, Selma Torquato, Edelmo Gonçalves and Oswaldo Peixoto. Eugenio Izecksohn Collection, Herpetological Collection of Instituto de Biologia, Universidade Federal do Rio de Janeiro (EI 9344). Verified by Eugenio Izecksohn. Previously known only from the type locality; extends range ca. 170 km SW and also significantly increases elevation range of the species (type locality is at sea level). First record for the state. One male specimen found in the water tank of a ground bromeliad in a remaining patch of the Atlantic Forest formation.

Submitted by **OSWALDO LUIZ PEIXOTO**, Departamento de Biologia Animal Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, 23851-970, Seropédica, Rio de Janeiro, Brazil, and **ELIZA M. X. FREIRE**, Departamento de Zoologia, Universidade Federal de Alagoas, 57021-090, Maceió, Alagoas, Brazil.

HYLA DUTRAI. BRAZIL: ALAGOAS: Quebrangulo Municipality (9°19'S, 36°28'W), 366m elev. 26–29 March 1997. S. P. C. Silva and A. M. P. T. C. Silva. Universidade Federal do Rio de Janeiro (ZUFRJ 7173). April 1997. A. Studare. ZUFRJ 7174. Both verified by S. P. de Carvalho e Silva. Previously known only from type locality, Areia Branca, state of Sergipe (10°45'S, 37°18'W), (Gomes and Peixoto, 1996. Iheringia Ser. Zool. 80:33–38). Extends range ca. 200 km north; new record for the state, suggesting that as in other species of the *marmorata* group in northeastern Brazil, *Hyla dutrai* has a wider distribution than previously

reported. Record based on two males (SVL 33, 34.9 mm) allows the first confirmation of the distinguishing red color present in living specimens, extending across the lower belly region to the undersides of thighs.

Submitted by **M. R. GOMES**, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Cidade Universitária, Rio de Janeiro, 21941-590, Brazil, and **O. L. PEIXOTO**, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, Seropèdica, Rio de Janeiro, 23851-970, Brazil.

MELANOPHRYNISCUS STELZNERI FULVOGUTTATUS (Redbelly Toad). BRAZIL: MATO GROSSO DO SUL: Bela Vista Municipality (ca. 22°02'S, 56°30'W). 22 January 1967. E. Izecksohn and J. Jim. Museu de História Natural, Universidade Estadual de Campinas (ZUEC 3470); Jardim Municipality (ca. 21°28'S; 56°10'W). 7 July 1973. Unknown collector. ZUEC 3518; Caracol Municipality (ca. 22°00'S; 57°00'W). 20 October 1997. D. Pazzoto, Jr. ZUEC 11510. All verified by Ariovaldo A. Giaretta. First records of the subspecies in Brazil and of the genus in western Brazil. This race was previously known from Paraguayan Chaco, Formosa (central Chaco), Resistencia (austral Chaco), and Corrientes in Argentina (Cei 1980, Monit. Zool. Ital. (N.S.) Monogr. 2:1–609).

Submitted by **MARCELO NOGUEIRA DE CARVALHO KOKUBUM**, Universidade Estadual Paulista, IBILCE, Rua Cristóvão Colombo s/n, 15054-000, São José do Rio Preto- São Paulo, Brazil, and **PAULO SÉRGIO BERNARDE**, Curso de Pós-Graduação em Zoologia, Departamento de Zoologia, Universidade Federal do Paraná, CP 19020, 81531-990, Curitiba-PR, Brazil; e-mail: bernarde@garoupa.bio.ufpr.br.

PEDOSTIBES TUBERCULOSUS (Malabar Tree Toad). INDIA: GOA: Cotegao Wildlife Sanctuary,15°30'N, 73°55'E. 26–28 October 1994. Romulus Whitaker. ZSI A8894. Verified by Shyamal K. Chanda. Adult male found ca. 1.5 m up on a tree adjacent to a stream within a riparian forest. General forest type was wet evergreen in a lowland situation. Species is restricted to the Western Ghats of southwestern India, being recorded from only a few localities in the southern ranges of the Ghats-Malabar, Ponmudi, Vanjikadavu, and Silent Valley, all within the southern state of Kerala (Dutta 1997, Amphibians of India and Sri Lanka: Checklist and Bibliography. Odyssey Publ. House, Bhubaneswar. 342 pp.; Pillai 1986, Rec. Zool. Surv. India 84:229–242; Inger et al. 1984, J. Bombay Nat. Hist. Soc. 81:406–427), and not reported from the Union Territory of Goa (Sekar 1991, Herpeton Pune 4:14–15; 1991, J. Bombay Nat. Hist. Soc. 88:125–127; 1992, J. Bombay Nat. Hist. Soc. 89:134–135). Present record is an extension of the species' range by ca. 750 km to the north, and suggests its presence in the intervening state of Karnataka.

Submitted by **INDRANEIL DAS** and **ROMULUS WHITAKER**, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

CROCODYLIA

CAIMAN LATIROSTRIS (Broadsnout Spectacled Caiman, Jacaré do Papo Amarelo). BRAZIL: ALAGOAS: Matriz do Camaragibe (09°09'06"S 35°32'00"W). 18 February 1986. D. M. Teixeira. Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ 6446). Verified by Ronaldo Fernandes. First record for the state; extends range of the southern populations ca. 1000 km airline NNE. Previously known from the states of Bahia, south to the state of Rio Grande do Sul and in the northeastern states of Pernambuco and Rio Grande do Norte. A recent revision (Medem 1983, Los Crocodylia de Sur America. Vol. 2) attributes the discontinuity of the populations to lack of appropriate collecting.

Submitted by **GUILHERME V. DE SOUZA** and **THAIS S. DE FREITAS**, Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, 20940-040, Brazil.

TESTUDINES

KINOSTERNON SCORPIOIDES (Scorpion Mud Turtle). BRAZIL: RORAIMA: 4°10'45"N, 61°0'46"W, Km 681 on the Boa Vista–Pacaraima Road. 16 August 1997. William E. Magnusson. Photograph digitized on CD-ROM and deposited in the Reptilia Collection of the Instituto Nacional de Pesquisas da Amazónia, Manaus, Brazil (Registration number 1523). Verified by Richard C. Vogt. Species has been recorded from widespread localities in South America, but not previously from the state of Roraima in Brazil, or any part of the Rio Negro drainage basin (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Privately printed. Richmond, Indiana. 363 pp.).

Submitted by **WILLIAM E. MAGNUSSON, ALBERTINA P. LIMA**, and **MARIA CARMOZINA DE ARAUJO**, Coordenaño de Pesquisas em Ecologia, Instituto Nacional de Pesquisas da Amazónia, CP 478, 69011-970 Manaus AM, Brazil.

PSEUDEMYS CONCINNA SUWANNIENSIS (Suwannee River Cooter). USA: FLORIDA: Taylor and Dixie Cos: Steinhatchee River, Sec. 19, T9S, R10E, just upstream of town of Steinhatchee, ca. 8 km upstream from river mouth on Gulf of Mexico, but within tidal influence. 22 April 1998. Dale R. Jackson and Michael A. Ewert. UF 113442 (subadult female, specimen and slides) and UF 113441 (first-year juvenile, color slides) collected by basking traps. Verified by David L. Auth. On the same day we observed from a small motorboat ca. one dozen basking *Pseudemys* (estimated carapace lengths 50–350 cm) in the next 6 km upstream; most appeared to be *P. concinna,* although the capture of a *P. f. floridana* (UF 113443, specimen and slide) at the same basking site as the two specimens above makes long-distance identification problematic. Taylor Co: Spring Creek, a tributary of the Fenholloway River at U.S. Rt. 98 (Sec. 31, T4S, R7E). June 1960. M. A. Ewert. Color photographs of adult female, UF 112988, collected and released. Verified by D. L. Auth. Site confirmation was verified 21 April 1998 based on existence of old railroad trestle (photographed in 1960) as well as physiographic features; DRJ earlier reported (Jackson 1997, Herpetol. Rev. 28:94) our mistaken identification of the site as the Econfina River crossing, ca. 20 km west on U.S. Rt. 98. Spring Creek is one of the few unpolluted sections of this river system, which otherwise has been degraded by four decades of industrial effluent that appears to have nearly extirpated the cooter population (although *Trachemys scripta* and *Apalone ferox* seem to have fared better). However, continued survival was confirmed 21–23 October 1997 by DRJ, who observed and photographed at a distance a basking adult *P. concinna* in the lowermost section of the river (Sec. 36, T5S, R5E), ca. 2 km inland from the Gulf of Mexico; though subject to strong tidal fluctuation, the river there is largely fresh, albeit polluted.

New drainage records (Jackson 1992, *in* P. Moler (ed.), Rare and Endangered Biota of Florida, Vol. 3. Amphibians and Reptiles, pp. 166–170. Univ. Press Florida, Gainesville; Jackson 1995, Chelonian Cons. Biol. 1:329–333) that broaden the known distribution of the species in the series of "small rivers" draining directly into the Gulf of Mexico between the Aucilla and Suwannee

rivers. Coupled with the previous report for the Econfina River (Jackson 1997, *op. cit.*), the Steinhatchee and Fenholloway river records virtually eliminate the conjectured disjunction between peninsular and panhandle populations of this species, which had been used by some to hypothesize separate specific identities for those populations (reviewed by Jackson 1995, *op. cit.*).

Submitted by **DALE R. JACKSON**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303 USA, and **MICHAEL A. EWERT**, Department of Biology, Indiana University, Bloomington, Indiana 47405 USA.

STERNOTHERUS ODORATUS (Common Musk Turtle) USA: TEXAS: Morris Co: 10.4 air km N Omaha on U.S. Rt. 259 in roadside ditch. 19 April 1997. Toby J. Hibbitts. TCWC 78792. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

TERRAPENE CAROLINA TRIUNGUIS (Three-toed Box Turtle) USA: TEXAS: Morris Co: 6.4 air km N and 0.8 air km E Omaha. 19 April 1997. Toby J. Hibbitts. TCWC 78839. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

SAURIA

CORYTOPHANES HERNANDEZII (Hernandez's Helmeted Basilisk). HONDURAS: SANTA BARBARA: Las Rosas (15°04'N, 88°26'W), ca. 14 airline km W San José de Colinas, ca. 1000 m elev. 15 October 1995. Resident of Las Rosas for M. R. Espinal. USNM 520003. Verified by L. D. Wilson. First record for country; extends range ca. 170 airline km SE Las Cañas, Departamento El Petén, Guatemala (Lee 1996, The Amphibians and Reptiles of the Yucatán Peninsula. Comstock Publ. Assoc., Ithaca, New York. xii + 500 pp.).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA; and **MARIO R. ESPINAL**, Residencial Cerro Grande, Bloque 48, Casa No. 2409, Zona 2, Comayagüela, Francisco Morazán, Honduras.

CORYTOPHANES PERCARINATUS (Keeled Helmeted Basilisk). HONDURAS: OCOTEPEQUE: Guarín (14°24'N, 88°09'W), Cerro El Pital, 1400 m elev. 12 August 1997, J. R. McCranie and L. D. Wilson. USNM 520004. Verified by S. W. Gotte. First record for country; extends range ca. 8 airline km N Canton El Aguacatal, Departamento de Chalatenango, El Salvador (KU 184183–84; verified by J. E. Simmons).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA; and **LARRY DAVID WILSON**, Department of Biology, Miami-Dade Community College, Kendall Campus, Miami, Florida 33176, USA.

ENYALIOIDES HETEROLEPIS. PANAMÁ: PROVINCIA DE PANAMÁ: Parque Nacional Soberanía, adjacent to the interstate of Pipeline Road and Río Macho, ca. 16.4 km N Gamboa, ca. 120 m elev. 13 November 1997. Kristen E. Nicholson. Museo de Vertebratos, Universidad de Panamá (MVUP 1745). Verified by Dr. Roberto Ibañez. A female specimen captured exiting a burrow located on a muddy slope ca. 10 m from a small stream. New locality that fills distribution gap; previously known only from Gatun (northern extent of Panama Canal) and near Cerro Jefe, Parque Nacional Chagres (ca. 35 km closest straight-line distance from Panama Canal and 39 km straight-line distance from Gamboa) (Boulenger 1885, Catalogue of the Lizards in the British Museum [Natural History], p. 114; Boucourt 1874, Ann. Sci. Nat. 19:115; Burt and Burt 1931, Bull. Am. Mus. Nat. Hist. 61:265–267; Fowler 1916, Proc. Nat. Acad. Sci. Philadelphia 68:405–406; Ibañez et al. 1994, Scientia 9:17–31; Schmidt 1933, Smithsonian Misc. Coll 89:1–20).

Submitted by **KRISTEN E. NICHOLSON**, Department of Biology, University of Miami, Coral Gables, Florida 33124, USA.

EUMECES LATICEPS (Broadhead Skink) USA: TEXAS: Morris Co: 6.4 air km N and 0.8 air km E Omaha. 19 April 1997. Toby J. Hibbitts. TCWC 78710. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

GERRHONOTUS LIOCEPHALUS (Texas Alligator lizard). MÉXICO: AGUASCALIENTES: Los Alisos, Sierra del Laurel, Municipality of Calvillo (21°58'N, 102°45'W), in oak forest. 22 October 1983. Gilfredo de la Riva. Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA[VR] 00135). Verified by Mario Mancilla. First record for the state of Aguacalientes. Nearest records of *G. liocephalus* are from 3 km N Pueblo Nuevo, municipio El Salto, 9 km SE Llano Grande, Municipio Durango, Durango, and 19.2 km NE Santa Lucía, 1990 m, in Sinaloa (Good 1994, Herpetol. Monogr. 8:180–202).

Submitted by **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México Distrito Federal 04510, México; and **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes. Centro Básico, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Nacogdoches Co: A juvenile female was collected from the Health and Physical Education building at ground level on the Stephen F. Austin State University campus. 19 April 1989 at 2100 h. Daniel Saenz. TCWC 79501. Verified by Kathryn Vaughan. This individual is the first in a series of 200 voucher specimens from Saenz (1996, J. Herpetol. 30:461–466). New county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **DANIEL SAENZ**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA.

LIOLAEMUS MELANOPS. ARGENTINA: LA PAMPA: Dept. Curacão, 40 km N Casa de Piedra on Ruta Prov. 23 (37°51'S, 67°06'W, 365 m). 5 May 1998. L. J. Avila and M. Morando. Verified Gustavo Scrocchi. Herpetological collection, Fundación Miguel Lillo, Tucumán, Argentina (FML 7502). First record for province of La Pampa and northernmost record for the species (Cei 1986, Mon. IV Mus. reg. Sci. nat. Torino. 527 pp.).

Submitted by **LUCIANO JAVIER AVILA** and **MARIANA MORANDO**, CRILAR ñ CONICET, Mendoza y Entre Ríos s/n, C.P. 5301, Anillaco (La Rioja), Argentina.

SERPENTES

AGKISTRODON CONTORTRIX CONTORTRIX (Southern Copperhead). USA: FLORIDA: SANTA ROSA CO: SE 1/4 Sec. 31, T6N, R27W, in Blackwater River State Forest ca. 1.5 km south of the Escambia County (Alabama) line. A male (57.0 cm snout-vent length; 7.1 cm tail) collected from a gully-eroded first-order stream valley in a mature southern temperate hardwood forest. 19 April 1998. Grayal Farr and D. B. Means. Two 35mm slides cataloged together as UF 112975. ESCAMBIA CO: 4.8 km W Brynville on Fla. Road 4. 14 April 1968. F. H. Kaiser. UF 74422 (formerly FSU 439). Both verified by David L. Auth. First records for Santa Rosa and Escambia counties, and unequivocally establishes that the species occurs in Florida outside of the Apalachicola River Valley. The Escambia Co. record and an unverified report from Okaloosa Co. (roadkill on Florida Road 189, 0.8 km S of the Covington Co., Alabama, state line. Jim Godwin. Ca. 1984. Specimen not saved. Paul E. Moler, pers. comm.) were previously noted as dots on a published range map of the species, but the above data were not given (Means 1992, Rare Southern Copperhead, *in* P. E. Moler (ed.), Rare and Endangered Biota of Florida. Volume III. Amphibians and Reptiles, pp. 242–246. University Press Florida, Gainesville.).

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute and Land Conservancy, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

CHIRONIUS QUADRICARINATUS QUADRICARINATUS. BRAZIL: BAHIA: Canavieiras (15°40'S, 38°39'W). 25 June 1990. A. J. S. Argólo. Coleção Zoológica Gregório Bondar by Centro de Pesquisas do Cacau/CEPLAC (CZGB 1058); 30 August 1992. A. J. S. Argólo. CZGB 2066; Itapicurá (11°19'S, 38°13'W): June 1993. Paulo Cardoso. CZGB 2453. All verified by Ronaldo Fernandes. In Brazil, subspecies occurs in the Campos Cerrados of the states of Mato Grosso, Minas Gerais, Bahía, and Goiás (Dixon et al. 1993, Mus. Reg. Sci. Nat. Tor. Monografie XIII). These authors have examined only one specimen from Bahia, which has no specific locality data. The two localities cited here certify the occurrence of the taxon in the cerrado ecosystem (northern Bahia) and "restinga" (sea shore vegetation, eastern Bahia).

Submitted by **ANTÓNIO JORGE SUZART ARGÓLO** Laboratório de Ofiologia, Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilháus-Itabuna, CEP 45600-000, Ilháus, Bahía, Brazil, and Universidade Estadual de Santa Cruz, Km 16 Rodovia Ilháus-Itabuna, CEP 45650-000, Ilháus, Bahía, Brazil.

COLUBER CONSTRICTOR (Racer). USA: GEORGIA: WALKER CO: Chickamauga. 4 September 1954. S. A. Minton and P. W. Smith. INHS 7611. Verified by Jeanne M. Serb. New county record (Williamson and Moulis 1994, Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.



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CROTALUS MOLOSSUS MOLOSSUS (Blacktail Rattlesnake). USA: TEXAS: Gillespie Co.: AOR, 4.1 mi N Willow City on Willow City loop road. 30 August 1997. Christopher R. Harrison. UTEP 17520. Verified by Carl S. Lieb. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CHRISTOPHER R. HARRISON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA, and **TRAVIS J. LaDUC**, Texas Memorial Museum and Department of Zoology, The University of Texas at Austin, Austin, Texas 78712-1064, USA.

ECHINANTHERA AFFINIS. BRAZIL: BAHIA: Vitória da Conquista (14°51'S; 40°50'W). 5 July–31 December 1995. Coleção Zoológica Gregório Bondar by Centro de Pesquisas do Cacau/CEPLAC (CZGB 4241–43); 1 January to 31 October 1996. CZGB 4724–25. All collected by L. dos Santos. Verified by R. Fernandes. Species is found in southeastern and southern Brazil, from southeastern Minas Gerais through Espírito Santo, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina, to northeastern Rio Grande do Sul (Di-Bernardo 1992, Comun. Mus. Ciénc. PUCRS, sér. zool. 5:225–256). All specimens were found in Atlantic seasonal forest, 941 m elev. First record for the state of Bahía and the northermost record for this species.

Submitted by **ANTÓNIO JORGE SUZART ARGÓLO**, Laboratório de Ofiologia, Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilháus-Itabuna, CEP 45600-000, Ilháus, Bahia, Brasil, and Universidade Estadual de Santa Cruz, Km 16 Rodovia Ilháus-Itabuna, CEP 45650-000, Ilháus, Bahía, Brazil.

DIPSAS INDICA PETERSI. BRAZIL: BAHIA: Arataca (15°16'S, 39°25'W), Santa Inês Farm. 17 April 1989. Collector unknown. Coleção Zoológica Gregório Bondar by Centro de Pesquisas do Cacau/CEPLAC (CZGB 622); Aurelino Leal (14°19'S, 39°19'W), Santa Rosa Farm. 1 December 1994. J. A. J. Santos. CZGB 3318; Barro Preto (14°48'S, 39°28'W), Morro Redondo Farm. 29 August 1989. C. Shintomi. CZGB 747; Manoela Farm. 3 february 1995. M. Brito. CZGB 3457; January-April 1997. J. R. Martins. CZGB 5206; Camacã (15°25'S, 39°30'W). 1 July 1986. A. Albino. CZGB 96; São Francisco Farm. September 1990. R. F. da Silva. CZGB 1189; Floresta Azul, Venturosa Farm (14°48'S, 39°38'W). June–July 1997. S. P. de Andrade. CZGB 5524; Ibirataia (14°04'S, 39°38'W), Bethel Farm. July–September 1997. Collector unknown. CZGB 5748; Ilhéus (14°47'S, 39°03'W), CEPLAC Regional Center. 29 July 1987. J. H. A. Franco. CZGB 193; 27 June 1988. Collector unknown. CZGB 292; 3 May 1989. V. A. Moreira. CZGB 686; 16 May 1991. R. A. de Matos. CZGB 1363; 2 September 1991. J. S. Carvalho. CZGB 1436; 30 September 1991. R. A. de Matos. CZGB 1455; 1 June 1992. Collector unknown. CZGB 1812; 17 February 1993. A. J. S. Argôlo. CZGB 2251; 17 February 1993. A. J. S. Argôlo. CZGB 2252; 22 March 1993. P. S. Silva. CZGB 2318; 29 April 1993. A. Conceição. CZGB 2366; 26 July 1993. S. Lacau. CZGB 2481; 8 February 1994. P. Bezerra. CZGB 2856; 6 March 1995. A. de S. Santos. CZGB 3537; 22 May 1996. V. Pinto. CZGB 4485; Santa Maria Farm. June 1993. V. R. dos Santos. CZGB 2444; 18-22 October 1993. J. P. de Sena. CZGB 2681; 7-12 November 1993. J. P. de Sena. CZGB 2688; 25 August 1994. V. Nascimento. CZGB 3126; Riachuelo Farm. December 1994. Collector unknown. CZGB 3377; Riachuelo Farm. January–March 1996. Collector unknown. CZGB 4340; 25 September 1996. Collector unknown. CZGB 4692; Itabuna (14°48'S, 39°18'W), Coroa Grande Farm. 12 October 1996. Collector unknown. CZGB 4705; Itacaré (14°17'S, 39°00'W), Arco de Pedra Farm. July 1990. Collector unknown. CZGB 1057; Formosa Farm. December 1996. C. Gally. CZGB 4930; Itajuípe (14°40'S, 39°22'W). 24 August 1989. L. Oliveira. CZGB 796; Ituberá (13°44'S, 39°08'W), Califórnia Farm. 5 September 1997. R. Magalhães. CZGB 5828; Pau Brasil (15°28'S, 39°39'W), Água Santa Farm. July–August 1997. Collector unknown. CZGB 5630; Uruçuca (14°36'S, 39°17'W), Boa Nova Farm. November 1989. T. Costa. CZGB 854; Valença (13°22'S, 39°04'W), Monte Sinai Farm. 4 October 1995. Collector unknown. CZGB 4129. All verified by Ronaldo Fernandes. Subspecies is known from the Atlantic slopes of the coastal range of southeastern Brazil, from the state of Paraná to Espírito Santo (Hoge and Romano 1975, Mem. Inst. Butantan 39:51–60). According to these authors, it should occur also at Bahia. These are the first records of *D. i. petersi* for Bahia, extending its distribution over 600 km north to Soretama (Linhares), which was its northern limit in the literature.

Submitted by **FÁTIMA QUEIROZ ALVES**, Departamento de Zoologia, Instituto de Biologia, UNESP, CEP 18618-000, Rubião Jr, Botucatu, São Paulo, Brazil, and **ANTÓNIO JORGE SUZART ARGÔLO**, Laboratório de Ofiologia, Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilhéus-Itabuna, CEP 45600-000, Ilhéus, Bahia, Brazil, and Universidade Estadual de Santa Cruz - UESC, Km 16 Rodovia Ilhéus-Itabuna, CEP 45650-000, Ilhéus, Bahia, Brazil.

DRYADOPHIS CLIFTONI (Clifton's Lizard Eater). MÉXICO: NAYARIT: Santa María del Oro lagoon, 800 m elev. (21°21'43"N, 104°34'08"W). November 1991. Paulino Ponce-Campos. Universidad Autonoma de Guadalajara (COHERP-UAG-R-243). Verified by H. M. Smith. First record for the state (listed in error, Flores Villela and Gerez 1994, Biodiversidad y Conservacion en México: p. 319; correctly listed by those authors for Sinaloa, but omitted from Sonora, Durango, and Jalisco, for all of which records are available in the literature). Only one record is known for Jalisco (Hardy 1963, Copeia 1963:669–672), near Talpa; we photographed one (COHERP-UAG-R-418) from 161 air km E Talpa at Barranca de Oblatos-Huentitan, municipality of Guadalajara, 100 m elev., 300 m NW Arcediano bridge on Rio Santiago, 20 m from the river, 20°44'54"N, 103°22'43"W. 20 October 1996. Paulino Ponce-Campos. Verified by H. M. Smith.

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**, Bosque Tropical A. C., Apartado Postal 5-515, Gaudalajara, Jalisco 45042, México.

ELAPHE GUTTATA (Corn Snake). USA: LOUISIANA: Allen Parish: Louisiana Rt. 26, 0.1 mi NW Rt. 147, 5.7 mi NW of Calcasieu River. 24 April 1996. Steve Shively. LSUMZ 57630; 1 mi S jct. U.S. Rt. 190 and Topsy-Bel Road. 17 April 1998. Avery A. Williams. Seale Museum of Louisiana, McNeese State University (SML 9316); 6 mi S jct. U.S. Rt. 190 and Topsy- Bel Road. 22 April 1998. Avery A. Williams. SML 9317; Topsy-Bel Road, 3 mi N Texas Eastern Road (parish line). 26 April 1998. Kirk Manuel. SML 9318; U.S. Rt. 190, 2.1 mi W LeBlanc. 2 May 1998. Kirk Manuel (SML 9320); Jefferson Davis Parish: Topsy area, on Topsy-Bel Road. 1 May 1998. Kirk Manuel. SML 9319. All verified by Jeff Boundy. First parish records. These records extend the distribution of this species to the southwest from Vernon, Rapides, and Evangeline parishes as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

FARANCIA ABACURA (Mud Snake). USA: FLORIDA: FRANKLIN CO: St. Vincent Island on Insulator Road, 100 m NW of site B (NE 1/4 Sec. 30, T9S, R9W). 20 March 1983. S. P. Christman. UF 55865 (large road-killed adult); site A (NW 1/4 Sec. 11, T10S, R9W) on the SE edge of the island near Oyster Pond. 22 April 1983. S. P. Christman. UF 55622 (hatchling trapped in a drift fence bucket); on Road E6 (SE 1/4 Sec. 34, T9S, R9W). 14 August 1997. R. Cordray. UF 112482 (road-killed gravid female, 13 left and 3 right oviducal ova >3.0 cm long, 119.0 cm snout-vent length, 13.7 cm tail). Judging by the fact that there were only 3 large ova and about 9 additional vascularized areas in the right oviduct, this female had recently oviposited part of her clutch of about 25 eggs. All specimens verified by David L. Auth. First records for any of the eastern Gulf Coast barrier islands of Apalachee Bay (Blaney 1971, Herpetologica 27:406–430).

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute and Land Conservancy, 1313 North Duval Street, Tallahassee, Florida 32303, USA, and **STEVEN P. CHRISTMAN,** Route 3, Box 2831, Quincy, Florida 32351, USA.

HETERODON NASICUS (Western Hognose Snake). MÉXICO: AGUASCALIENTES: municipality of Aguascalientes (21°57'N, 102°17'W) in grassland and dry forest. 1 November 1991. Gilfredo de la Riva. Universidad Autónoma de Aguascalientes, Centro Básico, Departamento de Biología [UAA(VR) 00209]. Verified by Carlos Balderas. First record for state of Aguascalientes; extends range ca. 160 km SE of Zacatecas, 210 km SW of San Luis Potosí (Platt 1969, Univ. Kansas Publ. Mus. Nat. Hist. 18:253–420) and 125 km NW of Jalisco (Pérez-Ramos 1987. Herpetol. Rev. 18:56).

Submitted by **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes. Centro Básico, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, and **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México Distrito Federal 04510, México.

HETERODON PLATIRHINOS (Eastern Hognose Snake). USA: GEORGIA: DECATUR CO: 5.6 km NW Faceville. 5 September 1954. S. A. Minton and P. W. Smith. INHS 7616. Verified by Jeanne M. Serb. New county record (Williamson and Moulis 1994, Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

IMANTODES GRACILLIMUS (Slender Blunthead Tree Snake). MÉXICO: JALISCO: Cajón de Peña Dam, Rio Tomatlán, municipality of Tomatlán, 135 m elev. (19°59'N, 105°11'W). July 1991. Local collector for Paulino Ponce-Campos. Universidad Autonoma de Guadalajara (COHERP-UAG-R-230). Verified by H. M. Smith. First record for the state; previously recorded from Nayarit (Islas Tres Marias), Colima, Michoacan, and Guerrero.

Submitted by **PAULINO PONCE-CAMPOS** and **SARA M. HUERTA-ORTEGA**, Bosque Tropical A. C., Apartado Postal 5-515, Gaudalajara, Jalisco 45042, México.

LAMPROPELTIS CALLIGASTER CALLIGASTER (Prairie Kingsnake) USA: TEXAS: MORRIS CO: DOR 1.6 km N of Naples on a county road. 19 April 1997. Toby J. Hibbitts. TCWC 78776. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

LAMPROPELTIS CALLIGASTER OCCIPITOLINEATA (South Florida Mole Kingsnake). USA: FLORIDA: DESOTO CO: Arcadia. Late March 1995. Chuck Hurt. UF 112928. Verified by David Auth. Offspring from gravid female collected from wild. New county record; extends range ca. 96.5 km W of previous documented locality.

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA, e-mail: kenneyk@grove. ufl.edu, and **CHUCK HURT**, P.O. Box 234, Nocatee, Florida, USA.

LAMPROPELTIS GETULA HOLBROOKI (Speckled Kingsnake). USA: MISSOURI: DOUGLAS CO: DOR, Missouri Rt. 181 near jct. with Missouri Rt. AP. 10 September 1993. C. A. Phillips. INHS 11221. Verified by Jeanne M. Serb. New county record (Johnson 1987, The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. 368 pp.; Powell et al. 1993, Missouri Herpetol. Assoc. Newsl. 6:3–31).

Submitted by **CHRISTOPHER A. PHILLIPS** and **JOHN E. PETZING**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820.

LAMPROPELTIS GETULA NIGRA (Black Kingsnake). USA: OHIO: VINTON CO: within city limits of Wilksville. 12 April 1995. David C. Sapienza. KU Color Slides 11259–260. Verified by Travis W. Taggart. A threatened species in Ohio; was documented from a nature preserve, thus the specimen was not collected. Female, ca. 48 inches in total length; laid 9 eggs in spring of 1995. New county record, and the northernmost record in Ohio.

Submitted by **JOSEPH T. COLLINS**, The Center for North American Amphibians and Reptiles, 1502 Medinah Circle, Lawrence, Kansas 66047, USA, and **DAVID C. SAPIENZA**, Lake Hope State Park, 27331 State Route 278, McArthur, Ohio 45651, USA.

LIOPHIS POECILOGYRUS SCHOTTI. BRAZIL: MARANHÃO: Presidente Dutra - BR 226, Km 48. Fazenda São Pedro. 10 December 1985. Museu Paraense Emélio Goeldi (MPEG 17673). Verified by Rubens N. Yuki. Species is found in the Amazon Rainforest-Cerrado-Caatinga (Dixon and Markezich 1992, Texas J. Sci. 44:131–166). This is the first record for the state of Maranhão.

Submitted by **NELSON RUFINO**, Laboratório de Herpetologia, Museu Paraense Emílio Goeldi, Campus de Pesquisa, Avenida Perimetral, Guamó, Caixa Postal 399, CEP: 66.017-970. Belém, Pará, Brazil.

MASTICOPHIS FLAGELLUM (Coachwhip). USA: LOUISIANA: ALLEN PARISH: 1 mi W Reeves on U.S. Rt. 190. 17 July 1971. Jim Roberts. LSUMZ 76325; Kinder area. 13 March 1967. Jerry G. Walls. Seale Museum of Louisiana, McNeese State University (SML 1502); 3.5 mi S U.S. Rt. 190 on Topsy-Bel Road. 7

May 1998. Avery A. Williams. (SML 9321). All verified by Jeff Boundy. First parish records. These specimens fill the gap between Beauregard and Evangeline parishes as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

MICRURUS COLLARIS (Coral Snake). BRAZIL: AMAPÁ: Cachoeira Santo Antônio (00°40'S, 52°30'W), Rio Jarì (01°09'S 51°54'W). 19 May 1987. Museu Paraense Emélio Goeldi (MPEG 17871). Verified by Rubens N. Yuki. This species is known from southeastern Venezuela and the Guianas (Campbell and Lamar 1989, The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp.). According to Campbell and Lamar (*op. cit.*), there is a disputed record from the state of Pará. This is the first record for the state of Amapá.

Submitted by **NELSON RUFINO**, Centro de Referéncia em Educaõ Ambiental Professor Eidorfe Moreira, Escola Bosque, Avenida Nossa Senhora da Conceiõ, s/n. Cep: 66.815-590, Belém (Outeiro), Pará, Brazil.

OXYBELIS AENEUS (Mexican Vine Snake). MÉXICO: AGUASCALIENTES: "El Tepozan," Municipality of Calvillo (21°58'N, 102°45'W), in subtropical dry forest. 11 August 1982. Gilfredo de la Riva. Universidad Autónoma de Aguascalientes, Centro Básico, Departamanto de Biología (UAA[VR] 00094). Verified by Mario Mancilla. First record for Aguascalientes; extends range ca. 75 km NE of Zacatecas (Keiser 1974, Bull. Texas Mem. Mus. 22:1–51), 175 km NW of Guanajuato (Duges 1896, Naturaleza 2:479–485), and 350 km NW of Queretaro (Dixon et al. 1972, Southwest. Nat. 16:225–237).

Submitted by **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes. Centro Básico, Departamento de Biología. Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México; and **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México Distrito Federal 04510, México.

PHALOTRIS LEMNISCATUS. ARGENTINA: CORRIENTES: Departamento Mburucuya: Parque Nacional Mburucuya (27°59'S, 57°58'W). 12 November 1996. J. A. Cespedez and R. H. Aguirre. Colección Herpetológica de la Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 05776). Verified by B. B. Alvarez. First vouchered record for Argentina (mentioned as probable by Lema 1984, Iheringia Ser. Zool. Porto Alegre 64:66–68; Cei 1993, Mon. XIV Mus. Reg. Sci. Nat. Torino 550–552; and Williams and Francini 1991, Bol. Mus. Reg. Sci. Nat. Torino 9[1]:64). Other countries where species has been recorded are Brazil and Uruguay (Ferrarezzi 1993, Dissertacao de Mestrado, Curso Pos-grad. Instituto Biociencias, USP. 277 pp.; Puorto and Ferrarezzi 1993, Mem. Inst. Butantan, 55[1]:40–44).

Submitted by **EDUARDO FEDERICO SCHAEFER**, Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400 Corrientes, Argentina; e-mail: schaefer@unefcen.edu.ar.

PITUOPHIS CATENIFER SAYI (Bullsnake). USA: MINNESOTA: Carlton Co: Split Rock Twp., 15 km W Moose Lake (SWSW Sec. 24, T46N, R21W). 12 September 1996. Leonard and Sandra Pasek. JFBM 13512. Verified by James Underhill. County record (Oldfield and Moriarty 1994, Amphibians and Reptiles Native to Minnesota. Univ. Minnesota Press, Minneapolis. 237 pp.). Extends the range ca. 100 km north.

Submitted by **JOHN J. MORIARTY**, Hennepin Parks, 3800 County Road 24, Maple Plain, Minnesota 55359, USA.

PSEUSTES SHROPSHIREI. VENEZUELA: DISTRITO FEDERAL: Canales de Naiguatá, vertiente Norte del Parque Nacional Avila, 720 m elev. (10°35'N, 66°40'W and 10°38'N, 66°50'W). 8 May 1989. Daniel Lew. Museo de Historia Natural La Salle (MHNLS 11400). Verified by María José Praderio. First state record. ESTADO CARABOBO: Valle, entre la entrada y Cerro el Café, Valencia (10°17'N, 68°07'W). 5 May 1989. Marco Aleman. Colección de Vertebrados Universidad Experimental Rómulo Gallegos (CVUNERG 125). Verified by Marco Natera. First state record. Captured in gallery (riverine) forest. ESTADO MIRANDA: Parque Nacional Guatopo, 400 m elev. (10°05'N, 66°25'W). 19 August 1965. José M. Pelaez. MHNLS 1644. Verified by Celsa Seóaris. First estate record. ESTADO ZULIA: San José de los Altos, Sierra de Perijó, 1460 m elev. (10°55'56"N, 72°26'22"W). July 1975. Francisco Delascio. Verified by Celsa Seóaris. MHNLS 6249). First state record.

MHNLS 1644, 11400, and CVUNERG 125 are the only confirmed records of this species east of the Andes. Species was previously known from Venezuela on the basis of two specimens (Museo de Ciencias Naturales de Caracas, MCNC 3622, 4896) taken in the state of Táchira (Las Mesas, entre la Grita y La Fría, 08°10'08"N, 72°09'50"W (Rivas and Molina 1996, Resúmenes del IV Congreso Latinoamericano de Herpetología, Santiago, Chile: 292).

Submitted by **GILSON RIVAS FUENMAYOR**, Museo de Historia Natural La Salle, Apartado 1930, Caracas 1010-A, Venezuela, and **CÉSAR R. MOLINA R.**, Postgrado en Biología, mención Ecología, Facultad de Ciencias, Universidad Central de Venezuela, Caracas, Venezuela; e-mail: cmolina@strix.ciens.ucv.ve.

REGINA RIGIDA SINICOLA (Gulf Crayfish Snake) USA: TEXAS: Morris Co: 6.4 air km N and 0.8 air km E Omaha. 19 April 1997. Terry L. Hibbitts. TCWC 78749. Verified by James R. Dixon. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA and **TERRY L. HIBBITTS**, 602 Hilltop circle, Wylie, Texas 75098, USA.

SIBON NEBULATA. BRAZIL: ALAGOAS: Rio Largo (ca. 9°30'S; 35°50'W) in a small patch of Atlantic Forest. 13 September 1996. Collected by Eliza M. X. Freire. Museu de História Natural da Universidade Federal de Alagoas (MUFAL 1361) and Museu Nacional da Universidade Federal do Rio de Janeiro (MNRJ 6344). Verified by Ronaldo Fernandes. First record for the state; these specimens extend the range of the species ca. 1500 km southeast of Belém, Pará, Brazil (Cunha and Nascimento 1978, Publ. Avul. Mus. Par. Emílio Goeldi 31; Kofron 1990, Amphibia-Reptilia 11:207–223).

Submitted by **ELIZA MARIA XAVIER FREIRE**, Departamento de Zoologia e Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade 452, Maceió, Alagoas, 57021-090, Brazil, and Departamento de Vertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 20940-090, Brazil.

SIMOPHIS RHINOSTOMA. BRAZIL: BAHIA: Vitória da Conquista, Baixa da Taboa Farm (15°15'S, 41°09'W). 1 August–19 November 1997. W. S. Dutra. Colección Zoológica Gregório Bondar by Centro de Pesquisas do Cacau/CEPLAC (CZGB 5874). Verified by R. Fernandes. Species is found in dry districts in the south-central section of Brazil (Amaral 1978, Serpentes do Brasil. Second ed. Melhoramentos/Universidade de São Paulo, São Paulo. 246 pp.). First record of species for the state of Bahía, extending its range into northeastern Brazil.

Submitted by **ANTÓNIO JORGE SUZART ARGÓLO**, Laboratório de Ofiologia, Centro de Pesquisas do Cacau/CEPLAC, Km 22 Rodovia Ilháus-Itabuna, CEP 45600-000, Ilháus, Bahía, Brazil, and Universidade Estadual de Santa Cruz, Km 16 Rodovia Ilháus-Itabuna, CEP 45650-000, Ilháus, Bahía, Brazil.

TANTILLA MELANOCEPHALA. ARGENTINA: PROVINCIA DE CORRIENTES: Departamento Mburucuyú: Area Natural Protegida Mburucuyú (28°00'S, 58°00'W). 24 March 1994. S. Montanelli. Colección Herpetológica Corrientes, Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 4988). Verified by Alejandro Giraudo. First record with precise locality for Argentina. The species was reported from the Argentinian provinces of Corrientes, Misiones, Gran Chaco, and Uruguay, and the northern areas of South and Central America (Koslowsky 1898, Rev. Mus. La Plata 8:197; Seriá 1921, Ann. Soc. Cient. Argentina 92:165; Seriá 1936, Inst. Mus. Obra Cincuent. 51; Peters and Orejas Miranda 1970, Bull. U.S. Nat. Mus. 297:295; Avalos and Mischis 1975, Bol. Acad. Nac. Cienc. Córdoba 51[1–2]:72), but without reference to collected material.

Submitted by **SILVANA MONTANELLI**, Protected Area Mburucuyú, C. C. 1, 3427 Mburucuyú, Corrientes, Argentina, and **BLANCA BEATRIZ ALVAREZ**, Cátedra de Anatomía Comparada, Departamento de Biología, Facultad Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400 Corrientes, Argentina.



Alligator mississippiensis (American Alligator), juvenile male. Auburn University live animal collection. Illustration by Margaret Gunzburger.

New Amphibian and Reptile Records in Illinois

JOHN E. PETZING
CHRISTOPHER A. PHILLIPS
MICHAEL J. DRESLIK
Illinois Natural History Survey (Center for Biodiversity)
607 East Peabody Drive, Champaign, Illinois 61820, USA
e-mail (JEP): jpetzing@mail.inhs.uiuc.edu
e-mail (CAP): chrisp@mail.inhs.uiuc.edu
e-mail (MJD): dreslik@students.uiuc.edu

ALLAN K. WILSON
MICHAEL REDMER
Department of Zoology, Southern Illinois University
Carbondale, Illinois 62901, USA
e-mail (AKW): akwilson@siu.edu
e-mail (MR): mykredmer@aol.com

THOMAS G. ANTON
4400 West Lake, 101-B, Glenview, Illinois 60025, USA
e-mail: TAnton2963@aol.com

DAVID MAUGER
27640 Egyptian Trail, Monee, Illinois 60449, USA
e-mail: dmauger@ameritech.net

and
MICHAEL J. BLANFORD
P.O. Box 3436, Carbondale, Illinois 62901, USA

Numerous contributions to the Geographic Distribution section of *Herpetological Review* have been made by Illinois herpetologists in the 1990s, especially by Tucker (1994, Herpetol. Rev. 25:79–80) and Redmer and Ballard (1995, Herpetol. Rev. 26:49–53). Specimens reported herein are housed in the following collections: Field Museum of Natural History (FMNH), Illinois Natural History Survey (INHS) and Southern Illinois University at Carbondale (SIUC). County records were verified by checking the Illinois Herpetological Vouchered Database, located at the Illinois Natural History Survey, which contains data on Illinois amphibian and reptile species from thirty U.S. collections. Using information from the database, a web page was developed to provide county-level distribution data for amphibians and reptiles in Illinois. This web site can be accessed via the following URL:

http://www.inhs.uiuc.edu/cbd/main/misc/herp/herp.html

The database can be searched in either species mode or county mode. Distribution maps or county species lists may be printed out for field reference or other relevent uses.

CAUDATA

Ambystoma opacum (Marbled Salamander). FAYETTE CO: 8 km NW St. Peter, pond W side Co. Rd. 1700E and 0.75 km S Little Hickory Creek (SE 1/4 SE 1/4 NE 1/4 Sec. 11, T5N, R2E; UTM Zone 16: N4306160m, E331855m). 13 March 1997. J. E. Petzing and M. J. Dreslik. Verified by C. A. Phillips. INHS 13306. New county record.

Ambystoma talpoideum (Mole Salamander). POPE CO: 1 km W New Liberty on New Liberty-Unionville Road (NW 1/4 Sec. 17, T16S, R7E). 11 April 1995. M. Redmer and K. Cook. Verified by R. A. Brandon. SIUC H-5517. First specimen from county; confirms previous record of Klimstra and Hutchison (1965, Trans. Illinois State Acad. Sci. 58:151–156), which lacks a voucher. Collected alive on road along a swamp.

Ambystoma texanum (Smallmouth Salamander). CHRISTIAN CO: 2.6 km S Willeys at the Flat Branch (SW 1/4 Sec. 17, T13N, R1W;

UTM Zone 16: N4382300m, E308700m). 26 March 1997. C. A. Phillips and J. E. Petzing. Verified by J. M. Serb. INHS 12932. New county record; JASPER Co: 3 km S Hidalgo, E side Illinois Rt. 130 and just S Co. Rd. 1900N (NE 1/4 NW 1/4 Sec. 19, T8N, R10E; UTM Zone 16: N4331000m, E401230m). 20 March 1997. C. A. Phillips and J. E. Petzing. Verified by J. M. Serb. INHS 13285. New county record; MCDONOUGH Co: 8 km NE Macomb at East Fork LaMoine River (SE 1/4 Sec. 16, T6N, R2W; UTM Zone 15: N4485425m, E701610m). 1 May 1997. J. E. Petzing, S. B. Amundsen, W. C. Handel and J. E. Hofmann. Verified by C. A. Phillips. INHS 12990. New county record; WILL Co: NE side of main entrance to McKinley Woods Forest Preserve (SE 1/4 SW 1/4 SE 1/4 Sec. 30, T34N, R9E). 5 June 1996. J. DalPonte and D. Mauger. Verified by C. A. Phillips. INHS 12589. New county record.

Ambystoma tigrinum (Eastern Tiger Salamander). ALEXANDER Co: 1.5–2 km NW Diswood on Diswood-McClure Road (NE 1/4 Sec. 4, T15S, R2W). 26 March 1995. M. Redmer and K. Tolch. Verified by R. A. Brandon. SIUC H-5504. New county record. AOR; FAYETTE Co: 0.5 km S Vandalia (NE 1/4 Sec. 21, T6N, R1E). 24 May 1994. C. A. Phillips, J. M. Serb and F. T. Burbrink. Verified by K. S. Cummings. INHS 11264. New county record; POPE Co: Brownfield. 13 May 1950. P. W. Smith and W. L. Burger. Verified by C. A. Phillips. INHS 4958. Series of 12 larvae. County record that was not plotted in Smith (1961, Bull. Illinois Nat. Hist. Surv. 28:1–298); POPE Co: jct. of Homberg and Golconda to Bay City Roads (south center of S 1/2 Sec. 10, T14S, R6E). 5 March 1995. M. Redmer and K. Cook. Verified by R. A. Brandon. SIUC H-5507. AOR. This record is included because of the specific locality data and because the specimen is an adult.

ANURA

Bufo americanus (American Toad). WARREN Co: 1.6 km NW Monmouth, trib Cedar Creek at Co. Rd. 2100N (NE 1/4 Sec. 24, T11N, R3W; UTM Zone 15: N4534100m, E695800m). 9 September 1997. J. E. Petzing, C. A. Phillips, K. S. Cummings and C. A. Taylor. Verified by J. M. Serb. INHS 13317. New county record.

Acris crepitans (Northern Cricket Frog). CHRISTIAN Co: Lake Sangchris State Park. 6 June 1991. M. Bavetz. Verified by R. A. Brandon. SIUC H-4537. New county record; CLINTON Co: 6.4 km NNW Frogtown at Co. Rd. 1850N along Shoal Creek (NW 1/4 Sec. 24, T3N, R4W; UTM Zone 16: N4285590m, E282663m). 15 April 1997. J. E. Petzing and C. A. Phillips. Verified by J. M. Serb. INHS 12978. New county record; DEWITT Co: 4 km NE Kenney, Ten Mile Creek at Co. Rd. 500E (border between NE 1/4 SE 1/4 Sec. 2 and NW 1/4 SW 1/4 Sec. 1, T19N, R1E; UTM Zone 16: N4443930m, E325540m). 19 October 1996. J. E. Petzing and K. S. Petzing. Verified by C. A. Phillips. INHS 12782. New county record; DOUGLAS Co: Villa Grove, Embarras River at Illinois Rt. 130 (SE 1/4 SE 1/4 Sec. 3, T16N, R9E; UTM Zone 16: N4413410m, E400710m). 20 October 1996. J. E. Petzing. Verified by C. A. Phillips. INHS 12785. New county record; EDWARDS Co: 5 km E West Salem, Bonpas Creek at Co. Rd. 1900N (NW 1/4 NW 1/4 Sec. 14, T1N, R14W; UTM Zone 16: N4264400m, E417600m). 1 October 1996. C. A. Phillips and J. E. Petzing. Verified by J. M. Serb. INHS 12720. New county record; HENRY Co: 3.2 km S Colona at Big X interchange (NW 1/4 Sec. 25, T17N, R1E). 22 September 1994. C. A. Phillips. Verified by J. M. Serb. INHS 11391. New county record. Confirms literature record [Garman 1892, Illinois Lab. Nat. Hist. Bull. 3(13):215–388]; MCDONOUGH Co: 8 km NE Macomb at the East Fork LaMoine River (NE 1/4 Sec. 21, T6N, R2W; UTM Zone 15: N4485600m, E701451m). 9 October 1996. J. E. Petzing, C. A. Phillips and C. A. Taylor. Verified by J. M. Serb. INHS 12751. New county record.

Pseudacris crucifer (Spring Peeper). SCHUYLER Co: 5 km S Industry, West Branch Sugar Creek at U.S. Rt. 67 (NE 1/4 Sec. 11, T3N, R2W; UTM Zone 15: N4458400m, E704320m). 9 October 1996. J. E. Petzing, C. A. Phillips and C. A. Taylor. Verified by J. M. Serb. INHS 12771. New county record.

Pseudacris triseriata (Western Chorus Frog). LAWRENCE Co: Red Hills State Park, first ravine along U.S. Rt. 50 in the northern part of the park. 15 October 1994. M. Bavetz, M. Blanford and M. Redmer. Verified by R. A. Brandon. SIUC H-4762. New county record; MCDONOUGH Co: 8 km NE Macomb at East Fork LaMoine River (NE 1/4 Sec. 21, T6N, R2W; UTM Zone 15: N4485600m, E701451m). 9 October 1996. J. E. Petzing, C. A. Phillips and C. A. Taylor. Verified by J. M. Serb. INHS 12752. New county record.

Rana areolata (Crawfish Frog). ALEXANDER Co: 1.5–2 km NW Diswood on Diswood-McClure Road (NE 1/4 Sec. 4, T15S, R2W). 26 March 1995. M. Redmer and K. Tolch. Verified by R. A. Brandon. SIUC H-5508. New county record. AOR; MASSAC Co: 2 km E Unionville on Unionville-New Liberty Road (west center of Sec. 14, T16S, R6E). 5 March 1995. M. Redmer and K. Cook. Verified by R. A. Brandon. SIUC H-5506. New county record. AOR; UNION Co: 4 km NE Dongola in front of "Christian Church" (NW 1/4 Sec. 17, T13S, R1E). 24 May 1997. M. Redmer. Verified by R. A. Brandon. SIUC H-5542. New county record.

Rana blairi (Plains Leopard Frog). HENDERSON Co: 4.4 km S Gladstone at trib Carthage Lake (SE 1/4 Sec. 28, T10N, R5W; UTM Zone 15: N4521500m, E671600m). 10 September 1997. J. E. Petzing, K. S. Cummings, C. A. Phillips and C. A. Taylor. Verified by J. M. Serb. INHS 13331. New county record; MCDONOUGH Co: 8 km NE Macomb at the East Fork LaMoine River (NE 1/4 Sec. 21, T6N, R2W; UTM Zone 15: N4485600m, E701451m). 9 October 1996. J. E. Petzing, C. A. Phillips and C. A. Taylor. Verified by J. M. Serb. INHS 12753. New county record; SCHUYLER Co: 3 km NW of Beardstown, Coal Creek Ditch at U.S. Rt. 67 (NW 1/4 Sec. 25, T1N, R1W; UTM Zone 15: N4435232m, E716252m). 10 October 1996. J. E. Petzing, C. A. Phillips and C. A. Taylor. Verified by J. M. Serb. INHS 12772. New county record.

Rana catesbeiana (Bullfrog). DEWITT Co: 9.5 km S LeRoy, Voegtlin's Pond (impoundment of tributary North Fork Salt Creek) (SE 1/4 SE 1/4 Sec. 19, T21N, R4E; UTM Zone 16: N4457340m, E347990m). 23 April 1997. J. E. Petzing, C. A. Phillips and C. E. Backe. Verified by J. M. Serb. INHS 12988. New county record; MORGAN Co: 9 km WNW Jacksonville at Mauvaise Terre Creek (NE 1/4 Sec. 9, T15N, R11W; UTM Zone 15: N4405140m, E729210m). 23 August 1996. R. E. DeWalt and R. S. Steinberg. Verified by C. A. Phillips. INHS 12645. New county record; TAZEWELL Co: 1.6 km N Cloverdale, tributary Farm Creek at U.S. Rt. 150 (NE 1/4 Sec. 2, T25N, R4W; UTM Zone 16: N4502800m, E287150m). 9 July 1997. J. E. Petzing, C. A. Phillips and K. S. Cummings. Verified by J. M. Serb. INHS 13168. New county record; WOODFORD Co: 3 km N Germantown Hills (NW 1/4 SE 1/4 Sec. 17, T27N, R3W; UTM Zone 16: N4518905m, E291115m). 24 September 1997. J. E. Petzing and C. A. Taylor. Verified by C. A. Phillips. INHS 13334. New county record.

Rana clamitans (Green Frog). HENDERSON Co: 6 km NE Gulfport and just S Lone Tree, Co. Rd. 900E at trib Carthage Lake (SE 1/4 SE 1/4 Sec. 24, T10N, R6W; UTM Zone 15: N4522300m, E667000m). 9 September 1997. C. A. Phillips, J. E. Petzing, C. A. Taylor and K. S. Cummings. Verified by J. M. Serb. INHS 13327. New county record; TAZEWELL Co: 3.2 km NE Harvard

Hills at tributary of Tenmile Creek (E 1/2 SE 1/4 Sec. 4, T26N, R3W). 9 July 1997. J. E. Petzing, C. A. Phillips and K. S. Cummings. Verified by J. M. Serb. INHS 13152. New county record.

Rana palustris (Pickerel Frog). VERMILION CO: 4.4 km E Georgetown at the former Peabody Coal site, now the Harry "Babe" Woodyard State Natural Area (Illinois Department of Natural Resources) (NE 1/4 SW 1/4 Sec. 2, T17N, R11W; UTM Zone 16: N4423500m, E451100m). 12 June 1996. J. E. Petzing and C. A. Phillips. Verified by J. M. Serb. INHS 12496. New county record.

Rana pipiens (Northern Leopard Frog). IROQUOIS CO: 4.8 km N Watseka, 0.3 km S jct. Co. Rd. 2200N and Co. Rd. 2100E (NE 1/4 Sec. 17, T27N, R12W; UTM Zone 16: N4519800m, E438400m). 2 April 1997. J. E. Petzing and C. A. Phillips. Verified by J. M. Serb. INHS 12944. New county record.

Rana sphenocephala (Southern Leopard Frog). CLINTON CO: 6.4 km NNW Frogtown, Co. Rd. 1850N along Shoal Creek (NW 1/4 Sec. 24, T3N, R4W; UTM Zone 16: N4285590m, E282663m). 15 April 1997. J. E. Petzing and C. A. Phillips. Verified by J. M. Serb. INHS 12977. New county record; EDWARDS CO: 4.5 km E West Salem, Bonpas Creek floodplain on S side Co. Rd. 1900N (NW 1/4 NW 1/4 Sec. 14, T1N, R14W; UTM Zone 16: N4264480m, E417700m). 20 March 1997. C. A. Phillips and J. E. Petzing. Verified by J. M. Serb. INHS 12922. New county record; MCDONOUGH CO: 8 km NE Macomb at East Fork LaMoine River (NE 1/4 Sec. 21, T6N, R2W; UTM Zone 15: N4485600m, E701451m). 9 October 1996. C. A. Phillips, J. E. Petzing and C. A. Taylor. Verified by J. M. Serb. INHS 12757. New county record.

Scaphiopus holbrookii (Eastern Spadefoot). PULASKI CO: 1.5 km W Ullin (NE 1/4 Sec. 27, T14S, R1W). 30 May 1997. M. Redmer. Verified by R. A. Brandon. SIUC H-5541. New county record. DOR.

TESTUDINES

Chelydra serpentina (Common Snapping Turtle). GALLATIN CO: Long Pond, 6 km N Old Shawneetown and 4 km W Ohio River (SE 1/4 Sec. 9, T9S, R10E; UTM Zone 16: N4178790m, E402830m). 17 June 1994. M. J. Dreslik and E. O. Moll. Verified by C. A. Phillips. INHS 12745. New county record.

Chrysemys picta (Painted turtle). CRAWFORD CO: 4.2 km W Annapolis, Maple Creek at Co. Rd. 2000N (NE 1/4 NW 1/4 Sec. 16, T8N, R13W; UTM Zone 16: N4332950m, E425165m). 7 October 1996. L. M. Page, R. S. Steinberg, T. Kompare and M. Pyron. Verified by C. A. Phillips. INHS 12795. New county record; HARDIN CO: 2 km W Cave-In-Rock (NW 1/4 Sec. 23, T12S, R9E; UTM Zone 16: N4146700m, E395000). 24 May 1997. C. A. Phillips, L. R. Phillips and L. Schultz. Verified by J. M. Serb. INHS 13277. New county record.

Graptemys pseudogeographica (False Map Turtle). GALLATIN CO: Round Pond, 7 km N Old Shawneetown (NW 1/4 Sec. 10, T9S, R10E; UTM Zone 16: N4179400m, E403170m). 16 June 1994. M. J. Dreslik and E. O. Moll. Verified by C. A. Phillips. INHS 12820. New county record. HARDIN CO: 2 km W Cave-In-Rock at Herrin Club (NW 1/4 Sec. 23, T12S, R9E; UTM Zone 16: N4146700m, E395000m). 24 May 1997. C. A. Phillips, L. R. Phillips and L. Schultz. Verified by J. M. Serb. INHS 13017. New county record.

Pseudemys concinna (Eastern River Cooter). GALLATIN CO: Round Pond, 7 km N Old Shawneetown (NW 1/4 Sec. 10, T9S, R10E; UTM Zone 16: N4179400m, E403170m). 17 June 1994. M. J. Dreslik and E. O. Moll. Verified by C. A. Phillips. INHS 12746. New county record. This species is listed as endangered in Illinois and has only been sight/photo vouchered from Gallatin County (Moll and Morris 1991, Trans. Illinois State Acad. Sci. 84:77–83).

Trachemys scripta (Slider). DUPAGE CO: Downers Grove, 1 km E Lemont Road at I-55. 23 June 1988. M. Redmer and J. Cobula. Verified by C. A. Phillips. INHS 10775. New county record; FAYETTE CO: 6.1 km S Herrick (39°9'29"N, 88°58'38"W). 21 July 1992. A. K. Wilson. Verified by R. A. Brandon. SIUC R-2711. New county record; MARSHALL CO: Illinois Rt. 26, 0.5 km S jct. with Co. Rd. 115N (SW 1/4 Sec. 23, T29N, R3W). 30 September 1994. T. Anton and D. Mauger. Verified by A. Resetar. FMNH 251614. New county record. DOR on Illinois Rt. 26; WILL CO: Training area of the Joliet Arsenal (NW 1/4 Sec. 14, T34N, R9E). 27 August 1993. M. Redmer and R. Humbert. Verified by A. Resetar. FMNH 251323. New county record.

Kinosternon flavescens spooneri (Illinois Mud Turtle). HENRY CO: Frankenreider Farm, 5 km N of Annawan (SE 1/4 Sec. 22 and SW 1/4 Sec. 23, T17N, R5E; UTM Zone 16 N4591200m, E258000m). 1993. M. Tuma. Verified by C. A. Phillips. INHS 12811. New county record. Carapace and plastron only.

Kinosternon subrubrum (Eastern Mud Turtle). ALEXANDER CO: 4 km S Sandusky and ca. 0.04 km W Illinois Rt. 127 jct. with unnamed road (NE 1/4 Sec. 36, T15S, R2W). 16 April 1994. K. Tolch and C. Oyler. Verified by R. A. Brandon. SIUC R-2925. New county record. DOR.

Apalone mutica (Smooth Softshell). FAYETTE CO: 6.1 km S Herrick (39°9'53"N, 88°58'11"W). 16 July 1992. A. K. Wilson. Verified by R. A. Brandon. SIUC R-2710. New county record.

Apalone spinifera (Spiny Softshell). FAYETTE CO: 6.1 km S Herrick (39°9'35"N, 88°58'35"W). 4 September 1994. A. K. Wilson. Verified by R. A. Brandon. SIUC R-2712. New county record; WILL CO: Joliet Army Training Area on Baseline Road bridge, 60 m S Jackson Creek (Sec. 24, T34N, R9E). 29 August 1993. T. Anton and M. Redmer. Verified by A. Resetar. FMNH 251297. New county record. Hatchling DOR on Baseline Road.

SAURIA

Ophisaurus attenuatus (Slender Glass Lizard). IROQUOIS CO: 0.8 km NW Leesville (NE 1/4 NE 1/4 Sec. 1, T29N, R11W; UTM Zone 16: N4542800m, E454400m). May 1994. E. Richter. Verified by C. A. Phillips. INHS 12565. New county record. DOR on a sandy road.

SERPENTES

Diadophis punctatus (Ringneck Snake). FAYETTE CO: 2.75 km S Herrick at the Russ Tate residence (NW 1/4 Sec. 33, T9N, R2E; UTM Zone 16: N4339180m, E328345m). 9 June 1993. R. Tate and J. E. Petzing. Verified by R. A. Brandon. SIUC R- 2879. New county record. Found under a piece of tin on side of a hill close to the edge of a oak-hickory forest. Specimen was kept in captivity until it died in June 1995; HENDERSON CO: 6 km NE Gulfport and just S Lone Tree, SW corner Chicago, Burlington and Quincy RR and Co. Rd. 900E (NE 1/4 NE 1/4 Sec. 25, T10N, R6W; UTM Zone 15: N4522548m, E667105m). 27 May 1997. J. E. Petzing and W. C. Handel. Verified by C. A. Phillips. INHS 13169. New county record; SHELBY CO: NW corner of Stewardson, 1 km W of the Illinois Rt. 32/Norfolk and Western RR jct. (NW 1/4 SW 1/4 Sec. 34, T10N, R5E; 39°15'58"N, 88°37'59"W). 21 October 1996.

A. Manuel. Verified by C. A. Phillips. INHS 12822. New county record. DOR.

Elaphe obsoleta (Eastern Rat Snake). EDWARDS CO: 1.2 km W Bennington, drainage channel W of Little Wabash River at Co. Rd. 1850N (SE 1/4 Sec. 18, T1N, R10E; UTM Zone 16: N4263933m, E401055m). 1 October 1996. J. E. Petzing and C. A. Phillips. Verified by J. M. Serb. INHS 12744. New county record. Caught on top of a grassy levee; WOODFORD CO: Illinois Rt. 26, 1 km N Spring Bay at jct. with Zimmerman Road (NW 1/4 Sec. 1, T27N, R4W). 30 September 1994. T. Anton and D. Mauger. Verified by A. Resetar. FMNH 251610. New county record. DOR.

Heterodon platirhinos (Eastern Hognose Snake). FAYETTE CO: 3.1 km S Herrick (39°11'8"N, 88°59'8"W). 24 April 1994. M. Tate. Verified by R. A. Brandon. SIUC R- 2700. New county record. An adult female captured by Michael Tate laid 22 eggs on 21 June 1994. A hatchling mortality was taken as a voucher by A. K. Wilson.

Lampropeltis triangulum (Milk Snake). HARDIN CO: 2 km W Cave-In-Rock at Herrin Club (NW 1/4 Sec. 23, T12S, R9E; UTM Zone 16: N4146700m, E395000m). 24 May 1997. C. A. Phillips, L. R. Phillips and L. Schultz. Verified by J. M. Serb. INHS Herpetological Slide 1997-2. New county record. Specimen not vouchered because it was found in a protected area; MARSHALL CO: 7.2 km N Lacon on Illinois Rt. 26 (SW 1/4 Sec. 18, T30N, R2W). 30 September 1994. T. Anton and D. Mauger. Verified by A. Resetar. FMNH 251612. New county record. DOR.

Nerodia sipedon (Northern Water Snake). SHELBY CO: 3.6 km E Herrick and 0.5 km E Co. Rd. 1675E on Co. Rd. 3300N (SW 1/4 Sec. 13, T9N, R2E). 20 April 1996. J. E. Petzing. Verified by C. A. Phillips. INHS 12451. New county record. DOR.

Opheodrys aestivus (Rough Green Snake). FAYETTE CO: 3.1 km S Herrick (39°11'7"N, 88°59'8"W). 15 June 1994. R. Tate. Verified by R. A. Brandon. SIUC R-2701. New county record; FRANKLIN CO: Missouri-Pacific RR tracks at Illinois Rt. 149 (NE 1/4 Sec. 27, T7S, R1E). 14 September 1994. M. Blanford and M. Redmer. Verified by R. A. Brandon. SIUC R-2796. New county record.

Storeria dekayi (Brown Snake). MCDONOUGH CO: 8 km NE Macomb at East Fork LaMoine River (NE 1/4 Sec. 21, T6N, R2W; UTM Zone 15: N4485600m, E701451m). 9 October 1996. C. A. Taylor, C. A. Phillips and J. E. Petzing. Verified by J. M. Serb. INHS 12759. New county record.

Storeria occipitomaculata (Redbelly Snake). SHELBY CO: 5 km N Herrick and 6 km W Tower Hill/Herrick blacktop (SE 1/4 SW 1/4 Sec. 36, T10N, R1E). 29 October 1994. J. Calvert and N. Wilson. Verified by R. A. Brandon. SIUC R-2804. New county record.

Thamnophis proximus (Western Ribbon Snake). IROQUOIS CO: just E Iroquois County Conservation Area (NW 1/4 SW 1/4 Sec. 19, T29N, R10W). 22 July 1996. R. Milas and M. Pingleton. Verified by C. A. Phillips. INHS 12563. New county record.

Thamnophis radix (Plains Garter Snake). PUTNAM CO: Granville city limit, trash dump along Illinois Rt. 71 (NE 1/4 Sec. 9, T32N, R1W). 28 May 1994. D. Mauger. Verified by A. Resetar. FMNH 251604. New county record.

Thamnophis sauritus (Eastern Ribbon Snake). EDWARDS CO: 1.2 km W Bennington, Little Wabash River at Co. Rd. 1850N (SE 1/4 Sec. 18, T1N, R10E). 1 October 1996. C. A. Phillips and J. E. Petzing. Verified by J. M. Serb. INHS 12743. New county record. Juvenile found DOR on Co. Rd. 1850N.

Virginia valeriae (Smooth Earth Snake). FAYETTE CO: 3.1 km S Herrick (39°11'11"N, 88°59'15"W). 20 April 1994. C. Tate. Verified by R. A. Brandon. SIUC R-2702. New county record. Completes presumed range hiatus shown in Conant and Collins (1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Record is on the northern limit of presumed range.

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New County Records from Sierra and Nevada Counties, Tahoe National Forest, California, USA

CAROL L. SPENCER
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118-4599, USA
e-mail: cspencer@calacademy.org

MARILYN M. TIERNEY
Tahoe National Forest, Downieville Ranger District 15924
Highway 49, Camptonville, California 95922, USA

MICHELLE S. KOO
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118-4599, USA
e-mail: mkoo@calacademy.org

and

JENS V. VINDUM
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118-4599, USA
e-mail: jvindum@calacademy.org

The following new county records are from within the boundaries of the Tahoe National Forest, California. Localities for the six species were compared with the following references: Blanchard (1942), Ferguson (1961), Fitch (1938), Klauber (1972), Stebbins (1985), Wilson (1978), and Zweifel (1952, 1974); and the following museum collections: AMNH, BYU, CAS, Chico State University, CM, FMNH, KU, LACM, MCZ, MVZ, SDSNH, SSU, TNHC, UMMZ, University of Nevada (Las Vegas), UNR, USNM, and UTA (museum codes from Leviton et al. 1985). All specimens were verified by Robert C. Drewes.

Ambystoma macrodactylum (Long-toed Salamander). CALIFORNIA: NEVADA CO: Tahoe National Forest, pond along dirt road W of Eagle Lakes Rd, Sec. 23, T17N, R12E (39°19'56.1"N, 120°35'28.5"W, 1645 m). 16 May 1997. M. M. Tierney and J. V. Vindum. CAS 202865. Eleven larvae.

Coluber constrictor (Racer). CALIFORNIA: SIERRA CO: Tahoe National Forest, Yuba River, Hwy 49, 30 m below 18.27 mile marker, Sec. 36, T19N, R10E (914 m). 22 Jun 1997. M. M. Tierney. CAS 203365.

Crotalus viridis (Western Rattlesnake). CALIFORNIA: SIERRA CO: Tahoe National Forest, Humbug Creek, ca 100 m upstream from North Yuba Trail bridge (39°30'24.2"N, 120°57'58.0"W, 756 m). 17 May 1997. M. M. Tierney and J. V. Vindum. CAS 202876.

Diadophis punctatus (Ringneck Snake). CALIFORNIA: SIERRA CO: Tahoe National Forest, Kanaka Creek drainage, County Rd 191, 0.2–0.4 km E Kimberley Creek, SE 1/4 of SW 1/4 Sec. 5, T18N, R22E. 3 Sep 1997. M. M. Tierney. CAS 203485.

Elgaria coerulea (Northern Alligator Lizard). CALIFORNIA: SIERRA CO: Tahoe National Forest, S side Brandy City Pond, (39°32'37.7"N, 121°01'30.3"W, 1097 m). 25 July 1997. C. L. Spencer and J. V. Vindum. CAS 203344. C. L. Spencer and J. V. Vindum. 20 Aug 1997. CAS 203459. Gravid female with seven embryos (CAS 203460–466).

Lampropeltis zonata (California Mountain King Snake). CALIFORNIA: SIERRA CO: Tahoe National Forest, Hwy 49, 6.32 km E (by road) Yuba County line (39°31'06.1"N, 120°59'31.8"W). 13 May 1997. M. M. Tierney. CAS 202935. Hwy 49, 37.43 km E (by road) Yuba County line (39°34'13.9"N, 120°44'2.0"W). 17 May 1997. M. M. Tierney and J. V. Vindum. CAS 202889.

Although distribution maps (Basey 1976; Stebbins 1985; Zeiner 1988) indicate that these species should occur in the Tahoe National Forest, no previous voucher specimens were found for these counties. This lack of data is symptomatic of our current knowledge of the distribution of many species occurring in northern California. The distribution maps of Stebbins (1985) and Zeiner (1988) indicate that approximately 31 species are expected to occur in the Tahoe National Forest. However, only 24 are confirmed by voucher specimens. Further, enlarging our scope to consider the four counties of which Tahoe National Forest is comprised (Nevada, Sierra, Placer and Yuba Counties), 33 native species of amphibians and reptiles are known to occur based on museum records from thirteen collections including the four largest California collections (CAS, LACM, MVZ, SDSNH). Despite museum records dating back to 1876, twelve of these 33 species are known from five or fewer localities. Thus, species records are not only lacking, but many species with records are poorly documented.

The surprising lack of documentation may be attributed, in part, to the use of shaded distribution maps in publications. Shaded distribution maps belie the actual known occurrence of species as validated by voucher specimens. Often range maps are presumed to show documented distribution, when, in fact, these maps represent projected ranges based on the habitats in which the species are expected to occur. Without revisiting arguments set forth by Tucker (1995) on the drawbacks of shaded maps to show ranges, we would like to reiterate that shaded maps may inhibit investigation by researchers who assume that these maps represent a well-documented species distribution. We advocate efforts to validate the assumptions made in shaded distribution maps by further collecting of voucher specimens in unsurveyed areas.

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New Herpetological Records for the State of Mato Grosso, Western Brazil

CHRISTINE STRUSSMANN
Rua Antonio Dorilêo, nº 508, Apartamento 34
78085-600 Cuiabá, Mato Grosso, Brazil
e-mail: eunectes@nutecnet.com.br

and

MARCOS ANDRÉ DE CARVALHO
Departamento de Biologia e Zoologia, Instituto de Biociências
Universidade Federal de Mato Grosso, Rua Fernando Correa, s/nº
78060-900 Cuiabá, Mato Grosso, Brazil
e-mail: mac@cpd.ufmt.br

For the past ten years we have been collecting and receiving specimens of reptiles and amphibians mainly from the southern part of the state of Mato Grosso in western Brazil. Literature records on the herpetofauna of this state are old and scarce. Some of the published records are also imprecise; they do not mention detailed localities and were published at a time when "Mato Grosso" (or "Matto Grosso") referred to an area at least three times larger than today (as in Amaral 1925). Prior to 1944, that name was applied to a huge area, then divided into two new political units: the state of Mato Grosso and "Território do Guaporé" (subsequently named "Território de Rondônia," and the state of Rondonia presently). Mato Grosso was again divided in 1979, resulting in the two new states of Mato Grosso and Mato Grosso do Sul. In spite of this, authors in recent revisionary studies still tend to treat them as a single unit (as in Dixon et al. 1993).

A preliminary review of our collecting data and of herpetological material housed at the vertebrate collection of the Universidade Federal de Mato Grosso (UFMT) has revealed new state records for the state of Mato Grosso (as presently defined). There are also new locality records that, although not new for the state, considerably extend the known range of the species considered. We here report new records for one anuran, five lizards, and

four snakes. Acronyms for institutions housing material here mentioned (other than UFMT) follow Leviton et al. (1985). Anuran identity was verified by José P. Pombal Jr., and reptiles were verified by Marcos Di-Bernardo.

ANURA

Rana palmipes. TANGARÁ DA SERRA: Usina Hidrelétrica Juba I, Rio Juba (14°44'S, 58°06'W). March 1994. C. Strussmann. UFMT 2067. Published information on the species in Mato Grosso is restricted to the material obtained by Natterer at Vila Bela, extreme western part of the state (see Miranda-Ribeiro 1923; see also a distribution map in Hillis and de Sá 1988). Extends documented distribution in Mato Grosso ca. 270 km to the east.

LACERTILIA

Coleodactylus brachystoma. ITIQUIRA: "Prainha," Rio Correntes along the right bank (17°36'S, 54°49'W), under a fallen board. 31 October 1994. C. Strussmann. UFMT 2117; BARÃO DE MELGAÇO: under rocks in a forested low hill named "Ilha do Paraíso" (ca. 16°17'S, 55°53'W), situated between Chacororé and Chá Mariana bays. November 1994. C. Strussmann. UFMT 2199, 2217, 2233, 2235. According to Vanzolini (1970), *C. brachystoma* occurred in forested patches amidst cerrados in Goiás and Minas Gerais. Localities here reported extend documented range of species to the west, in excess of eight longitudinal degrees.

Gonatodes hasemani. JAURU: under a fallen log in an isolated relict of semideciduous forest along the right bank of Rio Jauru, about one kilometer up the Cachoeira da Fumaça (ca. 15°14'S, 58°44'W). 24 November 1994. C. Strussmann. UFMT 2203, male. A female was collected from a pitfall in a semideciduous forest along the left bank of Rio Guaporé (15°07'S, 58°58'W). November 1996. Collector unknown. UFMT 2502; VILA BELA DA SANTÍSSIMA TRINDADE: Fazenda São Francisco, Serra da Borda. A female was obtained from a pitfall in the gallery forest of Córrego Longa Vida (14°41'32"S, 59°39'43"W). 23 June 1997. Carlos de Sá Neves. UFMT 2575. Nascimento et al. (1988) stated that forests of Rondonia seemed to constitute the eastern limits for the species (see also Avila-Pires 1995). We here extend the distributional limits of this lizard to at least 260 km SE of the political frontier between the states of Rondonia and Mato Grosso.

Kentropyx viridistriga. POCONÉ: PARQUE NACIONAL DO PANTANAL: Porto Caracará (17°52'S, 57°27'W). On floating grasses and shrubs, in a seasonally flooded plain. August 1986. C. Strussmann and J. C. Dalponte. UFMT 0008, 0025, 0044. A specimen from "Matto Grosso" (without any additional information on locality) was mentioned and described by Gallardo (1962). Gallagher and Dixon (1992) did not mention any documented Brazilian record for *K. viridistriga* in their recent taxonomic revision of the genus, although they stated that the species is "probably restricted to flood plain systems of ...and western Brazil."

Lygodactylus wetzeli. CÁCERES: Curtume Tannery (16°03'S, 57°40'W). 15 January 1993. M. A. Carvalho, C. Strussmann, and M. I. Castrillon. ZUEC 1521, UFMT 1899. These specimens confirm the occurrence of *L. wetzeli* at Cáceres, mentioned with doubt by Smith et al. (1977). Only a small hatchling from Mato Grosso was available to those authors, who stated that "it is so diminutive that specific allocation is not certain from its own structure ..."

Prionodactylus eigenmanni. JAURU: amidst leaf litter in a semideciduous forest along the left bank of Rio Guaporé (15°07'S, 58°58'W). November 1996. C. Strussmann. UFMT 2506; 2541. First state record.

SERPENTES

Liophis longiventris. TANGARÁ DA SERRA: Usina Hidrelétrica Juba I, Rio Juba (14°44'S, 58°06'W). 1994. Collector and collection date unknown. UFMT 2085. The species was described by Amaral (1925) from the huge "Matto Grosso" region, without any additional explanation on the type locality. The only previous documented record for the state of Mato Grosso was mentioned by Dixon (1983) from the vicinity of the lower course of Rio das Mortes (12°51'S, 51°46'W) in the extreme eastern part of the state (about 650 km of the locality here cited).

Oxybelis fulgidus (Green Whip Snake). BARRA DO BUGRES: ESTAÇÃO ECOLÓGICA DE SERRA DAS ARARAS (15°39'S, 57°13'W), in the gallery forest along the left bank of Córrego Salobo. 16 September 1992. C. Strussmann and F. A. Machado. UFMT 1774. First documented record for state.

Micrurus paraensis (Pará Coral Snake). DENISE: (14°46'S, 57°05'W), Fazenda Rio Claro. 1992. Márcia Ferreira. UFMT 2413. First state record, extending known range of the species SE ca. 710 km from the nearest previous record in Ouro Preto do Oeste, eastern Rondônia (Cunha and Nascimento 1993). The specimen clearly fits the taxon usually treated as a subspecies of *M. psyches* (as in Campbell and Lamar 1989), but referred to as a distinct species and figured in Cunha and Nascimento (1993).

Micrurus surinamensis (Aquatic Coral Snake). NOVA OLÍMPIA: (14°47'S, 57°17'W), Fazenda Itamarati. Collector and collection date unknown. UFMT 2412. An additional locality from those depicted by Schmidt (1952), Campbell and Lamar (1989), and Roze (1996).

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BOOK REVIEWS

A Field Guide to the Life and Times of Roger Conant, by Roger Conant. 1997. SELVA, an imprint of Canyonlands Publishing Group, Provo, Utah. 498 pp. Hardcover. US $49.95 (plus $3.50 shipping and handling). ISBN 0-9657446-0-4. (Available from Canyonlands Publishing Group, P.O. Box 970129, Orem, Utah 84097-0129, USA or tel. 801-434-7793).

JOSEPH C. MITCHELL
Department of Biology, University of Richmond
Richmond, Virginia 23173 USA
e-mail: jmitchel@richmond.edu

Few people have exerted as great an influence in the science of herpetology, public education, and zoo biology as Roger Conant. He has had two careers, zoo biology and academic/field herpetology, and he has excelled in both. Readers are fortunate to be given an inside look into the life of someone who has witnessed the many changes that have occurred during the better part of the 20th century.

This 8.5 x 11 inch autobiography has 64 chapters spanning the period of 1909 to the present, four essays, 18 short anecdotal stories, vignettes of 20 well known herpetologists and 15 zoo personalities, and 31 color and 155 black-and-white photographs. The stories in this book are an impressive collection of behind-the-scenes tales of a professional scholar, zoo curator, administrator, and adventurer. Conant's fluid writing style and his impeccable attention to detail make these stories entertaining as well as informative and historically accurate. I cannot begin to describe all the stories, the people with whom Conant has interacted, and the exciting adventures that fill this book. I will, however, briefly describe some interesting aspects of his life and note some of the captivating stories.

Conant was born in 1909 and lived most of his youth in New Jersey. After graduating from high school at 16, he obtained a part-time job at a private zoo. There he developed a keen interest in the zoo field while learning how to handle a diversity of animals. His primary career was in the zoo field, spending six years at the Toledo Zoo and the remainder of his career at the Philadelphia Zoo (1935–1973). A particularly interesting incident that occurred during his years at the Toledo Zoo, and one which was to affect him the rest of his life, was the bite Roger sustained from a speckled rattlesnake (*Crotalus mitchellii*). This chapter accounts in vivid detail how the doctor permanently disabled his left thumb by cutting through nerves and how he nearly lost his life to a nasty case of tetanus. While at Philadelphia, he served as curator of reptiles, chief of public relations, and ultimately, director. He gave weekly radio programs to the public about the zoo and its animals and wrote numerous stories for the zoo's magazines for over 33 years. In 1937, Conant toured many of the zoos in Europe to obtain insights into zoo methodology and promotion. While in Germany, he had to give the Nazi salute and utter "Heil Hitler" whenever he had to enter a building. What an experience that must have been!

Conant's zoo career ran parallel to his other major interests in herpetology. These include the first scholarly treatise on the reptiles of a single state (Ohio), numerous papers on the systematics of North American watersnakes and other species, development and production of three editions of the most widely read herpetology book in the world (the field guide to eastern amphibians and reptiles in the Peterson Field Guide series), and completion, with his life-long friend Howard Gloyd (and the assistance of his wife Kathryn), of a world-class treatment of the snake genus *Agkistrodon* published in 1990. He conducted extensive field work in the New Jersey Pine Barrens where he lived much of his adult life, in Delmarva, Big Bend Texas, and several parts of Mexico.

This autobiographical "field guide" is actually several books in one. It is a history of the zoo business, a review of herpetology as it developed in the 20th century, a series of adventure stories to exotic places, and a love story. Many people, many of whom contributed to the zoo world and scientific community in their own right, crossed Conant's path. Almost all of them are mentioned. The one- to three-page vignettes alone offer insights into the world of herpetology and zoos in times past. The stories in this book are brought to life by Conant's descriptions of events, animals, and people.

Three chapters under the title of "Attempting the Impossible" describe the difficulties and adventures Conant and his late wife, Isabelle Hunt Conant, endured during preparation of the first herp field guide for the Peterson series. Accurate color photography was not available in the early 1950s and the Conants had to rely on other methods. All the illustrations in the published plates are of animals in natural poses arranged by Conant and photographed in black and white and hand colored by his wife. Most of the stories about the field guide are about seeking photographs and information on all the amphibians and reptiles of eastern North America. The first edition appeared in 1958. The second, which appeared in 1975, expanded its coverage westward to cover the gap created by the western field guide that did not include parts of the midwest. Two additional chapters on herping in Big Bend and three on the New Jersey Pine Barrens add more stories related to the field guides.

Isabelle Hunt Conant died in 1976, a loss that is lamented over and over in this book. Conant visited Howard Gloyd soon thereafter and learned of Gloyd's own terminal illness. After his death, Conant married Gloyd's wife, Kathryn. They have been companions ever since, traveling all over the world in pursuit of information and specimens for the equally monumental book on the snake genus *Agkistrodon*, and vacationing in tropical countries.

Conant spent many months in Mexico over a span of 20 years, focusing largely on natricine snakes in isolated bolsons. The stories told in 15 chapters clearly demonstrate that this has long been one of his favorite places. He has since traveled to every conti-

nent except Antarctica; there are many stories about travel and wildlife in Africa, Asia, and South America.

Conant's ancillary essay entitled "Herpetology Then and Now" reveals how he developed his perspectives on science, the value of collections, herpetoculture, and systematics. His statement, "Herpetoculture is not herpetology" may not be taken well by some people, although Conant does explain his position.

Chapters at the end of the book cover Conant's concern about the changing environment and the changes in the herpetological and zoo worlds. He clearly laments the loss of habitat and wildlife he has witnessed in his lifetime. He blames most of it on human BREED and GREED, the title to a near final chapter. He believes strongly that many of society's ills are due to human overpopulation and bases his conclusions on an experiment with mice in a cage left to their own reproductive madness. But most of all, he misses his second wife with whom he spent most of his life. His concluding chapter suggests that he will retire from it all but in the end, he notes, "Oh, what the hell. I can't just loaf. I've still too many things to do. How many frequent flier miles do Kathryn and I still have available?" I expect that Roger Conant will continue to make contributions to herpetology in the coming years and travel to more exotic places. His biography is far from being complete.

I could go on for pages about the contents of this book but something should be said about the book itself. The paper is a little thin and some of the pages are crinkled; however, the two-column layout and the font size make it easy to read. I found only one computer error (massa-sauga, p. 35) and no obvious mistakes in photograph captions or layout. Unfortunately, there is no bibliography or index. I wish he would have at least provided a list of his own publications. The price is quite reasonable, especially for today's books of this size. I should note also that the Toledo Zoo underwrote the book financially and all proceeds from its sales go to that institution.

If you want to delve into how field herpetology and zoo biology were conducted over the past eight decades, if you want to read adventure and travel stories, or if you simply want to read a well-written book, then buy this one. Every herpetologist and zoo curator would benefit from Roger's historical perspectives and insights into the personalities of our predecessors. This book would be a valuable addition to your library.

Tales of Giant Snakes: A Historical Natural History of Anacondas and Pythons, by John C. Murphy and Robert W. Henderson. 1997. Krieger Publishing Company, Krieger Drive, Malabar, Florida 32950. ISBN 0-89464-995-7, x+221 pp. US $29.50.

JAMES LAZELL
The Conservation Agency
6 Swinburne Street, Jamestown, Rhode Island 02835, USA
e-mail: jcinjtown@aol.com

Big things,
while still at large,
look much bigger
than they really are....
Paul Fountain (1902)

This is a wonderful book, quite literally a book full of wonders. The wonders begin with the front dust jacket: a photo of three yahoos (probably all Ph.D. herpetologists) acting as though they are attempting to restrain two anacondas that are acting, in turn, as though they are quite dead. The scene is a site of utter environmental devastation that makes an Army Corps of Engineers project look good. This photo is captioned: "Catching large anacondas for the Venezuelan anaconda project. William F. Holmstrom." Holmstrom appears from time to time in the rest of the text, and two of his papers are cited, but I could never find any explanation or description of the "Venezuelan anaconda project." I am left to conclude it is or was not the sort of thing any respectable person would care to be associated with.

The cover photo was shot from an angle to maximize the apparent sizes of the snakes, a technique noted by Murphy and Henderson elsewhere, as in the wondrous photo postcard reproduced on p. 32. Here a facial view and three loops of an anaconda dwarf two humans—tiny and out of focus—in the background. The dramatic effect is terrific, especially considering it dates from 1932. Given a good modern camera and a bright, sunny day (good depth of field), one could shoot a similar picture today using a dead garter snake. Little things, displayed just right, look much bigger—to our great delight.

There are lots more wonderful photos. For example, as a sort of logo punctuating sections of the book appears the picture of a Sumatran woman dragging a reticulated python. The snake's head dangles almost to her knees; its neck is draped over her shoulder; its body plunges to the ground at her heel; then the snake stretches out beyond that point for more than two times her height—and the end of the snake's tail is not even in the picture. What a woman!

Not only is this book wonderfully illustrated with 50 black-and-white photos, drawings from original accounts, trading cards, and handbills (and eight maps), but the text is wonderfully organized. The table of contents lists eight chapters: Introduction, Giants in the Landscape, How Big Do Giant Snakes Get?, Food and Feeding, Sex Among the Giants, Encounters, Attacks On Humans, and finally Exploitation, Populations, and Conservation. In the contents, each chapter is further divided into as many as 30 or more headings and subheadings, making it easy for the reader to zoom right to a particular item of interest such as: "Do Giant Snakes Eat Fruit?," "Charming Prey," "Aggregations," or "Postpartum Behavior." Thus, this is a well constructed reference book. (Beware, however: some of the juiciest bits on food and feeding may appear in Encounters or Attacks On Humans. Do not just refer to one place.) A more detailed index would be helpful.

Bear in mind that the title begins "Tales...," and tales there are—great chunks of them quoted straight from the explorers, missionaries, scientists, zoo collectors, medical doctors, and multitudes of liars (and not a few truth tellers) of every stripe: wonderful tales....

How about the dugout canoe of fellows who ate, at one sitting, a twenty-foot python and both the pigs it had swallowed? How many people can fit in one dugout canoe? Bah, that is nothing compared to the three gentlemen who ate also in one sitting—a 130 foot python. I would have had a hard time finishing my third even when I was in high school (my doctor has forbidden me to attempt such feats today; cholesterol, you know).

And speaking of eating, consider the quoted advice given to missionaries in Africa: "Remember not to run away, the python can move faster...You must let him swallow your foot. It is quite painless and will take a long time.... Wait patiently until he has swallowed about up to your knee. Then carefully take out your knife...." Of course, that is nothing compared to what the missionaries have gone forth to tell the local folks.

Short of UFO's and encounters with extraterrestrials, no area of "science" is so rife with great woolly yarns and colossal whoppers as the chronicles of giant snakes. Throughout this book, which

provides the biggest and best of them, Murphy and Henderson's voices of reason prevail. They clearly label the "absurd," the "flights of fancy," the "greatly exaggerated," and the "outrageous." So, how big do snakes really get? The authors do not know. "It is more fun" they say, "to argue and speculate..., and if we knew for certain...we'd no longer have reason to discuss such an entertaining and enjoyable topic."

Still, if I have one general complaint about this book, it is that the authors should have spent a bit more time on scientific investigation of size. The view that such effort is out of place in a book of "tales" is unacceptable because a lot of real science is included herein, recast from dry journals into lively narrative. I remember being present, some of the time, when Allen Greer (1974) was calculating crocodile lengths from the available bits and pieces, skulls and bones, in museum collections. The work was not dull; it could be written as a really good story. I miss an attempt to locate the largest actual museum specimens of giant snakes or to extrapolate sizes of giants from heads, or other parts, that actually exist. Perhaps someone will now take that up and see it through.

The bottom line, for me, is that no giant snake story claiming even 30 feet is credible. The largest actual specimen may have been "Colossus," a reticulated python said to have been 28.5 feet, that lived at the Pittsburgh Zoo at least until November 1956. But, alas, where is this specimen now? For me, it suffices to say that a reward for any snake over 30 feet, which has grown from $1,000 "many years ago" to $50,000 today, remains unclaimed.

The last chapter of this book is arguably the most important. It is packed with facts about human interactions with giant snakes, from the estimate that, in 1985, 884.5 miles of skins from the big four giant snakes were consumed by the leather industry, to the fact that reticulated pythons alone are consumed "at a rate that exceeds one-half million per year," even today. "The lack of baseline data...needs to be corrected...before these snakes are dangerously reduced or completely gone..." say Murphy and Henderson, and: "Including snakes, specifically the giants, in the emerging environmental ethic...appears to us to be particularly important."

This book is not without irksome errors. The subtitle could use tightening; the book is not constructed on a historical timeline. Spellcheck should have caught the likes of "assissted" (p. x) and "Brueni" (for Brunei, p. 128). However, no machine, but only good proof reading, could catch items like "after a violent struggle of two" (p. 124), or "the prayers of all suffers" (p. 175). The sentence beginning "He then makes the totally erroneous assertion that the tail does not have to be anchored...to an object for the snake to strike..." only comes out all right if you keep on reading and do not bog down on the idea that a snake's tail does have to be anchored. As Murphy and Henderson explain, it does not. There are too many incomplete or confusing sentences, but that is minor quibbling. One particularly unfortunate error is in Map 1, p. 8: Trinidad is left out of the range of the anaconda, even though there are lots of citations to and stories about anacondas on that island in the text.

This book should be extremely popular. It will appeal not just to herpetologists, but to the broadest audience of natural history and science readers. It will prove an invaluable reference in school libraries and should inspire young readers, both with what is known and unknown about its immensely popular subject, and with how real scientists document observations. Even us old pros who live or work within the ranges of giant snakes, and encounter them frequently in the wild, may look again with renewed interest and try to answer some of the fundamental questions about these magnificent creatures clearly called for in this book. "Is the last giant snake on the planet destined to end its life so someone can have a pair of python cowboy boots?" Not likely now that Murphy and Henderson have published.

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How to Photograph Reptiles and Amphibians, by Larry West and William P. Leonard. 1997. Stackpole Books, Mechanicsburg, Pennsylvania. 128 pp and 100 color photos. Softcover. US $16.95 plus postage. ISBN 0-8117-2454-9.

J. ERIC JUTERBOCK
Ohio State University, 4240 Campus Drive
Lima, Ohio 45804, USA
e-mail: juterbock.1@osu.edu

and

DAVID M. DENNIS
College of Biological Sciences, Ohio State University
484 West 12th Avenue, Columbus, Ohio 43210, USA
e-mail: dennis.4@osu.edu

To judge from the crowds at the live exhibits at recent SSAR meetings, amphibians and reptiles are becoming more popular, generally, as well as subjects for photography. The increases in popularity and photography of these creatures may relate to increased concern about biodiversity, the reports in the media of disappearing or deformed frogs, or even the increased number of books, like this one, concerned with herptiles.

How to Photograph Reptiles and Amphibians, by West and Leonard, consists of five sections. (Although it identifies four parts, "The Equipment," "Photographics," "Photographing Reptiles and Amphibians," and "Making a Good Photo Great," respectively, it has a photographic portfolio of the authors' work embedded between parts two and three. The portfolio section is no different than any of the other sections; it consists of text, photos, and photo captions). There are also "Acknowledgments," "Preface," and "Resources" sections, the latter listing references and sources of audio tapes and photographic equipment.

In "The Equipment," the authors discuss hardware and operations for cameras, lenses, flash equipment, support, and film, after which they propose an equipment "starter package" for someone interested in herp photography. Their presentation here is pretty basic, typical of books of this genre, and appears accurate, if occasionally simplified. "Photographics" discusses exposure and flash photography (which is either exposure or light, which is covered therein!). "Photographing Reptiles and Amphibians" is the one section in the book (exclusive of the portfolio) which deals specifically with herptiles. However, it really goes into little detail, suggesting field guides, natural history books and field work to increase your opportunities to find subjects; some of the information contained under the headings "Stalking" and "Photographing Difficult Subjects" is probably useful to the beginner. "Making a Good Photo Great" is mostly about the value of learning the biology of, and respecting, your subjects; there is approximately one page of discussion of composition.

Although this book has a paper cover, and we probably would not expect it to hold up forever as a field guide, it does have a

sewn binding and our copy has been through many reads, searches and flip-throughs without incident, so it should survive use as a reference. The printing job is good, and the photos in good register with apparently accurate color. Only one typo stood out; Tamaron for Tamron in the caption on p.18.

It is not especially easy for us to judge how well this book meets the authors' goal(s), since they never identify their audience, nor unequivocally identify their goal. To judge from the size and content, we assume that the book is aimed at someone who wants to photograph herps, but has little experience with photography. If "the primary emphasis of this book is on techniques for photographing amphibians and reptiles in nature" (p. ix), for beginners, the book should be reasonably useful and it is not expensive; it is also not an exhaustive treatment. However, the clearly promotional description on the back cover suggests an audience and goals that are not really attained. Given the authors' stated bias toward photographing wild subjects under natural conditions, this may be understandable. Still, there is no "thorough discussion of light" and, in our view, only an incomplete view of "making a good picture great."

Although, in general, we are less concerned with what is in the book than what is not there, a couple of things do merit discussion. The most important of these complaints concerns the illustrations. It does not seem to us as though the illustrations were photographed specifically for the text. There are no references in the text to the photos that illustrate particular points. If one searches around and reads all of the photo captions, it is often possible to find an illustration of a textual point, but that is a lot to ask of the reader. And, not infrequently, the locations of photos do not make it easy. For example, the caption of the photo of the tortoise on p. 2 mentions fill flash, which is not discussed in the text until p. 59; that for the salamander on p. 5 mentions using a tripod to allow slow shutter speed and small aperture, thus maximizing depth of field, a concept discussed on p. 35. A better system would have been to use the standard technique of photography magazines, where (often smaller) images of the same subject, photographed with only the target variable changed, are grouped on the same or opposing pages. This allows the reader to easily and clearly get the point. Another standard is to indicate the type of film used, since this could easily have as large an effect on the results as do equipment and exposure conditions, which they indicate. It is also a bit disingenuous for the authors to imply by repeated reference to the value of "natural pictures" or "stalking" (e.g., "we would rather have one excellent photograph of an animal exhibiting its natural behavior than one thousand posed portraits of captive animals." p.100) that they are not manipulating their subjects. We have enough experience with amphibians and reptiles to know that clean specimens and backgrounds are uncommon at best, and that, except for frogs, which almost always look good as they sit, most of the herps that you do find out in nature are not in aesthetically pleasing postures. Snakes are seldom in pleasing coils (e.g., pp. 28–31) and salamanders rarely have their tails attractively curled (e.g., p. 95). Even if they are doing it outside, the authors are cleaning, posing and staging more than they would appear to want you to know. For example, how is it that the salamander "on a log on the forest floor" on p. 63 is on exactly the same piece of background as the salamander "in a mossy rock outcrop" on p. 95?

For the most part, photographing herptiles is no different than any other close-up subject. Lighting, exposure, depth of field and focus are almost always problems to conquer. What makes herp photography most different is handling the herps. Barely more than one page of text ("Photographing Difficult Subjects" in their part four) discusses this topic. Perhaps the question to ask yourself is this: why am I photographing herps? If the reason one photographs herps is for the aesthetic or philosophical value, or the challenge, of meeting the animal on its terms, and the photographs are like one's journal of this experience, then whatever satisfies the photographer is fine. If, however, you are photographing to sell images, or to impress students, colleagues or editors, doing something for its purity probably will not work all of the time. Attractive, aesthetically pleasing backgrounds are required; they may be out in the habitat where you found the herp, but you will probably have to search for that special site. You may find that you have to arrange it. The goal is to be pleasing but biologically correct. Good poses are a part of composition; coiled snakes are more pleasing than kinked, elongate snakes and salamanders with long, thin tails look better with them looped around than stretched out straight. In order to photograph an entire subject when it is elongate, one must back away to a point where the background dominates the composition and the details of the subject are no longer clear. Clean animals look better than those with mud or leaf litter all over them. How does one get the subjects in such condition?

West and Leonard discuss lighting in several contexts in this book, but it always seems to be a contrast between the prized "natural light" and the "clinical" artificial light. With the exception of some discussion of fill flash (mostly as a way to put a highlight in the eye), there is virtually no discussion of modifying light, natural or otherwise. The need for depth of field and to stop motion make having as much light as possible critical in close-up photography. We do not understand why a tripod, which limits mobility and composition in close-up situations, is used with a flash, nor why flash pictures are so often shot at an aperture of f11. The cost of the latter is depth of field, apparent in many of the photo examples. In fact, the shallow depth of field apparent in many of the flash and tripod photos serves as testimonial to the need for a good TTL (through the lens, a reference to the metering system) flash, and learning to modify light. The goal is to have light from a flash not look like light from a flash! In this way, one gets the best of both worlds, apertures of f32 or f22 and pleasing light. Softboxes, reflectors and diffusers all allow the photographer to modify the light from a flash so that it looks like diffuse natural light, the ideal situation for close-up subjects; the latter two devices can be used to reduce the harshness of direct sun, too. We might add that, especially in portrait-style close-ups, the point of focus should be the eye, because the viewer is attracted to the animal's face. If depth of field is going to fail you, better that the focus trail off toward the rear of the subject, than that the face be soft.

The bottom line? *How to Photograph Reptiles and Amphibians* can serve as an inexpensive beginning for the novice herp photographer. We can agree with much of what West and Leonard say. We do have some concern about what is not in the book, however, even for novices. If it were us, we'd look for *John Shaw's Closeups in Nature* and spend a few (1–5) dollars more for a comprehensive reference. Very little that Shaw does not say about close-up photography as it relates to herps is found in West and Leonard's book.

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Monitor Lizards: Natural History, Biology and Husbandry, by Daniel Bennett. 1998. Edition Chimaira, Frankfurt am Main. 352 pp. 64 color plates. Softcover. DM 88.00 (US $49.95). ISBN 3-930612-10-0. (Available from Bibliomania!, P.O. Box 58355, Salt Lake City, Utah 84158-0355, USA).

MICHAEL S. Y. LEE
Department of Biological Sciences, Monash University, Clayton, Melbourne, VIC 3168, Australia
e-mail: mike.lee@sci.monash.edu.au

This enthusiastically written and attractively presented book represents a labor of love from its author and publishing team. It is an extensively revised version of *A Little Book of Monitor Lizards*, published privately by Bennett three years ago. The text has been expanded considerably, the number and quality of the photographs are greatly improved, the binding is more professional, and recent references have been incorporated (many from 1997—an impressive achievement considering my review copy reached me after a long sea journey in December that year).

Several English-language books on monitors have been released recently (De Lisle 1996; Green and King 1993; Steel 1996), and inevitably there is some overlap between them. Bennett's book, by design and good fortune, manages to minimize this redundancy by focusing on areas relatively poorly covered by the others. There is a detailed section on captive care—much of it based on extensive personal experience—covering everything from selecting a healthy young monitor to converting a spare room into an enclosure when it grows up. Each of the 45 currently recognized species of monitor is given an extensive individual treatment, with illustrations and detailed discussion on taxonomy, morphology, distribution, natural history, and rearing. This section occupies most of the book and is easily the most detailed and well-referenced species-by-species account of varanids published. The author has done a remarkable job in surveying the scientific and semipopular literature for information on each species, and bringing it all together. Until now, it was impossible to find such syntheses except for a handful of well-known species. Similarly, the discussion of monitor folklore neatly summarizes widely scattered accounts of an area many herpetologists will find fascinating but of which they might otherwise be largely unaware.

Few others would have the time, interest, and persistence to cast their bibliographic nets so widely. The popularity of monitor lizards among reptile keepers and the general public has led to a plethora of articles in the semipopular literature, such as nature and terrarium magazines, and herpetological society newsletters. Important natural history information in such sources often escapes the attention of the scientific community. Conversely, scientific papers can be intimidating to lay people, yet often contain much information useful for reptile enthusiasts. Bennett has performed an immensely useful service by tracking down and synthesizing information from these widely scattered and often obscure sources and making it readily accessible to all readers. The coverage of scientific and semipopular references is truly impressive; even in the discussion of the fossil record of varanids (an area I thought I knew reasonably well), I came across citations of interesting papers of which I was unaware. One of the most valuable aspects of this book will no doubt be its extensive bibliography, containing over 1100 references.

Because the author's main interest, and the stated focus of the book, is on ecology and captive care, it is not surprising that the chapter on evolution and phylogeny is rather brief. The importance of precise taxonomic knowledge is rightly emphasized by Bennett throughout, but the recent explosion of work on the phylogenetic relationships of varanids is not adequately covered; there is a simple listing of putative subgeneric groups but no discussion (or tree diagram) of relationships within or between these groups. As well, many heterodox ideas are presented without supporting arguments: e.g., the striking similarities between varanids and snakes are clearly convergent (there is much evidence that they are homologous), and the success of monitors in Australia is attributed to facultative bipedality (the usual explanation is that scarce and unpredictable resources of this region favor reptiles over mammals). More serious are some factual errors: for instance, mosasaurs are reputed to grow up to 50 m (50 ft would be stretching it), and all anapsid reptiles except turtles are said to have perished 250 million years ago (procolophonoids survived for another 50 million years). Perhaps I found this section disappointing because of my strong interests and opinions in the area—the non-specialist reader will probably not notice or care too much!

The book is crammed with fascinating natural history anecdotes, many again based on the author's personal experience. Unfortunately, some of the more intriguing reports lack sources; readers would no doubt like to be able to track down the original references for themselves. For instance, the nares of Bengal monitors are said to close to a slit ontogenetically, accompanied by a change in foraging technique that involves poking the snout into the earth. Similarly, some monitors are said to disembowel prey with their foreclaws, and *Varanus prasinus* is said to occasionally copulate while dangling via only its prehensile tail.

Finally, some gloss is lost because of numerous spelling and grammatical errors scattered throughout the text. In particular, many references either are not listed, or cited under the wrong year (e.g., Philippen 1995 on p. 15; Orlov and Tuniev 1986 on p. 17; Baverstock et al. 1994 on p. 18). These typos are especially prevalent in the bibliography: on page 302 alone, for instance, such glitches afflict a dozen citations.

These problems are minor, however, and easily can be remedied in a future edition (which will be eagerly awaited). Until then, almost anyone interested in reptiles will want this book, which represents the most comprehensive, up to date, and reasonably priced of the current cohort of monitor books. It covers areas the others gloss over, and will be particularly useful for those interested the natural history and captive care of these spectacular lizards.

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Sampling Amphibians in Lentic Habitats, edited by Deanna H. Olson, William P. Leonard, and R. Bruce Bury. 1997. Northwest Fauna Number 4. Society for Northwestern Vertebrate Biology. x + 134 pp. Available from Society for Northwestern Vertebrate Biology, 4820 Yelm Hwy SE, Suite B-175, Olympia, Washington 98503, USA. US $12.00 + $1.50 postage.

JOHN J. MORIARTY
Minnesota Frog Watch, 3800 County Road 24,
Maple Plain, Minnesota 55359, USA
e-mail: frogs@tc.umn.edu

Sampling Amphibians in Lentic Habitats is an important reference for anyone conducting or thinking about conducting amphibian surveys. It expands on *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians* (Heyer et al. 1994) by providing tested, area specific techniques and field forms. The book is written for the Pacific Northwest, but is useful for anyone working in ponds and lakes. Much of the book is also useful for lotic habitats, although such habitats are not a focus of the book.

The book is organized into seven chapters written by some of the leading amphibian field people in the Northwest. In order, these chapters progress through all the necessary steps needed to conduct an amphibian inventory or monitoring program. Using this book, a general field biologist can design, setup, and report on a monitoring program. It is as close to a cookbook as an amphibian techniques manual can be. Although some people feel that "cookbooks" simplify too much, I believe that they are very useful to the non-specialist field biologist.

"Amphibian Inventory and Monitoring: A Standardized Approach for the PNW," by Olson and Leonard, is the introductory chapter that covers the reasons for conducting surveys and the requirement for the use of standardized methods. They emphasize the need for consistent and repeatable methods. The chapter also includes a table of distribution, habitats, and habits of the amphibians found in lentic habitats in the Pacific Northwest and examples of data collection forms.

"Design of Amphibian Surveys," by Gary M. Fellers, is an explanation of the various steps needed to successfully plan a survey. Most of the chapter may seem elementary to experienced surveyors, but it nicely explains the advantages and disadvantages of various items needed to plan and set up a survey. It is a good review even for those of us who think we know how to do a survey.

"Basic Amphibian Survey for Inventory and Monitoring in Lentic Habitats," by Chris Thoms, Charlotte C. Corkran, and Olson, takes one into the field with the survey plan from the previous chapter. The chapter is thorough and includes things like field safety and post-survey cleanup, as well as how to approach and divide up a site for surveying.

"Surveying and Monitoring Amphibians Using Aquatic Funnel Traps," by Michael J. Adams, Klaus O. Richter, and Leonard, provides details on the proper use of funnel traps for collecting amphibian larvae. They discuss the various types of traps and the problems with them. Although funnel traps are important in the detection of some salamander larvae, they still have some problems with detectability of select species. Funnel traps should be used in conjunction with other survey techniques.

"Integrated Sampling for Amphibian Communities in Montane Habitats," by R. Bruce Bury and Donald J. Major, presents the elements of an adaptive survey for dealing with remote and variable habitats. Using standard techniques the authors explain how to conduct surveys under non-standard situations, while still allowing for repeatability.

"A Habitat-based Method for Monitoring Pond-breeding Amphibians," by Charles M. Crisafulli, provides survey methods for wetlands and lakes that are too large for complete surveys, or for studies focused on selected habitat types. The author explains how to delineate habitat types and document their boundaries. The chapter also goes through the various methods that can be used in such specific habitats. These methods are very similar to those introduced in the Basic Surveys and Integrated Sampling chapters and help to enforce the basic techniques used in all surveys.

"Checklist for Amphibian Survey Reports," by Charles R. Peterson, gives a step by step procedure on how to prepare a final report of the survey data. The outline for the report is very complete and if followed should produce a thorough report. One nice addition would be a section on how to select the method of dissemination of reports by a government agency, professional journal, or other avenues.

A section of 40 color plates shows different lentic habitat types found in the Northwest—providing a good overview of the wide variety of habitats that amphibian surveyors may encounter in the region.

The book concludes with a complete Literature Cited section and list of General References. The list includes all the major national and regional publications of importance, plus some. One title that caught my attention was Petranka's (1997) *Salamanders of the United States and Canada* (Smithsonian Institution Press, Washington, D.C.). Unfortunately, it has not been published yet and may not be available until mid-1998.

The Pacific Northwest finds itself in excellent shape for amphibian monitoring with the publication of this book and the field guide of Corkran and Thoms (1996). The combination of the two books provides the needed methodologies along with excellent identification keys for all the species. Other regions of the United States and Canada should follow their lead. *Sampling Amphibians in Lentic Habitats* is a must-have book for anyone conducting field surveys of amphibians in the United States.

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Geckos der Welt: alle Gattungen [Geckos of the World: All Genera], by Herbert Rösler. 1995. Urania Verlag, Leipzig, Germany. 256 pp. Hardcover. 88.– DM (approx. US $52.00). ISBN 3-332-00549-9.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: abauer@king_kong.vill.edu

This is a very different book from other recent treatments of geckos (e.g., Bartlett and Bartlett 1995; Henkel and Schmidt 1995; Seufer 1991), and one that has more general applicability outside of the realm of herpetoculturists. As the title implies, the book provides an overview of all living gekkotan genera, including a great many that are completely unknown to most amateur herpetologists and barely recognizable to even specialists.

The book opens with a review of gekkotan systematics and characteristics. Included are overviews of fossil geckos, body size and form, skin structure and function, sensory organs, sexual dimorphism, and locomotion (including the morphology of digital scansors). This section is well-illustrated by line drawings, scanning electron micrographs, and close-up color photos. Another introductory section deals with distribution and natural history and features maps illustrating subfamilial distributions (that for the Gekkoninae is incorrect but a replacement was provided on an errata sheet), an overview of activity period, social behavior, reproduction, and growth and longevity. Although the chapter heading suggests that the information is based on animals in the wild, many of the data presented have been supplemented by the author's own extensive observations on captive behavior, reproduction, and longevity. *Oedura* and *Phelsuma* are highlighted in particular.

The core of the book is a set of generic accounts, each providing brief physical characterizations of the lizards, natural history notes, a distribution statement, and literature citations. Most genera are illustrated by one or more color photos of representative species (the only taxa missing photos are the pygopods *Aclys*, *Ophidiocephalus*, and *Pletholax* and the gekkonines *Briba*, *Calodactylodes, Carinatogecko, Dravidogecko, Gymnodactylus*, *Luperosaurus*, and *Pseudogekko*). Most photos depict living specimens in captivity, but preserved museum specimens have been figured in some cases. Although not especially aesthetic, even these serve the purpose of giving the reader at least a sense of the appearance of a typical member of the genus. Photo quality varies considerably and many photos could have been improved by enlargement, judicious cropping, better depth of field, choice of a better background, or better lighting. Nonetheless, the vast majority are sharp and clear and provide "a face to go with the name." Only the photo of *Cnemaspis kandiana* is badly out-of-focus. A number of species are missidentified in the figure legends, the most glaring example being a photo of *Hemidactylus triedrus* labeled as *Cyrtodactylus tiredrus*. In fairness to the author, however, this and several lesser typos and misidentifications were noted on an errata sheet in my review copy. A few accounts are accompanied by representative habitat photos. More of these might have been a good thing, providing temperate zone gecko enthusiasts with a better sense of where the objects of their affection live.

In all, 96 genera are included in the work. The taxonomy employed is current for the publication date of the book, based primarily on the work of Kluge (1993), and including newly erected genera, such as *Saltuarius*. However, there have been several recent generic level revisions postdating Rösler's book: *Dravidogecko* has been sunk into *Hemidactylus* (Bauer and Russell 1995), *Phyllodactylus* has been broken into seven genera (Bauer et al. 1997), *Pseudothecadactylus* has been resurrected from the synonymy of *Rhacodactylus* (Good et al. 1997), *Millotisaurus* has been placed in the synonymy of *Lygodactylus* (Pasteur 1995), and Rösler's *Homopholis* is now referred to *Blaesodactylus*, and his *Platypholis* to *Homopholis* (Kluge and Nussbaum 1995). It is clear, however, that the author made every effort to accurately reflect the state of affairs in gecko systematics, praise that can be bestowed on precious few herpetocultural publications.

The generic accounts are followed by a 39-page chapter dealing with gecko husbandry. This provides basic information about terrarium construction, temperature, water, and food regimes, handling and transport of geckos, breeding, incubation, and disease and is based primarily on the author's own extensive personal experience with a wide variety of geckos in captivity. Unfortunately, the husbandry portion of the text largely excludes pygopods, resulting in a certain asymmetry in the completeness of the book as a whole.

Of special value in the husbandry section are three reference tables. The first provides a correspondence between gecko characteristics and behavior and the probable implications of these traits for keeping the animals (e.g., required substrates, environmental requirements, pairing or dominance problems). The second provides a brief physical description, recommended terrarium type, and comments for 78 species of geckos. The third table presents a wide variety of parameters of reproduction, egg dimension, incubation, and hatchling size for 49 species of geckos. The first of these tables will be especially useful for novice keepers, or those who may encounter an unknown, or incorrectly identified, gecko in the pet trade.

Finally, the text concludes with short sections on conservation status (especially as relating to geckos being kept in Germany), a list of gecko-focused organizations, and a brief glossary of 84 terms, most of which will be familiar to all but the most novice herpetologists. The literature cited section is extensive, with more than 1000 references, and current through approximately mid-1995 (many 1994 and 1995 references are included along with short synopses in an addendum). The literature citations contain some typos but are generally correct and include a wide array of papers dealing with systematics, natural history, and husbandry in a variety of languages (predominantly English and German). An index to scientific names and general topics is also included.

Although I noted a range of minor typos throughout the book, the text as a whole appears to be factually sound. The 41 genera with which I have had some field experience are generally accurately portrayed, although the brevity of accounts necessitates oversimplification in some cases. For example, *Ailuronyx seychellensis* is noted as occurring on palm trees. While this is true, I have also found them on banana plants, in abandoned houses, and in outhouses. For most readers, however, such minor quibbles will be irrelevant, and the text will provide a good first introduction to most gecko genera.

In its current form, in the original German, this book will be most useful to professionals and very serious amateur herpetologists. The fact that most genera are illustrated in color and that there is a comprehensive and up-to-date literature section make the book a handy guide to the living gekkotans. I can imagine that most herpetologists will find photos of genera they had never heard of and that the book will help both herpetoculturists and academic biologists gain some appreciation for the diversity of geckos. An English translation would be most welcome as it would make

Rösler's extensive breeding data for dozens of species more easily accessible to North American herpetoculturists who, as a group, lack experience with as broad a range of gekkotans as their European counterparts. *Geckos der Welt* is not perfect, but a more comprehensive illustrated guide to geckos and their biology has not been published. Accordingly, I recommend this book highly to anyone who wants or needs a single source of general information for gekkotan lizards.

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PUBLICATIONS RECEIVED

A Classification of North American Biotic Communities, by David E. Brown, Frank Reichenbacher, and Susan E. Franson. 1998. The University of Utah Press, Salt Lake City. x + 142 pp. Softcover. US $19.95. ISBN 0-87480-562-7. Accompanying 42" x 42" map. US $20.00 [Book and map set, $34.95]. ISBN 0-87480-567-8.

This book outlines a uniform hierarchical classification of biotic communities north of the Panama Canal. The categories employed, from more to less inclusive are: biogeographic realm, hydrologic regime, formation-type, climatic zone, biotic community (regional formation), series (alliance of generic dominants), and association (plant community of specific taxa). The latter two categories are not dealt with comprehensively, but some examples are provided. A large number of the community types are illustrated in a series of 118 black and white photographs and all are indicated on the large accompanying map. The book also presents a detailed rationale for the system employed and an extensive bibliography. The classification scheme employed should provide a standard nomenclature for herpetologists and others involved in biotic inventorying or studies in ecological biogeography.

Aquatic Fauna in Peril: The Southeastern Perspective, edited by George W. Benz and David E. Collins. 1997. Special Publication 1, Southeast Aquatic Research Institute. Lenz Design & Communications, Decatur, Georgia. xviii + 554 pp. Hardcover. US $45.00. ISBN 0-9654841-0-6.

A proceedings volume based on a conference held in 1994 and sponsored by the Tennessee Aquarium. The book incorporates 17 chapters along with appendices (including state by state threatened and endangered lists) and subject, common name, and scientific name indices. Of herpetological interest are chapters by C. Kenneth Dodd, Jr. on "Imperiled amphibians: a historical perspective," Kurt A. Buhlmann and J. Whitfield Gibbons on "Imperiled aquatic reptiles of the southeastern United States: historical review and current conservation status," and Linda V. LaClaire on "Amphibians in peril: resource management in the southeast." The volume as a whole outlines the biogeography, ecology, conservation threats and status, and management of aquatic vertebrates and invertebrates throughout the southeastern United States and the text is supplemented by numerous maps, graphs, tables, and black and white and color photographs.

A Natural History of Australia, by Tim M. Berra. 1998. Academic Press, San Diego. x + 304 pp. Hardcover. US $44.95. ISBN 0-12-093155-9.

A Natural History of Australia presents one American's view of the geology and biology (including human) of the island continent. Although many plant and animal groups are dealt with, vertebrates receive the most attention. Amphibians and reptiles are dealt with in a 37-page chapter. As with other groups, the basic characteristics of families are outlined and selected taxa are illustrated by color photos or line drawings, and shaded range maps are provided. Summary information regarding snake bite and venom toxicity is also presented. Although the level of generality does not make this book suitable as a field guide, it is an excellent introduction to the Australian environment in general. In addition to the excellent graphics and entertaining prose, readers will find appendices on Australian slang and idiom and political, social, and demographic details particularly interesting. Bibliographic references and an index are supplemented by a listing of National Geographic articles dealing with Australia.

Early Notice for 1999 Annual Meeting

Although next year's annual SSAR meeting, to be held jointly with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists at Penn State, seems like a long ways off (24–30 June 1999), the Call for Papers will be mailed much earlier than in years past—by 5 October 1998. The deadline for submission of abstracts is 15 December 1998. Further details are contained in the official Meeting Announcement and Call for Papers, to be mailed to all Canadian, Mexican, and U.S. members of SSAR. Overseas members wishing to receive this information may do so by contacting the Local Committee Chair, Jay Stauffer (e-mail: vc5@psu.edu; tel. 814/863-0645). A meeting web page is under development and may be accessed at: www.outreach.psu.edu/C&I/ASIH/.

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CHAIRPERSONS

Common and Scientific Names
BRIAN I. CROTHER
Department of Biological Sciences
Southeastern Louisiana University
Hammond, Louisiana 70402, USA

Conservation
C. KENNETH DODD, JR.
U.S.G.S. Florida Caribbean Science Center
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology, P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
MARTHA L. CRUMP
Department of Biological Sciences, Box 5640
Northern Arizona University
Flagstaff, Arizona 86011, USA

Long Range Planning
LOUIS J. GUILLETTE, JR.
Department of Zoology
University of Florida
Gainesville, Florida 32611, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
Worcester, Massachusetts 01602-2597, USA

1998 Local Committee
JAMES P. BOGART
Department of Zoology
University of Guelph
Guelph, Ontario, Canada N1G 2W1

Nominating
ROBIN M. ANDREWS
Department of Biology
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061, USA

Regional Society Liaison
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Resolutions
GEORGE R. PISANI
Department of Biological Sciences
University of Kansas
Lawrence, Kansas 66045-2106, USA

Seibert Awards
DAWN S. WILSON
Department of Biology/314
University of Nevada – Reno
Reno, Nevada 89557-0015, USA

Student Travel Awards
TODD ESQUE
U.S.G.S. Biological Resources Division
345 East Riverside Drive
St. George, Utah 84790, USA

Zoo Liaison
JEFF ETTLING
Department of Herpetology
Sedgwick County Zoo
Wichita, Kansas 67212, USA

COORDINATORS

Elector
DAVID L. HARDY, SR.
585 South Main Avenue
Tucson, Arizona 85701, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

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Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings. **Corresponding authors should include an e-mail address (if available); this will greatly facilitate communication with the editors.**

Originals of illustrative material (e.g., tables, photographs, or diagrams) should be submitted with the text, with appropriate precautions taken to ensure delivery without damage. Illustrations should be discussed in the text and numbered sequentially with Arabic numbers. References to illustrations should be placed in parentheses at the end of sentences. Original photographs should be submitted as black and white glossy prints. For further guidelines, authors should consult *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (6th edition, 1994, Council of Biology Editors, Inc., 11 South LaSalle Street, Suite 1400, Chicago, Illinois 60603, USA).

Submissions for Natural History Notes, Geographic Distribution, Herpetological Husbandry, Current Research, Regional Society News, and Legislation & Conservation should be sent directly to the appropriate section editor. Please send review copies of books to the Book Review Section Editor. Manuscripts intended for publication as Articles, Points of View, Techniques, or Recent Population Changes, as well as news notes and other material, should be sent to the Editor. Deadline for receipt of meeting announcements, news notes and related material is two months prior to each issue (e.g., 1 January for March issue).

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Herpetological Review

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SSAR Officers (1998)

President
DARREL R. FROST
American Museum of Natural History
Central Park West at 79th Street
New York, New York 10024, USA

President-elect
VICTOR HUTCHISON
Department of Zoology
University of Oklahoma
Norman, Oklahoma 73019, USA

Secretary
ELLEN J. CENSKY
Section of Amphibians and Reptiles
Carnegie Museum of Natural History
Pittsburgh, Pennsylvania 15213, USA

Treasurer/Publications Secretary
ROBERT D. ALDRIDGE
Department of Biology
Saint Louis University
3507 Laclede Avenue
St. Louis, Missouri 63103-2010, USA
e-mail: ssar@sluvca.slu.edu

Immediate Past President
HENRY R. MUSHINSKY
Department of Biology
University of South Florida
Tampa, Florida 33620-5150, USA

Directors
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CLAUDIA LUKE (2000)

SSAR Editors

Journal of Herpetology
RICHARD A. SEIGEL, Editor
Department of Biological Sciences
Southeastern Louisiana University
SLU 814
Hammond, Louisiana 70402, USA

WILLIAM S. PARKER, Managing Editor
Division of Science and Mathematics
Mississippi University for Women
Columbus, Mississippi 39701, USA

Contributions to Herpetology* and *Facsimile Reprints in Herpetology
KRAIG ADLER, Editor
Section of Neurobiology & Behavior
Cornell University
Ithaca, New York 14853, USA

Herpetological Circulars
JOSEPH T. COLLINS, Editor
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Catalogue of American Amphibians and Reptiles
ROBERT POWELL, Editor
Department of Natural Sciences
Avila College
Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170 tel.; (209) 299-0161 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
208 South Great Road
Lincoln, Massachusetts 01773, USA
e-mail: ttyning@massaudubon.org

Advertising Manager
ELIZABETH A. JOHNSON
31 Maple Street
Milford, New Jersey 08848, USA
(908) 995-0201 tel.
e-mail: ejohnson@ptdprolog.net

Associate Editors

DANIEL D. BECK
Central Washington University
e-mail: beckd@cwu.edu

SHARYN B. MARKS
Humboldt State University
e-mail: sbm1@axe.humboldt.edu

DARYL R. KARNS
Hanover College
e-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
e-mail: jeffrey_lovich@usgs.gov

BRIAN W. BOWEN
University of Florida
e-mail: bowen@gnv.ifas.ufl.edu

DEANNA H. OLSON
USDA Forestry Science Lab
e-mail: olsond@ccmail.orst.edu

HAROLD W. AVERY
U.S. Geological Survey
e-mail: hal_avery@usgs.gov

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

Current Research
ANNE M. MAGLIA
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: magliaa@falcon.cc.ukans.edu

Current Research
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: csheil@falcon.cc.ukans.edu

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: soniak@unt.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biological Sciences
Southeastern Louisiana University, SLU 814
Hammond, Louisiana 70402, USA
e-mail: jdemuth@selu.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cwpaint@unm.edu

Natural History Notes
R. KATHRYN VAUGHAN
Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
e-mail: rkvaughan@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@aix1.ucok.edu

Editor-at-Large: *Adam P. Summers*
Copy Editors: *Jeff Parmelee, Jenny Pramuk, Martin J. Rosenberg, Amy Sproston*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

WWW: http://falcon.cc.ukans.edu/~gpisani/SSAR.html



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1998 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).
1999 — Pennsylvania State University, University Park, Pennsylvania, USA, 24–30 June (Jay Stauffer, Chair).

SSAR BUSINESS

HR Staff Changes

Lee Fitzgerald has stepped down as an Associate Editor for *HR*. In addition to this most recent role, Lee previously toiled as a Section Editor for Natural History Notes. On behalf of SSAR, the editors thank Lee for his efforts and contributions to colleagues.

Hal Avery (U.S. Geological Survey) and Sharyn Marks (Humboldt State University) have joined our staff as Associate Editors. E-mail addresses for each are provided on the inside front cover.

SSAR Grants-in-Herpetology

Proposals are now being accepted for the 1999 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include in-situ behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

6. INTERNATIONAL. Proposals may address needs in any of the above five categories, but applicants must be from countries where herpetological research has historically been underfunded, and where alternative sources of financial support are scarce or nonexistent.

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be members of the SSAR with the exception of those applying for support of regional herpetological society projects, or those applying in the international category. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 1998 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) TITLE PAGE giving the title of the project, the name, mailing address, office and home telephone numbers and, if possible, fax number and e-mail address of the applicant. The title page should include a statement indicating that applicants "will comply with all applicable permit regulations, and adhere to all appropriate animal care guidelines in the course of conducting funded projects." (B) BACKGROUND AND OBJECTIVES of the proposed project. (C) METHODS of carrying out the project. (D) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). Include an explicit explanation of how an SSAR award of $500 would be applied toward the objectives of the project, and provide a current listing of all current and pending support for the project. (E) BRIEF RESUMÉ of the applicant or project coordinator. (F) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed 1200 words, excluding title page, literature cited, resumé, and budget. Applicants must indicate word count on their application.

Applicants must designate to which of the six categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than 31 DECEMBER 1998 to be considered. Failure to meet these guidelines may result in elimination of a proposal from consideration. The awards will be announced on or around 1 April 1999. Successful applicants are encouraged to submit the results of their research for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Joseph R. Mendelson III, Chair, SSAR Grants-in-Herpetology, Department of Biology, Utah State University, Logan, Utah 84322-5305, USA. Tel. (435) 797-2097; Fax (435) 797-1575; e-mail: sapo@biology.usu.edu.*

SSAR Henri Seibert Award for 1999

The Henri Seibert Award was initiated in 1992 to provide recognition for the best student papers given at the annual meeting of the SSAR. To be eligible, the presented paper must be the results of research conducted by the presenter, who must also be a current SSAR member. The research must have been done while the student was in either an undergraduate or graduate degree program. The presentations will be judged by the SSAR student prize committee. One Seibert Prize of US $200 may be given in each of the four categories: Conservation, Ecology/Evolution,

Physiology/Morphology, and Systematics. Please indicate the category to which you are submitting your abstract on the abstract form in the Call for Papers (to be mailed in early October 1998). Note also that past winners of this award are not eligible for participation in future Seibert Award competitions. Please refer to *Herpetological Review* 28(4):175 for recommendations to students entering next year's Henri Seibert competition.

Kennedy Student Award Committee Annual Report—1998

The Kennedy Award Committee has completed its work for Volume 31 of the *Journal of Herpetology*. The Committee has selected "The effects of reproductive mode and climate on reproductive success in the Australian lizard, *Lerista bougainvillii*" by Carl P. Qualls (Vol. 31[1]:60–65). As an undergraduate, Carl performed research under Bob Jaeger at The University of Southwestern Louisiana. The work reported in Volume 31 was a portion of his doctoral research under Rick Shine at the University of Sydney. Currently, he is a post-doctoral student in Robin Andrews' laboratory at Virginia Polytechnic Institute and State University, where is working with brown tree snakes in Guam.

Fifteen manuscripts were in competition this year. The Committee noted the high quality of the submitted papers. Committee members were: Robin Andrews (Virginia Polytechnic Institute & State University), David Duvall (Oklahoma State University), Robert E. Gatten, Jr. (University of North Carolina), Terry D. Schwaner (Southern Utah University), and Ken R. Marion (Chair, University of Alabama at Birmingham).

NEWSNOTES

David Wake Elected to U.S. National Academy

David B. Wake, long-time SSAR member and Gompertz Professor of Integrative Biology at the University of California at Berkeley, was recently elected to the U.S. National Academy of Sciences. He also serves as director of the Museum of Vertebrate Zoology. David is well known for a broad range of outstanding studies in evolutionary biology and is the leading authority on the systematics of plethodontid salamanders. In recent years, he has also investigated the neuroethology of salamander feeding mechanisms.

Election to the select membership of the National Academy is a singular honor for an American scientist and SSAR salutes David for this richly deserved tribute to his career as a research scientist.

North Texas Herpetological Society Scholarship Giving Reaches $10,000

Over the past six years the North Texas Herpetological Society has hosted its spring symposium. Its purpose is to provide education and further conservation efforts worldwide, particularly with regard to reptiles and amphibians. This is accomplished primarily with a day of speakers, an education room open to the general public, and through the dissemination of unrestricted scholarships

About Our Cover: *Siphlophis cervinus*

The similarity between the South American Emerald Treeboa, *Corallus caninus*, and the Indo-Australian Green Tree Python, *Morelia viridis*, is famous. But many other reptiles, separated by huge phylogenetic and geographic distances, share motifs of color and pattern, often resembling one another to an astonishing degree. Among the snakes, the harlequin decorations involving black-and-cream rings, spots, or bands coupled with a brilliant red or orange mid-dorsal stripe are particularly striking. Such a pattern can be seen, for example, in the South African *Homoroselaps lacteus*, in the Central American *Scolecophis atrocinctus*, and in the South American *Oxyrhopus leucomelas*.

It also appears in an odd little snake called *Siphlophis cervinus*. The Neotropical genus *Siphlophis* includes five species: *S. cervinus*, *S. leucocephalus*, *S. longicaudatus*, *S. pulcher*, and *S. worontzowi* (Peters and Donoso-Barros 1970. Catalogue of the Neotropical Squamata. Part 1. Snakes. Washington, DC, 347 pp.). Four of these species are Brazilian endemics (Peters and Donoso-Barros 1970, *op. cit.*), a bizarre Panamanian reference for *S. longicaudatus* notwithstanding (Villa, Wilson, and Johnston 1988. Middle American Herpetology. A Bibliographic Checklist. Columbia, Missouri, 131 pp.). The Liana Snake, *Siphlophis cervinus*, ranges from Panama and Trinidad south to Bolivia and tropical Brazil. It is a denizen of rainforests, where it leads a mostly arboreal life. Under cover of darkness, it forages actively in shrubs and trees for lizards, and has been known to consume *Anolis* and *Tropidurus*. Juvenile Liana Snakes, which hatch from eggs, resemble adults in color and pattern.

Why would a snake, especially a nocturnal one, possess such a startling combination of colors? And why would species dissimilar in habits and habitats look so much alike? We know something about sight in vertebrates, but next to nothing about vision, the complex interaction of the brain's processing of optic nerve information and how this is presented to the consciousness (Walls 1942. The Vertebrate Eye. Bull. 19. Cranbrook Inst. Science, 785 pp.). When we can simulate the way other creatures see, it will be instructive to take a walk in the woods....to look at things through the eyes of a civet or an owl, or some other predator. Surely many peculiarities of the animal world, especially those involving color and pattern, will begin to resolve themselves.

The cover photo depicts an adult male *Siphlophis cervinus* approximately 750 mm long. The sleeping snake was photographed by **William W. Lamar** during late afternoon, as it lay coiled among vegetation in Amazonian rainforest along the Pindoyacu River, Loreto, Peru. Lamar made the shot on a tripod with an aged Pentax LX 35mm camera and a Vivitar Series 1, 105mm macro lens. The image was captured under natural light at f27 on Fujichrome Velvia film.

Commenting on his photo technique, Bill said, "I have minimal equipment, and all of it is old and badly worn. I like a variety of approaches, at various focal lengths, using both fill-flash and natural light, and very slow film. I know the look I want to capture: intimate, immediate, and natural. The problem is, I lack the skills to get what I want. But the trying is worthwhile!"

Bill Lamar is Adjunct Professor in the School of Sciences at The University of Texas at Tyler, and a Research Associate at The University of Texas at Arlington Collection of Vertebrates and the Natural History Museum of The University of Kansas. He has lived or worked in Latin America for over twenty years and is well-known for his scientific and popular publications. Excerpts from his memoir, *Primitive at Heart*, can be found in editions of *Fauna* magazine. He recently authored *The World's Most Spectacular Amphibians & Reptiles* (World Publications), now in its third printing. Lamar spends much of his time in the tropics of Latin America, where he works with documentary film makers and conducts natural history tours for GreenTracks, Inc.

Separation and imaging of Lamar's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

to deserving graduate students in the fields of herpetology, wildlife science, and conservation ecology.

The NTHS is proud to announce that, as of this year, a total of $10,000 has been awarded to graduate students from five different universities. The annual symposium is generally held in April. Interested individuals wishing to be put on next year's notification list should contact the Scholarship Chairman, K.C. Rudy (animan@flash.net) or write the NTHS at P.O. Box 1043, Euless, Texas 76039, USA.

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 1998, with notification by 1 December 1998. Grantees are expected to complete their Academy visit by 15 September 1999. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

Brett Stearns Award for Chelonian Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round-trip transportation and limited per diem expenses—to researchers who wish to visit our collections to support their work in chelonian biology. Preference will be given to graduate students.

Proposals should include a short (e.g., one page) description of the research project and a budget. In the case of graduate students, a letter of support from the student's faculty advisor is required.

Proposals are due on 15 October 1998; notification will be made by 1 December 1998. Awardees are expected to complete their Academy visit by 15 September 1999. Please call (415) 750-7039 for further information.

Proposals should be sent to: *Chelonian Research Awards, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

The CAS chelonian holdings are included in the Department of Herpetology database: www. calacademy.org.

MEETINGS

Meetings Calendar

1–5 October 1998—3rd Annual Meeting of the Canadian Amphibian and Reptile Conservation Network in conjunction with the 8th Annual Meeting of the IUCN/SSC Task Force on Declining Amphibian Populations in Canada (DAPCAN), University of Saskatchewan, Saskatoon, Saskatchewan, Canada. Contact: Andrew Didiuk, Local Organizer; e-mail: Andrew.Didiuk@ec.gc.ca; tel: 306-975-4087; fax: 306-975-4089.

2–6 March 1999—19th International Symposium on Sea Turtle Biology and Conservation, South Padre Island, Texas, USA. *(Refer to detailed information below).*

13–17 May 1999—Fourth International Symposium on Isolated Vertebrate Communities in the Tropics, Bonn, Germany. Hosted by the Zoologisches Forschungsinstitut und Museum Alexander Koenig. To receive announcements and to obtain further information, please contact: Prof. Dr. W. Böhme, Adenauerallee 160, 53113 Bonn, Germany; tel. +49 228 91 22 250, fax ++49 228 216 979, e-mail: r.hutterer.zfmk@uni-bonn.de.

8–11 October 1999—Second Symposium on the Status and Conservation of Florida Turtles, Eckerd College, St. Petersburg, Florida, USA. Contact: Gopher Tortoise Council, c/o George L. Heinrich, 1223 Alhambra Way S., St. Petersburg, Florida 33705-4620, USA; tel. (813) 865-6255; e-mail: highpine@gte.net.

19th International Sea Turtle Symposium

The 19th International Symposium on Sea Turtle Biology and Conservation will be held at South Padre Island, Texas, USA from 2–6 March 1999. This will be the last symposium of the millennium. We have chosen a primary historical theme for the meeting entitled, "The Promise, the Pain, and the Progress of 50 years of Sea Turtle Research and Conservation."

The symposium meeting site will be the South Padre Island Convention Center which is located adjacent to a salt marsh on Laguna Madre. The primary lodging site, "Bahia Mar Resort," which has many lodging options including condominiums of various sizes, is located within walking distance across the narrow island on a wide Gulf of Mexico beach. Excellent rates for rooms, food, air fares, and ground transportation have been negotiated with local vendors who have agreed to provide a 10% return to the Symposium. Southwest Airlines and Advantage Rental Cars have also agreed to give us special rates.

Registration will begin on Tuesday afternoon (2nd March) followed by an evening social at the Convention Center. Friday evening is set aside for the banquet and dance. The last official activity will be the IUCN Marine Turtle Specialist Group meeting on Saturday morning (6th March). If you have not previously attended a turtle symposium and are therefore not included in the symposium mailing list, then please contact Jane Provancha, Symposium Secretary, Aquatics Ecological Program, DYN-2, Kennedy Space Center, Florida 32899, USA; e-mail: Jane.Provancha-1@ksc.nasa.gov; Fax: (407) 853-2939.

Travel funds are available to assist international participants in their efforts to attend the Symposium in Padre Island. Awards should not be expected to cover the full cost of travel. Priority will be given to those who will be presenting papers or posters, those who apply before the deadline, and to individuals from relatively under-represented regions. If you are in need of assistance for travel to the Symposium, contact the relevant regional committee representatives before 1 December 1998. A copy of your abstract should accompany your application if you will be presenting a paper or poster. Candidates should have no hesitation in contacting their regional chair for letters of invitation or advice.

Americas/Caribbean: Wallace J. Nichols, University of Arizona-Wildlife Ecology, Fax: (650) 651-1579; e-mail: jnichols@ag.arizona.edu.

Asia and Pacific: Marydele Donnelly, IUCN, MTSG, Fax: (202) 872-0619; e-mail: mdonnelly@cenmarine.com.

Africa and Europe: Brendan Godley and Annette Broderick, Marine Turtle Research Group, University of Glasgow, Fax: + 44 141 330 5971; e-mail: MTN@bio.gla.ac.uk.

A limited number of travel awards will be made available to students travelling from within the USA. Candidates should contact Travel Committee Chair, Wallace J. Nichols (above).

Symposium on the Status and Conservation of Florida Turtles

A Second Symposium on the Status and Conservation of Florida Turtles will be held at Eckerd College in St. Petersburg, Florida on 8–11 October 1999. Co-sponsored by Eckerd College, the Gopher Tortoise Council, and the Florida Turtle Conservation Trust, this symposium will address the problems faced by Florida turtle species, as well as conservation strategies and specific recovery solutions.

Paper session topics include populations, habitat, disease, commercial trade, and conservation measures. In addition to a poster session and field trips, workshops on the identification of emydid turtles, field methods, and environmental education are scheduled.

A volume describing the conservation biology of Florida turtles at the end of the 20th century is planned. We anticipate that it will include 25, mostly multi-authored, accounts. Anyone wishing to contribute to one or more species accounts is asked to contact Peter Meylan (e-mail: meylanpa@eckerd.edu).

For more information about the symposium, contact the Gopher Tortoise Council, c/o George L. Heinrich, 1223 Alhambra Way S., St. Petersburg, Florida 33705-4620, USA; tel. (813) 865-6255; e-mail: highpine@gte.net.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Molecular Phylogeny and Biogeography of Elapid Snakes

Keogh sequenced regions of the 16S rRNA and cytochrome *b* mitochondrial DNA genes from 17 species (distributed among 16 genera) of elapid snakes. These data were analyzed separately, as well as combined as a single data set. Results of his analyses support several hypotheses (e.g., American and Asian coral snakes are a natural [monophyletic] group; true sea snakes do not form a monophyletic group, but rather have arisen several times from terrestrial Australo-Papuan elapids). Keogh suggests an African, Asian, or Afro-Asian origin of elapid snakes, and an independent Asian origin of American (micrurine) coral snakes (dispersal via land bridges) and the hydrophiines. This study discusses the possible Gondwanan and Laurasian origin of the Elapidae.

KEOGH, J. S. 1998. Molecular phylogeny of elapid snakes and a consideration of their biogeographic history. Biol. J. Linn. Soc. 63:177–203.

Correspondence to: J. Scott Keogh, Division of Botany and Zoology, Australian National University, Canberra, ACT 0200, Australia.

Varanid Biogeography

The authors sequenced regions of the 12S rRNA gene from 21 extant species of *Varanus*. Results of their study indicate that the Australian varanids form a monophyletic group, and that the pygmy monitors (subgenus *Odatria*) may form a monophyletic clade with respect to the large monitors (subgenus *Varanus*). Their results support an Asian origin of Australian varanids. Asian varanids were found to be more closely related to the Australian taxa than were the African varanids, possibly suggesting a non-Gondwanan origin of Varanidae. Both parametric and nonparametric statistics were employed to test hypotheses of relationships based on their 12S data, which were constrained according to previously described topologies based on hemipenial, lung, and chromosomal morphology.

FULLER, S., P. BAVERSTOCK, AND D. KING. 1998. Biogeographic origins of goannas (Varanidae): A molecular perspective. Mol. Phylog. Evol. 9:294–307.

Correspondence to: Susan Fuller, School of Applied Science, Southern Cross University, P.O. Box 157, Lismore, 2480, New South Wales, Australia.

Invasion Ecology of *Bufo marinus*

The investigators employed mark-recapture studies in Australia and South America to demonstrate that *Bufo marinus* achieves much higher densities in Australia (where they are an introduced species) than in their native habitats in South America. From the population model presented in their study, predictions of adult equilibrium densities and tadpole survival rates at equilibrium are consistent with what they reported in South America and Australia. Also, the mean basic reproductive number estimated for these two continents is greater than 1, which confirms the invasion and reproductive potential of this toad. Only postmetamorphic survivals contribute to adult equilibrium densities and it was determined that adult equilibrium densities are increasingly sensitive to incremental change in adult survival. Basically, higher adult survival in Australia likely explains the higher densities of this species on that continent. Survival estimates also were found to be in favor of Australian *B. marinus* over their South American counterparts (nearly 3:1). The major ecological factors contributing to the greater densities of this toad in Australia, as compared to South America, are unkown.

LAMPO, M., AND G. A. DE LEO. 1998. The invasion ecology of the toad *Bufo marinus*: from South America to Australia. Ecol. Appl. 8(2):388–396.

Correspondence to: M. Lampo, Centro de Ecología, Instituto Venezolano de Investigaciones Científicas, Apartado 21827, Caracas 1020-A, Venezuela.

Morphology of *Dibamus taylori* and Relationship of Dibamidae within Squamata

Jakob Hallerman describes, in great detail, the nasal capsule and nasal sac of *Dibamus taylori,* employing techniques of serial sectioning. The morphology of *D. taylori* is compared with representatives of several other lizard genera, and a discussion of the similarities and affinities between *Dibamus* and Scincomorpha, amphisbaenians, and snakes is included as well. Cartilaginous and epithelial characters, as well as characters from other regions of the body, are employed in a phylogenetic analysis, indicating the following relationships (((Dibamidae, Amphisbaenia) Serpentes) Scleroglossa).

HALLERMANN, J. 1998. The ethmoidal region of *Dibamus taylori* (Squamata: Dibamidae), with a phylogentic hypothesis on dibamid relationships within Squamata. Zool. J. Linn. Soc. 122:385–426.

Correspondence to: Jakob Hallermann, Zoologisches Institut und Zoologisches Museum der Universität, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany; e-mail: fb6a044@rrz-cip-1.rrz.uni-hamburg.de.

Integrative Approach to the Study of Pheromones

In this paper, Houck discusses the emergence of the use of integrative methodology in amphibian research. She focuses her review on studies of physiological changes associated with behavioral performances, specifically those relating to reproductive pheromones. Integrated approaches are used most often in two types of studies within the field of pheromonal research: 1) those examining pheromonal influences on behaviors directly linked with courtship success; and 2) field studies of the hormonal basis of reproductive behavior. She provides an excellent overview of most of the recent works on salamander reproductive pheromones and behavior, and shows how seemingly disparate works (e.g., studies on neural pathways, behavior, chemical composition of pheromones, and phylogenetic relationships) all combine to give a greater understanding of the role of pheromones in reproductive behavior.

HOUCK, L. D. 1998. Integrative studies of amphibians: from molecules to mating. Amer. Zool. 38:108–117.

Correspondence to: L. Houck, Department of Zoology, 3029 Cordley Hall, Oregon State University, Corvallis, Oregon, 97331, USA; e-mail: houckl@bcc.orst.edu.

Synchronous Emergence as an Antipredator Mechanism

The authors tested the hypothesis that synchronous metamorphosis in *Bufo boreas* acts as a mechanism against predation by garter snakes (*Thamnophis*). In laboratory experiments, they measured the time to emergence from water, the number of metamorphs emerging together, and level of aggregation of toads with and without the presence of garter snakes. They found that in the presence of a predator, toads will emerge sooner, will aggregate more, and more toads will emerge in synchrony. Although toads emerged synchronously, many individuals were not at the ideal developmental stage for terrestrial movement. Therefore, the authors suggest that variability in emergence time may be a flexible response to multiple selection pressures caused by the presence of a predator.

DEVITO, J., D. P. CHIVERS, J. M. KIESECKER, A. MARCO, E. L. WILDY, AND A. R. BLAUSTEIN. 1998. The effects of snake predation on metamorphosis of western toads *Bufo boreas* (Amphibia, Bufonidae). Ethology 104:185–193.

Correspondence to: J. Devito, Department of Biology, Angelo State University, San Antonio, Texas 76909, USA; e-mail: jill.devito@angelo.edu.

Multiple Paternity in *Rana temporaria*

By collecting newly-laid egg masses, raising the larvae, and examining allozyme frequencies of individuals from each clutch, the authors examined the occurrence of multiple paternity and sperm competition in *Rana temporaria.* They found lower than expected (from single mating) levels of average relatedness. They suggest that egg clutches of these frogs often contain individuals sired from different males and that communal breeding effects paternity patterns in these and other frogs.

LAURILA, A., AND P. SEPPA. 1998. Multiple paternity in the common frog (*Rana temporaria*): genetic evidence from tadpole kin groups. Biol. J. Linn. Soc. 63:221–323.

Correspondence to: A. Laurila, Division of Population Biology, Department of Ecology and Systematics, P.O. Box 17, FIN-00014 University of Helsinki, Finland; e-mail: anssi.laurila@helsinki.fi.

Sexual Condition, Diet, and Temperature in Desert Lizards

To determine the effects of sexual condition on food consumption and body temperature selection in the herbivorous desert lizard, *Uromastyx philbyi,* the author conducted laboratory experiments on male and gravid and non-gravid females. Lizards were fed *ad libitum* and the amount of food consumed by each over a 21-day period was measured. To determine temperature selection, lizards were subjected to thermogradients and their body temperatures were measured for a 24-h period. Zari found that both sexes had significantly higher body temperatures during daytime conditions than at night. Gravid females had the lowest food consumption rate, chose the highest body temperatures, and remained at these selected temperatures for a longer period of time. The author suggests that this probably allows for more rapid egg development. Also, the reduced energy intake of this species (relative to others) is most likely an adaptation to life in a hot desert environment.

ZARI, T. A. 1998. Effects of sexual condition on the food consumption and temperature selection in the herbivorous desert lizard, *Uromastyx philbyi.* J. Arid Envir. 38:371–377.

Correspondence to: T. Zari, Department of Biological Sciences, Faculty of Science, King Abdul Aziz University, P.O. Box 9028, Jeddah 21413, Saudi Arabia.

Relationships and Evolution of the *Bufo bufo* Species Group

In this study, the authors investigate the phylogenetic relationships of frogs in the *Bufo bufo* species group using mitochondrial DNA sequences. They test the two major hypotheses for the colonization of the Tibetan Plateau: 1) vicariant speciation by uplifting of the Plateau, in which case populations at high elevations should be monophyletic, and 2) dispersal after the uplift, in which case high elevation and low elevation populations should be closely related. The single most parsimonious tree resulting from their analysis suggests that species in the *Bufo bufo* group form a monophyletic assemblage and that within the group, the Asian species (also a monophyletic assemblage) form two major clades. Their hypothesized groupings support neither the vicariant nor the dispersal hypothesis for colonization of the Tibetan Plateau. Instead, they suggest that a combination of vicariance and subsequent dispersal is responsible for the current distribution of *Bufo* in this area.

MACEY, J. R., J. A. SCHULTE, A. A. LARSON, Y. WANG, B. S., TUNIYEV, AND T. J. PAPENFUSS. 1998. Phylogenetic relationships of toads in the *Bufo bufo* species group from the eastern escarpment of the Tibetan Plateau: A case of vicariance and dispersal. Mol. Phylog. Evol. 9:80–87.

Corresponding author: A. Larson, Department of Biology, Box 137, Washington University, St. Louis, Missouri 63130, USA; e-mail: Larson@wustl.edu.

LETTERS TO THE EDITOR

Morphology and the Status of the Snake Genus *"Ptyas"*

JAMES LAZELL
The Conservation Agency
6 Swinburne Street, Jamestown, Rhode Island 02835, USA
e-mail: jcinjtown@aol.com

Three species of Asian racers bearing a close and detailed resemblance to the North American *Coluber constrictor*, type species of the genus *Coluber*, have often been separated from other racers as the genus *Ptyas*. I reiterated the history of the putative genus *Ptyas* and discussed the one morphological character then said to distinguish *Ptyas* from *Coluber*: relative tooth size (Lazell et al. 1991). Variation within and among the species in question—American *constrictor*, mainland Asian *mucosus* and *korros*, and Sulawesi *dipsas*—is broadly overlapping and not even the extremes are distinctive in tooth size. Therefore, Lazell et al. (1991) formally synonymized "*Ptyas*" under *Coluber*. The purpose of this note is to correct apparent errors which have led to continued use of the name "*Ptyas*."

Zhao and Adler (1993) separated *Coluber* from *Ptyas* at the generic level in their key couplet 26 (p. 88): "Top of head normally with nine large, symmetric shields" leading to *Coluber* and "Top of head not as in 26A" leading to *Ptyas*. The clear implication is that *Ptyas* does not have the common colubrid arrangement of head shields and is distinct in this respect from *Coluber*. This is erroneous. Two errors have been compounded. First, Pope (1935) mistakenly believed *Coluber* had a single loreal and *Ptyas* had two loreals. The number of loreals is variable in *Coluber* sensu lato and has not been used as a generic character since Pope (1935).

Second, loreals are not among the "nine, large symmetric shields" on the top of the head in *Coluber*. The head shields of all three Asian species number nine and are identical in configuration to those of *Coluber constrictor* (Lazell et al. 1991, Fig. 1 for *Coluber dipsas*). There is no morphological basis for recognition of a genus "*Ptyas*" as separate from *Coluber* sensu stricto.

Acknowledgments.—I am indebted to K. Adler (in litt. 15 January 1997) and E. Zhao (in litt. 2 May 1997) for explaining the sources of these two errors. V. Wallach assisted me in checking head scales at the Museum of Comparative Zoology.

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LAZELL, J. D., J. E. KEIRANS, AND G. A. SAMUELSON. 1991. The Sulawesi black racer, *Coluber* (*Ptyas*) *dipsas*, and a remarkable ectoparasitic aggregation. Pacific Sci. 45(4):355–361.

POPE, C. H. 1935. The Reptiles of China. America Museum of Natural History, New York: lii + 604 pp.

ZHAO, E., AND K. ADLER. 1993. Herpetology of China. SSAR Contributions to Herpetology 10, Oxford, Ohio. 522 pp.

Early Reptile Photography

JOHN EDWARDS
26, Rhondda Grove
London E3 5AP, England

I enclose a transparency of a photograph of an unknown keeper at London Zoo holding a *Boa constrictor* (Fig. 1). The original is actually a Magic Lantern Slide about 3.25 inches square. The photograph has been developed onto glass in order that it can be projected onto a screen, just as modern colour transparencies are projected.



FIG. 1. Keeper with Boa Constrictor. Photographed from life by Frank Haes, 1865.

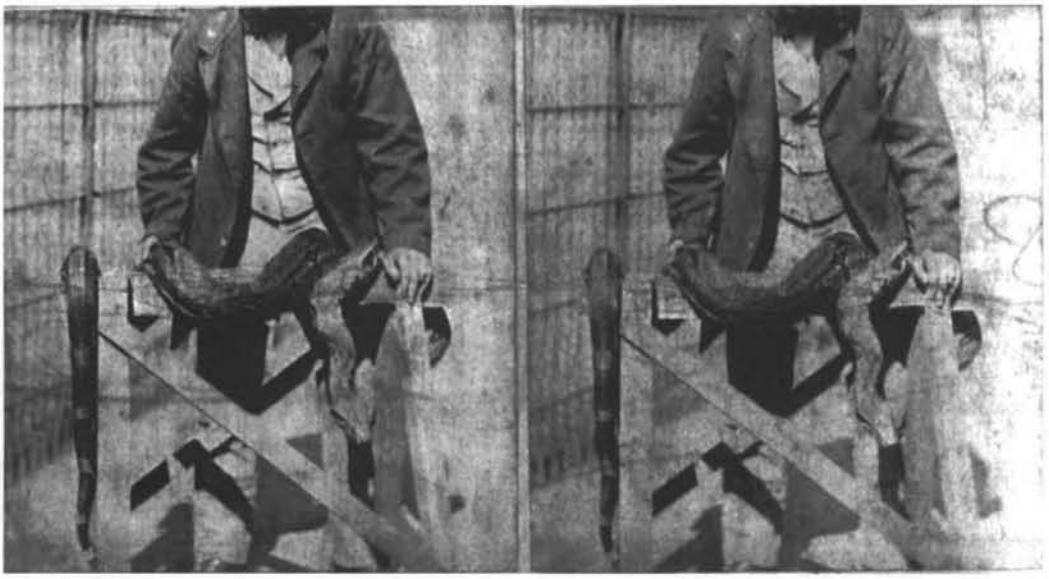


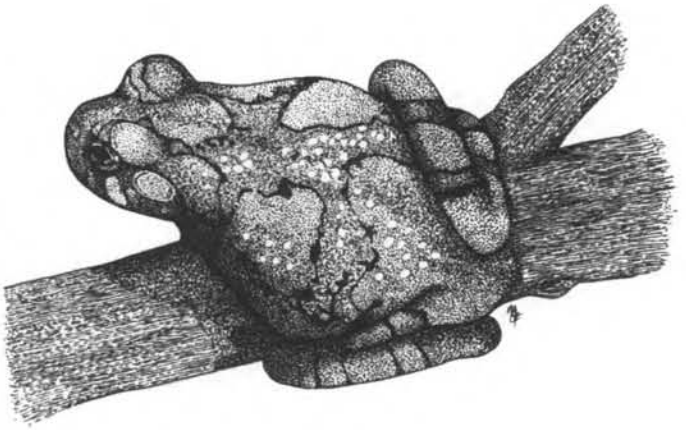
FIG. 2. The Boa Constrictor. Photographed from life by Frank Haes, 1865. This is an example of the stereoscopic card method of publication typical of the period.

Magic Lantern Slides by this photographer, Frank Haes (1832–1916), are extremely rare and indeed, the only ones I know of are in my own collection. Most of his London Zoo photographs were published in the form of stereoscopic cards—that is, two slightly different photographs (the view as seen from each eye) were mounted side by side and when looked at through a viewer a three-dimensional view is obtained (Fig. 2). This was particularly desirable when an animal was photographed from behind bars. Haes took photographs at the London Zoo in the summer of 1864 and amongst the images known to have been secured, was one of a tortoise and another of a Tasmanian or Thylacine Wolf, neither of which I have seen. This tortoise was the only reptile in the 1864 series and may thus be the earliest photograph ever taken of a reptile. Certainly it is the oldest known to me. Haes wrote about his 1865 season at the Zoo in *The Photographic News* for 23 February 1866. On page 91, he wrote:

> 'The Boa Constrictor, of which you have before four portraits, was not in good health at the time; it is since dead. It measured about thirteen feet in length, and in the thickest part girthed nearly eighteen inches. The yellow snake of Jamaica was an active fellow, and looks in the photograph spiteful enough.'

I recently acquired a rather battered stereoscopic card of a Boa Constrictor by Haes (Fig. 2). It is impossible to say which of the photographs is earlier—they may have been taken within minutes of each other. Haes also photographed 'Yellow Snake of Jamaica' (I am not sure what this might have been—probably the Yellow Tree Boa *Epicrates inornatus* [Reinhardt] which was first received at London Zoo in 1851 and which bred on several occasions between 1851 and 1873. Thus the photographs which I possess are the earliest which I have seen personally, although I know that other have existed and may, I hope, still exist.

The snakes were photographed around their keepers' necks, or draped over trestles because the glass fronts of their cases reflected the light. For this reason, I think that venomous snakes were not photographed! It is a curious fact that the Count of Montizon, who photographed a living pike (believed to be the first photograph ever taken of a living fish), never seems to have attempted a reptile. One would have thought that a tortoise would have been easier than a fish. In this connection, I have always thought that at least part of Montizon's reasons for taking animal photographs was to demonstrate his skills as a photographer, rather than an interest in zoology. Many early photographs of animals which purport to be of living specimens are actually of museum specimens.



Hyla chrysoscelis, by Michael G. Frick

INSTITUTIONAL PROFILE

Department of Herpetology, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia: History and Current Research

NATALIA B. ANANJEVA
Curator of Herpetology
Head of the Laboratory of Herpetology and Ornithology
Zoological Institute, Academy of Sciences, 199034 St. Petersburg, Russia
e-mail: nbanorus@glasnet.ru

Early History

The origins of herpetology in St. Petersburg can be traced to the time of Peter the Great when the first museum in Russia—called the Cabinet of Curiosities, or Kunstcamera—was founded in this capital of the Russian Empire. In 1717, Peter the Great personally purchased for the Kunstcamera the famous collection of Albertus Seba, a wealthy merchant and amateur naturalist in Amsterdam, including 120 amphibians and reptiles (the first Seba collection) which became the original specimens of our herpetological collection (Juriev 1981). The Academy of Sciences was founded in 1724 and the Kunstcamera (together with its associated library) became its responsibility. This period was a time of exploration and description in herpetology. Many new collections were obtained by the first expeditions of the Academy of Sciences and by purchases abroad (including part of the second Seba collection, purchased at auction in 1752). Among the first expeditions of interest to herpetologists was Peter S. Pallas's trip in 1768–1773 in eastern Russia and Siberia. Herpetological studies can be traced to Pallas and the historical center of Russian herpetology was the Zoological Museum (now Institute) in St. Petersburg. One result of Pallas's great expedition was that a number of new amphibians and reptiles were described. Most of the collections (including amphibians and reptiles) were taken to the Crimea where he finished writing his classic book, "Zoographia Rosso-Asiatica" (Svetovidov, 1978). Unfortunately, most of his material is no longer available; some specimens later were transferred to the Zoologisches Museum der Humboldt-University in Berlin and the Museum National d'Histoire Naturelle in Paris.

The further development of herpetological research is associated with the official recognition of the Zoological Museum as an independent Institution in 1832, whereas previously it was only a part of the Kunstcamera. The first museum director, Johann F. Brandt, was well known for his herpetological activity; he described some new species of Asian reptiles and enlarged the collection (from various expeditions within the Russian Empire and abroad, particularly from Baron Georg Heinrich von Langsdorff in Brazil; and through exchanges with other museums). Brandt and Alexander A. Strauch, who replaced him in the post of the museum director, both of whom were academicians, were founders of the Russian school of herpetology.

Strauch is an especially important figure in the history of Russian and, indeed, world herpetology (Scarlato 1982; Adler 1989). He had serious scientific communication with most of the leading herpetologists of the day and used these contacts to increase the herpetological collection through purchase and exchange with other museums. A very significant source of new and interesting materials was from the first expedition of the famous explorer Nikolai M. Przewalski in the vast unknown regions of Central Asia. By 1882, the herpetological collection included 5889 catalogue numbers representing 1222 species of reptiles (119 species of turtles, 14 crocodiles, 596 lizards, and 493 snakes) and 1285 catalogue numbers of 283 species of amphibians (9 caecilians, 224 frogs, and 50 salamanders), i.e., it was widely representative for its time (Strauch 1889). As a result of his own careful study of these, Strauch wrote several monographs and world synopses of turtles, crocodiles, lizards, snakes, and salamanders (Strauch 1866, 1869, 1870, 1873, 1887, 1890). His review of the snake fauna of the Russian Empire (1873) and results of his identification and description of the amphibians and reptiles (1876) from Przewalski's first expedition to Central Asia are of special value for Russian and world herpetology.

The Department of Herpetology was officially recognized as a separate administrative unit only in 1915 and until that time it was part of a combined division of fishes, amphibians, and reptiles in the Zoological Museum. The curator of this combined division during the period 1896–1903 was the widely known herpetologist Alexander M. Nikolsky (Mazurmovich 1983; Adler 1989). Nikolsky was the author of several important monographs, including synopses of the herpetofaunas of Turkestan (1899) and the Caucasus (1913), and the first comprehensive books on our amphibians and reptiles ("Fauna of Russia and Adjacent Countries," in three volumes, 1915, 1916, 1918). Another important contribution of Nikolsky was the study, identification, and description of the rich herpetological materials collected in Iran by N. A. Zarudny, who was one of the first zoologists to study the diverse fauna of Persia. Nikolsky's contemporary, the well-known herpetologist Jacques von Bedriaga, was informally associated with the Zoological Museum. His most famous and important contribution was a large monograph (in quarto and nearly 800 pages; 1898–1912) devoted to the study of the huge herpetological collections made by Przewalski and other Russian explorers during their Central Asian expeditions (Adler 1989; Bogdanov 1891; Zhao and Adler 1993).



FIG. 1. Main buildings of the Russian Academy of Sciences, Saint Petersburg, along the north bank of the Neva River, opposite the Hermitage (December 1986). From left, the buildings house the Academy Administration, Anthropology Museum, and Zoological Institute (where herpetology is located on the top floor at the far right of the complex). The gold spire of the Fortress of Peter and Paul, where Russian czars are buried, is at the far right.

Modern History

Sergius F. Tsarevsky was curator of the newly independent Department of Herpetology during 1915–1929; he published important works on the taxonomically complicated groups *Eryx* and *Phrynocephalus*. After the museum's name was changed to the Zoological Institute in 1930, Sergius A. Chernov, a student of Nikolsky, was appointed curator of the Department of Herpetology, succeeding Tsarevsky. Chernov, who became the leading Soviet herpetologist during his curatorship (1930–1961), conducted extensive herpetological field work in the Transcaspian region (1932), the Caucasus (1937–1939), and in Tajikistan (1942–1944). The results were published as a series of articles and several monographs including regional synopsis of herpetofauna of Armenia (1937, 1939) and Tajikistan (1959). His most widely-known work was a book, "Field Guide to the Reptiles and Amphibians of the USSR," coauthored with Paul V. Terentjev (three editions in 1936, 1940, 1949), that was translated into English in 1965. During the last years of his life, Chernov studied the taxonomy of Palearctic snakes, focussing on peculiarities of the skull (Adler 1989).

Paul Terentjev, a prominent herpetologist and author of the world's first textbook of herpetology, worked in the Department of Herpetology during World War II including the German siege of Leningrad (1941–1944). He studied taxonomy and biogeography, mostly of the Anura, but also conducted ecological, biometric, and evolutionary research (Adler 1989; Scarlato 1982).

In 1962, Ilya S. Darevsky, a former student of Chernov, was appointed curator of the Department of Herpetology and, later, head of the Laboratory of Ornithology and Herpetology from 1976 to 1996. His research interests are associated with taxonomy, morphology, natural history, biogeography, and speciation in reptiles. Much of his research is devoted to the phenomenon of natural parthenogenesis and polyploidy in higher vertebrates, discovered by him in 1957 in a polymorphic group of Caucasian rock lizards related to *Lacerta saxicola* (Darevsky 1967; English translation, 1978). This important discovery has stimulated similar research and made Darevsky a leader of the new branch of science that concentrates on the study of the hybridogenous origin and speciation of clonal species of reptiles. It was developed successfully by Darevsky and his department colleagues (Larissa Kupriyanova, Felix Danielyan), and partly in collaboration with herpetologists from the USA (Thomas Uzzell), Canada (Robert W. Murphy), and Austria (Josef Eiselt).

Beginning in 1996, the curatorship of the Department of Herpetology and administration of the Laboratory of Ornithology and Herpetology passed to Natalia B. Ananjeva. Today, the herpetology staff consists of nine persons: five research workers (Natalia Ananjeva, Leo Borkin, Ilya Darevsky, Larissa Kupriyanova, Nikolai Orlov), two collections managers (Larissa Johanssen, Konstantin Milto), one technical assistant (Julia Smirnova), and a Ph.D. student (Igor Danilov). As of 1997, we also have a Ph.D. student (Spartak Litvinchuk) and a Ms.D. student (Svetlana Kalyabina) who are preparing their dissertations in our department.

Herpetologists of the Zoological Institute traditionally conduct research associated with the problems of biodiversity of amphibians and reptiles of Russia and adjacent countries, their taxonomy, ecology, phylogeny, and biogeography, continuing the traditions established in the last century. The most important results during the last two decades have been taxonomic revisions of rock lizards (Darevsky), agamid lizards (Ananjeva), viperid snakes (Orlov), and brown frogs (Borkin) of Palaearctic Asia, using a number of approaches and methods including biochemical and cytological analysis (Proceedings of the Zoological Institute of the USSR Academy of Sciences, 1977, 1979, 1981a, 1981b, 1984, 1986, 1987, 1990). These workers personally led more than 50 expeditions which include field studies in all regions of the former USSR.

Current Research

Traditionally, research interests focus mainly on Asia. One of the most intensively explored regions—from Nikolsky's day to the present—is the Caucasus. Despite intensive studies over long periods by many herpetologists, even during the last two decades a lot of new distributional data on amphibians and reptiles was obtained and many new species and subspecies were described from the territory of the Caucasus. The study of the herpetofauna of Armenia and adjacent areas of Turkey and Iran also continues. Significant herpetological research has been done during the last three decades in Middle Asia and Kazakhstan. As a result, several taxonomic revisions and descriptions of new forms were published by research workers and students in our department. Important work by Boris Tuniyev, a postdoctoral fellow, was based on the results of joint work with our staff and was devoted to the analysis of the origins of the herpetofauna of the mountain systems of Alpine Folding (Orogenesis) in the Caucasus and Central Asia (1995).

New data were also obtained in eastern Siberia, the Far East, and the European part of Russia. This information was published in a number of papers in Russian, German, and English and shortly will be summarized in a new edition (Ananjeva, Borkin, Darevsky, and Orlov 1998) of a synopsis of the amphibians and reptiles of Russia and adjacent territories (the former USSR).

The department's Asiatic herpetological research is not limited by the geographical boundaries of the former USSR. Extensive field work has been done in Mongolia (Ananjeva, Borkin, Orlov) within the framework of the joint Soviet-Mongolian Biological



FIG. 2. Staff of the Department of Herpetology, including doctoral students (November 1957). Left to right (seated): Sergei A. Chernov (curator), Paul V. Terentjev (professor at Leningrad University), Lev I. Khosatzky (docent at Leningrad University); (standing): Kirill B. Yuriev (Ph.D. student), Ilya S. Darevsky (postdoctoral fellow), Ludmila N. Lebedinskaya (collection manager), Günther Peters (Ph.D. student from Berlin), Abdulla M. Alekperov (Ph.D. student from Baku).

Expedition in 1981–1988 which led to important results on the distribution, natural history, ecology, and taxonomy of amphibians and reptiles that are published in a number of papers and monographs on amphibians (1988) and reptiles (1998). Through collaborations with herpetologists from various institutions in Moscow (Sergius Kuzmin, Valentina Orlova, Dmitri Semenov) and Mongolian colleagues (Khorlooghiyn Munkhbayar, Khayankhyarvagijn Terbish), they summarize more than 100 years' study of the Mongolian herpetofauna, from Przewalski, Kozlov, and other famous Russian explorers of Central Asia up to the present time, and can be used as a basis for the future herpetological research of this region.

During the last decade, special attention has been given to long-term research on the herpetofauna of tropical forests of southeast Asia. Darevsky and Orlov personally have led more than 10 expeditions to Vietnam beginning in 1982; as a result of this herpetological study of Vietnam, and also of Laos, Nepal, and Sikkim (India), a large number of species endemic to tropical forests that are difficult to access, in the coastal area and adjacent islands, were collected. A number of new species and subspecies of frogs, lizards, and snakes, and two new genera of scincid lizards, were described. This research is one of the central programs of the Department of Herpetology today and is conducted in concert with herpetologists from the USA (Field Museum of Natural History and Museum of Vertebrate Zoology, University of California at Berkeley) and Canada (Royal Ontario Museum).

The integrative study of biomorphological diversity in squamates is now being researched by Natalia Ananjeva who is examining different trends of adaptation to the arid and mesic, petro-, and psammophilous lizards and snakes. A major area of interest is the study of integument, using light and electron microscopic methods (especially SEM) conducted during the last decade in cooperation with the Department of Zoology, Kazakh State University (Tatyana Duysebayeva). This research includes a comparative study of different types of scalation patterns and evolutionary trends in different branches of squamates, and also the morphology of derivative structures (skin sense organs, callose scalation) that are of special interest for clarifying questions of ecology, behavior, and phylogeny. Other interesting results were obtained during a comparative study of the egg tooth of squamates.



FIG. 3. Part of the lizard collections, including Galapagos iguanas on the lowest shelf, with staff (from left: Svetlana A. Kalyabina, Julia A. Smirnova) (September 1997).

The Department of Herpetology also is active in conservation of herpetofauna. Ananjeva, Darevsky, Borkin, and Orlov participated as authors or editors in several editions of the "Red Books" of the USSR and of Russia and for some popular books and booklets on animal protection. A book about rare and endangered amphibians and reptiles of the world (Darevsky and Orlov 1988) and collected papers (edited by Darevsky and Vladimir Krever, 1987) on amphibians and reptiles of the protected reserves of the USSR has been published. Captive breeding of rare species is conducted in our department's terrarium and in cooperation with the St. Petersburg Zoo and Tula Zooexotarium, with special focus on rare and endangered species and species that are of special scientific and economic value (parthenogenetic rock lizards, boids, viperids, rare and endangered amphibians and reptiles of Vietnam). Captive breeding of rare frogs, lizards, and snakes of Indochinese tropical forests are being actively developed.

The paleontological activities of Lev I. Khosatzky and Lev A. Nessov have been closely connected with our department. Both of them worked as docents in the Department of Vertebrate Zoology of St. Petersburg State University. Khosatzky mainly studied Neogene turtles of the USSR and described some of the most common turtles from the late Cretaceous of Mongolia. Some of his papers and monographs (Khosatzky and Oleg Redkozubov 1989) were devoted to the Neogene herpetofauna of Moldavia. The paleoherpetological collection of our department was founded as a result of his work. He was the graduate supervisor for Ananjeva and Borkin during their study at the University. Khosatzky also trained many paleo- and neoherpetologists, among them Nessov, who made great contributions to the study of Jurassic, Cretaceous, and Paleogene amphibians and reptiles of the USSR. During 25 years of his scientific work, he published 67 papers and one monograph (Nessov 1995) devoted to fossil amphibians and reptiles. A second monograph was published after his death (Nessov 1997). His publications include descriptions of 44 amphibian and 92 reptilian taxa (Averyanov 1996). The most important among them are descriptions of the oldest salamander (the middle Jurassic *Kokartus*), one of the last labyrinthodonts, *Ferganobatrachus* (late Jurassic), rare Cretaceous salamanders and frogs, numerous new taxa of Jurassic, Cretaceous, and Paleogene turtles, rare forms of lizards (among them the oldest amphisbaenians and xenosaurids), sea snakes, crocodiles, dinosaurs, and pterosaurs. Most of the materials studied by Nessov are now deposited in our institute's paleoherpetological collection. Some current studies in paleoherpetology are carried out by Alexander Averyanov and Igor Danilov. The latter is involved now in studying important Mesozoic turtles from Mongolia.

Studies on speciation conducted in our department have had wide international recognition. One mechanism of interest—so called "neorthodoxal speciation"—is associated with clonal reproduction, hybridization, and polyploidy. A long series of publications on the unisexual rock lizards of the Caucasus (Ilya Darevsky, Larissa Kupriyanova) has become a classic study of speciation mechanisms. They use an integrative approach involving morphological, karyological, and cytological methods, skin graft technique, protein electrophoresis, and analysis of repetitive DNA sequences that allow an estimate of the significance of hybridization in the origin of parthenogenetic species, their relationships with bisexual species, and the role of interspecific hybridization (between parthenogenetic females and males of potential parental species) in the origin of triploid males. New data about parthenogenetic agamids and geckos, with descriptions of new species, have been obtained from Vietnam. The analysis of hybridogenous speciation in fish, amphibians, and reptiles led them to new concepts of gradual hybridization of unisexual and bisexual forms that explains the origin of polyploid complexes in vertebrates.



FIG. 4. Present staff of the Department of Herpetology, including students (August 1997). Left to right: Leo J. Borkin, Konstantin D. Milto, Natalia B. Ananjeva, Larissa K. Johanssen, Ilya S. Darevsky, Igor G. Danilov, Larissa A. Kupriyanova, Andrei A. Barabanov (first-year student at Saint Petersburg University), Nikolai L. Orlov.

Important results were obtained from a study of European green frogs of the hybridogenous *Rana esculenta*-complex (Leo Borkin) in the former USSR, Poland, Germany, and Sweden. Using flow DNA-cytometry, evidence of selective elimination of chromosomes of one of the parent's genomes during gametogenesis was obtained in hybrid males. A large variety of mixed population systems has been discovered in the territory of the former USSR (hybrid frogs coexisting only with one of the parental species, or with both parental species; or existing mostly as males or females or living without parental species at all).

Another interesting case of neorthodoxal speciation is the polyploid complex of green toads in Central Asia that also has been studied by cytogenetic methods. An analysis of samples from Kazakhstan, Kirgizia, and other republics permit an understanding of the trends of geographical and altitudinal distribution of diploid and tetraploid species, and zones of sympatry and hybridization (with sterile hybrids) have been discovered. It has been hypothesized that tetraploid toads, which have a vast distribution from the Caspian Sea to Mongolia, originated through autopolyploidy, i.e., without hybridization.

Comparative karyological studies of lizards (Larissa Kupriyanova) have led to important conceps about their chromosome evolution. Ideas about chromosome variation in lacertid lizards and evolution on the karyological level have also been formulated.

Publications, Current Collections, and Other Activities

From 1977 to 1990, eight volumes of collected papers in herpetology were published by the Zoological Institute. A list of the world's herpetofauna (Ananjeva, Borkin, Darevsky, and Orlov) with their common names in four languages (Russian, English, German, and French) was published in 1988. In 1993, these herpetologists, together with Folium Publishing Company, founded a new English-language journal—the *Russian Journal of Herpetology* —that has been published twice a year, beginning in 1994 (web address: http://www.folium.ru/rjh).

A large number of specimens of amphibians and reptiles collected by Russian zoologists and explorers over several generations are stored in the Department of Herpetology; our department houses one of the largest collections of herpetofauna of Russia and adjacent countries, including Central and Southeast Asia. There are now 5444 registration numbers of amphibians and 20568 of reptiles (a registation number represents one sample from one locality). Ours is the largest herpetological collection in Russia, as well as in all of the countries formerly part of the USSR; it contains numerous type specimens. Recently, the collection was moved to a special fire-proof storehouse outside the city, although all accessioning is conducted at the old institute. The tedious job of moving, rearrangement in the new storehouse, and inventorying is possible only due to the hard work and enthusiasm of collection managers Larissa Johanssen, Igor Danilov, and Konstantin Milto. Collections of fossils and skeletons of recent species were organized and increased considerably during recent years due to the efforts of Ananjeva and Danilov.

For a long time, the Department of Herpetology has been the center for herpetology in the USSR. Ilya Darevsky was the head of the Herpetological Committee of the USSR Academy of Sciences, Natalia Ananjeva was a Secretary of this Committee, and staff of our department actively participated in the organization of all the Soviet Herpetological Conferences (in 1964, 1968, 1973, 1977, 1981, 1985, 1989). During this period more than 30 herpetologists from all the parts of the Soviet Union, Mongolia, and Vietnam have received their Candidate and Doctoral Degrees under Darevsky's guidance. In 1989, Darevsky was elected as President of Nikolsky's Herpetological Society, the Russian national herpetological society. Members of our department also have played essential roles in the establishment and running of the World Congress of Herpetology, beginning in 1982.

Our international projects and programs have become of increasing importance during the last decade. One of the most important is our longterm joint program of research in arid territories of the Palaearctic region (with scientists at the Museum of Vertebrate Zoology, University of California at Berkeley [T. J. Papenfuss], Washington University in St. Louis [J. R. Macey], and the Chengdu Institute of Biology, Academia Sinica [Zhao Ermi and his colleagues]).



FIG. 5. Ilya S. Darevsky and Nikolai L. Orlov, during expedition to Vietnam (October 1994).

In 1989, 1990, 1992, and 1995, Ananjeva and Orlov conducted extensive expeditions in Central Asia. Herpetologists from the Royal Ontario Museum, headed by R. W. Murphy, worked on Caucasian rock lizards together with Darevsky and Kupriyanova. The new program of herpetological research in Indochina is conducted together with colleagues from the Royal Ontario Museum, Museum of Vertebrate Zoology, and Field Museum of Natural History. Borkin has done long-term cooperative studies with herpetologists from Canada and Japan on the study of brown frogs of the Palaearctic and in the study of the hybridogenous complex of European green frogs with herpetologists from Germany, Poland, and Sweden. Finally, a joint project on viperid snakes has been done by Orlov and Boris Tuniyev with Göran Nilson and Claes Andrén from Göteborg University, Sweden.

After dissolution of the USSR, cooperative projects with herpetologists from the former member republics (Turkmenistan, Kazakhstan, and Kirgistan) continue to be developed. The Second Asian Herpetological Meeting was organized with the participation of members of our department in Ashgabat, Turkmenistan, in 1995 and the Third Asian Herpetological Meeting will be held 1–5 September 1998 in Almaty, Kazakhstan.

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ARTICLES

Facultative Paedomorphosis in an Indiana Population of the Eastern Tiger Salamander, *Ambystoma tigrinum tigrinum*

HOWARD H. WHITEMAN[1]
RICHARD D. HOWARD
XANTIPPI SPRAY
and
JILL McGRADY-STEED[2]
Department of Biological Sciences, Purdue University
West Lafayette, Indiana 47907, USA

[1]*Present address: Department of Biological Sciences,*
Murray State University, Murray, Kentucky 42071-0009, USA
e-mail: howard.whiteman@murraystate.edu

[2]*Present address: Rutgers University, Department of Ecology, Evolution, and*
Natural Resources, Cook College, P.O. Box 231, New Brunswick, New Jersey
08903-0231, USA

Facultative paedomorphosis is an environmentally-induced polymorphism (polyphenism) of some salamander species in which larvae either transform into terrestrial forms that mature on land to become metamorphic adults, or retain their larval morphology and aquatic existence while becoming sexually mature paedomorphic adults (Semlitsch 1985; Whiteman 1994). Facultative paedomorphosis has been found in a variety of species in the families Ambystomatidae and Salamandridae (e.g., Brandon and Bremer 1966; Collins 1981; Eagleson 1976; Harris 1987; Kalezic and Dzukic 1985; Kalezic et al. 1989; Patterson 1978; Shaffer 1984; Sprules 1974a). This polymorphism is especially well known in the *Ambystoma tigrinum* complex, occurring in several of the currently recognized subspecies (Collins 1981). However, paedomorphosis appears to be rare in the eastern tiger salamander, *A. t. tigrinum*; published accounts are limited to a few specimens from Michigan (Hensley 1966; Jones et al. 1993). Here we document facultative paedomorphosis in an eastern tiger salamander population in Indiana.

We collected tiger salamanders from Sharon Chapel pond, a permanent, 1.2 ha borrow pit pond located 9.6 km west of West Lafayette, Indiana, USA, in the Purdue University Horticultural Farm. We obtained paedomorphic individuals during May 1992 while collecting *Rana catesbeiana* tadpoles with plastic minnow traps baited with liverwurst wrapped in cheesecloth. We also sampled for tiger salamanders using minnow traps in March 1993, and both minnow traps and a 50 m section of drift fence with pitfall traps (for breeding metamorphic adults) during March 1994. Each individual was transported to the laboratory, identified to morph (by presence or absence of larval characters such as gills and tailfin in sexually mature individuals) and sex (by the presence [males] or absence [females] of large darkened papillae posterior to the slit-like [males] or rounded [females] cloaca), and measured for various morphological parameters including snout–vent length (SVL; using a metric ruler) and mass (g; using an Ohaus model GA-110 balance). After taking these measurements, we marked salamanders with individual toe clips and released them back into the pond.

We compared the SVL and mass of metamorphic and paedomorphic adults using a two-tailed t-test. Recaptured individuals were excluded from analyses, and we did not analyze differences between sexes because few females were captured. We also calculated mean growth rates (SVL and mass) for recaptured metamorphic adults.

We captured five paedomorphic adults in 1992 (3M:2F; Fig. 1, 2), eight metamorphic adults in 1993 (all males), and eight metamorphic adults in 1994 (six recaptures, two new females). One of the six recaptures had been captured originally as a paedomorphic male in 1992, and the others were caught as metamorphic adults in 1993. Paedomorphic adults were significantly larger than metamorphic adults in both SVL and mass (Table 1). Mean growth rate (± 1 S.E.) for recaptured metamorphic males was 0.7 (± 1.0) mm SVL and 0.9 (± 2.8) g mass over a single year. The transformed paedomorphic male, in contrast, grew 1.5 mm/yr SVL and lost 22.1 g/yr mass over a two-year period.

Morphologically, paedomorphic salamanders differed from those found in Colorado populations of the Arizona tiger salamander, *Ambystoma tigrinum nebulosum* (Whiteman, pers. observ.). Heads of paedomorphic adults from Sharon Chapel appeared less shovel-shaped and flattened (Fig. 1) and tails wider (apparently laden with fat deposits; Fig. 2) than those of the western subspecies.

The presence of facultatively paedomorphic salamanders has usually been associated with the absence of fish in permanent ponds and lakes (Collins 1981; Sprules 1974a); however, a variety of abiotic and biotic factors influence the production and maintenance of these alternative morphs (e.g., Harris 1987; Jackson and Semlitsch 1993; Licht 1992; Semlitsch 1987a; Sprules 1974b; Whiteman et al. 1996). Sharon Chapel pond is permanent, but contains small predatory fish (bluegill, *Lepomis macrochirus*) and bullfrogs (*Rana catesbeiana*), both of which are known to consume larval amphibians (e.g., Bury and Luckenbach 1976; Moyle 1973; Semlitsch 1987b). However, European millefoil (*Myriophyllum spicatum*) was extremely dense in the pond and may have provided a refuge from these predators. We speculate that individuals became paedomorphic in this population because of favorable aquatic growth conditions (abundant food, low competition, or low predation; Werner 1986; Wilbur and Collins 1973). The large body size of paedomorphic adults (Table 1) provide some support for this hypothesis.

We did not capture any paedomorphic individuals after 1992. Because one paedomorphic salamander was recaptured as a metamorphic adult, some or all of the paedomorphic salamanders in the pond may have transformed.

TABLE 1. Mean (± 1 S.E.) body size measurements for paedomorphic and metamorphic eastern tiger salamanders from Sharon Chapel pond in Tippecanoe County, Indiana.

	Paedomorphic Adults	Metamorphic Adults	t	p
SVL (mm)	131.6 ± 2.4	117.8 ± 2.2	3.83	0.02
Mass (g)	117.1 ± 3.5	44.23 ± 2.1	19.05	<0.0001
N	5	10*		

*N = 9 for mass

The appearance of paedomorphic eastern tiger salamanders in this Indiana locality suggests that other polymorphic populations might also exist throughout the range of this subspecies, and that



FIG. 1. Paedomorphic eastern tiger salamander from Tippecanoe Co., Indiana.

sampling permanent wetlands might reveal such populations. It also suggests that regardless of their current prevalence, paedomorphic adults may have been historically common in eastern tiger salamanders. The large amount of anthropogenic change which has occurred during the last two centuries in the eastern and midwestern United States has had a significant impact on aquatic habitats and the organisms that live in them (Dahl 1991; Lannoo 1998; Russell 1989; Tiner 1984), and might have had similar negative effects on facultatively paedomorphic salamanders. Wetland destruction, fish and bullfrog introductions, and agricultural and industrial effluent have all been suggested as possible factors influencing the rarity of facultative paedomorphosis in the Midwest (Larson 1998; Whiteman and Howard 1998). Such factors could also apply to much of the rest of *A. t. tigrinum*'s range as well.



FIG. 2. Top view of paedomorphic eastern tiger salamander. Note quarter for size comparison. SVL = 139 mm, total length = 255 mm, mass = 124.2 g.

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Rediscovery of the Agamid Lizard *Calotes kinabaluensis* de Grijs (Lacertilia: Agamidae) in Borneo, with Notes on its Habitat

ROBERT F. INGER
Department of Zoology, Field Museum of Natural History
Chicago, Illinois 60605, USA
e-mail: inger@fmnh.org

and

MAKLARIN LAKIM
Kinabalu Park, Sabah Parks, P.O. Box 10626
88806 Kota Kinabalu, Sabah, Malaysia

Mount Kinabalu, Sabah (northern Borneo), is one of the better explored areas of Southeast Asia from the herpetological standpoint. Yet much uncertainty still remains. *Calotes kinabaluensis* de Grijs, a relatively large agamid (snout-vent length 133 mm, total length 448 mm), was described 60 years ago on the basis of a unique holotype collected in 1900 at "Mount Kina Balu" (de Grijs 1937). Ota and Hikida (1996) reported the second known individual (snout-vent length 143 mm, total length 474 mm), collected in the late 1970's (date imprecise) from "Kinabalu Park." As Kinabalu Park, which covers most of the forested mass of the mountain, runs from 200 to 4100 m above sea level and covers a variety of forest types, the habitat of *C. kinabaluensis* is uncertain.

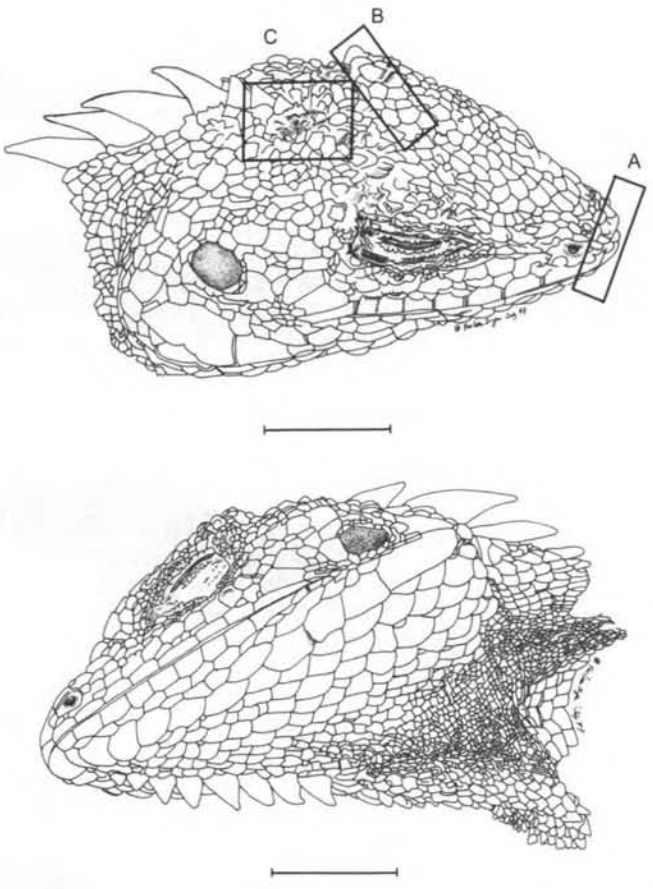


FIG. 1. *Calotes kinabaluensis*. Upper, oblique view of side and top of head. Lower, oblique view of underside of head. Areas marked A, B, C are enlarged in Fig. 2. Scale bars equal 10 mm.

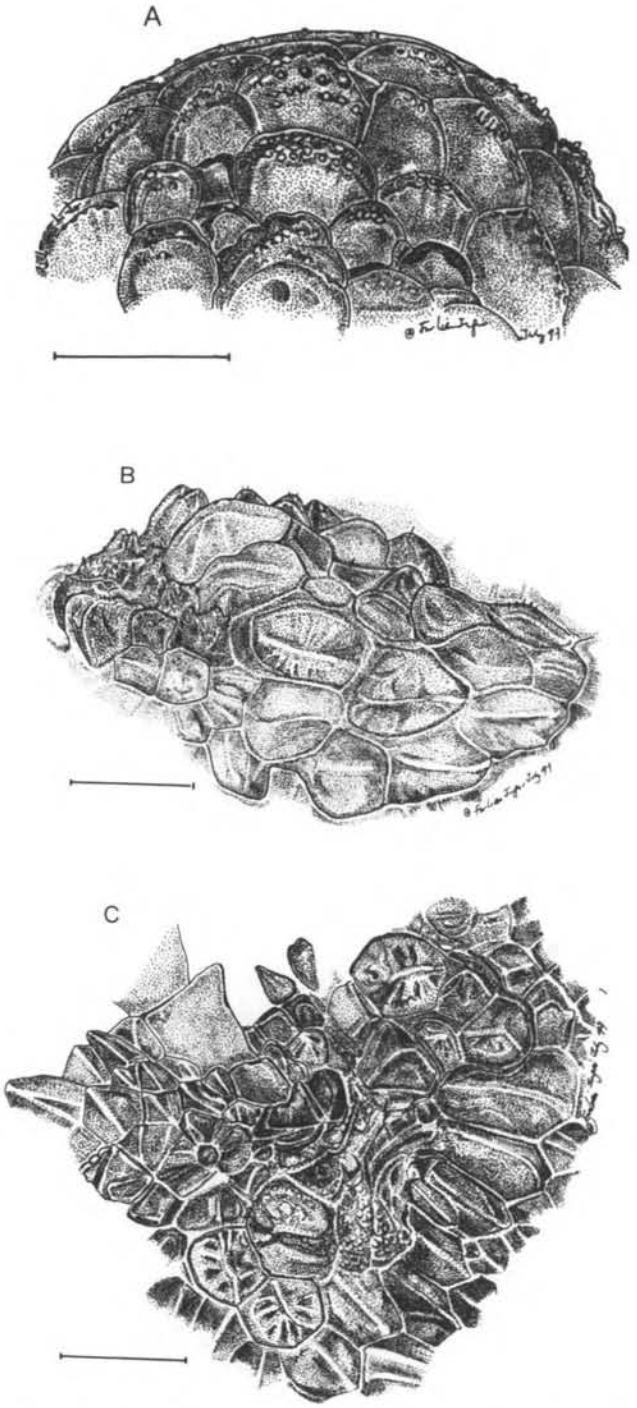


FIG. 2. *Calotes kinabaluensis*, neotype. A. Dorsal view of end of snout. Scale bar equals 2 mm. B. Section across frontal and supraocular region. Scale bar equals 2.5 mm. C. Parietal region and base of nuchal crest. Scale bar equals 2.5 mm.

We report here a third specimen (Sabah Parks 02670) collected in primary lowland rain forest (forest designation after Kitayama, 1992) at 900 m at Sayap, Kinabalu Park, on 23 March 1997. This specimen was collected at night resting on a leaf of a shrub 0.2 m above ground and 1.5 m from a small stream. The long tail and long limbs, as well as the few observations of this species, suggest that its usual stratum is the canopy.

The Sayap specimen has a snout-vent length of 130 mm and a total length of 428 mm. It agrees with the original description (de Grijs 1937) and the expanded description presented by Ota and Hikida (1996). In life the head and body of the Sayap specimen were green. The trunk had chocolate brown and black spots forming bands. Ventrally the body was brown with green spots. The tail was mostly brown with small green areas.

Ananjeva et al. (1991), in a survey of skin sense organs in iguanian lizards, reported that *Calotes mystaceus* had scale organelles on supralabials, nasals, postoculars, postparietals, and mentals. Ota and Hikida (1996) observed "...some marginal scales with short hair-like sense organs associated with pits" on their specimen of *C. kinabaluensis*. In the new specimen of *C. kinabaluensis* scale organelles, most of them knob-like and surmounted by hairs, appear on the scales on top of the snout (Figs. 1 and 2) and on the supralabials, canthals, supraciliaries, supraoculars, and the scales at the rictus behind the labials.

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Underwater Breeding Behavior of the Japanese Stream Toad (*Bufo torrenticola*)

HIROSHI TSUJI*
Department of Biology, Osaka City University
Sugimoto, Sumiyoshi-ku, Osaka 558-8585, Japan
e-mail: bufo@sci.osaka-cu.ac.jp

and

TAKEO KAWAMICHI
Department of Biology, Osaka City University
Sugimoto, Sumiyoshi-ku, Osaka 558-8585, Japan

**Author to whom correspondence should be sent*

Although most species of anurans breed in aquatic environments, breeding usually occurs in shallow water or on land beside water (Jameson 1955, Wells 1977). Underwater breeding behavior is extremely rare, occurring in the Pipidae and some members of Leiopelmatidae and Ranidae. *Bufo torrenticola*, an inhabitant of central Japan, is an unusual toad, for it breeds on the bottom of pools of fast-flowing mountain streams (Maeda and Matsui 1989). This paper provides the first quantitative study of the underwater breeding behavior of *B. torrenticola*.

Study site.—This study was conducted on a branch of the Hirakura River (34°27'N, 136°15'E), in Mie Prefecture, central Japan (see Tsuji and Kawamichi 1996a, for details). Field observations were made at a major breeding pool located mid-stream (elevation 500 m, Tsuji and Kawamichi 1996b), from 6–17 April 1991. This pool was elliptical in shape (16 x 7 m), with a sloping waterfall about 10 m high at the upstream end. The water was 90 cm deep in the center and shallower near the shore. The pool's right bank consisted of a rocky cliff, and the left bank was a wooded slope. The pool's rock bottom was partially covered with loose rocks of various sizes, gravel, and sand. The current was fast along the right shore, but water was relatively still along the left shore. The water temperature ranged from 8.5–13.0°C during the study period.

Methods.—The toad population in the breeding pool was censused 44 times at night, and 18 times during the day, at intervals of 2–8 h, throughout the 12-day breeding period in 1991. Oviposition occurred over six days in the latter part of this period. Most of the toads detected in the pool were captured and individually marked (see Tsuji and Kawamichi 1996a, for marking technique). During each census, the location of lone males, lone gravid females, and amplectant pairs in the pool were noted on maps. We used a clear plastic box for viewing underwater to observe toads in deeper parts of the pool. Despite the use of a 4.5-

TABLE 1. The cumulative number (percentage) of observations of male and female *Bufo torrenticola* in three positions. [a]Excluding attacked paired females. [b]One on the trail near the pool.

	Submerged	At surface	On land	Total
Males	825 (87.7)	66 (7.0)	50 (5.3)	941
Lone	720 (86.1)	66 (7.9)	50 (6.0)	836
Struggling	105 (100)	0	0[b]	105
Females	419 (93.1)	20 (4.4)	11 (2.4)	450
Lone	9 (75.0)	2 (16.7)	1 (8.3)	12
Paired[a]	374 (93.0)	18 (4.5)	10 (2.5)	402
Attacked paired	36 (100)	0	0[b]	36

volt headlamp and a 6-volt flashlight to observe toads at night, the toads did not appear to be disturbed by our presence. After completing field investigations, the maps were divided into 120 quadrats (1 m x 1 m), and the number of toads in each quadrat was determined and used for analyses. Only single males, single gravid females, and pairs that were not ovipositing were included in quadrat counts. The water depth for each quadrat was determined as the deepest point for each quadrat. Toad positions were categorized into three types: 1) submerged; 2) at surface—head or upper part of body above water at shore; and 3) on land—positioned on land around shore.

When toad-balls (male[s] clinging to a pair) were found, their location was noted on maps and the numbers of male(s) clinging to a pair was counted. Males clinging to a pair in a toad-ball were referred to as "struggling males," while the focal pair of the toad-ball was referred to as the "attacked pair." When the number of struggling males in a toad-ball could not be counted exactly, a minimum estimate of toads that could be counted was used.

Results.—A total of about 200 males (including amplectant males) and 100 females was captured and marked in the pool during the breeding period (see Tsuji and Kawamichi 1996a). Combining data among censuses, the cumulative number of observations of male toads in the pool was 941, and 450 observations of females were made (Table 1). These figures include multiple observations of some individuals.

There was a significant difference between males and females in the three positions, submerged, at surface, or on land (χ^2 = 9.97, df = 2, $P < 0.01$). However, the percentage of submerged toads was about 90% for each sex, with relatively low numbers occurring at the surface or on land (Table 1). With the exception of one of each sex, all toads at the surface or on land were found at night.

The cumulative number of toads observed per quadrat over the breeding season ranged from zero to 84 (mean ± SD = 10.1 ± 14.0) for males and from zero to 32 (5.8 ± 6.9) for pairs not ovipositing. Both sexes were more widely distributed in the pool at night than during the day. Males occurred in 81 of 120 study quadrats (67.5%) at night, and in 40 (33.3%) during the day. Pairs that were not depositing eggs occurred in 68 of 120 quadrats (56.7%) at night, and in 43 (35.8%) during the daytime. Submerged males were found in 82 (68.3%) of the 120 quadrats, and pairs were found in 71 (59.2%) quadrats.

Using the data from six censuses conducted between 1500 h on 11 April and 0800 h on 12 April, during which breeding activity was greatest, the mean number of toads observed per census was 29.2 ± 6.4 (range = 22–37) for males and 16.5 ± 3.0 (range = 12–20) for pairs, and they occurred in 21.5 ± 4.8 quadrats (range = 14–27) and 13.5 ± 2.1 (range = 10–15), respectively. The mean number of toads observed per occupied quadrat per census was 1.37 ± 0.14 (range = 1–8) for males and 1.22 ± 0.11 (range = 1–3) for pairs.

Egg-strings were found in 8 of 120 quadrats (6.7%), with over 80% of all egg-strings concentrated in two adjacent quadrats. A huge mass of egg-strings was formed on one of these two quadrats, thus it is referred to as the communal oviposition site.

Lone females were observed only 12 times in just eight quadrats, with most of them in water less than 30 cm deep (Fig.1) and less than 1 m from the right shore of the pool.

The cumulative number of submerged toads observed in each quadrat was positively correlated with water depth (males: r = 0.630, N = 82; pairs: r = 0.566, N = 71; $P < 0.001$ for both; Fig.1). When I removed struggling males or attacked pairs in submerged, the cumulative number of submerged toads observed in each quadrat was still positively correlated with water depth (males: r = 0.609, N = 82; pairs: r = 0.521, N = 71; $P < 0.001$ for both). However, males and pairs differed in their distribution patterns; males were most frequently found in the deepest quadrat (90 cm deep), whereas pairs were mostly at the communal oviposition site which was 40 cm deep (Fig. 1). Most of submerged males actively moved around the pool bottom, possibly searching for females.

A total of 36 toad-balls, all submerged, were found in the pool (Table 1). Toad-balls were found in 17 of 99 occupied quadrats (17.2%), and 15 (41.7%) toad-balls were found in three quadrats in the deeper part (> 80 cm deep) of the pool. Struggling males represented 12.7% of all submerged males, while attacked pairs represented 8.6% of all submerged pairs (Table 1). The cumulative number of both struggling males and attacked pairs was positively correlated with water depth (males: r = 0.569, pairs: r = 0.556; N = 17, $P < 0.02$ for both; Fig. 1). With one exception, no toad-balls were found at the communal oviposition site (Fig. 1).

Discussion.—This study confirms that *B. torrenticola* is unusual in the genus *Bufo*, in that it is an underwater breeder in fast-flowing mountain streams. Underwater activity is a dominant part of the species' typical breeding behavior, because: 1) breeding males and females were submerged on the pool bottom most of time; 2) toad-balls, direct male-male competition for paired females, occurred only underwater; 3) many of the pair formations are considered to have taken place inside the study pool (unpubl. data); and 4) spawning pairs remained underwater and seldom surfaced during the spawning period of 1–2 h (Tsuji and Kawamichi 1998). However, the breeding activity of *B. torrenticola* is not entirely underwater. In the beginning of the

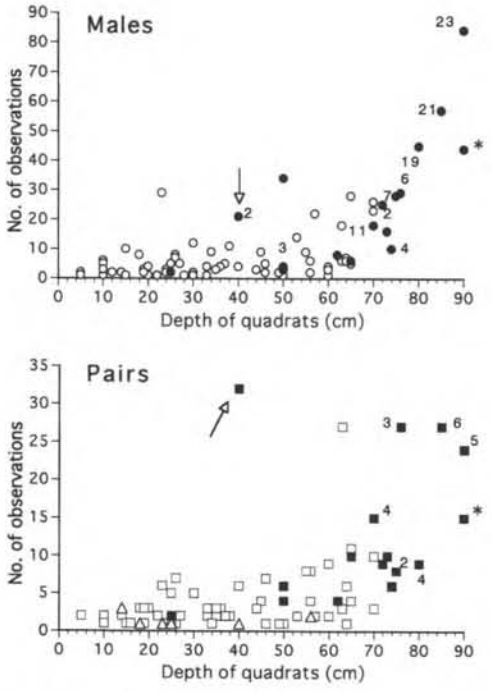


FIG.1. The relationship between the cumulative number of observations of submerged males or pairs, and water depth. Solid symbols: toad-ball observations. Triangles: single gravid females. Figures beside solid circle: number of struggling males (no figure = 1). Figures beside solid squares: number of attacked pairs (no figure = 1). Arrows indicate the quadrat containing most of the communal egg-masses, and asterisks indicate quadrats containing part of the egg-masses. Two quadrats for 4 observations at 50 cm depth.

breeding season, males searched for mates while on migration routes to the stream (Tsuji and Kawamichi 1996a), and they also occasionally waited for females on shore around the pool at night. Such males may be able to intercept newly arriving females to the pool. In general, the males of explosive breeders occur widely around the edges of ponds until spawning commences, whereupon they concentrate around oviposition sites (e.g., *Bufo bufo*, Davies and Halliday 1979; *Rana sylvatica*, Howard 1980). Although this was seen occasionally in *B. torrenticola*, males more often searched and struggled for mates in the deeper parts of the breeding pool. However, lone females commonly were found in shallow water near shore, and paired females were most often found at the communal oviposition site.

Breeding adult *B. torrenticola* showed predominantly nocturnal activity; both sexes were more abundant (Tsuji and Kawamichi 1996a) and more widely distributed in the pool at night than during the day, and almost all toads at the surface or on land were found at night. During the day, however, many toads were found in the relatively deeper parts of the pool. The diurnal breeding activity of *B. torrenticola* may be associated with the early breeding in spring, color dimorphism in visual mate recognition (see discussion in Tsuji and Kawamichi 1996a), and/or underwater breeding.

Besides *B. torrenticola* and members of Pipidae living in the water, underwater breeders are known for the tailed frog, *Ascaphus truei* (Jameson 1955), and the Japanese steam-breeding frog, *Rana sakuraii* (Kusano and Fukuyama 1989), both breeding in fast-flowing streams. Thus, underwater breeding behavior is considered to have evolved independently among anuran groups. The possible benefits of breeding on the bottom of fast-flowing streams include: 1) richly oxygenated waters; 2) low metabolic demands in relatively cold water; 3) relatively stable water temperature; 4) no danger of drying; and 5) predator avoidance (see Olson 1989). On the other hand, possible costs are restricted activity in the water and risk of the eggs being washed away. For two Japanese underwater breeders, *B. torrenticola* and *R. sakuraii*, the most striking adaptation to underwater breeding is enlarged dorsal skin of males (Maeda and Matsui 1989; pers. observ.) that might assist cutaneous respiration in the water and allow them to be vigorously active there.

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Avoidance of Fire by Louisiana Pine Snakes, *Pituophis melanoleucus ruthveni*

D. CRAIG RUDOLPH
S. J. BURGDORF
JOHN C. TULL
Wildlife Habitat and Silviculture Laboratory, Southern Research Station
U.S.D.A. Forest Service, Box 7600 SFA Station
Nacogdoches, Texas 75962, USA

MARC EALY
Department of Biology, Stephen F. Austin State University
Nacogdoches, Texas 75962, USA

RICHARD N. CONNER
RICHARD R. SCHAEFER
Wildlife Habitat and Silviculture Laboratory, Southern Research Station
U.S.D.A. Forest Service, Box 7600 SFA Station
Nacogdoches, Texas 75962, USA

and
ROBERT R. FLEET
Department of Biology, Stephen F. Austin State University
Nacogdoches, Texas 75962, USA

Wildfire and prescribed fire are important influences on pine ecosystems in the southeastern United States (Komarek 1968, 1974; Platt et al. 1988). Although considerable research on the impact of fire on vertebrates due to changes in vegetation structure has been reported, the direct impact of fire on vertebrates is not well known (Means and Campbell 1981). The Louisiana pine snake (*Pituophis melanoleucus ruthveni*) occupies a limited range in eastern Texas and western Louisiana (Conant 1956; Reichling 1995). Within this range it is generally found on sandy soils in longleaf pine (*Pinus palustris*) savannas (Young and Vandeventer 1988). Historically these longleaf pine savannas were maintained by frequent, low intensity ground fires (Komarek 1968; Platt et al. 1988, 1989). In recent decades wildfire frequencies have declined severely due to suppression efforts, and maintenance of these fire climax communities is currently dependent on prescribed fire (Conner and Rudolph 1989; Landers 1987; Platt et al. 1988; Van Lear 1985).

The association of Louisiana pine snakes with longleaf pine savannas and the dependence of these savannas on frequent fire suggests that Louisiana pine snakes have adapted to frequent fire. The influence of wildfires has declined precipitously in recent decades and prescribed fires have only maintained a substantial ecosystem role in limited situations. We have previously hypothesized that these alterations in the fire regime have resulted in apparent declines and local extirpations of Louisiana pine snakes (Rudolph and Burgdorf 1997). The massive increase in woody midstory vegetation and consequent decline of herbaceous vegetation are hypothesized to have had a detrimental impact on pocket gopher populations (*Geomys breviceps*) and ultimately on Louisiana pine snakes.

Since 1993, radio-transmitters (Holohil Systems Ltd., SI-2T transmitters) have been implanted in Louisiana pine snakes at a variety of sites in Texas and Louisiana using the protocol of Weatherhead and Anderka (1984). These transmitters provide a location signal that varies with temperature, providing an estimate of snake body temperature. Preliminary results of ongoing studies demonstrate that Louisiana pine snakes are associated with sandy soils, savanna habitats with abundant herbaceous vegetation, and presence of Baird's pocket gophers (*G. breviceps*). Louisiana pine snakes spend substantial amounts of time underground, primarily in pocket gopher burrow systems, or coiled on the surface adjacent to entrances to pocket gopher burrow systems (Rudolph et al., unpubl.).

Sites where instrumented snakes were located were periodically prescribe-burned by land managers, providing an opportunity to observe snake behavior during exposure to fire. Habitat at all sites consisted of a longleaf pine overstory with a well developed herbaceous understory dominated by bluestem (*Schizachyrium* spp.) and other grasses. Nine snakes were located in burn areas during 1994–97. All nine snakes survived exposure to the prescribed fires with no apparent damage. Six of the snakes were known to be in the burned areas, but were not under observation during the course of the prescribed burns, and it is not known if they were above or below ground at the time of the fires. Three snakes were under observation during the course of the prescribed fires and observations are detailed below.

A prescribed fire on 25 Februrary 1994 burned the area where an adult female Louisiana pine snake was located. At 1155 h the snake was coiled on the surface 1 m downslope from the burrow it used to access a pocket gopher burrow system where it had hibernated. It remained in this position until the approach of the fire at 1438 h. Immediately prior to the passage of the fire the air temperature was 25°C and the transmitter temperature was 27.5°C. The approaching fire was backing downslope at approximately 5 m per min. with flame heights of 0.5–0.8 m. When the fire front was approximately 15 m from the snake, it began moving downslope away from the fire and the burrow entrance. After progressing approximately 2 m the snake reversed direction and moved toward the approaching fire and into the burrow. The fire was 10 m distant as the snake moved underground. The transmitter temperature immediately began to drop from 27.5°C toward the burrow temperature of approximately 11–14°C. Burrow temperatures for this and other observations were estimated from transmitter temperatures of instrumented snakes located in pocket gopher burrows during the general period of the prescribed fire in question.

A prescribed fire on 10 March 1997 burned the area where two Louisiana pine snakes were located. One snake, an adult female, was coiled on the surface at 1145 h. Numerous pocket gopher mounds were evident but, to avoid disturbing the snake, they were not investigated in detail. The snake was in the same position at 1300 h. as the fire approached. Air temperature was 24°C and transmitter temperature was 27.5°C as the backfire with 0.3–0.6 m flame heights moved downslope at approximately 1 m per min. The snake began moving when the fire was 2 m distant and entered a burrow approximately 5 m distant. The burrow presumably allowed access to the pocket gopher burrow system. The fire passed over the snake's burrow entrance at 1352 h. Transmitter temperature at 1400 h was 22°C and dropping toward the burrow temperature of approximately 12–16°C.

The second snake observed on 10 March 1997, an adult male, was located at 1150 h. moving out of a debris pile. It was inadvertently disturbed in the process of being located and rapidly moved approximately 30 m and sought shelter under grass cover. It was still in this location at 1504 h. as the fire approached. The snake was not visible and was not approached closely because of the risk of disturbing it again. As the fire approached the snake, air temperature was 24°C and the transmitter temperature was 23.5°C. The fire was a backfire moving downslope at approximately 2 m per min with 0.4–0.8 m flame heights. The snake maintained its position under grass cover until the flames were within 20 cm at 1516 h. The snake then emerged from beneath the grass cover and moved rapidly across the slope, parallel to and approximately 1.5 m in front of the fire. After moving 15 m the snake reversed direction and moved 95 m in the opposite direction still paralleling the fire front. When relocated at 1524 h. the snake was underground approximately 2 m in front of the advancing fire. The fire passed over the snake's position at 1533 h. The transmitter temperature was unchanged at this time, but began dropping immediately and had reached 18.5°C by 1715 h. After the passage of the fire, no evidence of an entrance to a burrow was located, although numerous pocket gopher mounds were in the immediate vicinity.

These observations suggest that Louisiana pine snakes are not at excessive risk of death or injury because of frequent fire in fire climax pine communities. Snakes located on the surface near known burrow systems simply retreat underground, even if this requires moving toward the advancing fire. Once underground, presumably at the 10–20 cm depth typical of pocket gopher burrows, they are insulated from the effects of the passing fire. Results of our telemetry studies (Rudolph et al., unpubl.) demonstrate that Louisiana pine snakes are underground, or on the surface within a few meters of known burrows, a large majority of the time. Given the large differences at which the snakes apparently detected the advancing fires, it is impossible to reasonably speculate on the possible cues that they might be using to detect fires. It is very possible that different cues are used in different situations.

Snakes on the surface and not near known burrows may be at greater risk. This would occur primarily when snakes were moving substantial distances; ie. between pocket gopher burrow systems, or had sought temporary surface shelter during moves. The third snake discussed above fits this scenario. Even in this situation, behavior of the pine snake served to minimize risk. The snake's immediate behavior was to move a safe distance away from the fire and then initiate what appeared to be rapid searching for a subterranean retreat. This behavior did not cease until the snake gained an underground retreat, even though movement of just a few meters directly away from the advancing fire would have temporarily removed the risk.

The prescribed fires that have largely replaced wildfires in Louisiana pine snake habitat differ substantially from historical fires (Frost 1993; Komarek 1968). Prescribed fires are typically conducted in late winter-early spring whereas wildfires are/were more frequent later in the growing season. In addition, due to a number of concerns, prescribed fires seldom achieve the intensity of many wildfires. These differences presumably influence the interaction of Louisiana pine snakes and fires, however, comparative data are lacking.

The observed behaviors of these Louisiana pine snakes are sufficient to reduce the risk of mortality or injury to a low level from all but the most rapidly advancing fires that occur in the longleaf pine ecosystem. In all of the observed instances the fires were relatively slowly advancing backfires. The potential for mortality or injury to snakes due to rapidly advancing headfires is presumably greater, especially for snakes without immediate access to a

burrow. Wildfires, due to their greater intensity, may pose more of a risk than prescribed fires.

Erwin and Stasiak (1979) and Seigel (1986) reported mortality and injury to several snakes, including *P. melanoleucus*, as a result of prescribed fires conducted in prairie habitats in Nebraska and Missouri. These observations demonstrate that snakes are susceptible to death or injury during fires. The authors of both studies suggested that the timing of fires probably influenced their impact on snakes. Means and Campbell (1981) reported significant mortality of eastern diamondback rattlesnakes (*Crotalus adamanteus*) due to prescribed fires in a longleaf pine ecosystem. All reported instances were of snakes in ecdysis and it was hypothesized that reduced mobility and sensory abilities were associated with the mortality. Similar effects are possible with Louisiana pine snakes, but relevant observations are not available.

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Diel and Monthly Variations in Capture Success of *Phrynosoma cornutum* via Road Cruising in Southern Texas

SCOTT E. HENKE
Caesar Kleberg Wildlife Research Institute
Texas A&M University-Kingsville, Kingsville, Texas 78363, USA
e-mail: kfseh00@tamuk.edu

and

MELISA MONTEMAYOR*
Texas Parks and Wildlife Department
4200 Smith School Road, Austin, Texas 78744, USA

**Present address: Texas Department of Transportation, 1817 Bob Bullock Loop, Laredo, Texas 78043, USA*

Road cruising may be a time-efficient capture method for Texas horned lizards (*Phrynosoma cornutum*) and may yield better capture success per unit effort than systematic searches and funnel and pitfall trapping (Fair and Henke 1997). However, it is unknown if road cruising can be used to assess activity patterns of *P. cornutum*. *Phrynosoma* may show changes in their activity patterns due to season (Fair 1995; Potter and Glass 1931) and ambient temperature (Prieto and Whitford 1971). We hypothesized that *P. cornutum* would be most active and, therefore most vulnerable to collection, during the warmest months, and that *P. cornutum* in southern Texas would exhibit one daily peak in activity during spring and autumn and two daily peaks in activity during summer as suggested by Potter and Glass (1931). We sought to test this hypothesis by collecting information on the success of sighting and capturing *P. cornutum* during road cruising searches throughout a four year period.

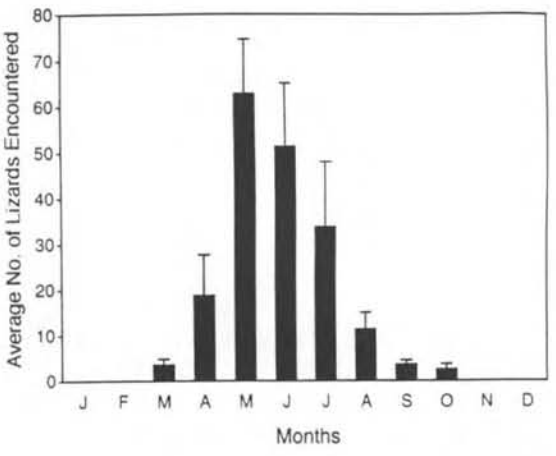


FIG. 1. Average number of *P. cornutum* collected monthly via road cruising during March 1991 to October 1994 in southern Texas. Bars extending above the means are the standard errors of the means. Average number of *P. cornutum* for January, February, November, and December was calculated using three years of data; the average number of *P. cornutum* for the remainder of the months was calculated using four years of data.

TABLE 1. Average number of *Phrynosoma cornutum* collected each month during diurnal hours via road cruising in southern Texas from March 1991 to October 1994.

	Morning			Afternoon			Evening		
Month	mean	SE	%[1]	mean	SE	%[1]	mean	SE	%[1]
March	0.75Ba [2,3]	0.2	21.4	2.25Bb	0.8	64.3	0.50Ba	0.3	14.3
April	2.25Ba	1.4	12.0	9.50ABb	4.2	50.7	7.00Bb	3.5	37.3
May	12.75ABa	3.4	20.3	23.75Ab	3.9	37.9	26.25Ab	6.4	41.8
June	31.75Aa	12.8	62.0	9.25ABb	1.2	18.0	10.25Bb	2.8	20.0
July	20.50ABa	7.8	60.7	6.00Bb	2.7	17.8	7.25Bb	4.4	21.5
August	4.75Ba	3.0	42.2	2.25Ba	1.0	20.0	4.25Ba	1.9	37.8
September	1.25Ba	0.6	35.7	1.50Ba	0.3	42.9	0.75Ba	0.5	21.4
October	0.00Ba	0.0	0.0	1.50Ba	1.0	60.0	1.00Ba	0.4	40.0

[1]Percent of *P. cornutum* collected within the specified time period during each month.
[2]Means with the same upper case letter are not different ($P > 0.05$) between months within the same time period.
[3]Means with the same lower case letter are not different ($P > 0.05$) between time periods within the same month.

We marked and released *P. cornutum* on the Chaparral Wildlife Management Area (WMA; 28°20'N, 99°30'W) in southern Texas from March 1991 to October 1994. The Chaparral WMA is a 6154 ha mesquite (*Prosopis glandulosa*) shrubland with sandy loam soils and contains multiple secondary roads. Average monthly temperatures range from 6.1°C in January to 36.1°C in August (Stevens and Arriaga 1985). Mean annual precipitation is 54.6 cm, of which 85% occurs during spring (April and May) and autumn (September and October; Stevens and Arriaga 1985). Lizards were actively sought and captured by road cruising, marked by toe-clipping and the use of passive integrated transponders (Camper and Dixon 1988), and released at site of capture. Because *P. cornutum* are considered diurnal (Stebbins 1954), search efforts were limited to daylight hours. Date and time of day of captures were recorded. Time of day was separated into three time periods: sunrise to 1100 h (morning), 1101 to 1600 h (afternoon), and 1601 h to sunset (evening). Sunrise occurred as late as 0725 h during the winter equinox and sunset as late as 2040 h during the summer solstice. However, an equal sampling effort was maintained throughout the study. Each time period was divided into five 1-h intervals beginning at 0600 h and ending at 2100 h. One randomly selected interval was chosen during each time period and intervals were rotated so that each hour interval within a time period was sampled 73 times per year. A 19.5-km route was searched for *P. cornutum* at a speed of approximately 30 kph during each time period each day.

We used a repeated measures design with months and time of day as main effects and years as replications. The distribution of captures was tested to verify normality with the Shapiro-Wilk test (PROC UNIVARIATE procedure; SAS 1989). A general linear analysis of variance (PROC GLM; SAS 1989) was used to test the main and interactive effects on the number of captures of *P. cornutum*. Multiple comparisons were made using Tukey's studentized range (HSD) test when a significant *F*-test was noted. Statistical significance was inferred at $P < 0.05$. For the purposes of this study, we classified *P. cornutum* as exhibiting one daily peak in activity if lizards were encountered more frequently during the afternoon than at other time periods, and as exhibiting two daily peaks in activity if lizards were encountered with equal frequency during the morning and evening time periods, and less frequently during the afternoon.

A total of 692 *P. cornutum* was collected on 749 occasions during the four year study; 86, 231, 132, and 300 horned lizards were captured in 1991 through 1994, respectively. Forty-three *P. cornutum* (6.2%) were recaptured at least once during the study. Of the recaptures, 35 lizards were recaptured only once, four lizards were recaptured twice, three lizards were recaptured three times, and one *P. cornutum* was recaptured five times.

May yielded the greatest number of captures of *P. cornutum*, followed by June and July (Fig. 1). Cumulatively, these months resulted in nearly 80% of the *P. cornutum* collected. *Phrynosoma cornutum* were not collected nor observed on secondary roads during November through February during any year (Fig. 1). After a seasonal hibernation period, *P. cornutum* in southern Texas generally were first observed crossing roads during the third week of March (i.e., 20, 16, 25, and 26 March during 1991 through 1994, respectively); whereas, they typically were last observed crossing roads prior to hibernation during the second week of October (i.e., 10 October, 15 September, 6 October, and 21 October during 1991 through 1994, respectively).

Number of captures of *P. cornutum* differed by month, time of day, and the interaction of the two main effects ($P < 0.0001$). Due to a significant interaction, separate analyses were conducted on the number of captures of *P. cornutum* per month and by the time of day. During June, *P. cornutum* were encountered most often during the morning (Table 1). However during May, the likelihood of encountering *P. cornutum* on secondary roads was greatest from midday to sunset (Table 1). *Phrynosoma cornutum* exhibited one daily peak in activity only during March, while during the remainder of the year the probability of encountering *P. cornutum* occurred with equal frequency between two or more time periods (Table 1). The earliest and latest time of capture occurred in June and was 0630 and 2046 h, respectively.

Neither of our predictions of *P. cornutum* activity held true. July and August are the warmest months in southern Texas (Stevens and Arriaga 1985); however, *P. cornutum* activity peaked in May and declined with each subsequent month. Perhaps this was a result of *P. cornutum* seeking mates. *Phrynosoma cornutum* breed shortly after spring emergence (Milne and Milne 1950). Also, we predicted *P. cornutum* would exhibit two daily peaks in activity from June through August; however, they were most active during the morning hours of June and July with few occurrences of crossing roads in the evening. *Phrynosoma cornutum* are known to remain near active harvester ant (*Pogonomyrmex* spp.) mounds, their main dietary staple (Whiting et al. 1993), and only leave the area when they cause the ant colony to shutdown

(Munger 1984). Also, lizards retreat to shelter after their body temperature exceeds their comfort zone. The preferred temperature of *P. cornutum* is 38.5°C (Prieto and Whitford 1971). Soil temperatures taken after 1600 h during summer in southern Texas can exceed 50°C (Henke, unpubl. data). Although speculative, perhaps *P. cornutum* in our study spent mornings locating active ant mounds and the remainder of the day engaged in localized feeding and thermoregulation.

Phrynosoma cornutum in our study emerged from hibernation earlier than previously documented (Potter and Glass 1931). Also, daily low temperatures dropped to 11°C during mid-September 1992 (National Oceanic and Atmospheric Administration 1993), which coincided with the lack of *P. cornutum* observed crossing roads after mid-September of that year. Cessation of *Phrynosoma* activity occurs with the onset of cold weather during autumn (Wright 1949).

Researchers in southern Texas can use these data to concentrate their capture efforts during peak activity periods of *P. cornutum*. Also, this information could be used in conservation efforts to educate the public as to the active periods of *P. cornutum* and make the general public aware of *P. cornutum* use of secondary roads. Fair (1995) documented road fatalities of *P. cornutum* as a major mortality source in areas with many secondary roads. To our knowledge, there were no *P. cornutum* fatalities as a result of our surveys.

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Breeding Habitats of the Siberian Salamander (*Salamandrella keyserlingii*) within a Fen in Kushiro Marsh, Japan

MASATO HASUMI
Biological Institute, Faculty of Science, Niigata University
Niigata 950-2181, Japan
e-mail: mhasumi@sc.niigata-u.ac.jp

and

FUSAYUKI KANDA
Department of Biology, Hokkaido University of Education at Kushiro
Kushiro 085-8580, Japan

The breeding ecology of the Siberian salamander, *Salamandrella keyserlingii* (Hynobiidae), warrants assessment in Japan. Although this species is widely distributed in Siberia, ranging from the Ural Mountains to Kamchatka, it is restricted to Kushiro Marsh on eastern Hokkaido Island in northern Japan (Mikamo 1955). Kushiro Marsh is a wetland complex in a floodplain along the Kushiro and Akan Rivers, with several small freshwater lakes, extensive reed beds, sedge meadows, and peat bogs (Scott 1991). In 1987, selected areas of this marsh and surrounding hillsides were designated as Kushiro Shitsugen National Park (26,861 ha). The central zone that occupies approximately 25% of this park has special protection by law, and here development is prohibited. In this zone, there is a major breeding population of *S. keyserlingii* (Nakabayashi et al. 1986). However, most other breeding populations of this species are located outside of the National Park and have been adversely affected by development, and consequently have declined within the last decade (Hashimoto 1991; Hasumi and Kanda 1996; Ueda 1988).

Conservation measures have met with limited success due to our lack of knowledge of the breeding habitat requirements of *S. keyserlingii*. Transplantation of individuals of this species from developed areas to within Park boundaries has been attempted. In 1986–1990, a total of 66 adult males, 150 adult gravid females, and 2140 pairs of egg sacs (each breeding female deposits one pair; mean = 197.8 eggs, N = 78, SD = 32.9, range = 111–280, in Otanoshike; Hasumi and Kanda 1996) were transplanted into eight artificial ponds newly made within an area of the Park where this species did not occur (Hashimoto 1991). For these five years, a total of 63 pairs of egg sacs were deposited in this area. Currently, only a relatively small number of egg sacs (at most 41 pairs in 1994; Kushiro-shi, unpubl. data) are deposited annually. For comparison, the past largest breeding population in the present developed area had produced 1036 pairs of egg sacs in 1986 (Hashimoto 1991). There are other studies in which translocations were attempted as conservation measures with success (e.g., Natterjack toads in Britain; Beebee 1996).

Habitat conditions may be suboptimal for breeding at the artificial ponds. It is unlikely that vegetation is unsuitable because the sedges used for oviposition have grown thick in these ponds. However, sedges were not dense at the ponds in 1986 (Hashimoto 1991), and the number of egg sac pairs deposited there in 1986–1990 (0, 4, 27, 16, and 16; respectively by year) indicates a possible delay in the recognition of these artificial ponds as a suitable breeding site. One possible explanation for this low reproductive rate is that these ponds (each measuring approximately 10 x 2.5 m, and about 1 m deep) are too deep for successful breeding. In fact, it is unclear why a water depth of 1 m was chosen for constructing these ponds. The water depth this species requires for breeding habitats is unknown. Other species

have shown associations with oviposition site depth (Crump 1991; Petranka and Petranka 1981; Richter 1997). Thus, our study objective was to examine breeding habitat requirements, focussing on oviposition site depth, for the Siberian salamander in Japan, by determining water depths of natural breeding habitats within a low marsh fen and comparing these depths with water depths of nonbreeding habitats within the same fen.

We conducted this study in a marsh located outside the National Park in Otanoshike, Kushiro-shi, Hokkaido Prefecture, Japan (43°01'02"N, 144°17'38"E; 4 m elevation). This marsh has a triangular area of approximately 20 ha, clipped off with a main road now under construction (Hasumi and Kanda 1996) and two residential sections having lesser roads and abandoned developed areas. The Otanoshike-ogawa River (5–6 m wide) flows slowly through the central region of this marsh from the northwest to the southeast. Along the approximately 30 m distance from the right bank (Fig. 1) of this river, vegetation changes from a composition chiefly of sedges and woody plants (mainly *Spiraea salicifolia*) to a forest that is dominated by an overstory of a single species of the alder *Alnus japonica* and is irregularly interspersed with small open fields. There are many bodies of water on the southeastern edge of this right bank, which collectively form the fen, the breeding habitat of *S. keyserlingii*. This population is located at what corresponds to the southern limit of the distribution for this species.

After sunset, a female deposits a pair of egg sacs side by side in open water near the surface by attaching the adhesive tips of the sacs to dead leaves of sedges. During three consecutive breeding seasons (23 April–7 May 1995, 20 April–12 May 1996, and 11 April–19 May 1997), we marked each oviposition site within the fen every day and recorded maps of oviposition sites after establishing the plots described below. We did not consider the role of plants in accounting for egg sac distribution because sedges were distributed throughout the fen. We carried out afternoon surveys because the water surface on the fen occasionally was iced to the thickness of approximately 1–2 cm in the morning. In addition, the water surface of the river occasionally was iced in the morning. Snow had fallen during the night of 9 May 1996, and approximately 10 cm of snow covered this marsh by the next morning (Hasumi and Kanda 1997). Salamanders in 1996 and 1997 exhibited an indistinct end to the breeding season, and therefore we obtained additional data on 29 May and 30 May, respectively.

Fen water depth was determined by measuring depths across a grid-system placed in the fen. We divided a 50 x 13.5 m fen into 0.5 x 0.5 m plots (N = 2700). Water depths within plots were measured to within 1 cm by averaging five point-measurements. Depths were collected over three days, after breeding activity ceased, 2–4 May 1995. In 1995, as in other years, the bottom of the fen was frozen until mid-May. Because rainfall increased water depths, to estimate depths during spawning at oviposition sites, we adjusted plot measurements by determining a standardized depth for the fen. This was done by measuring daily water depths at 1200 h at a fixed point over the breeding periods, 23 April–7 May 1995, 20 April–12 May 1996, and 11 April–19 May 1997. To standardize plot depth measurements, we adjusted plot-data on the day after eggs were laid. This was done by determining the difference between the single fixed-point depth value on that day and the depth measured after breeding (when plot depths were determined). The difference was added to all plots to determine oviposition site depth.

To map the fen topography, we categorized plot water depths into nine depth classes: ≤0, 1–10, 11–20, 21–30, 31–40, 41–50, 51–60, 61–70, and 71–80 cm. We averaged water depths of a set of nine plots ("plot-cluster," 1.5 x 1.5 m area), consisting of a central plot ("plot-center," 0.5 x 0.5 m area) which was characterized as either "utilized" or "unutilized" for egg sac deposition and eight surrounding plots, in order to characterize breeding habitats of this species. For a plot at the edge of the fen, we averaged water depths of a set of four or six plots. We

TABLE 1. Oviposition sites of *Salamandrella keyserlingii* characterized by water depths within a 50 x 13.5 m fen divided into 2700 plots of 0.5 x 0.5 m in Kushiro Marsh, Japan, during three consecutive breeding seasons. Water depths of a set of nine plots (plot-cluster), consisting of a central plot (plot-center) utilized or unutilized for oviposition and eight surrounding plots, are averaged. Within years, each average depth of plot-cluster is compared with its plot-center depth among those 2700 plots.

			Water depth (cm)				Center vs. cluster		
Year	Plot characteristic		N	Mean	SD	Range	t	df	*P*
1995	Utilized	Center	40	44.2	9.7	32–66	1.804	78	0.075
		Cluster	40	40.62	7.78	24.9–54.5			
	Unutilized	Center	389	40.7	4.3	35–53	20.184	776	<0.001
		Cluster	389	32.71	6.48	14.0–53.5			
1996	Utilized	Center	43	39.7	12.5	7–61	0.700	72	0.486
		Cluster	43	38.15	8.02	18.0–53.4			
	Unutilized	Center	841	35.4	5.6	28–52	20.669	1680	<0.001
		Cluster	841	29.22	6.63	5.7–51.8			
1997	Utilized	Center	60	38.9	9.7	11–65	1.496	118	0.137
		Cluster	60	36.54	7.86	19.2–56.5			
	Unutilized	Center	739	36.0	4.8	30–48	20.849	1476	<0.001
		Cluster	739	29.81	6.56	5.7–53.4			
1995–1997	Utilized	Center	130	39.8	10.6	7-66	2.140	237	0.033
		Cluster	130	37.35	7.77	18.0–56.5			
	Unutilized	Center	700	36.0	4.9	30–50	21.533	1398	<0.001
		Cluster	700	29.45	6.38	5.7–50.5			

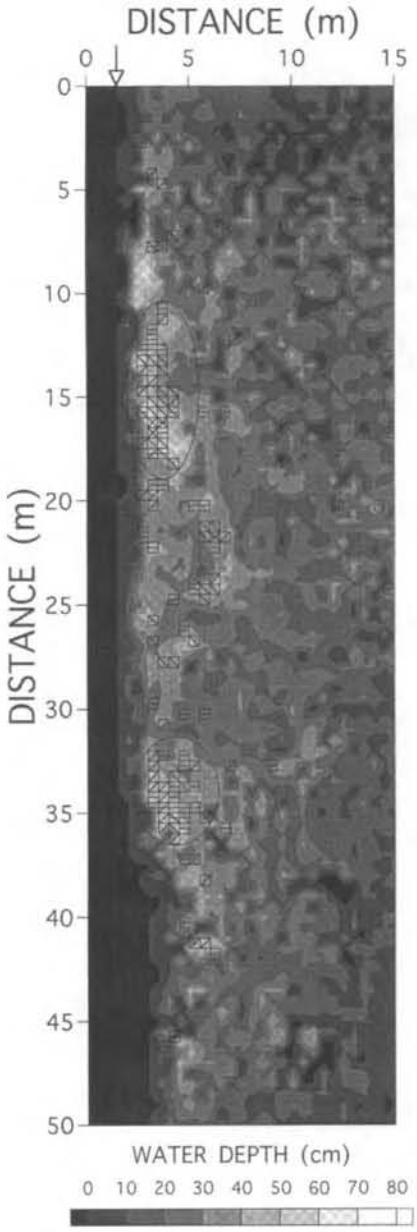


FIG. 1. Topography of a 50 x 13.5 m fen divided into 2700 plots of 0.5 x 0.5 m, showing two dimensional water depths every 10 cm. Left black 50 x 1.5 m area (arrow) corresponds to the right bank. Fen-tussocks are expressed by black (≤0 cm) and many blackish (1–10 cm) areas. Each square area represents a plot utilized for egg sac deposition of *Salamandrella keyserlingii* in 1995 (line from upper left to lower right), 1996 (line from upper right to lower left), and 1997 (horizontal centerline). Ellipses represent "hot spots" (communal breeding locations) in 1995 (upper) and 1996 (lower). Hot spots in 1997 separate into both these ellipses.

compared the average depth of the plot-cluster with the water depth of the plot-center using the Aspin-Welch test when exhibiting unequal variances (Snedecor and Cochran 1980) or Student's t-test ($\alpha = 0.05$).

Breeding activity varied slightly each year, with breeding typically completed in April or May, resulting in the deposition of approximately 60–80 pairs of egg sacs within the fen (Fig. 1; year/date of completion of breeding/number of egg sac pairs, 1995/28 April/78, 1996/10 May/62, 1997/30 May/74). A few egg sacs were deposited in a specific location outside the fen (1996/three pairs, 1997/one pair). All eggs were viable each year.

The fen was relatively shallow throughout and included a great number of tussocks (Fig. 1; black, ≤0 cm, and many blackish, 1–10 cm, areas), each consisting of a mass of sedges assuming a shape like a hummock (Tanaka 1962). Among the 2700 plots, the maximum water depth was 73 cm. In 1995, egg sacs were deposited neither in shallow plots less than 32 cm (2020 plots/74.8%) nor in deep plots more than 66 cm (2 plots/0.074%). Seven and 12 of those 2020 shallow plots were utilized for oviposition in 1996 and 1997, respectively. A total of 130 plots (4.8%) were utilized for oviposition in three years (1995: 78 egg sac pairs, 40 plots; 1996: 62 pairs, 43 plots; 1997: 74 pairs, 60 plots). Among years, 4 of 40 utilized plots in 1995 were utilized again in 1996, and 7 of 40 1995 plots and 4 of 43 1996 plots were reutilized in 1997. Furthermore, only two plots were utilized over three consecutive years.

Plots utilized for oviposition during these three years tended to occur in two places. In 1995, 19 of the 40 plots (47.5%) occurred at one locality; but in 1996, 12 of the 43 plots (27.9%) occurred on another location (Fig. 1). These "hot spots" (communal breeding locations) changed between 1995 and 1996. In 1997, 12 (20.0%) and 15 (25.0%) of the 60 plots with oviposition occurred on those two locations.

Depth of plot-centers did not differ from the average depth of plot-clusters when those centers were utilized for oviposition (Table 1). In contrast, in every comparison, water depths of unutilized plot centers differed from those of clusters. Thus, unused areas appeared to have more variable water depths. Although many plots with apparently suitable depths (i.e., ± 1 SD of the mean) were not utilized, each year the mean depths of these plot-clusters (1995, N = 389, mean = 32.71 cm, SD = 6.48; 1996, N = 841, mean = 29.22 cm, SD = 6.63; 1997, N = 739, mean = 29.81 cm, SD = 6.56; 1995–1997, N = 700, mean = 29.45 cm, SD = 6.38) were significantly lower (each $P < 0.001$) than their plot-centers (1995, mean = 40.7 cm, SD = 4.3; 1996, mean = 35.4 cm, SD = 5.6; 1997, mean = 36.0 cm, SD = 4.8; 1995–1997, mean = 36.0 cm, SD = 4.9).

Female *Salamandrella keyserlingii* oviposited neither in shallow sites nor in deep sites. In addition, they also did not oviposit in sites with moderate depths (i.e., about 40 cm) but small overall areas (0.5 x 0.5 m). These disproportionate depth associations strongly suggest that relatively large areas (1.5 x 1.5 m), having a water depth of around 40 cm, are used as breeding habitats by this species. Our data agree with those of others. For example, in another population, 42 pairs of egg sacs were deposited in a pool (4 x 3 m) having a water depth of 30–40 cm in 1995, but no egg sacs were deposited in an adjacent pool (3 x 1 m) having a water depth of 10 cm (Hasumi and Kanda 1996). Moreover, Nakabayashi et al. (1986) stated for this species that the mean water depth of 13 breeding ponds was 48.2 cm.

Other species have demonstrated associations with breeding site depth. In *Ambystoma opacum*, reduced nest densities occur in the deepest and shallowest sections of a pool (Petranka and Petranka 1981). In *Hyla pseudopuma*, oviposition sites containing deep water receive more eggs than sites with shallow water (Crump 1991). Richter (1997) reviewed water depths used for amphibian oviposition, primarily for North American species, and found that many utilized medium water depths between 10–100 cm. The ponds to which *S. keyserlingii* were transplanted may have been too deep (1 m) to allow successful breeding. The present study suggests that egg laying success could be improved by providing moderate water depths of around 40 cm.

Contrary to our expectations, only two of the 2700 plots were utilized for egg sac deposition of *Salamandrella keyserlingii* over three consecutive breeding seasons. There may be a tendency to use traditional sites at a slightly larger spatial scale, however. For example, there may be a few "hot spot" locations used by the salamanders, and one or more of these locations may be used each year (see Fig. 1). Traditional use of specific breeding areas is common in lentic or lotic breeding habitats (e.g., Tsuji and Kawamichi 1996). This low overlap of "microsites" (plots) used among years presumably reveals the plasticity of breeding habitat use in the Siberian salamander. This notion may contribute to conservation planning of this species.

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TECHNIQUES

Methods for Anaesthetizing and Marking Larval Anurans

BRADLEY R. ANHOLT*
SONJA NEGOVETIC**
and
CHRISTIAN SOM
Zoological Institute, University of Zurich
Winterthurerstrasse 190, 8057 Zurich, Switzerland

**Present address: Department of Biology, University of Victoria*
P.O. Box 3020, Victoria, British Columbia, V8W 3N5, Canada
e-mail: banholt@uvic.ca
***Present address: Experimental Ecology, Swiss Federal Institute*
Zurich, Switzerland

The marking of groups or individuals can provide invaluable ecological information. Marked groups can be used to estimate population sizes using standard methods (Krebs 1989). Marks can be used to distinguish among sibships or closely related species in experiments. Individual marks can be used to estimate whether survival and recapture rates depend on phenotypic characters such as morphology, color, or behavior (Lebreton et al. 1992). The power of these methods has made their use widespread for many taxa. Unfortunately, anuran larvae have remained difficult to mark reliably. In setting out to mark tadpoles we found we had two distinct problems: 1) how to anaesthetize tadpoles with minimal, preferably zero, mortality; and 2) how to mark individual tadpoles with unique marks.

Anaesthesia.—We tested three anaesthetics suggested in Fellers et al. (1992): chloretone (chlorbutanol; 1,1,1-trichloro-2methyl-2propanol), benzocaine (ethyl4-aminobenzoate), and tricaine methanesulfonate (TMS; MS-222; ethyl 3-aminobenzoate). We rejected the first two because in preliminary experiments with *Rana temporaria* we found that mortality rates were unacceptably high if anaesthesia occurred within 10 min. At concentrations of 0.01% chloretone, 6 of 48 tadpoles did not recover from anaesthesia and at 0.001% benzocaine, 3 of 48 tadpoles failed to recover. At lower concentrations, anaesthesia took up to 30 min to occur.

At concentrations of 0.02% (1:5000) TMS, 20 of 20 *R. temporaria* tadpoles (mean = 128.8 mg; SD = 24.2 mg) recovered from the anaesthesia. All animals were immobile within 4 min and recovered after about 30 min. Although amphibians vary widely in their ability to tolerate anaesthetics (Fellers et al. 1992), we were later able to mark nearly 1000 tadpoles of *Rana lessonae* and *R. esculenta* that had been anaesthetized this way. The only difficulty occurred when the tadpoles first to recover from anaesthesia began to eat the tailfins of still immobilized animals. This problem was eliminated when tadpoles were placed in separate containers after marking.

Marking.—Donnelly et al. (1992) reviewed methods for marking larval amphibians. We were searching for a method that would not affect the predation risk experienced by tadpoles and therefore rejected fin clips (Turner 1960) and vital stains (Travis 1981) as being unlikely candidates. We were unsuccessful in our attempts to mark tadpoles by injecting organic dyes (Seale and Boraas 1974) and acrylic polymers (Cecil and Just 1976).

Tadpoles were first anaesthetized in a 0.02% solution of TMS and then rinsed in fresh water. We marked the tadpoles with a biologically inert fluorescent polymer (elastomer) from North-

west Marine Technology Inc. The elastomer is available in a variety of colors and when used in combination provides a substantial number of individually recognizable marks.

We injected the tadpoles under the skin, above the musculature of the tail, with a tiny amount (0.2 mm wide; 1 mm long) of fluorescent elastomer using a 1 ml tuberculin syringe and No. 20 needle (19 mm long; 0.4 mm diameter). Injection was done while observing through a stereomicroscope at 6.5X. The procedure can mark animals as small as 8 mm snout–vent length and takes less than 10 s for a single mark. Multiple marks take longer because of the care that must be taken to avoid damaging the tail fin by creating multiple injection wounds. With larger animals it is possible to slide the needle from the tail well up onto the backs of the tadpoles. We found this preferable because it was possible to read the marks more effectively and we had the impression that the marks were less likely to be lost from the back than the tail. Although flexible, the elastomer is not as flexible as a tadpole's tail and can be forced out through the skin. Injections below the tail musculature were not effective.

We have used the material for marking tadpoles in two experiments where we wanted to examine the effect of predators on tadpoles of the closely related *Rana esculenta* and *R. lessonae* which are morphologically indistinguishable and must be identified by electrophoresis. We had hoped to eliminate the cost of electrophoresis for identifying survivors at the end of the experiment.

In the first experiment we marked 280 animals with one of four colors and kept them in four 1000 liter outdoor fiberglass tanks that contained dead *Phragmites* as substrate and actively foraging *Anax imperator* larvae. Out of 160 surviving animals, 136 were still identifiably marked after 8 days. We believe that mark retention would have been higher if we had marked all animals on the back and rejected animals for the experiment that had imperfect marks.

In the second experiment we marked 12 lots of 60 animals with a combination of three marks with the constraint that adjacent marks had to be different colors. With five available colors this gave us 80 unique combinations. The purpose of the marking was to measure survival probabilities of individual genotypes as well as look at the effect of morphology on survival. Although many animals lost marks, the remaining marks and electrophoretic information allowed us to resolve the identity of almost every surviving animal at the end of the experiment. In treatments without predators, survival was up to 100% after five weeks, and some animals had metamorphosed.

Particularly, we were concerned that the marking procedure would change the risk of predation for the tadpoles. We tested these possibilities in two experiments. In the first experiment we used pairs of marked and unmarked *R. temporaria* tadpoles matched for size and exposed them to an *Anax imperator* larva. In four experimental blocks of 12 pairs, marked animals were captured first 22 of 48 times (binomial test; $P = 0.65$). In the second experiment we videotaped the startle response of resting tadpoles and measured the distance travelled in the first 0.2 s (5 frames on PAL). Again, there was no detectable difference in the distance travelled between 20 marked and 20 unmarked tadpoles (t-test; $t = 0.8$; $P = 0.4$)

Conclusions—Tadpoles can be marked with extremely low mortality by anaesthetizing in low concentrations of TMS and injecting fluorescent elastomer subcutaneously. Mark retention is less than 100% but still acceptable for many applications. The marks appear to have little or no effect on tadpole behavior and viability.

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Snake Mortality Associated with Late Season Radio-transmitter Implantation

D. CRAIG RUDOLPH
SHIRLEY J. BURGDORF
RICHARD R. SCHAEFER
R. N. CONNER
Wildlife Habitat and Silvicultural Laboratory, Southern Research Station
U.S.D.A. Forest Service, Box 7600 SFA Station
Nacogdoches, Texas 75963, USA

and

ROBERT T. ZAPPALORTI
Herpetological Associates, Inc., Plant and Wildlife Consultants
2525 Dover Road, Forked River, New Jersey 08731, USA

Radio-telemetry is an increasingly used procedure to obtain data on the biology of free-living snakes (Reinert 1992, 1994). In Texas and Louisiana we have been using the surgical technique of Weatherhead and Anderka (1984) to implant transmitters in timber rattlesnakes (*Crotalus horridus*) and Louisiana pine snakes (*Pituophis melanoleucus ruthveni*) to obtain information on biology and habitat preferences. In New Jersey transmitters were surgically implanted following the procedure described by Reinert and Cundall (1982), with recent improvements and modifications (Reinert 1992), to investigate the biology and habitat preference of timber rattlesnakes (Reinert and Zappalorti 1988a, 1988b) and northern pine snakes (*P. m. melanoleucus*) (Burger and Zappalorti 1988, 1989, 1991). During the course of this research we have implanted SI-2T transmitters (Holohil Systems Ltd.) in 30 *C. horridus* and 28 *P. m. ruthveni*; and SM-1 transmitters (AVM Instrument Co.) and LF-1 transmitters (L. L. Electronics, Inc.) in 37 *P. m. melanoleucus*, 28 *C. horridus*, and several in other snake species.

Snakes were captured, returned to the laboratory, and surgically implanted with transmitters using the two techniques cited above. In Texas and Louisiana all transmitters were implanted subcutaneously. In New Jersey, all transmitters were implanted in the coelomic cavity (Reinert and Cundall 1982). Snakes were maintained in the laboratory for 2–15 days, with access to a heat source to facilitate healing (Smith et al. 1988), prior to release. Snakes received replacement transmitters at approximately 6–18 month intervals and were entered in the data set repeatedly for each surgery.

In New Jersey, to avoid poor healing or infection during hibernation (Reinert, pers. comm.), snakes rarely were implanted with transmitters after September 1, unless there was a specific need or important reason to do so, e.g., discover an unknown hibernation site, monitor winter body-temperature, or to prevent the loss of a long-term study specimen. In Texas and Louisiana, as research progressed, we suspected that elevated mortality and behavioral anomalies might be occurring in snakes that received implants 1–2 months prior to hibernation in the fall. Observations after release suggested that snakes receiving transmitters in the fall suffered higher mortality during subsequent hibernation than snakes receiving transmitters during spring and summer. In addition, snakes undergoing fall surgeries appeared to exhibit a greater tendency to be present on the surface during the subsequent winter than snakes operated on in the preceeding spring and summer.

We tested these hypotheses using Texas data accumulated over a four-year period between 1993 and 1997. A total of 39 rattlesnake surgeries were performed. Three snakes were deleted from the data set because of causes of death unrelated to surgery (two killed on roads and one died of a pre-existing fungal disease). Five individuals were lost after 1–6 months because of unknown causes and also were deleted. Of the remaining 31 surgeries, 21 were performed between 1 February and 31 August (early surgeries) and 10 were performed between 1 September and 31 October (late surgeries). Six snakes died following surgery and release, 2 of 21 following early surgeries, and 4 of 10 following late surgeries. This difference is significant ($\chi^2 = 4.03$, $P = 0.045$).

Also, we examined the influence of surgery date on timber rattlesnake behavior between a sample of snakes subjected to early surgery, and those subjected to late surgery, specifically the occurrence of the snakes above or below ground during the primary hibernation period (Dec.–Feb.). For this three-month period, snakes subjected to early surgery (N = 19) were on the surface near their hibernacula during only 8 of 74 relocations (10.8%). Of the six snakes subjected to late surgery, 10 of 24 relocations (41.7%), including observations of all six individuals, were of snakes on the surface. This difference is highly significant ($\chi^2 = 11.51$, $P = 0.001$). Of the four snakes that ultimately died during the hibernation period following late surgery, an even higher percentage of relocations were of snakes on the surface (71.4%).

Similar results were obtained for Louisiana pine snakes. A total of 37 surgeries were performed. Eight were deleted from the data set for reasons similar to those for rattlesnakes (three killed on roads, five lost). Of the remaining 29, 25 were early surgeries and 4 were late surgeries. A total of 8 snakes died following surgery and release, 4 of 25 after early surgeries and 4 of 4 after late surgeries. This difference is highly significant ($\chi^2 = 12.18$, $P = 0.001$).

Limited data for pine snakes also are available in relation to surface activity during Dec.–Feb. For the three-month period, snakes subjected to early surgeries were on the surface near their hibernacula during 2 of 37 relocations (5.4%). Snakes subjected to late surgeries were on the surface during 4 of 5 relocations (80%) prior to their deaths. This difference is highly significant ($\chi^2 = 20.02$, $P = 0.001$).

Although the sample sizes are small due to our discontinuation of late surgeries, the differences are unequivocal. Snakes receiving surgically implanted transmitters in the fall experience a significantly higher mortality rate than snakes implanted earlier in the season. They also spend significantly more time on the surface during the subsequent winter. We suggest that individuals subjected to late surgeries that spend more time on the surface during the subsequent winter may be attempting to thermoregulate in a effort to hasten healing of their surgical wounds. Individuals operated on earlier in the season have had more time to heal prior to hibernation and do not exhibit thermoregulatory behavior to the same extent.

How the above scenario translates to higher mortality rates is open to speculation. Several additional observations are perhaps relevant. Of the eight snakes of both species that died following late surgeries, all died within 1–4 months after surgery, in all cases prior to the end of the winter hibernation period for these populations. Of the eight snakes in question, five were observed 7–16 days prior to being found dead. All five were in apparent good health and showed no obvious signs of infection. When verified as dead, two were isolated transmitters, four were skeletal remains and transmitters, one a badly decayed carcass, and one an extremely fresh carcass with no indication of cause of death on necropsy. This last individual was found mid-morning following a night of sub-freezing temperatures. All eight transmitters or remains were on the surface within 5 m of the snake's hibernaculum. We suspect that all eight snakes died on the surface. The

limited information available suggests that predation, and perhaps hypothermia, contributed to cause of death.

If the snakes were more vulnerable to predation while on the surface at low temperature, and this was a factor in the above results, the differences between species may be relevant. Following late surgeries, rattlesnakes survived at a higher rate (6 of 10) than pine snakes (0 of 4). It is possible that even when exposed at low temperatures, the larger and venomous rattlesnakes are better able to deter avian and mammalian predators.

Similar results were observed in New Jersey. A total of 75 early surgeries (April–August) and 9 late surgeries (September–October) were performed on six species of snakes, primarily timber rattlesnakes and northern pine snakes. A total of eight snakes died, four following early surgery (5%) and four following late surgery (44%). This difference is highly significant, $\chi^2 = 14.26$, $P < 0.001$). As observed in Texas, snakes that received late implants (September–October) spent more time basking and remained on the surface longer than those that did not (Zappalorti et al. 1983; Zappalorti and Burger 1985). Additionally, in New Jersey late implant timber rattlesnakes (N = 3) and northern pine snakes (N = 3) emerged sooner in the spring and spent more time basking than snakes receiving early implants.

These results strongly suggest that researchers should refrain from surgical procedures and release of snakes immediately prior to hibernation if possible. These data also suggest that effects of surgical procedures can alter snake behavior, apparently for several months in some situations, following relatively minor surgery. The implications for conclusions based on resulting data are obvious.

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A Simple Stomach Flushing Method for Small Frogs

CLAUDIO E. G. PATTO

Graduate Program in Ecology, Universidade Estadual de Campinas, C.P. 6109 CEP 13083-970 Campinas, São Paulo, Brazil

e-mail: patto@obelix.unicamp.br

Amphibian dietary studies conventionally employ dissection of fixed animals. This kind of study requires large samples, sometimes difficult to justify in light of amphibian population declines (Wake 1991). Another drawback is the destruction of specimens that could otherwise be useful for other purposes. Moreover, destructive sampling may interfere with population studies by affecting density-dependent processes.

Non-destructive techniques have been used in a variety of dietary studies on large anurans including direct observation (Murphy 1976), stomach eversion, and stomach flushing (Gittins 1987; Legler and Sullivan 1979; McAlpine and Dilworth 1989). These methods, when carried out properly, cause low or no mortality, do not disrupt population processes, and allow individuals to be sampled repeatedly over time. However, dietary studies of small frogs still rely on the collection and dissection of animals (Lima and Moreira 1993; Vitt and Caldwell 1994).

In this report I describe an adaptation of the stomach flushing method for use in small frogs. The method was used to study the diet of the small leptodactylid frog *Hylodes asper* (Müller), an endemic species of the Atlantic forest of southeast Brazil. The range of snout-urostyle length (SUL) of postmetamorphic individuals of this species varies from 20 to 47 mm.

After capture, frogs that were too strong to immobilize with one hand (usually animals >35 mm SUL), were anesthetized for a few seconds in a plastic bag containing cotton soaked with chloroform. In preliminary tests of the procedure, three frogs died after being exposed to chloroform for more than 20 seconds; 10 seconds of exposure seems to be a safe limit. Small individuals were not anesthetized to avoid unnecessary trauma. I used chloroform instead of liquid (Leclerc and Courtois 1993) or injected anesthetic (Letcher 1992) due to the faster recovery rate and because no anesthetic remains on the frog's body.

Anesthetization prevented frogs from using their hands to remove the flushing tubes from their mouths. After anesthetization I introduced a thin flexible silicone tube (Sigma Equipment: 1

mm OD and 0.5 mm ID, 5 cm long) through the mouth into the stomach. When the tube reached the pylorus (the tube could be felt through the wall of the abdomen and the pylorus resisted further introduction), it was retracted approximately 1 mm. I then positioned the animal head down with its mouth pointing into a 100 ml collecting bottle and pumped water through the tube using a 20 ml syringe to wash out the stomach contents. While pumping water, I firmly pressed the lower portion of the abdomen to prevent water from opening the pylorus and allowing the passage of food to the intestine. If I felt additional food through abdominal palpation, I repeated the procedure until all contents had been removed. When the procedure produced no further stomach contents, I repeated it once more to ensure that no food remained.

I toe-clipped study specimens for individual identification. Anesthetized animals were allowed to rest before they were released at the place of capture. In most cases, the frog fled within a few seconds by jumping. After release I preserved the stomach content samples by adding ethanol to the collecting bottle.

During 18 days in the field, I obtained 121 stomach contents from 97 animals. Twenty animals were recaptured, of which 13 were recaptured once and 7 twice. Food was found in the stomachs of 88% of the recaptures (only 3 of the recaptures lacked food). This suggests that the animals were not injured by the procedure and resumed normal feeding activities.

To check if food remained in the frogs' stomachs after flushing, I dissected six animals, three that had been killed in a preliminary collection and three that died during anesthetization trials. None contained food remains in the stomach. I performed the same test on an abundant invader species, *Leptodactylus fuscus* (Schneider). Twenty animals with SUL ranging from 35 to 45 mm were flushed. Food was found in 60% of the animals and no food remains were subsequently found by dissection.

The stomach flushing method can be used on small anurans species as well as larger anurans. Most animals seem to recover after release.The method may be especially useful for dietary analyses of rare, endemic, or protected species, and in studies of population processes or of long term population trends. Furthermore, the whole procedure takes approximately 10 minutes from capture to release, somewhat less than that needed to sample the contents of a fixed animal, and can be performed by one person. The method uses little equipment, but must be performed immediately on freshly captured animals to diminish digestive loss and facilitate prey identification.

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Using Decoys to Capture Spotted Turtles (*Clemmys guttata*) in Water Funnel Traps

PATRICIA MANSFIELD
E. C. P., Inc., 21 Sunset Lane
Osterville, Massachusetts 02655, USA
e-mail: tmansfield@juno.com

ERIC G. STRAUSS
and
PETER J. AUGER
Environmental Studies Program, Boston College
Chestnut Hill, Massachusetts 02167, USA
e-mail (EGS): strausse@mail1.bc.edu

The hoop trap described by Legler (1960), as well as the D-shaped funnel trap described by Graham (1995), have been used to capture spotted turtles, *Clemmys guttata*. These traps are set partially submerged in water, allowing enough air space for captured turtles to breathe. Funnel traps like these are commonly used to capture aquatic turtles and typically require bait placed inside of them, in order to attract turtles (Graham 1995; Legler 1960; Plummer 1977; Ream and Ream 1966). Although the baited funnel trap has demonstrated its ability to capture spotted turtles in aquatic environments (Dunson 1986; Graham 1995; Klemens 1993; pers. obs.), we have found bait to be an ineffective attractor in the early spring, when turtles emerge from brumation, and water temperatures are below optimum feeding temperatures. In this paper we report on a new technique to attract spotted turtles into water funnel traps in the early spring, using man-made spotted turtle decoys in lieu of bait.

We used a variety of trap capture techniques at our study site in Bridgewater, Massachusetts, including: D-shaped and hoop funnel traps baited with canned sardines in oil; D-shaped and hoop funnel traps set with decoys; and empty control D-shaped and hoop funnel traps. The trapping period was from 6 April to 20 June 1997. All trapping combinations were deployed simultaneously in temporary bodies of water, known as vernal pools. Spotted turtles were also searched for and captured by hand during this same time period.

Decoys were made out of aluminum foil shaped and wrapped with plaster of Paris gauze strips. These decoys lasted for most of the study period but eventually deteriorated. Subsequent decoys have been made out of cement poured in plaster of Paris casts. Each decoy was hand painted with acrylic paints to closely resemble *C. guttata* markings and color. Once the paint dried, decoys were sealed with clear polyurethane. Decoys (one per trap) were then suspended with fishing line, fully submerged in a trap to look as if they were swimming, or mounted to look as if they were standing on the floor of the bottom of a trap.

Traps with *C. guttata* decoys repeatedly and successfully captured both male and female *C. guttata* (5 adult captures: 3 male and 2 female, in 508 trap days). Baited traps yielded only one capture (1 adult female, in 492 trap days). Empty traps (76 trap days), deployed as controls, yielded no captures. Hand captures yielded nine *C. guttata* (5 adult females, 1 adult male, 1 juvenile female, and 2 hatchlings, in 64 search days [a search day is the equivalent of a three and a half hour daytime period of active searching for *C. guttata* on the study site]).

An unexpected result was 3 *Chrysemys picta* captures in decoy traps (1 adult female, and 1 juvenile which was captured twice). In comparison, no *C. picta* were captured in either baited or unbaited traps during our study period.

Our first attempt at using decoys to capture *C. guttata* was in the spring of 1990 at a site where a year earlier we were involved in an extensive spotted turtle population study (Graham 1995). Baited traps from a portion of this site, identified as Vernal Pool 1 and Vernal Pool 2, yielded 13 *C. guttata* captures (5 adult females and 8 adult males) in 584 trap days from 10 May to 16 July 1989. The following year, one decoy trap was set in Vernal Pool 1 and a second decoy trap was set in Vernal Pool 2 from 29 April to 15 May 1990, for a total of 32 trap days. These decoy traps yielded a total of 6 *C. guttata* (3 adult females, 3 adult males).

Although water temperatures below 14°C inhibit *C. guttata* feeding activity (Ernst 1982), these temperatures are not too low for mating activity. Spotted turtles have been observed mating in water temperatures as low as 8.5°C (Ernst 1967).

Because our trapping was conducted in the spring, we believe that our capture success the result of *C. guttata* mating activity. Decoys are routinely used by hunters and biologists to attract waterfowl and deer. Some references comment on commercial turtlers' use of floating decoys to attract sea turtles during mating season (Caillouet 1995; Carr 1952; Rebel 1974). Although scientific literature on using decoys to attract *C. guttata* is scarce, we have found one study that used live adult female *C. picta* along with bait to attract other turtles (Frazer et al. 1990).

Frazer et al. (1990) placed live adult female painted turtles, *Chrisemys picta*, in hoop net traps along with bait, and had significantly higher capture rates in these traps than in traps set only with bait. Unlike our findings, however, these researchers note that the reason for conspecific attraction in their study could not be attributed to an "apparent attraction to sexual activity" because the study was carried out in August, not during spring or fall mating seasons (Frazer et al. 1990). The potential for trapped turtles to attract other turtles into a trap has been noted by others (Cagle and Chaney 1950; Dunham et al. 1988; Plummer 1979). Cagle and Chaney (1950), have suggested that the first turtle in a trap may influence the outcome of the entire catch.

Although we believe that the attraction of *C. guttata* to water funnel traps baited with decoys in the early spring is primarily related to mating behavior, a number of questions regarding the apparent tendency for turtles to be attracted to one another or to turtle decoys remain. For example, does the localized activity (or presence) of decoy turtles (live or artificial) signal to other turtles that there may be a particular resource to exploit (e.g., food, mates, heat, or even basking sites)? Our decoy traps also attracted two *Chrysemys picta*. These results, as well as the findings of Cagle and Chaney (1950) and Frazer et al. (1990), imply that in addition to mating activity, there are likely to be other instances when one turtle may benefit by pursuing another turtle. The use of decoys to attract turtles may help researchers investigate those factors that play a role in a turtle's attraction to other turtles.

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We thank Jose Rosado for providing access to the Harvard MCZ library and herpetological collections. We also thank Jeff Lovich, Tom French, Joan Milam, and Whit Gibbons for help regarding literature and relevant information on this topic. Preparation for this note was supported by E. C. P., Inc. Finally, we are grateful to James Lazell and Jeff Lovich for their suggestions which helped to improve this manuscript.

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A New Capture Technique for Arboreal Lizards

ANN PATERSON
Department of Biology, University of Miami
P.O. Box 249118, Coral Gables, Florida 33124, USA
e-mail: apaterso@fig.cox.miami.edu

Lizards of many species are commonly used in research on behavior, ecology, and population biology. Many types of studies require individuals to be captured and then re-released. Lizards may be captured using a variety of techniques, including pitfall and wire mesh traps (Doan 1997; Simmons 1987), mouse glue traps (Bauer and Sadlier 1992), and baited traps (Zani and Vitt 1995). However, it is often useful to be able to quickly capture specific individuals, which is not always possible when using traps. Commonly used techniques include hand-capture, using a noose attached to the end of a pole (e.g., Medica et al. 1971, cited in Simmons 1987; Tokarz et al., in press), using rubber bands to knock lizards from their perches (Simmons 1987), using baited nooses (Strong et al. 1993), and using scooping devices on the ground (Brattstrom 1996). Several specialized techniques for capturing arboreal lizards have been developed, including the use of sticky poles (Durtsche 1996) and mechanical grabbers (Witz 1996). These techniques can be used with success on a variety of species, notably many anoline lizards.

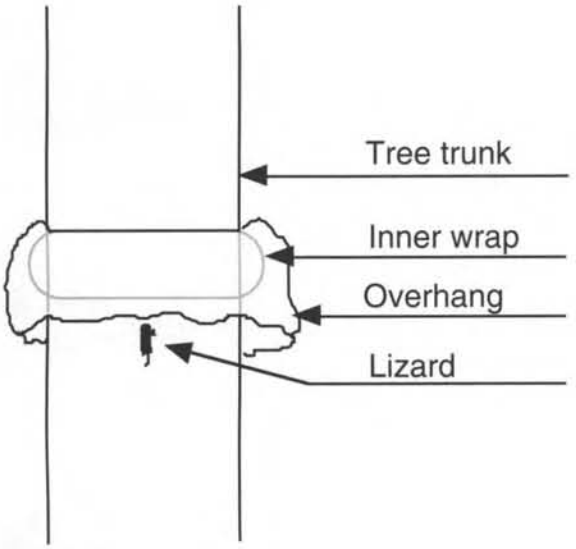


FIG. 1. An overhang is created by first tightly winding bridal veil around the tree (the inner wrap) and then loosely tucking the last wrap of fabric into the top of the inner wrap. When the lizard moves up the tree, it will be trapped between the overhang and the trunk.

However, it can be extremely difficult to capture some arboreal species, particularly those that are small, wary, and/or fast-moving, using the above techniques. Hand capture may be difficult or impossible. Even if these species will allow themselves to be noosed, the thread used for the noose must often be very fine and is difficult to manipulate or see. Although using rubber bands can be effective (Simmons 1987), this technique is often undesirable as it is more likely than others to result in injury to the lizard (Conant and Collins 1991; Witz 1996). Using mechanical devices may be difficult when lizards are easily disturbed, fast-moving, and able to escape to inaccessible refuges. To reliably capture the bark anole, *Anolis distichus*, I developed and used a new, simple technique which may also be applicable to other trunk-dwelling species.

Individual *A. distichus* usually are found on the trunks of trees and generally avoid the ground except when capturing prey. This species is sufficiently wary and agile to make noosing and hand capture almost impossible. Most individuals respond to capture attempts by running up tree trunks beyond reach.

I was able to capture *A. distichus* from the trunks of trees using a mesh barrier to facilitate hand capture. After locating individuals, I approached their trees from the side opposite the lizard and tightly wrapped a mesh barrier (bridal veil fabric, available in many sewing and craft stores) several times around the tree above the lizard (approximately 2 meters above the ground). I tucked the final wrap loosely under the top of the previous layers so that it provided an overhang (Fig. 1). The lizards were reluctant to pass the mesh barrier or to venture onto the ground, so it was possible to capture them by hand in a confined area. If they attempted to pass the barrier they often became caught between the tightly wrapped layer and the overhang long enough to allow capture. They could be easily removed from the mesh without injury.

This method of capture for *A. distichus* is easily used and inexpensive. Other types of similar fabric should work equally well (e.g., mosquito netting). Although not appropriate for some species that will readily escape across the ground, it may be useful for many other trunk-dwelling species.

Acknowledgments.—I thank Stephen McMann, Marion Preest, and Kirsten Nicholson for their many helpful comments. In addition, I thank Sandra Perez for familiarizing me with the use of bridal veil fabric as a tool for capturing and holding bees.

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HERPETOLOGICAL HUSBANDRY

Notes on the Captive Maintenance and Reproduction of Oates' Twig Snake (*Thelotornis capensis oatesii*)

SEAN C. FOLEY
Department of Herpetology, Riverbanks Zoo and Botanical Garden
Columbia, South Carolina 29202, USA
e-mail: spfaff@scsn.net

The twig snakes of the genus *Thelotornis* are arboreal, rear-fanged colubrids native to savannahs and coastal forests of eastern and southern Africa and the rainforests of central and western Africa (Branch 1988). Two species are recognized: *Thelotornis capensis* and *T. kirtlandii*. In addition, three races of *T. capensis* have been described: *T. c. capensis, T. c. mossambicanus*, and *T. c. oatesii* (Branch 1988). Information on captive reproduction and husbandry of *Thelotornis* is sparse and few institutions house them. Slavens and Slavens (1996) list two institutions as holding *Thelotornis,* while the ISIS Reptile Abstract (1997) current as of 30 June 1997 lists four institutions as maintaining *Thelotornis* with reproduction occurring only at the Riverbanks Zoo. Recently, the St. Louis Zoo reproduced *T. c. oatesii* using captive born animals acquired from the Riverbanks Zoo (Ettling, pers. comm.). This paper summarizes husbandry, reproductive events, and neonate care of *T. c. oatesii* at the Riverbanks Zoo.

A single, wild-caught adult male was acquired in December 1993 followed by two additional males and a single female (all wild-caught adults) in September 1994. According to Shine et al. (1996), *Thelotornis* are sexually dimorphic in that males have longer tails, smaller heads and thinner bodies. Here, it was possible to accurately sex the adult snakes using these characteristics; however, sexing was confirmed by hemipenial probing (> than 10 subcaudals for males, 1–2 subcaudals for the female). Upon arrival, the snakes were moved into quarantine facilities for 90 days and individually housed in aquaria measuring 61.0 x 40.6 x 30.5 cm. Cage furniture consisted of a potted plant (*Pothos*), several branches, and a water bowl. Heat and light were provided by an incandescent 60 W light bulb placed on one end of the cage. Paper towels and newspaper were used as substrates.

All snakes were offered live or prekilled young mice (6–18 g). One male accepted live mice, while the other three snakes refused. Their natural diet is composed mainly of lizards, frogs, snakes, and rarely, birds (Shine et al. 1996) and in captivity, they readily accepted live *Anolis carolinensis*. Because of the difficulty in obtaining large numbers of *Anolis* and the possibility of introducing parasites to the snakes, it was deemed necessary to wean the snakes off of the lizards and on to mice. First, a small mouse liberally scented with *Anolis* "soup" (minced *Anolis* mixed with water) was offered. If this failed, a live *Anolis* was used as bait. The lizard was either placed in a clear jar within the snake's sight or directly in the snake's enclosure. This elicited an immediate hunting response. A scented mouse was then placed between the snake and the lizard. After the snakes regularly accepted scented mice, the amount of *Anolis* soup was reduced every few feedings until they took unscented prekilled small mice (process took between 1–8 mo.).

TABLE 1. Comparison of egg and hatchling data of six clutches of *Thelotornis capensis oatesii* at the Riverbanks Zoo (R) and St. Louis Zoo (S), and one clutch of *T. c. capensis* by Haagner (H). Egg data: clutch weight, mean egg weight, incubation temperature, and incubation period with N as the number of eggs per clutch. Hatchling data: weight, snout-vent length (SVL), and total length (TL). Means are provided followed by ranges in parentheses and N as the number of hatchlings measured.

	Riverbanks				St. Louis		Haagner
EGG DATA							
Clutch #	R1	R2	R3	R4	S1	S2	H1
Weight (g)	70.5	23.3	82.4	70.0	39.5	31.6	60.6
Mean	6.4	7.8	9.15	6.36	5.64	6.32	6.06
N	11	3	9	11	7	5	10
Incubation temperature (°C)	26.7	28.9	26.7	—	27.8	—	28.0
Incubation period (days)	73–76	59–61	72–76	—	62–63	—	56–57
HATCHLING DATA							
Weight (g)	4.0 (2.0–5.0) N = 10	5.0 (4.8–5.2) N = 3	6.5 (5.0–7.2) N = 7	—	3.7 (3.3–4.2) N = 3	—	3.5 (3.0–3.9) N = 10
SVL (mm)	185 (165–220) N = 6	195 (185–205) N = 3	226.7 (215–233) N = 7	—	175 (146–195) N = 3	—	—
TL (mm)	285.5 (245–320) N = 10	283.3 (275–290) N = 3	354 (340–370) N = 7	—	252.3 (225–304) N = 3	—	310.2 (292–331) N = 10

As soon as the snakes began feeding, they were treated prophylactically with anthelmenthics. A one time dose of praziquantel (Droncit, Miles Inc., Shawnee Mission, Kansas 66201, USA) was administered IM at 7.0 mg/kg. In addition, two doses of fenbendazole (Panacur, Hoechst-roussel Pharmaceuticals, Sommerville, New Jersey 08876, USA) at 1.0 ml/kg and two doses of metronidazole (Flagenase 400 pediatrico, Laboratorios Liomont, Cuajimalpa, Mexico 05000) at 4.0 ml/kg were administered in food items 10–14 days apart.

A fiberglass exhibit measuring 122 cm tall x 107 cm wide x 81 cm deep was used to house a pair of snakes. Light and heat were provided by one 150 W spot light and two 135 W flood lights placed directly on the screen wire that covers the top of the exhibit. This created basking spots of 29.4–35.0°C. In addition, a 61 cm double fluorescent light fixture equipped with Duro-Test Vita-Lites was used for supplemental light and for the benefit of the plants. A fiberglass rock water bowl was provided at all times. An *Elaeagnus* shrub was planted in the right rear corner of the exhibit and covered ca. 70% of the enclosure at the time of this writing. Dried grasses and rocks were arranged on the exhibit floor for aesthetic value.

Beginning in October 1994, the photoperiod was gradually, over a period of three months, shortened to 8 h of light and 16 h of dark. Likewise,the ambient temperature was slowly decreased to a daytime high of 22.2°C and to a nighttime low of 16.7°C. In mid-February, the photoperiod was gradually increased to 14 h of light and 10 h of dark, while the ambient temperature was increased to a daytime high of 25.6°C and nighttime low of 22.2°C. The St. Louis Zoo reported a photoperiod ranging from 9 h of light in November to 13 h of light in July with a year-round, daytime ambient temperature of 25.6–26.7°C (nighttime low of 23.9°C in the summer and 22.2–23.3°C in winter) (Ettling, pers. comm.). Shine et. al. (1996) describe both sexes of *T. capensis* as having highly seasonal reproductive cycles; consequently, some method of cycling may be necessary to induce reproduction in captivity.

In March 1994, a male was placed on exhibit followed by the female in December of the same year. On 3 May 1995, courtship behavior was observed. This behavior was typified by the male crawling over the female while frequently flicking its tongue and jerking its head. Copulation was noted on 15 May 1995. During the courtship process, the male ceased to feed while the female's appetite markedly increased. Her diet was doubled to two mice per week. By late June, the female's girth noticeably increased. On 6 July 1995, the female shed. The snake was removed from exhibit and placed in an aquarium measuring 61.0 x 40.6 x 30.5 cm. Several branches and a plant were added. A nest box was assembled by placing damp sphagnum moss in a plastic shoe box measuring 25 cm x 40 cm. It was then covered by a similarly sized shoe box that had an access hole cut in it. During this time (post-shed to oviposition), the female was offered food but refused. Over the next several days, the snake entered the nest box on many occasions. On 16 July 1995, eleven fertile eggs were laid underneath the moss within the nest box. As the entire clutch of eggs was adherent, individual egg lengths and weights were not available (Table 1). The female was returned to the exhibit on 19 July 1995. Copulation was again observed on 5 September 1995. On 13 October 1995, a clutch of four eggs was laid, three of which were fertile. The infertile egg (yellow, smooth, and shiny) was discarded.

The following year the snakes were cycled by manipulating the temperature and photoperiod as discussed previously. On 9 May and 20 May 1996, copulation was observed. On 12 June 1996, the female shed. On 21 June 1996, a clutch of nine fertile eggs was laid. Although the female remained off exhibit, a second clutch of eleven fertile eggs was produced on 4 September 1996. As a nest box was not provided, the snake laid the eggs under the newspaper substrate.

At the St. Louis Zoo, one female *T. c. oatesii* laid a clutch of seven eggs on 14 May 1997, while a second female laid a clutch of five eggs on 13 July 1997 (Ettling, pers. comm.) (Table 1). Both breedings represent second generation reproduction. One female was 1 yr 7 mo 16 d old at the time of oviposition, while the other female was 1 yr 9 mo 13 d. The males were the same age as the females. Haagner (1995) reported a clutch of 10 eggs laid by a wild-caught *T. c. capensis* (Table 1).

Incubation medium consisted of two parts vermiculite to one part water by weight. This was placed in a covered glass jar (0.5 liter). A variety of temperatures were used to incubate the eggs; however, no correlation seemed to exist between incubation temperature and hatchling size (Table 1).

Initially, the hatchling *Thelotornis* were placed in aquaria measuring 50.8 x 30.5 x 25.4 cm with two or three snakes per cage. Within three weeks, an attempt at cannibalism was observed; consequently, the snakes were separated and housed individually. Each enclosure contained a water bowl, several branches, and a small plant. Paper towels and newspaper were used as substrates

The hatchlings were offered food after ecdysis occurred (usually within ten days after hatching). Like the adults, they readily accepted *Anolis* lizards. Usually, one or two snakes per clutch immediately accepted live newborn mice. Tease feeding with newborn mice proved to be a successful strategy. For the remaining snakes, the same methods used to entice the adults to feed on mice were implemented with the hatchlings. All hatchlings were feeding on unscented newborn mice within three months.

Because *Thelotornis* are not widely held, a lack of captive husbandry and reproductive parameters exists. Their reputation as poor captives can be summed up by Patterson (1987), who stated that perhaps only one out of every 30–40 twig snakes settles into captivity and most do not adapt to an alternative diet. However, the techniques implemented at the Riverbanks Zoo illustrate that *T. c. oatesii* will thrive and reproduce in captivity and can be trained to accept a rodent diet.

Acknowledgments.—I thank Scott Pfaff for the opportunity to work with these outstanding serpents and for his helpful comments on the text, and Jeff Ettling and his staff at the St. Louis Zoological Park for their contribution of valuable data.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 29, Number 1 (March 1998).

CAUDATA

AMBYSTOMA CALIFORNIENSE (California Tiger Salamander). **SURVEY TECHNIQUE.** *Ambystoma californiense* is generally fossorial during the nonbreeding season and little is known of its underground habits. A new technique for locating and observing these salamanders underground is described herein. During Fall 1995, pipeline construction was scheduled to cross known *A. californiense* habitat 10 km SW of Santa Maria, California, USA. In an attempt to "clear" the pipeline right-of-way prior to construction, a fiber optic scope was utilized to locate *A. californiense* underground. The scope was an Olympus IF11D4-30 with a 3 m probe that could be powered by a car battery or with a portable battery. With this scope I was able to locate and observe a number of juvenile *A. californiense* within California ground squirrel (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*) burrows. All salamanders were located at depths of 1.3–2.1 m (length of the probe, not depth under the surface). These depths documented only the first salamander observed in each burrow. Within one burrow, a ground squirrel was observed in a bed of dried grass and upon its retreat from the probe, three juvenile *A. californiense* were observed in the grass below and to the side of the ground squirrel's location. *Ambystoma californiense* observed were generally active (possibly due to the bright scope light) and were often located along the sides of the burrows.

The scope was effective, although somewhat limited, in locating *A. californiense*. It was able to negotiate the 90° turns of the rodent burrows; however, two or more sharp turns would cause it to jam in the burrows. The directional head was helpful in guiding the probe around turns, although many burrows were too complex or too deep for the 3 m probe. I was able to verify presence, but not absence, of *A. californiense* within a certain burrow system.

Upon identification of several burrows containing *A. californiense*, an attempt was made to entice them above ground for capture and possible relocation. These burrow systems were encircled with silt fencing, pitfall traps were installed inside the fence, and a water truck was brought in to apply water to the enclosed areas. The enclosures (20 m^2) were saturated twice a day for two days using a total of 18,925 L of water. One juvenile *A. californiense* was caught in a pit-fall trap the morning after the second day of watering. Even with this limited success, the experiment was discontinued due to the size of the habitat to be crossed and the water required to simulate rain.

I thank Tom Olson for reviewing this manuscript and for the loan of and training on the fiber optic scope.

Submitted by **VINCENT J. SEMONSEN**, Essex Environmental, 1810 Sunset Avenue, Santa Barbara, California 93101, USA.

ANURA

BUFO BOREAS (Western Toad). **MORTALITY.** While conducting a study of the movements and habitat use of adult *Bufo boreas* in the Targhee National Forest in southeastern Idaho, USA, I observed the mortality of numerous recently metamorphosed toadlets resulting from trampling by domestic sheep. My study area was centered on a 15 ha temporary pond, located within a pine/spruce forest. This area was within a grazing allotment that was grazed by sheep for about a week as they were driven towards private land. The pond is an important breeding site for *B. boreas* but usually dries by late July or early August. Over 20 pairs of *B. boreas* bred there in 1993 and 1995, but the only successful reproduction was in 1995. Because of the prolonged drought in the area, 1995 may have been the first successful reproduction since about 1986. By late July 1995, a large number (1,000's) of newly metamorphosed toadlets had concentrated at the shallow west shore; by 1 August the pond had dried.

On 4 August 1995, 500–1000 sheep were herded to within 150 m of the dried pond. At 0700 h on 5 August, I arrived at the pond and discovered the sheep were being driven into the dried pond from the west shore, through the concentration of toadlets and towards the habitat frequented by adult toads. After an hour the sheep were driven out of the pond through the opposite shore. As a result, an extensive area of riparian vegetation was completely flattened, and the majority of the toadlets were dead or dying. Hundreds were trampled by the sheep and by the end of the day hundreds more had desiccated. I checked three telemetered adults toads that were located in another part of the pond that was trampled by sheep and found they had escaped injury, apparently by hiding under logs or in rodent burrows.

Submitted by **PAUL E. BARTELT**, Herpetology Laboratory, Department of Biological Sciences, Campus Box 8007, Idaho State University, Pocatello, Idaho 83209-8007, USA. *Present address*: Department of Biology, Waldorf College, 106 South 6th Street, Forest City, Iowa 50436, USA.

BUFO PARACNEMIS (Sapo-boi). **DEATH FEIGNING.** In tropical anurans, death feigning or thanatosis (Edmunds 1974. Defense in Animals. Longman, New York, 357 pp.) is documented in hylids (Sazima 1974. J. Herpetol. 8:376–377; Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill, New York. 670 pp.; Azevedo-Ramos 1995. Rev. Bras. Biol. 55:45–47). In the genus *Bufo*, there is a brief report of such behavior in *B. ictericus* in southeastern Brazil (Haddad and Sazima 1992. *In* L. P. C. Morellato [ed.]. História Natural da Serra do Japi: Ecologia e Preservação de uma Área Florestal no Sudeste do Brasil, pp. 188–211. Editoria da Unicamp/FAPESP, Campinas). Herein we report death feigning in *B. paracnemis*, a large toad widely distributed in South America (Frost 1985. Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.).

On 24 February 1997, we found seven *B. paracnemis* (61–106 mm SVL; 16–115 g) resting under a board in a deforested area near the Mucuri River, Municipality of Mucuri, State of Bahia, eastern Brazil. When handled, the two smaller specimens (61, 65 mm SVL; 16, 22.7 g) exhibited death feigning. The smallest specimen adopted a typical motionless posture, with its limbs close to the body and eyes closed (Fig. 1) for 15–20 min. This behavior was preceded by secondary defensive mechanisms, observed in all specimens, including attempted escape, inflation of lungs, and emptying of the bladder. Although the function of death feigning is not well understood, it has been related to the avoidance of dead prey by certain predators or to the minimization of prey injury when seized by a predator. (Sazima, *op. cit.*; Azevedo-Ramos, *op. cit.*). Voucher specimens are deposited in the Coleção

Zoológica da Universidade Federal do Espírito Santo (ZUFES 140349-354) and the Museu Nacional do Rio de Janeiro (MNRJ 18913).



FIG. 1. Juvenile *Bufo paracnemis* feigning death.

We thank Ivan Sazima and José Perezx Pombal, Jr. for reading this manuscript and for identification of the toad. CZ thanks the PICDT/CAPES (fellowships grant) and RLT the CNPq (grant 302657/87-8). We dedicate this note in memory of Adão José Cardoso for his contribution to the knowledge of Brazilian anurans.

Submitted by **CLAUDIO ZAMPROGNO, MARIA DAS GRAÇAS F. ZAMPROGNO**, and **ROGÉRIO L. TEIXEIRA**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil.

ELEUTHERODACTYLUS SCHWARTZI (NCN). **REPRODUCTION.** On 10 October 1996, we observed five nests of the terrestrial frog *Eleutherodactylus schwartzi* on Great Dog Island, British Virgin Islands, West Indies. To our knowledge, this is the first report of nests of this species, which is endemic to the British Virgin Islands.

The nests were within separate bromeliads located in a patch of ground bromeliads (*Hohenbergia antillana*) that were ca. 16 x 13 m. Based on locations of advertisement calls of males after dark, the distribution of *E. schwartzi* on the island was almost exclusively confined to this patch. Rain had fallen on the days before our initial visit, and the habitat was moist. All nests were within an area ca. 3 m in radius. Each globular egg mass was attached to the inner surface of a leaf near the center of the bromeliad and towards its base. The center was moist, but there was no standing water. One nest was within an arboreal bromeliad (*Tillandsia* sp.), whereas the remaining nests were within bromeliads on the ground. Four nests contained a single clutch, whereas one contained two clutches. The eggs in three clutches were white and firm and were presumably newly-laid, whereas the others were discolored and larger. Movement and the presence of eyespots in the embryos within these larger eggs indicated that they were further along in development.

A male frog was in attendance at each nest and was either hunched over the eggs, or near the center of the bromeliad facing the eggs. In one case, a male appeared from the center of the bromeliad and approached the eggs when we held back the leaf for photography. One male (in Nest 2 below) was attending two egg masses located within a few centimeters from each other. We observed this frog switching positions from covering one egg mass to the other. Male parental care has not previously been reported for *E. schwartzi*.

The details of the nests recorded on 10 October were as follows: *Nest 1*: 12 eggs, white; egg diam 4.6–4.9 mm; located at a height of 180 cm within *Tillandsia* sp. in a tree. This nest together with the attending male, was transported to the laboratory on Guana Island. All eggs, which were kept at 26–28°C became infested with mold with the exception of one egg that hatched on 21 October. Both the hatchling and the male were deposited in the collection at the Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ 125947–948). *Nest 2*: Egg mass 1 with 13 eggs, white; egg diam 4.4–4.9 mm; Egg mass 2 with 5 eggs, discolored; movement within eggs; egg diam 5.5–8.0 mm; located 40 cm from ground within *H. antillana*. *Nest 3*: 5 eggs, discolored; movement within eggs; egg diam 5.4–6.1 mm; located 36 cm from ground within *H. antillana*. *Nest 4*: 10 eggs, white; egg diam 5.0–5.5 mm; located 30 cm from ground within *H. antillana*. *Nest 5*: 10 eggs, discolored; movement within eggs; egg diam 8.4–8.8 mm; located 25 cm from ground within *H. antillana*.



FIG. 1. Male *Eleutherodactylus schwartzi* attending two egg masses within a bromeliad.

By 16 October, all the older egg masses in Nests 2, 3, and 5 had disappeared and presumably had hatched. In Nest 4, a frog was hunched over the eggs, which had been reduced from 10 to 6. The eggs were now discolored and appeared close to hatching. Five of the 13 eggs on the newer egg mass in Nest 2 were desiccated on the leaf. There was no trace of the other eggs or the older egg mass. An adult frog was at the base of the leaf. Folding back the leaf during our initial visit could have changed the microclimate and resulted in the eggs drying. Very little rain had fallen in the days preceding our second visit. Gad Perry and Kate LeVetring provided valuable assistance in locating the frogs and nests.

Submitted by **KRISTIINA OVASKA**, 4180 Clinton Place, Victoria, British Columbia, Canada (e-mail: kovaska@jdmicro.com), **JEANNINE CALDBECK**, Thetis Island, British Columbia, Canada VOR 2YO, and **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA.

PHYSALAEMUS NATTERERI (NCN). **PREDATION.** On 20 August 1996 a crab-eating fox (*Cerdocyon thous*) was collected on the highway between Caldas Novas and Ipameri (17°42'S, 48°32'W), State of Goiás, Brazil. Stomach analysis revealed *Physalaemus nattereri*, a small, nocturnal leptodactylid known for its defensive deimatic strategy of suddenly exposing the large ocelli on its back (Sazima and Caramaschi 1986. Rev. Biol. [Lisb.] 13:91–101) and for its ability to secrete holocrine substances from its inguinal glands (Vizotto 1964. Ci. e Cult. 16:168–169).

The present record obtained from a wild predator confirms the observations of Sazima (1973. Ci. e Cult. 25[supl.]:390), who observed predation of *P. nattereri* by captive representatives of all terrestrial vertebrates classes, except the burrowing owl (*Athene cunicularia*), suggesting that the deimatic behavior shown by *P. nattereri* of raising the posterior part of the body and hiding the anterior and ventral parts has a more defensive than inhibitory effect on a potential predator.

The partially digested specimen of *P. nattereri* was identified by José Perez Pombal Jr., and is deposited in the mammal collection of Museu Nacional (Universidade do Rio de Janeiro) as the stomach content of MN 37658.

Submitted by **ALEXANDRA MARIA RAMOS BEZERRA**, Universidade do Rio de Janeiro, Departamento de Vertebrados, Setor de Mastozoologia, Quinta da Boa Vista, s/n°, São Cristóvão, Rio de Janeiro 20940-040, RJ, Brazil.

TESTUDINES

CLEMMYS MARMORATA PALLIDA (Southwestern Pond Turtle). **COPROPHAGY.** Ernst et al. (1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D.C., 578 pp.) reported intra- and interspecific coprophagy in North American tortoises (*Gopherus* spp.). In addition, red-eared sliders (*Trachemys scripta elegans*) are known to eat pig feces (D. Holland, pers. comm.). Western pond turtles (*Clemmys marmorata*) feed on a wide range of prey items (primarily aquatic invertebrates) and scavenge extensively (Bury 1986. J. Herpetol. 20:515–521). Here we present the first report of coprophagy in the southwestern pond turtle (*Clemmys marmorata pallida*).

On 3 July 1996 (1135 h), the first author observed a juvenile *C. m. pallida* (63.9 mm CL, 43 g) feeding on a coyote (*Canis latrans*) scat in a stream in the Chino Hills State Park, San Bernardino County, California, USA. The scat (6.0 g) was analyzed and found to contain mammal bones and hair, arthropod parts, plant material and seeds, and unknown waste matter. It is unclear what nutritional benefit the turtle obtained from eating the feces.

We thank Stephen H. Bryant, Curtis Clark, W. David Edmonds, and Dan C. Holland, for their comments and help with identification of arthropod and plant components.

Submitted by **ROBERT H. GOODMAN JR.** and **GLENN R. STEWART**, Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, California 91768, USA.

CLEMMYS MUHLENBERGII (Bog Turtle). **PARASITES.** Although leeches of the genus *Placobdella* parasitize many species of freshwater turtles, there are no published records involving *Clemmys muhlenbergii* (Moser 1995. Texas J. Sci. 47:71–74; Watermolen 1996. J. Fresh. Ecol. 11:211–217). Such data are needed since leeches are known vectors of turtle endoparasites such as trypanosomes (Woo 1969. Can. J. Zool. 47:1139–1151) and haemogregarines (Siddall and Desser 1992. Can. J. Zool. 70:123–128).

Between 10 June and 5 September 1996, 23 bog turtles were captured 107 times from four spring-fed, wet meadows in Floyd County, Virginia, USA, and examined for leeches. Upon initial capture, 7 male and 5 female turtles (mean ± SD; [range]: CL = 92.64 ± 3.71 mm [87.4–99.07 mm]; mass = 121.08 ± 14.16 g [98–145 g]) were parasitized by a total of 20 leeches. Leech prevalence was 52.2% and mean intensity was 1.67 ± 1.53 (range = 1–8). The parasites were distributed on the turtles as follows: carapace = 60%; plastron = 20%; posterior limbs = 15%; tail = 5%. Because all leeches were removed from each turtle, it was possible to document recolonization. An adult female *C. muhlenbergii* captured on 1, 11, 15 July, and 17 August, 1996 was parasitized by 8, 5, 1, and 2 leeches, respectively. A male captured on 10 June, 15 and 18 July, and 1 August, 1996 had 1, 3, 3, and 1 leeches. Another male captured on 19 June and 16 July, 1996 had a single leech on both occasions. When identification was possible (23 of 36 cases), leeches were identified as *Placobdella multilineata*. Thirty-three leeches were deposited into the Royal Ontario Museum's invertebrate collection (ROM IZI 4363).

Because *P. multilineata* is known to parasitize several species of turtles (Forrester and Sawyer 1974. J. Parasitol. 60:673; Sawyer and Shelley 1976. J. Nat. Hist. 10:65–97) that are known hosts of haemogregarines (Wang and Hopkins 1965. J. Parasitol. 51:682–683; Patterson and Desser 1976. J. Protozool. 23:294-301; McAuliffe 1977. J. Parasitol. 63:580–581), and because *P. multilineata* is a known vector of alligator haemogregarines (Khan et al. 1980. J. Parasitol. 66:324–328), future research should investigate blood parasites in *C. muhlenbergii*.

We thank Melody A. Kirkendall and C. Shay Garriock for assistance in the field, Don Stacey of the Invertebrate Zoology Department of the Royal Ontario Museum for confirming leech identifications, and Carola A. Haas and Joseph C. Mitchell for support and guidance. This research was supported by the U.S. Fish and Wildlife Service, Virginia Department of Game and Inland Fisheries, and the Wildlife Conservation Society.

Submitted by **RAYMOND A. SAUMURE**, Department of Natural Resource Sciences, McGill University, 21111 Lakeshore Road, Ste-Anne-de-Bellevue, Québec, H9X 3V9, Canada, and **SHAWN L. CARTER**, Department of Fisheries and Wildlife, Virginia Polytechnic Institute and State University, 100 Cheatham Hall, Blacksburg, Virginia, 24061-0321, USA.

LACERTILIA

CNEMIDOPHORUS (Whiptail Lizards). **DIET.** During 1993 field work in the Mexican state of Morelos, we collected representatives of three species of *Cnemidophorus*. Although species of *Cnemidophorus* are known to feed primarily on small insects, they occasionally prey on other reptiles. Nothing is known, however, about the sizes and kinds of reptiles consumed.

A female *C. deppei infernalis* (SVL 80 mm, tail 167 mm, mass 12 g) was collected on 14 February 1993 at Las Piedras (18°40'N, 98°59'W), in the municipality of Ayala, Morelos, México, at 1020 m elevation, in dry, tropical forest habitat. Its stomach contained a small snake, *Leptotyphlops maximus* (SVL 116 mm, mass 0.51 g).

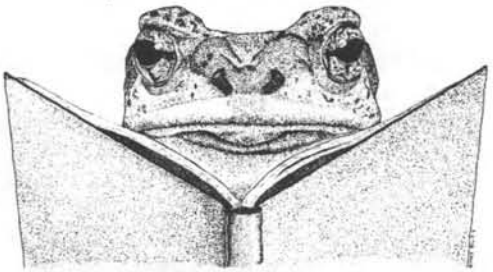
On 13 June 1993 we collected a male *Cnemidophorus sacki gigas* (SVL 129 mm, tail 163 mm, mass 65.0 g) at El Caracol

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(18°53'N, 99°00'W), in the municipality of Yautepec (1031 m elevation) in tropical dry forest. Its stomach contained six eggs of a conspecific, possibly a full clutch (mean egg mass 0.35 g ± 0.23 (0.05–0.61 g, mean length 14.5 ± 0.56 mm (14.0–15.4 mm), mean width 11.2 ± 0.7 mm (10.0–11.7 mm).

Finally, an adult male *Cnemidophorus costatus costatus* (SVL 97.0 mm, mass 27.5 g) was collected on 30 July 1993 in the same area of El Caracol. Its stomach contained the remains of a snake, *Masticophis mentovarius* (SVL 140 mm, mass 1.38 g).

These data suggest that *Cnemidophorus* in this area not only eat small invertebrates, but also reptiles and the eggs of lizards. Lizards of the genus *Cnemidophorus* are known to be an active foragers, spending considerable time searching for prey on the ground. These new data confirm their foraging habits, as the prey eaten were found in leaf litter, and the *Cnemidophorus* eggs consumed are known to be deposited on the ground among dry foliage.

We thank L. A. Fitzgerald for his comments on this manuscript, and R. J. Torres for his help in the field.

Submitted by **ALFREDO CHÁVEZ-MARTÍNEZ**, Departamento de Zoología del Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Morelos, Avenida Universidad, Col. Chamilpa, Código Postal 62210, Cuernavaca, Morelos, México, and **AURELIO RAMÍREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, Código Postal 04510, México, Distrito Federal, México.

CTENOSAURA PECTINATA (Brown Iguana) **DIET**. Reports from different locations throughout its range indicate that *C. pectinata* predominantly feeds on leaves, fruits, and insects, and to a lesser extent on nestling birds and mice (Evans 1951. Amer. Mus. Novit. 1493:1–26; Fitch et al. 1971. Southwest. Nat. 15:397–399; Alvarez del Toro 1972. Los Reptiles de Chiapas. Gob. del Edo. de Chiapas. México). Its diet on Isla Isabel, México (a 98.3 ha island 28 km off the coast of Nayarit, 21°52'N, 105°54'W), is known only from unpublished anecdotal records, and includes the new leaves and fruits of "ruache" trees (*Crataeva tapia*) during the rainy season, sooty tern (*Sterna fuscata*) and brown pelican (*Pelecanus occidentalis*) nestlings, and one report of a 3 cm^3 piece of fish. Herein we report the stomach contents of 10 *C. pectinata* captured on this island.

Lizards were captured by noosing in March 1992, during the dry season, when ruache trees do not produce leaves or fruits. The only new leaves available are those of herbaceous plants thriving on dew that accumulates overnight. At this time of year, five of the nine seabird species inhabiting the island were breeding. Six lizards were captured between 0900 and 1300 h in the northeastern part of the island, in a ruache forest that is also a major nesting site of blue-footed boobies (*Sula nebouxii*). Four additional lizards were captured in adjacent grassland.

Lizards were measured (SVL) and weighed. Eight males measured 29–36 cm SVL (33 ± 1.9 cm) and weighed 750–1650 g (1248 ± 254 g); two females measured 19–23.4 cm (21.2 ± 2.2 cm) and weighed 27–34 g (34.1 ± 3.7 g). Stomach contents were flushed out with water, and preserved in 70% ethanol. Stomachs of nine of the ten lizards contained food items. Five males and both females had *Portulaca oleracea* leaves in their stomachs. The stomachs of two other males contained animal tissue and bone fragments that were probably the remains of nestling birds, based on their size and porosity. These data and those coming from unpublished observations suggest that *C. pectinata* living in the northern part of Isla Isabel are food generalists, and opportunistically feed on nestling seabirds.

Submitted by **CRISTINA RODRIGUEZ-JUAREZ** and **JOSE LUIS OSORNO CEPEDA**, Instituto de Ecología, Universidad Nacional Autónoma de México, A.P. 70-275, 04510. D.F., México.

EUMECES LATICEPS (Broadhead Skink). **NATURAL NESTS**. Observations on natural nests in *Eumeces laticeps* suggest that eggs are laid from late June through July, that clutch size is 6–20, and that eggs are 13.0–19.8 mm long and 9.0–14.8 mm wide (Martof 1956. Herpetologica 12:111–114; Mount 1975. The Reptiles and Amphibians of Alabama. Alabama Agri. Exp. Sta. Auburn, Alabama. 347 pp.; Palmer and Braswell 1995. Reptiles of North Carolina. Univ. North Carolina Press, Chapel Hill. 412 pp.; Smith 1946. Handbook of Lizards. Cornell Univ. Press, Ithaca, New York. 557 pp.). Martof (*op. cit.*), however, mentioned one nest found in mid-September from the Blue Ridge of Georgia. Here we add to this observation by presenting information on two other clutches from Georgia.

On 2 July 1997 two *E. laticeps* were found in Seminole County, Georgia, USA, brooding 15 and 16 eggs, respectively. Both specimens were situated in oval cavities beneath a single sheet of roofing tin that was on the ground. The nests were less than one meter apart, and appeared very similar to a nest described by Martof (*op. cit.*) from Thomas County, Georgia. During discovery of the first nest, a nearby colony of imported fire ants (*Solenopsis invicta*) was disturbed. Several ants reached the nearest *Eumeces* nesting chamber and were quickly consumed by the attending female. No ants were observed to reach the second nest.

Both clutches and the attending females were collected. Eggs from both clutches appeared to be of similar size and shape, and no damage to any of the eggs was noted. Several days later, it was discovered that one of the eggs from the clutch of 15 was ruptured, and most of the contents lost. Closer examination of the container housing this clutch revealed a single large worker fire ant, although it is not known if the egg was damaged by this ant, or during transit.

Mean length for the 14 remaining eggs in this clutch was 18.06 ± 0.53 mm (range 17.40–19.13 mm); width 13.49 ±0.43 mm (range 12.75–14.10 mm); and mass 1.84 ± 0.14 g , (range 1.6–2.0 g). The attending female (SOCM 0287) measured 115.0 mm SVL, 238.8 mm TL, and 26.2 g mass. Mean egg length in the second clutch was 18.30 ± 0.87 mm (range 16.78–19.87 mm); width 12.93 ± 0.49 mm (range 12.20–13.95 mm); mass was 1.68 ± 0.20 g (range 1.3–2.0 g). The attending female of this clutch (SOCM 0288) measured 111.7 mm, 271.7 mm TL, and weighed 26.9 g.

The size of eggs in these two clutches corresponds with the upper end of known ranges for natural nests. Smith (*op. cit.*) indicated that eggs of this species increase in size as they near hatching. Thus it is possible that both clutches discussed above were near hatching.

Submitted by **ROBERT A. MOULIS** and **GERALD K. WILLIAMSON**, Savannah-Ogeechee Canal Museum and Nature Center, 681 Fort Argyle Road, Savannah, Georgia 31419-9239, USA.

PHRYNOSOMA PLATYRHINOS (Desert Horned Lizard). **PREDATION**. Known predators of horned lizards (genus *Phrynosoma)* were recently summarized (Duncan et al. 1994. Herpetol. Rev. 25:68) but no invertebrates were included. We observed apparent predatory behavior on *P. platyrhinos* by a scorpion during a nocturnal survey of the East Pinta Sands, Cabeza Prieta National Wildlife Refuge, Arizona, USA. The area is a sparsely-vegetated sand sheet within the Lower Colorado River Valley Subdivision, Sonoran Desertscrub community (Turner and Brown 1982. *In* D. E. Brown, ed., Biotic Communities of the American Southwest—United States and Mexico, pp. 181–221. Desert Plants 4). At 2120 h on 6 May 1997, we discovered an adult *Hadrurus arizonensis* (Arizona giant hairy scorpion) carrying on its back a juvenile *P. platyrhinos* in an upside-down position (Fig. 1). The scorpion had a firm grasp with its chelicerae on the lizard's dorsal skin at the base of the tail. The lizard's left rear leg was held in the scorpion's left pedipalp, and the right rear leg was supported by its right pedipalp, so that the lizard's head rested on the base of the scorpion's tail. The lizard was still alive, and managed to break free after we had been observing the pair for ca. 30 min. We held the lizard overnight and released it, apparently unharmed, the following morning. The scorpion had a body (carapace + mesosoma) length of 44 mm, tail (metasome + telson, excluding recurved portion of telson) 51 mm, and mass 8.3 g. Lizard SVL was 52 mm, tail 26 mm, mass 6.4 g.

Although horned lizards commonly spend summer nights burrowed into the ground (Heath 1965. Univ. California Publ. Zool. 64:97–136), nocturnal activity by *P. platyrhinos* has been described (Pianka and Parker 1975. Copeia 1975:141–162). This potentially puts it into contact with *H. arizonensis*, which is most active in the first hour after sunset (Fox 1975. Unpubl. Ph.D. dissertation, Arizona State Univ., Tempe). Laboratory tests found that while stinging was a common behavior in capturing large prey, *H. arizonensis* venom had no lethal or immobilizing effect on several lizard and mouse species. Envenomation, however, was not necessary for successful ingestion of vertebrate prey so long as the scorpion could immobilize its prey with its pedipalps (Hadley and Williams 1968. Ecology 49:726–734). *Hadrurus arizonensis* has been found in densities up to 0.5/m^2 in the Colorado Desert (Williams 1980. Occ. Pap. California Acad. Sci. 135:1–127), and thus may be a significant predator on horned lizards in shared habitat.

We thank George Bradley for assistance with scorpion description and literature.



FIG. 1. Juvenile *Phrynosoma platyrhinos* captured by an adult *Hadrurus arizonensis*.

Submitted by **DALE S. TURNER**, School of Renewable Natural Resources, University of Arizona, Tucson, Arizona 85721, USA, and **JIM RORABAUGH**, Arizona Ecological Services Office, U.S. Fish and Wildlife Service, 2321 West Royal Palm Road #103, Phoenix, Arizona 85021, USA.

PTYODACTYLUS OUDRII (NCN). **PARENTAL CARE.** Parental care through egg-attendance is a common behavior in some vertebrates but is relatively rare in reptiles. Reported examples in reptiles are indeed very primitive and include a) the active manipulation of eggs soon after oviposition to locate them at favorable places, b) parents remaining in the vicinity of the eggs after oviposition, returning to them regularly, c) a more complex behavior where the parent(s) remain coiled around the eggs to facilitate embryonic development by thermogenesis, d) active defense of clutches against potential predators and finally, more rarely, e) the care of newly hatched juveniles (cf. Shine 1988. *In:* C. Gans and R. B. Huey, eds., Biology of the Reptilia. Defense and Life History. Vol. 16, Ecology B. A. R. Liss Inc. New York, pp. 275–329). All these behaviors are likely to increase the survival of offspring.

The manipulation of eggs after oviposition is rare in Squamata and so far, has never been reported in geckos. The only reported exception refers to the relocation of eggs soon after oviposition in the Moorish gecko, *Tarentola mauritanica*, to settle them at suitable places (Nettman and Rykena 1979. Salamandra 15:53–57). Here, we describe a noteworthy example of parental care by manipulation, body rubbing of the eggs, and egg licking in *Ptyodactylus oudrii*. To our knowledge, this is the first time that this complex type of parental care has been reported in reptiles.

Ptyodactylus oudrii is an insectivorous, small sized (adult SVL 50 mm, mass 3.4–7 g) gecko found in mountain areas of Tunisia, Algeria, and Morocco (Heimes 1987. Salamandra 23:212–235; Le Berre 1989. Fauna du Sahara I. Poisson-Amphibies Reptiles. Lechevalier-R. Chabaud, Paris, 352 pp.) in very harsh, arid zones throughout its distribution. The species lives in small colonies (mean = 10 individuals, range 4–20) on the vertical and overhead walls of caves and culverts under roads (García-Márquez et al. 1996. Bol. Asoc. Herpetol. Esp. 7:28–30). The presence of a morphological adaptation in their limbs (a "plumage" structure instead of claws) allows them to walk on these surfaces. As in other species of *Ptyodactylus*, this gecko performs communal oviposition, fixing the clutches directly onto the overhead or lateral walls of the caves. Clutch size is often two, with calcified, spherical, white eggs, 12–14 mm diameter. In captivity, *P. oudrii* completes its reproductive cycle in 40 days, laying multiple clutches per year (unpubl. data).

A total of 31 *P. oudrii* (15 males and 16 females) were captured near Ouarzazate (30°55'N, 6°51'W, S Morocco) in May 1990 and transported by car to Sevilla (southern Spain) for detailed observations of parental care. The geckos were kept in communal cages (3 x 3 x 1 m) under lab conditions, at ambient temperatures (28–31°C) with a 12:12 h light regime. The walls of the cages consisted of a mesh grid (0.3 cm width) with a cover allowing the geckos to walk on overhanging surfaces. A glass terrarium was also used for detailed observations. Both the cage and the terrarium were provided with a 10 cm sand substrate and were watered regularly to increase ambient humidity. Food (crickets, cockroaches, and mealworms) and water were provided *ad libitum*. The geckos completed several reproductive cycles in captivity, showing no apparent stress.

A unique nesting site was observed in each cage. The clutches hung from the ceilings of each cage, or, less often, on the vertical walls of the terraria, typical behavior observed in free-ranging

geckos (see García-Márquez et al. in press *op. cit.*). Clutch size was consistently two with different clutches easily distinguishable. The remains of previous nesting attempts (e.g., shells, carcasses) were also observed at each nesting place. Parental care observed included egg cleaning by continuous body rubbing and egg-licking with the tongue. Geckos moved freely within the clutches. All geckos available in the colony (both sexes, all age-classes) performed active manipulation of eggs during incubation, returning regularly. Each individual attended not only to its own clutch, but to others, an example of communal parental care. Eggs were not moved from their original oviposition location. Often, several geckos remained in the vicinity of a clutch after oviposition, returning to it regularly, thus keeping the nesting site attended by at least one individual at all times.

The manipulation of eggs by *P. oudrii* may represent an active defense against pathogens or fungal attacks (e.g., Forester 1979. Copeia 1979:332–341; Shine 1988, *op. cit.*). Other potential sources of mortality such as predation or egg desiccation might also be reduced. According to Noble and Mason (1933 in Shine 1988, *op. cit.*), parental care in reptiles may have evolved more rapidly in non-burrowing species where appropriate limbs to excavate a nest are lacking. Also, parental care is more likely to occur in harsh, highly variable environments (Huntingford 1984. The Study of Animal Behaviour. Chapman and Hall, 411 pp. Cornwall). Presumably, both factors may have played an important role in the evolution of this behavior in *P. oudrii*.

Animals were collected under a license from the Kingdom of Morocco (77-c/57-51-0).We thank Arturo González for raising the geckos in captivity. Comments provided by Claudia Keller and Carmen Díaz Paniagua improved this note. The work was financed by a DIGICYT project (PB# 94-0008) and a travel grant from Junta de Andalucía (group 4088).

Submitted by **JOSÉ ANTONIO MATEO** and **MARIANO CUADRADO**, Estación Biológica Doñana, Pabellón del Perú, Avda. de María Luisa, Apartado de Correos 1056, Sevilla E-41080, Spain.

SCELOPORUS UNDULATUS ELONGATUS (Northern Plateau Lizard). **MATING BEHAVIOR**. On 7 June 1997 at 0915 h, I encountered a male and female *Sceloporus undulatus elongatus* on a small rock outcrop at the confluence of Currant Creek and Flaming Gorge Reservoir, Sweetwater County, Wyoming, USA. The male was positioned diagonally across the back of the female so that his cloaca was to the right of hers. He was biting her neck just behind the left side of her head. The female attempted to remove the male from her back by lifting her hindlegs, one at a time, and scratching the male, while also moving around in a circle. The female then rolled onto her back, squirmed, and dislodged the male. Next, she stood parallel to the male and arched her back. Meanwhile, the male had righted himself. The female turned and faced the male while still in the arched posture, then charged him. The male retreated about 1 m up the rock outcrop. At this point, I captured both lizards (male: 57 mm SVL; 78 mm tail length; 5 g; female: 73 mm SVL; 86 mm tail; 14 g).

The behavior of the female could be interpreted in one of two ways. She may have been startled by me, thus triggering an escape attempt. Alternatively, this may have been rejection behavior in response to attempted copulation.

I thank Kristi L. Ashton and Alan de Queiroz for comments and suggestions on the manuscript.

Submitted by **KYLE G. ASHTON**, Department of EPO Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA.

SERPENTES

CHAMAELYCUS FASCIATUS (NCN). **DIET.** Few data are available on the feeding habits of *Chamaelycus fasciatus*, a small African colubrid snake reaching 350 mm total length (Doucet 1963. Les Serpents de la Côte d'Ivoire. Acta Tropica 20(3):201–340). Doucet (*op.cit.*:245) and Villiers (1975: 108. Les serpents de l'ouest africain. Intitiations et études africaines. No. II. 3ème édition, Université de Dakar, Institut Fondamental d'Afrique Noire. Les Nouvelles Editions Africaines, 195 pp.) reported it feeding on beetles and reptile eggs. An adult male (SVL 272 mm, tail 48 mm), collected in Congo, area of Loango, cataloged in the Paris Natural History Museum (MNHN 1973.1249) had a gerrhosaurid lizard, *Gerrhosaurus nigrolineatus* (SVL 62 mm, tail 135 mm), in its stomach (MNHN 1997.3339).

Submitted by **IVAN INEICH**, Museum National d'Histoire Naturelle, Laboratoire de Zoologie (Reptiles and Amphibiens), 25 rue Cuvier, F-75005 Paris, France; e-mail: Ineich@cimrs1.mnhn.fr.

CONOPHIS VITTATUS VITTATUS (Road Guarder, Guardo Camino). **CLUTCH SIZE.** On 17 March 1994 we collected a gravid *Conophis vittatus vittatus* from tropical dry forest at the Biological Field Station Chamela, Jalisco, México (19°30'N, 105°03'W). The snake was kept in captivity for two months after capture, with oviposition occurring on 21 May. The snake measured 620 mm SVL, tail 140 mm, mass 87.8 g before oviposition, and weighed 64.1 g after oviposition. Clutch size was 12 eggs and mean egg mass was 2.07 g (3.25–0.70 g). Mean egg length and width were 23.9 mm (18.5–29.5 mm) x 12.2 mm (9.5–14.3 mm); relative clutch mass (RCM) was 0.28 g. The RCM value is comparable to those for snakes of similar size (Seigel et al. 1986. Herpetologica 42:179–185; Ramírez-Bautista et al. 1995. Herpetol. Rev. 26:12–13).

We thank S. Monk for comments on the manuscript.

Submitted by **AURELIO RAMÍREZ-BAUTISTA** and **CARLOS BALDERAS- VALDIVIA**, Instituto de Biología, UNAM, Departamento de Zoología, A.P. 70-153, C. U., C. P. 04510, México 20, Distrito Federal, México.

BOTHROPS FONSECAI (Fonseca's Lancehead). **REPRODUCTION and SIZE.** Among the heavy-bodied pitvipers of the *Bothrops alternatus* group, *B. fonsecai* is the least known. This snake is found in montane areas of southeastern Brazil with mixed broadleaf and *Araucaria* pine forest (Campbell and Lamar 1989. The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York, 425 pp.). Here we provide data on reproduction and size for this species from two localities in São Paulo State.

A large (967 mm SVL, 112 mm tail length [TL]) female *B. fonsecai* was found DOR on 22 January 1993 in the Serra do Mar at Cunha (23°10'S, 44°55'W, 1120 m elevation), and deposited in the reptile collection of the Museu de História Natural, Universidade Estadual de Campinas (ZUEC 1562). The oviducts contained 14 fully-developed embryos, one of which was dam-

aged and not measured (SVL mean ± SD [range] in mm = 217.7 ± 5.9 [205–229]; TL = 36 ± 3.5 [27–42]).

The only reported measurements for *B. fonsecai* are that of the male holotype (Hoge and Belluomini 1959. Mem. Inst. Butantan 28:195–206). We measured 12 adult males that were collected in the Serra da Mantiqueira at Campos do Jordão (22°44'S, 45°35'W, 1540–1600 m elevation) and deposited at ZUEC (SVL = 661.6 ± 72 [550–755 mm]; TL = 104.1 ± 11.9 [80–120] mm). One female collected at this site measured 810 mm SVL and 100 mm TL. The related *Bothrops cotiara* averages 700–800 mm in total length and may reach 1000 mm (Campbell and Lamar, *op. cit.*).

We thank H. K. M. Corrêa and P. E. G. Coutinho for collecting the Cunha snake; O. Augusto, S. A. Chini, and C. R. C. Souza for help with fieldwork at Campos do Jordão; the Instituto Florestal (through M. J. Robim and J. L. Carvalho) for logistical support at Campos do Jordão and Cunha sites; and the CNPq for financial support.

Submitted by **IVAN SAZIMA** and **PAULO ROBERTO MANZANI**, Departamento de Zoologia and Museu de História Natural, Universidade Estadual de Campinas, 13083-970 Campinas, São Paulo, Brazil.

ERYTHROLAMPRUS BIZONA (False Coral Snake). **DIET**. In the garden of a hotel in Curimagua, Estado Falcón, Venezuela, ca. 1150 m elevation, we found a false coral snake, *Erythrolamprus bizona* (CIEZAH 387), which subsequently regurgitated an adult *Ninia atrata* (CIEZAH 388). The *Ninia* was partially digested from the anal plate to the tail. Ophiophagy is well known in the genus *Erythrolamprus* but this is the first report of identified prey in Venezuela (Roze. 1970. Ciencia y Fantasia de las Serpientes de Venezuela. Editorial Fondo de Cultura Científica, Caracas. 160 pp.; Lancini and Kornacker. 1989. Die schlangen von Venezuela. Verlag Armitano Editores. Caracas. 381 pp.). The two specimens are deposited in the Herpetological Collection of the Centro de Investigaciones en Ecología y Zonas Áridas (CIEZAH), Universidad Francisco de Miranda, Coro, Venezuela.

Submitted by **ABRAHAM MIJARES-URRUTIA** and **ALEXIS ARENDS R.**, Centro de Investigaciones en Ecología y Zonas Áridas (CIEZA), Universidad Francisco de Miranda, Apartado 7506, Coro 4101-A, Venezuela; e-mail (AM): amijares@reacciun.ve and (AA): aarends@funflc.org.ve.

CROTAPHOPELTIS HOTAMBOEIA (White Lipped Snake). **SNAKEBITE**. The venom of *Crotaphopeltis hotamboeia* is thought to be harmless to humans (Spawls and Branch 1995. The Dangerous Snakes of Africa. Ralph Curtis Books, Sanibel Island, Florida. 192 pp.) yet fatal to small mammals and fowl (Frei 1910. Ztschr. F. Infektionskr., par Krankh U hyg. D. Haoustiere 3:211–217; FitzSimons 1912. The Snakes of South Africa; Their Venom and the Treatment of Snake-bite. T. Maskew Miller, Cape Town, South Africa. 547 pp.). At the Serena Lodge in Amboseli National Park, Kenya, at ca. 0130 h on 2 November 1989, a 22 year-old female was bitten while trying to rescue a *C. hotamboeia* (ca. 60 cm SVL) from a domestic cat. The bite was on the right index finger, and although the wounds were small, bleeding was immediate, profuse, and lasted several minutes. By dawn a large, medial hematoma was present. The hematoma was darkest at the wrist and extended up the right arm almost to the elbow. The hematoma and profuse bleeding are characteristic of a venom possessing anticoagulatory, hemorrhagic, spreading, and possibly hemolytic factors. The hematoma disappeared over the next several days, with no further ramifications. The snake was released in Amboseli on the day following the incident.

We thank Michael C. Cheptumo, Curator of the Snake Park at the National Museum of Kenya, Nairobi, who verified the identification of the snake from a photograph.

Submitted by **PHYLLIS A. BREDEHOFT**, Division of Neonatology, Children's Mercy Hospital, 2401 Gillham Road, Kansas City, Missouri 64108, USA, and **DONALD D. SMITH**, Division of Allergy and Rheumatology, University of Kansas Medical Center, 3901 Rainbow Boulevard, Kansas City, Kansas 66160, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). **PREDATION**. In his monograph on the ringneck snake (*Diadophis punctatus*), Fitch (1975. A Demographic Study of the Ringneck Snake, *Diadophis punctatus*, in Kansas. Misc. Publ. 62, Univ. Kansas Mus. Nat. Hist. 53 pp.) recorded three avian predators: the red-tailed hawk (*Buteo jamaicensis*), broad-winged hawk (*B. platypterus*), and great horned owl (*Bubo virginianus*). Here, we add a non-raptor, the American robin (*Turdus migratorius*), to this list of avian predators.

On 15 August 1996, DLH saw an adult robin capture a ringneck snake (ca. 20 cm TL). The encounter was observed through 7 X 42 binoculars and took place on the front lawn of DLH's Cincinnati, Ohio (USA) home. After pecking at the snake numerous times, the bird coiled the apparently dead snake in its bill and flew into the crown of a nearby tree. Later in the afternoon, SEH located a robin nest in the tree. The nest held two fully-grown young who fledged the following day.

The American robin previously has been reported as a predator of *Storeria dekayi* (Netting 1969. Wilson Bull. 81:471), *Thamnophis sauritus* (Eiserer 1976. The American Robin. Nelson Hall, Chicago, Illinois. 175 pp.), and *T. sirtalis* (Davis 1969. Wilson Bull. 81:470–471).

Submitted by **DAVID L. HEDEEN**, Department of Entomology and Applied Ecology, University of Delaware, Newark, Delaware 19717, USA; and **STANLEY E. HEDEEN**, Department of Biology, Xavier University, Cincinnati, Ohio 45207, USA.

EUNECTES MURINUS (Green Anaconda) and ***PHRYNOPS GIBA*** (Gibba Turtle). **PREDATION.** On 7 January 1997, we observed a male *Eunectes murinus* constricting a *Phrynops giba* in the Bush Bush Wildlife Sanctuary, Trinidad, West Indies (Fig. 1). The anaconda had been there less than 24 h, as we had been to this location (10°02.273 N, 61°23.473 W; reading obtained from Trimble ScoutMaster GPS) the previous day. Our intrusion prompted the anaconda to release its hold, allowing the turtle to escape, apparently unharmed. The anaconda had a total body length of ca. 3.65 m; the turtle's carapace length was ca. 16 cm. Mole (1924. Proc. Zool. Soc. London [1]:235–278; cited in Murphy 1997. Amphibians and Reptiles of Trinidad and Tobago. Krieger Publ. Co., Malabar, Florida. 245 pp.) reported that turtles are included in the diet, but does not list species.We are unaware of other reports of anacondas attempting to eat turtles, and it is unclear whether this attempted predation would have been successful.

We thank Kim Phillips (Hiram College) for allowing us to accompany her to the Bush Bush Wildlife Sanctuary, and C. L.

Abercrombie (Wofford College) for assistance in identification of these species.

Submitted by **CARRIE ELVEY** and **KAREN NEWLON**, Department of Biology, Hiram College, Hiram, Ohio 44234, USA.

HIEROPHIS VIRIDIFLAVUS (Western Whip Snake). **NESTING HABITAT.** The western whip snake (*Hierophis viridiflavus*) is a large (up to 180 cm total length), oviparous colubrid that is widespread and extremely abundant over much of the Italian peninsula (Bruno and Maugeri 1990. Serpenti d'Italia e d'Europa, Editoriale G. Mondadori, Milano, 224 pp.). Little is known about the nesting habitat of this species. This note provides preliminary information on this issue.

On 16 May 1996, a female *H. viridiflavus* (86.0 cm SVL, 15.5 cm tail length) was captured in the internal pinewood (*Pinus pinea*) area of the Forest of Castel Fusano (ca. 20 km W of Rome). Palpation revealed that the snake was gravid. The snake was marked by ventral scale-clipping and released. On 22 May 1996 she was recaptured, 530 m from the site of first capture, in a spot where sandy dunes face the sea. Evidently she was in the process of laying eggs, and in fact egg-laying occurred on 30 May 1996 at 0740 h. Three eggs were deposited in a rodent shelter in the sandy soil. This clutch size is consistent with other data for this species (Capula and Luiselli. 1995. Herpetol. Rev. 26:38–39; Luiselli 1995. Rev. Ecol. [Terre et Vie] 50:365–376). The latest contact with this snake occured on 24 October 1996, when she was seen basking on dry leaves, 37 m from the first capture spot and 480 m from the oviposition site.

Because young snakes were frequently seen in the sandy dunes facing the sea, we suggest that female snakes in general tend to use the sandy dunes facing the sea for nesting.

We thank U. Agrimi, F. M. Angelici, M. Capula, B. Hansen, and C. Sisto for critically reviewing of an earlier draft of the manuscript.

Submitted by **ERNESTO FILIPPI** and **LUCA LUISELLI,** Department of Animal and Human Biology, University of Rome "La Sapienza," via Alfonso Borelli 50, I-00161 Rome, Italy.

LAMPROPELTIS CALLIGASTER CALLIGASTER (Prairie Kingsnake). **ALBINISM.** On 4 September 1996 an amelanistic *Lampropeltis c. calligaster* was collected from under a pile of mulch surrounding a recently planted river birch in Independence, Jackson County, Missouri, USA (T49N, R31W, Sec. 5). The snake (male: 552 mm SVL, 100 mm tail length) is a partial albino with xanthophores, pink eyes, and is similar in appearance to the specimen described by Clark et al. (1983. Herpetol. Rev. 14:120) from adjacent Wyandotte County, Kansas. The snake is currently on display at the Lakeside Nature Center, Kansas City, Missouri, and will be deposited in the Bobby Witcher Memorial Collection at Avila College, Kansas City, Missouri, upon its death.

Submitted by **KEVIN D. HOGAN**, Lakeside Nature Center, 5600 East Gregory Boulevard, Kansas City, Missouri 64132, USA, and **DONALD D. SMITH**, Division of Allergy and Rheumatology, University of Kansas Medical Center, 3901 Rainbow Boulevard, Kansas City, Kansas 66160, USA.

LAMPROPELTIS GETULA FLORIDANA (Florida Kingsnake). Combat Ritual. Combat rituals between male snakes have been recorded in rattlesnakes, *Sistrurus miliarius* (Carpenter 1979. Copeia 1979:638–642) and *Crotalus lepidus* (Carpenter and Murphy 1976. Copeia 1976:764-780), and speckled kingsnakes, *Lampropeltis getula holbrooki* (Carpenter and Gillingham 1977. Southwest. Nat. 22:517–524). Zug (1993. Herpetology: An Introductory Biology of Amphibians and Reptiles. Academic Press, Inc., San Diego, California. 527 pp.) noted that combat rituals in snakes may be performed due to territoriality, or to establish dominance in the presence of a sexually receptive female. Here we describe a combat ritual observed in Florida kingsnakes (*Lampropeltis getula floridana*) in southern Florida. On 7 February 1993, at 1415 h and 24°C, two male *L. g. floridana* were observed along a canal bank just north of Clewiston, in Glades County, Florida, USA. It had been raining all morning, was overcast and very windy. The snakes (116 cm and 130 cm SVL) were first noticed after hearing them rustling in dry grass. The snakes were entwined, with their anterior segments off the ground, biting one another, swaying, and pushing against each other, with each one briefly forcing the other beneath it. After ca. 5 min of observation, both snakes were captured. Both had numerous, bloody bite marks along their bodies, and the largest snake had one hemipenis everted. Although no females were observed in the immediate vicinity, five other *L.g. floridana*, including two females, were captured within 50 m and 0.5 h of these two males, indicating great activity at this time. Our observation suggests that *L.g. floridana* may begin breeding as early as February in southern Florida. All snakes were released at their capture site after data collection.

Submitted by **KENNETH L. KRYSKO***, Department of Biological Sciences, University Park Campus, Florida International University, Miami, Florida 33199, USA, **LEONARD E. KRYSKO**, 7575 128 Street N, Seminole, Florida 33776, USA, and **BRIAN DIERKING**, 6338 Baldwyn Avenue, New Port Richey, Florida 34653, USA. *Present address: Department of Wildlife Ecology and Conservation, N-Z Hall, University of Florida, Gainesville, Florida 32611, USA.

PSAMMOPHIS SCHOKARI (Schokari Sand Snake). **DIET.** *Psammophis schokari* is the most widespread and often-encountered snake in Egypt's deserts (pers. obs.); however, little is known about its diet. Flowers (1933. Proc. Zool. Soc. London:735–851) states that he found *P. schokari* hunting in vegetation, probably for lizards of the genera *Mesalina* and *Acanthodactylus*. Schleich et al. (1996. Amphibians and Reptiles of North Africa, Koeltz Scientific Publishers, Koenigstein. 630 pp.) reports *P. schokari* preying on *Agama impalearis*. On 25 June 1997 an immature *Chamaeleo chamaeleon* was found in the stomach of a roadkilled *P. schokari* in the Zaranik Protected Area, North Sinai, Egypt. No other prey was found in the stomach. We believe this is the first record of *C. chamaeleon* in the diet of *P. schokari*. Both specimens were too damaged for measurements. The two species are common and widespread in the sands of North Sinai and share similar desert vegetation microhabitats. The frequency of predation of *C. chamaeleon* by *P. schokari* may thus be potentially high in this region.

We thank Mr. Waheed Salama, Manager of the Zaranik Protected Area, for his hospitality and cooperation.

Submitted by **SHERIF BAHA EL DIN**, Nature Protection Sector, Egyptian Environmental Affairs Agency, 3 Abd Alla El Katib Street, Dokki, Cairo, Egypt, and **OMAR ATTUM**, University of Louisville, 8807 Linn Station Road, Louisville, Kentucky 40222, USA.

RHINOBOTHRYUM LENTIGINOSUM (NCN). **DIET**. Little is known about the diet of the neotropical colubrid *Rhinobothryum lentiginosum*. Cunha and Nascimento (1993. Bol. Mus. Par. Emílio Goeldi sér. Zool. 9:1–191) stated that *R. lentiginosum* feeds on lizards, although they did not provide the number of specimens examined or the lizard taxa found. Here we provide nine substantiated food records of *R. lentiginosum* from Brazilian Amazonia.

Twelve specimens of *R. lentiginosum* were examined. Eleven of these are in the Museu Paraense Emílio Goeldi (MPEG). Data from an additional specimen were provided via personal communication from L. J. Vitt and J. P. Caldwell. The remains of nine prey items were found in six of these snakes (Table 1). Our results indicate that *R. lentiginosum* is a lizard specialist. Further, all prey items are primarily arboreal (unpublished data), indicating that *R. lentiginosum* may forage in the vegetation.

Logistical support and permission to examine snakes at MPEG were kindly provided by T. C. S. Avila-Pires, I. F. F. dos Santos, and A. C. M. Lima. The Conselho Nacional de Desenvolvimento Científico e Tecnológico provided a grant to M. Martins. L. J. Vitt and J. P. Caldwell kindly provided unpublished information.

TABLE 1. Gut contents of six specimens of *Rhinobothrium lentiginosum* from Brazilian Amazonia. TL = total length.

Source	Locality	TL (mm)	Gut contents
MPEG 16570	Marabá, Pará	1480	*Plica plica*
MPEG 16672	Amapá	1279	*Mabuya* sp.
MPEG 16840	Marabá, Pará	1233	*Plica umbra* and the remains of another lizard
MPEG 17011	Marabá, Pará	1275	*Polychrus marmoratus* and the remains of another lizard
MPEG 18779	Benfica, Pará	1046	*Polychrus marmoratus* and the remains of another lizard
Vitt & Caldwell	Altamira, Pará	580	*Gonatodes humeralis*

Submitted by **M. ERMELINDA OLIVEIRA**, Departamento de Parasitologia, Instituto de Ciências Biológicas, Universidade do Amazonas, 69077-000 Manaus, Amazonas, Brazil, and **MARCIO MARTINS**, Departamento de Zoologia, Instituto de Biociências, Universidade Estadual Paulista, Caixa Postal 199, 13506-900 Rio Claro, São Paulo, Brazil.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 29, Number 1 (March 1998).

CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). USA: GEORGIA: DOUGHERTY CO: Albany. 18 January 1969. L. R. Davis. INHS 10284. Verified by P. W. Smith. New county record (Williamson and Moulis 1994, Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

AMBYSTOMA TEXANUM (Smallmouth Salamander). USA: ILLINOIS: CLAY CO: 7.2 km NW Noble. 11 June 1977. R. L. Mayden. INHS 10428. Verified by P. W. Smith. New county record.

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

AMBYSTOMA TIGRINUM (Tiger Salamander). MÉXICO: AGUASCALIENTES: Asientos, Presa "El Llavero" (22°04'N, 102°05'W) in thorn shrub. 17 August 1980. Javier Espinosa and Joel Vásquez-Díaz. Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA-VA 00036-1–4, UAA-VA 00037); at Presa "Charcas Verdes," 2 km E of "La Tinajuela" (22°04'N, 101°55'W). 23 August 1989 (UAA-VA 00152); at "La Tinajuela." 16 August 1993 (UAA-VA 00162). All verified by Mario Mancilla. First records for the state and range extension of 135 km NW Guanajuato (Maldonado-Koerdell 1948. Mem. Revta. Soc. Cient. Antonio Alzate 56(2/3):185–226).

Submitted by **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes. Centro Básico, Departamento de Biología, Avenida Universidad 940, C. P. 20100, Aguascalientes, Aguascalientes, México, and **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México, Distrito Federal 04510, México.

AMBYSTOMA TIGRINUM TIGRINUM (Eastern Tiger Salamander). USA: SOUTH CAROLINA: CHESTERFIELD CO: 34°31'N, 80°13'W, ca. 1.5 mi N of U.S. Rt 1 on Wildlife Drive at jct of Wildlife Drive and Little Alligator Creek, Carolina Sandhills National Wildlife Refuge. 27 April 1997. W. B. Blihovde. KU Color Slide 11256. Verified by Lou Ehrhart. First record of an ambystomid salamander on the refuge.

Submitted by **WILLIAM B. BLIHOVDE**, Department of Biology, University of Central Florida, Orlando, Florida 32816-2368, USA.

AMPHIUMA MEANS (Two-toed Amphiuma). USA: LOUISIANA: TANGIPAHOA PARISH: Joyce Wildlife Management Area, ca. 4 km S Ponchatoula. 22 April 1996. John G. Himes and Christo-

pher Sheil. Louisiana State University Mueum of Natural Science (LSU 57944). Verified by Travis W. Taggart. Adult captured by hand in cypress-tupelo gum swamp. Fourth parish record; extends range ca. 19 km S of presently known distribution and represents the southwesternmost record for this species (Dundee and Rossman 1989. Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge. 300 pp.; Conant and Collins 1991. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.; Doody et al. 1995. Herpetol. Rev. 26:150).

Submitted by **JOHN G. HIMES**, Museum of Life Sciences, Louisiana State University in Shreveport, One University Place, Shreveport, Louisiana 71115-2399, USA, and **CHRISTOPHER A. SHEIL**, Department of Herpetology, Natural History Museum, University of Kansas, Lawrence, Kansas 66045, USA.

EURYCEA CIRRIGERA (Southern Two-Lined Salamander). USA: GEORGIA: Dougherty Co: N of Albany. 2 March 1969. L.R. Davis. INHS 10038. Verified by P. W. Smith. New county record (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

EURYCEA QUADRIDIGITATA (Dwarf Salamander). USA: GEORGIA: Dougherty Co: Albany. 26 January 1969. L. R. Davis. INHS 10033. Verified by P. W. Smith. New county record (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

ANURA

ACRIS CREPITANS BLANCHARDI (Blanchard's Cricket Frog). USA: ILLINOIS: Livingston Co: 1.6 km W Pontiac, Vermilion River at Co. Rd. 1800N (SE 1/4, SE 1/4 Sec. 17, T28N, R05E; UTM Zone 16: N4527480m, E359910m). 6 September 1995. K. S. Cummings, C. A. Taylor and A. E. Mankowski. INHS 12115. Verified by C. A. Phillips. New county record.

Submitted by **JOHN E. PETZING, KEVIN S. CUMMINGS** and **CHRISTOPHER A. TAYLOR**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

ASCAPHUS TRUEI (Tailed Frog). USA: CALIFORNIA: Shasta Co: Squaw Creek drainage: unnamed tributary of Horse Creek (a tributary of Squaw Creek), 1 km NW Little Bagley Mountain, SE1/4 of NE1/4 Sec. 35, T37N, R2W. 25 September 1993 (16 tadpoles); Pit River drainage: Baker Creek, tributary of Kosk Creek (a tributary of the Pit River), 4 km NW Big Bend, NW1/4 of NW1/4 Sec. 24, T37N, R1W. 30 March 1994 (KU Color Slide 11252,1 tadpole); Pit River drainage, Shotgun and Little Shotgun Creeks, tributaries of Kosk Creek (a tributary of the Pit River), both 5 km NW Big Bend, center of Sec. 13, T37N, R1W. 4 April 1994 (KU Color Slides 11253–254, 2 and 9 tadpoles, respectively). All observations by Lee and Matthew Simons. Ten specimens from the Squaw Creek drainage sample were sent to Redwood Sciences Laboratory for tissue samples (RSL 1456–1465); the balance were released immediately. Representatives from each site of the Pit River drainage samples were photographed and released. Specimens and slides verified by Hartwell Welsh. First records for each drainage (Bury 1968. Herpetologica 24:39–46; Bury et al. 1969. J. Herpetol. 3:157–161). Pit River drainage samples represent easternmost localities for the species in California (Stebbins 1985. Peterson Field Guide to Western Reptiles and Amphibians. Second ed. Houghton Mifflin Co., Boston, Massachusetts 336 pp.; Hartwell Welsh, pers. comm., 17 September 1992). Many sites in the area remain unsampled. Specimens were handled and collected under permits from the California Department of Fish and Game.

Submitted by **LEE H. SIMONS** and **MATTHEW SIMONS**, Shasta Natural History Foundation, 913 Shasta Avenue, Yreka, California 96097-3115, USA.

BUFO CRISTATUS. MÉXICO: PUEBLA: Municipio de Zacapoaxtla, Apulco, Cascada de La Gloria, 1500 m elev. (19°55'N, 97°38'W). 6 July 1995. Emilio Roberto Muñoz. Benemerita Universidad Autonoma de Puebla (EBUAP 544–545). Verified by Adrian Nieto Montes de Oca. Extends the known distribution of this species ca. 40 air km ENE of Tezuitlán, Puebla (Mendelson 1997. Herpetologica 53:278). Both are subadult males (SVL 42.7 mm and 37.7 mm, respectively); found in leaf litter in primary cloud forest near the Cascada (waterfall) de La Gloria. Another specimen (TNHC 54943) of this rare species, brought to our attention by David C. Cannatella, lacks any more precise locality data other than "Mexico." This specimen is an adult male (SVL 68.8 mm) and verifies the speculation by Mendelson (1997 *op cit.*:283) that this species lacks vocal slits. This is not the specimen collected and photographed by R. Altig in 1970 (see Mendelson, *op cit*: Fig 6; the most recent sighting of this species before discovery of the individuals reported herein); Altig's specimen was sent alive to W. F. Blair at TNHC (R. Altig, per. comm.), but evidently never was preserved and deposited in a museum.

Submitted by **JOSEPH R. MENDELSON III**, Department of Biology, Utah State University, Logan, Utah 84322, USA, and **LUIS CANSECO-MARQUEZ**, Laboratorio de Herpetología, Escuela de Biología, Benemerita Universidad Autónoma de Puebla, C.P. 72570, Puebla, México.

BUFO TERRESTRIS (Southern Toad). USA: ALABAMA: Dale Co: Fort Rucker Military Reservation. 10 March 1974. V. L. Morris. INHS 10141. Verified by P. W. Smith. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

CHIASMOCLEIS CAPIXABA. BRAZIL: BAHIA: Nova Viçosa (17°53'S, 39°22'W). 7 April 1997. Monique Van Sluys. Museu Nacional do Rio de Janeiro 18924–19025 and 19052–274. Verified by Ulisses Caramaschi. More than 300 individuals fell in pitfalls along drift fences after a night rain. Species was recently described (Cruz et al. 1997. Alytes 15[2]:49–71) from Aracruz, state of Espírito Santo, and was known only the from type local-

ity. First record for the state of Bahia; extends range ca. 600 km north from type locality and represents the northernmost record for the species. Frogs of the genus *Chiasmocleis* are rarely found in nature due to their short breeding period (Kasahara and Haddad 1997. J. Herpetol. 31:139–142).

Submitted by **MONIQUE VAN SLUYS**, Setor de Ecologia, DBAV, IB, Universidade do Estado do Rio de Janeiro, 20550-013, Rio de Janeiro, Rio de Janeiro, Brazil.

ELEUTHERODACTYLUS COQUI (Puerto Rican Coqui). DOMINICAN REPUBLIC: DISTRITO NACIONAL: Santo Domingo, Calle Rosa Duarte No. 21, Gazcue, Santo Domingo 2, República Dominicana (UPRRP 5746–47) and Calle Eric Leonard Ekman No. 10 (Camino del Oeste), Arroyo Hondo, Santo Domingo, República Dominicana (UPRRP 5748). 15 January 1996. R. L. Joglar, N. Rios-López and I. Cruz. Verified by Richard Thomas. Museo de Biología, Universidad de Puerto Rico-Recinto de Río Piedras. First record for Dominican Republic. One population at each of two localities (each now confined to a residence and backyard), within the city limits. Two calling males were collected at Calle Rosa Duarte No. 21, Gazcue, Santo Domingo 2, República Dominicana. This population presumably is established, because juveniles and subadults also were observed. The owner of the residence at this locality enjoyed the coquis melodious calls and, during a visit to Puerto Rico, paid local kids to collect live specimens for transport to the Dominican Republic. At the second locality, Calle Eric Leonard Ekman No. 10 (Camino del Oeste), Arroyo Hondo, Santo Domingo, República Dominicana, two males were heard calling, and four additional individuals were observed (one collected) on a dry night. In December 1992, owners of the residence at this locality moved from Bayamín, Puerto Rico, to Santo Domingo, Dominican Republic, and took with them their houseplants, in which Coquis probably were transported. One year after our first visit (12 January 1997), several males were heard calling at both residences. *Eleutherodactylus coqui* have been introduced in Vieques and Culebra, Puerto Rico (Rivero and Joglar 1979. Herpetol. Rev. 10:101), St. Thomas and St. Croix, U.S. Virgin Islands, southern Florida and Louisiana (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions and Natural History. Univ. Florida Press, Gainesville. 720 pp.) and in 1994 in Maui, Hawaii (R. Campbell, pers. comm.).

Submitted by **RAFAEL L. JOGLAR** and **NEFTALI RIOS-LÓPEZ**, Departamento de Biología, Universidad de Puerto Rico-Recinto de Río Piedras, Apartado 23360, San Juan Puerto Rico 00931-3360.

HYLA CINEREA (Green Treefrog). USA: ALABAMA: DALE CO: Fort Rucker Military Reservation. 4 June 1974. M. A. Morris. INHS 10303. Verified by M. Redmer. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

HYLA SQUIRELLA (Squirrel Treefrog). USA: ALABAMA: DALE CO: 8 km S Daleville. 3 August 1974. J. C. Morris. INHS 10143. Verified by M. Redmer. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

HYLA VIGILANS. VENEZUELA: FALCÓN: Municipio Monseñor Iturriza, Sanare (ca. 10°52'N, 68°23'W). No date. Ramón A. Rivero. EBRG 2968. Verified by Jesús Manzanilla. First report from the state of Falcón, and the northwesternmost report of the species (La Marca 1992, Cuad. Geogr. Univ. Los Andes, Mérida 9:1–197).

Submitted by **ABRAHAM MIJARES-URRUTIA**, **ALEXIS ARENDS**, Centro de Investigaciones en Ecología y Zonas Áridas (CIEZA), Universidad Francisco de Miranda, Apartado 7506, Coro 4101-A, Venezuela (e-mail: amijares@funflc.org.ve/aarends@reacciun.ve) and **RAMÓN A. RIVERO**, Estación Biológica El Limón, Servicio Autónomo PROFAUNA, Ministerio del Ambiente y de los Recursos Naturales Renovables, Apartado 184, Maracay, Venezuela.

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog, Rana Platanera). PUERTO RICO: COAMO: (18°05'00"N, 66°21'30"W) at the Criminal Investigation Bureau building. 13 July 1997. Sr. Norat, Sergio Serrano, and Carlos Rosa. Verified by Richard Thomas. Museo de Biología, Universidad de Puerto Rico-Recinto de Río Piedras. (UPRRP 5749). One adult female was collected. New record; extends range ca. 50 km southwest and is first record for the southern part of island. Species was introduced in Puerto Rico in the 1950s (Thomas and Joglar 1996. *In* J. Figueroa, ed., The Scientific Survey of Puerto Rico and The Virgin Islands, pp. 181–196. Ann. New York Acad. Sci. Vol. 776). In 1978, the frog was reported as inhabiting the Aguadilla, Isabela, Quebradillas area in northwestern Puerto Rico (Rivero 1978. Los Anfibios y Reptiles de Puerto Rico. Editorial Universitaria U. P. R. San Juan. 152 pp.). By 1995, it had expanded its range ca. 100 km east into northeastern Puerto Rico (Joglar and Rios López 1995. Herpetol. Rev. 26:105–106).

Submitted by **RAFAEL L. JOGLAR**, **NEFTALÍ RIOS-LÓPEZ**, and **MARÍA CARDONA**, Departamento de Biología, Universidad de Puerto Rico-Recinto de Río Piedras, Apartado 23360, San Juan Puerto Rico 00931-3360.

POLYPEDATES LEUCOMYSTAX (Java Whipping Frog). JAPAN: OKINAWA PREFECTURE: Miyakojima Island, Miyako Island Group, in sugarcane field in the town of Gusukube, ca. 2.7 km SSE Miyako Branch of Okinawa Prefectural Agricultural Experiment Station, 22°44'70"N, 125°20'57"E. 12 February 1998. Setsuko Iwanaga. Zoological Collection of Kyoto University (KUZ 47305). Verified by Hidetoshi Ota. Adult male perched on sugarcane stalk. First record for island group. Species was artificially introduced into Japan from southeastern Asia after World War II. In Japan, its range has been confined to Okinawajima and a few adjacent islets of the Okinawa Island Group (Ota 1995. Island Stud. Okinawa 13:63–78).

Submitted by **SETSUKO IWANAGA**, Laboratory of Sugarcane Insect, Okinawa Prefectural Agricultural Experiment Station, 4-222 Sakiyama, Naha, Okinawa 903-0814, Japan.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: ILLINOIS: JASPER CO: 6.25 km SSE Newton and just SW (5 m) jct of Co. Rd. 1000E and Co. Rd. 500N (NW 1/4, NW 1/4 Sec. 34, T6N, R9E; UTM Zone 16: N4308455m, E396970m). 6 August 1997. D. J.

Olson. Illinois Natural History Survey (INHS 13869). Verified by C. A. Phillips. New county record filling gap in expected distribution (Smith 1961. The Amphibians and Reptiles of Illinois. Illinois Nat. His. Surv. Bull. 298 pp.).

Submitted by **DANIEL J. OLSON**, Department of Biological Sciences, Eastern Illinois University, Charleston, Illinois 61920, USA.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: LOUISIANA: BEAUREGARD PARISH: Camp Edgewood area, from jct U.S. Rt. 171 and U.S. Rt. 190 at Ragley, 6.5 mi S on U.S. Rt. 171, 6 mi W on Camp Edgewood Road. 6 February 1986. Doyle, Esters, and Thomas. Seale Museum of Louisiana, McNeese State University (SML 8483). 10 March 1987. Goodwin and Lovinggood. SML 8544. Both specimens verified by Jeff Boundy. First parish record as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

PSEUDACRIS FERIARUM (Upland Chorus Frog). USA: LOUISIANA: JEFFERSON DAVIS PARISH: Topsy area, from U.S. Rt. 190 at Bel, 8 mi S on Topsy-Bel Road. 12 February 1998. Avery A. Williams. Seale Museum of Louisiana, McNeese State University (SML 9314–15). Both specimens verified by Jeff Boundy. First parish record (Dundee and Rossman 1989. The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

PSEUDACRIS TRISERIATA (Upland Chorus Frog). USA: GEORGIA: DOUGHERTY CO: Albany. 18 January 1969. L. R. Davis. INHS 10216. Verified by P. W. Smith. New county record (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

RANA BLAIRI (Plains Leopard Frog). USA: ILLINOIS: GREENE CO: DOR, Hillview-Eldred Road, 8.75 km N Eldred at Apple Creek, SE 1/4, NE 1/4 Sec. 28, T11N, R13W. 19 April 1997. J. K. Tucker. Illinois Natural History Survey (INHS 13744). Verified by C. A. Phillips. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA, and **DANIAL A. WARNER**, Department of Animal Ecology, Iowa State University, Ames, Iowa 50011, USA.

RANA CLAMITANS (Green Frog). USA: ILLINOIS: PIKE CO: 3.5 km SSE Kinderhook, Grubb Hollow along Co. Rd. 1950N, just E Ill. Rt. 96 (SE 1/4 Sec. 31, T14S, R6W; UTM Zone 15: N4393040m, E660150m). 21 October 1997. J. E. Petzing and C. A. Phillips. INHS 13402. Verified by M. J. Dreslik. New county record.

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

RANA CLAMITANS (Green Frog). USA: MISSOURI: PERRY CO: 19 km E Perryville (37°42'07"N, 89°37'12"W) by a spring. 15 October 1994. B. Churchwell, J. Krejca, and S. Taylor. SIUC H-4776. Verified by R. A. Brandon. County record; fills gap between Bollinger, Cape Girardeau, St. Francois, and Ste. Genevieve counties (Johnson 1987. The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. 368 pp; Powell et al. 1993, Missouri Herpetol. Assoc. Newsl. 6:7–26).

Submitted by **STEVEN J. TAYLOR**, Center for Biodiversity, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820, USA, **JEAN K. KREJCA**, Department of Zoology, University of Texas, Austin, Texas 78712-1064, USA, and **BETH CHURCHWELL**, The Nature Conservancy, 2800 South Brentwood Boulevard, St. Louis, Missouri 63144, USA.

RANA CLAMITANS CLAMITANS (Bronze Frog). USA: ILLINOIS: KANE CO: West branch Big Rock Creek and Rt. 30, Sec. 21, T38N, R6E. 27 August 1970. D.W. Greenfield and Gary Decker. NIU-HDW (1614). Verified by P. L. Meserve. New county record.

Submitted by **HARLAN D. WALLEY**, Northern Illinois University, Dekalb, Illinois 60115, USA.

SCAPHIOPUS COUCHII (Couch's Spadefoot) USA: COLORADO: OTERO CO: AOR, Co. Rd. 2, 2.4 mi S jct. Co. Rd. KK. 24 August 1997. University of Northern Colorado Museum of Natural History (UNC-MNH Photograph 27). Verified by Hobart M. Smith and David Chiszar. Specimen represents a range extension of ca. 40 mi NW of known Colorado populations (Livo et al. 1996. Herpetological Micro-biogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY**, **JAMES SIFERT**, **BEN HILL**, **THERESA CHILDERS**, **JERRY D. MANZER**, **ENOCH BERGMAN** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: COLORADO: PUEBLO CO: Line 27, Station 2. 24 July 1967. Collector unknown. UCM 59555-59556; Boone, Grid A, Line 1, Station 25-28. 30 June 1967. Collector unknown. UCM 59557. Both verified by Hobart M. Smith. New county record (Hammerson 1982. Amphibians and Reptiles in Colorado. Publ. Colorado Division of Wildlife).

Submitted by **KYLE G. ASHTON**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA.

SYRRHOPHUS CYSTIGNATHOIDES (Rio Grande Chirping Frog) USA: TEXAS: FAYETTE CO: fairgrounds (29°55'31"N, 96°52'54"W) below sandstone cliffs on hill along the Colorado River flood plain. Juvenile female collected 11 February 1998; adult male collected 8 March 1998. Andre de la Reza, Collin Balcombe, and Todd Schlenke. Verified by David Cannatella. TNHC 56738–39 (DCC 3566–67). This resident of the Rio Grande Valley was probably introduced into the San Antonio, Houston, Fort Worth, and Tyler areas via the potted plant trade (Brach 1992.

Texas J. Sci. 44:490; Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp; McGown et al. 1994. Herpetol. Rev. 25:32). This also seems the most likely reason for its introduction into Fayette County.

Submitted by **ANDRE G. DE LA REZA**, **COLLIN BALCOMBE**, and **TODD SCHLENKE**, Department of Zoology, University of Texas, Austin, Texas 78712, USA.

TESTUDINES

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle) USA: COLORADO: Kiowa Co: Adobe Creek beneath Co. Rd. E, 1.4 mi E jct Rt. 96. 11 May 1997. University of Northern Colorado Museum of Natural History (UNC-MNH Photograph 22). Verified by Hobart M. Smith and David Chiszar. County record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **JUSTIN HOBERT**, **CHAD MONTGOMERY**, **THERESA CHILDERS**, **JERRY D. MANZER**, **ENOCH BERGMAN**, **JAMES SIFERT**, **BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

GRAPTEMYS OUACHITENSIS (Ouachita Map Turtle). USA: KANSAS: Russell Co: Wilson Reservoir, Sec. 32, T12S, R12W. 25 October 1996. Tommie Berger. KU 224654. Verified by Lynnette Sievert. New county record; represents the most northwestern record for Kansas (Collins 1993. Amphibians and Reptiles in Kansas. Third Ed. Univ. Press Kansas, Lawrence. xx + 397 pp.).

Submitted by **GREGORY SIEVERT**, Division of Biological Sciences, Emporia State University, Emporia, Kansas 66047, USA, and **JOSEPH T. COLLINS**, The Center for North American Amphibians and Reptiles, 1502 Medinah Circle, Lawrence, Kansas 66047, USA.

KACHUGA SMITHII SMITHII (Brown Roofed Turtle). NEPAL: border of Saptari/Sunsari Districts (Koshi River at Koshi Barrage, 26°32'N, 86°55'E). 20 June 1996. David Edds. Chitwan National Park (Nepal) turtle collection (DE-NT 9). Verified by T. M. Maskey. First record of this subspecies from Nepal. Moll (1987. J. Bombay Nat. Hist. Soc. 84:7–25) described a new subspecies, *K. s. pallidipes,* including a paratype from the Karnali River in western Nepal (three specimens of which were captured in the Karnali by the author in 1996: DE-NT 10–12); characteristics of this single specimen from eastern Nepal clearly correspond to those of the nominate race, including profuse pigmentation of the head, limbs, penis, and plastron. Sympatric with *K. tentoria flaviventer.* Mitchell and Rhodin (1996. Chelonian Conserv. Biol. 2:66–72) noted decorated shells of *K. smithii* for sale as ceremonial artifact masks in Kathmandu.

Submitted by **DAVID EDDS**, Division of Biological Sciences, Emporia State University, Emporia, Kansas 66801, USA.

KACHUGA TECTA (Indian Roofed Turtle). NEPAL: Nawalparasi District (Narayani River at Tribenighat 27°27'N, 83°55'E). 10 April 1996. David Edds. Chitwan National Park (Nepal) turtle collection (DE-NT 6). Verified by T. M. Maskey. Second record from Nepal, following Hall (1980. J. Bombay Nat. Hist. Soc. 77:521–522), and extending Nepal distribution ca. 215 km west. Das (1991. Colour Guide to the Turtles and Tortoises of the Indian Subcontinent. R & A Publishing Ltd., Avon, England. 133 pp.) and Mitchell and Rhodin (1996. Chelonian Conserv. Biol. 2:66–72) noted Hall's record from eastern Janakpur (Dhanusa District); Moll (1987. J. Bombay Nat. Hist. Soc. 84:7–25) and Iverson (1992. A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.) suspected the species existed in Nepal. In vegetation-choked waters; sympatric with *K. tentoria flaviventer.*

Submitted by **DAVID EDDS**, Division of Biological Sciences, Emporia State University, Emporia, Kansas 66801, USA.

KACHUGA TENTORIA FLAVIVENTER (Yellowbelly Indian Tent Turtle). NEPAL: Nawalparasi District (Narayani River at Tribenighat 27°27'N, 83°55'E) and border of Saptari/Sunsari Districts (Koshi River at Koshi Barrage 26°32'N, 86°55'E). 10 April 1996 and 20 June 1996. David Edds. Chitwan National Park (Nepal) turtle collection (DE-NT 7–8). Verified by T. M. Maskey and K. B. Shah. First records of *K. tentoria* from Nepal. In vegetation-choked waters; sympatric with *K. tecta* in Narayani, and with *K. s. smithii* in Koshi. Moll (1987. J. Bombay Nat. Hist. Soc. 84:7–25), Das (1991. Colour Guide to the Turtles and Tortoises of the Indian Subcontinent. R & A Publishing Ltd., Avon, England. 133 pp.) and Iverson (1992. A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.) noted *K. t. flaviventer* from tributaries of the Ganges River in northern India.

Submitted by **DAVID EDDS**, Division of Biological Sciences, Emporia State University, Emporia, Kansas 66801, USA.

TERRAPENE ORNATA (Ornate Box Turtle). USA: TEXAS: Rockwall co: Rockwall. 12 May 1997. Photographed by Dixon Glaze. The specimen was found on private property and was only allowed to be photographed. Verified by C. J. Franklin. University of Texas at Arlington (UTA Color Slide 23641). New county record (Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo, Department of Herpetology, 650 South R. L. Thorton Freeway, Dallas, Texas 75203, USA, and **DIXON GLAZE**, Rockwall, Texas, USA.

TRACHEMYS SCRIPTA (Slider). USA: ALABAMA: Wilcox Co: 2.4 km W Camden and 0.8 km E jct Alabama Rts. 221/164, backwater of Alabama River at Alabama Rt. 10 (31°59.573'N, 87°19.613'W). 12 March 1996. J. M. Serb and T. J. Near. INHS 12254. Verified by C. A. Phillips. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JEANNE M. SERB**, **THOMAS J. NEAR,** and **JOHN E. PETZING**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

LACERTILIA

AMEIVA BIFRONTATA. VENEZUELA: ESTADO ARAGUA: Municipio Mario Bricego Iragori, trail between Bahía de Cata and Playa Catica, Parque Nacional Henri Pittier, 10°30'N, 67°44'W, 90 m elev. February 1993. R. Cornieles. Museo del Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Maracay (MIZA 15-354, 15-355) Verified by R. Rivero. Specimens constitute the first record for the state of Aragua and the Parque Nacional Henri Pittier

(Manzanilla 1996. Acta Cient. Venezuela 47[3]:1–12) and fill the distributional gaps between the states of Miranda and Sucre in the east, and the state of Falcon in the west (Lesn and Ruiz 1971. Caribbean J. Sci. 11[3-4]:195–201; Cordero 1987. Acta Cient. Venezuela 38:234–258; Bisbal 1990. Acta Cient. Venezuela 41[3]:177–185).

Submitted by **JESUS MANZANILLA**, **RICARDO CORNIELES,** and **ALBERTO FERNANDEZ-BADILLO**, Museo del Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Maracay, Venezuela.

ANOLIS CAROLINENSIS (Green Anole). USA: GEORGIA: CANDLER CO: 1.6 km W Metter. 23 June 1977. L. M. Page, M. A. Morris, and R. L. Mayden. INHS 10407. Verified by P. W. Smith. New county record (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

GALLOTIA GALLOTI EISENTRAUTI. SPAIN: CANARY ISLAND: EL HIERRO ISLAND: El Matorral, Frontera (UTM 3075789/203253). 16 May 1997. Miguel A. Rodríguez-Domínguez. Recovering Center for The Hierro's Giant Lizard, Canary Government (CR 971116). Verified by M. Molina-Borja. First record for El Hierro island. Adult male collected in a tropical pineapple property with several fruit-bearing trees. Two other live individuals were observed, but not captured. The subspecies was known only from Tenerife Island (Bischoff 1982. Bonn. zool. Beitr. 33:363–382). The method of introduction of this species is not known. However, the area where lizards were found is very close to an Agriculture Product Cooperative, and merchandise trucks arrive regularly from Tenerife. We believe that they have been recently and accidentally introduced by humans in this manner to El Hierro Island.

Submitted by **MIGUEL A. RODRÍGUEZ-DOMÍNGUEZ** and **MIGUEL RUÍZ-CABALLERO**, Recovering Center for The Hierro's Giant Lizard, Canary Government, Frontera 38911, El Hierro, Canary Islands, Spain.

GERRHONOTUS LIOCEPHALUS (Texas Alligator lizard). MÉXICO: AGUASCALIENTES: Los Alisos, Sierra del Laurel, municipality of Calvillo (21°58'N, 102°45'W) in oak forest. 22 October 1983. Gilfredo de la Riva. Departamento de Biología, Universidad Autónoma de Aguascalientes. Verified by Mario Mancilla. Nearest records of *G. l. liocephalus* are from 3 km N Pueblo Nuevo, Municipio El Salto, 9 km SE Llano Grande, Municipio Durango, Durango, and 19.2 km NE Santa Lucía, 1990 m, in Sinaloa (Good 1994. Herpetol. Monogr. 8:180–202).

Submitted by **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México, Distrito Federal 04510, México, **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes, Centro Básico, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México.

HOLBROOKIA MACULATA BUNKERI (Bunker's Earless Lizard). NEW MEXICO: DOÑA ANA CO: 32–55 km E El Paso. 27 June and 1 August 1970. W. S. Parker. LACM 113389–90. LUNA CO: 8 km E and 2 km S Hermanas. 22 June 1992. J. N. Stuart. MSB 54265. All verified by Ralph W. Axtell. First record for New Mexico (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. 431 pp.) and United States. Supported by range extensions northward from previous records on the dunes near Samalayuca, Chihuahua, México, at El Tule [Escuela Nacional de Estudios Profesionales Iztacala (= ENEPI) field nos. 36320–3, 36326]; Los Chontes (ENEPI 36327, 36339–40); Las Coates (ENEPI 36356); and eastward, at Puerto Ancho (ENEPI 36367–70), Chihuahua, collected in June 1997 by four of the authors and Adam Chiszar. The New Mexico specimens include two males with T/SV ratios of 1.25 and 1.37, and one female with a ratio of 0.91, all within the known range of *H. m. bunkeri* (males 1.0–1.37, females 0.91–1.14). The available UCM material of the other subspecies in New Mexico have ratios in *H. m. approximans* (auctorum) of 0.70–1.02 in 20 males, and 0.62–0.90 in 25 females from various localities in western New Mexico, southwestern Colorado and central eastern Arizona, and in *H. m. ruthveni* of 0.87–0.97 in 14 males, 0.72–0.90 in 10 females.

Submitted by **HOBART M. SMITH**, **DAVID CHISZAR**, **CLINT HENKE,** and **FRANK VAN BREUKELEN**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA; and **JULIO A. LEMOS-ESPINAL**, Laboratorio de Ecologia, Unidad de Biologia, Tecnologia y Prototipos, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México, Apartado Postal 314, Tlalnepantla, Estado de México, México.

LEPIDODACTYLUS LUGUBRIS (Mourning Gecko). ECUADOR: GALAPAGOS ISLANDS: Isla Santa Cruz in Puerto Ayora. 14 June 1997. Showichi Sengoku. Japan Wildlife Research Center Photo Collection Color Slide No. 97060125. Verified by Hidetoshi Ota. Several individuals around garden lanterns of the Hotel Galapagos at night (1800-2400 h). A number of individuals of this gecko, together with few *Phyllodactylus galapagensis* (Galapagos Leaf-toed Gecko), observed not only around garden lanterns, but also on outside walls of the hotel during the second visit from 25–29 June 1997. Islands record; lending support to Hoogmoed (1989. Not. Galapagos [47]:12–16), who listed this species as occurring in the Galapagos Islands, but without providing evidence.

Submitted by **SHOWICHI SENGOKU**, Japan Wildlife Research Center, Yushima 2-29-3, Bunkyo-ku, Tokyo 113, Japan.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard) USA: COLORADO: PUEBLO CO: DOR, Co. Rd. 10, 0.2 mi NE Co. Rd. 707 (Pipeline Road). 24 August 1997. University of Northern Colorado Museum of Natural History (UNC-MNH 797). Verified by Hobart M. Smith and David Chiszar. County record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY**, **THERESA CHILDERS**, **JERRY D. MANZER**, **ENOCH BERGMAN**, **JAMES SIFERT**, **BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

PHRYNOSOMA DITMARSI (Rock Horned Lizard). MÉXICO: SONORA: thornscrub hillside at El Chorro, 8 km (by road) NE

of Nácori Chico (Municipio Nácori Chico), ca. 1000 m elev. 4 September 1984. C. H. Lowe and B. E. Martin. UAZ 45884 (male, SVL 64 mm) with 11 color slides. Verified by Peter A. Holm and Philip C. Rosen. This is only the fourth known locality record for an endemic Sonoran species whose existence was lost to science for 73 years (Lowe et al. 1971. J. Arizona Acad. Sci. 6[4]:277; Roth 1997. Sonoran Herpetologist 10:2–6; Sherbrooke 1997. Sonoran Herpetologist 10[1]:6–8). The new locality is 140 km NNE of another report, also in the drainage of the Río Yaqui (Perrill 1983. Herpetol. Rev. 14:123], whereas the two earlier locality reports (Lowe et al. 1971, *op. cit.*; Lowe and Howard 1975. Southwest. Nat. 20:264–270) were in the more westerly Río Sonora drainage (Baviacora is 115 km directly west) in Madrean evergreen woodlands. Both Río Yaqui localities establish the use of thornforest/scrub habitat by this species, and suggest that additional populations, perhaps isolated in varied habitats, may be located. Currently the Rock Horned Lizard is listed as threatened by the Mexican government, but remains unstudied in the field.

Submitted by **WADE C. SHERBROOKE**, Southwestern Research Station, American Museum of Natural History, P.O. Box 16553, Portal, Arizona 85632, USA, and **BRENT E. MARTIN** and **CHARLES H. LOWE**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

PHRYNOSOMA DOUGLASII (Short-horned Lizard) USA: COLORADO: Kiowa Co: DOR, Co. Rd. E, 0.2 mi E jct. Rt. 96 (38°19.434'N, 103°20.611'W). 15 August 1997. University of Northern Colorado Museum of Natural History (UNC-MNH 767). Verified by Hobart M. Smith and David Chiszar. County record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **ENOCH BERGMAN**, **BEN HILL**, **CHAD MONTGOMERY**, **THERESA CHILDERS**, **JERRY D. MANZER**, **JAMES SIFERT**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

SCELOPORUS UNDULATUS (Fence Lizard). USA: ALABAMA: Escambia Co: W of Brewton, Burnt Corn Creek at Ala. Rt. 41 (31°07.776'N, 87°05.253'W). 11 March 1996. P. A. Ceas, J. M. Serb, J. C. Porterfield, and T. J. Near. INHS 12250. Verified by C. A. Phillips. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JEANNE M. SERB**, **JOHN E. PETZING**, and **THOMAS J. NEAR**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

TROPIDURUS STROBILURUS (Lava Lizard). BRAZIL: ESPIRITO SANTO: Município de Presidente Kennedy, Praia das Neves (21°16'S, 40°48'W). 30 January 1996. G. J. Zerbini and A. F. B. Araujo. Universidade de Brasília (UnB 2175). Verified by G. R. Colli. First record for the state of South Espírito Santo; known along the Atlantic Forest from the state of Pernambuco to Santa Cruz in the state of Espírito Santo (Jackson 1978. Arq. Zool. São Paulo 30:1–79). Praia das Neves is the most meridional record for this species and about 250 km S of Santa Cruz. The specimens were found in an isolated 70 ha fragment of "Mata de Restinga" vegetation, about 1 km from the beach.

Submitted by **GLAUCIA JORDÃO ZERBINI**, **ELISABETH M. M. DA COSTA**, **ALEXANDRE F. B. ARAUJO**, and **REUBER A. BRANDÃO**, Departamento de Zoologia-ZOO/IB, Universidade de Brasília, 70 910-900, Brasília, Distrito Federal, Brazil.

SERPENTES

AGKISTRODON CONTORTRIX (Copperhead). USA: ALABAMA: Dale Co: Fort Rucker Military Reservation. 14 April 1974. M. A. Morris and S. S. Morris. INHS 10165. Verified by P. W. Smith. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

CROTALUS TIGRIS (Tiger Rattlesnake). USA: ARIZONA: Cochise Co: Peloncillo Mountains, Sec. 32, T22S, R32E. 30 July 1995. Andrew T. Holycross. Museum of Vertebrate Zoology (MVZ photograph). Verified by Harry W. Greene. A female *C. tigris* was captured crossing Geronimo Trail 3.2 km E of the Cottonwood Cemetery driveway among foothills dominated by *Fouqueria* and *Opuntia* spp. Specimen photographed and blood taken from the caudal vein. Extends range 17 km N of Guadalupe Canyon and the only other specimen reported from this range (Painter and Milensky 1993. Herpetol. Rev. 24:155–156) and E of the Santa Rita Mountains in southeastern Arizona.

Submitted by **ANDREW T. HOLYCROSS**, Zoology Department, Arizona State University, Tempe, Arizona 85287-1501, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: ALABAMA: Dale Co: Fort Rucker Military Reservation. 13 February 1971. M. A. Morris. INHS 10158. Verified by P. W. Smith. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

DINODON RUFOZONATUM (Red Banded Snake). RUSSIA: PRIMORSKY REGION: Nadezhdinsky District: ca. 15 km W Venevitinovo Village near Bolshevistsky Creek, 2 km upstream from its jct with Malaya Elduga River, 43°28'N, 141°25'E. 8 July 1995. A. Kotlobay and D. Maslov. Zoological Museum of M. V. Lomonosov University, Moscow, Russia (Cat. No. R-10294). Verified by V. F. Orlova. Confirms previous unverified records of species for Primorsky region (Zhao and Adler 1993. Herpetology of China. Publ. Soc. Study Amphib. Rept., Oxford, Ohio. 522 pp.). The female specimen was captured in rubbish near the creek. In 1987, another adult was captured and one more was sighted by D. Maslov in the M. Elduga River Valley on a forest road, flooded after a strong rain. In 1988, an adult was captured near a hunter's cabin at Bolshevistsky Creek by P. Tupeleev. In 1989, a dead adult was found by V. Solkin near the river.

Submitted by **DMITRI A. MASLOV**, Department of Biology, University of California, Riverside, California 92521, USA, and

ANATOLY A. KOTLOBAY, Department of Biochemistry, School of Biology, Moscow State University, 119899 Moscow, Russia.

ELAPHE EMORYI (Great Plains Rat Snake). USA: NEW MEXICO: Otero Co: White Sands Missle Range, Range Road 9 at Malpais Springs, ca. 27.4 km W and 23.3 km N Tularosa. 31 July 1997. Doug Burkett and Larry Kamees. University of New Mexico Museum of Southwestern Biology (MSB 60999). Verified by D. S. Sias. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUG BURKETT** and **LARRY KAMEES**, P.O. Box 399, White Sands Missle Range, New Mexico 88002, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

ELAPHE GUTTATA (Corn Snake). USA: ALABAMA: Dale Co: Fort Rucker Military Reservation. 20 July 1974. M. A. Morris and R. C. Morris. INHS 10166. Verified by P. W. Smith. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). USA: COLORADO: Prowers Co: AOR Co. Rd. 13, 0.1 mi N Baca Co. line. 3 June 1997. University of Northern Colorado Museum of Natural History (UNC-MNH Photograph 23). Verified by Hobart M. Smith and David Chiszar. Adult specimen; represents a southeast range extension of ca. 35 miles and northwestern extension of 40 miles. A hatchling second specimen (Baca County, on canyon wall east side of Co. Rd. 30 at Two Buttes Dam on 23 September 1997) was found within 1 mile of the first specimen (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY**, **LEEANN COMPTON**, **THERESA CHILDERS**, **ENOCH BERGMAN**, **JERRY D. MANZER**, **JAMES SIFERT**, **BEN HILL**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

ELAPHE GUTTATA MEAHLLMORUM (Southern Plains Rat Snake) MÉXICO: HIDALGO: Huejutla: Huejutla, Hotel Rivera (21°08'36"N, 98°25'12"W), ca. 150 m elev. 1 November 1995. Ricardo Reyes Avila. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autonoma de México (MSFC 8436). Verified by Andrián Nieto Montes de Oca. First record for Hidalgo; extends range ca. 152.8 km SE and 126.4 km E of closest known localities at 30 mi N Valles, San Luis Potosí and Old Mill at Hacienda San Nicolás Conca (Sharpton's Finca), 10.4 mi S Arroyo Seco, San Luis Potosí, as reported by Smith et al. (1994. Texas J. Sci. 46:259–292). The presence of this species in Huejutla is probably due to human introduction.

Submitted by **FERNANDO MENDOZA QUIJANO**, Instituto Tecnológico Agropecuario No. 6, Km 5.5 Carr. Huejutla-Chalahuiyapa, Apartado Postal 94, Huejutla de Reyes, C.P. 43000, Hidalgo, México, (e-mail: mendoza@mail.ibiología.unam.mx), **RICARDO REYES AVILA** and **LAURA CONTRERAS NARVAEZ**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autonoma de México, Apartado Postal 70-399, México Distrito Federal 04510, México.

ELAPHE OBSOLETA LINDHEIMERII (Texas Rat Snake). USA: COLORADO: Kiowa Co: DOR, Rt. 287, 1.6 mi S jct. Co. Rd. N (38°25.046'N, 102°43.763'W). University of Northern Colorado Museum of Natural History (UNC-MNH 848). Verified by Hobart M. Smith and David Chiszar. First state record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.); specimen represents a range extension of ca. 200 miles from Kansas populations of *Elaphe obsoleta* and ca. 180 miles from Oklahoma populations of *E. o. lindheimerii* (Conant and Collins 1991. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition. Houghton Mifflin Co., Boston, Massachusetts. xviii + 450 pp.).

Submitted by **CHAD MONTGOMERY**, **THERESA CHILDERS**, **JERRY D. MANZER**, **ENOCH BERGMAN**, **JAMES SIFERT**, **BEN HILL**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

FARANCIA ABACURA (Mud Snake). USA: GEORGIA: Calhoun Co: 2.4 km S Leary. 13 May 1972. L. R. Davis. INHS 10003. Verified by P. W. Smith. New county record (Williamson and Moulis 1994. Distribution of Amphibians and Reptiles in Georgia. 2 Vols. Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

GOMESOPHIS BRASILIENSIS (Brazilian Burrowing Snake). BRAZIL: DISTRITO FEDERAL: Estação Ecológica de Águas Emendadas: Lagoa Bonita (15°35'S, 47°41'W). 26 May 1992. Reuber A. Brandão and Victor S-J Perdigão. Universidade de Brasília (UNB 2970). Verified by T. de Lema. First record for central Brazil. Species was known from states of Rio Grande do Sul, Santa Catarina, Paraná, São Paulo and Minas Gerais (Peters and Orejas-Miranda 1970. Bull. U.S. Natl. Mus. 297:1–347). In Estação Ecológica de Águas Emendadas, streams of three major Brazilian hydrographic basins (Amazon, São Francisco, and Platina) come together. The Rio Mestre D´Armas belongs to the Platina Basin and its margins are covered with gallery forest, which may represent a pathway for faunal dispersal (Vanzolini 1994. Ann. Acad. Bras. Ci. 66 [supl.1]:173–176) between the Cerrado (mainly known as "Chapadas do Brasil Central") and neighboring vegetational systems, and contributes to lower the level of endemism found in the Cerrado (Cerqueira 1982. *In* Mares and Genoways (eds.), Mammalian Biology in South America, pp. 53–75. Univ. Pittsburgh Press, Pittsburgh, Pennsylvania). This new distributional record may corroborate their hypothesis.

Submitted by **ANA LÚCIA DA COSTA PRUDENTE**, Curso de Pós-Graduação em Zoologia, Universidade Federal do Paraná, CP 19020, CEP 81.531-990, Curitiba, Paraná, Brazil, and **REUBER A. BRANDÃO**, Laboratório de Fisiologia Animal - CFS/IB, Universidade de Brasília, CEP 70.910-900, Brasília, Distrito Federal, Brazil.

HETERODON NASICUS (Western Hognose Snake). MÉXICO: AGUASCALIENTES: municipality of Aguascalientes (21°57'N, 102°17'W) in grassland and dry forest. 1 November 1991. Gilfredo de la Riva. Universidad Autónoma de Aguascalientes, Centro Básico, Departamento de Biología (UAA-VR 00209). Verified by Carlos Balderas. First record for state of Aguscalientes; extends range ca. 160 km SE of Zacatecas, 210 km SW of San Luis Postosí (Platt 1969. Univ. Kansas Publ. Mus. Nat. Hist. 18:253–420) and 125 km NW of Jalisco (Pérez-Ramos 1987. Herpetol. Rev. 18:56).

Submitted by **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes, Centro Básico, Departamento de Biología, Avenida Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, and **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México, Distrito Federal 04510, México.

HYDROPS TRIANGULARIS. PARAGUAY: Departamento Presidente Hayes: Río Paraguay ca. 14 km by river S from Puerto Rosario, 24°32'22"S, 57°10'15"W. 26 January 1995. E. Buongermini P., T. Waller, and P. Micucci. Museo de Historia Natural del Paraguay (MNHNP 06462). Verified by Marta Motte. First record for the Paraguayan basin. A male collected while crossing the river.

Submitted by **EMILIO BUONGERMINI P.**, Museo Nacional de Historia Natural del Paraguay, Sección de Herpetología, Caballero 1060, Asunción, Paraguay, CP 1324, and **TOMAS WALLER**, Zavalía 2090 3°B, Buenos Aires, Argentina, 1428.

LAMPROPELTIS CALLIGASTER RHOMBOMACULATA (Mole Kingsnake). USA: FLORIDA: Calhoun Co: near Blountstown. May 1996. C. J. Longden. Florida Museum of Natural History, University of Florida (UF Color Slide 111098). Verified by David Auth. New county record (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Second Ed. Windward Publ., Miami, Florida. 176 pp.). Offspring from gravid female collected from wild. Laid 4 eggs 17 June; 3 eggs hatched 20 August 1996.

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA.

LAMPROPELTIS GETULA (Common Kingsnake) USA: COLORADO: Bent Co: DOR, Co. Rd. 24, 0.1 mi S jct Rt. 50. 16 August 1997. Verified by Hobart M. Smith and David Chiszar. University of Northern Colorado Museum of Natural History (UNC-MNH 765). County record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.). An additional specimen (UNC-MNH 611 from Otero County found DOR on Co. Rt. 109, 0.1 mi N jct Co. Rd. Y; 37°55.416'N, 103°32.403'W on 2 June 1997) was also recovered, confirming the natural presence of this species in Otero County. All specimens taken in eastern Colorado have been found south of the Arkansas River drainage. Specimen is intermediate between the races *holbrooki* and *splendida*.

Submitted by **ENOCH BERGMAN, CHAD MONTGOMERY, THERESA CHILDERS, JERRY D. MANZER, JAMES SIFERT, BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

LAMPROPELTIS GETULA (Common Kingsnake). USA: FLORIDA: Franklin Co: St. Vincent Island. An adult male collected on "Christman's Road" between roads 4 & 5. 18 May 1983. Steven P. Christman. UF 57740. Verified by David L. Auth. Another adult male was found on 12 April 1987 at the Picalene Indian midden (archaeological site 8FR365) on the Apalachicola Bay side of St. Vincent Island in NE 1/4 SE1/4 Sec. 20, T9S, R9W by D. Bruce Means, and was also verified by David L. Auth. Four 35 mm slides of this second specimen were catalogued together as UF 111442. First published records of species on any of the eastern Gulf Coast barrier islands of Apalachee Bay (Blaney 1971. Herpetologica 27:406–430).

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute and Land Conservancy, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

LAMPROPELTIS GETULA GETULA (Eastern Kingsnake). USA: FLORIDA: Bay Co: SR 22, ca. 17 mi W Wewahitchka. May 1997. C. J. Longden. Florida Museum of Natural History, University of Florida (UF Color Slide 109826). Verified by David Auth. New county record (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Second Ed. Windward Publ., Miami, Florida. 176 pp.).

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA, e-mail: kenneyk@grove.ufl.edu, and **LEONARD E. KRYSKO**, 7575 128 Street North, Seminole, Florida 34646, USA.

LAMPROPELTIS GETULA SPLENDIDA (Desert Kingsnake). USA: NEW MEXICO: Lincoln: DOR U.S. Rt. 54 at Mile Marker 106, 46.7 km N Tularosa, ESE 1/4 Sec 36, T9S, R8. 27 August 1997. Doug Burkett. University of New Mexico Museum of Southwestern Biology (MSB 61000). Verified by D. S. Sias. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **DOUG BURKETT**, P.O. Box 399, White Sands Missle Range, New Mexico 88002, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: ARIZONA: Coconino Co: Aubrey Valley: 35°30'01"N, 113°07'35"W. 5 June 1997. Betsy Dunkirk. ASU 30876. Verified by Jeff Howland. Specimen found dead in two pieces next to Arizona Game and Fish Department Black-Footed Ferret (*Mustela nigriceps*) acclimation pen no. 6. First specimen from the Aubrey Valley; extends range ca. 90 km west from the nearest documented specimen in Coconino County (Jeff Howland, pers. comm.; George Bradley, pers. comm.). Supports previous observations of *L. triangulum* in this valley. Kim Kime reported (Arizona Game and Fish Department, Heritage Data Management System) seeing a ca. 60 cm long specimen near this locality on 21 July 1994 at 0345 h while spotlighting for Black-Footed Ferrets. Steve Campbell reports capturing a female specimen in the Aubrey Valley near the town of Seligman (Yavaipai County: SW 1/4 of NE 1/4 Section 4, T23N, R7W) on 11 July 1992, although this speci-

men has not yet been deposited in an institutional collection nor reported in the literature.

Submitted by **ANDREW T. HOLYCROSS**, Zoology Department, Arizona State University, Tempe, Arizona 85287-1501, USA, and **ROB SIMONSON**, Arizona Game and Fish Department, Nongame Branch, 2221 West Greenway Road, Phoenix, Arizona 85023-4312, USA.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: TEXAS: IRION CO: Barnhart. 22 May 1997. Jeff Wright. Angelo State Natural History Collections (ASNHC 12909). Verified by Terry C. Maxwell. New county record (Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). Apparent intergrade between *L. t. annulata* and *L. t. celaenops*. The status of *L. triangulum* in this area of Texas is uncertain and deserves further investigation. The only known specimens that exist from this area are UTA 38339 from 8 km S of Barnhart in Crockett County and ANSP 26588 from San Angelo in Tom Green County. TNHC 7134 from Texon in Reagan County was collected in 1949 but reported lost in 1962. It is assumed that this snake was identified properly. Institutional acronyms follow Leviton et al. 1985 (Copeia 1985:802–832).

Submitted by **JERRY F. HUSAK**, Department of Biology, Angelo State University, San Angelo, Texas 76909, USA, and **JEFF WRIGHT**, 11633 Hawk Avenue, San Angelo, Texas 76904, USA.

LAMPROPELTIS TRIANGULUM GENTILIS (Plains Milk Snake) USA: COLORADO: CROWLEY CO: DOR, Rt. 96 2.9 mi W jct Co. Rd. 27 (38°14.499'N, 103°37.645'W). 2 June 1997. Verified by Hobart M. Smith and David Chiszar. University of Northern Colorado Museum of Natural History (UNC-MNH 582). County record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **ENOCH BERGMAN, CHAD MONTGOMERY, THERESA CHILDERS, JERRY D. MANZER, JAMES SIFERT, BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

LAMPROPELTIS TRIANGULUM GENTILIS (Plains Milk Snake) USA: COLORADO: BACA CO: AOR, NW corner Co. Rd. 45 and Co. Rd. 6 (37°04' 37.96"N, 102°16' 25.19"W). 11 May 1997. Adult pair found beneath tin. University of Northern Colorado Museum of Natural History (UNC-MNH Photograph 25). Southern range extension of ca. 25 miles (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.); LAS ANIMAS CO: live under log on side of Co. Rd. 18.2, 1.0 mi S jct Co. Rd. 193.7 (37°07.181'N, 103°17.975'W). 24 September 1997. UNC-MNH Photograph 26. Southern range extension of ca. 60 miles and a northern extension from New Mexico populations of ca. 50 miles (Livo et al. 1996, *op. cit.*). Both verified by Hobart M. Smith and David Chiszar.

Submitted by **CHAD MONTGOMERY, THERESA CHILDERS, ENOCH BERGMAN, JERRY D. MANZER, JAMES SIFERT, BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

LIOTYPHLOPS TERNETZII. ARGENTINA: ENTRE RIOS: Department Colón: Parque Nacional El Palmar (Ubajay), 31°47'S, 58°18'W. 25 October 1984. Herpetological collection of Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN 32922). Verified by G. Scrocchi. First province record for the genus (Vuoto 1995. Mem. Mus. Cs. nats. y antropol. Prof. A. Serrano, Serie Nueva Zool. N° 5:17 pp., E. Ríos) extends known range ca. 600 km S from previously cited localities (Bergna and Alvarez 1992. Facena 9:106; Giraudo 1994. Cuad. Herpetol. 8[2]:229-231).

Submitted by **SONIA KRETZSCHMAR**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 San Miguel de Tucumán, Argentina; e-mail soniak@unt.edu.ar.

MASTICOPHIS FLAGELLUM (Coachwhip). USA: NEW MEXICO: LOS ALAMOS CO: Los Alamos National Laboratory, 0.8 km W White Rock, 396510mN, 388610mE. 17 July 1997. Esther I. Nelson. University of New Mexico Museum of Southwestern Biology (MSB 61001). Verified by D. S. Sias. New county record (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **ESTHER I. NELSON**, Los Alamos National Laboratory, P.O. Box 1663, M887, Los Alamos, New Mexico 87545, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, 87504, USA.

MASTICOPHIS FLAGELLUM FLAGELLUM (Eastern Coachwhip). USA: KENTUCKY: PULASKI CO: Pulaski, 14 mi S [of Eubank] [DOR] on [Rt.] 27. 6 June 1948. Collector unknown. UMMZ 221630. Verified by Arnold G. Kluge. County record; third record for the state (Collins and Hirschfeld 1971. J. Herpetol. 5:193) and first record for eastern Kentucky (Conant and Collins 1991. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. xviii + 450 pp.). Specimen was found in the personal collection of the late William Simpson of Detroit. The locality information in brackets was interpreted from a water and mildew damaged jar label. Specimen may have been collected by Jack Cody whose name was associated with some other specimens from Kentucky in the Simpson Collection. Specimen is a female, light phase with black pigment on the head and neck, SVL 1468 mm, with 205 ventral scales.

Submitted by **GREGORY E. SCHNEIDER**, Division of Reptiles and Amphibians, Museum of Zoology, University of Michigan, Ann Arbor, Michigan 48109-1079, USA.

MASTICOPHIS LATERALIS (Striped Racer). USA: CALIFORNIA: MENDOCINO CO: Rt. 162, 21.25 km NE (by road) of Rt. 101, rocky slope on the E side of the main stream of the Eel River. 11 October 1992. J. V. Vindum. CAS 186406; Rt. 162, 28.69 km NE (by road) of Rt. 101, rocky slope on the N side of Middle Fork Eel River. 3 September 1994. J. V. Vindum. CAS 196344. Both verified by R. C. Drewes. Second and third records from Mendocino County and first records from the Eel River drainage. Extends the range ca. 42 km N of MVZ 97839 (California: Mendocino Co: 16 km S of Willits), ca. 120 km S of westernmost Trinity County record (Lind 1992. Herpetol. Rev. 23:124), and ca. 65 km WSW of MVZ 193333 (California: Tehama Co: Round Valley Road, ca 0.4 km N Salt Creek Saddle). These new records occur W of the North Coast Range crest, which was thought to be a geographic barrier to the westward dispersal of the species in northern California (Bury 1970. J. Herpetol. 4:165–178).

Submitted by **JENS V. VINDUM**, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.

NERODIA SIPEDON PLEURALIS (Midland Water Snake). USA: MISSOURI: PERRY CO: 12.9 km E Perryville (37°45'46"N, 89°42'59"W). 15 October 1994. B. Churchwell, J. Krejca, and S. Taylor. SIUC R-2807. Verified by R. A. Brandon. Dead on paved road near pond, farm fields, and woodlots. County record; not previously reported in Missouri counties bordering the Mississippi River south of Ste. Genevieve County (Johnson 1987. The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. 368 pp; Powell et al. 1993. Missouri Herpetol. Assoc. Newsl. 6:7–26).

Submitted by **STEVEN J. TAYLOR**, Center for Biodiversity, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820, USA, **JEAN K. KREJCA**, Department of Zoology, University of Texas, Austin, Texas 78712-1064, USA, and **BETH CHURCHWELL**, The Nature Conservancy, 2800 South Brentwood Boulevard, St. Louis, Missouri 63144, USA.

OXYBELIS AENEUS (Mexican Vine Snake). MÉXICO: AGUASCALIENTES: "EL TEPOZAN," municipality of Calvillo (21°58'N, 102°45'W) in subtropical dry forest. 11 August 1982. Gilfredo de la Riva. Universidad Autónoma de Aguascalientes, Centro Básico, Departamento de Biología (UAA-VR 00094). Verified by Mario Mancilla. First record for Aguascalientes; extends range ca. 75 km NE Zacatecas (Keiser 1974. Bull. Texas Mem. Mus. 22:479–485), and 350 km NW Queretaro (Dixon et al. 1972. Southwest. Nat. 16:225–237).

Submitted by **JOEL VAZQUEZ-DIAZ** and **GUSTAVO QUINTERO-DIAZ**, Universidad Autónoma de Aguascalientes. Centro Básico, Departamento de Biología. Av. Universidad 940, C.P. 20100, Aguascalientes, Aguascalientes, México, and **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México, Distrito Federal 04510, México.

PITUOPHIS CATENIFER SAYI (Bullsnake). USA: MINNESOTA: CARLTON CO: Split Rock Twp., 15 km W Moose Lake (SW 1/4 SW 1/4 Sec. 24, T46N, R21W). 12 September 1996. Leonard and Sandra Pasek. JFBM 13512. Verified by James Underhill. County record (Oldfield and Moriarty 1994. Amphibians and Reptiles Native to Minnesota. Univ. Minnesota Press, Minneapolis. 237 pp.) This extends the range ca. 100 km north.

Submitted by **JOHN J. MORIARTY**, Hennepin Parks, 3800 County Road 24, Maple Plain, Minnesota 55359, USA.

PSEUSTES POECILONOTUS POLYLEPIS. VENEZUELA: ESTADO ARAGUA: Municipio Girardot, La Pedrera, Tucupido. Parque Nacional Henri Pittier, 10°16'N, 67°31'W, 600 m elev. 1997. C. Linares. Museo del Servicio AutÛnomo PROFAUNA, Ministerio del Ambiente y de los Recursos Naturales Renovables, Maracay (EBRG 3340). Verified by R. Rivero. First record for state of Aragua and the Parque Nacional Henri Pittier, filling gaps between the state of Carabobo and the Distrito Federal (Manzanilla et al. 1996. Acta Cient. Venezuela 47[3]:1–12).

Submitted by **KAREL LEMOINE** Instituto de ZoologÌa Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Maracay, Venezuela, **GILSON RIVAS**, Museo de Historia Natural La Salle, Caracas, Venezuela, and **JESÚS MANZANILLA**, Museo del Instituto de Zoología Agrícola, Facultad de Agronomía,Universidad Central de Venezuela, Maracay, Venezuela.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). USA: FLORIDA: SEMINOLE CO: Casselberry, ca. 3 km E jct Florida Rt. 436 and Oxford Road under a brick in backyard of residential home at 1516 East Boulevard. 27 March 1998. Douglas T. Bowman, Jr. and Richard D. Owen. Deposited in the Florida Museum of Natural History collection (UF112961). Verified by F. Wayne King and David Auth. First documented occurrence of species in county. Populations of this snake exist at numerous locations in southern Florida and they appear to have been established there via the exotic plant trade (Conant and Collins 1991. Peterson Field guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.; Wilson and Porras 1983. The Ecological Impact of Man on the South Florida Herpetofauna. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9:1–89). Considering the widespread use of exotic plants in the Florida landscape, as well as the parthenogenic reproductive mode of the snake, we suggest that this observation be considered a range extension of the species. In the near future additional observations of the Brahminy Blind Snake will likely be made in the area between central and south Florida, and possibly in northern Florida as well.

Submitted by **RICHARD D. OWEN**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 36611, USA, **DOUGLAS T. BOWMAN, JR.**, 1217 Needlewood Loop, Oviedo, Florida 32765, USA, and **STEVE A. JOHNSON**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA.

REGINA SEPTEMVITTATA (Queen Snake). USA: VIRGINIA: WYTHE CO: Patterson, Little Reed Island Creek. 27 June 1977. L. M. Page, M. A. Morris, and R. L. Mayden. INHS 10423. Verified by P. W. Smith. New county record (Mitchell 1994. The Reptiles of Virginia. Smithsonian Inst. Press, Washington, D.C. 352 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

RHADINAEA FULVICEPS. VENEZUELA: ESTADO ZULIA: Perija, Palmar River Basin, Las Lajas River. 10°23'N, 72°35'W, 700 m elev. May 1991. Profauna Zulia (sic). Museo de la Estación Biológica de Rancho Grande, Profauna, Maracay (EBRG 2555). Verified by K. Lemoine. Specimen constitutes first record for the state of Zulia and Venezuela (Myers 1974. Bull Amer. Mus. Nat. Hist. 157:1–262; Lancini and Kornacker 1989. Verlag Armitano Ed. Caracas, Venezuela, p. 381) and the easternmost locality; extends known range ca. 560 km NE of Colombia (Perez-Santos and Moreno 1988. Mus. Reg. Sci. Nat. Torino. Monografía IV, p. 132).

Submitted by **JESÚS MANZANILLA**, Museo del Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Apartado 4579, Maracay 2101-A, Venezuela, **ABRAHAM MIJARES-URRUTIA**, Centro de Investigaciones de Ecología y Zonas Aridas (CIEZA), Universidad Francisco de Miranda, Apartado 7506, Coro 4101-A, Venezuela, and **RAMÓN RIVERO**, Instituto Autónomo Profauna, Ministerio del Ambiente y de los Recursos Naturales Renovables, Maracay, Venezuela.

RHINOCHEILUS LECONTEI TESSELLATUS (Longnose Snake) USA: COLORADO: Prowers Co: DOR, Co. Rd. B.5, 2.1 mi W jct Co. Rd. 11 (37°39.928'N, 102°36.263'W). 23 June 1997. Verified by Hobart M. Smith and David Chiszar. University of Northern Colorado Museum of Natural History (UNC-MNH 854). Range extension; closest known localities are ca. 25 miles north and 25 miles south (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY, THERESA CHILDERS, ENOCH BERGMAN, JERRY D. MANZER, JAMES SIFERT, BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

SALVADORA GRAHAMIAE LINEATA (Texas Patchnose Snake). USA TEXAS: Tom Green Co: FM 1223, 35.6 km S jct U.S. Rt. 87 and FM 1223. 7 November 1997. Jeff Wright. Angelo State Natural History Collections (ASNHC 12910). Verified by Terry C. Maxwell. New county record (Dixon 1987. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JERRY F. HUSAK**, Department of Biology, Angelo State University, San Angelo, Texas 76909, USA, and **JEFF WRIGHT**, 11633 Hawk Avenue, San Angelo, Texas 76904, USA.

SISTRURUS CATENATUS EDWARDSII (Desert Massasauga) USA: COLORADO: Baca Co: DOR, Co. Rd. 12, 1.2 mi S jct Co. Rd. JJ (37°26'17.60"N, 102°51'24.25" W). 10 May 1997. University of Northern Colorado Museum of Natural History (UNC-MNH 516). Verified by Hobart M. Smith and David Chiszar. Three additional specimens (AOR, Co. Rd. RR, 0.2 mi E jct, Co. Rd. 12, 13 August 1997; DOR, Co. Rd. 12, 2.4 mi N jct, Co. Rd. MM, 10 September 1997, UNC-MNH 801; AOR, Co. Rd. 12, 2.7 mi S jct Co. Rd. MM, 7 October 1997) were recovered in the same general area, indicating that a small population of Massasaugas still exists in Baca County; these localities represent a range extension of ca. 30 miles. Species is threatened by habitat conversion and persecution in much of its range; the last record of this species from Baca County was in 1882 (see Mackessy et al. 1996. Herpetol. Rev. 27:36). This record is a recent county record (Livo et al. 1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY, THERESA CHILDERS, ENOCH BERGMAN, JERRY D. MANZER, JAMES SIFERT, BEN HILL,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

STORERIA DEKAYI (Brown Snake). USA: ILLINOIS: Clay Co: E of La Clede. 4 May 1969. D. Cooley. INHS 9825. Verified by P. W. Smith. New county record.

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

STORERIA DEKAYI WRIGHTORUM (Midland Brown Snake). USA: FLORIDA: Franklin Co: SR 65, ca. 4.0 mi N U.S. Rt. 98 just N of Cash Bayou. 30 March 1997. Kenneth L. Krysko and Anthony T. Reppas. Florida Museum of Natural History, University of Florida (UF Color Slide 109633). Verified by F. Wayne King. New county record (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Second Ed. Windward Publ., Miami, Florida. 176 pp.). Gravid female.

Submitted by **KENNETH L. KRYSKO**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA; e-mail: kenneyk@grove.ufl.edu, and **ANTHONY T. REPPAS**, Department of Interdisciplinary Studies, University of Florida, Gainesville, Florida 32611, USA.

STORERIA OCCIPITOMACULATA (Redbelly Snake). USA: KANSAS: Crawford Co: Center of SW 1/4 Sec. 32, T27S, R24E. 7 October 1997. Dan Mosier. KU 224646. Verified by John E. Simmons. New county record (Collins 1993. Amphibians and Reptiles in Kansas. Third Ed. Univ. Press Kansas, Lawrence. xx + 397 pp.) for this threatened species in Kansas.

Submitted by **DAN MOSIER**, Kansas Department of Wildlife and Parks, 102 Hatchery Road, Farlington, Kansas 66734, USA, and **JOSEPH T. COLLINS**, The Center for North American Amphibians and Reptiles, 1502 Medinah Circle, Lawrence, Kansas 66047, USA.

TANTILLA CORONATA (Southeastern Crowned Snake). USA: ALABAMA: Dale Co: Fort Rucker Military Reservation. 4 July 1974. M. A. Morris. INHS 10163. Verified by P. W. Smith. New county record (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 347 pp.).

Submitted by **JOHN E. PETZING** and **CHRISTOPHER A. PHILLIPS**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). USA: MISSOURI: Perry co: 16 km E Perryville (37°43'07"N, 89°40'42"W) and (37°42'41"N, 89°40'45"W). 16 October 1994, B. Churchwell, J. Krejca, and S. Taylor. SIUC R-2806 and SIUC R-2805, respectively. Verified by R. A. Brandon. Each specimen found dead on a dirt road near farm fields and woodlots. County record (Johnson 1987. The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. 368 pp; Powell et al. 1993, Missouri Herpetol. Assoc. Newsl. 6:7–26).

Submitted by **STEVEN J. TAYLOR**, Center for Biodiversity, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820, USA, **JEAN K. KREJCA**, Department of Zoology, University of Texas, Austin, Texas 78712-1064, USA, and **BETH CHURCHWELL**, The Nature Conservancy, 2800 South Brentwood Boulevard, St. Louis, Missouri 63144, USA.

Range Extensions of Some Anuran Species for Santa Catarina and Rio Grande do Sul States, Brazil

PAULO CHRISTIANO DE ANCHIETTA GARCIA
Fundação Zoobotânica do Rio Grande do Sul
Museu de Ciências Naturais, Núcleo de Vertebrados
Rua Dr. Salvador França, 1427
90690-000, Porto Alegre, Rio Grande do Sul, Brazil

and
GIOVANNI VINCIPROVA
Universidade Federal do Rio Grande do Sul
Instituto de Biociências, Departamento de Zoologia
Avenida Paulo Gama, 40. Prédio 12105
90040-060, Porto Alegre, Rio Grande do Sul, Brazil

Examination of anuran specimens deposited in Coleção de Anfíbios do Museu de Ciências Naturais (MCN), of the Fundação Zoobotânica do Rio Grande do Sul, along with new material obtained in recent collections, deposited in Coleção de Répteis e Anfíbios of the Departamento de Zoologia da Universidade Federal do Rio Grande do Sul (UFRGS-DZ) and Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP), revealed nine previously unrecorded species from the State of Rio Grande do Sul. It also allowed us to extend known ranges of three species for the state of Santa Catarina. Additionally, we correct the erroneous record of *Thoropa miliaris* for Rio Grande do Sul. Identifications were verified by José Perez Pombal, Jr., and Ulisses Caramaschi.

HYLIDAE

Hyla albopunctata. SANTA CATARINA: Canoinhas Municipality (26°10'38"S, 50°23'24"W, 834 m). 20 December 1994. P. C. A. Garcia. MCP 3114–17. RIO GRANDE DO SUL: Santo Antônio das Missões Municipality (28°30'41"S, 55°13'40"W, 213 m). 17 January 1977. T. O. Bocaccio. MCN 11706. There was no previous documented record for *H. albopunctata* in Rio Grande do Sul, even though de Sá (1995) provided a distribution map for the species which included northern Rio Grande do Sul.

Hyla caingua. RIO GRANDE DO SUL: Cruz Alta Municipality (28°38'19"S, 53°36'23"W, 452 m). 4 November 1975. T. Lema, A. Lise and S. Scherer. MCN 8883–84, 8886; Santo Antônio das Missões Municipality (28°30'41"S, 55°13'40"W, 213 m). 3 October 1989. P. C. Braun. MCN 13362; Panambi Municipality: Condor (28°17'33"S, 53°30'06"W, 418 m). 30 July 1997. G. Vinciprova. UFRGS-DZ 1683. These records extend known range of the species ca. 220 km SE from Depto. de Playadito, Province de Corrientes, Argentina, as reported by Carrizo (1990).

Hyla hylax. SANTA CATARINA: Florianópolis Municipality: Córrego Grande (27°37'00"S, 48°30'00"W, 100 m). 11 September 1990. P. C. A. Garcia. MCP 3122. 12 December 1990. P. C. A. Garcia. MCN 13430–1. 18 September 1991. P. C. A. Garcia. MCP 3120. 11 September 1992. P. C. A. Garcia. MCP 3121. These records extend the known range of the species ca. 240 km S from Paranaguá Municipality: Prainha, Paraná State, as reported by Heyer (1985b).

Hyla microps. RIO GRANDE DO SUL: Tenente Portela Municipality, Parque Estadual do Turvo (27°22'16"S, 54°54'01"W, 390 m). 24 June 1985. J. Pilla. MCN 1097, 1106, 1116. These records extend known range of the species ca. 200 km W from São Francisco de Paula Municipality, Rio Grande do Sul, as reported by Kwet (1998).

Hyla nahdereri. SANTA CATARINA: Campos Novos Municipality, Ibicuí River (27°34'30"S, 51°10'10"W, 934 m). 25–29 January 1989. T. Lema et al. MCP 892–5; Rancho Queimado Municipality (27°40'21"S, 49°01'18"W, 810 m). 11 October 1991. P. C. A. Garcia. MCN 13432–33. 11 October 1993. P. C. A. Garcia. MCP 3123–24. These records extend the known range of the species ca. 230 km SSW from the type locality (São Bento do Sul, Santa Catarina, Frost 1985), to which the species had been restricted.

Scinax rizibilis. SANTA CATARINA: Florianópolis Municipality, Córrego Grande (27°37'00"S, 48°30'00"W, 100 m). 27 January 1991. P. C. A. Garcia. MCN 13443–44, MCP 3134–37. RIO GRANDE DO SUL: Terra de Areia Municipality (29°35'07"S, 50°04'15"W, 14 m). 29 September 1995. G. Vinciprova. UFRGS-DZ 1678–82. These records extend known range of the species ca. 400 km S from Corupá, Santa Catarina, the type-locality of *H. mirim*, a junior synonym for *H. rizibilis* according to Andrade and Cardoso (1987).

Sphaenorhynchus surdus. SANTA CATARINA: Lontras Municipality (27°09'58"S, 49°32'31"W, 330 m). 21 February 1991. P. C. A. Garcia. MCP 1302–05. Lages Municipality (27°48'58"S, 50°19'34"W, 884 m). 19 December 1995. A. Cardoso, P. C. A. Garcia and G. Vinciprova. UFRGS-DZ 1626–27; Tubarão Municipality (28°28'00"S, 49°00'25"W, 9 m). 10 December 1986. T. Lema and M. Di Bernardo. MCN 1325. RIO GRANDE DO SUL: São Pedro de Alcântara Municipality: (29°20'07"S, 49°43'37"W, 16 m). 29 December 1977. P. C. Braun and C. A. S. Braun. MCN 11929–30, MCN 12028–31. These records extend known range of the species ca. 600 km SSW from the type locality (Curitiba Municipality, Paraná, Frost 1985).

Phyllomedusa distincta (Perereca-da-Folhagem). RIO GRANDE DO SUL: Terra de Areia Municipality (29°35'07"S, 50°04'15"W, 14 m). 15 December 1995. G. Vinciprova and A. J. Cardoso. UFRGS-DZ 1621. 25 september 1997. G. Vinciprova. UFRGS-DZ 1684. These records extend the known range of the species ca. 150 km S from Lauro Müller Municipality, Novo Horizonte, Santa Catarina, as reported by Pombal, Jr. and Haddad (1992:228).

CENTROLENIDAE

Hyalinobatrachium uranoscopum (Rã-de-Vidro). RIO GRANDE DO SUL: Planalto Municipality (27°19'44"S, 53°03'31"W, 568 m): Rio do Mel. 19 January 1994. G. Vinciprova. UFRGS-DZ 1392; Planalto Municipality: Rio do Mel. 20 January 1994; Planalto Municipality: Rio do Mel. G. Vinciprova. UFRGS-DZ 1456; Planalto Municipality. 23 January 1994. G. Vinciprova. UFRGS 1465–66. 14 March 1997. These records extend the known range of the species ca. 170 km SE of San Antonio Depto., Misiones Province, Argentina, and 350 km W from Lauro Müller Municipality, Santa Catarina, as reported by Heyer (1985a).

LEPTODACTYLIDAE

Leptodactylus chaquensis. RIO GRANDE DO SUL: Bossoroca Municipality (23°43'48"S, 54°54'01"W, 228 m). 7–11 January 1972. P. C. Braun and I. J. Borowski. MCN 4500–07. São Vicente do Sul Municipality (29°41'30"S, 54°40'46"W, 129 m). 30 November 1981. MCN 12790. M. I. Vieira. Uruguaiana Municipality (29°45'17"S, 57°05'18"W. 66 m). 8 November 1973. E. Huber. MCN 5484–91. Uruguaiana Municipality: Touro Passo. February 1974. Miguel Bombim. MCN 6745–46. These records extend the known range of the species ca. 100 km E from Misiones Province, Argentina (Cei 1987) and 170 km NE of Artigas Depto., Uruguay (Vaz-Ferreira et al. 1984).

Eleutherodactylus binotatus (Rã-da-Mata). RIO GRANDE DO SUL: São Pedro de Alcântara Municipality (29°20'07"S, 49°43'37"W, 16 m). 21 February 1966. T. Lema. MCN 4158. This records extends known range of the species ca. 200 km S from Florianópolis Municipality, Santa Catarina, as reported by Garcia (1996).

Cyclorhamphus valae. RIO GRANDE DO SUL: Cambará do Sul Municipality: Fortaleza dos Aparados (29°02'52"S, 50°08'41"W, 1031 m). 6 January 1976. P. C. Braun et. al. MCN 9956. This record extends known range of the species ca. 90 km SW from type-locality (Gruta, Lauro Müller Municipality) as reported by Heyer (1983).

Thoropa saxatilis (Rã-das-pedras). RIO GRANDE DO SUL: Cambará do Sul Municipality, Fortaleza dos Aparados (29°02'52"S, 50°00'41"W, 1031 m). 6 January 1976. P. C. Braun. MCN 9717–18; Cambará do Sul Municipality, Itaimbezinho. 21 December 1976. S. Scherer and A. Lise. MCN 11705; Cambará do Sul Municipality. 12 January 1978. P. C. Braun, C. A. S. Braun and J. Rodrigues. MCN 12250. The possibility of occurrence of *T. saxatilis* in Rio Grande do Sul was already mentioned by Cocroft and Heyer (1988), who argued that *T. miliaris* could have been misidentified by Braun and Braun (1980). We confirm that specimens mentioned by Braun and Braun in fact belong to *T. saxatilis*. *Thoropa miliaris* should be removed from the species list of anurans for Rio Grande do Sul.

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Herpetofauna of the Highly-polluted Onondaga Lake Ecosystem, Onondaga County, New York

PETER K. DUCEY[1]
WILLIS NEWMAN
KIMBERLY D. CAMERON[2]
and
MICHAEL MESSERE[3]
Department of Biological Sciences
State University of New York at Cortland, Cortland, New York 13045, USA
e-mail (PKD): duceyp@cortland.edu

[1]Author to whom correspondence should be sent.
[2]Present address: Department of Biology, State University of New York College of Environmental Science and Forestry, Syracuse, New York, USA
[3]Present address: Department of Biology, State University of New York at Albany, Albany, New York 12206, USA

So much of the earth is now affected by human activities that greater investigative efforts will have to be directed toward disturbed habitats. Study of these newly formed "ecosystems" is necessary for understanding the dynamics of novel species assemblages as well as pollutant-organism interactions. Herein we report on the herpetofaunal populations in and around Onondaga Lake, considered among the most polluted lakes in North America (Effler and Hennigan 1996).

Onondaga Lake lies on the northwestern corner of the Syracuse urbanization area (population ca. 390,000), Onondaga County, central New York State, USA, and is surrounded by urban industrial and commercial sites and residential communities. The Onondaga Lake ecosystem was operationally defined as those aquatic, wetland, and terrestrial habitats in and around the lake up to a maximum of 250 m from the lake shorelines. Thus defined, the ecosystem is bounded on all sides by major highways and thoroughfares which are probably effective barriers to herpetofaunal terrestrial dispersals. Water enters the lake from six creeks and the Syracuse Metropolitan sewage treatment facility. Water leaving the lake enters the Seneca River of the Lake Ontario drainage system. The terrestrial habitats around the lake are largely parkland, old field, and deciduous forests over industrial waste beds, construction fill, or dredged lake sediment material (Effler and Hartnett 1996; VanDruff and Pike 1992). Several small wetlands, some connected to the lake, are scattered among the terrestrial areas.

The lake has a 150-year history of municipal and industrial pollution (Effler and Harnett 1996; Effler and Hennigan 1996).

TABLE 1. Amphibian and reptile species in the Onondaga Lake ecosystem, 1994–1997. * = less than three individuals found in four years of surveys. Catalog numbers are for voucher specimens or slides from Bowers Natural History Museum, SUNY Cortland.

Species	Life history stage	Voucher numbers
Bufo americanus	adult, calling males	96-101
Hyla chrysoscelis/H. versicolor	adult	96-110
Pseudacris crucifer	adult, juvenile	96-111
Rana clamitans	adult, larvae, juvenile	96-102
Rana pipiens	adult, larvae, juvenile	96-103
Ambystoma maculatum	adult, larvae	96-106
Notophthalmus viridescens	aquatic adult*	96-107
Nerodia sipedon	adult, gravid female	97S-11
Storeria dekayi	adult, neonate	96-104
Thamnophis sirtalis	adult, neonate	96-105
Chelydra serpentina	adult, egg	96-109
Chrysemys picta	adult, egg	96-108
Sternotherus odoratus	adult*	

Municipal sewage effluent and industrial discharge have been released into the lake since the mid-1800's (Effler and Hartnett 1996). By the late 1960s, 2.5×10^6 kg of ionic materials and 10 kg of mercury per day were being released into the lake by its single largest neighboring industry (Effler 1987). These releases were stopped by 1988, but the sewage and other industrial releases have continued. Today the lake's sediments and water column contain elevated levels of heavy metals (especially Hg), benzenes, chlorinated benzene compounds, polycyclic aromatic hydrocarbons, nitrites, and ammonia (Becker and Bigham 1995; Effler and Hennigan 1996; Normandeau Associates 1996; Wang and Driscoll 1995).

Studies of the vertebrates of the Onondaga Lake area have been limited, with the bulk of the work focused on gamefishes (Effler 1996; Tango and Ringler 1996; VanDruff and Pike 1992). There have been no previous surveys of the herpetofauna of this site.

We surveyed the lake ecosystem for herpetofauna from May 1994 through August 1997 using a combination of field techniques. We searched transects and quadrats throughout the ecosystem and used a form of time-constrained searching (termed select point sampling) in all terrestrial habitats over all seasons. For aquatic sampling we used dip-netting transects and trapping arrays using metal minnow traps and hoop turtle traps. Aquatic sampling was done in the lake and all other wetlands within the ecosystem. Auditory monitoring was conducted for all wetlands in the spring and summer of each year.

We found seven species of amphibians and six species of reptiles in the ecosystem (Table 1). This is considerably less than the nineteen amphibian species and fifteen reptile species recorded for Onondaga County as a whole during 1990–1996 (NYSDEC 1997). The species in the Onondaga Lake ecosystem are generally those most commonly reported across New York State (NYSDEC 1997) with a few notable exceptions. *Plethodon cinereus,* the most widely reported salamander in New York and usually the most abundant locally (PKD, pers. obs.), is absent from the terrestrial habitats surrounding the lake. The second most widely reported salamander in New York, *Notophthalmus viridescens,* although often in dense populations in farm ponds and disturbed areas, was extremely rare in the wetlands near Onondaga Lake. *Rana catesbeiana, R. sylvatica, Eurycea bislineata, Lampropeltis triangulum,* and *Storeria occipitomaculata* are widely distributed and locally abundant in central New York, and are generally tolerant of disturbed habitats, but were not found within this ecosystem.

Voucher specimens and/or slides for each species except *Sternotherus odoratus* are deposited in Bowers Natural History Museum of SUNY Cortland.

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BOOK REVIEWS

Snakes: The Evolution of Mystery in Nature, by Harry W. Greene. 1997. University of California Press. 351 pp. Hardcover. US $45.00. ISBN 0-520-200014-4.

RICHARD A. SEIGEL
and
NADIA A. SEIGEL
Department of Biology, Southeastern Louisiana University
Hammond, Louisiana 70402-0736, USA
e-mail (RAS): rseigel@selu.edu

This is a great time to be studying snakes. In addition to increasing recognition that snakes make good "model organisms" for many kinds of ecological and evolutionary studies, snakes are receiving long-overdue attention in the form of detailed book-length reviews and monographs. Although many current graduate students may not realize it, this is a major change from the not-too-distant past. When we first began working with snakes in 1979, the major review works available as an introduction to snake biology were Parker and Grandison's *Snakes: A Natural History*, Wright and Wright's *Handbook of Snakes*, and, of course, Klauber's epic two-volume *Rattlesnakes*. Although these were (and are) great books, they were either too limited in scope or too out-of-date to be of much use for graduate students looking to get "jump started" on snake ecology and evolution.

Things have really changed today. In addition to a number of recent edited or multi-authored volumes on snake ecology, evolution, and behavior (mainly targeted at professionals), we now have two terrific single-author volumes intended for a broader audience: Rick Shine's *Australian Snakes: A Natural History* (1991), and Harry Greene's *Snakes: The Evolution of Mystery in Nature* (1997), the subject of this review.

Greene's book is an oversized, 351-page volume that attempts to appeal to a wide audience, from the professional to the interested layperson. The book is divided into three major sections. Part One: Lifestyles, is a 153-page overview of snake biology and evolution, with material that will interest the biologist and the sophisticated layperson alike. Part Two: Diversity, is a 110-page family by family review of snake diversity and taxonomy. Much of the text is fascinating for snake biologists, but may be of limited interest to the general public. Part Three: Synthesis, is the shortest section of the book, and comprises a 40-page discussion of snake evolution, biogeography, a brief biography of some past workers on snake biology, and a short overview of snake conservation and management. We do wish the last section had been longer, especially in convincing the public for the need for appropriate protection for snake biodiversity. Interspersed among these sections are 13 short essays on "Special Topics," which range from "Deadly Colubrids and Famous Herpetologists" to "The Coralsnake Mimicry Problem." These short essays were generally very entertaining and most will be highly interesting to the layperson.

The utility of any book can be judged on three criteria: the quality of the information presented, the quality of the writing, and the quality of the presentation. We judged this book on two levels: one from the view of the professional herpetologist, the other from the viewpoint of a non-specialist educator who happens to enjoy snakes. From both of our viewpoints, this book rates as "outstanding" in all three of the above criteria. Greene's writing style ranges from warm anecdotes regarding snake studies in the field (our favorite being his detailed account on how to **try** to catch a coachwhip), to concise summaries about what we know (and don't know) about snake biology. We were especially impressed by the clear and entertaining visualization of how snakes manage to eat very large prey on pp. 55 and 59. The only area that we felt was weak was the introduction to phylogeny and taxonomy on pp. 13–17, which one of us (NAS) felt was rather confusing for non-biologists.

The information content of this book is top-notch, and will prove an essential reference for herpetologists and other biologists interested in snakes. Even those actively engaged in research on snakes will find highly useful reviews of snake phylogeny, evolution, feeding, and behavior. If you are a graduate student in herpetology, you should run, not walk, to your nearest computer and order this book from the appropriate electronic bookstore. (We found a 30% discount on one Web site we checked.)

No review of this book could be complete without mentioning the photographs. Executed by Michael and Patricia Fogden, they are nothing less than stunning. Although this is far from a "coffee-table" book, you could easily leave this book out for your dinner guests for their delight and edification. If you can repeat some of Greene's stories about the behavior of some of the many rare and unusual species illustrated in the text, your reputation as a naturalist is bound to be inflated among your friends and family.

Criticisms are an expected part of a book review, but we were hard-pressed to find many substantive ones. The book seems well constructed, the text is legible (although a bit small), the index and table of contents both work well, and the price is terrific (especially for a book with so many color plates). Several minor points should be mentioned. First, we wished that the references had been in the text, rather than summarized in the back of the book. Although this may make the text slightly more accessible for the general public, it reduces the book's utility for the professional community by a small degree. The references were, however, extensive and complete. Second, the absence of a glossary was a notable flaw, especially in a book targeted at least partially for the non-specialist. Although some complex systematic terms are defined in an appendix, a concise list of biological terms seems essential in a book such as this. Perhaps this could be corrected in a revised edition. Third, the book was somewhat lacking in diagrams and line drawings; the same section on feeding that we praised above was also a bit confusing when Greene discusses skeletal systems; a line drawing would have helped a lot.

Comparisons between Greene's book and Rick Shine's text on the natural history of Australian snakes are perhaps inevitable. Both are superb products from two of the outstanding snake biologists of their time and appeal to much the same audience. However, choosing between the two is fruitless; both should be on the bookshelf of anyone interested in snakes. Perhaps the most striking contrast between the two texts concerns their respective attitudes towards venomous snakes. On p. 215 of Greene's book he states that "big elapids are among the scariest of animals." We agree wholeheartedly, but our conversations with Shine suggest that he would concur only if you replaced the word "elapids" with "rattlesnakes"!

In summary, this is a great book, and will stand as a long-lasting tribute to Harry Greene's broad accomplishments in herpetology. You will want a copy on your bookshelf, a copy for your graduate students, and we suspect you will find it an invaluable reference for lecture classes as well.

Herpetology, by F. Harvey Pough, Robin M. Andrews, John E. Cadle, Martha L. Crump, Alan H. Savitzky, and Kentwood D. Wells. 1998. Prentice Hall, Upper Saddle River, New Jersey. 577 pp. Hardcover. US $72.00. ISBN 0-13-850876-3.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: abauer@king-kong.vill.edu

Despite what we would like to think, herpetology as an academic discipline is still a small field. Unlike general biology, genetics, biochemistry, or introductory ecology, the demand for textbooks is limited and the market is unlikely to support a diversity of competing titles. Until this year the only available herpetological textbook in English has been that by Zug (1993), which in turn replaced earlier texts by Goin, Goin, and Zug (1978), Porter (1972), and Goin and Goin (1962). It is certainly true that a larger, more well-illustrated, up-to-date herpetology text was sorely needed, and *Herpetology* does fit the bill. Nonetheless, I have a very mixed reaction to this contribution from Pough and colleagues. The book achieves its major aims, and will be used by herpetology classes around the country, but it is rife with errors and lacks the tight editorial supervision demanded by a book with six authors. The errors themselves would be excusable if they were errors of omission (after all, we each have our own views about what topics and examples are essential), but many of the errors in this text are errors of commission and, as such, they provide misinformation to novice readers (i.e., students).

Herpetology is organized into four sections: "What are amphibians and reptiles?", "How do they work?", "What do they do?", and "What are their prospects for survival?" The first section deals mainly with the basic anatomy, systematics, evolution, diversity, and distribution of amphibians and reptiles. It also includes an introductory chapter on herpetology as a discipline. The second section treats physiology, reproduction, and functional morphology. The third section covers behavior and ecology, and the fourth contains only a single chapter dealing with conservation, a topic that must be addressed in any modern herpetology course. Each chapter concludes with a summary. These are highly variable in level of detail, with some providing useful overviews and others being too sketchy to really serve a function. Overall, the authors present a fairly comprehensive overview of herpetology and I was not struck by many glaring omissions of topics or concepts (but see below). However, the interests of at least some of the authors are reflected in the depth of coverage of certain fields and in the apparent non-random distribution of errors, typos, and editing rigor. There are also a few quirks in the organization of material within the book. For example, there are two sections dealing with the structure and function of pit organs. Oddly, the longer section is not listed under "Pit organs" (p. 303), but rather on p. 111 under the sensory systems subsection in the general section on snakes. Perhaps most confusing, a section on "Pets and Zoo Exhibits" in the last chapter says nothing about zoo exhibits.

My own interests in systematics, biogeography, and morphology perhaps make me more acutely aware of errors in the first section of the book than in others, and perhaps I am being too picky, but I noted more than 100 factual errors (each relatively small) in this section of the book. The remainder of the book was less striking in this regard, although typographical errors, the use of outdated names and other evidences of editorial slack, are liberally sprinkled throughout the text. I am especially troubled by those errors relating to taxonomy and distribution. While such trifles may be regarded as of minor concern with respect to broad conceptual issues, they are among the many bits of factual information that we require our students to know and which distinguish amphibian systematists and reptile ecologists from those asking purely theoretical questions in the same conceptual disciplines.

Some of the difficulties with taxon names can be attributed to simple typographical errors (e.g., *Ichtyophis* for *Ichthyophis*, p. 47; *Rhotropus* for *Rhoptropus*, p. 98; *Basiliscus basilicus* for *B. basiliscus*, p. 395). Others reflect the use of outdated names (e.g., *Gerrhonotus multicarinatus* is used instead of *Elgaria multicarinata* in a figure caption, p. 104; *Heteropholis* is used instead of *Naultinus* for the South Island, New Zealand green geckos, p. 98; *Amphibolurus ornatus* is used rather than *Ctenophorus ornatus*, pp. 177, 202; a cladogram reproduced from an older source shows the family Polychridae rather than the Polychrotidae, p. 318; *Aporosaura anchietae* [misspelled as *anchiatae*] is used in place of *Meroles anchietae*, p. 138), or in many cases, the same species is cited under two different names, suggesting that the names were employed as they were used in the primary literature without a uniform attempt to standardize and update them (e.g., a diagram is labeled *Trionyx spiniferus* rather than *Apalone spinifera*, on p. 143, although the latter name is found in a figure legend on p. 81; *Trachydosaurus rugosus* and *Tiliqua rugosa* are both used in the text and indexed separately; *Tropidonotus natrix* is used instead of *Natrix natrix* on p. 184, although the name in current use appears at least four other places in the text). In still other instances, species are wrongly assigned to genus or even to family (*Trionyx triunguis* is listed as *Apalone triunguis*, p. 171; *Gallotia stehlini* is referred to the Agamidae rather than the Lacertidae, p. 413; *Hyla kivuensis* is used for *Hyperolius kivuensis*, p. 142). Finally, a variety of incorrect statements result from higher order taxonomic changes that were obviously incorporated into the familial summaries, but whose ramifications for other parts of the text were not considered. Chief among these are the recognition of the Eublepharidae as distinct from the Gekkonidae, and the recognition of several families of pleurodont iguanians. The terms gekkonid and iguanid thus are sometimes used to refer only to the more restricted families recognized by the authors and sometimes to the more inclusive groups of limbed gekkotans and pleurodont iguanians, respectively. Thus, *Coleonyx* is referred to as a gekkonid rather than a eublepharid (p. 314), the herbivorous specializations of iguanines (pp. 304–5), meaning the group introduced earlier (p. 94) as the Iguanidae, are discussed and *Uma* is listed as a member of the Iguanidae (p. 244), whereas it is elsewhere (p. 257) correctly assigned to the Phrynosomatidae.

Many errors have also crept into the written statements of distribution and especially into the printed maps. I applaud the use of maps showing country boundaries. These help the reader to more clearly pinpoint the edges of ranges and allow a more accurate comparison with more detailed physical or political maps should one be so inclined. However, having gone to the trouble of preparing such useful maps, the authors have used outdated base maps (they illustrate a united U.S.S.R. and Czechoslovakia and a divided Germany) and they have made numerous errors with respect to plotted ranges. One of these, showing the distribution of gekkonids in the Caspian Sea, is obviously an oversight, but others deserve some comment.

According to the maps provided, sirenids are endemic to the United States, as their distribution in northeastern Mexico is not

plotted. The illustrated distribution of salamandrids in South Asia does not extend far enough to the west to encompass the entire Indian range of *Tylototriton verrucosus*, nor does it include northern Iraq, where *Neurergus* and several other taxa occur. The map for pipids excludes most of Namibia, although *Xenopus laevis* is common in most of the permanent waters of the country, including desert springs. That for bufonids suggests a complete absence of this group in North Africa, where seven species of toads occur. It also does not extend far enough north in central Canada to encompass the true range of *Bufo hemiophrys*. Pelomedusids are not mapped in southwestern Africa where the genus *Pelomedusa* is extremely common. The map for the Trionychidae excludes the Philippines, New Guinea, the Horn of Africa, and Angola (essentially the distributions of *Pelochelys* and *Trionyx*). Agamids are omitted from Greece and portions of Mongolia and the southern parts of Asian Russia. Among iguanids, the distribution of *Brachylophus* in Fiji is mapped, but that in Tonga is not. The gekkonid map omits northern Mexico, California, and Florida, as well as large areas of the Palearctic range of the family. Eublepharids are illustrated as absent from western peninsular India, most of Iran, Kenya, and mainland China and Vietnam where they occur (although the last two localities are recent discoveries and cannot reasonably have been expected to appear on the maps). Varanids are not shown as occurring in much of their Asian range. Scincids are not depicted in the Caucasus or the Russian far east. Likewise, their North American distribution is also incorrect, with the range of *Eumeces septentrionalis* in northern Minnesota, southern Manitoba, and North Dakota largely excluded. Anguids are not illustrated as occurring in the inland of California (nor in western Nevada, where they have recently been recorded). The boid genus *Candoia* extends further into the Pacific than indicated on the corresponding map on page 119, reaching the Tokelau Islands. The mapped distribution of viperids in southwestern Canada is too restricted; in Alberta *Crotalus viridis* extends to almost 52° N. Elapids are incorrectly shown as absent from much of Peru.

In some cases the maps and written description of distribution do not match: The text for the Scolecomorphidae (p. 51) mentions Cameroon, Malawi, and Tanzania, whereas the map excludes Malawi but also illustrates the family's occurrence in Mozambique and Nigeria. Likewise, pygopodids are not mapped as occurring in New Guinea, where two species, one endemic, actually occur, although the text on this point is correct (p. 99). *Laticauda crockeri* is not, as indicated on page 126, restricted to freshwater lakes in the Philippines, rather it occurs on Rennell Island in the Solomons.

Additional errors plague other portions of the book as well. My own favorite group of herps, the Gekkota, is hit fairly hard with inaccuracies. The squamate phylogeny presented represents the Gekkonidae, Pygopodidae, and Eublepharidae as an unresolved trichotomy. I know of no systematist who would not regard the Eublepharidae as the sister group to the others. On page 92 gekkonids but not eublepharids are mentioned as having temperature-dependent sex determination (TSD), although the most well studied lizard in this regard is the eublepharid *Eublepharis macularius*. Elsewhere *Gekko* is singled out as an example of a gekkonid exhibiting TSD. This is true for some members of the genus but sex chromosomes have been identified in at least one species of *Gekko*. Gecko setae are mentioned as being 60–90 microns in length. Such long setae characterize only some groups of geckos, with most species having much shorter structures. The genus *Rhacodactylus* is stated to be viviparous, when in fact only one species of six, *R. trachyrhynchus*, is. *All* geckos are cited as having autotomic tails [note that the italics here and throughout the review are mine]; *Nephrurus asper* does not. The description of another defensive strategy, regional integumentary loss, is also incorrect. Contrary to the book's description, the whole skin is not lost, the morphological adaptation to the loss is in the dermis, not the epidermis, and the skin takes many months to regenerate, although fibroblasts cover the wound site rather quickly. Likewise, contrary to the text on page 428, the tail-squirting mechanism in *Diplodactylus* (*Strophurus*) does not involve the use of hollow spines as conduits of the secretion. Sphaerodactyls are known to have arisen within gekkonines; thus, the recognition of the Sphaerodactylinae on page 98 creates a paraphyletic group. Finally, there are six, not five, eublepharid genera, all of which lack spectacles (on page 107 eublepharids are listed as having spectacles, whereas gekkonids are not).

Such problems are not limited to geckos, however. They begin with the origin of tetrapods (three living lungfish species are stated to exist—there are actually six, p. 24), continue through amphibians (*Karaurus sharovi*, a well-known Jurassic salamander, is stated to be from Russia, p. 38—it is in fact from Kazakhstan), and on to reptiles (*all* cordylids, except *Cordylus giganteus*, are described as rock-dwelling, p. 105—in fact *Cordylus macropholis* is associated with vegetation and *Chamaesaura* spp. are grassland inhabitants). Many of the other misstatements in the text are contradictory and are clearly evidence of lack of critical editing. On page 111 it is stated that there are more than 1800 snake species, although elsewhere the more reasonable number of 2700 is given. On page 125 there are "approximately 70 species of sea snakes," while on page 126 only 60 species are acknowledged. In the chapter on reproduction, figure 7-1 shows a stylized *Cnemidophorus* as the representative of gynogenetic reproduction whereas an ambystomatid is illustrated to represent parthenogenesis. This is in contrast to the (correct) attribution in the text of parthenogenesis to reptiles and gynogenesis (or perhaps hybridogenesis, or both) to ambystomatids. A statement on p. 125 that "species of the *Hydrophis* group have lost the one-to-one association of ventral scales with vertebrae" appears to contradict that on p.112 that "the 1:1 relationship between ventral scale rows and vertebrae, characteristic of *all* other snakes, does not hold in Typhlopidae and Anomalepididae."

Several other comments reflect over generalizations or exaggerations. For example, contrary to the statement that *nothing* is known of the natural history of *Osteolaemus*, there exist basic (though limited) data on reproduction, diet, and other life history parameters. Likewise, the statement that "*all* scleroglossans use some visual displays in aggressive and courtship interactions" (p. 363) is without firm basis. Vocal signals are not limited to gekkonids, as claimed by the authors (p. 364), although they may be the only squamates to produce complexly modulated calls. There are exceptions to the statement (p. 241) that metatarsals I–IV in lizards are tightly bound, specifically in geckos, in which the feet exhibit a secondary symmetry.

Still other statements, while true, may be confusing to the uninitiated. On page 113 the enlarged quadrate of leptotyphlopids is referred to as part of the lower jaw. Although it functions in the movement of the mandible, the quadrate forms the distal part of the upper jaw articulation and students who may remember their comparative anatomy may be stymied by this interpretation. The term chondrocranium is used to mean larval skull (p. 272). This is not the general use of the term which is typically applied to the endochondral portion of the skull except the visceral (or splanchnocranial) skeleton. The usage here includes both the chon-

drocranium and splanchnocranium and implies that the term applies during only the larval life stage. On page 231 it is stated that the lack of maxillary bones yields a pointed snout in *Necturus*. It should be clarified that the skull is pointed, but that the snout as a whole is definitely not. The presence of sonograms with no corresponding discussion of how to "read" them, and the discussion of physiological parameters without an explanation of the units involved may also prove to be difficulties for students who have not had courses in associated disciplines.

The production values of the book are generally high, typical of modern, expensive textbooks, although several of my colleagues have noted dissatisfaction with the thinness of the paper (photos and even text tend to show through pages), and the quality of the binding (like most textbooks it is low but serviceable). Photo and figure reproduction are generally good, but there are notable exceptions. Some figures taken from other sources did not reproduce well and probably should have been redrafted or reproduced by other means. In particular, those illustrating the morphology and mechanics of fossorial reptiles (pp. 258–259) and the feeding of a larval ambystomatid (p. 268), are problematic. Many problems are associated with the figure captions. Some figures from the primary literature were apparently relabeled, resulting in errors in the textbook that are not present in the original (e.g., p. 335). The skull diagrams of snakes (pp. 115–117) lack a legend to the many abbreviations used as does the series of diagrammatic tadpole cross-sections on page 277. The reptile heart diagrams on page 183 have some, but not all, of the abbreviations explained. Contrary to the caption accompanying the illustration of a gila monster on page 300, the grooves in the teeth of the lower jaw are not illustrated. A photograph of the Cuban crocodile bears the caption "*Crocodilus rhombifer* (Crocodylidae, Australia)" thus including a generic misspelling and allocation to the wrong continent.

The litany of minor faults listed above could, for the most part, be dealt with by a detailed errata sheet. On the level of broader issues and topics in *Herpetology*, I am disappointed with one major omission. The book's discussion of distribution is almost exclusively ecological. Historical factors are mentioned, but there is no historical biogeographic framework for explaining amphibian and reptile distributions. Thus, distributions are presented more as disparate facts rather than as a unified record of earth and biotic spatial history. Indeed the terms biogeography, zoogeography, tectonics, or vicariance do not appear in the index and are effectively absent from the text. There is also little information about extinct lineages of amphibians and reptiles, although these are often treated, at least in passing, in herpetological courses. In particular, most students have an interest in dinosaurs and some placement of these and other extinct lineages into broader phylogenetic and functional frameworks would probably be appreciated. Other omissions are more a matter of taste and personal preference, although I would have liked to have seen a more detailed treatment of venoms and a review of basic tadpole mouthpart terminology, and among the topics that might have been mentioned in the section on feeding and diets are the many nectivorous lizards and their potential role in pollination, and the existence of herbivory in at least one frog species.

Finally, the book is provided with a bibliography of over 1500 references, many as recent as 1997. The authors state clearly in the preface that the references are biased towards more recent and accessible literature. This is a practical goal and one that is met reasonably well. However, if students are to use the references as an entrée into the literature it is somewhat troubling to find that foreign language citations are few and that there are no senior author citations for leading herpetologists like Mertens, Darevsky, and Lanza, whereas there are 51 such citations for the papers by the authors of the textbook.

My specific complaints aside, I am loathe to discard the baby with the bath water and do feel that Pough et al. have done a service to the discipline in producing an up-to-date herpetology text. I acknowledge the tremendous effort that has gone into this volume and merely wish to note that the final product has perhaps emphasized the forest at the expense of the trees. There is clearly room for improvement and much tighter editorial control in subsequent revisions. Nonetheless, the most important question regarding any textbook is "should I adopt it for class use?" The answer in this case is a qualified yes. The shortcomings of *Herpetology* do not outweigh the benefits of being able to offer students an extensively illustrated and up-to-date course text. Nonetheless, I would not be comfortable assigning this book to my students without providing them with an errata sheet and redrafted maps. The fact of the matter is that "-ology" courses are a combination of major themes and concepts and a lot of nuts and bolts details, the type that are necessary in order for students to gain a comfortable working background with the organisms. I would hope that the authors and Prentice Hall would consider a corrected second edition of the book at the earliest possible date, even if major updates and additions are not contemplated in the near future.

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Amphibiens et Reptiles du Maroc (Sahara Occidental compris), Atlas biogéographique (Amphibians & Reptiles of Morocco [Including Western Sahara], Biogeographical Atlas), by Jacques Bons and Philippe Geniez. Trilingual (French, Spanish, English). Published by the Asociación Herpetológica Española, Barcelona, Spain.1996. Softcover, 320 pp. ISBN 84-921999-0-3. Pts 9,000.- (approx. US $60.00).

ULRICH JOGER

Hessisches Landesmuseum
Friedensplatz 1, 64283 Darmstadt, Germany
e-mail: u.joger@hlmd.tu-darmstadt.de

Wolfgang Böhme stated in his foreword to *Amphibians and Reptiles of North Africa* by Schleich et al. that "in northern, i.e. palearctic Africa, a herpetological field guide is lacking so far." As it is always more informative if book reviews can be done in a comparative way, it is fortunate that this is not entirely true. First, a fieldguide to Saharan herps and fishes was published by LeBerre

in 1989. Second, Bons and Geniez have produced a new "biogeographical atlas" of the amphibians and reptiles of Morocco that is a direct competitor to Schleich et al.'s book, as it covers 11 of the 12 amphibian species and 93 of the 110 reptile species of Schleich et al.'s more geographically inclusive book. In fact, as a field guide for the non-specialist, the atlas of Bons and Geniez is more useful as it depicts every single species (except the extralimital *Acanthodactylus savignyi*) in a good color photograph whereas Schleich et al., although presenting a great many more or less detailed drawings, depict only about two-thirds of the species photographically, and the quality of these figures varies considerably. Some specimens were dead when shots were taken. Others are represented by extralimital specimens (e.g., *Blanus cinereus*, *Coronella girondica,* and *Vipera latastei* from Spain) or even different species (e.g., *Leptotyphlops cairi* for *L. macrorhynchus* in Fig. 117, an Asian *Echis carinatus* in Fig. 145). It is especially regrettable that less than half of the endemic species and only five of 15 southern Saharan species are illustrated in color. However, Schleich et al. include keys for all genera, whereas the 'atlas' regrettably lacks these.

Amphibians and Reptiles of North Africa is devoted to the herpetofauna of Morocco, Algeria, Tunisia, and Libya, with Egyptian species listed in an appendix. The book is made up of a general part and a species section. The general part is subdivided into an introduction, a general species list (not complete, see below), a description of climate and vegetation, a large zoogeographical section, including a number of transects showing species community change and a country-based list of species numbers per genus (not complete, see below), an equally extensive ecological section with tables on habitat choice, seasonal activity and reproduction cycles, population density and biomass, and transects through selected habitats. This general part, making up some 90 pages, contains a wealth of information. However, it is very difficult to review the extensive tables in detail, as they accumulate data from different authors without giving references.

The rest of the book consists of the species accounts. When available, the authors try to present details about morphology, ecology, behavior, habitat, activity pattern, population structure and dynamics, ecological parameters (community, prey, predators), reproduction, distribution and systematics. Schleich et al. obviously have tried to incorporate as much available information on each species as possible. As a consequence, the account of a well known species, *Uromastyx acanthinura,* occupies 13 pages with 33(!) line drawings and 6 color photos (albeit all of the nominate subspecies), whereas *Acanthodactylus longipes,* for instance, is accorded just one page, two drawings, and no photograph. Bons and Geniez generally devote only about one half text page (ranging from one quarter of a page to two half pages, in each of the three languages, French, Spanish, and English) to each species.

Despite providing more material, however, Schleich et al. display a great deal of information in an apparently unselective and confusing way. For instance, a two-page color plate is devoted to the different color phases a chameleon can attain. As there is only one species of *Chamaeleo* in North West Africa, this illustration appears unnecessary. It would have been much better to show a specimen of the desert form, C. *chamaeleon "saharicus,"* which has lost the ability of color change to a great extent. This special ecotype (or subspecies?) is not even mentioned. There are many other examples of interesting but superfluous information, such as (still in *C. chamaeleon*) drawings of hemipenis, movements of chromatophores, and the mechanism of tongue protrusion. A few examples from other species include: a sonogram of the distress call of the lacertid *Psammodromus algirus*, flow diagrams of social behavior in *Scincus scincus* and *Uromastyx acanthinura*, a cross section through the head of *Trogonophis wiegmanni*, illustrations of snake movement types, etc. The book could well be intended as an introduction to general herpetology for North African biology students, had it been written in French, the teaching language of most North African universities.

Much of the information presented by Schleich et al. seems to have been extracted from the literature without critical evaluation. There are many inaccuracies, but their sources are difficult to trace, as references to the origin of data and figures are only exceptionally given in an easily traceable way. Despite an extensive bibliography, many relevant articles were missed. I found the following more serious mistakes:

- Plate 51, intended to show *Tarentola boehmei*, in fact shows *T. mauritanica juliae*.
- *Psammophis sibilans* is reported as an inhabitant of Morocco, Algeria and Tunisia. In fact, the only place in North Africa where it occurs is the Nile valley (Brandstätter 1996).
- *Gymnodactylus moerens* is regarded a synonym of *Quedenfeldtia trachyblepharus*. Obviously, the authors overlooked that Arnold (1990) had separated *Q. moerens* as a separate species.
- *Scelarcis perspicillata* is included in *Podarcis*, although it had been demonstrated long ago that it is not related to that genus (Odierna et al. 1987; Mateo and Cano 1991). Other examples of taxonomic differences between the two books are given in Table 1.
- The Egyptian spitting cobra is called *Naja nigricollis*, although the species found in Egypt is in fact *N. pallida* (Golay et al. 1993).
- *Echis coloratus*, the second species of saw-scaled viper in Egypt (Joger 1984), is not included in the Egyptian species list nor in the key.
- *Testudo graeca* which does not inhabit Egypt (Buskirk 1996) appears in the Egyptian key.
- The revision of the *Chalcides chalcides* complex by Caputo (1993) unfortunately came to the attention of the authors once printing had already started. They included the revised taxonomy as an appendix, proposing corrections to the appropriate chapter. However, no corrections were proposed for the species lists (p. 8–9, p. 27, p. 36–51, p. 55–59) where *Chalcides mertensi, C. minutus,* and *C. pseudostriatus* are lacking, and *C. parallelus* appears under the name *C. ghiarai*.

There are some other omissions in those species lists such as *Lacerta pater* (lacking in the general species list, p. 9), *Bufo brongersmai* (not listed in the list of endemics of the Atlantic coastal strip, p. 27), the genera *Scincopus* and *Echis* (lacking in the regional checklist for Morocco, p. 55–56), genus *Agama* (not indicated for Libya, p. 55). In the checklist on p. 55, only one species of *Sphenops* is mentioned for Libya, whereas according to the map on p. 367, three species of that genus should occur there.

Despite a confusing number of species lists concerned with ecological and geographical variables, there is no species checklist for individual countries except a partial one for Egypt (excluding species only known from Sinai and species also occuring in other North African countries) which is presented as an appendix. Trying to extract reliable distribution information from the maps, which are often just raw sketches may result in erroneous or incomplete data. Examples include:

TABLE 1. Differences in the taxonomic treatment of North African amphibian and reptile species (* = more "progressive" taxonomy).

Schleich et al. (1996)	Bons and Geniez (1996)
*Salamandra algira**	*S. salamandra algira*
*Agama impalearis**	*A. bibronii*
Chalcides ghiarai	*Ch. parallelus**
Eumeces (schneideri) meridionalis	*E. algeriensis meridionalis**
Scincus scincus laterimaculatus	*S. albifasciatus laterimaculatus**
*Mesalina simoni**	*M. olivieri simoni*
Podarcis perspicillata	*Scelarcis perspicillata**
Acanthodactylus erythrurus lineomaculatus	*A. lineomaculatus**
Telescopus obtusus	*T. dhara**
*Echis arenicola**	*E. leucogaster*

- *Salamandra algira*: not shown from Tunisia from where it is known (Salvador 1996).
- *Stenodactylus sthenodactylus*: not shown from the Tunisian coast where it occurs (e.g., on the island of Djerba, which is mentioned in the 'island checklist' on p. 53).
- *Trapelus tournevillei*: only a small part of its actual distribution in Tunisia shown.
- *Acanthodactylus longipes*: not mentioned for Tunisia where it is abundant in dune areas.
- *Acanthodactylus scutellatus*: said to occur in Morocco where, according to Bons and Geniez, it is not present.
- *Sphenops delislei*: not mentioned for Morocco/West Sahara.
- *Bufo mauritanicus, Bufo viridis,* and *Mauremys leprosa* are reported to occur south of the Sahara (Mali/Niger). These records are erroneous (Joger and Lambert 1996).

In some difficult species complexes, the authors add to the existing nomenclatural confusion by using different names in different sections of their book. For instance, *Scincus albifasciatus* is listed as a valid species on p. 9, but is included in the species account of *Scincus scincus* and is lacking in the scincid key (p. 322). *Uromastyx* (*acanthinura*) *geyri,* the taxonomy of which is unsettled, appears as full species on p. 8 and 58. *Macrovipera* is sometimes included in *Vipera*. *Dicroglossus occipitalis* is called *Rana occipitalis* in the general section. *Acanthodactylus longipes* and *A. dumerilii* are regarded as semispecies in the *A. scutellatus* complex, whereas in the general section they are not separated from *A. scutellatus*, except in the species list on p. 9. A similar confusion applies to *A. bedriagai*, *A. busacki,* and *A. maculatus* in the *A. pardalis* species group.

TABLE 2. Mapped dots for rare species of Moroccan reptiles.

	Schleich et al. (1996)	Bons and Geniez (1996)
Dasypeltis scabra	2	5
Natrix natrix	7	16
Lamprophis fuliginosus	5	7
Bitis arietans	7	29
Vipera monticola	2	32
Lacerta andreanskyi	6	22
Psammodromus microdactylus	8	14
Mesalina pasteuri	1	6

These deficiencies not only demonstrate an insufficient literature survey but also suggest a lack of field experience.

Jacques Bons and Philippe Geniez, on the other hand, are well known specialists on Moroccan herps as evidenced by their extensive publication lists. Jacques Bons' field data have been accumulated over more than 40 years. Moreover, these authors relied on information gathered from about 200 field observers, among them many prominent herpetologists. The resulting distribution maps are really fascinating. There are two maps for each species: One for the traditional territory of Morocco, depicting single localities, and one for Morocco and the Western Sahara, showing distribution in squares of 22 x 25 km. Schleich et al. have only few dot maps for less common species; a comparison of some of them shows large differences (Table 2).

In contrast to Schleich et al., Bons and Geniez restrict the species part of their atlas to taxonomic and geographic information. Unfortunately, their texts are too short and lack identification characters (except in some cases, as in distinguishing between the two *Quedenfeldtia* species). When they discuss subspecies, as in *Scelarcis perspicillata* and *Tropiocolotes tripolitanus*, or high intraspecific variability, as in *Rana saharica*, they show additional photos. The general part of the text makes up some 50 pages (in fact only half pages, as it is bilingual, French and Spanish, with a rather poor English translation appended). An introduction is followed by a taxonomic list with scientific and vernacular names in three languages (but not in Arabic!). Climate and vegetation are briefly outlined. A biogeographical section classifies all species according to their affinities and gives information on centers of endemism and on altitudinal distribution. The history of herpetological research in Morocco, and the methodology of mapping the 'atlas' are explained. An interesting table displays abundance statistics derived from the number of individual recordings (*Agama bibronii* heading the list with more than 1000 observations; the rarest species being *Echis leucogaster* and *Scincopus fasciatus*). A section on conservation is included.

In conclusion, which book can be recommended for information on the North African herpetofauna? The choice is not easy. Certainly, the work of Schleich et al. contains much more information on the subject than any other. It would be an injustice to the authors not to acknowledge the great effort they have made. However, as outlined above, their uncritical and incomplete treatment of primary literature precludes the use of their work as a handbook and it is too expensive and inadequately illustrated to serve as a fieldguide. It could best be seen as a preliminary draft of a future handbook on North African herpetofauna. As a

source of taxonomic or distribution information, it can only be used with considerable caution. For that purpose, the atlas of Bons and Geniez is much more reliable. However, the latter is restricted to Morocco and the western Sahara.

To the participants of my annual student excursions to North Africa, I am recommending a combination of the taxonomically outdated Saharan fieldguide of LeBerre (1989) with the up-to-date atlas of Bons and Geniez (1996). Together they contain all North African herp species and cost less than the book of Schleich et al. Coming back to my introductory remarks on Böhme's statement, I have to admit that, in a strict sense, his complaint still holds true: a comprehensive and accurate fieldguide on North African herps is still needed.

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RODOLFO RUIBAL

Department of Biology, University of California
Riverside, California 92521, USA

For the past fifty years the herpetofauna of Argentina has been José Miguel Cei's subject of study. His first publication on the biology of Argentine amphibians was in 1948 when he was professor at the Universidad Nacional de Tucumán in northern Argentina. Later, as Director of the Instituto de Biologia at the Universidad Nacional de Cuyo in Mendoza, he continued his intensive study of amphibians and published on a diversity of topics ranging from reproductive cycles, ecology, and taxonomy to a series of papers with V. Erspamer on the biochemistry of anuran skin secretions. In 1962 he published *Batracios de Chile* and in 1980 produced *The Amphibians of Argentina*, a 600-page comprehensive study in English published by the Monitore zoologico italiano (Italian Journal of Zoology). This book set a high standard, with detailed descriptions as well as extensive illustrations, including color figures of almost all the species, and extensive ecological information. In the early 1970's he had started studying Argentine reptiles and in 1986 authored, in Spanish, a 500-page book on the reptiles of western and southern Argentina (*Reptiles del Centro, Centro-oeste y Sur de la Argentina*) published by the Museo Regionale di Scienze Naturali in Turin, Italy. The text was a detailed description of each species, complete with ecological information and excellent color photographs of living specimens. The text included an English version of the keys.

Cei's most recent book covers the reptiles of the northern and eastern part of Argentina: *Reptiles del Noroeste, Nordeste y Este de la Argentina*, published in 1993 by the same museum in Turin. This is a 950-page tome presenting the rich and diverse fauna of this mostly tropical and subtropical region. The reptilian fauna of this part of Argentina contains 77 genera, in contrast to the 37 genera found in the more southern portion of Argentina covered in the 1986 volume. Like his previous books, it is profusely illustrated with excellent color photos of live specimens and of the habitats. The keys are in Spanish and English. The geography of the area covered includes a diversity of ecosystems ranging from tropical forests, semi-arid Chacoan habitats, pampas, and Andean mountains and plateaus.

Cei has done extensive field work throughout Argentina and has observed most of the species of this region in nature. This has certainly contributed to the excellent and diverse content of his species descriptions. Cei's taxonomic presentations are detailed and complete. Each species is presented with a diagnosis and if appropriate a discussion of the history of the species. This is followed by a more detailed description, the distribution and finally a section on the biological aspects of the species, including (when available) information about habitat, ecology, reproduction, feeding behavior, etc. The genera are also presented with a historical review and followed by a discussion of generic characters. The section (about 60 pages) on *Liolaemus* presents an excellent summary of the characteristics of the various subgenera and "groups" of this diverse genus. Cei also uses subgeneric classification in *Stenocercus*. He uses "group" classification for numerous genera. He supports his subgeneric and group classification on the arguments of Dubois (1982). Unfortunately, this citation was left out of the bibliography.

The text of this volume is encyclopedic. In his Introduction, Cei includes a section on hemipenal structure, another on karyotypic data, and a further section on biogeography. Under his infraorder Serpentes he presents a detailed discussion of the phyletic relationships of snakes. He follows McDowell's snake classification and presents a sophisticated and interesting discussion of snake evolution. His bibliography is extensive, with the earliest paper cited being a 1770's article by a Jesuit who published on the reptiles and amphibians of Paraguay.

Unfortunately, final proof reading was not possible by Cei and consequently the tome comes with a list of errata and corrections. Most of the errors are minor typos.

The book includes an appendix that adds the results of the Second Argentine Herpetological Congress of 1992 which appeared when the manuscript was at the printers, as well as a number of other papers that appeared at this time.

In summary, this opus is an excellent addition to the more than 40 years of research and publication carried out by Cei. His monographic studies of amphibians and reptiles have set a very high standard for fellow herpetologists.

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Lizards, by Manfred Rogner. 1997. Krieger Publishing Company, Malabar, Florida. 2 vols., 646 pp. Cloth. US $97.50. ISBN 0-89464-972-8.

GREGORY J. WATKINS-COLWELL
Department of Biology, Sacred Heart University
5151 Park Avenue, Fairfield, Connecticut 06432, USA
e-mail: GJWC@AOL.COM or Colwell@shu.sacredheart.edu

This two volume set represents an ambitious, and overall successful, attempt to distill all that is known about lizards into bite-sized morsels that are relevant to the hobbyist and amateur herpetologist. Information presented by the author should prove useful to the lizard keeper, but may be of limited use to scientific ventures beyond those reached via animal husbandry. These books originally were written and published in German in 1992. The version reviewed here was translated into English by John Hackworth.

The text is divided into three main divisions; the Introduction (2 pages), The Care and Husbandry of Lizards in the Vivarium (11 pages), and taxon accounts (565 pages). The books also include bibliographies of 323 (Vol. 1), and 338 (Vol. 2) citations that relate chiefly to captive management, and an index.

The Introduction includes background information on reptile classification, and very basic anatomy and life history of lizards and lizard-like reptiles (the author includes crocodilians and *Sphenodon*). This section is informative, but rather short. Most of this information would have been better presented in a separate section on lizard biology, rather than crammed into a two-page introduction lacking figures.

The section on care and husbandry provides a broad overview of vivarium design, lighting, temperature, nutrition, and reproduction. Oddly, this section also provides a chart of lizard squamation and some of the basic gekkonid toe morphologies. This material would have been better suited to a section on basic anatomy.

The taxon accounts are organized by family and subfamily using, in some cases, antiquated and, in other cases, fictional nomenclature. A brief overview is provided for each family, including an estimated number of species recognized, habitats utilized, and some basic defining characters that are attributable to the entire family, a daunting task especially when using paraphyletic groupings. Each family and subfamily is then represented in the text by species that at least occasionally enter the pet trade in Europe or North America. Many species are also depicted in attractive color photos. For each genus the number of species and a general physical description are provided. Species accounts within each genus are arranged alphabetically and organized into sections entitled "Distribution," "Description," "Habitat," and "Lifestyle, husbandry and reproduction." The last of these is generally the longest section.

Throughout the text subtle errors in taxonomy are made. These volumes could have referenced some of the more widely read and accepted systematics papers of recent years. Yet, virtually none of the changes in taxonomy that are associated with phylogenetic analyses of the past decade have been cited. This is most evident in the section entitled "Iguanas: Family Iguanidae," in which one can read about *Anolis* and *Basiliscus*. Frost and Etheridge (1989) elevated the subfamilies within the classic "Iguanidae" to familial status, an analysis and treatment that has been often discussed and debated, but generally accepted (but see Macey et al. 1997).

Additionally, all anoles are treated as *Anolis* of the subfamily "Anolinae." A few species listed as *Anolis* have the current generic name in parentheses (*Anolis* (*Norops*) *allogus*, etc.). In one case, the current genus name is provided in parentheses in the caption to a photo, but not in the text for that species—*Anolis* (*Norops*) *chrysolepis*. Guyer and Savage (1986) formally proposed the resurrection of the genus name "*Norops*" for anoles exhibiting "beta" caudal vertebrae as described by Etheridge (1959). Further reclassification of the genus *Anolis* was detailed by Savage and Guyer (1989) who employed the use of *Norops*, *Ctenonotus*, *Semiurus*, and *Dactyloa* as generic rankings. Although the acceptance of this classification is, at best, spotty, Rogner does list Guyer and Savage (1986) and Savage and Guyer (1989) in the bibliography for Volume 1 (with multiple typographical errors in the latter, including the wrong first initial for Guyer) but does not explain in the text why he chose not to use the nomenclature proposed by these authors.

High quality color photographs are used throughout both volumes. Many are of species seldom encountered by the average U.S. hobbyist. Among these are many species from Australia, Fiji, and Sri Lanka. At least one photo appears to be incorrectly captioned. The photo of a gecko on page 105 of Volume 1 is captioned "*Tarentola delalandii*." However, based on the figure on page 10 of the same volume, it seems that the species is a *Hemidactylus*.

The main goal of this set seems to be to provide information useful in the care and management of captive lizards. Perhaps specialists in the captive care of specific groups of lizards can find minor fault with some sections. For example, basic care information for all geckos of the genus *Phelsuma* is provided in the section for *P. abbotti* (alphabetically the first species treated) and all other species are referenced back to *P. abbotti*. Care and management information for all other species begins with the "See *P. abbotti*" or cites some other species that is, in turn, referenced to *P. abbotti*. Some species contain augmented information, indicating that the care requirements within the genus are not absolutely uniform. However, for most species the qualifying sentences are not strong enough, nor do they possess enough information to ensure that the reader will not become confused and maintain the species as one would *P. abbotti*. Few, if any, day gecko breeders consider *P. abbotti* to be representative of the genus in terms of its needs in captivity. In fact, it could be argued that there is no single representative "typical" species of *Phelsuma* with respect to care. A more valuable reference for care and maintenance of day geckos might be McKeown's (1993) book on the subject.

The last three chapters of Volume 2 are devoted to Amphisbaenia, Rhynchocephalia, and Crocodilia. It is somewhat disappointing that a book that could offer so much information for the lizard-keeping enthusiast apparently needs to include these non-lizard groups. Rogner explains that amphisbaenians may not,

in fact, be lizards and cites Böhme (1988) as evidence. However, Rogner does not then explain why he includes these animals in his book. That is, he provides evidence against their inclusion, but includes them anyway. The information on husbandry of amphisbaenians is limited to four species, but is particularly interesting given their rarity in the pet trade.

Tuataras, another group of non-lizards, are referred to as the "Bridged Lizards" (the literal translation of the German "Brückenechsen"). Rogner provides no indication that they are not lizards, aside from noting that they belong to the Order Rhynchocephalia. He also indicates a single species of the Order, *Sphenodon punctatus*, but refers to three subspecies including *S. p. reischeki* "which some herpetologists consider to be a separate species." In fact, the second species is *Sphenodon guentheri*. Rogner continues by providing information on the care in captivity for some of the tuataras kept in zoos. While this information is interesting it is not practical for the keeper, given the complete protection afforded tuataras.

Crocodilians are described in the text as "Armoured Lizards." Rogner points out, correctly, that they are "more closely related to birds than to any other reptiles living today," but does not indicate why he includes them in his treatise on lizards. Inclusion of these three groups of reptiles (Amphisbaenia, Rhynchocephalia, and Crocodilia) in a book on lizards may be similar to including lungfish in a book on frogs, or platypus in a book devoted to waterfowl. While the information is interesting and of some use, and the photos are attractive, it simply doesn't fit with the theme of the book. If the title of the two volume set were "Lizard-shaped Reptiles" then they could logically be included, but it is not.

Taxonomic errors and the inclusion of non-lizards aside, Rogner's two volume set "Lizards" is the most thorough and up-to-date popular treatise of the general biology and care in captivity of non-ophidian squamates to come along in quite some time. Its value as a reference for the general husbandry of many species may be unprecedented as some species are covered nowhere else in the hobbyist literature. No other current reference on this topic covers as much of the diversity of lizards in as much detail as this set. This set should make a welcome addition to most lizard keepers' libraries, providing that it is not relied upon as a taxonomic reference.

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Frogs and Reptiles of the Sydney Region, by Ken Griffiths. 1997. University of New South Wales Press, Sydney, Australia. 125 pp. Softcover. US $24.95. ISBN 0 86840 432 2. [Available in the USA from International Specialized Book Services, Inc., 5804 N.E. Hassalo Street, Portland, Oregon 97213-3644, USA].

A short guide to the 35 frogs and 70 reptiles found in greater Sydney and adjacent areas of New South Wales. Species accounts include identifying features, brief ecological notes, species status in the Sydney region, and one or more color photos per species. In addition, short sections on observing, recording, and photographing amphibians and reptiles, reptile legislation, a glossary, selected secondary references, and an index are provided. The reptile section of the book is an updated and revised version (with new photographs) of the author's 1987 book *Reptiles of the Sydney Region* (Three Sisters Productions, Winmalee, NSW).

Herpetología Neotropical, Actas del II Congresso Latinoamericano de Herpetología, II Volumen, edited by Jaime E. Péfaur. 1996. Universidad de Los Andes, Mérida, Venezuela. 451 pp. Softcover. US $40.00. ISBN 980-221-944-4. [Available from the editor, Facultad de Ciencias, Núcleo La Hechicera, Universidad de Los Andes, Mérida 5101, Venezuela].

This is the second volume published as a result of the Second Latin American Herpetolgical Congress held in Mérida, Venezuela in 1990 (the first being the *Directotio de Herpetologos Neotropicales*, 1994). Included are 25 contributions dealing with the anatomy, evolution, reproduction, ecology, biogeography, and management of the Latin American herpetofauna, along with the herpetological history, and bibliography of Venezuela. Each paper is written in Spanish, Portuguese, or English. Although other regions are represented, Venezuelan and Brazilian contributions are the most numerous. All scientific contributions are fully referenced and most are accompanied by black and white photographs, illustrations, maps, or graphs.

Biologie und ôkologie der Kreuzkrîte, by Ulrich Sinsch. 1998. Laurenti Verlag, Dr. Burkhard Thiesmeier, Akademiestr. 39, D-44789, Bochum, Germany. 222 pp. Softcover. DM 44 (approx. US $25 + $3 postage). ISBN 3-933066-01-8.

This monograph provides a comprehensive overview of the biology of the natterjack toad (*Bufo calamita*), a well-known European species of particular conservation concern in some areas. Included are sections on evolution and taxonomy, biogeography, physiology, behavior, ecology (reproductive, larval, adult, and population), and conservation. The work pulls together the author's own extensive research on this species as well as that conducted by others throughout Europe. It includes an extensive bibliography (through 1997) and a subject index. Over 100 black and white illustrations and photos and four color plates complement the text. The book should be of special value to amphibian biologists with ecological and conservation interests and to anyone working with the European herpetofauna.

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U.S.G.S. Florida Caribbean Science Center
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
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Flagstaff, Arizona 86011, USA

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University of Florida
Gainesville, Florida 32611, USA

Meetings
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Department of Biology
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Worcester, Massachusetts 01602-2597, USA

1998 Local Committee
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Department of Zoology
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Guelph, Ontario, Canada N1G 2W1

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COORDINATORS

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585 South Main Avenue
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P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
208 South Great Road
Lincoln, Massachusetts 01773, USA
(413) 442-2165
e-mail: ttyning@massaudubon.org

Advertising Manager
ELIZABETH A. JOHNSON
31 Maple Street
Milford, New Jersey 08848, USA
(908) 995-0201
e-mail: ejohnson@ptdprolog.net

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DANIEL D. BECK
Department of Biological Sciences
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Ellensburg, Washington 98926, USA
e-mail: beckd@cwu.edu

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Wildlife and Fisheries Sciences
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DARYL R. KARNS
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Hanover, Indiana 47243, USA
e-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
Department of Biology
University of California
Riverside, California 92521-0427, USA
e-mail: jeffrey_lovich@usgs.gov

BRIAN W. BOWEN
Dept. of Fisheries & Aquatic Sciences
University of Florida
7922 NW 71st Street
Gainesville, Florida 32653, USA
e-mail: bowen@gnv.ifas.ufl.edu

DEANNA H. OLSON
USDA Forestry Science Lab
3200 SW Jefferson Way
Corvallis, Oregon 97331, USA
e-mail: olsond@ccmail.orst.edu

Section Editors

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Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

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ANNE M. MAGLIA and
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: magliaa@falcon.cc.ukans.edu
e-mail: csheil@falcon.cc.ukans.edu

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106, USA

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: soniak@unt.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biological Sciences
Southeastern Louisiana University, SLU 814
Hammond, Louisiana 70402, USA
e-mail: jdemuth@selu.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cwpaint@unm.edu

Natural History Notes
R. KATHRYN VAUGHAN
Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
e-mail: rkvaughan@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@aix1.ucok.edu

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1998 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).
1999 — University of Pennsylvania, University Park, Pennsylvania, USA, 24–30 June (Jay Stauffer, Chair).

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES
1998 ANNUAL MEETING
together with
AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS
THE HERPETOLOGISTS' LEAGUE
CANADIAN ASSOCIATION OF HERPETOLOGISTS
16 – 22 July 1998
University of Guelph, Ontario, Canada

Keynote Address: "THE EVOLUTION OF MORPHOLOGICAL NOVELTIES," by Sharon Emerson, The Herpetologists' League Distinguished Herpetologist (University of Utah).

Symposium: "RECENT ADVANCES IN ANURAN COMMUNICATION: A SYMPOSIUM HONORING DR. STAN RAND." *Organizer:* Michael J. Ryan, Clark Hubbs Regents Professor in Zoology, Department of Zoology, University of Texas, Austin Texas 78712, USA; e-mail: mryan@mail.utexas.edu. Tel: (512) 471-5078; Fax: (512) 471-9651.

Symposium: "PHENOLOGY OF FISHES, AMPHIBIANS, AND REPTILES: INTEGRATING ORGANISM-LEVEL AND POPULATION-LEVEL PERSPECTIVES." *Organizers*: Eric Schultz and Kentwood Wells, Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3042, USA.

Symposium: "TO FREEZE OR NOT TO FREEZE: AMPHIBIANS AND REPTILES IN THE COLD." *Organizer:* Kenneth B. Storey, Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, Canada K1S 5B6; e-mail: kbstorey@ccs.carleton.ca. Tel: (613) 520-3678; Fax: (613) 520-4497.

Symposium: "HERPETOLOGY IN THE LAB AND FIELD: A SYMPOSIUM IN RECOGNITION OF THE CAREER OF RONALD A. BRANDON." *Organizers:* Steve Reilly, Department of Biological Sciences, Ohio University, Athens, Ohio 45701, USA; e-mail: reilly@ohio.edu. Tel: (614) 593-3343, and Ronn Altig, Drawer GY, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi 39762, USA. e-mail: rga2@Ra.MsState.edu. Tel. (601) 325-7561.

Conservation Forum/Point-Counterpoint: "CITES: BENEFIT OR HINDRANCE TO THE CONSERVATION OF AMPHIBIANS AND REPTILES." *Participants:* Sue Lieberman (U.S. Fish and Wildlife Service), Brian Bowen (University of Florida). *Organizer:* C. Kenneth Dodd, Jr., Florida Caribbean Science Center, U.S. Geological Survey, 7920 N.W. 71st Street, Gainesville, Florida 32653, USA. e-mail: Ken_Dodd@usgs.gov.

Contributed Paper and Poster Presentations: Several concurrent sessions will be held each day throughout the conference.

Student Paper Awards: Seibert Prizes (US $200 each) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. Refer to the December 1997 issue of *HR* for details.

Student Travel Grants: Ten travel grants of US $200 each will be available for SSAR student members. Refer to the December 1997 issue of *HR* for details.

Multimedia Presentations: "HERPETOLOGY OF THE WEST" and "AMPHIBIANS OF THE APPALACHIANS" by David Dennis and Eric Juterbock; "HERPETOLOGICAL NAMESAKES" by Kraig Adler and David Dennis.

Social Activities: General Reception at the University Center Building, SSAR Auction, Picnic at Guelph Lake, ROMMY II, Graduate Student Reception, and ASIH Banquet.

Field Trips: Metro Toronto Zoo, Long Point Provincial park, Royal Ontario Museum, Niagara Falls and Winery.

Live Exhibit: Live amphibians and reptiles of Ontario will be on display and available for viewing and photo sessions.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Costs: Pre-registration $170.00 Canadian (approx. US $120) regular, $85.00 CAN (approx. US $60) student/accompanying person. After April 1, 1998, costs are $220.00 CAN (approx. US $155) regular, $125.00 CAN (approx. US $88) student/accompanying person.

Further Details: See December 1997 issue of *HR* (pp. 169–171). Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of SSAR in January 1998. Overseas members wishing to receive this information may do so by contacting *Tana McDaniel, Department of Zoology, University of Guelph, Guelph, Ontario, Canada N1G 2W1. Tel: (519) 824-4120 ext. 6260; fax: (519) 767-1656; e-mail: meeting@uoguelph.ca.* Please visit the meeting web site at http://www.uoguelph.ca/~ichsherp for additional and updated information.

SSAR BUSINESS

New Conservation Brochure Available

The SSAR Conservation Committee has produced a black and white brochure entitled "Conserving Amphibians and Reptiles." The brochure is posted on SSAR's Conservation page at http://falcon.cc.ukans.edu/~gpisani/conservation.html. Individuals or organizations desiring hard copies can download the brochure using free Acrobat software, available through the web site. Please use this option as quantities are limited and there are no postage costs to the Society! You may run off as many copies as needed for distribution. Copies of the brochure also can be obtained through the Publications Secretary or by writing: *Dr. Ken Dodd, U.S. Geological Survey, 7920 NW 71st Street, Gainesville, Florida 32653, USA.*

SSAR Grants-in-Herpetology Committee Annual Report (1998)

An award in the amount of $500 was made to each of the following individuals:

Conservation.—**Marc J. Mazerolle**, Dalhousie University. Project title: "Amphibian abundance, movements, and population structure in harvested and pristine ombrotrophic peat bogs of southeastern New Brunswick."

Laboratory Research.—**Kyle G. Ashton**, University of Colorado. Project title: "The evolution of body size within *Crotalus viridis*, the western rattlesnake."

Field Research.—**Sarah Annette Conditt**, University of Missouri. Project title: "Vocal mediation of mating tactic switches in the green treefrog, *Hyla cinerea*." **Stephanie M. Rollmann**, University of Chicago. Project title: "Courtship pheromones, female receptivity, and sexual isolation in plethodontid salamanders."

Travel.—**Rafe M. Brown**, University of Texas. Project title: "Biogeography, systematics and evolution of direct development in platymantine ranids of SE Asia and southwestern Pacific islands."

Education.—**Trevor A. Hare** and **Dennis Caldwell**, Tucson Herpetological Society. Project title: "Tucson Herpetological Society Conservation Publications and Distribution."

1998 Grants-in-Herpetology Committee.—Carole L. Hom, University of California, Davis; Randy Jennings, Western New Mexico University; Julian C. Lee (Chair), University of Miami; Joseph Mendelson III, University of Kansas; Janice Perry, Arizona-Sonora Desert Museum; Barbara Savitzky, Christopher Newport University; Kelly Zamudio, University of California, Berkeley.

SSAR congratulates the 1998 GIH recipients and thanks the committee members for their efforts.

About Our Cover: *Emys orbicularis*

Emys orbicularis, the European Pond Turtle, is unique in being the only Old World member of the subfamily Emydinae. It has now and then been observed throughout Denmark during this century, but such specimens generally have been considered released pets. However, in 1996 four turtles were found in Central Jutland (mainland, western Denmark) in an area rich in forests and freshwater habitats. In the last 20 years about 24 specimens have been observed within a radius of 20 km.

The four new specimens were morphologically similar to the nominate subspecies (rather big, dark colored, and males with a reddish brown iris) indigenous to the northern part of the range. Genetic tests, however, showed that three of the specimens possessed the same DNA haplotype as populations from Poland, Lithuania, and the Black Sea, that is, the eastern part of the species' range. The fourth specimen was of a hitherto unknown haplotype, but definitely descendent from the type distributed in East Germany and Hungary (Bringsøe 1997. Forekomst af europæisk sumpskildpadde, *Emys orbicularis*, i Danmark. Nord. Herpet. Foren. 40[2]:57–64). These haplotypes have been termed Ia and IId respectively (Lenk et al. 1998. Phylogeographic patterns in the mitochondrial cytochrome b gene of the European pond turtle [*Emys orbicularis*]: First results. Mertensiella: in press).

Although traps were set up and searching was intensified during 1997, only two more specimens were found in the possible metapopulation of Central Jutland. DNA analyses indicated an eastern origin (haplotype Ia). If these specimens had been introduced in this century, they would probably have originated from South Europe, the source of most specimens collected for the pet trade. However, the genetic studies clearly indicate that none of the Jutland specimens originated from South European stock.

It is possible that *E. orbicularis* immigrated to Denmark via two routes: one from the south through Germany, and another from the east over the Baltic as the Baltic Sea was a freshwater lake ca. 9000 years ago. Similar dispersal patterns are believed to apply to other Danish animal species.

One proof for viable populations being able to survive in Denmark is still missing: observation of young. However, juveniles are shy and may be difficult to observe. Hatchlings of *E. orbicularis* often hibernate in the nests, which makes them vulnerable to frost. From northern Germany it is known that they often die under these circumstances.

Thus, it is still an open question whether the Danish occurrences form indigenous populations or have been introduced, or if they are a mixture of both. Certainly, *E. orbicularis* is very rare in Denmark. Otherwise the northernmost known breeding populations are in southern Lithuania, at a latitude slightly south of Central Jutland.

The cover photo was taken by **Henrik Bringsøe** on 13 June 1997 on a field trip during the Sixth Nordic Herpetological Symposium held in Ry, Denmark. The locality of this individual is the lake Velling Igelsø (measuring 380 x 250 m), where most of the specimens from 1996–1997 have been found. It is a male of haplotype Ia which had been caught in the lake shortly before and which was now going to be released.

The photo was taken with ordinary equipment consisting of an old Olympus OM1 body and 28 mm Olympus lens on Kodachrome 200 film, under natural light. In order to take the photo from the same level as the turtle, the camera was held as close to the water surface as possible. A cloud cover prevailed on this day, a common condition in the relatively cold and humid Central Jutland.

Bringsøe describes himself as "an amateur working with a number of disciplines of herpetology, including ecology, conservation, and herpetoculture. Two main areas of my activities are herpetology of Greece and Denmark." He is a contributor to one saurian volume of the German work *Handbuch der Reptilien und Amphibien Europas* and will be an author in the chelonian volume. He currently serves as the chair of Nordisk Herpetologisk Forening—the Scandinavian region's largest herpetological society, and is an NGO advisor to Denmark's CITES authority.

Separation and imaging of Bringsøe's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

NEWSNOTES

New Gecko Society Launched

The Global Gecko Association (GGA) is a new organization dedicated to gecko enthusiasts worldwide. Membership is open to anyone with an interest in gekkonids, from the professional herpetologist to the hobbyist.

The GGA is a not-for-profit organization committed to promote interest in gekkonids in a whole variety of ways, from responsible captive care, to study in the wild, conservation, academic research and beyond. Furthermore, the GGA will serve people who are interested in gekkonids by providing a voice and means of communicating and sharing of resources and ideas.

Members will receive two issues of the Association's Journal annually, together with regular members' Newsletters. The *Journal of the Global Gecko Association* will be produced in color and contain articles and papers, book reviews, interviews and other items of interest that reflect the full breadth of the GGA's objectives. Many of the leading figures in the "gecko world" have agreed to contribute. Newsletters will keep members fully updated with Association events, gecko related news and views from around the world, veterinary advice, and provide a mechanism for members to communicate with each other. Advertising will be accepted for the Newsletters only.

For membership and other information visit the GGA web-site at http://www.gekkota.com or write to: *Global Gecko Association, P.O. Box 739, Westview Station, Binghamton, New York 13905, USA.*

J. Larry Landers Student Research Award

The Gopher Tortoise Council annually awards the J. Larry Landers Student Research Award to the best student research project. Awards have averaged approximately $500 over the past few years. The focus of the project can be on the gopher tortoise, its habitat, or related areas of interest. Applications should include an outline of the project, a proposed budget, and a brief vita. To be considered for the 1998 award, proposals should be received by 31 August 1998. Proposals should be sent to: *Bob Herrington, Chairman of the Research Advisory Committee, Department of Biology, Georgia Southwestern State University, Americus, Georgia 31709, USA.*

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 1998, with notification by 1 December 1998. Grantees are expected to complete their Academy visit by 15 September 1999. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

Ernie Liner to Receive Honorary Doctorate

Long-time SSAR member Ernest A. Liner, of Houma, Louisiana, is to receive an honorary Doctor of Science degree from the University of Colorado, Boulder, at its summer commencement ceremonies on Saturday, 8 August 1998. Ernie, as he is affectionately known to herpetologists throughout North America, is an amateur herpetologist. Until his retirement in 1987, he was employed for most of his professional life by the pharmaceutical firm of E. R. Squibb and Sons.

Since 1949, Ernie has published nearly 100 titles, mostly on the herpetofaunas of Louisiana and Mexico. He published an invaluable checklist of the amphibians and reptiles of Mexico, together with their Spanish and English common names, in 1994. Currently, he is continuing his monographic work on the herpetology of Nuevo Leon and has also assumed responsibility for updating the bibliographic analyses of the Mexican herpetofauna initiated by Hobart and Rozella Smith. He has produced highly useful herpetological indices to numerous journals and is presently completing a monumental index to the entire multivolume series *Biology of the Reptilia*, edited by Carl Gans and now published by SSAR.

Ernie is a member of numerous herpetological societies and has served on the governing boards of both ASIH and SSAR. Besides his herpetological research and activities, Ernie is a grower of prize-winning orchids and a renowned chef. He published A Herpetological Cookbook in 1978, including such recipes as "Fricassee of Iguana," "Congo Eel with Cucumbers," and "Picayune Frogs a la Creole." The book is not without scientifically appropriate instructions, for example, the recipe for "Ophidia a la Minton" begins: "Skin and gut snake. Remove tail with scent glands. Behead and make skull of head. . . ." A new, enlarged edition is being issued this summer by the publisher of Reptile & Amphibian Magazine.

SSAR congratulates Ernie on this high honor.

Wildlife Links: Request for Proposals

The National Fish and Wildlife Foundation, through a cooperative agreement with the United States Golf Association, requests preproposals for research and management projects that address wildlife conservation needs on golf courses. Areas of interest include: examination of management and design options for increasing biodiversity on golf courses; research to determine the role of habitat characteristics in the designation of golf courses as wildlife corridors or barriers; preparation of management guidelines for specific species or species suites; programs to monitor the success of wildlife habitat conservation programs on golf courses; and the effects of golfer and maintenance activities on wildlife. All projects must address issues of management concern to the golf industry, and should provide management recommendations applicable on at least a regional basis. Approximately $80,000 will be available. Request should not exceed $25,000, yet multi-year funding is possible.

Deadline for preproposals is 31 July 1998; full proposal deadline will be early September 1998, with funding available in Feb-

ruary of 1999. For preproposal guidelines, contact: *Katie Distler, NFWF, 1120 Connecticut Ave. NW, Suite 900, Washington, DC 20036, USA; tel. (202) 857-0166; e-mail: distler@nfwf.org.*

Loggerhead Sea Turtle Bibliography Changes WWW Site

The comprehensive bibliography of the loggerhead sea turtle has changed its WWW location. It can now be accessed through the Florida Museum of Natural History's herpetology home page at http://www.flmnh.ufl.edu/natsci/herpetology/herpetology.htm. The site contains references to more than 2000 citations on extant and fossil *Caretta*. In addition, there is now a search feature, new graphics, and full use of specialized grammatical marks in international languages. The references have been updated through November 1997. The bibliography will be updated every 6–12 months. For more information contact: *Dr. Ken Dodd, U.S. Geological Survey, 7920 NW 71st Street, Gainesville, Florida 32653, USA.*

MEETINGS

Meetings Calendar

12–15 June 1998—Highlands Conference on Plethodontid Salamanders, Highlands Biological Station, Highlands, North Carolina, USA. For more information contact: Plethodontid Conference, Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA, or send an e-mail message to Judy Hill at: JHILL@wpoff.wcu.edu. Additional information: http://www.wcu.edu/hibio.

25–27 June 1998—22nd Annual Meeting of the International Herpetological Symposium, Inc., Holiday Inn-Cincinnati Airport, Cincinnati, Ohio, USA. Contacts: Stan Draper, IHS Secretary, P.O. Box 16444, Salt Lake City, Utah 84114-0444, USA; e-mail: sdraper@npsp.com; or Pete Strimple, Liaison Committee Chair, 5310 Sultana Drive, Cincinnati, Ohio 45238, USA; tel. (513) 451-2392; e-mail: pds0404@aol.com.

16–22 July 1998—41st Annual Meeting, Society for the Study of Amphibians and Reptiles; 46th Annual Meeting of The Herpetologists' League; 78th Annual Meeting, American Society of Ichthyologists and Herpetologists. Hosted by the University of Guelph, Guelph, Ontario, Canada. *Refer to meeting announcement in this issue for details.*

1–5 September 1998—Third International Asian Herpetological Meeting, Almaty, Kazakhstan. To receive the First Announcement and Preliminary Registration Form, please contact one of the meeting organizers: Dr. Tatjana Dujsebayeva, Department of Biology, Kazakh State University, Al-Farabi Prospect, 71, Almaty, 480078, Kazakhstan; tel. (3272) 472677; fax (3272) 472609; e-mail: zool@plague.almaty.kz; Dr. Natalia Ananjeva, Department of Herpetology, Zoological Institute, Universitatskaja nab., 1, Saint-Petersburg, 199034, Russia; tel. (812) 2180711; fax (812) 2182941; e-mail: anb@zisp.spb.su; or Dr. Theodore Papenfuss, Asiatic Herpetological Research, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA; tel. (510) 642-3567; fax (510) 643-8238; e-mail: asiaherp@uclink2.berkeley.edu.

13–17 May 1999—Fourth International Symposium on Isolated Vertebrate Communities in the Tropics, Bonn, Germany. Hosted by the Zoologisches Forschungsinstitut und Museum Alexander Koenig. To receive announcements and to obtain further information, please contact: Prof. Dr. W. Böhme, Adenauerallee 160, 53113 Bonn, Germany; tel. +49 228 91 22 250, fax ++49 228 216 979, e-mail: r.hutterer.zfmk@uni-bonn.de.

3rd Annual Meeting of the Canadian Amphibian and Reptile Conservation Network

The 3rd Annual Meeting of the Canadian Amphibian and Reptile Conservation Network will be held in conjunction with the 8th Annual Meeting of the IUCN/SSC Task Force on Declining Amphibian Populations in Canada (DAPCAN), at the University of Saskatchewan, Saskatoon, Saskatchewan, Canada, from 1–5 October 1998.

The principal feature of this year's conference will be a symposium on the Conservation Biology and Monitoring of Reptile Populations in Canada, plus our regular program of featured speakers, research papers, posters, workshops, field trips, discussions, and a general meeting on all aspects of the conservation biology of amphibians and reptiles in Canada.

Overnight field trips are planned to Grassland National Park and the South Saskatchewan River Escarpments. Topics that are being considered for symposia or round-table discussion are: Herpetological Education, Ethics, and Highway Mortality.

Please forward your ideas, comments, suggestions or proposals for this meeting to: Andrew Didiuk, Local Organizer; e-mail: Andrew.Didiuk@ec.gc.ca; tel: 306-975-4087; fax: 306-975-4089.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Anne Maglia or Christopher Sheil; postal and e-mail addresses may be found on the inside front cover. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Adhesive Tail Tips of Carphodactyline Geckos

Bauer employs electron microscopy to visualize and describe the morphology of the adhesive tail tips of carphodactyline geckos (Reptilia: Diplodactylidae). He surveyed representatives of the genera *Naultinus, Hoplodactylus, Bavayia, Eurydactylodes,*

Rhacodactylus, and *Pseudothecadactylus* and determined that the New Caledonian and Australian species exhibit discrete, adhesive pads similar in gross morphology to the subdigital scansorial pads. The internal structure of these pads closely resembles that of the subdigital scansors as well. These adhesive tail tips show a phylogenetic trend toward increasing complexity. Similarities among the microstructures of the subdigital and tail tip scansorial pads represents phylogenetic convergence and Bauer considers them as iterative homologues of one another.

BAUER, A. M. 1998. Morphology of the adhesive tail tips of carphodactyline geckos (Reptilia: Diplodactylidae). J. Morphol. 235:41–58.

Correspondence to: Aaron M. Bauer, Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA; e-mail: abauer@king-kong.vill.edu.

Developmental Temperatures Influence Turtle Temperature Choice and Growth Rate

In this investigation, the author reports on her study of the effects of embryonic temperature on juvenile temperature choice and growth rate in the Snapping Turtle, *Chelydra serpentina,* a species with known temperature-dependent sex determination (TSD), with males produced at intermediate incubation temperatures, and with sexual dimorphism (males larger than females). This study examines the hypothesis that male-producing egg temperatures maximize growth rates and determines and measures the separate effects of embryonic temperature and sex on the growth rate and temperature choices of juveniles. The author found incubation temperature to be linearly and negatively correlated with growth rate of male and female juveniles (i.e., male-producing temperatures enhanced, but did not maximize growth rates). Developmental temperature also was found to be negatively correlated with juvenile temperature choice. Temperature choice was found to be repeatable, even after a six-month hibernation period. The author comments that the multiple effects of embryonic temperature may create long-term differences between the physiology and behavior of male and female *C. serpentina* and may have important implications for the evolution of TSD.

O'STEEN, S. 1998. Embryonic temperature influences juvenile temperature choice and growth rate in snapping turtles *Chelydra serpentina.* J. Exp. Biol. 201:439–449.

Correspondence to: Shyril O'Steen, Department of Ecology and Evolutionary Biology, SH 321, University of California at Irvine, Irvine, California 92697-2525, USA; e-mail: sosteen@uci.edu.

Median Lingual Process of Frogs

The authors report the discovery of prominent median protuberances on the tongue of eight species of *Colostethus* (Anura: Dendrobatidae), a surprising find that is the first of its kind among New World anurans. Previously, median protuberances of the tongue were known only among Asian and African ranoids. Variation in this protuberance among New World dendrobatids and Old World ranids was documented with electron microscopy and four tentative morphologies were described (Type A–D). *Colostethus* exhibits nonretractile protuberances and all examined species except one conform to Type C protuberances, being elongate and longitudinally reclining. The possible function of the median lingual protuberance is discussed, but is still unknown. The authors also describe a new species, *C. atopoglossus,* and discuss the systematics of the genus. These data contribute to our understanding of morphological variation among Neobatrachians, as well as to our understanding of the systematics of this group.

GRANT, T., E. C. HUMPHREY, AND C. W. MYERS. 1998. The median lingual process of frogs: a bizarre character of Old World ranoids discovered in South American dendrobatids. Am. Mus. Novitates 3212:40 pp.

Correspondence to: Taran Grant, Investigador Asociado, Laboratorio de Herpetología, Universidad del Valle, A. A. 25360, Cali, Valle del Cauca, Colombia; e-mail: tagrant@biologia.univalle.edu.co.

Postfreeze Survival in Wood Frogs

The authors experimentally induced freezing in fall-collected juvenile *Rana sylvatica.* By manipulating the duration of freezing, they found that the percent of frogs that recovered from freezing was reduced as the duration of freezing increased. This may have implications for potential geographic variation in freezing tolerance—frogs in colder climates may be able to survive longer freezing periods. Also, they found that injecting some of the frogs with glucose prior to freezing increased their survival rates. They hypothesize that the major cryoprotectant properties of glucose may not relate to the reduction of ice formation, but rather may act to keep energy levels of frozen tissues high, thereby allowing frozen cells to stay viable for longer periods.

LAYNE, J. R., JR., J. P. COSTANZO, AND R. E. LEE, JR. 1998. Freeze duration influences postfreeze survival in the frog *Rana sylvatica.* J. Exp. Zool. 280:197–201.

Correspondence to: Jack R. Layne, Jr., Department of Biology, Slippery Rock University, Slippery Rock, Pennsylvania 16057, USA; e-mail: JRL@SRUVM.SRU.EDU.

Polymorphism and Sex-Specific Fitness Differences in Salamanders

In this paper, Whiteman reports on his study of the facultatively paedomorphic tiger salamander, *Ambystoma tigrinum nebulosum,* in which he recorded life history traits as measures of fitness parameters in several populations. He found that paedomorphic males bred more frequently than metamorphic males, and that there were differences in the sex-ratios among the two morphs—more paedomorphs were male and more metamorphs were female. He suggests that these ratios reflect sex-specific fitness differences consistent with the parental investment theory of Trivers (1972). Because of the unique nature of the environment in these ponds, males are more likely to be paedomorphic and to remain in breeding areas consistently, whereas females are more likely to metamorphose to exploit a variety of resources. Whiteman suggests that the propensity in these salamanders to become paedomorphic relates to sex; therefore, future studies of fitness differences among polymorphic animals should consider each sex separately.

WHITEMAN, H. H. 1997. Maintenance of polymorphism promoted by sex-specific fitness payoffs. Evolution 51:2039–2044.

Intergenic Spacer in Ambystomatid mtDNA

McKnight and Shaffer describe an approximately 240bp long tandem duplicate in the mtDNA (between $tRNA^{Thr}$ and $tRNA^{Pro}$) of ambystomatid salamanders. This region is quite stable, found in all *Ambystoma* surveyed, and quite active—some species have several additional base pairs in this region. They discuss the general features of this intergenic spacer and hypothesize that it may have arisen by a duplication (and editing) event at the 5′ end (including $tRNA^{Thr}$ and $tRNA^{Pro}$ and the control region) early in the origin of this group of salamanders. The authors hypothesize about the possible reasons for the stabitlity of this spacer—either it is because of its strong secondary structure or because it acts as an alternative site of initiation of replication or transcription. They discuss the possible evolution of this sequence within this group (e.g., additional insertion events) and propose that this region may be informative for future work on the phylogenetic relationships of this group, as well as the evolutionary history of this region of mtDNA.

McKnight, M. L., and H. B. Shaffer. 1997. Large, rapidly evolving intergenic spacers in the mitochondrial DNA of the salamander family Ambystomatidae (Amphibia: Caudata). Mol. Biol. Evol. 14:1167–1176.

Correspondence to: H. Bradley Shaffer, Section of Evolution and Ecology, University of California, Davis, California 95616, USA; e-mail: hbshaffer@ucdavis.edu.

LETTERS TO THE EDITOR

Quo Vadis? Three American CITES Proposals for American Reptiles

HENRIK BRINGSØE
Esthersvej 7, DK-4600 Køge, Denmark

Before the Tenth Meeting of the Conference of the Parties held in Harare, Zimbabwe, from 9 to 20 June 1997, the United States put forward three proposals for inclusion of North American reptile taxa in CITES Appendix II: *Crotalus horridus, Macroclemys temminckii*, and *Graptemys* spp. For the genus *Graptemys*, the twelve currently recognized species—*barbouri, caglei, ernsti, flavimaculata, geographica, gibbonsi, nigrinoda, oculifera, ouachitensis, pseudogeographica, pulchra,* and *versa*—were included. The subspecies *kohnii* was included within *pseudogeographica*.

In March 1997, I was made aware of the proposals in my position as NGO advisor (representing Nordisk Herpetologisk Forening, the Scandinavian Herpetological Society) for the Danish CITES authority, the National Forest and Nature Agency under the Ministry of the Environment. It was emphasized that these species were in decline, which I have no reason to doubt. However, I was surprised that for nearly all of them the threat was *not* international trade. Rather, the problems were of a domestic nature, typically habitat destruction and various types of uncontrolled hunting or killing. I will briefly go through the main threats to these species; with one exception (Pritchard 1989), all information has been based on the supporting material of the U.S. CITES proposals.

1. *Crotalus horridus.*—The decline over much of the species' range has been caused mainly by habitat loss and destruction as well as collection for rattlesnake roundups. Highway mortality, intentional killing, and collection for commercial pet trade have also been mentioned. Poachers are known to have devastated some populations. However, the international trade in *C. horridus* has been minimal. It certainly does not seem to be very popular among terrarium-keepers or herpetoculturists in Europe.

2. *Macroclemys temminckii.*—This turtle mainly lives in slow-moving rivers, their major tributaries, and associated bodies of water (Pritchard 1989). Much of the natural habitat of the alligator snapping turtle has been eliminated which is by far the most important reason for its decline. A survey in Missouri has revealed that 90% of the habitat now is gone. Pollution is another factor. The U.S. proposal stresses draining of lowlands and swamps, now turned into fields of soybeans and cotton, as an important (perhaps the most important) contribution to the decline of *M. temminckii*.

The most serious utilization of this species is the meat trade for the U.S. market. It is much larger than the pet trade. Especially rapacious has been the Louisiana market for meat. In addition to this commercial trade, *M. temminckii* also is trapped for personal consumption.

For the international pet trade, which has been increasing, mostly juveniles are collected whereas the meat trade utilizes adults which are more valuable for the recovery of natural populations. Although state programs exist for the alligator snapping turtle, no national programs established specifically for the purpose of protecting this species are known.

3. *Graptemys* spp.—It is emphasized that the greatest threat to map turtles is habitat destruction such as alteration of nesting habitats (e.g., waterfront development), water pollution, degradation of waterways, and recreational use of water areas. Basking individuals of many species are shot for target practice. Also, map turtles often are regarded as vermin or at least as competitors for fish. Occasionally humans eat the turtles and their eggs. A number of individuals drown in nets or on trot lines.

Map turtles are popular in the pet trade both domestically and abroad. There is limited captive breeding of some species but most adult captives are wild-caught individuals. Only for *G. barbouri* has the international pet trade been mentioned as a threat to its survival. This species appears to be the one in greatest demand internationally.

None of the three proposals was accepted at the meeting in Harare in June 1997. Those on *C. horridus* and *M. temminckii* were withdrawn, and the one on *Graptemys* spp. was rejected. Appendix III listing, which does not require conference approval, was mentioned as an alternative. But is CITES really an appropriate tool to protect species that suffer from the degradation and reduction of habitats and other domestic abuses?

It is disturbing that the U.S., with its great experience in CITES, has put forward such proposals that do not meet the basic criteria of the convention, i.e., that a species is or may be threatened by international trade. These criteria appear in Article II of the Convention and, in more detail, in Resolution 9.24: "Criteria for Amendment of Appendices I and II" (Resolution of the Conference of the Parties, adopted in Fort Lauderdale, U.S.A., in November 1994). The latter has replaced the Berne Criteria.

Other countries have taken the appropriate measures in their own legislation to prevent habitat destruction and other threats of a national nature. Making such CITES proposals may give an impression that the U.S. Department of the Interior is trying to distract attention from the true cause of these declines. As experienced elsewhere, habitat protection and restoration is costly, but these are virtually the only effective means to correct past mistakes. Of course, it is much easier and less expensive to initiate species protection, regardless of needs for habitat protection! Has the U.S. Department of the Interior taken this step as a feint to show the world that they care about their wildlife?

My intention is *not* to prevent protection of these reptile species. However, the step taken in Harare to reject Appendix II listings was a first signal to the U.S. Department of the Interior to direct their attention to the severe national problems mentioned above and not to blame international trade. It is my firm belief that effective conservation should aim at solving the *real* reasons for the decline, i.e., to initiate an extensive habitat protection program, although it will not at all be as cheap as implementing protection via CITES. CITES listings, including the easy adoption in Appendix III, should be abandoned (except for *G. barbouri*). Furthermore, the awareness of nature protection by the public throughout all social classes in a society is essential to gain wide support. In a civilized and democratic world we will have to accept that the attitude of the public is of utmost importance in conserving nature through habitat protection and prevention of unsustainable hunting and killing.

This case shows that a change of attitude in the U.S. Department of the Interior and perhaps in the U.S. Fish and Wildlife Service, from the dogmatic and conservative view of species protection alone, would be desirable. Perhaps a generational change will be necessary.

I would appreciate it if a representative from the American conservation authorities could present the country's strategy outlining how an *effective* conservation of *C. horridus*, *M. temminckii*, and *Graptemys* spp. can be carried out in order to change the negative development and regain the former status of the populations.

Quo vadis? Where do you go?

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POINTS OF VIEW

Bibliographic Accuracy: Importance in Herpetological Publications

ERNEST A. LINER
310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA

and

VICTOR H. HUTCHISON
Department of Zoology, University of Oklahoma
Norman, Oklahoma 73019, USA
e-mail: vhutchison@ou.edu

Bibliographic citations are important sources of information for readers. The accuracy of citations often reflects the care authors have given to their entire paper; inaccurate bibliographies may lead readers to doubt the trustworthiness of authors. Altig (1996) concluded that "from current involvement with large bibliographic listings that at least one-third of the published citations contains errors." One of us (EAL) reviewed over 1000 citations for a bibliography and found at least 20% had errors. Our intent here is to point out many inconsistencies and errors we encountered in compiling bibliographies. As in most fields of knowledge, the now vast herpetological literature appears in many types of publications: newspapers, popular nonscientific and scientific magazines or periodicals, bulletins, journals, occasional papers, proceedings, symposia, reports (business and government), monographs, circulars, and scientific and popular books. Cataloguing these materials into accurate bibliographies can be mind-boggling. Several abstracting services are available such as *Zoological Record, Biological Abstracts, Biologische Zentralblatt, Dissertation Abstracts, Index Medicus, International Abstracts of Biological Sciences, Bibliographie deutschen Zeitschriftenliteratur, Referatvnii Zhurnal,* and *Bulletin Signaletique*. Other good sources are supplied by the journals themselves either on a yearly or other cumulative basis. Some of the herpetological literature does not appear in these standard abstracting sources. As literature increases, some herpetologists have provided valuable service by producing bibliographies on taxonomic units (e.g., *Smithsonian Herpetological Information Service* series, *Catalogue of American Amphibians and Reptiles*), specific topics (e.g., Neill 1958; Harless and Morlock 1973), specific states (e.g., Carpenter and Krupa 1989), countries (e.g., Miyata 1982), geographic regions (e.g., Busack 1976), and habitats (e.g., Neill 1958). One can find errors in most of these bibliographies, even those compiled by abstracting services. The only sure way to provide accurate citations is to check each item directly from the original source. This is virtually an impossible task for editors and many authors who do not have access to large libraries. Even these major depositories will not have everything. A result of these problems is that many references are hand-me-downs copied from other sources. Errors in citations thus become compounded into more errors. With increasing frequency, references are being placed on the Internet by journals, abstracting services, organizations, and individuals. Some of these bibliographies are not checked by an editorial process or by direct reference to the original; errors are likely to be quite common.

We hope that this paper will raise the awareness of the importance of correct citations in herpetological (and other) publications. We believe that the points raised are clearly applicable to most fields of knowledge. Style manuals such as the CBE style manual (Council of Biology Editors 1994) provide guidelines on the preparation of a bibliographic reference under different scenarios. The CBE style manual has been adopted by many biological journals and should be readily available to every writer of biological papers.

We address here each element of a typical bibliographic citation in the order that they most frequently occur in biological publications. Many minor differences exist in the way citations are listed in journals and the style sheet for each journal should be consulted before preparing the literature cited section for a manuscript to be submitted for consideration for publication.

Surname.—This is the last name of the author (first author, if two or more). Errors are quite frequent in the spellings of surnames. Latinized names of a person, particularly in the older literature (e.g., Linné, Linnaeus) are often not treated uniformly. Frequently names are spelled differently for the same person. Russian names frequently are spelled several different ways, often

due to differences in the translation (e.g., -sky vs. -ski or skii; Darevsky, Darevski, Darevskii). One of us (EAL) is working on a massive bibliography (a bibliographic index for the *Biology of the Reptilia*) and found, in several instances, the same reference entered more than once under different spellings or with various prefixes and suffixes to the surname. The use of hyphenated surnames (e.g., Chun-Lee or Chun Lee) can also produce confusion. The example could be listed under C or L for the same person based upon the use of the hyphen. This is frequent in some Asian, Spanish, and English names and is becoming more frequent in the United States where surnames are combined at marriage, either with or without the hyphen. Sometimes authors create problems by not being consistent in use of their hyphenated surname.

Another frequent problem with surnames is the use of da, de, dela, del, van, and von (to name a few), capitalized or not, and sometimes not separated from the surname. Some authors alphabetize under personal-name prefixes followed by whatever name follows. Others use the surname name before the prefix. Some bibliographies list under last names with the prefix first (e.g., Amaral, Alfredo do vs. do Amaral, Alfredo; Wettstein, O. v. vs. von Wettstein, O.). Sometimes this style shows up under both versions in the same publication and leads to duplication in large bibliographic compilations. This problem is compounded by the manner in which nominal prefixes are used in different countries. The simple thing to do is to list under prefixes instead of the body of the last name, but the recommendations in the CBE style manual (Table 7-1, Council of Biology Editors 1994) should be followed.

The use of the umlaut frequently produces problems (e.g., Müller or Mueller for the same author). Inconsistency here leads to duplication in listings and placement in different alphabetical positions. Diacritical marks create a special problem because they are sometimes used and sometimes not, especially in U.S. publications. If the marks are used in the original article, then they should be used in later citations. If both accented and unaccented versions occur in the name of the same author in the original publication or in later listings, the diacritical marks should be added. The accent marks normally do not interfere with alphabetizing, except the umlaut. Where diacritical marks are not available on typewriters or word processors, they should be added by hand to manuscripts. Complete guidelines for proper use of the surname in bibliographic listings are given in the CBE style manual, *The Chicago Manual of Style* (University of Chicago Press 1993), and the *Manual for Preparing Records in Microcomputer-based Bibliographic Information Systems* (Di Lauro and Brandon 1990).

The importance of correctness in the use of names of authors in literature citations goes beyond just the need for accuracy in finding original sources (Garfield 1982). Citation analysis is now widely used for evaluation of the "quality" or "importance" of publications written by faculty members and scientists in governmental and industrial laboratories (Garfield 1988a). The basis of this indicator of productivity is that important papers will be cited more frequently by others. Although obvious limitations exist in this assessment method (Garfield 1988b, 1989; Hutchison 1993; Lindsey 1980), its future use is likely to increase (administrators find numbers easier to use than the more subjective, but often more accurate, verbal descriptions of scientific quality). If authors' names are spelled incorrectly or the wrong initials or given names are used in a citation, the papers will not be included in a citation analysis for an individual, unless such incorrect spellings also are searched in the data banks; these considerations are seldom used. For example, about 40% of the citations to the publications of the second author (VHH) are incorrect (e.g., "Hutchinson" or "Hutcheson" instead of "Hutchison"). In the leading textbook and reference on amphibian biology (Duellman and Trueb 1986), "Hutchinson" appears throughout. Various spellings of the name appear within the same paper (e.g., Dunlap 1989), sometimes on the same page (e.g., Rodríguez et al. 1996), and even within the literature cited section (e.g., Innocenti et al. 1993). Some names are misspelled in the literature cited but do not appear within the text at all (e.g., Luke 1994) or are spelled differently in the text and literature cited section (e.g., Bols et al. 1992). Such errors in books and review papers (e.g., Badia et al. 1993; Bradshaw 1986) are more likely to be perpetuated than incorrect citations in original papers. Thus, authors of books and review papers should take particular care to reduce such errors, but some typographical or other errors are inevitable. Authors should check original sources in all cases.

Copy editors and printers also can contribute to errors in names (e.g., they often believe that "Hutchison" is an error and change it to "Hutchinson"). Errors by printers sometimes occur outside the control of authors, especially where some of the published material is not included with the proofs reviewed by the authors. The authors of *Turtles of the United States and Canada* (1994) are listed incorrectly as Ernst, Barbour, and Lovich on the title page, but the correct order of names (Ernst, Lovich, and Barbour) appears on the dust jacket and on the copyright page with the ISBN number. Such errors may lead to incorrect library listings (e.g., the electronic card catalog at the University of Michigan Libraries has the book correctly under Ernst, Lovich, and Barbour; at Washington University it is Ernst, Barbour, and Lovich).

Given Name.—The current trend in scientific publications is to reduce the length of papers to save on the escalating costs of paper, printing, and distribution. Included within these cost-saving moves is the use of initials only instead of the full first name and middle initial(s). We believe that this is a false economy and leads to many errors in bibliographies. A simple typographical error or an incorrect emendation can lead one astray. Where one initial instead of two or more is used for the same author, listings may appear in incorrect alphabetical order. Sometimes this problem is the result of an author not being consistent in use of initials. The use of the same initials for two or more authors with different names often leads to incorrect multiple listings. Sometimes the correct author(s) can be determined from the time period (e.g., 1800's or 1900's) or subject matter (e.g., anatomy, ecology, systematics). The CBE style manual states that if one or more authors have the same initials with a given surname then the given name should be spelled out; this is rarely done.

Personal-name suffixes (Sr., Jr., II, III, etc.) often produce problems. As with hyphenated surnames, similar problems can occur with given names (e.g., Ming-Chung). Initials of such hyphenated names should include the hyphen (i.e., M-C. for the example given). If two or more persons from the same family are publishing papers, especially in the same field of study, the differences should be shown. When these personal name suffixes are not used, who is the real author? We have found many instances where only the first author is listed alphabetically and then chronologically, with all second coauthors out of alphabetical order. All of the authors' names should be in strict alphabetical order and then in chronological order for papers with the same authors listed in the same order.

Year.—Normally the year of publication is given as printed in the publication. Sometimes the actual date of publication is not as printed but is actually in the following year. For example, the fourth number of a quarterly publication is sometimes delayed up to several months and actually appears in the following year. This can lead to problems, particularly in taxonomy where the actual date of publication determines nomenclatorial priority. Often publications will give the actual date (year) of issue, which should be included within parentheses in a citation [e.g., 1997(1998)]. Frequently the year given for a reference is incorrect, usually an error either in typing or in copying. The use of a, b, c, etc., is used in a given year to designate papers by the same author(s). Errors occur here particularly with multiple authors. Some publications are published in installments that often lead to confusion of the dates of publication. When it is known that a certain installment was actually published then that year should be used. If the date is not known, then hyphenated years should be used (e.g., Günther 1880–1898). The published proceeding of conferences, meetings, and symposia sometimes are published as the date of the meeting and not the date of actual publication. Both dates should be given, but the date of publication should be the one used in bibliographic citations.

Title.—The title should be a simple item to handle in bibliographies, but often it is not. The title should be cited as given in the original paper, but some authors fail to put "The," "An," etc., as the first word. Often words in the title are transposed or words are altered. If an author says the article was in a different language (e.g., Russian), it is understandable that slight differences will show up in translations. Usually this is not a problem but becomes a problem when English titles show up differently in English publications. Articles in edited volumes should always be cited as "*IN: names (ed.), book or volume title, publisher, city of publication, total pages, and pages being cited within the volume.*" All of these elements may not be used by some journals and the order may differ, but the name(s) of the editor(s) and title are essential. These are not always given, making it very difficult to find the original paper or book chapter. Sometimes the portion of a title that follows a colon (or occasionally a period in serially published articles or subtitles of a book) is omitted in bibliographies. As in author names the use of an umlaut can throw a title in a different alphabetical sequence (über vs. ueber). Recently, there has been a tendency to omit material (e.g., order, family) contained in parentheses as part of original article titles. Similarly, when trinomial names are spelled out in the original document, abbreviations should not be used for the specific name in a citation (e.g., *Thamnophis sirtalis sirtalis* in the original source should not be reduced to *Thamnophis s. sirtalis* or *T. s. sirtalis*). When writers copy references from the table of contents of a journal, rather than from the actual article within the issue, errors can be introduced; some journals abbreviate titles, use only initials of authors' names, etc., in the table of contents.

Source.—Common errors in listing the source (publication title or publisher) include the listing of wrong or incomplete information. Such problems often come from the improper use of abbreviations. Preferred citation names and abbreviations are given in *Abbreviated Titles of Biological Journals, The World List of Scientific Periodicals, British Union Catalogue of Periodicals*, and others. The style sheets of many journals specify which standardized list to use, but the abbreviations for most biological journals are quite similar in the guides. For citations to books, the publisher's name usually is given followed by the city of origin. Authors sometimes produce errors by listing the printer, rather than the publisher. The following are good sources for correct citation to books: *British Museum General Catalogue of Printed Books,* Library of Congress's *The National Union Catalogues,* Bowker's *Books in Print,* and similar standard sources available in most major libraries and on the Internet. We warn again that the ideal source for a correct citation is the original itself.

Serial journals usually are issued as a volume or a number. If a publication is issued as a number rather than as a volume, the issue number should be in parentheses. When parentheses are not used, wrong numbers often are given for the publication. Wrong volume numbers are listed often, sometimes with obviously transposed numbers or typographical errors; other errors are sometimes not so obvious. Some journals (e.g., *Copeia)* do not have volume numbers; in such cases the year of issue should be used as the volume. Where a journal has several issues a year, each issue usually is numbered and often included in parentheses following the volume number. As with other elements of citations, some journals now omit the issue number as another "economy." Wrong issue numbers occur frequently. Page numbers follow, and are separated from the volume and issue numbers, usually by a colon or a comma. Many errors occur in the pagination portion of citations. Authors sometimes do not cite a fractional page at the end of an article or will include a blank page behind an article or give incorrect pagination. Plates or appendixes at the end of an article should be included as part of the pagination or added after the pagination if the publication used Roman numerals for the appended material. Occasionally, only the first page of an article is given; this can lead to problems when one orders photocopies through an interlibrary loan or tries to track down original materials. For these reasons we abhor the tendency of some current journals (e.g., *Science*) to save space by using only the first page numbers of articles listed in the literature cited section.

Ethics and Professionalism.—We have encountered all of the above problems (and others not discussed) in compilations of several bibliographies from multi-volume works. Checking every reference from its original source is not always possible. Anytime a reference appears with different versions, the only *sure* way to find the correct version is to check the original citation. The failure to consult original articles, especially those cited in research papers and reviews, is unprofessional. When one deals with thousands of references on a variety of subjects, the determination of the correctness of citations can be extremely time-consuming. In one case a reference was listed five times. The first four were identical so one might assume that it was correct. The fifth occurrence had some variances; it was checked and found to be correct. The first four were wrong!

Many problems emerge from citations listed as "in press," "in manuscript," "submitted," and "in preparation." Occasionally the journal listed in a citation as "in press" had no such article published several years before or after the date of the citation. The cited manuscript either was withdrawn, anticipated but never submitted, or was submitted and then rejected by the journal. Sometimes the article was in a journal other than the one cited, and sometimes with additional authors. Occasionally we found after checking all available sources that the article never was published. Such misuses of "in press" are clearly unethical. Reviewers and editors have a duty to help ensure that such abuses do not occur.

Authors appear to be increasingly careless in citing publications that they have not seen and are simply copying the references from other sources. Resultant errors then are made worse

by additional mistakes and, in time, through aggregation of these errors, a citation may become quite distinct from the original. When it is impossible or impractical to consult an original reference as cited in a subsequent document, the original full citation should be given, followed by "cited in" and the name and date for the secondary source (e.g., "Jones 1952, cited in Smith 1978"). Authors sometimes are careless in citing even with the original paper in hand, and sometimes incorrectly cite their own papers! It falls upon the author to be more careful; editors and reviewers cannot check out every reference from its original source, particularly with very lengthy bibliographies.

Conclusion.—Although the errors of existing bibliographies are now history, we hope that this summation of some common problems will lead to renewed vigilance on the part of authors, reviewers, and editors, and the incidence of errors will decline. We know that we have made some of the same errors we have discussed, but we will be monitoring our own bibliographic citations more carefully in the future.

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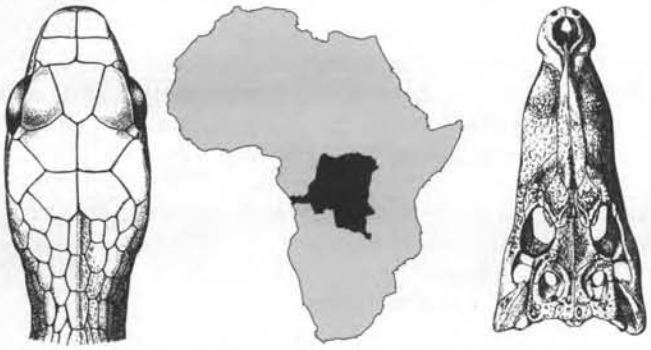
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CONTRIBUTIONS TO THE HERPETOLOGY OF THE *BELGIAN CONGO*

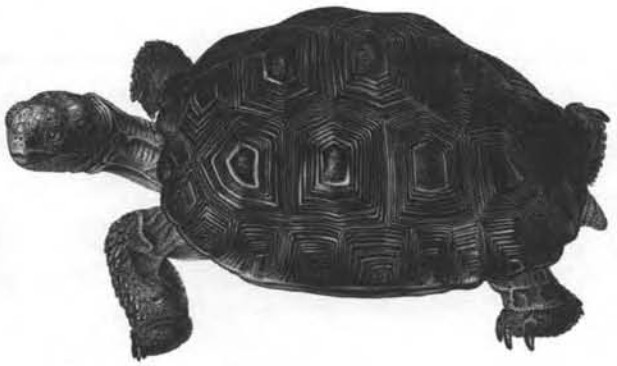
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John VanDenburgh

Foreword by Peter C. H. Pritchard

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ARTICLES

Arrangement of Oviductal Eggs and Intra-clutch Egg Shape Modification in the Habu, *Trimeresurus flavoviridis* (Viperidae)

MASAHIKO NISHIMURA
Habu Study Section, Okinawa Prefectural Institute of Health and Environment Ozato 2003, Okinawa 901-12, Japan
e-mail: mnish@ii-okinawa.ne.jp

Several works on reptile reproduction have described inter-clutch egg size variation. For example, egg size has been shown to vary seasonally in lizards (e.g., Nussbaum 1981), and is limited by female size in several turtle species (e.g., Congdon and Gibbons 1983, 1987; Rowe 1994). However, no works have described intra-clutch variations in egg size and shape.

Egg ellipticity (width/length) is rather constant in lizard species (Werner 1989), but is highly variable in the viperid snake *Trimeresurus flavoviridis,* ranging from 0.286 to 0.691 (Nishimura and Kamura 1993). This large variation is partly due to the fact that smaller females produce slender eggs in *T. flavoviridis* (Ford and Seigel 1989; Nishimura 1983), indicating that egg shape is influenced by maternal size. The present work describes another source of variation, intra-clutch variation, in egg shape of *T. flavoviridis*.

Between 1981 and 1995, 256 gravid *Trimeresurus flavoviridis* were collected from the Okinawa Islands, south of Japan (26°30'N, 127°45'E). Of these, 135 snakes oviposited whole clutches, 90 snakes died or were sacrificed before oviposition, and 31 snakes died after ovipositing some of the oviductal eggs. Weight, length, and width of oviposited eggs were measured within 36 h (usually <16 h) of oviposition. Oviductal eggs were measured after freezing the females. I classified the egg shape into three categories: normal, peaked at one side, and weakly peaked at one side.

All embryonated and oviposited eggs had white shells with several scar marks on them. I considered these eggs to be fertilized. Most unfertilized oviposited eggs were small and irregularly shaped. Some oviductal immature eggs had normal shapes with yellowish and scarless shells. I observed embryos in some of these eggs (see Koba et al. 1970). In the present work I used data from fertilized eggs and those of normally shaped oviductal eggs.

As noted above, the means of egg width (Ford and Seigel 1989; Nishimura 1983) and length (Nishimura 1983) vary with maternal size of *T. flavoviridis*. Therefore, the variation of egg size in a clutch was described as a proportion to the mean of the other eggs.

Arrangement of oviductal eggs.—Two females contained follicles as large as oviductal eggs. One had three eggs and two large follicles in the right oviduct and in the left ovary, respectively, and the other had five eggs and two eggs in the right and left oviduct, respectively, and one large follicle in the left ovary. Shiroma (1993) suggested that several eggs ovulated from the right or left ovary move to the opposite oviduct in *T. flavoviridis*.

All pre-ovipositional females with complete ovulation had eggs in both oviducts. Of these I checked the egg arrangements in 54 females. In 48 females all eggs in the right oviduct were situated anterior to those in the left oviduct. Among the remaining six females, one egg in the right oviduct was positioned posteriorly to (three clutches) or side by side with (three clutches) eggs in the left oviduct. The former type of clutch has been described by Koba et al. (1970) who dissected 17 gravid females in July (ovipositional season). They reported that two females had eggs only in the right oviduct. However, it is conceivable that these two females partially oviposited before dissection and originally contained eggs in the left oviduct.

Variation in egg shape of pre-oviposited clutch.—Compared to the eggs positioned in the middle of the abdominal cavity, the eggs positioned most anteriorly and posteriorly were longer and slightly smaller in width, and the weight of these eggs deviated only slightly from the average (Table 1).

Among 18 eggs of peaked shape, 15 were positioned anteriorly or posteriorly, and the remaining three eggs were situated side by side with eggs in the other oviduct. The peaked points of the eggs were directed to either the anterior or posterior edge of the egg row.

Full term clutches were positioned between the gall bladder and vent. The most posterior egg was positioned along the left kidney and opposite oviduct (usually the right oviduct) in the trunk of decreased width. Females with full term clutches or just after oviposition had consumed a considerable proportion of the fat bodies. However, most of the anterior fat body, which had not been consumed, decreased the space for the most anterior egg. The slender and peaked shape in the most anterior and posterior eggs may be due to the space constraints at both ends of the abdominal cavity.

TABLE 1. Relative size of the most anteriorly and posteriorly positioned eggs in the abdominal cavity of *Trimeresurus flavoviridis*. The measurements of the eggs of pre-ovipositional females (died in the oviposition season) were divided by the respective mean of the eggs ($N \geq 2$) intermediately positioned in each clutch. The most anterior eggs of partially oviposited females were left in the oviduct for more than one day and the measurements were divided by the respective mean of oviposited eggs ($N \geq 2$) in each clutch.

	Length		Width		Mass	
	N	Mean ± S.E.	N	Mean ± S.E.	N	Mean ± S.E.
Pre-ovipositional female						
Most anterior egg	36	1.115 ± 0.017	32	0.984 ± 0.016	33	1.049 ± 0.033
Most posterior egg	35	1.127 ± 0.015	31	0.961 ± 0.012	32	1.014 ± 0.014
Partially oviposited female						
Most anterior egg	10	1.136 ± 0.019	10	1.031 ± 0.025	10	1.140 ± 0.048

Variation in egg shape of oviposited clutches.—About half of the oviposited clutches contained neither pointed nor weakly pointed eggs. The maximum number of eggs in a clutch that was clearly peaked or weakly peaked was three while that of clearly peaked eggs was two (Table 2). Most of these peaked eggs appeared to be positioned at the anterior or posterior edge of the egg row.

TABLE 2. Frequency of oviposited clutches with peaked eggs in *Trimeresurus flavoviridis.*

No. of peaked eggs		Clutch	
Not-clearly peaked	Clearly peaked	Number	Proportion
0	0	43	0.45
1	0	11	0.12
2	0	8	0.08
3	0	3	0.03
0	1	12	0.13
1	1	10	0.10
0	2	4	0.04
1	2	5	0.05
Total		96	1.00

Variation in egg shape of partially oviposited clutches.—Ten females died with one or two oviductal eggs two or more days after oviposition. The mass and length of the most anterior oviductal egg were larger than those of oviposited eggs, and the relative mass of the former was larger than that of the most anterior egg in pre-ovipositional clutches (Table 1).

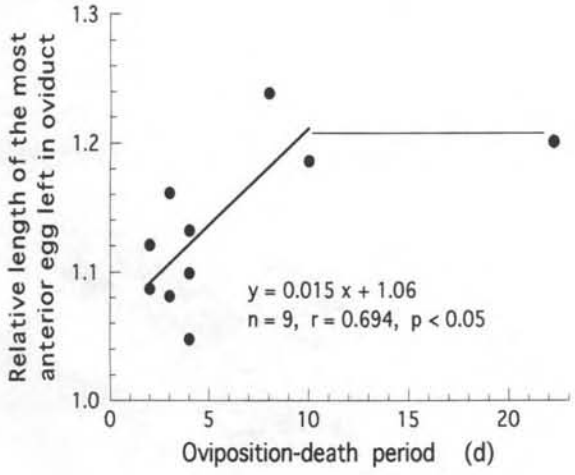


FIG. 1. Period from oviposition to death and the relative length of the most anterior egg remaining in the oviduct in *Trimeresurus flavoviridis.* The length of the most anterior egg was divided by the mean length of oviposited eggs in each clutch to determine the relative length of the most anterior egg.

The period (days) from oviposition to death was positively correlated with the relative length of the most anterior egg remaining in the oviduct (Fig. 1), especially in the 2–10 day period (Fig. 1, N = 9, R = 0.694, P < 0.05), but was not correlated with the relative egg mass (N = 10, R = 0.080). Therefore, at least for the most anterior egg remaining in the oviduct, the length may increase by about 10% in 10 days. On the other hand, female SVL was negatively correlated with the relative width of the eggs (N = 10, R = -0.767, P < 0.01). A significant increase in egg mass of the slender shaped eggs oviposited by small females (Ford and Seigel 1989; Nishimura 1983) was attributed to an increase in egg width.

My results indicate that in *Trimeresurus flavoviridis*, the volume of the abdominal cavity and other eggs may restrict the growth of oviductal eggs and cause shape modification in some anterior and posterior eggs within a clutch.

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Variation, Distribution, and Taxonomic Status of the Xantusiid Lizard *Lepidophyma tarascae*

UBALDO GUZMAN-VILLA
OSCAR FLORES-VILLELA
WALTER SCHMIDT-BALLARDO
Museo de Zoología, Facultad de Ciencias
Universidad Autonoma Nacional de México
A.P. 70-399, México D.F. 04510, México

and

ROBERT L. BEZY
Amphibians and Reptiles, Natural History Museum of Los Angeles County
Los Angeles, California 90007, USA

Lepidophyma tarascae was described by Bezy et al. (1982) on the basis of three specimens from "near Mexiquillo, Aquila District, Michoacán, México." This locality is on the coast of Michoacán, ca. 16 km (by Hwy 200) WNW Caleta de Campos at 18°08'N, 102°56'W, but was listed inadvertently as 18°08'N, 103°56'W in the original description. Our observations indicate that the vegetation near Mexiquillo consists of degraded "Bosque Tropical Caducifolio" (Rzedowski 1978), whereas Alvarez and Diaz-Pardo (1983:143) list the type specimens as having been collected in "encinar." Moreover, field work conducted by the authors in the vicinity of Mexiquillo has failed to produce additional specimens of the species. A special effort was made to search rocky habitats similar to that mentioned in the original description. As members of the genus can be extraordinarily difficult to collect, additional work is necessary to establish definitively whether *L. tarascae* actually occurs at Mexiquillo, or whether the designated type locality may have been in error.

Recent field work, however, has established the presence of *Lepidophyma tarascae* in the northern sector of the Sierra de Coalcomán. A specimen (MZFC 8603) was collected in a cave (Cueva de la Virgen) on the canyon of the Rio Chilitos (18°52'N and 102°50'W) in the municipality of Aguililla, Michoacán. This is ca. 65 km N of the designated type locality and places the species near the Balsas Basin. The Coalcomán locality lies at 1225 m elevation in a transition zone between tropical deciduous forest and oak woodland, conforming closer with the vegetation reported by Alvarez and Diaz-Pardo (1983:143) for the type series.

The specimen from the Sierra de Coalcomán differs somewhat in morphology from the type series of *Lepidophyma tarascae*. It has slightly fewer total femoral pores (14 vs. 16–18) and gulars (40 vs. 41–43) and more dorsal scales (159 vs. 145–150). It shares with the type series the presence (on each side of the neck) of an uninterrupted longitudinal row of enlarged tubercles extending from the posteroventral margin of the tympanum to above the gular fold (Fig. 3 in Bezy et al. 1982), a feature that was utilized by Bezy and Camarillo (1995) to identify *L. tarascae* in their key to the xantusiids of Mexico. However, in the Coalcomán specimen this post-tympanic row of tubercles is not as distinct, i.e., it is less clearly separated from the scattered enlarged tubercles of the upper nuchal area than it is in the type series, approaching the condition observed in some *L. smithii* from Chiapas (e.g., MVZ 191448–49). The Coalcomán specimen lacks another distinctive feature found in the type series of *L. tarascae*. It has three dorsal interwhorls separating the enlarged caudal whorls throughout the length of the tail, whereas in the type series there are two in most of the proximal caudal segments (but three distally).

As is often the case with *Lepidophyma*, species decisions must contend with limited sample sizes, discordant morphological variation, and geographically disjunct populations (Bezy 1984). Although the Coalcomán specimen differs somewhat from the other three known specimens of *L. tarascae* we provisionally assign it to that species. The four specimens thus assigned to *L. tarascae* have fewer total femoral pores (14–18) than all other members of the genus except *L. dontomasi*, *L. occulor*, and *L. smithii*. From these *L. tarascae* differs most markedly from *L. dontomasi* in having strongly enlarged lateral tubercle rows. In some morphological features the Coalcomán specimen bridges the morphological gap between *L. tarascae* and *L. smithii*. However, we retain *L. tarascae* as a separate species as all four known specimens differ from *L. smithii* (302 specimens examined) and *L. occulor* (11 examined) in having fewer than 162 dorsal scales and fewer than 44 gulars.

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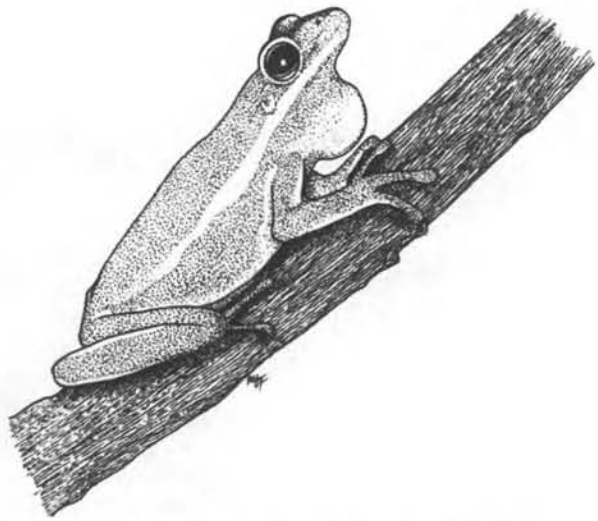
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Hyla cinerea (Green Treefrog). Illustration by Michael G. Frick.

The Circular Aesculepian Temple (Tholos) at Epidauros, Greece: An Early Snake Pit?

BAYARD H. BRATTSTROM
Department of Biological Science
California State University, Fullerton, P.O. Box 6850
Fullerton, California 92634-6850, USA

There were only a few circular temples (Tholos) built in ancient Greek times. The rotunda temples at Olympia and Delphi are probably the most famous and definitely the most complete although there is another in the market place at Athens. In the theater, sports, and healing complex at Epidauros, Greece, there is a unique Tholos designed or built, as were the others, by Polycleitus the Younger or his students between 360 and 320 BC. There is nothing left of this temple, which was located just west of the Temple of Asklepios, except for the foundation. Several portions of the tile floor, portions of the roof and two circles of columns from the temple are now in the museum at Epidauros. The Tholos had an external doric and an internal free standing corinthian colonade (Berve and Gruben 1962; Brilliant 1972; Dinsmoor et al. 1973; Lawrence 1957). The temple was unique, not only among circular temples, but apparently among most Greek temples in that it had a subterranean pit, cellar, or basement under the temple (Figs. 1–2). In addition, the floor of the temple had a large central circular opening. Below the floor, the underground portion of the temple consisted of a labyrinth of three circular walls, each within the other. The walls were separated enough for a small passage between them and the passageways were linked by breaks or half walls within each of the circular walls. Each of these little doorways to the next inner passageway was located at a different position in each wall. Whether or not there was a covering for the opening in the middle of the temple and whether there were stairs descending into the subterranean passages is uncertain.

Though unique, the purpose or function of the rotunda and its subterranean circular passageways, in spite of much speculation, is still unknown. An inscription, which recorded the accounts of monies received and spent on the building, called it the Thymela (place of sacrifice; Lawrence 1957). Many (Berve and Gruben 1962; Pillement 1973) have suggested that holy snakes of the healing god Askelepios were kept there. The circumstantial evidence for this suggestion included the fact that this was a sports, gymnasium, bath, and healing center and that the god Askelepios (son of Apollo) had a temple at Epidauros as did his daughter Hygieia, goddess of health. The Physician Hippocrates (450–370 BC) visited Epidauros and there was a festival called "Hippocrates Day" or the "Festival of the Receiving of the Staff" (Berve and Gruben 1962). The staff was, of course, the Asclepian staff with a single (and later two) coiled snakes that has been the symbol of the medical profession for centuries. The first portrayal of the snake on a staff is probably from 1100 BC and snakes may have had an association with curing peoples' ills in Mesopotamia in the 2600s BC (Gimbutas 1982; Laughlin 1962; Schouten 1967). There is, of course, a real, living snake called the Asclepian (Aesculapian) snake (*Elaphe longissima*), and snakes have long been associated with good or evil in many different human cultures.

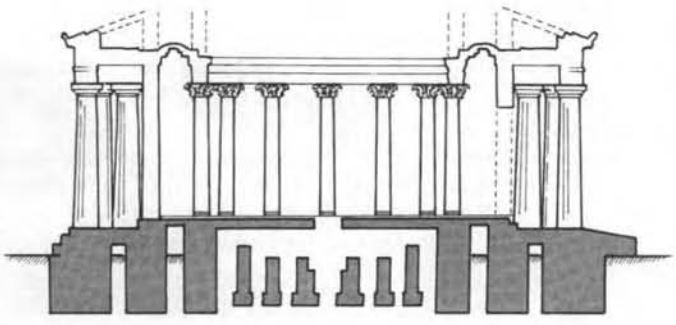


FIG. 1. Diagram of the Tholos at Epidauros, Greece showing location of subterranean area which may have been a snake pit. Modified from several sources, especially Berve and Gruben (1962), and personal observation.

As a herpetologist and a naive tourist at Epidauros, I asked myself this question; Was the Tholos at Epidauros a snake pit? Considering the biology of the Asclepian snake, the climate of Greece, and the nature of the Epidaurian complex, I propose that the subterranean portions of the Tholos was, in fact, one of the earliest known snake pits.

Temperature Regulation of Snakes

Many lizards, such as the common European wall lizard (*Lacerta* sp.), seen crawling over the Grecian ruins today, bask in the sun and have high body temperatures. While they do bask in the sun on cool spring days, most snakes have lower preferred body temperatures than most lizards (Brattstrom 1965). Snakes seldom have body temperatures above 30°C. Because snakes are limited by both high and low temperatures, the yearly activity cycle of snakes corresponds to the prevailing temperature changes in an area. Most snakes in southern Europe emerge from underground retreats in March and April, engage in some basking behavior on cool mornings, feed, and mate. As the spring turns into summer the snakes become increasingly nocturnal in their activity (Brattstrom 1965). By mid-summer through early fall it is usually so hot in Mediterranean climes that snakes spend this period in activity in underground retreats. In mid-summer even the wall lizard is active only in the early morning and late afternoon (pers. obs.). There may be a period in the late fall when the temperature again allows the snakes to be active. As winter begins and the temperatures drop, the snakes again become inactive and retreat to subterranean retreats to avoid the cold. Thus, the snakes avoid the summer's heat and the winter's cold in inactivity and torpor. The subterranean basement of the Tholos at Epidauros would have been an excellent place to store snakes from both the heat and the cold. Such cellars, like caves at that latitude, maintain a constant temperature that is the average temperature of the area. Hence, both the summer and winter temperature of the underground portion of the Tholos would be, estimated on the basis of latitude, about 15–20°C.

Keeping Snakes: Snake Parks and Pits

Snakes have long been associated with good or evil (Gimbutas 1982). They are seldom portrayed as neutral. Snakes have been associated with power, healing, or other beneficial traits (as in keeping pestilence down by consuming rats and mice). Associations of snakes and good health go back to Mesopotamian times and snakes played an important role in Egyptian mythology. A natural evolution of this interest in snakes would be the keeping of colonies of snakes. The Hopi Indians of the American South-



FIG. 2. Photograph of the three-walled subterranean basement at Epidauros. This is all that remains on the site. Portions of the temple are preserved in a nearby museum. (Photo by P. Murphy)

west, for example, collect gopher snakes and rattlesnakes and keep them for weeks prior to harvest snake dances, at which time they are released. Today, snakes are kept for a variety of reasons, ranging from entertainment and education to venom collection and religious ceremonies. In addition to reptiles in zoos in the United States, we find numerous road-side snake pits, snake farms, reptile gardens, and serpentaria. Others occur in South Africa, Australia, Japan, China, Thailand, Brazil, and Mexico. Snakes are also kept for religious purposes in Hindu temples in India (especially associated with Kali cults) and by Christian "snake cults" in the American Appalachian region. It is not, therefore, out of line to think that Epidaurians might have also kept snakes. Indeed, there may have been snake pits in the stoa of the Asclepieum at Athens and in the Erechtheum (Dinsmoor et al. 1973).

Snakes at Epidauros

Biological and cultural evidence, along with the circumstantial evidence of Hippocrates, Asklepios, the snake staff, the healing environment of Epidauros, and the fact that many cultures have kept large numbers of snakes for many reasons, suggest that the subterranean basement of the Tholos at Epidauros would be an excellent place to keep snakes. Clearly, it is conjecture whether snakes were passed up through the floor by some important person, or deposited down into the hole in the floor of the Temple by worshippers or those wanting to be cured of an affliction. I only want to suggest that the function of the basement of the Tholos at Epidauros was for holding snakes, and indeed, may have been one of the first snake pits. At the least, I encourage others who might explore archaeological or historical evidence to consider this hypothesis and search for other evidence to support or disprove the hypothesis.

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Reticulate Melanism in Southwestern Populations of *Chrysemys picta bellii* (Testudines: Emydidae)

JAMES N. STUART

Museum of Southwestern Biology, University of New Mexico
Albuquerque, New Mexico 87131-1091, USA
e-mail: StuartJN@unm.edu

The western painted turtle (*Chrysemys picta bellii*) ranges from the Great Lakes region and central Mississippi Valley westward to the Pacific coast, with disjunct populations occurring in the southwestern United States and northern Mexico (Stebbins 1985). Among specimens of *C. p. bellii* from North Dakota, Smith et al. (1969) discovered an unusual color pattern which they termed "reticulate melanism." This condition, typified by a net-like arrangement of dark lines overlaying the normal carapacial pattern, was documented subsequently in other *C. p. bellii* populations in Minnesota and southern Canada (Ernst and Ernst 1973; MacCulloch 1981; Schueler 1983). Based on reported localities of occurrence, Lovich et al. (1990) and Ernst et al. (1994) considered this melanistic pattern to be limited to northern populations of *C. p. bellii*. This note documents the prevalence and characteristics of reticulate melanism in southwestern populations of this turtle.

Methods.—I defined reticulate melanism (RM) based on descriptions and illustrations provided by Smith et al. (1969) and Schueler (1983). Schueler (1983) observed that Canadian *C. p. bellii* with carapacial RM also typically exhibit a parallel condition in which the longitudinal stripes on the top of the head are either obscured or disrupted by a dark reticulate or vermiculate pattern. My preliminary observations indicated that this cephalic pattern develops earlier than carapacial RM in maturing males, and Schueler (1983) found it in all males with well-developed carapacial RM. Because of its similarity to and apparent correlation with carapacial RM development, the reticulate head pattern was considered a component of RM in this study.

I examined preserved specimens of sexually mature *C. p. bellii* from three drainage systems in New Mexico (Rio Grande, Pecos River, and San Juan River) where native populations occur (Degenhardt et al. 1996). Specimens are deposited in the University of New Mexico Museum of Southwestern Biology (MSB). Straight-line plastron length (PL; to nearest mm) and sex were recorded for each specimen. Males were considered sexually mature based on the presence of secondary sexual characteristics (elongated foreclaws and thickened tail base); females ≥ 130 mm PL were considered sexually mature (Christiansen and Moll 1973). Based on my preliminary observations and those of Schueler (1983), RM progresses with maturation from the anterior part of

the body (top of head first, then the anterior laminae of the carapace) to the posterior part of the carapace. To quantify this progression, specimens were categorized into five stages: Stage 0—no cephalic or carapacial RM; Stage 1—early development of cephalic RM only; Stage 2—well-developed cephalic RM only; Stage 3—cephalic RM, plus RM on anterior 25% of carapace; Stage 4—cephalic RM, plus RM on ≥ 50% of carapace. RM stage and PL were compared using Spearman's correlation coefficient. Other characteristics of RM development were evaluated qualitatively using museum specimens and a sample of ca. 50 live *C. p. bellii* captured in the Rio Grande in 1995–96.

Results.—A total of 268 preserved adult *C. p. bellii* (159 males, 109 females) were examined. Males in the sample were 74–167 mm (117.3 ± 1.4 SE) and females were 130–202 mm (147.8 ± 1.4 SE). Data for RM development in males are presented in Table 1 and Figure 1. All females were categorized as Stage 0. The supraocular and medial head stripes in nine females (132–194 mm PL) were slightly mottled, but in no case did the cephalic pattern approach the distinct stripe modifications seen in melanistic males. No female possessed a shell pattern resembling that of males with carapacial RM.

RM stage was positively correlated with plastron length in males ($r = 0.77$, $P < 0.01$). Males with no RM (Stage 0), cephalic RM (Stages 1–2), and both cephalic and carapacial RM (Stages 3–4) comprised 35.8%, 34.0%, and 30.2% of the sample, respectively (Table 1). The majority (76.1%) of males examined were from the Rio Grande drainage, therefore geographic variation among the three river systems was not compared statistically. However, the occurrence of RM in the small subsamples from the Pecos and San Juan rivers appeared to follow the pattern of development seen in the Rio Grande population. Carapacial RM was typically darkest and most contrasting in those individuals with the most extensive development of this shell pattern. In addition, cephalic RM was usually most pronounced in the largest individuals with extensive carapacial RM. The cephalic pattern was essentially restricted to that part of the skin which overlays the prefrontal, frontal, and parietal bones of the skull; disruption of the head and neck stripes beyond this limited area was observed in ca. 30% of males (Stages 3–4) where it was very slight. The ventral surface of the body was unaffected by RM in virtually all specimens examined, although one Stage 4 male had an extensively-spotted plastral pattern.

TABLE 1. Summary data for straight-line plastron lengths (PL, in mm) of 159 adult male *Chrysemys picta bellii* from New Mexico, grouped by reticulate melanism (RM) developmental stage (0–4). See text for explanation of RM stages.

RM Stage	N (% total)	PL Mean ± SE (Range)
0	57 (35.8)	101.7 ± 1.7 (74–135)
1	26 (16.4)	114.4 ± 2.4 (93–139)
2	28 (17.6)	124.1 ± 2.7 (84–155)
3	7 (4.4)	132.9 ± 3.5 (122–149)
4	41 (25.8)	133.6 ± 1.7 (114–167)

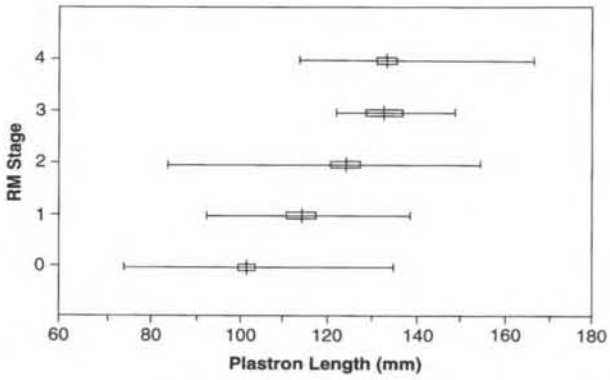


FIG. 1. The relationship between straight-line plastron length (PL, in mm) and reticulate melanism (RM) developmental stage (0–4) in 159 adult male *Chrysemys picta bellii* from New Mexico. Box plots of PL include mean, one standard error, and range (from Table 1). See text for explanation of RM stages.

Two other features possibly connected to RM development were noted but not quantified in this study. Based on examination of museum specimens and live males with Stage 4 RM from the Rio Grande, individuals with well-developed carapacial RM (70–100% of carapacial surface affected) often had overall darker carapaces than females and Stage 0 males. In addition, the junctions between the nuchal and first marginals of most specimens at Stages 3–4 were often sharply indented, producing a serrated or "sawtooth" appearance to the anterior edge of the carapace (visible in photographs in Smith et al. 1969:174, and Schueler 1983:83). Both of these features were much less frequently observed in mature females and were rarely seen in Stage 0 males.

Discussion.—The results of this study closely parallel those of Schueler (1983) for Canadian *C. p. bellii*; he noted that all large (> 150 mm PL) males were melanistic. In this study, all males > 135 mm had cephalic RM and all males > 155 mm had carapacial RM in addition to the cephalic pattern. It is noteworthy, however, that in few examined specimens was the carapacial reticulum as dark and continuous as in the example illustrated by Ernst et al. (1994:282); a narrow vermiculate or broken reticulate pattern was more typical of fully melanistic *C. p. bellii* from New Mexico.

It is unclear if the serrated anterior marginals and overall darker carapace of melanistic males is connected to RM development. These features may actually be secondary characteristics of maturity rather than components of RM as they are also present in some large females. The underlying cause for development of the anterior carapacial serration is apparently unknown.

Although the causes and characteristics of male melanism have been partially elucidated in other emydid turtles (e.g., *Trachemys* spp.), data for *C. p. bellii* are relatively limited and, in some cases, conflicting. Previous studies indicated that RM was restricted to northern populations of *C. p. bellii* (probably due to an absence of studies elsewhere). However, the commonness of this pattern in New Mexico, near the southern distributional limit of the subspecies, indicates that its occurrence is not influenced by latitude. Data presented in MacCulloch (1981), Schueler (1983), and this study demonstrate that RM is limited to males, although Ernst and Ernst (1973) reported that females also may exhibit this pattern. Ward (1984) stated that only females in *C. picta* are melanistic, but it is unclear as to what form of melanism or to which

subspecies he was referring. Apparently, androgens are involved in the development of melanism in males of some *Trachemys* spp. (e.g., Garstka et al. 1991), but their role in RM development in *C. p. bellii* is unknown (Lovich et al. 1990). Unlike male melanism in some *Trachemys scripta*, which involves disruption and reorganization of the pattern on almost all surfaces of the skin and shell (Lovich et al. 1990), RM in *C. p. bellii* is restricted to the carapace and top of the head. Restriction of this form of melanism to dorsal surfaces underlaid with bone suggests that its location on the body may be influenced by: 1) thickness of soft tissue; and 2) exposure of the surface to sunlight during basking. Additional studies are needed to clarify the geographic distribution of RM in *C. p. bellii* and investigate the possible roles of sex hormones and ultraviolet radiation exposure in its development.

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Mummification Following Winterkill of Adult Green Frogs (Ranidae: *Rana clamitans*)

MICHAEL J. LANNOO
Muncie Center for Medical Education, Indiana University School of Medicine
MB 209, Ball State University, Muncie, Indiana 47306, USA
e-mail: MLANNOO@GW.BSU.EDU

J. ALAN HOLMAN
Michigan State University Museum
East Lansing, Michigan 48824-1045, USA

GARY S. CASPER
Section of Vertebrate Zoology, Milwaukee Public Museum
800 Wells Street, Milwaukee, Wisconsin 53233, USA

and

ERIN JOHNSON
Muncie Center for Medical Education, Indiana University School of Medicine,
MB 209, Ball State University, Muncie, Indiana 47306, USA

Continued reports of amphibian declines from around the world (e.g., Drost and Fellers 1996; Green 1997; Kuzmin 1994; Joglar and Burrowes 1996; Pechmann et al. 1991; White 1995) dictate that amphibian mass mortalities be reported (e.g., Blaustein et al. 1995; Márquez et al. 1995), and their causes be determined, where this is possible. Here, we describe the circumstances of an apparently natural mass mortality of green frogs (*Rana clamitans melanota*).

On 10, 11, and16 May 1996, we collected 23 adult ranid carcasses adjacent to a small, seasonal wetland, dominated by sedges (*Carex* sp.), located at T35N, R17W, in Polk County (section 29), Wisconsin, USA. Carcasses were placed in the sun to evaporate surface moisture, and stored in individual zip-lock bags. Additional preservation was not necessary, animals remain today as they were when discovered. Exceptions are the few animals that developed surface fungus; these were rinsed with 70% ethanol. Twelve frogs have been deposited in the Michigan State Museum (Herpetological Skeletal Collection 4444–4455), eleven in the Milwaukee Public Museum (30251–30261). Because animals were similarly sized (see below) and clustered, they were assumed to be a single species. One carcass was sent to J.A.H. for identification using ilial morphology (Holman 1984, 1995). Age estimations based on skeletochronological methods were conducted (N = 19). To observe lines of arrested growth (lag lines), the central portion of one of the femurs of each carcass was embedded in paraffin according to standard histological techniques (Kiernan 1990), and sectioned at 12 µm. Body measurements (total length), the presence of eggs, and the number of femoral lag lines were determined. Lag lines within the bone were counted. To this total an additional line was added marking the winter of 1995–1996 (for a similar assumption see Acker et al. 1986).

All carcasses were desiccated, blackened, leathery (Fig. 1), and entangled in detritus near the wetland edge. Carcasses were not pliable, joints were rigid. There was no evidence of insect larvae within the carcasses. Adipocere was not present. At the time the dead frogs were collected the water was out of its banks; the water's edge was in the lawn of the owners, and the deepest portion of the wetland was about one half meter. This wetland usually dries by late summer and remains dry through the winter; 1995 was unusual in that the wetland refilled prior to freeze-up. The dead frogs were found in two areas just above the waterline along the shallow northeastern side of the basin. Most skeletons

were intact, held together by skin, ligaments, and desiccated muscles and tendons; bones were clearly visible (Fig. 1). Eggs in gravid females were conspicuous (Fig. 1). Of the 23 frogs collected, 8 were gravid females. Seven of these females were intact, the remaining female consisted of a set of ovaries found dried together with a partially disarticulated skeleton of what appeared to be a single frog (no duplicated limbs or vertebral columns).

Based on ilial morphology (Holman 1984, 1995) these frogs were identified as *Rana clamitans*. Our skeletochronological analysis supported this identification in that lag line morphology did not resemble the tight rings illustrated for northern leopard frogs (*Rana pipiens*; LeClair and Castanet 1987). Green frogs are probably the most common ranid species in Wisconsin, occurring in every county (Casper 1996).

Because most green frogs inhabiting these northern latitudes overwinter as Gosner (1960) stage 25 (i.e., legless) tadpoles (Vogt 1981) an additional year was added to our age estimates. (We note that several features of green frog life history, including a long breeding season [Minton 1972; Vogt 1981; Wells 1977], the potential for double clutching [Wells 1976], and tadpoles that may or may not overwinter, produce a variability in this species that mitigates against confidence in calculating a-posteriori age assessments.) Based on lag line counts and the presence of eggs in some individuals, our animals were young adults. Age estimates indicate that 15 of 19 animals were two and one-half years old, two were one and one-half years old, two were three and one-half years old. Wells (1977) reported that both sexes usually reach sexual maturity in the year following metamorphosis (i.e., about two and one-half years) although some may postpone breeding until the following year. Martof (1956) indicated that green frogs in natural populations probably live at least five years. Our green frog carcasses ranged in size from 60–80 mm. These animals were small compared with reports from other studies (Minton 1972: males 60–84.5 mm, females 64–88 mm; Vogt 1981: 60–90 mm; Walker 1946: males 69–90 mm, females 72–92 mm; Wells 1977: males 90–103 mm, females 98–105 mm). These size differences may be due in part to artifact; desiccation shrinks overall body length (Spindler 1994). Even so, these frogs were large enough to be breeding animals. Green frog males are sexually mature at 60–65 mm (Martof 1956; Ryan 1953). The smallest male Wells (1977) found calling was 63 mm, the smallest female that laid eggs was 71 mm. By comparison, Wells (1977) reported that newly metamorphosed animals range in size from 28 to 38 mm.

The winter of 1995–1996 was severe in the Upper Midwest. The National Weather Service station in Amery, Wisconsin, the nearest weather station (located about 29 km southeast of the site), reported that snowcover was continuous from November 26 to April 10—137 days (U.S. Department of Commerce, National Oceanographic Administration, National Weather Service). The deepest snowcover, 40 cm, occurred on March 25–27. During this time of snowcover the average daily maximum air temperature was -4.1°C and the average daily minimum was -12°C; both maximum and minimum temperatures were 2°C below the 1930–1950 annual average. One local fisherman claims that there were 125 cm (41 inches) of ice on the nearby lakes. Lakes and wetlands stayed frozen until the spring melt. Several fish winterkills in the region were reported to the Wisconsin Department of Natural Resources office in nearby Cumberland. A shallow portion of the adjacent Little Butternut Lake experienced a fish kill.

Almost certainly the cause of the death of the green frogs described here is winterkill, possibly a result of a poor hibernating site choice during an abnormally high water period. Green frogs usually hibernate in permanent waters (Harding 1997; Oldfield and Moriarty 1994). If death had occurred during the previous summer or fall, evidence of decomposition or ingestion by insect larvae should have been apparent. In our experience in the Upper Midwest, warm weather mass mortalities are usually associated with drying conditions or disease and affect aquatic larval stages. Dry conditions were not a factor in producing the deaths of our animals. These adult frogs were found in vegetation within 25 m of Little Butternut Lake; in fact, one group of frogs was found closer to the lake than to the opposite side of their wetland. We can envision no warm weather scenarios under mesic conditions that could plausibly create a mass mortality of apparently healthy green frog adults and produce clusters of carcasses that show little evidence of decomposition or scavenging.

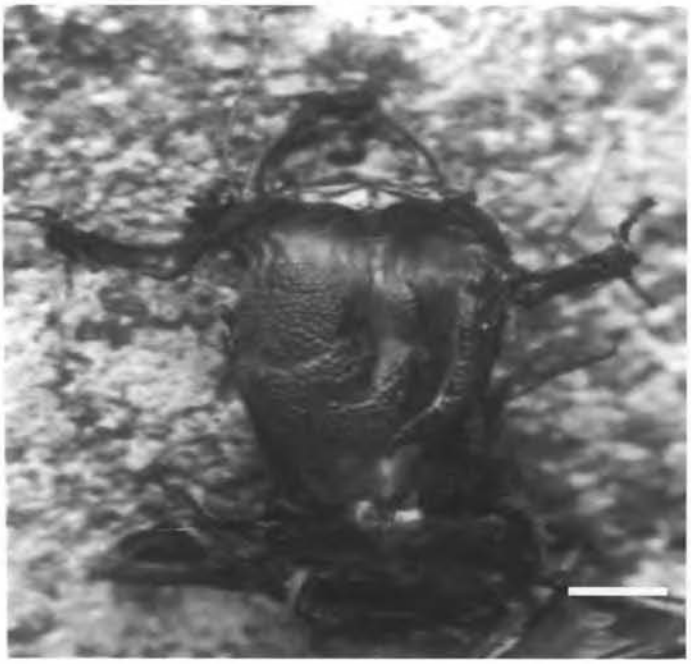


FIG. 1. Ventral view of mummified gravid female green frog (*Rana clamitans melanota*). Note darkened, desiccated body and distinct skeletal features. While most of the viscera have shrunken, the ovaries and individual ova can be distinguished. Scale bar = 1 cm.

In the usual sense, winterkills occur in water, most frequently in basins that are shallow (shallow water restricts dissolved oxygen availability) and during winters when snowfall is high (deep snow restricts sunlight penetration and therefore photosynthesis; see Lannoo 1998). Aquatic winterkills have been reported previously for amphibians (Bradford 1983; Corn and Fogleman 1984; Manion and Cory 1952) and in some areas may be a common cause of mortality (Barica and Mathias 1979; Lannoo 1996; M. Redmer, pers. comm.). Three facts, however, suggest that aquatic winterkill was not the cause of death in these animals. First, all carcasses were found above the water level of the wetland, which admittedly could have lost water since its spring melt. Secondly, in our experience spring melt following a winterkill can create an olfactory experience not soon forgotten for those living downwind. But immediately following ice off, the wetland did not reek of methane, hydrogen sulfide, or other byproducts of anaerobic decomposition; nor did it smell of aerobic decomposition. Thirdly,

and most convincing to us, the lack of decomposition suggests that the time from death to mummification could have been, at most, six months (mid-October 1995–mid-April 1996, see below), which seems to be a time course too rapid for animals to mummify while embedded in ice.

Thus, a terrestrial winterkill scenario is most likely. These animals appear to have been trapped out of the water. After death but before decomposition, carcasses were frozen and covered with snow, which dehydrated and preserved them. In general, mummification is a common process, and mummified frogs have been produced following exposure to phosphoric acid in France (Weigelt 1989). However, authoritative books on the subject of taphonomy (Behrensmeyer and Hill 1980; Weigelt 1989) do not address mummification following aquatic winterkills. Weigelt (1989) reports that mummification can take place anytime a carcass loses most of its water content before decomposition begins. Under freezing conditions, water loss occurs through sublimation. Rapid sublimation is known to occur in dry snow, as has been proposed for the preservation of the Hauslabjoch "ice man" (Spindler 1994). This process of sublimation in snow cover produces a natural form of freeze-drying, and seems to be a more likely explanation than preservation in ice for the presence of the mummified carcasses we discovered.

We close with an encouragement to report mass mortality events. Such accounts would allow a better assessment of the relationships between amphibians and the environmental conditions they experience.

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A Glimpse into the Life of a Zoo Herpetologist

JAMES B. MURPHY
Department of Herpetology
National Zoological Park, Washington, D.C. 20008, USA
e-mail: NZPDOH02@sivm.si.edu

and
WINSTON CARD
Department of Herpetology, Dallas Zoo, Dallas, Texas 75203, USA
e-mail: winstoncard@sprintmail.com

A Profile of Zoo Herpetologists

The following account is based on our impressions of valued colleagues in zoos, refined over many years of friendship and interactions with them. Many of these exhibited characteristics could be applied to herpetologists in other settings as well. A number of zoo herpetologists developed their interest in amphibians and reptiles as youngsters. As their interest expanded, many maintained large living collections, especially snakes. It was not easy to like snakes because most people, including parents, viewed these creatures with loathing and disgust. Consequently, the young enthusiast had to continually defend his or her interest as being acceptable in polite society. Since the young herpetologist was generally on the defensive, the possibility of developing argumentative, antisocial and aggressive patterns in response to criticism was real indeed. An interest became an obsession and social interactions with non-herpetologists became less frequent. In later years, marital relationships, especially when the partner was not interested in herpetology, could be strained beyond repair. A number of our colleagues have had multiple marriages. One zoo herpetologist was separated from his second wife. He was offered a curatorial job in another city which was accepted but his wife remained behind. After several years in his new post, he was asked about his unsatisfactory relationship with her. He was unable to remember his wife's first name even though they were still legally married. He pointed out that if he were to face death unless he remembered, he would die!

If the zoo herpetologist had an interest in collecting organisms other than amphibians and reptiles, there were parallel patterns in these collections as well. Those interested in plants tended to collect certain groups: cacti, succulents, cycads, bromeliads, and carnivorous plants. Be it invertebrate, fish, bird, or mammal, there was one consistent theme characterizing a zoo herpetologist's collection: carnivory! If invertebrates were collected, they were often spiders, scorpions, or predatory insects. Living fish collections included catfish, primitive fishes such as elasmobranchs, gar, bircher, lungfish, and predaceous fishes. When birds were kept, they were most often raptors. A mammal collection reflected similar specialization: small exotic carnivores.

Since most of our colleagues throughout the years have been male, opportunities for women being limited, our analyses are based on behavior of men in herpetology. It is refreshing to see women entering the zoo profession in increasing numbers and it will be interesting to try to analyze their behavior in the future. Clearly not all men in the profession reflect all of these patterns but the following list may help define the zoo herpetologist:

—Academic careers often are less than stellar. This may be due to a lack of interest in coursework not directly related to herpetology.

—Friendships are mostly limited to other herpetologists.

—There is a measure of uncertainty among zoo herpetologists in that they are not certain whether they should view themselves as professional herpetologists or herpetoculturists. In reality, they are a blend of the two disciplines. Zoo herpetologists must consider theoretical issues in biology but use applied methods to maintain living collections.

—One does not enter the zoo field to make money. When discretionary income is available, it is often spent on herpetological literature or field trips.

—Living collections of amphibians and reptiles are often maintained at home as well as at the zoo. There is a trend to maintain exotic rather than domestic animals. A propensity for herps may happen because they are generally small and easily accommodated. If one were interested in mammals, it would not be easy to keep a hippopotamus in the back yard. The types of wild creatures kept by zoo herpetologists are usually not responsive to human interaction but rather are likely to be highly defensive or independent of any human activity. Hence, any animal that responds positively to a human advance is generally considered to be undesirable. This is different from many other zoo workers who seem to derive pleasure from bonding with animals in a personal way. Should a favorite animal expire, it can be a highly traumatic event. There may be a reason for this difference. Zoo herpetologists view their animals as individual members of a species group which are integral parts of a complex ecosystem. Life and death are part of the natural mosaic so the loss of any one amphibian or reptile is viewed as inevitable and not particularly troubling, especially since a strong personal bond has not been created. Frustration often stems from the loss of an important specimen in a breeding program which may be irreplaceable, with conservation implications. Unlike workers in other animal departments in the zoo, herpetologists almost always use technical names for their charges and almost never use a pet name.

We do not wish to offend any of our non-herp zoo colleagues who wish to bond with their animals but there is an inherent danger to this approach. First, animals should imprint on conspecifics rather than humans. Second, zoo visitors receive the wrong message. Animals should be viewed not as individual entities dependent on humans per se but rather as part of a larger group with selection pressures shaping this taxonomic unit. In other words, individual animals live and die in the wild but are part of a broader species and community assemblage. The zoo visitor needs to be shown that zoo workers are aware of the distinction between individual and group and that zoo professionals are making every effort to maintain captive animals in as wild a state as possible with minimal human interference and interaction. With this approach, thorny issues such as euthanasia and culling of *individual* specimens inappropriate for breeding programs can be addressed. Some zoo workers invest considerable time and money to save an individual animal through such protocols as elaborate veterinary procedures or hand rearing neonates which are possibly inferior and lack fitness. These resources could be directed in more positive directions.

—Priorities may be skewed. One keeper had an extensive array of terrariums arranged throughout his living room but there was virtually no furniture. His wife complained bitterly that all he cared about were his reptiles. She underscored her argument by pointing out that he took food from their baby's mouth in order to have the money necessary to buy mice to feed his snakes.

—Career advancement in the zoo field beyond herpetology is not a high priority. There are a few exceptions to this trend: Carl Kauffeld, late Director of the Staten Island Zoo; John Werler, re-

tired Director of the Houston Zoo; and Roger Conant, retired Director of the Philadelphia Zoo serve as examples, disproving the general rule.

—There are two distinct modes of dress. One group, certainly in the minority, dresses in sartorial splendor with nicely pressed and laundered clothes. The second group appears to have found mismatched clothing at a garage sale. These items seem to be infrequently washed and never ironed. A supervisor at a midwestern zoo regularly wore a beanie with a propeller attached. One male zoo herpetologist, apprehensive and anxiety-ridden, was preparing for an eagerly expected date with a winsome young lass. His personal habits were not exemplary for he rarely cleaned his clothes. He threw his soiled garments into a pile roughly waist-high which could accurately be visualized as a steaming compost pile. As he was sorting through this unmentionable heap to locate the least offensive article of clothing to wear on his date, he discovered a large, dried pizza.

—Many of our colleagues reflect vigorous heterosexual behavior with little evidence of success in the game of love. As stated earlier, there were few women in the profession in the early days. At the herpetological conferences, those beleaguered women were the center of attention. It was a situation remindful of the spring emergence of red-sided garter snakes in Manitoba, Canada where scores of male snakes pursue females. At these conferences, female mate choice was operative.

—For male zoo workers, there has been a trend toward permanent facial hair even during those periods in the United States when grooming styles were less hirsute.

—Dining habits tend to reflect a high degree of carnivory with food consumed in impressive quantities. In at least two instances, keepers ate mice and grubs to shock zoo visitors who disliked snakes. Occasionally, culinary habits were questionable. One keeper's residence was so overrun with cockroaches that they marched in phalanxes at night. The butter dish was always left on the kitchen sink at night rather than in the refrigerator to ensure that the butter was soft and could be easily spread on slices of bread each morning. As dawn approached, mummified roaches would be stuck in the butter in a scene remindful of the La Brea tar pits. As the keeper prepared his morning repast, he would scrape legs, wing covers, and antennae off the spread. Although he generously offered buttered toast to his house guests, the gift was never accepted.

—A number of our colleagues have had or currently have a motorcycle.

In summary, zoo herpetologists are generally highly focused, somewhat aggressive individuals who enjoy and nurture live animals but may not be as considerate toward their fellow man. They should feel lucky that they have been able to combine their interest with their profession.

Curators Versus Keepers

At the present time, the rights of zoo employees to work in a non-abusive environment are well protected legally and if their rights are trampled, legal options are available to redress grievances. Yet during the period between 1950–1975, employees might be subjected to unimaginable conditions by a few unreasonable curators. Several examples will serve to illustrate this point. A curator, after observing dirty waterbowls contaminated with fecal matter, demanded that all departmental employees drink from the vessels in order to learn proper sanitary procedures. In another instance, zoo keepers were taught how to fold a paper towel properly when cleaning animal enclosures and if the towels were not folded in an acceptable manner, keepers could suffer severe consequences, including suspension.

In some zoos, keepers were not allowed to feed their charges as these employees were regarded as incompetent by the curator. It was a privilege, reserved only for the curator, to feed these herpetological treasures. A curator who had told his people never to feed pink mice to a saw-scaled viper watched a keeper violate his instructions. He raced from the public area to the service section, reached into the enclosure and pulled the mouse from the snake's mouth. There would be no eating of prohibited substances in his domain! In response to this transgression, the curator forced this guilty keeper to scrub the floor of the entire rear service area with a toothbrush. Should a specimen expire of unexplained causes, some curators berated their keepers incessantly; employees might be punished for allowing the creature to die!

One woman keeper was carrying a large tray of rodent water bottles to a sink for cleaning. Unhappily, she lost her balance and fell amidst broken shards of glass whereupon she suffered lacerations. The curator, seeing her standing unsteadily in the doorway dripping blood, yelled and ran into the room past her. As she tried to reassure him that she was not severely injured, he ignored her and held the broken pieces in his hands, exclaiming that he had used those same bottles for many years and their loss was catastrophic; those bottles were irreplaceable!

Some keepers could truly test the patience of a curator. One was characterized by the curator as clumsy, scattered, and careless; an inordinate number of snakes under his care escaped. The curator, under strain from many administrative duties, engaged in a daily ritual to calm his shattered nerves. Every morning, he walked through the public area and inspected all of the enclosures. At the end of his tour, he would pause at the front of his favorite terrarium and visibly relax. This particular exhibit reflected his personal touch for he had landscaped the cage with an interesting variety of tropical plants and stocked it with beautiful Neotropical treefrogs. On one particularly stress-filled morning, he was startled to see a garter snake in his terrarium eating the last of his treefrogs. In a fury, he shouted for the hapless keeper to come immediately to see the carnage. His employee, busy at work in the rear section, heard his call and ran into the public area at full stride, whereupon he lost his balance, slid into the curator and upended him. The curator, by now completely out of control, rose to his feet, pulled the keeper off the floor by his hair, and repeatedly banged his head on the exhibit glass, all the while shouting how incompetent and stupid he was to allow such a fiasco to occur. The curator had to be restrained by fellow workers!

Although bushmasters were highly desired in zoo collections, they were delicate captives and little was known of their reproductive biology. This same curator had a particular fondness for bushmasters but his success rate with them was marginal. A potentially gravid female was imported and set up in isolation in the rear section. Each day, the curator would fantasize about beautiful baby bushmasters and stare into the cage to see if she had oviposited. One memorable day, she was coiled around a clutch of newly-laid eggs. All of the eggs were removed for artificial incubation. These were the primitive days before incubators and vermiculite were used to incubate reptile eggs so his plan was to create a suitable spot which offered appropriate heat and humidity. He chose a site that seemed to cover all requirements for humidity: a metal stock tank half-filled with water which housed a variety of small crocodilians and aquatic turtles. He placed a wooden plank on top of the tank and set the egg container on top.

For additional heat, a reflector and heat bulb were suspended from the ceiling above the eggs. His final task was the most important. A line was drawn on the floor around the tank. His nemesis, the now frog-less keeper, was not allowed to cross this line to view the eggs under any circumstance. It was inevitable that a disaster would occur. One day, when the curator was not at the zoo, the keeper noticed that the bulb was no longer burning. Rather than calling the curator at home, he chose to replace the bulb himself. As he stood on the plank to change the darkened bulb, he lost his balance and dumped all of the eggs into the tank whereupon crocodilians and turtles alike feasted on this unexpected fare. The keeper's life thereafter was exceedingly unpleasant.

Keepers occasionally were expected to work many additional hours over the normal 40-hour weekly complement without compensation. If they were unwilling, they were singled out as malingerers without a serious interest in herpetology and their professional commitment was questioned; in rare cases, curators physically attacked keepers when a dispute arose. Some institutions reflected a militaristic philosophy since keepers had to stand at attention for daily inspection and if a uniform was not suitably presentable, the offender was sent home to change.

To our knowledge, the record for fired keepers by a single curator is over four score. His explanation was that he would fire them until he found a decent one. This curator also fired his wife who was a keeper in the department. At home, she was not allowed to touch his rare books. After she finished reading each page, she had to call him to turn the next page. This marriage began to show signs of stress. The wife had a tame pet rat which she carried with her constantly. As the couple's relationship was deteriorating, he lamented one day that she loved that rat more than she cared about him. He paused pensively for a moment, then said,"But it is truly an exceptional rat!"

Some keepers devised amusing methods for retaliating by harassing curators in subtle ways. One curator demanded that all objects removed from within an enclosure be replaced in exactly the same spot. To ensure that this was done, measurements were taken with a ruler. To destroy the curator's sense of order, keepers moved waterbowls less than one inch daily from the anointed spot with wagers made on how much the dish could be moved before the curator noticed the new placement. In one zoo, the keeper staff was so badly mistreated that they created a "Keeper's Bill of Rights" which was ceremoniously presented to the curator. Included in this document were statements such as all staff must be treated as human beings rather than beasts of burden, and that allowances be made for personal time off the job. The keepers also requested that their personal habits, although bizarre, must not be a topic of discussion in a public forum. The curator's response was predictable and explosive; all keepers were threatened with immediate termination!

It was unusual for keepers to be given time on the job for independent research projects and travel money for professional herpetological conferences or field studies was rare indeed. In fact, should a keeper desire these "curatorial benefits," he was perceived as overly ambitious and a threat to the internal stability of the department. The prevailing philosophy was that a keeper's only responsibility was to clean cages forever and any deviation from this was unacceptable. Needless to say, keepers had virtually no say in the composition of the collection.

Collections were generally structured to reflect the personal interest of the curator but a good part of the pleasure in developing these assemblages seemed to have been the enjoyment derived from showing them off to colleagues. "Are you ready for this?" could be heard in the building as the visitor was hauled from one enclosure to the next. This is not to say that certain curators were not enlightened managers who encouraged their employees in many positive ways. These administrators often directed highly productive departments with meaningful contributions by the entire staff. The message to be taken is that the managerial history of zoo herpetology during this period varied, ranging from a repressive environment directed exclusively by the curator to one that was open and positive for all employees. It is surprising that some of the most dedicated keepers who suffered under unsympathetic curators remained in the profession and it is to their credit that, generally, they did not continue the abusive practices of their former employers as they rose through the administrative labyrinth.

Interactions with Venomous Reptiles in Zoos

Card and Roberts (1996) surveyed incidents of envenomation in zoos between 1970–1995. Yet there were a number of close calls with venomous reptiles which remain unreported. Policies for the handling of these reptiles varied according to the institution; some facilities had explicit procedures for handling potentially dangerous reptiles whereas the policy at other zoos could be characterized as casual indifference. For instance, keepers at one famous zoo would dare each other to lift venomous snakes by sliding their hands beneath the coils. This practice, which involved copperheads, moccasins, and rattlesnakes, continued until the participants were caught by the curator.

In one zoo, a keeper was holding a young black mamba and attempting to remove a dried, stuck shed skin. The snake turned and bit the keeper but the fang fortunately glanced off his thumbnail. Naturally, the keeper released the snake which quickly escaped into the zoo through a gap beneath the door. The snake was discovered shortly thereafter. The same keeper had a difficult time distinguishing venomous coral snakes (*Micrurus*) from false coral snakes (*Erythrolamprus*). His solution was to free-handle both snakes to see if one attempted to bite him; if one of the snakes did so, it was identified as a coral snake. A third episode involving this keeper deserves mention. His task was to clean the habu (*Trimeresurus flavoviridis*) exhibit. To do this, he was required to remove the snake from the exhibit and place it in a garbage can while servicing the cage. To save time, he placed the snake on the rim of the can a few feet behind him, then bent over to begin the cleaning. The habu, poised to strike, focused on the only target within reach—a human derriere. During the course of his duties, it just so happened that the keeper backed up several times and pushed the snake's head back with his rather substantial buttocks, disorienting the snake completely; there was simply too much area to strike!

Feeding venomous reptiles can be hazardous. One keeper used to feed a group of boomslangs (*Dispholidus*) by holding up a tray of dead newborn mice into the exhibit enclosure which stimulated the snakes to launch off of the branches, writhe around in the tray, and feed voraciously. Somehow the keeper's fingers were never viewed as potential food items, even though the snakes crawled over his digits constantly. In another zoo, the curator was convinced that his charges "knew" him personally, accepted him as their caretaker, and would never attempt to bite him as he fed them. Consequently, he fed them with his fingers or used very short forceps for feeding and, in fact, was never bitten during the many thousands of feeding interactions over his career.

Captive king cobras often have difficulty properly shedding

their eyecaps. As a result, a snake with this problem must be taken from its enclosure, held by the attendants, and the eyecaps removed manually. At one midwestern zoo, the curator and two assistants were engaged in this dangerous undertaking but they had not noticed that the snake was ready to shed again. As they held the cobra, it slid out of its old skin like a sausage. The curator, as senior of the department, was entrusted to hold the snake's head. In a flash, the snake partially crawled out of its skin and rose several feet in the air, staring him in the face. Imagine the surprise of the crew as they held an evacuated shed skin with part of an enraged cobra within. Quick thinking saved the day. On the count of three, the handlers threw the snake several feet away, then recaptured it and returned it to the cage. At another zoo, a keeper took the liberty of shedding a golden eyelash viper by hand even though this was expressly forbidden by the curator. When the misdeed was discovered, the keeper was summoned immediately. The curator, in a rage, pointed out that such actions were not permitted in his department under any circumstances; he also said that he had noticed the shedding problem earlier and had planned to remove the skin himself. The keeper answered,"A *good* reptile man would have shed the snake two days earlier!" He was immediately relieved of his position. Several years later, one of us (JBM) was visiting this curator who was still furious about the unmitigated gall of his former keeper—whom he characterized as the most incompetent individual in the profession. The curator raised his arms above his head, looked at his hands with pride and said,"These are the hands that shed the bushmaster and the king cobra!"

One curator was handling a rock rattlesnake on a snake hook when it started to crawl slowly up the shaft toward his hand. He asked the keepers if they had any idea what a rattlesnake's reaction was to human scent. Their response was negative so he allowed the snake to flick its tongue a few times on his finger. Naturally it bit him!

Another zoo herpetologist was despondent since his long standing love affair had collapsed. He concluded that life was no longer worth living so he decided to commit suicide. He believed that a bite from an eastern diamondback rattlesnake, his favorite snake, would be the most heroic way to end his now tattered and insignificant life. He thrust his arm into the zoo exhibit which housed several of these ophidians, shielded his eyes with his other hand, and waited for the inevitable. Nothing happened! After waiting with his arm extended for five minutes in front of their heads, he waved his hand and tapped their snouts. Again, nothing happened. Clearly this was an omen from a higher power; suicide was not meant to be!

Colima, México was a desirable destination for herpetologists for there were several reptile dealers who usually offered interesting reptiles from the region. One zoo herpetologist was proud of his newly acquired BMW sports car and decided to take it to Colima on its maiden voyage. When he visited the local dealers, he saw several gravid Mexican west coast rattlesnakes and cantils which he purchased to bring back to Fort Worth, Texas, where he was employed at the zoo. As he started toward home, his new car coughed a few times and expired. Since he was completely isolated in a remote region and replacement parts were unavailable, he fretted about whether he would be forced to abandon his car there. As luck would have it, a fellow herper from Texas drove by in his pickup truck and noticed the stranded owner and vehicle. He offered to tow the vehicle back to Fort Worth but the only line available was a very short rope. Since necessity is the mother of invention, they attached the vehicles with the flimsy cord; the zoo worker steered the rear car as they set off for home. Since the herper was an avid road collector and speedy driver, every time a snake was seen on the road, he would slam on the brakes and retrieve it. Unfortunately, the zoo worker's reflexes were not keen enough to respond so he slammed into the reinforced bumper of the pickup truck during each sighting. Snakes were plentiful on the road and this catastrophe occurred rather frequently. On top of this, the recently purchased rattlesnakes and cantils gave birth during the return trip and the youngsters escaped into the car where they occupied every suitable hiding place. Although the herpetologist tried to capture them when they were visible, he was mostly unsuccessful for there were many avenues of escape. When he reached Fort Worth, the front of his car was completely demolished and looked like a metal accordion. Every morning, he searched for young snakes in his ravaged car, finding over 50 during a two-week period.

At one zoo, the collection was heavily geared toward venomous snakes, and aquaria housing them were stacked one upon another in the cramped service section until the enclosures nearly reached the ceiling. An adult Egyptian cobra escaped and although the entire area was diligently searched, the snake remained undiscovered, One day, as the curator was cleaning cages, the snake, which had crawled around the cages up to the curator's eye level, struck at his face. According to the curator's analysis, as the snake extended its body in mid-strike, it realized that it was about to strike its *favorite* person. The snake's only option was to close its mouth as it bounced off the curator's cheek. The fact that the cobra did not envenomate convinced the curator that his snakes could identify their favorite human and would never harm him. This curator also crawled into the king cobra's cage periodically when the enclosure needed cleaning. As the snake reared defensively, he tied a handkerchief around its head so the snake could not see him during the cleaning operation. When the curator was finished, he simply untied the cloth and exited the cage.

At the present time, safety is paramount. There are emergency snakebite procedures incorporated as standard policy in zoos, and a computerized list of holdings at each zoo is periodically published (Boyer and Murphy 1994). Recommendations for antivenoms in case of snakebite are available (Minton 1994).

Zoo Herpetologists and the Press

Although zoo directors generally encourage their herpetological employees to be cooperative with reporters, some in herpetology find the prospect of dealing with the press unpleasant. Whenever a snakebite occurs or snakes emerge in the spring, the local press often descends on the herpetological staff for in-depth coverage on the biology of venomous reptiles and the potential for snakebite. This can be an annual ritual in places where snakes are common such as Texas. Most of the time, the zoo herpetologist handles these inquiries with aplomb but there are exceptions. One curator regularly pointed out that people who keep or collect venomous snakes are stupid and deserve to be bitten.

Another curator viewed the press with utter disdain. When a young female reporter scheduled an appointment to interview him at the zoo, he placed trays of thawed, eviscerated mice and beheaded chicks in front of his office door, which forced her to carefully wend her way through the myriad bodies to reach his inner sanctum. Prior to the interview, he worked up a frothy sweat by cleaning crocodilians, thereby ensuring that he would be covered with fish slime and algae when she arrived.

One keeper, on a nationwide television program, assured the

viewers that baby snakes were much more attractive than human babies, as the former resembled the adult whereas the latter looked like a pink, rather disgusting, unformed blob of protoplasm.

Curators and the Zoo Visitor

Considering the curator's view of his kingdom and his ambivalence about the role of the public in his castle, the interaction between the two could be bizarre. Visitors seem predisposed to bang on the glass fronts of snake enclosures. At times, the sound is deafening to humans and is reminiscent of the staccato burst of machine gun fire. Curators have been known to react violently by physically throwing visitors out of their building. Zoo visitors have been subjected to verbal abuse as well. One curator, upon noticing a visitor flicking her tongue at a snake in a exhibit, loudly yelled that she should remove her tongue from the glass and put it back in her mouth where it belonged. Not all visitors accepted the curator's rebuke passively and shouting matches could be heard throughout the building.

While knowing that visitors were essential to continued paychecks, curators were often indifferent about the public's presence in the zoo. Some desperately worked to avoid any interaction with the public, including public speaking. Nowadays, as resources shrink and zoo conservation programs require public support, curators must be visible and effective advocates of their institution's mission. The loss of biodiversity and threats to amphibian and reptile conservation must be effectively presented to a wide audience; the modern zoo herpetologist is uniquely suited to this task.

Practical Jokes

The director of a small southwestern zoo built a planted outdoor aviary with funds donated by a well-known zoo supporter. The donor requested that the new exhibit be named in honor of his family and that an elaborate dedication ceremony be arranged with local dignitaries in attendance. Funds were available for construction but there were no additional monies to buy expensive birds so the director stocked the aviary with parakeets solicited from the community. On the dedication day, as the distinguished guests arrived, the director realized that the aviary seemed unusually quiet—no chattering, multi-hued parakeets were flitting through the branches. As the group peered into the aviary, the only creatures in view were some extremely well-fed Texas ratsnakes draped over the branches. One of the director's colleagues had slipped in the night before and released the snakes into the exhibit.

A zoo keeper had a large, tame Gulf Coast toad which lived for years at the zoo. Every morning, he retrieved the anuran from its aquarium and placed it on his working cart as he serviced his exhibits. The toad did not attempt to escape but quietly sat on the cart. Throughout the day, the keeper would feed mealworms to his pet. Another keeper, on his way to work, found a dead toad on the road which resembled the pet toad. As the first keeper was busy at work, the second keeper picked the pet toad off the cart, deftly substituted the dead toad, yelled that he had been bitten by it, then threw the dead toad on the floor and squashed it with his foot. The first keeper, unaware of the switch, grabbed his coworker and tried to beat him into submission. Revenge was sweet. The aggrieved keeper later slipped a snapping turtle into the perpetrator's aquarium of exotic tropical fishes.

One zoo herpetologist was asked to appear on a local television program to talk about venomous snakes. To spice up his presentation, he placed a live rattlesnake, moccasin, and copperhead in a cloth sack and started for the studio. He was bitten by one of the snakes on his leg through the bag but he could not identify the culprit. Fortunately, crotalid polyvalent antivenom was the drug of choice so the issue was somewhat moot. Convalescence was painful and arduous; he slowly hobbled around on crutches for many weeks. One day, his colleague removed the bolts which held the crutches together. As the victim unsteadily stood and placed his weight on them, the crutches collapsed; he fell down the stairs, amusing his companion greatly. Recovery was extended by a few weeks.

One keeper was fond of Exuma Island rock iguanas and he had a tame specimen at home. During the summer, the lizard was kept in an outdoor enclosure from which it escaped. A thorough search of the neighborhood was mounted but the lizard was nowhere to be found. The keeper was crestfallen. A coworker found a deceased specimen of similar size in the freezer at the zoo. Since both keepers drove to work together each morning, the joker put the thawed carcass on the road, yelled that he saw the escaped saurian and promptly drove over it so that it wouldn't escape again. The exasperated lizard owner was not at all pleased!

The director at a major zoo was inspecting the reptile house with the staff. As he leaned over the railing to examine an exhibit closely, he failed to notice some foreign material on the rail. Earlier, a zoo visitor had placed his child on top of the railing whereupon the youngster promptly defecated. When the director checked his shirt, there was a prominent horizontal stripe emblazoned on the garment. He called each member of the staff in turn over to the exhibit and demanded that each bend over the railing to view the exhibit closely for signs of uncleanliness. As a result, each had a similar design on his shirt. Although the zoo had a standard uniform policy, matching brown stripes had not been envisioned.

In 1953, Roger Conant described a new subspecies of the diamondback watersnake, the Tabasco watersnake (*Nerodia rhombifer werleri*) from México, in honor of his colleague, John Werler, the now-retired Director of the Houston Zoo. The more common nominate form was the snake of choice to feed several king cobras at the zoo, so periodic shipments of the watersnakes arrived at the zoo from an animal dealer. A new keeper was told to feed several of the food snakes to the cobras. After the cobras had dined, the keeper was told that the snakes which he had used were, in fact, the very rare namesake of the Director and this serious transgression was grounds for immediate termination. Werler continued the ruse and berated the keeper forcefully for his oversight and carelessness. Eventually, the keeper was told of the joke but some anxious moments preceded the confession.

The Future of Zoo Herpetology

At the annual meeting of the International Herpetological Symposium in San Antonio, Texas in 1996, Curator David Grow from the Oklahoma City Zoo gave a disturbing presentation. His message was simple and direct. There is a trend in zoos of the United States to reduce space and financial support for herpetological programs. In spite of the fact that reptiles and amphibians rank high in visitor popularity (Marcellini and Jenssen 1988), those administrators entrusted with the responsibility of allocating resources have been trapped in a phylogenetic and financial mindset: mammals rank first, followed by birds, fishes and large aquaria, and finally herps. Grow pointed out that there has only been one herpetarium constructed in the United States during the last decade. Moreover, when a new exhibit is planned, precious little space is devoted to herps.

We would like to take Grow's argument a step beyond. If one reviews the index of Card and Murphy (in press), there are roughly 175 names listed of people who have worked in herpetological facilities, mostly reptile buildings. In these herpetologically saturated environments, training, techniques, and novel ideas for captive management have been developed and honed in an impressive way. The beneficiaries have been the animals housed at the zoo. Lately, there has been a trend in zoo planning to stress biodiversity and total immersion mixed exhibits with a wide variety of animals and plants. Although we applaud these efforts, there are several deleterious side effects. The first problem is keepers are trained to be generalists rather than specialists. The second is that the mechanical and electrical support equipment needed to ensure sophisticated environmental parameters for herps is rarely included in a facility designed mostly for mammals and birds. The third is that the smaller or less dramatic amphibians and reptiles tend to pale in comparison with the more active endotherms and may be overlooked. The last is the opportunity for teaching herpetology in a zoo setting will be diluted in a large, generalized exhibit. Successful exhibits and programs can and have been developed for herpetological facilities that address the biology of amphibians and reptiles in an interesting way (see Chiszar et al. 1993; Marcellini and Murphy 1998; Murphy and Chiszar 1989, for examples).

Zoo herpetology has a vivid and rich history, but appears to be declining. Unless there is a reversal of attitude by the majority of zoo professionals, the zoo visitor may have to be content with the occasional large python, Komodo monitor, giant tortoise, massive crocodilian, or other equally dramatic and hardy examples. The danger is that many of the less glamorous species will be ignored and the opportunities for education will be lost. That is truly a shame.

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TECHNIQUES

A Portable Device for Restraining Frogs

MICHELLE T. CHRISTY
School of Biological Sciences, The University of Sydney
New South Wales 2006, Australia

Researchers often conduct field studies in relatively isolated areas without assistance. In many instances access by foot only is possible, which encourages the use of lightweight, durable, waterproof, and easily transportable equipment. It is sometimes necessary for captured animals to be restrained, such as during the application of tags or the fitting of radio-tracking devices (e.g., Carpenter 1954; Kluge 1981; Martof 1953; Prestt 1971). Restricting the movement of study animals is often difficult if the researcher is working alone.

Many devices for restraining animals have been described (e.g., Fowler 1978; Jones and Hayes-Odum 1994; Quinn and Jones 1974), but few examples exist for amphibians. Heyer et al. (1994) suggest that salamanders and frogs should be placed in a wet zip-lock bag and tagged directly through the plastic. Although the technique works for some tagging methods, it is not always suitable, particularly when fitting radio-tracking devices where the researcher must have access around the body. Here I describe an alternative method for restraining frogs while fitting tracking devices or applying tags. The device is light, durable and waterproof, quickly and safely restrains frogs, and can be used by a single worker.

The device, known as the "strapper," consists of a base of about 20 cm x 20 cm x 1 cm, to which are attached four elasticised straps (Fig. 1). It weighs approximately 180–250 g depending on the material and size of the base (i.e., a cedar base weighs approximately 180 g, polypropylene base weighs approximately 225 g). The base is likely to become wet, so should be made of moisture resistant wood or polypropylene. Each of the four elastic straps are secured to the base with a 10 mm stainless steel countersunk screw and threaded through a shoulder strap slide (as used in brassieres) and a strip of loop and hook fastening tape (e.g., Velcro™) is sewn to the topside of the unsecured end. The four straps are gapped by 1 cm, 2.5 cm, and 1 cm in sequence, respectively. Four strips of the complementary surface of fastening tape are attached to the underside of the base with matching spacing.

Wrapping damp gauze around the straightened legs and tightening two of the elastic straps around the waist and thighs secures the frog, holding the legs firmly together. The upper body is positioned inside the loop of one of the remaining two elastic straps with the arms pinned in front of the tightened strap. Again, damp gauze should be used to provide moisture, cover the frog's eyes and protect the frog from potential skin damage. Once tightened, the straps are doubled back and secured to the underside of the board using the Velcro. This position inhibits the frog's movements and thus decreases the risk of injury during handling.

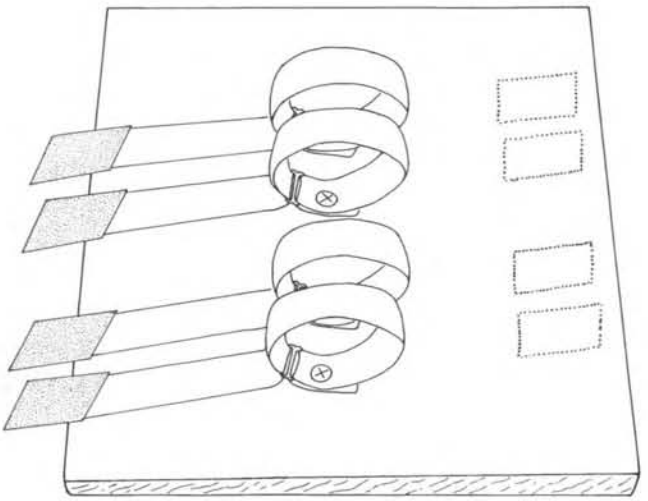


FIG. 1. The strapper incorporates four lengths of elastic secured to the base. The elastic is threaded through a shoulder slide and secured using Velcro™.

The two head straps can accommodate size variation in restraining frogs (i.e., the inside strap fits smaller frogs, the outside strap larger ones). These dimensions allow securing of frogs with a small (2.5 cm) to relatively large (15 cm) snout-urostyle length. However, by increasing or decreasing the gaps between the straps, the strapper can be modified to accommodate most size ranges.

During the past 24 months, the strapper has been used to secure in excess of 600 green and golden bell frogs (*Litoria aurea*) during Passive Integrated Transponder (PIT) implantation procedures or attachment of transmitters on waist belts. It would be possible to use only the lower body straps, or upper body straps, or further modify the strapper to make it compatible with alternative transmitter attachment or tagging methods (e.g., Emlen 1968; Kaplan 1958; Kluge 1981; Rathbun and Murphy 1996). The use of the strapper adds approximately 30 seconds to the PIT tagging procedure, but needs only to be used when the researcher's dexterity is compromised or the frog is uncontrollable. The fitting of the waist belt transmitter, from capture to release, takes approximately five minutes using the strapper. Thus far no adverse effects of using this method have been noted. After 24 months of field use, the strapper shows no sign of deterioration, however, I expect the elastic straps will need to be replaced bi-yearly, depending on use.

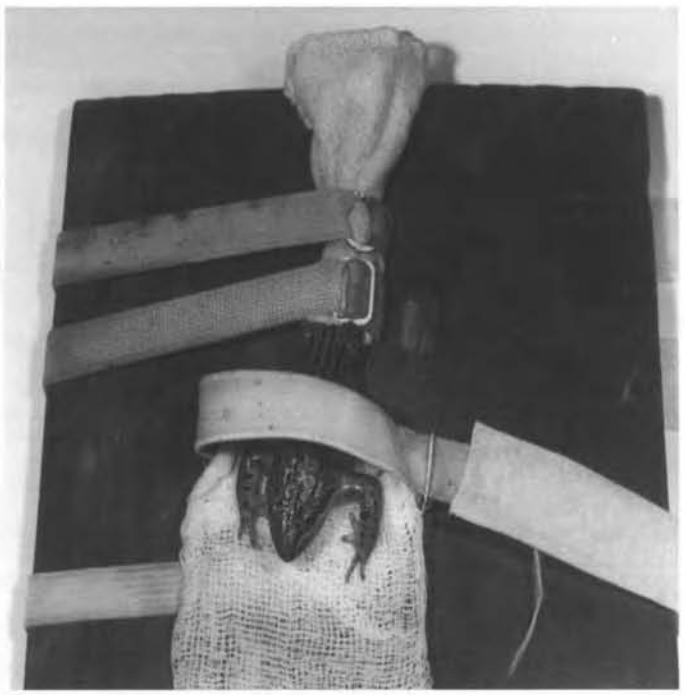


FIG. 2. The frog is secured by tightening two of the elastic straps around the waist and thighs and one of the remaining straps around the upper body. Damp gauze provides moisture and protection from potential skin damage.

In my work, the reasons for using such a device are four-fold. First, unlike some frog species, *L. aurea* can be feisty and difficult to handle. Second, as they are recognized in New South Wales as 'endangered' on Schedule 1 of the Threatened Species Conservation Act 1995, extreme care must be taken to minimize potential stress and damage to individuals. Those in the smaller size range (e.g., 35–40 mm) are most susceptible. Third, some applications, such as the fitting of transmitter belts, can be more quickly and easily completed if the frog is restrained using the strapper, leaving the researcher's hands free. It is particularly useful when working alone. Fourth, the strapper is particularly useful for researchers inexperienced or lacking confidence in PIT tagging or handling frogs in general. In most cases, the strapper has decreased handling time required to restrain difficult individuals, thus reducing the time taken to perform the tasks and, ultimately, the stress experienced by the animal.

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A New Method for Marking Individual Anuran Larvae

TIMOTHY M. RICE
SEAN E. WALKER
BRIAN J. BLACKSTONE
and
DOUGLAS H. TAYLOR
Department of Zoology, Miami University, Oxford, Ohio 45056, USA

e-mail (TMR): trice@miamiu.muohio.edu
e-mail (SEW): walkers2@miamiu.muohio.edu

Several reliable methods to mark anurans at the postlarval stage have been published (Elmberg 1989; Emlen 1968; Ferner 1979; Howard 1978; Nace 1982; Rice 1993; Robertson 1984; Ryan 1980; Wells 1977, 1978). However, few practical techniques to mark anuran larvae exist. This is undoubtedly due to the delicate tissues and lack of limbs or digits at this life stage. Commonly used methods include clipping notches on the tail fin (Turner 1960), staining with neutral red (Guttman and Creasey 1973; Herreid and Kinney 1966; Travis 1981), and injecting or spraying with dyes (Seale and Boraas 1974; Taylor and Deegan 1982). However, these methods have various limitations. The effects of fin clipping on growth, swimming behavior, and mortality of larvae have not been evaluated. Although neutral red staining is easy to perform, it has short-term permanence (Guttman and Creasey 1973), causes decreased growth (Travis 1981), and can not be used for individual identification. Taylor and Deegan's technique (1982) of spraying pigments on several larvae at once is useful because individuals do not need to be handled. However, the authors reported that their methods cause some mortality and require expensive equipment. Injecting pigments mixed with an organic solvent directly into larval tissues causes no mortality, but some preliminary work is necessary to develop the proper solvent formulation (Seale and Boraas 1974). Here we report on a useful alternative to the above methods for individually marking large numbers of larval anurans. In addition to evaluating the effects of our marker on survivorship and growth, we also quantified its effects on the locomotor behavior of the larvae.

Bullfrog larvae (*Rana catesbeiana*) were collected at Miami University's Ecology Research Center, Butler County, Ohio, USA, during November 1995. These larvae were held in a 500 L aquarium designed to provide a continuous flow of dechlorinated water at 18°C. Larvae were held under a 12L:12D photoperiod and fed trout chow *ad libitum*. On 19 May 1996 we selected 20 larvae at the premetamorphic stage (stage 25, Gosner 1960) to use in the evaluation of our tagging method. Larvae were weighed on a Mettler balance (to nearest 0.01g) and measured with Vernier calipers (SVL to nearest 1.00 mm), and randomly placed into either the tagged or untagged group (N = 10 per treatment). Each treatment group was maintained in a 37 L aquarium with a continuous flow of dechlorinated water at 25°C.

Larvae outfitted with tags were anesthetized via submersion in a solution of tricaine methanesulfonate (approximately 0.050 g per L dechlorinated water) until movement ceased. Individual larvae were then removed from anesthesia and a single stitch of polyester thread (thread diam. = 0.20 mm, needle diam. = 0.75 mm) was made through the base of the tail, directly into the musculature and slightly above the midline. Attached to the thread was a label made of plastic field flagging (5 mm x 5 mm) upon which a unique number was written in waterproof ink. The two ends of the thread were tied with enough slack to allow the label to remain free of the fin and allow for growth of the tail (Fig. 1). Total time required to tag all individuals was kept to a minimum by ensuring that two larvae were under anesthesia concurrently, such that each time a larva was removed for tag application another was added to the tricaine methanesulfonate.

Mass and SVL of all tagged and untagged larvae were measured at the beginning and every 2 wk until the first individual achieved forelimb emergence (stage 42, Gosner 1960), after wk 8. Comparisons of these measurements between tagged and untagged larvae were made with Student's t-tests within each 2 wk interval. Repeated-measures analyses among all time periods were not possible since the identity of individual untagged larvae was unknown between consecutive weeks. Upon reaching stage 42, final mass and SVL measurements were made on individual larvae, and the time spent in the experiment was also noted as an indication of metamorphic duration. Mass and SVL at stage 42, as well as time spent in the experiment, were compared between tagged and untagged larvae with Student's t-tests.

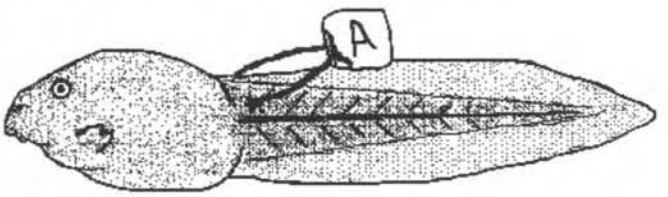


FIG. 1. Diagrammatic representation of tag location on a larval *Rana catesbeiana*. Tags are made of polyester thread and field flagging, and attached to the larva with a single stitch applied at the proximal end of the tail slightly above midline.

Locomotor tests were conducted at wk 6, at which time larvae had small to moderate hindlimbs (stages 34–38), between 1200 and 1700 h. The locomotor behavior of larvae was evaluated by placing individual larvae into 1 L crystallizing dishes containing approximately 600 ml of dechlorinated water at 25 C. Following a 5 min acclimation period, locomotor behavior of the animals was monitored using a video based data acquisition system, the Videomex-V (Columbus Instruments, Columbus, OH). This system measured the distance traveled (cm) and average velocity (cm/sec) for 30 sec intervals during the total 5 min period. The two aspects of locomotor behavior we examined were the total distance traveled and the maximum velocity of each larva. Total distance traveled was calculated by summing the distance traveled over all of the 30 sec intervals. Maximum average velocity was the fastest velocity measurement recorded in one of the sampling intervals. Comparisons between tagged and untagged larvae were conducted using separate Student's t-tests.

Application of a tag required approximately 5–10 min per individual, but most of this time was spent waiting for the anesthesia to take effect; the actual stitching and tying of the tag could be performed in < 1 min. Little blood loss was observed, but after several days the application site on most larvae became slightly inflamed, however, no infections were observed. One label fell off the day after the initiation of the experiment; however, the thread was still attached to the tail of this individual. Upon reapplication, this tag and all the others remained attached during the course of the experiment. The only mortality observed during the experiment was an untagged individual that died between wk 6 and wk 8.

There was no significant difference in mean mass between tagged and untagged larvae from 0–10 wk after the start of the experiment ($t \leq 1.11$, df = 17–18, $P \geq 0.281$ for all time intervals; Fig. 2A). Both groups increased in mass between wk 0 and wk 10. There was also no significant difference in SVL between tagged and untagged larvae during this time period ($t \leq 1.09$, df = 17–18 $P \geq 0.288$ for all time intervals; Fig. 2B). The two groups increased only slightly in snout-vent length through the 10 weeks, indicating that they were near maximum length at the initiation of the study. Since the tags did not affect growth rates, it was not unexpected that there were also no significant differences among final mean mass, mean SVL, nor mean time spent in the experiment, between tagged and untagged larvae at stage 42 ($t \leq 0.906$, df = 17, $P \geq 0.377$ for all parameters). Tagging the larvae also did not affect the locomotor activities we measured, since there were no significant differences in total distance traveled ($t = 1.591$, df = 18, $P = 0.129$) or maximum average velocity ($t = 0.094$, df = 18, $P = 0.926$) between tagged and untagged larvae.

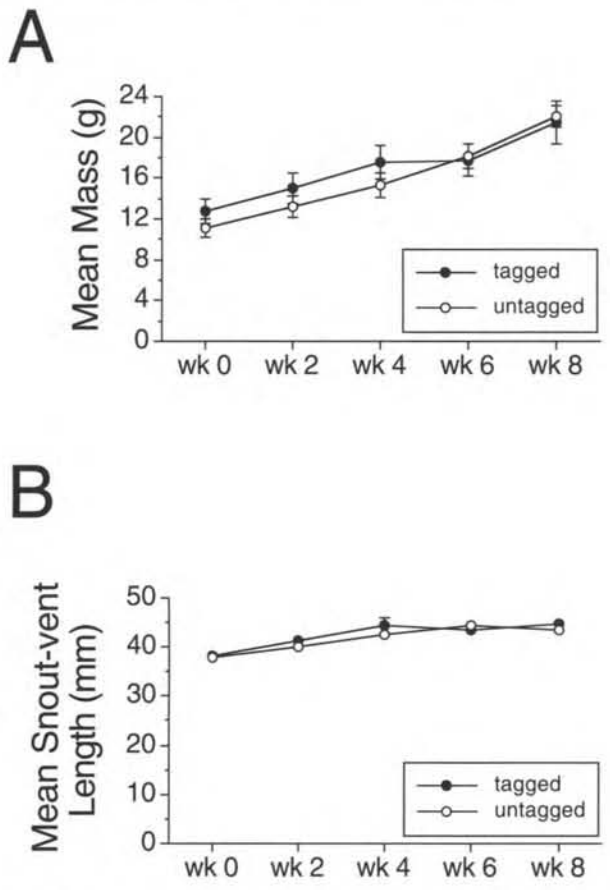


FIG. 2. Mean mass (A) and mean SVL (B) of tagged and untagged *Rana catesbeiana* larvae at 2-wk intervals. Bars indicate ± 1 SE. Sample sizes were 10 in each group, except on week 8, when there were only 9 untagged larvae due to mortality. Larvae were initially at Gosner stage 25 and began to metamorphose after wk 8. There were no significant differences between groups for either parameter at any week.

Our tagging method provides an alternative to other methods because the materials are inexpensive, can be purchased at local stores, and can be applied by one person with a minimum of training. Since individuals can be given a unique number as well as a color-code, many more larvae can be marked and recognition of each is easy. Furthermore, the empirical evidence presented above indicates that the tags are long-lasting and cause no adverse effects on growth, survivorship, or normal activity. We have marked over 250 *R. catesbeiana* larvae thus far (60 in one day) with both individual and color-coded labels. Individuals as small as 1.00 g and 18 mm SVL have been tagged, and smaller individuals could probably be marked by using thinner needles and thread. Tags have remained attached on at least 60% of our larvae that survived from early premetamorphic stages to metamorphosis (8–14 mo in the laboratory). The important step in the procedure is to ensure that the thread is knotted tightly, since most tag loss results from improperly applied tags rather than from the tag being torn from the larva's body.

This tagging method would be especially useful for laboratory evaluations of behavior because such experiments often require identification of individuals without handling. Our techniques could also be used for certain field studies in the absence of predators and snagging objects. However, the potential utilization of our tags for studies examining exercise physiology or forced locomotion might be limited, as the effects of the tags on hydrodynamic properties and muscle performance of anuran larvae need to be evaluated prior to experimentation.

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Sticky Traps: An Effective Way to Capture Small Terrestrial Lizards

SHARON DOWNES
and
PEDRO BORGES
Biological Sciences A08, University of Sydney
New South Wales 2006, Australia
e-mail (SD): sdownes@bio.usyd.edu.au

In their endeavors to capture small, fast, terrestrial lizards, herpetologists have devised an impressive variety of sampling techniques. Among those most widely used are pitfall trapping, rubber bands, hand collection, and noosing; more recently, refuge tubes, baited lizard sticks, and glue sticks and traps have been used (for a review see Durtsche 1996; Whiting 1998). Although many of these techniques are efficient, they are either labor intensive (e.g., pitfall trapping), demand that the collector has a certain degree of prior experience (e.g., rubber bands, hand collection, baited lizard sticks, glue sticks), require more than one person to be effective (e.g., refuge tubes), or are not well suited to capturing small animals (e.g., noosing, glue traps). In addition, many of these techniques are not suitable in urban environments which often consist of concrete structures surrounded by long dense grasses. Here we report a method used to catch large numbers of small, fast, terrestrial lizards (common garden skinks, *Lampropholis guichenoti*, *L. delicata*, *Saproscincus mustelinus*: ≤ 45 mm snout-vent length; ≤ 1.5 g) around urban environments in southeastern Australia. Our method is inexpensive, simple, and extremely effective. The procedure can be performed by one person, demands no previous lizard catching experience, and is ideally suited to urban landscapes.

Our technique consists of placing 50 mm wide, clear packing tape (e.g., many commercial brands are readily available in newsagencies), adhesive-side uppermost, on hard flat surfaces enroute to basking sites. To reduce the stickiness of the tape and facilitate removal without damage to the animal, it is adhered once to a cotton fabric, and then removed and immediately used. The tapes vary in length depending on the geometry of the surface (but rarely exceed 600 mm), and are fastened by placing smaller pieces of transparent tape adhesive-side down on each end and in contact with the surface. During strong winds, rocks are also positioned on both ends of the tape, and occasionally (especially for long tapes) in the center. The tapes are strategically placed (see below), but they are always away from obvious ant trails. Unless the traps are visited at regular intervals (at least 3–5 min), it is imperative that they are placed in the shade to prevent thermal stress to captured lizards.

Skinks walk onto the tape and the soles of their feet fasten to the adhesive surface. The ventral surface and tail of the skink often adhere also; and occasionally, the neck of the skink becomes stuck. Although held fast by the tape, we never have any difficulty removing skinks from the traps. The skink is very slowly removed by degrees from the tape, beginning at the head and working toward the tail which is usually in a curved configuration. Once the body of the skink is free, the tail is gently lifted from the tape by moving the unstuck body of the lizard toward the tip of the tail and following the curvature. The speed at which the skink is removed is positively correlated with the size of the captured individual and negatively correlated with the stickiness of the trap. The lizard is removed without ill effect, and without the aid of solvents or lubricants. As this can be done in situ, traps can be left in place and used repeatedly for a full day.

We employed our technique from November 1996 through March 1997, at a number of urban cemeteries and parks around Sydney, Australia, where garden skinks are locally abundant (10 lizards/2m^2; S. Downes, unpubl. data). We scanned small areas (20 x 50 m) of habitat for garden skinks and set several traps (8–10 at a time) on suitable sites. One of us continually checked the traps (moving from one trap to the next in the order in which they were placed) and removed captured skinks. During early afternoon (the most active period of the day for our skinks during summer), up to 30 garden skinks (both adults and hatchlings) would be collected each hour using our method, compared with around 12 skinks per hour using hand collection. Undergraduate students with little or no prior experience in animal handling or capture enjoyed similar success using our traps. No skinks were killed, although a small proportion (around 3–5%) lost the tip of their tail through struggling to escape.

We suspect that our method is particularly successful for capturing large numbers of small lizards that display aggregative social behaviors: garden skinks are highly social (Torr 1990) and after one animal becomes stuck to a trap, others typically investigate and also become entrapped (see also Whiting 1998). Although we used our method primarily to capture small lizards, we have employed a similar technique (using a commercial cockroach trap) to successfully catch larger terrestrial lizards from rock crevices along urban creeks (e.g., water skinks, *Eulamprus quoyii*, to 10 cm SVL and 40 g: see also Bauer and Sadlier 1992). In this case, our technique involves attracting a lizard to the trap either by adhering a live cricket to the center of the strip, or luring it using a cricket tied to a fishing line (note however, that the animals were held for only a short time using this method). We envisage that employing similar baiting tactics with live insects would further improve the rate that lizards are captured on the sticky traps (see also Whiting 1998). Additionally, when used intermittently with conventional methods, sticky traps may be well suited to catching individuals in mark-recapture studies that develop aversion to the standard capture technique.

Our traps take only minutes to set up and may be especially useful in areas where dense vegetation predominates among a few basking rocks, or rocky substrate hinders excavation for pit traps. They may also prove effective when used in place of conventional pit traps in conjunction with drift fencing (see also Bauer and Sadlier 1992). This non-destructive technique should enable researchers (even those with limited prior experience in capturing lizards) to successfully obtain very large numbers of small locally abundant species of lizards, including hatchlings and juveniles that are otherwise hard to detect.

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Comparison of Histological Staining Procedures for Skeletochronological Studies

C. REED ROSSELL, JR.
and
JOSIAH L. SHEEHAN
Department of Environmental Studies, Warren Wilson College
Asheville, North Carolina 28815, USA

e-mail (CRR): rrossell@warren-wilson.edu

Skeletochronology is the study of growth periodicity in the mineralized bone structure of animals (Castanet et al. 1993). This technique can be used to accurately estimate the age of amphibians whose annual growth patterns are cyclical (Castanet et al. 1993). Because of its reliability, skeletochronology has become widely used by ecologists studying salamander populations (Wake and Castanet 1995).

Preparing samples for skeletochronological analysis is a fairly complex process (Castanet and Smirina 1990). One important component is the selection and proper use of stains (Castanet et al. 1993). Hematoxylin and eosin (H&E) are the standard stains used in histological studies (Davenport 1960; Humason 1972). However, the protocol for using these stains is tedious and time consuming.

We examined an alternative staining procedure to simplify and reduce sample processing time. We compared the Jordet J-322 Dip-Quick Stains (Jorgensen Laboratories, Loveland, Colorado, USA) to the standard H&E stains for estimating the age of individual salamanders.

From October 1995 through April 1996 the longest phalange from the hind foot of 63 *Ambystoma talpoideum* were collected using a surgical scalpel. Samples were fixed in 10% buffered neutral formalin, then stored in 70% ethanol (Wake and Castanet 1995). Phalanges were decalcified in 3% nitric acid and washed in tap water (Humason 1972), and standard histologic procedures were used for preparing samples (Davenport 1960; Humason 1972). Phalanges were cross-sectioned at 5 µm and processed at the Animal Disease Diagnostic Laboratory in Asheville, North Carolina.

Each sample (N = 63) was replicated for comparing the two staining procedures. The H&E procedure consisted of immersing each sample in each of the following: xylene (15 min), 100% ethanol (2 min), 95% ethanol (2 min), 70% ethanol (2 min), distilled water (2 min), Mayer's Hematoxylin (15 min), tap water (10 min), 80% ethanol (2 min), eosin (3 min), 95% ethanol (3 min), 100% ethanol (3 min), and xylene (3 min). The Dip-Quick procedure entailed dipping each sample into fixative (methyl alcohol) five times, stain #2 (eosin, sodium azide, and buffer solution) eight times, counter stain #3 (thiazine, sodium azide, and buffer solution) three times, and rinsing with distilled water five times. The duration of each dip was ca. one second.

After staining, cover slips were placed over all samples with the toluene solution Permount (Fisher Scientific, Fair Lawn, New Jersey, USA). One of the authors and a lab assistant counted growth marks, following methods described by Castanet et al. (1993). Only a few discrepancies occurred between counts. These slides were re-evaluated and discussed until a consensus was reached.

The Dip-Quick stains effectively highlighted growth marks in all samples. The number produced by the Dip-Quick stains was identical to those produced by the H&E stains in 92% of the samples. The Dip-Quick stains produced an additional growth mark in one sample, and the H&E stains produced an additional growth mark in four samples. The clarity of the growth marks produced by the Dip-Quick stains was comparable, if not better, than that produced by the H&E stains.

Compared to the H&E procedure, the Dip-Quick procedure saved a considerable amount of processing time and was much simpler to use. The Dip-Quick stains required ca. 21 sec/slide, and 2–3 slides could be processed simultaneously (12 min/100 slides). In contrast, the H&E procedure required ca. 62 min/slide, and 30 slides could be processed simultaneously (206 min/100 slides). Thus, the Dip-Quick method resulted in a time savings of ca. 3 h/100 slides.

The Dip-Quick stains were more expensive than the H&E stains (US $40/100 ml for the Dip-Quick refill kit vs. $17.90/500 ml Mayer's Hematoxylin and $35.80/500 ml eosin) [Fisher Catalogue 1996]. However, comparing the actual costs was difficult because the H&E stains are reusable if filtered regularly (D. Seal, pers. comm., Animal Disease Diagnostic Laboratory, Asheville, North Carolina).

Skeletochronology is currently one of the most accurate and sophisticated techniques available for aging salamanders (Castanet and Smirina 1990; Castanet et al. 1993). The Jordet J-322 Dip-Quick Stains proved to be an effective alternative for staining *A. talpoideum* samples for skeletochronological analysis. The procedure is straightforward and saves a considerable amount of processing time. Although more expensive than the standard stains, the Dip-Quick stains are not cost prohibitive. Therefore, we recommend the Dip-Quick stains as an alternative for staining samples for skeletochronological studies of salamanders. However, the Dip-Quick stains may not be appropriate for large-scale clinic or diagnostic use (i.e, processing >100 slides/day). The Dip-Quick stains need to be refilled periodically as they evaporate, or replaced when they begin showing signs of discoloration.

Acknowledgments.—We thank the North Carolina Academy of Science Yarbrough Grant Committee for funding this research, William Rapp and Deloress Seal at the Animal Disease Diagnostic Lab for lab assistance, and Yanu Gallimore for counting growth marks. Laurence Hardy, William Rapp, Larry Raymond, Irene Rossell, and one anonymous reviewer provided valuable comments on earlier drafts of this manuscript.

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FIG. 2. Undersurface of device showing the framework upon which the boards are mounted, and the plastic water bottle in place.

The positioning of the device is vital to maximize access to trapped animals. The direction of pool water flow towards the skimmer box means that a weakened animal will float towards, and often into, the skimmer box where ultimately it will drown. The device was therefore placed over the skimmer box as shown in Fig. 2. Its first observed success, one week after its installation, was the emergence via the inclined ramp of a juvenile viper, *Vipera berus*.

HERPETOLOGICAL HUSBANDRY

A Safe, Single-Application Procedure for Eradicating Mites on Reptiles

ROBERT E. ESPINOZA*
Ecology, Evolution, and Conservation Biology / FA 314
University of Nevada, Reno, Reno, Nevada 89557-0015, USA
e-mail: espin_r@unr.edu

CHRISTOPHER R. TRACY
Department of Zoology, University of Wisconsin, Madison
Madison, Wisconsin 53706, USA
e-mail: crtracy@students.wisc.edu

and
C. RICHARD TRACY
Biological Resources Research Center / FA 314
University of Nevada, Reno, Reno, Nevada 89557-0015, USA
e-mail: dtracy@unr.edu

**Author to whom all correspondence should be addressed.*

Mites are common ectoparasites that can cause serious health problems for squamate reptiles—particularly under captive conditions (Frye 1981; Lane and Mader 1996; Mader 1989; Marcus 1983). Mites can be difficult to extirpate completely (e.g., Mader 1989; Montanucci 1997), and as a result, numerous commercial products are now available to kill these pests (e.g., Abrahams 1992; Boyer and Boyer 1991). However, some of these products are unsatisfactory for one or more reasons, including toxicity, the need for veterinary direction, required changes in husbandry, high cost, or a lack of long-term efficacy (Mahaney 1995; Montanucci 1997).

Several non-commercial techniques have been described for eradicating mites from captive reptiles and their surroundings. One method traps mites by simply lining the perimeter of the animal's enclosure with masking tape (Mahaney 1995). Yet despite its ease of application, this method only removes dispersing individuals, and thus mites that remain in the substratum, on refugia in the enclosure, or on the animals themselves, will not be captured.

Recently, Montanucci (1997) described a procedure for eradicating mites by selectively removing the most critical stages of their life cycle—gravid females and egg cases. Although this method is reportedly effective, the process seems inordinately elaborate, and may require a substantial time investment. Specifically, this procedure includes a twice-weekly washing of the cage and refugia, and manual removal of gravid female mites and egg cases. Due to the lengthy life cycle of these pests, this process may ultimately take more than a month to eliminate an entire mite population (Montanucci 1997).

In our lab, we kill mites living on reptiles by immersing the reptiles in vegetable oil. The oil entraps and subsequently suffocates the mites by occluding their respiratory passages. This method offers the advantages of low cost and safety while completely eradicating the entire mite population with a single application. After several years of refinement, we have improved the efficacy of this method which is described below.

Unlike some methods (e.g., Mahaney 1995; Montanucci 1997), ours works by killing the mites that are on the animals. If one starts with a mite-free environment (see below), prevention of reinfestation is reduced to a process of killing mites on all new reptiles before they are introduced into established vivaria.

To eliminate mites from terraria, we have used a variety of mite-killing solutions including 70% isopropanol (rubbing alcohol), 10% bleach or ammonia, or dish or laundry detergent and hot water. The terrarium, and all non-living items that have come in contact with mites, are scrubbed and soaked for 5–10 min with one of these solutions, rinsed thoroughly, and air dried until no odors are detectable. Mites can also be removed or killed by spraying these items with the pressure from a garden hose (Montanucci 1997), but care should be taken to ensure that the treatment is thorough, because if critical areas are neglected (e.g., plastic frames of some aquaria, porous rocks, etc.), a reinfestation is likely to occur. For this reason, we generally dispose of the substratum (e.g., soil, sand, gravel, etc.) rather than attempting to disinfect and dry it.

To kill mites on reptiles, we thoroughly coat each animal with vegetable oil. In our experience, neither the type nor the brand of vegetable oil appears to affect the outcome. First, the animal is cooled to room temperature (ca. 20°C) to facilitate handling, then it is placed in a large container (e.g., a size-matched bowl, tub, or bucket) with enough oil to partially submerge the animal (i.e., one-third to one-half of the animal's height). We then use our hands to drip the oil liberally over the animal taking care to completely cover and massage the oil over all parts of the body (e.g., neck and body skin folds, joints of appendages, cloacal region, all parts of the head including the region surrounding the eyes). We have not witnessed any signs of distress from dripping the oil around the eyes, nares, or mouth. Highly infested animals, or those with large imbricate scales (e.g., desert spiny lizards, *Sceloporus magister*), are massaged in the oil for up to 1 min to ensure that the animal is thoroughly coated. The animals are then blotted with paper towels and held in a clean cage with a newspaper lining until the oily sheen on their scales diminishes (1–3 days). Water, heat sources, and refugia are provided, although we typically do not feed the animals during this time.

Reptiles that we have subjected to this treatment apparently are

unharmed; however, the oil-immersion procedure often elicits ecdysis soon after treatment. In one instance, four of six juvenile boa constrictors (*Boa constrictor*) exhibited dysecdysis following the oil treatment. The remaining unshed patches of old skin were easily removed after the snakes had been soaked in warm water for 15 min (see Rossi 1996).

Over the past seven years, this method has been successfully used on 17 species of lizards representing 10 genera and five families. We have also used the method on desert tortoises (*Gopherus agassizii*) and boa constrictors (*Boa constrictor*)—the latter infected with the snake mite *Ophionyssus natricis*. We have not observed a reinfestation following this procedure.

Given the simplicity and efficiency of the oil-immersion technique, we both use and recommend the procedure as a preventative measure when new reptiles are introduced into established mite-free collections. Recently, we "de-mited" approximately 60 field-caught chuckwallas (*Sauromalus obesus*) that were infested with mites (probably *Hirstiella pyriformis*; Mader et al. 1986). With two "oilers" and two "blotters," we were able to demite the 60 animals in less than one hour.

Acknowledgments.—We thank B. Kondratieff for the initial suggestion of using oil to kill mites. We thank our colleagues C. Carreño, T. Esque, and three anonymous reviewers for providing helpful comments on earlier versions of the manuscript. R. Espinoza was supported by a Porter Fellowship from the American Physiological Society. Chuckwallas were collected under a Nevada state permit (#96-58) granted to E. D. Brodie, Jr. and P. Ustach.

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NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their note (e.g., Reproduction, Morphology, Habitat, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send three copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover): R. Kathryn Vaughan (lizards, amphisbaenians, crocodilians, Sphenodontia); Charles W. Painter (amphibians); or Paul A. Stone (snakes, turtles). Authors are requested to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a text-only version of the file.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1997. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 4th ed., Herp. Circ. 25:1–40; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

AMBYSTOMA MABEEI (Mabee's Salamander). **BREEDING MIGRATION.** *Ambystoma mabeei* reportedly migrates to breeding ponds from late fall through early spring (Martof et al. 1980. Amphibians and Reptiles of the Carolinas and Virginia. Univ. of North Carolina Press. Chapel Hill, 264 pp.). Hardy (1969. Bull. Maryland. Herpetol. Soc. 5:65–77) found that in North Carolina *A. mabeei* migrated to breeding sites from January to March, but little is known of the breeding phenology of this species in other parts of its range. Hardy (*op. cit.*) noted that at least some museum specimens collected in November and December from South Carolina appeared to be fully ripe, suggesting that *A. mabeei* may breed earlier in the southern part of its range. During a study of herpetofaunal communities associated with isolated ephemeral wetlands in Marion Co., South Carolina, USA, three *A. mabeei* were captured in pitfall traps as they attempted to enter the wetlands. On 11 November 1996, we captured a single adult male attempting to enter a 0.41 ha forested wetland (SVL 45.2 mm; meteorological conditions during the 24 h prior to capture were: clear skies; precipitation = 0 mm; max air temp. = 10°C; min air temp. = 1°C; mean water temp. = 13.6°C). On 12 December 1996, a single adult male was captured at the edge of a second, 0.38 ha wetland (SVL 51.0 mm; overcast skies; precipitation = 1.4 mm; max air temp. = 27°C; min air temp. = 12°C; mean water temp. = 11.2°C) and on 20 December 1996, another adult male was taken from the same wetland (SVL 45.5 mm; clear skies; precipitation = 0 mm; max air temp. = 7°C; min air temp. = -5°C; mean water temp. = 5.9°C). No additional *A. mabeei* have been captured during subsequent daily monitoring of drift fences encircling each wetland. The present findings in South Carolina provide further evidence that *A. mabeei* may breed earlier in the southern part of its range. Large breeding migrations and successful reproduction of *Ambystoma* spp. appear to be tied to appropriate rainfall and temperature conditions during a relatively narrow period (Pechmann et al. 1991. Science 253:892–895). As research at the wetlands continues we hope to determine whether the paucity of *A. mabeei* captures from these sites reflects true population densities or unfavorable environmental conditions during the 1996–97 breeding season.

Submitted by **KEVIN R. RUSSELL**, Department of Forest Resources, Clemson University, Clemson, South Carolina 29634, USA, **HUGH G. HANLIN**, Department of Biology and Geology, University of South Carolina–Aiken, Aiken, South Carolina 29801, USA, and **J. WHITFIELD GIBBONS**, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

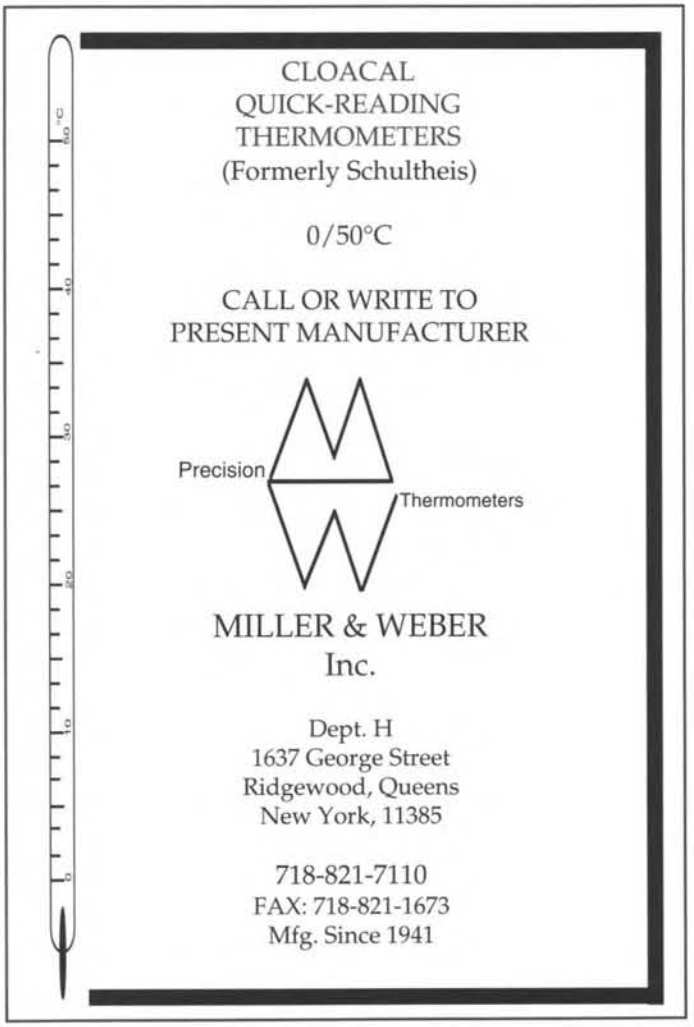
EURYCEA LUCIFUGA (Cave Salamander). **REPRODUCTION**. *Eurycea lucifuga* has a broad east-west distribution in limestone regions of the eastern and central United States (western Virginia to northeast Oklahoma; Hutchison 1966. Cat. Amer. Amphib. Rept. 24:1–2). Female reproductive data are available for eastern (Appalachian) populations but are sparse for western (Ozarkian) populations. Available information consists primarily of data on larval ecology from Missouri and Oklahoma (Myers 1958. Quart. J. Florida Acad. Sci. 21:125–130; Rudolph 1978. Amer. Midl. Nat. 100:141–159), and data on maturity and clutch size from Arkansas (Trauth et al. 1990. Proc. Arkansas Acad. Sci. 44:107–113).

Sanders and Plummer collected 55 female *E. lucifuga* in monthly samples from March 1977–April 1978 from two caves in Independence Co., Arkansas (Search Cave, 9.6 km N of Batesville, and Blowing Cave, 1.6 km W of Cushman), and Sanders collected 45 females in monthly samples from July 1978–October 1979 from four nearby caves on the eastern shore of Lake Barkley in Trigg Co., Kentucky (Rimcrest Cave, River Road Cave, Taylor Bluff Cave, and Taylor Bluff Annex Cave). Herein we briefly describe reproduction in female *E. lucifuga* from each locality (Sanders 1981. M.S. Thesis, Murray State Univ., Murray, Kentucky).

In Arkansas, based on the presence of yolking follicles, size at maturity was 55–58 mm SVL. Adults averaged 58.8 mm SVL (SD = 2.09; N = 15; range 55–62.5 mm). Ova increased in diameter beginning in June and reached maximum size (3.0 mm) in August–September. Oviducts increased in width beginning in June and reached maximum width (1.1 mm) in September. One specimen in September with large oviductal follicles apparently was ready to oviposit. Large empty oviducts after September suggests that oviposition occurred in October. Clutch size averaged 73.7 eggs (SD = 18.1; N = 15) and was not correlated with SVL (r = 0.30; P>0.05). Larvae were first seen in December.

In Kentucky, size at maturity was 49–57 mm SVL. Adults averaged 56.8 mm SVL (SD = 3.86; N = 14; range 49–62.0 mm). Ova increased in diameter beginning in June and reached maximum size (2.9 mm) in July–August. Oviducts increased in width beginning in June and reached maximum width (1.2 mm) in August. One specimen in September with large oviductal follicles apparently was ready to oviposit. Large empty oviducts in eight females in September suggests that oviposition occurred in September. Clutch size averaged 75.3 eggs (SD = 33.1; N = 14) and was correlated with SVL (r = 0.88; P>0.001). Larvae were first seen in October.

Other than a slight indication that Kentucky *E. lucifuga* may oviposit earlier in the year compared to Arkansas *E. lucifuga*, our results generally suggest that, in the reproductive attributes measured, *E. lucifuga* from the two study areas were similar to one another and to other Appalachian (Hutchison 1956. Natl. Speleol. Soc. Occas. Pap. 3:10–16; Green et al. 1967. West Virginia Acad. Sci. 39:297–304) and Ozarkian populations (Trauth et al., *op cit.*). Although reproductive attributes of a species often vary geographically in wide-ranging species, these results are concordant with



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morphological and genetic analyses that show *E. lucifuga* is undifferentiated throughout its range (Merkle and Guttman 1977. Herpetologica 33:313–321).

Submitted by **JOSHUA C. CARLYLE**, Department of Biology, Box 2251, Harding University, Searcy, Arkansas 72149, USA, **DONALD E. SANDERS***, Department of Biology, Murray State University, Murray, Kentucky 42071, USA, and **MICHAEL V. PLUMMER**, Department of Biology, Box 2251, Harding University, Searcy, Arkansas 72149, USA. *Present address: Harding Academy, 1100 Cherry Road, Memphis, Tennessee 38117, USA.

NOTOTRITON ABSCONDENS (Cordilleran Moss Salamander). **REPRODUCTION.** Eggs of only three of the 13 recognized species of *Nototriton* have been reported: *N. barbouri* (McCranie and Wilson 1992. Herpetol. Rev. 23:115–116), *N. guanacaste* and *N. picadoi* (Good and Wake 1993. Herpetol. Monogr. 7:131–159).

We found a clutch of eggs in close proximity to a female *N. abscondens* on 27 May 1994 at Cascajal de las Nubes, Province of San José, Costa Rica, 1750 m elev. (Fig. 1). The clutch contained 17 eggs which adhered in a tight cluster and were not connected by thin jelly strands. Yolk diameter of formalin-preserved eggs averaged 2.7 ± 0.2 mm. Diameter of the egg capsule averaged 4.1 ± 0.3 mm. The yolk was yellowish white. The eggs were in an early stage of embryogenesis (prior to the onset of neurulation). Two of the eggs were dead when collected and the remainder died within 72 h. The female (32 mm SVL; 73 mm TL) was found adjacent to the eggs but was not exhibiting any brooding behavior such as coiling around the eggs. The ovaries contained numerous previtelligenic ova and seven partially yolked ova (ca. 1 mm diameter). One oviduct was folded and enlarged, which is consistent with the female having recently oviposited. The eggs were identified based on their proximity to this female. However their size and structure are consistent with those of other species of *Nototriton*. Because the eggs of *N. abscondens* were found at an early developmental stage, the proximity of a female cannot be taken as a sign that brooding occurs in this species.

The clutch was found on the soil surface under a mat of liverworts ca. 1.8 m above ground on a vertical road bank. The road bank faces southwest and rises ca. 2.5 m, on top of which is dense forest. The upper part of the road bank is covered by *Gunnera* and ferns that provide shade. Other salamanders occurring at this site are *N. richardi*, *Oedipina uniformis*, *O. poelzi*, *Bolitoglossa subpalmata*, and *B. robusta*.



FIG. 1. Adult female *Nototriton abscondens* with a clutch of eggs. Photographed in the laboratory 24 h after discovery.

The clutch (MVZ 225898) and female (MVZ 225897) have been deposited in the Museum of Vertebrate Zoology, University of California, Berkeley.

We thank D. Wake and P. Léon for assistance in the field, The Ministerio de Recurson Naturales, Energía y Minas for a scientific collecting permit, and F. Bolaños and the University of Costa Rica for the use of facilities. This work was supported by NSF BSR 90 19810. ELJ was supported by a predoctoral fellowship from NSF, and MGP was supported by a postdoctoral fellowship from the Ministerio de Educación y Ciencia of Spain.

Submitted by **ELIZABETH L. JOCKUSCH** and **MARIO GARCIA-PARIS**, Museum of Vertebrate Zoology and Department of Integrative Biology, University of California, Berkeley, California 94720, USA.

PLETHODON DORSALIS (Zigzag Salamander). **REPRODUCTION**. Although nesting activity has been reported for many species of eastern *Plethodon*, we are unaware of any reports of such activity in *P. dorsalis*. On 2 August 1995 we found an aggregation of *P. dorsalis* in a series of fissures situated in the clay floor of a cave located in the Central Basin (northern Rutherford County) of middle Tennessee, USA. The fissures were located near the end of the twilight zone, ca. 20 m from the mouth of the cave. Thirty-three adult *P. dorsalis*, including seven females brooding eggs, were unearthed within a m^3 of the cave floor. Clutch size ranged from 4–7 eggs; mean clutch size was not determined because we were uncertain if all clutches were intact when unearthed.

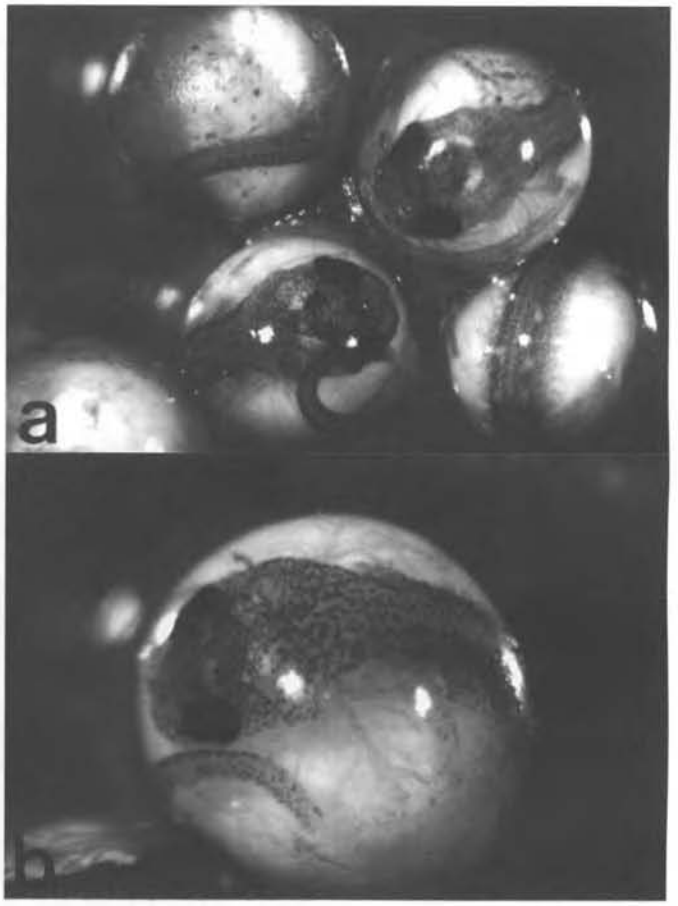


FIG. 1. Embryos of *Plethodon dorsalis* collected and photographed 2 August 1995. (A) Note body pigmentation, large yolk mass, and vascular supply to the developing gills. (B) Note faint outline of gill edge.

The yolk mass was large in all eggs, although the embryos were well developed with a mid-dorsal stripe evident on all individuals (Fig. 1). Eggs placed in an environmental chamber (12L/12D cycle; 15°C) hatched on 1 and 2 September. The developmental stage of the embryos at the time of discovery and the hatching date suggests that egg deposition occurs in early to mid June in the Central Basin. The occurrence of nest sites in the floor of a cave supports the suggestion by Smith (1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Survey, Urbana. 298 pp.) and Mount (1975. The Reptiles and Amphibians of Alabama. Auburn University. 347 pp.) that nesting in *P. dorsalis* occurs in subterranean passages or cavities rather than in logs.

Submitted by **BRIAN T. MILLER** and **JOYCE L. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA, **DAVID L. CAMPBELL**, The Nature Conservancy, 50 Vantage Way Suite 250, Nashville, Tennessee 37228, USA, and **PETE WYATT**, Tennessee Wildlife Resources Agency, 6032 West A.J. Hwy., Talbot, Tennessee, USA.

GYMNOPHIONA

CHTHONERPETON INDISTINCTUM (NCN). **ALBINISM.** On 18 December 1996 an albino male *Chthonerpeton indistinctum* (SVL 265 mm; diameter 7.8 mm; ring number 77) was collected on the edge of the Parana River near Barranqueras City, Chaco Province, Argentina (27°29'S, 58°54'W) This specimen is UNNEC 05158 (Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Corrientes, Argentina). This is the first report of albinism in this species.

Submitted by **PEDRO MATIAS CACIVIO**, Pedro Marnol 243. Ciudad de Resistencia, Chaco, C.P. 3500, Argentina, and **JORGE ABEL CESPEDEZ**, Catedra de Anatomia Comparada, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, C.P. 3400, Corrientes, Argentina.

ANURA

ASCAPHUS TRUEI (Tailed Frog). **PREDATION.** There are few reports of predators on *Ascaphus truei*. During surveys of headwater streams on the Olympic Peninsula, we observed two instances of predation on *A. truei* on 22–23 August 1996. Both occurrences were in a SW-facing tributary of Matheny Creek, Jefferson Co., Washington, USA (T24N, R10 1/2 S, SE1/4 Sec. 12; 305 m). Water temperature was 12°C and air temperature was 14°C on both days at the start of the surveys. The surrounding forest was old growth, dominated by Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*).

On 23 August, a live, metamorphosing *A. truei* was found in the mandibles of a hellgrammite (Megaloptera) in a pool in the stream. The frog was nearly transformed, having only 5 mm of tail remaining (17 mm SVL, 22 mm TL). On 22 August, we observed a Cope's giant salamander (*Dicamptodon copei*; 54 mm SVL; 107 mm TL; 10.0 g) that lunged at and bit a metamorphic *A. truei* (19 mm SVL; 23 mm TL) that hopped in front of it. When the salamander was collected, it released the frog. Although *D. copei* is cited as a major predator of *A. truei* (Leonard et al. 1993. Amphibians of Washington and Oregon, Seattle Audubon Society, Seattle, Washington. 166 pp.) and these salamanders have been documented feeding on eggs and larval specimens, we find no records of their feeding on metamorphic *A. truei* (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest, University of Idaho Press, 332 pp.).

Three species of stream-dwelling amphibians were abundant in the stream: *A. truei*, 3.6/m^2; *D. copei*, 2.8/m^2; and *Rhyacotriton olympicus*, 1.2/m^2 (density estimates from pooled data of 10 variable-width belts). Late-stage metamorphosing individuals may be more conspicuous and susceptible to predation than larvae or adults. During this time of year, metamorphosing *A. truei* may be an important food source for predators.

We thank John O'Leary and Brian Dickey for field work and Don Major and Bruce Bury for commenting on this note.

Submitted by **LAWRENCE L. C. JONES** and **MARTIN G. RAPHAEL**, USDA Forest Service, Pacific Northwest Research Station 3625 93rd Avenue SW, Olympia, Washington 98512, USA.

PHRYNOHYAS VENULOSA (Veined Treefrog, "Rana lechosa"). **ANTIPREDATOR DEVICE.** Skin secretions in the neotropical frog *Phrynohyas venulosa* have been suggested as an adaptive response to arid environments (Neil and Allen 1959. Publ. Res. Div., Ross Allen's Reptile Inst. 2:1–76). Secretions are used to line tree cavities in which these frogs seek refuge (Goeldi 1907. Proc. Zool. Soc. London. 135–140; Vellard 1948. Acta Zool. Lilloana 5:137–174), thus preventing water loss within the holes (McDiarmid 1968. Contrib. Sci. Los Angeles Co. Mus. 68:1–15). Smith (1941. Chicago Nat. 4:35–43) first suggested that the secretions are probably a deterrent to predation, a suggestion also made by other authors (Duellman 1956. Misc. Publ. Mus. Zool. Univ. Michigan 96:1–47; Neil and Allen, *op. cit*; Duellman 1970. Monogr. Mus. Nat. Hist., Univ. Kansas (1):xi + 753 pp). The following account documents an instance of the secretion acting as an antipredator device. The observation was made on 11 November 1995, between 0830–1130 h at the Universidad Central de Venezuela, Maracay, Estado Aragua, Venezuela.

A cat-eyed snake, *Leptodeira annulata ashmeadii,* was observed and photographed on a "cereza" tree (*Malpighia glabra*) partially immobilized due to the action of a viscous substance similar to that secreted by *P. venulosa*. The snake was ca. 1.5 m above ground, and was coiled on the tree trunk around the entrance of a hole 8 cm in diameter and ca. 20 cm deep. After 3 h the snake appeared exhausted from struggling and the substance had nearly



FIG. 1. *Leptodeira annulata ashmeadii* immobilized by sticky skin secretions of *Phrynohyas venulosa*.

hardened. The snake was removed and held in captivity. After 24 h in captivity, the snake appeared to have recovered, and after 10 days it was sacrificed, preserved, and deposited in the Museo del Instituto del Zoología Agrícola, Facultad de Argonomía, Universidad Central de Venezuela, Maracay (MIZA 521).

Phrynohyas venulosa is common in this area (Manzanilla et al. 1995. Acta Científica Venezolana 46[3]:1–9) and the tree hole where the snake was found and similar nearby tree holes have been observed as shelters that are often used by this frog. (e.g., MIZA 319, 524). Although we did not observe a frog depositing skin secretions around this particular tree hole, the similarity in appearance to secretions of *P. venulosa* and our previous observations of frogs at this site support our conclusion that the material encountered by the *Leptodeira* was indeed produced by a *P. venulosa*. The secretion may have the dual function of decreasing water loss within the cavity inhabited by the frog, as well as being an effective device against potential predators. Other than being immobilized, we observed no ill effects to the snake.

We extend our gratitude to Dr. Alberto Fernandez-Badillo (Instituto de Zoología Agrícola, UCV, Maracay) for identifying the frog and snake.

Submitted by **JESUS MANZANILLA**, Estación Biológica "Dr. Alberto Fernández Yépez," Facultad de Argonomía, Universidad Central de Venezuela, Apartado 4579, Maracay 2101-A, **ENRIQUE LA MARCA**, Universidad de los Andes, Escuela de Geografía, Laboratorio de Biogeografía, Apartado 116, Mérida 5101-A, and **OSVALDO VILLAREAL** and **DINORA SANCHEZ**, Facultad de Agronomía de la Universidad Central de Venezuels, Maracay, Venezuela.

RANA CAPITO SEVOSA (Dusky Gopher Frog). **PREDATION.** At 1200 h on 10 May 1997, we collected an adult female banded water snake, *Nerodia fasciata*, (SVL 69.7 cm; tail 21.3 cm) at Salt Pond in the Conecuh National Forest Wildlife Management Area, Covington Co., Alabama, USA, that regurgitated two intact and two partially digested *Rana capito sevosa* tadpoles; one was preserved (AUM 34164).

Salt Pond is a fishless, ephemeral sinkhole (<1 ha) and one of the few known remaining breeding sites of *R. c. sevosa* in southern Alabama (C. Guyer, pers. comm.). This species breeds almost exclusively in fishless ponds and the introduction of predatory fishes appears to eliminate populations at these ponds (Mount 1980. Survey for the Presence or Absence of Threatened or Endangered Reptiles and Amphibians, Conecuh National Forest, Alabama. Unpubl. Rept., U.S. Forest Service. 108 pp.). Bailey (1989, unpubl. M.S. thesis, Auburn University. 56 pp.) observed caddisfly larvae and an adult central newt, *Notophthalamus viridescens louisianensis*, feeding on egg masses of *R. c. sevosa*. There are no reported observations of predation on tadpoles. Our observations suggests that *N. fasciata* may be an important natural predator of *R. c. sevosa* tadpoles.

Submitted by **MATTHEW J. ARESCO** and **ROBERT N. REED**, Department of Zoology and Wildlife Science, Auburn University, Alabama 36849-5414, USA.

RANA CATESBEIANA (Bullfrog). **DIET.** Bullfrogs and green frogs (*Rana clamitans*) live sympatrically throughout much of their range (Conant and Collins 1991. Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Consumption of post metamorphic *R. clamitans* has been documented in studies of bullfrog diets (Bury and Whelan 1986. Ecology and Management of the Bullfrog. U.S. Fish and Wildlife Service Resource Publication 155. 24 pp. and references therein). However, no one has reported *R. clamitans* tadpoles in the diet of *R. catesbeiana*. This was assumed by Fulk and Whitaker (1969. Proc. Indiana Acad. Sci 78:491–496) but due to the difficulties in identifying tadpoles from bullfrog stomach contents, it has never been verified.

In laboratory experiments, we found *R. catesbeiana* consume both *R. clamitans* and conspecific tadpoles and show no preference between them ($P = 0.09$). Tadpoles and frogs were collected in October 1996 using seines and hand nets. Bullfrogs were collected in Woo Pond on the western border of Cheshire Township in New Haven Co., Connecticut, and green frogs were collected in Dentist Marsh in the Yale-Myers Research Forest near Union, Tolland Co., Connecticut, USA. Three adult *R. catesbeiana* were kept in separate 37.8 L aquaria and given earthworms *ad libidum*. One hundred fifty *R. clamitans* tadpoles (Gosner stage 25–29; mean 3.8 ± 0.9 g) were kept in eight 18.9 L containers. Forty *R. catesbeiana* tadpoles (Gosner stage 25–29; mean 13.5 ± 2.4 g) were kept in two 124.9 L containers. Both were fed crushed rabbit pellets and fish food. Three foraging experiments were conducted in containers (14 x 35 x 50 cm) that were filled with 8.4 L of water to a depth of 4 cm. There were three replicated containers and one control for each experiment. The control containers lacked adult *R. catesbeiana* and contained the same number and type of tadpoles as the experimental containers. Different tadpoles were used in each experiment. All tadpoles survived in the control containers. The experiments were monitored at the same time each day for five days.

In the first experiment, 10 *R. clamitans* tadpoles and one adult *R. catesbeiana* were placed in each box. On average, the *R. catesbeiana* consumed 1.3 ± 0.83 tadpoles per day. The second experiment was conducted in a similar manner with three *R. catesbeiana* tadpoles. On average, 0.6 ± 0.23 *R. catesbeiana* tadpoles were eaten per day. In the third experiment, three *R. catesbeiana* tadpoles, three *R. clamitans* tadpoles, and one adult *R. catesbeiana* were placed in each container. Both species of tadpoles were eaten (Manly's alpha preference: 0.56 for *R. clamitans* tadpoles and 0.44 for *R. catesbeiana* tadpoles). *Rana clamitans* tadpoles were taken at an average rate of 0.6 ± 0 per day and *R. catesbeiana* tadpoles at an average rate of 0.4 ± 0.23 per day.

We thank David Skelly and Joseph Kiesecker for their advice and for reviewing earlier versions of this manuscript. This research was supported by the Sperry-Carpinter Fund.

Submitted by **KAREN H. BEARD** and **JONATHON BAILLIE**, Yale School of Forestry and Environmental Studies, 205 Prospect Street, New Haven Connecticut 06511, USA.

TESTUDINES

DERMOCHELYS CORIACEA (Leatherback Sea Turtle). **COPULATION.** Carr and Carr (1986. Herpetol. Rev. 17:24–25) observed a pair of *Dermochelys coriacea* copulating near Culebra Island, Puerto Rico. We report a second observation of copulation for this species near Suriname. At Matapica Beach, Suriname, on 24 June 1994 at ca. 1600 h, we observed two *D. coriacea* ca. 30 m offshore, one on top of the other. The upper turtle was clutching the lower turtle with its front flippers. The lower turtle was completely submerged, and was heard taking deep breaths at regular intervals. We do not know how long the turtles had been together before we noticed them. After ca. 20 min, the upper turtle shook loose and swam away underwater, while the lower turtle remained quiescent at the surface. After another 10 min, it began swimming on the surface, parallel to the beach.

From local fisherman and conservation workers, we learned that copulating *D. coriacea* are not an uncommon sight in the waters near this nesting beach. Eckert and Eckert (1988. Copeia 1988:400–406) used data on the distribution of epibionts on the carapaces of female *D. coriacea* to infer that turtles nesting in St. Croix must have mated outside of tropical waters. In contrast, our observations demonstrate that these turtles do mate in tropical waters. It may be that *D. coriacea* in Suriname have different mating patterns from those in St. Croix.

We thank Peter Dutton for encouragement and Marc Girondot for comments. Funding was provided by the Natural Sciences and Engineering Council of Canada (to N. Mrosovsky).

Submitted by **MATTHEW H. GODFREY**, Department of Zoology, University of Toronto, Ontario M5S 3G5, Canada, and **R. BARRETO**, Faculty of Environmental Studies, York University, North York, Ontario M3J 1P3, Canada.

LACERTILIA

ANOLIS NITENS CHRYSOLEPIS (Goldenscale Anole). **PREDATION**. *Anolis nitens chrysolepis* is a medium-sized lizard of the family Polychrotidae, reaching 75 mm SVL. This diurnal, nonheliophilic and terrestrial lizard is an inhabitant of the forests of NE South America

On 20 November 1996 at 0930 h, while searching for amphibians in the region of Saul in French Guiana, ca. 8 km from the village, not far from "Montagne Belvédère" (3°36'N, 53°10'W), we observed a whip spider, *Heterophrynus longicornis* Butler (Arachnida, Amblypigi), eating a juvenile *Anolis nitens chrysolepis* (preserved, IRSNB n° 14576) headfirst. Measurement of the remainder of the lizard's body suggested a SVL of ca. 35 mm. The *Heterophrynus* and its prey were in a vertical, rotting stump 30 cm above the ground, in primary forest near a small stream. The weather was dry; the temperature and relative humidity in the stump were 29°C and 87%, respectively

Known predators of *A. nitens* include the snakes *Oxybelis aeneus, O. argenteus*, and *O. fulgidus* (Avila–Pires 1995. Lizards of Brazilian Amazonia, Zoologische Verhandelingen 299:86–87, Leiden). Whip spiders are nocturnal and are known to prey on invertebrates (we observed specimens eating small crickets at night). We believe that this is the first observation of predation on a lizard. It is interesting to note that males of *Gonatodes annularis* (Gekkonidae) often are encountered in stumps or tree trunks inhabited by whip spiders, and that they often have scars. It is possible that *Heterophrynus longicornis* also prey on this and other small lizard species.

Submitted by **PHILIPPE KOK**, Department of Herpetology, Institut royal des Sciences naturelles de Belgique, 29 rue Vautier, 1000 Bruxelles, Belgium.

ANOTOSAURA BRACHYLEPIS (NCN). **PREDATION.** *Anotosaura brachylepis* is a microteiid known onty from the Serra do Cipó range in Minas Gerais, southeastern Brazil (19°20'S, 43°44'W). This lizard reaches 61 mm SVL and 200 mm in total length. It occurs in montane fields, is regarded as a rare species (Dixon 1974. Herpetologica 30:13–18), and appears to be fossorial (I. Sazima, pers. comm.). However, except for systematic studies on the genus (Amaral 1933. Mem. Inst. Butantan 7:53–74; Dixon 1973. Univ Kansas Mus. Nat Hist. Misc. Publ. 57:1–47; Dixon, *op. cit.*), no additional information is available.

During a study of the feeding habits of *Tropidurus montanus* (Tropiduridae) in the Serra do Cipó, I found a juvenile *A. brachylepis* (30 mm SVL, 92.7 mm TL) in the stomach of an adult female *T. montanus* (71.7 mm SVL, 152 mm TL, 10.5 g). The body of the prey was broken into two parts, and the tail was in four pieces, but all of these were intact and undigested. Insects also were found in the stomach. *Tropidurus montanus* is sympatric with *A. brachylepis* in the Serra do Cipó. Predation on this microteiid by *T. montanus* probably is opportunistic, since the latter seems to be omnivorous (pers. obs.). The two lizard specimens are deposited in the Museu de Historia Natural da Universidade Estadual de Campinas: *T. montanus* (ZUEC 01967) and *A. brachylepis* (ZUEC 01968).

I thank I. Sazima for the identification of *A. brachylepis* and for reading the manuscript.

Submitted by **MARA CÍNTIA KIEFER**, Departamento de Zoologia, Instituto de Biologia, Universidade Estaduat de Campinas, Caixa Postal 6109, 13081-970 Campinas, São Paulo, Brazil.

CHAMELEO OWENI (Owen's Chameleon). **REPRODUCTION.** On 13 August 1995 a female *Chameleo oweni* was collected in the Southwestern Province of Cameroon, near Nguti. The specimen was in the process of digging a hole when found. The following day the specimen oviposited 9 eggs. The eggs were placed in a small container with moist humus until their arrival at the University of Texas at Arlington on 14 December 1995. Upon arrival all of the eggs appeared to be in good condition except for one that had decomposed. Eight eggs were measured (mean size 17.56 mm x 11.03 mm). The eggs were then incubated in a 1:1 mixture of vermiculite and water. The incubation temperature was maintained at 28°C. Eight neonates hatched (mean SVL = 31.5 mm, TL = 44.6 mm, 0.68 g) after an incubation period of 155 days. Nothing is known regarding the reproductive behavior of this species in the wild.

My thanks to Jonathan A. Campbell for his encouragement and support of this project, Dwight P. Lawson for providing the specimens for this study, and the staff of the Dallas Zoo Department of Herpetology for all of their helpful comments and review of this manuscript.

Submitted by **CARL J. FRANKLIN**, Dallas Zoo, Department of Herpetology, 650 R.L. Thornton Freeway (I-35E) Dallas, Texas 75203, USA.

HEMIDACTYLUS MABOUIA (Tropical House Gecko). **CANNIBALISM**. *Hemidactylus mabouia* is an exotic gekkonid presumably introduced via slave ships to Brazil (Vanzolini 1978. Papéis Avulsos Zool., S. Paulo 31(20):307–343). We report an instance of cannibalism in this species. On 15 March 1997 we examined the stomach contents of 67 specimens of this gecko (62 of the stomachs contained food) collected in a pasture near Pontal do Ipiranga, municipality of Linhares, Espírito Santo, eastern Brazil (ca. 19°19'S, 39°43'W, near sea level). One adult male (43.2 mm SVL, 2.7 g) had in its stomach a conspecific juvenile with a broken tail (21.9 mm SVL, 0.4 g), ingested headfirst. Conspecific prey occurred with 1.6% frequency in our samples. Low incidence of cannibalism has been observed in other lizard species, and opportunistic foraging has been regarded as the main explanation for occasional cannibalism in lizards (Polis and Myers 1985. J. Herpetol. 19:99–107; Rocha 1992. Herpetol. Rev. 23:60). Specimens were deposited in the Coleção Zoológica da Universidade Federal do Espírito Santo. CZ thanks the PICDT/CAPES for a fellowship grant, and RLT thanks the CNPq for a post-doctoral grant (Proc. No. 302657/87-8).

Submitted by **CLAUDIO ZAMPROGNO**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil, and **ROGÉRIO L. TEIXEIRA**, Museu de Biologia Mello Leitão, 290650-000 Santa Teresa, Espírito Santo, Brazil.

MABUYA QUINQUETAENIATA QUINQUETAENIATA (Bean Skink). **FORAGING.** On 6–7 July 1996, I observed *Mabuya q. quinquetaeniata* in Lake Nasser, Egypt. This skink is common throughout Egypt's Nile River Valley (Marx 1968. Checklist of the Reptiles and Amphibians of Egypt. USNMRUN 3, Cairo), and can be found actively foraging through leaf litter and grasses (pers. obs.). Skinks were active by 0800 h on the rocky banks of the lake, in close proximity to the water (<1 m). Dragonflies were particularly abundant within 1 m from the edge of the water. An adult *Mabuya q. quinquetaeniata* would wait motionless for extended periods of time until a dragonfly hovered slightly above it, after which the skink would jump into the air and pull down its prey. If the dragonfly was too high, the skink would stand in a tripod position to lessen the distance between itself and its prey, and then jump. This behavior was seen among many of the larger adults. Thus, *Mabuya q. quinquetaeniata* exhibits both active and sit-and-wait foraging behaviors, like some New World species of *Mabuya* (Vitt 1991. J. Herpetol. 25:79–90; Vrcibradic and Rocha 1996. J. Herpetol. 30:60–67).

I thank Ericka Macklouf for editing the text.

Submitted by **OMAR A. ATTUM**, 8807 Lin Station Road, Louisville, Kentucky 40222, USA.

SCELOPORUS BELLI (Bell's Spiny Lizard). **PATTERN.** *Sceloporus belli* is unusual in the genus in having strong dimorphism in dorsal pattern. Mature males are essentially unicolor except for a broad dorsolateral light line bordering a broad lateral dark (brown) line below which lies a distinct lateral light line separated from the blue abdominal semeions by a narrow, indistinct brownish line. On the contrary, in females the dorsolateral light lines are obscured by a series of somewhat chevron-shaped black transverse marks extending from a paravertebral area across each dorsolateral light line; furthermore the lateral area is variegated light and dark, not stripe-like; the lateral light line is interrupted by numerous black streaks, and the sublateral area blends with the essentially unmarked abdomen.

As in most other species of *Sceloporus*, and in all other taxa of the *undulatus* group except *S. virgatus*, males also regularly differ from females in possessing conspicuous gular and/or abdominal semeions. In *S. belli* there is a single, median blue patch on the throat and an elongate pair on the sides of the abdomen. The latter pair is black-bordered medially, as in most other taxa of the *undulatus* group, but black is usually absent in the gular region (present in most other taxa). Also, as in most other species of the genus, and in all of its group, there is a pair of enlarged postanal scales in males (presumably serving to help anchor the hemipenes), but none in females.

However, as noted in the original description of *S. belli* (Smith et al. 1995. Texas J. Sci. 47:124), some males have the female dorsal pattern. One such specimen (University of Colorado Museum 58593) was taken 3 July 1996, basking at the top of Cerros Colorados (ca. 22 air km SE Samalayuca), Chihuahua, Mexico, by one of us (JAL-E). We have noted six other female mimics, all in the Museum of Southwestern Biology and all from the state of Chihuahua, as follows: 39947, Ojo de los Reyes, 4.7 km SE Galeana, 1 mi N Angostura, 12 May, 1977; 35043, 35045, 15 km E, 7 km N San Buenaventura, Hy 10, 19 June 1971; 8961, 8966, 3 mi S El Sueco, Hy. 45, 2 August 1962; and 56335, jct Hy 16 and 45, just SW Cd. Chihuahua, 7 August 1975. These five localities are scattered over a 310 x 140 km span of the northern central part of the state. The mimics may occur elsewhere, but are not represented among the 70 specimens, about half males, in the UCM collection from as far north as 15.6 km S Cd. Chihuahua and southward into Durango. We have not re-examined material from elsewhere (e.g., southern Coahuila, northern Zacatecas).

All seven mimics are sexually mature, even though some were noted as "young" in the original description. The smallest two, at 52 and 56 mm SVL, taken in May and June, respectively, have well-developed gonads, totalling 3.4 and 4.0% respectively of the gross body weight, typical of breeding males. The largest specimen, 74 mm SVL, also taken in June, has gonads totalling 2.2% of the body weight. The other four (taken in July and August) are 63–68 mm in SVL, and are therefore presumably sexually mature although their gonads totalled only 0.2–0.4% of the body weight, having regressed greatly from the active reproductive state.

In addition, a single testis was removed, sectioned (10 µm) and stained (hematoxylin/eosin) from each of the seven mimics. Active sperm production was evident in the three specimens taken in May and June. The regressed testes of the four taken in July and August showed no such activity, as expected, although residual sperm were noted in the epididymis of one animal. Thus there is no question that the mimics with the female dorsal pattern were functional males, not sterile as an adjunct of the female dorsal pattern.

Certain variations in male coloration of various sceloporine lizards are well known to reflect reproductive behavior. Examples include *S. undulatus erythrocheilus* (Rand 1997. Anim. Behav., ms. submitted), *Urosaurus ornatus* (Thompson and Moore 1991. Anim. Behav. 42:745–753), and *Uta stansburiana* (Sinervo and Lively 1996. Nature 380:240–243). Each of these taxa exhibits different throat colors and/or patterns that signal social status and, consequently, behavior, in a subordinate-dominant continuum. These patterns are all honest signals, however, presumably used in the assessment of fighting ability in aggressive interactions.

In both lizards (Cooper 1984. Anim. Behav. 32:1142–1150) and sunfishes (Stacey and Chiszar 1978. Behaviour 64:271-297), female coloration has been shown to decrease aggression among males. No cases have yet been documented in lizards of males adopting female coloration in avoidance of aggression.

In sunfishes, female mimics enter nests of territorial males and fertilize eggs deposited there (Dominey 1980. Nature 284:546–548). Gross (1982. Z. Tierpsychol. 60:1–26) described two alternative male phenotypes in the bluegill sunfish (*Lepomis macrochirus*): sneakers and satellites. Both cuckolded territorial males, but satellites had female coloration and sneakers did not. Sneakers were regularly attacked by males and satellites were not, presumably due to female mimicry.

That female mimicry can reduce aggressive behavior in lizards was demonstrated experimentally by Cooper (*loc. cit.*), who painted male *Holbrookia propinqua* with female coloration and introduced them into the territory of unaltered males. These artificial female mimics were not attacked, and in fact were courted by resident males. Thus in *S. belli*, female mimicry may be an alternative male reproductive tactic for non-territorial males to cuckold territorial males.

On the other hand, the significance of female mimicry in some male *S. belli* may lie strictly in its phylogenetic origin, with no reproductive exploitation. The dorsal pattern of female *S. belli* is basically the same as that in both sexes of most other members of the *undulatus* group of *Sceloporus*: a paravertebral series of dark spots or transverse streaks bordering medially a pair of dorsolat-

eral light lines, which are interrupted by the paravertebral streaks in some taxa (as in *S. belli*), not in others, in which they may be reduced to small spots. The sides are marked much like the dorsum.

It is the male *S. belli* that differs from the general rule of sexually indistinguishable dorsal pattern, in its loss of dorsal markings and development of a dark lateral stripe. The occasional appearance of the female dorsal pattern in male *S. belli* might be merely a paedotypic retention of the ancestral markings characteristic of both sexes in all subspecies of *S. undulatus* (Reilly et al. 1997. Biol. J. Linn. Soc. 60:119–143). It may, for that reason, be geographically limited, perhaps in the area of closest contact with its possible ancestral relative, *S. u. consobrinus* (Smith et al., *loc. cit.*).

The only other member of the *undulatus* group with distinct sexual dimorphism in dorsal pattern is *S. woodi*, a diminutive species of Florida with basically the same modification of the male dorsal pattern as in *S. belli*. Whether occasional males of that species have the typical female dorsal pattern, as in *S. belli*, is unknown.

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Submitted by **EARL T. LARSON** and **FRANK VAN BREUKELEN**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA; **JULIO A. LEMOS-ESPINAL**, Laboratorio de Conservación, CyMA, UICSE, Escuela Nacional de Estudios Profesionales Ixtacala, UNAM, Apartado Postal 314, Tlalnepantla, Estado de México, México; **ROYCE E. BALLINGER**, School of Biological Sciences, University of Nebraska, Lincoln, Nebraska 68588-0118, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

SCINCELLA LATERALIS (Ground Skink). **AQUATIC BEHAVIOR.** Escape behaviors, such as retreat to refugia (Brooks 1967. Ecol. Monogr. 37:71–87) and tail autotomy (Dial and Fitzpatrick 1983. Science 219:391–393), have been reported for *Scincella lateralis*. We report here observations of escape into an aquatic habitat by this chiefly terrestrial species.

During a field collection of this species at Thistlewaite Wildlife Management Area (St. Landry Parish, Louisiana, USA), we witnessed several instances of aquatic behavior in adults and juveniles in a population of ground skinks. The general habitat of the collecting area is bottomland forest dominated by water oak (*Quercus nigra*) and palmetto (*Sabal minor*) in high areas, and by bald cypress (*Taxodium distichum*) and tupelo (*Nyssa aquatica*) in low areas. Standing water occurs in both elevations, of which the lower portions are usually flooded. On 23 March 1997 from 1400–1500 h CST, we followed a path along a small gravel levee in search of ground skinks. Numerous lizards were sighted on the slopes of the levee, which at first bordered dry oak-palmetto forest, but further along bordered cypress-tupelo swamp. Typically, ground skinks attempted to avoid capture by dashing to underground retreats in the gravel bed of the levee. However, upon our approach an adult of unknown gender was observed to run without hesitation into the swamp and swim to a branch over 1 m out; the water depth was ca. 0.5 m. We later observed another adult (sex unknown), as well as a juvenile, swim across shallow water to evade capture. Finally, a female was observed to dive under water and reappear shortly afterwards with only its head peeking out from the surface. This female (45 mm SVL) was subsequently collected *in aquatica*.

During none of the swimming events that we observed did the lizards appear challenged by the aquatic habitat. Indeed, the ground skinks were adept swimmers and utilized lateral undulations of their elongate bodies for propulsion through the water. Aquatic behavior has also been documented in other lizards: *Cnemidophorus sexlineatus* (Trauth et al. 1996. Herpetol. Rev. 27:20–21) and *Tupinambis teguixin* (Olmos 1995. Herpetol. Rev. 26:37). *Scincella lateralis* is notoriously difficult to capture (Lewis 1951. Am. Midl. Nat. 45:232–240) and the aquatic escape behavior appears to be a strategic asset in habitats where standing water is not uncommon, such as the lowland regions of southern Louisiana.

We thank the Louisiana Department of Wildlife and Fisheries for granting both access to Thistlewaite Wildlife Management Area and permission to collect lizards (permit LNHP-97-025 to JAA).

Submitted by **JONATHAN A. AKIN** and **VICTOR R. TOWNSEND, JR.**, Department of Biology, University of Southwestern Louisiana, Lafayette, Louisiana, 70504-2451, USA.

SERPENTES

AGKISTRODON PISCIVORUS PISCIVORUS (Eastern Cottonmouth). **PREDATION.** Predation on juvenile *Agkistrodon piscivorus* by vertebrates is well documented (Ernst 1992. Venomous Reptiles of North America. Smithsonian Institution Press, Washington, D.C., 275 pp.; Mitchell 1994. Reptiles of Virginia. Smithsonian Institution Press, Washington, D.C., 352 pp.). Here we document the first case of predation on *A. p. piscivorus* by an invertebrate, the ghost crab (*Ocypode quadrata*).

At 0900 h on 15 October 1996, we observed a juvenile *A. p. piscivorus* (ca. 275 mm TL, with sulfur-yellow tipped tail) in the right claw of an adult *O. quadrata* at Back Bay National Wildlife Refuge (BBNWR), Virginia Beach, Virginia, USA. The snake initially might have been seized just posterior to the head; the skin and musculature in this area were mutilated. However, when the crab was first spotted the still-living snake was being held by the lower jaw. The *O. quadrata* dragged the snake into the vegetation atop a sand dune and disappeared.

Ocypode quadrata is both an opportunistic scavenger and an effective predator (Herreid and Full 1988. Energetics and Locomotion. *In* Burggren and McMahon, eds., Biology of the Land Crabs. Cambridge Univ. Press, New York. 479 pp.). At BBNWR, *A. p. piscivorus* generally is found in open water or marsh habitats, whereas *O. quadrata* is restricted to dune and beach habitats; therefore, predation on *A. p. piscivorus* by *O. quadrata* most likely is limited to chance encounters when *A. p. piscivorus* enters the habitat of *O. quadrata*.

Submitted by **CHAD L. CROSS**, Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266, USA, and **CHARLES MARSHALL**, Back Bay National Wildlife Refuge, 4005 Sandpiper Road, Virginia Beach, Virginia, 23456, USA.

ANILIUS SCYTALE (False Coral Snake). **DIET.** In June 1976, O. R. Cunha and F. P. Nascimento collected an adult male (365 mm SVL) *Anilius scytale* from Curupati-Viseu, Para, Brazil; this specimen was deposited in the Museu Paraense Emílio Goeldi (MPEG 12326). We examined the stomach contents of this specimen and found an adult male *Tantilla melanocephala melanocephala* (MPEG 19132, 190 mm SVL). *Anilius scytale*

has been reported to eat species of *Amphisbaena, Aulura,* and *Leposternon*, as well as earthworms (Cunha and Nascimento 1993. Bol. Mus. Para Emílio Goeldi 9:19–20; Duellman 1990. *In*: A. H. Gentry [ed.], Four Neotropical Rainforests, pp. 455–505. Yale Univ. Press, New Haven, Connecticut). We believe that this is the first report of *A. scytale* eating a colubrid snake.

Submitted by **FRANCISCO VALLS-MORAES**, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brazil, 1500, Butantan, CEP: 05503-900, São Paulo, SP, Brazil, and **RUBENS NOBUO YUKI**, Museu Paraense Emílio Goeldi, Caixa Postal 399, CEP: 66040-170, Belem, PA, Brazil.

CORALLUS HORTULANUS (Deer Snake). **PREDATION.** *Corallus hortulanus* (formerly *C. enydris*; see McDiarmid et al. 1996, J. Herpetol. 30:320–326) is an arboreal species that occurs in forests and river valleys in tropical South America. This snake is nocturnal, and records on its foraging behavior in the wild are scarce. Its diet includes frogs, small rodents, bats, and birds (Cunha and Nascimento 1978. Mus. Par. EmÌlio Goeldi, Publ. Avul. 31, 218 pp.). Here, we report a bird taken in the wild by *C. hortulanus* at the Reserva Biológica de Poço das Antas (22°30'S 42°19'W), ca. 130 km northeast of Rio de Janeiro, Brazil.

On 11 October 1995 (1630 h), while checking the nest of a white-bearded manakin (*Manacus manacus*: Passeriformes: Pipridae), we noticed the female was absent. The nest was 1.1 m above the ground and contained two eggs. Nearby, we discovered an adult female *C. hortulanus* twisted around the branch the nest sat on, at about the same height as the nest. The snake had a remarkable swelling in its abdomen which proved to be the female manakin (Fig. 1). The bird had been swallowed head first and was nearly intact (with many of its feathers still dry), indicating it had been recently eaten. The snake measured 49.8 cm SVL (62 cm total length), and weighed 22.5 g (excluding prey). The prey weighed 17 g immediately after being removed from the snake's stomach. We found no other food items in the snake's digestive tract. We deposited the snake at the Museu Nacional do Rio de Janeiro (MNRJ 4784).



FIG. 1. Size relation between the predator, *Corallus hortulanus*, and its prey, *Manacus manacus*.

We thank Dionízio M. Pessamílio, Whitson José da C. Júnior, and the other officers of Reserva Biológica de Poço das Antas for logistical support. Carlos F. D. Rocha and Monique Van Sluys commented on this note and provided additional information. Ivandy N. Castro Astor and Jozélia M. S. Correia received student fellowships from the Coordenaçao de Aperfeiçoamento do Ensino Superior and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) respectively. CNPq provided a research grant (process no. 301524/88-2) to Maria Alice S. Alves.

Submitted by **IVANDY N. CASTRO ASTOR***, Reserva Biológica de Poço das Antas-IBAMA, C. P. 109.981; 28.860-970, Casimiro de Abreu, Rio de Janeiro, Brazil; **JOZÉLIA M. S. CORREIA***, Rua Major Martinez, 434; 21.610-120, Deodoro, Rio de Janeiro, RJ, Brazil; and **MARIA ALICE S. ALVES**, Setor de Ecologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524; 20.550-013, Rio de Janeiro, RJ, Brazil. *Post Graduate Program in Ecology, University of Brasilia, Brasilia, DF. 70.910, Brazil.

FARANCIA ERYTROGRAMMA ERYTROGRAMMA (Rainbow Snake). **EGGS**. Data on clutch and egg size in *Farancia erytrogramma* consist of scattered anecdotes. Collectively, these data suggest that eggs are laid from June to August, that clutch size ranges from 20–52 eggs, and that egg dimensions range between 25.8–38.6 mm in length and 25.4–29 mm in width (Palmer and Braswell 1995. Reptiles of North Carolina. Univ. North Carolina Press, Chapel Hill. 412 pp.). Here, we add to this data base by presenting information on two other clutches.

On 20 July 1972 a female *F. erytrogramma* collected near the Ogeechee River in Chatham County, Georgia, USA, deposited 30 eggs. This snake was captured in early July, and was not weighed prior to egg deposition. Egg length was 32.26 ± 1.618 mm (mean ± SE; range = 29.90–37.00 mm); egg width was 20.92 ± 0.604 mm (mean ± SE; range = 19.60–22.10 mm), and egg mass was 7.87 g. ± 0.595 g (mean ± SE; range = 6.715–8.809 g). One noteworthy feature of these eggs was that eight pairs of eggs were attached by a thread-like strand.

Another Chatham County snake collected on 30 April 1996 near the Little Ogeechee River laid 17 eggs on 30 June. The weight of the female was 234 g after deposition. Egg length was 29.07 ± 1.944 mm (mean ± SE; range = 26.80–33.61 mm), and egg width was 17.57 ± 1.048 mm (mean ± SE; range = 14.68–18.82 mm). Unfortunately, this clutch of eggs was not weighed. As in the 1972 clutch, a single, thread-like strand attached one pair of eggs.

Submitted by **ROBERT A. MOULIS** and **GERALD K. WILLIAMSON**, Savannah-Ogeechee Canal Museum & Nature Center, 681 Fort Argyle Road, Savannah, Georgia 31419-9239, USA.

HETERODON SIMUS (Southern Hognose Snake) **DIET.** Natural food records for the southern hognose snake (*Heterodon simus*) are scarce. The species has been reported to feed primarily, if not exclusively, upon anurans (Ashton and Ashton 1981. Handbook of Reptiles and Amphibians of Florida. Part 1, The Snakes. Windward Publishing, Inc., Miami. 176 pp.; Mount 1986. *In* Mount [ed.], Vertebrate Animals of Alabama in Need of Special Attention, pp. 34–35, Alabama Agr. Expt. Sta., Auburn Univ., Alabama). Palmer and Braswell (1995. Reptiles of North Carolina. Univ. North Carolina Press, Chapel Hill, North Carolina, 412 pp.) reported only two food records for wild *H. simus* in North Caro-

lina; both were eastern spadefoot toads (*Scaphiopus holbrookii*). Here, we report three observations of stomach contents in *H. simus*, including two species previously unrecorded in this snake's diet.

A hatchling female *H. simus*, found DOR (10.3 km W of Wagram, Scotland Co., North Carolina, USA) by J. C. Beane and T. J. Thorp on 5 October 1996, contained the remains of an adult six-lined racerunner (*Cnemidophorus s. sexlineatus*). The snake (ca. 180 mm TL; 157 mm SVL) was badly mangled. The lizard was too badly fragmented for measurement, but its total length may have equaled or exceeded that of the snake. Both were deposited in the North Carolina State Museum of Natural Sciences (NCSM 44810). A second *H. simus* (NCSM 45195), also a hatchling female (170 mm TL, 148 mm SVL) found DOR (4.2 km NNW of Old Hundred, Scotland Co., North Carolina, USA) by J. C. Beane and D. A. Jackan on 24 October 1996, contained remains of a subadult *C. s. sexlineatus* and a subadult ground skink (*Scincella lateralis*). A third specimen (NCSM 39554), an adult male (380 mm TL, 303 mm SVL) found DOR (9.8 km W of Wagram, Scotland Co., North Carolina, USA) by J. C. Beane and T. J. Thorp on 8 October 1995, contained the remains of an adult *S. holbrookii*.

Lizards, including *Cnemidophorus*, have been reported as prey of *H. nasicus* and *H. platirhinos* (Platt 1969. Univ. Kansas Publ. Mus. Nat. Hist. 18:253–420). Weaver (1965. Bull. Florida State Mus. Biol. Sci. 9:275–304) reported a second-hand observation of a fence lizard (*Sceloporus undulatus*) that was killed by the bite of a *H. simus*, but that account did not indicate whether the snake actually ate the lizard, or under what circumstances the bite occurred. To our knowledge, our observations represent the first published records of reptiles as natural prey of *H. simus*.

Observations were made as a result of "Project Simus," for which partial funding was provided by a grant from the North Carolina Herpetological Society.

Submitted by **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, Box 29555, Raleigh, North Carolina 27626-0555, USA, **THOMAS J. THORP**, Three Lakes Nature Center and Aquarium, 400 Sausiluta Drive, Richmond, Virginia 23227, USA, and **DALE A. JACKAN**, 4801 Metcalf Drive, Raleigh, North Carolina 27612, USA.

LEPTODEIRA ANNULATA (Banded Cat-Eyed Snake). **SEXUAL DIMORPHISM**. An adult male specimen (470 mm SVL) of this species, probably originating from South America, based on its color pattern (Natural History Museum of Lyon or Musée Guimet, Lyon, France: MG 42002026; "Sumatra," obviously in error) displays numerous thin tubercles on its chin. These tubercles are present on chin scales, infralabials, and gulars. Such sexually dimorphic tubercles were previously not reported for this genus (Duellman 1958. Bull. Am. Mus. Nat. Hist. 114[1]:1–152; Shine 1993. *In* R. A. Seigel and J. T. Collins [eds.], Snakes: Ecology and Behavior, pp. 49–86. McGraw-Hill, New York).

We extend our gratitude to Joël Clary (curator of the Musée Guimet collections) for the loan of the specimen.

Submitted by **IVAN INEICH** and **PATRICK DAVID**, Muséum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles & Amphibiens), 25 rue Cuvier, F-75005 Paris, France. e-mail (II): ineich@cimrs1.mnhn.fr.

LIOPHIS MILIARIS (Common Water Snake). **PREY.** *Liophis miliaris* is known to prey on anurans (Martins et al. 1993. Amphibia-Reptilia 14: 307–309; Michaud and Dixon 1989. Herpetol. Rev. 20:39–41; Vitt 1983. Herpetologica 39:52–66) and fishes (Marques and Souza 1993. Rev. Brasil. Biol. 53:645–648; Michaud and Dixon, *op. cit.*). At 1000 h on 25 February 1994, we collected a small *L. miliaris* (221 mm SVL, 56 mm tail length, 8.99 g) at llha do Mel, Paranaguá Municipality, Paraná, Brazil (48°20'W; 25°30'S). The snake was moving on the ground in a mangrove-forested transitional area. Immediately after collection, the snake regurgitated an adult gymnophthalmid lizard, *Placosoma glabellum* (31 mm SVL, 0.5 g). The lizard had been swallowed head first, and comprised ca. 5.6% of the snake's mass. The lack of digestive activity indicates that it had been swallowed recently. Both specimens were deposited at the Universidade Estadual de Londrina herpetological collection (*L. miliaris* = CZUELHP.199; *P. glabellum* = CZUELHP.200). Identifications were verified by Julio Cesar de Moura-Leite. This is the flrst report of a wild *Liophis miliaris* feeding on a lizard.

Submitted by **REGINALDO ASCÊNCIO MACHADO, PAULO SÉRGIO BERNARDE**, Universidade Estadual de Londrina, Departamento de Biologia Animal e Vegetal, P.O. Box 6001, 86051-970, Londrina, Paraná, Brazil, and **SÉRGIO AUGUSTO ABRAHÃO MORATO**, Companhia Paranaense de Energia, Coordenadoria de Engenharia Ambiental, Rua Voluntarios da Pátria, 233, 8° andar, 80020-942, Curitiba, Paraná, Brazil.

MICRURUS DIASTEMA and ***M. LIMBATUS*** (Diastema Coral Snake and Tuxtlan Coral Snake, respectively). **DIET.** *Micrurus diastema* (N = 7) and *M. limbatus* (N = 4) were kept in captivity (southern Veracruz, México) for 24 mo, during which time they were offered 15 local species of snakes as prey, with each coral snake being offered each prey species 2–6 times. Prey were offered once per week to each coral snake. Snakes offered as prey were always alive and shorter than the coral snakes and were left with the latter for a maximum of 24 h. Consistent with Roze (1996, Coral Snakes of the Americas: Biology, Identification and Venoms. Krieger Publ., Malabar, Florida), four species were always accepted promptly: *Geophis semidoliatus, Ninia diademata, N. sebae,* and *Sibon sartorii,* although the latter two taxa appeared particularly resistant to *Micrurus* venom. Five species elicited no response in the coral snakes: *Adelphicos quadrivirgatus*, Boa constrictor, Drymobius margaritiferus, Leptotyphlops goudotii,* and *Tantilla schistosa**. Six species were not only rejected as prey but they also appeared to elicit strong escape responses in both species of *Micrurus*: *Coniophanes fissidens, C. piceivittis, Ficimia publia*, Rhadinaea decorata, Stenorrhina degenhardti**, and *Toluca lineata.* (* indicates that Roze reported records of these or closely related species in the diet of *M. diastema;* no specific records were reported for *M. limbatus.*)

We initially also offered *Conophis lineatus* to the coral snakes, but this was discontinued early in the study after a 42 cm *C. lineatus* devoured a 70 cm *M. diastema* and a 50 cm *M. limbatus.* No other taxa were observed to attack the coral snakes during our tests.

Submitted by **JORDAN RODRIGUEZ GARCIA**, Facultad de Biología, Universidad Veracruzana, Xalapa, Veracruz, México; **GONZALO PÉREZ-HIGAREDA**, Estación de Biología Tropical "Los Tuxtlas," Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 51, Catemaco, Veracruz, México; **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA; and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA.

MICRURUS NIGROCINCTUS (Coral Snake). **REPRODUCTION.** Palo Verde National Park is a seasonal dry forest in northwestern Costa Rica (10°19'–10°24'N and 85°18'–85°25'W). One of us (MP) observed a pair of *M. nigrocinctus* copulating in the park (ca. 20 m above sea level on the lower slopes of a 210 m limestone hill). Copulation in this species under natural conditions has not been reported.

On 14 October 1995 at 1100 h, the intertwined tails of two *M. nigrocinctus* were discovered protruding from underneath a log. MP retrieved a Sony Hi-8 camcorder and returned with three other people about 10 min later. The snakes' tails had not moved and MP immediately started taking video. Approximately 3 min later, the log was lifted and the two snakes were completely exposed. When the log was first lifted, the tails were intertwined and the bodies were coiled with the male positioned slightly more on top. The snakes were both ca. 80–90 cm total length, and the male appeared slightly thinner than the female. The female was opaque in color and clearly was in a shed cycle, though her eyes were not noticeably opaque. The snakes were disturbed by the sunlight and/or presence of people, and soon after pulled apart and moved under a nearby log. The everted right hemipenis of the male was observed as the snakes ended the copulation.

A copy of the video tape (ca. 6 min duration) is on file at the Museum of Vertebrate Zoology.

Submitted by **MELISSA A. PANGER**, Department of Anthropology, 232 Kroeber Hall, University of California, Berkeley, California 94720, USA, and **HARRY W. GREENE**, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA.

OPHEODRYS AESTIVUS (Rough Green Snake). **SPIDER-WEB ENTRAPMENT.** On 8 October 1995 in the town of Elkton, St. John's Co., Florida, USA, we observed an adult *Opheodrys aestivus* (75 cm SVL) approximately 6 m up in a stand of laurel oaks (*Quercus laurifolia*). The snake was dead, bound and suspended in the web of a golden orb-weaving spider, *Nephila clavipes* (Araneidae). The spider, an adult female, was still present, but no interactions were observed. Neither animal was collected. It is unclear how the snake became entrapped in the spider web, but one possibility is that this was an act of predation. Spiders of this genus are known to prey on vertebrates (McKeown 1963. Australian Spiders, Angus and Robertson, Sydney, 287 pp.; Hill and Phillipps 1981. A Colour Guide to Hong Kong Animals. Government Printer, Hong Kong, 281 pp.). Without further evidence, however, we must conclude that this entrapment was an unusual and previously unreported cause of mortality in *O. aestivus*.

Submitted by **KEVIN C. ZIPPEL**, Department of Zoology, University of Florida, Gainesville, Florida 32611, USA, and **LYNN KIRKLAND**, St. Augustine Alligator Farm, St. Augustine, Florida 32085, USA.

PSEUDOBOA CORONATA (False Coral Snake). **DIET.** *Pseudoboa coronata* is known to eat small rodents (Cunha and Nascimento 1983. Bol. Mus. Para. Emílio Goeldi, nova ser. Zool. 122:1–42), as well as ground birds, small fishes, and lizards (Beebe 1946. Zoologica 31:11–52; Cunha and Nascimento 1978. Publ. Avul. Mus. Para. Emílio Goeldi 31:1–217; Duellman 1978. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 65:1–352). *Pseudoboa nigra*, although considered mainly saurivorous (Vanzolini et al. 1980. Répteis das Caatingas, Acad. Bras. Ciências, 161 pp.), is the only species of the genus known to eat snakes (Cunha and Nascimento 1983, *op. cit.*). Here we report ophiophagy in *P. coronata*.

In December 1995, a female *P. coronata* (Museu Paraense Emílio Goeldi [MPEG] 19027, 568 mm SVL, 13.8 mm max. diam, 68 g preserved) from Ananindeua (1°22'S, 48°23'W), Pará, Brazil, was found alive with the posterior 8 cm of an adult *Mastigodryas boddaerti* (MPEG 19028, 757 mm SVL, 10.5 mm max. diam, 27 g preserved) protruding from its mouth. The *P. coronata* had been unable to completely swallow the much larger *M. boddaerti*; however, digestion of the anterior portion of the prey was well underway.

Ingestion of large prey presents a physical challenge to a snake and may lead to increased vulnerability to predators by complicating locomotion (Sazima and Martins 1990. Mem. Inst. Butantan 52[3]:73–79). However, if these potential problems can be overcome and the prey is not regurgitated, there is a huge energetic reward for the predator (Schoener 1971. Ann. Rev. Ecol. Syst. 2:369–404).

We thank João Batista da Silva, who collected the snake, and José Maria Cardoso da Silva for help with the manuscript.

Submitted by **ULISSES GALATTI** and **RUBENS NOBUO YUKI,** Departamento de Zoologia, Museu Paraense Emílio Goeldi, Caixa Postal 399, CEP 66040-170, Belém, Pará, Brazil. e-mail (UG): ulisses@museu-goeldi.br and (RY): yuki@museu-goeldi.br.

REGINA ALLENI (Striped Crayfish Snake). **ANTIPREDATOR BEHAVIOR.** On 21 November 1996 at 1330 h, a southern black racer (*Coluber constrictor priapus*) was observed consuming a *Regina alleni*. This occurred in a roadside ditch located on Avon Park Air Force Range, Highlands County, Florida, USA.

The *C. constrictor* (ca. 97 cm SVL) had grabbed the *R. alleni* (ca. 38 cm SVL) around the base of the skull. The lower one third of the *R. alleni* was tightly coiled around the vegetation in an apparent attempt to prevent being swallowed. The *C. constrictor*



followed short intervals of ingestion by quick jerks of its head, possibly to pull the *R. alleni* from the vegetation. The *C. constrictor* appeared more agitated during the second half of the event, when it began engulfing the *R. alleni* faster, jerking its head with more force, and vibrating its tail. The *C. constrictor* interrupted feeding for 13 min when it encountered the still-fastened coils of the *R. alleni*. Feeding resumed at 1425 h when the *R. alleni* released its grasp on the vegetation and became motionless. At 1440 h, the *C. constrictor* paused, with ca. 5 cm of the prey still visible, then retreated to a patch of saw palmetto.

The *C. constrictor* appeared to have difficulty consuming the *R. alleni* when the latter was coiled about vegetation. Guyer and Laska (1996. Herpetol. Rev. 27:203) reported a *Boa constrictor* that also coiled its body in such a way as to interfere with a predation attempt.

I thank Dick Franz for helpful suggestions, and Pat Walsh of the Avon Park Air Force Range Natural Resources Staff for providing access to the site. This research was funded by the Avon Park Air Force Range through Cooperative Agreement 1445-0009-1544, Research Work Order No. 169 of the Florida Cooperative Fish and Wildlife Research Unit.

Submitted by **CHRISTOPHER J. O'BRIEN**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA.

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These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins 1997. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*. Fourth Edition. SSAR Herpetol. Circ. 25:1–40; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*. Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al. 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985[3]:802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

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Recommended citation for new distribution records appearing in this section is: Marques, O. A. V., and G. Puorto. 1996. Geographic Distribution. *Chironius laevicollis*. Herpetol. Rev. 27:212.

CAUDATA

AMBYSTOMA CINGULATUM (Flatwoods Salamander). USA: FLORIDA: Jefferson Co: State Road 59, 8.4 km N of jct. with U.S. Rt. 98, SE 1/4 Sec. 32, T2S, R3E. One live adult examined closely then released by D. B. Means as it was moving E to W at 2230 h on 31 October 1997. A second adult was found squashed 50 m S of first location at 2355 h on 29 November 1997 by D. B. Means. Verified by David Auth. UF 108837. First record for Jefferson County; partly rejects the hypothesis that the species is naturally absent from the Florida panhandle between the Suwannee River and Wakulla County because of biogeographical reasons (Palis 1997, Herpetol. Nat. Hist. 5:53–65). Almost all of the adult natural habitat of *A. cingulatum* in southern Jefferson County has been converted to dense slash pine plantations (Means and Palis 1995. Conserv. Biol. 10:426–437), but aerial photographs indicate that small cypress domelike wetlands—potential breeding habitat—are still common in the landscape. Palis's (ibid.) other hypothesis, sampling bias, is not rejected.

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

AMBYSTOMA MACULATUM (Spotted Salamander). USA: PENNSYLVANIA: Schulkyll Co: small runoff pond along Blue Mountain Railroad, adjacent to the Little Schulkyll River, ca. 1.6 km N of Hawk Mountain Road. 9–12 June 1996. C. Paul Rogers and Todd Bauman. Jacksonville State University Collection (JSUC A012–A024) Larvae verified by G. R. Cline. New county record; fills gap among neighboring counties. Specimens collected at Hawk Mountain Sanctuary fill in the gap between central Berks county specimens and the new county record.

Submitted by **C. PAUL ROGERS**, Department of Biology, Jacksonville State University, Jacksonville, Alabama 36265-1602, USA, and **TODD BAUMAN**, Hawk Mountain Sanctuary, Kempton, Pennsylvania 19759-9449, USA.

EURYCEA CIRRIGERA (Southern Two-lined Salamander). USA: TENNESSEE: Hardin Co: 2.4 km E Counce, Robinson Creek (Tennessee River drainage) at Tenn. Rt. 57 (35°02.929'N, 88°15.074'W). 27 March 1996. C. A. Taylor and M. H. Sabaj. Illinois Natural History Survey (INHS 12318). Verified by C. A. Phillips. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **JOHN E. PETZING** and **MARK H. SABAJ**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

EURYCEA CIRRIGERA (Southern Two-lined Salamander). USA: TENNESSEE: Moore Co: 10 km NE Lynchburg, Hurricane Creek at Raysville Road (35°20.789'N, 86°17.859'W). 15 March 1996. Jeanne Serb, Thomas Near, Patrick Ceas and Jean Porterfield. Illinois Natural History Survey (INHS 12257). Veri-

fied by Christopher A. Phillips. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **JEANNE M. SERB** and **JOHN E. PETZING**. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

PLETHODON DORSALIS (Zigzag Salamander). USA: TENNESSEE: Hickman Co: 4 km NW Primm Springs, Tatum Creek at Tatum Creek Road (35°51.161'N, 87°16.903'W). 15 March 1996. Jeanne Serb, Thomas Near, Patrick Ceas and Jean Porterfield. Illinois Natural History Survey (INHS 12261). Verified by Christopher A. Phillips. New county record (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Center for Field Biol. Misc. Publ. 12:1–94).

Submitted by **JEANNE M. SERB** and **JOHN E. PETZING**. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

ANURA

ADENOMERA cf. ***MARMORATA***. BRAZIL: RIO GRANDE DO SUL: Municipio São Francisco de Paula: Centro de Pesquisas e Conservação da PUCRS (Pró-Mata, 29°30'S, 50°10'W). 1000 m. 20 December 1996. Axel Kwet. Museu de Ciências da PUCRS (MCP 2421). Verified by Andreas Schlüter. First record for the genus for Rio Grande do Sul. Related to *Adenomera marmorata*, but with different calls in the more northerly populations of this species near São Paulo (Heyer et al. 1990, Arquivos de Zoologia São Paulo 31[4]:230–410). Southernmost record for the genus *Adenomera*. Common species in the disturbed *Araucaria* forest of the Pró-Mata Reserve.

Submitted by **AXEL KWET**, Zoologisches Institut der Universität Tübingen, Lehrstuhl für spezielle Zoologie, Auf der Morgenstelle 28, D-72076 Tübingen, Germany.

BUFO AMERICANUS AMERICANUS (Eastern American Toad). USA: MINNESOTA: Crow Wing Co: 22.5 km NE Brainerd. July 1949. R. C. Schroder. Verified by C. A. Phillips. Illinois Natural History Survey (INHS 4240). Confirms literature/sight record (Oldfield and Moriarty. 1994 Amphibians and Reptiles Native to Minnesota. University of Minnesota Press).

Submitted by **JOHN E. PETZING,** Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

BUFO SPECIOSUS (Texas Toad). USA: NEW MEXICO: Otero Co: 9.2 km (road) N of Texas border on New Mexico Rt. 506, N edge Sec. 3, T26S, R18E. 31 August 1991. William G. and Paula B. Degenhardt. University of New Mexico Museum of Southwestern Biology (MSB 60774). Verified by Charles W. Painter. First record for county and extends range ca. 50 km W of the Eddy County records plotted in Degenhardt et al. (1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **WILLIAM G. DEGENHARDT**, Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

ELEUTHERODACTYLUS MARNOCKII (Cliff Chirping Frog). USA: TEXAS: Tom Green Co: S Concho River, 8 km S Christoval, 756 m (31°08'17"N, 100°29'38"W). 31 May 1996. J. F. Husak and M. S. Husak. Angelo State Natural History Collection (ASNHC 12885). Verified by T. C. Maxwell. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JERRY F. HUSAK**, Department of Biology, Angelo State University, San Angelo, Texas 76909, USA.

GASTROPHRYNE ELEGANS (Elegant Narrowmouth Toad). MÉXICO: TAMAULIPAS: Rancho Los Colorados, 26 km NE Aldama, 5 m. 12 January 1992. James R. Dixon. TCWC 70392. Verified by Kathryn Vaughan. First state record and northward range extension of 240 airline km from 6 km NW Tihuatlan, Veracruz (UIMNH 3625). Found under a stone following moderate rainfall.

Submitted by **XOCHITL SAMPABLO-BRITO**, Universidad de Tamaulipas, Cuidad Victoria, Tamaulipas, México, and **JAMES R. DIXON**, 705 Inwood Drive, Bryan, Texas 77802, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad). USA: TEXAS: Stonewall Co: 0.5 km N Texas Rt. 83 in Salt Fork of the Brazos River. 2 August 1997. Kenneth G. Ostrand, Warren C. Conway, Ricardo Jimenez, Jr., Randy R. Young. Museum of Texas Tech University (MTTU 11766). Verified by Ann M. Anderson. County record. One individual observed in riverside pool. Expands the range of this species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). Previously reported distributions included counties surrounding Lubbock.

Submitted by **KENNETH G. OSTRAND**, **WARREN C. CONWAY**, **RICARDO JIMENEZ, JR.**, and **RANDY R. YOUNG**, Department of Range, Wildlife, and Fisheries Management, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125, USA.

HYLA AVIVOCA (Bird-Voiced Treefrog). USA: GEORGIA: Jasper Co: Charlie Elliott Wildlife Center, Margery Lake, 33°27'26"N, 83°43'54"W. 24 May 1997. John B. Jensen. UGAMNH 37052. Jones Co: Piedmont National Wildlife Refuge, Allison Lake, 33°07'07"N, 83°41'19"W. 9 July 1997. John B. Jensen. UGAMNH 37051. Bibb Co: cove on west side of Lake Wildwood, 32°51'59"N, 83°46'48"W. 14 June 1997. John B. Jensen. UGAMNH 37053.

Wharton (1978, Georgia Geol. Surv. Bull. 114:1–227) reported "a remarkable disjunct population" of *Hyla avivoca* within the Piedmont physiographic region of central Georgia. This population, thought to be isolated from populations of the Coastal Plain, is also depicted as disjunct in Conant and Collins (1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed., Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Records noted above document its occurrence in three continuous counties between previously known sites in the Piedmont and the upper Coastal Plain, and represent new county records (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712). Further, these new records suggest a continuous range of this species along the Ocmulgee River drainage of central Georgia.

All specimens were verified by M. E. McGhee, and are deposited in the University of Georgia Museum of Natural History (UGAMNH).

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA; e-mail: forsyth_nongame@mail.dnr. state.ga.us.

HYLA MICROPS (Nova Friburgo Treefrog). BRAZIL: RIO GRANDE DO SUL: Municipio São Francisco de Paula: Centro de Pesquisas e Conservação da PUCRS (Pró-Mata, 29°30'S, 50°10'W). 1000 m. 26 January 1997. Axel Kwet. Museu de Ciências da PUCRS (MCP 2476–2480). Verified by Andreas Schlüter. First record for Rio Grande do Sul. Common species in forests and near-forest areas of the Pró-Mata Reserve.

Submitted by **AXEL KWET**, Zoologisches Institut der Universität Tübingen, Lehrstuhl für spezielle Zoologie, Auf der Morgenstelle 28, D-72076 Tübingen, Germany.

HYLA TRITAENIATA. BRAZIL: MATO GROSSO DO SUL: Sonora municipality: Rio Correntes along the left bank in a small fen located near low waterfalls and in front of a small sandy beach locally known as "Prainha," (17°36'S, 54°49'W). 2 November 1994. C. Strussmann. Coleção de Vertebrados do Instituto de Biociências da Universidade Federal de Mato Grosso (UFMT 2147–50). Verified by Marcelo Napole. First state record. Species was described by Bokermann (1965, Rev. Brasil. Biol. 25[3]:259) from São Vicente (Cuiabá municipality) and Rondonópolis, both in the state of Mato Grosso, and apparently has not been mentioned in the literature since the original description. Locality here reported extends known distribution ca. 130 km to the south.

Submitted by **CHRISTINE STRUSSMANN**, Rua Antonio Dorileo 508, Apartado 34, Residencial Coxiponês, COOPHEMA, 78085-600 Cuiabá, Mato Grosso, Brazil.

PHRYNOHYAS IMITATRIX (Rio Golden-eyed Treefrog). BRAZIL: RIO GRANDE DO SUL: Municipio São Francisco de Paula: Centro de Pesquisas e Conservação da PUCRS (Pró-Mata, 29°30'S, 50°10'W). 1000 m. 19 December 1996. Axel Kwet. Museu de Ciências da PUCRS (MCP 2422). Verified by Andreas Schlüter. First record for Rio Grande do Sul and second species of the genus *Phrynohyas* in the state. The female specimen was found after heavy rains on a road in the forest of Pró-Mata Reserve.

Submitted by **AXEL KWET**, Zoologisches Institut der Universität Tübingen, Lehrstuhl für spezielle Zoologie, Auf der Morgenstelle 28, D-72076 Tübingen, Germany.

PHYLLOMEDUSA TARSIUS (Brownbelly Leaf Frog). VENEZUELA: PORTUGUESA: Distrito Guanare: 23 km NW Guanare on road to Biscucuy (90°09'N; 69°53'W), 360 m. 18 November 1990 (2200 h). Allan L. Markezich and Donald C. Taphorn. Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora, Coleccion de Anfibios, Museo de Ciencias Naturales (MCNG 2527). Verified by William E. Duellman. First record from Portuguesa and the second documented specimen as well as the northernmost and highest elevational record from western Venezuela. It was collected ca. 220 km NNE of the first western Venezuelan record, which was from the state of Barinas (La Marca 1996, Herpetol. Rev. 27:149). Only one other specimen is known from Venezuela—in the state of Bolivar in the eastern region of the country (La Marca, *op. cit.*).

Submitted by **ALLAN L. MARKEZICH**, Department of Natural Sciences and Engineering, Black Hawk College, Moline, Illinois 61265-5899, USA.

PHYSALAEMUS AGUIRREI. BRAZIL: BAHIA: Caravelas (17°43'S, 39°15'W). 9 April 1997. Monique Van Sluys. Museu Nacional do Rio de Janeiro (Cat. No. 18916). Verified by José Perez Pombal Jr. Individuals were collected using pitfalls with drift fences set in Restinga vegetation. Known only from type locality (Atlantic Rainforest in Linhares, Espírito Santo; Duellman 1993, Univ. Kansas, Mus. Nat. Hist. Spec. Publ. 21:1–372). First record for state of Bahia; extends range ca. 600 km northward from type locality, and represents the northernmost record for the species.

Submitted by **MONIQUE VAN SLUYS**, Setor de Ecologia, DBAV, IB, Universidade do Estado do Rio de Janeiro, 20550-013, Rio de Janeiro, Rio de Janeiro, Brazil. e-mail: vansluys@uerj.br.

PHYSALAEMUS CROMBIEI. BRAZIL: BAHIA: Nova Viçosa (17°53'S, 39°22'W). 7 April 1997. Monique Van Sluys. Museu Nacional do Rio de Janeiro (Cat. Nos. 19035–19038). Verified by José Perez Pombal Jr. Individuals were collected using pitfalls with drift fences set in Atlantic Rainforest. Known only from type locality (Santa Tereza, Espírito Santo; Duellman 1993, Univ. Kansas, Mus. Nat. Hist. Spec. Publ. 21:1–372). First record for state of Bahia; extends range ca. 600 km northward from type locality, and represents the northernmost record for the species.

Submitted by **MONIQUE VAN SLUYS**, Setor de Ecologia, DBAV, IB, Universidade do Estado do Rio de Janeiro, 20550-013, Rio de Janeiro, Rio de Janeiro, Brazil; e-mail: vansluys@uerj.br.

RANA BLAIRI (Plains Leopard Frog). USA: TEXAS: KENT CO: jct. Texas Rt. 208 and the Double Mountain Fork of the Brazos River. 23 August 1997. Kenneth G. Ostrand, David J. Echels, Warren C. Conway, Jarrod DePew, Gregory D. Pleasant. Museum of Texas Tech University (MTTU 11765). Verified by Ann M. Anderson. County record. One individual observed in riverside pool. Expands range of species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). Previously reported distributions included all surrounding counties except Lynn County to the west.

Submitted by **KENNETH G. OSTRAND, DAVID J. ECHELS, WARREN C. CONWAY, JARROD DEPEW**, and **GREGORY D. PLEASANT**, Department of Range, Wildlife, and Fisheries Management, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125, USA.

RANA FORRERI (Forrer's Grass Frog). MÉXICO: MÉXICO: Municipio de Ixtapan de la Sal: San Alejo (18°50'13"N, 99°43'30"W) 1650 m. 20 November 1994. R. Cruz. Colección Herpetológica del Instituto de Biología, Universidad Nacional Autónoma de México (IBH 11131). Municipio de Santo Tomas de los Platanos: "El llano" (19°10'54"N, 100°14'19"W) 1200 m. 28 August 1995. G. Barrios (IBH 11132). Municipio de Ixtapan del Oro: Camino a la Cascada (19°15'27"N, 100°15'42"W) 1700 m. 29 August 1995. G. Casas (IBH 11133). Municipio de Amatepec: Presa La Cofradia (18°39'39"N, 100°13'47.9"W) 1340 m. 7 November 1995. X. Aguilar (IBH 11135). Municipio de Tejupilco: 4 km al N de Bejucos, Rio el Salto (18°46'44.4"N, 100°25'30.3"W) 1726 m. 7 December 1996. R. Cruz. (IBH 11134). Municipio de Malinalco: Km 3, carr. Chalma-Malinalco (18°54'52"N, 99°27'52"W) 1560 m. 13 May 1979. J. L. Camarillo (IBH 3244–47). Municipio de Tejupilco: 1–3 km al E de Bejucos (18°46'30"N, 100°25'30"W) 520 m. 25 June 1982. A. Ramirez y E. Ramos (IBH 3915). Verified by Fausto R. Méndez de la Cruz. First records for the state of México. (Camarillo and Smith 1992, Greater Cinncinatti Herpetol. Soc. Contr. Herpetol. [1]:39–41).

Submitted by **GUSTAVO CASAS-ANDREU**, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado

Postal 70-153, 04510 México, Distrito Federal, México, and **GABRIEL BARRIOS QUIROZ** and **RICARDO CRUZ AVINA**, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario 100, 50000 Toluca, Estado de México, México.

RANA SPHENOCEPHALA UTRICULARIUS (Southern Leopard Frog). USA: TEXAS: Rockwall Co: Rt. 205, ca. 2 mi S of Rockwall at 0930 h during heavy rain. AOR. 19 May 1997. C. J. Franklin. University of Texas at Arlington Collection of Vertebrates (UTA A-51506). Verified by R. L. Gutberlet. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp).

Submitted by **CARL J. FRANKLIN**, Department of Herpetology, Dallas Zoo, 650 South R. L. Thorton Freeway (I-35), Dallas, Texas 75203, USA.

SPEA BOMBIFRONS (Plains Spadefoot). USA: COLORADO: Saguache Co: wetlands on S side of -E- Road, 3 km E 63 Road. 23 June 1997. M. B. Wunder. UCM 58813–14; 2 km N Weisman Lake. 27 July 1997. M. B. Wunder. UCM 58806. All verified by Hobart M. Smith. First county records (Livo et al. 1997, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. 1997 Interim Summary. Publ. Colorado Herpetol. Soc.).

Submitted by **MICHAEL B. WUNDER**, **JEREMY L. SIEMERS**, and **ANNE E. OCHS**, Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado 80523, USA.

TESTUDINES

APALONE SPINIFERA ASPERA (Gulf Coast Spiny Softshell). USA: GEORGIA: Lanier Co: Alapaha River, ca. 2.5 km downstream from Georgia Rt. 37 bridge, 31°01'16"N, 83°02'02"W. 5 June 1997. John B. Jensen and William Whitesell. UGAMNH 36540. Verified by M. Elizabeth McGhee. Juvenile male captured in a baited hoop-trap set overnight. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712), and although unvouchered records exist for Berrien and Irwin counties, Georgia (Knepton 1956, J. Tennessee Acad. Sci. 31[4]:322–324), this also represents the first confirmed record for the entire Suwannee River drainage (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

CYCLEMYS DENTATA (Asian Leaf Turtle). INDONESIA: KALIMANTAN BARAT: Kalimantan Timur: Upper reach of Belayan River at Sungai Durian, ca. 50 km upstream from Tabang. 15 August 1996. I. Gyurján. Hungarian Natural History Museum (HNHM 97.1.1). Verified by U. Fritz. First record for East Kalimantan Province, ca. 750 air km NE of the only documented locality in Indonesian Borneo (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana, 363 pp.).

Submitted by **BALÁZS FARKAS** and **ISTVÁN GYURJÁN**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary.

ERETMOCHELYS IMBRICATA (Hawksbill). USA: FLORIDA: Monroe Co: Key West National Wildlife Refuge, Marquesas Keys, 24°34'1"N, 82°10'0"W, ca. 35 km W Key West. UF 105430–31. Verified by Anne Meylan. Nest found on 22 December 1995 was excavated on 30 March 1996 and contained 146 eggs (6 dead hatchlings, 140 unhatched eggs). Unhatched eggs with well-developed embryos collected for species confirmation. First nesting record for Marquesas Keys (Anne Meylan, pers. comm).

Submitted by **THOMAS J. WILMERS**, National Key Deer Refuge, P.O. Box 430510, Big Pine Key, Florida 33043, USA, and **ELAINE M. WILMERS**, 30246 Watson Boulevard, Big Pine Key, Florida 33043, USA.

KINOSTERNON BAURII (Striped Mud Turtle). USA: GEORGIA: Glynn Co: Jekyll Island, Georgia Rt. 50 (Beachview Drive), 0.5 mi S from Georgia Rt. 50/US Rt. 520 jct. (31°02'78"N, 81°24'51.2"W). 12 May 1997. Michael Frick. Savannah Ogeechee Canal Museum and Nature Center (SOCM 0344). Verified by Robert A. Moulis. New county and island record (Williamson and Moulis 1993, Savannah Sci. Mus. Publ. 3:1–712; R. A. Moulis, unpubl. data). CCL= 1.9 cm. CCW= 1.5 cm. Turtle was found dead on road apparently emerging from adjacent fresh water slough. Caruncle or egg tooth present and still showing an unhealed plastron from yolk sac absorption.

Submitted by **MICHAEL G. FRICK**, Caretta Research Project, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

KINOSTERNON FLAVESCENS FLAVESCENS (Yellow Mud Turtle). USA: COLORADO: Bent Co: Purgatoire River State Wildlife Area, SW 1/4 of NW 1/4 Sec. 27, T23S, R52W. 21 June 1995. Michelle D. Keefer and Steven D. Keefer. UCM Ancillary Herpetological Photographic Collection 134–136. Verified by Hobart Smith, David Chiszar, Geoffrey Hammerson, and Lauren Livo. First county record (Livo et al. 1997, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records: 1997 Interim Summary. Publ. Colorado Herpetol. Soc.).

Submitted by **STEVEN D. KEEFER** and **CHARLES W. LOEFFLER**, Colorado Department of Natural Resources, Division of Wildlife, 6060 Broadway, Denver, Colorado 80216, USA.

NOTOCHELYS PLATYNOTA (Malayan Flatshell Turtle). INDONESIA: KALIMANTAN BARAT: Kalimantan Timur: Upper reach of Belayan River at Sungai Durian, ca. 50 km upstream from Tabang. 15 August 1996. I. Gyurján. Hungarian Natural History Museum (HNHM 97.2.1); slides of another specimen also deposited in HNHM. Verified by J. R. Buskirk. Extends range by ca. 400 air km SW and 325 air km E of nearest documented localities in Indonesian Borneo, and is possibly the first record for East Kalimantan Province (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana, 363 pp.).

Submitted by **BALÁZS FARKAS** and **ISTVÁN GYURJÁN**, Department of Zoology, Hungarian Natural History Museum, Pf. 137, H-1431 Budapest, Hungary.

PSEUDEMYS CONCINNA SUWANNIENSIS (Suwannee River Cooter). USA: GEORGIA: Lowndes Co: Withlacoochee River near Knights Ferry Landing, 30°42'42"N, 83°27'17"W. 13 June 1997. John B. Jensen and Robert Moulis. UGAMNH 36539. Verified by Dale R. Jackson. Adult captured in a baited hoop-trap overnight. First state record for this subspecies. (Williamson and

Moulis 1994, Savannah Sci. Mus. Publ. 3:1–712). More than 20 individuals of various size classes were observed basking on logs and rocks in the Withlacoochee River, and a similar number were also observed in the Alapaha River (5 June 1997) in both Lanier and Echols counties. Previously this species was unknown from the Georgia portion of the Suwannee River drainage (of which the Withlacoochee and Alapaha rivers are a part) as well as from its more northerly reaches within Florida (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

LACERTILIA

CNEMIDOPHORUS UNIPARENS (Desert Grassland Whiptail). USA: NEW MEXICO: Cibola Co: 49 km S and 1 km W Laguna, S Sec. 8, T4N, R5W. 29 July 1991. William G. and Paula B. Degenhardt. University of New Mexico Museum of Southwestern Biology (MSB 52807). Verified by James N. Stuart. New record for county and another record of sympatry with *C. velox*. Location is illustrated in Degenhardt et al. (1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.) as Habitat Photo Figure 9.

Submitted by **WILLIAM G. DEGENHARDT**, Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

CYCLURA CYCLURA FIGGINSI (Exuma Island Ground Iguana). BAHAMAS: Exuma Island Chain: Leaf Cay. 0.5 km NE Norman's Pond Cay, 23°47'19"N, 76°07'90"W. 28 March 1997. Chuck Knapp. Two specimens photographed (UF 107144, unsexed adult, UF 107145, adult male). Verified by David L. Auth. First record for Leaf Cay; nearest recorded population inhabits North Adderly Cay, 0.4 km north of Leaf Cay. Augments documentation by Schwartz and Henderson (1988, West Indian Amphibians and Reptiles: A Checklist. Publ. Milwaukee Pub. Mus., Milwaukee, Wisconsin. 264 pp.)

Submitted by **CHUCK KNAPP**, Department of Conservation, John G. Shedd Aquarium, Chicago, Illinois 60605, USA, and **SANDRA BUCKNER**, P.O. Box N8893, Nassau, The Bahamas.

GECKONIA CHAZALIAE (Helmethead Gecko). A correction. MAURITANIA. Schleich et al. (1996, Amphibians and Reptiles of North Africa. Koeltz Scientific Publ. ii + 630 pp: map page 235) show *G. chazaliae* as occurring continuously throughout the coastal area of Mauritania. This continuous distribution differs from previous interpretations which recognize *G. chazaliae* present only at Cape Blanc (21°07'97/100N, 16°57'45/100W), the type locality of this species, and then appearing further south in Senegal. This distributional hiatus is approximately 500 km wide. Our recent surveys in this gap have not found any specimens of this species nor do any exist in any European museums.

Submitted by **IVAN INEICH**, Muséum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles & Amphibians), 25 rue Cuvier, F-75005 Paris, France (e-mail: ineich@cimrs1.mnhn.fr), **AMADOU TIDIANE DIA** and **BOCAR ALPHA LY**, Centre National d'Elevage et de Recherches Vétérinaires, BP 167, Nouakchott, Islamic Republic of Mauritania, and **FRANCOIS COLAS**, CIRAD-EMVT, Département d'Elevage et de Médecine Vétérinaire du CIRAD, BP 5035, F-34032 Montpellier Cedex 1, France.

HEMIDACTYLUS FRENATUS (House Gecko). MÉXICO: MÉXICO: Municipio de Tejupilco: Bejucos (18°46'30"N, 100°25'30"W), 600 m. 1 May 1997. R. Cruz and G. Barrios. Colección Herpetológica del Instituto de Biología, Universidad Nacional Autónoma de México (IBH 11262). Verified by Adrian Nieto Montes de Oca. First state record (Camarillo and Smith 1992, Greater Cincinnati Herpetol. Soc. Contr. Herp. 1:39–41).

Submitted by **GUSTAVO CASAS-ANDREU**, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, 04510 México, Distrito Federal, México, **GABRIEL BARRIOS QUIROZ** and **RICARDO CRUZ AVINA**, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario 100, 50000, Toluca, Estado de México, México.

LAEMANCTUS SERRATUS SERRATUS (Serrated Casquehead Iguana). MÉXICO: PUEBLA: municipality of Heuhuetla: Sierra Norte near Huehuetla (20°6'N, 97°37'W), 14 km NW Cuetzalan del Progreso, 460 m. 10 January 1996. Enrique Martínez Romero. Captured in disturbed tropical rain forest (INEGI 1987, Síntesis Geográfica, Nomenclator y Anexo Cartográfico del Estado de Peubla, Carta de Vegetación). Laboratorio de Herpetología, Escuela de Biología, Universidad Autónoma de Puebla (EBUAP-481). Verified by Adrián Nieto Montes de Oca. First record for the state and extends range 127 km (airline) SW from the closest known locality in Veracruz (Tamiahua) (McCoy 1968, Copeia 1968:665–678).

Submitted by **LUIS CANSECO-MARQUEZ** and **QUADALUPE GUTIERREZ-MAYEN**, Laboratoria de Herpetología, Escuela de Biología, Universidad Autónoma de Puebla, Ciudad Universitaria, Edificio 76, Blvd. Valsequillo y Avenida San Claudio, Col. San Manuel, CP. 72570, Puebla, Puebla, México.

NEUSTICURUS ECPLEOPUS. BRAZIL: PARA: Municipio de Paragominas: Fazenda Cauaxi (03°45'S, 48°25'W). 21–30 June 1997. Juliana M. da Silveira, Celso B. Miranda and Claudia Azevedo-Ramos. Museu Paraense Emilio Goeldi (MPEG 17940–44). Verified by Rubens Nobuo Yuki. Specimens collected in small streams ("igarapes") in primary forest. Extends the range ca. 380 km N from previous known locality in southeastern Para (Avila Pires 1995, Zool. Verch. 299:427–436) and represents the the easternmost range limit in Amazonia.

Submitted by **JULIANA M. DA SILVEIRA, CELSO B. MIRANDA**, and **CLAUDIA AZEVEDO-RAMOS**, DPE/Centro de Filosofia e Ciencias Humanas, Universidade Federal do Para, 66070-100 Belem, Para, Brazil. e-mail: claudia@ufpa.br.

SAUROMALUS OBESUS OBESUS (Western Chuckwalla). USA: NEVADA: Nye Co: ca. 100 m S of unpaved road (unmarked), 3 km off Rt. 95, 1.2 km SE of the Esmeralda County line (37°25'30.7"N; 117°08'09.5"W; 1451 m). 6 September 1997. R. E. Espinoza and C. A. Carreño. University of Nevada, Reno Vertebrate Museum, Herpetological Collection (UNR 5125). Verified by Bradford D. Hollingsworth. Represents the northernmost known locality in Nevada and extends the range ca. 30 km N (airline) from the closest reported locality near Bonnie Claire Flat in Esmeralda County (Ustach 1997, Herpetol. Rev. 28:158). Chuckwallas also were collected on isolated rock outcrops at two sites between the new and previously reported northern records: (UNR 5124) ca. 1 km off the N side of Rt. 267, ca. 10 km W of Scotty's Junction (37°09'30"N, 117°10'40"W, ca. 1200 m), and (UNR 5123) at Stonewall Pass, 6.6 km S of the Esmeralda County line on Rt. 95 (37°23'09"N, 117°08'29"W, 1512 m). These records

partially fill the gap between the Bonnie Claire Flat locality and the new northernmost record. In each case, these chuckwallas were found at elevations above those typically recorded for the species. This is especially noteworthy given their high latitudinal distribution.

Submitted by **ROBERT E. ESPINOZA**, Biological Resources Research Center, and Ecology, Evolution, and Conservation Biology/314, University of Nevada, Reno, Reno, Nevada 89557-0015, USA, **CARRIE A. CARREÑO** Nevada Natural Heritage Program, 1550 East College Parkway, Suite 145, Carson City, Nevada 89706-7921, USA, **CHRISTOPHER R. TRACY**, Department of Zoology, University of Wisconsin, Madison, Wisconsin 53706, USA, and **C. RICHARD TRACY**, Biological Resources Research Center, and Ecology, Evolution, and Conservation Biology/314, University of Nevada at Reno, Reno, Nevada 89557-0015, USA.

SCELOPORUS ARENICOLUS (Dunes Sagebrush Lizard). USA: TEXAS: GAINES Co: shinnery dunes, ca. 0.1 air mi N jct Andrews/Gaines County line with New Mexico border, 32°31.435'N, 103°03.860'W. TAMU 77834. (male, 58 mm SVL, 60 mm tail [regenerated]); ca. 12 air mi S and 4.55 air mi E Hobbs, New Mexico, 32°31.435'N, 103°03.860'W. TAMU 77835 (male, 63 mm SVL, 47 mm tail [regenerated]). Both specimens 21 June 1997 by Charles W. Painter and Don Sias. Verified by A. M. Snyder. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game & Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **DON S. SIAS**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

SCELOPORUS CHANEYI (Chaney's Spiny Lizard). MÉXICO: TAMAULIPAS: Prov. Miquihuana: 12 km on road from La Pena to Valle Hermoso, 2550 m, in oak forest. 13 March 1996. TCWC 77268 (female); Joya Pelone, 21 km on road from La Pena to Villa Hermoso, 2880 m, in pine forest. 9 April 1996. TCWC 77269 (male), TCWC 77270 (female); El Aserradero, 15 km on road from La Pena to Villa Hermoso, 2640 m, in pine forest. 13 March 1996. TCWC 77271 (female). All specimens collected by Xochitl Sampablo-Brito and verified by Ernest Liner. Range extension of ±24 km S of summit of Sierra de la Gloria (CAS 165250–252), near the Nuevo Leon/Tamaulipas state line.

Submitted by **XOCHITL SAMPABLO-BRITO**, Universidad de Tamaulipas, Cuidad Victoria, Tamaulipas, Mexico, and **JAMES R. DIXON**, 705 Inwood Drive, Bryan, Texas 77802, USA.

TARENTOLA MAURITANICA (Common Wall Gecko). USA: CALIFORNIA: SAN DIEGO Co: 1.5 km S El Cajon city limits in a private residential community (32°46'15"N, 116°56'02" W), 200 m. 8 September 1997. Mike Sloop. San Diego Natural History Museum (SDSNH 68675). Verified by L. L. Grismer. An adult female 56 mm SVL (5.5 g) with ovarian eggs in right ovary. Several individuals were detected by the property owners in March 1996, one month after moving to the neighborhood. On the evening of 23 September 1997, I counted 10 individuals (7 adults, 3 hatchlings). Adults were extremely wary and observed near lights at the top of stucco walls and rafters on two buildings. Geckos were found on residential buildings 0.2 km from the core area, and populations >20 individuals have been observed. A resident said that a local pet shop sold this species and other exotic reptiles. It is unclear when the introduction occurred. The colony has survived at least two successive winters (1995–1996). This lizard is expected to expand its range from this localized site in San Diego area. Previously introduced in New Jersey via cork bark shipments from the Mediterranean region, but attempts to colonize were unsuccessful (Conant 1945, Copeia 1945:233). New state record and first record of a breeding population in the United States.

Submitted by **CLARK R. MAHRDT**, Herpetology Department, San Diego Natural History Museum, P.O. Box 1390, San Diego, California 92112, USA.

VANZOSAURA RUBRICAUDA. ARGENTINA: LA RIOJA: Department Chilecito: Chilecito (29°10'S, 67°30'W). July 1990. Guillermo Gnida. Herpetological collection of the Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina (MACN 33499); Department Capital: Dique Los Sauces, 22 km W La Rioja (29°25'S, 66°51'W). 7 October 1965. Emilio Maury. MACN 25153. All verified by Ricardo A. Martori. Extends range ca. 250 km air line NW from previous and vouchered citation in La Rioja province (Gallardo 1951, Com. Inst. Nac. Invest. Cs. Nat. Cs. Zool. Tomo II[1]:1–8).

Submitted by **LUCIANO JAVIER AVILA**, Centro Regional de Investigaciones La Rioja (CRILAR), Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICET), Anillaco, La Rioja, Argentina.

XENOSAURUS NEWMANORUM (Xenosauro de Newman, Newman's Knob-scaled Lizard). MÉXICO: VERACRUZ: La Selva, 7.2 km E Huayacocotla (20°34'07"N, 98°30'17"W), 2000 m. 29 May 1991. Jose L. Camarillo R. Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México (ENEPI 3884). Verified by Jonathan A. Campbell. Found on the ground in pine forest. First record for Veracruz (Smith and Smith 1976, Synopsis of the Herpetofauna of Mexico, Vol. 3. John Johnson, North Bennington, Vermont), and extends the range 103 km SE from type locality in Xilitla region, San Luis Potosí (King and Thompson 1968, Bull. Florida St. Mus. 12:93–123.

Submitted by **JOSE L. CAMARILLO R.**, Laboratorio de Herpetología, CYMA UIICSE, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México, A.P. 314, Tlalnepantla, México.

SERPENTES

ARIZONA ELEGANS (Eastern Glossy Snake). USA: NEW MEXICO: GUADALUPE Co: 27.2 km SE of Santa Rosa, DOR. 26 September 1965. P. B. and W. G. Degenhardt. University of New Mexico Museum of Southwestern Biology (MSB 13821). Verified by Don S. Sias. First record for county (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **WILLIAM G. DEGENHARDT** and **JAMES N. STUART**, Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

CHERSODROMUS LIEBMANNI (Leibmann's Earth Runner). MÉXICO: OAXACA: Municipality of Totontepec Villa de Morelos, Totontepec (17°15'N, 96°01'W), 1840 m. 26 March 1992. José Luis Camarillo Rangel. Colección Herpetología, Escuela Nacional de Estudios Profesionales Iztacala, Universidad Nacional Autónoma de México (ENEPI 04593). Verified by Aurelio

Ramírez Bautista. Second record for the state and extends range 99 km SE (straight line) from Peña Verde, Oaxaca (Canseco and Flores 1995, Herpetol. Rev. 26:109).

Submitted by **MARIO MANCILLA-MORENO**, Laboratorio de Herpetología, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, C.U. 04510, México 20, Distrito Federal, México, and **JOSE LUIS CAMARILLO RANGEL**, Laboratorio y Colección de Herpetología, CyMA, Escuela Nacional de Estudios Profesional Iztacala, Universidad Nacional Autónoma de México, Apartado Postal 314, Tlalnepantla, Estado de México, México.

CHIRONIUS FLAVOLINEATUS (Cobra-cipó, Boettger's Sipo). BRAZIL: AMAZONAS: HUMAITÁ: Escola Agrotécnica Humaitá (7°31'S, 63°02'W). 9 November 1991. Guarino R. Colli. Colecão Herpetológica da Universidade de Brasília (CHUNB 00217–218). AMAPÁ: FERREIRA GOMES: Fazenda Teimoso (1°02'06"N, 51°10'02"). 17 April 1997. Guarino R. Colli and Ayrton K. Péres Jr. CHUNB 00219. All verified by Nelson Jorge da Silva Jr. First records for the states of Amapá and Amazonas; both sites in Amazonian Savanna habitats; extends range ca. 250 km NW from previous northern limit of distribution [Ilha de Marajó; Dixon et al. 1993, Revision of the Neotropical Snake Genus *Chironius* Fitzinger (Serpentes, Colubridae). Monographie XIII, Museo Regionale di Scienze Naturali, Torino. 279 pp.] and ca. 800 km N of western limit of distribution (central Bolivia, *ibid.*).

Submitted by **GUARINO R. COLLI** and **AYRTON K. PÉRES JR.**, Departamento de Zoologia, Universidade Brasília, 70910-900, Brasília, Distrito Federal, Brazil; e-mail (GRC): grcolli@guarany.cpd.unb.br.

CLONOPHIS KIRTLANDII (Kirtland's Snake). USA: KENTUCKY: GRAVES CO: on Bellville Road, 0.1 km W jct. with Kentucky Rt. 97. 14 July 1997. Collected by Scott Shupe. Department of Biology, Murray State University (MSU 1451). Verified by Ed Zimmerer. This locality is ca. 150 km SW of the closest known site and is in the Terrepene Creek drainage, a tributary of the Obion River system which drains most of west Tennessee to the Mississippi River.

Submitted by **SCOTT SHUPE**, Woods & Wetlands Wildlife Center, P.O. Box 469, Cadiz, Kentucky 42211, USA, and **ED ZIMMERER**, Department of Biological Sciences, Murray State University, Murray, Kentucky 42071, USA.

DASYPELTIS ATRA (African Egg-eating Snake). TANZANIA: RUKWA REGION: Mbizi Forest Reserve, 7°53'36"S, 31°40'32"E, 2250 m. January 1997. Mogens Andersen. Zoological Museum, University of Copenhagen (ZMUC R6122). Verified by Jens Bødtker Rasmussen (following Broadley and Howell 1991, Syntarsus 1:1–70). Previously only known in Tanzania from the northern part of the country; Bukoba and Mt. Klimanjaro (Broadley and Howell 1991, *op. cit.*). This new locality is situated 550 km (airline) from the previous southernmost locality, Mt. Kabobo on the NW coast of Lake Tanganyika in The Democratic Republic of Congo (Laurent 1956, Ann. Mus. Roy. Congo Belge, Sér. 8 , Sci. Zool., Vol. 48).

Submitted by **PETER GRAVLUND, ANDERS BERGGREEN,** and **MOGENS ANDERSEN**, The Zoological Museum, 1 Department, Herpetological Section, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen, Denmark.

HETERODON PLATIRHINOS (Eastern Hognose Snake). USA: WISCONSIN: ASHLAND CO: Rt. 2 km N of Prentice Park, Sec. 6, T47N, R4W. 9 September 1997. Seth Ames. Verified by Robert W. Henderson. MPM 30244. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Public Mus., Milwaukee, Wisconsin. 87 pp.). Extends range ca. 45 km NE of nearest records mapped by Vogt (1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee, Wisconsin. 205 pp.), and represents a departure from the bulk of records in NW Wisconsin, which fall within the Omega, Vilas soil region, characterized by sand barrens of jack pine and scrub oak (Hole 1980, Soil Guide for Wisconsin Landlookers. Publ. Geol. Nat. Hist. Surv., Univ. Wisconsin-Ext., Madison. 66 pp.). This occurrence was from a sandy lacustrine soil along Lake Superior, rather than within the red clay soils of the surrounding landscape.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA, and **SETH AMES**, Northland College, Ashland, Wisconsin 54806, USA.

HYPSIGLENA TORQUATA DESERTICOLA (Desert Night Snake) USA: IDAHO: NEZ PERCE CO: Salmon River, UTM Zone 11. 519300E, 5089605N (m)(NAD27). 16 June 1995. Robin L. Llewellyn. Idaho Museum of Natural History (IMNH 1482). Verified by Charles R. Peterson. Found underneath a piece of driftwood along the Salmon River beach on Craig Mountain. In July 1996, two more snakes were located along the Salmon River, one underneath a piece of driftwood and the other caught in a funnel trap. New county record (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press, Moscow. 332 pp.).

Submitted by **ROBIN L. LLEWELLYN**, Department of Biological Sciences, Idaho State University, Campus Box 8007, Pocatello, Idaho 83209, USA.

LAMPROPELTIS CALLIGASTER (Prairie Kingsnake). USA: TEXAS: ROCKWALL CO: Rt. 205. ca. 1.5 mi S Rockwall. DOR. 19 May 1997. C. J. Franklin. University of Texas at Arlington Collection of Vertebrates (UTA R-42502). Verified by C. L. Stewart. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp).

Submitted by **CARL J. FRANKLIN**, Department of Herpetology, Dallas Zoo, 650 South R. L. Thorton Freeway (I-35), Dallas, Texas 75203, USA.

LAMPROPELTIS GETULA CALIFORNIAE (California Kingsnake). USA: NEW MEXICO: SAN JUAN CO: San Juan River, ca. 7.6 km upstream (S) of confluence with Mancos River, 36°55'34.7"N, 108°57'26.3"W. 17 August 1997. Stephen R. Davenport. University of New Mexico Museum of Southwestern Biology (MSB 60810). Verified by W. G. Degenhardt. Found ca. 30 m from river in Cottonwood-Russian Olive grove at 2030 h. First record of this subspecies in New Mexico (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.). Extends range S from adjacent Montezuma County, Colorado, in San Juan River basin (Hammerson et al. 1991, Herpetol. Rev. 22:67).

Submitted by **STEPHEN R. DAVENPORT, JAMES N. STUART**, and **DONALD S. SIAS**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131-1091, USA.

LAMPROPELTIS TRIANGULUM CELAENOPS (New Mexico Milk Snake). USA: NEW MEXICO: GUADALUPE CO: U.S. Rt. 285 at S edge of Vaughn city limits (male, 420 mm SVL, 70 mm tail) KU Color Slide 11249; U.S. Rt. 285, ca. 2.5 mi (by road) S Vaughn (male, 330 mm SVL, 55 mm tail) KU Color Slide 11250. Both specimens collected 12 June 1997 by Brian Hubbs. Verified by J. E. Simmons. New county record (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **BRIAN HUBBS**, Box 802, Oakhurst, California 93644, USA.

LAMPROPELTIS TRIANGULUM TRIANGULUM (Eastern Milk Snake). USA: ILLINOIS: OGLE CO: 5 km W Oregon (SW 1/4 Sec. 4, T23N, R10E). 9 September 1997. Gaylen W. Parker. HDW-NIU 1667–1668. Verified by Richard King. New county record; range extension of 50 km between Winnebago and Dekalb County records (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY, ALEJANDRO QUERAL-REGIL,** and **TONYA BITTNER**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

MASTICOPHIS MENTOVARIUS MENTOVARIUS (Neotropical Whipsnake). MÉXICO: TABASCO: 18 km E Frontera. 7 September 1976. Diderot F. Gicca. UF 42337. Verified by F. Wayne King. First record for the state, bridging a coastal gap of over 500 km between records for southern Veracruz and central Campeche (Johnson 1982, Cat. Am. Amph. Rept. 295:1–4).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA; **DAVID CHISZAR, HOBART M. SMITH** and **FRANK VAN BREUKELEN**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

NERODIA TAXISPILOTA (Brown Water Snake). USA: NORTH CAROLINA: NASH CO: 12.8 km N Rocky Mount, Swift Creek at U.S. Rt. 301 (36°04.687'N, 77°44.917'W). 25 June 1996. Jeanne Serb, Thomas Near, Mark Sabaj and Jonathan Armbruster. Illinois Natural History Survey (INHS 12638). Verified by Christopher A. Phillips. New county record (Palmer and Braswell 1995, Reptiles of North Carolina. Univ. North Carolina Press, Raleigh. xiii + 412 pp.).

Submitted by **JEANNE M. SERB** and **JOHN E. PETZING**, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

PHILODRYAS OLFERSII (Lichtenstein's Green Racer). ARGENTINA: SANTA FE PROVINCE: La Capital Department: bank of Clucellas Island, Santa Fe stream (31°39'S, 60°42'W). 25 September 1997. Ambrosio Regner. Instituto Nacional de Limnología, Santa Fe (INALI 176, adult female). Verified by Alejandro R. Giraudo. First province record and the southwesternmost known population. Species previously known from Chaco, Corrientes, Entre Ríos, Formosa, Jujuy, Misiones, and Salta provinces in Argentina (Williams and Francini 1991, Boll. Mus. Reg. Sci. Nat. Torino 9[1]:75; Cei 1993, Mus. Reg. Sci. Nat. Torino Monogr. 14:637–638). The specimen was captured on a tree in the subtropical gallery forest in the alluvial valley of the Parana River.

Submitted by **ROQUE O. QUAINI**, Subsecretaría de Medio Ambiente y Ecología, Patricio Cullen 6161, 3000 Santa Fe, Argentina, and **VANESA ARZAMENDIA**, Instituto Nacional de Limnología (CONICET), José Macia 1933, 3016 Santo Tomé, Santa Fe, Argentina.

PHILODRYAS VIRIDISSIMUS (Common Green Racer). BRAZIL: BAHIA: Porto Seguro, Fazenda Vera Cruz (16°20'S, 39°10'W, 90 m). 14 November 1994. R. P. Silva. Instituto Butantan (IB 57195). Verified by Hebert Ferrarezzi. The species was known from the Amazonian forest of northern South America; its occurence in the Atlantic forest of eastern South America was uncertain (Thomas 1976, unpubl. Doctoral Dissertation, Texas A&M University, College Station). First record from Atlantic forest; extends distribution eastward.

Submitted by **OTAVIO A. V. MARQUES** and **FRANCISCO L. FRANCO**, Laboratorio de Herpetologia, Instituto Butantan, Avenida Vital Brasil, 1500, CEP 05503-900, São Paulo, São Paulo, Brazil.

PSEUDABLABES AGASSIZII. BRAZIL: MINAS GERAIS: Serra do Cipó (19°20'S, 43°44'W), ca. 1200 m, near Km 108 of MG-010 Road. 31 January 1997. Mara Cíntia Kiefer. Museu de História Natural da Universidade Estadual de Campinas (ZUEC 2075, female 256 mm SVL, 73 mm TL, 9.0 g body mass). Verified by Paulo R. Manzani and Ivan Sazima. Found while moving on the ground at 1200 h. Distribution known for southern and southwestern Brazil, northeastern Argentina, and Uruguay (Peters and Orejas-Miranda 1970, U.S. Natl. Mus. Bull. 297:252). First documented record for Minas Gerais; extends range of species eastward into southeastern Brazil.

Submitted by **MARA CÍNTIA KIEFER**, Museu de História Natural, Instituto de Biologia, Universidade Estadual de Campinas, Caixa Postal 6109, 13081-970 Campinas, São Paulo, Brazil.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). MÉXICO: DISTRITO FEDERAL: Delegación Alvaro Obregón, San Angel (99°12'N, 19°18'W). 13 June 1995. Zeferino Uribe. Colección Nacional de Anfibios y Reptiles (CONAR), Instituto de Biología, Universidad Nacional Autónoma de México (IBH 11281). Verified by Fernando Mendoza Quijano. First record for the district. Specimen was found in crop soil in a garden. Closest state where species was previously known is Morelos (Dixon and Hendricks 1979, Zoologische Verhandelingen 173:1–39).

Submitted by **MARIO MANCILLA-MORENO** and **AURELIO RAMIREZ-BAUTISTA**, Laboratorio de Herpetología, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, C.U. 04510, México 20, Distrito Federal, México.

SALVADORA GRAHAMIAE (Mountain Patchnose Snake). USA: NEW MEXICO: TORRANCE CO: DOR, U.S. Rt. 60, 17.7 km E jct. New Mexico Rt. 47, ca. 14.5 km SW Mountainair. 9 October 1997. Bruce L. Christman and Sandra L. Kilpatrick. University of New Mexico Museum of Southwestern Biology (MSB 60991). Verified by Donald S. Sias. VALENCIA CO: Lovelace Ranch, W of Los Lunas [ranch headquarters are ca. 32 km W and 13 km S Los Lunas, Sec. 31, T6N, R2W; precise locality not specified in original data]. 17 June 1967. Mike Williamson. MSB 18037. Verified by William G. Degenhardt. Both specimens represent new county records (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.).

Submitted by **BRUCE L. CHRISTMAN**, P.O. Box 180, Jemez Springs, New Mexico 87205, USA, **SANDRA L. KILPATRICK**, 857 Sommerset Drive, Charleston, West Virginia 25302, USA,

CHARLES W. PAINTER, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico 87504, USA, and **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

STORERIA DEKAYI (Brown Snake). USA: WISCONSIN: MARQUETTE Co: 5.6 km W Westfield and just NNW Lawrence Lake dam (35°53.03'N, 89°32.86'W). October 1996. R. Doerscheln. Verified by C. A. Phillips. Illinois Natural History Survey (INHS 12812). New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Milwaukee, Wisconsin. 87 pp.).

Submitted by **JOHN E. PETZING** and **MARK H. SABAJ**, Illinois Natural History Survey, Center for Biodiversity, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, USA, and **RONALD DOERSCHELN**, Westfield, Wisconsin, USA.

TANTILLA HOBARTSMITHI (Southwestern Blackhead Snake). USA: UTAH: CARBON Co: Rock Creek Ranch, Desolation Canyon, about 0.8 km SW of confluence of Rock Creek and Green River. 14 June 1995. Geoffrey Hammerson. UCM Ancillary Collection (Color Slide 139). Verified by Hobart M. Smith. First record for county and Green River drainage (Cox and Tanner 1995, Snakes of Utah. Publ. Brigham Young Univ., Provo, Utah. 92 pp.). Specific identity is based on anterior coloration and geographic considerations; hemipenes were not examined (see Cole and Hardy 1981. Bull. Am. Mus. Nat. Hist. 171:199–284). Two adults were found about 30 cm apart under debris adjacent to an abandoned ranch building on the flat canyon bottom.

Submitted by **GEOFFREY A. HAMMERSON**, The Nature Conservancy, 68 Landing Road, Higganum, Connecticut 06441, USA, and **AUDREY D. BENEDICT**, Cloud Ridge Naturalists, 8297 Overland Road, Ward, Colorado 80481, USA.

THAMNOPHIS SAURITUS SACKENII (Peninsula Ribbon Snake). BAHAMA ISLANDS: NEW PROVIDENCE ISLAND: Maillis Farm, Adelaide. 4 July 1997. Peter Maillis and Gregory Mahomed. Specimen preserved in alcohol and held in Nassau, Bahamas. Two photographs by S. D. Buckner deposited in the Florida Museum of Natural History herpetological collection (UF Cat. Nos. pending). Verified by Paul Moler. This snake represents the first report of this species from the Bahamas. The snake measured 43 cm SVL, 50.3 cm TL (tip of tail missing). Sex was not determined. It was caught at 1630 h in a garden behind the house of Mrs. A. P. Maillis. A similar snake, possibly the same animal, had been seen previously in a nearby pond. This species is common in south Florida. It was reported that a neighbor had imported exotic trees for his yard, and the specimen may have been transported accidentally to the site in the exotic plants. It is believed that the plants had originated in nurseries from south Florida.

Submitted by **SANDRA D. BUCKNER**, The Bahamas National Trust, Nassau, Bahamas, and **RICHARD FRANZ**, Florida Museum of Natural History, P.O. Box 117800, University of Florida, Gainesville, Florida 32611-7800, USA.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). BAHAMA ISLANDS: ABACO: Port of Marsh Harbour. 27 August 1997. Simeon Pinder. Specimen frozen and held in Nassau, Bahamas. Five photographs by S. D. Buckner deposited in the Florida Museum of Natural History herpetological collection (FSU Cat. Nos. pending). Verified by Paul Moler. This snake represents the first record from the Bahamas. It measures 59 cm SVL, 73.3 cm TL. Sex was not determined. The snake apparently had arrived in a shipment of lumber and was crushed as the lumber was being loaded onto trucks. We presume that this common Florida snake accidentally was transported with the lumber from a port in Florida, as most imported commodities entering the Bahamas originate from ports in that state.

Submitted by **SANDRA D. BUCKNER**, The Bahamas National Trust, Nassau, Bahamas, and **RICHARD FRANZ**, Florida Museum of Natural History, P.O. Box 117800, University of Florida, Gainesville, Florida 32611-7800, USA.

Snakes of Santa Rosa County, Florida: Inadequate Sampling and Serendipity

JEFF BOUNDY
Louisiana Department of Wildlife and Fisheries
P.O. Box 98000, Baton Rouge, Louisiana 70898-9000, USA
e-mail: boundy_jj@wlf.state.la.us

and

FRANK BURBRINK
Museum of Natural Science, Louisiana State University
Baton Rouge, Louisiana 70803, USA
e-mail: fburbri@lsuvm.sncc.lsu.edu

Ashton and Ashton (1988) provide distributions by county for all of the snakes of Florida. It is evident from their maps, when compared with species expected to occur in each county (maps in Conant and Collins 1991), that sampling rate for snakes (species recorded/species expected) varies. The four westernmost panhandle counties all appear to have received moderate and equal sampling: observed/expected ratios are 0.73 for Escambia and Okaloosa counties, 0.68 for Santa Rosa County, and 0.70 for Walton County. Snakes that have not been recorded for each county are not necessarily rare species, and it would be expected that surveys for snakes in either of these counties would reveal a majority of recorded species plus a few unrecorded ones. Our field work in Santa Rosa County revealed a disproportionately large number of species new to the county (8 new vs. 12 recorded). Inadequate sampling for Santa Rosa County is evident from the fact that these additional species of snakes were collected in five trips totalling less than 10 field days, bringing the total observed/expected ratio to 0.88. During field work by the authors (and Alec Knight, Armin Meier, Joseph Slowinski, Ashleigh Smythe, and Tonya Snell), two new species, *Nerodia sipedon* and *Crotalus adamanteus*, were observed but not collected. Five expected species, *Nerodia clarkii, Rhadinaea flavilata, Virginia valeriae, Agkistrodon contortrix*, and *Crotalus horridus*, were not observed. The following species are represented by vouchers in the Louisiana State University Museum of Natural Science (LSUMZ). Species identifications were verified by Douglas Rossman.

Elaphe guttata (Corn Snake). Hwy 191, 4.2 mi S Munson. 30 March 1994. J. Boundy and J. Slowinski. LSUMZ 56373.

Heterodon platirhinos (Eastern Hognose Snake). Blackwater State Forest, 1 mi. on Charley Foster Road from jct. with Sandy Landing Road. 2 April 1996. F. Burbrink and J. Slowinski. LSUMZ 57675.

Heterodon simus (Southern Hognose Snake). 9 mi E on road to Riley's Corner from Rt. 191, ca. 6 mi. S Munson. 24 May 1994. J. Boundy and J. Slowinski. LSUMZ 56507.

Lampropeltis calligaster (Prairie Kingsnake). 6 mi SE Munson on Bud Bass Road, 1 mi. E of jct with Bryant Bridge Road. 24 March 1997. F. Burbrink and A. Meier. LSUMZ 58522.

Lampropeltis triangulum (Milk Snake). Rt. 191, 4.2 mi SW Munson. 24 April 1994. J. Slowinski and A. Knight. LSUMZ 56494. Blackwater State Forest near Munson. 1 April 1996. F. Burbrink, J. Slowinski, and A. Smythe. LSUMZ 58161.

Thamnophis sirtalis (Common Garter Snake). 1 mi N Riley's Corner, ca. 10 air mi. SE of Munson. 24 May 1994. J. Boundy and J. Slowinski. LSUMZ 56508.

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New Distributional Records for Reptiles from North Carolina

JEFFREY C. BEANE
North Carolina State Museum of Natural Sciences
P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA
email: jeff_beane@mail.ehnr.state.nc.us

Palmer and Braswell (1995) summarized the geographic distribution of reptiles in North Carolina (USA). I here report additional distributional records, some of which are based on specimens formerly housed in the collections of Duke University and the personal collection of the late Elmer E. Brown, both now on deposit with the North Carolina State Museum of Natural Sciences (NCSM). All specimens were verified by William M. Palmer and Alvin L. Braswell and are deposited at NCSM. New county records and range extensions are based on Palmer and Braswell (1995).

"Previously unvouchered records" are records for counties with previous literature records not supported by voucher specimens.

TESTUDINES

Chelydra serpentina serpentina (Common Snapping Turtle). CRAVEN CO: 5.2 km NNE of Havelock, Cherry Point Marine Base. 20 May 1993. R. R. Swaisgood. NCSM 32595. Previously unvouchered record. Brimley (1915) and Palmer and Braswell (1995) reported sight records for Craven County. FORSYTH CO: 5.5 km ENE of Walkertown. 31 May 1994. J. C. Beane, T. K. Bohannon, D. W. Herman, A. B. Somers, T. J. Thorp, and J. S. Zawadowski. NCSM 36349. New county record. SURRY CO: 8.5 km NW of Mountain Park, Mitchell River. 18 July 1949. J. R. Bailey and J. R. Charles. NCSM 37107. Previously unvouchered record. Palmer and Braswell (1995) reported sight records for Surry County. WILKES CO: 1.3 km SSW of Doughton. 1 June 1996. J. C. Beane, R. A. Davis, D. W. Herman, T. J. Thorp, J. L. Warner, and J. S. Zawadowski. NCSM 41591. New county record.

Kinosternon subrubrum subrubrum (Eastern Mud Turtle). CUMBERLAND CO: 6.4 km WSW of Spring Lake, Fort Bragg Military Reservation, McPherson Creek. 1 July 1992. M. K. Jones. NCSM 31851. New county record. SURRY CO: 5.3 km W of Bottom. 23 May 1994. J. C. Beane, A. B. Somers, T. J. Thorp, and P. Sheridan. NCSM 36131. 5 km N.NE of Mountain Park. 24 June 1995. J. C. Beane, C. K. Cheshire, and S. K. Eanes. NCSM 38717. Northwesternmost localities for North Carolina. Extends range to base of Blue Ridge escarpment and ca. 40 km NW of nearest record in Surry County.

Sternotherus odoratus (Common Musk Turtle). MARTIN CO: 3.7 km S of Hamilton, Conoho Creek. 26 May 1994. A. L. Braswell, R. G. Campbell, and B. L. Beaman. NCSM 36271. Roanoke River near Williamston at Bertie County line. 16 June 1994. V. P. Schneider, J. Fisher, and E. Williams. NCSM 36509. New county records.

Chrysemys picta picta (Eastern Painted Turtle). ANSON CO: 3.4 km ESE of Lilesville. 10 May 1992. A. L. Braswell. NCSM 31632. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Anson County.

Pseudemys concinna concinna (Eastern River Cooter). ROCKINGHAM CO: 0.8 km NNE center of Mayodan, Mayo River. 28 January 1997. G. B. Pottern. NCSM 50066. New county record. Extends range ca. 35 km NNW of nearest records in Guilford County.

Terrapene carolina carolina (Eastern Box Turtle). EDGECOMBE CO: 6.4 km ESE of Battleboro. 12 September 1992. A. L. Braswell et al. NCSM 31860. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Edgecombe County. FORSYTH CO: 3.4 km W of Clemmons along Yadkin River near Davie County line. 22 February 1996. A. B. Somers and K. Bridle. NCSM 40588. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Forsyth County. GASTON CO: Stanley. 1 June 1963. T. Murphy. NCSM 34194; 7 September 1963. T. Murphy. NCSM 34207, 34208, 34253. 4.8 km SE of Stanley. 12 May 1963. T. Murphy. NCSM 34195-34196. 3.2 km SW of Stanley. 7 September 1963. T. Murphy. NCSM 34211; 9 September 1963. T. Murphy. NCSM 34216, 34217, 34252. Previously unvouchered records. Palmer and Braswell (1995) reported a sight record for Gaston County. PERQUIMANS CO: ca. 2.4 km NE of Hertford. 19 June 1964. D. M. Davis et al. NCSM 34227, 34241, 34242. Previously unvouchered records. Palmer and Braswell (1995) reported a sight record for Perquimans County. STOKES CO: 2.8 km WSW of Walnut Cove. 20 May 1994. J. C. Beane, A. B. Somers, and T. J. Thorp. NCSM 36129. 3.5 km ENE of Walnut Cove. 26 March 1996. A. B. Somers, K. Bridle, and M. K. Govus. NCSM 40587. Previously unvouchered records. Palmer and Braswell (1995) reported a sight record for Stokes County.

Trachemys scripta scripta (Yellowbelly Slider). BERTIE-MARTIN COUNTY line: Roanoke River near Williamston. 16 June 1994. V. P. Schneider, J. Fisher, and E. Williams. NCSM 36506-36507. New county records. EDGECOMBE CO: 6.4 km ESE of Battleboro. 12 September 1992. A. L. Braswell et al. NCSM 31854. New county record. GASTON CO: 4.8 km SSE center of Gastonia, floodplain of Anthony Creek. 16 May 1996. S. Tracy. NCSM 41460; 18 May 1996. S. Tracy. NCSM 41641. New county records. Extends range ca. 43 km W of nearest records in Mecklenburg County. NORTHAMPTON CO: 12.9 km WSW of Jackson, Occoneechee Neck. 6-7 May 1997. E. D. Bruner, Jr. NCSM 51279-51280. Previously unvouchered records. Palmer and Braswell (1995) reported sight records for Northampton County.

SAURIA

Anolis carolinensis (Green Anole). BERTIE CO: 1.1 km ENE of Edenhouse, Chowan River at U.S. 17. 17 August 1992. R. W. Laney et al. NCSM 48313. New county record. Extends range ca. 33 km NW of nearest record in Washington County.

Sceloporus undulatus hyacinthinus (Northern Fence Lizard). JONES CO: 4.8 km WNW of Pollocksville. 19 May 1993. A. L. Braswell and R. R. Swaisgood. NCSM 32585. New county record. ROCKINGHAM CO: 8.9 km SW of Stacey. 21 May 1961. R. Highton et al. NCSM 36015. New county record.

Cnemidophorus sexlineatus sexlineatus (Six-lined Racerunner). ASHE CO: ca. 4.8 km N Jefferson, east slope of Phoenix Mountain. 1947. E. E. Brown. NCSM 47750. New county record. Extends range ca. 60 km NW of nearest literature record in Wilkes County and ca. 85 km NW of nearest voucher-supported record in Yadkin County. Partially fills range hiatus shown in Conant and Collins (1991). CLEVELAND CO: 6.8 km WSW of Boiling Springs, along Broad River. 21 June 1994. J. C. Beane et al. NCSM 36603. New county record. IREDELL CO: ca. 3.2 km N of Davidson. 27 June 1949. E. E. Brown. NCSM 47761. Previously unvouchered record. Brown (1992) reported one or more specimens from Iredell County, but did not report specific locality, repository, or catalog numbers. JONES CO: Great Lake, Croatan National Forest. 24 June 1970. J. R. Bailey et al. NCSM 34027 (5 specimens). 4.5 km WNW of Pollocksville near Trent River. 19 May 1993. A. L. Braswell and R. R. Swaisgood. NCSM 32575. New county records. RANDOLPH CO: 14.9 km S of Farmer. 20 May 1992. S. L. and M. S. Alford. NCSM 31685. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Randolph County.

Eumeces fasciatus (Five-lined Skink). ASHE CO: ca. 4.8 km N of Jefferson, east slope of Phoenix Mountain. 1947. E. E. Brown. NCSM 50555. New county record. CABARRUS CO: ca. 8 km E of Davidson, Egg Rock Woods. 25 June 1949. E. E. Brown. NCSM 50556; 3 April 1950. E. E. Brown. NCSM 50558. Previously unvouchered records. Brown (1992) reported one or more specimens from Cabarrus County, but did not report specific locality, repository, or catalog numbers. EDGECOMBE CO: 6.4 km ESE of Battleboro near Swift Creek. 8 July 1991. C. McGrath and J. Alderman. NCSM 31536; 23 August 1991. C. McGrath and J. Alderman. NCSM 31547; 12 September 1992. A. L. Braswell et al. NCSM 31857. New county records. IREDELL CO: ca. 3.2 km N of Davidson. 27 June 1949. E. E. Brown. NCSM 47761. New county record. JONES CO: Trenton, Trenton Mill Pond. 7 October 1979. J. R. Bailey et al. NCSM 41587. New county record.

Eumeces laticeps (Broadhead Skink). DARE CO: Roanoke Island, 4.8 km NW of Manteo, Fort Raleigh National Historic Site property. 17 July 1997. J. C. Beane and Laura H. Terry. NCSM 52491. New county record. First insular record for North Carolina. Extends range ca. 42 km E of nearest records in Tyrrell County.

Scincella lateralis (Ground Skink). BURKE CO: Forest Service road between NC 181 and Table Rock Mountain. 15 May 1949. E. E. Brown. NCSM 52930. Previously unvouchered record. Brown (1992) reported one or more specimens from Burke County, but did not report specific locality, repository, or catalog numbers. IREDELL CO: Mooresville, 169 Scotland Drive. 1 August 1997. J. H. Reynolds. NCSM 52891. New county record. ROWAN CO: Salisbury. 12 November 1949. E. E. Brown. NCSM 52931-52932; 27 October 1951. E. E. Brown. NCSM 52933. Previously unvouchered records. Brown (1992) reported one or more specimens from Rowan County, but did not report specific locality, repository, or catalog numbers.

SERPENTES

Coluber constrictor constrictor (Northern Black Racer). CLEVELAND CO: ca. 1.6 km E of Lawndale. 13 October 1975. E. E. Brown. NCSM 52936. Previously unvouchered record. Brown (1992) reported one or more specimens from Cleveland County, but did not report specific locality, repository, or catalog numbers. Palmer and Braswell (1995) reported a sight record for Cleveland County.

Elaphe guttata guttata (Corn Snake). STOKES CO: Hanging Rock State Park, ca. 3.5 km SE of Moores Springs. 3 October 1993. J. B. Sealy III. NCSM 36639. Previously unvouchered record. Dow and Schwaner (1990) reported a specimen from the same approximate locality, supported by a frozen blood sample and photographs.

Elaphe obsoleta (Eastern Rat Snake). CHOWAN CO: SE Edenton. 14 November 1993. P. R. Trail. NCSM 40082. Previously unvouchered record. Palmer and Braswell (1995) reported sight records for Chowan County. HENDERSON CO: SW Mills River, Pisgah National Forest. 3 June 1968. R. Highton and R. T. Danstedt. NCSM 35658. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Henderson County.

Farancia abacura abacura (Eastern Mud Snake). BERTIE CO: 6.9 km SSW of Woodard, Middle Prong of Three Sisters Creek off Broad Creek. 2 April 1996. R. W. Gaul, Jr., Trip Lamb, and J. Horton. NCSM 40495. New county record.

Farancia erytrogramma erytrogramma (Rainbow Snake). HARNETT CO: 2.7 km N of Bunnlevel near Upper Little River. 8 July 1997. H. A. Randolph. NCSM 52615. New county record. ONSLOW CO: Jacksonville, Mill Creek drainage. Date and collector not specified. NCSM 34870-34873. Previously unvouchered records. Palmer and Braswell (1995) reported a sight record for Onslow County.

Lampropeltis calligaster rhombomaculata (Mole Kingsnake). CATAWBA CO: 5.8 km SSW Sherrills Ford. Ca. 10 September 1996. W. Gilbert. NCSM 44465. New county record.

Lampropeltis getula getula (Eastern Kingsnake). GRANVILLE CO: 4.3 km ESE of Providence. 22 June 1997. W. H. Rowland, Jr. NCSM 52092. New county record. SURRY CO: 5.2 km N of Mountain Park at Mitchell River. 4 June 1993. S. K. Eanes. NCSM 32668. Previously unvouchered record. Brown (1992) and Palmer and Braswell (1995) reported sight records for Surry County. WILKES CO: 1.3 km SSW of Doughton. 10 May 1996. T. J. Thorp, J. C. Beane, and J. S. Zawadowski. NCSM color slide JCB 96-782. New county record.

Lampropeltis triangulum triangulum (Eastern Milk Snake). SURRY CO: vicinity of Mountain Park. Early 1980s. S. K. Eanes. NCSM 32066. Previously unvouchered record. Palmer and Braswell (1995) reported a specimen from Surry County supported by a photograph.

Lampropeltis triangulum elapsoides (Scarlet Kingsnake). CHOWAN CO: Edenton, Blount St. near Edenton Bay. Mid-August 1992. C. Burns. NCSM 32065. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Chowan County.

Nerodia erythrogaster erythrogaster (Redbelly Water Snake). BERTIE CO: 1.4 km SE of Grabtown. 9 June 1992. R. W. Gaul, Jr. NCSM 31810. New county record. ANSON CO: 6.4 km SE of White Store, Bell Creek. 18 March 1990. R. G. Arndt et al. NCSM 32021. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Anson County. This record extends range 28 km W of that sight record and ca. 56 km WSW of nearest voucher-supported record in Richmond County.

Nerodia sipedon sipedon (Northern Water Snake). GUILFORD CO: 2.4 km SE of Stokesdale, Rock Branch. 20 September 1995. W. M. Palmer, A. L. Kyles, R. Pegram, and L. Earnest. NCSM 39516. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Guilford County. ROWAN CO: 4.0 km SSE of Mount Ulla at Sills Creek. 23 March 1964. E. E. Brown. NCSM 52937. Previously unvouchered record. Brown (1992) reported one or more specimens from Rowan County, but did not report specific locality, repository, or catalog numbers.

Nerodia taxispilota (Brown Water Snake). LEE CO: 4.8 km NE of Cumnock, Deep River at Chatham County line. 7 June 1996. J. C. Turner. NCSM 41772. New county record. Extends range ca. 33 km NNE and 44 km WNW of nearest records in Moore and Harnett counties, respectively.

Opheodrys aestivus (Rough Green Snake). LINCOLN CO: ca. 9.7 km W of Lincolnton. 13 October 1975. E. E. Brown. NCSM 52934. Previously unvouchered record. Brown (1992) reported one or more specimens from Lincoln County, but did not report specific locality, repository, or catalog numbers.

Regina rigida rigida (Glossy Crayfish Snake). COLUMBUS CO: Lake Waccamaw. 3 September 1981. E. E. Brown. NCSM 52883. New county record.

Regina septemvittata (Queen Snake). DAVIDSON CO: 6 km SE of Jackson Hill, Beaverdam Creek. 10 September 1961. T. and P. Murphy. NCSM 33722. 4.8 km N of Denton, Lick Creek. 26 August 1962. T. Murphy and M. Bailey. NCSM 33732-33733. New county records. NASH CO: 2.7 km NNW center of Rocky Mount, Tar River at Battle Park. 15 April 1996. M. E. Ruff. NCSM 40795. New county record. Extends range to edge of Coastal Plain and ca. 82 km E of nearest records in Vance and Wake counties.

Storeria occipitomaculata occipitomaculata (Northern Redbelly Snake). CALDWELL CO: Globe. 9 August 1954. E. E. Brown. NCSM 52436. Previously unvouchered record. Brown (1992) reported one or more specimens from Caldwell County, but did not report specific locality, repository, or catalog numbers. ROCKINGHAM CO: 6.9 km SW of Ellisboro. 27 March 1992. T. J. Morgan. NCSM 31627. New county record.

Thamnophis sauritus sauritus (Eastern Ribbon Snake). NORTHAMPTON CO: 12.9 km WSW of Jackson. 27 April 1997. E. D. Bruner, Jr. NCSM 50924. New county record. SCOTLAND CO: Camp Mackall Military Reservation. 10 August 1985. J. C. Beane and T. J. Thorp. NCSM 25863. Previously unvouchered record. Palmer and Braswell (1995) reported a sight record for Scotland County.

Thamnophis sirtalis sirtalis (Eastern Garter Snake). CLEVELAND CO: ca. 1.6 km E of Fallston. 13 October 1975. E. E. Brown. NCSM 52935. Previously unvouchered record. Brown (1992) reported one or more specimens from Cleveland County, but did not report specific locality, repository, or catalog numbers. SURRY CO: 2.6 km E of Level Cross. 8 July 1992. A. B. Somers. NCSM 31773. New county record.

Micrurus fulvius fulvius (Eastern Coral Snake). PENDER CO: 3.6 km WSW of Atkinson, Cone's Folly. April 1995. Bob Murray. NCSM 37878. Previously unvouchered record. Brimley (1922) and Palmer and Braswell (1995) reported a sight record from near Topsail Inlet in Pender County.

Acknowledgments.—I thank the many individuals whose field work resulted in new distributional records. S. D. Busack, W. M. Palmer, and A. L. Braswell reviewed an earlier draft of the manuscript.

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BOOK REVIEWS

A Research Guide to the Lizards of Cuyabeno, by Laurie J. Vitt and Stella de la Torre. 1996. Monograph 1, Museo de Zoología (QCAZ), Centro de Bioversidad y Ambiente Pontificia Universidad Católica del Ecuador. 165 pp, 36 color plates. Softcover. US $30.00. ISBN 9978-77-042-9.

JOSEPH R. MENDELSON III

Natural History Museum, and Department of Systematics and Ecology
The University of Kansas, Lawrence, Kansas 66045-2454, USA

Present address: Department of Biology, Utah State University
Logan, Utah 84322-5305, USA

This book is divided into two major sections: 1) an introduction including description of the study site and its four vegetation types, and a review of basic methods for field ecologists, and 2) species accounts for the 25 species of lizards (including one amphisbaenid) known to occur at Cuyabeno. The text is presented in English and Spanish and color plates of all species are grouped at the end of the book. A prologue by Dr. Tjitte de Vries, director of the Centro de Bioversidad y Ambiente at Pontificia Universidad Católica del Ecuador, indicates that this book is intended as a foundation for future studies at Cuyabeno and as a field guide for ecotourists. Cuyabeno is an equatorial lowland rainforest site that is being managed for research in ecology and sustainable resource exploitation.

Vitt and de la Torre have taken an interesting and novel approach with this book. As the title indicates, this is, in fact, a *guide* for research—and not necessarily only for Amazonian lizards. As such, the introduction serves as an excellent primer for field ecological studies. The authors emphasize several points in this section including the crucial importance of collection and deposition of voucher specimens in active museums. Researchers also are encouraged to take advantage of the unique opportunity at the moment of capture to gather a suite of basic ecological data that include body, ambient, and substrate temperatures, as well as basic observations of behavior, weather, and habitat. These data, kept in association with the voucher specimens, may complement the dietary and reproductive data that can be recovered later through dissection, and will maximize the scientific value of each specimen. Samples from the authors' own database for *Norops nitens* provide good examples of a practical format and proof that the authors make the effort to collect these various data themselves. The "Basic Ecological Data Collection" section of the introduction is the most unique, and the strongest, contribution of

this book. I would consider assigning this section as "required reading" for students developing undergraduate, master's, or *licenciatura* projects involving field work. Throughout the book, the authors emphasize the critical importance of considering phylogeny (= history) in all ecological studies. They also offer well-founded advice, based upon their considerable experience, regarding sample sizes and the suitability of different species for the investigation of various ecological questions—indeed, potentially exciting research projects are suggested throughout the book.

The authors' summary of ecological data gathering techniques could have been expanded to include more discussion of trapping techniques—viz., pitfall traps, which I have found to be quite effective for capturing some of the more elusive leaf litter gymnophthalmids. Night collection of sleeping lizards is mentioned only briefly in a few species accounts—certainly one cannot gather much in the way of behavioral or active temperature data from sleeping lizards, but it is the only way by which I have collected such elusive species as *Dactyloa transversalis.* Also, a brief illustrated guide to preservation techniques would have augmented this otherwise complete section—poorly prepared voucher specimens are only slightly better than none at all.

The species accounts and color plates comprise the remainder of the book. Species are partitioned into sections by family, each prefaced by nice pen-and-ink illustrations of representative species drawn from one of the plates. Vitt and de la Torre are appropriately explicit regarding the source of the taxonomy they have chosen with respect to generic allocation of species (e.g., Frost 1992, for Tropiduridae; Guyer and Savage 1986, for anolines) and Avila-Pires (1995) is cited often as the source for other taxonomic information. The taxonomy used by the authors is consistent throughout, except that *Norops nitens* (sensu Avila-Pires 1995) is referred to as *Norops chrysolepis* in the caption for Plate 13.

Each species account includes a black and white photograph, a brief introduction, and the following sections: Activity, Size and Morphology, Foraging and Diet, Escape, Reproduction, Description, and Comment. The authors state in the Introduction that their intent was to "provide enough information on identification of species that students and other researchers working in the area will have no difficulty identifying lizard species." Thus, the description section in each account is neither a full description nor diagnosis of the species, but rather an assemblage of character descriptions that should aid in identification of individuals in the hand. In a few cases in which two or more similar species occur in the area, explicit diagnostic comparisons are made. I found the lack of uniformity among the descriptions frustrating; however, I must admit that, along with the illustrations provided, most people should be able to correctly identify the lizard species considered in this book. The Foraging and Diet and Reproduction sections, in most cases provide data collected by the authors at Cuyabeno, augmented by references to other works (e.g., Duellman 1978; Dixon and Soini 1986). The remaining sections provide general information that should prove useful to persons trying to locate, capture, and identify lizards at Cuyabeno (or elsewhere). The Size and Morphology section presents data on sizes of individuals from Cuyabeno and, in most cases, little in the way of morphological information beyond general comments on the habitus of the species. In some cases (e.g., *Alopoglossus angulatus)* no "morphological" information is presented; in others the information is misleading. For example, both *Iphisa elegans* and *Kentropyx pelviceps* are described as "fusiform;" these lizards bear little resemblance to one another. Inclusion of a key to the lizard species of Cuyabeno would have been helpful. Also, a more complete treatment of species that quite possibly occur at Cuyabeno, but have not yet been documented, would inevitably have been helpful to some future researchers. A few such species (e.g., *Enyalioides cofanorum)* are mentioned in passing, but others that probably occur there (e.g., *Bachia trisnale),* are not.

I found a few typographical errors, but none of them critical to the sense of the text. I found the Spanish translation to be accurate with respect to the English text. The black and white photographs nicely augment the species accounts and seem to be of high quality; however, the halftones were not of high resolution and some are not as useful as they could have been. Most of the color plates are excellent. The photograph of *Pseudogonatodes guianensis* is a bit dark—although this is how they actually appear in the hand. The photograph of the male *Gonatodes concinnatus* is also a bit dark and does not show well the distinctive orange cephalic coloration that is described in the text.

Vitt and de la Torre have produced a unique and useful book. The species accounts, given their stated purpose, are useful, and the introduction is a nice summary of how to do modern field ecology. As such, this book contributes far more than the relatively useless checklists that reserves, parks, and even countries, commonly provide, and breaks beyond the traditional "see and identify" boundary of field guides by suggesting how and why to conduct research on these lizards. Finally, the authors are to be commended for taking the initiative to produce a bilingual volume—certainly not all researchers and ecotourists are *gringos.*

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Snakes in Question: The Smithsonian Answer Book, by Carl H. Ernst and George R. Zug. 1996. Smithsonian Institution Press, P.O. Box 960, Herndon, Virginia 22070-0960, USA. 203 pp., 64 color photos, 44 black and white photos, 27 line drawings. Hardcover, US $49.00; softcover, US $24.95. ISBN 1-56098-648-4 (hardcover), 1-56098-649-2 (softcover).

MARK WITWER

1029 Sunhigh Drive, West Chester, Pennsylvania 19380, USA

Those of us who do educational programs about snakes for children and civic groups know how many questions are out there! This book capitalizes on that interest, using a question-and-answer format to answer the most common questions about snakes. The species and topics discussed are global in scope, but many of the examples used will be most familiar to North American readers.

The book is nicely produced. The softcover edition has a sturdy glossy cover, attractively designed around an excellent close-up photograph of *Rhabdophis subminiatus* by Richard Bartlett. The pages are securely bound, the print dark and easily read, the text conveniently arranged into sections and broken up by attractive graphics. The overall effect is to invite a reader to browse.

The content is divided into five chapters (Snake Facts, Folk Tales, Giant Snakes: Big and Biggest, Snakebite, Snakes and Us) and each chapter has multiple subdivisions. Separating the chapters into "bite-sized" chunks is good pedagogy, and helps to make the information accessible.

The first and longest (73 pages) chapter answers over fifty general questions about snakes (e.g., "Do Snakes Hear?", "Can Snakes Change Colors?", "When Did the First Snake Appear?"). The answers contain a wealth of moderately detailed information, and are sometimes cross-referenced with each other and with other chapters. The information is accurate and up-to-date (e.g., snakes can hear airborne sounds; constriction does not kill primarily by suffocation; snakes may not all have indeterminate growth). The vocabulary in this chapter borders on semitechnical, but some terms are immediately clarified in parentheses. A passage from the answer to "How Do Snakes Spend the Winter?" is illustrative: "Most snakes are probably facultative hibernators, whose winter inactivity is triggered by external cues such as dropping air temperatures. Some, however, appear to be obligatory hibernators, in which some endogenous (internal) control mechanism—a biological clock—initiates winter inactivity at approximately the same time each year." Terms not explained in parentheses may be found in the glossary (e.g., "facultative" and "obligatory" in the passage above) but this is not always the case. The vocabulary in this chapter will be difficult for some readers, particularly younger ones.

Chapter Two is the shortest of the five chapters (10 pages) and addresses common myths about snakes (e.g., "Do Snakes Hypnotize Their Prey?", "Do Venomous and Nonvenomous Snakes Interbreed?"). The answers here are less technical, and include some interesting historical and cultural information.

Chapter Three (25 pages) departs from the question-and-answer format to discuss the world's larger snakes. The expected large boids and king cobra (*Ophiophagus hannah*) are profiled here, in addition to many others (taipans, mambas, asian ratsnakes, rattlesnakes, etc.). The language is nontechnical and a large number of interesting species are covered—certainly most of the species of high interest to the general public. I found very few errors in the book, but three appear in this chapter. First, both the caption and accompanying text identify Figure 3.15, a Gaboon Viper (*Bitis gabonica*), as a Rhinoceros Viper (*Bitis nasicornis*). A correctly identified *Bitis nasicornis* appears in color plate 10B. Second, the caption to Figure 3.11 gives the maximum known length of the black mamba (*Dendroaspis polylepis*) as 3 meters. The accompanying text and Appendix 2 both give the maximum length as 4.5 meters. Spawls and Branch (1995) give the maximum length for this species as "probably about 3.5 m." Third, page 117 states that *Thelotornis kirtlandii* is one of four colubrids which has caused human fatalities, although these fatalities are now attributed to *Thelotornis capensis* (Spawls and Branch 1995).

Chapter Four (29 pages) explores venoms (e.g., "What Is Venom?", "Can Venom Be Used as Medicine?"), venomous snakes (e.g., "How Many Snakes Are Venomous?"), and snakebite (e.g., "How Do Fangs Work?", "If Bitten, What Next?"). This material is thorough and easily read. The chapter also contains some excellent tables and line drawings. Table 4.1 is a two-page list of venom components, described by their actions and the taxa possessing them. Table 4.3 lists the LD_{50}'s and venom yields of 81 species. The line drawings throughout the book are good to excellent in quality and serve to clarify the text. In this chapter, the drawings of representative skulls and maxillae (Figures 4.8 and 4.10) of aglyphous, opisthoglyphous, proteroglyphous, and solenoglyphous snakes are outstanding.

The short (14 pages) final chapter provides a very strong conclusion to the book. Threats facing snakes and their importance to humans worldwide are highlighted first, including several useful historical examples of the importance of snakes in rodent control. This is followed by a thorough discussion of why snakes appear in our homes and lawns, with good advice on what to do about it. A slightly edited version of these first sections of Chapter Five would make an excellent flyer for distribution to the public. Putting this information into the hands of landowners and those using natural areas might have significant local impacts for snake conservation. (Are any herpetological organizations out there looking for a worthy project?) The next section addresses the question, "Should I Keep a Snake as a Pet?". Because they have seen so much poor care, the authors do not believe that any amphibian or reptile should be kept as a pet. They explain their position clearly, and graciously ("We also know many people who take good care of their snakes ..."). Then, to their credit, they go on to address those who are determined to keep snakes, giving the best two-page summary of advice to beginners that I have read anywhere (pp.150–151). The final brief sections concern herpetological careers.

Throughout all of the chapters, black and white photographs are used to good effect. Most are of very good quality and, like the line drawings, serve to clarify the text. There are very few of these photographs that I would have left out.

The 64 color photographs are grouped as 24 plates, all found on 16 glossy pages located about one fourth of the way through the book. Although most of these photographs are small, many are technically very good (some are excellent); some also illustrate significant biological phenomena (e.g., coral snake mimicry; color variation in *Sistrurus m. miliarius*). The quality is not uniform, however; quite a few appear underexposed, overexposed, or faded. Redundancy with the black and white photographs occurs at least twice: the same black mamba head shot shown in Plate 7C is in black and white in Figure 3.11, and two almost identical African birdsnake photographs (apparently of the same snake) appear in Plate 16D and Figure 1.25 .

The chapters are followed by five appendices which contain a great deal of information in convenient list form. Included are the taxonomic hierarchy of snakes to the subfamily level, the number of genera and species in each family, body sizes of a large number of species, comparative speeds of some snakes and other creatures (including humans), reproductive data for a number of snake species, and a short list (ten) of professional and regional herpetological organizations.

Following the appendices are a glossary, general bibliography, and subject bibliography. The glossary is moderate in length, but considering the general audience and the vocabulary level in much of the book, it could be longer. The general bibliography contains 27 books on snakes and general herpetology published between 1957 and 1994. The subject bibliography (a short list of references for most sections of the five chapters) is particulary useful, directing the interested reader to books and papers while freeing the text from citations.

The final sections of the book are a taxonomic index (by common name) and a subject index. A great deal of effort obviously went into constructing the detailed taxonomic index. (Reading a page or two of it will convince reluctant students of the value of scientific names!) Given the general audience of the book, it was wise to index common names; but many readers will miss having a standard taxonomic index as well. The subject index is surprisingly brief (about two full pages) and should have been expanded. "Mimicry" is in the title of the first color plate, and I went looking for it under "m" in the subject index. No luck. Neither was it under "d" for defense. I finally found it as a subheading under

color. And although Duvernoy's gland is in the glossary, I could not find it in the index at all.

Despite its minor flaws, this book is a gold mine of useful information, conveniently and attractively arranged, and deserves wide readership. Members of the general public with an interest in or curiosity about snakes will learn much from it. Science educators will find it a useful reference; anyone who regularly speaks or writes about snakes for the public should have a copy. Professional herpetologists may find it useful in helping to frame concise answers to commonly asked questions. While the $49 hardcover price seems high for a book of this length, the softcover price is half that much and well worth it. The softcover edition's lower price, attractive cover, and inviting question-and-answer format makes it an excellent book to take to programs and hold up as recommended reading for interested listeners.

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Green Iguana: The Ultimate Owner's Manual, by James W. Hatfield III. 1996. Dunthorpe Press, P.O. Box 80385, Portland Oregon, 97280, USA. Softcover. US $28.50. 655 pp. ISBN 1-883463-48-3.

WINSTON CARD
Department of Herpetology, Dallas Zoo
650 South R. L. Thornton Freeway (I-35E), Dallas, Texas 75203, USA
e-mail: winstoncard@sprintmail.com

There are numerous manuals, popular articles, and videos dedicated to the care of green iguanas (*Iguana iguana*) in captivity (Bartlett and Bartlett 1995; Coborn 1994; de Vosjoli 1992; Ferrel 1992; Frye 1995; Frye and Townsend 1993; Roberts and Roberts 1976). Indeed, this area has been discussed in the popular literature ad nauseum. Owners of pet iguanas are now confronted with yet another iguana husbandry manual that is no less than 600 pages in length.

As the title suggests, this book was designed specifically for individuals interested in iguanas as pets. The first 98 pages are dedicated to simplified descriptions of iguanas in mythology, morphology, behavior, and some information concerning the author. The next 240 pages cover various aspects of husbandry. The last three sections (each of about 100 pages) cover medical troubleshooting, domestication, and breeding.

Ten appendices are also included at the end of the book covering a variety of subject matters related to iguana husbandry. Perhaps the most useful information is contained in Appendix D, which provides detailed instructions on how to construct an indoor iguana habitat.

James Hatfield is to be commended in his efforts to compile information for this voluminous work. The author traveled extensively and apparently spent many hours with various academic authorities on *Iguana iguana*. This fact is stated several times in the text.

Although this book is rather large, it contains little new information. The author does an inadequate job clarifying existing controversies, such as those relating to nutrition and reproduction. Although these topics are discussed, Hatfield offers no tangible evidence to support many of his opinions that contradict what has been published elsewhere. Many of the criticisms outlined for other iguana husbandry manuals (see Rodda 1994), can also be applied here.

Chapter Eight, concerning domesticating green iguanas, is perhaps the most "unique" portion of this book. Outlined here are techniques for training captive iguanas to beg for food, correct bad behaviors, proper petting techniques, and even the proper way to hand feed pet iguanas. You might also apply these same techniques to train your wayward German Shepherd!

The author tends to be verbose, anthropomorphic, and prone to exaggerations throughout the text. For example, in Chapter Nine a story concerning the killing of an adult "Fer-de-Lance" by the author with a machete to save two terrorized iguanas in Costa Rica is related. Hatfield claims to have deduced the emotional state of the two animals by "the contorted looks" on their faces.

Repeated reference is made to an iguana questionnaire that the author apparently distributed to other iguana owners, veterinarians, and perhaps a few academic herpetologists. However, nowhere in the book is a complete analysis of the data obtained from these questionnaires presented. Comments attributed to respondents litter the 600 pages of text. The quotes appear to serve no real purpose and tend to be distracting. Removal of the comments from the text would reduce the size of this book significantly.

I cannot recommend this book for reasons outlined above. Readers will find little pertinent information not already available in one of the smaller manuals. In fact, one will be required to wade through a great deal of superfluous text to get to the desired husbandry information.

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Komodo, The Living Dragon, by Dick Lutz and J. Marie Lutz. 1997. DIMI Press, Salem, Oregon. 195 pp. Softcover. US $16.95 plus shipping. ISBN 0-931625-27-0.

BRUCE A. YOUNG
Department of Biology, Lafayette College
Easton, Pennsylvania 18042, USA
e-mail: youngab@lafvax.lafayette.edu

Recent years have seen the publication of several valuable works on the biology of monitor lizards (e.g., Bennet 1995; De Lisle 1996; King and Green 1993), reflecting increased scholarly and popular interest in these species. This self-published book is a new edition of the 1991 original, which due to some unfortunate errors and inaccuracies was not well received. The authors make it clear that they were motivated to reissue this work in part to correct these earlier difficulties; unfortunately they were not wholly successful. For example, the authors note that, "Far too many writers reproduce unquestioned the previous exaggerations

of the species' size, though only one specimen has ever [sic] documented as larger than 9 ft, 6 in (2.85 m)." While the tone of this statement is admirable, it is difficult to reconcile with the back cover of the book which reads, "Komodo the 10 foot long reptile."

My disappointment with the book stems from a deeper concern. The authors state as their goal to provide a popularized version of Auffenberg's (1981) classic *The Behavioral Ecology of the Komodo Monitor.* Is such a popularization necessary? Auffenberg's work is very readable and most of it is comprehensible to an interested non-professional reader. Furthermore, although Auffenberg's book is a benchmark study and still of significant value, it is now 16 years old. The Lutzs have incorporated little of the subsequent scientific literature on *Varanus komodoensis*, including studies on behavior (Horn 1985), thermoregulation and energetics (Green et al. 1991), and locomotion (Suzuki and Hamada, 1992; Suzuki et al. 1991). If a popularization of Auffenberg's work was desirable it is not evident that the Lutzs are in the best position to carry it out. This book leaves one with the sense that the authors lack a well-developed familiarity with *V. komodoensis*: their understanding of the Komodo dragon seems to be based on visits to several zoos and a single visit to Komodo Island where, judging by their repeated criticisms of the park guides, the authors never felt at ease.

The apparent unfamiliarity with these animals leaves a telling mark on this book—*V. komodoensis* is treated independently of all other varanids. This was certainly not the case with Auffenberg's work, nor is it the case in the other recent books on *Varanus*. Even in a book dedicated to one species, as this one is, some more general context is critical. Treating *V. komodoensis* independently leaves the Lutzs prone to make statements of dubious validity. For example, they state that in contrast to the Komodo dragon, "... other lizard species usually carry their bodies closer to the ground and spend much of their movement time running." They go on to remark that, "The dragon's tongue tips are not far enough apart to make their directional reading work well, so it swings its head back and forth to improve its reception." Both of these statements, and several others, are provided without any support or citation.

To me the most interesting aspect of this book was the chronology of captive Komodo dragons. The differing travel routes, prosperity, and fates of these animals are fairly well presented. Nonetheless, the Lutzs' contention that early attempts to maintain captive specimens caused the animals to lead, "nasty, brutish, and short" lives is not well supported by the information they present. One of the earliest captive specimens, Buchben, lived 17 years in captivity during which time she laid several clutches of eggs.

The book ends with a lengthy discussion of the captive breeding of *V. komodoensis* in the United States; in fact, the Lutzs state that this new information was one of the reasons they decided to reissue this book. But of the 21 text pages devoted to this topic, 16 are taken verbatim from publications of the National Zoo. Much of the remainder is a table of the location of living captive specimens, which differs from information presented in the text. The National Zoo's successful captive breeding of *V. komodoensis* is certainly a noteworthy accomplishment; interested individuals would seem best served by obtaining information directly from the National Zoo. Furthermore, the Lutzs' claim that the captive breeding in the U.S. has, "... assured the continued survival of this unique reptile" seems at odds with the passing reference they make to the fact that the Gembira Loka Zoo and Botanical Gardens has been breeding Komodo dragons since at least 1968.

Readers interested in the biology of the Komodo dragon would be better served by purchasing one of the other recent works on monitor lizards, or finding a copy of Auffenberg's (1981) book. Individuals interested in the conservation and captive breeding of these interesting animals should probably contact one of the zoos involved.

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Frogs of the Genus *Eleutherodactylus* (Leptodactylidae) in Western Ecuador: Systematics, Ecology, and Biogeography, by John D. Lynch and William E. Duellman. 1997. The University of Kansas Natural History Museum Special Publication No. 23: 236 pp. Softcover. US $35 plus shipping. ISBN 0-89338-054-7.

HINRICH KAISER

Department of Biology, La Sierra University
Riverside, California 92515, USA
e-mail: hkaiser@lasierra.edu

As soon as I heard about the publication of this volume, I knew I needed to have it. Why? First of all, having been exposed to the incredible *Eleutherodactylus* fauna in the tropics, these species and their natural history can give excellent pointers to outsiders and insiders alike about the ecology and biogeography of the region in general. Secondly, how often do two seasoned war horses of herpetology get together anymore to produce tomes for posterity? Lastly, I have worked on *Eleutherodactylus* (eleuths for short) for a while, so naturally I looked to this book for some additional insights.

Although the book's title limits its scope geographically, the authors add a lot of information on eleuths that goes well beyond western Ecuador. Thus, the statement on the back cover, announcing that the book I was holding was "the definite work on the largest genus of vertebrates" is true and an excellent advertising slogan. I found hidden in its pages a wealth of information, and I believe these descriptions, data, and miscellaneous bits of information to be the result of a lot of dedication, an attitude of "never quit," and a lot of hard work. Just for putting such a comprehensive monograph together, the authors must be commended.

As far as the content is concerned, there are few deviations from some of the authors' previous collaborations (e.g., Lynch and Duellman 1980) or individually produced taxonomic surveys (e.g., Duellman 1970; Lynch 1979, 1981). Noteworthy are ex-

tended character descriptions that are not just limited to their separate section (pp. 24–41) but which permeate the species accounts that comprise the main body of the book. Furthermore, the authors provide an appendix (pp. 219–234) listing all applied species names for *Eleutherodactylus* including synonymies, and a gazetteer (pp. 208–218) for localities in western Ecuador. Keeping with the style of their previous taxonomic surveys, the book is heavy on systematic commentary; the authors provide good reason for this, however, by reiterating (p. 2) that eleuths should be "ideal subjects for ecological studies" but that researchers have not used them "because these frogs have been a notoriously difficult group taxonomically." In my opinion, a thorough reading of this volume might help people discover a fascination for eleuths, and an appreciation beyond the "little brown frog" denominator.

The book is divided into four main sections. The first one details the abiotic factors important to the western Ecuadorian eleuth fauna, but this information is also applicable to research on any number of other organisms in that neck of the woods. The latitudinal profiles (Fig. 3) are a welcome addition to a geography section in a systematics text like this, and they help those unfamiliar with the extreme Andean topography to visualize the terrain. The subdivisions on physiography, river systems, bioclimate regimes, vegetation, and even geologic and climatic history are accompanied by a variety of useful tables and figures, and some key primary literature on these topics is later supplemented by the authors' own experience in each of the species accounts. I found the last subdivision of this section, on human environmental modifications, timely, yet unexpected and somewhat poignant. It is unfortunately true that we have arrived at a time where comments such as these are necessary, not only for their historical value in a biogeographic assessment, but because deforestation and environmental mismanagement now set the stage in a lot of places in the tropics for fundamental changes in the behavior of biota. The term "requiem," as used in reference to extirpation during habitat loss (I have heard it in reference to primary rain forests in the West Indies as well as Central America), is rapidly becoming cliché—an abomination.

The section on systematics is the largest in the book and comprises detailed descriptions of western Ecuadorian eleuths, including the description of nine new species. A very welcome inclusion in this section is a 30-page treatise on eleuth characters and definitions of the relevant species groupings (series and subgenera). This is a revision and expansion of the character lists the authors published previously (e.g., Lynch 1979; Lynch and Duellman 1980), and it gets eleuth systematists up to date. Although a lot of this information is very useful, and required reading for anyone attempting to describe a new *Eleutherodactylus* adequately, I am surprised that there is no mention of the variability in vocalizations, at least for those species for which calls are known. This has been a deficiency in many descriptions of *Eleutherodactylus*, sometimes simply because the specimens were found in museums long after having been collected. There are very few instances where the authors mention calls in the species accounts, although many frogs were apparently observed during times of breeding activity.

The key to the species is comprehensive and its appearance in Spanish, in addition to English, is appropriate. Species accounts and maps are of high quality, and it is a relief to see that some of the detailed field notes which each of the authors has taken over decades and which have been hidden from view have now made it into print. For eleuth enthusiasts like myself, the 64 color plates alone are reason enough to get this volume into the library. I remember rummaging around in the University of Kansas Herp Slide Collection of eleuths and looked at the color diversity of what some, including myself, have called "small brown frogs"—my view was drastically changed on that count! The photo choices are excellent, and the quality of reproduction challenges the high gloss of TFH.

Section three, on ecology, could probably stand on its own as a descriptive paper on "the *Eleutherodactylus* way of life" (p. 150). The authors present data collected over time from nine eleuth communities, and this can certainly serve as an example for studying eleuth communities elsewhere. Because the section includes very little in the way of testing on the four addressed variables (abundance, body size, food, microhabitat), it should be encouraging to anyone to see how much work still needs to be completed. I tremendously enjoyed the five figures (Figs. 58–62) on eleuth microhabitats, showing the positions of individual species in the landscape, and I remember seeing similar ones for Caribbean *Anolis*. This type of information might take some of the guesswork out of finding a species by its call. The authors present a thorough discussion of their information, and I concur with their hope that, given this more accessible taxonomy, more detailed studies can now be undertaken.

The last major section concerns the biogeography of western Ecuadorian eleuths. Here the authors, who previously have produced seminal papers on biogeography (e.g., Duellman 1979; Lynch 1988), formulate some solid biogeographic hypotheses for the current distribution of the *Eleutherodactylus* fauna, by bioclimatic regimes, altitude, and regional geography. Again, tables, graphs, and maps abound and some of these are particularly useful to forge a link between large-scale abiotic factors (e.g., altitude, latitude) and speciation. Examples given include the distributions of several sets of sister species (Figs. 71–72, 74–78), as well as of several species groups (Figs. 79–84). The clincher for their biogeographic argument is a regional speciation model (Figs. 85, 86) which the authors show to be mostly congruent with biogeographic patterns observed in other taxa. I consider this section very successful in design and content, and I think similarly thorough scenarios need to be developed for many other regions.

At this point I may have lost some readers. Why bother reviewing if you have nothing negative to say at all? I feel it is not as important to see what's wrong than what's right in research these days. In particular, I wanted to see whether Lynch and Duellman, household names in herpetology, can throw together a piece of work like this and create a new standard. Quantity isn't equivalent to quality, and both authors freely admit that during all these years of publishing in high quantities a few mistakes went by unnoticed. Therefore, high page count doesn't impress anyone anymore. I think in this book the pages are well invested, the overall quality is excellent, and it is indeed the new standard for traditional eleuth research. It should not be missing on your shelf, so get it before KU runs out.

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The Snakes of Sumatra. An Annotated Checklist and Key with Natural History Notes, by Patrick David and Gernot Vogel. Edition Chimaira, Frankfurt am Main. 260 pp. Softcover. US $39.95. ISBN 3-930612-08-9.

WOLFGANG WÜSTER
School of Biological Sciences, University of Wales
Bangor LL57 2UW, Wales, UK
e-mail: w.wuster@bangor.ac.uk

Interest in Southeast Asian herpetology has been increasing steadily over the last few decades. This has been reflected in a growing number of comprehensive publications on the snakes of several countries, such as Cambodia (Saint Girons 1972), Thailand (Cox 1991) and Malaysia (Tweedie 1983), and several further works that are in preparation. However, several countries have remained insufficiently covered by this expanding literature. Foremost among these is Indonesia. The last comprehensive lists for that country are those of de Rooij (1917) and de Haas (1950), both of which are now outdated. Several works have been published on the faunas of various islands (in den Bosch 1985; van Hoesel 1959; Hodges 1993; Stuebing 1991), but the herpetofauna of Sumatra has received scant attention. The publication of David and Vogel's book on the snakes of Sumatra is thus a valuable addition to the literature on the herpetofauna of southeast Asia in general, and Indonesia in particular.

After the foreword and introduction, the book starts with eight pages on the geography and herpetofauna of Sumatra, including a brief history of past herpetological research on the island. This is followed by four pages on materials and methods and a list of the 127 snake species recorded from the island. A substantial part of the introduction is devoted to a discussion of the high species richness of the Indonesian snake fauna and its causes, with much emphasis being placed on the effect of physical, ecological and climatic diversity. It seems strange that the most obvious cause, namely the fact that Indonesia straddles two major faunal regions and consequently includes much of the diversity of both, is not taken into consideration.

The main part of the text consists of the individual species accounts. These contain the following information: primary systematic data, including original name, describer, year, reference and type locality (including current name, where appropriate); a partial synonymy containing synonyms specifically relevant to Sumatra; taxonomic comments, addressing problems of nomenclature or systematics; locality records on Sumatra; total range of taxon; ecological notes on the Sumatran population (principally published altitude data); natural history notes; and a list of other subspecies and their ranges in the case of polytypic taxa.

It is worth noting what is not included in the species accounts: there are no descriptions of the individual species (although differences between some pairs of similar species are mentioned in some cases), and the types are not cited. In both cases, the reader is told that this information is "readily available in the literature." This reviewer feels that a list of name-bearing types would have been useful, and would not have required much additional space. The relevant literature may be "readily available" to those with large museum libraries a few yards down the corridor, but this is not the case for many university-based researchers.

This systematic part is followed by an annotated list of species which had been previously reported for Sumatra, but probably do not occur there, and a key to the families, and, within families, to all species. The key includes the species of doubtful occurrence, which will facilitate their identification if their presence on Sumatra is eventually confirmed. The keys rely mostly on scalation characters, which will facilitate the identification of living specimens. In some cases, simpler characters might have been found: the pattern of *Daboia russellii* would probably be a better character for distinguishing it from other vipers than the number of dorsal scale rows! In the case of the Elapidae, the key is potentially confusing at point 4, as Sumatran specimens of *Naja sumatrana* are not necessarily uniformly black: many specimens show light crossbars, and some are various shades of brown or tan rather than black.

The impressive bibliography includes approximately 500 references, some annotated. The bibliography is generally very up-to-date, with large numbers of recent references. The final part of the book consists of a very useful gazetteer of the island, which also includes current spellings of older names.

Illustrations come in the shape of ink drawings of the head of several species (generally excellent, but excessive shading obscures important scalation details in some, e.g., the supralabials in *Trimeresurus borneensis* on p. 161), and a section of 33 small color photographs, representing nine habitats and 18 species. The quality and choice of photographs is disappointing: the plates appear distinctly faded in the two copies of the book that I have seen, and the quality of several of the shots is rather poor. Presumably this is due to the fact that photographs of Sumatran specimens are rather thin on the ground.

This book represents a welcome preliminary account of the snake fauna of Sumatra. It will be useful for anyone concerned with the herpetofauna of that island, and the gazetteer and comprehensive bibliography will make it useful to anyone with natural history interests in Indonesia.

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Note added in press: After returning proofs for this review, I obtained a copy of the book from a second printing. The problems of obscure line drawings and faded color plates, noted above, have been corrected in this new printing.

SSAR Committee Chairs and Coordinators

CHAIRPERSONS

Common and Scientific Names
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Department of Biological Sciences
Southeastern Louisiana University
Hammond, Louisiana 70402, USA

Conservation
C. KENNETH DODD, JR.
U.S.G.S. Florida Caribbean Science Center
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology, P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
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Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
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Long Range Planning
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Department of Zoology
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Gainesville, Florida 32611, USA

Meetings
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Department of Biology
Worcester State College
Worcester, Massachusetts 01602-2597, USA

1998 Local Committee
JAMES P. BOGART
Department of Zoology
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Guelph, Ontario, Canada N1G 2W1

Nominating
ROBIN M. ANDREWS
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COORDINATORS

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585 South Main Avenue
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Towson, Maryland 21204, USA

Information for Contributors

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Saint Louis University
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St. Louis, Missouri 63103-2010, USA
e-mail: ssar@sluvca.slu.edu

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Herpetological Conservation
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P.O. Box 8089
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HERPETOLOGICAL REVIEW

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
208 South Great Road
Lincoln, Massachusetts 01773, USA
(413) 442-2165
e-mail: ttyning@massaudubon.org

Advertising Manager
ELIZABETH A. JOHNSON
35 Eighth Street
Frenchtown, New Jersey 08825, USA
(908) 996-4056
e-mail: ejohnson@ptdprolog.net

Associate Editors

DANIEL D. BECK
Department of Biological Sciences
Central Washington University
Ellensburg, Washington 98926, USA
e-mail: beckd@cwu.edu

LEE A. FITZGERALD
Wildlife and Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
e-mail: Lfitzgerald@tamu.edu

DARYL R. KARNS
Biology Department
Hanover College
Hanover, Indiana 47243, USA
e-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
Department of Biology
University of California
Riverside, California 92521-0427, USA
e-mail: jeffrey_lovich@usgs.gov

BRIAN W. BOWEN
Dept. of Fisheries & Aquatic Sciences
University of Florida
7922 NW 71st Street
Gainesville, Florida 32653, USA
e-mail: bowen@gnv.ifas.ufl.edu

DEANNA H. OLSON
USDA Forestry Science Lab
3200 SW Jefferson Way
Corvallis, Oregon 97331, USA
e-mail: olsond@ccmail.orst.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

Current Research
ANNE M. MAGLIA and
CHRISTOPHER SHEIL
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: magliaa@falcon.cc.ukans.edu
e-mail: csheil@falcon.cc.ukans.edu

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106, USA

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo, Miguel Lillo 251
4000 Tucumán, Argentina
e-mail: postmaster@scro.untmre.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biological Sciences
Southeastern Louisiana University, SLU 814
Hammond, Louisiana 70402, USA
e-mail: jdemuth@selu.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cwpaint@unm.edu

Natural History Notes
R. KATHRYN VAUGHAN
Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
e-mail: rkvaughan@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@aix1.ucok.edu

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Symposium: "PHENOLOGY OF FISHES, AMPHIBIANS, AND REPTILES: INTEGRATING ORGANISM-LEVEL AND POPULATION-LEVEL PERSPECTIVES." *Organizers*: Eric Schultz and Kentwood Wells, Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3042, USA.

Symposium: "TO FREEZE OR NOT TO FREEZE: AMPHIBIANS AND REPTILES IN THE COLD." *Organizer:* Kenneth B. Storey, Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, Canada K1S 5B6; e-mail: kbstorey@ccs.carleton.ca. Tel: (613) 520-3678; Fax: (613) 520-4497.

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Further Details: See December 1997 issue of *HR* (pp. 169–171). Meeting Announcement and Call for Papers was mailed to all Canadian, U.S., and Mexican members of SSAR in January 1998. Overseas members wishing to receive this information may do so by contacting *Tana McDaniel, Department of Zoology, University of Guelph, Guelph, Ontario, Canada N1G 2W1. Tel: (519) 824-4120 ext. 6260; fax: (519) 767-1656; e-mail: meeting@uoguelph.ca.* Please visit the meeting web site at http://www.uoguelph.ca/~ichsherp for additional and updated information.

About Our Cover: *Uroplatus phantasticus*

Uroplatus phantasticus is an aptly named endemic gekkonid from Madagascar. It has been dubbed the 'satanic' leaftail gecko in reference to its fleshy, horn-like ocular tufts, and the belief by some Malagasy that these lizards are in fact little devils incarnate. Inhabiting mid-elevation moist forests of the east-central portion of the country, they are nocturnal prowlers among slender, sparsely-leafed, woody plants and saplings within one to two meters of the ground. The flattened heads and membranous fringes lining the head, body, and legs of most of its congeners, which aid in eliminating telltale shadows as they sleep adhered to the trunks of trees by day, are absent in *U. phantasticus* and its smaller-tailed, close relative *U. ebenaui*.

Described by Boulenger in 1888, *Uroplatus phantasticus* often has been relegated to the synonomy of *U. ebenaui* (e.g., Bauer and Russell. 1989. J. Nat. Hist. 23:169–203). However, recent collections in northern Madagascar by Nussbaum and Raxworthy (1995. Copeia 1995:118–124) suggest that this is indeed a species distinct from *U. ebenaui*.

Nine species were included within the genus *Uroplatus* in the most recent summary of the Madagascar herpetofauna (Glaw and Vences 1994. A Fieldguide to the Amphibians and Reptiles of Madagascar. 2nd ed., Cologne. 480 pp.). A tenth, *U. malama*, a smoother-skinned, southern representative of the *ebenaui* species group, has since been described (Nussbaum and Raxworthy 1995, *op. cit.*). It seems likely that other species await discovery.

The cover image, of an adult male *Uroplatus phantasticus* ca. 85 mm in total length, was taken by **Bill Love** at the private farm of Soafiavy Export in Antananarivo. Olaf Pronk, the director, assisted him in posing and recording it photographically, as he has done with numerous other seldom-seen endemic herps during visits spanning the past seven years. Lighting was provided by two Nikon SB26 Speedlights in TTL mode, both mounted on a Stroboframe dual flash macro bracket with the arms extended about 20 cm above and below a Nikon F90X camera body. A 105 mm AF Micro-Nikkor lens caught the shot on Fujichrome Velvia (ASA 50), exposed at f32 while handheld.

About his photography and our cover shot, Bill says: "I shoot mostly straightforward I.D.-style photos of herps. I think the additional artistic appeal of this image is enhanced by three factors: the low eye-level view highlighted the 'horns' in silhouette and made an exciting, almost confrontational pose; only the immediate area of the subject was lit adequately, negating incidental daylight and background scenery beyond flash range to artificially create an appropriate nocturnal scene; and the brilliance of the previous shot left the lizard's pupils contracted, producing the bizarre, extra-terrestrial look of the huge eyes."

Bill is a writer of popular herpetological articles, and several regular advice/information columns in *Reptiles*, *The Vivarium*, and *Reptilia* magazines. His slides frequently appear in books, periodicals, calendars, zoo graphics, and commercial advertising. His main passions, natural herp photography and everything Malagasy, have been combined by lecturing about and leading ecotours to Madagascar through his company, Blue Chameleon Ventures.

Separation and imaging of Love's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida.

SSAR BUSINESS

SSAR Election Results

Results of the recent SSAR election are as follows:

President-elect (to serve as President for 1999) ..... *Victor Hutchison.*

Secretary ..... *Ellen Censky (unopposed).*

Treasurer ..... *Robert Aldridge (unopposed).*

Directors ..... *C. Kenneth Dodd, Jr., and Claudia Luke.*

NEWSNOTES

Summer Course on Biology of Plethodontid Salamanders

"Biology of Plethodontid Salamanders" will be taught at Highlands Biological Station June 1–12, 1998. The instructor will be Stephen G. Tilley. The southern Appalachians are renowned for the diversity of the salamander fauna. This course acquaints students with plethodontid salamanders and shows how studies of these animals have enhanced our understanding of a series of major evolutionary and ecological topics. This is a lecture, field, and laboratory course that will include discussions of original research papers. Three semester hours credit at the advanced undergraduate/graduate level are available through either Western Carolina University or the University of North Carolina at Chapel Hill. For further information contact: *Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA. Tel. (704) 526-2602, fax (704) 526-2797, e-mail: hibio@wcu.edu.*

Southwestern Research Station Volunteer Positions for 1998

Approximately 30 volunteer positions are open in 1998 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

Zoo Internship Available

The Kentucky Reptile Zoo, a nonprofit organization, is seeking a student intern for the 1998 spring, summer, and fall seasons. The zoo is an educational exhibit, and a reptile breeding and venom research facility located near Kentucky's Red River Gorge and Natural Bridge State Park. The intern will assist in the captive maintenance of the zoo's reptile collection, collect admissions to the exhibit, give interpretive talks and interact with the public, assist with educational outreach programs, and perform other duties as assigned. In addition, the intern will be responsible for the completion of at least one research project related to the field of herpetology. The intern will not be involved in the handling of any venomous reptiles.

Desirable qualifications include a willingness to handle snakes and other reptiles on a daily basis, ability to communicate effectively with people, writing skills, orientation to details, and self-motivation. Students majoring in the biological or natural sciences are preferred. Former interns have arranged for academic credit with their colleges or universities. Benefits include experience with the most extensive and diverse collection of snakes in the area, housing, and $55/week to cover expenses. Personal transportation is recommended. Starting dates are flexible, but a minimum commitment of three months covering Spring (March–May), Summer (June–August), or Fall (September–November) is required. Application deadlines are Febuary 1 (Spring), April 1 (Summer), and June 1 (Fall).

To apply, send a cover letter and resume to: *Jim Dykes, Internship Coordinator, Kentucky Reptile Zoo, 1275 Natural Bridge Road, Slade, Kentucky 40376, USA.*

Announcement

The Museum of Natural Science at Louisiana State University is seeking a collections-oriented herpetologist to curate its collection of nearly 80,000 amphibian and reptile specimens, teach appropriate graduate and undergraduate courses, and conduct an active and productive research program. Review of applications will begin in early April, and the anticipated starting date for the position is 4 January 1999. For further information, contact Dr. Douglas A. Rossman, Chair, Search Committee, Museum of Natural Science, 119 Foster Hall, Louisiana State University, Baton Rouge, Louisiana 70803, USA. Telephone (504) 388-3081; fax (504) 388-3075. Position availability is contingent upon budgetary approval. EO/AA Employer.

LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. Please direct all communications to the Section Editor.

USA: US Fish and Wildlife Service: Effective 4 November 1997 the USFWS listed northern populations (ranging from New York and Massachusetts south to Maryland) of the bog turtle (*Clemmys muhlenbergii*) as threatened under the Endangered Species Act. The listing also designates southern populations as threatened due to similarity of appearance. Under this listing southern populations are exempt from incidental take during otherwise lawful activities. Additionally, it was determined that "any benefit potentially provided by designation of critical habitat for the bog turtle would be outweighed by the increase in threats to the species and its habitat from illegal collecting and vandalism caused by such a designation...." The final rule concerning this listing can be found in Federal Register Vol. 62 No. 213. pp. 59605–56923.

For additional information, contact: *Carole Copeyon, Pennsylvania Field Office, U.S. Fish and Wildlife Service, 315 South Allen Street, Suite 322, State College, Pennsylvania 16801, USA*

USA: US Fish and Wildlife Service: The USFWS has proposed threatened species protection for the flatwoods salamander (*Ambystoma cingulatum*). The flatwoods salamander is endemic to the longleaf pine flatwoods of the southeastern U.S. coastal plain. The principal threat to this species is loss of its native habitat, which has declined to less than 20% of its original distribution. Historically, these salamanders ranged from Alabama, south to north-central Florida, and north into Georgia and southern South Carolina; however, none have been captured in Alabama since 1981. Since 1990, all historical records for which adequate locality data were given, have been surveyed. Of these 97 sites, only 12 had flatwoods salamanders present. Further surveys of appropriate habitat throughout their range have located only 47 remaining populations of flatwoods salamanders.

For additional information concerning the proposal, contact: *Linda LaClaire, Jackson Field Office, U.S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Suite A, Jackson, Mississippi 39213, USA. e-mail: linda_laclaire@fws.gov.*

USA: Ohio: The Ohio Department of Natural Resources Division of Wildlife has recently adopted new regulations concerning the purchase or sale of any amphibian or reptile taken in Ohio. The regulations also provide special protection for wood turtles (*Clemmys insculpta*). The regulation states that, "...It shall be unlawful to buy sell or offer for sale any reptile or amphibian which was taken in Ohio without first obtaining permission from the chief of the Division of Wildlife. Provided further it shall be unlawful to buy, sell, transport, or possess wood turtles, without first obtaining permission from the chief of the Division of Wildlife."

For more information, contact: *Dr. Martin J. Rosenberg, Department of Biology, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106-7080, USA.*

New Zealand: On 4 July 1997, agents from the Police and Wildlife Enforcement Group apprehended one Freddy Angel on charges of smuggling tuatara (*Sphenodon punctatus*) from Stephens Island. Mr. Angel pleaded guilty in a preliminary hearing on 7 July to the following charges: conspiring with Anson Wong (a wildlife trader from Penang, Malaysia) to trade in endangered species; possession of four tuatara; and unlawfully hunting or killing protected species. Mr. Angel previously had served a five-year prison sentence for stealing tuatara from the Southland Museum and removing tuatara illegally from Stephens Island. Unfortunately, as this case demonstrates, the black-market value (estimated at US $6,000–9,000 each for tuatara) of many protected amphibians and reptiles outweighs the risk of being caught.

Tuatara are the sole extant members of the ancient order Rhynchocephalia and are protected under the TIES (Trade In Endangered Species) act and CITES Appendix I. Congratulations to New Zealand's law enforcement responsible for the capture. For more information about this case contact: *Phil Bishop, Department of Zoology, University of Otago, P.O. Box 56, Dunedin, New Zealand. e-mail: phillip.bishop@stonebow.otago.ac.nz.*

MEETINGS

Meetings Calendar

18 April 1998—21st Annual All Florida Herpetology Conference, University of Florida, Gainesville. *Refer to conference announcement elsewhere in this issue for details.*

1–3 June 1998—Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests: An International Symposium. Hanoi, Vietnam. Contact: Natalia Ananjeva (St. Petersburg, Russia), e-mail: nbanorus@glas.apc.org.

12–15 June 1998—Highlands Conference on Plethodontid Salamanders, Highlands Biological Station, Highlands, North Carolina, USA. To be placed on the mailing list, or to up-date your address, please send your name, address, and numbers (phone, FAX, e-mail) to: Plethodontid Conference, Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA, or send an e-mail message to Judy Hill at: JHILL@wpoff.wcu.edu. Additional information: http://www.wcu.edu/hibio.

25–27 June 1998—22nd Annual Meeting of the International Herpetological Symposium, Inc., Holiday Inn-Cincinnati Airport, Cincinnati, Ohio, USA. Contacts: Stan Draper, IHS Secretary, P.O. Box 16444, Salt Lake City, Utah 84114-0444, USA; e-mail: sdraper@npsp.com; or Pete Strimple, Liaison Committee Chair, 5310 Sultana Drive, Cincinnati, Ohio 45238, USA; tel. (513) 451-2392; e-mail: pds0404@aol.com.

16–22 July 1998—41st Annual Meeting, Society for the Study of Amphibians and Reptiles; 46th Annual Meeting of The Herpetologists' League; 78th Annual Meeting, American Society of Ichthyologists and Herpetologists. Hosted by the University of Guelph, Guelph, Ontario, Canada. *Refer to meeting announcement in this issue for details.*

1–5 September 1998—Third International Asian Herpetological Meeting, Almaty, Kazakhstan. To receive the First Announcement and Preliminary Registration Form, please contact one of the meeting organizers: Dr. Tatjana Dujsebayeva, Department of Biology, Kazakh State University, Al-Farabi Prospect, 71, Almaty, 480078, Kazakhstan; tel. (3272) 472677; fax (3272) 472609; e-mail: zool@plague.almaty.kz; Dr. Natalia Ananjeva, Department of Herpetology, Zoological Institute, Universitatskaja nab., 1, Saint-Petersburg, 199034, Russia; tel. (812) 2180711; fax (812) 2182941; e-mail: anb@zisp.spb.su; or Dr. Theodore Papenfuss, Asiatic Herpetological Research, Museum of Vertebrate Zoology, University of California, Berkeley, CA 94720, USA; tel. (510) 642-3567; fax (510) 643-8238; e-mail: asiaherp@uclink2.berkeley.edu.

13–17 May 1999—Fourth International Symposium on Isolated Vertebrate Communities in the Tropics, Bonn, Germany. Hosted by the Zoologisches Forschungsinstitut und Museum Alexander Koenig. To receive announcements and to obtain further information, please contact: Prof. Dr. W. Böhme, Adenauerallee 160, 53113 Bonn, Germany; tel. +49 228 91 22 250, fax ++49 228 216 979, e-mail: r.hutterer.zfmk@uni-bonn.de.

Special Notice on *ALYTES*

The International Society for the Study and Conservation of Amphibians (ISSCA) announces a special offer to institutions (universities, libraries, museums, associations, etc.). ISSCA will donate a complete set of Volumes 1–14 (1982–1996) of its journal *ALYTES*, an international journal devoted to amphibian biology, to any institution that a) agrees to take the journal for 5 years, and b) pays postage on sending the journal to the institution. In North America, the cost would be US $640.00 (subscription plus surface mail shipping). Checks payable to "ISSCA" should be sent to: *Dr. Mark Wygoda, Department of Biological and Environmental Sciences, P.O. Box 92000, McNeese State University, Lake Charles, Louisiana 70609, USA.*

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Christopher Sheil or Anne Maglia (postal and e-mail addresses on inside front cover). Readers are encouraged to send us your comments concerning Current Research. We are most interested in knowing what you'd like to see here, and how we can improve this section's utility for all readers.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Five New Gekkonid Genera

The genus *Phyllodactylus* has long been systematically problematical. Despite the removal of several monophyletic groups the genus remains polyphyletic. Through the evaluation of morphological features and allozymes, Bauer et al. found that Old World *Phyllodactylus* are not closely related to New World *Phyllodactylus*. Further, Old World species as a unit do not form a demonstrably monophyletic group. In order to resolve the Old

World species, the authors described five new genera as well as resurrecting another genus. Redescriptions and diagnoses are provided for two other currently recognized genera. The authors restrict *Phyllodactylus* to New World species only (although the monophyly of this group is not strongly established), with the Madagascan species *P. brevipes* remaining *incertae sedis*.

BAUER, A. M., D. A. GOOD, AND W. R. BRANCH. 1997. The taxonomy of the southern African leaf-toed geckos (Squamata: Gekkonidae), with a review of Old World "*Phyllodactylus*" and the description of five new genera. Proc. Calif. Acad. Sci. 49(14):447–497.

Rhacodactylus Phylogenetics

Good et al. examined phylogenetic relationships of the New Caledonian giant geckos of the genus *Rhacodactylus*. Both allozyme and morphological data yield largely congruent patterns of relationships. A "total evidence" approach was used, incorporating 13 allozyme and 29 morphological characters, to determine a single most-parsimonius phylogenetic tree. In addition to the relationships within the genus *Rhacodactylus*, the authors tentatively regard *Pseudothecadactylus* as valid because allozyme data conflict strongly with morphological data that suggest that these geckos evolved from within *Rhacodactylus*.

GOOD, D. A., A. M. BAUER, AND R. A. SADLIER. 1997. Allozyme evidence for the phylogeny of giant New Caledonian geckos (Squamata: Diplodactylidae: *Rhacodactylus*), with comments on the status of *R. leachianus henkeli*. Aust. J. Zool. 45:317–330.

Chelonian Population Structure

Dodd recently tested the hypotheses that in chelonian species with sexual size dimorphism, the smaller sex will mature at a smaller size and a younger age than the larger sex, sex ratios should be biased in favor of the earlier maturing sex, and deviations from a 1:1 sex ratio result from maturation of the smaller sex at a younger age. The data used to test these hypotheses were collected from 1991 to 1995 on an insular population of Florida box turtles (*Terrapene carolina*). Contrary to predictions, the earlier maturing sex grew to larger sizes than the late maturing sex. A sex ratio imbalance did exist, but did not result from faster maturation of the smaller sex.

DODD, C. K., JR. 1997. Population structure and the evolution of sexual size dimorphism and sex ratios in an insular population of Florida box turtles (*Terrapene carolina bauri*). Can. J. Zool. 75:1495–1507.

Catalogue of Amphibians and Reptiles in the Silesian Museum

The Silesian Museum in Opava was founded in 1814. In 1945 most of the zoological collection in the museum was destroyed, leaving few scientifically valuable specimens. Post-war herpetological collections contain several hundred vouchers from the Czech Republic as well as material from Slovakia, Balkan Peninsula, Russia, Africa, Asia, and America. Gvozdik and Benes have taken advantage of this collection in their recent catalogue of amphibians and reptiles from two Czech Republic regions, northern Moravia and Silesia.

GVOZDIK, L., AND B. BENES. 1997. Amphibians and reptiles of northern Moravia and Silesia, Czech Republic, in the Silesian Museum, Opava. Cas. Slez. Muz. Opava. 46:23–49.

21ST ANNUAL ALL FLORIDA HERPETOLOGY CONFERENCE

Co-sponsored by The Florida Museum of Natural History and The Gainesville Herpetological Society

18 April 1998
The University of Florida, Gainesville, Florida

Registration: $15 per person (before 13 April); $17 per person (after 13 April).

Speakers include: Keynoters William Duellman and Peter Pritchard, Susan Donoghue, Neil Ford, Michael Grace, Kathy Love, Charles Peterson, and Scott Stahl.

Also featured: Florida Herpetology Graduate Student Symposium, organized by Richard Franz; Florida Live Snake Exhibit, organized by Kevin Enge; Captive Breeder Exhibits, Herp Art, Books, and Jewelry, and Evening Barbeque and Auction.

For information or to register, contact: *David Auth, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA, or call (352) 392-3264.*

Developmental Constraints

For many years researchers at the Department of Vertebrate Zoology, St. Petersburg State University have been studying developmental constraints of the anuran sacrum. The purpose of these studies is to examine the range of variability of a morphological structure in its whole spectrum of possibilities. To date several papers and at least one book have been published, mostly on ranid frogs. Recently, Malashichev published an analysis of the sacrum variability in *Bombina*.

MALASHICHEV, Y. B. 1997. Qualitative analysis of sacrum variability in some *Bombina* species. *In* W. Böhme, W. Bischoff and T. Ziegler, (ed.). Herpetologia Bonnensis, pp. 257–263.

Chelonian Phylogeny

Both molecular and morphological data for the 23 major lineages of living turtles and seven key fossil taxa were used to examine the phylogeny of chelonians. This approach resulted in a very well-resolved tree with only a few of the deep branches within the Cryptodira left as an unresolved polytomy. The addition of fossil data provided little added resolution to the tree and resulted in a sharp decline in bootstrap proportions for nodes near the fossils.

SHAFFER, H. B., P. MEYLAN, AND M. L. MCKNIGHT. 1997. Test of turtle phylogeny: Molecular, morphological, and paleontological approaches. Syst. Biol. 46(2):235–268.

Phrynosoma Biogeography and Taxonomy

The short-horned lizard (*Phrynosoma douglasi*) ranges throughout much of western North America. Zamudio et al. analyzed mtDNA sequences from 38 populations of *P. douglasi* to deter-

mine the biogeographic and phylogenetic relationships within this species. They found that *P. douglasi* as currently recognized is paraphyletic with respect to *P. ditmarsi*. In light of their data the authors discuss the taxonomic implications for this group.

ZAMUDIO, K. R., K. B. JONES, AND R. H. WARD. 1997. Molecular systematics of short-horned lizards: biogeography and taxonomy of a widespread species complex. Syst. Biol. 46(2):284–305.

Advances in Amphibian Research in the Former Soviet Union

With the breakup of the USSR, a large amount of information on the biology of amphibians, formerly published in state subsidized journals, no longer had a publishing outlet. As years passed, studies on the biology of amphibians expanded into new and exciting research fields. Clearly, a new journal was needed to serve the growing number of amphibian biologists within the territory of the former Soviet Union, as well as to introduce western biologists to the breadth of research now underway. In 1996, I was asked by Dr. Sergius Kuzmin of the Russian Academy of Sciences to assist with the production of the first two issues of such a new journal, *Advances in Amphibian Research in the Former Soviet Union*.

AARFSU publishes original research papers on the systematics, biogeography, ecology, evolution, behavior, morphology, genetics, physiology, paleontology, and conservation of amphibians throughout the huge territory occupied by the former Soviet Union. Papers are published in English allowing dissemination of important research results to an international audience. The response to the first two issues has been enthusiastic among Russian and former USSR amphibian biologists, hence the decision to continue the publication as a research journal. The wide range of topics covered in the first two issues have provided non-USSR biologists with a valuable insight into Nearctic amphibian research and to a literature that is still very difficult to obtain.

Sergius and I hope these first two issues deepen our understanding of amphibian biology both within the former USSR and among western scientists inasmuch as we often share common problems in the study and conservation of amphibians and their habitats. The modest subscription price will ensure that future issues maintain the high quality we hope is evident in volumes 1 and 2.—*Submitted by C. Kenneth Dodd, Jr., Biological Resources Division, U.S. Geological Survey, 7920 N.W. 71st Street, Gainesville, Florida 32653, USA.*

Contents of Volumes 1 and 2 (journal name omitted from citations):

ALEKSEEVA, T. A., AND I. G. VLADIMIROVA. 1996. The influence of temperature on the rate of oxygen consumption in the Semirechensk salamander (*Ranodon sibricus*). 1:209–212.

BOBROV, V. V. 1996. Amphibian zoogeographical regions of the former Soviet Union. 1:201–208.

DUNAYEV, E. A. 1996. Cranial characteristics of salamanders (Caudata) in the fauna of the former Soviet Union. 1:27–46.

IORDANSKY, N. N. 1996. Evolution of the musculature of the jaw apparatus in the Amphibia. 1:3–26.

KUBYKIN, R. A. 1996. The Green Toad on islands in Lake Alakol, Southeastern Kazakhstan. 1:217–220.

KUTENKOV, A. P. 1996. Natural breeding ponds of the common frog (*Rana temporaria*), and their location in the Karelia-Kola Region. 1:139–148.

KUZMIN, S. L. 1996. The taxonomic position of amphibian species from "Zoographia Rosso - Asiatica" by P.S. Pallas. 1:47–65.

KUZMIN, S. L., AND D. N. TARKHNISHVILI. 1996. Food niche dimensions in a Caucasian amphibian assemblage. 1:117–129.

LUKINA, G. P., AND V. A. KONEVA. 1996. Notes on the biology of the Caucasian Parsely Frog (*Pelodytes caucasicus*) in Krasnodar Region. 1:109–116.

LYAPKOV, S. M. 1996. The influence of predators on Brown Frogs during and after metamorphosis. 1:149–159.

MANTEIFEL, Y. B., AND A. V. ZHUSHEV. 1996. Avoidance of predator chemical cues by tadpoles of four east European anuran species (*Bufo bufo, Rana arvalis, R. lessonae,* and *R. temporaria*). 1:161–180.

MISYURA, A. N., V. Y. GASSO, AND V. N. SUKHANOVA. 1996. Comparative ecology and biochemistry of amphibians and reptiles in polluted habitats. 1:191–200.

NOVITSKY, R. V. 1996. Characteristics of polymorphism in the common frog (*Rana temproaria*) in Byelorussia. 1:91–108.

RAVKIN, Y. S., ET AL. 1996. Characteristics of amphibian distribution in the West Siberian Plain. 1:67–90.

RESHETNIKOV, A. N. 1996. Hygrotactic and olfactory orientation in juvenile common toads (*Bufo bufo*) during the postmetamorphic period. 1:181–190.

SAKULINA, N. A. 1996. The ground substance layer in the skin of the common frog (*Rana temporaria*). 1:213–216.

THIESMEIER, B. 1996. A morphological and ecological approach to the classification of larvae of the Semirechensk salamander (*Ranodon sibiricus*) and the long-tailed clawed salamander (*Onychodactylus fischeri*). 1:131–138.

BLINOVA, T. K., AND V. N. BLINOV. 1997. Distribution and abundance of amphibians in the forested steppes and steppes of southern Transuralia. 2:31–44.

CHUBINISHVILI, A. T. 1997. The status of natural populations of the *Rana esculenta* complex in response to anthropogenic influences: a morphogenetic approach. 2:117–124.

DOLMEN, D., J. V. ARNEKLEIV, AND R. A. KUBYKIN. 1997. Habitat and abundance of the Semirechensk Salamander (*Ranodon sibiricus*) at a site in the Borokhujir River Valley, Kazakhstan. 2:45–70.

DUNAYEV, E. A. 1997. A record of the green toad (*Bufo viridis*) with five legs in Moscow Province. 2:169–171.

GONCHAROVA, G. I., AND D. V. SEMENOV. 1997. Amphibian status in Moscow Province: Long-term observations at the village of Saltykovka. 2:163–165.

KISELEVA, E. I. 1997. Aspects of the chemical ecology and chemosensory guided behavioral reactions in anuran tadpoles. 2:95–101.

KOTOVA, E. L. 1997. Reproduction and morphometrics of anurans in the southwestern part of the Russian Far East. 2:147–155.

KURANOVA, V. N. AND S. V. SAVELIEV. 1997. The effect of radiation and chemicals on amphibian ontogeny. 2:167–168.

KUTENKOV, A. P. 1997. Distribution of anuran amphibians in the Karelia-Kola Region. 2:133–136.

KUZMIN, S. L., AND D. N. TARKHNISHVILI. 1997. Feeding in some anuran species from Vietnam. 2:103–109.

LEONTYEVA, O. A., D. V. SEMENOV, AND A. V. ESENIN. 1997. Brown frogs as bioindicator of heavy metal contamination: preliminary results on the common frog (*Rana temporaria*) in Moscow Province. 2:125–131.

MASLOVA, I. V. 1997. New data on the spawning activity of Dybowsky's frog (*Rana dybowskii*) and the Siberian newt (*Salamandrella keyserlingii*). 2:143–146.

MESCHERSKY, I. G. 1997. The food habits of the Iranian long-legged frog (*Rana macrocnemis*) in North Ossetia. 2:111–116.

OKULOVA, N. M., ET AL. 1997. The green frogs in Ivanovo Province. 2:71–94.

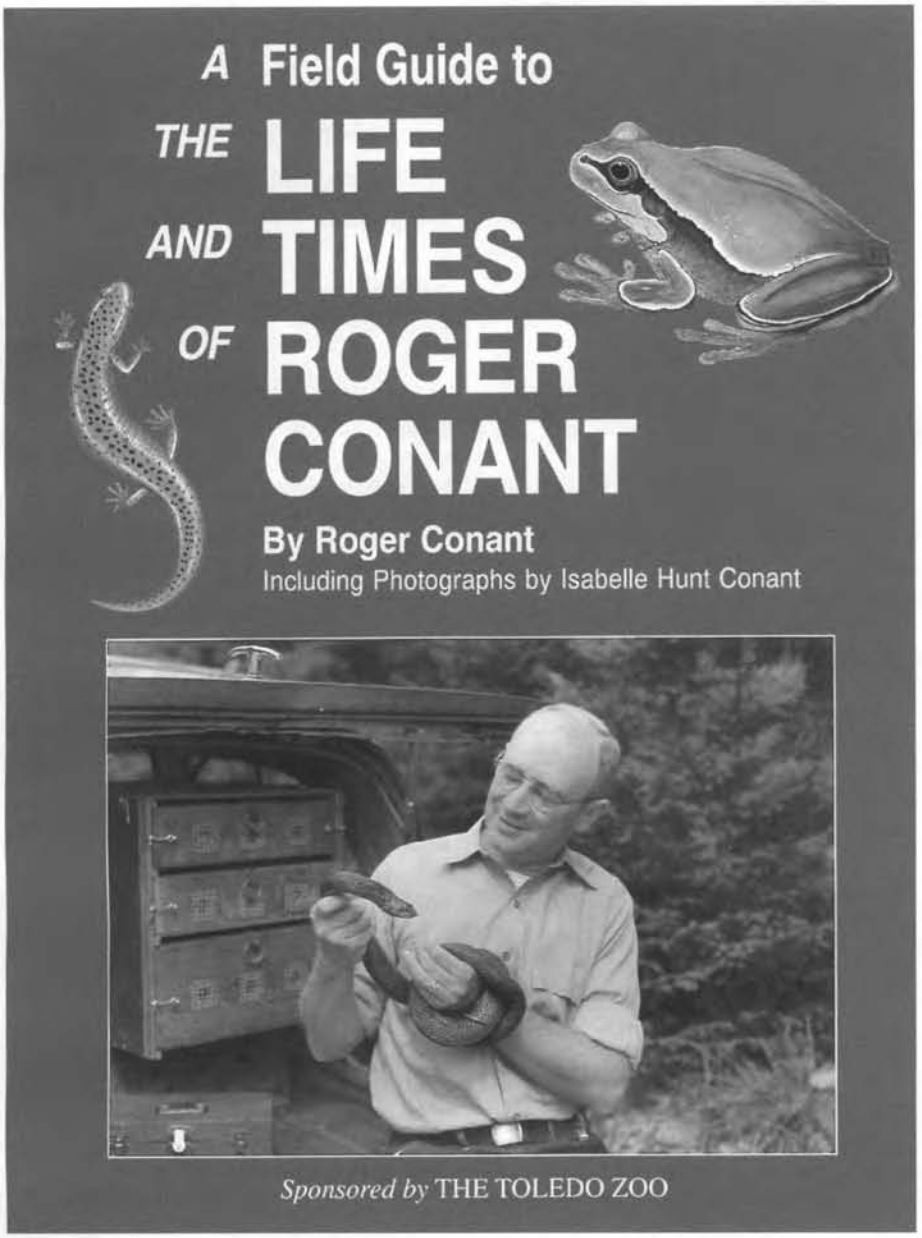
RESHETNIKOV, A. N., AND Y. B. MANTEIFEL. 1997. Newt-fish interactions in Moscow Province: a new predatory fish colonizer, *Perccottus glenii*, transforms metapopulations of newts, *Triturus vulgaris* and *T. cristatus*. 2:1–12.

SOLOVJOV, A. N. 1997. Records of the Siberian newt (*Salamandrella keyserlingii*) in Kirov Province. 2:137–142.

TARKHNISHVILI, D. N., AND I. A. SERBINOVA. 1997. Normal development of Caucasian salamander (*Mertensiella caucasica*). 2:13–30.

TIMOFEEV, B. I. 1997. Notes on the reproduction of *Neurergus crocatus* in captivity. 2:173–176.

VLADIMIROVA, I. G., T. A. ALEKSEEVA, AND A. A. LEBEDEVA. 1997. The rate of oxygen consumption in some amphibian species. 2:157–162.



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A marvelous tour de Conant!"

William Conway
President, Wildlife
Conservation Society and
Director, Bronx Zoo

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INSTITUTIONAL PROFILE

Herpetology in Southern Ontario

JAMES P. BOGART
Department of Zoology, University of Guelph
Guelph, Ontario, Canada N1G 2W1

and
ROBERT MURPHY
Centre for Biodiversity and Conservation Biology
Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario Canada M5S 2C6

The Ontario herpetological fauna consists of 24 species of amphibians and 25 reptile species. Most reach the northern limits of their range in southern or central Ontario. Our fauna is by no means rich but does provide interesting distributional and physiological questions. Long-term monitoring of distributional and life history information in Ontario is mostly done by an extensive network of volunteers. The resulting Ontario Herpetofaunal Summary was started in 1984 and this successful monitoring program was profiled in Heyer et al. (1994). Ontario enjoys a healthy interaction of amateur and professional herpetologists in the Universities, Museums, the Ontario Ministry of Natural Resources, the Canadian Wildlife Service, the Canadian Forest Service, the World Wildlife Fund (Canada) and regional herpetological societies. Input from these agencies and societies have been used by DAPCAN (Declining amphibian populations task force, Canada) and COSEWIC (Committee on the status of endangered wildlife in Canada) to flag species and habitats that are of special concern in Ontario and in Canada (Green 1997).

The University of Guelph

The University of Guelph is a research-intensive institution with more than 1500 graduate students. Although the campus is more than a century old, the University was established in 1964 as a diversification and expansion of three Colleges (Agricultural, Veterinary, Home Economics) of the University of Toronto. The expansion included colleges of Arts, Biological Sciences, Family and Consumer Studies, Physical and Engineering Science, and Social Science. The 344-hectare campus combines traditional buildings dating back to the last century with contemporary concrete and glass structures.

Herpetology at Guelph

Several faculty members at Guelph use amphibians and reptiles in their research. Dr. Dale Smith in the Ontario Veterinary College studied healing in snakes and assists with radio-telemetry work; Dr. Steve Scadding investigates regeneration in the Axolotl; Dr. Don Stephens studies amphibian muscle physiology; and Dr. Pat Wright studies metabolism in frogs. Herpetological research is the primary focus of Drs. Bogart and Brooks in the Department of Zoology.

Dr. Bogart and his students work on a range of herpetological problems. Two Ph.D. students are studying evolution at the species level. Andrew Chek is studying tropical speciation through an examination of vocalizations and sequence-derived phylogenies of wide ranging species groups of hylid frogs in Brazil. Leslie Rye is examining introgression at the nuclear and mitochondrial DNA level in the garter snakes of Canada and eastern North America. The MSc students being advised by Dr. Bogart include Dave Britton who is examining spatial relationships and diversity of amphibians and reptiles of the Georgian Bay Islands in Lake Huron. Janine Glaser is studying the effects of aerial spraying of gylphosate herbicide on wood frog populations in forest plantations in northern Ontario. Tana McDaniel is studying ecological partitioning in leopard and pickerel frogs in eastern Canada, and Josh Feltham is attempting to derive a sequenced-based phylogeny for hybrid salamanders of the genus *Ambystoma*. Dr. Bogart is continuing his research on polyploid amphibians. He has recently investigated tetraploid sand frogs of the genus *Tomopterna* with Dr. Alan Channing in southern Africa and finally completed a monograph on the *Ambystoma* hybrids in New England and New York with Dr. Michael Klemens.

Dr. Bogart and his students have undertaken a project that attempts to incorporate data bases from the Ontario Herpetofaunal Summary and the Canadian Forest Service into a Geographical Landscape System (GLS) analysis for amphibians and reptiles in Ontario. The past and present locality information for amphibians and reptiles in Ontario is used to examine ranges, follow declines, and monitor trends over time. This system has other distinct advantages. By overlaying temperature profiles, water courses, elevation gradients, soil substrate, forest types and cover, or any of a wide variety of possible environmental or ecological correlates, the statistical probabilities that a geographic position would be a favorable habitat for an individual amphibian or reptile can be estimated. This project is a collaborative effort that involves Mike Oldham, of the Ontario Heritage Foundation who has incorporated the Ontario Hepetofaunal data and screens the new locality information, Dan McKenney of the Canadian Forest Service in Sault Ste. Marie who does his magic with computer analyses and graphics, and students at Guelph who, often in conjunction with their other projects, gather locality information, test statistical "hot" spots, and ground truth anomalous information. It is expected that the project will eventually be expanded and carry itself through the efforts of interested people and agencies. A web page (http://fcor2.glfc.forestry.ca/english/res/herp/herp.html) describes the project and has been set up as a first attempt for a dynamic Ontario Herpetofaunal Atlas.

Dr. Ron Brooks is continuing his long-term and intensive monitoring of amphibian and reptilian populations in Ontario. Investigations of life history strategies, population ecology, conservation biology, and reproduction of reptiles and amphibians form the major thrust of the research activities of Ron and his students. Much of Ron's research is being done at the Wildlife Research Station in Algonquin Provincial Park in Central Ontario. The



Calling male gray treefrog (*Hyla versicolor*), one of the species involved in Bogart's studies of polyploid amphibians.

projects being done in the Park include: Dave Cunnington's analysis of optimal egg size of the spotted salamander in lakes with and without predatory fish; Shane de Solla's investigation of home range and containment levels of the snapping turtle; Lisa Enright's investigations of the effects of selective logging on forest amphibian communities; Kevin Judge's examination of the importance of metapopulation dynamics to the persistence of amphibian populations; Cam MacDonald's study of age-related reproductive success and population ecology of the bullfrog; and Janet Lochead's investigation of pre-ovulatory parental investment of the snapping turtle. Nicky Koper has conducted a laboratory study on the relative importance of light and food on the growth of the painted turtle. Jon Edmonds is examining the population ecology of the stinkpot turtle in Georgian Bay and Rob Wilson is studying habitat selection and thermoregulation of the fox snake populations around the Great Lakes.

Herpetology at the Royal Ontario Museum

The Royal Ontario Museum is located adjacent to the University of Toronto in vibrant downtown Toronto. It is Canada's largest and most prestigious museum. Unlike most Canadian museums, the ROM's mandate is not restricted to the province. The museum is also quite unusual in combining earth and life sciences along with art and archaeology. Its collections are international in scope. A visit to the museum reveals the phenomenal Chinese collections, including three 12th and 13th century Buddhist Temple paintings, and a Ming Dynasty tomb, among other treasures.

The herpetological collections at the ROM are maintained by one shared technician, a team of highly dedicated volunteers, and the two permanent staff members, Ross MacCulloch (Assistant Curator) and Bob Murphy (Sr. Curator), the first academically-trained Curator (Ph.D.-type) of Herpetology in the museum. In 1984 the herpetology collections at the ROM numbered about 14,000 specimens, and most of these were from Ontario. The collection of amphibians and reptiles now numbers more than 40,000 specimens, plus an additional 35,000 samples of frozen tissues. The resource has become international in scope, and much of the preserved material is backed-up by the extensive array of frozen tissues. Significant collections have been made in Australia, Liberia, Guyana, México, southern California, and the Caucasus—southern Russia (Daghestan), Armenia, and Georgia. Smaller collections have been made in other places, such as Peru and the Philippine Islands. However, the single greatest strength of the collection is Vietnam, where, since 1994, we have collected more than 10,000 specimens.

The research facilities of the ROM are quite adequate for phylogenetic investigations. The ROM has its own x-ray and video digitizing facilities for morphological investigations, as well as a cytology lab. Nearby at the University of Toronto, the ROM-based research group has access to a state-of-the-art flow cytometry facility, SEM, and similar technical laboratories. Bob's molecular lab is equipped for simultaneously running 20 starch gels (cheap nuclear gene information), five radiation-based sequencing gels, and automated DNA sequencing; they don't buy data from a core facility. Macintosh G-3 266 MHz and Dell Pentium Pro 300 MHz computers facilitate efficient data evaluation. The lab has frequent international visitors. For example, Liu Wanzhao is currently visiting from the Kunming Institute of Zoology, China; soon Drs. Nikolai Orlov and Natasha Ananjeva will be on board from the Zoological Institute of St. Petersburg, Russia (repeat visitors), and then Gustavo Aguirre-L. and Georgina Santos-B. from México will visit, Gus for his third time. Sometimes there are visitors from America.



Dave Britton with one of his study subjects, a fox snake (*Elaphe vulpina*), at a site in Georgian Bay.

Ross MacCulloch is concentrating his field-based efforts on herpetofaunal diversity surveys in Guyana. His laboratory research has concentrated on allozymes of Caucasian lacertas. These forays include investigating the number of clones in uniparental species, population differentiation among widely-distributed species, and taxonomic status of isolated subspecies. And there is no doubt Ross is the king of flow cytometry in the lab.

Bob's research remains scattered across the globe—go ahead and try to find him—and equally varied in topic. If there is a central theme to the work (and such is highly debatable) then it's in molecular systematics, conservation genetics, methods of molecular data gathering and cladistic analysis, and international evaluations of Guiness. Molecular macroevolutionary topics include the phylogeny of rattlesnakes (a study of about 3000 bp of sequence data, and including all but three species of rattlesnakes), Baja California reptile genetics (forever), the phylogeny and evolution of the sympatric occurrence of ecotypes of Vietnamese frogs, and phylogenetic constraints on the evolution of unisexuality in reptiles. Microevolutionary research continues in the population genetics of Caucasian lacertas (in collaboration with Ilya Darevsky and crew, Ross, and others), and ever-present Baja projects. Most population genetics works are developing into true conservation genetics studies via involvement in conservation policy and strategies. Research into methods of data analysis continue in the form of ivory-tower development and application of randomization methods for searching and locating character covariation (which is not the same as philosophically flawed confidence estimation), as well as documenting the absurdity of using frequency (allozyme and morphological) information of phylogeny estimation—just wait for ROMMY II! However, such thought-inspiring debate has taken a back seat to biodiversity documentation and conservation efforts.

As a faculty member at the University of Toronto, Bob currently sponsors several graduate and undergraduate honors research students. Most senior, Jinzhong Fu is studying the evolution of lacertid lizards. His research has concentrated on DNA sequence data, spanned the micro- macroevolutionary boundary, and is now entering the realm of the phylogenetic perspective of lizard ecology. Fu will complete his dissertation in 1998. Amy Lathrop has undertaken a daunting doctoral dissertation topic, the evolution of *Megophrys*. Her study includes both microgeographic

evaluations of Vietnamese populations of widely distributed species (she's a veteran of four tours), taking the driver's seat in describing several new species of Vietnamese megophryids, as well as investigating higher taxonomic phylogenies. Broad-based, she uses both molecular and morphological data equally. She'll be done in '99. M.Sc. student Raoul Bain has now fully recovered from his "most interesting bout of malaria"—he's a three-time veteran of Vietnam field work. Raoul (alias Rommy II), is writing-up his morphological and molecular evaluations of the large, odoriferous ranids of Vietnam, and has substantial documentation that some "species" are actually quite large species complexes. Doctoral student Tanya Trépanier started in 1997 and is looking at the evolution of fringe-toed lizards (*Uma*) in excruciatingly great detail, SSCPs and all, and on an international basis. Her "preliminary" molecular data—only 2000 bp thus far from 20+ populations—are very exciting. She will follow her Ph.D. in biology with a law degree, only to become involved in international conservation law and policy-making. Michéle Bobyn was close to finishing her Ph.D. unscrambling the phylogeny of *Cnemidophorus* when she decided to take employment as a forensics specialist with the Province of Ontario's Centre for Forensic Sciences—something useful for society, but then, Canadians are like that, eh! Dr. Leslie Lowcock is back in town and he's threatening to continue his work on the damage to the anuran genome by pesticides and fertilizers. Finally, undergraduate student projects range from evaluating Vietnamese frog voices to DNA sequencing studies.

Elsewhere in the ROM, recent paleontological research (which does have some relevance to extant species) in the laboratory of Prof. Hans-Dieter Sues focuses on changing diapers, dinosaurs, and therapsids, and includes cladistic investigations of rhynchocephalians, diaper tabs, and crocodilians. Hans' field work concentrates in eastern North America and Central Asia. And Prof. Chris McGowan continues to actively publish on ichthyosaurs—like it will ever end. His recently graduated student, Ryosuke Montani, has prepared the first "proper" phylogenetic evaluation of the group.

As well, there is no shortage of herpetologically-oriented work at the University of Toronto. Check out the U. of T. Zoology web site and look up Prof. Robert Reisz (paleontologist), Prof. Rick Ellinson (developmental biologist), Prof. Richard Liversage (regeneration), Prof. Nick Mrosovsky (bio-rhythms), Prof. Dan Brooks (parasites), and Prof. Sherwin Desser (parasites).

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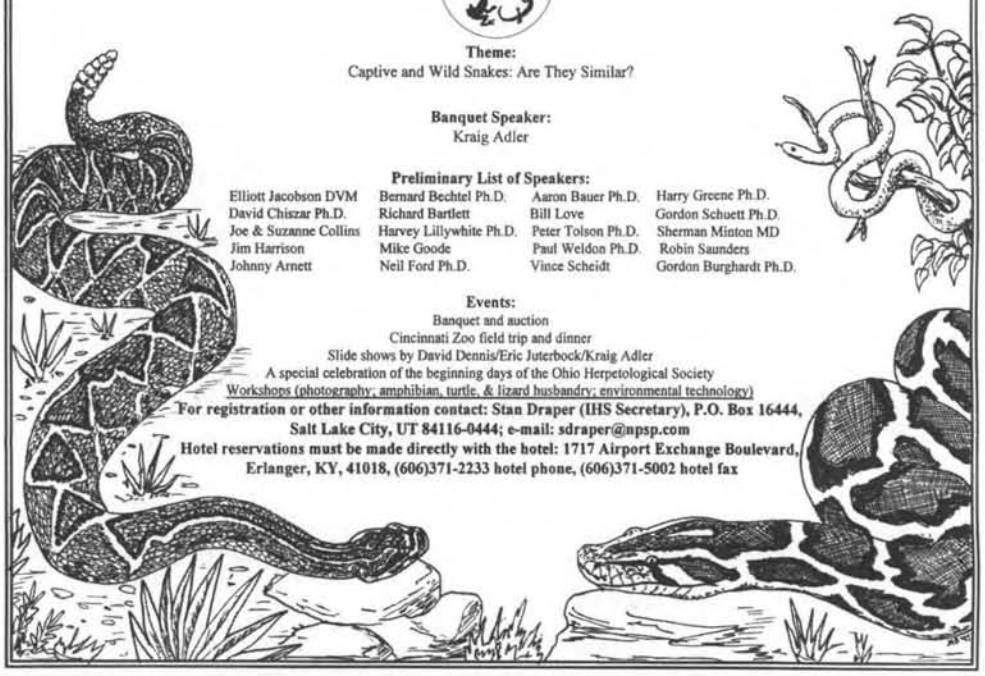
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ARTICLES

Amphibian Species Diversity Exceeds that of Mammals

FRANK GLAW
Zoologische Staatssammiung München
Münchhausenstr. 21, D-81247 München, Germany

and
JÖRN KÖHLER
Zoologisches Forschungsinstitut und Museum Alexander Koenig
Adenauerallee 160, D-53113 Bonn, Germany
e-mail: uzs13b@uni-bonn.de

Since the official beginning of zoological nomenclature by Linné in 1758, the number of known mammals has always been higher than that of amphibians. Wilson and Reeder (1993) recognized 4629 mammal species, while their number was estimated to be about 4675 in the middle of 1995 (Hutterer 1995). These estimates prompted us to check the current number of valid amphibian species and their description rates to compare them with those of mammals.

To estimate the current number of living valid amphibian species we compiled a synthesis of the data provided in *Amphibian Species of the World* (Frost 1985) and the additions and corrections to this work by Duellman (1993). The *Zoological Record* (1990–1995) was used as the main data source to complete this synthesis. Additionally, we searched recent herpetological and zoological journals for taxonomic changes (descriptions of new species, resurrections from synonymy, and new synonyms). All these data (available at www.mabnetamericas.org) were processed on IBM compatible computers using Microsoft Access and Excel software. Calculations about expected future discovery rates of amphibian species were based on a linear regression of the description rates between 1964 and 1994. Our taxonomic classification follows Duellman (1993). The data on mammal species richness were taken from Wilson and Reeder (1993) as updated by Hutterer (1995).

Annual rates of amphibian species descriptions have been extremely variable (Fig. 1). Most of the outstanding peaks are due to important contributions of single scientists (1758: Linné; 1768: Laurenti; 1799: Schneider; 1803: Daudin; 1824: Spix; 1841: Duméril and Bibron; 1859: Günther; 1882: Boulenger; 1968: Taylor). Despite this variability, increasing rates of description are evident. This trend becomes obvious when the rates are clustered in decades (Fig. 2). Comparison of Fig. 2 with the graph provided by Wilson and Reeder (1993) demonstrates that the largest burst of species discoveries in mammals is over (see also Morell 1996), whereas description rates in amphibians are still increasing. Decrease of description rates between 1910 and 1919 as well as between 1940 and 1949 possibly are due to the first and second world wars, respectively.

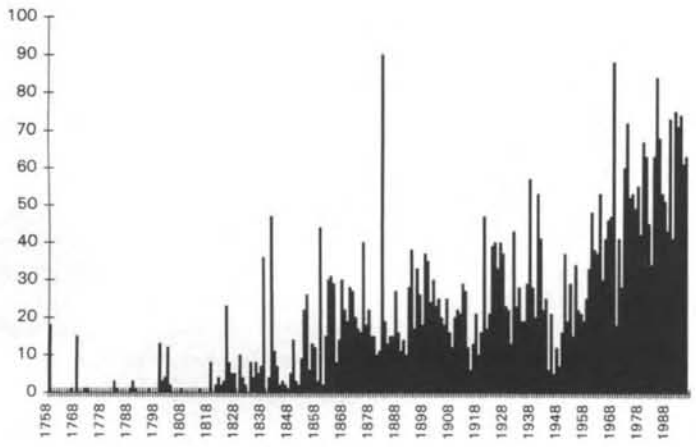


FIG. 1. Annual amphibian species descriptions since 1758 (synonyms not included).

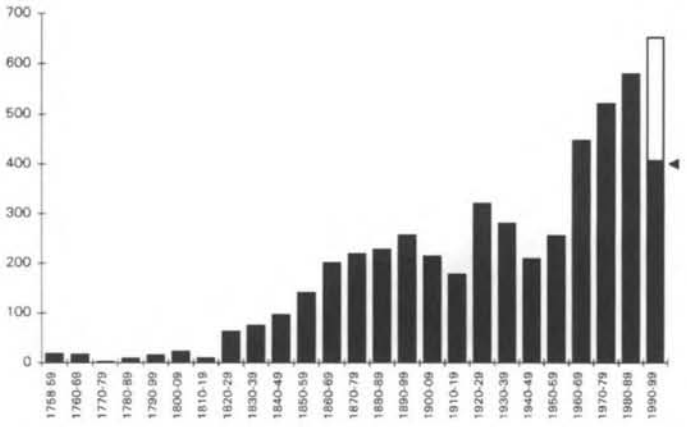


FIG. 2. Amphibian species descriptions since 1758 clustered in decades (synonyms not included). Arrow indicates end of 1995. Species descriptions until the end of this century are extrapolated.

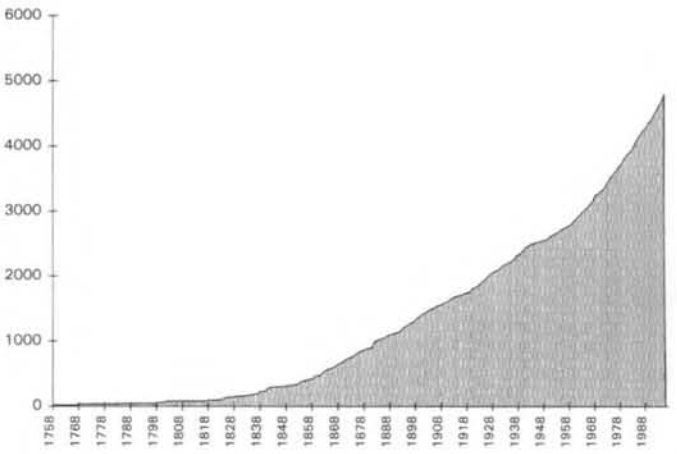


FIG. 3. Increase of valid recognized amphibian species from 1758 to 1995.

The cumulative analysis (Fig. 3) revealed that the number of recognized species strongly increases. The total number of valid amphibian species at the end of 1995 was at least 4780 (Anura: 4204, Urodela: 411, Gymnophiona: 165). Species richness of the ten largest anuran families at the end of 1995 was as follows: Leptodactylidae (906; among them 544 species in the genus *Eleutherodactylus*), Hylidae (754), Ranidae (711), Bufonidae (400), Microhylidae (316), Hyperoliidae (230), Rhacophoridae (228), Dendrobatidae (180), Centrolenidae (116), and Myobatrachidae (116). The largest family of the order Urodela is the Plethodontidae (263 species). The biogeographical portions

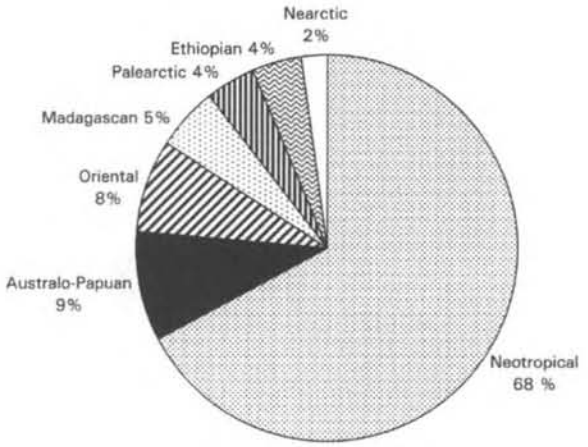


FIG. 4. Percentages of amphibian species described from the beginning of 1986 through the end of 1995 in different biogeographical regions.

of species descriptions during the last ten years are shown in Fig. 4. A comparison with the total number of mammal species showed that since 1994 amphibian species diversity exceeded that of mammals when both vertebrate classes had around 4650 species.

For comparison of species numbers several factors must be taken into account, e.g., subjective opinions and different species concepts of taxonomists, completeness of taxonomic inventories, percentage of synonyms, access of characters and methods. However, we consider these factors to be of similar significance in amphibians and mammals. Our comparison of species discovery rates suggests that the actual number of amphibian species is much higher than that of mammals. If we assume a continuous linear increase of species numbers in amphibians we will have reached 5000 species at the end of this century. The increasing use of modern techniques, especially the analysis of advertisement calls in anurans as well as biochemical and genetic studies, undoubtedly will lead to the discovery of many new species in the future. Recent field surveys in tropical rainforest areas (e.g., Madagascar and Bolivia) indicate that this trend seems realistic for at least the next two or three decades. These estimates demonstrate the urgent need for well-managed national and international biodiversity research programs for amphibians.

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Does *Batrachoseps* Occur in Alaska?

DAVID B. WAKE
ELIZABETH L. JOCKUSCH
and
THEODORE J. PAPENFUSS
Museum of Vertebrate Zoology, University of California
Berkeley, California 94720-3160, USA

Present address of ELJ: Department of Molecular and Cellullar Biology, University of Arizona, Tucson, Arizona 85721, USA

The Alaska worm salamander, *Batrachoseps caudatus* Cope, 1889, was collected only once, in 1882, on Annette Island, one of the southernmost islands in Alaska (Cope 1889). The species is known from a single specimen (USNM 13561) preserved in the National Museum of Natural History, Washington, D.C. The specimen was sent to the Museum by Lt. H. E. Nichols, in command of the ship "Hassler," which worked in Alaskan waters in 1882. The specimen, supposedly collected at Hassler Harbor on Annette Island, was catalogued into the collections of the National Museum of Natural History along with other specimens of species known to occur in southeastern Alaska, but also with specimens that occur in the vicinity of Mare Island, near San Francisco, California (we are grateful to R. Crombie for providing archival information). A morphologically similar species, the California slender salamander, *Batrachoseps attenuatus* (Eschscholtz 1833), occurs in the vicinity of Mare Island, and a California animal may have been mixed with Alaskan material. The species may not exist in Alaska at all (Wake 1993). However, Lt. Nichols was known to have been careful and precise, and perhaps there has been an inadequate search in this area (Hendrickson 1954; Hodge 1976). While it would seem unlikely that an amphibian species would be endemic in Alaska, recent discoveries have led to suggestions that there may have been Pleistocene refuges, or even an ice-free corridor along the North Gulf Coast of present-day southeastern Alaska (MacDonald and Cook 1997). Accordingly, we decided to make a careful search for these salamanders. Such activity seemed appropriate, given the rapid changes taking place in southeastern Alaska due to forest harvest and other human activities. If there is an endemic salamander in Alaska, care should be taken to make certain that it survives.

Through the courtesy of Jim and Pat Beal of Metlakatla, Alaska, we were able to visit a number of sites on Annette Island between August 4 and August 10, 1996. We failed to find any *Batrachoseps*, although in our collective judgement the environmental conditions for such an occurrence were favorable.

Annette Island consists of two distinct parts. There is a low southeastern peninsula that is the population center for the island, including the village of Metlakatla, a now largely abandoned army camp and large airport, a fish hatchery, dump, radio towers, fish cannery, and boat harbor. The population of the island is something less than 2000 people, all of whom live on this peninsula. The peninsula is relatively flat, with one 150 m hill and many inlets, bogs, and ponds. The remainder of the island is high, rocky, and rough, with a number of old logging roads. The highest point on the island is 1094 m. Rock, most of it Paleozoic (mainly Silurian), dominates the main part of the island; in the north and east portions of the main island upper Triassic and middle to upper Jurassic rocks are exposed (Berg 1972). The youngest rocks on the island are Cretaceous, dated at 87 myr, and these are extremely limited in extent. There is a rich and dense fringing forest around the entire island, sometimes extending well inland. However, the forest is usually not more than a few hundred meters wide, and

often narrower than that. Then the forest breaks up into muskeg in the interior and at higher elevation.

We traveled by boat, stopping at various places and going ashore in a Zodiac. We made brief stops in several areas, but four sites deserve special mention:

1. Hassler Harbor (55°07.75'N, 131°35.00'W), northeast side of Annette Island, between Nedzaheen Cove and Harbor Point. This was our main destination and we spent the largest amount of time here, visiting the area twice. The Harbor itself is small but well protected, and it is easy to see why it was an anchorage for the "Hassler" (which is known to have been here on August 10, 1882; Hodge 1976). It is protected by the very small but forested Pow Island. The forest fringing Annette Island near the Harbor is narrow, but the habitat appears suitable for plethodontid salamanders. The understory vegetation is dense and diverse, and several species of huckleberries (*Vaccinium* spp.) were especially abundant. There is abundant downed timber, some of it well rotted, and loose rocks were abundant along creeks and where the creeks cut through underlying rock, which in this region is upper Triassic and middle to upper Jurassic (Berg 1972). We also worked small talus zones, although they are not abundant in the forested zone where we concentrated our work. The soil was moist and seemingly ideal for salamanders, and temperatures in the shade at mid-day on sunny days reached 21°C.

2. Crab Bay region (55°07'N, 131°22'W), east side of Annette Island. This was among the most favorable habitats we investigated. We spent a full day here. Large cedar, spruce, and hemlock trees occur on a relatively flat base with abundant cover, appropriate for plethodontids. Metamorphosed limestone outcrops are found (upper Triassic in age, Berg 1972), and there are several small caves. We investigated a wide range of habitats, including creek margins and caves. Many of the invertebrate associates of plethodontid salamanders found in Washington, Oregon, and California were present, including snails, slugs, snail-eating beetles, millipedes, and earthworms. We found newts (*Taricha granulosa*) in the creek, and one under a piece of bark.

3. Peninsula north of Annette Bay near landing (55°15.2'N, 131°31.3'W), extreme northwest Annette Island. This was excellent habitat, with some fine forest, notable for the size of the yew trees. The trees were especially large and understory vegetation was dense on the slopes along the north shore of the Bay. However, we did not penetrate very far into the woods (ca. 200 m) before we encountered rock (the entire peninsula is middle or upper Jurassic in age [Berg 1972]) and muskeg. Newts were common in this area.

4. Tamgas Harbor, along the east side on main part of Annette Island, just above Creek Point. This is near the fish hatchery. The forest in this protected area is excellent—large spruce, hemlock, and cedar trees. This is near the southern end of the island, and rocks in the area are all Silurian or older in age (Berg 1972). The habitat appears to be ideal for salamanders, but we found none.

5. Metlakatla Peninsula. This area is highly disturbed by all kinds of activities, especially those associated with the now nearly abandoned airport. There are numerous ponds, and at night we found toads (*Bufo boreas*) to be relatively common on the roads. We did not spend much time in this area because it did not look appropriate for plethodontid salamanders.

Abundant habitat exists on Annette Island for plethodontid salamanders, and many of the animal and plant associates of plethodontids further to the south are found here. For Alaska, the climate is mild, and plethodontids should be able to survive the winters easily. We found two species of amphibians, and local residents described a third, possibly *Ambystoma gracile* or *A. macrodactylum*. However, no one, including good amateur naturalists with whom we spoke, described a salamander that might have been a plethodontid. They were familiar with newts and toads, however.

We are not certain that the "Hassler" spent more than a single day anchored at Hassler Harbor. If it really was as short a time as a day, it seems unlikely that three experienced salamander collectors working under ideal conditions at the same time of the year for five days would fail to find the species. However, we did fail to find one species that local residents described to us, and of course it is risky to make positive statements on negative evidence under any circumstances.

Plethodontid salamanders probably do not occur in Alaska, although they might come relatively close. However, these are not members of the genus *Batrachoseps*, but rather of *Ensatina*. There are no authenticated records for salamanders of the genus *Batrachoseps* north of the Columbia River. Furthermore, the absence of Cenozoic rocks on Annette Island suggests that more recent strata were ground off by Pleistocene glaciers. If so, it is likely that there was no Pleistocene refugium on Annette Island. The limestone outcrops generally are highly degraded and the little exposed limestone that contains caves does not have sufficiently large caves to have formed long-term refuges. It seems unlikely that plethodontid salamanders would have survived the Pleistocene glaciation on this island. The toads and newts have most likely arrived recently. Allozymes and mitochondrial DNA sequences of Alaskan newts are very similar to those from populations from the state of Washington (Tan 1994); this suggests that the newts made it to Alaska after the glaciers receded.

Some parts of southeastern Alaska may have escaped Pleistocene glaciation, and it may be that the specimen in the National Museum of Natural History came from one of these areas and was mislabeled. However, if we admit to the possibility of mislabeling, it seems most likely that the salamander came from the vicinity of the California port of the "Hassler," Mare Island, near Vallejo, Solano County, California. The species *Batrachoseps attenuatus* is common in the Vallejo area, and the holotype of *Batrachoseps caudatus* (which has been examined by DBW) cannot be distinguished from large members of that species.

In summary, we found no plethodontid salamanders on Annette Island, although conditions appeared to be favorable. Given the good conditions and the favorable environment, the fact that three experienced collectors failed to find any *Batrachoseps* seems significant. The geological evidence together with the great geographic separation from other *Batrachoseps* makes it unlikely that the genus occurred on Annette Island in 1882, and the virtual identity of the specimen to members of *Batrachoseps attenuatus* suggests that the holotype is a mislabeled specimen of that species. We conclude by concurring with other authors (e.g., Schmidt 1953) that *Batrachoseps caudatus* Cope, 1889, should be considered a subjective junior synonym of *Batrachoseps attenuatus* (Eschscholtz, 1833).

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Rare Nesting Occurrence of the Leatherback Sea Turtle, *Dermochelys coriacea*, in Northwest Florida, USA

TERESA J. CALLESON
GEORGE O. BAILEY
and
H. LEE EDMISTON
Apalachicola National Estuarine Research Reserve
Florida Department of Environmental Protection
Eastpoint, Florida 32328, USA
e-mail (TJC): calleson@digitalexp.com

In the continental United States, Florida is the only state to consistently document nesting of the leatherback sea turtle, *Dermochelys coriacea*, although nesting has been reported from Texas to Georgia (Ernst et al. 1994; Ruckdeschel et al. 1982). From 1979–1992, as many as 188 leatherback nesting emergences were documented in a given year, with 50.1% of all such events occurring in Palm Beach County in southeast Florida (Meylan et al. 1995). In northwest Florida, observations of leatherbacks have been noted for the mouth of the Ochlockonee River near Panacea and St. Andrew Bay near Panama City (Yerger 1965). Aerial surveys conducted by the National Marine Fisheries Service in 1987 and 1993 produced 13 sightings in northwest Florida, including three solitary leatherback sightings in the waters off Dog Island in Franklin County and two additional sightings near Cape San Blas in Gulf County in 1993 (K. Mitchell, pers. comm.). Although numerous leatherback sightings have been recorded for this region, few nesting events are revealed in historical accounts.

A single leatherback nest was confirmed between Phillips Inlet and Destin in September 1962 when hatchlings were discovered on the beach (Yerger 1965). St. Vincent National Wildlife Refuge in Franklin County was the site of an additional leatherback nesting event in 1974 (LeBuff 1990; Meylan et al. 1995). Nearby St. Joseph Peninsula State Park in Gulf County also documented three emergences, including two nests and a false crawl, more recently in 1993 (Meylan et al. 1995; J. Mitchell, pers. comm.). The first documented nesting event in the park occurred on 31 May 1993, and later nest excavation revealed the presence of 110 eggs, including 86 yolked eggs (J. Mitchell, pers. comm.).

In 1995, four leatherback emergences (Fig. 1) were documented in Franklin County, resulting in three nests with verified eggs and a false crawl. The first documented nesting event occurred on 5 May 1995, and the final emergence was documented on 10 June 1995. Since leatherbacks generally average 5–7 nests per season (NMFS and USFWS, 1992) with only about 16–31 individuals of the species nesting in Florida each year (Meylan et al. 1995), these 1995 accounts may be attributed to multiple emergences by the same nesting female.

The location of each nesting event was obtained with the use of a hand-held Loran-C unit. All four emergences occurred on St. George Island with the second nest located within St. George Island State Park boundaries. The distance between consecutive nesting attempts varied from 0.8 to 13.7 km, with an average distance of 8.4 km between successive emergences. Northwest Florida was impacted by three hurricanes during the 1995 nesting season, and the final nest was not relocated to evaluate hatching success after Hurricane Erin in August.

In early August, the first leatherback nest was evaluated and was found to include 127 unhatched eggs including 85 large, yolked eggs and 42 smaller, yolkless eggs. The presence of smaller, yolkless eggs is common for this species, although their exact function has yet to be determined (Leslie et al. 1996; Rostal et al. 1996). Ultrasonography has revealed that these are the last eggs produced in the oviduct (Rostal et al. 1996). Close examination of this clutch revealed that the eggs also lacked the presence of white spots or visible embryos, and thus were probably infertile since white spot development between the vitelline membrane and the shell membrane is generally considered an indicator of fertile eggs (Whitmore and Dutton 1985).

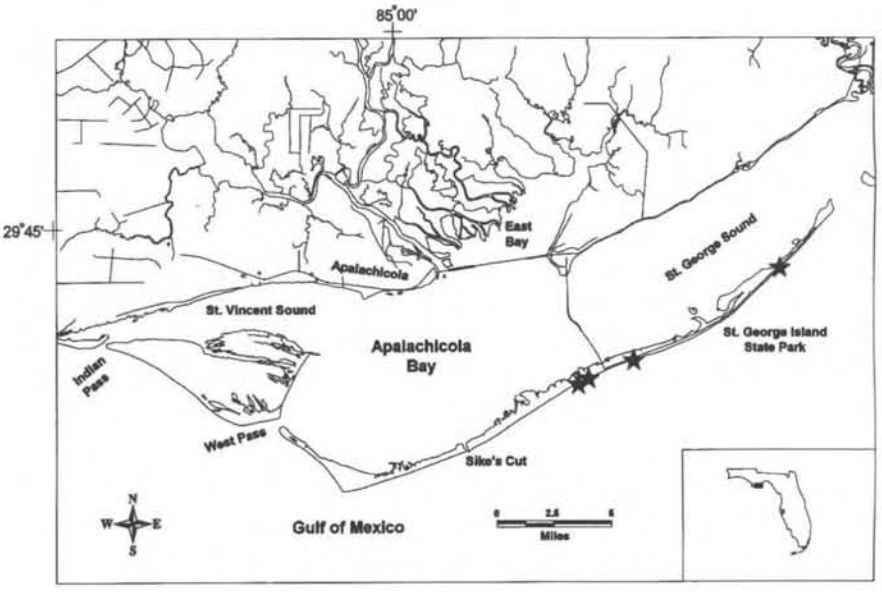


FIG. 1. Leatherback emergence locations in Franklin County, Florida, during the 1995 nesting season.

Staff from the St. George Island State Park examined the second nest for hatching success in mid-August. This clutch, comprised of 139 unhatched eggs of similar size ranges as the first documented clutch, included 96 yolked eggs (Ogles, pers. comm.). Once again, no eggs appeared to contain embryos. These clutch sizes, although representing only two samples, appear consistent with previous studies which exclude smaller, yolkless eggs from clutch size estimates (Hirth and Ogren 1987; Leslie et al. 1996). Hirth and Ogren (1987) found leatherbacks to lay an average clutch of 81.57 eggs on beaches near Laguna Jalova, Costa Rica.

Poor nest site selection, infertility, embryonic mortality, poaching, predation, and root development have been recognized in the past as reasons for reduced hatching success for leatherback and green sea turtles, *Chelonia mydas* (Leslie et al. 1996; Whitmore and Dutton 1985). Due to the few historical records of leatherbacks in northwest Florida and the characteristics of these two clutches, evidence seems to suggest infertility as the reason for lack of embryonic development and hatching success. The panhandle region of Florida, especially Franklin County, is relatively undeveloped in comparison to other regions of the state. Certainly the possibility exists that leatherback females nested on remote beaches in the past, thus escaping human detection. Further monitoring of local nesting beaches in years to come may provide additional knowledge concerning the nesting density of the leatherback sea turtle and a better estimate of the number of nesting females in northwest Florida.

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Scolecophidian Arboreality Revisited

INDRANEIL DAS*
and
V. WALLACH
Museum of Comparative Zoology, Harvard University
26 Oxford Street, Cambridge, Massachusetts 02138, USA
e-mail (VW): vwallach@oeb.harvard.edu

**Present address: Centre for Herpetology, Madras Crocodile Bank Trust*
Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India

Arboreality in scolecophidians was reviewed recently by Gaulke (1995). We compile here records that are hitherto unpublished as well as reports that were omitted in Gaulke's review on arboreality in the Typhlopidae and Leptotyphlopidae.

On 8 March 1994, an adult *Ramphotyphlops braminus* (ZSI 25115) was found under peeling bark, ca. 1.5 m vertically above substrate and ca. 5 m up along a reclining termite-infested dead coconut tree (*Cocos nucifera*) on Car Nicobar (09°10'N; 92°47'E), Bay of Bengal, India. The animal presumably was feeding on worker termites, among which it was found. Data associated with the following museum specimens provide additional evidence for arboreality among scoledophidians: one *Leptotyphlops tenellus* (USNM 286953) from a palm tree in St. George, Trinidad, and another (USNM-field no. 175504), collected from under bark of a tree more than 1 m off ground; *Ramphotyphlops angusticeps* (FMNH 41968), 4 m up in a palm tree, Guadalcanal, Solomon Islands; and *R. depressus* (USNM 121256), found climbing a tree, Manus Island, Bismarck Archipelago, Papua New Guinea (fide letter 170465 by Emil Bogen to the USNM).

There are several other anecdotal literature records of arboreality in scolecophidians that were cited by Gaulke (1995), including *R. angusticeps* at night in fronds of a small palm tree about 4 m above the ground, Guadalcanal, Solomon Islands (McCoy 1980); five *R. suluensis* from 2–3 m in height in a tree at night, Sulu Archipelago, the Philippines (Gaulke 1995, 1996); *R. nigrescens* 5 m up on a she-oak tree (*Casuarina* sp.), Australia (Shine and Webb 1990); and *L. dulcis* 1 m up in a sycamore tree (*Platanus occidentalis*), Waco, Texas, USA (Plsek *fide* Gehlbach in Vanzolini 1970).

Additional literature records suggesting arboreal activity include one *Leptotyphlops albifrons* ca. 0.5 m up the rough bark of a half dead tree, another coiled around a live bamboo twig in daytime close to the ground, Guyana (Beebe 1946), and a third under the bark of a tree (Mole 1924); *L. dulcis* in nest of screech owl (*Otus asio*), Texas, USA (Gehlbach and Baldridge 1987); *L. macrolepis* ca. 0.6 m up a vertical concrete wall, Colombia (Dunn 1944); *L. macrorhynchus* from thatched roof of a house, Pakistan (Minton 1966); *L. tenellus* ca. 2 m up a tree trunk, Brazil (Vanzolini 1970); *L. tesselatus* in the wall of an old adobe house in Lima, Peru (Schmidt and Walker 1943); *Ramphotyphlops australis* from a dead standing blackboy [burnt yacca grass tree], *Xanthorrhoea* sp., in a dry swamp, Australia (Chapman and Dell 1975); one *R. braminus* ca. 2 m up on a dead mango tree, *Mangifera indica*, Australia (Swanson 1981), and one in an insect hole within a piece of sugarcane (*Sachharum officinalis*) a considerable height above the ground (Annandale 1906); *R. cumingii* from the trunk of a tree that had bored ant tunnels beneath the bark and multiple specimens from root masses of aerial ferns, including the giant tree fern (*Asplenium nidus*), high in forest trees (Taylor 1919, 1922); *Typhlops richardii* 1.5 m up on a papayo tree (*Metopium toxiferum*), Puerto Rico (Tolson and Campbell 1989); and *T. arenarius* 1.5 m up on a large tree, Madagascar (Glaw and Vences 1994). Edgar and Lilley (1993) characterized *R. olivaceus* from

Seram, Maluku, eastern Indonesia, as being arboreal and fossorial. Data associated with their unregistered material in the BMNH provide further support: one specimen (S143) from an epiphyte at 2.2 m; one (S198) 2.5 m up tree on vine; one (S211) 2 m up tree climbing in vines; one (S250) 2.5 m up ant nest in leaf; one (S271) 2 m up in tree; and one (S270) 2.5 m up in vine.

For whatever reason (expanding range, foraging for food, and/or following pheromone trails of conspecifics of the opposite sex), the above reports make it clear that arboreality is, at the least, an occasional occurrence in scolecophidians. It may be a common activity and some species may be more abundant in trees than underground. We suggest that collectors also look up, as well as down, in the future.

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TECHNIQUES

Sodium Brevital as an Anesthetizing Agent for Crotalines

LYNDA R. MILLER
and
WILLIAM H. N. GUTZKE
Ecological Research Center, Department of Biology
University of Memphis, Memphis, Tennessee 38152, USA
e-mail (LRM): LRMILLER@MSUVX2.MEMPHIS.EDU

Many different methods of anesthetizing reptiles exist. Two such methods are cold narcosis, which involves cooling the animal to just above freezing, or the use of an anesthetic gas such as halothane, that is inhaled by the animal. When working in a potentially harmful situation such as the mouth of a pit viper, these methods may not be acceptable means of anesthetizing the animal. Cold animals are still capable of striking and could prove a danger when working in close proximity to the fangs. Apparatus associated with using a gas anesthetizing agent interferes with any work being done in the mouth region. The presence of a trachea tube is necessary to maintain a sufficient level of anesthetization, thus limiting work space and manueverability when working in the oral area. Injection of sodium brevital, a barbituate, proves useful when gas and cooling are not convenient methods. Dosages of 15 mg of sodium brevital per kilogram body weight have previously been reported (Wang et al. 1977). This is successful with many species of lizards and snakes. However, venomous snakes of the subfamily Crotalinae are unable to withstand this dosage. This may be attributed to the reduced musculature in comparison with colubrids. We have found that one-third of the published dosage of 15 mg/kg of body weight (i.e., 5 mg/kg) injected approximately mid-way between the cloaca and the end of the tail will anesthetize crotalines sufficiently for procedures involving the vomeronasal duct which is located in close proximity to the fangs (Miller and Gutzke, in press). Pregnant individuals and neonates tolerate only one sixth of the published dose (i.e., 2.5 mg/kg body weight).

In our study, 18 animals were anesthetized with sodium brevital. Species included were *Agkistrodon piscivorus, A. contortrix, Crotalus horridus, C. atrox, C. lepidus, C. mitchelli, C. viridis*, and *Sistrurus miliarius*. Animals ranged in size from approximately 4 g for neonate *A. piscivorus* up to 1500 g in the large adult crotalines. Induction of anesthetization occured within 30 min of injection. The soporific state was maintained for 1–1.5 h while the surgery was performed. All anesthetic and surgical events occured at room temperature, approximately 22–23°C. Recovery time varied from 10–24 h with full recovery within 48 h. The snakes were maintained in the laboratory long term (in excess of one year) after the anesthetization procedure and no adverse affects due to the sodium brevital were observed.

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Reptile Sheds Yield High Quality DNA

ANNMARIE CLARK
BEECS Genetics Analysis Core, University of Florida
Box 110700, Gainesville, Florida 32611-0700, USA
e-mail: aclark@icbr.ifas.ufl.edu

Venomous, small, or endangered reptiles may pose special problems in securing tissue samples for genetic analysis. Obtaining blood from venomous reptiles requires specialized training. The difficulty and danger of this approach, especially for inexperienced handlers, is apparent. Collection of tissue samples from very small individuals (e.g., *Tantilla*) may be difficult without sacrificing the animal. Benefits of non-invasive sampling apply to all collections of tissue from live animals, but are especially compelling when rare or endangered taxa are involved.

In an earlier report, Bricker et al. (1996) describe methodology to obtain high molecular weight DNA from shed snake skins. While effective, this method requires special training and safety equipment. Optimally, DNA extraction procedures should be safe for personnel with modest lab experience, require minimal handling of toxic materials, and have minimal disposal costs, yet still reliably produce high quality DNA. Several different DNA extraction methods were considered as protocols for shed snake skins (e.g., Ausubel et al. 1995, Bricker et al. 1996, Hillis et al. 1996). Those requiring large volumes of biohazardous reagents were rejected due to the expense of waste disposal. Methods using guanidine thyocyanate (Bricker et al. 1996) were also ruled out due to the possible generation of toxic hydrogen cyanide gas. The favored approach was a modification of a protocol using CTAB (hexadecyltrimethylammonium bromide) and proteinase K.

To assess the durability of DNA available for extraction, robustness of the protocol, and its effectiveness across species, sheds were obtained from a variety of conditions. Here I report the results of DNA isolations from shed skins for 11 species of snakes and 2 species of lizards. Fourteen snake sheds (*Crotalus)* were collected in the field, where they had been exposed to weathering conditions for undetermined periods. Other sheds were collected from captive animals and were in optimal condition when received for isolations. Colleagues who provided samples were asked to allow sheds to air dry thoroughly before shipping them to our laboratory.

Sheds were collected from neonates, hatchlings, or adults of *Crotalus horridus* (N = 19), *C. adamanteus* (N = 1), *C. enyo* (N = 1), *C. lepidus klauberi* (N = 1), *C. mitchellii* (N = 1), *C. triseriatus armstrongi* (N = 1), *C. unicolor* (N = 2), *C. willardi* (N = 1), *Pituophis melanoleucus* (N = 2), *Pituophis catenifer* (N = 1), *Tantilla relicta* (N = 1), *Ophisaurus apodus* (N = 1), and *Iguana iguana* (N = 1). All sheds are stored at room temperature in separate paper envelopes or loose plastic sample bags.

A 1-inch square piece of shed (approximately 0.02 g), preferably from the dorsal surface, is cut into small pieces and placed into a sterile 1.5 ml Eppendorf tube. Scissors used to process the sheds are cleaned thoroughly, dipped in ethanol, and flamed between specimens to prevent cross contamination. Gloves are used and the work area is thoroughly cleaned with ethanol between samples. Each sample is treated with 700 ul of CTAB extraction buffer (100 ml 1M Tris-HCl, pH 8.0, 280 ml 5M NaCl, 40 ml 0.5M EDTA, pH 8.0, 20 g CTAB, 2 ml 2-mercaptoethanol, dH_2O to 1 liter [Ausubel et al. 1995]) and 5 ul proteinase K (20 mg/ml in 50% glycerol). The mixture is shaken on a mechanical vortex for about 5 s and incubated at 50°C overnight. Samples placed in a 65°C water bath for 2–4 h also gave good yields.

After removal from the water bath, tubes are shaken again before addition of 700 ul buffered phenol. This mixture is shaken briefly and placed on a rocking platform for 5 min and subsequently centrifuged at 12,000 rpm for 5 min. Generally the supernatant in phenol extractions is the aqueous phase containing the DNA. However, due to an inversion, the supernatant in this first extraction step is phenol; the aqueous phase with DNA is at the bottom of the tube with the debris from the shed. This inversion was observed in all 33 extractions. The top layer is drawn off with a pasteur pipette and set aside in a sterile 1.5 ml Eppendorf tube. The bottom layer is drawn off with a new pipette by pushing aside the debris and drawing up as much of the liquid as possible. This aqueous phase is transferred to another sterile 1.5 ml Eppendorf tube. Again, 700 ul phenol are added, the mixture is shaken, incubated on a rocker for 5 min, and centrifuged as before. After centrifuging, the supernatant is drawn off and placed into another sterile 1.5 ml Eppendorf tube. (If a separation of layers does not occur, the previous step is repeated with the top layer from the first step.) Two extractions, each using 700 ul phenol:chloro-form:isoamyl alcohol (25:24:1) and the supernatant from the previous step, are done by shaking the mixture, incubating for 5 min on a rocker, centrifuging for 5 min as above, and drawing off the supernatant into sterile tubes. Two additional extractions, each using 700 ul chloroform:isoamyl alcohol (24:1) and the supernatant from the previous step, are sufficient to remove residual phenol.

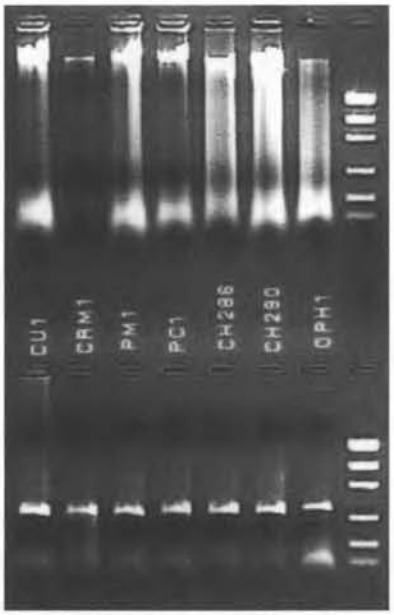


FIG 1. Representative sampling of DNA isolations (top of gel) using this protocol and the resulting PCR amplifications (bottom of gel) using cytochrome *b* primers corresponding to H15149 (Kocher et al. 1989) and L14725 (Meyer 1993). Lanes 1 through 8 from left to right are 1: *Crotalus unicolor*, 2: *C. mitchellii*, 3: *Pituophis melanoleucus*, 4: *P. catenifer*, 5: *C. horridus*, 6: *C. horridus*, 7: *Ophisaurus apodus*, and 8: low mass DNA ladder.

In a new tube, the supernatant is combined with 50 ul 3M sodium acetate and 2.5 volumes of ice cold 95% ethanol, shaken or mixed, and stored at -20°C overnight. The tubes are then centrifuged at 12,000 rpm for 10 min, and the ethanol is removed by careful pipetting, so as not to dislodge the DNA pellet. The pellet is washed by adding 1 ml 70% ethanol and centrifuged for 10 min. The ethanol is carefully removed as above, and the pellet is dried, preferably in a speed-vac, although this can also be accomplished by inverting the tubes at room temperature for 2–4 h or

until the ethanol has evaporated completely. The DNA pellet is resuspended in 200 ul TE buffer (10 mM Tris-HCl, 1 mM EDTA, pH 8 [Ausubel et al. 1995]).

This method of extracting DNA from sheds is relatively safe and can be easily taught to students with limited lab experience. A small amount of shed skin (0.02g) yielded 0.79–19.7 ug/ml DNA, which is sufficient for such molecular procedures as PCR, RFLP analysis, microsatellite screening, etc. All but one sample yielded ample amounts of high quality DNA and consistently produced a PCR product (Fig. 1). The sample that did not produce PCR products was damp, odiferous, and in poor condition when received. Of the 33 sheds processed using this protocol, 10 have been sequenced and used in data analysis. This method of DNA extraction probably is applicable to all species of reptiles that shed, thereby greatly facilitating the collection of samples from venomous, small, or rare reptiles as well as those in zoo collections.

Acknowledgments.—I thank B. W. Bowen for his encouragement and the Biotechnology Program at UF for providing the lab space to perfect this protocol. My thanks also go to F. Kraus for generously sharing a prototype protocol and to P. E. Moler, W. H. Martin, M. J. Russell, R. Harrington, A. J. Hendershott, A. L. Braswell, T. Johnson, G. McLaughlin, and R. Bartlett for providing the sheds of the various species of *Crotalus*. Special thanks to A. L. "Sam" Bass for her support and patience.

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Tadpole Jello: A Technique for Monitoring Food Consumption and Manipulating the Chemical Composition of Larval Foodstuffs

MICHAEL K. MOORE*
and
SARAH GRIMKÉ FARAGHER†
Department of Biology, University of Southwestern Louisiana, Lafayette, Louisiana 70504, USA

*Current Addresses: *Department of Biology, Mercer University Macon, Georgia 31207, USA, e-mail: moore_mk@mercer.edu*
and
†Department of Biological Sciences, Northern Arizona University Flagstaff, Arizona 86011-5640, USA

We have adapted the method of Hay et al. (1994) to make an agar-based food source for anuran larvae that can be used in studies of growth and development. Currently we are using this technique to study the impact of the potential defense chemicals found in algae and other periphyton on the growth and development of ranid larvae. Our basic food source is the widely used 3:1 mix of ground rabbit chow and TetraMin fish flake (e.g., Britson and Kissell 1996). Once ground, the mixture is passed through a fine sieve to promote a uniform particle size. For every 4 g of base food, 0.75 g of agar is brought to a boil in 30 ml of distilled water. Another 30 ml of cold distilled water is added to the 4-g base. The two solutions are then mixed together, put in a mold (Fig. 1), and allowed to solidify for at least 10 min. For our study of plant defensive compounds, the base food is evenly coated with the compound by first dissolving a known amount of the substance in an appropriate solvent. This solution is then mixed with the dry base food in a Rotavapor (Büchi Instruments) until the solvent has evaporated. When only small amounts of solvent are necessary, we omit the evaporation procedure. Once the food has been coated with the chemical, water is added and the procedure is followed as outlined above. Once the entire mixture has been allowed to solidify, we imprint it with a surface grid and cut food squares of the desired size.

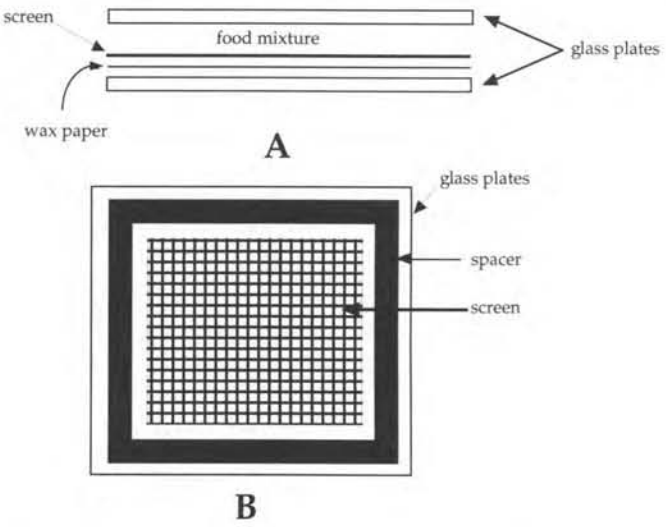


FIG. 1. Examples of molds used to construct tadpole foods. (A) Simple mold for obtaining a very thin and uniform coating of food on the screen base. (B) Top view of a mold type used to make foods of greater thickness. The diameter of the spacer controls food thickness. For larger tadpoles, a spacer of 1–2 mm works best.

We have used several types of molds to shape the foods (Fig. 1). In most cases, we use the fiberglass window screen for a grid to measure the amount of food consumed during a trial. Without the screen, one can determine the amount of food consumed by weighing the food before and after the trial. It is our experience that the food will increase slightly in mass when placed in water, so control foods are necessary to factor out this effect. For small tadpoles, a very thin food coating is necessary for counting uncovered squares of screen. The thinnest and most even covering of the screening is obtained by placing the wax paper and screening directly between two plates of glass (Fig. 1A). The mixture of 4 g food to 0.75 g agar described above is enough to provide 400 cm^2 of food area using this technique. We have found that using a spacer for increasing the thickness of the food (such as in Fig. 1B) is only appropriate for larger tadpoles.

A similar method currently is being used by aquaculturists to raise commercial bullfrog larvae (D. Lester, pers. comm.). In this method, 4 g of kelgin, 2 g of sodium hexametaphosphate, and 168 g of commercial trout chow are combined and added to 1

liter of water. This solution is then spread onto a screen or put into a patty mold and allowed to solidify. Depending on the relative health of the metamorphosing froglets, differing amounts of soy protein, bone meal, and yeast are added to the trout chow. This method allows for the quantification of food consumption and prevents food from either fermenting in the tank or being filtered out as the water is cycled. Aquaculturists have used this method successfully in southwestern Louisiana for 15 years.

The advantages of this feeding technique for laboratory and mesocosm studies of tadpoles as well as for aquaculture include the ability to quantify the amount of food consumed by tadpoles, to localize the placement of foodstuffs, and to manipulate the chemical composition of the larval food. Another benefit that we have found is that food offered in this way is less likely to foul the water than an equivalent amount of flake food. Amounts of food consumed and the timing of food consumption are critical parameters in studies of the growth, development, and metamorphosis of anuran larvae. This technique can allow for more precise determination of food consumption at different stages of development. Alterations in the chemical composition of larval food, in particular the effects of potential plant defensive compounds on the growth of larval anurans, is an area that is largely unexplored. This technique may help facilitate more of these types of studies.

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Non-lethal Technique for Obtaining Tissue for Molecular Studies of *Ambystoma* Salamanders

KIMBERLY D. CAMERON[1]
STEVEN B. BROYLES
and
PETER K. DUCEY[2]
Department of Biological Sciences, State University of New York at Cortland, Cortland, New York 13045, USA

[1] *Current Address: Department of Biology, State University of New York College of Environmental Science and Forestry, Syracuse, New York, USA*
[2] *Author for correspondence and reprints*

Electrophoretic analysis of allozymes has been used effectively in studies of the systematics, evolution, and ecology of salamanders (e.g., Bogart 1982; Bogart et al. 1987; Carter 1997; Shaffer 1984; Shaffer et al. 1991). In most studies, the tissues tested included combinations of heart, liver, and skeletal muscle, necessitating the sacrificing of individuals. Although such specimens may be useful as vouchers and additions to museum collections, many ecological or evolutionary studies could benefit from having a non-lethal technique for obtaining tissue samples for molecular analyses. We investigated whether the autotomized tail tips of salamanders could be used as tissue for allozyme electrophoresis.

Many salamander species autotomize parts of their tails in antipredator defense (Brodie 1977; Wake and Dresner 1966). When seized by a predator, the tail breaks intervertebrally with differing degrees of wound closure and little blood loss (Wake and Dresner 1966). Over time, salamanders regenerate nearly identical replicas of the original tail (Wake and Dresner 1966). Researchers should be able to simulate predator attack, inducing autotomy and obtaining tail tissue for analyses, in a manner that allows specimens to be returned to their natural populations. We examined whether tail tissue that has been sampled via autotomy is appropriate for electrophoretic identification of members of the *Ambystoma jeffersonianum* complex of mole salamanders.

The *Ambystoma jeffersonianum* complex consists of diploid (2n = 28) *A. laterale*, *A. jeffersonianum*, and polyploid female taxa of hybrid origin incorporating primarily *A. laterale* or *A. jeffersonianum* genomes, and in some cases genomes from *A. texanum* and *A. tigrinum* (Kraus et al. 1991; Lowcock et al. 1987; Uzzell 1964; Uzzell and Goldblatt 1967). *Ambystoma laterale*, *A. jeffersonianum*, and two triploid taxa (*A. (2)laterale-jeffersonianum*, *A. laterale-(2)jeffersonianum*) exist in New York State: *A. laterale* is found in the northern areas and on Long Island, whereas *A. jeffersonianum* is found in the southern parts of the state. A broad zone containing diploid species and unisexual taxa exists throughout central New York (Uzzell 1964; Uzzell and Goldblatt 1967). This complex of salamanders has been studied extensively since the early 1960's due to persistent questions regarding their evolutionary history, ecological roles, and reproductive biology.

Allozyme identification has been used to study polyploidy, gene flow, and hybridization in this complex of salamanders (Bogart 1982; Bogart et al. 1987; Kraus 1991; Uzzell and Goldblatt 1967). Morphological differences may suggest polyploidy, but cannot be reliably used to distinguish different ploidy levels (Lowcock and Bogart 1992; Lowcock and Murphy 1991). Flow cytometry of red blood cells can differentiate taxa based on ploidy, but cannot be used to determine evolutionary or phylogenetic history (Lowcock et al. 1991). Erythrocyte size measurements (Austin and Bogart 1982; Uzzell 1964), measurements of shed epidermal cells (Licht and Bogart 1987), and karyotype analyses (Sessions 1982) can indicate ploidy levels, but none of these techniques provides information on genome composition (Austin and Bogart 1982). Molecular techniques such as enzyme electrophoresis and mitochondrial DNA analysis are effective methods for determining ploidy levels, genome composition, and evolutionary relationships in *Ambystoma* salamanders (e.g., Bogart et al. 1987; Kraus and Miyamoto 1990). Currently, enzyme electrophoresis is preferred in some research projects because of its simplicity and cost effectiveness (e.g., Bogart et al. 1987; Kraus 1991; Kraus et al. 1991). We hypothesized that tissue from autotomized tail tips would be sufficient to allow us to correctly identify members of this complex via enzyme electrophoresis.

Material and Methods.—Nine salamanders of the *A. jeffersonianum* complex, collected as adults from Cortland County, New York (USA), were housed individually at 17–22°C. Each salamander was mildly agitated by prodding before a Boston clip (wire and folded metal clip for clamping stacks of paper) was placed on the distal 1/4 of the tail, causing almost immediate autotomy. Use of the clip allows salamanders to autotomize naturally along intervertebral planes which minimizes trauma and blood loss and maximizes speed of regeneration (Wake and Dresner 1966; PKD, unpubl. data). We froze each autotomized tail piece individually. Enzymes were extracted from small sections of tail tissue in 400µl of a 0.2 M Tris-Hcl (pH 7.5) extraction buffer. The enzyme extract was absorbed onto 4 mm x 8 mm wicks cut from Whatmann #MM chromatography paper. Samples were stored at -70°C until electrophoresis could be performed.

Wicks were loaded into 10% starch gels. A Clayton-Tretiak buffer system (pH 6.1; Clayton and Tretiak 1972) was used to resolve aspartate aminotransferase (AAT), malate dehydrogenase (MDH-1,2), and superoxide dismutase (SOD). All three enzyme stains have been used in previous electrophoretic studies of *Ambystoma* salamanders and were useful in diagnosing species within the *A. jeffersonianum* group (Bogart et al. 1987; Elinson et al. 1992; Taylor 1992). Staining protocols were identical to those described by Wendel and Weeden (1989). Allozymes were scored in a manner consistent with Taylor (1992).

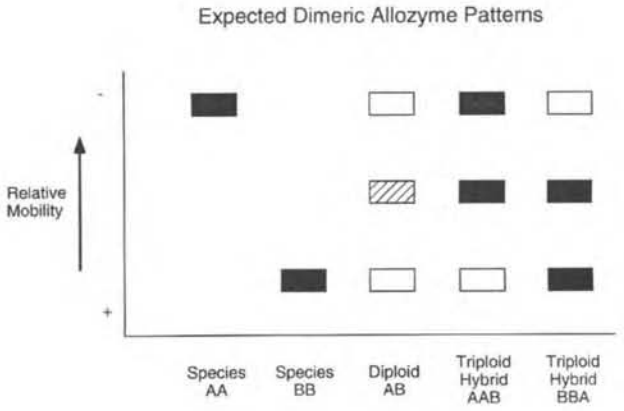


FIG. 1. Expected dimeric allozyme patterns for parental homozygotes (AA and BB), heterozygotes or diploid hybrids (AB), and triploid hybrids (AAB and ABB). The box fill patterns represent the relative staining intensities within individual genotypes. Open boxes have a stain intensity of 1, cross-hatched boxes a stain intensity of 2, and filled boxes a stain intensity of 4.

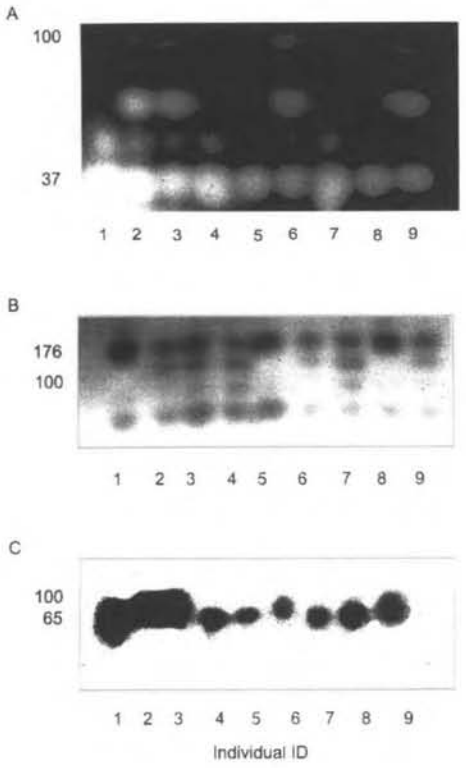


FIG. 2. Electrophoresis gels for three enzymes from nine individuals of the *Ambystoma jeffersonianum* complex: (A) superoxide dismutase (SOD-1); (B) malate dehydrogenase (MDH-1 and MDH-2); aspartate aminotransferase (AAT). rf values are shown to the left of each gel.

We used unbalanced stain intensities of allozymes to predict the genomic composition and ploidy level of each salamander (Danzmann and Bogart 1982). For example, a diploid salamander that is heterozygous for a dimeric isozyme will appear 3-banded with a relative stain intensity of 1:2:1 (Fig. 1). A triploid hybrid salamander with two homozygous genomes from parental species 1 and one genome from species 2 will also appear 3-banded, but with a relative stain intensity of 4:4:1 (Fig. 1). This result is due to the unequal genomic contribution of both parental species and random combination of protein subunits in constructing active dimeric enzymes. Tetraploid individuals are known to occur at low frequencies in some populations (Bogart et al. 1989; Lowcock et al. 1991). Their allozyme patterns should be readily distinguishable from those of the triploids (Danzmann and Bogart 1982). For example, a tetraploid with three genomes from one parental species should express a 9:6:1 stain intensity ratio for dimeric isozymes such as MDH-1 and SOD-1. A balanced tetraploid will express a stain intensity ratio of 2:4:2 for these isozymes, which is, however, indistinguishable from a diploid heterozygote (1:2:1).

We attempted to corroborate our electrophoretic determination of polyploid hybrids through a double-blind examination of erythrocyte size. Erythrocytes of diploid *Ambystoma* salamanders range in area from 500–900μm^2 while erythrocytes of polyploid salamanders range from 700 to 1500μm^2 (Austin and Bogart 1982; Uzzell 1964). However, most individual studies have shown little or no overlap in diploid and polyploid cell areas suggesting some variability is due to differences in laboratory techniques (Austin and Bogart 1982; Bogart et al. 1987). In our study, one researcher collected approximately 100µl of blood from each salamander by clipping a single toe and placed it in 0.7% saline solution. Another researcher measured the diameter of 10–15 erythrocytes from each sample using a light microscope with an ocular micrometer. Areas were determined by assuming the shape of an erythrocyte to be elliptical.

Results and Discussion.—Electrophoretic analysis of tail tissue resulted in clearly recognizable banding for all individuals and yielded evidence of polyploidy in four of the nine salamanders. Five salamanders (ID #1, 4, 5, 7, and 8) were homozygous for a slow-moving SOD-1 allozyme (r_f = 37), indicating diploid *A. jeffersonianum* (Figs. 2A, 3A). Four individuals (ID #2, 3, 6 and 9) exhibited both slow and fast (r_f= 100) allozymes with staining intensity ratios of 1:4:4 (Figs. 2A, 3A). Numerous studies have documented that *A. laterale* possess the fast SOD-1 allozyme (rf = 100), that *A. jeffersonianum* possess the slower allozyme (rf = 37), and that the staining intensity patterns of 1:4:4 which we found represent triploids with two *A. jeffersonianum* genomes and one *A. laterale* genome (LJJ) (Bogart et al. 1987; Elinson et al. 1992; Kraus and Miyamoto 1990). Our results for the MDH and AAT loci supported the results for the SOD-1 locus (Figs. 2B and C; 3B and C). MDH-2 appeared monomorphic among the nine

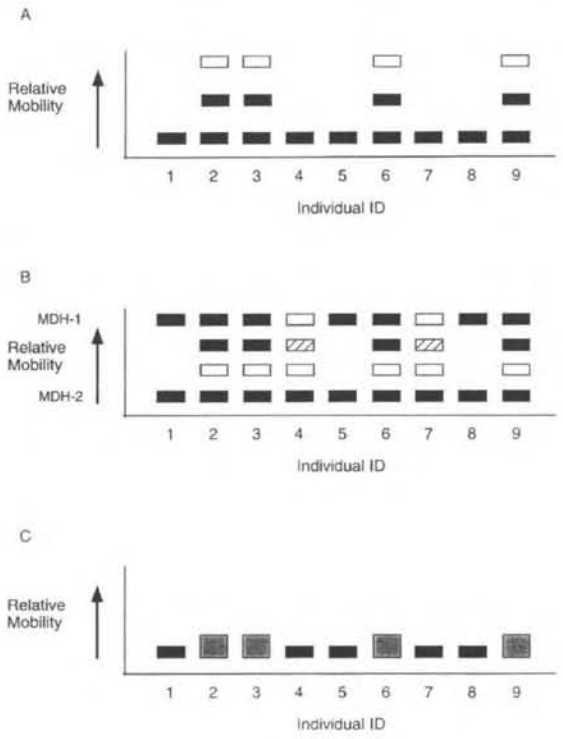


FIG. 3. Interpretation of gels in Fig. 2. (A) Allozyme patterns for superoxide dismutase (SOD-1). Individuals 1, 4, 5, 7, and 8 appear to represent diploid individuals of *Ambystoma jeffersonianum*. Individuals 2, 3, 6, and 9 appear to represent triploid hybrids with two *A. jeffersonianum* genomes. (B) Allozyme patterns of malate dehydrogenase (MDH-1 and MDH-2). No variability was exhibited for MDH-2. Individuals 1, 5, and 8 appear to represent diploid individuals of *A. jeffersonianum* that are homozygous for MDH-1. Individuals 4 and 7 are heterozygous at MDH-1. Individuals 2, 3, 6, and 9 appear to represent triploid hybrids with two *A. jeffersonianum*. (C) Allozyme patterns of aspartate aminotransferase (AAT). A wide, indistinct band (represented by a lighter filled box) was observed for individuals 2, 3, 6, and 9. Box fill patterns are the same as in Fig. 1.

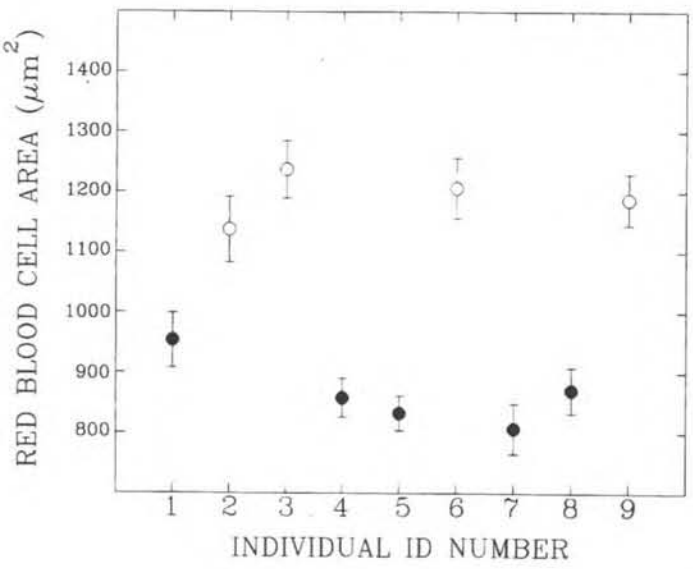


FIG. 4. Means (standard error) for erythrocyte area from nine individuals of the *Ambystoma jeffersonianum* complex. Individual ID numbers correspond to the same numbers represented in the allozyme profiles of Figs. 2 and 3. Putative diploids are represented by hollow circles and putative triploids are represented by filled circles.

specimens examined. MDH-1 was polymorphic: three individuals (ID #1, 5, and 8) were homozygous for the fast moving allozyme (rf = 176) (suggesting diploid *A. jeffersonianum*; Bogart et al. 1987), four individuals (ID #2, 3, 6, and 9) additionally had a slower allozyme (rf = 100) and 4:4:1 staining intensity patterns (suggesting polyploidy LJJ; Bogart et al. 1989), and two individuals (ID #4 and 7) were heterozygous with 1:2:1 staining intensity patterns. MDH-1 variation for individuals 4 and 7 is probably representative of diploid *A. jeffersonianum* rather than diploid hybrids as diagnostic *A. laterale* allozymes were absent at SOD-1 and AAT loci. Previously studied populations of *A. jeffersonianum* were homozygous for the faster MDH-1 allozyme (Bogart et al. 1987; Shaffer et al. 1991; Taylor 1992), hence our results may indicate some level of meiotic recombination within the unisexual taxa as has been suggested by others (Kraus and Miyamoto 1990; Sessions 1982). For AAT, our results were inconclusive (Figs. 2C, 3C), but only individuals 2, 3, 6, and 9 showed wide indistinct bands. Taken together, our results for these three enzymes were sufficient to hypothesize that four individuals (ID #2, 3, 6, and 9) were polyploid, possessing a single *A. laterale* and two *A. jeffersonianum* genomes.

To test these ploidy designations, we compared the allozyme results with measures of erythrocyte area. Erythrocyte areas for the four proposed polyploids (range of individual mean areas 1138–1238 μm^2) were considerably larger than for the proposed diploids (range 807–954 μm^2; Fig. 3). These results are consistent with previous studies that demonstrated significantly larger erythrocytes in polyploid members of the *A. jeffersonianum* complex (Austin and Bogart 1982; Uzzell 1964) and support the validity of our electrophoretic results.

Allozyme electrophoresis has proved an effective method for identifying ploidy and genomic composition in *Ambystoma* salamanders (e.g., Bogart, et al. 1987; Kraus and Miyamoto 1990; Lowcock and Bogart 1992). The present study demonstrates that diagnostic allozyme analysis in the *A. jeffersonianum* complex can be accomplished without lethal sampling to obtain heart, spleen, and liver tissue. By utilizing autotomized pieces of salamander tails, researchers can obtain sufficient enzyme activity, test representative sample sizes, and still cause only limited disturbance of natural populations. Because many herpetofaunal populations are already under severe pressure, non-destructive techniques, like those presented here and elsewhere (e.g., Gonser and Collura 1996; Licht and Bogart 1987; Lowcock et al. 1987), should become standard tools for genetic studies of amphibian populations.

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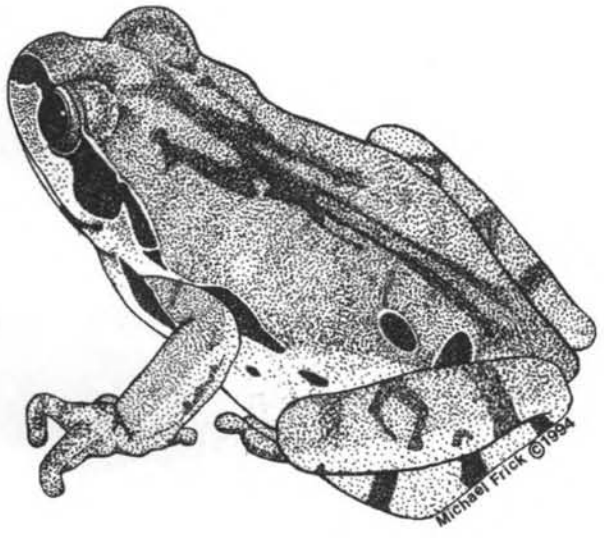
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Pseudacris ornata (Ornate Chorus Frog). USA: South Carolina: Jasper Co. Illustration by Michael G. Frick.

A Method of DNA Sampling in Lizards with Tail Autotomy

PEDRO J. CORDERO
ALFREDO SALVADOR
and
JOSÉ P. VEIGA
Departamento de Ecología Evolutiva, Museo Nacional de Ciencias Naturales C. S. I. C., José Gutierrez Abascal, 2, 28006-Madrid, Spain

e-mail (PJC): mcnct2r@fresno.csic.es

Studies on breeding success using multilocus DNA fingerprinting in lizards are rare and DNA ordinarily is obtained from blood samples (Olsson et al. 1994, 1996). However, blood sampling in lizards can be difficult, especially in small individuals, and may not provide sufficient high molecular weight DNA for fingerprinting. Blood has been obtained from the orbital sinus (Moore 1986), tail cuts (Tokarz 1987), a minute cut in the corner of the mouth (Olsson et al. 1994), or the caudal vein (Wilson and Wingfield 1994), but this manipulation could cause injury or haematoma and the amount of blood taken might affect some traits in study animals.

In our studies with *Psammodromus algirus*, we tried the above methods and found that the most efficient blood sampling was from the caudal vein. However, in subadult and juvenile individuals the amount of blood obtained is insufficient for some procedures. Here, we present an alternative method of DNA extraction from tail fragments, as autotomy (tail separation) may occur in nature and might not represent a significant handicap to the individual animals manipulated.

Five adult individuals of *P. algirus* were captured near Navacerrada (Madrid province, Spain). Tails from these individuals were removed and stored in absolute ethanol at 4°C until pro-

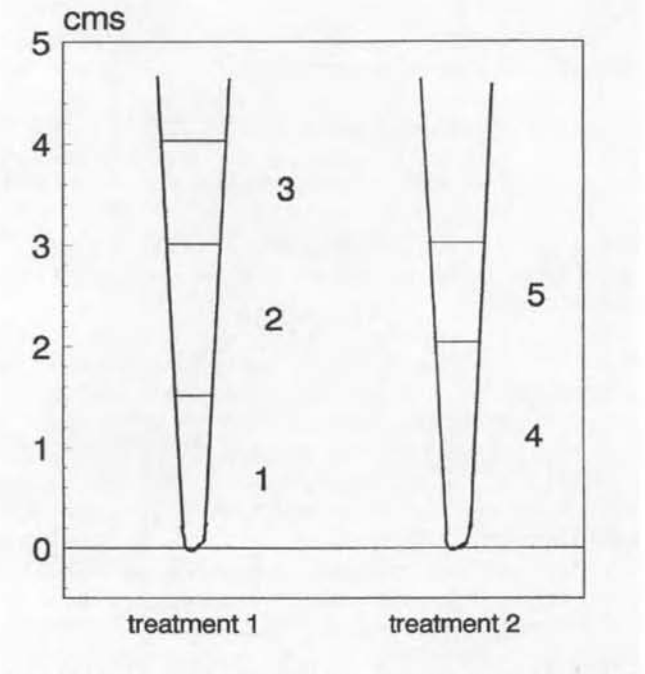


FIG. 1. Tail fragments analyzed. Treatment 1. Each individual tail was cut in three fragments: Fragment 1, from tip up to 1.5 cm; fragment 2, between 1.5 and 3 cm; fragment 3, between 3 and 4 cm. Treatment 2. Each individual tail was cut in two fragments: Fragment 4, from tip up to 2 cm; fragment 5, between 2 and 3 cm.

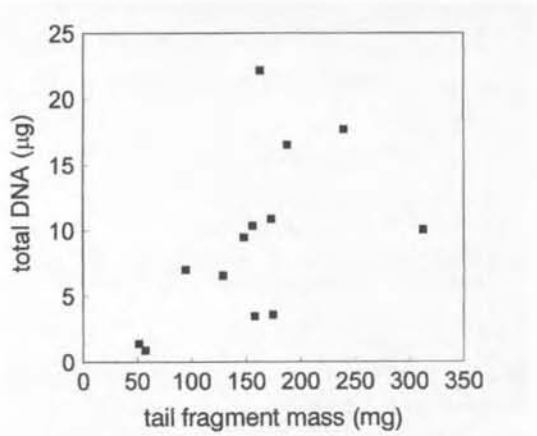


FIG. 2. Relationship between DNA content and tail fragment mass.

cessed. To assess the minimum size of tail fragment necessary to isolate adequate amounts of DNA for fingerprinting, tails were cut in two different ways. In treatment 1, we made cuts in three individuals (A–C) at 1.5, 3, and 4 cm from the tip of the tail. In treatment 2, we cut tails of two individuals (D, E) at 2 and 3 cm from tip of the tail (Fig. 1). A sample of 30 µl of blood, stored in absolute ethanol, was used as a standard for comparison. Tail fragments were dried on Whatman paper to remove the ethanol, weighed, and digested separately in 650 ml SET buffer (150 mM NaCl, 50mM Tris/HCl pH 8.0, 1mM EDTA Na_2 pH 8.0), 15 µl proteinase K (20 mg ml^{-1}) and 7.5 µl of 250 g l^{-1} SDS and incubated overnight at 55°C. DNA was purified by one extraction with phenol, followed by one with phenol/chloroform and one with chloroform iso-amyl alcohol (24:1). It was then precipitated with 0.1 volumes 3M sodium acetate and 2 volumes of cold (-20°C) absolute ethanol and pelleted at approximately 11,000 rpm for 5 min. The DNA was washed with 75% ethanol, dried at 37°C for 30 min and resuspended by overnight incubation in TE (1mM EDTA Na_2, 10mM Tris/HCl, pH 8.0). The amount of buffer added for resuspension ranged from 20–70 µl, depending on the size of the DNA pellet. 15 µl of the redissolved DNA was digested with 10U of Hae III in the presence of 4 mM spermidine, according to manufacturer instructions. The concentration and size of cut DNA was assessed by fluorometer and mini-gel. The mini-gel was prepared in 1x TAE (40mM Tris, 40 mM acetic acid, 1 mM EDTA Na_2) with .8% LE agarose, stained with 0.5µg.ml^{-1} Ethidium Bromide and electrophoresed for 30 min at 100V. Uncut and cut DNA from tail fragments together with Lambda DNA - Hind III markers were revealed by UV light.

High molecular weight DNA (>23 Kb.) was obtained from all samples analyzed. Distal tail fragments of 1.5 cm weighing 52–95 mg produced 0.89–7.03 µg DNA, whereas distal tail fragments of 2 cm and 129–156 mg yielded 6.58–10.37 µg (Table 1). Although 1.5 µg of DNA may be enough to obtain a minisatellite DNA (May et al. 1993), we considered 5.0 µg as the minimal amount of total DNA per sample necessary to obtain predictable results. Therefore, the shortest distal fragments (1.5 cm) did not yield sufficient DNA for minisatellite analysis. Longer distal fragments (2 cm) were more than enough to run one or two gels, 3 cm of tail (fragments 1+2 or 4+5) produced sufficient DNA for several assays, a necessity when the same individual must be scored in different family assemblages.

We plotted the amount of DNA produced versus fragment mass (r_s= 0.65, N = 13, p = 0.017) to obtain predictable estimates of fragment size required for adequate DNA collection. The lower limit mass to yield 5 µg of DNA corresponded about to 80 mg of tail fragment (Fig. 2). In our experiment, 2 cm of tail fragment produced more DNA than 30 µl of blood (Table 1), a volume which is available only from large individuals (unpubl. data).

Different genetic assays require different amounts of DNA. For example, PCR amplification for microsatellites or sequencing requires small quantities of template DNA, in the order of nanograms. As shown in Table 1, any of the fragments in our analysis produced more than enough genomic DNA for these amplifications.

TABLE 1. DNA yield obtained from tail fragments of five individuals (A–E) of *Psammodromus algirus* according to segment position (1 to 5, Fig. 1) and mass.

Individual	Tail fragment	Mass (mg)	Total DNA (µg)
A	1	58	0.89
A	2	158	3.50
A	3	175	3.60
B	1	52	1.40
B	2	148	9.50
B	3	173	10.90
C	1	95	7.03
C	2	240	17.70
C	3	313	10.06
D	4	129	6.58
D	5	163	22.17
E	4	156	10.37
E	5	188	16.53
BLOOD	—	30µl	7.28

Our sampling method can be used for species with autotomy in which bleeding may be difficult or traumatic. Although tail loss may reduce home range size and movement rates in *P. algirus* (Salvador et al. 1995), this effect was recorded only in males with a regenerated tail shorter than 150 mm (Salvador et al. 1996). As the length of intact tail in this species may reach 200 mm in adults, the consequences of removing fragments of 2–3 cm for DNA sampling may be negligible. The use of this sampling method in other species of lizards with caudal autotomy is recommended if the fragment of tail removed produces enough DNA and does not modify the behavior or any component of fitness of the species under study.

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Use of a Fluorescent Marking Technique on Small Terrestrial Anurans

MARTIN A. SCHLAEPFER
Department of Natural Resources, Fernow Hall, Cornell University
Ithaca, New York 14853-3001, USA

The choice of a marking technique for research should be based on the objective of the study, effectiveness of the technique, ease of application, and the potential risk to the organism. While toe-clipping is convenient and inexpensive, and thus remains a common technique for marking adult anurans (Donnelly et al. 1994), there is some evidence that it may affect behavior or survivorship (Clark 1972; Golay and Durrer 1994; but see Lemckert 1996). The use of a marking technique that potentially affects the organism's behavior or survival is usually unacceptable; thus, alternatives to toe-clipping should be considered. Marking amphibians with fluorescent pigments appears to be a promising alternative (Donnelly et al. 1994; Windmiller 1996). A pressurized application of fluorescent powder was applied successfully to aquatic and terrestrial salamanders (Ireland 1973, 1991; Nishikawa and Service 1988; Taylor and Deegan 1982). However, the effectiveness, details of application, and risks of this technique have not been quantified for other amphibians.

I recently used a pressurized fluorescent marking technique on small terrestrial leaf-litter frogs (*Eleutherodactylus podiciferus*; Leptodactylidae) in Costa Rica to evaluate its applicability. Inert fluorescent powder was applied to a hind leg of frogs using a pressurized source of air similar to that described in Nishikawa and Service (1988). However, Nishikawa and Service (1988) used a small 2-liter source of pressurized N_2, whereas I used a source of pressurized air delivered by a SCUBA tank. The nozzle of the spray gun was modified to accommodate a variety of interchangeable nozzle openings. The 7/64 inch (2.8 mm) opening was optimal, as it did not clog the nozzle yet produced a concentrated point. The yellow, fluorescent, granular powder (50–350 mm) produced a mark 3–4 mm in diameter on the hind leg of the frog when delivered at a pressure of 100 psi, approximately 0.5 cm from the skin.

I compared the use of fluorescent pigments in the field to toe-clipping with respect to i) ease of application and disturbance to frogs, ii) risk to frogs (i.e., survival), iii) longevity of the mark, and iv) logistics and cost. I caught and marked 68 adult *E. podiciferus* (10–24 mm SVL) in 1996, alternating between the fluorescent powder technique, and toe-clipping a single foot digit (digit IV). Clipped toes were disinfected with a dab of Bactine® to reduce the likelihood of infections (Martin and Hong 1991). Juveniles (< 10 mm SVL) were judged to be too fragile to mark with either method. Frogs were marked during two Periods: Period I, 2–8 July: 22 yellow-marked and 23 toe-clipped frogs were released; Period II, 20–23 July: 11 yellow-marked and 12 toe-clipped frogs were released. To determine whether marks were disappearing, a description of each individual's natural markings (modified from Savage and Emerson 1970) were noted, as well as SVL. Frogs were recaptured during Period II and Period III (13 August).

The pressurized powder technique was more difficult to apply, and seemingly more harmful to the frogs than toe-clipping. Applying the pigment required holding the frog tightly on a flat surface and then releasing a blast of air. If the frog was not properly immobilized, legs were occasionally dislocated by the blast (N = 5; 15%). Also, frogs were occasionally blown away, literally. One frog died due to the fluorescent powder procedure, and 30–50% of the frogs appeared to be stunned to various degrees by the blast of air. Recovery from the blast, measured by a return to a righting position and the ability to jump when touched, was often incomplete several minutes later. *Eleutherodactylus podiciferus* may have been particularly susceptible to the blast of air due to its small size. Toe-clipping was easier and quicker to apply than the pressurized powder, although it would not have been possible to clip the smaller, inner toes (I–III) on the younger individuals (<18 mm SVL) due to their small size. Fingers are also very small and would be difficult to clip for the same reason (pers. obs.). None of the toe-clipped frogs suffered visibly from the clipping procedure.

Eleven of the 68 marked frogs were recaptured. Six were toe-clipped and 5 bore yellow fluorescent spots (Period II: 2 toe-clipped and 3 yellow from Period I; Period III: 2 toe-clipped from Period I, 2 toe-clipped from Period II, and 2 yellow from Period II). No toe-infections or other effects of either technique were observed on recaptured individuals. I was unable to detect any significant difference in survivorship between the two marking methods, because of low recapture rates.

Yellow spots were still clearly visible on 3 of 5 recaptured frogs with these marks. The other two had faded to a light gray spot during the three weeks since the application, but were still visible, particularly under UV light. Nishikawa and Service (1988) found that fluorescent marks on salamanders would last 1–2 years in the laboratory. Toe-clips were still clearly visible on the two individuals marked in Period I and caught in Period III, suggesting that they do not regenerate within a 5–6 week period. No unmarked individuals fit the profile of a previously marked individual (using natural variation and SVL); thus, no lost yellow marks or regenerated toe-clips could be confirmed among the recaptured individuals.

I agree with Ireland (1991) that the equipment was rather cumbersome to transport into the field, weighing 3.2 kg excluding the source of air (a SCUBA tank and the regulator). It was also expensive, costing US$ 340 in 1996 (including UV lamp, but excluding the price of the SCUBA tank and the regulator). Toe-clipping required a pair of surgical scissors and a bottle of Bactine® (weight: 120 g; cost: $12).

It appears that toe-clipping is easier, less harmful, more convenient, and less expensive to apply to *E. podiciferus* than pressurized fluorescent powder. Fluorescent marking has the advantage that marked organisms may be identified by day, or by night using a UV lamp, without further handling. Nishikawa and Service (1988) also found higher rates of recapture per unit effort of salamanders that had been marked with fluorescent powder relative to other studies that used toe-clipping. Fluorescent powder may

therefore still present an interesting alternative technique for marking larger frogs, which can be properly immobilized and which are less likely to suffer from the blast of air during the application of the powder. I concur with Donnelly et al. (1994) who recommended that researchers test a variety of techniques on their organism prior to adoption for field or laboratory studies, because effectiveness and application will vary with body size and life history.

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Female *Ambystoma opacum* (Marbled Salamander) with eggs. USA: South Carolina: Beaufort Co. Illustration by Michael G. Frick.

Review of Radio Transmitter Attachment Techniques for Turtle Research and Recommendations for Improvement

WILLIAM I. BOARMAN
USGS-Biological Resources Division
Department of Biology, University of California, Riverside
Riverside, California 92521, USA
e-mail: william_boarman@usgs.gov

TRACY GOODLETT
On-Track Consulting and Research
429 West Petris Avenue, Ridgecrest, California 93555, USA

GLENN GOODLETT
On-Track Consulting and Research
429 West Petris Avenue, Ridgecrest, California 93555, USA
e-mail: ggoodlett@aol.com

and

PAUL HAMILTON
USGS-Biological Resources Division
Department of Biology, University of California, Riverside
Riverside, California 92521, USA

Abstract.—How a radio, sonic, or satellite transmitter is attached to a turtle or tortoise may affect the transmitter's transmission range and the animal's behavior, survival, and reproductive success. We reviewed 113 scientific papers, reports, and semi-technical articles reporting on radio-tracking projects with turtles and conclude that little information is available in the literature to evaluate the effects of transmitters on the study animals. We also provide step-by-step directions on a successful method we used to attach transmitters to desert tortoises (*Gopherus agassizii*) that minimizes potential of affecting the animal's behavior, physiology, reproduction, or survival while maximizing distance of transmission. We believe this method can be used on many other species of turtles and tortoises.

Biotelemetry has become indispensable for studying turtle migration, dispersal, home range, habitat use, physiology, and the effectiveness of relocation efforts. The most common types of telemeters used on turtles are radio, sonic, and satellite transmitters, which each have advantages depending on the specific applications. An important consideration for using radio transmitters and all marking techniques is assuring they do not affect significantly the behavior, physiology, reproductive success, and survival of the animals (Anonymous 1987; Brander and Cochran 1969; Ireland and Kanwisher 1978; Kaufmann 1992a; Renaud et al. 1993b; Schubauer 1981; Schwartzman and Ohmart 1977). Therefore, non-invasive methods of transmitter attachment must be developed and tested (Anonymous 1987). Furthermore, as there are tradeoffs between transmitter weight, transmitter longevity, and transmission range (Brander and Cochran 1969; MacDonald and Amlaner 1980), transmitter attachment methods should be developed to optimize performance to meet study objectives.

We reviewed 113 published and unpublished accounts of the use of radio, sonic, and satellite tracking of turtles to determine the attachment methods used and to identify problems for the study animals caused by the transmitters. We also outline the method we have used for five years to attach transmitters to desert tortoises (*Gopherus agassizii*) without causing physical harm to the study animals, while maximizing transmitter longevity and range. This method can be used for multi-year applications with other species of turtles.

Review of Transmitter Attachment Methods and Their Problems.—In the 113 publications, articles, and reports we reviewed, radio transmitters, which consist of three major components (body

of transmitter, battery, and antenna), were attached externally to the carapace of turtles by several means: cemented on with epoxy, silicone sealant, dental acrylic, or some other adhesive; strapped on with harnesses; or attached via bolts, wire, cable or nylon ties, or monofilament line passed through holes drilled in the carapace, usually through the posterior carapace or marginal scutes (Table 1). These methods were used to attach either the transmitter and battery directly to the carapace or to allow the transmitter to trail loosely behind the animal.

Some less conventional modes of attachment were used. In one instance, transmitters were sewn onto the carapace of soft-shelled turtles (Plummer and Shirer 1975). Transmitters also were attached with some success using black plastic electrical tape (Eckler et al. 1990; Moll and Legler 1971). Whereas implantation is the norm in snakes (Fitch and Shirer 1971; but see Ikeda et al. 1979), it has been rarely employed in turtles (Table 1). Many authors (23%) did not mention how or where transmitters were attached, making it difficult to evaluate the potential effect of the transmitter on the animals, and hence the possible limitations on interpreting study results.

Problems caused by transmitters are well documented for birds and mammals (Kenward 1987; White and Garrott 1990), but are poorly known for turtles. We know of only three limited studies designed in part to test the effects of different transmitters or attachment methods on turtles. Timko and Kolz (1982) estimated that a satellite transmitter caused a captive loggerhead turtle to spend twice as much time on the water surface, but concluded the transmitter caused no "radical" change in behavior. However, their sample size was one, and no control was reported. Kemmerer et al. (1983) found that after equipping 20 loggerhead turtles with transmitters, the turtles spent more time on the surface during the first 3 days than the following 17 days of study. Beavers et al. (1992) found three different adhesive attachment methods had no effect on loggerhead turtle behavior, but their sample size was one per method and they made no mention of methods or criteria.

We located six papers reporting problems observed during the course of field studies with turtles. Keinath and Musick (1993) reported the transmitter and harness cemented to a leatherback turtle (*Dermochelys coriacea*) were bitten by a tiger shark (*Galeocerdo cuvieri*), the resultant damage causing the harness to chafe the turtle's skin. Equipment poorly attached to harnesses slapped against and severely damaged the carapaces of leatherback turtles (Eckert and Eckert 1986). Implanting transmitters into the oviducts of northern long-necked turtles (*Chelodina rugosa*) caused oviducal adhesion in at least two turtles, reducing reproductive output in the year studied, and the surgical procedure resulted in the death of one turtle (Kennett et al. 1993). The act of attaching transmitters may have caused up to 55% of female yellow mud turtles (*Kinosternon flavescens*) to move to new nesting locations (Iverson 1990); the transmitter attachment method was not noted, however. Brill et al. (1995) found submergence behavior of green turtles (*Chelonia mydas*) was affected for up to three hours after they attached transmitters to the rear marginals of the carapace by inserting nylon straps (tie-wraps) through drilled holes. Some shell deformation occurred in hatchling gopher tortoises (*Gopherus polyphemus*) because epoxy holding on the transmitters encroached growth areas between scutes (Butler et al. 1995). On the other hand, Hopkins and Murphy (1981) reported no damage to carapace or flippers from transmitters on 37 loggerhead turtles.

Although not published, other problems have occurred. For instance, J. Congdon (pers. comm.) found transmitters placed on the carapaces of painted turtles (*Chrysemys picta*) became entangled in filamentous algae preventing the turtles from diving. C. K. Dodd, Jr. (pers. comm.), has made similar observations on common mud turtles (*Kinosternon subrubrum*). H. Avery (pers. comm.) observed female desert tortoises impeded by transmitters, which were mounted on the anterior carapace, that got hooked by stems of desert shrubs. We found one desert tortoise shell that became deformed because normal shell growth was inhibited by a transmitter antenna that was attached improperly for one year. Similar results from desert tortoises were reported by K. Berry (pers. comm.) and A. Karl (pers. comm.). Such deformation is most likely to occur in animals that experience relatively rapid growth during the course of study (e.g., juveniles or animals equipped for several years). Although unreported, drilling holes into the shell and underlying bone may lead to potentially harmful infection, and this effect may not be observable until sometime after the transmitters have been removed (B. Homer, pers. comm.). Bertram (1979) did comment on the absence of any wounds after removing a transmitter that had been bolted onto the carapace of a hingeback tortoise (*Kinixys belliana*) two years earlier.

Transmitters may attract the attention of predators (Keinath and Musick 1993; cf. Renaud et al. 1993b) or people (Stoneburner 1982). To reduce the potential for such effects, transmitters should be camouflaged in some way. For instance, Dizon and Balazs (1982) covered their transmitters with roofing tar and sand before attaching to Hawaiian green turtles (*Chelonia mydas*). Schwartzman and Ohmart (1977) mixed neutral color compounds to the epoxy or painted the dried epoxy after attachment to desert tortoises. Satellite transmitters placed on sea turtles are routinely painted black (C. K. Dodd, Jr., pers. comm.).

Authors occasionally mention transmitter failures, problems, or malfunctions (Table 1), but rarely are the causes known, mentioned, or hypothesized. We found several accounts in the literature of the loss of transmitters. Stoneburner (1982) laments the theft of seven out of eight buoy transmitters attached to loggerhead turtles (*Caretta caretta*). Timko and DeBlanc (1981) lost 4 of 22 transmitters and Timko and Kolz (1982) lost their only transmitter when the linen lanyard used to attach floating transmitters to Kemp's ridley turtles and a loggerhead turtle became abraded and parted (see also Renaud et al. 1992; Renaud et al. 1993b; Renaud and Carpenter 1994; Schubauer 1981). After being in place for five months, the vertically-protruding antenna broke off a transmitter attached to a hingeback tortoise (*Kinixys belliana*, Bertram 1979). In one study of the desert tortoise, 9% of transmitters (10 of 111) fell off the animals over four years (EG&G 1993).

Attaching Transmitters to Desert Tortoises.—For nearly two decades, researchers have been attaching transmitters to the carapaces of desert and gopher tortoises with epoxy cement (for example, see Schwartzman and Ohmart 1977). We modified the methods used by Schwartzman and Ohmart (1977), Mike Cornish (pers. comm.), Charles Peterson (pers. comm.), and others to attach radio transmitters securely to desert tortoises apparently without causing shell deformation, predator attraction, mating disruption, or transmitter loss, while also yielding greater transmitter range. We present the following step-by-step description of the protocol we used so that the method can be adapted to other species of turtles and tortoises.

We used three different types of transmitters depending on the size of the tortoise. Two-stage battery-powered transmitters (AVM Instruments SB-2*), weighing 35 g, were attached 108 times to 43 tortoises (171–296 mm midline carapace length [MCL], 1075–5200 g). One-stage battery-powered transmitters (AVM Instruments SM-1H), which are smaller (26 g) and weaker, were at-

tached 24 times to 14 tortoises between 146 and 239 mm MCL (800–3150 g). One-stage solar-assisted transmitters (AVM Instruments SM-1H-solar), weighing 4.2 g, were attached 41 times to 21 immature and subadult tortoises between 97 and 207 mm MCL (220–1800 g). Whip antennas on the larger two transmitters ranged from 280 to 320 mm in length and were made of 20 gauge, insulated, stranded wire. The whip antennas for the solar transmitters were 150 mm long and made of single 24 gauge, insulated, stranded wire.

We used the following step-wise procedure to attach the non-solar assisted transmitters to 57 desert tortoises (Fig. 1a):

1. We tested the transmitter to confirm that it worked.
2. All dirt was brushed off of the carapace.
3. We pre-positioned the transmitters to the first left or first right costal scute of the tortoise's carapace, as flush to the carapace as possible.
4. To position the antenna, we cut short sections of flexible 3 mm plastic tubing, and epoxied each section to the first four vertebral scutes (see also Butler et al. 1995). Each section was cut slightly shorter than its associated scute. Super glue was used to hold each section of tubing in place while we applied a quick drying, pliable putty epoxy (Power Poxy Adhesives, Inc., Power Poxy® #40001*) over each section of tubing in a continuous layer from the scute surface on one side of the tube to the scute surface on the opposite side of the tube. We were cautious not to get any epoxy on the scute sutures or on neighboring scutes.
5. We ran the antenna through the tube sections leaving approximately 50–120 mm of antenna hanging loose beyond the posterior of the animal.
6. The transmitter was then attached with putty epoxy, using care not to bridge the scute margins. Spaces between the transmitter and carapace were filled in with epoxy to prevent the transmitter from getting caught in vegetation.
7. Both the transmitter and the putty epoxy were painted with a flat colored, lead-free paint to reduce reflectivity and contrast.
8. Finally, the transmitter was checked again for proper operation and the tortoise was released immediately.

The entire procedure takes approximately 15 min. The transmitters were removed about every two years for battery replacement by cutting through the epoxy with a pocket knife, a simple process that took less than 10 min.

Using similar procedures, solar-assisted transmitters were attached to the fifth vertebral scutes of 21 tortoises using putty epoxy, but the antenna was left loose. We did not use any tubing to attach the antenna to the tortoise. Some transmitters were attached with the antenna oriented vertically and others horizontally.

To simplify and expedite transmitter removal during future scheduled battery replacement, we initially attached a brass base plate with Devcon® Five-Minute Epoxy®* to the carapace, then attached the transmitter to a metal post on the plate. Transmitters attached in this manner became detached 22 times between day 1 and 26 months later. No additional losses were experienced after eliminating use of the brass plate (i.e., using the methods described above).

For the first two years, we attached the antenna to the marginals, partially encircling the animal. Later, we began attaching the transmitter to the first right or left costal, as described above, which facilitated placement of the antenna over the vertebral scutes and letting the distal 50–120 mm of antenna trail behind the tortoise. This improvement increased transmission range by approximately 20% (pers. obs.). Diverting the antenna down to the last one or two costal scutes on females would keep it from possibly interfering with copulation, although we have observed unimpeded copulations with the antenna attached to all vertebral scutes. Leaving antennas loose on solar-assisted transmitters caused antennas to break 19 times, but was necessary to maximize the range of these weaker transmitters. Vertical orientation of antennas also resulted in greater range compared to horizontal orientation, but made the antenna more vulnerable to breakage. To reduce the breakage problem, a smaller, more resilient gauge antenna was used and the base of each antenna was enclosed in a small spring.

Placed on the vertebrals, the tubing allowed the antenna to be pulled through the tubes as the tortoise grew, thus preventing shell deformation. We have attached antennas in this manner to 57 tor-

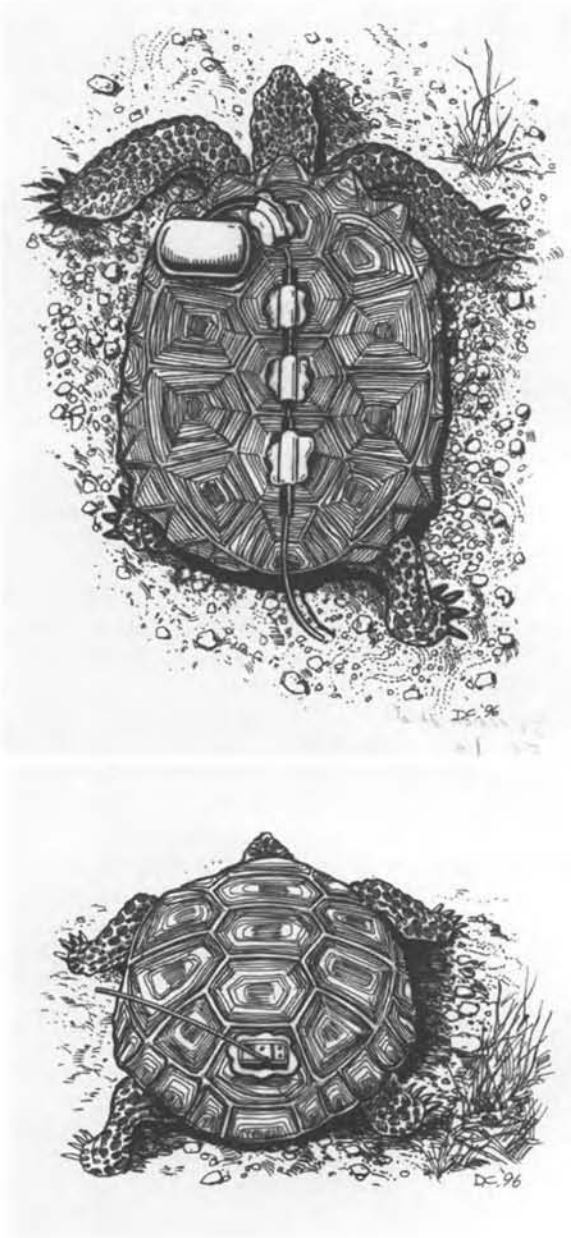


FIG. 1. Drawing showing how we attached radio transmitters to the carapaces of desert tortoises: (a) larger battery-powered transmitters were attached to tortoises larger than 146 mm (midline carapace length; 800 g) and (b) smaller solar-assisted transmitters were attached to immature and subadult tortoises between 97 and 207 mm (220–1800 g).

TABLE 1. Methods of transmitter attachments in chelonians. Methods are categorized as one of the following classifications: "adhesive" (transmitter was attached to the shell of the turtle with glue, epoxy, dental acrylic, or fiberglass), "harness" (transmitter was strapped around the shell without otherwise disturbing the shell), "hole in shell" (holes were drilled, screwed, or punched through the shell, and bolts, string, wire or other filament was strung through the hole[s] to attach the transmitter), "implantation" (transmitters were surgically implanted within the body), "tape" (transmitter was attached with electrical tape), "sewn" (the transmitter was sewn into the shell of a soft shell turtle), or "not mentioned" (method was not evident). Papers that reported on problems are indicated by superscripts. An "*" notes data on effect of the transmitter on the health, development, behavior, or ecology of the turtle. A "+" denotes problems with transmitters falling off or otherwise being lost from the turtle. A "†" notes a non-specified problem with transmitter use on a turtle.

Method	Species	Source
adhesive	*Caretta caretta*	Beavers et al. 1992; Hays et al. 1991; Renaud et al. 1992+; Renaud and Carpenter 1994
	Chelonia mydas	Renaud et al. 1992+; Renaud et al. 1993b+
	Chelydra serpentina	Ireland and Kanwisher 1978
	Clemmys guttata	Lovich 1990, pers. comm.
	Clemmys marmorata	Rathbun et al. 1992
	Clemmys muhlenbergii	Eckler et al. 1990†; Larson 1984; Lovich et al. 1992, pers. comm.
	Dermochelys coriacea	Standora et al. 1984†
	Gopherus agassizii	Barrett 1990; Bulova 1994; Burge 1977b; Esque 1994; Goldsmith and Shaw 1994; Martin 1995; O'Connor et al. 1994a, b; Peterson 1993; Schwartzman and Ohmart 1977; Stewart 1993; Turner et al. 1984; Zimmerman et al. 1994
	Gopherus flavomarginatus	Tom 1994
	Gopherus polyphemus	Butler et al. 1995*; Diemer and Moler 1982; Diemer 1992†; Smith 1995; Wilson et al. 1994
	Lepidochelys kempii	Renaud et al. 1993a
	Lepidochelys olivacea	Beavers and Cassano 1996; Plotkin et al. 1995, 1996
	Sternotherus depressus	Dodd et al. 1988
	Terrapene carolina	Madden 1975+
	Terrapene ornata	Nieuwolt 1993
	Trachemys scripta	Moll 1994, pers. comm.
	Testudo kleinmanni	Geffen and Mendelsson 1988†, 1989
	generic	Belzer and Reese 1995
harness	*Caretta caretta*	Stoneburner 1982+
	Chelonia mydas	Ireland 1980; Standora et al. 1982
	Dermochelys coriacea	Duron-Dufrenne 1987; Eckert and Eckert 1986*; Eckert et al. 1986; Keinath and Musick 1993*
	Lepidochelys kempii	Byles 1989*+
hole in shell	*Caretta caretta*	Byles and Dodd 1989+; Hopkins and Murphy 1981*; Keinath et al. 1989*+; Kemmerer et al. 1983; Standora et al. 1982; Renaud and Carpenter 1994; Wibbels et al. 1990†; Yano and Tanaka 1991†
	Chelonia mydas	Baldwin 1973; Brill et al. 1995*; Dizon and Balazs 1982; Mendonça 1983; Ogden et al. 1983†
	Chelydra serpentina	Froese 1974; Galbraith et al. 1987†; Ireland and Kanwisher 1978; Brown and Brooks 1991; Brown et al. 1990; Obbard and Brooks 1981
	Chrysemys picta	Taylor and Nol 1989; Christens and Bider 1987†
	Clemmys insculpta	Kaufmann 1995, 1992a, b
	Emydoidea blandingii	Ross and Anderson 1990; Rowe and Moll 1991†
	Gopherus polyphemus	Diemer 1992†
	Kinixys belliana	Bertram 1979+
	Lepidochelys kempii	Byles 1989*+; Timko and DeBlanc 1981+
	Macroclemys temminckii	Harrel et al. 1996; Sloan and Taylor 1987
	Pseudemys concinna	Buhlmann and Vaughan 1991
	Terrapene ornata	Doroff and Keith 1990; Ellner and Karasov 1993; Legler 1971
	Trachemys scripta	Florence 1975†; Moll and Legler 1971†; Schubauer et al. 1990
	generic	Schubauer 1981
implantation	*Chelonia rugosa*	Kennett et al. 1993*†
	Geochelone gigantea	Swingland and Frazier 1980
	Gopherus flavomarginatus	Aguirre et al. 1984
sewn	*Apalone mutica*	Plummer and Shirer 1975
tape	*Clemmys muhlenbergii*	Eckler et al. 1990
	Trachemys scripta	Moll and Legler 1971†
not mentioned	*Batagur baska*	Moll 1980
	Caretta caretta	Soma and Ichihara 1977; Soma 1985; Timko and Kolz 1982+
	Chelonia mydas	Ireland 1979; Carr 1967
	Chelydra serpentina	Ultsch and Lee 1983

TABLE 1. cont'd

Method	Species	Source
not mentioned	*Gopherus agassizii*	Berry 1974; Burge 1977a; Christopher et al. 1993; DeFalco 1995; EG&G 1993*+; Henen 1994; Jennings 1993; Turner et. al. 1987, 1986; Wallis et al. 1992
	Gopherus polyphemus	McRae et al. 1981
	Kinosternon flavescens	Iverson 1990*
	Kinosternon subrubum	Burke et al. 1994
	Mauremys japonica	Yabe 1992
	Pseudemydura umbrina	Fullagar 1967
	Terrapene carolina triunguis	Kiester et al. 1982; Schwartz et al. 1984
	Testudo hermanni	Swingland et al. 1986

toises for up to five years, and have observed only one shell that became slightly deformed when the widened distal end of the antenna failed to slide through the tubing. We now use antennas with continuous surfaces rather than ones with additional insulation at their ends.

Attachment to the first right or left costal prevented the transmitter from interfering with mating when males mounted females. We did not measure the effect of transmitters on tortoise behavior, but did observe several instances of males mounting females unobstructed by the transmitter and two transmittered animals successfully righting themselves after falling on their carapace.

Attaching the transmitter to the first right or left costal scute generally resulted in a fairly flush alignment with the top of the carapace, thus minimizing problems that could occur when tortoises with transmitters turn around inside their burrows. Three of our transmittered animals were found stuck in collapsed burrows following an unusually rainy winter, but we were unable to determine if the transmitters contributed to burrow collapse or tortoise entombment. None of three known mortalities of our transmittered animals were attributed to the presence of the transmitter (one was a road kill, one probably died from a respiratory disease, and one died of unknown causes).

Discussion.—Based on five years of observation, the method described herein successfully reduced loss of transmitters, increased transmission range, and prevented deformation of the shells, while minimally altering the animals' behavior. However, experiments designed explicitly to measure transmitter effect were not conducted.

Transmitter design is a three-way compromise between battery size, longevity, and transmission range (Brander and Cochran 1969; Macdonald and Amlaner 1980; Mech 1983). We found antenna orientation to affect transmission range. We found that transmission range was increased by allowing the antenna to lie across the top of the carapace. This orientation likely reduced nulls in the transmission signal caused by an open loop and reduced slightly ground attenuation (Mech 1983).

Allowing the transmitter and/or antenna to bind together two or more scutes may cause deformation of the shell as the animal grows. If the antennas were attached directly to the shell with epoxy, they would connect several scutes together for as long as the transmitter was attached; which may be the life of the animal if the animal becomes lost with the transmitter still attached. This would be particularly critical in rapidly growing turtles (e.g., hatchlings and juveniles). Although undocumented, shell deformations could be hazardous if they impede normal behavior or damage underlying tissues (B. Homer, pers. comm.).

We found that our transmittered tortoises were still able to mate apparently unimpeded by the transmitter and were able to successfully right themselves if tipped over during mating or aggression. Eckler et al. (1990) also observed the behavioral effect of attaching transmitters to 45 bog turtles (*Clemmys muhlenbergii*), and reported seeing successful foraging, mating, and nesting. They epoxied the transmitters to the fourth costal scute and attached the antennae directly to the carapace.

The method chosen for attaching radio transmitters depends on the size, behavior, potential future growth, and catchability of the species, as well as characteristics of the environment and the principal study objectives (e.g., length of study, type of data desired). It is essential that the transmitter not affect significantly the behavior, survival, or reproductive success of the study animals. Therefore, for relatively long-term applications (the length of time depends on the animal's growth rate, which depends in part on the animal's age), attachment should avoid causing shell deformation. Studies should be conducted to evaluate the effect that transmitters and their attachment methods have on turtles and tortoises with the results reported in the literature. Furthermore, studies using radio transmitters should provide sufficient detail on attachment methods to allow readers to evaluate the potential effect the transmitters may have on the animals and the study's results.

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Bufo terrestris (Southern Toad). USA: Georgia: Chatham Co. Illustration by Michael G. Frick.

Increasing Lizard Capture Success Using Baited Glue Traps

MARTIN J. WHITING
Department of Zoology, University of Stellenbosch
Private Bag X1, Matieland 7602, South Africa
and
**Department of Herpetology, Transvaal Museum*
P.O. Box 413, Pretoria 0001, South Africa
e-mail: whiting@tm.up.ac.za
**address for correspondence*

Bauer and Sadlier (1992) recently drew attention to the effectiveness of household glue traps for the sampling of herpetofauna, particularly lizards. Here I report on an experiment to test the effectiveness of baiting glue traps to capture the cordylid lizard *Platysaurus capensis*, as well as additional observations on sampling lizards with glue traps.

I used nontoxic Catchmaster® 9 x 12 cm Baited Mouse Glue Traps and to a lesser extent Catchmaster® 13 x 21 cm Baited Mouse, Insect & Snake Glue Boards (Atlantic Paste & Glue Co., Inc, 4-53rd Street, Brooklyn, New York 11232, USA) to sample *P. capensis* at Augrabies Falls National Park, South Africa (28°35' S, 20°20'E). The former trap is raised on a 9 mm plastic platform, the latter trap consists of flat, laminated cardboard. My field assistants and I have captured over 1000 *P. capensis* using glue traps. Since *P. capensis* inhabits rocky areas, glue traps were attached to rock using putty (Bostik®) to prevent lizards escaping with the trap. Traps were placed along crevices and across known activity corridors. In an attempt to increase capture success, I began baiting traps with brown unripened Namaqua figs (*Ficus cordata*) painted red to resemble ripe figs which were unavailable at the time of study, and which form part of *P. capensis*' diet (Whiting and Greeff 1997). To measure the effectiveness of this method, I baited 37 traps with a single red-painted fig (mean diameter of 40 figs: 6.17 ± 0.09 mm, Whiting and Greeff 1997) placed in the center of the trap. Thirty-seven unbaited traps served as controls. Baited and unbaited traps were placed in alternate sequence, during 28–29 August 1996 and continuously monitored. No lizard was caught more than once. Assuming an equal probability of capture as the null hypothesis, significantly ($\chi^2_1 = 23.14$, $P < 0.0001$) more lizards were caught on fig-baited (46 lizards) than control (10 lizards) traps. Also, significantly ($\chi^2_1 = 4.55$, $P < 0.05$) more lizards sampled (tongue-flicked) traps containing red-painted figs (16 lizards) compared to controls (6 lizards).

Platysaurus capensis were also attracted to traps baited with live, moving insects. In some cases lizards were caught after being chased onto a trap line they might otherwise have avoided. During the breeding season, males were often caught when they inspected trapped females.

In addition to *P. capensis*, geckos (*Pachydactylus* spp.) and the gerrhosaurid *Cordylosaurus subtessellatus* also were inadvertently caught. Also, during field work in Namibia, the subterranean gecko *Ptenopus garrulus* was captured by placing glue traps at the entrance to their burrows.

Bauer and Sadlier (*op. cit.*) suggested removing lizards from glue traps using corn oil. Lizards with relatively hardy integuments (such as *P. capensis*) may first be removed from a trap prior to the application of oil to remove excess glue. This greatly increases the longevity of the trap. Trap longevity can also be increased by avoiding windy situations or removing traps with the onset of wind.

This work supports Bauer and Sadlier's assertion that glue traps should be added to the arsenal of zoologists involved in herpetological sampling. In the case of autecological studies, especially for visually oriented species, capture success may be increased through trap baiting.

Acknowledgments—For assistance capturing *P. capensis* using glue traps at Augrabies Falls National Park, I am indebted to L. Bartman, P. W. Bateman, D. L. Bellars, S. Kirkman, S. V. Nelson, and L. Simpson. In Namibia, *P. garrulus* were captured during a field trip with W. E. Cooper, Jr. I thank N. H. G. Jacobsen for commenting on the manuscript.

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A Simple Device to Prevent Small Vertebrate Animals from Drowning in Swimming Pools

MICHAEL J. TYLER
Department of Zoology, University of Adelaide
South Australia 5005, Australia

In many parts of the world small mammals, reptiles, and amphibians drown after falling into swimming pools, from which they are unable to escape. My attention was drawn to this matter following the discovery of a drowned pine marten, *Mustela martes,* in a pool at Toulouse, France, and of a live toad, *Bufo bufo,* in the skimmer box of the same pool. Here I describe the design of a simply constructed wooden raft now proven, from its use there, to have assisted the escape of such animals.

The device consists of two units comprising tongue and grooved wooden planks attached to a 4 x 4 x 50 cm square section wooden frame (Fig. 1). The two identical components are connected by a continuous brass hinge, permitting the ramp to adjust to changing water levels. The ramp is equipped with closely spaced bars to provide purchase for a creature leaving the water (Fig. 2). To minimize the angle at which the device touches the water, an empty plastic water bottle has been attached to the undersurface by means of a plastic strap (Fig. 1).



FIG. 1. Device in position: the right hand portion is placed directly above the skimmer box.



FIG. 2. Undersurface of device showing the framework upon which the boards are mounted, and the plastic water bottle in place.

The positioning of the device is vital to maximize access to trapped animals. The direction of pool water flow towards the skimmer box means that a weakened animal will float towards, and often into, the skimmer box where ultimately it will drown. The device was therefore placed over the skimmer box as shown in Fig. 2. Its first observed success, one week after its installation, was the emergence via the inclined ramp of a juvenile viper, *Vipera berus*.

HERPETOLOGICAL HUSBANDRY

A Safe, Single-Application Procedure for Eradicating Mites on Reptiles

ROBERT E. ESPINOZA*
Ecology, Evolution, and Conservation Biology / FA 314
University of Nevada, Reno, Reno, Nevada 89557-0015, USA
e-mail: espin_r@unr.edu

CHRISTOPHER R. TRACY
Department of Zoology, University of Wisconsin, Madison
Madison, Wisconsin 53706, USA
e-mail: crtracy@students.wisc.edu

and
C. RICHARD TRACY
Biological Resources Research Center / FA 314
University of Nevada, Reno, Reno, Nevada 89557-0015, USA
e-mail: dtracy@unr.edu

**Author to whom all correspondence should be addressed.*

Mites are common ectoparasites that can cause serious health problems for squamate reptiles—particularly under captive conditions (Frye 1981; Lane and Mader 1996; Mader 1989; Marcus 1983). Mites can be difficult to extirpate completely (e.g., Mader 1989; Montanucci 1997), and as a result, numerous commercial products are now available to kill these pests (e.g., Abrahams 1992; Boyer and Boyer 1991). However, some of these products are unsatisfactory for one or more reasons, including toxicity, the need for veterinary direction, required changes in husbandry, high cost, or a lack of long-term efficacy (Mahaney 1995; Montanucci 1997).

Several non-commercial techniques have been described for eradicating mites from captive reptiles and their surroundings. One method traps mites by simply lining the perimeter of the animal's enclosure with masking tape (Mahaney 1995). Yet despite its ease of application, this method only removes dispersing individuals, and thus mites that remain in the substratum, on refugia in the enclosure, or on the animals themselves, will not be captured.

Recently, Montanucci (1997) described a procedure for eradicating mites by selectively removing the most critical stages of their life cycle—gravid females and egg cases. Although this method is reportedly effective, the process seems inordinately elaborate, and may require a substantial time investment. Specifically, this procedure includes a twice-weekly washing of the cage and refugia, and manual removal of gravid female mites and egg cases. Due to the lengthy life cycle of these pests, this process may ultimately take more than a month to eliminate an entire mite population (Montanucci 1997).

In our lab, we kill mites living on reptiles by immersing the reptiles in vegetable oil. The oil entraps and subsequently suffocates the mites by occluding their respiratory passages. This method offers the advantages of low cost and safety while completely eradicating the entire mite population with a single application. After several years of refinement, we have improved the efficacy of this method which is described below.

Unlike some methods (e.g., Mahaney 1995; Montanucci 1997), ours works by killing the mites that are on the animals. If one starts with a mite-free environment (see below), prevention of reinfestation is reduced to a process of killing mites on all new reptiles before they are introduced into established vivaria.

To eliminate mites from terraria, we have used a variety of mite-killing solutions including 70% isopropanol (rubbing alcohol), 10% bleach or ammonia, or dish or laundry detergent and hot water. The terrarium, and all non-living items that have come in contact with mites, are scrubbed and soaked for 5–10 min with one of these solutions, rinsed thoroughly, and air dried until no odors are detectable. Mites can also be removed or killed by spraying these items with the pressure from a garden hose (Montanucci 1997), but care should be taken to ensure that the treatment is thorough, because if critical areas are neglected (e.g., plastic frames of some aquaria, porous rocks, etc.), a reinfestation is likely to occur. For this reason, we generally dispose of the substratum (e.g., soil, sand, gravel, etc.) rather than attempting to disinfect and dry it.

To kill mites on reptiles, we thoroughly coat each animal with vegetable oil. In our experience, neither the type nor the brand of vegetable oil appears to affect the outcome. First, the animal is cooled to room temperature (ca. 20°C) to facilitate handling, then it is placed in a large container (e.g., a size-matched bowl, tub, or bucket) with enough oil to partially submerge the animal (i.e., one-third to one-half of the animal's height). We then use our hands to drip the oil liberally over the animal taking care to completely cover and massage the oil over all parts of the body (e.g., neck and body skin folds, joints of appendages, cloacal region, all parts of the head including the region surrounding the eyes). We have not witnessed any signs of distress from dripping the oil around the eyes, nares, or mouth. Highly infested animals, or those with large imbricate scales (e.g., desert spiny lizards, *Sceloporus magister*), are massaged in the oil for up to 1 min to ensure that the animal is thoroughly coated. The animals are then blotted with paper towels and held in a clean cage with a newspaper lining until the oily sheen on their scales diminishes (1–3 days). Water, heat sources, and refugia are provided, although we typically do not feed the animals during this time.

Reptiles that we have subjected to this treatment apparently are

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 28, Number 1 (March 1997).

CAUDATA

AMBYSTOMA TEXANUM (Smallmouth Salamander). **REPRODUCTION.** Salamanders were trapped from a temporary pond in Washington Township (T3S R10E NW1/4 Sec. 32), Hardin County, Ohio, USA between 1985 and 1995. On 14 March 1985 and 13 March 1995, salamander eggs were discovered hanging above the water from branches of buttonbushes (*Cephalanthus occidenatils*). We presumed these eggs were laid by *Ambystoma texanum* as this species represented 92% of all salamanders captured at this site. Additionally, these egg masses were similar to those known to be produced by *A. texanum.* Other salamanders encountered at this site were *A. tigrinum* (3%) and triploid/tetraploid ambystomid hybrids (5%). On 13 March 1995, 27 egg masses were laid in four buttonbushes, each 2–3 m high and clumped together in a 4 x 9 m area where the pond was ca. 50 cm deep. Branches were 1–2 cm thick and several had as many as 3 egg masses with 1–25 eggs/mass. Height of the egg masses above the water averaged 50 cm and ranged from 6–130 cm. During the morning of 14 March 1995, we observed 10 additional egg masses added to the branches above the water. All egg masses were desiccated by 15 March. Weather during the egg-laying episode in 1985 was light rain with sleet, air and water temperature was 14°C; during the 1995 period the skies were clear, air and water temperature was 11°C. In both years, rains preceding egg laying were not sufficient to raise the water level to the egg height. The landowner indicated he had not observed the water at this height during the preceding 25 years (A. G. Matson, pers. comm.). Without direct observation of the egg-laying process, it appeared that salamanders, probably *A. texanum,* climbed up the branches and laid eggs outside of their normal watery environment. We believe this is the first report of this unusual behavior.

Submitted by **NELSON J. MOORE**, Department of Biological Sciences, Ohio Northern University, Ada, Ohio 45810, USA, and **ARTHUR G. MATSON**, 7110 Country Road 60, Dola, Ohio 45835, USA.

PLETHODON KENTUCKI (Cumberland Plateau Woodland Salamander). **MORPHOLOGY.** Developmental aberrations that result in dicephaly often are reported in mammals (Siebert et al. 1989. Teratology 40:305–310; Camon et al. 1992. Anatomy and Embryology 185:45–56) and reptiles (Wallach 1995. Herpetol. Rev. 26:127–129). While the occurrence of twins in amphibian eggs has been noted (Lindberg 1995. Herpetol. Rev. 26:142), reports of dicephalic amphibians are rare. Here we document a dicephalic hatchling *Plethodon kentucki* from a clutch of 12 eggs deposited by a female collected at Big Black Mountain in Harlan County, Kentucky, USA (Marvin 1996. Am. Midl. Nat. 136:385–400). This dicephalic individual (ca. 14 mm SVL; similar in size to the other hatchlings) lived for several days after hatching, but was accidentally killed by overheating while being photographed. The left eye and lower jaw of the left head were misshapen, and the left head was slightly smaller than the right one (Fig. 1). A ventral view of the individual revealed the presence of two hearts. The preserved specimen was deposited in the University of Oklahoma Museum of Natural History (OMNH 34850). Eight of the remaining hatchlings appeared normal, whereas two exhibited kyphosis immediately behind the forelimbs and another's jaw was misshapen. The abnormal morphology of these four hatchlings is one of several cases of developmental abnormalities observed in *Plethodon* at this locality. Marvin (1995. Herpetol. Rev. 26:30) captured a juvenile *P. glutinosus* with extreme scoliosis (OMNH 34849), and another *P. glutinosus* with less severe scoliosis. The proportion of individuals observed in this area with developmental abnormalities was 0.65% (4/614) for *P. kentucki* and 1.68% (2/119) for *P. glutinosus.* These observations may indicate an unusual rate of developmental abnormalities for salamanders at this locality. We thank C. McCallister for photograph processing.

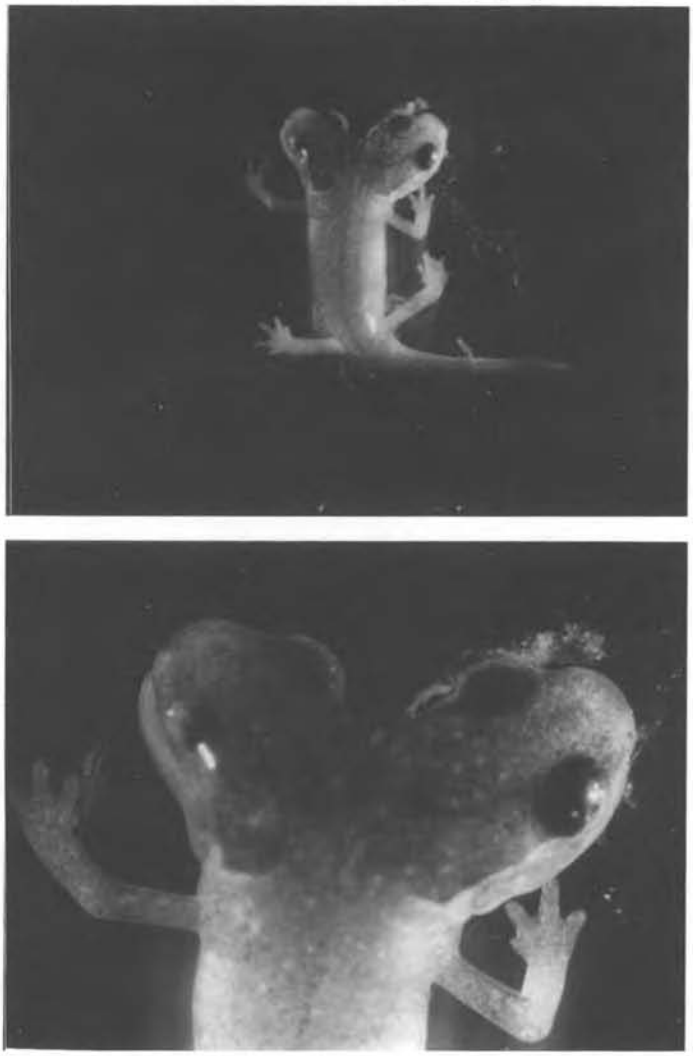


FIG. 1. Dorsal view of dicephalic hatchling *Plethodon kentucki* (top); close up dorsal view of cephalic region (bottom).

Submitted by **GLENN A. MARVIN** and **VICTOR H. HUTCHISON,** Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA.

ANURA

CYCLORAMPHUS BORACEIENSIS (Flattened Waterfall Frog). **PREDATION**. On 22 December 1995 at ca. 1700 h in the Parque Estadual da Serra do Mar, Núcleo Picinguaba, Ubatuba, São Paulo, Brazil, we found a juvenile *Bothrops jararaca* (475 mm SVL) that contained an adult male *Cycloramphus boraceiensis* (40 mm SVL). This finding supports the hypothesis that the in-

guinal glands of *Cycloramphus* do not play an antipredatory role, at least with respect to *B. jararaca* (DeLucca et al. 1996. Braz. J. Morph. Sci. 13:15–19). Voucher specimens are in the Museu de História Natural da Universidade Estadual de Campinas (ZUEC 9701).

Submitted by **ARIOVALDO A. GIARETTA** and **RENATO NUNES**, Departamento de Zoologia, Instituto de Biologia, Universidade Estadual de Campinas CP 6109, 13081-970 Campinas, Sao Paulo, Brazil.

LEPTODACTYLUS BOLIVIANUS (NCN). **BEHAVIOR.** Based on comparative morphology and behavior, Heyer (1969. Evol. 23:421–428) divided the genus *Leptodactylus* into four species groups. Females of *L. ocellatus* have been observed to actively protect the tadpoles by attacking a potential predator; Vaz-Ferreira and Gehrau (1975. Physis 34:1–14) found that females would strike a dead bird suspended on a pole above tadpole aggregations.

Currently, maternal attendance in *L. bolivianus* is not well understood. Wells and Bard (1988. J. Herpetol. 22:361–364) did not observe aggressive attacks in *L. bolivianus* as seen in *L. ocellatus* (Vaz-Ferreira and Gehrau, *op. cit.*), although they indicated that additional work might reveal this type of behavior. Herein, I report attack behavior observed from 13–18 July 1993 in three different females of *L. bolivianus* (mean SVL 79.2 ± 2.5 mm) in the same area studied by Wells and Bard (*op. cit.*). All females tested were guarding tadpoles in open water ca. 10 cm in depth. No changes were observed in tadpole behavior after the female's attack.

During my observations, made both day and night, a female attending a school of tadpoles would suddenly attack a meterstick that I was holding near her head. After the attack, the female returned to her original site 20 cm away. Subsequently, I presented each of three females with a rubber ball attached to a 40 cm stick. Two trials of 15 presentations each were made to each female. I moved the ball over the ground from a distance of 40 cm through the grass until it was 20 cm from the female, where it was held immobile for 1 min. I recorded the female's response (attack or escape). Five minutes later I began another test that was suspended if the female disappeared and did not return before the next five minutes. All three females displayed the same type of aggressive behavior. The frogs jumped from a distance of 30–40 cm away toward the ball, knocking it with their heads or pushing it with their hands. The females responded in the same manner to stimuli suspended over their heads.

Occasionally, females performed bouts of the pumping behavior described by Wells and Bard (*op. cit.*) prior to attacking the rubber ball. This behavior was highly variable among the females tested. I recorded 58 attacks of the model by the three females. Female 1 attacked 24 of 30 presentations with five attacks preceded by bouts of pumping behavior; Female 2 attacked 30 of 30 presentations with one bout; and Female 3 attacked 4 of 6 presentations with zero bouts. These results were obtained only during the nocturnal tests (2200–0100 h).

Females detected during the day were always completely hidden in the vegetation. Any attempt to present the rubber ball was followed by escape or no response. In contrast, females of *L. ocellatus* in Uruguay (Vaz-Ferreira and Gehrau, *op. cit.*), Goias, Brazil (J. Caldwell, pers. comm.), and Cordoba, Argentina (pers. obs.) attacked during the day.

This work was done while I was a short-term Fellow at the Smithsonian Tropical Research Institute (Panamá), which I gratefully acknowledge. Special thanks to J. Caldwell, who greatly improved the quality of this manuscript with suggestions and comments.

Submitted by **MARCOS VAIRA,** Instituto "Konrad Lorenz," Calle 5 N° 293, 5147-Córdoba, Argentina. Present address: Museo de Ciencias Naturales, Universidad Nacional de Salta, CONICET, Mendoza 2, 4400-Salta, Argentina.

PSEUDACRIS OCULARIS (Little Grass Frog). **PREDATION.** At 11–17 mm SVL, *Pseudacris ocularis* is the smallest terrestrial vertebrate in North America (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co. Boston, Massachusetts. 450 pp). Numerous instances of invertebrate predation on anurans have been reported and spiders are among the known predators (McCormick and Polis 1982. Biol. Rev. 57:29–58). Herein we report an observation of a spider preying on an adult *P. ocularis.* This is the first report of predation on this species by a spider.

On the afternoon of 11 April 1992 at 1500 h in a cypress dome on the campus of the University of Central Florida (UCF), we encountered a gravid female *P. ocularis* (12.25 mm SVL) being held by an immature male wolf spider, *Lycosa* sp. Both were in a small depression ca. 3 cm deep and ca. 3 m from the water's edge. The initial attack was not observed; however, when the pair was first detected the spider had its fangs firmly embedded in the frog immediately posterior to the skull. Although the frog was still alive and struggled to free itself, the spider was in obvious control. After ca. 5 min of observation, both were collected and placed in the UCF vertebrate collection (UCF-21H). The spider maintained its grasp on the frog until placed in the preservative. Based on this observation as well as the small size of adults, we suggest that *P. ocularis* may be an important prey item for many species of vertebrates and invertebrates.

We thank G. B. Edwards of the Florida Department Agriculture and Consumer Services (Div. Plant Services) for identifying the spider.

Submitted by **RICHARD D. OWEN** and **STEVE A JOHNSON**, Department of Biology, University of Central Florida, P.O. Box 25000, Orlando, Florida 32816, USA.

RANA CURTIPES (Bicolored Frog). **REPRODUCTION.** *Rana curtipes* is commonly encountered in the Malnad region of western Ghats, particularly during the monsoon season, May–September. It is observed rarely during other times of the year and there is little information available on reproduction. Herein we report observations of amplexus in this species.

Rana curtipes initiates breeding during the later monsoon months (August–November). Three observations of mating behavior occurred in areas vegetated by ferns, grasses, and small bushes where the amplectant pairs were well concealed. Prominent sexually dimorphic characters visible during the breeding season include the development of two cream-colored spots on either side of the urostyle in the males. In addition, the urostyle of the females is slightly elevated distally. The vocal sacs are internal and vocalization is feeble, produced by the males only during the breeding season. The males are smaller than the females; males range from 30.2–65.0 mm (mean = 46.8 mm SVL; SD = 14.25 mm), whereas the females range from 40.4–80.0 mm (mean 56.8 mm SVL; SD = 16.87 mm). Amplexus was axillary in all observations. Initially, the forelimbs of the male were placed near the

shoulders of the female. However, as breeding proceeded the male achieved a posterior position and firmly gripped the female immediately behind the axilla. The thigh and shin of the male were placed parallel to the thigh and shin of the female, partly exposing the elevated urostyle of the female underneath the cloacal region of the male. Amplexus lasted for 1–4 days, during which time the males produced a characteristic call of "knu-knu-knu—" that lasted 2–80 sec. Females were observed to carry the males in this position to the aquatic breeding grounds. During such overland movements, the position of the hindlimbs of the male would be flexed and rested upon the thighs of the female. In one of three observations, oviposition occurred during darkness and lasted for 30 minutes.

We thank Richard A. Seigel and Charles W. Painter for their valuable comments on this manuscript.

Submitted by **S. V. KRISHNAMURTHY**, Department of Studies in Environmental Science, Kuvempu University, Jnanasahyadri, Shankaraghatta-577 451, India, and **KATRE SHAKUNTALA**, Department of Zoology, Bangalore University, Jnana Bharathi, Bangalore-560 056, India.

SAURIA

AMEIVA CHRYSOLAEMA FICTA (NCN). **PARASITISM.** *Ameiva chrysolaema ficta* is a moderately large (males to ca. 120 mm SVL) ground-dwelling lizard found in xeric habitats of the lower Península de Barahona of Hispaniola (Schwartz and Klinikowski. 1966. Bull. Mus. Comp. Zool. 133:425–487; Schwartz and Henderson. 1991. Amphibians and Reptiles of the West Indies. Univ. Florida Press; Schell et al. 1993. Cat. Amer. Amphib. Rept. 563:1–6). Lizards were collected during June 1995 in *Acacia* scrub 4.5 km NW Oviedo, Provincia de Pedernales, República Dominicana. A single nematode, 4.5 mm in length, was found encysted in the peritoneum of a subadult male (80 mm SVL) collected 4 June 1995 and was identified using scanning electron microscopy as an immature anisakine ascarid, *Terranova* sp., probably *T. caballeroi*. The lizard most likely served as a paratenic or intermediate host for the nematode, adults of which should occur in a predator of the lizard, most likely one or more species of snake. Powell et al. (1990. Carib. J. Sci. 26:72) found adult parasites in *Antillophis parvifrons protenus*, a known predator of *Ameiva* (Henderson et al. 1987. J. Herpetol. 21:330–334). Only one of 37 *A. chrysolaema ficta* was infected, and no parasites were found in 25 *A. leberi* or 40 *A. taeniura vulcanalis* collected in the same area during the same period.

Birt et al. (Herpetol. Rev., in press) found larval *Terranova*, similar to those of *T. caballeroi*, in *Anolis barkeri* from México and summarized the literature dealing with terrestrial *Terranova* in squamates.

Richard E. Glor, Laurel M. Hartley, Ellen J. Censky, John S. Parmerlee, Jr., and Andrew H. Price helped in the field. Permits were issued by Lic. Geraldino Caminero M.Sc., Director, Departamento de Vida Silvestre. Field work was funded by NSF Grant no. BIR-9224486 awarded to RP.

Submitted by **AMY L. SPROSTON***, Department of Biology, Luther College, Decorah, Iowa 52101, USA, **JOHN H. GREVE**, Department of Veterinary Pathology, Iowa State University, Ames, Iowa 50011, USA, and **ROBERT POWELL**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145, USA. *Present address: Department of Systematics and Ecology and Natural History Museum, University of Kansas, Lawrence, Kansas 66045, USA.

ANOLIS BARKERI (Barker's Anole). **PARASITISM.** *Anolis barkeri* is a moderately large (male SVL ≤ 100 mm) anole with distinctly aquatic habits and an opportunistic feeding strategy (Brandon et al. 1966. Herpetologica 22:156–157; Kennedy. 1965. Zoologica [N.Y.] 50:41–43; Meyer. 1968. Copeia 1968:89–95; Meyer. 1968. Bull. So. California Acad. Sci. 67:255–262; Robinson. 1962. Copeia 1962:640–642). Specimens were collected along a permanent stream above Lago Escondido near the Estación Biología "Los Tuxtlas" in southern Veracruz, México. Although most lizards were released after marking, ten individuals died or were killed and dissected; all were deposited in the collection at the station (UNAM–LT, numbers not assigned at this time). Six small nematodes, 3.50–3.75 mm in length, were found encysted in the peritoneum of a juvenile female (34.4 mm SVL) collected 22 June 1996 and were identified using scanning electron microscopy as immature anisakine ascarids, probably *Terranova* sp. The anole most likely served as a paratenic host for these nematodes, adults of which should occur in a predator of the lizard, most likely one or more species of snake. Barus and Coy Otero (1966. Poeyana, ser. A [23]:1–16) described *T. caballeroi* from Cuban *Alsophis cantherigerus pepei*. Collins (1969. J. Elisha Mitchell Sci. Soc. 85:141–144), Sprent (1979. J. Helminthol. 53:265–282), and Camp (1980. Proc. Helminthol. Soc. Washington 47:276–277) recorded this nematode in *Agkistrodon piscivorus piscivorus*, *Coluber constrictor*, *Heterodon platirhinos*, and several species of *Nerodia* from the southeastern United States. Powell et al. (1990. Carib. J. Sci. 26:72) found adult parasites in *Antillophis parvifrons protenus* from Hispaniola. The nematodes in *Anolis barkeri* may be juvenile *T. caballeroi*, although the cecum is shorter than ceca from *Terranova* larvae that are more probably *T. caballeroi* from Hispaniola. Regardless of specific status, these nematodes from México represent new host and geographic records.

Field work was funded by NSF Grant no. BIR-9531312 awarded to Alicia Mathis, Department of Biology, Southwest Missouri State University.

Submitted by **RANDY A. BIRT**, Department of Biology, Evangel College, Springfield, Missouri 65802, USA, **JOHN H. GREVE**, Department of Veterinary Pathology, Iowa State University, Ames, Iowa 50011, USA, and **ROBERT POWELL**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145, USA.

ANOLIS PENTAPRION (Lichen Anole). **FRUGIVORY and CANNIBALISM.** The diet of this species was analyed from a large population at San Rafael, a disturbed area of some 20 ha near Santa Rosa Cintepec (municipality of Catemaco), Veracruz, México (400 m).

The local habitat has undergone significant alteration in recent years, including the cultivation of an introduced shrub, grosella (*Eugenia uniflora* of the family Myrtaceae). During the warm rainy season (May–September), the shrub produces a small, red, bland but juicy fruit that is prized for human consumption. *Anolis pentaprion* has taken to eating the mature grosella fruit. Six stomach contents of 20 adult *A. pentaprion* contained the remains and seeds of grosella fruit. Small lizards (hatchling *A. pentaprion*) were also present in four stomachs, and arthropods (principally insects) occurred in almost all of the rest. These observations confirm a cannibalistic habit, as well as a facultative omnivory.

We are indebted to Biol. Alvaro Campos Villanueva for identification of plant material.

Submitted by **GONZALO PEREZ-HIGAREDA**, Estación de Biologia Tropical "Los Tuxtlas," Apartado Postal 51, Catemaco, Veracruz, México; and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

BARISIA IMBRICATA PLANIFRONS (Oaxacan Imbricate Alligator Lizard). ANTIPREDATOR BEHAVIOR. The anguid lizard *Barisia imbricata* is distributed in the mountainous regions of northern and central Mexico. It is subdivided into four subspecies, with the subspecies occurring in central and southern Oaxaca assigned to *planifrons* (Guillette and Smith 1982, Trans. Kansas Acad. Sci. 85(1): 13–33).

On 24 July 1994 an adult male *Barisia imbricata planifrons* was caught on Cerro San Felipe just north of the city of Oaxaca, 2200 m elevation. As it attempted to hide in the forest litter it had to be extracted with some force, eliciting the following behavior. Immediately after capture it curled into a loop, attempting to hide the head under the tail. At the same time the hemipenes were everted. After attaining this posture the lizard remained completely motionless. Even leaving it on the forest floor did not put the lizard at ease, and as it did not "uncurl" after being watched for about 15 minutes, it was left in peace.

In order of occurrence, the following phenotypic categories, as defined by Greene (1988. *In* Gans and Huey (eds.), Biology of the Reptilia, Vol. 16, Ecology B. pp. 1–152. Academic Press, New York), could be recognized: 1) locomotor escape (attempting to avoid capture by hiding in forest litter); 2) head hide (by attaining a loop posture, the head was hidden under the tail); and 3) eversion of hemipenes.

Locomotor escape is a common phenomenon in most lizards. The loop posture has been observed in different gerrhonotine lizards, e.g., *Elgaria multicarinata* (Compton 1933, Copeia 1933(4):225; Fitch 1935, Trans. Acad. Sci. St. Louis 29(1):1–38) and *Elgaria kingi* (Bowker 1987, Herpetol. Rev. 18(4):73, 75). In both species the loop posture was accompanied by a bite to either the tail or one of the extremities. This was not observed in *Barisia imbricata*.

I thank Fernando M. Quijano (UNAM) for help in identifying the lizard.



FIG. 1. Male *Barisia imbricata planifrons* in loop posture hiding its head under the tail.

Submitted by **THOMAS BILLE**, Department of Population Biology, Zoological Institute, University of Copenhagen, Universitetsparken 15, 2100 Copenhagen Ø, Denmark.

EMOIA CAERULEOCAUDA (Pacific Blue-tailed Skink). **CAPTIVE REPRODUCTION**. Information on life history attributes of *Emoia caeruleocauda* from the Mariana Islands is limited. McCoid (1994. Herpetol. Rev. 25:98–100) reported on egg, clutch, and hatchling size. Herein we present additional information on hatchling size, incubation period, size at maturity, and reproductive periodicity based on a captive sample.

In July 1995, 10 *E. caeruleocauda* were collected on Guam, Mariana Islands, and shipped to Kingsville, Texas. Initially, the group of 10 was divided between two 20 gallon aquaria, but all lizards repeatedly fought and there were five fatalities. In February 1996 the four surviving adults and a large female juvenile were placed in three 10 gallon aquaria and divided into two male-female pairs and a single adult male. Each aquarium had a sand substrate, water dish, potted ivy plant, two flattened rocks for cover, and a plastic hide box filled with soil. Lizards were maintained on a 12h:12h light:dark schedule via UV emitting fluorescent bulbs set in aquarium reflectors and given water and food (live crickets) ad libitum. Temperatures and humidity varied daily between 24°–33°C (although a hot spot for basking exceeding 50°C was created in each tank with the use of broad spectrum 50 watt heat lamps) and 70%–92%, respectively. These weather parameters resemble daily diurnal ranges on Guam (Anonymous 1990. NOAA Natl. Clim. Data Center, Asheville, North Carolina. 8 pp.).

Between July 1995 and February 1996, four clutches were deposited in the two tanks but we were unable to discern which females deposited clutches. In early February 1996, the two separated females began laying eggs. From February through July 1996, 12 clutches were deposited (five in one tank and seven in the other). In the tank with five clutches, time between clutches was 24–29 days (mean 26.75) and in the seven clutch tank, time between clutches was 28–35 days (mean 31.75). We observed an invariant clutch size of two (McCoid 1994. *op. cit.*) and an incubation period of 40–42 days. All clutches produced at least one viable egg. Hatchlings were slightly larger (mean SVL 23.4 mm, N = 5) than those reported by McCoid (1994. *op. cit.*).

Size at sexual maturity in female *E. caeruleocauda* has been estimated as ca. 43 mm SVL (McCoid 1989. Job Progress Rep. E-1-4. Div. Aquatic Wildl. Res., Gov. Guam. 45 pp.). We measured the maturing female mentioned above as depositing her first clutch of eggs at 45.9 mm SVL.

Submitted by **MICHAEL JAMES MCCOID**, **SCOTT E. HENKE**, Caesar Kleberg Wildlife Research Institute, Texas A&M University, Kingsville, Texas 78363, USA, **REBECCA A. HENSLEY**, Texas Parks and Wildlife Department, Coastal Fisheries Division, 6300 Ocean Drive, Suite 2500, Corpus Christi, Texas 78412, USA, and **CRAIG CLARK**, Ohio Cooperative Wildlife Research Unit, Ohio State University, Columbus, Ohio 43210, USA.

GECKONIA CHAZALIAE (Helmeted Gecko). **MAXIMUM SIZE**. During a recent project devoted to Mauritanian littoral biodiversity (C.C.E., "Projet Biodiversité du Littoral Mauritanien" –1993/1995), important herpetological collections and observations were made on the entire coast of Mauritania (Ineich et al., in prep.). Among these, six adult specimens of *Geckonia chazaliae*

were collected during the day and night at Cap Blanc on 14 May 1995 (21°07'97/100N, 16°57'45/100W) and deposited at the Paris Natural History Museum (MNHN 1996.6267–6271, 1996.6385; 3 males and 3 females).

One female (MNHN 1996.6270) was remarkable by its snout-vent length of 74 mm, exceeding by 10 mm the maximum known (Schleich et al. 1996, Amphibians and Reptiles of North Africa, Koeltz Scientific Publ., 630 pp.). The maximum width of its body was 27 mm. It was collected around 1500 h under a stone. It was kept in captivity for several months by one of us (FG), and laid eggs four times (2 eggs, 1 egg, 2 eggs, and 1 egg) from June 1995 to January 1996. Egg size varied from 7–12 x 12–15 mm.

Submitted by **IVAN INEICH**, Museum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles & Amphibiens), 25 rue Cuvier, F-75005 Paris, France (e-mail: ineich@cimrs1.mnhn.fr), **AMADOU TIDIANE DIA** and **BOCAR ALPHA LY**, Centre National d'Elevage et de Recherches Vétérinaires, BP 167, Nouakchott, Islamic Republic of Mauritania, **FRANCIS GIRARD**, 202 rue du Chateau des Reutiers, F-75013 Paris, France, and **FRANCOIS COLAS**, CIRAD-EMVT, Département d'Elevage et de Médecine Vétérinaire du CIRAD, BP 5035, F-34032 Montpellier Cedex 1, France.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). **INTRASPECIFIC INTERACTIONS**. The edificarian *Hemidactylus turcicus* has been established in south Texas, USA, for at least 45 years (Conant 1955. Amer. Mus. Novit. 1726:1–6) and has since spread north and west throughout the state. We report on a population of *H. turcicus* from the Rio Grande Valley, located on a house and in an RV park 3.2 km E Edinburg, Hidalgo Co., Texas. Data are presented on tail-break frequencies, sex ratio, and certain behaviors. Specimens were externally sexed by the presence of pre-anal pores on males (Selcer 1986. Copeia 1986:956–962), preserved in 10% formalin, and will eventually be deposited in the TCWC.

Selcer (1987. J. Herpetol. 21:74–78) reported males fighting over insects with resultant body scars and missing tails and toes, but did not record tail-break rates of either sex. To the best of our knowledge, tail-break frequencies have not been published for any population of *H. turcicus*. During a study to determine recolonization rates, we hand collected 53 geckos (2200–2400 h) on 25 June 1994 from the study site. Care was taken not to damage geckos during collection and natural tail-break frequencies were accurately recorded. Males (N = 17) had a 41.2% tail-break frequency and females (N = 34) a 35.3% frequency. Tail-break frequencies between sexes were compared using a c^2 test and were not statistically different ($0.9 < p < 0.5$). Pooled tail-break frequency was 35.8%. During confinement, prior to preservation, it was noted that many geckos would spontaneously autotomize tails, suggesting that examination of museum specimens may lead to inflated estimates of tail-break rates.

Between April 1992 and December 1992, we frequently observed, from a distance ≤ 1 m, *H. turcicus* forage on windows and screens at the south Texas study site. Geckos (N = 2–5) on any given window were usually of both sexes and approaches between individuals during feeding were routinely as close as 1 cm. At no time were any agonistic encounters observed or any vocalizations heard. In a recent study (Vaughan et al. 1996. J. Herpetol. 30:46–51) involving competition for perch sites between *H. turcicus* and *Crytopodion scabrum*, no vocalizations, either in mixed species or single species enclosures, were heard or aggressive interactions observed (R. Vaughan, pers. comm.). Marcellini (1977. Amer. Zool. 17:251–260) and Frankenberg and Marcellini (1990. Isr. J. Zool. 37:107–118) described agonistic displays and vocalizations of *H. turcicus* during intraspecific encounters. If vocalizations, as suggested by Marcellini (1977, *op. cit.*), are normally associated with intraspecific interactions and territoriality, then levels of intraspecific aggression may be low in some Texas populations. Additional observations support this conclusion. Geckos normally foraged beneath lights at the study site. At three specific collecting points (Base plates I–III) in the trailer park, 5–8 adult geckos of both sexes were clustered around lights attached to a 155 cm^2 metal base plate mounted to the wall. During the day, space beneath these base plates served as diurnal refugia for those geckos that foraged around the light at night. At these sites and other known diurnal refugia, geckos were observed diurnally in quiescent contact in these communal situations. Other species of arboreal geckos with which we are familiar (*H. frenatus, Lepidodactylus lugubris, Gehyra mutilata, G. oceanica*, and *Perochirus ateles*) are solitary in diurnal refugia. These observations suggest that, comparatively, *H. turcicus* is relatively gregarious and may display low levels of intraspecific aggression.

Sex ratio in our sample was biased in favor of females (1:2). Selcer (1986, *op. cit.*) reported a balanced (1:1) sex ratio, but his sample size was considerably larger. Of our 53 specimens (mean snout–vent length (SVL) = 49.8 mm, SD = 7.4), we scored only the two smallest (23.4 and 25.2 mm SVL) as juveniles. Only juveniles were collected on the ground while all others were collected generally under lights from sides of buildings at heights of 0.1–3.0 m.

We thank Eric Moum and David Hensley for assistance in the field and Rosemary Hensley for logistic support at the study site. A draft of this manuscript was reviewed by James R. Dixon, Robert Powell, and Andy Holycross. We also thank Walter Meshaka, Paul Klawinski, Oscar Flores-Villela, Kathryn Vaughan, and Kyle Selcer for sharing information.

Submitted by **MICHAEL JAMES MCCOID** Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&M University, Kingsville, Texas, 78363, USA, and **REBECCA A. HENSLEY** Texas Parks and Wildlife Department, 6300 Ocean Drive, Suite 2500, Corpus Christi, Texas, 78412, USA.

IGUANA IGUANA (Green Iguana). **LONGEVITY.** There has been a tremendous increase in knowledge of care and culture of green iguanas in the past 20 years. Yet, to my knowledge, there are few (or no) longevity records for this species (Burghardt and Rand, eds.,1982, Iguanas of the World, Noyes Publ, Park Ridge, New Jersey, 472 pp.; Frye 1995, *Iguana iguana*: Guide for Successful Captive Care, Krieger Publ. Co. Malabar, Florida). The purpose of this note is to establish one such record. A female iguana was purchased as a hatchling from a pet shop early in 1968. She died 14 January 1996, at an age of nearly 28 yrs. At her death, her SVL was 432 mm, her head was 103 mm long, and she weighed 1792 g.

Submitted by **KAREL L. ROGERS**, Biology Department, Grand Valley State University, Allendale, Michigan 49401-9403, USA. E-mail: rogersk@gvsu.edu.

LACERTA AGILIS (Sand Lizard). **DERMATOPHAGY.** *Lacerta agilis* is the most common lizard in the Czech Republic, and it inhabits a variety of habitats including manmade structures in urban environments. In 1994 a survey of the diet of *L. agilis* was conducted as part of a wider ecological study (Gvozdík 1995.

A Contribution to Ecology and Morphometry of Sand Lizard, *Lacerta agilis* Linnaeus, 1758. Unpubl. M.S. Thesis, Palacky Univ., Olomouc.[in Czech]) near a river embankment in the town of Opava, Opava County, Czech Republic (49°56'N, 17°54'E, elev. 250 m). On 14 August 1994 an adult male *L. agilis* (65.5 mm SVL) was captured with a portion of its shed skin attached to the posterior part of the body. The stomach contents were obtained by stomach flushing (James 1990. Herpetol. Rev. 21:87–88) and were preserved in 10% formalin. The stomach content analysis did not reveal any invertebrate prey items, but several pieces of lizard skin were found. Because shed skin occurred on the lizard's body and in its stomach simultaneously, it is probable that the shed skin was consumed as a deliberate act, rather than being ingested during aggressive, mating, or other activities with a conspecific (Weldon et al. 1993. J. Herpetol. 27:219–228). This report is in contrast to the comprehensive study by Lukina (1976. *In* A. V. Jablokov, ed., Sand Lizard, pp. 179–213. Nauka, Moscow. [in Russian]), who did not record skin in the contents of 3945 stomachs of *L. agilis*.

Submitted by **LUMÍR GVOZDÍK**, Department of Zoology, Palacky University, tø. Svobody 26, 771 46 Olomouc, Czech Republic.

SCELOPORUS JARROVII (Yarrow's Spiny Lizard). **REPRODUCTION IN MEXICO.** Although the reproductive biology of *S. jarrovii* has been studied in the United States (Goldberg 1971. Herpetologica 27:123–131; Ballinger 1973. Ecology 54:269–283), there are, to my knowledge, no published accounts of its reproduction in Mexico. In this note I report on an examination of gonads from 19 *S. jarrovii* from Morelos, Mexico. Specimens were examined from the Texas Cooperative Wildlife Collection (TCWC): 3824–3826, 3828–3830, 3832–3838, 3841, 6873–6877. Except for TCWC 3824, which was from Lagunas de Zempoala (19°05'N, 99°19'W; ca. 3050 m elev.), 8 August 1950, all others were from 3 km W Huitzilac, (19°03'N, 99°15'W; ca. 3050 m elev.) and were collected 26–31 July 1949 (TCWC 3825–3826, 3828–3830, 3832–3833, 3834–3838, 3838, 3841) or 8 August 1950 (TCWC 6873–6875, 6877). The left gonad was removed and embedded in paraffin for histological examination. Sections of testes were cut at 5 µm and stained with hematoxylin and eosin counterstain. Gross observations were made of ovaries. The female sample (N = 4) had a mean snout–vent length (SVL) of 65.3 mm ± 3.2 SD (range = 62–68); male sample (N = 15) mean SVL = 81.6 mm ± 7.4 SD (range = 71–93). All lizards were reproductively active. Testes were undergoing spermiogenesis; lumina of seminiferous tubules were lined by sperm and several rows of metamorphosing spermatids were present. Each of the 4 females were reproductively active: TCWC 6875 contained 4 oviductal eggs; TCWC 3824 contained 5 enlarged eggs measuring 6 mm diam; TCWC 6877 contained 2 enlarged eggs measuring 4 mm diam; TCWC 3834 contained 3 enlarged eggs measuring 3 mm diam. These observations contrast with those of Goldberg (1971) who found male *S. jarrovii* from the Baboquivari (= Quinlan) Mountains (31°95'N, 111°59'W; 1920 m elev.) Pima County, Arizona, USA (ca. 1870 km N of the Morelos population) did not begin spermiogenesis until September; females did not accumulate yolk until autumn with ovulation occurring in mid-November to early December. Similarly Ballinger (*op. cit.*) found male *S. jarrovii* collected in August from the Chiricahua Mountains, Cochise County, Arizona, contained neither spermatids nor spermatozoa. Clearly, the *S. jarrovii* reproductive cycle is accelerated in Morelos when compared to that of *S. jarrovii* in southeastern Arizona. It is conceivable that this acceleration is because of a shortened activity season resulting from a colder climate in the high elevation habitat (3050 m) of the Morelos population. In any case, my observations have indicated significant variation in timing of the reproductive cycle between populations of *S. jarrovii* in different parts of its range.

I thank James R. Dixon and Kathryn Vaughan (Texas A & M University) for permission to examine *Sceloporus jarrovii*, and Robert L. Bezy (Natural History Museum of Los Angeles County) for taxonomic verification.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA.

TROPIDURUS MELANOPLEURUS (NCN). **PARASITES.** *Tropidurus melanopleurus* is a tropidurid lizard found on the eastern slopes of the Andes from Argentina to Perú. Captures of some individuals for an ecological study of this species (see Pérez-Mellado and de la Riva 1993. Copeia 1993:969–976) led me to examine the digestive tract of 36 lizards for parasites from which three helminth species were found: *Parapharyngodon sceleratus* (Travassos, 1923) (Nematoda: Oxyuroidea: Pharyngodonidae) from the cloaca, *Strongyluris oscari* Travassos, 1923 (Nematoda: Heterakoidea: Heterakidae) from the gut, and *Physaloptera retusa* Rudolphi, 1819 (Nematoda: Physalopteroidea: Physalopteridae) from the stomach and gut.

This is the first helminthological record for *T. melanopleurus* as a host for the helminths mentioned above. Nevertheless, these nematodes are common species of the neotropical helminth fauna and have been recorded from other species of *Tropidurus* and from other reptile hosts (Barus 1973. Folia Parasitol. 20:131–139; Masi-Pallarés et al. 1973. Rev. Parag. Microb. 8:67–113; Pereira 1935. Arch. Inst. Biol. Rio de Janeiro 6:5–27; Vicente 1981. Atas Soc. Biol. Rio de Janeiro 22:7–18; Vicente and Santos 1967. Atas Soc. Biol. Rio de Janeiro 11:75–77).

Global prevalence (percentage of parasitized lizards in relation to sampled lizards) is 66.7%, similar to the near 67% of *T. torquatus* and *T. spinulosus*, (Vicente 1981. Atas. Soc. Biol. Rio de Janeiro 22:7–18). There were no differences between males and females with regard to infestation prevalence (68.8% in males; 65% in females). Among the parasite species, *P. retusa* was the most prevalent species (53% of the lizards parasitized), *P. sceleratus* 25%, and *S. oscari* 14%. The mean intensities of infestation (mean total number of specimens of each parasite species in relation with the number of hosts parasitized by that parasite) were 4.4 for *S. oscari*, 3.3 for *P. sceleratus*, and 2.4 for *P. retusa*.

I thank Valentín Pérez-Mellado and Ignacio de la Riva for permitting the helminthological analysis of the digestive tract of the lizards.

Submitted by **VICENTE ROCA**, Department of Animal Biology (Animal Parasitology), University of Valencia, Dr. Moliner, 50 46100 Burjassot (Valencia), Spain. e-mail: Vicente.Roca@uv.es

TUPINAMBIS MERIANAE (Common Tegu). **PREDATION.** Verified reports of predation on *Tupinambis* species by predators other than humans are rare. Juvenile *T. teguixin* were reported in the diet of gray hawks (Haverschmidt. 1968. Birds of Surinam: I–XXIX. Edinburgh and London), and Gudynas wrote, "There are no known predators of *Tupinambis teguixin* in Uruguay except for man and his dogs." (Gudynas 1981. Bull. Chicago Her-

petol. Soc 16[2]:29–39). On 10 October 1996, on a dirt road near the Jejui Mi headquarters of Mbaracayu Reserve, Canindeyu, Paraguay (24°15'S, 55°32'W), we (RP and LAF) found the remains of an adult *T. merianae* regurgitated by a large cat. Based on the size of scales, feet, and its large jowls, the specimen was an adult male, > 350 mm snout–vent length. Four Ache Indians, who use the reserve as their traditional hunting gounds and are themselves important predators of *Tupinambis merianae,* verified the large pieces of *Tupinambis* skin and bone fragments, mixed with fresh grass leaves, as being regurgitated by either a jaguar (*Panthera onca*), or a puma (*Puma concolor*). Though both jaguar and puma occur in the reserve, jaguar are encountered at much higher rates along standardized biodiversity transects in the semideciduous Atlantic rainforest characteristic of Mbaracayu (Hill, in press. Cons. Biol.). On 23 October 1993, also at Mbaracayu Reserve, RV found scat of a jaguar containing the remains of an adult *T. merianae.* These are the first reports of predation on *Tupinambis* by large felids.

Submitted by **RENÉ PALACIOS**, CITES-Paraguay, Ministerio de Agricultura y Ganadería, 1599 Avda. Rca. Argentina, Asunción, Paraguay, **RAMÓN VILLALBA**, Fundación Moises Bertoni, Carlos Arguello 208, Asunción, Paraguay, and **LEE A. FITZGERALD**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258, USA.

SERPENTES

BOTHROPS ALTERNATUS (Vibora de la Cruz). **REPRODUCTION**. Little is known about reproduction of *Bothrops alternatus* in Argentina. On 15 January 1995 I captured a gravid female (1110 mm SVL, 1220 mm total length) 65 km NE Villa Minetti (8 km NE of Centro Educativo Rural Nro. 249), Departamento 9 de Julio, Provincia de Santa Fe, Argentina. The environment where the specimen was collected is a flooded salt meadow ("bajos submeridionales de Santa Fe" [Lewis and Pire 1981. Ser. Fitogeog. INTA 18:22–31]) characterized by the lack of arboreal structure. "Espartillares" (*Spartina argentinensis*) is found in dense islands of 1.5 m in height; in one of these the snake was found with several specimens of *Mabuya dorsivittata* (Scincidae) and *Leptodactylus gracilis* (Leptodactylidae). Dissection revealed 26 embryos (14 in right oviduct, 12 in left oviduct); 14 males (with everted hemipenes) and 12 females (mean male SVL = 217.3 mm; mean female SVL = 251.5 mm). Previously published clutch sizes for *B. alternatus* include 10–18 (Cei 1993, Reptiles del Noroeste, Nordeste y Este de la Argentina, Mon. XIV, 929 pp.), 16 (Orrego-Aravena 1971, Rept. La Pampa, Bib. Pam. Ser. Foll. 14), and 20–30 (Vaz-Ferreyra et. al. 1980, Rel. Prog. y Cria Rept. R.O.U., Res. Jor. C. Nat. 1: 121–122; Miranda et. al. 1983, Guia Of. Bon., Asoc. Coop. Zool. La Plata). The specimen (ZV-UNRC 3610) was deposited in the herpetological collection of the Orintación Zoologia Vertebrados of the Universidad Nacional de Río Cuarto, Río, Río Cuarto, Argentina

Submitted by **LISANDRO CARDINALE**, Departamento de Ciencias Naturales, Universidade Nacional de Río Cuarto, 5800 Río Cuarto, Córdoba, Argentina and **LUCIANO JAVIER AVILA**, CONICET - Departamento de Ciencias Naturales, Universidad Nacional de Río Cuarto, Córdoba, Argentina.

CROTALUS PRICEI (Twin-spotted Rattlesnake). **REPRODUCTION.** On 24 July 1995, a female *Crotalus pricei* was collected from the Barfoot talus slide in the Chiricahua Mountains, Cochise Co., Arizona. The snake was brought to the Arizona-Sonora Desert Museum and housed in an individual vivarium, where she was offered water but no food. Between 1330–1500 h on 4 August 1995, the female (SVL 499 mm, tail length 35 mm, capture mass unknown) gave birth to 7 neonates (2 male:5 female). The neonates were weighed immediately upon discovery; their mass ranged from 5.5–6.4 g (mean ± SD = 5.73 ± 0.31). The combined mass of the seven neonates was 53% of the 76.3 g postpartum mass of the female. The size of this litter is within the published range (3–9), but the neonates were heavier than for previous reports (range 2.4–5.6 g) (Armstrong and Murphy 1979. Univ. Kansas Mus. Nat. Hist. Spec. Publ. 88 pp; Lowe et al. 1986. The Venomous Reptiles of Arizona. Arizona Game and Fish Department, Phoenix, 115 pp.; Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. 2nd ed., Houghton Mifflin Company, Boston, Massachusetts, 336 pp.).

I thank Dennis Caldwell for assistance in the field work and William Altimari for comments on this manuscript.

Submitted by **PATRICIA A. MAHANEY,** Arizona-Sonora Desert Museum, 2021 North Kinney Road, Tucson, Arizona 85743, USA.

HYPSIGLENA TORQUATA JANI (Texas Night Snake). **MAXIMUM SIZE**. Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern North America. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.) list the maximum size of *Hypsiglena torquata jani* as 508 mm total length (TL). On 16 May 1996, an adult female measuring 615 mm TL and 530 mm SVL was taken from Lajitas, Brewster Co., Texas, USA (UTM coordinates 13 618865E 3237654N). This individual represents a new record for maximum size for this taxon. The specimen has been deposited in the Museum of Texas Tech University (TTU 11623).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

PITUOPHIS MELANOLEUCUS ANNECTENS (San Diego Gopher Snake) and ***MASTICOPHIS LATERALIS LATERALIS*** (California Striped Racer). **PREDATION**. At 1021 h on 3 September 1996, while driving on the Santa Rosa Plateau Reserve, Riverside County, California, USA, I observed an adult male American kestrel (*Falco sparverius*) fly from a fence post with a snake in its talons. The kestrel alighted next to the road on a wooden bird nesting box and proceeded to eat the snake. I examined the snake through binoculars and identified it as a juvenile (ca. 350 mm total length) *Pituophis melanoleucus annectens*. At 1030 h on 20 September 1996, while riding on Camp Joseph H. Pendleton Marine Corps Base, San Diego County, California, USA, six of us observed a male American kestrel alight from next to the road with a juvenile (ca. 350 mm total length) *Masticophis lateralis lateralis* in its talons.

Although American kestrels are known to prey upon a wide variety of insects, small mammals, birds, and lizards (May 1935. The Hawks of North America. The National Association of Audubon Societies, New York. 140 pp.), only Dawson (1923. The Birds of California. Vol. 4. South Moulton Company, San Diego. pp. 1549–2121) records them taking "small snakes...as occasion offers." These are apparently the first records of American kestrels preying on gopher snakes and striped racers.

My thanks to Galen B. Rathbun and Scott B. Terrill for reviewing the manuscript. The Nature Conservancy graciously allowed the use of facilities on the Santa Rosa Plateau Reserve and the United States Marine Corps granted permission to conduct herpetological observations on Camp Joseph H. Pendelton.

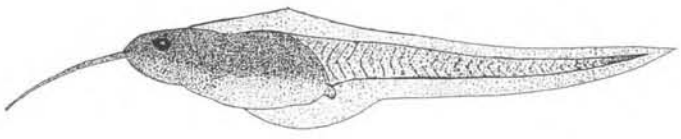
Submitted by **MARK R. JENNINGS**, National Biological Service, California Science Center, Piedras Blancas Research Station, P.O. Box 70, San Simeon, California 93452-0070, USA, and Research Associate, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-9961, USA.

TRIMORPHODON BISCUTATUS QUADRUPLEX (Lyre Snake). **DIET.** Diet records from wild *Trimorphodon biscutatus* include lizards and small mammals (including bats), but captive specimens also accept amphibians and birds (Scott and McDiarmid 1984. Cat. Am. Amph. Rept. 353:1–4). Here I report a bird in the diet of a wild-caught individual. On 26 August 1996 at 0950 h, a male *T. biscutatus* (1150 mm SVL, 1400 mm TL, 360 g including prey) with a pronounced prey bulge was observed in the rafters of an unused ranger station at Puerto Chamorro, next to the Rio Tempisque in Palo Verde National Park, Guanacaste District, Costa Rica. The snake was captured and a groove-billed ani (*Crotophaga sulcirostris*, Cuculiformes) was removed from its stomach. The bird had been ingested headfirst, weighed 55 g, and was a fledgling (molting into juvenile plumage with all flight feathers less than 75% adult size).

A large female *T. biscutatus* (1380 mm SVL, 1635 mm TL, 450 g, with opaque eyes indicating pre-shed conditions) was found 2 m from the above-mentioned male, also in the rafters of the ranger station. A number of juvenile *Ctenosaura similis* (spiny-tailed iguanas) were observed around the station's roof tiles and surrounding trees, and numerous groove-billed anis and orange-fronted parakeets (*Aratinga canicularis*) landed on the roof during a one-hour observation period. Prey thus appeared to be spatially predictable and in high abundance for the snakes.

I thank the Organization for Tropical Studies for providing field accommodations and logistic assistance, and the Costa Rican Ministerio del Ambiente y Energia (Sistema Nacional de Areas de Conservacion) for a research permit.

Submitted by **ROBERT N. REED**, Department of Zoology and Wildlife Science, Auburn University, Auburn, Alabama 36849-5414, USA. e-mail: rreed@ag.auburn.edu.



Xenopus laevis (African Clawed Frog). USA: California: San Bernardino Co. Illustration by Dan Holland.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 28, Number 1 (March 1997).

CAUDATA

AMBYSTOMA TEXANUM (Smallmouth Salamander). USA: ILLINOIS: Scott Co: DOR on Hillview-Eldred Road, 0.2 km S Glasgow Road, 3.6 km W Glasgow, Sec. 26, T13N, R13W. 5 April 1997. J. K. Tucker. Illinois Natural Survey (INHS 12954). Green Co: DOR on Hillview-Eldred Road, 4.5 km N Hillview, Sec 14, T12N, R13W. 5 April 1997. J. K. Tucker. INHS 12959. Both verified by C. A. Phillips. New county records.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA.

AMBYSTOMA TIGRINUM TIGRINUM (Eastern Tiger Salamander). USA: ILLINOIS: Greene Co: DOR on Hillview Road, 2.8 km E Eldred, Sec 16, T10N, R13W. 5 April 1997. J. K. Tucker. Illinois Natural History Survey (INHS 12955). Verified by C. A. Phillips. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA.

PLETHODON ELONGATUS (Del Norte Salamander). USA: CALIFORNIA: Humbolt Co: Six Rivers National Forest, Lower Trinity Ranger District, Mingo Creek watershed, 1144 m (3754 feet) elev. (40°45'23"N, 123°35'30"W; UTM coordinates 450054E, 4511666N, Datum NAD27 CONUS, UTM Zone 10). 12 May 1997. G. A. Schmidt. Photograph deposited in Museum of Vertebrate Zoology, University of California, Berkeley (MVZ 226096, subadult). Verified by B. R. Norman; McAlister Creek watershed, 985 m (3233 feet) elev. (40°44'17"N, 123°34'32"W; UTM coordinates 451395E, 4509632N, Datum NAD 27 CONUS, UTM Zone 10). 12 May 1997. B. R. Norman. Photograph deposited in Museum of Vertebrate Zoology, University of California, Berkeley (MVZ 226097, subadult). Verified by G. A. Schmidt. All coordinates obtained by resource-grade (2–5 m accuracy) global positioning system (GPS) receiver. These represent the southernmost records for the species; extends known range (Jones and Raphael 1990, Herpetol. Rev. 21:37) 7.5 km S (MVZ 226096) and 9.5 km S (MVZ 226097).

Submitted by **GREGORY A. SCHMIDT**, Six Rivers National Forest, 1330 Bayshore Way, Eureka, California 95501, USA, and **BRADFORD R. NORMAN**, California Cooperative Fishery Research Unit, Humbolt State University, Arcata, California 95521, USA.

ANURA

BUFO FERNANDEZAE. ARGENTINA: CHACO: temporary pond at the crossing of roads 16 and 95, Presidencia Roque Saenz Peña (26°47'S, 60°27'W). 2 December 1989. F. Cruz and G. Perotti. Herpetological Collection Fundación Miguel Lillo (FML 5994). Species previously recorded from Chaco province at Paraná River borders (Cei 1980. Monitore Zool. Ital., N. S., Monogr. 2); extends the range 140 kms westward. SALTA: Hickman (23°12'S, 63°34'W). 20 December 1948. S. A. Pierotti. FML 5836; first province record. FORMOSA: Ingeniero Juárez (23°54'S, 61°51'W).

27 November 1951. S. A. Pierotti. FML 5946. Estancia Riacho Negro, Clorinda (25°24'S, 57°47'W). 19 and 21 August 1950. S. A. Pierotti and E. Budin. FML 910 and 866. Formosa City (26°11'S, 58°11'W). 3 November 1950. E. de Pierotti. FML 927. Laguna Oca (26°14'S, 58°12'W). 14 May–25 June 1956. S. A. Pierotti. FML 2042. Destacamento Potrero 6. 10–14 November 1950. S. A. Pierotti and E. Budin. FML 6189; first province record. All verified by E. O. Lavilla.

Submitted by **MANUEL SIÑERIZ LOUIS**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, San Miguel de Tucumán, Argentina.

BUFO STERNOSIGNATUS. VENEZUELA: YARACUY: Municipio Bolívar, Hacienda El Jaquar, ca. 15 km NNW Aroa. 750 elev. 28 August 1995. Ramon Rivero. Museo de la Estación Biológica de Rancho Grande, Profauna, Maracay (EBRG 2810). Verified by Luis Fernando Navarrete. Male specimen 49.4 mm total length; constitutes the first record for Estado Yaracuy. Previously known from several localities in Estados Araqua, Carabobo, Distrito Federal, Falcón and Portuguesa (Boulenger 1882, Catalogue of the Batrachia of the British Museum; Lutz 1927, Mem. Inst. O. Cruz 20; Shreve 1947, Bull. Mus. Comp. Zool. 99; Rivero 1961. Bull. Mus. Comp. Zool. 126; Solano 1969, Vroff Zool. Staatssamml. Munchen, 13). Fills the distributional gap between Venezuelan Coastal Range localities and mountain environments in Estados Falcón and Portuquesa.

Submitted by **ENRIQUE LA MARCA**, Universidad de los Andes, Facultad de Ciencias Forestales, Instituto de Geografia y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela, and **JESÚS MANZANILLA PUPPO**, Universidad Centeral de Venezuela, Facultad de Agronomía, Estación Biológica "Dr. Alberto Fernández-Yépez," Maracay, Venezuela.

BUFO WOODHOUSII WOODHOUSII (Woodhouse's Toad). USA: TEXAS: Bailey Co: 1.2 km S FM 298 on County Road 237. 2 July 1997. Kenneth G. Ostrand, James T. Anderson, Warren C. Conway. Museum of Texas Tech University (MTTU 11763). Verified by Ann M. Anderson. County record; one individual observed on road. Expands range of species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, Texas. 434 pp.).

Submitted by **KENNETH G. OSTRAND**, **JAMES T. ANDERSON**, and **WARREN C. CONWAY**, Department of Range, Wildlife, and Fisheries Management, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409, USA.

COCHRANELLA OYAMPIENSIS (Glass Frog). VENEZUELA: BOLIVAR: Karuay River, 150 m downriver from Salto Karuay, 23 km W Kavanayen, Parque Nacional Canaima (5°40'N, 61°50'W). 900 m elev. 9 August 1996. J. Celsa Señaris and Oswaldo Vernet. Museo de Historia Natural La Salle (MHNLS 13407–409). Verified by José Ayarzagüena. First county record and significant increase of the elevation range for the species. All specimens are males and were calling between 2000 and 2100 h from the upper surface of leaves of small trees, 200–250 cm above the surface of the water in small creek, tributary to the main channel.

Submitted by **JOSEFA CELSA SEÑARIS**, Department of Herpetology, Museo de Historia Natural La Salle, Apartado 1930, Caracas 1010-A, Venezuela.

DENDROBATES GRANULIFERUS (Granular Poison Frog). PANAMÁ: CHIRIQUI: Punta Burica: Distrito de Barú: Corregimiento de Puerto Armuelles, Chorogo, San Bartolo Límite, 8°17'23.8"N, 83°00'07.0"W, ca. 600 m elev. 1 May 1996. Querube Fuenmayor. Museo de Vertebrados de la Universidad de Panamá (MVUP 1651). Verified by Jay M. Savage. New record for the country. Previously known to occur only in Costa Rica, where populations are present on the Pacific and Caribbean versants (Savage 1968, Copeia 1968:745–776; Silverstone 1975, Los Angeles Co. Nat. Hist. Mus. Sci. Bull. 21:1–55; Myers et al. 1985, Amer. Mus. Novitates 3144:1–21). Extends the range ca. 40 km (airline) SSE from the nearest locality in the Golfo Dulce region, i.e., 3.2 km SE of Golfito (Savage 1968, *op. cit.*; Silverstone 1975, *op. cit.*).

Submitted by **ROBERTO IBAÑEZ D.**, Smithsonian Tropical Research Institute, Apartado 2072, Balboa, Panamá, **CESAR A. JARAMILLO**, Círculo Herpetológico de Panamá, Apartado 10762, Estafeta Universitaria, Panamá, Panamá, and **QUERUBE FUENMAYOR**, Asociación Nacional para la Conservación de la Naturaleza (ANCON), Apartado 1387, Panamá 1, Panamá.

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: LOUISIANA: Calcasieu Parish: Lake Charles, McNeese State University campus. 13 July 1997. Avery A. Williams and Mark L. Wygoda. Seale Museum of Louisiana, McNeese State University (SML 9313). Verified by Jeff Boundy. First parish record, and the only known record in the state outside of the New Orleans area as mapped by Dundee and Rossman (1989 The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge. 300 pp.). This specimen, a gravid female, was collected from an area landscaped with jasmine (*Trachelospermum* sp.) on the south side of the Student Union Annex building. Males of this species were initially heard calling from the collection site on 21 May 1997.

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **MARK L. WYGODA**, Department of Biological and Environmental Sciences, McNeese State University, Lake Charles, Louisiana 70609, USA.

HYLA ORNATISSIMA. VENEZUELA: BOLIVAR: Salto Karuay, 23 km W Kavanayen, Sector Oriental del Pargue Nacional Canaima (5°40'N, 61°50'W). 900 m elev. 5–8 August 1996. J. Celsa Señaris and Oswaldo Vernet. Museo de Historia Natural La Salle (MHNLS 13377, 13382–85, 13401–02, and 133403). Verified by José Ayarzagüena. First record for Venezuela and a significant increase in the elevation range of the species. All specimens (seven males and one female) were collected at night between 1900 and 2100 h on a small bank of the river where the gallery forest was more open.

Submitted by **JOSEFA CELSA SEÑARIS** and **OSWALDO VERNET**, Department of Herpetology, Museo de Historia Natural La Salle, Apartado 1930, Caracas 1010-A, Venezuela.

HYLA VERSICOLOR (Gray Treefrog). USA: ILLINOIS: Scott Co: DOR on Hillview-Eldred Road, 0.3 km N Sandy Creek, Sec. 23, T13N, R13W. 5 April 1997. J. K. Tucker. Illinois Natural History Survey (INHS 12956). Verified by C. A. Phillips. New county record. Only *Hyla versicolor* (slow call type) were heard calling from chorus bordering roadside at this location.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA.

HYLODES PHYLLODES. BRAZIL: RIO DE JANEIRO: Angra dos Reis Municipality: Ilha Grande (23°11'S, 44°12'W). Over a small shallow stream on rock, 240 m high in the forest area of Vila Dois Rios, a village in the Atlantic rainforest of the Ilha Grande State Park, an island located in the south of the state of Rio de Janeiro, southeastern Brazil, on 6 January 1997. Male 34.7 mm SVL, collected when calling at 1030 h by C. F. D. Rocha. Museu Nacional do Rio de Janeiro (MNRJ 18809). Verified by José P. Pombal Jr. and Ulisses Caramaschi. First documented record for the state of Rio de Janeiro. At Ilha Grande, this species lives in forests in small shallow streams with many granite boulders. We have found it in different habitats on the island (from sea level up to 300 m elev.), including undisturbed forest, secondary forest with recovering vegetation in the last 20 years, secondary forest with recovering vegetation in the last 50 years, and along trails linking local small villages. In all these habitats *H. phyllodes* is relatively abundant.

Submitted by **CARLOS FREDERICO DUARTE ROCHA** (CNPq grant Nº 300 819/94-3), **MONIQUE VAN SLUYS** (Nº 301 117/95-0) and **FÁBIO H. HATANO** (PIBIC/SR-2/UERJ), Sector de Ecologia, Instituto de Biologia, Universidade do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, Rio de Janeiro, 20550-019, Rio de Janeiro, Brazil.

PLEURODEMA BORELLI (Rufous Four-eyed Frog) ARGENTINA: FORMOSA: Departamento Patiño: Estancia Yacaré, Arroyo Monte Lindo (60°54'W, 24°01'S). 22 November 1944. S. A. Pierotti. Colección Herpetológica Fundación Miguel Lillo, Tucumán, Argentina (FML 00399). Verified by M. L. Lions. First province record; extends range of the species 427 km NE from former records (Cei 1980, Mon. Zool. Ital. (N.S.) Monog. 2:1–597).

Submitted by **JORGE ABEL CESPEDEZ**, Cátedra de Anatomía Comparada, Departamento de Biología, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, CP 3400, Corrientes, Argentina.

PSEUDACRIS CLARKII (Spotted Chorus Frog). USA: TEXAS: Lamb Co: jct. FM 1055 and County Road 184. 2 July 1997. Warren C. Conway, James T. Anderson, and Kenneth G. Ostrand. Museum of Texas Tech University (MTTU 11764). Verified by Ann M. Anderson. County record; many individuals heard calling just after dusk. Expands range of species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, Texas. 434 pp.).

Submitted by **WARREN C. CONWAY, JAMES T. ANDERSON, KENNETH G. OSTRAND**, Department of Range, Wildlife, and Fisheries Management, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409, USA.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: ILLINOIS: Scott Co: 1.6 km S jct. U.S. Rt. 67 and I-72 adjacent to Illinois Rt. 100, Sec. 27, T14N, R13W. 27 March 1997. J. K. Tucker, C. A. Phillips, and J. E. Petzing. Illinois Natural History Survey (INHS 12939). Verified by M. Dreslik. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA, **CHRISTOPHER A. PHILLIPS** and **JOHN E. PETZING**, Illinois Natural History Survey, Center for Biodiversity, 607 E. Peabody Drive, Champaign, Illinois 61820, USA.

PSEUDACRIS STRECKERI ILLINOENSIS (Illinois Chorus Frog). USA: ILLINOIS: Scott Co: 1.6 km S jct. U.S. Rt. 67 and I-72 adjacent to Illinois Rt. 100, Sec. 27, T14N, R13W. 27 March 1997. J. K. Tucker, C. A. Phillips, and J. E. Petzing. Illinois Natural History Survey (INHS 12950). Verified by M. Dreslik. First vouchered record for county; other chorus sites were previously reported from the county (Brown and Rose 1988, Illinois Nat. Hist. Surv. Biol. Notes 132:1–13).

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA, **CHRISTOPHER A. PHILLIPS** and **JOHN E. PETZING**, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

PSEUDACRIS TRISERIATA TRISERIATA (Western Chorus Frog). USA: ILLINOIS: Greene Co: DOR on Hillview-Eldred Road, 1.6 km N Apple Creek, Sec. 21, T11N, R13W. 18 April 1997. J. K. Tucker. Illinois Natural History Survey (INHS 13048). Calhoun Co: 6.4 km S Calhoun/Pike county line adjacent to Illinois Rt. 100 in roadside chorus, Sec. 22, T8S, R2W. 31 May 1997. J. K. Tucker and D. A. Warner. INHS 13043–44. Pike Co: N side of Illinois Rt. 106 at Little Blue Creek, Sec. 30, T5S, R2W. 31 May 1997. J. K. Tucker and D. A. Warner. INHS 13051. All verified by C. A. Phillips. New county records.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA.

PSEUDACRIS TRISERIATA TRISERIATA (Western Chorus Frog). USA: ILLINOIS: Scott Co: E side of Illinois Rt. 100, 1.6 km S jct. U.S. Rt. 67 and I-72, Sec. 27, T14N, R13W. 27 March 1997. J. K. Tucker, C. A. Phillips, and J. E. Petzing. Illinois Natural History Survey (INHS 12940). Verified by M. Dreslik. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA, **CHRISTOPHER A. PHILLIPS** and **JOHN E. PETZING**, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA.

RANA CAPITO CAPITO (Carolina Gopher Frog). USA: NORTH CAROLINA: Cumberland Co: 12.6 km NW Cumberland, Fort Bragg Military Reservation. 3 March 1997. Jeffrey C. Beane and Erich L. Hoffman. NCSM 52616–52617. Verified by Alvin L. Braswell. Specimens reared from one of several egg masses found in two adjacent borrow pits. Collected under permit NC-97-ES-45. New county record; extends range ca. 4 km E of nearest records in Hoke County (Beane and Hoffman 1995, Herpetol. Rev. 26:153; NCSM files).

Submitted by **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA, and **ERICH L. HOFFMAN**, Fort Bragg DPWE, AFZA-PW-DS Endangered Species Branch, 18th Airborne Corps, Fort Bragg, North Carolina 28307-5000, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: TEXAS: Cochran Co: 3.94 km W of FM 1780 on County Road 210. 29 June 1997. James T. Anderson, Warren C. Conway, Kenneth G. Ostrand. Museum of Texas Tech University (MTTU 11762). Verified by Ann M. Anderson. Specimen found in roadside pool. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES T. ANDERSON, WARREN C. CONWAY**, and **KENNETH G. OSTRAND**, Department of Range, Wildlife, and Fisheries Management, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409, USA.

TESTUDINES

EMYDOIDEA BLANDINGII (Blanding's Turtle). USA: NEW YORK: Jefferson Co: crossing Figert Road at jct. with St. Rt. 3 on the Fort Drum Military Reservation (44°03'32"N, 75°33'05"W). 24 July 1995. Morgan McCosh and William Stewart. Adult male, 27 0 mm carapace length, 203 mm plastron length, 1,542 g body mass. Lewis Co: wetland pool on the SE side of RR tracks crossing through Bonaparte Fen between Armitage Road and North Bonaparte Road (44°08'03"N, 75°21'33"W). 27 May 1997. Donald J. Leopold and Dudley J. Raynal. Adult female. Both verified by Alvin R. Breisch. NYSM Color Slide 0001 (Jefferson County specimen) and Color Slide 0002 (Lewis County specimen). Jefferson County specimen is a new county record; extends range ca. 30 km E of known populations (Petokas and Alexander 1978, Herpetol. Rev. 9:107). Lewis County specimen is first county record; extends range another 15 km NE (Petokas and Alexander 1981, New York Fish Game J. 28(1):119–120).

Submitted by **GLENN JOHNSON**, Department of Environmental and Forest Biology, College of Environmental Science and Forestry, State University of New York, Syracuse, New York 13210, USA, and **TODD C. WILLS**, Public Works Environmental Division, Fort Drum, New York 13601, USA.

GRAPTEMYS PULCHRA (Alabama Map Turtle). USA: MISSISSIPPI: Oktibbeha Co: near the confluence of Hollis Creek and Noxubee River, NE 1/4 Sec. 27, T17N, R14E. 10 July 1997. J. Bradford. Mississippi Museum of Natural Science (MMNS 5362). Verified by R. L. Jones. Adult female (PL = 220 mm) accidentally drowned in hoop trap. First county record (Ernst et al. 1994, Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 578 pp.; Jones et al. 1996, Geographic Distribution. *Graptemys pulchra*. Herpetol. Rev. 27:151).

Submitted by **R. BRENT THOMAS**, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi 39762, USA, and **JOHNNY BRADFORD**, U.S. Fish and Wildlife Service, Noxubee Refuge, Brooksville, Mississippi, USA.

SIEBENROCKIELLA CRASSICOLLIS (Black Marsh Turtle). INDONESIA: BULITUNG ISLAND: an unnamed small stream, ca. 3 mi S Tanjung Padang (2°45'S, 107°37'E). 6 March 1996. Naoki Kamezaki. Herpetological Collection, Depertment of Zoology, Kyoto University (KUZ 19999). Verified by H. Ota. First record from island (Iverson 1992, A Revised Checklist with Distributional Maps of the Turtles of the World, Privately Printed, Richmond, Indiana. 363 pp.). Adult male (164.8 mm CL, 131.8 mm PL, 525 g body mass). At the collecting site, the stream was ca. 4 m wide with a muddy bottom. The species occurred sympatrically with *Cuora amboinensis*.

Submitted by **YUICHIROU YASUKAWA**, Tropical Biosphere Research Center, University of the Ryukyus, Nishihara, Okinawa 903-01, Japan, and **NAOKI KAMEZAKI**, Graduate School of Human and Environmental Studies, Kyoto University, Sakyo, Kyoto 606-01, Japan.

STERNOTHERUS ODORATUS (Common Musk Turtle). USA: ILLINOIS: Calhoun Co: DOR on Illinois River Road, near Pohlman Slough, Sec. 2, T13S, R1W. 6 June 1996. J. K. Tucker. Illinois Natural History Survey (INHS 13057). Verified by C. A. Phillips. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA, and **DANIEL A. WARNER**, Iowa State University, Department of Animal Ecology, Ames, Iowa 50011, USA.

STERNOTHERUS ODORATUS (Common Musk Turtle). USA: WISCONSIN: La Crosse Co: Mississippi River, Sec. 14, T16N R8W, UTM coordinates 4857532N, 636936E. 24 July 1997. Andrew Bartels and Eric Kramer. MPM 30227. Verified by Robert W. Henderson. Specimen drowned in submerged fyke net set for fish sampling in backwater in ca. 1 m of water over a soft silt/sand substrate. Collectors noted that this was the first observation of this species in nine years of continuous fish sampling at this site. New county record, within large gap in expected range between Trempealeau and Grant counties (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. Milwaukee, Wisconsin. 87 pp.)

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

TESTUDO MARGINATA (Marginated Tortoise). GREECE: PELOPONNISOS: Island of Sapientza and Island of Sfaktiria, two small rocky islands, the smaller distance of which from the SW end of Peloponnisos being ca. 1500 m southwards and 150 m westwards, respectively. 5 September 1996 and 8 September 1996, respectively. G. Chiras and B. P. Chondropoulos. Zoological Museum of University of Patra (ZMUP A-R 1376 and ZMUP A-R 1377, respectively) (color photograph records). Verified by E. Valakos. The Sapientza population lives in a habitat with tall, rather sparse maquis vegetation mainly consisting of *Arbutus* sp., *Phillyrea media*, *Quercus coccifera*, and *Pistacia lentiscus*, whereas on Sfaktiria these tortoises were encountered in areas with more dense and lower maquis dominated by the latter two of the above species. Both populations seem to be small, but demographically healthy; about a dozen young and older individuals were observed on each island during the one day trip.

No collection was made since *Testudo marginata* is a species protected by international conventions (Bern, CITES), the European Community Directive 92/43, and Greek law; it is also included in official international catalogues of threatened animal taxa. Furthermore, both Sapientza and Sfaktiria islands are parts of two sites proposed for accession to the European network of protected areas (Natura 2000). Both the registered populations are obviously isolated and marginal since the natural range of the species extends into the southern Balkans only (the population in Sardinia, Italy, is almost certainly introduced) (Arnold et al. 1978, Reptiles and Amphibians of Britain and Europe. Collins, London. 272 pp.; Haxhiu 1985, Rezultate to Studimit te Breschkave to Vendit Tone. Buletin I Shkencave te Natyres 2:99–104, translated by J. Buskirk, 1995 Chel. Conserv. Biol. 1:324–327.

Submitted by **BASIL P. CHONDROPOULOS**, Section of Animal Biology, Department of Biology, University of Patra, 260 01 Patra, Greece, and **GEORGE CHIRAS**, Sarantaporou 38, 262 23 Patra, Greece.

SAURIA

ANOLIS RECONDITUS (Blue Mountains Anole). JAMAICA: St. Andrew Parish: ca 0.6 km S Newcastle entrance, 0.48 road km N of milestone 17 from Kingston, ca 900 m., 1650 h (twilight). 26 February 1993. Numi C. Mitchell. MCZ A11595 (male) and A11596 (female). Verified by James Lazell. Extends known range ca. 1 km SE 19-mile Gully where they were observed by Hicks (1973. Breviora 404:1–23) and 2.4 km SW Hardwar Gap, the southernmost locality from which there are voucher specimens (Lazell 1966. Bull. Inst. Jamaica Sci. Series 18[1]:1–15).

Submitted by **NUMI C. MITCHELL**, The Conservation Agency Branch Office, 67 Howland Avenue, Jamestown, Rhode Island 02835, USA.

CNEMIDOPHORUS SEXLINEATUS VIRIDIS (Prairie Racerunner). USA: TEXAS: HOWARD CO: 9.66 road km W Big Spring on Texas Rt. 176 and ca. 0.805 road km N of Texas Rt. 176 on dirt road (32°16'31.6"N, 101°35'55.6"W). 27 July 1997. Toby J. Hibbitts. TCWC 76996. Verified by James R. Dixon. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.; Dixon 1996, Texas Herpetol. Soc. Spec. Publ. No. 2).

Submitted by **TOBY J. HIBBITTS**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

DIPLOGLOSSUS MONOTROPIS. COSTA RICA: HEREDIA: La Selva Biological Station, confluence of Rio Sarapiqui and Rio Puerto Viejo, 10°26'N, 83°59'W, elev. 40 m. 23 March 1997. Ronald M. Coleman. MVZ Color Slide 226066. Verified by Harry Greene. Single individual found at 1730 h (dusk) on concrete path/stairway leading from the Rio Puerto Viejo to the River Station building. Ca. 5 m from water's edge, 5 m above water line, disturbed riparian habitat, but within 25 m of secondary rainforest. First record for La Selva Biological Station; closest previous records in Costa Rica are from Cariblanco, 25 km SW (UCR 672) and the Rio Frio, 90 km NW (UCR 7606, LACM 44999). An uncataloged sighting exists for Chilamate, 7 km E of La Selva (Craig Guyer, pers. comm.).

Submitted by **RONALD M. COLEMAN**, Department of Integrative Biology, University of California, Berkeley, California 94720-3140, USA.

GYMNOPHTHALMUS UNDERWOODI. LESSER ANTILLES: Barbuda: just S Codrington. 21 July 1994. John Mussington. CM 146423. Verified by Ronald I. Crombie. Northernmost record for species. Previously recorded from Guadeloupe (Vanzolini 1990, Herpetol. Rev. 21:96; Schwartz and Thomas 1975, Carnegie Mus. Nat. Hist. Spec. Pub. 1:1–216), Dominica (Brooks 1983, Herpetol. Rev. 14:31), Grenadines (Lazell and Sinclair 1990, Herpetol. Rev. 21:96), St. Vincent, Barbados, Trinidad and Tobago (Schwartz and Thomas 1975, *op. cit.*).

Submitted by **ELLEN J. CENSKY**, Section of Amphibians and Reptiles, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213, USA, and **KEVIN LINDSAY**, Island Resources Foundation, P.O. Box 103, St. John's, Antigua, West Indies.

SERPENTES

BOTHROPS FONSECAI (Fonseca's Lancehead). BRAZIL: SÃO PAULO: Espírito Santo do Pinhal (ca. 22°10'S; 46°46'W) in coffee farm, ca. 880 m elev. 19 July 1996. Collected by plantation workers. Unversidade Estadual de Campinas (ZUEC 01982, 1985). Verified by Ivan Sazima. These specimens extend the range in the state of São Paulo ca. 140 km northwestward (Campbell and Lamar 1989, Venomous Reptiles of Latin America. Comstock, Ithaca, New York. 425 pp.).

Submitted by **PAULO ROBERTO MANZANI**, Departamento de Zoologia, Instituto de Biologia, Universidade Estadual de Campinas, 13083-970 Campinas, São Paulo, Brazil, **RONILSON AGNALDO MORENO**, Departamento de Farmacologia, Faculdade de Ciências Médicas, Universidade Estadual de Campinas, 13083-970 Campinas, São Paulo, Brazil, and **MIGUEL NASSIF MATTAR**, Fundação Pinhalense de Ensino, Avenida Hélio Vergueiro Leite 1, 13990-000 Espírito Santo do Pinhal, São Paulo, Brazil.

COLUBER CONSTRICTOR FOXII (Racer). USA: ILLINOIS: SCOTT CO: DOR on Hillview-Eldred Road, 4 km SSW Glascow, Sec. 35, T13N, R13W. 5 April 1997. J. K. Tucker. Illinois Natural History Survey (INHS 12962). Verified by C. A. Phillips. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA.

LAMPROPELTIS TRIANGULUM SYSPILA (Red Milk Snake). USA: ILLINOIS: MADISON CO: DOR on Ill. Rt. 100, 2.4 km S Clifton Terrace Road, Sec 4, T6N, R10W. 8 May 1997. J. K. Tucker and M. M. Tucker. Illinois Natural History Survey (INHS 13060). Verified by C. A. Phillips. New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Great Rivers Field Station, 4134 Alby Street, Alton, Illinois 62002, USA, and **MOYNELL M. TUCKER**, 120 W. Main, Grafton, Illinois 62037, USA.

MASTICOPHIS MENTOVARIUS MENTOVARIUS (Neotropical Whipsnake). MEXICO: TABASCO: 18 km E Frontera. 7 September 1976. Diderot F. Gicca. UF 42337. Verified by F. Wayne King. First record for the state, bridging a coastal gap of over 500 km between records for southern Veracruz and central Campeche (Johnson 1982, Cat. Am. Amph. Rept. 295:1–4).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA, **DAVID CHISZAR**, **HOBART M. SMITH**, and **FRANK VAN BREUKELEN**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

MICRURUS AVERYI (Coral Snake). BRAZIL: MATO GROSSO: Claudia, Fazenda Iracema (11°36'S; 55°09'W). 7 April 1997. Museu de Zoologia da Universidade de São Paulo (MZUSP 11252). Verified by Paulo E. Vanzolini. Adult female (SVL 591 mm, tail 62 mm, ventrals 209, subcaudals 29). First record for the state of Mato Grosso and also the eastermost record for the species. The specimen, which exhibited beak marks, was dropped by a hawk shot on the wing.

Submitted by **MYRIAM E. VELLOSO CALLEFFO**, Laboratório de Herpetologia, Instituto Butantan, Avenida Vital Brasil, 1500, CEP 05503-900, São Paulo, São Paulo, Brazil.

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blind Snake). LESSER ANTILLES: ANGUILLA: Mead's Bay, Mallihouana Hotel. 28 March 1996 and 25 August 1996. Roy Thomas and Anna Kennedy. Carnegie Museum of Natural History (CM 145826–827). Verified by Addison Wynn. First record for the West Indies. Other records for the New World include introductions to the United States (reviewed in Crawford and Somma 1993, Herpetol. Rev. 24:68; Meshaka 1994, Herpetol. Rev. 25:34; Thomas 1994, Herpetol. Rev. 25:34), Mexico (reviewed in Mendoza Quijano et al. 1994, Herpetol. Rev. 25:34; Eliosa Leon et al. 1995, Herpetol. Rev. 26:110), and Guatemala (Dixon and Hendricks 1979, Zool. Verhandelingen 173:1–39). Specimens were unearthed while digging holes for tree planting on hotel grounds. Presumably introduced on imported plant materials.

Submitted by **ELLEN J. CENSKY**, Section of Amphibians and Reptiles, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213, USA, and **KARIM HODGE**, Anguilla National Trust, The Valley, Anguilla, British West Indies.

STORERIA OCCIPITOMACULATA OBSCURA (Florida Redbelly Snake). USA: TEXAS: San Augustine Co: W side of jct. U.S. Rt. 96 on Texas Rt. 103 (31°24'20.6"N, 94°03'35.8"W). 12 August 1997. Toby J. Hibbitts and John H. Malone. TCWC 76995. Verified by James R. Dixon. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.; Dixon 1996, Texas Herpetol. Soc. Spec. Publ. No. 2).

Submitted by **TOBY J. HIBBITTS**, and **JOHN H. MALONE**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

TANTILLA RUBRA (Red Blackhead Snake). GUATEMALA: HUEHUETENANGO: 12 km SSE La Democracía, 950 m (91°50'58"W, 15°31'22"N, GIS portable recorder). 11 March 1991. Steven P. Christman. UF 96323. Verified by Jonathan A. Campbell. First record for Guatemala (Campbell 1989, Proc. West. Found. Vert. Zool. 4(1):1–21) and a range extension of ca. 50 km.

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA, and **HOBART M. SMITH, FRANK VAN BREUKELEN** and **DAVID CHISZAR**, University of Colorado Museum, Boulder 80309-0218, USA.

THAMNOPHIS MARCIANUS MARCIANUS (Checkered Garter Snake). USA: CALIFORNIA: Riverside Co: Mecca, 62nd Avenue and Johnson Street. 19 April 1997. Bradford D. Hollingsworth and Todd R. Prosser. La Sierra University Photographic Collection (LSUPC) 941. Verified by L. Lee Grismer. Specimen was found DOR between an open grape field and an orange grove. The nearest distributional records occur in the agricultural regions of the Imperial Valley, south of the Salton Sea (Rossman et al. 1996, The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman, Oklahoma. 325 pp.). The areas surrounding Mecca in the Coachella Valley, north of the Salton Sea, are primarily agricultural lands and separated from those in the Imperial Valley by 20 miles of native desert along the eastern shore of the Salton Sea. The two regions are connected by the Coachella Canal. It appears *T. maricanus* is expanding its range to the north in association with the growing agricultural industry in this area (Glaser 1970. The Distribution of Amphibians and Reptiles in Riverside County, California, Riverside Museum Press, Riverside, California, p. 38). The only other Riverside County records are along the Colorado River and its adjacent irrigated areas (Glaser 1970, *op. cit.*).

Submitted by **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and **TODD R. PROSSER**, 1591 Stoddard Avenue, Thousand Oaks, California 91360, USA.

TRIMORPHODON TAU TAU (Mexican Lyre Snake, Falsa Nauyaca Mexicano). MÉXICO: TAMAULIPAS: 40 km NE San Fernando on México Rt. 101. 20 December 1952. Rezneat M. Darnell and Ernest A. Liner. DOR. TU 15441. Verified by Hobart M. Smith. Female with scale counts within the subspecies range; extends range 150 km NNE of Santander Jiménez, Tamaulipas (Brown and Brown 1967, Texas J. Sci. 19:323–326) and 199 km ENE of Iturbide region, Nuevo León (Blody et al. 1987, Herpetol. Rev. 18:21; Lazcano et al. 1992, Bull. Chicago Herpetol. Soc. 27:4). Contrary to the town name Jiménez, as stated by Brown and Brown (*op. cit.*) and by McDiarmid and Scott (1970, Los Angeles Co. Mus. Cont. Sci. 179:1–43), the correct name of the town is Santander Jiménez. Also, the Brown and Brown reference (*op. cit.*) is in volume 19, not 29, as stated in McDiarmid and Scott (*op. cit.*).

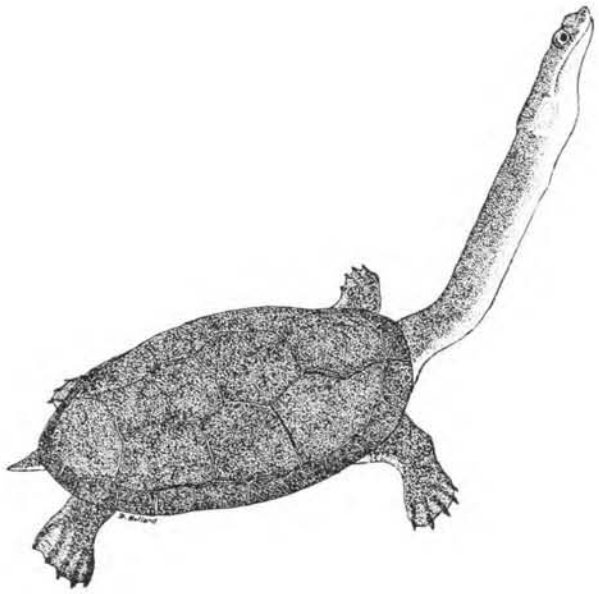
Submitted by **HAROLD A. DUNDEE**, Tulane University Museum of Natural History, Belle Chasse, Louisiana 70037-3098, USA, and **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

UNGALIOPHIS CONTINENTALIS (Isthmian Dwarf Boa). NICARAGUA: MATAGALPA: Selva Negra, 1300 m elev. (12°59'96"N, 85°54'55"W). March 1995. G. Köhler. Forschungsinstitut und Naturmuseum Senckenberg (SMF 77558). Verified by W. Böhme. First record for Nicaragua; extends range ca. 160 airline km SE of record from La Montanita, Departamento Francisco Morazán, Honduras (Wilson and Meyer 1985, The Snakes of Honduras. Second Ed. Milwaukee Publ. Mus., Wisconsin. 150 pp.; Villa and Wilson 1990, Cat. Amer. Amphib. Rept. 480:1–4).

Submitted by **GUNTHER KÖHLER**, Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a.m., Germany.

UROMACERINA RICARDINII (Cobra-cipó, São Paulo Sharp Snake). BRAZIL: ESPÍRITO SANTO: Municipality of Marechal Floriano: Alto Nova Almeida near Sítio Tres Marias (20°24'36"S; 40°49'26"W, ca. 680 m). 16 January 1996. Josimar Luís da Silva. Coleção Zoológica da Universidade Federal do Espírito Santo (ZUFES 150390). Verified by Ivan Sazima and Paulo Roberto Manzani. First record for state; extends known distribution northwards in the Atlantic Forest domain. Previously known from the state of Rio de Janeiro, south to the state of Rio Grande do Sul (Hoge 1957/58, Mem. Inst. Butantan 28:77–82; Peters and Orejas Miranda 1970, Bull. U.S. Nat. Mus. 297:321; Müller 1978, Salamandra 14:44; Lema 1973, Iheringia 44:64–73). An apparently disjunct population was discovered in the Amazonian forest in the state of Pará (Cunha and Nascimento 1982, Bol. Mus. Para. Emílio Goeldi 113:1–9).

Submitted by **CLAUDIO ZAMPROGNO**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil. E-mail: czamprog@server.npd.ufes.br.



Early Rewards from the Georgia Herp Atlas

JOHN B. JENSEN
Georgia Department of Natural Resources
Nongame-Endangered Wildlife Program
116 Rum Creek Drive, Forsyth, Georgia 31029, USA

and

ROBERT A. MOULIS
Savannah-Ogeechee Canal Museum
681 Ft. Argyle Road, Savannah, Georgia 31419, USA

Organized by the Georgia Department of Natural Resources, the Georgia Herp Atlas is a volunteer-supported effort to document the current distribution of reptiles and amphibians in the state. Volunteers are asked to provide verifiable evidence of herp observations made in Georgia and include standard collection information: precise locality, date, etc. Because of the strict collecting laws for reptiles and amphibians of Georgia and the large number of volunteers, many observations are substantiated by photographs rather than specimens. Included in this report are county records (Williamson and Moulis 1994) obtained during the inaugural year of the project. All specimens and photographs were deposited in the herpetological collections of either the University of Georgia Museum of Natural History (UGAMNH) or Savannah-Ogeechee Canal Museum (SOCM), as indicated. UGAMNH specimens and photographs were verified by Joshua Laerm, while those deposited in SOCM were verified by Robert Moulis.

CAUDATA

Ambystoma maculatum (Spotted Salamander). USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. June 1996. Dan Emsweller. SOCM 0025.

Plethodon ocmulgee (Ocmulgee Slimy Salamander). USA: GEORGIA: HOUSTON CO: near jct. of Grovania Road and Elko Road (32°22' 08"N, 83°43' 04"W). 9 October 1996. Dan and Pam Guynn. SOCM 0027. JONES CO: jct. of Route 18 and McKay Road (32°58'34"N, 83°36'40"W). 16 April 1994. Lisa Walcott-Moreley and Barbara Edwards. SOCM 0028.

Pseudotriton ruber ruber (Northern Red Salamander). USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. 11 October 1996. Dan and Michelle Emsweller. SOCM 0024.

ANURA

Acris crepitans crepitans (Northern Cricket Frog). USA: GEORGIA: DOOLY CO: Flint River Wildlife Management Area (32°08'13"N, 84°00'43"W). 18 September 1996. John Jensen and Todd Schneider. UGAMNH 27363.

Acris gryllus gryllus (Southern Cricket Frog). USA: GEORGIA: BROOKS CO: Pope's Mill Pond (33°53'54"N, 83°44'27"W). 8 June 1996. John Jensen and Mike Harris. UGAMNH 27362.

Bufo terrestris (Southern Toad). USA: GEORGIA: BIBB CO: Ocmulgee National Monument. 14 April 1996. Lisa Walcott-Moreley, Dan Guynn, and Jerry Amerson. SOCM 0026.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). USA: GEORGIA: BIBB CO: private residence on Gwinnett Drive 0.5 km W of Pierce Avenue, in Macon (32°51'52"N, 83°39'57"W). 26 August 1996. Todd Schneider. UGAMNH 27368.

Hyla avivoca (Bird-voiced Treefrog). USA: GEORGIA: TAYLOR CO: Rombulette Creek at Georgia Hwy 137 (32°28'16"N, 84°21'32"W). 15 July 1996. John and Jodie Jensen. UGAMNH 27361.

Hyla cinerea (Green Treefrog). USA: GEORGIA: BIBB CO: Ocmulgee National Monument. 15 October 1995. Lisa Walcott-Moreley. SOCM 0029. DOOLY CO: Flint River Wildlife Management Area (32°08'13"N, 84°00'43"W). 18 September 1996. John Jensen and Todd Schneider. SOCM 0030. MORGAN CO: Monticello Road 6.5 km S of Madison (33°31'02"N, 83°31'59"W). 25 September 1996. George West. SOCM 0031.

Hyla squirella (Squirrel Treefrog). USA: GEORGIA: TAYLOR CO: AOR. U.S. Hwy 19 0.2 km N of Ga. Hwy. 90 (32°26'34"N, 84°16'38"W). 15 July 1996. John and Jodie Jensen. UGAMNH 27360.

Pseudacris crucifer crucifer (Northern Spring Peeper). USA: GEORGIA: NEWTON CO: near confluence of Cornish Creek and Alcovy River (33°36'56"N, 83°48'11"W). 16 June 1996. John Jensen and Betsie Rothermel. UGAMNH 27340. TAYLOR CO: Cedar Creek at U.S. Hwy 19 (32°23'22"N, 84°17'48"W). John and Jodie Jensen. UGAMNH 27364.

Rana clamitans clamitans (Bronze Frog). USA: GEORGIA: NEWTON CO: near confluence of Cornish Creek and Alcovy River (33°36'56"N, 83°48'11"W). 6 July 1996. John Jensen and Betsie Rothermel. SOCM 0032.

Rana grylio (Pig Frog). USA: GEORGIA: BROOKS CO: Pope's Mill Pond (33°53'54"N, 83°44'27"W). 8 June 1996. John Jensen and Mike Harris. UGAMNH 27366, 27367.

Rana palustris (Pickerel Frog). USA: GEORGIA: WALKER CO: just north of Atwood Point Road approximately 0.3 km E of jct. with McCutchens Springs Road, on Pigeon Mountain (34°41'13"N, 85°23'00"W). 13 August 1996. John Jensen. UGAMNH 27365.

TESTUDINES

Chelydra serpentina serpentina (Common Snapping Turtle). USA: GEORGIA: COBB CO: Cameron Station Apartments at Franklin Road (33°55'58"N, 84°30'01"W). 18 September 1996. Tim Matthews. SOCM 0042. FAYETTE CO: Morning Creek near confluence with Flint River (33°27'59"N, 84°23'22"W). 25 August 1996. Sean Graham. SOCM 0043.

Pseudemys concinna concinna (Eastern River Cooter). USA: GEORGIA: MONROE CO: Lake Juliette (33°02'N, 83°48'W). 4 June 1996. Ben Granitz. SOCM 0034.

Sternotherus minor minor (Loggerhead Musk Turtle). USA: GEORGIA: CLAYTON CO: Flint River near Jonesboro. 28 August 1996. Sean Graham. SOCM 0033.

Sternotherus odoratus (Common Musk Turtle). USA: GEORGIA: MONROE CO: AOR US Hwy. 23 2.0 mi N of Ga. Hwy 18. Jerry Payne. UGAMNH 27342.

Terrapene carolina (Box Turtle). USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. 8 September 1996. Dan Emsweller. SOCM 0037. HOUSTON CO: near jct. of Grovania Road and Elko Road (32°22'29"N, 83°43'04"W). 12 August 1996. Dan Guynn. SOCM 0038. MONROE CO: D.O.R. Route 42 3.9 km N of jct with Route 74. 15 September 1996. Giff Beaton. SOCM 0039. ROCKDALE CO: A.O.R. Old Covington Road just east of Salem Road. 7 August 1996. Marci DeSart and Mike Armstrong. SOCM 0040. WALTON CO: D.O.R. Troy Smith Road 0.8 km N of jct with U.S. Hwy 78. 13 September 1996. Jeff Parrish. SOCM 0041.

Trachemys scripta scripta (Yellowbelly Slider). USA: GEORGIA: BURKE CO: Di-Lane Plantation: 0.5 km W of Commanche Frank Road, 2.4 km NW of Herndon Road. 14 June 1996. John Jensen, Vic VanSant, and Lynn Lewis. UGAMNH 27341. DOUGLAS CO: Sweetwater Creek State Park. 15 June 1996. Dan and Michelle Emsweller. SOCM 0035. NEWTON CO: near confluence of Cornish Creek and Alcovy River (33°36'56"N, 83°48'11"W). 6 July 1996. Betsie Rothermel. SOCM 0036.

SAURIA

Anolis carolinensis (Green Anole). USA: GEORGIA: CLAYTON CO: S. Hampton Ct., Jonesboro. 20 November 1996. Sean Graham and Josh Eldridge. SOCM 0044. FAYETTE CO: near confluence of Morning Creek and Flint River. 4 December 1996. Sean Graham. SOCM 0045. GILMER CO: White Path Road 3.2 km N of Ga. Hwy. 515. 14 October 1996. Ronny Holcomb. SOCM 0046. GORDON CO: Slatemine Road, west of Fairmount. 31 October 1996. Keith Bailey. SOCM 0047. HENRY CO: Turner Church Road in McDonough. 12 October 1996. Nicole Marlin. SOCM 0048. WALTON CO: River Bluff Road in Monroe. 23 September 1996. Jeff Parrish. SOCM 0049.

Cnemidophorus sexlineatus sexlineatus (Six-lined Racerunner). USA: GEORGIA: JOHNSON CO: near the jct. of Page Road and Bartow-Dublin Road (32°46'58"N, 82 40'08"W). 23 September 1996. James Harrison. SOCM 0050.

Eumeces laticeps (Broadhead Skink). USA: GEORGIA: LAMAR CO: Sappington Road in Redbone community, near Barnseville (32°59'29"N, 84°05'40"W). 30 June 1996. Jim Ozier. UGAMNH 27353.

Ophisaurus ventralis (Eastern Glass Lizard). USA: GEORGIA: BIBB CO: D.O.R. U.S. Hwy 23 1.6 km S of Monroe County line (32°56'29"N, 83°43'10"W). 29 May 1996. John Jensen. UGAMNH 27352.

Sceloporus undulatus hyacinthinus (Northern Fence Lizard) USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. 11 October 1996. Dan and Michelle Emsweller. SOCM 0051.

Sceloporus undulatus undulatus (Southern Fence Lizard) USA: GEORGIA: JOHNSON CO: near the jct. of Page Road and Bartow-Dublin Road (32°46'58"N, 82°40'08"W). 23 September 1996. James Harrison. SOCM 0052.

SERPENTES

Agkistrodon contortrix mokasen (Copperhead) USA: GEORGIA: GWINNETT CO: jct. of Shelburne Trace and Overlook View Drive, in Duluth. 26 September 1996. Carol Lowe. SOCM 0053.

Crotalus adamanteus (Eastern Diamondback Rattlesnake). USA: GEORGIA: TOOMBS CO: D.O.R. Ga. Hwy 86 3.2 km N of Ga. Hwy 152 (32°18'35"N, 82°15'49"W). 13 October 1996. Anselm Atkins and Margaret Kavanaugh. SOCM 0055.

Crotalus horridus (Timber Rattlesnake). USA: GEORGIA: MONROE CO: near jct. of McCrackin Road and Juliette Road, in Juliette. 16 August 1996. Ed Williams. UGAMNH 27344.

Diadophis punctatus punctatus (Southern Ringneck Snake). USA: GEORGIA: FAYETTE CO: private residence on Summer Place in Peachtree City. 29 September 1996. Brad Koehn, Andrew Harlfinger, and Matt Harlfinger. SOCM 0056.

Elaphe obsoleta obsoleta (Black Rat Snake). USA: GEORGIA: CRAWFORD CO: D.O.R. on County Road 115, 1.1 km W of Ga. Hwy. 42. 15 September 1996. Giff Beaton. SOCM 0057. GILMER CO: A.O.R., Legion Road ca. 3 km S of Ellijay. 4 October 1996. Ronny Holcomb. SOCM 0059. LAMAR CO: Sappington Road in Redbone community, near Barnseville (32°59'29"N, 84°05'40"W). August 1996. Jim Ozier. SOCM 0060. MONROE CO: Ga. Hwy 18 1.1 km W of Rum Creek Drive (33°56'26"N, 83°43'10"W). 17 May 1996. John Jensen. UGAMNH 27351. WALTON CO: private residence on Tara Blvd., in Loganville. September 1996. David Funderburk. SOCM 0061.

Elaphe obsoleta obsoleta x *spiloides* (Intergrade Rat Snake). USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. April 1996. Dan and Michelle Emsweller. SOCM 0058a, 0058b.

Heterodon platirhinos (Eastern Hognose Snake). USA: GEORGIA: CANDLER CO: D.O.R. Ga. Hwy. 121-23 ca. 150 m N of Canoochee River. 13 October 1996. Anselm Atkins and Margaret Kavanaugh. SOCM 0062.

Lampropeltis getula getula (Eastern Kingsnake). USA: GEORGIA: DOUGLAS CO: near jct. of Kings Hwy. and Queens Road. 5 September 1996. Dan Emsweller. SOCM 0063. LAMAR CO: Sappington Road 0.8 km E of Community House Road. 9 August 1996. Jim Ozier. SOCM 0064.

Lampropeltis triangulum elapsoides (Scarlet Kingsnake). USA: GEORGIA: WAYNE CO: adjacent to Ingram Road (31°39'38"N, 82°06'41"W). 18 April 1996. Robert Moulis and Jerry Williamson. SOCM 0008, 0009.

Nerodia erythrogaster erythrogaster (Redbelly Water Snake). USA: GEORGIA: CALHOUN CO: County Road 40 at Spring Creek (31°27'59"N, 84°26'56"W). 4 September 1996. John Jensen. SOCM 0065.

Nerodia floridana (Florida Green Water Snake). USA: GEORGIA: BURKE CO: A.O.R. Old River Road 1 km N of Sweetwater Creek (33°02'54"N, 81°36'29"W). 3 August 1996. Robert Redmond and James Waters. SOCM 0010.

Nerodia sipedon pleuralis (Midland Water Snake). USA: GEORGIA: FAYETTE CO: Flint River 0.4 km N of confluence with Morning Creek. 17 September 1996. Sean Graham. SOCM 0066.

Nerodia taxispilota (Brown Water Snake). USA: GEORGIA: CALHOUN CO: County Road 40 at Spring Creek (31°27'59"N, 84°26'56"W). 4 September 1996. John Jensen. SOCM 0067.

Opheodrys aestivus (Rough Green Snake). USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. 18 September 1996. Dan and Michelle Emsweller. SOCM 0068. GILMER CO: AOR. Ga. Hwy 515 ca. 7 km S of Ellijay. 2 October 1996. Ronny Holcomb. SOCM 0069. PUTNAM CO: Great Waters Golf Course at Reynolds Plantation. 17 September 1996. George West. SOCM 0070. WALTON CO: ca. 0.5 km N of jct. Georgia Hwy. 278 and New Hope Church Road, in between city limits (33°49'18"N, 83°48'20"W). 24 July 1996. Charles Rabolli. SOCM 0071.

Pituophis melanoleucus mugitus (Florida Pine Snake). USA: GEORGIA: WHEELER CO: DOR. U.S. Hwy. 280 0.6 km E of U.S. Hwy. 319 (32°05'22"N, 82°52'01"W). May 1996. Timmy Arbogast. SOCM 0019.

Regina septemvittata (Queen Snake). USA: GEORGIA: DOUGLAS CO: Sweetwater Creek State Park. 14 April 1996. Dan and Michelle Emsweller. SOCM 0072.

Storeria dekayi wrightorum (Midland Brown Snake). USA: GEORGIA: DOOLY CO: Flint River Wildlife Management Area (32°08'13"N, 84°00'43"W). 18 September 1996. John Jensen and Todd Schneider. SOCM 0073.

Storeria dekayi dekayi x *wrightorum* (Brown Snake). USA: GEORGIA: FAYETTE CO: near confluence of Morning Creek and Flint River. 4 March 1996. Sean Graham. SOCM 0074.

Storeria occipitomaculata occipitomaculata (Northern Redbelly Snake). USA: GEORGIA: BIBB CO: near the dam at Lake Tobesofkee. 8 September 1996. Jodie Jensen. UGAMNH 27350. WASHINGTON CO: private residence on Ridgeland Drive, in Sandersville (32°59'17"N, 82°48"54"W). 10 November 1996. Bobby Strange. SOCM 0075.

Thamnophis sauritus sauritus (Eastern Ribbon Snake). USA: GEORGIA: LAMAR CO: DOR. Ramah Church Road 0.8 km E of Community House Road, in Redbone Community (32°58'57"N, 84°04'29"W). August 1996. Jim Ozier. SOCM 0076.

Thamnophis sirtalis sirtalis (Eastern Garter Snake). USA: GEORGIA: DOUGLAS CO: near jct. of Kings Hwy. and Queens Road (33°41'03"N, 84°46'50"W). 2 September 1996. Dan and Michelle Emsweller. SOCM 0077. LAURENS CO: Beaverdam Wildlife Management Area (32°40'16"N, 82°56'29"W). 2 November 1996. Robert Moulis and Jeff Cook. SOCM 0023. MONROE CO: DOR. U.S. Hwy 23 5.6 km N of Georgia Hwy 18 (33°03'59"N, 83°46'54"W). 11 June 1996. John Jensen. UGAMNH 27346.

Virginia valeriae (Smooth Earth Snake). USA: GEORGIA: MONROE CO: adjacent to Rum Creek Drive 0.3 km N of Georgia Hwy 18 (33°01'55"N, 83°48'22"W). 5 June 1996. Ted Woodward. UGAMNH 27345.

Literature Cited

Williamson, G. K., and R. A. Moulis. 1994. Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Spec. Pub. 3:1–712.

Recent Amphibian and Reptile Distribution Records for Wisconsin

GARY S. CASPER

Section of Vertebrate Zoology, Milwaukee Public Museum
800 West Wells Street, Milwaukee, Wisconsin 53233, USA
e-mail: gsc@csd.uwm.edu

The following 46 distribution vouchers of amphibians and reptiles represent new county records for Wisconsin based on Casper (1996). These records were acquired through the Wisconsin Herpetological Atlas Project, a scientific program of the Milwaukee Public Museum (http://www.mpm.edu/collect/vertzo/herp/atlas/welcome.html).

All specimens were verified by Robert W. Henderson, except where otherwise noted. Collection acronyms are: MPM—Milwaukee Public Museum, Milwaukee, Wisconsin (numbers prefaced with "P-" refer to photographs); USNM—National Museum of Natural History, Washington, D.C.

CAUDATA

Ambystoma laterale (Blue-spotted Salamander). ADAMS Co: NE 1/4 of SE 1/4 Sec. 36, T18N, R5E. 24 April 1994. Bill Miller. MPM P-545. New county record; fills distribution gap in central Wisconsin (Casper 1996). Specimen found under plywood sheet at yard edge abutting oak woods.

Ambystoma maculatum (Spotted Salamander). CHIPPEWA Co: 205th Avenue, E 1/2 Sec. 26, T31N, R8W. 29 September 1995. Janine Polk. MPM P-592. New county record; slightly extends range south by ca. 25 km in northwestern Wisconsin (Casper 1996; Vogt 1981), but still north of the tension zone where the northern hardwoods province begins to change into the southern prairie forest province (Curtis 1959).

Ambystoma tigrinum tigrinum (Eastern Tiger Salamander). CHIPPEWA Co: County Line Road "a bit east" of Sherman Creek, S 1/2 Sec. 35, T28N, R10W. 30 September 1995. Janine Polk. MPM P-595. New county record (Casper 1996), very close to Eau Claire County record mapped by Vogt (1981). Collector watched specimen crawl across road from Chippewa County to Eau Claire County. TREMPEALEAU Co: Rt. 10 just E of Buffalo County line, SW 1/4 Sec. 6, T24N, R9W. 11 August 1996. Janine Polk. MPM P-549. New county record (Casper 1996), extends range ca. 25 km south from closest point plotted by Vogt (1981) in northwestern Wisconsin.

Hemidactylium scutatum (Four-toed Salamander). CHIPPEWA Co: just off Moon Ridge Trail (245th Avenue) and Norway Trail, NE 1/4 Sec. 5, T31N, R7W. 14 July 1996. Janine Polk. MPM P-550. New county record (Casper 1996). In rotten log in maple woods near stream and marsh.

Necturus maculosus maculosus (Common Mudpuppy). IRON Co: Secs. 17/18, T43N, R3E. September 1994. J. Zarzycki. MPM P-576. New county record within expected range (Casper 1996). RUSK Co: SW 1/4 of SW 1/4 Sec. 26, T35N, R6W. 22 August 1994. Christian W. Cold. MPM P-568. New county record within expected range (Casper 1996).

Notophthalmus viridescens louisianensis (Central Newt). CHIPPEWA Co: 225th Avenue, W 1/2 Sec. 16, T31N, R8W. 29 September 1995. Janine Polk. MPM P-591. New county record (Casper 1996) in center of large distributional gap mapped by Vogt (1981) and Conant and Collins (1991) in west-central Wisconsin. This distributional gap should now be considered an artifact of collecting bias.

Plethodon cinereus (Redback Salamander). CHIPPEWA Co: near Deer Fly Trail, SE 1/4 Sec. 2, T31N, R8W. 10 August 1996. Janine Polk. MPM P-551. New county record expanding distribution in west-central Wisconsin (Casper 1996). Under log in mature maple woods. This record and recent records for Dunn and Pierce counties (Casper 1996) warrant including all of northwestern Wisconsin within the expected range, thereby updating the distribution mapped by Conant and Collins (1991).

ANURA

Hyla chrysoscelis (Cope's Gray Treefrog). CHIPPEWA Co: SE 1/4 of SW 1/4 Sec. 32, T30N, R7W. 30 May 1995. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending). New county record (Casper 1996); extends range ca. 50 km east in northwestern Wisconsin (Vogt 1981). EAU CLAIRE Co: marsh along Langdell Road, NE 1/4 Sec. 28, T26N, R10W. 31 May 1995. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending). New county record within expected range (Casper 1996). *Hyla versicolor* was calling at same site. PEPIN Co: small marsh along Rt. H, NE 1/4 Sec. 11, T25N, R11W. 31 May 1995. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending). New county record, continuing documentation of distribution in west central Wisconsin (Casper 1996). RUSK Co: along 45 Road, SW 1/4 Sec. 16, T33N, R8W. 1 June 1996. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending). New county record (Casper 1996); extends range ca. 50 km east in northwestern Wisconsin (Vogt 1981).

Hyla versicolor (Gray Treefrog). EAU CLAIRE Co: marsh along Langdell Road, NE 1/4 Sec. 28, T26N, R10W. 31 May 1995. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending). New county record filling distributional gap in west central Wisconsin (Casper 1996). *Hyla chrysoscelis* was calling at same site.

Pseudacris crucifer crucifer (Northern Spring Peeper). PEPIN Co: small marsh along Rt. H, NE 1/4 Sec. 11, T25N, R11W. 31 May 1995. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending); new county record completing distribution in west central Wisconsin (Casper 1996). ROCK Co: wetland on west side of Eagle Road 0.3 mi. north of Gibbs Lake Road, NE 1/4 of SE 1/4 Sec. 22, T4N, R1E. 19 April 1995. Kathy Kirk. Identification by call, MPM audio tape (Cat. No. pending); new county record adding to southern Wisconsin range (Casper 1996). RUSK Co: W7047 Broken Arrow Road, NE 1/4 of NE 1/4 Sec. 19, T33N, R5W. 8 September 1996. Earl Meyer. MPM P-558; near Storm Road, NW 1/4 of NW 1/4 Sec. 19, T34N, R6W. 20 August 1994. Christian W. Cold. MPM P-566. New county record completing distribution in northwestern Wisconsin (Casper 1996). Considered a common frog in Rusk County.

Pseudacris triseriata (Western Chorus Frog). IRON Co: Threeten Road, NW 1/4 of SW 1/4 Sec. 22, T43N, R3E. 26 May 1996. Bruce Bacon. Identification by call, MPM audio tape (Cat. No. pending). New county record (Casper 1996) for northern Wisconsin, where this species is rare and local; calling from shallow sedge meadow. RUSK Co: Potato Creek Wildlife Area, NW 1/4 Sec. 20, T33N, R8W. 3 May 1996. Janine Polk. Identification by call, MPM audio tape (Cat. No. pending). New county record within expected range (Casper 1996).

Rana septentrionalis (Mink Frog). CHIPPEWA Co: on Bob Lake Road (175th Street), S 1/2 Sec. 23, T31N, R8W. 29 September 1995. Janine Polk. MPM P-593. New county record (Casper 1996); extends range ca. 50 km west and 85 km south of localities mapped by Vogt (1981). RUSK Co: near south shore Perch Lake off Perch Lake Road, NE 1/4 of NE 1/4 Sec. 1, T35N, R9W. 13 August 1994. Christian W. Cold. MPM P-565. New county record within expected range (Casper 1996).

Rana sylvatica (Wood Frog). RUSK Co: Potato Creek Wildlife Area at jct Rt. D and 45 Road, SW 1/4 Sec. 16, T33N, R8W. 3 May 1996. Janine Polk. Identification by call, MPM audio tape (cat. no. pending); NE 1/4 of NE 1/4 Sec. 19, T33N, R5W. 8 May 1996. Earl Meyer. Identification by call, MPM audio tape (cat. no. pending). New county record within expected range (Casper 1996).

TESTUDINES

Apalone mutica mutica (Midland Smooth Softshell). IOWA Co: channel of Wisconsin River, 2.5 mi W Gotham, Sec. 35, T9N, R1E. 13 August 1995. Steve Thiessen. MPM P-598. New county record (Casper 1996), contributing to continuous distribution in Wisconsin River.

Apalone spinifera (Spiny Softshell). DOUGLAS Co: Eau Claire River along Rt. Y, W 1/2 of SW 1/4 of SW 1/4 Sec. 24, T44N, R10W. 13 August 1995. Steve Thiessen. MPM P-598. New county record (Casper 1996), supporting unverified localities mapped by Vogt (1981), and confirming northern limit of range in western Wisconsin (Conant and Collins 1991).

Clemmys insculpta (Wood Turtle). BARRON Co. 8 July 1996. Randy McDonough and Steve Ward. MPM P-577. New county record within expected range (Casper 1996). Found in mixed hardwood forest 0.25 mi from nearest creek. Locality to quarter section available on request from Milwaukee Public Museum.

Emydoidea blandingii (Blanding's Turtle). BARRON Co: 4 mi NE Cumberland, 0.25 mi from Yellow River, NW 1/4 of NE 1/4 Sec. 22, T36N, R13W. 19 June 1995. David Evenson. MPM P-590. New county record, expanding northwestern Wisconsin range (Casper 1996). FOND DU LAC Co: Kettle Moraine State Forest, Long Lake campground, N 1/2 Sec. 25, T14N, R19E. July 1995. Jeff Lorch. MPM P-602. New county record expanding range in east central Wisconsin (Casper 1996).

Graptemys geographica (Common Map Turtle). CRAWFORD Co: Prairie du Chien, presumably Mississippi River, T7N, R7W. 30 August 1927. Francis M. Uhler. USNM 288149. Verified by Ronald I. Crombie. New county record (Casper 1996); fills distributional gap along Mississippi River in southwestern Wisconsin. WAUSHARA Co: Lake Alpine in Willow Creek basin of Fox River watershed, Sec. 4, T18N, R11E. 1991 & 1996. Roberta Plummer. MPM P-556 and P-584. New county record (Casper 1996); closes distributional gap in central Wisconsin.

Graptemys pseudogeographica pseudogeographica (False Map Turtle). CRAWFORD Co: Prairie du Chien, presumably Mississippi River, T7N, R7W. 30 August 1927. Francis M. Uhler. USNM 288153. Verified by Ronald I. Crombie. New county record (Casper 1996); fills distributional gap along Mississippi River in southwestern Wisconsin.

Sternotherus odoratus (Common Musk Turtle). COLUMBIA Co: Fox River W of Pardeeville, 0.3 mi E Swan Lake, Sec. 5, T12N, R10E. 11 June 1994. Randy Grimes. MPM P-600. New county record (Casper 1996); closes distributional gap in south central Wisconsin. Collector reports species as "fairly common" at the site. RICHLAND Co: on Lone Rock dike near boat landing along Wisconsin River, SE 1/4 Sec. 3, T8N, R2E. 6 June 1995. Al Cornell and Mike Anding. MPM P- 569. New county record (Casper 1996) within continuous lower Wisconsin River distribution.

SERPENTES

Diadophis punctatus edwardsii (Northern Ringneck Snake). DOUGLAS Co: Big Manitou Falls at Pattison State Park, Sec. 22, T47N, R14W. 16 June 1996. Chris Evavold. MPM P-536. New county record (Casper, 1996). Individual found on shaded park trail; extends range ca. 60 km W of verified localities mapped by Vogt (1981) and complements Vogt's unverified central Douglas County record. TAYLOR Co: 18 mi W Medford on Rt. 64, SW 1/4 Sec. 36, T31N, R3W. 19 June 1996. Jon Roti Roti. MPM P-547. New county record within expected range (Casper 1996).

Elaphe vulpina vulpina (Western Fox Snake). ONEIDA Co: 22nd Avenue north of Beaver Avenue, Sec. 4, T19N, R11E. April 1994. Roberta Plummer. MPM P-585. New county record (Casper 1996), adding to north central Wisconsin distribution. WAUSHARA Co: Rt. 17, Sec. 15, T37N, R9E. 30 July 1995. Ronald Eckstein. MPM P-582. New county record within expected central Wisconsin range (Casper 1996).

Heterodon platirhinos (Eastern Hognose Snake). RICHLAND Co: Lone Rock Wildlife Area, Sec. 3, T8N, R2E. 19 May 1995. Steve Thiessen. MPM P-542. New county record (Casper 1996) within documented southwestern Wisconsin range. Individual found at edge of open sand area and pine woods.

Lampropeltis triangulum triangulum (Eastern Milk Snake). RICHLAND Co: Rt. Q, Sec. 28, T10N, R1W. 5 July 1995. Gary Eldred. MPM 28002. Second specimen found 3 mi SE Sylvan, T11N, R2W. 19 July 1934. Charles E. Burt. USNM 99807. Verified by Ronald I. Crombie. This latter specimen was previously reported by Burt (1935) without giving the specimen number, and has been overlooked by subsequent authors. Re-discovered county record (Casper 1996; Vogt 1981); fills gap in southern Wisconsin range. LAFAYETTE Co: Old Rt. Q, SE 1/4 of SW 1/4 Sec. 27, T4N, R5E. 28 May 1995. Gary Eldred. MPM 28004. New county record (Casper 1996); fills gap in southern Wisconsin range.

Nerodia sipedon sipedon (Northern Water Snake). BARRON Co: NE shore of Rice Lake at 89 Monroe Avenue, NE 1/4 Sec. 16, T35N, R11W. 10 July 1996. Elizabeth L. Brown. MPM P-553. New county record (Casper 1996); adds to northwestern Wisconsin range. WAUPACA Co: Anderson Road just N of Rt. 49, E 1/2 Sec. 21, T24N, R11E. 1 October 1996. Mitch Taylor. MPM 27994. New county record (Casper 1996); expands central Wisconsin range.

Pituophis catenifer sayi (Bullsnake). DUNN Co: Red Cedar Road near Chippewa River, NW 1/4 Sec. 32, T26N, R12W. 30 April 1995. Janine Polk. MPM P-561. New county record closing distributional gap between Pierce and Eau Claire counties (Casper 1996); extends range ca. 85 km northwest from nearest confirmed locality mapped by Vogt (1981). RICHLAND Co: just W of Rt. 130 on Rt 14, W of Lone Rock, Sec. 1, T8N, R2E. 19 May 1995. Steve Thiessen. MPM P-597. New county record (Casper 1996); completes continuous distribution along lower Wisconsin River corridor.

Storeria dekayi (Brown Snake). CHIPPEWA Co: 205th Avenue, E 1/2 Sec. 26, T31N, R8W. 29 September 1995. Janine Polk. MPM P-594. New county record filling distributional gap in west central Wisconsin (Casper 1996; Conant and Collins 1991; Vogt 1981).

Storeria occipitomaculata occipitomaculata (Northern Redbelly Snake). WAUPACA Co: Sec. 21, T24N, R11E. Spring 1994. Mitch Taylor. MPM 27989. Found dead on road. New county record (Casper 1996); continues documentation of expected range throughout Wisconsin.

Thamnophis sauritus septentrionalis (Northern Ribbon Snake). ADAMS Co: in pothole ca. 5 mi W Briggsville, Sec. 32–34, T14N, R7E. 22 September 1929. Francis M. Uhler. USNM 307855. Verified by Ronald I. Crombie. New county record (Casper 1996); extends range ca. 75 km N of Dane County population and ca. 160 km W of Sheboygan County population for this highly localized species that occurs in isolated populations in Wisconsin.

Acknowledgments.—I thank the collectors named above for their contributions to the Herp Atlas, Jack Puelicher, Allen Young and Robert Henderson for their continuing support, and Ronald Crombie and George Zug for their kind assistance during my visit to the USNM collection.

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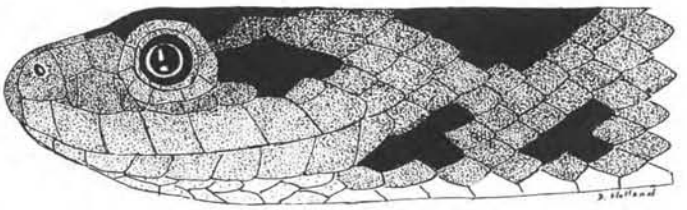
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BOOK REVIEWS

Amphibien der Westafrikanischen Savanne by Mark-Oliver Rödel. 1996. Edition Chimaira, Frankfurt am Main, Germany. ISBN 3-930612-06-2. Softcover, A5 format (15 x 21 cm), 283 pp., plus 8 color plates. Approx. US $39.95.

ALAN CHANNING
Biochemistry Department, University of the Western Cape
Private Bag X17, Bellville 7535, South Africa
e-mail: Alan@Mbiol.uwc.ac.za

There is little accessible literature on the frogs of West Africa and the title of this work encouraged me to get to grips with the frog fauna of a relatively unknown part of the world. However, I was both impressed and dismayed by this potentially useful book.

Mr. Rödel spent 19 months over a four-year period studying tadpole ecology in the Comoé National Park in northeastern Ivory Coast. This book reflects his own observations and draws on the work of colleagues and the published literature. The resulting product includes information about frogs found throughout the West African savanna belt from Senegal to the borders of Chad and Cameroon.

The text starts with a map of the part of West Africa covered, and with a description of the savanna. Details of geography, geology, and climate are provided for the Comoe National Park, and the major amphibian habitats—rivers, forests, and savannas—are outlined. The text is well researched and clearly written and is illustrated throughout with clear, well-labeled, stippled or line drawings. The production values are less impressive. The first signs of this are the fuzzy photographs included in the introductory section.

The book deals with 51 species under the following headings: synonomy, description, color in life, color in alcohol, call, eggs, tadpoles, habitat, biology, distribution, similar species, and other remarks. German common names are supplied for all the taxa. The list of species covered is comprehensive, not limited to savanna frogs as the title suggests, but also including frogs found in adjacent rain forest and gallery forest. Summaries are provided in German, English, and French.

Although some of the species accounts are based entirely on the literature, the author includes many of his own observations. One example that lays a long-standing error to rest concerns *Hemisus marmoratus*. It is repeatedly and incorrectly reported that the female lays her eggs in a burrow and then digs a tunnel to allow the tadpoles to reach the water. This error was first published in the late 1920s. The author has photographs and records to show that the tadpoles are carried on the back of the female, overland to water. Similar observations have been reported previously, but ignored in favor of repeating the mistakes of well known authors.

The calls are described with reference to published data, and sonograms and oscillograms for 25 species are presented, including the first sonograms of the calls of *Phrynobatrachus latifrons* and *Arthroleptis poecilonotus*. Where sonagrams of west African frogs are given, like *Hylarana galamensis*, no locality data are supplied. In view of the taxonomic confusion surrounding many frog names, with workers in southern, eastern, and western Africa using different names for the same species, and the same name for different species, it would have been valuable if the locality where the recording was made was given with the sonogram.

Many of the species have tadpole mouthparts illustrated by electron micrographs, showing close-ups of labial teeth. Many of the illustrations could have been cropped and enlarged, however, and a hand lens could be handy to see the detail. The tadpole descriptions, with details of development, are thorough and useful. The tadpoles of *Ptychadena schubotzi, Phrynobatrachus latifrons, Hyperolius c. concolor,* and *Afrixalus vittiger* are described for the first time. The extra tadpole details are a reflection of the author's research interests.

The distribution of each species is provided in the form of a list of countries where it has been recorded, with literature citations. The book would have been that much more useful with a map of the distributions in the savanna, as many species are peripheral or restricted to small pockets of specialized habitat, a fact that is lost in the lists of countries.

The final chapter deals with anuran communities in the savanna. It covers survival through the dry season, habitat partitioning, temporal partitioning, reproductive strategies, and tadpole phenology and communities.

The color plates illustrate 39 species, some habitats, eggs of six species, and predators recorded eating frogs. By radio tracking *Hoplobatrachus occipitalis,* the author was able to document that this species is preyed upon by both the Nile monitor, *Varanus niloticus,* and the softshell turtle *Cyclanotis senegalensis.* In addition to the monitor/*Hoplobatrachus* encounter, photos are also provided of a belostomatid water "scorpion" eating *Kassina fusca,* and a fishing spider eating *Hyperolius nitidulus.*

Citations are extensive and accurate, and are one of the strong points of this work. The author has not merely listed the references, but is able to comment on the contents, pointing out errors where they occur. He avoids repeating mistakes from the literature that have been corrected by subsequent authors. It is not often that I have come across such an accurate summary of the literature. I was particularly impressed by the citations from less well-known journals. In particular, the book is a valuable guide to earlier literature.

Some minor errors are present in the text, and the text as a whole could have been improved with careful editing. For example, the author is careless in misspelling *Hildebrandtia* consistently as "*Hildebrantia.*" My dismay is not, however, in the text or illustrations. The author has produced an accurate, readable text that has, however, been less than perfectly assembled into the book. I was initially confused to find figures of one species in the text of another, until I realized that the pages have been bound out of sequence. In my copy the page numbers run 1–48, 53–56, 49–52, 61–64, 57–60, 65–153, (154 is blank), 155–159, (160 is blank), 161–283. It appears as if the text files have been page set from a computer with little memory, as some accounts start on a new page, leaving the previous page half empty, while others run on. Perhaps the DTP program was unable to link files? The poor production and editing is further evidenced by appearance on page 112 of a figure legend *Ptychadena tournieri*, after Guibé and Lamotte 1957, with no accompanying illustration.

Overall, this book will be very useful for anyone wanting an introduction to the literature, or who intends visiting the area. The text is accurate, but the value of the book is marred by amateurish production.

The Neotropical Toad Genus *Atelopus*, by Stefan Lötters. 1996. M. Vences and F. Glaw Verlags GbR, Köln, Germany, 143 pp. US $39.95 (softcover).

RONALD ALTIG
Department of Biological Sciences, Mississippi State University
Mississippi State, Mississippi 39762, USA
e-mail: rga2@ra.msstate.edu

What a strange idea—gather all the literature on a single genus of frogs, categorize, summarize, and synthesize it, insert personal thoughts on selected subjects, and then present all of this as a small book (ca. 14 x 21 cm). The result is a great big, immensely annotated version of a CAAR account with a twist—lots of color photographs of garish frogs and their tadpoles presented as a series of montages on glossy paper in the center of the book.

Lötters divided his presentation into three sections. In the checklist (40 pages), each species account includes a brief description followed by various notations (e.g., type locality, range and habitat, citations of illustrations, the holotype designation, a list of materials presented in the original description, and references, including tadpoles). Lists of synonyms within the genus and taxa moved from *Atelopus* to other groups are presented in appendices, and whether one agrees with the taxonomy based on the literature or on Lötters' decisions is not the point—having the information and citations in one source is valuable. The section on biology (33 pages) includes summaries of morphology, musculoskeleton, cytogenetics and molecular systematics, life history and ecology, reproduction, hybridization, and trends in population declines. Three tables summarize the literature on the musculoskeleton, ecological observations, calls, and toxicity. The third section on distribution (10 pages) includes discussions based on political boundaries, physiogeographical regions (several pertinent figures after the appendices), intrageneric sympatry (with a table), and historical zoogeography and evolution. A genus/species index is included, and drawings that follow the appendices include a skull in two views, jaw musculature, eggs of *A. subornatus*, and multiple views of several tadpoles.

The writing is a bit stilted in a few spots but can always be understood. The text is on a coarse, non-glossy paper, and the small print used in parts of the checklist accounts is near the lower limits of easy reading for me. The 70 photographs of frogs (including an extended *A. subornatus* in the middle of an airborne leap), tadpoles, and eggs are of good to excellent quality.

I extended the concept of this book rather loosely into the future and vacillated on the idea of whether a similar book on every genus would be useful. The answer is probably no, but this book on a reasonably small genus of highly variable frogs with a rather voluminous but scattered literature is useful. Also, as we become more and more addicted to electronic literature searches that usually are limited in scope to the last 10 years or less, such a compilation is a ready source of information. The very point of interest often is hidden within a given paper, and Lötter's summarizations allows one to decide if a given reference is important enough to obtain. These summaries would be noteworthy only if the authors were diligent and accurate, and Lötters seems to have been. I cannot imagine a similar volume on large genera like *Rana* or *Bufo* containing the details to make them worthwhile.

In summary, I liked the book as a summary and a resource, and anyone interested specifically in these frogs or the neotropical fauna in general should have it in their library. I do think that one should always go to the primary literature and not cite this or any similar literature compilation.

Amphibien und Reptilien Deutschlands, edited by Rainer Günther. 1996. Gustav Fischer Verlag, Jena. 825 pp. Hardcover. DM 148,00 (approx. US $100). ISBN 3-437-35016-1.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: abauer@king-kong.vill.edu

Although there exist many field guides to and popular reviews of the amphibians and reptiles of Europe, comprehensive national herpetofaunal works for individual European countries are rarer. In the case of Germany, the last scholarly treatise on the subject was published by Dürigen (1897) a century ago. Since World War II, many German states (Bundesländer) and municipalities have been the subjects of detailed studies of amphibian and reptile distribution, ecology, and conservation status, but books encompassing Germany as a whole have tended to be superficial and nontechnical (e.g., Blauscheck 1985). After 99 years, finally there is a suitable replacement for Dürigen.

Amphibien und Reptilien Deutschlands began as a collaboration between Rainer Günther and late Hans Schiemenz prior to German reunification, and was intended to cover only the then-German Democratic Republic. Political changes in the country made this goal obsolete and facilitated the expansion of coverage to include the entire Federal Republic of Germany. Günther not only edited the volume, but was an author on virtually every chapter, including all of the species accounts. As a result, the book is characterized by a general uniformity of treatment uncommon in most edited works.

The book begins with a history of herpetology in German-speaking countries by F. J. Obst, and a review of the role of the Ice Age on the development of the middle European herpetofauna (including a review of 31 species represented by Plio-Pleistocene fossils) by G. Böhme. Both classes are introduced with overviews of the systematics and distribution of the German species, including brief summaries of higher order (interfamilial) relations. These sections provide a useful background but are not comprehensive. Well-illustrated keys are provided to eggs and larvae of amphibians and to adults of all species. Key couplets are often long and detailed, a necessity when dealing with groups of very similar species such as the green frogs (*Rana lessonae, R. ridibunda*, and *R.* kl. *esculenta*).

Species accounts are the core of the book, covering all 21 amphibians (seven salamanders and 14 frogs) and 14 reptiles (one turtle, seven lizards, and six snakes) native to Germany. Despite the commonly held view that central and western Europe have long been fully documented herpetologically, it should be noted that three species included in this volume are additions to the fauna since the publication of the latest non-technical book on German amphibians and reptiles (Blauscheck 1985). The additions are *Triturus carnifex* (limited in distribution to extreme southeastern Bavaria), *Lacerta bilineata* (recently elevated to specific status), and *Lacerta horvathi* (first recorded in southern Bavaria in 1990). Each account presents original and review data for German populations of the species. Data derived from extralimital populations are generally noted as such and are stressed only in the cases for which data are lacking for German animals (e.g., *Lacerta horvathi*). Each account is relatively comprehensive covering a review of the history and derivation of the Latin and German vernacular names applied to the species, appearance, color and pattern, size, sexual dimorphism, anomalies, karyotype, distribution, habitat, phenology, movement, retreat sites, population

size, vocalization, reproduction, development, diet, predation, defense, threats, and conservation. Individual accounts range from two paragraphs on *Triturus carnifex* to 42 pages for *Rana temporaria*. There is some variation in the way in which the sections dealing with distribution, population size, and conservation are dealt with. For some species these topics are presented on a general regional basis, in others comments are formally divided by Bundesländer. The maps are based on recent records, chiefly since 1960, with the majority of records since the mid-1970s. Points are plotted onto a standard national map showing major rivers and Bundesländer boundaries and divided into grid cells 11.5 km on a side.

The book concludes with red lists (federal and state) of amphibians and reptiles, references, and an index to German and Latin names. The reference list includes more than 2250 citations, perhaps a record for a book of this nature. Although citations are not as complete as one might like (publishers are not listed for books), the reference list as a whole will prove especially enlightening for North Americans who may be unaware of the diversity of outlets in which German herpetological research has been published.

The text is supplemented by 86 tables and illustrated by 328 black and white figures, maps, charts and graphs, ten black and white plates (mostly associated with the amphibian keys), and 16 color plates with 92 individual photos. The color figures are all adequate or better, although not exceptional. All German species are illustrated in color, usually with the locality of the specimen given. Only in the case of *Triturus carnifex* is an extralimital specimen illustrated. Other color photos include typical habitats, larvae, eggs, mating and defensive behaviors. Black and white photos (habitats, sexual variation, abnormalities, larvae, etc.) are not of uniform quality. Some show depth of field focal problems and others seem to have suffered in the conversion from color slides, with too little or too much contrast. Line drawings are unifomly well executed as are the many graphs, sonograms, pie charts, and histograms.

For most North Americans, language will be a barrier to accessing the information in this book and the amount of detail provided will be overkill. Further, the price will be prohibitive for many herpetologists who do not have active research interests in Europe. However, the book stands as one of the best and most comprehensive country guides available. Indeed, in its specificity and presentation of comprehensive primary literature-based data, *Amphibien und Reptilien Deutschlands* is practically unrivaled. The only comparable recent treatment of European species has been in the ongoing *Handbuch der Reptilien und Amphibien Europas*, edited by Wolfgang Böhme (most recent volume—Böhme 1993) which provides more of an emphasis on morphology (including osteology, hemipenial structure, etc.) and, of course, deals with distribution and biology continent wide. Günther has set an impressive example for authors of other European national herpetofaunal volumes to follow.

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The Amphibian Fauna of Sri Lanka, by Sushil K. Dutta and Kelum Manamendra-Arachchi. 1996. Wildlife Heritage Trust of Sri Lanka, 95 Cotta Road, Colombo 8, Sri Lanka. 230 pp. Hardcover with dust jacket. Price: Sri Lankan Rs. 1,500 (approx. US $59.00). ISBN 955-9114-10-7.

INDRANEIL DAS

Centre for Herpetology, Madras Crocodile Bank Trust
Post Bag 4, Mamallapuram 603 104, India

Last reviewed nearly forty years ago by Parakrama Kirtisinghe, the amphibian fauna of the island nation of Sri Lanka (then Ceylon) has increased from 35 species to 53 species. Though well produced for its time, with admirable pen-and-ink sketches, Kirtisinghe's (1957) work is, as expected in tropical countries where biological explorations are incomplete, sadly outdated. As an interim replacement (pending a revision of the fauna now being undertaken by these authors), we are provided with this volume that was brought out during the International Conference on the Biology of the South Asian Amphibians and Reptiles, held in Kandy, Sri Lanka, between 1–5 August 1996. Appropriately, the work honors one of the gifted Sri Lankan naturalists, the late P. B. Karunaratne, collector of many new species of both plants and animals, including some of the herpetological types described by P. E. P. Deraniyagala.

The Introduction contains a short history of explorations in Sri Lanka, a brief review of materials examined, the methods used, an account of Sri Lanka's climate and biogeography (plus a gazetteer with coordinates and altitudes of the 235 sites sampled), and a short (half page) section on amphibian conservation. One is alarmed to read that a decline in precipitation of as much as 25% has taken place during the last century, and few areas of primary forest remain untouched by man.

The book by Dutta (a Lecturer in Developmental Biology at Utkal University, Bhubaneshwar, India) and Manamendra-Arachchi (Research Associate with the Wildlife Heritage Trust of Sri Lanka, WHT, Colombo, Sri Lanka), however, is much more than a field guide. Because it contains synonymies, diagnoses, taxonomic comments, and is lavishly illustrated with both color and black and white photos, it approaches a monograph in technical quality. Born out of a partnership between Dutta (who examined virtually all relevant types as part of a thesis at the University of Kansas; see Dutta 1985) and Manamendra-Arachchi (who did fresh field work to gather new distribution and taxonomic data), the work illustrates all taxa currently recognized from the island (except the enigmatic *Nannophrys guentheri*, whose taxonomic status is questionable and also, surprisingly, the widespread *Microhyla ornata*) with a color photo and very often, photographs of the types and several non-types, from various localities in the country and sometimes from neighboring India. For most photographs, the captions provide information on size of specimen, location, and museum number. The authors deserve to be commended, not only for gathering a near-comprehensive collection of photos, but also for their industry in providing redescriptions of virtually all species through reexamination of the appropriate type specimens and new collections.

The system of classification of ranids is that proposed by Dubois (1992), while the caecilian accounts are based primarily on the work of Nussbaum and Gans (1980). Each species account includes the currently recognized scientific name, synonymy, including the type locality and present location of the primary type, a diagnosis, description (simple and superficial in terms of general body proportions, webbing of toes, etc.), plus color in life,

taxonomic comments, distribution, etymology, and a list of specimens examined (including localities). Accompanying every species is a small distributional dot map. Other illustrations include the hand and foot of frogs and toads, and sometimes other details of the body, such as drawings of head to show mandibles and cranial crests, and radiographs showing the skeletal system.

The weakest section of the book is the bibliography (as a referee of the manuscript of this work, my comments on the bibliography arrived too late to be incorporated). Presumably the section pertaining to amphibian taxonomy and nomenclature came from Dutta's (1985) unpublished doctoral thesis, although new references on the island's vegetation and biogeography have also been included. Problems include incomplete and sometimes incorrect references; about a third of the citations suffer from one or more of these problems. Future editions will benefit by clearing up these problems, as well as providing more substantial descriptions that have a bearing on amphibian phylogeny, such as osteology, vocalization, musculature, and especially details of larval stages, breeding biology, behavior, and chromosomal data.

The last few pages are adorned with color plates of various species of amphibians of virtually every family found in Sri Lanka, all suspected to be undescribed. Terse descriptions of morphological characters point out how they differ from name-bearing species, and although these await comparison with types of species now considered synonymous with species considered valid, it does indicate that the fauna will grow many fold. The rhacophorids are a group to watch out for, as this is the one most difficult, not only to sample, on account of their often arboreal habits, but also because of their frequent lack of clear external distinguishing features, polymorphism, and their rich but unassessed synonymy.

Issued by the Wildlife Heritage Trust of Sri Lanka, this is a well-produced volume with good printing and the binding appears solid enough to withstand years of use in the humidity of the Sri Lankan rainforests, home of much of the country's biodiversity. The Good Samaritan in the production of this and other high quality publications of the WHT is the Founder of the Trust, Rohan Pethiyagoda, also the Managing Editor of the new *Journal of South Asian Natural History*, and a competent ichthyologist in his own right. The volume bears testimony to what can be achieved by a small group of dedicated naturalists.

To sum up, this fine publication will contribute substantially to reawakening interest in a key indicator group of vertebrates, as well as increasing the accuracy of field and lab identifications. I, for one, look forward to the promised systematic revision of the fauna of this enchanting island.

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Gecko Fauna of the USSR and Contiguous Regions by Nikolai N. Szczerbak and Michael L. Golubev. 1996. Translated from the Russian by Michael L. Golubev and Sasha A. Malinsky. Editorial supervision by Alan E. Leviton and George R. Zug. Society for the Study of Amphibians and Reptiles. xii + 233 pp. Hardcover. US $48.00 plus shipping. ISBN 0-916984-39-7.

STEVEN C. ANDERSON

Department of Biological Sciences, University of the Pacific
Stockton, California 95211, USA, and
Department of Herpetology, California Academy of Sciences
San Francisco, California 94118, USA
e-mail: sanderson@uop.edu

When the Russian edition of this book first appeared in 1986, it was a landmark in herpetology in that it was the first work that attempted a revision of all of the gekkonid species of the vast area of the former Soviet Union as well as all of the species outside of the Soviet Union that belong to genera having representatives within that region. In addition, it covered genera such as *Tropiocolotes* and *Carinatogecko*, which occur in immediately adjacent countries. Thus it served as a revision of nearly all of the Palearctic geckos from North Africa to Mongolia. It did, however, exclude a number of genera that occur in areas far from the Soviet Union, e.g., *Stenodactylus* (which had recently been revised by Arnold 1980), *Pristurus* (a genus principally of the Arabian Shield), *Hemidactylus* (a pantropical genus with temperate and subtropical representatives), other genera with expanded digital ornamentation, such as *Asaccus*, *Ptyodactylus*, *Tarentola*, and strictly North African genera, such as *Hemitheconyx* and *Geckonia*. At least one review in English of the Russian edition has been published (Bauer 1987).

Unfortunately, the Russian edition was of limited availability, and limited access to non-Russian speakers (including most western Europeans and Americans, of course). The new edition thus brings this important work to a much wider audience of herpetologists and herpetoculturists. It has been printed on much better (acid-free) paper stock, with improved reproduction of illustrations, including 8 color plates (24 photos, many of which are new for this edition).

The book begins with an editors' preface, an explanation of the circumstances that gave rise to this English edition, differences between the two editions, etc. This is followed by the translator's introduction to the English edition. This section, written by Golubev, is a fascinating account of the original preparation of the work, the difficulties encountered, and the limitations of time, length, and content imposed by the Presidium of the Ukrainian SSR Academy of Sciences. I recommend this section to all readers, but especially to those dissatisfied with aspects of the work. It may not blunt all criticism (nor should it), but it will acquaint many American and European scholars with bureaucratic problems in research and publication that they are fortunate not to face (at least not in the same measure).

Apparently, it was decided at the beginning of the translation process that a revision of the work would not be practicable at this time, and thus only factual errors in the original text were corrected, the translation adhering closely to the Russian text (with necessary changes for rendering it clear in grammatically correct English). An important addition, however, is a supplemental bibliography of important papers on Palearctic geckos published since 1986. These new references are cited in footnotes identified with an asterisk, as the numbered footnotes of the original Russian edition have been retained.

The General Section, which begins the actual text of the book, includes a brief critical review of the prior study of the gecko fauna of the regions covered, materials and methods (including places and dates where field work was undertaken, characters used in systematic studies, ecological and behavioral observations), phylogenetic hypotheses and zoogeographical analysis, and a key to the genera. The bulk of the book is taken up with the Systematic Section, consisting of family (Eublepharidae and Gekkonidae), generic, and species accounts. The Literature Cited section contains 328 references, the Russian titles transliterated into Roman type for this edition, and an additional 53 new references.

In the systematic accounts, all taxa are defined or diagnosed and there are keys to all taxa. The keys that I have tested are workable and satisfactory. For the definitions and diagnoses, only morphological characters are used, and even osteological characters appear only in the family definitions. All taxa are given vernacular names, the English names being direct translations of the Russian names. In each species account, the vernacular and Latin names are typically followed by the type locality, the karyotype (when known), primary synonymy, diagnosis, additional characters useful in identification, holotype (or designation of lectotype or neotype), definition, color and pattern, sexual dimorphism and age variation, distribution, geographic variation, ecology, habitat, and other aspects of natural history, such as response to temperature, daily activity, seasonal activity, shedding, feeding, reproduction, growth rate, natural enemies, and aspects of behavior. Obviously, not all of these categories of information are available for all species, but many species were studied by the authors in the field, others were studied in captivity, and some species have a considerable literature covering natural history. Spot distribution maps are provided for each species, each locality numbered and identified in the map legend. Each species has been photographed. Often there is a photograph of the entire specimen, and in each case, critical areas of the specimen are enlarged, the scale patterns reinforced with pen and ink. Whereas, such illustrations may not be as aesthetically pleasing as many line drawings, the accuracy of representation is reliable. There are also a number of black and white habitat photographs.

The authors examined some 5000 specimens and the book contains a wealth of essential data, which are unlikely to be published again in such detail, in spite of the fact that the details of the original manuscript were much reduced by the constraints imposed by the Presidium. Consequently, this book is going to remain essential for the foreseeable future for all who study Palearctic geckos.

Although Szczerbak and Golubev have clarified much of the confusion concerning the nomenclature of geckos of temperate Asia, and while most of their generic allocations of species have been accepted since their study first appeared in 1986, controversy is bound to remain. Because their generic and subgeneric definitions are based on external morphology and, for the most part, on aggregate similarities rather than on synapomorphies, additional support from other characters and approaches will be needed. Indeed, it is possible to formulate different generic definitions and associations based on external morphology. The details of my own differences from their nomenclature are put forth in my book on Iranian lizards (Anderson, in preparation).

One serious problem, important because it embraces so many Asian species, involves the misapplication of the name *Tenuidactylus* Szczerbak and Golubev, 1984 (type species *Gymnodactylus caspius* Eichwald, 1831), which is a junior synonym of *Cyrtopodion* Fitzinger, 1843 (type species *Stenodactylus scaber* Heyden, 1827), Golubev's footnote on p. 126 not withstanding (see Kluge 1985). I have discussed this with Golubev and he agrees.

The phylogenetic hypotheses set forth in the first section of the book (pp. 16–23) will stir disagreements, again because they are based largely on plesiomorphic characters and because they are not supported by the sorts of cladistic analyses that have become standard in systematics in recent years. By way of example, the genus *Carinatogecko* appears to have been derived from a species group in *Tenuidactylus* (their subgenus *Mediodactylus*), making the latter genus paraphyletic. Similarly, *Agamura* appears to be derived from their subgenus *Cyrtopodion* in their analysis, and "... the genus *Tropiocolotes* is close to the genus *Alsophylax*, especially the subgenus *Asiocolotes*, which, probably, is the ancestral branch for the genus *Alsophylax*" (p. 18). Thus, the more accurate their phylogenetic conclusions, the more extensive will be the necessary nomenclatural changes, eventually. To bring gecko nomenclature into line with current systematic practice, either the paraphyletic "ancestral" genera will need to be more inclusive, or all of the derived taxa will need to be redefined.

I do not mean to be hypercritical here; the taxonomy and methodology employed in this book represents the state of the art of systematic practice in the Soviet Union in the mid-1980s. Further, the broad geographic area covered, the inaccessibility of several regions (e.g, Iran, Afghanistan, Baluchistan, much of the Arabian peninsula) makes the acquisition of fresh material for biochemical and karyotypic studies impossible. Thus, the phylogenetic hypotheses advanced here represent a new starting point for future testing and for a future taxonomy of Palearctic geckos.

I did not read the book with the view of catching typos or trivial mistakes. As explained in the Editors' Preface and the Translator's Introduction, at least six people read the manuscript, in part to catch such errors. Inevitably, some remain, and one which may cause confusion, is the use of *T[enuidactylus]* for *T[ropiocolotes]* on p. 9.

Recently, SSAR has been placing dust jackets on its *Contributions to Herpetology*, of which this book is Vol. 13 of the series. The front of the dust jacket is a drawing by David M. Dennis of the skin of *Eublepharis macularius* upon which the title is superimposed in red. Purists may complain that the money would have been better spent on other aspects of the book. However, part of the success of this series has been the marketing of books to readers outside of the scholarly professional community, and the dust jackets and color plates are intended to enhance the appeal to this larger audience.

There is a growing number of serious herpetoculturists for whom geckos have a particular appeal, and increasingly, these people are investing in the more technical literature concerning the groups of their interest. Many gecko enthusiasts will find this book useful, particularly for the natural history information it contains. Obviously, professional herpetologists who study the systematics of geckos or the herpetofauna of the Palearctic will need this publication in their personal and/or institutional libraries.

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Arnold, E. N. 1980. Reptiles of Saudi Arabia: A review of the lizard genus *Stenodactylus* (Reptilia: Gekkonidae). Fauna Saudi Arabia 2:368–404.

Bauer, A. M. 1987. [review of] The gekkonid fauna of the U.S.S.R. and adjacent countries, by N. N. Szczerbak and M. L. Golubev. Copeia, 1987(2):525–527.

Kluge, A. G. 1985. Notes on gecko nomenclature (Sauria: Gekkonidae). Zool. Meded. Leiden 59:95–100.

PUBLICATIONS RECEIVED

Snakes of Louisiana, by Jeff Boundy. 1997. Louisiana Department of Wildlife and Fisheries, Fur and Refuge Division, P.O. Box 98000, Baton Rouge, Louisiana 70898-9000, USA. 32 pp. Softcover. US $5.00. Available from the Louisiana Dept. of Wildlife and Fisheries, Information Division (address as above).

A short guide designed to deal with common questions regarding snake identification, snake bite, and snake folklore in Louisiana. In addition to general information and a checklist of Louisiana snakes by region of the state, the booklet provides short accounts (common and scientific names, identifying characteristics, habits, and distribution within Louisiana) for each of the native species. Sixty color photos illustrate the 40 species covered.

Verbreitung, Ökologie und Schutz der Gelbbauchunke, edited by Andreas Nöllert. 1996. Naturschutzreport Heft 11(1) [Thüringer Landesanstalt für Umwelt, Postfach 24, D-07727 Jena, Germany]. 325 pp. in two volumes. Softcover. DM 20,00 (approx. US $13.00). ISSN 0863-2448.

A collection of papers on the distribution, ecology and conservation of the discoglossid frog *Bombina variegata* in Europe. The papers were originally presented at a symposium held at the University of Jena in 1995. The 30 contributions in the first volume include papers on a wide variety of topics in ecology, conservation, and population biology as well as reviews of the distribution and status of populations in Germany (10 papers), the Netherlands, Switzerland, Italy, Slovakia and the Czech Republic, Romania, and the former Soviet Union (one paper each). The volume is well illustrated by charts, graphs, maps, and a large number of color and black and white photographs (chiefly of habitats). The majority of the contributions are in German, although six are in English. Each paper is followed by its own literature cited section, and a second volume containing an exhaustive bibliography of *B. variegata* (approximately 1300 titles) is also provided. This publication presents an up-to-date picture of a widespread and variable taxon of special conservation concern.

Sampling Amphibians in Lentic Habitats, edited by Deanna H. Olson, William P. Leonard, and R. Bruce Bury. 1997. Northwest Fauna Number 4, Society for Northwestern Vertebrate Biology, Olympia, Washington. Softcover. 134 pp. US $12.00. Available from Janet Jones, Treasurer, Society for Northwestern Vertebrate Biology, 4820 Yelm Highway SE, Suite B-175, Olympia, Washington 98503, USA.

Here is a straightforward handbook to assist biologists in inventorying and monitoring pond-dwelling amphibians. Although not revealed by the title, the authors state in the Preface that this book is focused on the Pacific Northwest—northern California to British Columbia, and eastward to the northern Rocky Mountains. The authors undertook this project in response to urgent calls for standardized survey protocols, and have responded by enlisting various experts to develop the methodologies, which were then field-tested. The result is an easy-to-use volume, complete with numerous color photographs depicting different wetland habitats, charts, maps, and a list of suppliers of necessary field equipment.

Occupational Health and Safety in the Care and Use of Research Animals, by the Committee on Occupational Safety and Health in Research Animal Facilities, National Research Council, National Academy Press, Washington, D.C. 154 pp. Softcover. US $39.95. ISBN 0-309-05299-8.

A review of animal care management and health hazards associated with the maintenance of animals for research purposes. Although there is little specific to amphibians and reptiles in the book, the basic information and recommendations regarding the appropriate protocols for minimizing health risks to those working with live animals are applicable to any animal care facility. The management of efficient occupational health and safety programs for institutions maintaining animal care facilities is also reviewed. The book is well referenced and includes a subject index.

Interpretive Atlas of Texas Lizards, by Ralph W. Axtell. 1986–1997, *et seq*. Privately published by and available from the author (Ralph W. Axtell, 2814 Rock Hill Road, East Alton, Illinois 62024, USA). Individual accounts available separately. Cost: US $0.10/page + postage and handling.

The most recent installment (number 17) in this series is *Urosaurus ornatus*, the tree lizard. This account totals 29 pages in addition to a detailed range map representing over 900 localities and based on ca. 3540 specimens. Axtell provides an in-depth discussion of distribution in Texas, along with information about type localities, geographic variation, and suggestions for future work.

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
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(209) 299-0161 fax
e-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
208 South Great Road
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Associate Editors

DANIEL D. BECK
Department of Biological Sciences
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Ellensburg, Washington 98926, USA
e-mail: beckd@cwu.edu

LEE A. FITZGERALD
Wildlife and Fisheries Sciences
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e-mail: Lfitzgerald@tamu.edu

DARYL R. KARNS
Biology Department
Hanover College
Hanover, Indiana 47243, USA
e-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
Department of Biology
University of California
Riverside, California 92521-0427, USA
e-mail: jeffrey_lovich@nbs.gov

BRIAN W. BOWEN
Dept. of Fisheries & Aquatic Sciences
University of Florida
7922 NW 71st Street
Gainesville, Florida 32653, USA
e-mail: bowen@icbr.ifas.ufl.edu

DEANNA H. OLSON
USDA Forestry Science Lab
3200 SW Jefferson Way
Corvallis, Oregon 97331, USA
e-mail: olsond@ccmail.orst.edu

Section Editors

Book Reviews
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA
e-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
P.O. Box 58355
Salt Lake City, Utah 84158-0355 , USA
e-mail: Herpbooks@sisna.com

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106, USA

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
e-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
e-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo
Miguel Lillo 251
4000 Tucumán, Argentina
E-mail: postmaster@scro.untmre.edu.ar

Legislation & Conservation
JEFFERY P. DEMUTH
Department of Biological Sciences
Southeastern Louisiana University
SLU 814
Hammond, Louisiana 70402, USA
e-mail: jdemuth@selu.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
e-mail: cwpaint@unm.edu

Natural History Notes
R. KATHRYN VAUGHAN
Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
e-mail: rkvaughan@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
e-mail: pstone@aix1.ucok.edu

Copy Editors: *Ellin Beltz, Anne M. Maglia, Jenny Pramuk, Martin J. Rosenberg, Christopher Sheil, Amy Sproston*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

WWW: http://falcon.cc.ukans.edu/~gpisani/SSAR.html



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1997 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).

1998 Annual Meeting
Society for the Study of Amphibians and Reptiles
41st Annual Meeting

together with
American Society of Ichthyologists and Herpetologists
and
The Herpetologists' League

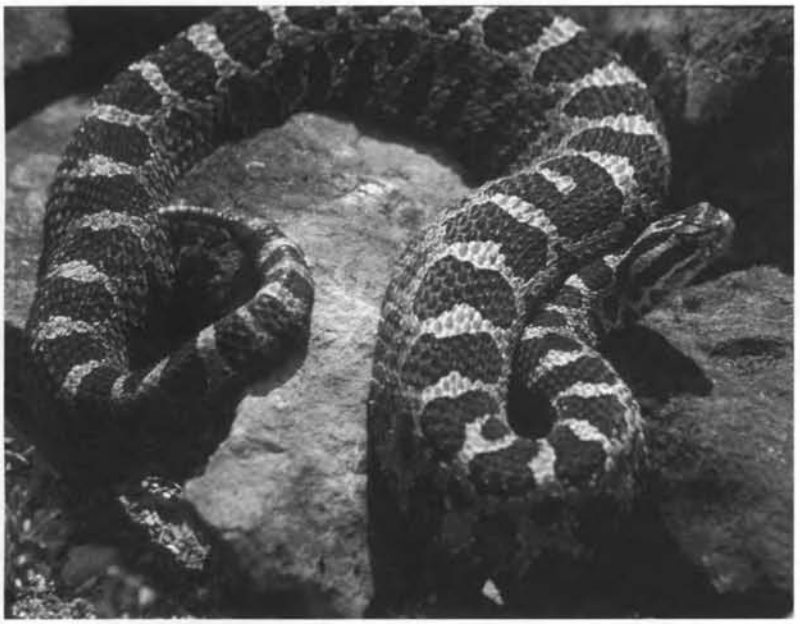
16 – 22 July 1998
University of Guelph, Guelph, Ontario, Canada

The University of Guelph is situated in the Ontario city of Guelph, population 90,000, 100 km (60 miles) west of Toronto. Guelph combines the advantages of a small town atmosphere with the convenience of being located next to a large urban center. The city is rich in 19th century history and architecture. It was founded in 1827 by John Galt in honor of Britain's Royal Family, earning it the moniker the Royal City.

Keynote Address: The keynote address ("The Evolution of Morphological Novelties") will be given by Sharon Emerson, HL's Distinguished Herpetologist for 1998.

Symposium: "Recent Advances in Anuran Communication: A Symposium Honoring Dr. Stan Rand." *Organizer:* Michael J. Ryan, Clark Hubbs Regents Professor in Zoology, Department of Zoology, University of Texas, Austin Texas 78712, USA; e-mail: mryan@mail.utexas.edu. Tel: (512) 471-5078; Fax: (512) 471-9651.

Symposium: "Phenology of Fishes, Amphibians, and Reptiles: Integrating Organism-level and Population-level Perspectives." *Organizers*: Eric Schultz and Kentwood Wells, Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3042, USA.



Sistrurus catenatus, the Eastern Massasauga Rattlesnake, is a threatened species in Canada. This specimen was encountered on the Bruce Peninsula in Ontario. Photo by Josh Feltham.

Symposium: "To Freeze or not to Freeze: Amphibians and Reptiles in the Cold." *Organizer:* Kenneth B. Storey, Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, Canada K1S 5B6; e-mail: kbstorey@ccs.carleton.ca. Tel: (613) 520-3678; Fax: (613) 520-4497.

Symposium: "Herpetology in the Lab and Field: A Symposium in Recognition of the Career of Ronald A. Brandon." *Organizers:* Steve Reilly, Department of Biological Sciences, Ohio University, Athens, Ohio 45701, USA; e-mail: reilly@ohio.edu. Tel: (614) 593-3343, and Ronn Altig, Drawer GY, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi 39762, USA. E-mail: rga2@Ra.MsState.edu. Tel. (601) 325-7561.

Contributed Paper and Poster Presentations: There will be concurrent sessions of contributed papers and posters throughout the conference.

Student Paper Awards: Henri Seibert prizes (US $200.00) will be awarded in four categories: Systematics, Ecology/Evolution, Conservation, and Physiology/Morphology. *Refer to details elsewhere in this issue of HR.*

Multimedia Presentations: "HERPETOLOGY OF THE WEST" and "AMPHIBIANS OF THE APPALACHIANS" by David Dennis and Eric Juterbock; "HERPETOLOGICAL NAMESAKES" by Kraig Adler and David Dennis.



The Town Lattice Covered Footbridge on the Speed River was built by 400 timberframers on a design dating back to the 19th Century. Photo courtesy of Guelph Visitor and Convention Services.

Social Activities: General Reception at the University Center Building, SSAR Auction, Picnic, Graduate Student Reception, and Banquet.

Live Exhibit: Live amphibians and reptiles of Ontario will be on display and available for viewing and photo sessions.

Vendors: Books, T-shirts, and equipment for those in the field of herpetology.

Venue: All paper and poster sessions will be held at the University of Guelph campus.

Costs: Pre-registration $170.00 Canadian (approx. US $120) regular, $85.00 CAN (approx. US $60) student, $85.00 (approx. US $60) accompanying person. After April 1, 1998, costs are $220.00 (approx. US $155) regular, $125.00 (approx. US $88) student, and $125.00 (approx. US $88) accompanying person.

Accommodations: The University of Guelph Residences are available to those delegates wishing on-site housing. Delegates may choose to stay in one of our local hotels or bed and breakfasts. Accommodations can be booked through our conference services. For details refer to the Call for Papers or visit our Web site.

Student Travel Grants: Ten travel grants of US $200.00 each will be available for SSAR student members. *Refer to details elsewhere in this issue of HR.*

Travel Arrangements: The official travel agency for the 1998 meetings is Golding Travel Ltd., South City Centre,



Ambystoma laterale-(2)jeffersonianum or LJJ. Several other genomic combinations of hybrid *Ambystoma* are encountered in southern Ontario. Photo by Jim Bogart.

304 Stone Road West, Guelph, Ontario, Canada N1G 3C4. Tel: (519) 836-5100, Fax: (519) 836-1322, e-mail: golding@wat.hookup.net. The recommended airport is Toronto's Pearson International Airport, ca. 100 km (60 mi.) east of Guelph. Shuttle service from the airport is available through "Red Car Service." The conference rate is $29.00 Can. per person each way, payable on the trip; please refer to the form in the Call for Papers. Travel by Rail: there is a twice daily service to Guelph from Toronto (Westbound) and Chicago (Eastbound).

Family Activities: There are many stimulating family activities offered in Guelph and the surrounding area. The African Lion Safari, Marine Land, and St. Jacob's Market are within a short drive of Guelph. Guelph also offers an assortment of historical museums, art galleries, and market places.

Climate: The University of Guelph is located in southwestern Ontario. July is usually warm and dry during the days with temperatures in the mid 20s C (mid to high 70s F). Nights are warm with temperatures around 20°C (low 70s F).

Collecting Permits: The general collection of vertebrates is discouraged at the meeting. Scientific collecting permits are required for the collection of all fish, amphibians, and reptiles in the province of Ontario. Inquiries should be made well in advance and directed to: *Daryl Coulson, Wildlife Biologist, Ministry of Natural Resources, District Office, 605 Beaverdale Road, Cambridge, Ontario, P.O. Box 21048, Canada N3C 2W1. Tel: (519) 651-8159.* Letters to the above address must provide details with respect to the 4 Ws: Who, What, Where, and Why.

Further Details: Contact: *J. P. Bogart, Department of Zoology, University of Guelph, Guelph, Ontario, Canada N1G 2W1. Tel: (519) 824-4120 ext. 6260; fax: (519) 767-1656; e-mail: meeting@uoguelph.ca.* Meeting Announcement and Call for Papers will be mailed to all Canadian, U.S., and Mexican members of SSAR in early December, 1997. Overseas members wishing to receive this information may do so by contacting Jim Bogart at the above address. Please visit the meeting web site at http://www.uoguelph.ca/~ichsherp/ for additional and updated information.

About Our Cover: *Morelia boeleni*

Boelen's Python, one of the most spectacular but also among the rarest pythons, symbolizes the astonishing diversity of New Guinea's snake fauna, recently summarized by Mark O'Shea (1996. A Guide to the Snakes of Papua New Guinea. Independent Publishing, Port Moresby. xii+239 pp.). Lying between distinct faunal regions, New Guinea is home to about 106 species of snakes, including an admixture of both Asian and Australian taxa, as well as species occurring nowhere else. Prominent among the endemics is *Morelia boeleni*, one of the least well-known large pythons. It is restricted to New Guinea, including at least one of the off-shore islands, where all records have come from mid-montane rainforests above 1000 m. O'Shea reports that this is the most protected reptile in Papua New Guinea, although it now is being bred in captivity by European and North American herpetoculturists.

Photographer **Jim Bridges** is known for his attention to detail, typically expending much time and film to capture his subject. Although trained as a commercial artist, and having won awards in both illustration and sculpture, photographic pursuits have gained him widespread recognition. Jim is well known in the herpetological and herpetocultural publishing fields, but the majority of his work has been published in books and non-herp magazines, for such organizations as the National Geographic Society, the National Wildlife Federation, and the Sierra Club.

A burgeoning interest in photography of amphibians and reptiles is reflected by a new herp photography column, written by Bridges for *The Vivarium* magazine, in which he offers tips for taking outstanding herpetological photos. In addition to his skills as a photographer, Jim is adept at electronic imaging techniques, having prepared all of *HR*'s color covers for publication.



Our cover depicts a captive-born, small adult *Morelia boeleni*, photographed in a studio set-up in Florida (see photo, right). A 20 x 24-inch darkroom developing tray was used for a stage. The two large, black triangular objects are Reflectasol Softboxes with studio strobe heads mounted in them. The flash heads, each producing about 200 watt-seconds of light, are powered by an AC power pack on the floor (barely visible under the table). A Canon F-1 camera and 50 mm f3.5 FL macro lens were used to capture this image on Kodachrome 25 film.

SSAR BUSINESS

1997 Annual Meeting: Seattle, Washington

The 40th annual meeting of SSAR occurred from 26 June–2 July 1997 in Seattle, Washington. This year SSAR met jointly with The Herpetologists' League and the American Society of Ichthyologists and Herpetologists on the beautiful campus of the University of Washington. The University, with Ted Pietsch chairing the local committee, served as host to a record number of attendees (>1600). Most of the meeting's events took place at the Husky Union Building.

The unofficial opening of the meetings, the annual meeting of the SSAR Board of Directors, took place on 26 June between 1430 and 2020 h. In attendance for all or most of the Board Meeting were Elected Officers Henry Mushinsky, Darrel Frost, Robert Aldridge, Ellen Censky, John Iverson, Wayne Van Devender, Charlie Painter, and Jim Bogart; Appointed Officers and Editors: Bob Hansen, Steve Corn, Tom Tyning, Rich Seigel; Committee Chairs and Coordinators: Dawn Wilson, George Pisani, Marty Crump, Ken Dodd, Terry Graham; Members: Andy Price, John Moriarty. Others attended to make presentations throughout the afternoon. A summary of business conducted was presented at the Business Meeting (see below).

Presentations

The meetings officially began at 0815 h on 27 June at Meany Hall with opening remarks and announcements from Ted Pietsch. Richard L. McCormick, President of the University of Washington, and Karl Hutterer, Director of the Burke Museum, welcomed all societies to the University. Margaret Stewart, Keynote Speaker and Past President of ASIH, gave an entertaining talk on her years of research entitled "Unfinished Business: What was, What is, and What's yet to be." She was followed by Marty Crump, who delivered HL's Distinguished Herpetologist Lecture on the trials and tribulations of her field work entitled "Frogs: unpredictability, flexibility, and the future."

A record number of papers (851) and posters (201) were presented in 82 oral sessions and three poster sessions. There was one SSAR sponsored symposium "Ecological Processes: Insights from Field Experiments and Natural History: A Symposium Celebrating the Career and Contributions of Margaret McBride Stewart." In addition, SSAR had a round table discussion on "Habitat conservation plans as a replacement for listing under the Endangered Species Act" on 30 June. The SSAR Conservation Forum, Point Counterpoint, was on sustainable use of amphibian and reptile resources and was held on 27 June.

President Henry Mushinsky called to order the 40th Annual Business Meeting of the SSAR at 1510 h in the Husky Union Building Auditorium on Sunday, 29 June. He noted that attendance was low at this business meeting because it had been scheduled at the same time as talks and that this was unavoidable because of the size of the meeting. Mushinsky reported that there was an effort underway to foster more cooperative efforts between the three societies (SSAR, HL, ASIH). The board thought that one way to address this was to have joint committees and that an opportunity presented itself in the Standard and Common Names Committee. Mushinsky said that the committee would be reconfigured to include members representing all three societies. He also made a plea for volunteers for the International Cooperation Program. He asked that anyone who was interested should contact Marty Crump.

There were several people who were recognized for services rendered to the society. They were Joe Collins for his years of service as Standard and Common Names Committee Chairman, Randy Krohmer for his efforts as Translations Editor, Karen Toepfer for her service as Treasurer, Dawn Wilson for chairing the Seibert Award Committee for the Seattle meetings, and Breck Bartholomew for developing an ad for the *Catalogue of American Amphibians and Reptiles*.

Mushinsky also reported that there has been an increase in the number of students participating in the Henri Seibert Student Award contest each year. This year there were 68 participants. Because of the high number of talks, they were grouped into four categories (Systematics, Conservation, Ecology, Physiology & Morphology) and the board had approved one award of $200 for each of these categories.

Treasurer Robert Aldridge reported that the society was in sound financial shape (see report elsewhere), that we had a record number of members (2575), and that renewals were on-track. The board had approved a 1998 budget of $194,642. *Journal of Herpetology* editor Rich Seigel reported that Managing Editor William Parker would be resigning in mid-1998. He welcomed any suggestion for replacement. He also stated that we had the highest number of submissions in the journal's history. He predicted that the backlog would increase to a 12-month lag time by the end of 1998. Allen Press had increased charges for their services and, therefore, the board had increased the budget for the journal to $79,947, but had asked Seigel to contact Allen Press about renegotiating. The editor said that we were moving toward putting the abstracts on the World Wide Web and that anyone who wanted to volunteer to help should contact George Pisani.

The timing of the Business meeting required Secretary Ellen Censky to present the remaining reports. The board approved an increase in the number of pages for *Herpetological Review* from 56 to 64 pages per issue. This will help reduce the backlog of accepted manuscripts. Editor Bob Hansen asked for suggestions from the membership for cover art. Twenty accounts were published in the *Catalogue of American Amphibians and Reptiles*. The board approved a modest increase in the CAAR budget to cover the cost of software and additional color for the accounts. *Contributions to Herpetology* will publish "Biology of the Reptilia, v. 19," edited by C. Gans and A. Gaunt in 1997, and "Lizards of Iran," by S. C. Anderson and "Herpetofauna of New Caledonia and Surrounding Islands," by A. Bauer and R. Sadlier in 1998. Other works in progress for 1998 are "Amphibians of Honduras," by J. R. McCranie and L. D. Wilson, "Biology of the Reptilia, v. 20," edited by Gans and Gaunt, and "Herpetological Illustrations from the Spencer Research Library, University of Kansas," compiled by S. Haines. *Herpetological Circulars* will publish No. 26 "Lineages of Zoo Herpetologists in the United States," by W. Card and J. B. Murphy in late 1997, and "Venomous Snakes: A Safety Guide for Keepers," by W. Altimari is slated for publication in 1998. Volume 1 of *Herpetological Conservation*, "Amphibians in Decline: Canadian Studies of a Global Problem," edited by D. Green, was sent to the printer on 27 May 1997. And finally, the booklet "Grants and Awards for Herpetologists," by J. C. Milam, was produced and is available.

The Conservation Committee sent a questionnaire to zoos and aquaria seeking advice on a conservation brochure. A prototype of the brochure will be ready in the coming year. Thanks to George Pisani and Breck Bartholomew, the Conservation Committee is represented on the SSAR Home Page. Grants-in-Herpetology and the Kennedy Award are announced elsewhere, as are the resolutions. The Student Travel Award Committee made 10 awards of

$200 each. However, because there was no Silent Auction this year, there may not be any awards next year. President Mushinsky made a plea for student members to become involved in this activity as it directly relates to them. In 1996, SSAR contributed $4,000 to the Third World Congress of Herpetology Student Travel Award. This money was combined with NSF money and a total of 18 students were awarded funds for travel to Prague. The SSAR portion was used to fund three non-U.S. members of the society: S. Downes (University of Sydney), J. Melville (University of Tasmania), and J. Rock (University of Otago). This decision was made because the SSAR portion had no restrictions, whereas NSF monies had to go to U.S. students.

Nominations for election to SSAR office for 1998 were announced. President-elect: Victor Hutchison and Harold Dundee; Secretary: Ellen Censky; Treasurer: Robert Aldridge; Director (Class of 2000): John Cadle, Kenneth Dodd, and Julian Lee; Director (Conservation): Dale Belcher, Claudia Luke, and Bern Tryon.

Social Programs

Special events and social programs were numerous and well attended. A display of most species of native amphibians and reptiles from the Pacific Northwest was available for viewing during the course of the meetings at Fisheries Teaching and Research. The display was presented by the Society for Northwestern Vertebrate Biology/Pacific Northwest Amphibian and Reptile Consortium, as well as SSAR and HL. It was sponsored by the University of Washington's College of Forest Resources and Center for Streamside Study, and the Pacific Northwest Herpetological Society.

The social events began the first evening (26 June) with informal gatherings at three local establishments, each of which offered its own unique atmosphere and a wide variety of local microbrews. The next evening (27 June), the General Reception was held in the foyer of Meany Hall. It featured music by the Dan Davison Jazz Combo, by Ray Troll and Russell Wodehouse, and by the "Rappin' Ratfish Brothers," along with generous servings of food and drink. The Graduate Student Reception followed the next evening with food and drink to fill the stomachs of all graduate students attending, and music in the rain by "Salamander" and the Roger Rogers Band. The Salmon Barbecue was held 29 June on the shores of Union Bay at the UW Waterfront Activities Center. The beer flowed, the salmon was barbecued, and the rain held off. The following night the SSAR Auction, with auctioneer Joe Collins, was held in the Husky Union Building. The auction was organized by Mark Adams and a wide variety of auction items had been solicited by Terry Steven-Ayers and others. Lively bidding took place until the closing minutes. The ASIH Banquet was held on the last evening of the meetings in the Husky Union Ballroom.

The annual multi-media event was held in conjunction with the General Reception. As always, "Herpetological Namesakes," by Kraig Adler and David Dennis and "Amphibians of the Appalachians" and " Herps of the West," by David Dennis and Eric Juterbock were well attended. In addition, "Ichthyologists Past and Present," was presented by Brooks Burr.

—Respectfully submitted by Ellen J. Censky, Secretary.

1997 SSAR Resolutions

Honoring Outgoing SSAR Officers and Editors

WHEREAS the following individuals have given freely of their time, skills, insight, and knowledge to the Society for the Study of Amphibians and Reptiles in this past year; and,

WHEREAS they have been therefore instrumental in advancing the Society's goals and furthering its growth as an international scientific society; and,

WHEREAS SSAR is dependent upon the generosity of these persons and those who have gone before them, and is greatly indebted to them for their fine efforts in its behalf;

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles urges these persons not to ride off into the sunset, but rather to continue to be available, with or without official titles, as resources to guide those who follow; and,

RESOLVED FURTHER that the Society offers its most sincere thanks to the following persons who have served in these capacities:

BRECK BARTHOLOMEW—*CAAR* Art/Advertising Volunteer
AARON BAUER—Chair, 1997 Nominating Committee
KURT BUHLMANN—*HR* Section Editor
JANALEE P. CALDWELL—Director
JOSEPH T. COLLINS—*Common and Scientific Names* Coordinator
DAVID CREWS—*Journal of Herpetology* Editorial Board member
WILLIAM E. DUELLMAN— Co-Chair, 1996 Local Committee
ERNIE LINER—Member, 1997 Nominating Committee
EMILIA MARTENS—Member, 1997 Nominating Committee
PAUL MOLER—Director
DOUG RUBY—*Journal of Herpetology* Associate Editor
KAREN TOEPFER—Treasurer
LINDA TRUEB—Co-Chair, 1996 Local Committee
WAYNE VAN DEVENDER—Member, 1997 Nominating Committee
MARVALEE WAKE—Member, 1997 Nominating Committee

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 June 1997 at its Annual Business Meeting.

Special Resolution Honoring Joseph T. Collins

WHEREAS Joseph T. Collins is a founding member of SSAR; and,

WHEREAS over the past 40 years of exemplary service to the Society in myriad capacities, Joe has been among the Society's most influential sources of guidance; and,

WHEREAS Joe has mentored many persons in his distinguished herpetological career; and,

WHEREAS SSAR has matured into the largest professional herpetological society under the guidance of these founders and their able successors;

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles conveys upon Joseph T. Collins special recognition for his years of service.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 June 1997 at its Annual Business Meeting.

Thanking The Local Committee

WHEREAS the University of Washington has provided an excellent setting for this large and diverse joint meeting; and,

WHEREAS Ted Pietsch and members of the Local Committee have overcome myriad logistic obstacles in the course of hosting this meeting; and,

WHEREAS the Local Committee has done a fine job of choreographing the many sessions and events associated with this meeting; and,

WHEREAS the UW beer and beverage policy has added new challenges to the success of certain of these events; and,

WHEREAS the gender semi-segregated shower facilities in certain dorms have provided participants with a renewed sense of togetherness and heightened awareness, enhanced by the strictly diurnal availability of hot water; and,

WHEREAS the well-labelled campus maps, coupled with the often unlabelled pathways and a generally uninformed student body have allowed meeting participants to sharpen their orienteering skills; and,

WHEREAS the outstanding meeting Web site sets a new standard of excellence for Annual Meeting information dissemination, and is evocative of more northern climes in its glacially slow-to-load front page.

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles (SSAR) extends its most sincere thanks to the 1997 Local Committee and others whose assistance contributed to the success of this meeting:

Ted Pietsch (Local Committee Chair), Mike Adams, Beth Babcock, Dianne Baker, Laurie Bauman, Erica Briese, Jeremy Brower, Morgan Busby, Shannon Claeson, Deanne Clare Drake, Tony Han, Ivan Henry, Michael J. Hickerson, Sandra Hines, Greg Hood, Kirt Hughes, Danika Blythe Jauch, Larry Jones, Amy Karpenske, Kathryn Kelsey, Art Kendall, Mike Kinnison, Tom Knight, Shawn Larson, Bill Leonard, Therese Littleton, Andrés López, Mike Mason, Ann Matarese, Michele McGrady, Jay Orr, Bill Pinnix, Susan Picquelle, Rebecca Reuter, Justin Rhodes, Renee Ripley, Todd Ritchie, John Rupp, Cassandra Sandkam, Joe Schumacher, Karin Snelson, Adrian Spidle, Stella Spring, Dan Stearn, Terry Stevens-Ayers, Duane Stevenson, Laura Swaim, Ray Troll, Allison Whitmer, Brian Urbain, UW Extension.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 June 1997 at its Annual Business Meeting.

Resolution Thanking SSAR 1997 Special Event Volunteers

WHEREAS the Annual Auction and Live Display have been features of SSAR annual meetings for many years; and,

WHEREAS these events have added materially to the enjoyment of our members; and,

WHEREAS the SSAR auction has served as a valuable source of revenue for the Society's several programs; and,

WHEREAS the 1997 Local Committee has worked hard to overcome successfully a number of unique obstacles in providing these events this year;

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles expresses its special thanks to these persons for assuring the success of these events this year:

Ted Pietsch (Local Committee Chair), Mike Adams, Larry Jones, Kathryn Kelsey, Terry Stevens-Ayers.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 June 1997 at its Annual Business Meeting.

FURTHERMORE;
WHEREAS a separate resource publication serving as a guide to funding opportunities in herpetology is of patently obvious value to the community, both within and outside the USA; and,

WHEREAS this value extends to all segments of that community including students, zoo personnel, university faculty, etc.; and,

WHEREAS the SSAR board expressed interest in supporting such a resource; and,

WHEREAS Joan Milam volunteered for the task of compiling said resource, and thereafter did so in a timely and professional fashion;

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles expresses its special thanks to Joan Milam for her efforts in behalf of the Society.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 June 1997 at its Annual Business Meeting.

Seibert Award Winners for 1997 Announced

The sixth annual Seibert Awards were presented at the 40th Annual Meeting of the SSAR in Seattle, 25 June–2 July 1997. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). In recognition of outstanding student presentations at the annual meeting, a single award was given in each of the following categories: Systematics (8 eligible presentations), Physiology/Morphology (9), Ecology/Evolution (26), and Conservation (14). All four awardees received a check for US $200 and a book from Academic Press.

The winners.—Systematics: Michele Donovan, Department of Biology, San Francisco State University, "The historical biogeography of the mole salamander, *Ambystoma talpoideum*." Physiology/Morphology: Michael Greene, Department of Zoology, Oregon State University, "Female sex attractiveness pheromones of the brown tree snake (*Boiga irregularis*)." Ecology/Evolution: Sharon Downes, School of Biological Sciences, University of Sydney, "Heat, sex or safety? Using habitat selection experiments to identify a lizard's priorities." Conservation: Sarah Cooper, Department of Biological Sciences, Idaho State University, "Modeling the location of snake dens of the eastern Snake River plain."

Honorable Mention.—Ecology/Evolution: Matthew Flowers, Department of Zoology, Arizona State University, "Sexual color dimorphism in chuckwallas, *Sauromalus obesus*, and implications for sexual selection."

The judges were Dawn S. Wilson, chair (University of Nevada, Reno), Ronn Altig (Mississippi State University), Lee Fitzgerald (Texas A&M University), Anna Graybeal (Field Museum of Natu-

ral History), Tod Reeder (San Diego State University), Paul Stone (University of Central Oklahoma), Wayne Van Devender (Appalachian State University), and Paul Verrell (Washington State University).

SSAR Henri Seibert Award for 1998

The Henri Seibert Award was initiated in 1992 to provide recognition for the best student papers given at the annual meeting of the SSAR. To be eligible, the presented paper must be the results of research conducted by the presenter. The research must have been done while the student was in either an undergraduate or graduate degree program. The presentations will be judged by the SSAR student prize committee. One Seibert Prize of US $200 may be given in each of the four categories: Conservation, Ecology/Evolution, Physiology/Morphology, and Systematics. Please indicate the category to which you are submitting your abstract on the abstract form in the Call for Papers.

Recommendations to Students Entering the Henri Seibert Competition

Be sure you are ready to enter into the competition. Of the 57 papers submitted to the Henri Seibert competition at the 1997 meeting in Seattle, less than half were deemed suitable for competition by the judges. The biggest problem dealt with lack of sufficient data and analyses—many papers reported preliminary results. Students should refrain from submitting preliminary results and forthcoming research to a "Best Student Paper" competition. Preliminary results may be presented in poster form which fosters more discussion than an oral presentation. The following recommendations are intended to aid students to improve the quality of their talks. The criteria presented below are applicable to any talk given at a scientific meeting.

1. Preparing the presentation

A. Audiovisual

- Slides should be clear and legible, even in the back of the room. Use large fonts.
- Avoid the temptation to use a myriad of colors. Stick to a few, easily seen, contrasting colors (e.g., reds are hard to see).
- Use only slides that add to the clarity of the presentation. Several slides showing the same thing tends to bore the audience.
- Time allotted to each slide should be sufficient to allow the audience to absorb the pertinent information. Explain each data slide with regard to axes and content.
- Use a pointer, especially for data slides, but do not overuse the pointer.
- Do not use full data sets in tables. Summarize your data so that tables can be easily seen and comprehended by the audience. Use figures to replace tables when possible.

B. Oral

- Practice, practice, practice! Smooth transitions should occur between slides. NO slide should surprise you by its appearance.
- Speak clearly and use appropriate volume. If you use a microphone, do not turn or walk away from the microphone to address each slide so that your voice fades in and out.
- Often too much time is spent on the methods. Use bullet slides combined with photos (study site/animal, design ...) to work quickly through your methods.

2. Describing your research

A. Design

- Present your research in a larger context by addressing previous studies (choose 1 or 2 to make your point). Relate your data to the knowledge of your field.
- Clearly state your hypothesis(es) and/or objectives up front.
- Flag techniques that are original to your study (i.e., this study is the first to address this question or to use this technique).
- If you deviate from the original plan of the study, be sure to adequately justify your changes or modifications.

B. Summary of Results

- Present your results clearly. Tables with N and P values are fine (but not necessary) if they are readable. Always indicate your sample sizes.
- Indicate the importance of your results. How do they relate to previous studies? Biology in general?

C. Importance of Study

- Summary slides of conclusions (bullet slide) are helpful in tying together many results.
- State the importance of your study and how your research has added to knowledge of the subject presented. Are your results generally applicable to larger biological questions?

D. Miscellaneous

- No one works in isolation. Be sure to acknowledge (briefly) collaborators and funding agents. This can be done at the beginning or end of the talk, but it may take away from the final message if done at the end.
- Try very hard to limit yourself to 12 minutes. Ability to handle questions is part of the judging criteria. Failure to leave time for questions can leave the audience frustrated.
- Again, practice your talk many times before giving it. You will find that the more you practice, the more confident you will feel and the more polished your talk will be.

Artwork and Slides Wanted for *HR*

We are seeking high quality illustrations of herpetological subjects for publication in *Herpetological Review*. Generally, original drawings should be of a scale that would permit reduction to fit a 90 mm wide column. Of particular interest are drawings of material for which locality data or museum catalogue numbers are available; this information should be included with the drawings. Original art (or good quality photocopies) should be packaged to ensure safe delivery and sent to the Editor.

Also, we are interested in evaluating outstanding color slides of amphibians and reptiles for possible use on future *HR* covers. If you would like your work to be considered, please contact the Editor prior to shipping any slides. Postal and e-mail addresses are listed on the inside front cover.

SSAR Student Travel Awards Call for Applications

Awards of US $200 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author (or co-author, see below) of a paper or poster to be presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that states: he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Student Travel Awards Committee are excluded from applying for a travel award.

APPLICATIONS MUST BE POSTMARKED BY 15 MAY 1998. Award recipients will be notified by 1 June 1997 and award checks will be disbursed at the meeting. Direct requests for information to: Todd Esque, U.S. Geological Survey, Biological Resources Division, 345 East Riverside Drive, St. George, Utah 84790, USA; tel. (801) 688-3215; e-mail: esque@usgs.gov. Please list the subject for any such e-mail as: SSAR Travel.

SSAR Student Awards Fund-raiser: 1997 Results and Call For 1998 Donations

Thanks to the many generous donations from several individuals to the 1996 silent auction in Seattle, the SSAR Student Travel Awards Committee (SSAR STAC) awarded ten US $200 travel grants to the following individuals: Kyle Ashton, Russell Bodie, Marguerite Butler, Melissa Dills, Maureen Kearney, William Lutterschmidt, Jeff Parmelee, Lora Smith, Tracey Tuberville, and Allison Welch. In 1997 the SSAR Student Travel Awards Frameable Art Silent Auction was not held, but the SSAR STAC is grateful to Joe Collins for auctioning donated materials on behalf of the Student Travel Awards.

The SSAR STAC announces the Fourth Annual Frameable Art Silent Auction to be held at the 1998 SSAR meeting in Guelph. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: Todd Esque, U.S. Geological Survey, Biological Resources Division, 345 East Riverside Drive, St. George, Utah 84790, USA; tel. (801) 688-3215; e-mail: esque@usgs.gov.

Directory of Herpetologists

SSAR, The Herpetologists' League, and the American Society of Ichthyologists and Herpetologists are preparing to issue a joint directory of herpetologists. This will be done by merging the membership lists of the three societies. If for some reason you DO NOT wish to be listed in the directory, please tell us by e-mail (Harold Dundee <dundee@plato.museum.tulane.edu>) or by snail mail (Dr. Harold A. Dundee, Tulane University Museum of Natural History, Belle Chasse, Louisiana 70037-3098, USA. Fax: (504) 394-5045). The default option is to list everyone.

Also, if you receive journals at your home address, but wish instead to have an institutional address published, please advise as above.

Journal of Herpetology: On-Line Abstracts

As a new service to our readers, the *Journal of Herpetology* is pleased to announce that starting with the March 1998 issue, the complete abstracts of major papers will be placed on-line on the SSAR Home Page on the World Wide Web (URL: http://falcon.cc.ukans.edu/~gpisani/publink.html). Abstracts will be available about five months prior to publication, and will remain on-line until the papers are published. We will provide the e-mail and "snail mail" addresses with the abstract, and interested readers are asked to contact the author for a pre-print of the full paper. If there is sufficient interest in this service, we also will begin providing brief summaries of Shorter Communications as well.

Please direct any questions or comments on this service to: *Richard. A. Seigel, Editor, Journal of Herpetology, Dept. of Biological Sciences, Southeastern Louisiana Univ., Hammond, Louisiana 70402-0736, USA. E-mail: rseigel@selu.edu.*

Needed: Slides of Herpetologists

The audiovisual program "Herpetologists Then and Now," first shown at the 1982 SSAR meeting in Raleigh, has been seen at many meetings in the US, Canada, and the UK in subsequent years and has undergone several revisions. The producers, Kraig Adler, David M. Dennis, and J. Eric Juterbock, plan another revision for 1998 and appeal for photographs of our colleagues or of herp activities, etc. (Sources of photos are not revealed.) Ideally, we want color slides (copies that we can keep) or, where necessary, black-and-white prints that we can make into slides. Please provide data (names, places, etc.). Humorous photos are especially desirable.

Materials should be sent to: *David M. Dennis, General Biology Annex, The Ohio State University, 1791 Neil Avenue, Columbus, Ohio 43210, USA (office phone: 614-292-1371).*

NEWSNOTES

Southwestern Research Station Positions And Grants For 1998

VOLUNTEERS—Approximately 30 volunteer positions are open in 1998 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, contact: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 1998. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin March 15, 1998, through September 1998. Five-day week; salary $210/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396; e-mail: swrs@amnh.org.*

Position Available: Curatorial Internship

The Wildlife Conservation Society, based at the Bronx Zoo in New York, is a world leader in the preservation of wildlife through captive management, field studies, and creation of reserves. The Department of Herpetology promotes conservation through administration of Species Survival Plan and studbook programs, development of reintroduction protocols in conjunction with our Wildlife Health Sciences division, field studies, an innovative exhibition of reptiles and amphibians, the management of a 750-specimen living collection, an interpretive program including the Reptile Conservation Station, and collaboration with local, state, federal, and international wildlife agencies.

We are seeking applicants for the position of curatorial intern to begin in January 1998. The program will include participation in the above mentioned activities. The curatorial intern would carry the title Herpetologist, and is recognized as a career path to a curatorship.

Requirements: Advanced degree in zoology, ecology, conservation biology, or related field with demonstrated interest in herpetology. Must have excellent communication, computer, interpersonal, and report writing skills. Please submit resume to: *Department of Herpetology, Wildlife Conservation Society, Bronx Zoo, Bronx, New York 10460-1099, USA.*

Contemporary Herpetology, a New Electronic Journal

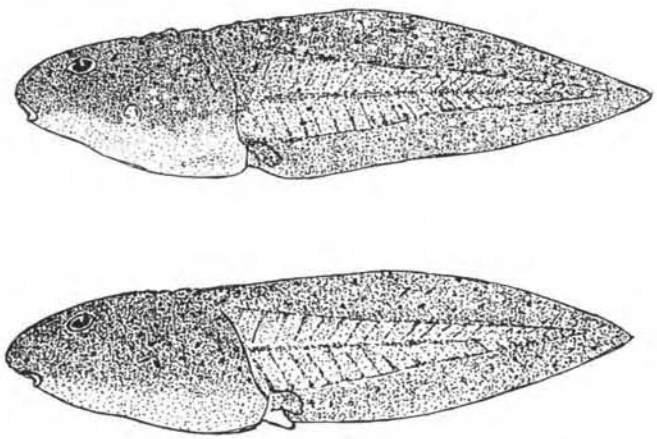
On 1 January 1998, *Contemporary Herpetology* (*CH*), a peer-reviewed electronic journal devoted to herpetology, will go online (URL: http://vmsweb.selu.edu/~pcsd4805/) with the following articles:

> A key to the anuran larvae of the United States and Canada, by Ronald Altig, Roy W. McDiarmid, and Kimberley A. Nichols.
>
> Taxonomic status of the Wyoming toad, by Hobart M. Smith, David Chiszar, and Joseph T. Collins.

We are currently soliciting papers, which can be submitted to managing editor Travis Taggart (ttaggart@selu.edu) via e-mail. *CH* will publish articles covering all aspects of herpetology, including ecology, ethology, systematics, conservation biology, and physiology. *CH* also will publish monographs, points-of-view, and faunistic surveys of poorly-known areas. *CH* will not publish herpetocultural or anecdotal papers. Internet technology provides publication capabilities that were either impossible or expensive in previous media, including full-motion video, full-color digital photography, computer simulations, and audio playback. For questions about *CH*, contact the editor, Joe Slowinski (jslowins@cas.calacademy.org; tel. 415-750-7041).

Graduate and Post-Graduate Research Grants

The Biological Research Station of the Edmund Niles Huyck Preserve offers grants (max. = $2500) to support biological research that utilizes the resources of the Preserve. Among the research areas supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2000-acre Preserve is located on the Helderberg Plateau, 30 miles southwest of Albany, New York. Habitats include northeast hardwood-hemlock forests, conifer plantations, old fields, permanent and intermittent streams, 10 and 100-acre lakes, and several waterfalls. Facilities include a newly expanded laboratory building, library, collections, and houses/cabins for researchers. Deadline: 1 February 1998. Application material: *Dr. Richard L. Wyman, Executive Director, E. N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, New York 12147, USA.*



Rana catesbeiana (Bullfrog), top, and *Rana aurora draytonii* (California Red-legged Frog), bottom. USA: California: San Diego and Riverside counties, respectively. Illustrations by Dan Holland.

LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. Please direct all communications to the Section Editor.

Colombia: The Colombian government announced in July that the Orinoco crocodile (*Crocodylus intermedius*) is "in danger of extinction" in its country. The announcement marks the first survey of these crocodiles in Colombia since the mid 1970s. The Orinoco crocodile is restricted to the lowland drainages of the Orinoco River in Venezuela and Colombia and is one of the seven most endangered crocodilians in the world (1992 IUCN/SSC Crocodile Action Plan). Initial declines were the result of commercial overexploitation from the 1930s through the 1950s; however, most commercial hunting ceased by the 1960s because of scarcity of animals. Habitat destruction, egg collection, illegal hunting, and competition with the spectacled caiman (*Caiman crocodilus*) all have been listed as causes for the species' lack of recovery in the past 20–30 years (Arteaga et al. 1994, in *Crocodiles: Proceedings of the 12th working meeting of the IUCN/SSC crocodile specialist group.*). Orinoco crocodiles are currently protected under CITES Appendix I. In addition, Venezuela has a conservation plan that includes headstarting and reintroducing crocodiles into two areas of protected crocodile habitat. With the forthcoming plan to protect Colombia's remaining populations, the future of *C. intermedius* looks increasingly optimistic.

USA: US Fish and Wildlife Service: The revised Notice of Review names 306 species that may warrant protection under the Endangered Species Act. The 1997 Notice contains 71 plants and animals proposed as endangered, 28 proposed as threatened and 207 candidates for proposal. The Notice is published primarily to inform potential investigators of the need for information concerning taxa in greatest jeopardy. Specifically, the Fish and Wildlife Service requests information: 1) indicating that a taxon should be removed from the Notice, 2) indicating that a taxon that is not on the Notice should be included, 3) recommending an area as critical habitat for a candidate taxon or that protection of critical habitat would not be prudent for a taxon, 4) documenting threats to any of the included taxa, 5) describing the immediacy or magnitude of threats facing candidate taxa, 6) pointing out taxonomic or nomenclatural changes, 7) suggesting appropriate common names, and/or 8) noting any mistakes such as errors in historical range. The following amphibians and reptiles are included in the Notice: *Ambystoma californiense* (= *A. tigrinum c.*; candidate), *Bufo boreas boreas* (southern Rocky Mountain population; candidate), *Rana chiricahuensis* (candidate), *Rana lutiventris* (Wasatch Front, West Desert, and Great Basin populations; candidate), *Rana pretiosa* (West Coast population; candidate), *Anniella pulchra nigra* (proposed endangered), *Clemmys muhlenbergii* (northern populations, proposed threatened), *Graptemys caglei* (candidate), *Kinosternon sonoriense longifemorale* (candidate), *Masticophis lateralis euryxanthus* (proposed endangered), *Nerodia sipedon insularum* (proposed threatened). The full Notice of Review as well as contacts for interested persons or organizations can be found in the *Federal Register* Vol. 62, No. 182, pp. 49398–49411 (September 19, 1997).

CITES: The tenth regular meeting of the Conference of the Parties (COP10) convened June 9–20, 1997 in Harare, Zimbabwe to consider proposed amendments to CITES. The following amendments concerning trade in amphibians and reptiles were adopted (proponent in parentheses): Order Testudinata: *Callagur borneoensis*—inclusion on Appendix II (Germany); Order Crocodylia: *Caiman latirostris*—transfer of Argentina population from Appendix I to II for ranching (Argentina); *Crocodylus niloticus*—maintenance of Madagascar and Uganda populations on Appendix II for ranching (Madagascar, Uganda); *Crocodylus niloticus*—annual export quota for 1998 through 2000 of 1000 skins and 100 hunting trophies (Tanzania). Additional information can be found in CITES update #55 (August, 1997).

MEETINGS

Third World Congress of Herpetology 2–10 August 1997, Prague, Czech Republic

ZBYNEK ROÇEK
Department of Paleontology, Geological Institute, Academy of Sciences
Rozvojová 135, 165 00 Praha 6 - Suchdol, Czech Republic
e-mail: Rocek@gli.cas.cz

and

MARVALEE H. WAKE
Department of Integrative Biology and Museum of Vertebrate Zoology
University of California, Berkeley, California 94720-3140, USA
e-mail: mhwake@socrates.berkeley.edu

The World Congress of Herpetology, an international non-governmental organization founded to support herpetology worldwide, held its third congress last August in Prague, Czech Republic. Previous congresses were held in Canterbury, England and Adelaide, Australia. These congresses are generally regarded as the most representative meetings of herpetologists both for number of nationalities (more than 850 representatives from 58 countries were in Prague) and scope of presented topics. Thus, they provide a platform for meetings and exchange of ideas with specialists from other fields of herpetology who usually hold separate meetings. Interdisciplinary approaches to problems through wide-ranging discussions are one of the most beneficial aspects of such large meetings. Bearing this in mind, the congresses are open, according to the Statutes of the WCH, to anyone who works in any field of herpetology or is interested in herpetology, regardless of whether they deal with extant or extinct taxa.

Two directions were followed in the course of preparation of the scientific program. The organizers preferred that the congress should be conducted along long-standing principles for scientific meetings of this kind, i.e., to enable people to present the results of their research and to discuss them with others. A free choice of what to present can reflect the range of topics and the state that each pertinent field has reached since the previous congress. Therefore, the main part of the congress consisted of contributed papers arranged in topical units (sessions in the case of talks, and topical arrangements in the case of posters). In addition, there were specialized symposia and round tables organized in advance by people who wanted to promote discussions of particular topics. The organizers' requirement was that contributors not give just review presentations; they therefore rejected abstracts that did not contain new and original results. On the other hand, they accepted some non-orthodox papers and presentations that criticized some routine and deeply-rooted approaches and methods (e.g., cladistics, model animal approaches, etc.).

The scientific program resulted in a very colorful and multilateral presentation of a wide range of views, but at the same time showed a few dominant fields of herpetology in which herpetologists' interests worldwide have been focused during the last decade of this century.

Undoubtedly, the principal arena of interest was the global decline of amphibian and reptile populations and related topics (impact of human activities, environmental contaminants and other possible causes of the declines, conservation biology, strategies for conservation, etc.). Of six simultaneous sections running over the whole week, one was devoted nearly completely to this topic (76 talks, plus a half-day workshop on conservation of Europe's threatened herpetofauna organized by the Societas Europaea Herpetologica Conservation Committee and the IUCN Species Survival Group for European Herpetofauna). Similar topics were covered by 27 posters. This, together with contributions dealing with conservation biology as a "side product," represented about 15% of all 773 papers submitted to the congress. Most of these presentations documented the degree of decline; only a few of them proposed methods and strategies to deal with declines. General concern about future developments in conservation and maintenance of the herpetofauna also was expressed in one of the resolutions addressed to many supra-national and national organizations; it specifically supported the work and perspective of the Declining Amphibian Populations Task Force.

Another dominant topic represented in the congress was evolution, associated with phylogeny and systematics. Several sessions and symposia were held during the congress that fit into this field, such as one-day sessions on "Evolution and Systematics of Anura" and "Evolution of Caudata," a one-and-a-half day session on "Evolution and Systematics of Reptilia," and one-day sessions on "Evolution and Systematics of Snakes" and the more specialized "Phylogeny and Systematics of the Viperidae." Also, this part of the congress comprised about 15% of the total number of contributions, including posters.

Predictably, a number of evolutionary contributions were based on fossil material. However, paleoherpetology in general was not, contrary to expectations of the organizers, well represented in the congress. This resulted in short (but high quality) sessions on "Paleozoic Amphibia" and "Early Reptiles," and a half-day symposium on "Mesozoic Amphibians and Reptiles." About a dozen contributions dealt also with the post-Mesozoic fossil record of amphibians and reptiles. Nevertheless, a relatively low number of paleontological contributions can be interpreted as a fact that the wall separating paleo- and neo-herpetologists still exists, and the fact that the object of study is a fossil is more significant than that it is an amphibian or reptile.

Another "strong" field represented in the congress was ecology, especially population ecology of amphibians (altogether nearly 100 presentations). Worthy of mention in this respect were also symposia on "Climate Variation and its Impact on Herpetofauna," "Temperature and Sex Determination in Reptilia," and "Sea Turtles: Biology, Ecology, Management."

There were many other topics represented to a lesser degree in the congress, such as accounts of regional herpetofaunas given in a session entitled "Zoogeography of Amphibia and Reptilia" and a similar part of the poster exhibit; they comprised about 50 presentations (about 7% of all papers submitted). However, one must also add papers presented in the symposium "Africa—The Neglected Continent: Biodiversity and Biology of the African Herpetofauna," and others.

The scope of topics also included behavior of reptiles, calling behavior in Amphibia, growth and development (e.g., the symposium on "Neonatology of Reptiles: Character States Expressed Most Strongly Within the First Year of Life"), physiology, amphibian and reptilian venoms, reproduction, chromosomal studies, parasitology, breeding in captivity, and methods and approaches. Some pre-organized symposia (such as "The Eurasian Green Toad as a Model Species for Studies in Evolutionary Biology" and "Plasticity in Amphibian Reproduction, Development, and Evolution") covered several topics already mentioned.

Large international meetings are also social events, and local organizers usually want to present typical cultural features of the host country. The Czech Republic is famous for its high-quality beer and classical music. Consequently, one evening gathering was held in the oldest brewery in Prague, dating back to 1496. Another night was spent on board a steamer on the Vltava River, which provided an opportunity to see the beautiful panorama of the city and its castle. However, the real highlight of the social program was the concert of old Czech music in the most famous concert hall in Prague. Long-lasting applause brought the musicians back to the stage; after the concert, people did not want to leave the concert hall, and stayed a long time on the main staircase talking in the warm summer night.

The business program included the WCH Business meeting, the International Herpetological Committee meeting and, because the European Herpetological Society was a co-organizer of the congress, also the 9th Ordinary General Meeting of Societas Europaea Herpetologica. In addition, several other committees, boards, and organizations held meetings at the congress site. Three

Herpetology '97

Abstracts of the Third World Congress of Herpetology

edited by Zbynek Roçek and Scott Hart

THIS NEW PUBLICATION CONSISTS OF MORE than 760 abstracts, submitted by authors to the Third World Congress of Herpetology. Authors from every continent and virtually all fields of herpetology are represented. Each abstract includes author's mailing address, key words, and in many cases, information regarding where the paper will be published in full. The book also includes topically arranged contents, as well as author and subject indexes. Hence, the book provides a good review in contemporary herpetology, especially valuable to those unable to attend WCH-3 in Prague. Moreover, because it is likely that not all presented papers will be published, this book makes available a great amount of valuable information to the scientific community.

Copies (nearly 260 pages; the free Programme Book is included) may be purchased from the Congress Secretariat (c/o Czech Medical Association, J.E. Purkyne, P.O. Box 88, Sokolská 31, CZ 120 26 Praha 2, Czech Republic. Fax: ++420 2 294610, e-mail: lon@czechmed.anet.cz). The price is 600 CZK (approximately US $18) plus handling and postage. Discount price is offered when more than 10 copies are purchased at once.

very attractive bids for the Fourth World Congress of Herpetology were proposed and are now being considered by the Executive Committee.

In sum, the congress reflected the current state of herpetology, and enabled the assessment of advances attained in this field of science, and its current and possible future trends. Those who were not able to be in Prague at least can have the book "Herpetology '97," which includes approximately 770 abstracts with the addresses of authors and a Subject Index. *(See ad elsewhere in this issue of HR for ordering details.)* Those who desire to become acquainted with the WCH documents (report of the Secretary General, Treasurer's report, report of the Congress Director, WCH-3 resolutions, etc.) are invited to visit the WCH Web page at: http://www.gli.cas.cz/herpet. The site originally contained information concerning WCH-3, but will be gradually changed into a source of information about current developments in the World Congress of Herpetology, until organizers of the WCH-4 open their own Web page.

Meetings Calendar

20–21 March 1998—Midwest Declining Amphibians Conference. Joint meeting of the Great Lakes and Central Division Working Groups of the Declining Amphibian Populations Task Force. Hosted by the Milwaukee Public Museum, Milwaukee, Wisconsin, USA. Contact: Gary S. Casper, Vertebrate Zoology Section, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA. Tel. (414) 278-2766; fax (414) 278-6100; e-mail: gsc@uwm.edu. Meeting Web site: http://www.mpm.edu/collect/vertzo/herp/DAPTF/Midwest.html.

1–3 June 1998—Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests: An International Symposium. Hanoi, Vietnam. Contact: Natalia Ananjeva (St. Petersburg, Russia), e-mail: nbanorus@glas.apc.org.

12–15 June 1998—Highlands Conference on Plethodontid Salamanders, Highlands Biological Station, Highlands, North Carolina, USA. To be placed on the mailing list, or to up-date your address, please send your name, address, and numbers (phone, FAX, e-mail) to: Plethodontid Conference, Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA, or send an e-mail message to Judy Hill at: JHILL@wpoff.wcu.edu. Additional information: http://www.wcu.edu/hibio.

26–27 June 1998—22nd Annual Meeting of the International Herpetological Symposium, Inc., Holiday Inn-Cincinnati Airport, Cincinnati, Ohio, USA. Contacts: Stan Draper, IHS Secretary, P. O. Box 16444, Salt Lake City, Utah 84114-0444, USA; e-mail: sdraper@npsp.com; or Pete Strimple, Liaison Committee Chair, 5310 Sultana Drive, Cincinnati, Ohio 45238, USA; tel. (513) 451-2392; e-mail: pds0404@aol.com.

16–22 July 1998—41st Annual Meeting, Society for the Study of Amphibians and Reptiles; 46th Annual Meeting of The Herpetologists' League; 78th Annual Meeting, American Society of Ichthyologists and Herpetologists. Hosted by the University of Guelph, Guelph, Ontario, Canada. *Refer to meeting announcement in this issue for details.*

1–5 September 1998—Third International Asian Herpetological Meeting, Almaty, Kazakhstan. To receive the First Announcement and Preliminary Registration Form, please contact one of the meeting organizers: Dr. Tatjana Dujsebayeva, Department of Biology, Kazakh State University, Al-Farabi Prospect, 71, Almaty, 480078, Kazakhstan; tel. (3272) 472677; fax (3272) 472609; e-mail: zool@plague.almaty.kz; Dr. Natalia Ananjeva, Department of Herpetology, Zoological Institute, Universitatskaja nab., 1, Saint-Petersburg, 199034, Russia; tel. (812) 2180711; fax (812) 2182941; e-mail: anb@zisp.spb.su; or Dr. Theodore Papenfuss, Asiatic Herpetological Research, Museum of Vertebrate Zoology, University of California, Berkeley, CA 94720, USA; tel. (510) 642-3567; fax (510) 643-8238; e-mail: asiaherp@uclink2.berkeley.edu.

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, P.O. Box 58355, Salt Lake City, Utah 84158-0355, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

The current contents of various herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Amphibian Community Ecology

Semlitsch et al. present results of 16 years of monitoring the amphibian community at a natural pond in South Carolina. Pond hydroperiod was found to be a primary source of variation in community structure. Temporal variation may favor the reproductive success of different species in different years, with juvenile production being episodic over time. Larval competition and salamander predation also have a detectable influence, but the strength of their influence on the success of species is mediated by pond hydroperiod. (Reprints available from the Savannah River Ecology Lab, P.O. Drawer E, Aiken, South Carolina 29802, USA.)

SEMLITSCH, R. D., ET AL. 1996. Structure and dynamics of an amphibian community: Evidence from a 16-year study of a natural pond. Pp. 217–248, *in* Long-term Studies of Vertebrate Communities. Academic Press.

Salamander Names

By action of the International Commission on Zoological Nomenclature (ICZN), the plethodontid salamander genus *Hydromantes* was placed on the Official List of Generic Names in Zoology with the type species being designated as *Spelerpes platycephalus*. This designation should prove satisfactory to both European and American herpetologists who have long had to deal with a confusing history of taxonomic priority with the generic name of these salamanders.

In other action by the ICZN, Hemidactyliini Hallowell, 1856, was conserved as a family-group name,while the older, but rarely used, Mycetoglossini Bonaparte, 1850, was suppressed.

ANONYMOUS. 1997. Opinion 1866: *Hydromantes* Gistel 1848 (Amphibia, Caudata): *Spelerpes platycephalus* Camp, 1916 designated as the type species. Bull. Zool. Nomencl. 54(1):72–74.

ANONYMOUS. 1997. Opinion 1873. Hemidactyliini Hallowell, 1856 (Amphibia, Caudata): conserved. Bull. Zool. Nomencl. 54(2):140–141.

Plethodontid Salamander Phylogeny

Jackman et al. analyzed sequence data for 555 bp of the mitochondrial gene cytochrome *b* in plethodontid salamanders representing the tribes Bolitoglossini and Plethodontini. They also analyzed 37 morphological characters. There was little conflict between the morphological and DNA data sets. Among the important findings are support for the monophyly of the supergenera *Hydromantes* (inclusive of both American and European species) and *Batrachoseps*, and of a sister-group relationship of *Batrachoseps* and the supergenus *Bolitoglossa*. They further demonstrate conclusively the monophyly of the Bolitoglossini. Their work also provides solid evidence for the independent evolution of highly projectile tongues: *Hydromantes* has a tongue specialized for distance, while that of the supergenus *Bolitoglossa* is specialized for speed.

JACKMAN, T. R., G. APPLEBAUM, AND D. B. WAKE. 1997. Phylogenetic relationships of bolitoglossine salamanders: a demonstration of the effects of combining morphological and molecular data sets. Mol. Biol. Evol. 14(8):883–891.

Wake summarizes recent, unpublished research involving protein variation and mitochondrial DNA sequences for salamanders of the *Ensatina eschscholtzii* complex, a well-known "ring species." These new data reveal that the complex includes a number of geographically and genetically distinct units that are at or near the species level. The complex is geologically old and apparently has undergone instances of range contraction, isolation, differentiation, and then expansion and secondary contact. This work nicely illustrates the difficulty of making taxonomic decisions in a complex exhibiting the full array of intermediate conditions between well-marked species and geographically variable populations.

WAKE, D. B. 1997. Incipient species formation in salamanders of the *Ensatina* complex. Proc. Natl. Acad. Sci. USA 94:7761–7767.

Desert Tortoise Health

The Arizona Game and Fish Department recently published a report by Dickinson et al. in which two Sonoran populations of desert tortoises were surveyed over a five-year period to determine their health status in comparison to Mojave Desert populations. Blood, nasal aspirate, choana and cloacal swabs, and fecal samples were collected repeatedly from 36 tortoises for comparative blood chemistry, microbiological, and parasitological assessments. Among the more disturbing results was the finding of *Mycoplasma agassizii* in three Sonoran tortoises. This *Mycoplasma* is the causative agent of upper respiratory tract disease (URTD), which has been blamed for massive die-off of Mojave populations of *Gopherus agassizii*.

DICKINSON, V. M., J. L. JARCHOW, AND M. H. TRUEBLOOD. 1996. Health studies of free-ranging Sonoran Desert Tortoises in Arizona: A final report. Arizona Game and Fish Department Technical Report No. 24, Phoenix, vi + 79 pp.

DNA Content and Techniques

Murphy et al. discuss the use of flow cytometry of blood as a tool for rapidly sorting individual specimens on the basis of cellular DNA content. In a previous paper, the authors found that flow cytometry enabled them to identify both cryptic sympatric and allopatric species of Vietnamese ranid frogs. Protocols for preparation of freezing solution, field procedures, preparation of reference standards, and flow cytometric analysis are among the topics discussed.

MURPHY, R. W., ET AL. 1997. Flow cytometry in biodiversity surveys: methods, utility, and constraints. Amphibia–Reptilia 18(1):1–13.

MacCulloch et al. examined the diploid nuclear DNA content of 72 species of amphibians and reptiles using flow cytometry. The authors found amphibian DNA content was generally greater than that of reptiles, but greater intraspecific variation occurred in reptiles. They were also able to identify several cryptic species among morphologically similar specimens. The use of flow cytometry in DNA content studies is discussed.

MACCULLOCH, R. D., D. E. UPTON, AND R. W. MURPHY. 1996. Trends in nuclear DNA content among amphibians and reptiles. Comp. Biochem. Physiol. 113B(3):601–605.

Jockusch examined the relationship among two life history traits—egg size and embryonic developmental time—and genome size in 15 species of plethodontid salamanders. There was little correlation between egg size and developmental time. However, genome size is positively correlated with embryonic developmental time.

JOCKUSCH, E. L. 1997. An evolutionary correlate of genome size change in plethodontid salamanders. Proc. R. Soc. Lond. B 264:597–604.

Living Fossil Identified

While studying postcranial osteological characters of Australian short-necked chelid turtles, Thomson et al. made a remarkable discovery. The Pleistocene fossil species *Emydura lavarackorum* (White and Archer, 1994) from Riversleigh, is indistinguishable from an undescribed extant form of *Elseya* from the Nicholson drainage of Queensland. This is the first time an Australian turtle has been described first as a fossil, representing a taxon presumed extinct, then discovered and redescribed as an extant form.

THOMSON, S., A. WHITE, AND A. GEORGES. 1997. Re-evaluation of *Emydura lavarackorum*: identification of a living fossil. Mem. Queensland Mus. 42(1):327–336.

Monophyly in Iguania and Acrodonta

Macey et al. recently estimated a phylogenetic tree for major lineages of iguanian lizards from 1488 aligned base positions (858 informative) of newly reported mitochondrial DNA sequences representing coding regions for eight tRNAs, ND2, and portions of ND1 and COI. Using their phylogenetic tree, the authors suggest that Iguanidae be redefined to include the eight families established by Frost and Etheridge in 1989. The authors also recommend that Acrodonta, Chamaeleonidae, and Agamidae be restored to their previous content following the suggestions of Schwenk (1994).

MACEY, J. R., ET AL. 1997. Evolutionary shifts in three major structural features of the mitochondrial genome among iguanian lizards. J. Mol. Evol. 44:660–674.

Historical Review

The Stephen H. Long Expedition to the Rocky Mountains was the first expedition to the West that included trained biologists in its party. A recent paper by Dundee discusses the part of this ex-

pedition from Council Bluff to the Rockies and the return to Cape Girardeau. Several of the type localities mentioned, as well as the dates of collection, are corrected and discussed. These include *Elaphe obsoleta, Coluber constrictor flaviventris, Thamnophis proximus, Thamnophis sirtalis parietalis, Sistrurus catenatus tergeminus, Masticophis flagellum testaceus, Cnemidophorus tessellatus, Bufo cognatus, Crotaphytus collaris,* and *Scincella lateralis*. Comments on the amphisbaenid genus *Bipes* and horned lizards, genus *Phrynosoma*, are included.

DUNDEE, H. A. 1996. Some reallocations of type localities of reptiles and amphibians described from the Major Stephen H. Long Expedition to the Rocky Mountains, with comments on some of the statements made in the account written by Edwin James. Tulane Stud. Zool. Bot. 30:75–89.

Russian Journal of Herpetology

The first issue of volume 4 of the *Russian Journal of Herpetology* was published recently. Although still quite young, this journal is attracting authors from around the Northern Hemisphere, and covering a broad range of topics. Anyone seeking more information about contributing or subscribing to this journal can visit their web site at: http://www.folium.ru/rjh.

ANANJEVA, N. B., AND T. N. DUJSEBAYEVA. 1997. SEM study of skin sense organs in two *Uromastyx* species (Sauria: Agamidae) and *Sphenodon punctatus* (Rhynchocephalia: Sphenodontidae). 4(1):46–49.

BORKHVARDT, V. G., AND Y. B. MALASHICHEV. 1997. Position of the epicoracoids in arciferal pectoral girdles of the fire-bellies *Bombina* (Amphibia: Discoglossidae). 4(1):28–30.

BORKIN, L. J., S. N. LITVINCHUK, AND Y. M. ROSANOV. 1997. Amphibians and reptiles of Moldavia: additions and corrections, with a list of species. 4(1):50–62.

COX, M. J., D. CHISZAR, AND H. M. SMITH. 1997. Mandibular protractions and their correlation with meal size in juvenile Thai snakes during ingestion of rodent prey. 4(1):31–33.

DANILOV, I. G., AND A. O. AVERIANOV. 1997. New data on the turtles from the early Eocene of Kirgizia. 4(1):40–45.

DAREVSKY, I. S., AND B. S. TUNIYEV. 1997. A new lizard species from *Lacerta saxicola* group — *Lacerta dryada* sp. nov. (Sauria, Lacertidae) and some comments relative to *Lacerta clarkorum* Darevsky et Vedmederja, 1977. 4(1):1–7.

IWANAGA, S., M. TODA, AND H. OTA. 1997. The first successful incubation of eggs of the endemic Ryukyu keelback, *Amphiesma pryeri* (Colubridae: Squamata). 4(1):79–80.

KAMELIN, E. R., Y. A. LUKIN, AND K. D. MIL'TO. 1997. Hybridization of *Vipera schweizeri* (Werner, 1935) and *Vipera lebetina obtusa*, Dvigubsky 1832. 4(1):75–78.

MACEY, J. R., ET AL. 1997. A taxonomic reevaluation of the gekkonid lizard genus *Teratoscincus* in China. 4(1):8–16.

ORLOV, N. L. 1997. Viperid snakes (Viperidae Bonaparte, 1840) of Tam-Dao Mountain Ridge (Vinh-Phu and Bac-Thai Provinces, Vietnam). 4(1):64–74.

SMIRNOV, S. V. 1997. Additional dermal ossifications in the anuran skull: Morphological novelties or archaic elements? 4(1):17–27.

WERNER, Y. L., ET AL. 1997. Observations and comments on active foraging in geckos. 4(1):34–39.

Japanese Journal of Herpetology

Sea turtle biologists will be particularly interested in the latest issue of the *Japanese Journal of Herpetology* in which Kamezaki and Matsui review 256 published studies of sea turtles in Japan. A comprehensive bibliography of the papers reviewed is included. For more information about this journal write: Tsutomu Hikida, Department of Zoology, Faculty of Science, Kyoto University, Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto, 606-01, Japan. The contents of the latest issue are listed below.

GORIS, R. C. 1997. Book Review: The Biology of a Symbiotic Community. Volume I. Population Biology of the Japanese Lizard *Takydromus tachydromoides* (Schlegel) (Lacertidae); and Volume II. The Component Symbiote Community of the Japanese Lizard *Takydromus tachydromoides* (Schlegel) (Lacertidae). 17(1):33–34.

KAMEZAKI, N., AND M. MATSUI. 1997. A review of biological studies on sea turtles in Japan. 17(1):16–32.

KURAMOTO, M. 1997. Further studies on sperm morphology of Japanese salamanders, with special reference to geographic and individual variation in sperm size. 17(1):1–10.

MORI, A., AND M. TORIBA. 1997. Observations of agonistic behavior between males of *Elaphe quadrivirgata*: Confirmation of male combat. 17(1):11–15.

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ARTICLES

Growth During Middle Age in a Schneider's Dwarf Caiman, *Paleosuchus trigonatus*

WILLIAM E. MAGNUSSON*
ALBERTINA P. LIMA
VALDENISE LOPES DA COSTA
ALDENIZA CARDOSO DE LIMA
MARIA CARMOZINA DE ARAÚJO

Coordenação de Pesquisas em Ecologia
Instituto Nacional de Pesquisas da Amazônia
CP 478, 69011-970 Manaus AM, Brasil
**e-mail: bill@cr-am.rnp.br*

Models of growth of reptiles can be difficult to interpret because of large intra-individual variation, and the resulting model of "mean" growth may not represent the most common form of growth of individuals in the population (Rickard et al. 1989). Empirical tests of models may be difficult for long-lived organisms, especially if individuals in some size classes are difficult to capture or recapture. This is the case for *Paleosuchus trigonatus*, for which Magnusson and Lima (1991) produced a growth model based almost entirely on very small individuals and individuals near asymptotic size. They assumed a monomolecular (von Bertalanffy by length) model of growth, but crocodilians frequently have other forms of growth (Magnusson and Sanaiotti 1995; Webb et al. 1983).

Juvenile *P. trigonatus* disperse widely until they are near adult size, at which time they establish permanent territories. Adults are long lived, and the probability of following the growth of intermediate-sized animals is small under normal circumstances. Here we report on an unusual series of events that allowed us to follow the growth of one male *P. trigonatus* and partially evaluate the model of Magnusson and Lima (1991).

When a large male *P. trigonatus* (#4) that occupied the center of our study area disappeared in 1986, the two resident males (#5 and #12) on each side of #4's territory expanded their territories to include the vacant area. The dynamics of the interaction between #4 and #5 have been described partially by Magnusson and Lima (1991). A juvenile male (#37) was captured in the area previously occupied by #4 in March of 1989. In April 1989, #12 was drowned in a turtle trap, and #37 remained in the area. Here, we describe the growth of #37 between 7 March 1989 and 23 July 1996 when he also was drowned in a turtle trap.

We do not know the age of #37 when he first was captured with a snout-vent length (SVL) of 59 cm, but his subsequent growth rate was higher than that predicted by the model of Magnusson and Lima (1991). To estimate his initial age, we applied his observed rate of decline in growth rate with length (-1.022 cm/year/cm), and the maximum asymptotic size of any individual in our study area (90 cm), in the monomolecular model. These values are greater than those in the "mean" model (-1.278 cm/year/cm and 80 cm, respectively) and, if in error, should underestimate initial age. However, the difference between initial age estimated with these parameters and those of the "mean" model is trivial (Fig. 1). Data for one known-age female at 6.9 yr (Fig. 1) indicate that the estimate of initial age of 9.0 yr for the male is reasonable.

Growth of #37 indicates that the underlying pattern of growth for *P. trigonatus* does not deviate grossly from the monomolecular model as do those for *Crocodylus johnstoni* (Webb et al. 1983) and one population of *Caiman crocodilus* (Magnusson and Sanaiotti 1995). The longitudinal data indicate that #37 reached 75 cm SVL at about 15 yr of age, considerably less that the 20 yr predicted by the model of Magnusson and Lima (1991), but still much greater than that expected from growth models of *Caiman crocodilus* (Magnusson and Sanaiotti 1995). As with large species of crocodilians, sexual maturity in *P. trigonatus* is attained at ages between one and two decades.

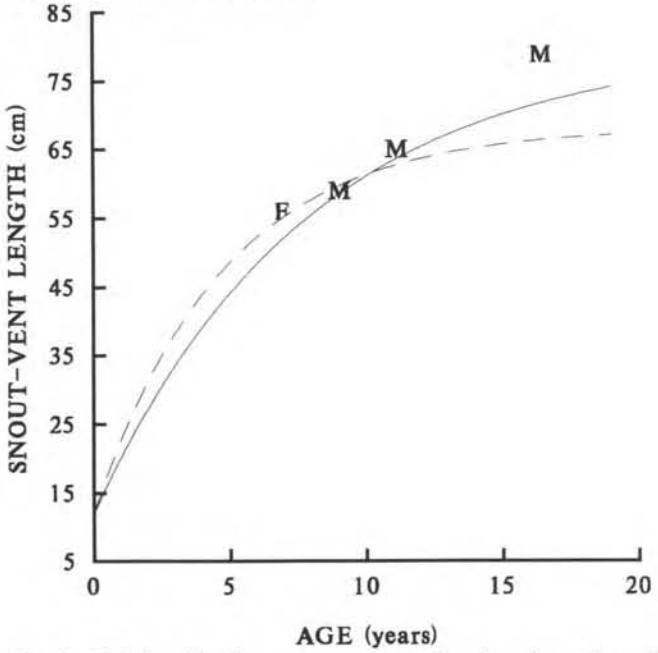


FIG. 1. Relationships between snout–vent length and age for males (solid line) and females (broken line) predicted for a population of *P. trigonatus* by Magnusson and Lima (1991). "F" represents a known age female and "M" represents data for male #37, assuming an age at first capture of 9 years (see text).

Acknowledgments.—We thank Richard Vogt for provoking the events that led to the initiation and termination of this study. The Brazilian Conselho Nacional de Desenvolvimento Científico e Tecnológico provided support in the form of Bolsas de Produtividade (William E. Magnusson), Aperfeiçoamento (Aldeniza Cardoso de Lima), Iniciação Científica (Valdenise L. da Costa), and Apoio Tecnico (Albertina P. Lima).

LITERATURE CITED

MAGNUSSON, W. E., AND A. P. LIMA. 1991. The ecology of a cryptic predator, *Paleosuchus trigonatus,* in a tropical rainforest. J. Herpetol. 25:41–48.

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RICKARD, R. S., R. M. ENGEMAN, G. O. ZERBE, AND R. B. BURY. 1989. A nonparametric comparison of monomolecular growth curves: application to western painted turtle data. Growth, Development Aging 53:47–56.

WEBB, G. J. W., R. BUCKWORTH, AND S. C. MANOLIS. 1983. *Crocodylus johnstoni* in the McKinlay River area, N.T. III. Growth, movement and population age structure. Aust. Wildl. Res. 10:383–401.

Behavioral Observations of *Polychrus gutturosus*, a Sister Taxon of Anoles

WENDY E. ROBERTS
Museum of Vertebrate Zoology and Department of Integrative Biology
University of California, Berkeley, California 94720, USA
Current Address: Mountain Research Center, P.O. Box 173490
Montana State University, Bozeman, Montana 59717-3490, USA
e-mail: wendy@peak.mrc.montana.edu

Polychrus gutturosus (Polychrotidae) is a rarely seen, highly arboreal lizard of lowland rainforests in Central and northern South America. The genus *Polychrus* consists of five species, all characterized by green color, long semiprehensile tails, extremely slow movement, and diets of arthropods and vegetative matter (Greene 1986; Vanzolini 1983; Vitt and Lacher 1981). Because *Polychrus* is the sister taxon of anoles (Frost and Etheridge 1989), this genus is especially important for interpreting evolution among iguanians, yet the behavior and ecology of these cryptic lizards remain poorly known. Here I report locomotor, agonistic, and copulatory behavior in *P. gutturosus* based on field observations in Costa Rica and Panama. I compare this behavior to other species of *Polychrus* and to anoline lizards.

I observed *Polychrus gutturosus* copulating at the La Selva Biological Station, Heredia Prov., Costa Rica on 9 May 1992. The lizards were 2 m up in a tree in tropical wet forest. Observations were made five days after the beginning of heavy rains. I had made no systematic attempts to find lizards of this species, and the observation of copulation was happenstance. My observations of this mating pair were not continuous, nor were individuals marked. However the extreme rarity of this species makes it highly unlikely that more than one male and one female were involved in copulation.

At 0800 h I found a male *P. gutturosus* in a small (~4 m high) *Hemalia patens* (Rubiaceae) tree. At 1200 h I returned and saw the male copulating with a female in the crotch of several small branches of the same tree less than 10 m from the edge of the Puerto Viejo River (Fig. 1). I next observed the pair from 1228–1300 h, from a distance of about 2 m horizontal from the animals. The male was positioned on top of the female with his right hemipenis inserted. The tails were partly entwined and draped over, but not grasping, nearby twigs. The female had an estimated snout–vent length (SVL) of 20 cm and was approximately one third longer than the male. The female was shedding and the only movement was an occasional horizontal head twitch by her. When observed again at 1340 h the pair had not moved, but the male had switched to the other side of the female's tail, using the left hemipenis. The pair separated at 1438 h.

During copulation the female was a dull olive green and the male was brown with faint light bands. Shortly after separation the colors of both animals darkened significantly, the female became a rich green with yellow throat and dewlap, and the male became distinctly banded dark brown and beige. The female then moved away at an extremely slow pace along twigs. The next morning at 0800 h the male was still within 2 m of the copulation site, on a *Heliconia* plant several meters above the ground. The female was not seen again.

H. W. Greene (pers. comm.) observed *Polychrus gutturosus* twice at La Selva. On 20 June 1984 one fell out of a small tree. Later, while being photographed, the lizard moved rapidly up the tree when pursued. On 24 July 1987 Greene caught a female *P. gutturosus* (SVL 170 mm, tail length [TL] 550 mm) in a *Heliocarpus* sp. (Tiliaceae) tree next to the Puerto Viejo river. It had palpable eggs and could switch from brown to green in seconds. When the female was returned to the tree its tail was not curled around a branch, but was kept in contact with branches along the length of the tail. It gaped and extended its dewlap when threatened with a finger. A dead male *P. gutturosus* (SVL 122 mm, TL 430 mm) was found at La Selva lying on a trail on 27 June 1984; the cause of death could not be determined. J. B. Losos collected a subadult *P. gutturosus* (SVL 88 mm, TL 288 mm, MVZ 212068) 40 m above the ground on a leaf next to a canopy tower in Panama. In captivity it locomoted by placing two toes on one side of a branch and three toes on the other side.

Lizards in the genus *Polychrus* are difficult to see because of their immobility, use of twigs as substrate, ability to change color, and long twiglike tail. These characteristics make it hard to distinguish them from their arboreal background (Beebe 1944; Cott 1926; Gorman et al. 1969). *Polychrus gutturosus* is particularly hard to see because it inhabits complex lowland rainforest, unlike *P. acutirostris*, which is found in more open semi-arid habitats (Vitt and Lacher 1981). The limited number of observations suggest that *P. gutturosus* occupies the forest canopy and occurs in low densities. *Polychrus marmoratus* was noted for its association with river courses (Vanzolini 1983), and two of the *P. gutturosus* sightings reported here occurred near rivers. However, river edges represent easy locations to observe canopy animals, perhaps accounting for these observations.



FIG. 1. Copulating *Polychrus gutturosus* in a small tree at the La Selva Biological Station, Costa Rica on 9 May 1992.

Polychrus gutturosus and *P. acutirostris* are sexually dimorphic in color while *P. marmoratus* is not (Vanzolini 1983). *Polychrus marmoratus* can change its color from bright green to somber brown based on changes in emotional or reproductive state (Vanzolini 1983). In aggressive encounters, dominant individuals of *P. acutirostris* became lighter while submissive individuals became darker; color change also occurred during thermoregulation (Vitt and Lacher 1981). *Polychrus peruvianus* and *P. femoralis* both showed ability to change color, although this capacity was less marked in *P. femoralis* (Gorman et al. 1969).

Members of the genus *Polychrus* show similarities to the highly arboreal and tropical *Varanus prasinus* and the Chamaeleonidae (Greene 1986). These lizards are green, have at least partly prehensile tails, and have special modifications of the feet for walking on twigs. All of these taxa have very slow movement, which may prevent detection both by prey and predators (Greene 1986). The only predation event recorded for *Polychrus* was a *P. marmoratus* taken by a white hawk (Beebe 1944), a visual predator.

Anoles frequently copulate in trees and some species have been found to alternate hemipenis use both when copulating with multiple females and when copulating more than once with one female (Tokarz and Kirkpatrick 1991). Like *P. gutturosus*, a male *P. acutirostris* also positioned itself on the back of the female, and pairing lasted 24 h, although most of that time the male did not have a hemipenis inserted in the female (Vitt and Lacher 1981). Copulation in *P. gutturosus* lasted between 2 and 6 hours, while in anoles, mean copulation times were 4.4 min for *Anolis sagrei* (Tokarz and Kirkpatrick 1991) and 10 min for *A. carolinensis* (Crews 1978). J. B. Losos (in litt.) measured copulation time in 11 other species of *Anolis* (14 individuals) and found a maximum copulation time of 17.8 min in *Anolis gundlachi*. Based on observation of copulation in May and palpable eggs in July, *Polychrus gutturosus* appears to breed during the May–December rainy season in Central America. *Polychrus acutirostris* also breeds during the wet season and lays one clutch per year (Vitt 1992).

Green color and arboreality are common and presumably primitive in Polychrotidae, but the special use of toes for locomotion, very long semi-prehensile tail, and long copulation time are unique to *Polychrus* and probably derived for the genus. While copulation has been observed in only two of the five species of *Polychrus*, these two species occupy very different habitats, and in both cases copulation was unusually long compared to anoles. This long copulation time perhaps is related to the general propensity for very slow motion and long periods of immobility in *Polychrus*.

Acknowledgments.—I thank O. Vargas for showing me the pair of copulating *Polychrus gutturosus*, and H. W. Greene and J. B. Losos for sharing their previous observations of this species. H. W. Greene read and commented on an early version of the manuscript. The author was supported by an Organization for Tropical Studies Predoctoral Fellowship sponsored by the Pew Society, and by a Regents Fellowship from the University of California. I thank Deborah and David Clark for facilitating work at the La Selva Biological Station.

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Feeding Habits of the Alligator Snapping Turtle (*Macroclemys temminckii*) as Indicated by Teleostean Otoliths

J. BRENT HARREL*
Department of Biology, Northeast Louisiana University
Monroe, Louisiana 71209, USA
e-mail: jbharrel@netdoor.com

and

GARY L. STRINGER
Department of Geosciences, Northeast Louisiana University
Monroe, Louisiana 71209, USA
e-mail: gestringer@alpha.nlu.edu

**Present address: U.S. Department of Agriculture, National Wildlife Research Center, Mississippi Research Station, P.O. Drawer 6099, Mississippi State, Mississippi 39762, USA*

Alligator snapping turtles (*Macroclemys temminckii*) are opportunistic scavengers that consume a variety of prey with fish representing a large portion of their diet (Ernst et al. 1994; Pritchard 1989; Sloan et al. 1996). However, little information exists about their preference for specific types of fishes in natural populations. This study investigates the feeding habits of *M. temminckii* as indicated by teleost otoliths in the scats. Considering the endangered and threatened status of these turtles in most states (Ernst et al. 1994; Pritchard 1989), determination of the dietary preferences of *M. temminckii* is important in understanding the ecology and life history of North America's largest freshwater turtle species.

Macroclemys temminckii is considered an ambush predator, luring fish within striking distance by its psuedo-annelid lure, located on the floor of its mouth. In Louisiana, predaceous fish, such as sunfish (*Lepomis* spp.), largemouth bass (*Micropterus salmoides*), and crappie (*Pomoxis* spp.) may be attracted to the lure (Dundee and Rossman 1989). To determine the types of fishes being consumed by *M. temminckii*, teleost otoliths were analyzed from scats. According to Treacy and Crawford (1981), otoliths are often the last remnant of bony fishes to be found in the stomach, intestine, or feces of predators, and often may constitute the only clue to the identity of fishes consumed by marine mammals.

Teleost otoliths have been utilized for determining the feeding habits of a wide variety of piscivorous animals including invertebrates and vertebrates for almost a century (Fitch and Brownell 1968; Schafer 1972; Scott 1903). In a study involving marine mammals, teleost otoliths were found to be reliable indicators of fish consumed (Treacy and Crawford 1981). The numerical proportion of different prey species may be estimated correctly using otoliths from scats according to studies by Dellinger and Trillmich (1988). Although teleost otoliths have been utilized for many years in determining the feeding habits of a wide variety of animals, their use with turtles has been neglected.

Macroclemys temminckii utilized in this study were captured from two northeast Louisiana (USA) water systems in Ouachita Parish, Cheniere Lake and Bayou Desiard. The greatest number of turtles were obtained from Bayou Desiard because of greater sampling effort. Cheniere Lake is located near West Monroe, Louisiana; Bayou Desiard is located in Monroe, Louisiana. Specific collecting sites are described in Harrel et al. (1996). Turtles were captured by hand and with hoop nets between late March 1993, and late September 1993, with most being captured in April, May, and September. Freshwater buffalo (*Ictiobus* spp.) heads and meat were used as bait in hoop nets. Buffalo otoliths were excluded from the otolith analysis in order to avoid bias introduced by the use of bait. The possibility exists that the turtles defecated during capture, but there was no way to control for this. Twenty-four *Macroclemys temminckii* were captured: 2 post-hatchlings, 14 subadults, and 8 adults. Limited holding facilities necessitated placing the turtles in groups. Within one hour of capture, the turtles were transported to galvanized containers 2.5 m diam. Turtles were housed for a minimum of three weeks before release and were not fed during their first week of captivity. However, after one week, freshwater buffalo filets were fed to the turtles. Turtles generally defecated within 36 h of being placed in the tank or after being fed. After defecation, turtles were removed from the containers, and the containers were drained. Fine mesh netting was placed over the drain hole to prevent the loss of otoliths. After the water was drained from the tank, sediments and fecal material were allowed to dry in the bottom of the container. Otoliths were removed from the dried material, cleaned, and stored for study.

Otoliths from the turtle scats were identified by comparison to a reference collection of Recent otoliths maintained by GLS. The vast majority of the otoliths were sagittae, the otoliths found in the sacculus of the labyrinth (Stringer 1979). Sagittae are generally examined in otolith studies because of the characteristic pattern found on the inner face, known as the sulcus, which is the primary means for identification of otoliths (Stringer 1986; Stringer 1992). In some cases, identification of otoliths to species level was not possible because of breakage, etching, or erosion during digestion.

The effect of the digestive acids upon the otoliths is quite variable. In some cases, the otoliths are well preserved compared to otoliths obtained directly from freshly-caught fish. In other cases, the otoliths display various degrees of dissolution and erosion. In rare cases, the otoliths are dissolved to the extent that identifications are severely limited. Another problem encountered was that juvenile otoliths of closely related species, such as the various species of *Lepomis*, are often not identifiable to species level. A potential problem also exists with hybridization of closely related species such as centrarchids (Dawley 1987; Douglas 1974; Trautman 1957).

TABLE 1. Fish species based on otoliths from the scats of *Macroclemys temminckii*.

Sample 1: 5 turtles: adult male (32.7 kg); adult male (20.9 kg); adult female (12.7 kg); female subadult (3.3 kg); male subadult (5.5 kg).

Fish Species identified on otoliths	Number of otoliths (right/left sagitta)
Centrarchus macropterus	4 (2/2)
Lepomis macrochirus	14 (6/8)
Lepomis miniatus	2 (1/1)
Lepomis microlophus	2 (1/1)
Lepomis sp. (juvenile)	1 (1/0)
Lepomis sp. (broken)	2 (2/0)
Micropterus salmoides	3 (3/0)
Pomoxis nigromaculatus	3 (2/1)
Dorosoma cepedianum	21 (12/9)
Centrarchidae (identifiable to family only)	6 (3/3)
Lapillus (unknown)	2
Sagittae (unknown)	3
Otoliths (broken or eroded beyond identification)	13
Total	**76**

Sample 2: 12 turtles: 3 male subadults (less than 4.5 kg each); 9 female subadults (less than 4.5 kg each).

Fish Species identified on otoliths	Number of otoliths (right/left sagitta)
Centrarchus macropterus	1 (1/0)
Lepomis macrochirus	22 (10/12)
Lepomis miniatus	3 (3/0)
Unknown sagittae	2 (1/1)
Total	**28**

Sample 3: 2 turtles: 2 posthatchlings (0.5 kg and 0.9 kg).

Fish Species identified on otoliths	Number of otoliths (right/left sagitta)
Unknown sagittae (broken)	2
Total	**2**

Sample 4: 1 turtle: subadult (7.1 kg).

Fish Species identified on otoliths	Number of otoliths (right/left sagitta)
Lepomis macrochirus	1 (0/1)
Lepomis sp. (eroded)	1 (n/a)
Total	**2**

Sample 5: 3 turtles: adult male (18.1 kg); adult male (16.8 kg); adult female (15.0 kg).

Fish Species identified on otoliths	Number of otoliths (right/left sagitta)
Pomoxis nigromaculatus	4 (2/2)
Lepomis sp. (broken)	1 (1/0)
Dorosoma cepedianum	1 (1/0)
Unknown sagitta (broken)	1 (n/a)
Lapillus (unknown)	1
Total	**8**

Note: Samples 1a, 1b, 2, and 3 from Bayou Desiard; Samples 4 and 5 from Cheniere Lake.

A total of 116 otoliths were recovered from scats of 24 *Macroclemys temminckii* (Table 1). All of the otoliths were sagittae except for three lapilli (from the utriculus of the labyrinth). Of the total otoliths recovered, 81 (69.8%) were identifiable to species level. Of those remaining, 11 otoliths (9.5% of the total) were identifiable to genus or family level. Only 24 otoliths (20.7%) were broken or eroded so that identification was not possible or represented species that were not found in the reference collection. The identification of the otoliths allows for determination of fish species being consumed by natural populations of *M. temminckii*. Also, fish species consumed by the turtles can be compared to species availability in the two water bodies. Fish species recorded as prey of *M. temminckii* and their percentage of the total otoliths are bluegill *Lepomis macrochirus* (31.9%), gizzard shad *Dorosoma cepedianum* (19.0%), black crappie *Pomoxis nigromaculatus* (6.0%), flier *Centrarchus macropterus* (4.3%), red-spotted sunfish *Lepomis miniatus* (4.3%), largemouth bass *Micropterus salmoides* (2.6%), and redear sunfish *Lepomis microlophus* (1.7%). Thus, turtles fed predominantly upon species of sunfishes from the family Centrarchidae (60.3% of the total number of otoliths). The number could be higher considering the unknown lapilli and unidentifiable otoliths.

Our results were compared to species availability data for Bayou Desiard and Cheniere Lake. Studies by the Louisiana Department of Wildlife and Fisheries (rotenone data) indicate that the most abundant species for these two waterways are gizzard shad *Dorosoma cepedianum* and *Lepomis* (the various species of *Lepomis* were classified together). *Lepomis macrochirus* and *Dorosoma cepedianum* were also the most commonly found otoliths in the turtle scats. The large percentage of centrarchids is also in agreement with the species availability data. *Macroclemys temminckii* seems to be feeding on the most available fish species. Contrary to the opinion of many sports fishermen, largemouth bass *Micropterus salmoides* do not seem to constitute a primary prey for *M. temminckii*. Unfortunately, dietary differences between sexes and age was not possible in this study because of the turtles' large size and limited holding facilities.

Many fishes, especially centrarchids, are attracted to littoral areas containing woody debris and logs. *Macroclemys temminckii* in Louisiana have a high preference for forested wetlands and heavily structured microhabitats, such as submerged logs (Harrel et al. 1996; Sloan and Taylor 1987). Turtles may move into structured habitats to better utilize prey resources. However, the recovery of large numbers of *Dorosoma* otoliths in relation to *Lepomis* is somewhat puzzling because these species occupy different habitats (open water versus structured). One possible explanation may be fish kills associated with low dissolved oxygen levels during the summer with *Dorosoma* incurring high mortality. Many of the *Dorosoma* carcasses would drift into the littoral zone where they would be eaten by *M. temminckii*. Although this study demonstrated the use of fish otoliths only in the scats of *M. temminckii* for determining feeding habits, the technique should be applicable for examining the fish composition of other turtles' diets.

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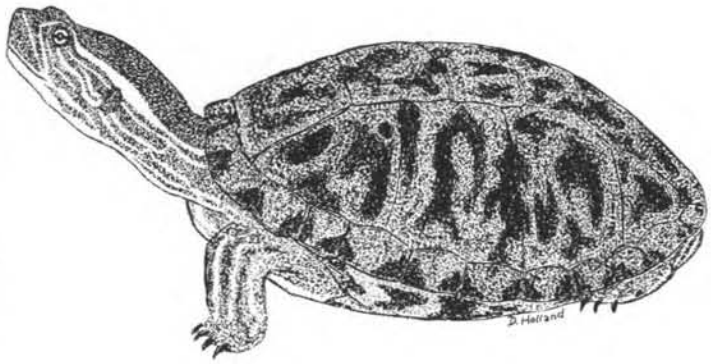
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Comments on the Snake Records of *Chilomeniscus cinctus, Crotalus exsul*, and *C. mitchellii* from Islas Magdalena and Santa Margarita, Baja California, México

HUMBERTO WONG
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
e-mail: humbwong@lasierra.edu

The latest herpetofaunal checklist encompassing the Pacific Islands of Baja California (Grismer 1993) was a comprehensive revision of previous works on this subject (Bostic 1975; Savage 1967; Wilcox 1980; Zweifel 1958). Of these checklists, only the ones of Grismer (1993), Zweifel (1958), and Bostic (1975) include the neighboring Islas Santa Margarita and Magdalena. From these islands, three records originating with Bostic (1975) require clarification as to their current status. These are the records of *Chilomeniscus cinctus, Crotalus exsul* (*sensu* Grismer et al. 1994), and *C. mitchellii*.

The sole museum specimen of *Chilomeniscus cinctus* from Isla Magdalena (USNM 37521) was collected in 1905 by E. W. Nelson and E. A. Goldman and listed by Van Denburgh (1922). Bostic (1975) reported *C. cinctus* only from Isla Santa Margarita whereas Grismer (1993) listed *C. cinctus* for both islands. A search of 23 museums (Appendix I) yielded approximately 735 *Chilomeniscus* specimens, none of which were from Isla Santa Margarita. Nevertheless, *Chilomeniscus* probably occurs on Isla Santa Margarita since suitable, sandy habitat exists in the pass between the northern and southern mountains (Goldman 1951; Nelson 1922). Thus, although the occurrence of *C. cinctus* on Isla Magdalena is reaffirmed, it should not be considered part of the fauna of Isla Santa Margarita until a voucher specimen is obtained.

Crotalus exsul (*sensu* Grismer et al. 1994) was first reported from Isla Santa Margarita by (Klauber 1930:3) on the basis of a single specimen (CAS 56046, Appendix II) collected by J. R. Slevin on 29 July 1922. An additional specimen (SDSNH 6606) was collected on 4 December 1931 by J. R. Pemberton. These records went unreported by Zweifel (1958), Bostic (1975), and Grismer (1993), but were listed by Campbell and Lamar (1989). Furthermore, I observed a dead specimen on the northeastern end of the island on 21 July 1995. Fishermen informed me that they had killed the snake earlier that morning. Bostic (1975) reported *C. exsul* from Isla Magdalena, but a museum search (Appendix I) failed to yield any specimens from this locality.

Numerous authors have reported *C. mitchellii* from Isla Santa Margarita (Campbell and Lamar 1989; Grismer 1993; Klauber,1936; McCrystal and McCoid 1986; Van Denburgh 1905; Van Denburgh 1922; Van Denburgh and Slevin 1914) although Bostic (1975) excluded it from the island's herpetofauna. The oldest museum record I was able to locate from this island (CAS 623) was collected in 1889 by W. E. Bryant. Bostic's (1975) deletion of *C. mitchellii* from Isla Santa Margarita's herpetofauna despite the deposited specimens is juxtaposed by his addition of *C. mitchellii* to Isla Magdalena that lacks voucher specimens. Van Denburgh (1905, 1922), Van Denburgh and Slevin (1914), Zweifel (1958), McCrystal and McCoid (1986), Campbell and Lamar (1989), and Grismer (1993) did not list *C. mitchellii* on Isla Magdalena. Mattison (1996) listed *C. mitchellii* for both Isla Magdalena and Isla Santa Margarita. Because of the conflicting nature of these reports, I provide here clarification on the current status of these records. On 21–22 July 1995, I visited Islas Magdalena and Santa Margarita. I observed a specimen of *C. mitchellii* (Appendix II) on Isla Santa Margarita cratered in the rocky hardpan near the locale where the aforesaid *C. exsul* was killed. On the other hand, no specimens of *C. mitchellii* from Isla Magdalena have been deposited in museum collections (Appendix I). Therefore, based on the lack of voucher specimens from Isla Magdalena, I recommend that only the *C. mitchellii* population from Isla Santa Margarita be recognized.

In summary, the herpetofaunal records for Isla Magdalena should be amended to include *Chilomeniscus cinctus* and exclude *Crotalus exsul* and *C. mitchellii*. Similarly, for Isla Santa Margarita, *C. exsul* and *C. mitchellii* should be recognized as present, whereas *C. cinctus* should be omitted until valid new records are brought forth.

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APPENDIX I

Museum acronyms used follow Leviton et al. (1985) except for the La Sierra University Herpetological Collection (LSUHC) and La Sierra University Photographic Collection (LSUPC). *Chilomeniscus* records were examined from the following museums: AMNH, ASU, BYU, CAS, CM, CSF, FMNH, KU, LACM, LSUHC, LSUMZ, MCZ, MSUM, MVZ, SDSNH, TAIC, TCWC, UAZ , UCM, UF, UMMZ, USNM, UTEP. *Crotalus mitchellii* and *Crotalus exsul* records were examined from the following museums: AMNH, CAS, LACM, LSUHC, MVZ, SDSNH, USNM.

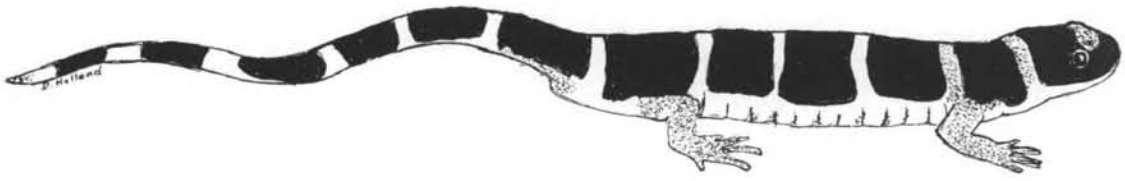
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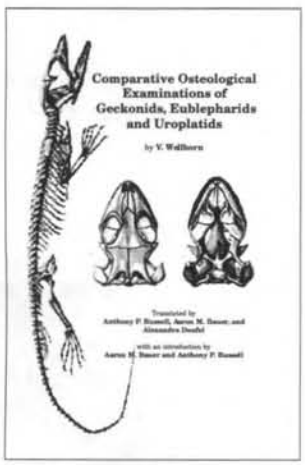
Specimens verified by the author or Jens Vindum (CAS).

Chilomeniscus cinctus: MÉXICO: BAJA CALIFORNIA SUR: Isla Magdalena (USNM 37521).

Crotalus exsul: MÉXICO: BAJA CALIFORNIA SUR: Isla Santa Margarita (CAS 56046, SDSNH 6606).

Crotalus mitchellii: MÉXICO: BAJA CALIFORNIA SUR: Isla Santa Margarita (LSUPC S683–S684).





Comparative Osteological Examinations of Geckonids, Eublepharids and Uroplatids

Vera Wellborn

Translated by A.P. Russell, A.M. Bauer and A. Deufel
With an introduction by A.M. Bauer and A.P. Russell.

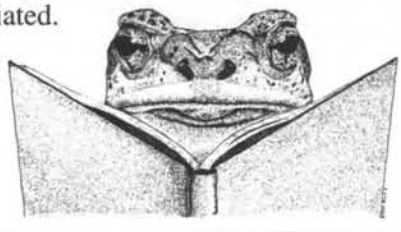
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Ingested Molted Skin as Possible Source of Ostracods and Mites in the Gut of Anurans

D. EDUARD VAN DIJK
Department of Zoology, University of Stellenbosch
Stellenbosch 7600, South Africa
e-mail: vdijke@iafrica.com

Mites have been described (Douglas 1992) as tertiary prey of the snake *Psammophylax rhombeatus*, i.e., mites are ingested by earthworms, earthworms are eaten by shrews, and the shrews by the snakes. Reference is made by Douglas to a review of mite-eating in amphibians (Simon and Toft 1992). *Psammophylax* has been reported by FitzSimons (1962) and others to feed on frogs, but the possibility that frogs might be alternatives to shrews was not considered by Douglas.

Considering frogs as a possible source of mites in the gut contents of snakes makes a simpler scenario possible, namely that mites feed on the skin of a frog that is molting, and are ingested when, as is often the case, the frog eats the molt. In connection with this scenario, the following observations on ostracods in the gut contents of *Xenopus laevis* may be suggestive:

Examination of the gut contents of *Xenopus laevis* was part of a Practical in Zoology at the University of Natal. Ostracods were seen in various parts of the alimentary tract, from stomach to rectum, and some observed at all sites, including the rectum, were still alive. It was noticed that the ostracods were associated with frog skin. Two conclusions were drawn. Firstly that the ostracods were ingested with molted skin, and secondly that survival of some of them could have resulted from protection from digestive juices afforded by folds of skin around them. That ostracods avidly attack the skin of tadpoles was observed by the author after capturing tadpoles of *Kassina senegalensis* with a fine net, which also captured and concentrated ostracods, to the obvious distress of the tadpoles when the contents of the net were put in an aquarium.

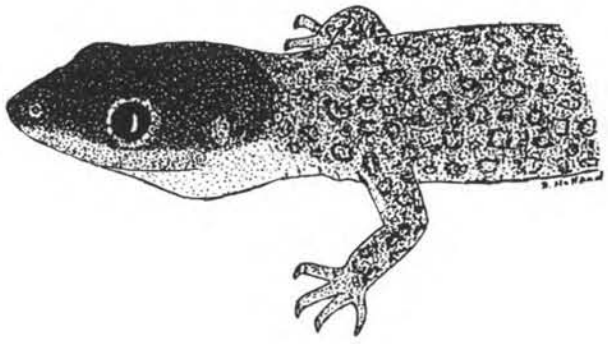
The scenario offered by Douglas is difficult to check. On the other hand, the finding of mites in association with skin in the gut of frogs would be highly suggestive of the alternate scenario described above. It is offered here in the hope that others might be able to throw some light on the matter from their experience.

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Insect Infestation of Mediterranean Marine Turtle Eggs

ANNETTE C. BRODERICK
Department of Veterinary Anatomy, University of Glasgow Veterinary School
Garscube Estate, Glasgow G61 1QH, Scotland, U.K.
and
Division of Environmental and Evolutionary Biology, Graham Kerr Building
Institute of Biomedical and Life Sciences, University of Glasgow
G12 8QQ, Scotland, U.K.

and

E. GEOFFREY HANCOCK
Department of Science, Glasgow Museums
Kelvingrove, Glasgow G3 8AG, Scotland, U.K.

There are numerous threats to marine turtle populations, many of which are because of man. There are also natural threats such as predation of eggs and hatchlings. These factors must be studied in an effort to assess their impact on these endangered species. Few studies have been conducted on the effect of insect infestation of marine turtle eggs.

Lopes (1982) identified *Eumacronychia sternalis* (Diptera; Sarcophagidae) living on eggs of the green turtle (*Chelonia mydas*) nesting on the Pacific coast of México. They were reported to have infested nearly 90% of nests transplanted to hatcheries as well as some *in situ* nests. Their data indicated that infestation reduced hatching success by at least 30%.

Other studies have documented larvae of the dipteran family Phoridae, specifically *Megaselia scalaris*, in nests of green (Fowler 1979) and hawksbill (*Eretmochelys imbricata*) turtles (Bjorndal et al. 1985) in Costa Rica. Several studies have shown that larvae of phorids also infest eggs of fresh water turtles (Acuña-Mesen and Hanson 1990; Vogt 1981) and a review of these is given by Iverson and Perry (1994).

In the Mediterranean, only coleopteran larvae have been reported infesting eggs of the loggerhead turtle (*Caretta caretta*) in Turkey (Baran and Türkozan 1996). No other published data exist on insect larval infestation of marine turtle nests in the Mediterranean. Our study was carried out in 1994 and 1995 on the north coast of the island of Cyprus (eastern Mediterranean), where both *Chelonia mydas* and *Caretta caretta* nest (Broderick and Godley 1996). Work was carried out at the main nesting site at Alagadi and other beaches along the coast. After hatching had occurred, nests were excavated to examine the clutch remains and determine the hatching success of individual nests. In the event of insect larvae being discovered among the remains, the number of infested eggs was recorded and the larvae taken to the laboratory to rear. Occasionally, we found pupae while collecting sand samples from the wall of the nest for other analyses. Samples were kept in glass jars covered with muslin at room temperature and checked at two-day intervals. When adult insects were observed they were left for at least 24 h to allow cuticles to harden before they were removed and preserved in alcohol. Samples were then returned to the U.K. for identification. In some instances other invertebrates were recorded in the nest and either identified immediately or preserved for later study.

In 1995, 11 of the hatched *C. caretta* nests at Alagadi were infested with insect larvae. This represents 23% of hatched nests that were excavated. In nests of *C. mydas*, insect larvae were recorded in 5 (9%) nests. In these clutches, infestation had occurred in 4.6% (N = 5, SE = 1.45) of *C. mydas* eggs and 10.6% (N = 11, SE = 4.81) of *C. caretta* eggs. Infested nests also were found at other beaches, although their effects were not quantified.

In Cyprus, *C. mydas* lay their eggs at a greater depth than *C. caretta* (Broderick and Godley 1993). This may account for the lower rate of infestation of *C. mydas* nests, their greater depth making them less accessible to burrowing female insects or their larvae. An additional factor may be that *C. mydas* covers her eggs with a large mound of sand, possibly masking their smell. Although levels of infestation are given for those nests that were hatched and excavated, we do not know to what extent unhatched nests may have been infested. In addition, infestation may have occurred in hatched nests at an earlier date and larvae migrated away from the nest to pupate in the sand. Nests can be marked accurately at laying and in principle be excavated at any time to search for insect infestation. However, this intrusive method may not be compatible with proper conservation practice.

Adult insects were reared successfully from seven nests. These samples have been identified as containing four species of flies from two different families (Diptera: Sarcophagidae and Phoridae) and one species of wasp, *Brachymeria podagarica* (Hymenoptera: Chalicidae). The sarcophagids are *Sarcophaga (Parasarcophaga) crassipalpis, Sarcotachina subcylindrica* and a species of *Wohlfahrtia*, possibly *indigens*. The phorid was the well-known polyphagous species *Megaselia scalaris*, which is worldwide in its distribution.

Sarcophaga (P.) crassipalpis and *S. subcylindrica* were found in the nests of both species of turtles. *Megaselia scalaris* was reared from a *C. caretta* and the *Wohlfahrtia* sp. from a *C. mydas* nest. The wasp is known to be a widespread parasitoid of muscoid flies, including the Sarcophagidae (Beaver 1986) and, in this instance, was found in association with *S. (P.) crassipalpis* in a *C. mydas* nest.

During earlier work in 1994, two other sarcophagids were recorded, both of which were reared from *C. caretta* nests. These were a species of *Sarcophaga (Parasarcophaga),* either *argyrocephala* or *hirtipes*, and an as yet unidentified member of the tribe Amobiini, subfamily Miltogramminae. Other observations include one larva of a beetle (Coleoptera: Scarabaeidae), not identifiable to species level, found in a *C. mydas* nest. In addition, one of the nests with fly larvae also contained an antlion larva (Neuroptera: Myrmeleonidae), and in several other nests enchytraeid worms (Annelida) were recorded in eggs of *C. caretta.*

There are several stages at which turtle nests could be attacked by insects. At the time of laying, eggs are exposed and cloacal secretions may act as an attractant. Infrequently, flies have been observed (by ACB) landing on eggs at this time. However, compared to the incubation period for the turtle eggs in Cyprus of 42–60 days (Broderick and Godley 1996), the life cycle of these insects is brief, particularly in the prevailing high temperatures found in Cyprus. *Megaselia scalaris*, for example, may complete this process in 20–25 days (Disney 1994) and *Sarcophaga* in as little as 13 days (Busvine 1980).

Members of the family Sarcophagidae, known colloquially in English as flesh-flies, are strongly attracted to both freshly dead and decomposing animal tissue. They are viviparous, the female producing active first instar larvae. The flies probably deposit their larvae on the sand and the larvae then burrow to the food source. This has been observed and experimentally demonstrated with another species that is predatory on earthworms (Lopes 1982). Several members of the Phoridae are able to burrow as adults through the soil, up to a depth of one meter, in order to lay their eggs on buried corpses (Disney 1994). We believe that turtle nests are exposed to potential infestation by insects at any time during the development of the embryo, despite being buried immediately after laying.

Lopes (1982) indicates that insect infestation is much higher in transplanted *C. mydas* nests. This may be because of exposure or damage to some of the eggs during this process, concentrating the nests in a small area, or a combination of these factors. To reduce the latter problem, a number of separate hatchery sites, relocated each season, might be considered as a preventative measure. Our observations of the parasitoid wasp *Brachymeria podagarica* indicate that, in Cyprus at least, it may exert some natural biological control over the sarcophagid fly infestations. Whether this insect could or should be encouraged in artificial hatcheries is debatable, but may be worth investigation.

These infestations may be primary factors in the reduction of the success of a nest or only affect moribund eggs or embryos. Their attraction to the nest in the first instance is likely the result of decay; whether they will subsequently attack viable eggs after utilizing their initial food source is not known. In a study on *Graptemys pseudogeographica*, a species of freshwater turtle, Vogt (1981) recorded infestation in eggs containing live hatchlings and suggested that most infestation occurred at pipping. Although it seems possible that infestation of nests poses a direct threat to incubating clutches, these insects may, in effect, remove decaying material from the nest, thereby decreasing the risk of further infection.

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Electronic Measurement of Saltatory Locomotion

PETER A. ZANI*
Department of Zoology and Oklahoma Museum of Natural History
University of Oklahoma, Norman, Oklahoma 73019, USA

**Present address: Department of Biology, University of Oregon*
Eugene, Oregon 97403-1210, USA
e-mail: pzani@darkwing.uoregon.edu

Locomotor performance of ectotherms has become a very popular issue in recent years (for review see Garland and Losos 1994) and the most common measure is sprint speed (e.g., Huey 1982; Losos 1990; Bauwens et al. 1995; but see Zani 1996). Jumping ability, like sprinting, is an ecologically relevant measure, and may offer insight into an animal's fitness (see Arnold 1983; Tsuji et al. 1989). Recently, electronic timing systems have been used to measure accurately locomotor performance (see Huey and Hertz 1982; Losos 1990). In this paper I present an extension of the current uses of electronic timing systems to measure performance of saltatory locomotion. The techniques presented here can be used to measure jump angle at takeoff, speed of a single jump, and locomotion speed in a series of consecutive jumps.

The construction of electronic timing systems necessary to implement these techniques, including the necessary programming, has been described elsewhere (Huey et al. 1981; Miles and Smith 1987) and will not be discussed extensively here. In essence, such systems consist of a series of infra-red light emitters and detectors. In normal operation (data gathering mode), each emitter is aligned to illuminate a detector. This causes the logic input to the data gathering computer to be a logic zero (0) for that channel. When an object passes between the emitter and the detector this logic level changes to a one (1). When this transition occurs it is called an event. The first event causes the computer to make a copy of its internal, free-running clock, mark that channel as "read," and then look at the next channel. Each time a photocell light beam is tripped, the free-running clock is read, and that channel is marked. When the number of events (input into the computer a priori) and the number of channels tripped are the same the computer returns to the monitor mode. All channel and time data received from the event computer are converted from binary mode by the data gathering computer to a floating point number for display and storage. The elapsed time between events is obtained from the data gathering computer. Speed is simply the distance separating the photocells divided by the elapsed time it takes an animal to travel that distance.

For measurement of sprint speed, photocells are placed at a known distance from the start point along the wall of a narrow racetrack (often at 0.25 m intervals). To measure jumping ability I positioned 20 photocells in a vertical array (Fig. 1) consisting of two pieces of Plexiglas (36 cm x 12 cm x 0.5 cm) affixed to a base (12 cm x 12 cm x 0.5 cm); holes were drilled at approximately 2 cm intervals, but one could vary this distance to suit the size of the animal being tested. The photocells are partitioned into two columns 8 cm apart. The first column is comprised of four photocells while the second column contains the remaining 16 photocells. The emitters are placed in one wall and the detectors placed in the opposite wall. When an animal is induced to jump through the photocell "plane" it breaks the infra-red light beams in the first group to initialize timing and breaks the beams in the second group to end timing. The time interval recorded between photocells is the time it takes to travel the 8 cm between the photocell columns. Because it is possible to record which individual detector is tripped (Miles and Smith 1987) one can determine the height of that detector. By recording the distance of the animal from that detector prior to the jump, it is relatively simple to determine the initial angle of each jump by measuring the two remaining sides of the right triangle it forms with starting position and the photocell-column base (Fig. 1). Jump angle can be measured even if more than one detector is tripped during a jump by using either the height of the detector first tripped or the average detector height tripped. By marking an animal's start and finish points, single jump length also can be determined.

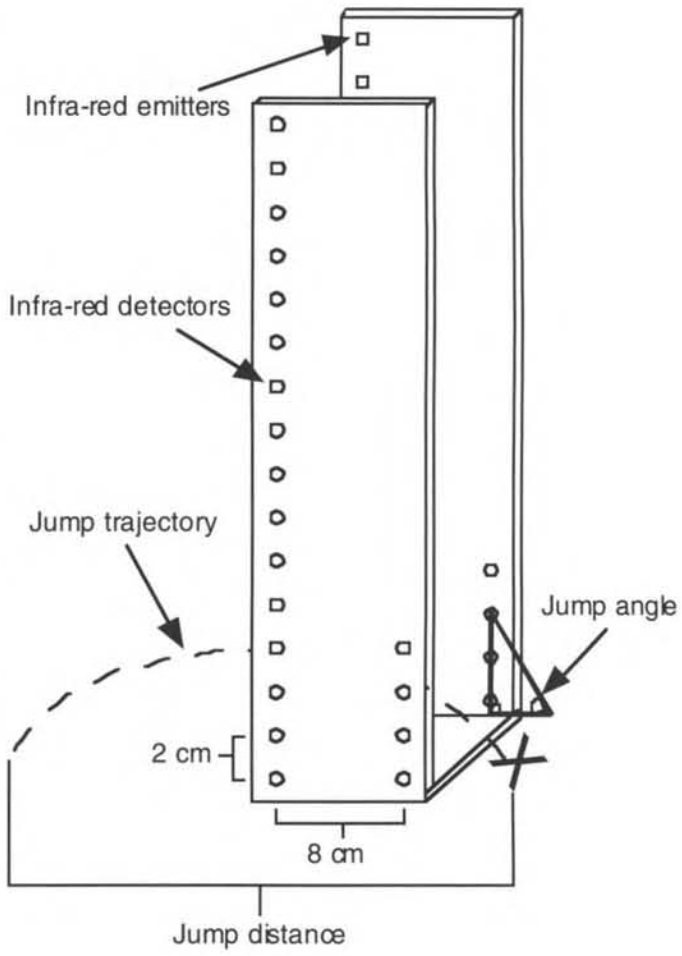


FIG. 1. Vertical photocell array designed to measure jumping ability. Infra-red photocells attached to the data gathering computer (not shown) measure elapsed jump time. "X" denotes the animal's start position. Jump angle is determined by measuring the three sides of the right triangle depicted (see text). Note: it is possible to add more than four photocells to the first column of photocells.

In addition to measuring components of single jumps, locomotion speed of saltatory animals over a longer distance also may be measured with the electronic timing system. To accomplish this one places the first group of four photocells at the beginning of a narrow racetrack and the second group of 16 photocells in a separate vertical array at the end of the racetrack. One can then estimate locomotion speed over a series of consecutive jumps.

Electronic timing systems can be used effectively to collect data estimating the components of jumping and sprinting in frogs, lizards, insects, and mammals. This technique should facilitate studies of saltation, a locomotion type yet to receive much attention.

Acknowledgments.—I thank R. Whitehead for building the vertical photocell array, J. B. Losos and D. B. Miles for helpful comments about electronic timing systems, and R. A. Schmaeng for building the timing system used to test these ideas. Development of this technique was made possible by a grant from the National Science Foundation (DEB-9200779) to L. J. Vitt and J. P. Caldwell.

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Improving Trapping Success of Amphibians Using a Side-Flap Pail-Trap

NICOLE D. NADOROZNY
Atlantic Cooperative Wildlife Ecology Research Network (ACWERN) and Department of Biology, Acadia University Wolfville, Nova Scotia B0P 1X0, Canada

and

ERIK D. BARR
Department of Biology, Acadia University Wolfville, Nova Scotia B0P 1X0, Canada

e-mail (NDN): nnadoroz@axe.acadiau.ca
e-mail (EDB): 019542b@axe.acadiau.ca

Monitoring the terrestrial movement of amphibians has traditionally been done using drift fences and pitfall traps (Corn 1994; Dodd and Scott 1994). Amphibians moving on the ground intercept the drift fence and are redirected towards traps at either end of the fencing. A number of problems have been recognized that influence the suitability of the pitfall in some circumstances. Because organisms with good climbing abilities (e.g., *Notophthalmus* spp., *Hyla* spp.) and jumping abilities (many *Rana* spp.) may escape, the trapping success of pitfalls is reduced when targeting these species (Corn 1994; Dodd and Scott 1994). Pitfalls are also difficult or impossible to set in certain locations because of rocky and root-bound substrates, frozen ground, or seasonally flooded areas. To overcome these difficulties, a simple and effective low cost trap was developed. We named it the side-flap pail-trap. The design, application, and success of the traps are outlined below.

Construction of the trap.—The main body of the trap consists of a plastic 11.4 L pail with a lid. Used commercial ice cream containers work well and are very economical. A 6 x 6 cm entrance opening is cut into the side of the pail 9 cm from the bottom. Two 1 cm slits are made 5 cm apart and 1 cm above the opening. An 8 cm square piece of stiff 1/4" x 1/4" galvanized steel mesh is hung on the inside of the pail using garbage twist ties inserted through the slits and the mesh. The mesh flap is cut larger than the opening and shaped to the curve of the pail so there are no gaps to allow escape. The door acts as a one-way valve; it swings into the pail and falls back flat against the bucket after an animal passes through. On the side of the pail opposite to the door, a 12.5 x 15 cm window is placed 7.5 cm off the bottom. This opening is covered on the inside by 1/4" x 1/4" galvanized steel mesh and attached on all four sides with duct tape (Fig. 1).

Set up in the field.—Each trap was buried 9 cm into the ground so the bottom of the entrance door was flush with ground level. A funnel made of the same 1/4" x 1/4" mesh was placed in front of the door to direct the organisms from the drift fence into the trap opening. To make the funnels secure, they were pushed approximately 3 cm into the ground and were stapled to the wooden stake at the end of the drift fence. Mud, grass, twigs, or rocks were used to cover any gaps between the funnel and the surface of the pail. Fences were 50–75 cm high x 30–40 m long nylon fabric stapled to wooden stakes. The bottom edge of the fence was buried in the ground. Four traps per fence were used with two traps on each end of the fence. Water and a 600 g rock were placed in each trap to provide refuge for the animals and to stabilize the trap.

The side-flap pail-trap required minimal set up time; each trap took approximately 0.5 person hours to set up and cost roughly

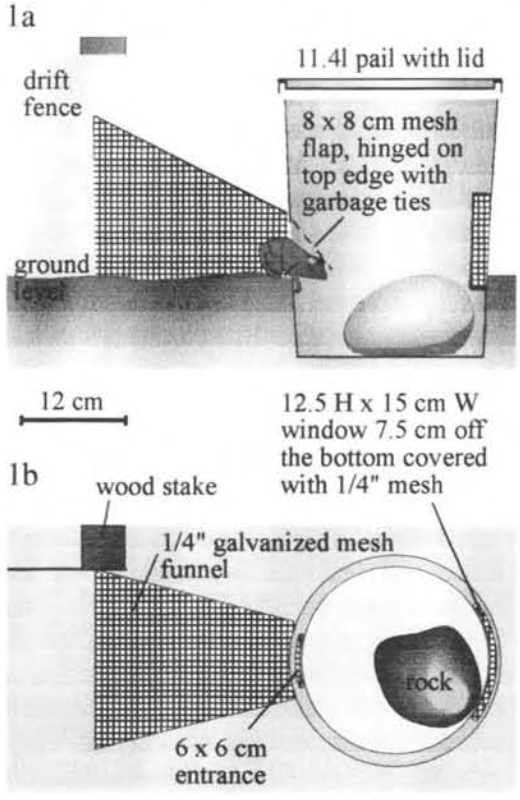


FIG. 1. Diagram showing a cross-sectional side view (1a) and top view with the lid removed (1b) side-flap pail-trap.

$1.00 (US). Garden shovels and spoons were the extent of additional equipment required. Traps were set up in field, forest, and riparian habitats. Substrate and flooding problems associated with pitfall traps were not a problem. The traps are durable, requiring minimum maintenance throughout the field season (we replaced duct tape on windows as required), and were removed easily at the end of the season by simply pulling them from the ground.

Monitoring of the traps.—The traps were used in a mark-recapture study to monitor amphibian movements into and out of 12 ponds in two different landscapes in the Annapolis Valley, Nova Scotia. The traps were used in habitats ranging from dry fields, forests, and riparian areas including stream flood plains. Traps were checked over a total of 195 days; everyday during rainy periods and every second day during drier, sunny periods. We checked the traps by pulling off lids and animals were retrieved easily because the bottom of the trap was close to ground level. Lids on the traps provided shade for animals and protection from predators.

Success of the traps.—Although this study was not designed to test the differences in capture success between the pitfall trap and the side-flap pail-trap, our new trapping technique was highly effective for capturing *Rana sylvatica, R. pipiens,* and *R. clamitans*, all considered to be good jumpers. Although abundances and species trapped were pond and landscape dependent, the following numbers have been included to show the relative success of the traps over 195 days: 196 *R. sylvatica*, 828 *R. pipiens,* and 324 *R. clamitans*. Juveniles of these species often were caught en masse and numbers of up to 30 individuals per trap were not uncommon. Other amphibian species trapped included *Ambystoma maculatum* (239), terrestrial phase of *Notophthalmus viridescens* (324), *Bufo americanus* (74), *Rana catesbeiana* (2), and *Hyla crucifer* (30). Small mammals (63) also were trapped; their survival rates approximated 30%, better than the standard pitfall trap with 0% survival (Bury and Corn 1987). Other occasional captures included three *Chrysemys picta* and six *Thamnophis sirtalis*.

In summary, the side-flap pail-trap, when used in conjunction with funnels and drift fencing, is a very effective technique for capturing amphibians in terrestrial habitats, especially ranid frogs. Setting the traps at ground level minimizes installation and dismantling times, and problems with substrates are avoided. Although the efficacy of the traps compared to other trapping techniques has not been assessed, our experience suggests that the side-flap pail-trap is a reliable technique for monitoring amphibian movements in terrestrial environments.

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Implanting an Arterial Catheter in Softshell Turtles

BRIAN P. BAGATTO*
EMMETT L. BLANKENSHIP
and
RAYMOND P. HENRY
Department of Zoology and Wildlife Science, 101 Cary Hall
Auburn University, Auburn, Alabama 36849-5414, USA

**Present address:*
Department of Biological Sciences, University of Nevada, Las Vegas
4505 Maryland Parkway, Box 454004, Las Vegas, Nevada, 89154-4004, USA
e-mail: bbagatto@ccmail.nevada.edu

When numerous blood samples are required from the same experimental animal, the preferred method of drawing blood is via an implanted catheter. Catheterization is especially advantageous in experiments involving the measurement of labile physiological parameters, such as blood acid-base balance, because it minimizes disturbance and promotes uniformity of sampling. Kerr and Frankel (1972) have discussed the inadequacies of the cardiac puncture technique in turtles when measuring blood gases. Additionally, turtles are able to displace their heart by retracting their head, therefore, the reliability of the sampling location is uncertain. Repeated cardiac sampling may not only damage the heart, it may also adversely affect physiological parameters because of prolonged handling of the animal. It is for similar reasons (in this case, vessel damage and prolonged handling) that repeated sampling of venous blood from extremities is not favorable. Implanting a catheter in, or cannulating the subclavian artery in *Trachemys scripta* has been briefly described (Jackson et al. 1974) and has proven to be a reliable method for repeated blood sampling. Ultsch et al. (1984) have mentioned a similar procedure for softshell turtles (*Apalone spinifera*), but provided insufficient detail to repeat this procedure. Here, we describe this procedure in more detail, including potential problems, to guide researchers who wish to apply this technique.

Recently it has been considered unacceptable to anesthetize reptiles using ice. This not only creates unnecessary stress to the animal, but it does not provide a satisfactory level of anesthesia. In softshell turtles, 3-aminobenzoic acid ethyl ester (MS-222, Sigma) provided an appropriately timed (about 1 h) and reliable anesthesia for this surgical technique. *Apalone ferox* (N = 17; mean mass ± SE = 1602 ± 343 g; range = 400–5900 g) and *Apalone spinifera* (N = 10; mean mass ± SE = 1944 ± 446 g; range = 312–4200 g) were anesthetized with MS-222 and cannulated using the following procedure. Anesthesia and surgery were performed at room temperature, which ranged from 22°C to 25°C. Using a dosage of 500 mg/kg, an unbuffered MS-222 solution (100 mg/ml) was injected intracoelomically (Bagatto et al. 1997). After injection, turtles were placed in an aerated, buffered solution of MS-222 (1 g/L with 15 ml of 0.5 M Na_2HPO_4 per L). Induction times ranged from 10 to 75 minutes (Bagatto et al. 1997). Animals were deemed anesthetized when manual pedal stimulation produced no withdrawal reflex.

The incision area was prepared in a routine manner for aseptic surgery using Betadine® as the antiseptic. A semicircular incision with its convexity directed anterolaterally was made on the left anterior quadrant of the plastral area. This created a "half-moon" flap with a base 2.5–3.0 cm long adjacent to the bony portion of the plastron and midway between the base of the neck and the left forelimb. Care was taken to avoid the numerous surface vessels, however, clotting occured quickly if they were transected. Blunt

dissection through the deltoideus muscle layer was directed toward the heart. A microdissecting retractor was used to hold the incision open and facilitate searching for the subclavian artery. The subclavian artery is the most anterior of a group of arteries that leave the heart and cross the ventral surface of the trachea and, therefore, is the first major artery encountered during dissection. Once the artery was isolated, it was exteriorized and ligated distally. Using cross action forceps with aquarium tubing mounted on the tips to reduce trauma, the artery was clamped proximally leaving enough length for arterial incision and insertion of the cannula (about 1.5–2.0 cm). An incision was made in the artery and PE 90 polyethylene tubing filled with heparinized reptile ringers was inserted approximately 1 cm into the artery toward the heart (Fig. 1). The insertion end of the cannula had been cut to a moderate bevel and the tip had been dulled to prevent piercing of the artery. Perforation of the cannula near the tip with a fine gauge needle may aid in preventing occlusion. The cannula was secured in two places within the artery using fine silk suture ligatures (Fig. 2). The arterial clamp was then removed and the cannula was flushed with heparinized reptile ringers.

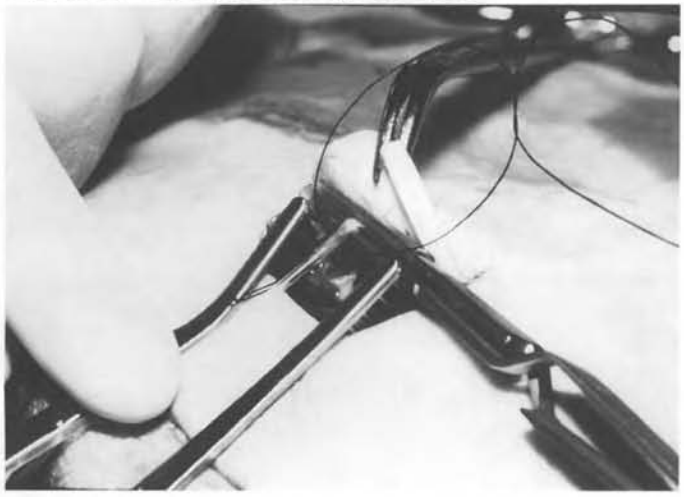


FIG. 1. Insertion of the polyethylene cannula in the left subclavian artery of a Florida softshell turtle, *Apalone ferox*.

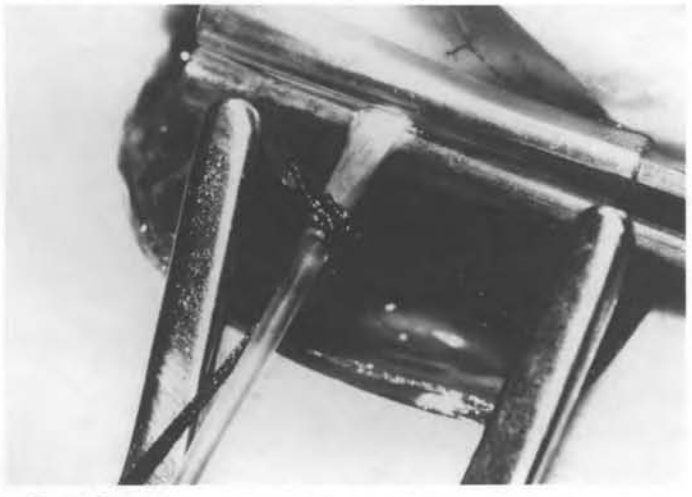


FIG. 2. Cannula secured with two fine silk suture ligatures.

The extremely long neck of softshell turtles allows them to displace their heart and attached vessels via neck movement; therefore, the cannula was positioned carefully within the turtle. After the cannula and artery were placed back into the animal, care was taken to ensure that the cannula was loose enough to accommodate normal movement but would not be occluded by the vessel wall. We recommend aspirating and flushing the cannula while flexing and extending the turtle's neck. If blood can be withdrawn during the full range of neck motion, the cannula and artery are in optimal position. The incision was sutured and sealed with tissue glue (any cyanoacrylate ester compound will do), which also secured the cannula at the incision. The cannula also was sutured to the plastron 2 cm from the incision and on the midventral left side so that it could be routed to the dorsal surface, thus avoiding the limbs (Fig. 3).

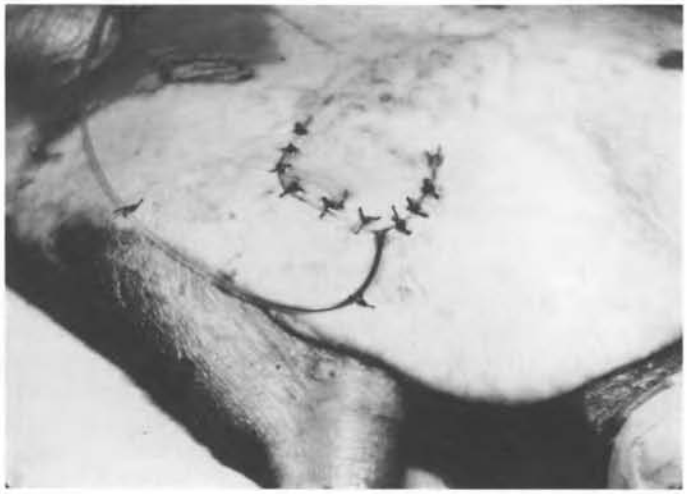


FIG. 3. Completed surgery showing sutured flap with cannula sutured in position.

The turtle should be recovered under running water, with care being given to ensure adequate ventilation. When the turtle can hold its head up under its own control, it should then be transferred to a disinfected opaque container filled with enough water to completely cover the shell. A perforated lid will secure the container and allow the animal to recover in darkness. Full recovery may take as few as 12 h, but at least 18 h of recovery time should be given. Blood sampled should be replaced with an equal volume of heparinized reptile ringers and sample volumes may range from a few microliters to 25% of the total blood volume of the animal (Bagatto and Henry, ms. submitted). This type of occluding arterial cannula should be used preferably in short term experiments. Experiments requiring a cannula to be operational for more than four days should utilize a nonoccluding procedure or a peripheral vessel. Experiments involving arterial catheters are usually terminal; thus, the catheters are not normally removed.

This simple yet effective way for anesthetizing and cannulating softshell turtles (*Apalone spinifera* and *A. ferox*) of variable size (300–6000 g) can be utilized so that arterial blood may be drawn repeatedly with minimal disturbance to the animal.

Acknowledgments.—We would like to thank Paul Buttenhoff for the photographs. This work was supported by NSF IBN 83-04844 to RPH and by an Auburn University Graduate Research Award to BPB.

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An Observation Technique for Snake and Lizard Hemipenes with Comments on Preparation

RUBENS NOBUO YUKI
Departamento de Zoologia, Museu Paraense Emílio Goeldi
Caixa Postal 399, Belém, Pará, Brazil. Cep: 66040-170
e-mail: yuki@Goeldi.museu-goeldi.br

The hemipenis preparation technique of Pesantes (1994) has permitted observation of the hemipenis of preserved snakes (e.g., species of *Xenoxybelis* and *Oxybelis* [Machado 1993], and *Helicops danieli* [Yuki 1994]). I have adapted Pesantes' technique (treatment in 2% KOH and 0.1N HCl solution, with subsequent filling of the organ with agar-agar) to prepare lizard hemipenes with good results (e.g., *Teius oculatus*, *Ameiva ameiva*, *Polycrus marmoratus*, and *Neusticurus bicarinatus*).

Unfortunately, a semi-everted hemipenis, prepared with Pesantes' technique, will not produce a general shape similar to that of organs that are completely everted, as the action of the KOH solution is not uniform. In order to allow later preparation of hemipenes of preserved snakes, it is preferable to not evert the hemipenes during preservation or else adapt the procedures of Manzani and Abe (1988) for hemipenial eversion. For lizards, it is preferable that the hemipenes remain inverted because complete eversion often will not occur satisfactorily from strong pressure caused by injecting formalin into the tail of some species (e.g., *P. marmoratus*, *N. bicarinatus*), in contrast to what occurs in other species (e.g., *A. ameiva*).

The observation of prepared hemipenes also may be difficult because of low refraction of light. I have used Book and Shear's (1974) muscle coloring solution to successfully color lizard and snake hemipenes. The composition of the solution is 1 g iodine + 2 g potassium iodine + 100 g distilled water. The potassium iodine should be dissolved in the water first, after which the iodine will more easily go into solution. The procedure to color the organs is simple: (1) immerse the hemipenis in the prepared solution for 5–10 seconds, (2) wash the hemipenis in water and observe, and (3) immerse the hemipenis in 70% ethanol for an indeterminate time until the organ reaches the desired tonality. This technique favors observation because it permits coloration of organs in various degrees of intensity, depending upon one's needs. Another benefit of this technique is that after the solution is applied, it returns the organ to its original color, even after lengthy immersion in alcohol.

Acknowledgements.—I thank Ulisses Galatti for comments on the manuscript. Financial support was provided by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brazilian Federal Government.

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Restraining and Marking Method for Snapping Turtles, *Chelydra serpentina*

HUGH QUINN
and
TIM PAPPAS
Cleveland Metroparks Zoo, 3900 Brookside Park Drive
Cleveland, Ohio 44109, USA
e-mail: hquinn@ix.netcom.com

Because of the size and aggressive nature of common snapping turtles (*Chelydra serpentina*), marking them by unique shell notching can be dangerous and difficult. We describe a safe and quick way to accomplish this task.

A turtle is placed on the ground and a polyvinyl chloride (PVC) pipe of appropriate length and diameter is placed over the turtle's head and held in place with one hand by the investigator. When positioning the pipe, caution should be taken to assure the hand grasping the pipe is out of turtle striking range. The front of the investigator's foot is then firmly placed on the posterior margin of the turtle's carapace (Fig. 1). The turtle becomes calm in a few seconds and remains so for several minutes. In this posture, the investigator can file notches in the carapace with the free hand for individual turtle identification (Ferner 1979).

We have found that a 10.16 cm diam pipe, ca. 60 cm in length, allows us to safely restrain common snapping turtles 4.54 kg and larger. Smaller pipe diameters are available, and work well with smaller turtles.



FIG. 1. A 15.3 kg common snapping turtle (*Chelydra serpentina*) with a 39.2 cm carapace is safely restrained and marked.

To expedite the marking process, we use a rotary power tool (Fig. 1). A circular grinding bit affixed to the power tool is appropriately shaped with a grindstone so it will carve the desired notch shape when touched to the shell. Shaping the bit is accomplished while both the bit and grindstone are rotating. Both electrical and

battery powered rotary power tools are available. Electrical tools obtain greater revolutions per minute (rpm) than battery operated units, expediting the notching process, but battery operated units are particularly useful in the field, where electrical power is not available. Several rechargeable battery packs can be utilized when marking a large number of turtles. Units reaching speeds of 10,000 rpm or greater are needed to rapidly notch the shell. Care must be taken not to cut soft tissue, potentially injuring the turtle.

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HERPETOLOGICAL HUSBANDRY

A Safer Capture Technique for Large Reptiles

C. J. FRANKLIN
and
R. W. HARTDEGEN
Department of Herpetology, Dallas Zoo
650 South R. L. Thornton Freeway, Dallas, Texas 75203, USA

Many techniques have been suggested for the safe handling of large and potentially dangerous reptiles. The use of a snare placed around the neck of lizards and crocodilians has been described (Fowler 1978; Jones and Hayes-Odum 1994). Another method requires the specimen's head to be pinned down or covered with a cloth prior to grasping it behind the head with one hand, while simultaneously securing the animal at the base of the tail (Ball 1972). However, information regarding the actual approaches to securing these animals is limited. Because of the potential harm that large reptiles can inflict through bites, scratches, and tail slaps, additional procedures that facilitate restraint should be considered.

Staff members at the Dallas Zoo's Department of Herpetology have employed a simple method that involves spraying the animal in the face with a fine mist of water. The spray generally results in the animal turning its head in the opposite direction and/or closing its eyes. Often the water alone obstructs the animal's vision sufficiently to permit a safer approach. This technique has been used effectively on large lizards such as *Varanus giganteus, V. gouldii*, subadult *V. komodoensis, V. olivaceus*, and *Iguana iguana*. Further, this technique has been used successfully for crocodilians (*Crocodylus acutus*, *Alligator mississippiensis*; R. Reams, pers. comm.), and large pythons (*Python* spp.; A. Mitchell, pers. comm.). Application of this technique could reduce the risk of injury to handlers of large reptiles.

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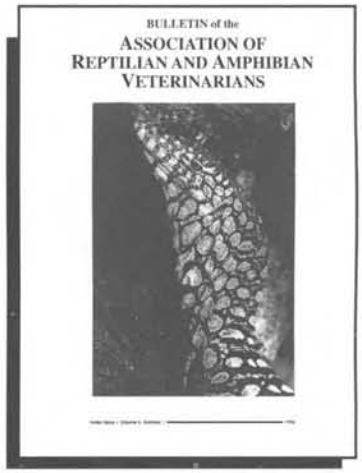
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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 28, Number 1 (March 1997).

CAUDATA

PLETHODON MISSISSIPPI (Mississippi Slimy Salamander). **VOCALIZATION.** Sound production is limited in the order Caudata (Duellman and Trueb 1994. Biology of Amphibians. John Hopkins Univ. Press. Baltimore, Maryland. 670 pp.). However, vocalization has been documented in the family Plethodontidae (Maslin 1950. Univ. Colorado Studies, Ser. Biol. 1:29–45). Members of the genus *Plethodon* produce soft squeaks, clicks, or yelps (Harper 1930. Copeia 4:153; Mansneti 1941. Copeia 4:266), and are the most vocal of the plethodontids (Neill 1952. Copeia 195–196). On 24 August 1996 around Poplar Cove Spring at the University of Mississippi Biological Field Station located in the North-Central Hills physiographic province of Lafayette County, Mississippi, USA, an adult *Plethodon mississippi* (75 mm SVL) was found under a wooden cover board. While this individual was being observed, it produced a series of five distinctive squeaks. This event paralleled the observation of Mansneti (*op. cit.*) for *P. glutinosus* in Maryland and *P. grobmani* in Florida. The production of squeaks has also been documented for *P. grobmani* (Harper, *op. cit.*) and *P. glutinosus* in Georgia (Neill, *op. cit.*).

Although Maslin (*op. cit.*) explained the anatomical mechanisms for sound production in caudates, the function of these vocalizations is only vaguely understood. Presumably, sound production plays a role in defense against predators (e.g., Brodie 1978. Copeia 1978:127–129) or social encounters (e.g., Davis and Brattstrom 1975. Herpetologica 31:409–412).

I thank R. Austin, E. D. Keiser, and S. Marshall for their assistance in preparing this note. I also thank the Mississippi Wildlife Heritage Program for funding.

Submitted by **JEREMY L. MARSHALL**, Biology Department, University of Mississippi, University, Mississippi 38677, USA.

ANURA

ATELOPUS CHIRIQUIENSIS (Chiriquí Harlequin Frog). **MATING BEHAVIOR and EGG LAYING.** The life history of the neotropical harlequin frogs of the genus *Atelopus* has been difficult to document (McDiarmid 1971. Bull. Los Angeles Co. Mus. Nat. Hist. 12:1–66). Several natural history studies have provided a general understanding of the life cycles of some species of *Atelopus*, but significant variation in some life history parameters may exist within the genus (Duellman and Lynch 1969. Herpetologica 25:231–240; Cocroft et al. 1990. Copeia 1990:631–643; Gray and Cannatella 1985. Copeia 1985:910–917; Jaslow 1979. J. Herpetol. 13:141–145).

Descriptions of egg-laying and reproductive behaviors are few or non-existent in *Atelopus* and information given here should be useful for conservation of this genus. Starrett (1967. Herpetologica 23:195–204), Mebs (1980. Salamandra 16:65–81), and Lynch (1986. J. Herpetol. 20:126–129) gave accounts of the eggs and larvae of *A. varius*, *A. cruciger*, and *A. subornatus*. These reports provided valuable descriptive information about the eggs of *Atelopus*, but did not address the actual event of deposition and related behaviors. On 18 February 1994, we observed paired *A. chiriquiensis* adults preparing to lay eggs on the substrate of a



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swift, montane stream in cloud forest (2005–2100 m) at Las Nubes Park Headquarters of Parque Internacional La Amistad, Provincia de Chiriquí, Panamá. The climate of these western Pacific slope highlands has been classified as temperate wet and dry (Rubio 1965. Comisión del Atlas de Panamá, pp. 31–33. Dirección de Estadistica y Censo, Panama City; Koppen 1931. Grundiss der Klimakunde, pp. xii–388. Walter de Gruyter & Co. Berlin). Water temperature was 10.8°C and air temperature was 17.6°C at 1300 h. We observed at least 85 males and 12 females along a 10 m stretch of creek. All females were found in axillary amplexus and solitary males were observed trying to pry amplexed males off of the backs of females. In all cases observed, males originally amplexed were able to hang on despite attempts to dislodge them. Amplectant pairs would submerge to the stream bottom for 15–30 min. Females may have been searching for egg laying sites. Of randomly selected individuals, average female size was 43.30 mm ± 0.57 SVL and 5.32 g ± 0.31 (N = 5); males measured 31.12 mm ± 0.62 SVL and 1.99 g ± 0.24 (N = 5).We returned to the same creek at 1845 h on 20 February 1996 and found several pairs (N = 5) and solitary males (N = 5) apparently still active in the darkness.

We collected 10 live specimens for further observation at the Smithsonian Tropical Research Institute. Two days later we observed egg laying by one pair in a small plastic container partially filled with unchlorinated water; 364 unpigmented eggs were laid in two strings over the course of 8–10 h on the late evening of 22 February and early morning of 23 February 1994. Egg deposition was monitored carefully every 30–40 min and it appeared that deposition was a single continuous process. Lack of pigment in the eggs of *A. chiriquiensis* is consistent with the observations for other species of *Atelopus* (Mebs, *op. cit.*; Lynch *op. cit.;* Starrett, *op. cit.*) . Eggs were laid in a massive clutch and were impossible to separate without breaking strings. It appeared that egg laying was a single event, as the female was entirely spent afterward.

The total length of a continuous string was estimated at 36–44 cm, considering that egg densities were consistently 11–13 per 25 mm of any given segment. Individual eggs measured 2.05 mm ± 0.30 (N = 10) in diameter in a protective gel case measuring 3.63 mm ± 0.34 (N = 10) in diameter. The number and size of eggs is larger for *A. chiriquiensis* (N = 364; 2.05 mm) than reported for *A. cruciger* (N = 271; 1.6–1.8 mm) (Mebs, *op. cit.*). During egg laying, the male kicked his legs two or three times before the female would squeeze out 3–5 more eggs into each string. Such leg movements may represent tactile cues to the female to synchronize egg release with milting. Eggs were watched carefully but did not appear to develop. The eggs were fixed in 10% formalin and deposited in the Higher Vertebrate Collection at the Museum of Biological Diversity at Ohio State University (OSUMZ 5054).

In June 1994 and May 1996, EDL returned to the original breeding site and found no *A. chiriquiensis*. It is likely that eggs are deposited during the short dry season of this region and that a massive migration of adult individuals occurs toward the stream valleys as hypothesized by Lynch (*op. cit.*). During June 1994, several adult *A. chiriquiensis* were found along the Rio Candela 9 km W Las Nubes. Amplectant pairs were seen migrating toward the stream, but the density of individuals did not match that seen in the previous February at Las Nubes. Perhaps local rainfall patterns determine the timing of reproduction.

We are grateful for the assistance of A. S. Rand, T. Hetherington, R. Ibañez, J. Kink, and M. Lindquist. Financial support was provided through a Smithsonian Tropical Research Institute short-term graduate fellowship (EDL). We thank IN.RE.NA.RE. for granting wildlife permits.

Submitted by **ERIK D. LINDQUIST**, Department of Zoology, The Ohio State University, Columbus, Ohio 43210, USA, and **DAVID W. SWIHART**, Abbott Laboratories, Abbott Park, Illinois 60064, USA.

HYLA MINUTA (NCN). **TADPOLE BEHAVIOR**. Heyer et al. (1975 Biotropica 7:100–111) considered tadpole predation by other tadpoles as an important ecological aspect of the tadpole communities in small, ephemeral ponds that are colonized by few anuran species and which are usually opportunistic breeders. *Hyla minuta* is widespread in Brazil, occurring in a variety of habitats. Herein, we report on the predatory behavior of tadpoles taken from a permanent pond ca. 1000 m elev. near São Bento do Sul, Santa Catarina, Brazil. The pond was fully exposed to the sun and was ca. 1.2 m at the deepest point with a dense growth of *Juncus* surrounding part of the pond. No predaceous fish were observed.

Freshly collected *H. minuta* tadpoles were placed in plastic bags for transportation. These tadpoles showed a bright red cast on the tail, appearing somewhat similar to *H. senicula*. After an hour in the bags the tail fin and tail musculature of some of tadpoles had been destroyed (Fig. 1); other individuals were bitten on the belly and died shortly thereafter. Injured individuals were attacked by the other tadpoles and were completely torn apart.

No information exists on the importance of this predatory behavior in natural habitats, however in the laboratory, *H. minuta* tadpoles (34 mm TL; stage 36) attacked and completely consumed *Physalaemus* sp. (*signifer* group, 16 mm TL; stage 33) tadpoles. The *H. minuta* tadpoles are facultatively carnivorous as they were observed to feed on commercial fish food and plant material in the laboratory.

Additional information is needed on the breeding habitats of *H. minuta*. As a facultative carnivore, *H. minuta* may better exploit food availability in each situation where it occurs, thus accounting for its widespread distribution and common occurrence.

We thank Sergio Caralho and Silva and Richard Schasse for help with field work, and W. R. Heyer for reading the manuscript.



FIG. 1. Effects of conspecific predatory behavior in *Hyla minuta* tadpoles, ranging from an undamaged individual (1) to one showing severe tail damage (4).

Submitted by **OSWALDO L. PEIXOTO**, Departamento de Biologia Animal, Instituto de Biologia-UFRRJ, 23851-970, Seropédica, Rio de Janeiro, Brazil, and **MARCIA DOS REIS GOMES**, Departamento de Zoologia, Instituto de Biologia, UFRRJ, Ilha do Fundão, Cidade Universitária, 21941-970, Rio de Janeiro, Brazil.

HYLA SANBORNI (NCN). **PREDATION**. The predation of adult anurans by invertebrates seldom has been reported in the literature (Hinshaw and Sullivan 1990. J. Herpetol. 24:196–197), although spiders may be considered one of the most important predators of small terrestrial anurans (Hayes 1983. Biotropica 15(1):74–76). Lycosid spiders are most frequently found on the banks of water bodies, where they await their prey (Wise 1993. Spiders in Ecological Webs. Cambridge University Press, New York. 328 pp.).

On 22 November 1994 at 2245 h (air temperature 22°C) in Rio Claro (22°24'S, 47°33'W), São Paulo, Brazil, a lycosid spider (*Diapontia* cf. *uruguayensis*; 9.5 mm cephalothorax and abdomen length) was observed on a 0.1 m high web in the emergent vegetation along the margin of a brook. The spider was positioned between two calling adult male *Hyla sanborni* (mean total length = 18.3 mm) separated by 0.5 m from one another. One of the frogs moved during a presumed territorial dispute, emitted an encounter call (*sensu* Wells 1977. Anim. Behav. 25:663–693) and invaded the web, where it was captured by the spider. The spider held the frog for 45 minutes, with its chelicerae introduced into the end of the frog's abdomen. At the end of this time, the frog was completely immobilized. Both frog and spider were collected and, in the laboratory, the spider was observed to eat the frog's viscera. The spider was preserved and deposited in the Departamento de Zoologia - UNESP - Sao José do Rio Preto (DZSJRP-UNESP, without catalog numbers).

We thank C. F. B. Haddad and A. Cais for suggestions on the text, and L. C. B. Renner for identifying the spider.

Submitted by **MARIA LÚCIA DEL-GRANDE**, Depto de Zoologia, UNESP, Cx.Postal 199, 13506-900, Rio Claro, SP, Brazil, **GISELE MOURA**, Depto de Zoologia, UNESP, Rubião Júnior, Cx. Postal 510, 18618-000, Botucatu, SP, Brazil. E-mail (MLD): arif@condor.polo.ibilce.unesp.br.

LITORIA INERMIS (Bumpy Rocket Frog). **REPRODUCTION**. The extent to which female frogs influence selection of amplectant partners is poorly known. While it is recognized that a female may make the primary choice of a male based on properties of his acoustic signal (Arak 1988. Behav. Ecol. Sociobiol. 22:317–327; Schwartz 1986. Ethology 73:116–127; Sullivan 1983. Anim. Behav. 31:1011–1017), female frogs, as they proceed through densely populated choruses towards their chosen partners, are undoubtedly susceptible to ambush by nearby males, and therefore may actually have little choice in their resultant mates. Few studies can be found that document amplexus as a result of female choice, and thereby actually confirm a female frog's choice of partner (see Arak, *op. cit.*).

At ca. 2200 h on 10 February 1996, while searching for breeding frogs in savanna woodland, we observed a pairing of *Litoria inermis* in a chorus ca. 40 km W Townsville, Australia (146°25'E19°25'S). A male frog was calling continuously from a small patch of bare ground between large grass tussocks. We watched for some minutes before a female approached and stopped within 10 cm of the calling male. The male called incessantly, but did not approach the female. The female then circled the calling male in a series of short low hops, and again stopped ca. 10 cm from its vocal sac. The female then made a few short hops towards the male until her snout appeared to touch the male's snout. Immediately, the male deflated his vocal sac and hopped onto the female to assume the amplexed position. Both frogs then hopped off into the moonrise.

Throughout the event, no other males approached the pair. The selected male did not make any approach towards the female until she touched his snout. The male was well within the chorus and other calling males were heard nearby. This suggests that the female selected and approached this calling male through the others. Ambush of the passing female by this or any other male was not observed. Males appeared to be evenly spaced and no satellite males were observed. While our observation represents only a single incidence, it supports the idea of amplexus initiation by female choice of reproductive partner and raises the question of the use of tactile communication to initiate amplexus between frogs.

Submitted by **R.W.R. RETALLICK** and **J.-M. HERO**, Department of Zoology, James Cook University, Townsville, Queensland, 4811, Australia.

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog). **PREDATION**. The Cuban treefrog (*Osteopilus septentrionalis*) of the West Indies has colonized Florida successfully over the past 40 years. The susceptibility of *O. septentrionalis* to novel predators in Florida is an open question, although predation by owls and snakes has been recorded for Florida (Love 1995. Herpetol. Rev. 26:201–202; Meshaka 1996. Florida Field Sci. 24:15; Meshaka and Ferster 1995. Florida Field Sci. 23:97–98). Here, we document predation by a new species, the common garter snake (*Thamnophis sirtalis*), on *O. septentrionalis* and present results of a field trial. Voucher specimens are housed in the Everglades Regional Collection Center in Everglades National Park, Homestead, Florida, USA.

On 21 November 1992 at 0200 h on Gumbo Limbo Trail, Royal Palm Hammock, Paradise Key, Everglades National Park, an *O. septentrionalis* ca. 40 mm SVL was offered to a *T. sirtalis* ca. 600 mm SVL that was resting 2.0 m above ground in the branches of a soapberry tree. Within 30 s of the offer, the snake grabbed the frog by its lateral aspect. Struggling and crying, the frog was ingested head-first within a few minutes. When the snake was observed 20 min later, it had not left its perch and the frog had not been regurgitated. Captive *T. sirtalis* have shown no ill effects for one week after ingesting *O. septentrionalis*.

On 19 July 1996 at ca. 2200 h we uncovered a male *T. sirtalis* (EVER 303586, 285 mm SVL) beneath a board near the buildings of a campground located near the intersection of US-1 and SW 344 Str., Florida City, Dade Co., Florida. When palped, the snake regurgitated a partially digested *O. septentrionalis* ca. 25 mm SVL.

It appears that the colonization of *O. septentrionalis* in Florida has progressed despite a list of novel predators which, like those of the West Indies (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville), are primarily ophidian.

Submitted by **WALTER E. MESHAKA, JR.**, Everglades Regional Collections Center, Everglades National Park, 40001 SR-

9336, Homestead, Florida 33034-6733, USA, and **KEVIN P. JANSEN**, Department of Biology, University of South Florida, Tampa, Florida 33620-5150, USA.

RANA SYLVATICA (Wood Frog). **EGG MASS FEATURES** and **LARVAL BEHAVIOR.** Although *Rana sylvatica* egg masses have been described (Johnson 1987. The Amphibians and Reptiles of Missouri. Missouri Dept. Conservation, Jefferson City. 368 pp.; Wright and Wright 1949. Handbook of Frogs and Toads. Comstock Publ. Co., Ithaca, New York. 640 pp.), observations from oviposition to hatching and afterwards are lacking. Such observations were recorded as part of a translocation project (Thurow 1994. Trans. Illinois Acad. Sci. 87:83–97) in McDonough Co., Illinois, USA. Observations from at least seven years are summarized below.

Different surface/volume (S/V) ratios of frog egg masses have been correlated with average temperature and water oxygenation differences (Moore 1940. Am. Nat. 74:89–93). Moore proposed that the rounded egg masses of early breeders like *R. sylvatica* should protect better against cold, and that the thin surface film masses of later breeders like *R. catesbeiana* should aid gas exchange at warmer temperatures. However, in nature, the S/V ratio of *R. sylvatica* egg masses changes, in a way which would further increase fitness: as an object departs from a spherical shape, the S/V ratio increases. Instead of crawling forward in shallow water during oviposition like *Bufo americanus*, *R. sylvatica* stays at an underwater branch, root, or weed stem and makes minor movements. Each string of eggs folds back on itself and adheres into a globular mass that becomes turgid when the jelly imbibes water and swells. During the 2–3 weeks before hatching, the egg mass changes shape and increases its S/V ratio, presumably through softening and deterioration because of bacterial action. Less than two weeks after oviposition the flattened mass may appear as loosely coiled strings of pearls, because some of the stickiness between strands has disappeared. Further deterioration of the jelly makes a soft continuous flat mass, if not a thick film. This S/V change favors oxygen diffusion as temperatures rise from March into April.

When embryos hatch in April, the jelly mass gives protection, aided by a transient hatchling behavior. Hatchlings tend to stay in or under the jelly mass for several days, gaining shelter from predators while their swimming abilities improve. There is a temporary hatchling attraction to the jelly mass, which lasts from hours to a few days. When hatching egg masses are agitated the tadpoles swarm out in a cloud, but most return into the jelly within a few minutes. In a few days the tadpoles disperse, to rest on or below underwater leaves or branches. Later in the spring larvae tend to move to deeper water away from the pond edges. Within a few days of hatching some of the hatchlings appear to feed on their own jelly masses which have algal growth both outside and inside (Gilbert 1942. Ecology 23:215–227).

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Submitted by **GORDON THUROW**, Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). **DEFENSIVE POSTURE.** Anurans frequently employ posture as a defensive mechanism (Duellman and Trueb. 1986. Biology of Amphibians. McGraw-Hill Book Co., New York xix + 670 pp). To our knowledge, no defensive postures have been described for western spadefoots, including *Spea multiplicata*.

On 28 May 1995 a *S. multiplicata* was found buried in moist, sandy soil under a small rock in Vogel Canyon, Otero County, Colorado, USA. Air temperature was 15°C, ground temperature was ca. 17°C. The animal was rinsed with water to wash off the sand prior to being photographed. At this time the spadefoot assumed a crouched position with the chin near the ground and the eyes closed. It remained rigid and immobile in this position for several seconds. When it began to relax, a slight touch on the snout was sufficient to induce resumption of the posture.

Crouching has been included as a defensive posture in *Scaphiopus holbrooki* by Marchisin and Andrews (1978. J. Herpetol. 12(2):151–155). C. K. Dodd, Jr. (pers. comm.) described *S. holbrooki* as tucking its body into a convex curve with eyes closed and limbs held tightly against the body. In contrast, the forelimbs of *Spea multiplicata* were not held so tightly against the body.

We thank C. Kenneth Dodd, Jr., for his assistance in the preparation of this note.



FIG. 1. *Spea multiplicata* defensive posture.

Submitted by **LAUREN J. LIVO**, EPO Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA, **DAVID CHISZAR**, Department of Psychology, Campus Box 345, University of Colorado, Boulder, Colorado 80309, USA, and **HOBART M. SMITH**, EPO Biology, Campus Box 334, University of Colorado, Boulder, Colorado 80309, USA.

TESTUDINES

CLEMMYS MUHLENBERGII (Bog Turtle). **PARASITISM.** The larvae of certain species of flesh fly (Diptera: Sarcophagidae) are parasitic on vertebrates, and one species, *Cistudinomyia cistudinis* (Aldrich), is a fairly common parasite of box turtles (*Terrapene*) and tortoises (*Gopherus* and *Testudo*) (Knipling 1937. Proc. Entomol. Soc. Washington 39:91–101). Chidester (1915. J. Parasitol. 2:48–49) also reported an instance of parasitism, apparently by this fly, on the painted turtle (*Chrysemys picta*). We here report several instances of parasitism, apparently by *C. cistudinis*, on the bog turtle (*Clemmys muhlenbergii*) in North Carolina, USA (Table 1).

Because the parasites were either not collected or not reared to adulthood, it is impossible to identify them to species. However, those larvae that were collected were positively identified as sarcophagids and are thought to be *Cistudinomyia cistudinis* (David L. Stephan, pers. comm.), the only North American sarcophagid known to be a true parasite on adult reptiles (Knipling, *op. cit.*).

TABLE 1. Records of flesh fly parasitism in *Clemmys muhlenbergii* from North Carolina. Where retained, specimens were deposited in North Carolina State Museum of Natural Sciences (NCSM) or entomological collections of North Carolina State University (NCSU).

Date	Locality	Size and sex of turtle	Collector(s)	# of fly larvae and location on host	Fate of specimens
19 July 1977	Henderson Co., ca. 2.4 km W of Etowah	adult female	R. T. Zappalorti	1 near left shoulder	Larva removed and discarded; turtle marked and released.
19 July 1977	Henderson Co., ca. 2.4 km W of Etowah	subadult female	R. T. Zappalorti	1 in neck	Larva removed and discarded; turtle marked and released.
4 May 1985	Clay Co., ca. 9 km NE of Shooting Creek	adult male	K. M. Fahey	9 between neck and right foreleg	Larvae removed and discarded; turtle collected and died a few weeks later (NCSM 31691).
29 May 1988	Macon Co., ca. 5.3 km S of Aquone	adult male	B. J. and R. W. Johnson	17 near right rear leg	Turtle found fresh dead (NCSM 29286); larvae to NCSU.
23 June 1996	Wilkes Co., ca. 4.8 km ENE of McGrady	adult female	J. C. Beane R. A. Davis W. H. Rowland, Jr.	4 between neck and right foreleg	Turtle marked and released; larvae to NCSU.

Our observations apparently represent the first published records of parasitism on *C. muhlenbergii* by a sarcophagid fly. These flies have been known to cause death in *Gopherus* (Knipling, *op. cit.*) and *Terrapene* (Rainey 1953. Herpetologica 9:109–110). It is possible that flesh fly parasitism could be a significant, if hitherto overlooked, cause of mortality in some bog turtle populations.

We thank D. L. Stephan for identifying the larvae and providing references, K. M. Fahey and D. W. Herman for sharing information, and Ira Gambill for property access. These observations were made possible in part by "Project Bog Turtle," a funding initiative of the North Carolina Herpetological Society.

Submitted by **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, Box 29555, Raleigh, North Carolina 27626-0555, USA, and **ROBERT T. ZAPPALORTI,** Herpetological Associates, Inc., 2525 Dover Road—Bamber Lake, Forked River, New Jersey 08731, USA.

LEPIDOCHELYS KEMPI (Kemp's Ridley), ***CARETTA CARETTA*** (Loggerhead), and ***MALACLEMYS TERRAPIN CENTRATA*** (Carolina Diamondback Terrapin). **DIET and PREDATION**. *Lepidochelys kempi* and *Caretta caretta* feed on a variety of marine vertebrates and invertebrates (Bjorndal 1985. Copeia 1985:736–751; Dodd 1988. U.S. Fish Wildl. Serv. Biol. Rep. 88:1–110). Here I report two separate accounts of marine turtles feeding upon *Malaclemys terrapin centrata*, a species not previously reported in the diets of *L. kempi* or *C. caretta*.

On 8 June 1993, a Savannah Science Museum (SSM) research team found a dead female *L. kempi* (SSM 12640; 63.5 cm curved carapace length [CCL]; 62.5 cm curved carapace width [CCS]) at Wassaw National Wildlife Refuge, Georgia, USA. Gastrointestinal (GI) tract analysis revealed food items commonly seen from *L. kempi* specimens in Georgia waters (unpubl. data): blue crabs (*Callinectes sapidus*), spider crabs (*Libinia dubia*), stone crabs (*Menippe mercenaria*), and mud snails (possibly secondary ingestion, *Nassarius obbsoletta*). In addition to these items, two freshly eaten *Malaclemys* also were found; one of adult male size (12.2 cm estimated CCL; 7.6 cm estimated CCW; SSM 13753), and one unsexed juvenile (CCL and CCW were not taken due to condition of specimen; SSM 13754). Both *Malaclemys* were crushed at the rear of the carapace, the second suffered more severe damage than the first.

On 22 May 1996, a subadult female *Caretta caretta*, (72 cm CCL; 65 cm CCW; SSM 13758), found dead in the Wilmington River (Wilmington Island, Georgia), also had remains of *Malaclemys* within its GI tract. These were badly decomposed and thus were not measured. Examination of the *Malaclemys* remains suggests that three individuals were eaten by the *Caretta*; based on the presence of three heads, six forelimbs, and three sections of carapace still containing nuchal bones. According to head size, two individuals were of juvenile size (SSM 13755–56) and the third was the size of a large adult female (SSM 13757). Additional stomach contents of the *Caretta* were horseshoe crabs (*Limulus polyphemus*), blue crabs (*Callinectes sapidus*), knobbed whelks (*Busycon carica*), and Keiner's whelks (*Busycon keineri*).

These observations are of interest as it is assumed that *L. kempi* and *C. caretta* feed upon slow to moderately slow-moving benthic organisms. These records also suggest that fish found in stomachs of *C. caretta* and *L. kempi* may have been captured alive rather than consumed as carrion from shrimp trawler by-catch.

I thank the Georgia Department of Natural Resources (Coastal Resources Division, Brunswick), the U.S. Fish and Wildlife Service (Savannah Coastal Refuges), and all of my co-workers at the Caretta Research Project and the Savannah Science Museum.

Submitted by **MICHAEL G. FRICK**, Caretta Research Project, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

TRACHEMYS GAIGEAE (Big Bend Slider). **REPRODUCTION.** Little information is available on clutch size in *Trachemys gaigeae*. Legler (1960. Herpetologica 16:139–140) reported clutches of 6–11 oviductal eggs in four females (169–202 mm carapace length) collected on 26 June 1959 in Chihuahua, Mexico. Here we report an unusually large clutch from a New Mexico *T. gaigeae*.

On 8 June 1988 one of us (CWP) collected a gravid female (224 mm straight-line carapace length along midline) from the north end of Elephant Butte Reservoir, Socorro Co., New Mexico, USA. The specimen was sacrificed 3–4 weeks later, dissected for tissue samples, and preserved in the Herpetology Division of the University of New Mexico Museum of Southwestern Biology (MSB 50523). Although a cursory examination indicated this specimen contained at least 10 shelled eggs (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.), a more thorough dissection revealed a clutch of 29 eggs (mostly to completely shelled), of which 24 were in the oviducts and 5 in the abdominal cavity. Mean egg length and width (post-preservation, in mm) were 37.3 ± 1.6 SD (34.5–40.3) and 22.8 ± 0.6 SD (21.5–24.0). A small (13.6 x 11.1 mm), ovoid , shelled egg also was present in one oviduct but was not included in the count of 29 full-sized eggs. In addition to eggs, there were two distinct sets of enlarged ovarian follicles which measured ca. 15 mm (N = 16) and 10–12 mm (N = 6) in diameter.

The number of full-sized eggs (29) is noteworthy in that the largest clutch reported for all species of *Trachemys* is 30 for *T. scripta callirostris* (Moll and Moll 1990. *In* Gibbons [ed.], Life History and Ecology of the Slider Turtle, pp. 152–161. Smithsonian Inst. Press, Washington, D.C.) and *T. s. elegans* (Tucker 1996. Herpetol. Rev. 27:142). The enlarged follicles suggest that this specimen could have produced an additional 1–2 clutches in 1988. Although *T. scripta* may produce 3 or more clutches per year (e.g., Moll and Moll 1990, *op. cit.*), multiple clutches in *T. gaigeae* have not been reported previously.

We thank C. S. Pease, E. Jaquez, and A. H. Price for assistance.

Submitted by **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, and **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, Endangered Species Program, P.O. Box 25112, Santa Fe, New Mexico 87504, USA.

TRACHEMYS SCRIPTA ELEGANS (Red-eared Slider). **COLONIZATION.** The presence of freshwater turtles in landlocked aquatic habitats depends on colonization across land. Parker (1990 *In* Gibbons [ed.], Life History and Ecology of the Slider Turtle, pp. 216–222. Smithsonian Inst. Press, Washington, D.C.) studied colonization of a farm pond by *Trachemys scripta* and found that juveniles (45–90 mm plastron length [PL]) were the most frequent colonists. Here, we report an instance where hatchling (30-33 mm PL) *T. scripta* have colonized a farm pond.

One of us (JMH) has a small (ca. 0.04 ha) farm pond on his property, located in Oklahoma Co., Oklahoma, USA (35°41'11"N, 97°14'0"W). The pond is surrounded partially by a drift-fence with pitfall traps, and is isolated from other aquatic habitats by at least 500 m. Previous pitfall trapping, seining, hoop netting, funnel trapping, and observations at the study pond indicate that there were no resident turtles of any species prior to April 1996. Between April and June 1996, four hatchling *T. scripta elegans* were captured in the pitfall traps. The first three hatchlings were measured, marked, and released into the pond, whereas the last one was released into the pond without measuring or marking. The three that were meaured averaged 31.8 ± 1.16 mm PL. On 17 September 1996, we recaptured one of these hatchlings in the pond in a funnel trap baited with sardines. During the 147 days between captures this hatchling increased its PL by 14.7 mm, and more than tripled its mass (9.02–29.4 g).

The most likely explanation for this colonization is that a gravid female from a nearby pond nested close enough to the study pond to allow her hatchlings to disperse to the study pond following their emergence from the nest. Nesting migrations by freshwater turtles are common (Gibbons et al. 1990. *In* Gibbons, *op. cit.*, pp. 201–215). One function of these migrations might be to provide suitable natal habitat for emerging offspring (Congdon et al. 1987. Herptologica 43:39–54). Our observation provides evidence for such a function.

Submitted by **PAUL A. STONE** and **JOHN M. HRANITZ**, Department of Biology, University of Central Oklahoma, Edmond, Oklahoma 73034, USA.

SAURIA

ANOLIS CRISTATELLUS WILEYAE (Virgin Islands Crested Anole). **FRUGIVORY.** Anoles have long been known to eat fruit (Lazell 1972. Bull. Mus. Comp. Zool. 143:22–74) but the frequency and enthusiasm with which they do so have not often been documented. Here we report several instances of frugivory observed in the British Virgin Islands. On 5 October 1996 we watched an adult male crested anole consuming the sweet, magenta fruits of *Melocactus intortus* (Cactaceae) on Guana Island. Anoles caught during the fruiting season often defecate red or purple masses containing seeds. Previous studies of stomach contents conducted at this site have shown that fruits are not uncommon in anole stomachs (G. Perry, unpubl.; material deposited in the Texas Memorial Museum, Austin); however, this was our first observation of intentional ingestion at this site. On 11 October 1996 we observed a pair of crested anoles feeding in a patch of *Trichostigma octandra* (Phytolaccaceae) profusely in fruit with crimson berries. The fruits were about 50 cm above the ground in clusters. Access seemed to be a problem; although the anoles easily could have ridden these small, semi-vining herbs down, they did not. The female anole climbed down a small vine to consume as many berries as she could reach. The male (now Museum of Comparative Zoology 182075) attacked the berries from the edge of a large boulder. It ate all the berries it could reach, even to the extent of lunging out, disengaging its forefeet, and sprawling forward, retaining a grip on the rock only with its rear feet. When captured, this individual defecated *Trichostigma* seeds and skins in a red matrix. On dissection, the entire gut was packed with fruit.

We are indebted to Dr. George Proctor, Puerto Rico Department of Natural Resources, and Dr. Fred Kraus, Hawaii Division of Forestry and Wildlife, for identifying the plants.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne St., Jamestown, Rhode Island 02835, USA, and **GAD PERRY**, Department of Zoology, Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210, USA.

ANOLIS STRATULUS (Saddled Anole). **NECTIVORY.** Nectar feeding has been recorded in anoles (Liner 1996. Herpetol. Rev. 27:78), but we believe it is far more commonplace and widespread than published records indicate. On 12 October 1996 we observed an adult male *Anolis stratulus* climbing on top of a shrub, *Pedilanthus tithymaloides* (Euphorbiaceae), on Guana Island, British Virgin Islands. The anole approached the shrub's flowers and proceeded to lick off drops of nectar that form on the tops of the flowers. This feeding behavior continued for over 10 min. The flowers are coral-red and the clear nectar is sweet to the taste.

We are indebted to Dr. Richard Howard, Gray Herbarium, Harvard, for confirmation of the plant's identity.

Submitted by **GAD PERRY**, Department of Zoology, Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210, USA, and **JAMES LAZELL**, The Conservation Agency, 6 Swinburne St., Jamestown, Rhode Island 02835, USA.

DRACAENA PARAGUAYENSIS (Paraguayan Caiman-lizard). **COURTSHIP.** The neotropical genus *Dracaena* (Sauria, Teiidae) contains two species of large-bodied lizards, both having diurnal, semiaquatic and semiarboreal habits, and known to feed mainly on freshwater snails (Vanzolini and Valencia 1966. Arq. Zool. 13:7–35).

Little information is available on the natural history of *D. paraguayensis* Amaral, which seems to be restricted to the seasonally flooded terrains of the Paraguay River basin, middle South America. Individuals of this species are seen commonly in selected wet habitats of the Pantanal wetlands, western Brazil (pers. obs.). Local inhabitants believe it to be venomous, as already noted by Amaral (1950. Copeia 1950:281–284), and refer to it as "bírbola" (a mis-pronounciation of the Portuguese word "víbora," which means viper).

On 27 January 1990, at 1005 h, at Santa Ines Ranch (ca. 16°30'S, 56°45'W) in the northern Pantanal, I found two *D. paraguayensis* interacting in shallow water (20 cm depth; 33.5°C water temperature). The lizards were discovered because of the loud puffs produced by one of them towards the other. I first heard the sound at a distance of about 7 m. As I approached, I could see them moving slowly among the dense aquatic vegetation (predominantly Pontederiaceae and Cyperaceae). It was evident that the puffs were being directed from a male to a female, as part of a courtship sequence. Movements then performed by the lizards may be summarized as follows: 1) Female moving continuously, at an approximate speed of 2 m/min; 2) Male following the female closely, sometimes trying to mount her. While moving, the male repeatedly puffed (about once each second), concomitantly inflating his dewlap. Occasionally, the male bit the female's tail at the base and lashed his own tail into the water; 3) When the female ceased locomotion, the male immediately positioned his body parallel, over and slightly behind relative to hers. The male then began to slide, from side to side, along the longitudinal axis of the female's body. Noisy puffs were produced repeatedly by the male during this phase too, presumably while mating; 4) The couple remained motionless for about 30 s, then moved away and out of my view.

Puffing behavior in courting lizards was known previously only for the genus *Tupinambis* (Carpenter and Ferguson 1977. *In* Gans and Tinkle [eds.], Biology of the Reptilia. Vol. 7, Ecology and Behavior A, pp. 335–554. Academic Press, New York) and was considered the most striking feature in the courtship of *T. teguixin* (Lopes 1986. Biologia reprodutiva e comportamento do teiu, *Tupinambis teguixin* (Linnaeus, 1758) em cativeiro (Reptilia, Teiidae). MsC thesis, Sao Carlos, 131 pp.). Most other behavioral units here reported as part of the courtship in *D. paraauayensis* are similar to those observed in *T. teguixin* by Lopes (*op. cit.*), except for tail lashing. On the other hand, I did not observe the frequent tongue protraction and mating and postmating behaviors of the kind described for *T. teguixin* (Lopes, *op. cit.*). It is possible that they also occur in the courtship of *Dracaena*, and that only a part of the entire courtship sequence of *D. paraguayensis* was witnessed by me.

Puffs sound different during courtship and as a defensive behavior (= "hiss", sensu Greene 1988. *In* Gans and Huey [eds.], Biology of the Reptilia. Vol. 16, Ecology B, pp. 1–152. Alan R. Liss, New York) in *T. teguixin* (Lopes, *op. cit.*). I also observed that, when attacked, *D. paraguayensis* produces more prolonged puffs in comparison with those produced during courtship.

The presence of courtship puffs in *Dracaena* and *Tupinambis* further emphasizes the close relationship between these two macroteiid genera, as suggested by Vanzolini and Valencia (*op. cit.*) and Presch (1974. Bull. So. California Acad. Sci. 73:23–32), based on morphological features.

I thank I. Sazima, A. S. Abe, and C. F. D. Rocha for helpful comments on an earlier version of the manuscript; B. L. Miranda for assistance in fieldwork, and O. Cid for facilities at the Santa Inês Ranch. Funds were provided in part by CNPq (grant 831105/89-5) and FEMA-MT (Fundação Estadual de Meio Ambiente, Mato Grosso). Fieldwork was conducted while I was a graduate student at UNICAMP (Universidade Estadual de Campinas, Sao Paulo).

Submitted by **CHRISTINE STRUSSMANN**, Rua Antonio Dorileo 508 apto. 34, 78085-600 Cuiaba, Mato Grosso, Brazil.

EUMECES SUMICHRASTI (NCN). **BROOD.** During the evening of 3 April 1992, a violent thunder and windstorm felled a large breadnut tree *(Brosimum alicastrum)* at the Caracol archaeological site (16°45'N, 89°7'W) in the Chiquibul National Park, Belize. The following morning, as the tree was being cut and sectioned for disposal, a clutch of eggs and an adult *Eumeces sumichrasti* were discovered in a cavity which would have been ca. 20 m above ground. This was considerably higher than nest sites described for *Eumeces fasciatus* (Cooper et al. 1983. Herpetol. Rev. 14:65–66) which were ca. 1 m above ground, with one nest as high as 10 m. The cavity containing the nest was located in a crotch formed by five branches. The cavity opening was 125 x 201 mm and was filled with coarse, rotting wood debris, similar to that described for *E. fasciatus* (Hecnar 1994. Canadian J. Zool. 72:1510–1516).

The presumed female (92 mm SVL; 190 mm total length; 18.0 g) and 11 eggs were recovered, apparently uninjured by the tree fall. This clutch size was slightly larger than the 5–10 observed for *E. fasciatus* by Cooper et al. (*op.* cit.). The eggs were distributed throughout the coarse woody debris; six were close to each other, buffered by debris and the remaining five were more widely scattered throughout the debris. Mean egg measurements were 15 x 11 mm and mean weight was less than 1 g.

The skink was relocated with six eggs and a handful of the woody debris to the crotch of another tree, ca. 1.5 m above ground, in adjacent tropical forest. It remained on top of the eggs in a loose semi-circular brooding position, reported as common in other species of *Eumeces* (Noble and Mason. 1933. Amer. Mus. Novitates 619). The remaining five eggs were scattered throughout a handful of the woody debris and placed in a plastic bag. The top of the bag was left loosely open to allow ventilation but retain moisture. The bag was placed in a shaded area in a camp hut. The skink was checked twice during the day of relocation. It remained with eggs in the new nesting location. The following day, the relocated nest was intact although the adult was absent.

On 9 April, four of the five eggs in the plastic bag hatched. The fifth egg appeared dry and later examination showed a less developed embryo with yolk sac. An examination of the relocated nest showed that all six eggs had apparently hatched, as evidenced by the remains of empty eggshells. The adult and hatchlings were not observed.

Mean measurements of the four captive hatchlings before release were as follows: 26 mm SVL; 70 mm total length; 0.67 g.

The base color of the hatchlings was black with vivid blue tails. The dorsal surface of the snout was marked with an orange diamond shape between the nostrils and an orange spot between the eyes. Three lines extended the length of the body, one from either nostril and the third from the diamond mark, passing through the interorbital spot. The three lines gradually shaded from orange on the head, to yellow to blue at the tail. A cream stripe extended laterally from the jaw, merging to blue at the tail. Ventral surfaces were cream except for the blue tail.

The Wildlife Conservation Society, Bowen & Bowen Ltd., and the Terra Foundation provided major project support during the time these observations were made. Permits to work at Caracol were obtained from the Forestry Department of Belize. I am grateful to S. Johnson of the Wildlife Conservation Society library for providing relevant literature. B. W. Miller provided field assistance and helpful comments. M. J. O'Farrell and J. R. Meyer reviewed an earlier version of the manuscript.

Submitted by **CAROLYN M. MILLER**, Wildlife Conservation Society, Gallon Jug, Belize.

MABUYA MACRORHYNCHA (NCN). **REPRODUCTION.** Data on the natural history of *Mabuya macrorhyncha* (Scincidae) are scare (Vanzolini and Rebouças-Spieker 1976. Pap. Avul. Zool. 29:95–109). On 17 October 1995, a female *M. macrorhyncha* was captured at Queimada Grande Island (24°29'S, 46°41'W), on the southeastern coast of Brazil. The lizard was maintained in a glass terrarium (35 x 20 x 25 cm) with a mixture of *Sphagnum* and plant debris as substrate. Water and direct sunlight were available, and the lizard was fed crickets and cockroaches. On 6 February 1996, the female (SVL = 76.0 mm) gave birth to three offspring (SVL = 33.0, 33.5, and 34.3 mm). The young appeared healthy and were able to eats small crickets and cockroaches some hours later.

Submitted by **ALEXANDRE P. ZANOTTI, SÁVIO S. SANT' ANNA**, and **JOÃO LUIZ D. LATUF**, Lab. Herpetologia, Instituto Butantan, Av. Vital Brazil 1500, 05503-900, São Paulo, Brazil.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard). **GROWTH**. *Phrynosoma cornutum* is a Texas threatened species and a federal species of concern. However, information concerning the basic biology of *P. cornutum* is limited.

We marked and released *P. cornutum* from March 1991 to October 1994 on the Chaparral Wildlife Management Area (28°20'N, 99°30'W) in southern Texas, USA. Lizards were captured by road cruising, marked by toe-clipping and passive integrated transponders, and released at site of capture. Recaptures permitted the calculation of growth rates. Daily growth is reported as mm snout-vent length (mm SVL/day) between recaptures for each individual within the same year, and then averaged for juveniles and adults. Lizards between 50 and 75 mm SVL were classified as juveniles, and those > 75 mm SVL were considered adults. Growth rates for adult horned lizards during hibernation were calculated as the average mm SVL of lizards captured in late autumn (September and October) and recaptured in early spring (March and April) of the next year.

We collected 689 *P. cornutum* during the study. Of these, 42 lizards were captured on 98 occasions; 34 were captured twice, 4 were caught three times, 3 were captured four times, and 1 lizard was caught 6 times. Of those that were captured more than once, 3 were classified as juveniles and 39 were considered adults. We did not capture any lizards < 61 mm SVL. Mean growth of juveniles (1M:2F) was 0.527 mm SVL/day (SE = 0.230; N = 3). Mean growth for adults was 0.391 mm SVL/day (SE = 0.176; N = 40). There was no difference (t = -0.697; df= 38; $P = 0.490$) in growth rates between adult males and females (0.248 ± 0.086 mm SVL/day; N = 17 and 0.497 ± 0.300 mm SVL/day; N = 23, respectively). Fifteen adults (8M:7F) were captured in late autumn and recaptured in early spring of the next year (interval between measurements = 160–242 days). Mean growth of adults during hibernation was 0.036 mm SVL/day (SE = 0.010; N = 15).

We thank the personnel of the Chaparral WMA for their assistance with data collection. Financial assistance was provided by Texas Parks and Wildlife Department and the Horned Lizard Conservation Society.

Submitted by **SCOTT E. HENKE**, Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&M University-Kingsville, Kingsville, Texas 78363, USA, and **MELISA MONTEMAYOR***, Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, Texas 78744, USA.

* Present address: Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, Texas 78363, USA.

PHYLLODACTYLUS XANTI (Leaf-toed Gecko). **REPRODUCTION.** The purpose of this note is to report on a histological examination of gonads from 36 *P. xanti* from southern California, USA. Specimens were examined from the Natural History Museum of Los Angeles County (LACM), Museum of Vertebrate Zoology (MVZ), and San Diego Natural History Museum (SDSNH). Imperial County: LACM 52617, 93854–93856, 93858, 93860, 93863, 93865–93866, 93867–93870, 93872, 93874–93875, 99457, 125332, 126013. SDSNH 34725, 49879–49881, 58588, 58922, 62115. Riverside County: MVZ 71085. San Diego County: LACM 93876–93877, 93879, 14003,143743–143744. MVZ 72588, 98164. SDSNH 43786. The left gonad was removed and embedded in paraffin for histological examination. Sections were cut at 5 µm and stained with hematoxylin and eosin counterstain. Histology slides were deposited at LACM. My female sample (N = 18) had a mean SVL of 52.8 mm ± 2.5 SD (range 47–57 mm); male sample (N = 18) mean SVL = 50.3 mm ± 4.3 SD (range 42–56 mm). Testes were classified (sample size in parentheses) as to their spermatogenic state: regressed (spematogonia present, no spermatocytes); recrudescent (renewal of germinal epithelium with spermatocytes, but no sperm); spermiogenesis (sperm formation in progress); January (1) recrudescence; February (4) spermiogenesis; March (1) spermiogenesis; April (6) spermiogenesis; May (1) spermiogenesis; August (1) regressed; October (1) recrudescent; November (2) 1 recrudescent, 1 spermiogenesis; December (1) spermiogenesis. The smallest reproductively active male (spermiogenesis in progress) measured 42 mm SVL. The presence of November, December and February spermiogenic males raises the possibility that reproductive activity may commence in winter. Ovaries were classified (sample size in parentheses) as to their reproductive state: inactive (no yolk deposition); vitellogenic (yolk deposition in progress); enlarged follicles (> 3 mm diameter); oviductal eggs. February (1) inactive; March (1) inactive; April (5) 2 inactive, 3 vitellogenic; May (5) 1 inactive, 1 enlarged follicles, 3 oviductal eggs (1 egg in 1, 2 eggs in each of 2); September (2) inactive; October (2) inactive; November (1) inactive; December (1) inactive. The smallest reproductively active female (enlarged follicles) measured 49 mm SVL. The presence of oviductal females in May

(range 1–2 eggs) reconfirms previous reports (Behler and King 1988. The Audubon Society Field Guide to North American Reptiles and Amphibians, Alfred A. Knopf, New York, New York. 743 pp.; Stebbins 1985. A Field Guide to Western Reptiles and Amphibians, Houghton-Mifflin Co., Boston, Massachusetts. 336 pp.).

I thank Robert L. Bezy (Natural History Museum of Los Angeles County), Harry W. Greene (Museum of Vertebrate Zoology, University of California), and Gregory K. Pregill (formerly of the San Diego Natural History Museum) for permission to examine *P. xanti*.

Submitted by **STEPHEN R. GOLDBERG,** Department of Biology, Whittier College, Whittier, California 90608, USA.

SERPENTES

AGKISTRODON CONTORTRIX CONTORTRIX (Southern Copperhead). **DIET**. Copperheads are known to feed on a variety of arthropod species, including moth caterpillars and cicada nymphs (Uhler et al. 1939. Trans. 4th North Amer. Wildl. Conf., pp. 605–622), dragonflies and millipedes (Brown 1979. Brimleyana 1:113–124), and mantids and grasshoppers (Hamilton and Pollack 1955. Nat. Hist. Misc. 140:1–4).

During the evening of 25 May 1996 I collected a male *Agkistrodon c. contortrix* (46.5 cm SVL) on County Road 119, 0.5 miles W of County Road 277, Jasper County, South Carolina, USA. On 2 June 1996 this snake disgorged a deeply-pleated light brown mass measuring 3.6 x 1.7 cm. Douglas Ferguson (USDA Systematic Entomology Laboratory) identified the mass as being the cocoon of a luna moth (*Actias luna*). Because the moth had not emerged (based on the lack of an opening and the presence of pupa remains within the cocoon), the most likely scenarios is that the snake consumed the cocoon, digested the contents, and disgorged the indigestible cocoon. The cocoon has been deposited in the entomology collection of the U.S. National Museum of Natural History.

Submitted by **CHUCK SMITH**, Department of Biology, The University of South Carolina, Columbia, South Carolina 29208, USA.

BOIGA IRREGULARIS (Brown Tree Snake). **INCUBATION and DIET.** *Boiga irregularis* is an exotic species on Guam that has been responsible for the extirpation or substantial reductions of Guam's forest birds (Savidge 1987. Ecol. 68:660–668), fruit bats (Wiles 1987. Pac. Sci. 41:148–157), and native lizard species (Rodda and Fritts 1992. J. Herpetol. 26:166–174). Despite intensive study, only one report of a successful incubation of a clutch of *B. irregularis* eggs has appeared in the literature (McCoid 1994. Herpetol. Rev. 25:69–70). We report here on the successful incubation of a second clutch on Guam and the diet accepted by the hatchlings.

On 18 May 1995 a *B. irregularis* (1.7 m total length) captured on Andersen Air Force Base deposited a clutch of 8 adherent eggs. Three of the eggs shriveled within a few days of deposition. The remaining 5 eggs were incubated at ambient temperature (ca. 25–30°C) and humidity (>95%) in a glass terrarium using slightly moistened casuarina needles (*Casuarina equistefolia*) as a substrate. After 74 days (31 July 1995), an egg that was discolored was opened, revealing a well-formed, live embryo 142 mm total length. After 120 days the eggs became noticeably dimpled (17 September 1995). The remaining 4 eggs pipped and the 4 snakes emerged on 21–22 September 1995 (125–126 days incubation period). This incubation period was 31–32 days longer than the 94 days reported by McCoid (1994, *op. cit.*).

We maintained two hatchlings (397 and 402 mm total length) in captivity. Three species of geckos, *Leptodactylus lugubris, Hemidactylus frenatus*, and *Gehrya mutilata,* were offered to the snakes, but only *L. lugubris* between 25–30 mm SVL were consumed. Size is apparently the basis for this selectivity, as we have not found juvenile *H. frenatus* or *G. mutilata* as small as 25–30 mm SVL and specimens of *L. lugubris* exceeding 30 mm SVL were not consumed. We also presented the snakes with small grasshoppers (25 mm total length), and on four occasions, they were consumed. A larger praying mantis (50 mm) was also offered, but not consumed. To our knowledge, this is the first record of *B. irregularis* on Guam deliberately consuming insects. Savidge (1988. J. Herpetol. 22:275–282) concluded that the insects (all <10 mm total length) found in larger *B. irregularis* (>600 mm SVL) resulted from incidental intake through consumption of lizards. However, our observations suggest a possible role for insects as prey for small *B. irregularis*. In some situations, control and containment efforts for *B. irregularis* involving prey base reductions may have to consider this previously unrealized prey item for young snakes.

Submitted by **MICHAEL A. LINNELL, DANIEL V. RODRIGUEZ**, USDA/APHIS/ADC, 1060 Route 16, Suite 103-C, Barrigada Heights, Guam 96921, USA, **RICHARD E. MAULDIN** and **RICHARD M. ENGEMAN**, Denver Wildlife Research Center, P.O. Box 25266, Denver, Colorado 80225-0266, USA.

BOTHROPS PRADOI (Prado's Lancehead). **UNUSUAL MORTALITY.** Snakes sometimes take prey that are too large to swallow; such prey may be regurgitated (Sazima and Martins 1990. Mem. Inst. Butantan 52:73–79) or may kill the snake (Howard 1949. Copeia 1949:289; Godley 1980. Ecol. Monogr. 50:411–436). In July 1995, while walking in the restinga of Cumuruxatiba in southernmost Bahia State, Brazil (17°37'S; 39°33'W), one of us (RV) found a dead female *Bothrops pradoi* (61.5 cm SVL; 71 cm total length) on the ground. The snake had a partially ingested adult male (90 mm SVL; 22 mm maximum diam; 66 mm maximum circunference) collared lizard, *Tropidurus torquatus,* in its mouth. The lizard had been ingested head first, up to the anterior margin of the hind legs, and the mouth of the snake was greatly distended. Gape width of the snake was 19 mm after the lizard was removed.

In the laboratory, we carefully checked the snake's body under a stereomicroscope, but detected no sign of injury. We also examined a radiograph of the snake and found that its skull and spinal column were intact. We were not able to define the cause of the snake's death, but we cannot ignore the possibility of asphyxia. The snake was a small adult and the lizard was comparatively large, with strongly keeled and imbricated dorsal scales, which would make the lizard difficult to swallow or regurgitate.

We thank the personnel of the Image Service of the Hospital Pedro Ernesto/UERJ for the radiographs of the snake. Ivan Sazima and P. R. Manzani confirmed the identification of the snake. The former also provided helpful comments on the manuscript. CFDR benefited from a research grant (process No.300819/94-3) from the Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq).

Submitted by **CARLOS FREDERICO D. ROCHA, HELENA G. BERGALLO, DAVOR VRCIBRADIC**, Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier 524, Maracanã, 20550-011, Rio de Janeiro, RJ, Brazil and **ROBERT VÁMOS**, Instituto Jacarandá, Cumuruxatiba, Prado, Bahia, Brazil.

IMANTODES CENCHOA (Chunk-Headed Snake). **REPRODUCTION.** Reproductive aspects of *Imantodes cenchoa* are poorly documented. We report on a clutch of eggs and hatchlings from a snake captured in primary forest in the Amazonian region (Reserva Extrativista do Alto Juruá, Acre, Brazil; 8°59'S, 72°43'W). At 0700 h on 25 January 1996, a female *I. cenchoa* (ZUEC 1922; 634 mm SVL; 910 mm total length [TL]) was collected on shrubs (1 m height) and subsequently maintained in a terrarium. This female laid two eggs (36.0 and 36.5 mm long; both 15.0 mm wide), one each on 26 and 27 January. The eggs were removed and incubated in a plastic jar with moist vermiculite. After 74 days (daily temperature range 25–31°C; ca. 90% humidity), both eggs hatched. Hatchling data: ZUEC 1936, 245 mm SVL; 340 mm TL; ZUEC 1937, 242 mm SVL; 335 mm TL; both weighed 2 g. The specimens are in the collection of the Museu de História Natural, Universidade Estadual de Campinas (ZUEC).

We thank I. Sazima and Emygdio L. A. Monteiro Filho for comments on the manuscript.

Submitted by **PAULO ROBERTO MANZANI** and **ADÃO JOSÉ CARDOSO**, Departamento de Zoologia, CP 6109, Instituto de Biologia, Universidade Estadual de Campinas, 13083-970, São Paulo, Brazil.

PHILODRYAS PATAGONIENSIS **(NCN). DIET**. *Philodryas patagoniensis* is a semi-arboreal species that occurs in a variety of habitats in Brazil, Bolivia, Paraguay, Argentina and Uruguay (Peters and Orejas-Miranda 1986. Catalogue of the Neotropical Squamata. Part I - Snakes, 2nd ed. Smithsonian Inst. Press, Washington, 174 pp.). Records of the food and foraging behavior of this snake in the wild are scarce (Sazima and Haddad 1992. *In* Morellato (ed.)., História Natural da Serra do Japi, pp. 212–236. Editora da Unicamp/Fapesp, Campinas; Vanzolini 1948. Rev. Brasil. Biol. 8:308–311). Here we report our records of a mammal, a lizard, and nestling birds taken as food in the wild by *P. patagoniensis* in restinga habitat of Barra de Maricá (22°57'42"S, 42°51'35"W), ca. 38 km E of Rio de Janeiro, Brazil.

On 13 January 1996 (0630 h) two of us (LPG and GDAC) found an adult female *P. patagoniensis* resting ca. 80 cm above ground, stretched on the branches of a scrubby thicket. The snake showed a remarkable volume in its body, and we suspected that it might have eaten a bird from a nearby nest, so we collected it for analysis of stomach contents. Dissection revealed that the snake had ingested a sub-adult *Metachirus nudicaudatus* (brown four-eyed opossum; Didelphidia, Marmosidae). The prey had been swallowed head-first and was nearly intact (Fig. 1). The snake measured 82 cm SVL (113 cm total length), and weighed 202 g (excluding the prey). The prey weighed 112 g immediately after being removed from the snake's stomach. Also found in the digestive tract of the snake were the tail and forelimb of a scincid lizard, *Mabuya agilis*. These specimens were deposited in the Department of Vertebrates of the Museu Nacional do Rio de Janeiro (snake and lizard (MNRJ 4739), opossum (MN 43077)) .

Predation on bird nestlings occurred on 19 January 1995 (midday), and involved a widespread bird species, *Coereba flaveola* (bananaquit; Passeriformes, Emberezidae). On this occasion, LPG and GDAC were attracted by the calls of nestling *C. flaveola* to a nest ca. 90 cm above ground among thorns in the bifurcation of an isolated cactus in a small clearing. A *P. patagoniensis* had its head and neck inside the globular nest. As the snake moved a little, the corpse of a young bird dropped from the nest. The snake held another nestling in its mouth. The snake carried this dead nestling as it descended to the ground and moved into the nearest thicket, but let it fall midway to the thicket. Another young bird survived the attack, apparently not injured, and remained in the nest.

None of these prey species previously have been reported in the diet of *P. patagoniensis*.

We thank Carlos F. D. Rocha, Bret M. Whitney, Leila M. Pessoa, Richard Sachsse, Rui Cerqueira, Sérgio P. C. e Silva, and Ulisses Caramaschi for commenting on this note and providing additional information. The snake was identified by Ulisses Caramaschi, the opossum by João Alves de Oliveira, and the lizard by Carlos F. D. Rocha. Érika F. Pereira helped in field work. Maria A. S. Alves benefited from a research grant (process no. 301524/88-2) provided by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).



FIG. 1. *Philodryas patagoniensis* and its prey, *Metachirus nudicaudatus*. Photo by M. A. S. Alves.

Submitted by **LUIZ A. P. GONZAGA**, Departamento de Zoologia, CCS, Universidade Federal do Rio de Janeiro, Cidade Universitária, 21941, Rio de Janeiro, RJ, Brasil, **GLÓRIA D. A. CASTIGLIONI**,* Programa de Pós-Graduação em Ecologia, Universidade Estadual de Campinas, Campinas, SP, 13081, Brasil, and **MARIA ALICE S. ALVES**, Ecology Sector, Universidade do Estado do Rio de Janeiro, R. São Francisco Xavier, 524, Rio de Janeiro, RJ, 20550-013, Brasil.

* Present address: Departamento de Zoologia, CCS, Universidade Federal do Rio de Janeiro, Cidade Universitária, 21941, Rio de Janeiro, RJ, Brasil.

TANTILLA PLANICEPS (California Black-headed Snake). **PREDATION.** At ca. 1900 h on 15 May 1982, I observed an adult loggerhead shrike (*Lanius lucovicianus*) with a juvenile *Tantilla planiceps* in its beak. The shrike was perched on the top strand of a barbed-wire fence that paralleled a road. The snake was moving, indicating it had been captured recently. The observation was made with 10x binoculars and lasted 5–10 s, after which the bird flushed. Field conditions were clear, calm, and warm. The habitat was grassland along Corral Hollow Road, Alameda Co., California, USA, 0.7 road mile W of the Alameda-San Joaquin Co. line.

Loggerhead shrikes eat invertebrates and small vertebrates (Peterson 1961. A Field Guide to Western Birds. Houghton Mifflin Co., Boston, Massachusetts, 309 pp.). This record may represent the first published account of a loggerhead shrike preying upon *Tantilla* (C. R. Mahrdt, unpubl. data).

I thank Robert Hansen for reviewing this note and Clark Mahrdt for sharing his extensive knowledge on the diet of the loggerhead shrike.

Submitted by **ED ELY**, Field Associate, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94116, USA.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 28, Number 1 (March 1997).

CAUDATA

AMBYSTOMA BARBOURI (Streamside Salamander). USA: TENNESSEE: Davidson Co: Nashville, Green Hills area, stream near Hillsboro High School. 5 March 1967. David H. Snyder. Austin Peay State University Museum of Zoology (APSU 1969). Verified by William H. Redmond. Non-gravid, adult female (SVL 73 mm); Jackson Co: Hix Hollow. 3 March 1973. T. Florence. Middle Tennessee State University Herpetological Collection (MTSU 326C, 327C). Verified by David H. Snyder. Juveniles (SVL 40 mm and 45 mm); Rutherford Co: ca. 1.1 km south of Tenn. Rt. 96 in field east of Rucker Lane. 2 October 1996. M. Brown. Middle Tennessee State University Herpetological Collection (MTSU 325C). Verified by David H. Snyder. Juvenile (SVL 44 mm). Originally identified as *Ambystoma texanum*, these specimens (reidentified based on tooth morphology and internaral distance) represent the first records of *A. barbouri* from Tennessee (Redmond and Scott 1996, Atlas of Tennessee Amphibians. Center for Field Biol. Austin Peay St. Univ. Misc. Pub. No. 12. 94 pp.) and extend the known range of the species ca. 170 km SW from Russell County, Kentucky (Kraus and Petranka 1989, Copeia 1989:94–110) into the Central Basin physiographic region of Tennessee. Redmond's and Scott's (*op. cit.*) Davidson and Jackson county records for *A. texanum* are therefore invalid and should be deleted from their Tennessee distribution map for this species.

Submitted by **A. FLOYD SCOTT**, Department of Biology and Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA, **BRIAN T. MILLER** and **MATTHEW BROWN**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA, and **JAMES W. PETRANKA**, Department of Biology, University of North Carolina at Ashville, North Carolina 28804, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: GEORGIA: Marion Co: 16 km SW Buena Vista (32°10'N, 84°35'W). 8 January 1997. Bob Herrington. Georgia Southwestern State University Vertebrate Collection 6375. Verified by Marilyn Herrington. County record; represents a 150 km range extension from the nearest record in Decatur County, Georgia (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp). Specimen is one of three collected by drift fences placed in a hardwood, floodplain forest bordering the Kinchafonnee Creek.

Submitted by **BOB HERRINGTON**, Department of Biology, Georgia Southwestern State University, Americus, Georgia 31709, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: NORTH CAROLINA: Stokes Co: 4 km W Prestonville along Snow Creek. 11 April 1997. Dennis W. Herman, Jeffrey C. Beane, Ann B. Somers, and Robert A. Davis. North Carolina State Museum of Natural Sciences (NCSM color slides JCB 97-587). Verified by Alvin L. Braswell. Adult photographed and released at landowner's request and due to protected status in state. New county record; fills gap between Rockingham and Surry counties (NCSM files).

Submitted by **JEFFREY C. BEANE** and **DENNIS W. HERMAN**, North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). GEORGIA: Burke Co: DiLane Wildlife Management Area. 22-28 April 1996. UGAMNH 32649-32652. Verified by M. E. McGhee and J. Jensen; Jones Co: Piedmont National Wildlife Refuge, 4.8 km NNW Headquarters. 29 August 1979. UGAMNH 15426. Verified by M. E. McGhee and J. Jensen; Piedmont National Wildlife Refuge, Little Falling Creek. 20 February 1980. UGAMNH 15246. Verified by M. E. McGhee and J. Jensen; Morgan Co: 0.8 km S US Rt. 278 on Co. Rd 164. 3 April 1980. UGAMNH File Record. Verified by L. J. Vitt and L. Logan; Putnam Co: Oconee National Forest, 0.5 km SW Rock Eagle Monument. 1 February 1997. UGAMNH 32423. Verified by M. E. McGhee and J. Jensen.

Submitted by **JOSHUA LAERM**, Museum of Natural History, University of Georgia, Athens, Georgia 30602, USA, **DENISE A. MAIDENS** and **LYNN LEWIS**, Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, Georgia 30602, USA.

TARICHA GRANULOSA (Roughskin Newt). USA: IDAHO: Latah Co: private pond adjacent to S side of Four Mile Road, 3.5 km E Viola. 20 March 1997. Ryan J. Monello. Washington State University Charles R. Connor Museum (CRCM 97-17). Verified by Kevin Pullen. Specimen was collected from a reproducing population, 2.4 km NNE of only previous collection site (Nussbaum and Brodie 1971, Herpetologica 27:260–270). Prior to collection, only one specimen had been recorded in the past 23 years (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. The University Press of Idaho, Moscow. 332 pp.). Two additional populations have been found in nearby private ponds. All three populations appear to be comprised of relatively few animals.

Submitted by **RYAN J. MONELLO** and **R. GERALD WRIGHT**, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844-1136, USA.

ANURA

CHACOPHRYS PIEROTTI (Lesser Chini Frog): BOLIVIA: TARIJA: Provincia Gran Chaco: Villa Montes, 21°16'S, 63°28'W. 7–27 January 1981 and February 1982. H. Meier. Zoologisches Forschungsinstitut und Museum Alexander Koenig Bonn (ZFMK 32584, 36447). Verified by W. Böhme. First record for Bolivia (De la Riva 1990, Boll. Mus. Reg. Sci. Nat. Torino 8:261–319).

Submitted by **JÖRN KÖHLER**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

HYLA REGILLA (Pacific Treefrog). USA: CALIFORNIA: IMPERIAL CO: All American Canal near El Centro, 32°47'N, 115°36'W. elevation 11 m below sea level. 27 March 1959. J. Berry. LACM 144117–18. Verified by Kimball L. Garrett. Extends the range far into the Lower Colorado River Subdivision of the Sonoran Desert and to below sea level (Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second Ed. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.). This new county record is ca. 85 km ESE of the previously reported locality at Scissors Crossing, San Diego County (Jameson et al. 1966, Proc. California Acad. Sci. 33:591) and ca. 115 km SE of the locality at Pushwalla Palms, Riverside County, California (Stebbins, *op. cit.*).

Submitted by **ROBERT L. BEZY**, Amphibians and Reptiles, Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA, and **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA.

LEPIDOBATRACHUS LAEVIS (Budgett's Frog): BOLIVIA: TARIJA: PROVINCIA GRAN CHACO: Villa Montes, 21°16'S, 63°28'W. 23 February 1986. H. Meier. Zoologisches Forschungsinstitut und Museum Alexander Koenig Bonn (ZFMK 44733). Verified by W. Böhme. First record for Bolivia (Faivovich 1994, Acta Zool. Lilloana 43:105-115).

Submitted by **JÖRN KÖHLER**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

LITORIA AUREA (Green and Golden Bell Frog). TERRITORY OF WALLIS AND FUTUNA: WALLIS ('UVEA) ISLAND (13°18'S, 176°12'W). 19 December 1996. Helene Guegan. Jens V. Vindum. CAS 202722. Verified by Jens Vindum. First confirmed record for this French Pacific territory. Gill (1995, Rec. Auckland Inst. Mus. 32:55–61), who provided the first and only review of the herpetofauna of Wallis ('Uvea) Island, noted that frogs, "said to be the Australian species *Litoria aurea*" had been reported from several lakes on the island, but did not examine specimens or confirm this identification. Frogs were apparently introduced into Wallis ca. 1930 by Georges Renaud, a surgeon and French administrator, in order to control insects (Anonymous 1991, Au Pays des Trois Royaumes. Association Pacifique, Paris.). The geographic origin of the frogs is uncertain as Renaud had connections to Australia and the New Hebrides (Vanuatu), as well as to New Caledonia. However, the extensive political, economic, and transportation links between New Caledonia and Wallis strongly suggest that the animals originated there. New Caledonia has previously been proposed as the source for the subsequent introduction of *L. aurea* into Vanuatu (Tyler 1975, Copeia 1975:355–356).

Submitted by **AARON M. BAUER**, Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA, **ROSS A. SADLIER**, Department of Herpetology, Australian Museum, 6-8 College Street, Sydney, New South Wales 2000, Australia, and **JEAN CHAZEAU**, ORSTOM Centre de Nouméa, B. P. A5, Nouméa, New Caledonia.

PLEURODEMA TUCUMANA. ARGENTINA: JUJUY: PARQUE NACIONAL CALILEGUA, DEPARTAMENTO LEDESMA : Río Yuto (550 masl) 200 m from the Park border (23°50'S, 64°50'W) 9 January 1996. Marcos Vaira. Museo de Ciencias Naturales Universidad Nacional de Salta (MCN 347). Verified by E. O. Lavilla. Two males calling in the muddy shore of a temporary pond filled by rainwater. First province record; extends known range ca. 145 km N from former records in Joaquin V. Gonzalez, Salta [Cruz et al. 1992, Acta Zool. Lilloana 42(1):101–107]. First record for the species in a Subtropical Montane Forest.

Submitted by **MARCOS VAIRA**, Museo de Ciencias Naturales. Universidad Nacional de Salta, Mendoza 2, 4400 Salta, Argentina.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: NEW MEXICO: CIBOLA CO: Pueblo of Laguna, 7.2 km N of Encinal, White Springs (SW 1/4 NW 1/4 Sec. 15, T11N, R6W), ca. 2330 m elev. 19 May 1997. S. E. Carr. University of New Mexico Museum of Southwestern Biology (MSB) 60771. Verified by Don S. Sias. Second record for San Mateo Mountains and confirms presence in this area of west-central New Mexico. Gehlbach (1965, Proc. U.S. Natl. Mus. 116:274) reported a specimen (CU 6338) from "Mark Elkin's Ranch, Mt. Taylor" (= Elkins Camp, Sec. 11, T12N, R7W) which was not mapped by Degenhardt et al. (1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xix + 431 pp.). Specimen provisionally assigned to *P. triseriata;* taxonomic status of New Mexico populations is unresolved.

Submitted by **STACEY E. CARR**, Department of Natural Resources, Pueblo of Laguna, P.O. Box 194, Old Laguna, New Mexico 87026, USA, **JAMES N. STUART** and **WILLIAM G. DEGENHARDT**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

TESTUDINES

CLEMMYS GUTTATA (Spotted Turtle). USA: WEST VIRGINIA: HAMPSHIRE CO: Edwards Run Wildlife Management Area (ERWMA), 3 km N Capon Bridge. 1992–1995. Three turtles were captured and released at ERWMA: an eight year old male (carapace length 99 mm) on 15 August 1992, an unknown age and sex adult turtle on 5 May 1992, and a five year old juvenile (carapace length 74 mm) on 17 September 1995. Photographs of these are catalogued in the West Virginia Biological Survey Collection at Marshall University (WVBS 10600). Verified by Thomas K. Pauley. Represents the first county record for this species and extends the known range in West Virginia 50 km W (Green and Pauley 1987, Amphibians and Reptiles in West Virginia, Univ. Pittsburgh Press. xi + 241 pp.).

Submitted by **ALLAN J. NIEDERBERGER**, West Virginia Division of Natural Resources, Romney, West Virginia 26757, USA, and **MICHAEL E. SEIDEL**, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755, USA.

CLEMMYS MUHLENBERGII (Bog Turtle). USA: NORTH CAROLINA: CHEROKKE CO: 4.8 km E Andrews. May 1988. J. M. Bauman. North Carolina State Museum of Natural Sciences (NCSM A.N. 95-8-15; specimen maintained in live collection). New county record; extends range ca. 14 km WNW of nearest records in Macon County (Palmer and Braswell 1995, Reptiles of North Carolina. Univ. North Carolina Press, Chapel Hill. 412 pp.). GRAHAM CO: 11.3 km ESE Robbinsville. July 1996. M. Hopey. NCSM 45684 (shell). New county record. Extends range ca. 18 km NW of nearest records in Macon County (Palmer and Braswell 1995, Reptiles of North Carolina. Univ. North Carolina Press, Chapel Hill. 412 pp.). Both verified by William M. Palmer.

Submitted by **DENNIS W. HERMAN** and **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, P. O. Box 29555, Raleigh, North Carolina 27626-0555, USA.

TRACHEMYS GAIGEAE (Big Bend Slider). USA: TEXAS: BREWSTER CO: Rio Grande at mouth of Reagan Canyon. 20 April 1997. W. G. Degenhardt, J. R. Dixon, M. Dixon, and M. E. Seidel. University of New Mexico Museum of Southwestern Biology (MSB) 60768–70 and a living specimen to be deposited in the Texas Cooperative Wildlife Collection (TCWC, field no. JRD 33425). Verified by James N. Stuart. Extends range downstream in the Rio Grande 37 km (airline) from its previously known limit at Rio Grande Village (near Boquillas) Brewster County, Texas (Ernst 1992, Cat. Am. Amphib. Rept. 538:1–14). *Trachemys gaigeae* was also collected along intermediate sites at the mouth of Maravillas and Big Canyons, indicating a continuous distribution along this portion of the Rio Grande downstream from Big Bend National Park.

Submitted by **MICHAEL E. SEIDEL**, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755, USA, **WILLIAM G. DEGENHARDT**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA, and **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

SAURIA

CHAMAELEO CHAMAELEON (Common Chameleon). PORTUGAL: ALGARVE: Lagos. 22 July 1994 (37°05'N, 08°41'W). SPAIN: ANDALUCA: Ayamonte. 1 August 1994 (37°15'N, 07°26'W); Torremolinos. 8 May 1994 (36°38'N, 04°30'W); Almuñecar. 12 September 1994 (36°43'N, 03°40'W). All specimens collected DOR. Department of Animal Biology and Ecology, University of Granada (AL 940721, adult female; HU 940801, adult male: MA 940508, adult male; GR 940912, adult male). All verified by J. M. Pleguezuelos. These records represent a considerable range extension of the species in the Iberian Peninsula, either as a continuous invasion, or as an interrupted but efficient incursion. This suggests that the *C. chamaeleon* has great adaptive plasticity. Efforts should be made for the conservation of this species in Europe.

Submitted by **MANUEL BLASCO**, Department of Animal Biology, University of Extremadura, 06071 Badajoz, Spain, and **DIEGO GONZALEZ**, Guadiana School, P.O. Box 147, Ayamonte, Huelva, Spain.

EUMECES BREVIROSTRIS INDUBITUS (Mexican Shortnose Skink). MEXICO: MICHOACAN: 6.8 km WNW Charán, 2286 m. 12 November 1970. Fred G. Thompson. UF 45523. Verified by F. Wayne King. First confirmed record for the state (the previous record was based on *E. dugesii* fide Dixon 1969, Los Angeles Co. Mus. Nat. Hist. Contr. Sci. 168:12), and the only record for the subspecies between western Mexico (state) and Jalisco and Durango (Robinson 1979, Los Angeles Co. Mus. Nat. Hist. Contr. Sci. 319:11). The specimen is an adult conforming in all respects with the distinctive characteristics of the subspecies.

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA; **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA, and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 90309, USA.

EUMECES OCHOTERENAE (Guerreran Skink). MEXICO: OAXACA: San Vicente, Putla district. 1972. Thomas MacDougall. UCM 52640. Verified by Richard L. Holland. First record for the state of Oaxaca and a range extension of ca. 160 km ESE of the nearest records in central Guerrero (Dixon 1969, Los Angeles Co. Mus. Nat. Hist. Contr. Sci. 168:13, 19–20). No Notable differences are apparent in comparison with material from Guerrero, the only state of previous record.

Submitted by **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA, and **FRANK VAN BREUKELEN**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: LOUISIANA: NATCHITOCHES PARISH: 31°44'6"N, 93°5'54"W, ca. 0.1 km NE Northwestern State University. 8 March 1997. John Ray. Northwestern State University Museum (NSU 5260). Verified by Kenneth Williams. First record for Natchitoches Parish (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.; Harold Dundee, personal comm. 22 January 1997.; David Good, personal comm. 24 January 1997).

Submitted by **JOHN RAY** and **BETSY COCHRAN**, NSU Box 3153, Natchitoches, Louisiana 71497, USA. E-mail: nsray2796@alpha.nsula.edu.

OPHISAURUS COMPRESSUS (Island Glass Lizard). USA: GEORGIA: CAMDEN CO: Cumberland Island , interdune area east of Cedar Dock Road. 17 February 1993. C. Robert Shoop and Carol Ruckdeschel. USNM 511177. Verified by R. I. Crombie. In 1986, we noted the unconfirmed presence of several species listed by other authors as potential residents of Cumberland Island, Georgia (Herpetol. Rev. 17:51). This specimen establishes the presence of this species on the north end of the island. Another specimen, subsequently found dead in the same habitat, has been deposited in the Cumberland Island Museum. Although present in surrounding Georgia counties, these lizards represent the first Camden County records (Williamson and Moulis 1994, Distribution of Amphibians and Reptiles on Georgia. Savannah Sci. Mus. Spec. Publ. No. 3).

Submitted by **C. ROBERT SHOOP**, Department of Biological Sciences, University of Rhode Island, Kingston, Rhode Island 02881-0816, USA, and **C. RUCKDESCHEL**, Cumberland Island Museum, P.O. Box 796, St. Marys, Georgia 31558-0796, USA.

PRIONODACTYLUS ARGULUS. BRAZIL: ACRE: Rio Branco, Centro Experimental da Universidade Federal do Acre, Km 29 da AC-010 (10°03'S, 67°51'W). 17 March 1993. M. Henzl and L. Ford. Museu Paraense Emilio Goeldi (MPEG 16774). Verified by R. N. Yuki. First state record (Avila-Pires 1995, Zool. Verh. Leiden 299:458).

Submitted by **ALMIRA CLAUDIA MARINHO LIMA**, Departamento de Zoologia, Museu Paraense Emilio Goeldi, Caixa Postal 399, CEP 66.040-170, Belem, Para, Brazil. E-mail: claudia@museu-goeldi.br .

PRIONODACTYLUS EIGENMANNI. BRAZIL: ACRE: Rio Branco, Centro Experimental da Universidade Federal do Acre, km 29 da AC-010 (10°03'S, 67°51'W). 10 March 1993, Museu Paraense Emilio Goeldi (MPEG 16767–16768); 11 March 1993

(MPEG16770–16771); 17 March 1993 (MPEG 16773). All collected by M. Henzl and L. Ford. Verified by R. N. Yuki. First state records (Avila-Pires 1995, Zool. Verh. Leiden 299:468).

Submitted by **ALMIRA CLAUDIA MARINHO LIMA**, Departamento de Zoologia, Museu Paraense Emilio Goeldi, Caixa Postal 399, CEP 66.040-170, Belem, Para, Brasil. E-mail: claudia@museu-goeldi.br.

SAUROMALUS OBESUS (Chuckwalla). USA: NEVADA: ESMERALDA CO: on isolated rocky outcrop near Bonnie Claire Flat, 1260 m elev. (37°08.845'N, 117°10.925'W). 16 May 1995. Paul C. Ustach. PCU Field No. 188. New county record and northwest range extension. LINCOLN CO: Hell's Half Acre, Hiko Range, 1400 m elev. 27 April 1995. Paul C. Ustach. PCU Field No. 181. Northern range extension. Both verified by Edmund D. Brodie, Jr. Specimens eventually will be deposited at the University of Texas at Arlington.

Submitted by **PAUL C. USTACH**, Department of Biology, Utah State University, Logan, Utah 84322-5305, USA.

SCELOPORUS HORRIDUS OLIGOPORUS (Mexican Horrible Spiny Lizard). MEXICO: NAYARIT: 3.9 km NW Chapalilla, 1036 m. 21 May 1966. Fred G. Thompson. UF 34831. Verified by F. Wayne King. An adult male 95 mm SVL with 2-2 femoral pores and strong abdominal and gular semeions. First record for the state (Smith 1939, Zool. Ser. Field Mus. Nat. Hist. 26:99, 106–108), where the only representatives of the species previously recorded are *S. h. albiventris*, which apparently is replaced in the western, more elevated part of the state, by *S. h. oligoporus*.

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainsville, Florida 32611, USA, **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA, and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA.

SCELOPORUS PARVUS SCUTULATUS (Southern Bluebelly Lizard). MEXICO: ZACATECAS: 25.3 km SW San Tiburcio, 2316 m. 7 August 1966. Fred G. Thompson. UF 34975. Verified by F. Wayne King. First record of the species for the state, supplementing the northernmost record for the subspecies 48 km N Matehuala, San Luis Postosí (Smith 1939, Zool. Ser. Field Mus. Nat. Hist. 26:255–6, 284). With 22 nape rows, 69 dorsals, anterior section of frontal not divided.

Submitted by **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA; and **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainsville, Florida 32611, USA.

SCELOPORUS UNDULATUS ELONGATUS (Nothern Plateau Lizard). USA: COLORADO: ROUTT CO: 1 km W Pagoda. 29 June 1997. Frank van Breukelen. UCM 58772. Verified by Richard L. Holland. First county record (Livo et al. 1996, Herpetological microbiogeography of Colorado II: documented and potential county records. Publ. Colorado Herpetol. Soc. 22 pp.) and a northeastern range extension of 42 km (airline) from the Yampa River south of Lay on the bluffs of the Williams Fork River.

Submitted by **FRANK VAN BREUKELEN,** Department of EPO Biology, University of Colorado, Boulder, Colorado 90309, USA, **JAN ROTH,** Sundance Museum, 417 Breeze Street, Craig, Colorado 81625, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado Museum, Boulder, Colorado 80309, USA.

SCINCELLA LATERALIS (Ground Skink). MEXICO: DURANGO: ca. 14.5 km SSW Picardias, 1341 m (confirmed by field notes; 1400 ft. on tags in error). 28 December 1969. Fred G. Thompson. UF 105868–869. Verified by F. Wayne King. These represent an apparently isolated population ca. 7 km W of the Coahuila border, ca. 33 km (airline) SSW Torreón, Coahuila (Schmidt and Owens 1944, Zool. Ser. FMNH 29:107) at much the same altitude (1320 m). No notable differences were detected from U.S. material.

Submitted by **HOBART M. SMITH**, Department of EPO Biology and Museum, University of Colorado, Boulder, Colorado 80309-0334, USA, **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA, and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA.

SERPENTES

BOTHROPS NEUWIEDI (Neuwied's Lancehead). BRAZIL: AMAZONAS: HUMAITÁ: Savanna Region. G. R. Colli. Departamento de Zoologia, Museu Paraense Emílio Goeldi (MPEG 18951, 17 October 1991, MPEG 18954–55, 30 October 1991). Verified by G. Puorto. New county record (Campbell and Lamar 1989, The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp.). The Humaitá Region is an area between the main distribution of this snake and an isolated population (Campbell and Lamar, *op. cit.*).

Submitted by **RUBENS NOBUO YUKI**, Departamento de Zoologia, Museu Paraense Emílio Goeldi, Caixa Postal 399, Belém, Pará, Brazil CEP 66017-970.

CHIRONIUS FLAVOLINEATUS. BRAZIL: AMAZONAS: HUMAITÁ: Escola Agrotécnica de Humaitá (7°31'S, 63°02'W). 9 November 1991. Guarino R. Colli. Coleção Herpatológica da Universidade de Brasília (CHUNB 00217–18); AMAPÁ: FERREIRA GOMES: Fazenda Teinmoso (1°02'06"N, 51°10'02"), 17 April 1997. Guarino R. Colli and Ayrton K. Péres Jr. CHUNB 00219. All verified by Nelson Jorge da Silva Jr. First records for the states of Amapá and Amazonas; both in Amazonian Savanna habitats; extends range ca. 250 km NW from previous northern limit of distribution (Ilha de Marajó; Dixon et al. 1993, Monographie XIII, Museo Regionale di Scienze Naturali, Torino. 279 pp.) and ca. 800 km N of western limit of distribution (central Bolivia, ibid.).

Submitted by **GUARINO R. COLLI** and **AYRTON K. PÉRES JR.**, Departamento de Zoologia, Universidade de Brasília, 70910-900, Brasília, Distrito Federal, Brazil. E-mail (GRC): grcolli@guarany.cpd.unb.br.

CLELIA RUSTICA (Mussurana) ARGENTINA: MENDOZA: ca. 20 km SSE of Malargüe city (35°28'S, 69°35'W). 2 December 1992. Gustavo Marino. Herpetological collection of PROBBAS, Consejo Nacional de Investigaciones Científicas y Técnicas, Corrientes, Argentina (CFA 226, female). Verified by Gustavo Couturier. First province record; extends range ca. 440 km air line W from nearest known locality in Villa Valeria, Córdoba Province (Scrocchi and Viñas 1990, Boll. Mus. Reg. Sci. Nat. Torino 8(2):487–499).

Submitted by **ALEJANDRO R. GIRAUDO**, Becario de CONICET, Instituto Nacional de Limnología, José Macia 1933,

3016, Santo Tomé, Santa Fe, Argentina, and **VENESA ARZAMENDIA**, Salvador Caputto 3945, 3000, Santa Fe, Argentina.

COLUBER CONSTRICTOR FLAVIVENTRIS (Eastern Yellowbelly Racer). USA: TEXAS: McMULLEN Co: DOR at jct FM 624 and Tex. Rt. 16 on Tex. Rt. 16. 3 May 1997. Travis J. LaDuc and Christopher R. Harrison. TNHC 55958. Verified by David C. Cannatella. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **TRAVIS J. LaDUC**, Department of Zoology, The University of Texas at Austin, Austin, Texas 78712-1064, USA and **CHRISTOPHER R. HARRISON**, Department of Wildlife and Fisheries Sciences, Texas A & M University, College Station, Texas 77843, USA.

CROTALUS VIRIDIS VIRIDIS (Prairie Rattlesnake). USA: WYOMING: SWEETWATER Co: 3.2 km W of Rt. 430 on road to Hiawatha. 27 June 1992. David Chiszar and Hobart M. Smith. UCM 57059. Verified by Alan de Queiroz. County record (Baxter and Stone 1980, Amphibians & Reptiles of Wyoming. Publ. Wyoming Game and Fish Department). Previously *C. v. concolor* was the only race of this species known from Sweetwater County.

Submitted by **KYLE G. ASHTON** and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA, and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: ARIZONA: MOHAVE Co: 1 mi S of Oatman on U.S. Rt. 66. 29 April 1997. Paul C. Ustach and Daniel H. Foley. DHF Field No. 111. Verified by Edmund D. Brodie, Jr. Found dead on road. Specimen eventually will be deposited at the University of Texas at Arlington.

Submitted by **PAUL C. USTACH**, Department of Biology, Utah State University, Logan, Utah 84322-5305, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: NEVADA: CLARK Co: Newberry Mountains, Hiko Spring, 630 m elev. (37°41'35"N, 85°22'33"W). 12 April 1995. Paul C. Ustach. PCU Photograph 005. Verified by Edmund D. Brodie, Jr. Individual was found stretched out in the middle of a dry wash about 400 m from the surface flow of Hiko Spring. Specimen eventually will be deposited at the University of Texas at Arlington.

Submitted by **PAUL C. USTACH**, Department of Biology, Utah State University, Logan, Utah 84322-5305, USA.

DIADOPHIS PUNCTATUS REGALIS (Regal Ringneck Snake). USA: TEXAS: EDWARDS Co: DOR, 10.2 road mi W Rocksprings on Tex. Rt. 55. 10 May 1997. Travis J. LaDuc. UTEP 17162. Verified by Carl S. Lieb. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.); size of specimen (335 SVL + 60 mm tail length) suggests *D. p. regalis* instead of *D. p. arnyi.*

Submitted by **TRAVIS J. LaDUC**, Department of Zoology, The University of Texas at Austin, Austin, Texas 78712-1064, USA.

FARANCIA ERYTROGRAMMA ERYTROGRAMMA (Rainbow Snake). USA: FLORIDA: BAKER Co: south prong of the St. Mary's River at U. S. Rt. 90 and State Road 10 bridge, between Macclenny and Glen St. Mary. 16 June 1988. William H. Kern. Florida Museum of Natural History (UF 72535). Verified by F. Wayne King. County record; fills gap of ca. 70 mi between Duval and Columbia counties. NASSAU Co: 2 mi E of U. S. Rt. 17 on S shore of St. Mary's River, White Oak Plantation. 13 May 1997. Patrick J. Ryder. UF 106014. Verified by F. Wayne King. County record; fills a gap of ca. 70 mi between Glynn County (Georgia) and Duval County (Florida). First two records for the St. Mary's River drainage (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part One. The Snakes. Windward Publ., Miami. 176 pp.; Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Pub. No. 2. 418 pp.).

Submitted by **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA.

LAMPROPELTIS TRIANGULUM TRIANGULUM (Eastern Milk Snake). USA: ILLINOIS: KANE Co: 6 mi W Geneva. 16 May 1974. SE Sec. 31, T40N, R8E. Doug Brown. Museum of Northern Illinois University (HDW-NIU 1347). Verified by Jerry Stubbs. Specimen found crossing Rt. 38. Documents county record of Necker (1939, Chicago Acad. Sci. Bull. 6[1]:1–10) for which no voucher specimen is known.

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

LYSTROPHIS MATOGROSSENSIS (South American Hognose Snake). BOLIVIA: SANTA CRUZ: SANDOVAL: Estancia Cascavel (16°38'S, 57°29'W). 12 September 1994. Julio R. Contreras. Herpetological collection of PROBBAS, Consejo Nacional de Investigaciones Científicas y Técnicas, Corrientes, Argentina (CFA 725, male). Verified by Gustavo J. Scrocchi. First record for Bolivia; extends range ca. 100 km air line W from westernmost known locality in Caceres, Brazil. The species was known only from Mato Grosso and Mato Grosso do Sul states, Brazil (Scrocchi and Cruz 1993, Papeis Avulsos Zool. 38:171–186).

Submitted by **ALEJANDRO R. GIRAUDO**, Becario de CONICET, Instituto Nacional de Limnología, José Macia 1933, 3016, Santo Tomé, Santa Fe, Argentina.

NERODIA SIPEDON PLEURALIS (Midland Water Snake). USA: TENNESSEE: SHELBY Co: Germantown, SE margin of pond adjacent to Wolf River, 0.2 km E of Germantown Parkway, 35°07'N, 89°48'W. 9 May 1997. MSUMZ Color Slide R-1133. Verified by William H. N. Gutzke. Extends species range to southwestern Tennessee (Morris, 1987, Systematics and Distribution of the Northern Water Snake, *Nerodia sipedon* [Linnaeus], with Comparisons to *Nerodia fasciata* [Linnaeus], Ph.D. Dissertation, Southern Illinois University, Carbondale). Range extension supported by Hassell's records (1961, A Herpetological Survey of Shelby Forest State Park. Masters Thesis, University of Memphis) in Shelby County and Norton's records (1971, The Herpetofauna of Hardeman County, Tennessee. Masters Thesis, University of Memphis) in Hardeman County. Logan's records (1969, A Survey of the Herpetofauna of De Soto County, Mississippi. Masters Thesis, University of Memphis) in DeSoto County suggest that the species also may occur in extreme northwestern Mississippi.

Submitted by **STEPHEN J. MULLIN**, Department of Biology, University of Memphis, Memphis, Tennessee 38152, USA, and **JAMES T. EUBANKS**, 4930 Verne Memphis, Tennessee 38117, USA.

OXYRHOPUS RHOMBIFER INAEQUIFASCIATUS (Falsa Coral, False Coral Snake). ARGENTINA: CORRIENTES: Corrientes: Captial. (27°35'S, 58°45'W). 4 December 1996. Laura Rey. Colección Herpetológica de la Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC- 05156). Verified by Gustavo Scrocchi. First province record (Cei 1993, Monograf. XIX . Mus. Reg. Sci. Nat. Torino).

Submitted by **LAURA R. REY**, Departamento de Herpetología, CEPSAN, Avenida Costanera 255 (3400) Corrientes, Argentina, and **MARIA LUISA LIONS**, Cátedra de Anatomía Comparada, Facultad de Ciencias Exactas y Naturales y Agrimensura, UNNE, 9 de Julio 1449, (3400) Corrientes, Argentina.

PSEUSTES SULPHUREUS. BRAZIL: SÃO PAULO: PARANAPIACABA (23°48'S, 46°03'W). August 1974. Collector unknown. Museo de Zoologi da Universidade de São Paulo (MZUSP 5622). Verified by Paulo E. Vanzolini. Species normally is found in Amazonian and Atlantic Forest. First state record; the southern limit of its range was reported previously as Maricá, RJ (22°57'S, 42°49'W) (Peters and Orejas-Miranda 1970, Bull. U.S. Nat. Mus. 297:259).

Submitted by **OTAVIO A. V. MARQUES** and **MYRIAM E. CALLEFFO**, Laboratório de Herpetologia, Instituto Butantan. Avenida Vital Brasil, 1500, CEP 05503-900, São Paulo, São Paulo, Brazil.

RHINOTYPHLOPS PRAEOCULARIS. NIGERIA: GONGOLA: Adamawa: Yola, 09°12'N, 12°29'E, ca. 500 m. Zoological Museum, University of Copenhagen (ZMUC R52197). Verified by V. Wallach. A rare species; only 12 specimens known, as follows: S Congo (Brazzaville, MNHN 1986.730), SW Zaire (vic. of Kisangani, USNM 20799, LACM 49690-93), NE Angola (Dundo, MD 5252, 5959, 5932, 5935, 5938), and "West Africa" (unknown locality, FMNH 75088). Adult female, 24 scale rows, 545 middorsals. First record for Nigeria and range extension of ca. 1500 (airline) km N of Brazzaville (Roux-Esteve 1974, Mem. Mus. Natn. Hist. Nat. 87A:1–313).

Submitted by **JENS B. RASMUSSEN**, Zoological Museum, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark.

TANTILLA CALAMARINA (Pacific Coast Centipede Snake). MEXICO: PUEBLA: 12.5 km SE Izucar de Matamoros, 1475 m (18°31'16"N, 98°24'59"W), on a microwave tower hill under a limestone boulder in xeric scrub thicket. 21 February 1992. Fred G. Thompson. UF 102793. Verified by F. Wayne King. First verified and credible record for the state (Wilson 1988, Cat. Am. Amph. Rept. 433:1–2). A record for Teziutlan, Puebla (Cope 1885, Proc. Am. Philos. Soc. 22:381), is neither verifiable (specimen lost) nor credible (geographically inconsistent), and was for those reasons rejected by Wilson (*loc. cit.*).

Submitted by **HOBART M. SMITH,** Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA, and **DAVID L. AUTH**, Florida Museum of Natural History, University of Florida, Gainsville, Florida 32611, USA.

THAMNODYNASTES HYPOCONIA (House Snake). ARGENTINA: SANTA FE: DEPT. GENERAL OBLIGADO: Villa Ocampo. (28°39'S, 59°20'W). 26 March 1997. P. M. Cacivio. Verified by R. H. Aguirre. Coleccion Herpetologica de la Facultad de Ciencias Exactas y Naturales y Agrimensura: (UNNEC 5194–95, females). First province records; confirms presumed distribution and extends known range at least 60 km S (Bergna and Alvarez 1993, FACENA 10:5–13; Cei 1993, Monogr. XIV. Mus. Reg. Sci. Nat. Torino: 695; Williams and Francini 1991, Mus. Reg. Nat. Sci. Nat. Torino 9(1):55–90).

Submitted by **PEDRO MATIAS CACIVIO**, Facultad de Ciencias Veterinarias, Universidad Nacional del Nordeste, Jose Marmol 243, CP 3400, Resistencia, Chaco, Argentina.

New Records and Natural History Notes for Lizards from Northwestern Argentina

RICHARD ETHERIDGE
Department of Biology, San Diego State University
San Diego, California 92182-4616, USA
e-mail: rether@sunstroke.sdsu.edu

and
ROBERT E. ESPINOZA*
Department of Biology, Colorado State University
Fort Collins, Colorado 80523-1878, USA

**Present address: Ecology, Evolution, and Conservation Biology 314*
University of Nevada, Reno, Nevada 89557-0015, USA
e-mail: espin_r@unr.edu

Field work in northwestern Argentina during the austral summer of 1995 resulted in significant new records for five species of *Liolaemus*—three of them recently described members of the *darwinii* complex—and for one species of *Pristidactylus*. The identities of all specimens were verified by Fernando Lobo. Voucher specimens have been deposited at San Diego State University (SDSU) or the Fundación Miguel Lillo (FML). Latitude, longitude, and elevation were determined with a Scout™ global-positioning device (Trimble Navigation Systems, Sunnyvale, California, USA).

Tropiduridae

Liolaemus cuyanus (NCN). LA RIOJA PROVINCE: Dpt. Gral. Lavalle, 42 km SW of Villa Unión on Ruta Nac. 40 (29°30'59"S, 68°30'51"W, 1050 m). 19 January 1995. SDSU 3435. An adult female was found basking on a rock along the road. The previous westernmost records are from 67°41'51"W in southern San Juan Province, and 67°38'0"W in southwestern Catamarca Province. This record constitutes a range extension of ca. 140 km west for the species and provides support for Cei's (1993) contention that this species is distributed throughout most of the non-Andean regions of this province. The substratum was one of loose sand with smooth stones and small boulders, but lacking dunes or extensive areas of open sand.

Liolaemus koslowskyi (NCN). LA RIOJA PROVINCE: Dpt. Gral. La Madrid, 10.8 km N of Villa Castelli on Ruta Prov. 26 (28°55'50"S, 68°11'11"W, 1410 m). 18 January 1995. SDSU 3597. This is the second record for this species from the valley of the Río Vinchina; extends the known range ca. 50 km north of the previously reported westernmost record (Etheridge 1993). Of greater significance, however, is the discovery of *Liolaemus olongasta* to the north (see below).

Liolaemus laurenti (NCN). LA RIOJA PROVINCE: Dpt. Independencia, sand dunes 51 km W of Patquia on Ruta Prov.

150 (30°12'21"S, 67°20'27"W, 900 m). 8 February 1995. SDSU 3475–76. Extends the range about 35 km east of Baldecitos, San Juan Province; SAN JUAN PROVINCE: Dpt. Caucete, sand dunes 4 km W of Bermejo on Ruta Nac. 210 (31°36'05"S, 67°41'51"W, 690 m). 9 February 1995. FML 3452(6). This locality extends the range ca. 260 km south of Baldecitos, which was previously the most southerly record (Etheridge 1992). All records for this species are from sand flats or dunes. The absence of records from the intervening region may be due to the fact that the only road connecting the two localities passes to the east of the Sierra del Valle Fértil and the Sierra de la Huerta where sandy habitats are absent. *Liolaemus laurenti* may occur on the scattered sand dunes of the great valley of the Río Bermejo that lies west of these ranges, but has eluded detection because there are no roads to access this area.

Liolaemus olongasta (NCN). LA RIOJA PROVINCE: Dpt. Vinchina, sand dunes just W of the jct. of Ruta Prov. 16 and road spur to Bajo Jagüé (28°39'26"S, 68°20'11"W, 1790 m). 18 January 1995. FML 3454 and SDSU 3544–47. This site is ca. 135 km north of the type locality, which was previously the most northerly record for this species (Etheridge 1993). Individuals were observed only on sand dunes. The dunes were surrounded by rocky ground where no other *Liolaemus* were seen. Etheridge (1993) noted the existence of a small series of *L. olongasta* recorded from "Jagzuél, al pie de la Cordillera," but the province was not specified. Given this new record, it is likely that the previously ambiguous locality may refer to either Alto Jagüé or Bajo Jagüé. The dunes are located near an upper tributary of the Rio Vinchina, ca. 35 km north of the most northerly record in this valley for *L. koslowskyi* (reported above). Thus, the distribution of *L. koslowskyi* appears to be interposed between that of *L. olongasta* on the dunes of Bajo Jagli in the north, and on the sand flats of Talampaya south of Villa Unión. Several of the females we collected in this region were gravid and exhibited bright yellow coloration along their posterior jaws. This suggests the presence of gravid female coloration in *L. olongasta;* SAN JUAN PROVINCE: Dpt. Jáchal, gravel flats 28.1 km E of Rodeo on Ruta Prov. 150 (30°12'40"S, 68°53'07"W, 1350 m). 19 January 1995. SDSU 3613–16. While specimens from this locality (between Rodeo and San José de Jáchal) do not represent a range extension, they are noteworthy because of their color pattern and the substratum upon which they were found. Although Etheridge (1993) had noted records for *L. olongasta* from San Juan Province, he had only observed this species on the Talampaya sand flats of western La Rioja Province. The dorsal color pattern exhibited by *L. olongasta* that live on sand is remarkably cryptic [e.g., individuals from the dunes near Bajo Jagüé and the Talampaya flats (Etheridge 1993, Pl. 2.4–5)]. In contrast, males from the gravel flats east of Rodeo have a darker, bolder pattern, with bright yellow dorsolateral stripes and numerous iridescent blue scales; SAN JUAN PROVINCE: Dpt. Jáchal, rocky flats 54 km NNE San José de Jáchal on Ruta Prov. 40 (29°57'24"S, 68°29'25"W, 1050 m). 21 January 1995. SDSU 3515. This record fills in a large gap between the type locality and the locality reported by Etheridge (1993) at 3 km northwest of San José de Jáchal; SAN JUAN PROVINCE: Dpt. Iglesia, gravel flats just N of Tocota on Ruta Nac. 141 (30°41'02"S, 69°26'38"W, 2550 m). 19 January 1995. Two hatchlings (26 mm SVL) that were collected, but subsequently lost, are apparently referable to this species and, if so, represent a range extension of ca. 70 km SSW of Rodeo.

Liolaemus pseudoanomalus (NCN). CATAMARCA PROVINCE: Dpt. Tinogasta, rocky flats 12.8 km S of Fiambalá on Ruta Prov. 45 (27°47'7"S, 67°39'40"W; 1470 m). 16 January 1995. SDSU 3540. This record extends the range reported for this species by Cei (1993) ca. 160 km northwestward into the valley of the Rio Abaucán. Etheridge (1993) noted that this species occurs here syntopically with *Liolaemus abaucan,* based on specimens from 8.2 and 8.8 km north of Fiambalá (SDSU 1310–11).

Polychrotidae

Pristidactylus scapulatus (NCN). SAN JUAN PROVINCE: Dpt. Iglesia, at the base of a small hill on rocky ground about 0.5 km S of Tocota, just E of Ruta Prov. 412 (30°41'2"S, 69°26'38"W, 2550 m). 20 January 1995. SDSU 3448. This locality is about half way between previous records for this species from the Cordillera de San Guillermo (3500 m) in extreme northwestern San Juan Province (Cei et al. 1983), and the Sierra de Uspallata (2520–2768 m) in extreme northwestern Mendoza Province (Cei and Roig 1976)—a distance of 400 km. The individual was an adult male that retreated into a rodent burrow (probably *Ctenomys* sp.) upon approach. In our experience, *P. scapulatus* is typically found in association with large boulders, but no such refugia were available in this area.

Acknowledgments.—We thank E. Lavilla, F. Lobo, J. C. Moreta, and S. Torres for invaluable field assistance. We are grateful to R. Laurent, M. Halloy, and R. Montero and their families for providing logistic support while in Tucumán. Lizards were collected under the authority of the Instituto de Herpetología, Fundación Miguel Lillo, Tucumán. Partial funding was provided to the junior author by the American Society of Ichthyologists and Herpetologists, the Chicago and San Diego Herpetological Societies, the Explorers Club, the Graduate Degree Program in Ecology at Colorado State University, and by generous contributions from the Burdett, Cousins, and Deaton families. This note was written while the junior author was supported by a Porter Fellowship from the American Physiological Society.

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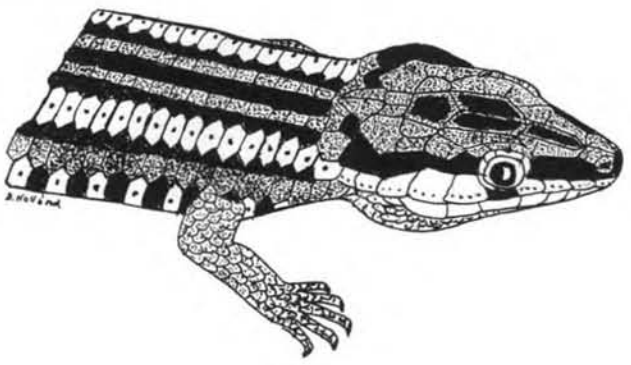
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Snake Fauna of St. Catherines Island, Georgia

JOHN L. BEHLER
Department of Herpetology, Wildlife Conservation Society
Bronx, New York 10460-1099, USA
e-mail: jbehler.wcs@mcimail.com

BRADFORD WINN
Nongame-Endangered Wildlife Program
Georgia Department of Natural Resources
1 Conservation Way, Brunswick, Georgia 31523, USA

and

ROYCE H. HAYES, JR.
St. Catherines Island Foundation, Inc.
182 Camellia Way, Midway, Georgia 31320, USA

St. Catherines Island, Liberty County, Georgia (USA), is a 56 km^2 (5,666 ha) barrier island situated 80 km south of Savannah, between Ossabaw and Sapelo islands. St. Catherines Island has been inhabited by humans for more than 4500 years (Larsen 1982) and has had an extensive cultural history (Thomas et al. 1978). As earlier studies of barrier island amphibians and reptiles (see Gibbons and Coker 1978) have shown, St. Catherines likewise has a depauperate herpetofauna (Zweifel and Cole 1974) compared with that occurring on the mainland. Certainly, Native American exploitation, followed by Spanish settlement, subsequent plantation agricultural activities and lumbering, and cattle and swine ranching, coupled with violent weather phenomena, impacted post-Pleistocene plant and animal colonizers and helped shape today's herpetofaunal elements.

Since 1970, the St. Catherines Island herpetofauna has been well scrutinized by zoologists from the American Museum of Natural History, New York University, Wildlife Conservation Society, Georgia Southern University, University of the South, Georgia Department of Natural Resources, and scores of visiting biologists from other institutions. Some twelve species of snakes are known from St. Catherines Island: *Nerodia fasciata, Thamnophis sirtalis, T. sauritus, Opheodrys aestivus, Coluber constrictor, Elaphe obsoleta, E. guttata, Cemophora coccinea, Lampropeltis getula, Agkistrodon piscivorus, Crotalus horridus,* and *C. adamanteus.* There have been no confirmed additions to Zweifel and Cole's (1974) list. Except for the natricines and *Coluber* and *Elaphe*, other species were not commonly seen before the mid-1980s. Large populations of feral hogs and cattle (both introduced in the 1930s) dramatically damaged and opened the understory and likely negatively impacted most resident snake populations. Since removal of the cattle (1975–1983) and suppression of the feral hogs (<100 adults 12/96), the understory has recovered, and snake observations have become more frequent.

In 1985, St. Catherines Island was evaluated as a potential release site for the endangered *Drymarchon couperi* by Dan Speake, Team Leader, Eastern Indigo Snake Recovery Plan. It was judged that suitable habitat existed and a plan was advanced to introduce the gopher tortoise (*Gopherus polyphemus*) to hold dune and savanna area on the north end of the island to enhance the "indigo snake" habitat. *Gopherus* has been introduced there, but no *Drymarchon* have been liberated.

On the basis of a 1983 photograph, Couper et al. (1996) reported a "confirmed" record of *Drymarchon couperi* from St. Catherines Island as the first such event for any barrier island. The photo was reported (to BW) to have been taken in the immediate vicinity of the student housing facilities during the senior author's visit to the island that year. One of us (RHH) recalls the photo event. Based upon examination of the developed photograph, habitat, and behavior of the snake in question, RHH in 1983 identified the snake as a racer (*Coluber constrictor*). Couper commented (to BW) that only one photograph (UCM Color Slide 114) was taken and the author provided the voucher slide to the University of Colorado Museum. UCM Color Slide 114 was the same photograph seen years earlier by RHH and clearly depicts a *Coluber constrictor*.

Many thousands of man hours have been devoted to the exploration of the fauna and flora of St. Catherines Island. Consequently, the herpetofauna is well known. It does not include the normally conspicuous and largest non-venomous snake species (*Drymarchon couperi*) in North America.

Acknowledgments.—Thanks are extended to David Chiszar for providing a duplicate copy of the voucher slide.

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Status of Possible Disjunct Populations of the Southern Toad, *Bufo terrestris*, in the Piedmont and Blue Ridge of Georgia

JOSHUA LAERM
Museum of Natural History, University of Georgia
Athens, Georgia 30602, USA
e-mail: laerm@museum.nhm.uga.edu

and

ARTHUR S. HOPKINS, JR.
Department of Geography, University of Georgia
Athens, Georgia 30602, USA

The status of disjunct populations of the southern toad, *Bufo terrestris* (Bonnaterre), in the Upper Piedmont and Blue Ridge physiographic provinces of South Carolina and Georgia, USA, is confused. Wright and Wright (1949, Handbook of Frogs and Toads of the United States and Canada. Comstock Publ. Assoc., Ithaca, New York. p. 199) questioned "are the isolated records (one, western South Carolina; one, northern Georgia)...misidentification or intermediates?" Martof et al. (1980, Amphibians and Reptiles of the Carolinas and Virginia. Univ. North Carolina Press, Chapel Hill. 264 pp.) do not indicate disjunct populations of *B. terrestris* in the Upper Piedmont or Blue Ridge of South Carolina. However, Blem (1979, Cat. Amer. Amph. Rept. 223.1–223.4.) and Conant and Collins (1991, Peterson Field Guide to Amphibians and Reptiles of Eastern and Central North America. Third Ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.) correctly map disjunct records. Ostensibly, these are based on previously published records of Pickens (1927, Copeia 165:106–110), Burt (1938,

Trans. Kansas Acad. Sci. 41:331–366), and Chamberlain (1939, Charleston Mus. Leafl. 12:1–38), as well as museum records (United States National Museum and Charleston Museum) from portions of Anderson, Greenville, and Pickens counties. These include records from both Upper Piedmont and Blue Ridge physiographic provinces.

Insofar as we can determine, Wright and Wright (*op. cit.*) are the only authorities to have commented on the possibility of disjunct populations occurring in adjacent regions of Georgia. Williamson and Moulis (1994, Savannah Sci. Mus. Spec. Publ. 3:1–712) include in their locality data (but do not map) a single record of *Bufo terrestris* from Rabun County, Georgia (10 mi. NE Dillard) based on a University of Georgia Museum of Natural History record. The specimen had been cataloged and correctly identified as a *B. americanus*. Additionally, we searched museums in the United States with holdings of *B. terrestris* from Georgia. We examined six *B. terrestris* from the Blue Ridge in Rabun County (UMMZ 45876-45881). Our attribution of these specimens to *B. americanus* is confirmed by Alan Resetar. We also examined a *B. terrestris* (UMMZ 91963) from the Upper Piedmont of Lumpkin County, which is referable to *B. woodhousii fowleri* (confirmed by G. Schneider; see also Williamson and Moulis 1994.). We conclude that while extralimital populations of *B. terrestris* appear well established in the Upper Piedmont and Blue Ridge of South Carolina, there is no evidence of their occurrence in adjacent regions of Georgia. Populations in Georgia are restricted approximately to the Fall Line south as indicated in Conant and Collins (*op. cit.*) and Williamson and Moulis (*op. cit.*).

New County Records of Amphibians and Reptiles from Georgia

GREGORY B. LACY
Department of Biological and Environmental Sciences
Georgia College and State University, Milledgeville, Georgia 31061, USA
e-mail: glacy@peachnet.campus.mci.net

Distribution records of the amphibians and reptiles of Georgia have been documented by Williamson and Moulis (1994) and additional records have been added by Laerm et al. (1996). However, distribution records for several Georgia counties are lacking, especially in the central part of the state. The Georgia College and State University Herpetological Collections hold numerous species that are the first records for counties. Identification of all specimens were verified by Dennis Parmley (unless otherwise noted), and are deposited in the GCSU comparative skeletal collection unless otherwise noted.

Desmognathus auriculatus (Southern Dusky Salamander). Hancock Co: 19.3 km S of Sparta. 23 April 1995. Dennis Maddox. GCSU 4238. Extends range 27 km north of nearest record in Wilkinson County.

Eurycea longicauda guttolineata (Three-lined Salamander). Spalding Co: no other data. 15 April 1990. Collector unknown. GCSU 2408.

Plethodon glutinosus (Northern Slimy Salamander). Jasper Co: 8.1 km SE of Monticello. 8 May 1991. Barry Hooper. GCSU 3630.

Bufo americanus (American Toad). Baldwin Co: Ivey-Weaver Road, 1.3 km E of North Jefferson Street, Milledgeville. 9 April 1991. D. Peck. GCSU 3612. Extends range southeast one county from Putnam and Jones counties.

Rana sphenocephala utricularius (Southern Leopard Frog). Baldwin Co: Lake Laurel Road, 6 km NE Milledgeville. 28 March 1991. Dennis Parmley. Verified by D. Walker. GCSU 3615. Completes county sequence in central Georgia.

Eumeces fasciatus (Five-lined Skink). Baldwin Co: Ivey-Weaver Road, 1.3 km E of North Jefferson Street, Milledgeville. 16 September 1992. David Peck. GCSU 3565. Fayette Co: Peachtree City. 23 March 1990. Dennis Parmley. Verified by D. Walker. GCSU 3701.

Eumeces inexpectatus (Southeastern Five-lined Skink). Baldwin Co: Ivey-Weaver Road, 1.3 km E of North Jefferson Street, Milledgeville. 27 April 1990. Vertebrate Zoology class. GCSU 2338.

Eumeces laticeps (Broadhead Skink). Baldwin Co: Ivey-Weaver Road, 1.3 km E of North Jefferson Street, Milledgeville. 10 April 1991. D. Peck. GCSU 3628.

Sceloporus undulatus undulatus (Southern Fence Lizard). Upson Co: 4.5 km NE of Rock. 11 April 1991. Collector unknown. GCSU 3637. Fayette Co: Peachtree City. 23 March 1990. Dennis Parmley. Verified by D. Walker. GCSU 3664.

Elaphe obsoleta spiloides (Gray Rat Snake). Seminole Co: 24.2 km S of Dresser, Lake Seminole. 15 July 1990. Dennis Parmley. Verified by D. Walker. GCSU 3916. Fills distribution gap in southwestern Georgia between Early, Miller, and Decatur counties.

Farancia abacura abacura (Eastern Mud Snake). Bibb Co: I-75, 2.6 km E jct. I-16 and I-75. 25 September 1994. G. B. Lacy. DOR. GCSU 4002. Extends range ca. 29 km west from Wilkinson County.

Farancia erytrogramma erytrogramma (Rainbow Snake). Seminole Co: 24 km S of Dresser, Lake Seminole. 12 July 1990. Dennis Parmley. Verified by D. Walker. GCSU 2378. Nearest Georgia record is ca. 80 km to the northeast.

Lampropeltis getula getula (Eastern Kingsnake). Baldwin Co: Ivey-Weaver Road, 1.3 km E of North Jefferson Street, Milledgeville. 3 October 1996. Gabe Gaddis. Juvenile. Photo GCSU CP0001. Completes county sequence in central Georgia.

Masticophis flagellum flagellum (Eastern Coachwhip). Baldwin Co: Blandy Hills Road, NW Milledgeville. 19 August 1992. Dennis Parmley. Verified by D. Walker. GCSU 3705.

Nerodia erythrogaster erythrogaster (Redbelly Water Snake). Baldwin Co: 6.4 km W Milledgeville. Collector unknown. 1 May 1989. GCSU 2175. Jasper Co: 6.4 km SE Monticello. 14 April 1991. Barry Hooper. GCSU 2175.

Nerodia taxispilota (Brown Water Snake). Baldwin Co: Lake Laurel, 3.4 km N Lake Laurel Road and Ga. Rt. 22. 3 June 1991. Collector unknown. GCSU 3569. Putnam Co: Rt. 441 at Lake Sinclair. 15 April 1990. Al Mead. GCSU 2394. Warren Co: 19.8 km S Warrenton. 17 October 1993. Collector unknown. GCSU 3781.

Opheodrys aestivus (Rough Green Snake). Fayette Co: Peachtree City. 3 September 1989. DOR. Dennis Parmley. Verified by D. Walker. GCSU 2302. Putnam Co: no other data. 8 October 1989. Collector unknown. GCSU 2296.

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BOOK REVIEWS

Die Blindwühlen, by Werner Himstedt. 1996. Die Neue Brehm-Bücherei Bd. 630, Westarp Wissenschaften, Magdeburg and Spektrum Akademischer Verlag, Heidelberg, Germany. 160 pp., 62 illustrations. Softcover. DM 39.90 (approx. US $25.15). Available from Verlagssitz Magdeburg, Kirchstrasse 5, D-39326 Hohenwarsleben, Germany.

MARVALEE H. WAKE
Department of Integrative Biology and Museum of Vertebrate Zoology
University of California, Berkeley, California 94720-3140, USA
e-mail: mhwake@socrates.berkeley.edu

Werner Himstedt has produced a long-needed, thoughtful, meticulous, and reasonably thorough and current overview of the information available about the indubitably most interesting (in my clearly unbiased opinion) but least well known amphibians, the caecilians. Himstedt wisely chose not to attempt to be all-inclusive, but presents considerable background information about caecilians while emphasizing his own work on the physiology, morphology, behavior and ecology of *Ichthyophis* in Thailand. The book, written in German, presents a scholarly and well chosen body of information, appropriate to all students of the biology of amphibians, and at the same time it is written in a manner that is accessible to the interested amateur keeper-and-observer of caecilians. The illustrations are excellent, many original and many re-drawn by Himstedt for clarity, and are large enough to be interpreted easily. A color plate illustrating six species in three families is of special interest.

The book includes eleven major sections, an extensive list of references, and an index. The introduction presents caecilians in a general context, then discusses early research on the systematics and biology of caecilians, including comments on the derivation of the name of the order. Special tribute is given to the pioneering work of the Sarasins, whose work published more than one hundred years ago remains the most comprehensive study of any species of caecilian. The second chapter on the ancestry of caecilians is a general view of the relationships of caecilians to other amphibians. Its emphasis on the impressions of Romer and Parsons and of Starck predominates (largely because of the two illustrations, and the absence of a cladogram based on more recent analysis), but Himstedt includes information on the Jurassic fossil caecilian with limbs, *Eocaecilia*, refers to recently published phylogenies based on molecular data, and comments on relationships of caecilians to other fossil and recent amphibians.

The third chapter, on the classification and geographic distribution of caecilians, is a general overview of the current taxonomy of caecilians. Himstedt notes that one should regard the classification that he presents as provisional, with considerable work remaining to be done on these little-known amphibians. Himstedt lists each family and its included taxa, with general comments on the key characters for each group. A general distribution map for each family, with brief discussion in the text, is included.

The fourth chapter, on the structure and function of organ systems, is a review of work on the skin and scales, the skeleton and musculature (including an extensive discussion of feeding mechanics), the intestine and lungs (including past and some recent physiological work on the latter, and reference to the recently described lungless species), the heart and circulatory system, the urogenital system (including reproductive cycles), and the brain and sense organs. The latter part on the nervous system is nearly 40 pages long, and includes considerable material and especially features Himstedt's thoughtful consideration of the structure and function of the eye and the tentacle, the former with comparison to the condition in salamanders, and the lateral line system. Himstedt is by training a neurophysiologist, and much of his analysis is based on his original work on caecilians. However, the discussion presented in this little book extends and integrates his work with that of others, and presents a synthetic approach to the neurobiology of these animals.

A short chapter on reproduction and development reviews much of the older and recent literature, and includes Himstedt's own observations, some, but not all, previously published. The chapter on the habits of caecilians is both a useful review of the literature on the ecology, life histories, and population biology of caecilians (and such literature is woefully limited, the Sarasins again having set the standard) and a presentation of Himstedt's own observations of the biology of *Ichthyophis kohtaoensis* based on his extensive field work in Thailand. Considerable new information about that species is presented; unfortunately, the two photographs of the field sites, while informative, did not reproduce well. The chapter on diet and prey capture is very short, slightly more than one page. Himstedt comments on the paucity of literature in this area, while summarizing much of the 100 years of data (mostly since 1970) that do exist on the termites, worms, and other terrestrial/fossorial animals that apparently compose the diet of caecilians. The chapter on burrowing behavior is inclusive of most of the information on burrowing mechanics, morphology, and comparisons among species, and adds new information from Himstedt's lab on the behavior of *I. kohtaoensis* in its tunnel systems. The short chapter on diel activity is similarly informative, and based largely on new information that Himstedt and his colleagues have gathered. Unfortunately, two recent papers on such activity in *Typhlonectes* were published too recently for Himstedt to have included them, but pose an interesting comparison the reader should consult.

The tenth chapter, on danger to and protection of caecilians, is an informed consideration of the apparently increasing rarity of caecilians as tropical habitats are progressively degraded. Himstedt presents information on the state of Thailand's forests, and cites the effect of a major monsoon and its consequences. He briefly compares Thailand with other southeast Asian countries, and closes with a plea for protection and the establishment of reserves so that such species as caecilians will be able to survive locally.

The final chapter deals with holding and breeding caecilians in captivity. He describes appropriate terrarium conditions for terrestrial species, including soil, humidity, water, and food, and presents comparable information for aquaria for aquatic caecilians. For each "set", he considers conditions for breeding caecilians, and he describes the work in his laboratory using endoscopy to examine the reproductive condition of males and females.

Himstedt is one of a small group of researchers who are exploring methods for breeding caecilians in order to provide both specimens for basic research and as means of conservation of the animals.

All in all, Himstedt's little book is a treasurehouse of new information and a synthesis of the literature, done in a scholarly way but one that should have broad appeal and readability. Some of the literature that might have provided useful information is not included, but Himstedt's selection is true to his goal. In addition, several recent publications on morphology, physiology, systematics, and behavior of caecilians appeared too late to be included, but they are part of the relative explosion of interest and information about the heretofore largely neglected caecilian amphibians. Himstedt's conscientious book provides the layperson and the professional with a ready update and background for the new work, and I trust he will continue his own outstanding research on caecilians. My only concern about this book, which deserves an extended audience and a long life, is that it is published only in German, presumably, and understandably, in large part for the increasingly large group of hobbyists who keep caecilians in captivity. The book is excellent for that purpose, as I have indicated, but it is much more than that—it is a compendium that belongs in the hands and before the eyes of anyone at any level of expertise who is interested in the biology of amphibians, tropical biology and conservation, morphology, physiology, and evolution. I urge everyone who reads German and shares these interests to buy the book, and those of you who would like to see English, Spanish, French and other translations to notify the publisher, so that new editions in these languages will be available very soon.

A Guide to the Reptiles and Frogs of the Perth Region by Brian Bush, Brad Maryan, Robert Browne-Cooper, and David Robinson. 1995. University of Western Australia Press, Nedlands, Western Australia (distributed in the USA by International Specialized Book Services, Inc., 5804 N.E. Hassalo St., Portland, Oregon 97213-3644, USA) xiv + 226 pp. Softcover. US $19.95. ISBN 1-875560-42-4.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: abauer@king-kong.vill.edu

Australia continues to be the source of a seemingly limitless number of popular and semi-technical herpetofaunal guides of high production quality. Here is another. The book covers the herpetofauna of a region of Western Australia radiating out from the city of Perth to Yanchep in the north and Mandurah in the south, and from the western slopes of the Darling Range to Rottnest and Garden Islands. The region is the most often visited part of Western Australia, and although it lacks many of the more spectacular forms inhabiting the Pilbara and Kimberley regions of tropical Western Australia, it has an especially high level of endemism.

The book covers almost 100 species including 16 frogs (all but two of which are myobatrachids), two chelids (*Chelodina oblongata* and the extremely rare *Pseudemydura umbrina*) , 52 lizards (27 skinks, 11 geckos, eight pygopods, three agamids and three varanids), and 26 snakes (15 elapids, six hydrophiids, three typhlopids, and two pythons). Keys and brief familial and generic synopses are provided but the species accounts form the core of the book. These are concise and include subheadings for habitat, description, and general comments (ecology, reproduction, diet, etc.). For frogs the general comments are replaced by a "mating call and breeding biology" section. All terrestrial species have their own accounts and are accompanied by one or more color photos (up to four, as in the case of the western brown snake, *Pseudonaja nuchalis*) and an outline map of Western Australia with the species' range shaded. In the case of sea snakes, however, a separate account is provided for only one of the six species, *Pelamis platurus*, and although a key to four sea turtles is provided, only an extralimital (Broome) specimen of *Chelonia mydas* is figured, and no individual species accounts are presented. Dangerously venomous snakes are marked as such in the guide and receive the most detailed treatment of any of the included taxa, including brief comments on venom.

Other sections of the book include an overview of habitat types encountered in the Perth area (supplemented with seven representative color photographs), and a review of the conservation of amphibians and reptiles that criticizes the existing legislation in Australia for being too restrictive of serious amateur naturalists and for favoring the protection of individual species over the more essential protection of habitats. There are also sections on snake bite and snake-human and snake-pet interactions, with first aid measures conveniently summarized on the last two pages of the book for easy emergency use.

The guide concludes with a glossary of 300 terms, aimed largely at the novice, an index to subjects (incomplete) and common and scientific names, and a reference section. Those hoping for a comprehensive bibliography for the region will be disappointed. Only 41 technical references are cited, six specific to the Perth area, and the remainder more general. Frog references are especially scarce. General Australian herp works are referenced separately, and most major works are included, although the contributions of Harry Ehmann and Mike Tyler to the *Encyclopedia of Australian Animals* series are not (see Bauer, 1993 for references to these and other Australian herp books).

The book is attractively laid out and photo quality is consistantly high throughout. The value of the photos is increased by a feature rarely seen in comparable guides, the indication of the locality associated with each photographed specimen. The few line drawings are also well-executed, but the range maps are too small to show distribution patterns within the Perth region itself. The quality of the text and accuracy of information is generally good, but there are some problems. For example, the erroneous belief that the setae of gecko scansors function as pitons to gain purchase in minute irregulatities on smooth surfaces is promulgated. My greatest complaint, however, is that the generic names used do not consistantly follow Cogger (1992), nor do they always follow the most recent systematic treatments. Thus, among geckos *Strophurus* is employed for the "tail-squirting" *Diplodactylus*, but *Phyllodactylus* is used in preference to *Christinus*, as is *Underwoodisaurus* instead of *Nephrurus* (for *N. milii*).

Do you need this book? Unless you plan to visit the Perth region, can't get enough of Australian herp photos, or are bibliomaniacal, probably not. On the other hand, this very aesthetically pleasing guide is cheap and provides a user-friendly alternative to the more technical works on the Western Australian herpetofauna by the late Glenn Storr and his colleagues.

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A Turtle Atlas to Facilitate Archaeological Identifications, by Kristin D. Sobolik and D. Gentry Steele. 1996. The Mammoth Site, Hot Springs, South Dakota. ISBN 0-9624750-7-6, 117 pp. US $19.95.

PETER A. MEYLAN
Natural Sciences, Eckerd College
St. Petersburg, Florida 33711, USA
e-mail: meylanpa@eckerd.edu

This book was compiled on the premise that a set of brief anatomical descriptions, combined with line drawings of turtle shells, constitutes a useful aid to the identification of turtle material from archaeological sites. It consists of 31 pages of double spaced text, 7 tables, 69 figures, and 6 maps. Forty-six of the figures are exploded views of carapaces or plastra rendered as unweighted line drawings. Most of the remainder are black and white photos of a single skeletal element from 13 different North American turtle taxa.

The text is superficial, especially when describing skulls and non-shell postcrania. There is little attempt to use the existing terminology for turtle skeletal morphology. Instead, a number of novel anatomical terms are introduced such as double track and single track vertebrae, stair stepping peripherals, pads (for dermal callosities in trionychids), and scute lines (for sulci). The authors also seem to have trouble with the singular versus plural forms of the terms scapula, ulna, epiplastron, and numerous others. An emydocentric view of turtle skeletal morphology, extensive use of secondary references, and poor writing all reduce the value of the text.

The authors are also clearly behind in their turtle taxonomy. The genera *Pseudemys, Trachemys,* and *Apalone* are not used. *Xerobates* is thought to include a single species, not two; *Chrysemys* (*sic*) *concinna* is equated with *Pseudemys texana*, and *Apalone*, it is said, has subsumed *Trionyx spiniferus*. Even common names suffer; the name Loggerhead Snapping Turtle is given for *Chelydra*.

This book contains too many mistakes. A plate of pubes (Fig. 15) is labeled as ischia, and a plate of ischia (Fig.16) is labeled as pubes. Descriptions in the text make it clear that the authors have these elements confused. An anomalous suprapygal of a *Gopherus berlandieri* is identified as a neural; it is suggested that Meylan (1987) justified the use of the term *Apalone* using biochemical characters (that is yet to come); and the oldest chelydrid is said to be Pliocene (Erickson 1973, describes a Paleocene form). Furthermore, the authors miss some good characters for identifying fragmentary turtle shell material such as the fusion of the shell of *Terrapene*, the large, continuous, dorsal keels on any costal bone of *Macroclemys*, and the hypo-xiphiplastral hinge in *Kinosternon*.

This book is a clear indication of why the peer-review process is a good idea. In their "final remarks," the authors suggest making identifications using this atlas and "most importantly, by making direct comparisons with a reference collection." I would have to suggest skipping directly to the second step.

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Smuggled-2: Wildlife Trafficking, Crime and Corruption in Australia, by Raymond Hoser. 1996. Kotabi Publications (P.O. Box 599, Doncaster, Victoria 3108, Australia). xx+259 pp. Paberback. AUS $25.00 (approx. US $22.00). ISBN 0-9586769-09.

YEHUDAH L. WERNER
Department of Evolution, Systematics and Ecology
The Hebrew University of Jerusalem, 91904 Jerusalem, Israel
e-mail: yehudahw@vms.huji.ac.il

Reptiles are relatively hardy in transportation. Only half a century ago, before the global rise of conservation and decline of postal services, it was normal to exchange live reptiles by international mail, not necessarily airmail. Now two modern processes are both countering and stimulating each other. On the one hand, most countries restrict collecting and exporting; on the other hand, herpetoculture is spreading. The blooming amateur market annually cycles millions of dollars in the United States alone. Some of its global volume in terms of herpetofauna has been reviewed for 1980–1985 by Luxmoore et al. (1988). This market, with its appetite for rarities, has stimulated, besides more positive results, the related phenomena of illegal collecting, trading, and smuggling, all of which are facilitated by the portability of reptiles (Hoser 1993).

Bureaucratic systems of licensing and inspecing have mushroomed almost everywhere. The mix of extensive legislation, haughty authority, insatiable desires, and ample money has generated its natural parasitic fauna of high-handedness, fanatic enforcement, corruption, and bribery—in some countries more than in others. It must have come as a shock to many readers of "Smuggled" (Hoser 1993; reviewed by Werner 1995), when Australia, celebrity of nature protection, was exposed by Raymond Hoser as a focus of negativity. It transpired that not only was smuggling of the endemic protected fauna rampant but many officials of governmental nature conservation agencies found a variety of ways to personally gain from it. Not merely bribery but perjury, violence, robbery, and even murder crowd the pages of "Smuggled" and make it a suspense story.

"Smuggled-2" is a sequel and like many a sequel is somewhat weaker than the initial book, perhaps mainly because the surprise element has dimmed. Still, it is compellingly interesting.

The twenty chapters may be seen as five clusters, each of which doubles as a separate appendix to "Smuggled." (I) Prefaces by others and chapters 1–3 depict the author's fight for legitimate (rather than illegal) conservation (especially in Australia), culminating in his "Smuggled," and the illegal war which aggrieved officials tried to wage against writing, publishing, and circulating the book. (II) Chapters 4–5 update the reader on the progress of inquiries into wildlife smuggling and related corruption, originally reported in "Smuggled." (III) Chapters 6–15 bring a deluge, in quantity and variety, of conservation-related crimes in Australia, often with the involvement of officials. Mixed in are some occurrences of possibly less criminal incompetent bungling of conservation authorities. Some of the contents is fresh, having occurred after the publication of "Smuggled." Other cases actually had occurred earlier, and it was the reading of "Smuggled" that stimulated witnesses to speak up. (IV) Chapters 16–17 widen the scope to encompass wildlife poaching in Africa and the astonishing Madagascar fiasco (March 1993), when police shot four visiting herpetologists, already prostrate by order, killing two and crippling the well-known F. J. Obst. (V) Chapters 18–19 consider

prospects for the future, including the potential of captive breeding for saving species. There is no index.

The bibliographies of published and unpublished source materials (Chapter 20; 29 pages), are intended to testify to every word in the book. Unfortunately the sources are not numberred and usually the text does not guide the reader to them. Still, everything appears to be true, because otherwise even in the most liberal of countries, no author could retain impunity, shooting such barrages of accusations at officialdom. In fact, Hoser's very ability to speak up (despite being harrassed for this) attests to the basic rectitude of the country, so many of whose emissaries are shown to be wrong doers.

The text is enriched with some 125 black-and-white photographs. These are not numbered and don't shine on the dull paper but they are fully explained and materially help in conveying the message. Most of the figures fall into one of four classes: "Good guys" (27 persons fighting corruption, innocent victims of corruption, etc.); "bad guys" (26 corrupt or allegedly corrupt nature inspectors and politicians, etc.); problematic animals and plants and equipment for smuggling them (39 figures); documents (24 newspaper clippings, letters to or from authorities, etc.).

Hoser fights on behalf of the animals and the lovers of animals, both against mercenary exploiters of fauna and flora and against fanatic or corrupt conservation-bureaucrats. I share his attitude that this is a war of light against dark. But I think that sometimes the light dazzles him. For example, he seems to imply that some confiscated animals should have been released into the wild, which is controversial in terms of population genetics and long-term effects. He assaults with a fervor that scorns the careful use of commas, apostrophes, and sometimes prepositions.

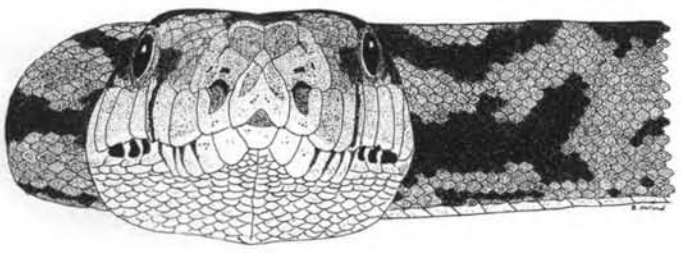
But all in all, assuming you are interested in conservation, if you have read "Smuggled" you will probably want this follow-up; if you have not read "Smuggled," then reading at least Smuggled-2 is a must.

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Morelia spilota (Carpet Python). Illustration by Dan Holland.

The Galápagos Tortoises: Nomenclatural and Surival Status, by Peter C. H. Prichard. Chelonian Research Monographs, Number 1, 85 pages, 12 black & white plates, 53 color plates. Hardcover edition (ISBN 0-965354-0-8) US $29.00, softcover edition (ISBN 0-965354-1-6) $19.00. Available through the Chelonian Research Foundation, 168 Goodrich Street, Lunenburg, Massachusetts 01462, USA.

CHARLES R. CRUMLY
Herpetology Department, San Diego Natural History Museum
P.O. Box 1390, San Diego, California 92112, USA

Mailing Address: Academic Press, 525 'B' Street
San Diego, California 92101, USA
e-mail: ccrumly@acad.com

The Galápagos are perhaps the most biologically famous of all island groups. The leading citizens of Galápagos are the giant tortoises, once called *Geochelone elephantopus*, now generally referred to as *Geochelone nigra*. Efforts by systematists to chart the evolution of Galápagos tortoises have been made difficult by many unfortunate events. Inadequate records, some centuries old, and the decimation of populations by pirates, poachers, and introduced animals have made it difficult to prepare a monographic revision. Even pulling together all the literature, finding specimens previously mentioned, and interpreting an often arcane scientific past can be intimidating.

To everyone's benefit, Peter Pritchard has prepared a useful literature survey. It will be possible for a future systematist to do a thorough job of revising this highly variable lineage. Many interesting speculations are presented by Pritchard. Although none are subjected to test, circumstanial evidence supports some of his hypotheses. Pritchard's personal viewpoints are evident. His well known rejection of modern cladistic methods is especially anachronistic (see page 30), but then the science of systematics has never been his strong suit. Rather, Pritchard has carefully and quite admirably canvassed an old and often vague literature. Alas, clarity has not yet been achieved for a variety of reasons.

Pritchard is an engaging writer prone to romantic images presented with an ease of communication rare among scientists, but he does not consistently provide the details one expects in scientific contribution. Frequent qualitative assessments, rambling but readable prose, and practically no quantitative or statistical evaluation make it impossible to recognize this work as a modern monographic revision. For example, he suggests that the first tortoises to reach Galápagos were already giants. Unfortunately, no real test of such an assertion is provided. No phylogenetic hypothesis is provided to demonstrate the relative size of the sister taxa of *Geochelone nigra*. No statistics are provided to illustrate the current range of size in *G. nigra* populations, or to document that there exist statistically significant differences among populations. The suggestion that dwarfism might be more likely once the archipelago was colonized, although possible, must be recognized for what it is—an intriguing, but unsupported, speculation. Pritchard's book is a good literature survey, but it does not fill the need for a modern, comprehensive, thorough, monographic revision of the Galápagos tortoises.

Although Pritchard claims the title of "first revisor" (see bottom of page 48), this work does not warrant the accolade. No list of diagnostic features is provided for each taxon. No key to the identification of specimens is presented. There is no list of specimens examined by Pritchard or any indication of how specimens

in well known collections (e.g. CAS, BMNH, USNM, AMNH, MCZ) ought to be allocated to the names he recognizes.

Here are a few minor quibbles. Except for a very few photographs of type material and an illustration that appeared in another publication, most of the pictures do not identify the tortoises using Pritchard's Latin names. None of the maps provide a scale bar, latitude or longitude marks, or a compass direction. Not all the maps consistently provide topographic relief, nor is the interval for topographic lines, when present, indicated in all maps. In fact, if it had been possible (I suspect it was not), I would have prerferred range maps that indicated both collection points and expected distributions.

I found Pritchard's detailed critique of Garman (1917) to be an odd indulgence. Despite Garman's deserved and secured position in the history of herpetology, this 1917 paper is an unfortunate contribution to the literature on Galápagos tortoises. Pritchard's valuable time could have been better spent. Both Van Denburgh's (1914) and Rothschild's (1915) earlier studies are better and of the same vintage. Also, I could not agree with Pritchard's characterization of my work, which leaves me wondering if he misinterpreted the results of others.

One final quibble—to be politically correct—why did Pritchard elect to preferentially use Anglicized island names? The Ecuadorian government has devoted a great deal of time and scarce financial resources to the conservation of Galápagos. It would have been a courtly gesture to recognize the appropriate Spanish names for all the islands as primary. Certainly the parenthetical use of the English names would have been better for recognizing Ecuador's sovereignty over Galápagos.

I am sure that most readers of this review will recognize many of the above comments as little more than picky and obsessive. Anyone who knows people interested in turtles will recognize the sort of person likely to make them. However, I do hope that a few of the points I have made will be taken seriously enough to result in the sort of monograph that Galápagos tortoises deserve.

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Recopilacion de Claves para la Determinacion de Anfibios y Reptiles de Mexico, by Oscar A. Flores Villela, Fernando Mendoza Quijano, and Gracia Gonzales Porter (compilers). 1995. Publ. esp. Mus. Zool. (10):iv + 1–285. Universidad Autónoma de México, Museo de Zoologíca, Departamento de Biología, Apartado Postal 70-399, México, D.F., 04510, México. ISSN 0188-6843. Cost not given.

ERNEST A. LINER
310 Malibou Boulevard
Houma, Louisiana 70364-2598, USA

This 8 1/2 x 11-inch paperback is a compilation of 104 keys to the amphibians and reptiles of México that have appeared in numerous publications since 1945, as well as including 16 keys presented for the first time. Some keys cover only certain parts of some genera. Three of the older keys have been modified. All previously-published keys are used with permission of authors or publishers, and original authors are listed for each key. The older keys are electrostatic copies of the originals, thus the printing throughout varies according to the quality and style of the original.

Previously published keys for the most part have not been modified to reflect current taxonomy, though notes at the end update the classification and make the user aware of new taxa that have since been described. A breakdown of the keys have Anura with 19, Gymnophiona with 6, Sauria with 32, Serpentes with 33, Testudines with 13, and Crocodilia with 1.

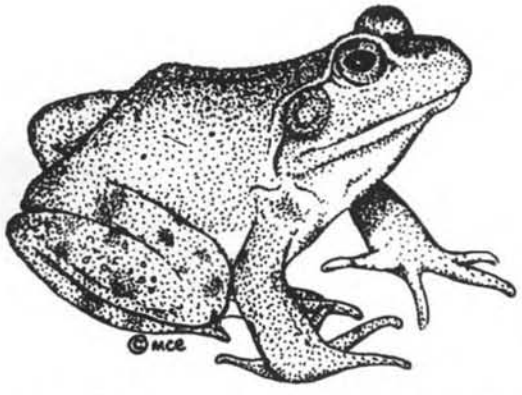
In several instances the Spanish version of a key is presented when the original had both English and Spanish versions. New keys consist of those by J. R. Dixon (*Tomodactylus*; *Coleonyx*; *Phyllodactylus* for Baja California and mainland México); E. Pérez-Ramos and G. Casas A. (*Rana*); K. DeQueiroz (Mexican iguanas); C. Lieb (*Anolis*; *Eumeces*); A. Nieto-Montes de Oca (*Anolis schiedi* group, two keys); R. L. Bezy and J. L. Camarillo (Xantusiidae); J. D. Johnson (*Masticophis*); K. P. Kofron (*Sibon*); D. A. Rossman (*Thamnophis*); I. Goyenechea (*Conopsis* and *Toluca*). The keys to *Anniella* and *Ophisaurus* were adapted and translated into Spanish from the original by Walter Schmidt Ballardo and *Xenosaurus* by Edmundo Pérez Ramon and Lucía Saldaña de la Riva.

The publication begins with an index followed by an introduction in Spanish and a short section on literature cited. This is only for the literature cited in the introduction; many more publications are listed in the notes sections under various keys to update them. This is followed by nine plates of drawings showing characteristics of the various groups. Some additional plates are included with various keys.

As stated, 85 of these keys have been published previously, but the value of this publication is to have all of the keys at one's fingertips. Even the older keys work due to the accompanying notations (in Spanish). Anyone working on the Mexican herpetofauna will welcome this addition to the literature. The compilers have produced a very useful piece of work.

ERRATUM

In the two book reviews by Lamar and Liner (Herpetol. Rev. 27[2]:103), J. T. Collins erroneously was listed as the *editor* of the SSAR Common Names publication; instead, he should be listed as *author*.



Rana catesbeiana (Bullfrog). USA: New Hampshire: Wonalancet. Illustration by Mark C. Erelli.

SSAR Committee Chairs and Coordinators

CHAIRPERSONS

Conservation
C. KENNETH DODD, JR.
National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
MARTHA L. CRUMP
Department of Biological Sciences, Box 5640
Northern Arizona University
Flagstaff, Arizona 86011, USA

Long Range Planning
ALAN H. SAVITZKY
Department of Biological Sciences
Old Dominion University
Norfolk, Virginia 23529-0266, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602-2597, USA

1997 Local Meeting
THEODORE W. PIETSCH
School of Fisheries
University of Washington
Box 355100
Seattle, Washington 98195, USA

Nominating
AARON M. BAUER
Department of Biology
Villanova University
Villanova, Pennsylvania 19085, USA

Regional Society Liaison
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Resolutions
GEORGE R. PISANI
Department of Biological Sciences
University of Kansas
Lawrence, Kansas 66045-2106, USA

Zoo Liaison
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Department of Herpetology
Sedgwick County Zoo
5555 Zoo Boulevard
Wichita, Kansas 67212, USA

COORDINATORS

Common and Scientific Names
JOSEPH T. COLLINS, Coordinator
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
585 South Main Avenue
Tucson, Arizona 85701, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

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Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings. **Corresponding authors should include an e-mail address (if available); this will greatly facilitate communication with the editors.**

Originals of illustrative material (e.g., tables, photographs, or diagrams) should be submitted with the text, with appropriate precautions taken to ensure delivery without damage. Illustrations should be discussed in the text and numbered sequentially with Arabic numbers. References to illustrations should be placed in parentheses at the end of sentences. Original photographs should be submitted as black and white glossy prints. For further guidelines, authors should consult *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (6th edition, 1994, Council of Biology Editors, Inc., 11 South LaSalle Street, Suite 1400, Chicago, Illinois 60603, USA).

Submissions for Natural History Notes, Geographic Distribution, Herpetological Husbandry, Current Research, Regional Society News, and Legislation & Conservation should be sent directly to the appropriate section editor. Please send review copies of books to the Book Review Section Editor. Manuscripts intended for publication as Articles, Points of View, Techniques, or Recent Population Changes, as well as news notes and other material, should be sent to the Editor. Deadline for receipt of meeting announcements, news notes and related material is two months prior to each issue (e.g., 1 January for March issue).

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Reprints of notes or articles published in ***HR*** should be ordered using the forms provided at the time page proofs are sent to the authors. Proofs are not sent to authors of Geographic Distribution notes; these authors should indicate (at time of submission) whether reprints are desired and if so, the appropriate order forms will be sent prior to publication. These are also available upon request from the editor or managing editor.

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Herpetological Review

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Herpetological Review

Volume 28, Number 3 — September 1997

BRIEF RESUMÉ of the applicant or project coordinator. (F) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed 1200 words, excluding title page, literature cited, resumé, and budget.

Applicants must designate to which of the six categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than 31 DECEMBER 1997 to be considered. Failure to meet these guidelines may result in elimination of a proposal from consideration. The awards will be announced on or around 1 April 1998. Successful applicants are encouraged to submit the results of their research for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Julian C. Lee, Chair, SSAR Grants-in-Herpetology, Department of Biology, P.O. Box 249118, University of Miami, Coral Gables, Florida 33124, USA. Tel. (305) 284-6420; fax (305) 284-3039; e-mail: jlee@umiami.ir.miami.edu.*

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Thanks to Reviewers

The Editor and the Society acknowledge, with considerable appreciation, the assistance of the following individuals in evaluating manuscripts submitted to *Herpetological Review*. An * indicates consultation on two or more manuscripts.

Kraig Adler, Roger A. Anderson, David Auth, Ralph W. Axtell*, Breck Bartholomew, Aaron M. Bauer*, Bernard Bechtel, Daniel Beck, Trevor Beebee, Dale Belcher, Robert L. Bezy, Richard Bothner, David Bradford Laura Brandt, Alvin Braswell, I. Lehr Brisbin, Walter C. Brown, William S. Brown, Richard C. Bruce*, Bryant Buchanan, Kurt A. Buhlmann*, Gordon Burghardt, Vincent J. Burke, Stephen D. Busack*, David Cannatella, Paul Chippindale, Joseph T. Collins, P. Stephen Corn, Alan de Queiroz, Kevin deQueiroz, C. Kenneth Dodd, Jr.*, Michael Dorcas, William E. Duellman, Harold Dundee*, Carl Ernst*, Michael Ewert, Gary Fellers* John W. Ferner*, Lance Fontenot, Thomas Fritts, Darrel Frost, J. E. Gates, David Germano, David Good, Richard A. Griffiths, James Harding, Marc P. Hayes*, Dennis Herman, W. Ronald Heyer*, J. Alan Holman, Marinus Hoogmoed*, Jeffrey M. Howland*, Joseph B. Hunn, Victor Hutchison, John Iverson, Elliott Jacobson, Frederic Janzen, Jerry D. Johnson, Kenneth Kardong, Michael Klemens, Arnold Kluge, Alec Knight, Julian C. Lee, Peter V. Lindeman, Jeffrey Lovich*, William Lutterschmidt, John D. Lynch, David L. Martin, Michael James McCoid*, C. J. McCoy, J. R. McCranie, Roy McDiarmid, Joseph R. Mendelson III, Walter Meshaka, Jr., Peter B. Meylan, Joseph C. Mitchell, Paul Moler*, Don Moll, Richard R. Montanucci*, R. S. Oldham, Mark A. Paulissen, George R. Pisani, S. Powell, Gregory Pregill*, Howard Reinert*, Anders G.J. Rhodin, John Rossi, Douglas A. Rossman, R. Ruibal, Alan Savitzky, Ivan Sazima, Gordon Schuett, Kurt Schwenk, Wade C. Sherbrooke*, Vaughn Shoemaker, C. Robert Shoop, John Simmons*, Geoffrey R. Smith, Hobart M. Smith*, Robert G. Sprackland, Samuel Sweet, Ian Swingland, Stephen Tilley*, Stanley Trauth, Bern Tryon, John K. Tucker, Jens Vindum, Laurie J. Vitt, Richard Vogt*, Jill Wicknick, John Wiens, and Larry David Wilson.

Illustrations Wanted for *HR*

We are always on the lookout for high quality illustrations of herpetological subjects for possible publication in *Herpetological Review*. Original drawings should be of a scale that would permit reduction to approximately 30 x 90 mm or smaller. Of particular interest are drawings of material for which locality data or museum catalogue numbers are available; this information should be included with the drawings. Original art (or good quality photocopies) should be packaged to ensure safe delivery and sent to the Editor (address on inside front cover).

NEWSNOTES

Varanid Society Newsletter

The first issue of *Varanids*, the quarterly newsletter of The Varanid Society, has just been published. The stated aim of the newsletter is to advance monitor research, including biology, husbandry, natural history, and conservation. To subscribe, send US $20 to: *The Varanid Society, 114-24 125th Street, South Ozone Park, New York 11420, USA.*

New Conservation Journal

Cambridge University Press, in association with the Zoological Society of London, plans to launch a new journal—*Animal Conservation*—in 1998. The aim of this new journal is to provide a forum for rapid and timely publication of novel scientific studies of past, present, and future factors influencing the conservation of animals species and their habitats. A central theme will be to publish important new ideas and findings from evolutionary biology and ecology that contribute towards the scientific basis of conservation biology. Full instructions for contributors can be found on the Internet at: http://www.cup.cam.ac.uk/journals/jnlscat/ani/anilFC.html.

Graduate Studies in Biological Conservation

The State University of New York at Albany now offers an interdisciplinary Master of Science degree that prepares students for careers requiring knowledge of both biology and public policy, in matters pertaining to biological conservation. Begun in 1996, the Biodiversity, Conservation and Policy Program teaches students how basic concepts in conservation biology, policy analysis, planning, and the political process interact during efforts to preserve species diversity and endangered habitats and ecosystems. To obtain further information about this program, contact:

Margaret M. Stewart, Program Director, Department of Biological Sciences, University at Albany, State University of New York, 1400 Washington Avenue, Albany, New York 12222, USA; e-mail: mstewart@csc.albany.edu or telephone: 518-442-4348.

Request for Box Turtle Photographs and References

Ken Dodd is writing a book entitled "The Natural History of North American Box Turtles." The book will include photographs of all living and fossil box turtles (genus *Terrapene*), in terms of identification, phenotypic variation, day to day activities (aggression, mating, egg deposition, etc.) and use/depiction in art or anthropology. Anyone willing to provide high quality color slides on a temporary loan basis should contact Ken by e-mail (kdodd@nervm.nerdc.ufl.edu) or regular mail at: *C. Kenneth Dodd, Jr., U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st St., Gainesville, Florida 32653, USA*. Any slides used will receive appropriate acknowledgment in the book.

Ken also is collecting pertinent references on box turtle biology, and would appreciate receiving copies of unusual citations, theses, papers in press, and unpublished reports. Spanish language references to the Mexican species are particularly sought. Send information to the address listed above.

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due by 15 October 1997, with notification by 1 December 1997. Grantees are expected to complete their Academy visit by 15 September 1998. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

MEETINGS

Meetings Calendar

3–5 October 1997—Second Annual Meeting of the Canadian Amphibian and Reptile Conservation Network and the 7th Annual Meeting of the IUCN/SSC Task Force on Declining Amphibian Populations in Canada (DAPCAN), Acadia University, Wolfville, Nova Scotia. Contact: Stan A. Orchard, Chairman, CARCN/RCCAR, 1745 Bank Street, Victoria, British Columbia, Canada V8R 4V7. Tel./Fax: (250) 595-7556; e-mail: sorchard@islandnet.com.

About Our Cover: *Ichnotropis capensis*

The lacertid genus *Ichnotropis* comprises a number of small, rough-scaled, terrestrial species inhabiting mesic and xeric savannah in central and southern Africa. The genus was last revised by Boulenger (1922), who recognized six species. Since then, additional species and races have been described, although there remains confusion in the literature concerning the number and diagnostic characteristics of the various taxa. A generic revision, including the description of a new species from Angola, is in preparation (Arnold and Branch, in prep.).

The genus is of further interest in containing a number of sympatric species that display a unique 'annual' reproductive strategy, in which their lives cycle asynchronously, thus reducing competition between them. The phenomenon was first described in two species by Don Broadley in Zimbabwe (Broadley, D. G., 1979. S. Afr. J. Zool. 14:133–138). Both species (*I. capensis* and *I. squamulosa*) mature within 5–8 months of hatching, and die soon after laying a single clutch (exceptionally two) of eggs. When they occur together, the life cycles of the two species are staggered, so that the juveniles and adults of both species are found at different times. Presumably this reduces competition for resources, but the phenomenon has been poorly studied, especially where the two species range out of sympatry. Full ecological understanding and analysis of this interesting phenomenon is hampered by taxonomic confusion within the genus, and the lack of a robust phylogeny.

The cover depicts a male Cape rough-scaled lizard (*Ichnotropis capensis*) in full breeding color. It was collected in October 1995 in dry sand forest outside Tembe Elephant Reserve in northern Zululand, Kwazulu-Natal, South Africa. Hatchling *I. squamulosa* were present at the time, but not adults, neatly illustrating the unique 'annual' cycling.

The cover photo was taken by **Bill Branch**, who was born in London but now lives in South Africa. He has been the herpetologist at the Port Elizabeth Museum, Eastern Cape Province, since 1979, has a broad interest in herpetology, and has authored four books on African reptiles, including the first field guide to the reptiles of the subcontinent (1988) and *Dangerous Snakes of Africa* (co-authored with Steve Spawls). His field guide is currently being revised, with the inclusion of over 80 new species! Currently, he chairs the IUCN SSC African Reptile and Amphibian Group.

We asked Bill about his set-up for photography. "There's not much to say about equipment. I have relatively basic stuff (the SA exchange rate is crippling!) consisting of a Nikon AF N6006 body and 55mm Micro Nikkor lens (which I use for 90% of my photography), now enhanced with a Nikon 1.4 teleconvertor TC-14A that Michael Fogden got for me. The main advantage of the teleconvertor is that it increases my working distance, allowing me to photograph small lizards from 6–10 inches. The latter has two advantages: the first is that I'm not 'sticking it up their nose' so they tend to behave a bit more naturally; the second, and possibly more important, is that it allows more space to get flash light from the front without working in the 'shadow' of the camera and lens. When using flash I use only a single light source (a Nikon speedlight SB-20 with SC-17 extension cord), not on the camera but on a small tripod placed at about 10 o'clock (i.e., coming over my left shoulder). I try to soften the harsh shadows by reflecting back with silver foil or white card. The film is the weakest element, and due to cost I have to use a local commercial Agfa film (ASA 100). I would love to be able to use better film. I'd give my right arm to afford Fuji's Velviglo!"

Separation and imaging of Branch's photograph is the work of **Jim Bridges** of Herpeto, Inc., Hollywood, Florida, USA.

18–19 October 1997—First International Symposium on Snakebite. Zhanjiang, People's Republic of China. Contact: Organizing Committee of the First International Symposium on Snakebite, No. 2 Cunjin Road, Zhanjiang City, Guangdong Province 524037, People's Republic of China. Tel./Fax 0086-759-3316724.

18–19 October 1997—Snake Ecology for the 21st Century. Texas Herpetological Society Fall Symposium, Camp Tyler, Texas, USA. Contact: Neil B. Ford, Department of Biology, University of Texas at Tyler, Tyler, Texas 75799, USA. Tel. (903) 566-7249; e-mail: nford@mail.uttyl.edu.

25 October 1997—Conservation Ecology of the Amphibians of the Mid-Atlantic Region, Jug Bay Wetlands Sanctuary, Lothian, Maryland, USA. Contact: Karyn Molines, Conference Chair, Jug Bay Wetlands Sanctuary, 1361 Wrighton Road, Lothian, Maryland 20711, USA. Tel. (410) 741-9330; Fax (410) 741-9346; e-mail: cswarth@umd5.umd.edu.

25–26 October 1997—Fourth Annual Conference of the Association of Reptilian & Amphibian Veterinarians. Sheraton Astrodome, Houston, Texas, USA. Contact: Wilbur Amand, VMD, P.O. Box 605, Chester Heights, Pennsylvania 19017, USA. Fax (610) 892-4813.

October 1997—III Congreso Argentino de Herpetologia, Corrientes - Argentina Asociacion Herpetologia Argentina Contact: Blanca B.A. de Avanza/Maria E. Tedesco Organizing Committe - Departamento de Biologia Anatomia Comparada - Facultad de Ciencias Exactas y Naturales y Agrimensura. Universidad Nacional del Nordeste 9 de Julio 1449 - 3400 Corrientes, Argentina.

7–10 December 1997—59th Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin, USA. Featured session: "Conservation and Management of Cold-blooded Animals." Contact: Bob Hay, Wisconsin Department of Natural Resources, Bureau of Endangered Resources, P.O. Box 7921, Madison, Wisconsin 53707-7921, USA. Tel. (608) 267-0849; e-mail: HAYR@DNR.STATE.WI.US.

1–3 June 1998—Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests: An International Symposium. Hanoi, Vietnam. Contact: Natalia Ananjeva (St. Petersburg, Russia), e-mail: nbanorus@glas.apc.org.

June 1998—Highlands Conference on Plethodontid Salamanders, Highlands Biological Station, Highlands, North Carolina, USA. To be placed on the mailing list, or to up-date your address, please send your name, address, and numbers (phone, FAX, e-mail) to: Plethodontid Conference, Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA, or send an e-mail message to Judy Hill (HBS Admin. Asst.) at: JHILL@wpoff.wcu.edu.

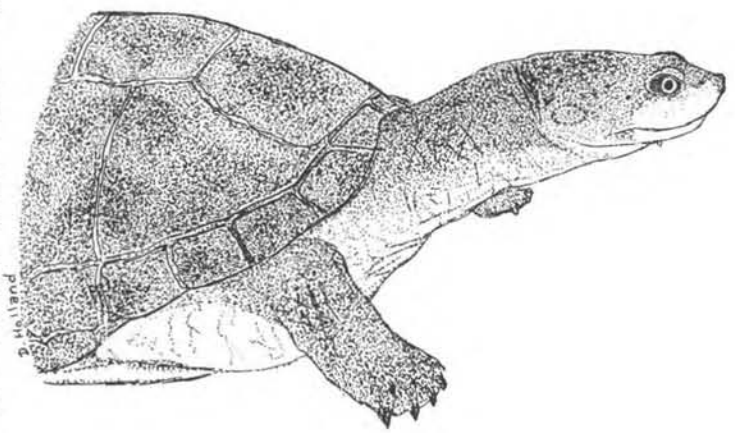
1–5 September 1998—Third International Asian Herpetological Meeting, Almaty, Kazakhstan. To receive the First Announcement and Preliminary Registration Form, please contact one of the meeting organizers: Dr. Tatjana Dujsebayeva, Department of Biology, Kazakh State University, Al-Farabi Prospect, 71, Almaty, 480078, Kazakhstan; Tel. (3272) 472677, Fax (3272) 472609, e-mail: zool@plague.almaty.kz; Dr. Natalia Ananjeva, Department of Herpetology, Zoological Institute, Universitatskaja nab., 1, Saint-Petersburg, 199034, Russia; Tel. (812) 2180711, Fax (812) 2182941, e-mail: anb@zisp.spb.su; or Dr. Theodore Papenfuss, Asiatic Herpetological Research, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA; Tel. (510) 642-3567, Fax (510) 643-8238, e-mail: asiaherp@uclink2.berkeley.edu.

LEGISLATION & CONSERVATION

This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. Please direct all communications to the Section Editor.

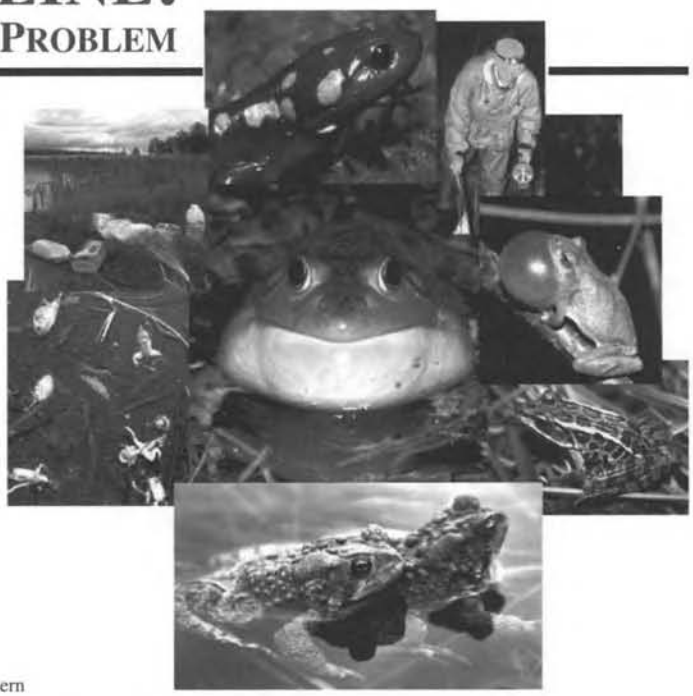
USA: Oklahoma: Current Oklahoma Department of Wildlife Conservation regulations protect all turtles under four inches and softshells over 18 inches from commercial harvest. However, legislation currently is being debated that would overturn these regulations and allow harvesting of turtles of any size. Earlier this year, the proposed legislation (bill HJR 1040) passed the Oklahoma House of Representatives (vote, 99–1) but was defeated by the Senate Wildlife Committee (vote, 6–4). Upon its defeat, HJR 1040 was tacked onto another, unrelated, bill (SB 196) that was meant to provide protection for Oklahoma paddlefish populations. Unfortunately, with the addition of HJR 1040, SB 196 forces a decision between protecting turtles or paddlefish that should not be necessary. In 1996, commercial turtle harvesters in Oklahoma reportedly grossed over $89,500 on the sale of 56,390 turtles. Most frequently sold were Red-eared Sliders (*Trachemys scripta*), which comprised 66% of the total harvest. The proposed legislation would not affect other Oklahoma regulations concerning the protection of alligator snapping turtles (*Macroclemys temminckii*), map turtles (*Graptemys geographica*), and chicken turtles (*Deirochelys reticularia*). For additional information, contact: *Richard L. Lardie, P.O. Box 9002, Vance AFB, Oklahoma 73705, USA.*

USA: U.S. Fish and Wildlife Service: The tenth regular meeting of the Conference of the Parties (COP10) convened 9–20 June 1997 in Harare, Zimbabwe to consider proposed amendments to CITES. The following results are for US proposals: twelve species of map turtles (*Graptemys* spp.) to Appendix II, defeated; alligator snapping turtles (*Malaclemys temminckii*) to Appendix II, withdrawn; timber rattlesnakes (*Crotalus horridus*) to Appendix II, withdrawn. Summaries of the above proposals can be found in Federal Register, Vol. 62, No. 73, 16 April 1997, pp. 18565–18567 (see also Herpetological Review, Vol. 28, p. 6). Additionally, a proposal by Cuba that would have transferred Cuban populations of Hawksbill Sea Turtles (*Eretmochelys imbricata*) from Appendix I to II was defeated. More information concerning COP10 and CITES may be found at an Internet site maintained by the U.S. Fish and Wildlife Service: http://www.fws.gov/~r9dia/cites.html.



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INSTITUTIONAL PROFILE

The Lizard Collections of the National Museums of Scotland

ROBERT GEORGE SPRACKLAND*

and

GEOFFREY N. SWINNEY

National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF, UK

**Present address: Young Forest Company, 951 Old County Road, Suite 134, Belmont, California 94002, USA*

e-mail (RGS): 102175.1650@compuserve.com

e-mail (GNS): gns@nms.ac.uk

This note introduces the lizard collections of the National Museums of Scotland. The collection, which comprises about 3070 individual specimens in 2350 lots, recently has been re-housed and extensively re-curated. All the material has been examined and identifications confirmed or reassigned, mainly by the senior author. The newly refurbished premises provide facilities for visiting researchers. During the re-curation process most wet-preserved specimens have been transferred to new glassware and all specimens have been catalogued into the Museum's database, thus improving access to both specimens and their associated data. A brief outline of the scope of the collection is given below.

The Natural History collections have their origins in those amassed by the University of Edinburgh and transferred into public ownership to form the Industrial Museum of Scotland and the Natural History Museum, Edinburgh in 1855. No lizard specimens survive from the original University collections. The earliest lizard specimen that now can be located in the collection is a specimen of *Polychrus marmoratus* (L.) which forms part of a small collection registered as 'A number of snakes [sic] from Trinidad' presented in 1856 by a Mr. G. P. C. Murray, a student at the University. Since that time the institution has undergone several changes of name, becoming successively the Edinburgh Museum of Science & Art (1864–1904), the Royal Scottish Museum (1904–1985), and the National Museums of Scotland (1985 to present). For a brief history of the collections see McGowan et al. (1990).

The only type material in the lizard collection is a paratype of the gecko *Tropiocolotes (Asiocolotes) depressus* Minton and Anderson, 1965, NMSZ 1964.58.1, presented by Jeremy A. Anderson. However, an unusually large gecko from Jamaica, discovered in the collection during the re-curation process, is thought to represent a new species and will be described shortly (Sprackland and Swinney, in prep).

About 100 donors and vendors have contributed specimens to the collections. Although the Museum had never had a herpetologist on staff it has attracted the donation of several large collections of reptiles. Most notable are those of Sir Andrew Smith, Sir Malcolm Donald MacEacharn, and Jeremy A. Anderson. Together these three collections make up 80% of the lizard collection.

Sir Andrew Smith (b. 1797; d. 1872) trained in Edinburgh and joined the army medical service as a Temporary Hospital Mate in 1815. He went on to rise to the rank of Director General of the Army Ordinance and Medical Departments. During his early and mid-career (1821–1837) he was stationed in South Africa where, in addition to his military duties, he was instrumental in founding the South African Museum and was its first honorary Superintendent. Through his interests in natural history he became the pre-eminent authority of his day on the fauna of southern Africa and the author of a five volume work, "Illustrations of the Zoology of South Africa" (Smith 1838–1849). He participated in several expeditions and led the 1834–1836 expedition into the Transvaal organized by the Cape of Good Hope Association for Exploring Central Africa (Kirby 1965; Smith et al. 1975). Following its exhibition at the Egyptian Hall in London, much of the material collected on the Association's expedition was sold at auction in London in June 1838 (Chalmers-Hunt 1966; Kirby 1965). Smith, however, maintained his own collection of reptiles. In 1859 his health was failing, whereupon he donated this collection, comprising 1700 lots which included 1010 lizards (in 545 lots), to the Museum. The collection is registered as NMSZ 1859.13. Although it contains some southern African material—including primary types, although none of lizard taxa—much of the collection is worldwide. Unfortunately, it is generally poorly labeled, perhaps reflecting Smith's poor state of health—some specimens have more precise locality data than others, whereas most are without data. About half the specimens carry no locality data while many others give only the most general locality information (e.g.. 'South America,' 'Australia,' etc.).

Jeremy Andrew Anderson, who is still an active collector resident in Pakistan, between 1962 and 1968 donated a large number of specimens, mostly collected from the Baluchistan and Sind. They are registered as NMSZ 1962.9, 1962.21, 1962.26, 1962.47, 1963.1, 1963.2, 1963.20, 1963.23, 1963.25, 1963.33, 1964.58, 1965.36, 1968.13, 1969.15, and 1989.49. (This last batch was received in 1963 but at that time allocated a register number, 1963.33, which had already been used for a different batch). In correspondence that accompanied the collection, Anderson notes that prior to collecting for the National Museums of Scotland (then the Royal Scottish Museum) he had sent extensive reptile collections to the 'Laborotoire d'Erpetology, Paris' (sic; letter from Anderson to A. S. Clarke, 29 March 1962). The collections he sent to Edinburgh in total numbered about 2040 herpetological specimens, 1390 of which are lizards. All the specimens carry locality data and some of the batches were accompanied by detailed field notes (NMS Natural History Archives File No. 183). Specimens from this collection were noted by Minton (1966), although sometimes with incorrect registration numbers, and currently are being studied by Steven C. Anderson (no relation to Jeremy A. Anderson).

Sir Malcolm Donald McEacharn (b. 1852; d. 1910) was born in London of Scottish parents. His business interests, initially in shipping but later diversifying into other areas, led him to settle in Melbourne, Australia, where he entered politics (Dunstan 1986). He amassed a collection, mainly of birds but also other natural history and ethnographical material. At least some of his collection he bought from G. A. Keartland, naturalist both to the Horn Expedition to Central Australia and the Calvert Expedition to northwest Australia, in 1894 and 1895 respectively (McEvey 1983). The collection, which contained 84 lots of lizards, was donated to the Museum by McEacharn's widow and son in 1925. It is registered as NMSZ 1925.9. A notebook accompanying the collection (NMS Natural History Archives File No. 25/35) gives collection data for a few of the lizard specimens but most of the collection has no specific locality data.

The re-housing and computerized documentation of the collection facilitates improved access and faster response times to inquiries about specimens held. During 1995, the majority of the herpetological collections were moved to new research and hold-

ing facilities at West Granton, providing roomier facilities for visiting researchers. The Museum welcomes inquiries and is keen to promote the use of its holdings in taxonomic and other research activity. We invite requests from researchers for use of the material. These should be addressed to the second author.

Acknowledgments.—We are grateful to Angus Kneale for technical assistance in computerization of the catalogue of lizards. The first author also thanks James Macdonald for numerous courtesies to facilitate work while at West Granton.

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ARTICLES

Alligator Attacks on Humans in the United States

MICHAEL R. CONOVER
and
TAMI J. DUBOW
Jack Berryman Institute, Department of Fisheries and Wildlife
Utah State University, Logan, Utah 84322-5210, USA

American alligators (*Alligator mississippiensis*) have posed a threat to human safety since Native Americans first settled within their range. Early explorers of Florida reported that both they and the Natives considered alligators dangerous and took precautions to minimize the threat (Le Moyne 1591; Van Doren 1955, as cited by Hines and Keenlyne 1977). However, this threat diminished during the 1800's and 1900's, owing to the collapse of the alligator population from hunting. During this period, alligators were confined to remote swamps where contact with humans was unlikely. This changed, however, beginning in 1969 with the passage of the Lacey Act Amendment, which effectively curtailed interstate shipment of illegal alligator hides, and with the passage of the Endangered Species Act in 1973. With alligator populations recovering, attacks on humans have become more common. Concomitantly, human populations and residential development of waterfront property have increased.

Yet, despite the sensational nature of an alligator attack on a human, we are aware of only two published papers in the scientific literature dealing with the subject; both were published almost 20 years ago and dealt with attacks in Florida (Hines and Keenlyne 1976, 1977). The object of this paper was to compile statistics about the frequency of alligator attacks of humans in the U.S. Our interest was to determine the frequency of alligator attacks on humans, identify characteristics of attacking alligators and their human victims, assess whether the number of attacks has increased recently, and determine what percentage of alligator attacks resulted in a human fatality.

TABLE 1. Summary of alligator attacks on humans in the U.S. Data were provided by the different state wildlife agencies (see acknowledgments). For all states, it is unclear when record keeping began. Hence, the period for each state begins with the first documented attack.

State	Period	No. attacks	Human fatalities
Alabama	?? –1995	4	0
Florida	1948–1995	218	7*
Georgia	1988–1995	5	1
Louisiana	1978–1995	1	0
South Carolina	1976–1995	6	0
Texas	1980–1995	2	0
Total		236	8

*These statistics exclude seven fatalities in Florida for which it could not be determined if the alligator attack caused the victim's death or if the attack occurred after death.

We mailed a questionnaire to the wildlife agencies of all states within the range of alligators. The questionnaire requested data on the number of attacks in the state, the period over which these attacks occurred, length and sex of the attacking alligator, age and sex of the victim, and information about the victim's activity prior to the attack.

All states returned the questionnaires. We found 236 recorded cases of alligator attacks on humans going back as early as 1948 and through the end of 1995 (Appendix 1). Two hundred and eighteen (92%) of the recorded attacks occurred in Florida, six (3%) in South Carolina, five (2%) in Georgia, four (2%) in Alabama, two (1%) in Texas, and one (0.4%) in Louisiana (Table 1).

Eighty-four percent of the victims of known sex were males; 16% were females. The average age of the victim was 31.8 (SE = 1.4) and ranged from three to 82 years old (Appendix 1). Twelve percent of the victims were less than 11 years old, 16% were 11–20 years old, and 20% were between 21–30.

Thirty-four percent of the victims were totally immersed in the water (e.g., swimming, floating) when attacked, 17% were partially in the water (e.g., wading), 38% were on shore, 2% in boats, and the location of 9% could not be determined (Appendix 1). Alligators attacked people swimming, snorkeling, or scuba diving 76 times (32% of all attacks); fishing, clamming, and baiting 21 times (9%); and playing golf or retrieving golf balls 24 times (10%). Eight attacks (3%) occurred when the victim was feeding alligators or other animals. In 20% of the attacks, humans made first contact (often inadvertent) by swimming into, jumping on, picking up, displaying, wrestling with, moving, or trying to harvest the alligator that attacked them.

Alligators involved in human attacks ranged in size from 0.3–3.8 m (mean = 2.0 m, SE = 0.06). For 75 attacks, the sex of the alligator was determined; 73% were males and 27% were females.

Eight people (four males, four females) have died in the U.S. from alligator attacks (3% of all attacks)—seven in Florida and one in Georgia. Their ages were 4, 4, 10, 11, 16, 29, 52, and 70. Four of these victims were swimming or snorkeling prior to the attack; three were walking along the shore or wading (these were the three youngest victims); and the activity of one victim is unknown. These statistics exclude seven fatalities in Florida for which it could not be determined if the alligator attack caused the victim's death or if the attack occurred after death.

Alligator attacks increased dramatically in the 1980's and from 1990–1995 (Table 2). For instance, there was only one recorded alligator attack in the 1940's and 1950's, but 78 in the 1980's and 110 from 1990–1995.

Many factors have contributed to the recent increase in the frequency of alligator attacks on humans. With the decline of alligator hunting and poaching due to protective legislation, populations have rebounded and alligators probably have become less wary of humans. Certainly alligators had less to fear from humans during the 1970's and 1980's than before. Since 1970, an increase in human population in Florida and the other southern states has occurred, along with residential development of waterfront property, and a growing popularity of water recreation activities. All of these factors have caused an increase in alligator-human interactions. Part of the recent increase, however, is an artifact that can be attributed to state agencies keeping better records of alligator attacks since 1970 and to a public that presently reports a higher proportion of attacks to government officials than was the case several decades ago.

State wildlife agencies have responded to the expanding alligator populations, threat of alligator attacks, and public concern (Hines and Scheaffer 1977) by implementing alligator manage-

TABLE 2. Chronology of alligator attacks in the U.S.*

Year	FL	GA	LA	SC	TX	Total
1948–1959	2					2
1960–1969						0
1970–1979	39		1	2		42
1980–1989	73	2		2	1	78
1990–1995	104	3		2	1	110
Total	218	5	1	6	2	232

*No information is available about four alligator attacks in Alabama.

ment plans (Hines and Woodward 1980; Taylor et al. 1991). These plans often call for the removal of nuisance alligators and improved public education about alligators and the dangers they pose. Furthermore, states have started harvesting alligators. But, as long as humans and alligators share the same space, some attacks are inevitable.

Acknowledgments.—We thank the following individuals for providing data for their respective states: Amos Cooper (Murphee Wildlife Management Area, Texas), Celeste Gutierrez-Sanders (Florida Game and Fresh Water Fish Commission), Walt Rhodes (South Carolina Department of Natural Resources), Stanley Stewart (Alabama Game and Fish Division), and Fred Todd and George Steale (Georgia Department of Natural Resources).

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APPENDIX 1. Compilation of alligator attacks on humans in the U.S.

		Alligator		Victim			
State	Date	Size (m)	Sex	Age	Sex	Injuries	Activity prior to attack
AL	*						
FL	07/30/48	2.8	?	?	F	Cuts, broken hand	Swimming
	09/16/52	1.8	?	9	F	Cuts and broken arm	Standing by water's edge
	06/09/72	1.5	?	15	M	Cuts on head	Swimming
	06/17/72	1.1	?	>18	M	Bite on leg	Swimming
	06/19/72	?	?	<18	F	Minor cuts	Wading
	07/12/72	1.5	?	10	F	Cuts on hand, arm	Standing by water's edge
	07/21/72	2.6	?	12	M	Punctures on upper body	Swimming
	08/03/72	2.4	?	6	M	Cuts on leg	Playing in shallow water
	07/05/73	2.6	?	10	M	Cuts on calf, knee, thigh	Wading
	07/29/74	?	?	14	M	Cuts on chest, head	Swimming
	08/16/73	3.4	M	16	F	Fatal	Swimming
	09/16/73	2.7	?	13	M	Cuts on upper body	Swimming
	06/15/74	1.8	?	10	F	Cuts on foot	Standing by water's edge
	08/01/74	2.7	?	10	M	Cuts on thigh, leg, foot	Swimming, fell out of canoe
	08/15/74	3.4	?	16	M	Cuts on arms and hand	Swimming
	06/16/75	3.6	M	45	M	Cuts on chest, back	Swimming
	06/30/75	2.4	?	14	M	Cuts on thigh	Swimming
	07/05/75	1.4	?	10	F	Cuts on thigh	Standing in water
	10/22/75	3.7	?	34	M	Cuts on shoulder, chest	Standing in water
	04/01/76	2.0	?	14	M	Cuts on arm	Wading
	08/25/76	?	?	66	M	Cut on arm	Swimming
	03/15/77	1.8	?	9	M	Cuts on hip	Swimming
	03/21/77	1.5	?	21	M	Arm and hand wounded	Swimming
	04/17/77	1.8	?	11	F	Punctures on leg	Sitting at water's edge
	04/24/77	1.8	?	21	M	Cut on head	Collided while snorkeling
	06/05/77	2.7	?	19	M	Cuts on back, shoulder	Swimming
	06/30/77	3.7	?	67	M	Cuts on head	Swimming
	07/01/77	2.4	?	8	M	Cuts on hand	Swimming
	07/14/77	1.5	?	9	F	Bite on foot	Swimming
	08/01/77	2.1	?	60	M	Bite on leg	Feeding fish
	08/12/77	?	?	25	F	Bite on buttock	Swimming

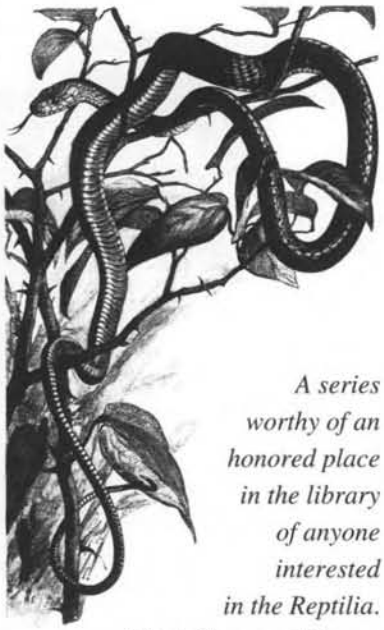
08/12/77	?	?	25	M	Bite on arm	Swimming
09/17/77	2.7	?	71	F	Cuts on leg	Feeding alligator and ducks
09/28/77	2.2	F	52	M	Fatal	Swimming
10/02/77	2.4	M	70	M	Cuts on head, wrist	Feeding alligator
05/12/78	3.7	?	30	M	Deep cut on thigh	Bird watching on shore
06/28/78	1.8	?	8	M	Broken arm, loss of flesh	Playing with fish on bank
07/03/78	2.1	?	23	M	Punctures, cuts on arm	Swimming
08/09/78	3.7	?	12	M	Bite on leg	Digging for clams
07/17/79	2.7	?	8	M	Bite on ankle	Swimming
08/15/79	2.4	M	18	M	Punctures on arm and back	Snorkeling
04/30/80	1.5	?	25	M	Gash on arm	Riding in sailboat
08/09/80	1.2	?	23	M	Bite on foot	Wading, kicked alligator
08/15/80	3.0	M	21	M	Bite on elbow	Swimming
09/22/80	3.1	M	?	M	Puncture and cuts to thigh	Walking on shore
05/21/81	2.2	M	24	M	Bite on foot	On dock with feet in water
06/01/81	1.5	?	38	F	Bite on leg	Wading
06/16/81	2.4	M	65	M	Puncture on calf	Standing at water's edge
06/18/81	2.1	M	22	M	Bites on feet	Floating in water
07/04/81	3.2	M	27	M	Severe injury to arm	Snorkeling
03/27/82	1.8	?	69	M	Bite on forearm	Installing pipe in water
08/12/82	2.3	F	?	M	Bite on hand	Removing weeds from canal
08/20/82	2.7	M	20	M	Mangled arm and wrist	Swimming
09/20/82	3.1	M	67	M	Bite on calf	Retrieving golf ball by canal
10/04/82	2.4	?	39	M	Bite on head	Collided while swimming
11/27/82	2.6	?	41	M	Bite on foot	Stepped into water
05/18/83	1.9	M	67	M	Severe damage to leg, arm	Rescuing dog on dry land
06/22/83	2.4	?	79	F	Long cut to arm	Swimming
07/11/83	2.3	M	62	M	Broken and cut arm	Standing in water
07/15/83	2.4	?	30	M	Swim flipper seized	Scuba diving
08/21/83	1.4	?	29	M	Bite on hand and foot	Wading
08/23/83	3.5	M	50	M	Bite on shoulder	Snorkeling
05/05/84	1.8	?	14	M	Cuts on buttock	Swimming, bumped alligator
05/15/84	1.1	?	42	M	Cut on thumb	Feeding alligator
07/01/84	2.2	F	21	F	Cuts on thigh	Swimming
07/02/84	2.4	?	30	M	Injuries to upper body	Snorkeling
08/06/84	3.8	M	11	M	Fatal	Swimming
05/08/85	1.5	F	79	F	Cuts on hand	Weeding 6m from lake
08/29/85	1.9	F	74	M	Leg amputated	Digging for mussels
09/06/85	2.0	?	53	M	Punctures on thigh	Fixing boat in water
03/20/86	1.4	?	11	M	Punctures and cuts on thigh	Wading after golf ball
05/02/86	1.6	F	9	M	Punctures on shin	Throwing rocks in lake
06/25/86	2.1	?	62	F	Shoulder, elbow, hand cuts	Swimming
07/15/86	1.6	?	14	M	Tears, bites on upper chest	Hanging off boat
07/16/86	1.8	?	3	M	Punctures on forearm	Wading
07/20/86	1.4	?	29	M	Punctures on hand, wrist	Reaching for fish in water
07/24/86	1.5	F	25	M	Punctures on back	Snorkeling
09/24/86	3.5	M	12	M	Punctures, broken ankle	Snorkeling
10/10/86	2.3	F	8	M	Punctures on leg	Feeding ducks
11/01/86	1.8	?	24	M	Punctures on hand, wrist	Forcing alligator from shore
11/13/86	2.4	?	28	M	Punctures, cuts on back	Swimming
11/16/86	1.8	?	35	M	Punctures, cuts on knee	Hunting in shallow water
12/31/86	1.8	M	33	M	Shoulder punctures, cuts	Snorkeling
05/10/87	1.4	?	32	M	Puncture wounds, gashes	Canoeing and swimming
06/22/87	1.5	?	27	M	Punctures, cuts to foot	Retrieving golf balls
06/25/87	0.3	M	33	M	Cuts on foot	Sitting on shore
07/13/87	3.4	M	29	M	Fatal	Snorkeling
08/11/87	0.3	?	?	M	No injuries	Fishing from bank
08/15/87	2.3	M	21	M	Four bites on foot	Floating with water ski
09/30/87	1.2	?	50	M	Punctures, cuts on hand	Swimming for golf balls
12/24/87	1.1	?	12	F	Injury on thigh	Fishing
12/29/87	1.2	M	27	M	Arm punctures, scratches	Showing alligator to public
01/13/88	1.8	?	50	M	Head, thumb injuries	Collecting golf balls
03/10/88	1.8	?	14	M	Punctures on foot	Fishing
03/25/88	?	?	30	M	No injuries	Diving for golf balls
06/04/88	3.3	M	4	F	Fatal	Walking along shore
07/15/88	2.2	F	14	M	Forearm punctures, cuts	Raft ran over alligator
07/28/88	2.0	?	?	M	Puncture and tear on foot	Playing golf
08/17/88	2.3	F	?	M	Thigh punctures, cut on face	Walking on seawall
10/03/88	?	?	30	F	Punctures on calf	Swimming
10/09/88	3.4	M	55	F	Punctures on hand	Dunking plant into water

02/27/89	0.6	?	9	F	Cut on forearm	Picked up "pet" alligator
03/07/89	?	?	10	M	Punctures on calf	Wading
03/27/89	1.0	?	41	M	Bite on thumbs	Taping alligator's mouth
04/13/89	1.0	?	14	M	Puncture on toe	Walked by alligator
05/15/89	1.0	?	56	M	Punctures on hand	Hooked alligator while fishing
06/17/89	0.8	?	?	F	Punctures on foot	Stepped on alligator
07/04/89	1.8	F	45	M	Gashes and bruises	Fishing and wading
07/25/89	2.9	M	51	M	Tears in wet suit	Diving for golf balls
08/17/89	3.0	M	82	M	Punctures on foot	Pulling weeds from bank
08/20/89	1.2	?	?	M	Cuts on hand	Drinking water from faucet
08/25/89	2.9	M	71	M	Punctures, cuts on feet	Searching grass for golf balls
09/03/89	1.7	?	32	M	Punctures on leg	Hunting
09/06/89	2.8	M	77	M	Cuts on leg	Wading, fishing
03/17/90	0.9	M	23	M	Minor punctures, cuts	Removing catfish from line
03/19/90	2.3	?	68	M	Cut on foot	Cutting grass near ditch
05/01/90	1.5	?	26	M	Cut on hand	Kneeling at water's edge
05/03/90	2.1	M	26	M	Punctures, deep cut on leg	Pulling alligator from road
05/28/90	2.1	?	43	M	Minor hand injuries	Snorkeling
06/08/90	1.4	?	41	M	Puncture on hand	Rescuing alligator in traffic
06/17/90	1.7	?	17	M	Two puncture wounds	Swimming
06/22/90	3.4	?	34	M	Five puncture wounds	Clearing shrubs
06/24/90	?	?	?	M	?	Swimming
07/06/90	2.9	?	?	M	Scrape on finger	Diving for golf balls
07/09/90	?	?	73	M	Punctures on back, bruising	Snorkeling
07/18/90	1.5	F	82	M	Cut on hand	Pulling aquatic weeds
07/20/90	0.4	?	59	F	Small scrape	Moving alligator from pool filter
08/03/90	2.4	?	23	M	Superficial scratch	Gathering clams
09/08/90	3.0	M	20	M	Punctures on arms	Skin diving
10/21/90	1.7	F	74	M	Punctures, cuts on arm	Gardening at water's edge
10/27/90	2.6	?	46	M	Minor cuts	Frogging, fishing
11/21/90	?	?	20	M	Minor cut on wrist	Diving for golf balls
01/27/91	0.6	?	27	M	Puncture on hand	Party on river bank
03/04/91	1.2	?	?	M	No injuries	Diving for golf balls
03/20/91	1.8	?	25	M	No injuries	Diving for golf balls
04/04/91	?	?	32	M	No injuries	Washing boat
05/19/91	2.0	M	29	M	Puncture wound on hand	Removing alligator from road
05/31/91	2.5	M	69	F	Bites on leg, loss of tissue	Walking
06/11/91	1.1	?	46	M	Minor cuts on thumb	Trying to catch alligator
06/14/91	0.9	?	25	M	Minor puncture on hands	Pushed alligator while swimming
06/23/91	0.8	?	54	M	Punctures, cuts on hand	Moving alligator from utility room
06/28/91	2.1	?	28	M	Deep cuts, tears on head	Swimming
07/09/91	1.2	?	29	M	Puncture wounds on ankle	Lawn maintenance
07/18/91	1.3	?	45	M	Hand punctures	Frogging, bailing boat
07/29/91	2.1	?	24	M	Severe cuts on leg, hand	Trying to catch alligator
08/14/91	2.4	M	71	M	Broken finger, shoulder cuts	Fell on sleeping alligator
08/24/91	2.4	F	24	M	Cut and bite to arm	Swimming
09/06/91	2.4	M	80	F	Lost hand	Rinsing T-shirt on shore
09/14/91	0.5	?	6	M	Cut on hand	Grabbed alligator in fish tank
05/11/92	1.4	?	20	M	Punctures, cuts on calf	Wading
06/09/92	3.0	?	32	M	Deep cut on arm	Wading after golf balls
06/12/92	0.8	?	31	M	Cuts on face	Splashing stick on water
06/23/92	2.9	?	47	M	Punctures on hands	Capturing nuisance alligators
06/24/92	1.7	M	32	M	Deep cuts, arm punctures	Swimming
07/14/92	1.2	?	14	M	Punctures and cuts	Feeding fish
08/11/92	1.5	?	31	M	Puncture on hand	Taping mouth closed
08/13/92	3.0	M	66	M	Deep cuts on leg, ankle	Wading, repairing dock
08/25/92	1.2	?	34	M	Deep cuts on arm	Hooked alligator while fishing
09/03/92	0.5	?	8	F	Puncture on finger	Playing in back yard
03/19/93	2.0	?	58	M	Cuts, bruises on chest, arm	Working on drainpipe
05/04/93	1.2	?	34	M	Scratches on hands	Cleaning yard
05/04/93	0.9	?	?	M	Punctures on finger	Removing nuisance alligator
05/10/93	2.3	?	50	M	Cuts on arm, leg	Washing hair on platform
05/14/93	1.5	?	16	M	Deep cuts, punctures on arm	Wrestling alligator
05/27/93	0.9	?	?	M	Punctures on hand	Removing alligator from pipe
06/19/93	3.5	M	10	M	Fatal	Canoeing and wading
07/04/93	2.2	M	?	M	Puncture wounds	Fishing
07/10/93	1.2	?	?	M	Punctures, tear on hand	Swimming
07/22/93	?	?	?	M	Chest punctures, cuts	Swimming
07/27/93	1.2	?	?	M	Punctures on calf	Surveying water depth
08/02/93	?	?	?	M	Punctures on calf	Working in yard

	08/05/93	2.4	?	?	M	Broken, cut arm	Swimming
	08/19/93	2.1	M	?	M	Puncture, cut on hand	Retrieving golf ball
	09/13/93	2.1	F	?	M	Minor injuries	Harvesting alligator
	10/02/93	2.9	M	70	F	Fatal	Unknown
	10/17/93	0.9	?	47	F	Punctures, cut on fingers	Feeding fish off dock
	11/24/93	1.9	M	56	M	Punctures on hand	Retrieving golf balls
	01/23/94	0.5	?	?	?	Bite on thumb	Picked up alligator in yard
	02/11/94	0.6	F	?	F	Wounds on finger	Sitting on bank
	04/13/94	3.0	M	?	M	Tearing of flesh on foot	Retrieving golf balls
	04/16/94	2.6	?	?	M	Puncture, cut on chest	Snorkeling
	04/23/94	?	?	32	M	Cut on arm	Grabbing alligator
	04/27/94	1.7	?	12	M	Superficial abrasion	Fishing
	06/19/94	1.5	?	34	M	Injury on arm	Moving alligator from road
	06/24/94	?	?	19	M	Cut on ankle	Wading
	06/25/94	3.4	M	9	M	Deep cut, puncture on leg	Jumping from a tree
	06/25/94	0.6	?	15	?	Cuts, scratches	Picking up alligator
	07/09/94	0.9	F	31	M	Small cuts	Alligator complaint
	07/15/94	1.5	?	42	M	Cuts on leg, foot	Working in water
	07/15/94	0.5	M	51	M	Punctures and cuts	Alligator education program
	07/17/94	0.6	?	20	M	Punctures, cuts on hands	Walking
	07/24/94	1.8	?	59	M	Teeth marks, cuts on hand	Retrieving golf balls
	07/28/94	2.1	M	29	M	Cut	Exhibition show
	07/29/94	1.5	?	32	M	Scratches on thigh	Raking aquatic weeds
	08/03/94	2.1	M	33	M	Punctures and cuts	Exhibition show
	08/13/94	2.4	?	61	F	Punctures on foot	Lying on inflatable raft
	09/25/94	0.8	?	22	M	Punctures on hand	Sitting on pond bank
	12/09/94	1.1	?	?	M	Bite on hand	Diving for golf balls
	04/19/95	3.0	M	7	M	Punctures on upper body	Jumped on alligator in water
	04/30/95	2.4	?	68	M	Punctures on ankle, calf	Golfing
	05/02/95	0.5	?	?	M	Cut on thumb	Grabbed alligator
	05/08/95	1.3	F	?	M	Cut on thumb	Moving alligator from road
	05/28/95	2.4	?	?	M	Punctures on thigh	Stepped on alligator
	05/29/95	1.5	?	45	M	Punctures on arm	Tried to capture alligator
	06/12/95	1.0	M	10	M	Puncture on finger	Catching minnows
	07/23/95	0.9	F	24	M	Punctures, cut on thumb	Exhibition show
	07/23/95	1.5	M	18	M	Dislocated wrist, calf wound	Wading after golf balls
	08/01/95	1.4	?	40	?	Cuts on foot	Walked up to alligator by road
	08/05/95	1.2	?	22	M	Cut on hand	Swimming
	09/01/95	1.5	?	31	M	Bite on hand	Hunting alligators
	09/02/95	1.2	?	16	M	Punctures on foot	Swimming
	09/02/95	2.0	?	26	M	Cuts on hand	Harvesting alligator
	09/04/95	1.5	?	30	M	Cut on finger	Wading after basketball
	09/10/95	2.2	F	12	?	Cut on hand	Near person feeding alligator
	09/23/95	2.5	M	10	M	Cuts, punctures on chest	Swimming
	10/05/95	2.2	?	?	F	Cut on leg	Walking at night
GA	06/04/88	3.3	M	4	F	Fatal	Walking along shore
	07/08/88	3.1	?	33	M	Deep cut on thigh	Attempting to catch alligator
	07/10/90	2.5	?	16	F	Deep cut on leg	Running along beach
	06/16/94	2.9	?	38	M	Deep cut on arm	Kneeling by pond
	09/25/94	3.3	?	29	M	Deep cut on arm	Entering water on golf course
LA	??/??/78	?	?	8	M	Unknown	Fishing/wading in a marsh
NC	No reported attacks						
SC	09/07/76	2.2	?	7	F	Cuts	Wading after golf ball
	06/07/79	2.5	?	25	M	Broken foot	Swimming
	07/??/85	2.2	?	12	F	Deep wound	Fell on gator's back
	09/??/87	1.2	?	31	F	Minor wound	Scuba diving
	06/??/90	1.2	?	?	M	Minor leg wound	Playing golf
	06/10/94	2.5	M	57	F	Deep wound	Collecting golf balls
TX	10/??/84	1.8	M	18	M	Minor leg wound	Swimming
	07/??/91	1.8	M	13	M	Minor leg wound	Swimming

*No information is available on the four alligator attacks in Alabama.

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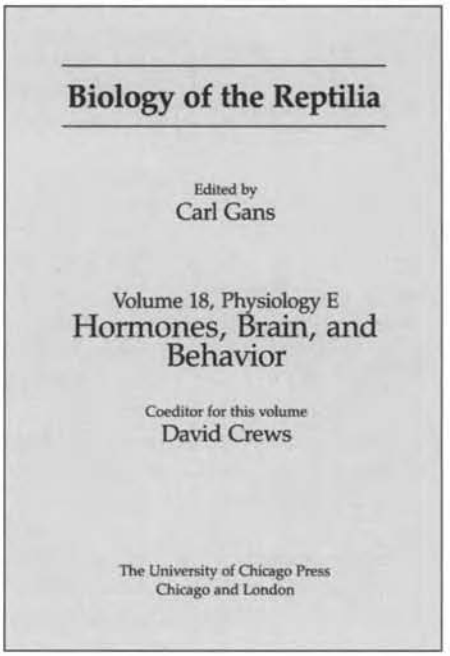
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Aggregation Behavior of the Lizard *Sceloporus mucronatus mucronatus* in Sierra del Ajusco, México

JULIO A. LEMOS-ESPINAL
Campo de Investigaciones Forestales y Agropecuarias del Distrito Federal
Av. Progeso #5, Viveros de Coyoacan, México 04110, México

ROYCE E. BALLINGER
School of Biological Sciences, University of Nebraska
Lincoln, Nebraska 68588, USA

SUSY SANOJA SARABIA
Campo de Investigaciones Forestales y Agropecuarias del Distrito Federal
Av. Progeso #5, Viveros de Coyoacan, México 04110, México

and

GEOFFREY R. SMITH*
Department of Biology, Earlham College, Richmond, Indiana 47374, USA
e-mail: smithge@earlham.edu

**Author to whom correspondence should be sent*

Some species of lizards form aggregations or groups of individuals in close physical proximity to one another (Burns 1970; Congdon et al. 1979; Cooper et al. 1985; Ruby 1977; Vitt 1974; Worthington and Sabath 1966); however, all of these aggregations were either observed in the winter or in the laboratory. In this note we describe our observations on summer aggregations of *Sceloporus mucronatus mucronatus*.

Sceloporus m. mucronatus (Cope) is a medium to large viviparous phrynosomatid lizard (Frost and Etheridge 1989) that occurs at high elevation in the Mexican states of Hidalgo, Veracruz, Puebla, and México (Smith 1936). It is abundant on rock outcrops and ledges that have numerous crevices that serve as refugia.

Our study site was located in Sierra del Ajusco, México (3400 m elevation), km 19 on the Ajusco-Tianguistence highway (México Highway 892). The site was an open area (ca. 1 ha) with basaltic rocks and lava interspersed with grassy patches (*Festuca amolissima*), and surrounded by a *Pinus hartwegii* forest. We visited the study site sporadically from 27 January 1991 to 30 May 1995. During each visit, we surveyed rock crevices for groups of lizards. For each aggregation, we recorded the number of lizards and their sex. Sex was determined definitively because males have bright blue ventral patches, whereas females have diffuse blue ventral patches. Means are given ± 1 SE.

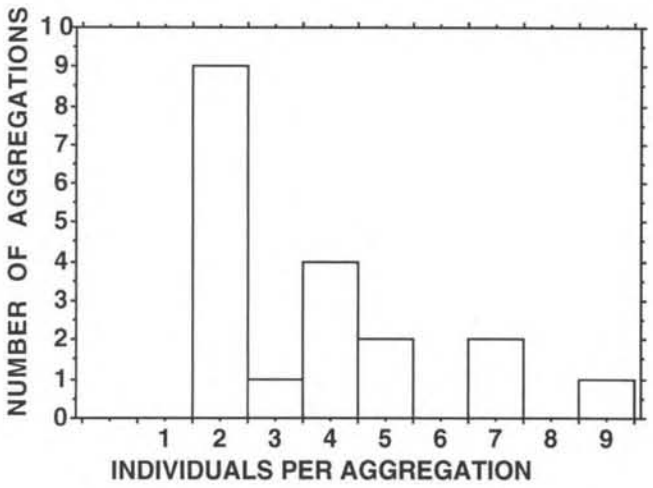


FIG. 1. The number of individuals in aggregations of *Sceloporus mucronatus* from the Sierra del Ajusco, México. Total number of aggregations is 19.

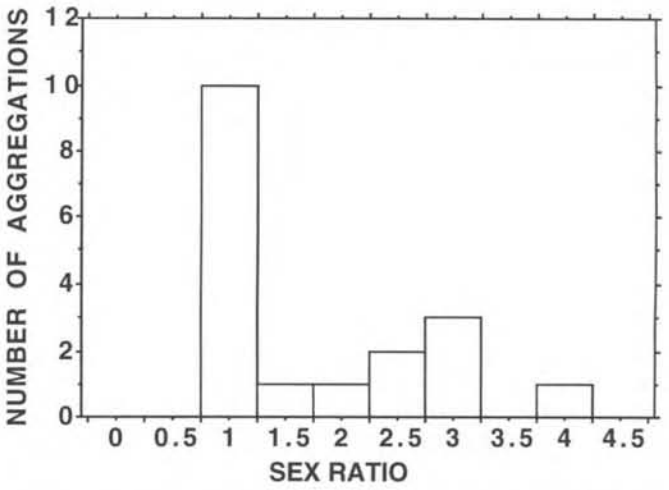


FIG. 2. The sex ratios of aggregations of *Sceloporus mucronatus* from the Sierra del Ajusco, México. The ratio is females:males. Total number of aggregations is 18.

We observed a total of 19 aggregations. Eighteen of these aggregations involved adults (individuals with SVL > 60 mm; sexual maturity occurs around 60 mm SVL; Mendez de la Cruz et al. 1988), and one was a pair of juvenile males. The number of individuals in an aggregation ranged from 2 to 9, with a mean of 3.7 ± 0.5 individuals per aggregation, with 2 being the mode (Fig. 1). The sex ratio of the aggregations ranged from 1 male: 1 female to 1 male: 4 females (Fig. 2). The mean sex ratio was 1.8 ± 0.2 females per male (N = 18). The sexes of all individuals in the 9 lizard aggregation could not be determined because all individuals could not be caught. Groups of two individuals were the mode, and these were always composed of a male and a female. Aggregations were found throughout the day from 1000 h to 1630 h. The majority of aggregations were seen on cloudy days (16), whereas three were seen on sunny days. Aggregations were seen during the summer (May–August) and in the winter (January).

At this time, we do not have the necessary information to determine the reasons for aggregation behavior in this population; however, we think two alternative, but not necessarily mutually exclusive, explanations deserve further evaluation. First, the aggregations may serve a social function or may reflect mating aggregations, suggested by the observation that all pairs were male-female pairs. Although we did not observe mating behavior, it has been reported to occur in the month of June (Mendez de la Cruz et al. 1988), and all recorded males were brightly colored, suggesting mating was taking place in the sampling period. Also, there appears to be a shift in aggregation behavior with age: older and larger individuals aggregate whereas younger and smaller individuals do not. The second explanation is that these aggregations may serve a thermoregulatory function: individuals aggregated to help maintain body temperature. There are several reports of winter aggregation in another high altitude, viviparous *Sceloporus*, *S. jarrovi* (Burns 1970; Congdon et al. 1979; Ruby 1977), and in *Urosaurus ornatus* (Vitt 1974; Worthington and Sabath 1966), all of which may be attributed to some extent to thermoregulatory considerations. The evidence for a thermoregulatory function of aggregation in *S. mucronatus* is weak compared to that for a social function. Aggregations were observed through-

out the day, and although they were primarily observed on cloudy days, aggregations also were seen on sunny days. Finally, if there was a thermoregulatory basis for aggregation one would expect to see juveniles together, but only one such grouping of juveniles was seen.

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Putative Anting Behavior in Wood Turtles

DEAN G. MCCURDY
Department of Biology, Carleton University
1125 Colonel By Drive, Ottawa, Ontario K1S 5B6, Canada
e-mail: dmccurdy@ccs.carleton.ca

and
THOMAS B. HERMAN
Centre for Wildlife and Conservation Biology
Acadia University, Wolfville, Nova Scotia B0P 1X0, Canada

"Anting behavior," the use of ants by vertebrates to remove epibionts, has been investigated primarily in birds. Despite numerous observations of this peculiar behavior (reviewed by Potter 1970), its exact function remains unclear. Suggested explanations for anting behavior include removal of ectoparasites (Groskin 1950), soothing of skin irritation caused by molting (Potter 1970), and inhibition of fungal and bacterial growth (Ehrlich et al. 1986).

Recently, observations of associations between ants and vertebrates have been expanded to include primates (Longino 1984) and reptiles, including turtles (Burke et al. 1993; Riley et al. 1985). Burke et al. (1993) found that the leech *Placobdella parasitica* was absent from snapping turtles (*Chelydra serpentina*) that had nested on mounds of the carpenter ant (*Formica obscuriventris*) in southeastern Michigan. All snapping turtles that did not visit mounds were parasitized by leeches, which commonly occur on that species (Brooks et al. 1990).

We found evidence of an association between wood turtles (*Clemmys insculpta*) and the ant *Formica* sp. (Fusca species group) during a study of movement patterns in wood turtles (McCurdy 1995) at the Saint Mary's River in Nova Scotia, Canada. Turtles were captured and radiotagged by searching the banks of the river in June, 1994. A subset of the radiotagged animals was then fitted with thread spools for trailing.

On 11 July 1994, Turtle 1 (a 20 year old male, based on plastron annuli counts; carapace length 211.5 mm; mass 1.31 kg) was thread- and radio-trailed 250 m upstream and 50 m inland to an ant mound. Here, he was found resting on top of the mound with the thread spool attached and still trailing. Ants covered the turtle for about 20 min, after which the turtle moved off the mound and walked 8 m northeast. He subsequently backtracked 6 m to the ant mound and returned to the river.

On 21 July, Turtle 2 (a 21 year old male; carapace length 209.0 mm; mass 1.05 kg) was tracked to a wooded hill northwest of the ant mound. His thread trail led directly over the same ant mound that Turtle 1 had visited. In addition, Turtle 2's trail back to the river followed the exact travel path used by Turtle 1 when the latter returned from the mound to the river. This was the only observation of two individuals using a common travel path during our study.

Ants were observed crawling over the legs, carapace and head of Turtle 1 during the observation of 11 July. While on the ant mound, Turtle 1 made no effort to rid himself of ants, consume them, or move away from the mound. Although wood turtles are opportunistic foragers, invertebrates comprise only a minor portion of their diet (Strang 1983). At the Saint Mary's site, wood turtles were observed eating a variety of food items including fungi, green leaves, fruit, and algae; however, ant-eating was never observed here or at another site in Nova Scotia (McCurdy and Herman, unpubl. data).

The ants found in the mound are from the same group involved in anting associations with birds and are thus good candidates for demonstrating a mutualism with wood turtles. Ants in the Fusca group have often been observed in anting associations with robins (*Turdus migratorius*; Nichols 1943), starlings (*Sturnus vulgaris*; Brackbill 1948), catbirds (*Dumetella carolinensis*; Brackbill 1948), wood thrushes (*Hylocichla mustelina*; Groskin 1950) and blue jays (*Cyanocitta cristata*; Potter 1970).

The function of anting behavior in wood turtles is not known, but it is instructive to compare this species with observations on snapping turtles. Ants may eat leeches from wood turtles, as suggested by Burke et al. (1993) for snapping turtles. Although leeches were not observed to be removed during the 11 July observation of Turtle 1, wood turtles at the Saint Mary's River were often parasitized by *P. parasitica*, and many individuals had more than 50 leeches at first capture. Over 90% of wood turtles in a New Jersey population captured during spring and fall carried leeches (Farrell and Graham 1991).

There are several other methods that turtles may use to remove leeches including associations with birds and fish, and basking. Map turtles (*Graptemys geographica, G. ouachitensis*, and *G. pseudogeographica*) and common grackles (*Quiscalus quiscula*) are involved in a mutualistic relationship in which *P. parasitica* are removed by the birds (Vogt 1979). Kaufmann (1991) observed wood turtles apparently cleaned by blacknose dace (*Rhinicthys atratulus*). These types of relationships were not observed during our study; however, all leech-removal associations between turtles and other vertebrates probably are isolated and difficult to observe.

Basking or drying (Boyer 1965) are unlikely to be effective in removing leeches from wood turtles, which are active at lower temperatures and spend less time basking than other turtle species (Ernst 1986; D. McCurdy, pers. obs.). As well, even though wood turtles are primarily terrestrial in summer, *P. parasitica* are able to survive long-term desiccation (Hall 1922).

Even if anting does not reduce leech loads, the behavior could benefit wood turtles in other ways. The formic acid sprayed by ants can be an effective deterrent of fungal or bacterial parasites (Ehrlich et al. 1986). The preference of wood turtles for humid microenvironments, which promote fungal and bacterial growth, provides another putative selection pressure for anting. Clearly, the relationship between wood turtles and *Formica* sp. requires further study to better understand the evolution of anting behavior in vertebrates.

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One Year Growth of Subadult *Macroclemys temminckii* in a Louisiana Bayou

J. BRENT HARREL*
Department of Biology, Northeast Louisiana University
700 University Avenue, Monroe, Louisiana 71209, USA

CHARLES M. ALLEN
Department of Biology, Northeast Louisiana University
700 University Avenue, Monroe, Louisiana 71209, USA
e-mail: biallen@alpha.nlu.edu

STEVE J. HEBERT
Game Division, Louisiana Department of Wildlife and Fisheries, P.O. Box 915, Minden, Louisiana 71058, USA

**Present Address:*
U.S. Department of Agriculture, National Wildlife Research Center
Mississippi Research Station, P.O. Drawer 6099
Mississippi State, Mississippi 39762, USA
e-mail: jbharrel@netdoor.com

No data exist concerning growth of subadult alligator snapping turtles (*Macroclemys temminckii*) in a natural environment. Growth is thought to begin in March and continue through July, but seems to slow substantially after 15 years of age (Dobie 1971). According to Drummond and Gordon (1979), captive turtles grew 1 mm in carapace length within the first 11–14 days after hatching and had increased 2.6 g in weight after the first 47–50 days. Allen and Neill (1950) reported carapace lengths of 84 mm and 90 mm and carapace widths of 75 mm for two turtles after five years in captivity. Other researchers have reported *M. temminckii* gaining 500 to 900 g per year (N. H. Douglas, pers. comm.). Although growth data can be collected from captive *M. temminckii*, this is unlikely to be representative of growth in a natural environment. Errors in conservation and management decisions may occur in the absence of accurate growth data for wild populations, particularly if growth time to sexual maturity is underestimated. *Macroclemys temminckii* is singularly important in that this species is classified as a restricted, threatened, or endangered species in most states (Ernst et al. 1994; Pritchard 1989).

We report one year growth data collected from 12 subadult *M. temminckii* in a Louisiana bayou (Harrel et al. 1996). The study site was Bayou Desiard, a slow-flowing bayou located 10 km north of Monroe, Ouachita Parish, Louisiana, USA. Turtles were captured using baited hoopnets, and measured to ensure that they were within our desired size range (Harrel et al. 1996). A 66 g radio transmitter was attached to each turtle's carapace and all were released (within 2 h) at the capture site. The 12 turtles used in the study were recaptured after one year (mean = 371 ± 1.8 days) and re-measured. The turtles were not captured at any other time, appeared healthy, and incurred no mortality. The sex of the turtles was determined laparoscopically at the conclusion of the telemetry study (Wood et al. 1983).

The following straight-line measurements were taken with a Mantax 24-inch steel (vernier) caliper to the nearest 0.1 inch: carapace length (CL) and width (CW), plastron length (PL) and width (PW), head length (HL), and pre-cloacal tail length. Carapace length was measured from the anterior portion of the nuchal to the posterior marginal edge, CW at the widest point (generally between the eighth and ninth marginals), PL along the mid-plastral seam from the anterior portion of the gular to the posterior portion of the anals, PW across the abdominals between the plastron/carapace seam, and HL from anterior to the bony premaxilla to the posterior bony portion of the supraoccipital. The pre-cloa-

TABLE 1. One year's (1992–1993) growth (cm, kg, %) for 12 subadult (3 male, 9 female) *Macroclemys temminckii* in a Louisiana Bayou.

Days of Growth	Carapace Length	Carapace Width	Plastron Length	Plastron Width	Head Length	Weight
			Males (N = 3)			
Mean 369.33	1.37 (5.3%)	1.13 (5.0%)	1.00 (5.1%)	1.63 (9.0%)	0.50 (5.5%)	0.15 (4.1%)
± SE 3.30	0.18	0.35	0.17	0.44	0.11	0.13
Range (366–376)	(1.0–1.6)	(0.6–1.8)	(0.7–1.3)	(1.1–2.5)	(0.3–0.7)	(-0.05–0.4)
			Females (N = 9)			
Mean 371.33	1.31 (5.2%)	1.13 (5.2%)	1.07 (6.0%)	1.39 (7.8%)	0.38 (4.4%)	0.38 (10.6%)
± SE 2.20	0.27	0.16	0.15	0.31	0.10	0.09
Range (365–383)	(0.1–2.6)	(0.6–2.0)	(0.5–1.8)	(0.5–3.3)	(0.0–0.8)	(0.00–0.8)

cal length (recapture only) was measured from the posterior edge of plastron to the anterior edge of the cloaca. Turtles were weighed to the nearest 0.1 lb on a Hanson 860 scale. English units were converted to metric. Three subadult males had the following mean measurements at time of capture: CL = 26.3 ± 0.23 cm; CW = 22.0 ± 0.31 cm; PL = 19.6 ± 0.30 cm; PW = 17.8 ± 0.81 cm; HL = 9.1 ± 0.00 cm; and weight = 4.2 ± 0.27 kg. The nine females had the following mean measurements at the time of capture: CL = 24.8 ± 0.48 cm; CW = 21.2 ± 0.49 cm; PL = 18.5 ± 0.35 cm; PW = 17.9 ± 0.65 cm; HL = 8.5 ± 0.21 cm; and weight = 3.7 ± 1.23 kg.

Mann-Whitney U-test showed males had significantly longer precloacal lengths (mean = 7.5 ± 0.10 cm) than did females (mean = 5.6 ± 0.08 cm), (P = 0.014, U = 27.000). The turtles' mean growth was small (Table 1). The Mann-Whitney U-test showed no significant difference in growth between male and female subadults in any measurement (P > 0.275, U ≤ 20.000).

Macroclemys temminckii is the largest North American freshwater turtle, and thus its growth rate may not be comparable to those of other turtle species. Dobie (1971) considered alligator snapping turtles to be sexually mature at carapace length = 37.0 cm for males and 33.0 cm for females. Using our one year's mean growth of 1.37 cm and a current carapace length of 27.67 cm, these male turtles would require approximatly seven more years to reach sexual maturity. Female mean carapace length is currently 26.11 cm and with a growth rate of 1.31 cm per year would require approximately five more years to reach sexual maturity. Our predictions assume a constant rate of growth. Obviously, researchers would need to follow growth over several years to test this hypothesis. Only one turtle lost weight during the study. Weight gain (or loss) may be dependent on several factors including time since last meal, time of year, time since defecation, and general quality of health. We concur with other authors that weight is not as reliable an indicator of turtle growth as shell growth (Bjorndal and Bolten 1988).

We anticipated more growth than was recorded for these subadult *M. temminckii* considering that growth was reported to slow substantially after 15 years (Dobie 1971). Our data support the concept that this species is slow growing and that it may take more than a decade to reach sexual maturity. In addition, external morphological differences (longer pre-cloacal lengths) between males and females are evident early in their ontogenetic development and may prove useful for distinguishing sexes without using laparoscopical methods. Turtles used in this study were tagged and released at their recapture location, and future recapture measurement of these turtles will be reported to determine if the growth rates have changed.

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Aggregation Behavior in Two Jordanian Snakes: *Coluber rubriceps* and *Typhlops vermicularis*

ZUHAIR S. AMR*
Department of Biology, Jordan University of Science and Technology
P.O. Box 3030, Irbid, Jordan

RATIB M. AL-ORAN
Department of Biology, Mutah University, Mutah, Jordan

and

WALID N. AL-MELHIM
Department of Biology, Jordan University of Science and Technology
P.O. Box 3030, Irbid, Jordan

** To whom correspondence should be addressed.*

Aggregation behavior in snakes has been attributed to prey abundance, communal hibernation, mating, and egg-laying (Gregory et al. 1987). Although aggregation for communal egg laying is known for several species (e.g., *Demansia psammophis* in Australia, Covacevich and Limpus 1972; *Leptotyphlops dulcis* in Kansas, Hibbard 1964), aggregation of gravid females of live-bearing species is comparatively rare (Gregory 1975; Reichenbach 1983; Rossman et al. 1996). Furthermore, in the Middle East there are no reports of aggregation behavior for any species of snake. In this note, we report aggregations of *Coluber rubriceps* (Venzmer 1919) and *Typhlops vermicularis* (Merrem 1820).

Aggregation of Coluber rubriceps.—In July 1993, the Chief of Agriculture in the Ma'an District, Jordan, brought to our attention an "outbreak" of snakes in Dlaghah village (35 km W Ma'an). Upon visiting the area (16 July 1993) we found ca. 600 newly hatched snakes and more than 200 unhatched eggs under a brick staircase leading to a four-year old house. The stairway was 2 m wide and 60 cm high, surrounded by cement pavement 1 m wide that surrounds the house. The pavement is wide, made of small rocks covered by cement, with many cracks on the sides. An irrigation canal is located at the back of the house. The house is surrounded by olive, fig, and grape trees.

Subsequently, in June 1994, another "outbreak" was reported from the same staircase in Dlaghah. About 350 gravid females were found. Only a few eggs were found clumped together. We collected a series of 35 gravid females, which were measured, weighed, and then dissected to determine number of eggs. The mean number of eggs per female was 4.8 (N = 35; SD = 1.43) and their mean weight was 1.85 g (N = 50; SD = 0.39). Mean total length of the females was 706.1 mm (N = 35; SD = 64.14), snout-vent length 510.5 mm (N = 35; SD = 46.45), with a mean weight of 37.78 g (N = 35; SD = 10.2).

Aggregation of Typhlops vermicularis.—In March 1991, a student brought 23 specimens of the blind snake, *T. vermicularis*, from Irbid, Jordan. The snakes were found under a stone in the garden of a house. Red soil (terra rosa) is the prevalent soil type in northern Jordan. No eggs were collected or seen at the site. Mean total length for the specimens is 152.6 mm (N = 23; SD = 29.4).

Discussion.—Despite several studies on the snakes of Jordan (Amr et al. 1994; Disi 1985; Disi et al. 1988; El-Oran et al. 1994), none of these reports mentioned aggregation behavior among any of the 34 snake species found in Jordan. *Coluber rubriceps* is a common species in southern Jordan, where it inhabits rocky and humid terrain. The blind snake, *Typhlops vermicularis*, is common in northern Jordan, where it prefers areas of moist soil.

The aggregations of *Coluber rubriceps* fall within the category of communal egg-laying. In the first "outbreak," newly hatched individuals were seen, while gravid females were encountered on the second occasion. This suggests that egg-laying takes place in late June–early July. Individuals of this species chose the same site for egg-laying in two successive years. Perhaps communal oviposition and female aggregation is mediated by chemical senses (Plummer 1981). Selecting the same site over a period of two years could be explained on the basis of "habitat conditioning" in which snakes use a particular site for aggregation even though alternative or similar sites are available (Burghardt 1983). Indeed, several old, ruined houses made of mud and stones are within 500 m of this particular house and seem to be suitable as a hiding place for snakes; however, after inspection of them, no snakes were found. Nest site selection is influenced by the immediate surroundings. In this study, the site is well protected, humid, and dark, with easy access for individual snakes which may be attracted by conspecific chemical cues. Covacevich and Limpus (1972) reported similar observations of nest site selection for the yellow-faced whip snake, *Demansia psammophis*. We suspect that gravid females gain an advantage against predators, in that a predator will not be able to take all individuals at the same time, thus allowing others to escape (Shine 1979). Predators of *C. rubriceps* include raptors and small carnivores such as the mongoose, *Herpestes ichneumon*.

We attribute the aggregation of *Typhlops vermicularis* to either mating or moisture conservation behavior. The latter was noted by Thomas (1965) among 19 specimens of *Typhlops richardi* found under a rotting *Cocos* log. *Typhlops vermicularis* is subterranean in dry regions and open habitats. Aggregation of several individuals may be directed by chemical cues. The time of year at which specimens were collected (March) is relatively cool and humid. This suggests that mating was the main function for blind snake aggregation on this occasion.

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Digital Webbing Formulae for Anurans: A Refinement

JAY M. SAVAGE
University of Miami, Department of Biology
P.O. Box 249118, Coral Gables, Florida 33124-0421, USA

and

W. RONALD HEYER
Division of Reptiles and Amphibians, National Museum of Natural History
Smithsonian Institution, Washington, D.C. 20560, USA

In 1967 we proposed a system of notation to describe the presence and extent of finger and toe webs in frogs and toads. The degree of webbing was expressed in terms of how many segments of the digits (phalanges), hand (distal metacarpal), or foot (distal metatarsal) are free of webbing. Myers and Duellman (1983) modified the original scheme to more accurately reflect conditions in anurans having the segment containing the terminal phalange expanded into a complex scansorial disk.

In the currently used system each finger and toe is represented by a Roman numeral and the extent of the webbing between the digits by an Arabic numeral. If the web extends to the tip of the digit, it is recorded as an O. If it extends to the base of the terminal phalange, the notation would be 1, if two phalanges are free of the web, it would be 2, etc. Since the division of the fingers and toes continues between the metacarpals and metatarsals, the webbing formula refers to the number of segments and/or fractions thereof free from the web. A typical webbing formula for a hand would be: I 2 - 2 II 2 - 3 III $2^{1}/_{2}$ 2 IV; for a foot I $1^{1}/_{2}$ - 2 II 1 - 2^{-} III 1 - $1^{1}/_{2}$ IV 2^{+} - IV. Superscripts (+ or –) indicate that the web reaches just proximal or distal to the subarticular tubercle or terminal distal joint (e.g., 2^{+} means 2 segments plus are free of the web).

Myers and Duellman (1983) used "1" to indicate that the terminal disk or entire terminal segment is free of the web. However, in many forms having digital disks, these two conditions are not identical. The situation is further complicated in those taxa having an intercalary cartilage between the distal and penultimate phalanges. For these reasons we propose that when the web, in disked forms, extends beyond the joint between the penultimate and distal phalanges toward or to the tip of the digit, it be scored as 3/4, 2/3, 1/2, 1/3, 1/4, or 0. In forms having an intercalary cartilage, we recommend that as a convention, it be considered part of the distal phalange and that the same type of notation as described above be used for formulae where the web extends beyond the 2nd phalange-intercalary cartilage joint toward or to the tip of the digit.

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Replacement Name for *Platymantis reticulatus* Brown, Brown, and Alcala, 1997 (Ranidae: Raninae)

WALTER C. BROWN
Department of Herpetology, California Academy of Sciences
Golden Gate Park, San Francisco, California 94118, USA

RAFE M. BROWN
Department of Zoology, Miami University, Oxford, Ohio 45056, USA

ANGEL C. ALCALA
Commission on Higher Education, DAP Building, San Miguel Avenue
Ortigas Center, Pasig City, Philippines

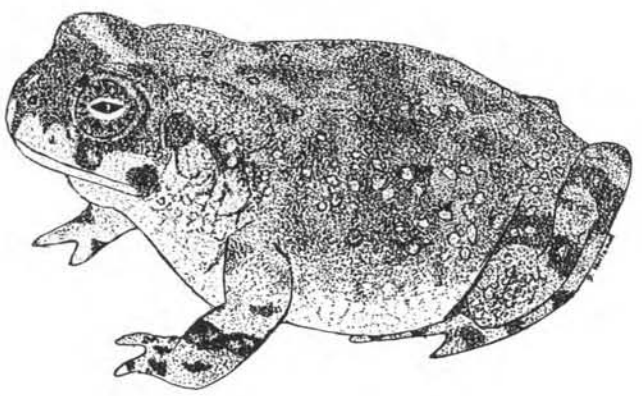
and

DARREL FROST
Department of Herpetology, American Museum of Natural History
Central Park West at 79th Street, New York, New York 10024, USA

Platymantis reticulatus Brown, Brown, and Alcala (1997:416) is a primary homonym of *Platymantis reticulatus* Zhao and Li (1984) (now *Micrixalus reticulatus* or *Ingerana reticulata*; see Zhao and Adler 1993; Dubois 1992). Under the provisions of Article 60c of the International Code of Zoological Nomenclature (Anon. 1985) we replace the name *Platymantis reticulatus* Brown, Brown, and Alcala, 1986, with *Platymantis isarog* (*nomen novum*). The species name *isarog* is a noun in apposition referring to the type locality of this species (Mt. Isarog (1200–1300 m), Camarines Peninsula, southeastern Luzon Island, Philippines).

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Bufo microscaphus californicus (Arroyo Toad). USA: California: San Diego Co., Roblar Creek. Illustration by Dan Holland.

TECHNIQUES

A Funnel Trap for Sampling Salamanders in Wetlands

DAVID M. MUSHET
e-mail: david_mushet@nbs.gov
NED H. EULISS, JR.
e-mail: ned_euliss@nbs.gov
and
BRUCE H. HANSON
Northern Prairie Science Center, 8711 37th Street Southeast
Jamestown, North Dakota 58401-7317, USA
e-mail: bruce_hanson@nbs.gov

and
SALLY G. ZODROW
College of Natural Resources, University of Wisconsin-Stevens Point
Stevens Point, Wisconsin 54481, USA

In response to our need to sample tiger salamanders (*Ambystoma tigrinum*) in diverse wetland habitats of the Prairie Pothole Region (PPR), we designed a funnel trap that overcomes many of the problems associated with other sampling methods (Berger 1984; Heyer 1976, 1979; Shaffer et al. 1994). We evaluated our trap in 17 seasonal and semi-permanent wetlands at the Cottonwood Lake Study Area (CLSA) in Stutsman County, North Dakota, USA; wetlands of the CLSA are typical of depressional wetlands found elsewhere in the PPR.

Our funnel trap has a welded rectangular frame constructed of 0.63 cm diameter steel rod covered with 0.32 cm mesh galvanized screen (Figs. 1 and 2). We constructed a 5 cm wide funnel opening that is raised 7.62 cm above trap bottom on one side of the trap, and attached a hinged mesh lid to the top of each trap. To firmly seat the trap in the substrate, we extended four steel rods 30 cm beyond the bottom of the trap; these legs can be omitted and weights may be substituted and used as anchors in wetlands with rocky substrates. An additional feature of our trap is a 200 cm drift fence that directs free-swimming salamanders to the opening of the trap. The drift fence is constructed of 0.32 cm mesh nylon, 91.4 cm wide, with the ends folded over to form end loops. We attached the drift fence to the trap by inserting a threaded steel rod through a small opening at the top of the trap and through the end loop in the drift fence. We then screwed the rod into a 0.63 cm nut welded to the bottom of the funnel opening. The opposite end of the drift fence was supported by inserting a length of 2.54 cm PVC pipe through the end loop and into the substrate. Lead weights attached to the bottom edge of the drift fence maximized contact with the substrate. Floats attached to the top of the submerged portion of the drift fence maintained its vertical orientation. Where water depths exceeded 91 cm we increased the height of the fence by adding a second length of 0.32 cm mesh nylon.

These traps have proven effective in all wetland vegetative zones and in water depths ranging from 10 cm to over 2 m. During each

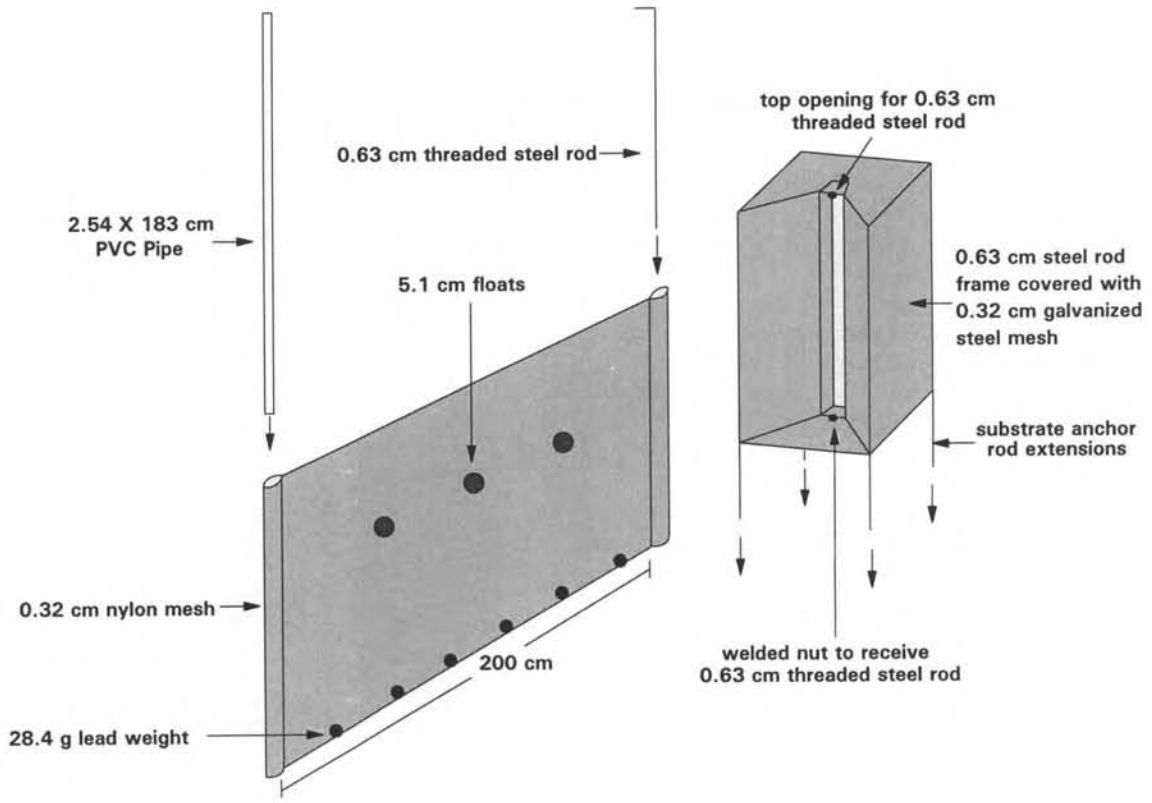


FIG. 1. A funnel trap for sampling amphibian larvae in wetlands. Overall height of trap and drift fence should be determined by the maximum depth anticipated in the wetland being sampled. The trap should be set 10 cm above the water surface to allow sampling of the entire water column while simultaneously providing oxygen to captured animals.

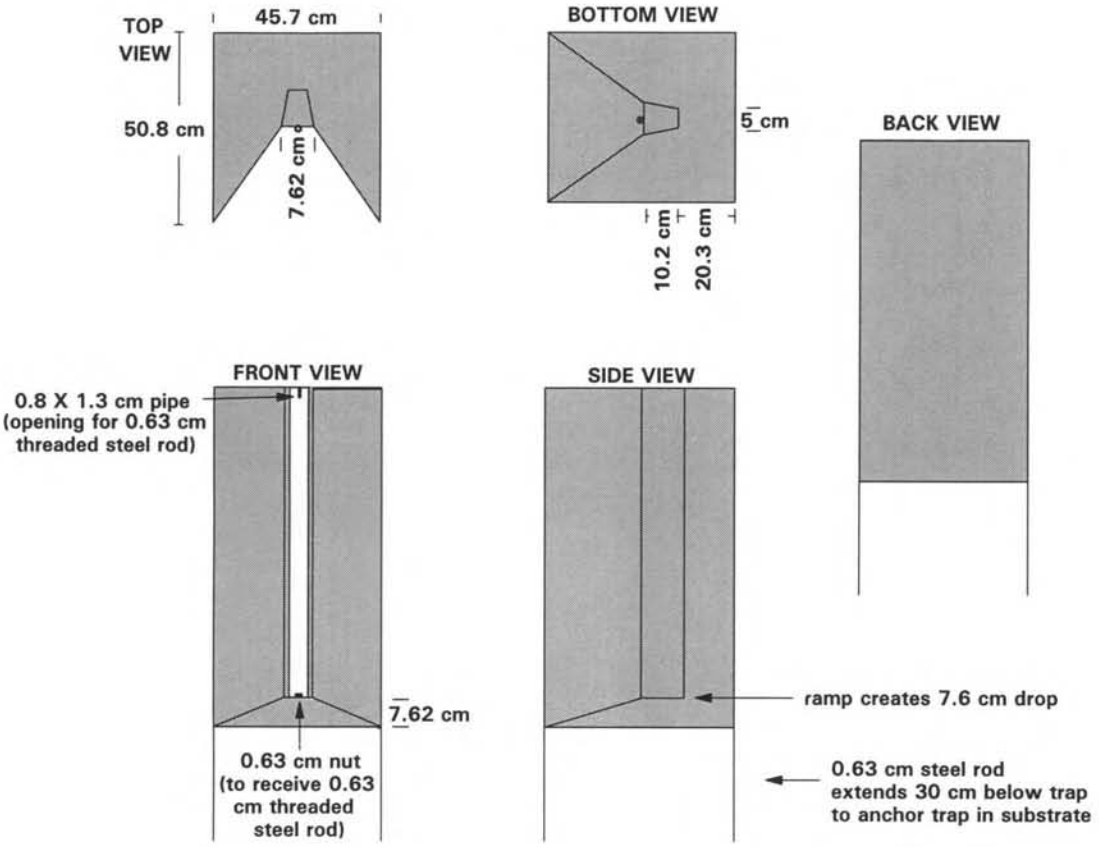


FIG. 2. Construction detail of a funnel trap designed to sample amphibian larvae in wetlands.

of three periods (18–29 July, 1–12 and 15–26 August) in 1994, and concurrent with our funnel trap sampling, we sampled five randomly selected semi-permanent wetlands with minnow traps (0.3 x 1.0 m), seines (4.0 x 1.3 m, 0.6 cm mesh), and dipnets (22.0 x 47.5 cm). Although we were able to deploy minnow traps (10 per wetland) in all five wetlands, our funnel traps (10 per wetland) captured more tiger salamanders (mean = 3.70/trap/24 h; N = 150; SD = 7.60) with less variance than the minnow traps (mean = 0.34/trap/24 h; N = 150; SD = 1.34). Seining and dipnetting were not satisfactory sampling techniques because of submergent and emergent vegetation, which severely limit the use of seines and dipnets as a quantitative tool in well-vegetated depressional wetlands of the PPR.

Our funnel traps cost ca. $45 per trap for materials; minnow traps are commercially available for $13.50 per trap. Labor to install funnel and minnow traps is similar. While the higher cost of our trap may limit its use to some extent, greater capture rate combined with the ability to sample the entire water column with reduced mortality may justify these higher costs. When sampling rare taxa our trap may detect populations other sampling techniques overlook.

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A Cage for Evaluation of *In Situ* Water Quality Using Frog Eggs and Tadpoles

MEGAN L. HARRIS

and

JAMES P. BOGART

Department of Zoology, University of Guelph
Guelph, Ontario, Canada N1G 2W1
e-mail (MLH): mharris@tox.uoguelph.ca

Evaluation of the early life history of larval amphibians occasionally has been accomplished with the use of field enclosures (Kupferberg et al. 1994; Tejedo and Reques 1994). The effect of a modified environment or of reduced water quality on embryo–larval development have become issues of concern (Vial and Saylor 1993). Several investigators have tested for compromised development by caging tadpoles in affected environments (Clark and Hall 1985; Cooke 1981; Materna et al. 1995), yet only sketchy descriptions of cage designs exist. Eggs and larvae of amphibians require specific levels of dissolved oxygen, temperature, and light intensity (Duellman and Trueb 1986), and this must be considered when designing holding cages. The following is the cage design used successfully for short-term studies of the early development of temperate ranid frogs (Harris 1996).

The cage has two components to accomodate the physiological needs of both embryos and tadpoles. The outer component is a cylinder (20 cm depth, 15 cm diameter) made from rigid 500 µm white Nitex nylon (Tetko Inc., New York) with 39% open area and 32 mesh counts/inch (Fig. 1). The cylinder is created by stitching together, with nylon thread, the overlapping ends of a 20 x 50 cm Nitex rectangle, and adding a Nitex bottom. Mesh edges are melted lightly with a soldering iron to prevent fraying, and inert silicone is placed along nylon edges to ensure that there are no pockets of material into which a swimming tadpole could enter. A removable Nitex lid is attached to the cage by stitching a 12 mm wide strip of velcro to the top of the cylinder with nylon thread and then attaching the opposite side of the velcro strip to the lid. The Nitex outer cage is strong enough to maintain its shape without buckling or folding inwards, which guarantees that a consistent volume of open, oxygenated water is available to swimming tadpoles. The inner component is a shallow kitchen strainer (5 cm depth, 10 cm diameter, plastic mesh) with the handle cut away. The lightweight plastic, coupled with a thin layer of flexible foam glued to the rim, allows the strainer to float at the water line inside the larger cylinder. Cages are anchored with the top sitting a few centimeters above the water line, and maintained by slipping 0.6 cm diameter wooden dowels through plastic rings (19 mm diameter, available in any craft/hobby store) sewn to the cage sides, and tapping the dowels into the pond bottom. Eggs separated into small clumps to avoid crowding have their protective jelly coat reduced and can no longer stay afloat; these eggs are maintained in the shallow inner basket, up in the oxygen-rich water zone at the surface until they hatch. Upon hatching, tadpoles are tipped gently into the much larger outer cage and a feeding routine initiated.

This design is considered appropriate for early life stage development studies of most temperate frog species and some salamander species. Mesh size is sufficiently small to preclude virtually all aquatic predators, but large enough to allow sufficient water movement, even with limited algal fouling. The cylindrical shape prevents entrapment in corners, and the cage size may be increased easily to accommodate extended study periods. In aquatic environments where large fluctuations in water level are common, or where there is a current, it might be useful to replace the dowel anchor system with a weighted anchor, rope, and single dowel to maintain cage position. Flotation may be achieved by attaching a strip of soft, flexible foam (like self-adhesive weather stripping) around the outside of the cage about 3/4 of the distance above cage bottom. Stitching this foam to the cage is recommended, but non-toxic glue may also work.

Consideration should be given to the natural placement of egg masses for each study species when placing cages in pond, ditch,

Fig. 1; M.L. Harris and J.P. Bogart

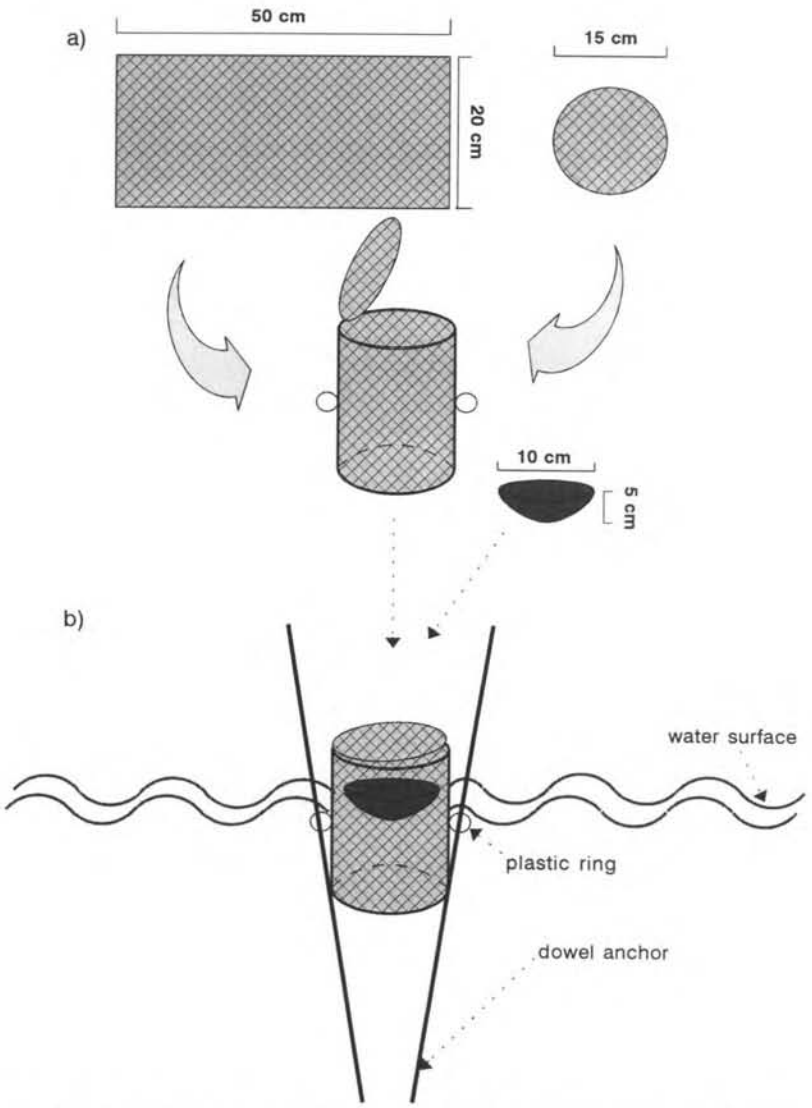


FIG. 1. Cage used to enclose frog embryos and tadpoles during *in situ* studies in pond environments (a, the two components of the cage and b, the assembled cage).

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or stream. For species that naturally receive reduced light or dissolved oxygen, the use of the inner floating basket may not be necessary. In most cases, the cages should be placed near shore, but out of the reach of wader-less people and curious animals (raccoons, dogs). The Nitex nylon should be white or pale to allow light penetration and prevent overheating.

Although there may be some temptation to skimp on materials (total cost of the described cage was US $7.38), cheaper types of screening often do not maintain the same structural integrity, and produce some mortality via entrapment of tadpoles. Metallic screening may have an associated toxicity to embryos and larvae (Harfenist et al. 1989).

The eggs and tadpoles of northern leopard frogs (*Rana pipiens*) and green frogs (*Rana clamitans*) were maintained in these cages in small permanent ponds in Ontario, Canada, and survival, deformity, and growth responses of the two species were evaluated in differing water quality for two or three weeks (Harris 1996). Studies were initiated once fertilized eggs reached Gosner Stage 8 (1960; late cleavage) and continued until tadpoles developed to Stage 25 (complete development of spiracle), at least two weeks. Survival in cages held in reference ponds was typically 90–100%. Occasionally, however, survival fell to 60–87%. In such cases, initial fertilization success was very poor (<70%), and the poor survival was attributed to the eggs being of inferior quality. With densities of ten individuals per cage, the developmental complications generally triggered by crowding (Rose 1960) were not witnessed. Habitability of aquatic sites to early life stages of amphibians may be assessed using this controlled cage environment.

Acknowledgments.—We thank Leslie Rye for the use of her sewing machine and for assistance in cage construction, Andrew Magloire, Jim McLister, and Lisa Peters for providing valuable assistance in completing the cages, and Christine Bishop and Mike van den Heuvel for reviewing this manuscript. Thanks also to Christine for providing an earlier prototype, and sharing the limitations of that design with us; her recommendations were considered in our cage design. This work was funded by an NSERC operating grant, and by a World Wildlife Toxicology Fund grant.

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Efficacy of Capture Methods for a Low Density Population of *Phrynosoma cornutum*

W. SCOTT FAIR
and
SCOTT E. HENKE
Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville
Box 218, Kingsville, Texas 78363, USA
e-mail (SEH): Kfseh00@tamuk.edu

Studies concerning *Phrynosoma cornutum* note that specimens are handled, but often neglect to describe the method of capture (Jameson and Flury 1949; Milstead et al. 1950; Munger 1984a, b, c; Sherbrooke 1990). Several researchers mention that incidental sighting and capture by hand was their collection method (Ballinger 1974; Donaldson et al. 1994; Whitford and Bryant 1979). Discussion of capture methods might be unimportant in areas with scant vegetation and relatively high lizard abundance, but areas with greater vegetation cover and lower densities of lizards could require extensive search time. Reptiles have been captured with direct search methods such as road cruising and systematic searches and trapping methods such as pitfall traps and funnel traps (Jones 1986); however, to our knowledge, no assessment of capture methods has been conducted for horned lizards. This study examines the efficacy of these collection methods for a low density population of *P. cornutum* and discusses the advantages and limitations of each method.

The study was conducted from March–October 1994 on the Marvin and Marie Bomer Wildlife Management Area (BWMA), an experimental wildlife management area operated by the Department of Animal and Wildlife Sciences of Texas A&M University-Kingsville, and on the adjoining Pena Ranch. The study area consisted of 58.4 ha of mixed mesquite (*Prosopis glandulosa*) shrubland and prairie grassland located 19.3 km south of Benavides in Duval County, Texas, USA.

Collection methods of *P. cornutum* included pitfall traps, funnel traps, road cruising, and systematic searches. Total capture time (man-hours) for each method was recorded monthly from April–October on ten 1-ha study plots.

A modified trap array (Jones 1986) was used for pitfall and funnel trapping. Three arrays were placed randomly in each of the 10 study plots. Each array contained three 7.6 m by 0.45 m drift fences and four 18.9 L buckets. Drift fences within each array were placed at approximately 120° angles. Buckets were located at the end of drift fences and the three fences converged on a central bucket. Buckets were buried with the top of the bucket flush with the soil surface. The drift fencing was buried 15 cm and vertically supported with wooden stakes. Ends of the drift fencing overlapped the buckets by 5 cm. A 30 cm path was cleared on each side of the drift fencing to exclude any obstructions for the lizards as they travelled along the fencing. Buckets had an elevated cover and contained approximately 3 cm of sandy soil. Buckets were sealed with lids when not in use.

Six funnel traps were placed randomly on the three arrays within a study plot each month. Traps were placed at the center of an array wing. A funnel trap consisted of hardware cloth (bright aluminum replacement screening, 1 mm mesh) rolled to form a 91

cm long and 18 cm diameter cylinder and stapled closed at one end. The open end was fitted with an inverted funnel made of hardware cloth and the two pieces were stapled together (Jones 1986). The funnel contained a 5 cm diameter oval opening. Funnel traps were covered with plywood measuring approximately 30.5 x 30.5 x 0.6 cm to shade captured animals from direct sunlight. Funnel traps were collected when not in use.

Pitfall and funnel trappings were conducted for five consecutive days each month from April to October. The traps remained open 24 h and were checked once a day between 0730 and 1000 h. Captured lizards were recorded and captures per unit effort were computed. Trapping effort was calculated as the hours *P. cornutum* were active each day multiplied by the number of trapping days. Active times for lizards were determined from tracking horned lizards with radiotelemetry in a concurrent study (Fair 1995).

Systematic searches were conducted twice per month from April to October on each of the 10 study plots. Searches were conducted by groups of 14–19 people walking in an evenly spaced line through the study plots looking for *P. cornutum*. Total lizard captures and total man-hours consumed were recorded for each study plot.

Road cruising consisted of one observer driving a truck around the perimeter of the study plots at 16 kph looking for *P. cornutum*. The number of *P. cornutum* sighted and captured within each study plot and on associated roads during each month and the total search time for each study plot during each month was recorded.

TABLE 1. Number of *P. cornutum* collected monthly, total effort (h), and total captures per effort hour for four capture methods on the Bomer Wildlife Management Area in Duval County, Texas, during 1994.

Month	Pitfall Traps	Funnel Traps	Systematic Searches	Road Cruising	Total Captures by Month
Apr	2	0	1	0	3
May	1	1	1	0	3
Jun	1	0	3	1	5
Jul	3	3	3	0	9
Aug	0	0	0	0	0
Sep	0	1	4	1	6
Oct	0	0	0	0	0
Total captures by method	7	5	12	2	26
Total effort (h)	470.00	470.00	223.81	3.89	1167.70
Total captures per unit effort	0.015	0.011	0.054	0.526	0.022

The distribution of captures per unit effort was tested to verify normality with the Shapiro-Wilk test (PROC UNIVARIATE procedure, SAS Inst. Inc. 1989). A completely randomized 1-way analysis of variance (PROC GLM procedure, SAS Inst. Inc. 1989) was used to test the effect of capture methods on lizard captures per effort hour. A priori orthogonal contrasts were used to test for differences between trap types (funnel vs. pitfall), search types (systematic searches vs. road cruising), and capture methods (trapping vs. searching). Sex ratios were analyzed by chi-square analysis to determine if they deviated from a 1:1 relationship for the capture methods. Juvenile:adult ratios for each capture method were analyzed by chi-square analysis to determine if they deviated from the observed ratio for all methods. Lizards were considered adults at snout–vent lengths ≥ 68 mm (Ballinger 1974). Yates correction for continuity was used in the chi-square analyses because the test criteria had a single degree of freedom. All tests were considered significant at the 0.05 alpha level.

Twenty-six *P. cornutum* (16 adults, 10 juveniles; 11 M, 11F) were caught using the four capture methods (Table 1). Four hatchlings were not sexed. July was the most successful month, resulting in nine captures from all the methods. July also was the most successful collecting month for pitfall and funnel trapping, each yielding three captures. Systematic searches captured four lizards in September, and three lizards in both June and July. However, no difference in the captures per unit effort was found ($F = 0.85$; df = 3, 24; MSE = 60.15; $P = 0.4799$) between the four capture methods (Table 1).

Pitfall and funnel trapping required the same effort and yielded seven and five *P. cornutum* captures, respectively. A priori contrasts yielded no difference ($P = 0.6745$) between the trap types. However, a trend was observed ($P = 0.0753$) between the search types. Road cruising yielded a higher mean of captures per effort hour than systematic searches. A trend also was noted ($P < 0.0913$) between the capture methods. Searching methods resulted in a higher mean rate of captures per effort hour than trapping methods.

Sex ratios did not deviate from a 1:1 relationship for pitfall trapping (3 M; 2 F; $c^2 = 0.000$; df = 1; $P = 1.0000$), funnel trapping (2 M; 2 F; $c^2 = 0.250$; df = 1; $P = 0.6452$), systematic searching (6 M; 5 F; $c^2 = 0.000$; df = 1; $P = 1.0000$), road cruising (0 M; 2 F; $c^2 = 0.500$; df = 1; $P = 0.4681$), or all capture methods combined (11 M; 11 F; $c^2 = 0.045$; df = 1; $P = 0.8793$). The juvenile:adult ratio of captured *P. cornutum* did not differ from the overall ratio of 1:1.6 for pitfall trapping (2 juveniles; 5 adults; $c^2 = 0.024$; df = 1; $P = 0.8941$), systematic searching (3 juveniles; 9 adults; $c^2 = 0.426$; df = 1; $P = 0.5204$), road cruising (1 juvenile; 1 adult; $c^2 = 0.188$; df = 1; $P = 0.7234$), or funnel trapping (4 juveniles; 1 adult; $c^2 = 2.173$; df = 1; $P = 0.1293$).

The two trapping methods and road cruising did not yield recaptured *P. cornutum*; however, systematic searches resulted in seven recaptured lizards. These recaptured lizards were initially caught by pitfall trap (N = 1), systematic search (N = 1), and random capture (N = 4). One lizard was recaptured twice during systematic searches.

Mortality of *P. cornutum* was not observed for pitfall and funnel trappings and systematic searches. Four *P. cornutum* were recovered dead from the dirt roads on the research area. Even though it was obvious these lizards were killed by vehicles, road cruising searches could not be determined as the cause of death. There was no mortality of *P. cornutum* during the time from capture to release for any method.

Search methods provided more captures per unit effort than trapping methods and road cruising provided more captures per

unit effort than systematic searches. Even though there was an order of magnitude difference in captures per unit effort between road cruising and funnel trapping, the monthly variation in capture rates caused there to be no significant differences in captures per unit effort when all capture methods were compared. Few studies report capturing horned lizards in pitfall traps and we found no studies where *P. cornutum* were captured in funnel traps. Rice et al. (1994) did not capture *P. cornutum* in pitfall or funnel traps in 19 days of trapping, but did capture *P. cornutum* in their study area by random searches. Parker (1971) captured 10 of 50 *P. solare* in pitfall traps over two years. Milstead (1959) collected 12 *P. modestum* with funnel traps in 18 days of trapping. Anecdotal information indicates horned lizards may have an aversion to pitfall traps. *P. cornutum* have been observed to approach drift fencing, turn 180° and move away from the fencing, rather than turn 90° and follow the fencing to the pitfall trap (M. Montemayor, pers. comm.).

The large number of recaptures in the systematic searches was surprising, while the lack of recaptures in the other three capture methods was not. In another Texas study conducted over several years, the researchers have captured in excess of 800 *P. cornutum* with a recapture rate of < 5% on initial recaptures and < 1% on subsequent recaptures (M. Montemayor, pers. com.). Six of the seven recaptures in this study occurred in the study plots which were grazed by livestock. These plots were free from tall herbaceous vegetation due to heavy grazing, thus making it easier to locate the lizards.

Each of the assessed capture methods has positive and negative aspects. Pitfall and funnel trapping require only one person to operate, do not require active monitoring, and can be permanent structures (funnel traps can be moved daily if needed). However, these methods are costly to set up in both time and money. Current prices (1996) for aluminum flashing (used as drift fences in the pitfall arrays) and hardware cloth (used in the construction of funnel traps) are US $15.50 per 7.6 m by 45 cm roll and approximately $2 per trap, respectively. Additionally, pitfall traps require frequent maintenance to keep paths around the drift fences clear of vegetation and debris, and to repair erosion around the buckets and flashing. Several instances occurred when funnel traps required mending because captured rodents chewed holes through the hardware cloth.

In contrast, road cruising and systematic searches required no setup time and were time efficient (a large area was covered in a short amount of time). Road cruising requires only one person to conduct; however, this method requires many secondary roads to yield sufficient numbers of lizards and these roads need to be maintained free of tall grass and ground litter to increase the probability of observing lizards. Also, road cruising is a potential source of mortality for *P. cornutum*. If an estimate of population size is required, then systematic searches should be conducted. Most population estimation methods require mark-recapture data (Krebs 1989), and the systematic search was the only method assessed which provided this type of information. This method can be costly if searchers are paid; therefore, volunteer searchers (e.g., Boy Scout troops, local conservation groups, etc.) are recommended. However, observer bias can be great if some searchers look for lizards more thoroughly than others. Also, if an estimate of relative density is required, it would be best to maintain the same searchers for each area to minimize observer bias.

The capture methods were analyzed in terms of captures per effort, but often effort is not the limiting factor in a study. Financial constraints are more commonly the limiting factor and this study did not include this component in the analysis. All four capture methods can be economically consuming. However, if *P. cornutum* are required in a short period of time, the following recommendations are offered. If secondary roads are abundant on the area of interest, then road cruising is recommended to yield the best capture rate per unit effort. If the area of interest has few secondary roads but searchers can be obtained, then systematic searches may prove to be the most productive method of capture. If secondary roads and number of searchers are limiting factors, then a trapping method is the best option; funnel traps are less expensive per unit. Researchers need to determine which factors are limiting, and then choose the capture method best suited for their available resources.

Acknowledgments.—We thank the many volunteers who helped in the systematic searches. The Wildlife Preservation Trust International, Inc., Houston Livestock Show and Rodeo, and Caesar Kleberg Wildlife Research Institute all graciously provided financial support. Texas Tech University provided materials for the project.

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A Camera Device for Recording Vertebrate Activity

CRAIG GUYER
Department of Zoology and Wildlife Science
Auburn University, Auburn, Alabama 36849, USA
e-mail: cguyer@ag.auburn.edu

CHARLES T. MEADOWS
STEVEN C. TOWNSEND
and
L. GLEN WILSON
Research Instrumentation, Alabama Agricultural Experiment Station
Auburn University, Auburn, Alabama 36849, USA

Basic data on vertebrate activity are difficult to obtain for many species in quantities sufficient for documenting patterns. To alleviate this problem, we designed a camera device to record the time, day, and identity of every vertebrate entering or exiting a gopher tortoise (*Gopherus polyphemus*) burrow. The apparatus may be modified for use with other vertebrates.

For a camera, we use a Canon™ Sure Shot Max/Date with a modified shutter release. Removing the plastic button (with hemostats) exposes four contacts; separate 30 gauge wires are soldered to three of these contacts at the points shown in Fig. 1. Each wire exits, and is cut 1" beyond, the hole left by the shutter release button, and remaining space is filled with hot glue to protect the soldered connection and immobilize the wire. Wires attached to points 1 and 2 (Fig. 1) are twisted together and soldered to an 18 gauge wire, the wire attached to point 3 is soldered to another 18 gauge wire, soldered connections are protected with shrink wrap, and the two wires are cut to a length of ca. 6". The carrying strap is removed from the camera and both wires are immobilized against the strap hole with a plastic bundle holder. Terminal ends of the wires are then attached to the female end of a two-pole quick connect; this latter arrangement reduces strain on the solder joint when the camera is connected to, or disconnected from, other components.

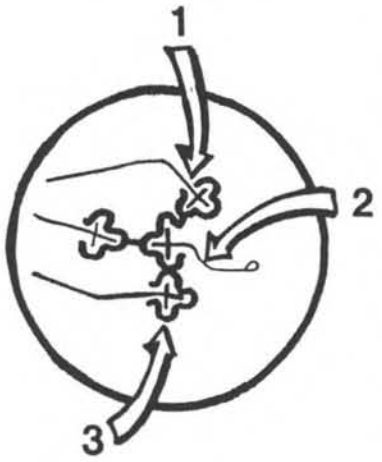


FIG. 1. Schematic of circuit board in camera used to trigger the shutter. Numbered arrows show points where 30 gauge wire is soldered to link camera shutter to timer box.

The base of the pressure switch (Fig. 2) consists of 10" diameter PVC pipe cut into 3" x 8" rectangles. A 1/8" hole, started on the convex side and countersunk through half the thickness of the PVC, is drilled at each end and a piece of masking tape is placed across the convex side of one end; this covers the terminal 1" of the base. The top (convex side) of the base is painted with EMI-RFI shield paint (available from specialty electronics shops). After drying, the masking tape is removed, conical metal inserts are placed in the countersunk holes, a 1/8" bolt is placed through each hole from the top, and one lead from a 4' length of 18 gauge, two-lead, stranded wire is attached to each bolt and bolted from below. A "sensitive area" is established by placing 1/8" wide strips of zip-a-line in the shape of a rectangle (excluding both bolts, and leaving a 1/4" wide border) on the upper surface of the base (Fig. 2A). Then four strips of 1/16" wide zip-a-line are placed within this rectangular area at ca. 1/8" intervals (Fig. 2A).

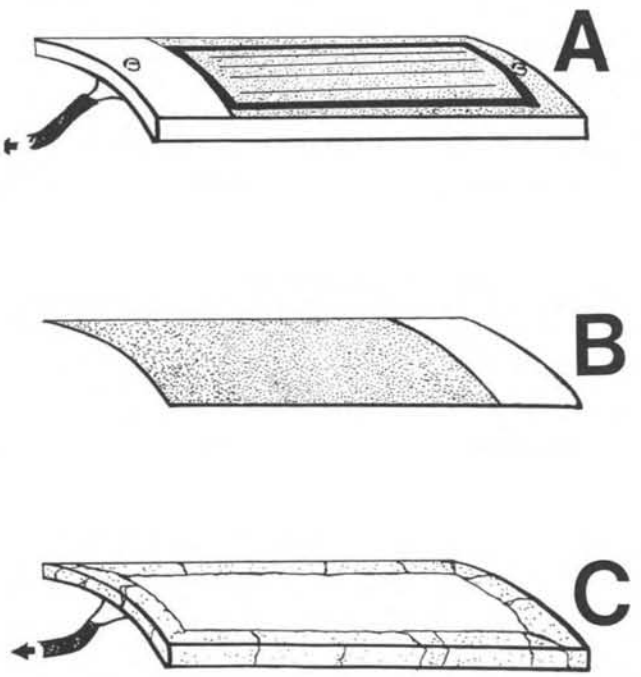


FIG. 2. Schematic of pressure switch. A) Base of switch (PVC); lead wires from timer box are bolted to the bottom at each end of the base. B) Top of switch (plastic transparency film) showing painted (bottom) side. C) Complete switch showing top attached to base with duct tape.

The top of the pressure switch, a 3" x 8" piece of clear plastic (we use 3M™ transparency film), is masked across one end and then spray painted with the EMI-RFI shield paint (Fig. 2B). A small bead of silicone sealant is then placed along the outer edge of the upper surface of the PVC (outside the "sensitive area"), and the top is added (painted side to zip-a-line side) so that its unpainted end overlaps the painted end of the base. The edge of the top is then secured to the PVC with duct tape (Fig. 2C). Within the pressure switch, the central painted portion of the plastic top avoids contact with the painted central portion of the PVC because of the zip-a-line. Any organism heavy enough to deflect the top so that the shield paint contacts the painted portion of the base completes a circuit that triggers the timer box.

Timer box circuitry (Fig. 3) is placed inside a protective metal box, the outside of which is shown (Fig. 4). Three wires enter the box, one from the pressure switch [hardwired; the lead wire from the switch must pass through a hole in the protective tub (see below)], one from the male end of a quick release (also hardwired; allows the camera to be detached from the timer box), and a third one to connect the timer circuitry to a 12 volt battery. The face of the timer box (Fig. 4) has three toggle switches, a test light, and a rheostat control. The toggles turn power on or off, send signals from the pressure switch to a test light or camera, and engage or disengage a variable delay set by the rheostat; if the rheostat is not engaged, a six second delay between successful triggerings of the pressure switch is effected. This minimum delay reflects the ability of the camera to recharge the flash and auto focus after each exposure. The rheostat, however, allows a variable delay

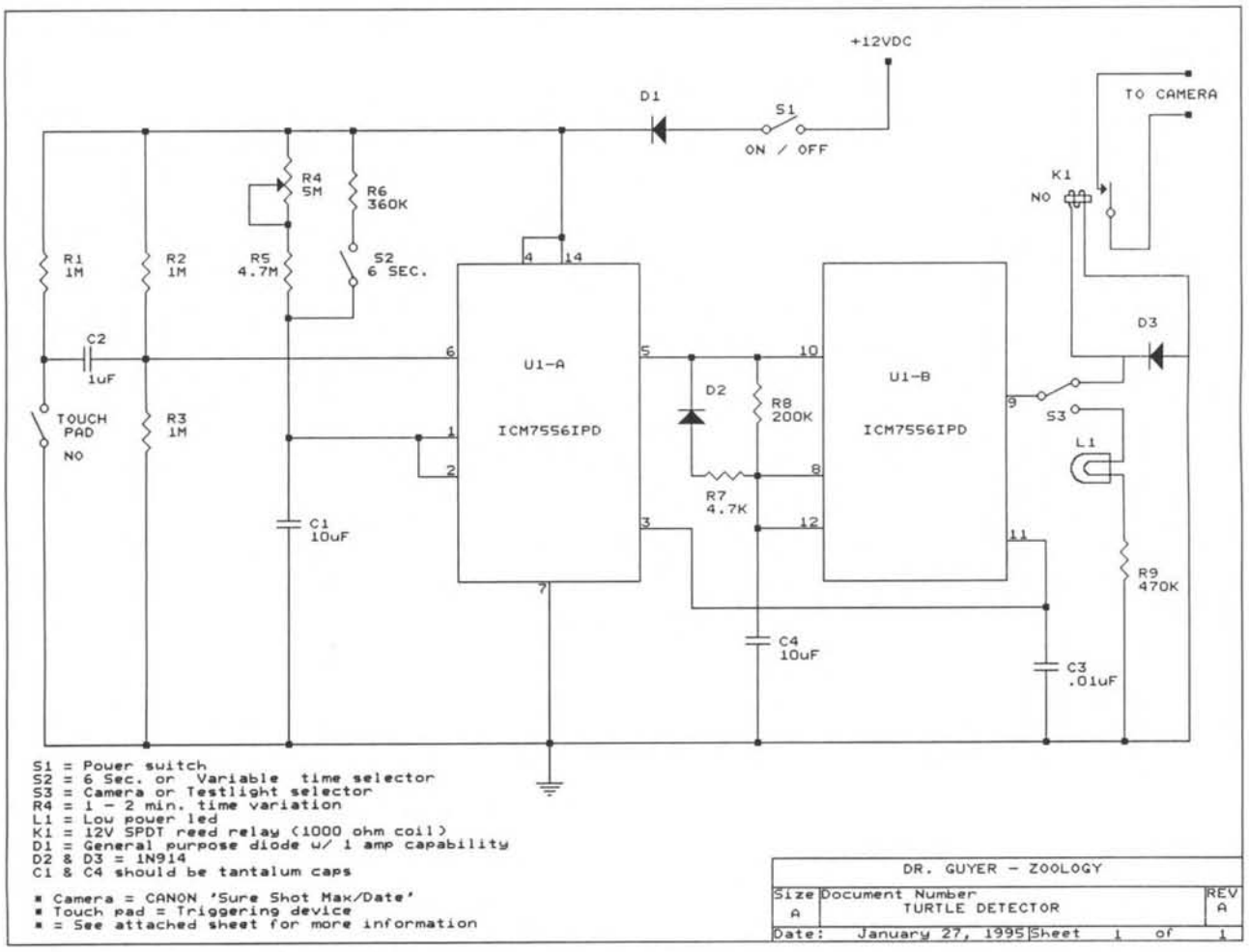


FIG. 3. Schematic of timer box circuitry. S1, S2, and S3 are switches (normally open) located on the front of the timer box (Fig. 4). R1, R2, R3, R5, R6, R7, R8, and R9 are resistors; R4 is a 1–2 min rheostat control. D1 is a general purpose diode with 1 amp capability and D2 and D3 are 1N914 diodes. C1, C2, C3, and C4 are capacitors (C1 and C4 are tantalum caps). K1 is a 12 V SPDT reed relay (1000 ohm coil). L1 is a low power LED. U1A and U1B are components to an integrated circuit timer.

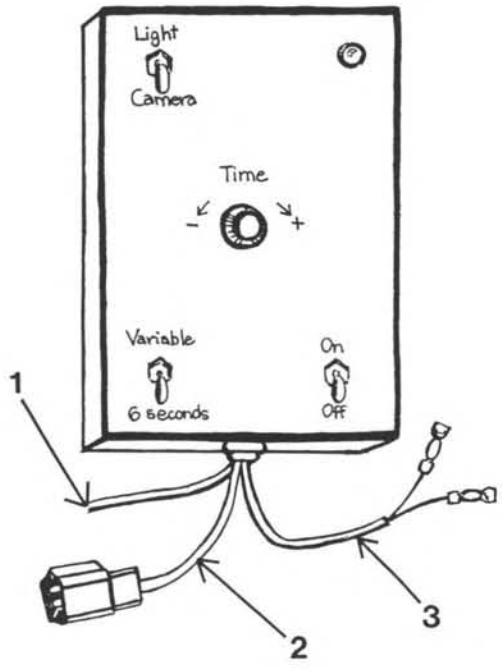


FIG. 4. Arrangement of control switches on timer box.

between camera shots; our current model can be adjusted between one and two minutes.

The timer box and pressure switch require a 12 volt, 1.2 amp·hr battery (we use Power Sonic™ model PS-1212); batteries last 1–2 weeks between rechargings. The camera's clock is run by a 3 volt lithium watch battery (CR 2025) that is expected to last ca. 3 years, and the flash and autofocus are run by a 3 volt lithium battery (CR 123 A/DL 123A) that is advertised to last through ca. 400 exposures (at 50% flash). For the latter, however, we find it necessary to check the charge every 1–2 weeks; batteries run down rapidly in the field.

To keep the camera free of dust and moisture, we use a plastic tub (Rubbermaid™ 3 quart, rectangular) with a tight fitting lid (Fig. 5A). On one side of the tub, we cut an opening following the outline of the camera (Fig. 5B) and cover this opening with plastic window material or plexiglass cut to size and fixed to the outside of the tub with silicone sealer. The side of the tub that now faces up becomes the top of the device in the field; a steel rod cut to ca. 2 ft. in length is now attached to the tub with two U-bolts that must pass through holes drilled through the top. Nuts are tightened on the bolts from inside the tub and the rod is positioned so that it passes beyond the tub for a distance of at least 1 ft. (Fig. 5A). We then attach a right-angle clamp to the rod so that it can be secured to a ring stand in the field. A 1/8" hole is drilled into the bottom of the tub, through which the wire from the pres-

sure switch passes (Fig. 5B) on its way to the timer box (Fig. 4).

Strips of styrofoam cut and glued to the inside of the tub hold the camera in place. The camera must be switched to auto flash, and the lens shutter opened, when placed in the field; to avoid draining the 3 volt battery, the camera lens shutter should be closed when the camera is not in use. The 12 volt battery is connected to the timer box and placed behind the camera (this also helps maintain the camera in position). The timer box then is switched to the desired settings and placed into the tub. Before the lid is placed on the tub, a small paper envelope with Drierite is added to control moisture.

The camera device is positioned by placing a ring stand behind a burrow entrance and clamping the protective tub to the stand. A single pressure switch is placed so that burrow occupants must cross it; switches can be linked with parallel circuitry so that the area covered is suitable for large burrows, or the size of the base can be modified.

Our camera device cost ca. US $175, which makes it comparable in price to a radio transmitter (assuming no labor costs). In field settings, the camera can document activity patterns, as can telemetry. We have used both technologies in studying gopher tortoises and feel that the camera method has the advantage of greater precision in that the length of time that an animal is in or out of a burrow can be measured. Comparable precision with telemetry gear requires relatively expensive data loggers and antennae. In addition, all animals entering a burrow, not just those with radios, can be assessed with the cameras. Additionally, if 10–15 cameras are available (the number of radios used in a typical telemetry project) they can be arranged at neighboring active burrows to determine the potential for social interaction. The primary disadvantage of the camera method is triggering of the pressure switch during rain storms. Associated with this is a greater cost in the film and film processing necessary to assess activity.

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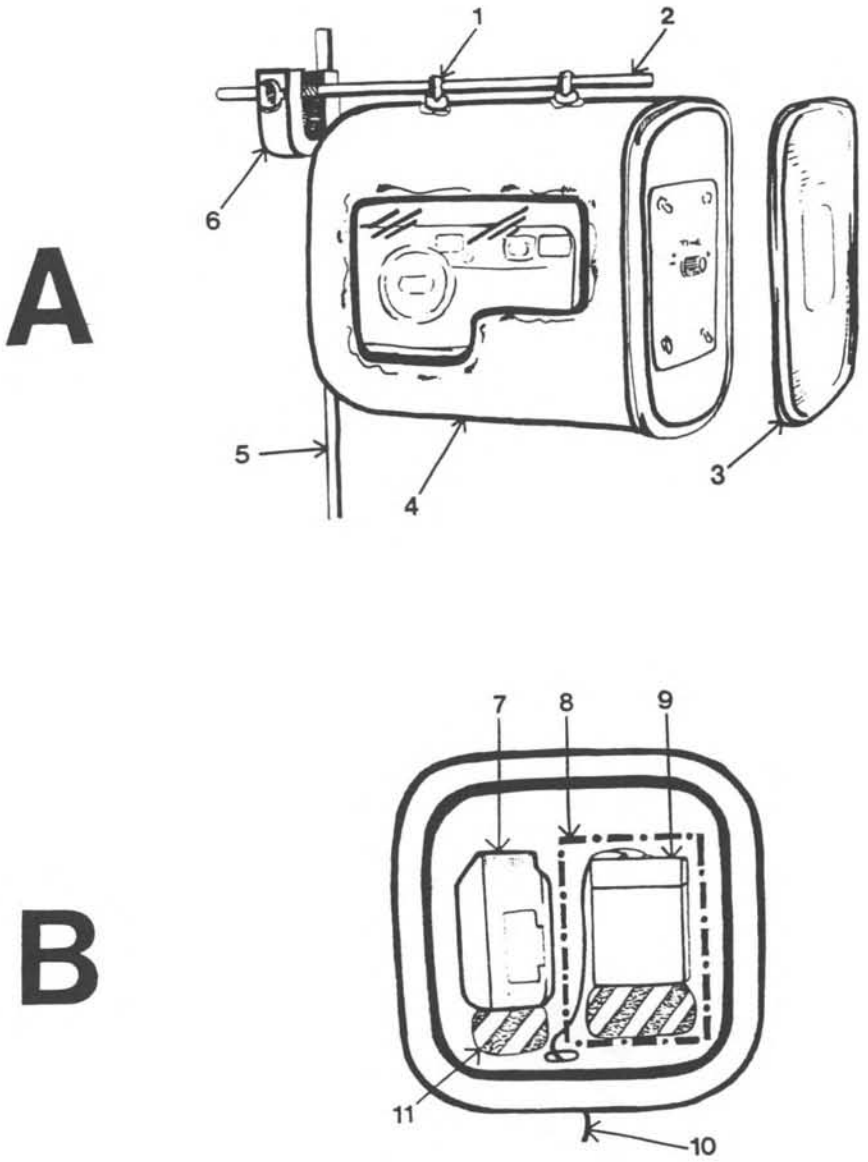


FIG. 5. Positions of camera, battery, and timer box in a protective case. A) Front view of protective case. Numbered parts are U-bolts (1), steel attachment rod (2), lid (3), plastic protective case (4), ring stand upright (5), and right-angle clamp (6); the camera and timer box are shown inside the case. B) Side view of protective case showing location of camera (7), timer box (outline only, 8), battery (9), lead from the pressure switch to the timer box (10), and styrofoam support (11).

HERPETOLOGICAL HUSBANDRY

Captive Breeding of *Eleutherodactylus antillensis* (Anura: Leptodactylidae) from Puerto Rico with Notes on Behavior in Captivity

SCOTT F. MICHAEL
Department of Microbiology, 620 LHRB
University of Alabama at Birmingham, Birmingham, Alabama 35294, USA
e-mail: scottm@uab.edu

Frogs of the genus *Eleutherodactylus* form a species-diverse and ecologically dominant element in many neotropical anuran communities. Due to its enormous size, this genus provides an excellent opportunity for investigations into the mechanisms of adaptive radiation and sympatric evolution. However, little is known of the life-histories of the majority of the 500-plus described species. Life history studies have been hindered by the fact that the majority of *Eleutherodactylus* species are nocturnal, cryptically colored, and wary. In addition, most are territorial breeders, with individuals often widely distributed throughout their habitat. As a tool for study of the basic ecology of these frogs, methods have been developed to breed certain species in captivity (Michael 1995). Here, observations of the captive reproductive behavior of another species, *Eleutherodactylus antillensis*, are reported.

Eleutherodactylus antillensis is a small to medium sized species (adult SVL 30–36 mm) occurring nearly island-wide in Puerto Rico (except for high elevations) and on several of the Virgin Islands (Rivero 1978; Schwartz and Henderson 1991). One female (49 mm SVL) and five male (33–36 mm SVL) frogs were collected from shrubs and low plants from roadsides and other open areas along Route 186, near El Verde field station (350 m elevation) in the Luquillo Mountains of Puerto Rico. These specimens are somewhat larger than the sizes previously reported for this species, and may reflect a difference in size in populations from different sites.

In captivity, frogs were housed in 10-gallon, glass aquaria (51 cm [length] x 26 cm [width] x 32 cm [height]) with regulated moisture, heat (25–27°C during the day, 21–23°C during the night), and light (12 h photoperiod), as previously described (Michael 1995). Retreat sites were provided by the inclusion of potted bromeliads (*Guzmania* and *Vriesea* sp.) and 1–4 cm deep piles of moist peat moss on a substrate of pebbles. Whenever possible frogs were fed a variety of moths attracted to outdoor lights, various spiders, grasshoppers, termites, and other insects captured locally in Alabama. During the winters, the diet consisted almost entirely of crickets (*Acheta domesticus*), house flies (*Musca domestica*), and fruit flies (*Drosophila melanogaster*).

For investigation of breeding behavior, a single male was generally housed with the female. The other males were housed together in other tanks. In captivity, males produced typical vocalizations, consisting of both the rapidly repeated two-note advertisement call as well as a call consisting of a series of short clicks (Drewry and Rand 1983). This second call has been shown recently to have an aggressive function (Ovaska and Caldbeck 1997a). Typically, the male housed with the female was more vocal than other males. The female was not heard to vocalize on any occasion. This is in contrast to females of the closely related species *E. coqui* and *E. cochranae* which both utilize aggressive vocalizations (Michael 1997; Stewart and Rand 1991, 1992).

Each of three males was used separately for breeding. Inclusion of more than one male with the female resulted in mating interference behaviors which precluded successful breeding. Separately, each courted and successfully mated with the female. Courtship usually took place during the early evening, similar to *E. coqui* and *E. cochranae* (Michael 1995; Townsend and Stewart 1986, 1994). The males generally began courtship by producing advertisement calls interspersed with territorial calls, then changed to the softer courtship call upon the approach of the receptive female (Michael 1996). A similar courtship has been described recently for *E. antillensis* from the Virgin Islands in the wild (Ovaska and Caldbeck 1997b). During a successful courtship, the male would lead the female down an excavated tunnel within the soil of one of the potted bromeliads. All of the egg clutches were deposited in these tunnels.

When two or more males were housed together with the female, mating was always unsuccessful. One male would assume a dominant role and call to the female and the other would assume a satellite role and remain quiet, near the calling male. Upon initiation of courtship, all three frogs would attempt to enter the nest site. Since the nest sites were all in excavated burrows, it was difficult to determine subsequent events. On two occasions the nest sites were exposed during courtship by removing the bromeliad from the pot. On both occasions all three frogs were found together in amplexus. Amplexus in these situations, as well as with only one male, seemed to consist of the males loosely laying on top and somewhat to the rear of the female. There was no evidence of clasping; however this may have been missed because of the difficulty in observing the frogs and disturbance to the frogs during observation. No eggs were found during examination of the nest site after three courtships where more than one male was present, even though the female showed evidence of having laid eggs (as determined by thinness and lack of white abdominal egg masses). The eggs were most likely eaten by one or more of the frogs, although eggs could not be clearly seen in the abdomens of any of the frogs.

The three males used for breeding each fathered multiple clutches (male A: 7; male B: 4; male C: 8). The matings with any one particular male were consecutive and breeding continued yearround. Every male placed with the female successfully mated. The number of eggs per clutch ranged from 11 to 32 (mean = 24; SD = 8; N = 9). Egg size was 4–5 mm at deposition, but the jelly coating swelled to a total diameter of 6–7 mm within a few days. The interval between clutches was extremely variable and depended on both the readiness of the male, as well as the feeding schedule of the female. The minimum breeding interval was eight days.

As a test for the utilization of internal fertilization in this species, male removal experiments were carried out during five of the oviposition events mentioned above (once with males A and B and three times with male C). During these experiments the courtship was monitored carefully and the male was removed from amplexus after a period of time had passed. Experiments were performed such that the male was removed 1.25 h, 5 h, 5.5 h, 6.5 h, and 7.66 h after the pair initially entered the nest site. After male removal, which usually resulted in both frogs abandoning the nest site, the female returned to the nest site within an hour and deposited eggs; apparently, once ovulation is initiated at the beginning of courtship the female is obligated to deposit eggs. During the 7.66 h trial the female had already deposited some of her eggs before the male was removed. The eggs from these experiments were monitored for several days for development. None developed except for the eggs that already had been laid during the 7.66 h time point, all of which developed normally. These

experiments indicate that *E. antillensis* apparently does not utilize internal fertilization as has been reported for *E. coqui* (Townsend et al. 1981) and the ovoviviparous species *E. jasperi* (Wake 1978).

To determine the extent of parental care in this species the fathers were monitored closely for several days following undisturbed mating. They tended to use excavated tunnels in the bromeliad pots as diurnal retreats, sometimes in the same pot as the clutch of eggs. However, in no case were the fathers ever found sitting directly on top of the eggs. In only one case was a father found in contact with the eggs, and then only with the very edge of his hind foot. This is in contrast to other Puerto Rican species— *E. cochranae, E. cooki, E. coqui*, and *E. hedricki*—in which male frogs have been documented to sit on and actively guard their clutches (Grant 1932; Michael 1995; Rivero 1963; Townsend et al. 1984). The female was also never found attending the eggs, as has been documented for several non-Puerto Rican species (reviewed by Townsend 1996), but tended to utilize a particular bromeliad axil as a diurnal retreat, regardless of the oviposition site.

A previous report, based on observation of a small introduced population of *E. antillensis* in Panama City, Panama, mentions that eggs are cared for either in turns or together by both parents (De Sousa et al 1989). However, an earlier and more detailed publication by the same authors indicates that only females were ever observed with the eggs, and then in only a small percentage of cases and never with eggs that were more than six days old (Castillo and Mayorga 1984). These observations are interesting as female egg attendance has never been reported for any other Puerto Rican species. Differences between these previous observations and those presented here may be due to behavioral differences between populations from Puerto Rico and Panama. Female parental care may also have been missed in this report due to the study of only a single female. In any case, it is clear that *E. antillensis* does not exhibit the same level of parental care as other Puerto Rican species. It is possible, however, that *E. antillensis* parents provide a considerable amount of protection to their eggs simply by defending an area of surrounding territory without actually maintaining contact with the clutch.

Hatching times for clutches for which exact deposition and hatching dates were known ranged from 12–20 days (mean = 18; SD = 2; N = 5). Hatchling size was 4–6 mm SVL (mean = 5; SD = 1; N = 8). Hatchlings were maintained in small, clear acrylic boxes (12 x 12 x 10 cm tall) with a crumpled, moistened, unbleached paper towel inside. These small cages then were placed inside an appropriately heated and lit aquarium. The tiny froglets were too small to eat fruit flies and were initially fed a diet of small springtails (*Folsomia candida*). Newly hatched *E. antillensis* were apparently completely developed and began to hunt actively and eat within several hours of hatching. This is in contrast to hatchling *E. coqui* and *E. cochranae* which generally remain in the nest site under parental protection for three to five days before dispersing to find food. Even when removed from the father, hatchlings of these two species do not eat for several days. The ability of *E. antillensis* hatchlings to hunt and consume prey immediately lends support to the observed lack of parental care.

Feeding springtails to the hatchling frogs allowed 90–100% to grow to a size where they were able to eat fruit flies, as opposed to the 95% mortality reported previously for *E. coqui* and *E. cochranae* that were not fed springtails (Michael 1995). However, a diet of springtails and fruit flies alone resulted in developmental problems similar to those reported previously for *E. cochranae* (Michael 1995). Subsequent hatchlings were fed a diet heavily supplemented with small insects locally collected in Alabama. These small insects were collected with a sweep net and potentially dangerous spiders, bees, large ants, and other noxious insects were removed. On this diet, juvenile frogs developed well. The three fastest developing frogs reached maturity and began to call (indicating that they were male) in five months, at which point they measured 22–25 mm SVL.

Captive breeding of *E. antillensis* has allowed the intimate observation of biologically interesting behaviors that are difficult to observe in the field. These include territorial and mating behaviors which indicate differences in the biology of *E. antillensis* compared to other *Eleutherodactylus* species.

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RECENT POPULATION CHANGES

Comparison of Current with Historical Elevational Range in the Boreal Toad, *Bufo boreas*

LAUREN J. LIVO
EPO Biology, University of Colorado
Boulder, Colorado 80309-0334, USA
E-mail: ljlivo@aol.com

and

DARRYL YEAKLEY*
USDA Forest Service, Arapaho National Forest, Clear Creek Ranger District
101 Chicago Creek, P.O. Box 3307, Idaho Springs, Colorado 80452, USA

**Present address: 832 South Vance Street, Apt. #C*
Lakewood, Colorado 80226, USA

The boreal toad, *Bufo boreas*, historically occupied habitats primarily between 2590 m and 3350 m elevation in Colorado (Hammerson 1986). Interest in this toad has increased with the realization that populations in the southern Rocky Mountains have undergone significant declines in the past several years (Carey 1993; Corn et al. 1989). In November 1993, this toad was added to Colorado's list of Endangered Species (Buhlmann 1994). In addition, it is a candidate species for listing as Endangered by the U.S. Fish and Wildlife Service with the current federal status of "warranted but precluded" (U.S. Fish and Wildlife Service 1995). Here we compare the historical elevational range occupied by this species in the Colorado Front Range with its current elevational range.

We determined the historical elevational range for *Bufo boreas* in the Front Range based on 35 records in Boulder and Gilpin counties made before 1988. Localities were obtained from a database (Colorado Division of Wildlife, 1994) and records from Campbell (1970), Oder (1932), Ellis and Henderson (1913), Johnson (1932), Cynthia Carey (pers. comm.), and personal observations. Most of the records in the database are based on museum records. Campbell (1970) and Oder (1932) provided information on sites where breeding by this species was observed.

Current elevational distribution was determined from 22 observations made during 1993 and 1994 in Boulder, Clear Creek, and Gilpin counties during surveys conducted by the U.S. Forest Service and Colorado Division of Wildlife. These observations include data from extensive 1994 survey work and from less systematic surveys made in 1993. Most survey effort (ca. 94%) was made at elevations between 2500 and 3400 m. Three of the sites with toads observed in 1994 were among the 20 historical sites we were able to survey.

Historical *Bufo boreas* sites in Boulder and Gilpin counties ranged in elevation from ca. 2450 m at Boulder (= Barker) Dam, (Colorado Division of Wildlife 1994) to ca. 3480 m at King Lake (Campbell 1970).

The sites at which toads were observed in Boulder, Clear Creek, and Gilpin counties in 1993 and 1994 ranged between 2390 m and 3640 m (N = 22) (Fig. 1). Elevation ranged from 2630–3350 m at seven historical breeding sites and 2840–3280 m at nine observed breeding sites (Fig. 2).

Campbell (1976) reported a high elevation record of 3615 m for this species in the San Juan Mountains of southern Colorado. The observation of a female *Bufo boreas* on 27 August 1993 at an elevation of 3640 m in the Woods Creek drainage (Clear Creek County, Colorado) represents a new high elevation record for this species. This species ranges above this elevation, however, as Campbell (1976) noted that one individual must have moved across a 3661 m pass, as it was observed on both sides.

Our observation of a toad at 2390 m is at a lower elevation than the historical record in the Front Range (2450 m). The lowest elevational records from both historical and observed sites along the Front Range are well above the low elevation records from elsewhere in Colorado. The lowest elevation records from Colorado include Pagosa Springs (2164 m) and "3 miles E, 4 miles S Collbran" (ca. 2070 m). However, the collection data for some of these records may be inaccurate (Hammerson 1986).

Survey work in southern and eastern Wyoming indicates that the elevational range there may be contracting, with this species disappearing at higher elevations. For example, in the Medicine Bow Mountains of southeastern Wyoming, historical records previously ranged up to 3200 m elevation. Data from recent surveys indicate that toads are now absent from elevations above 2925 m (Christopher Garber [deceased], Wyoming Nature Conservancy, pers. comm.).

Caution needs to be exercised in comparisons made between historical and observed elevational distributions of boreal toads. First, older records often lack precision, making it difficult to determine the precise site (and therefore the elevation) of the observation. Also, there can be considerable bias in data collection, particularly for a species as common as this toad once was. For example, Campbell (1970) reported several high-elevation occur-

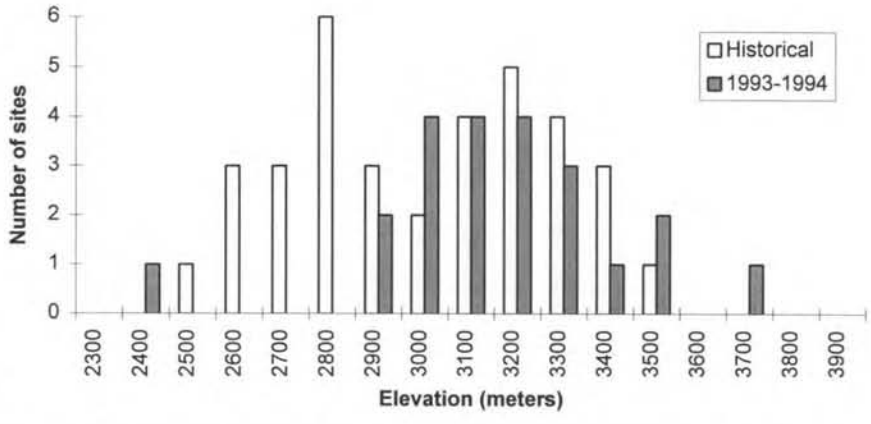


FIG. 1. Boreal toad historical and observed (1993–1994) elevational distribution.

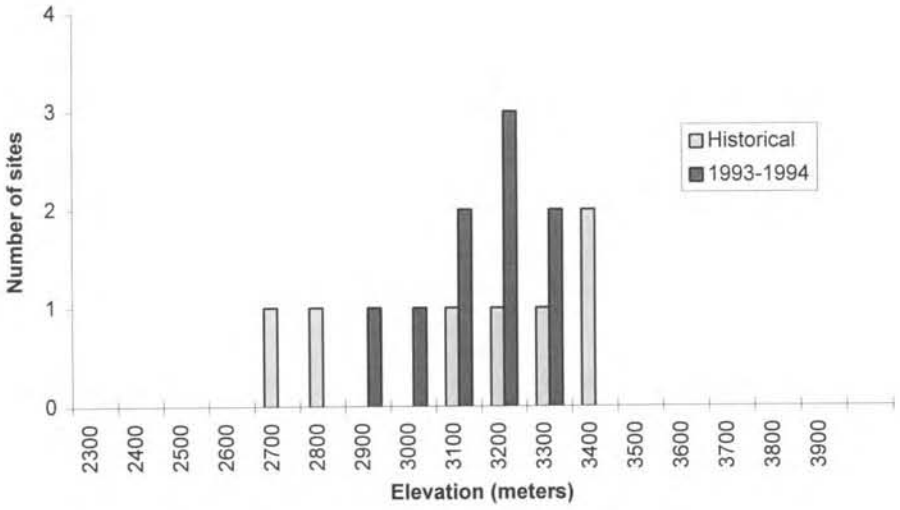


FIG. 2. Elevational distribution of historical and observed (1993–1994) boreal toad breeding sites.

rences that were not represented elsewhere. Museum and literature records seldom mention whether breeding was observed at the site where a specimen was taken (Corn et al. 1989). Explicit mention of breeding or of tadpoles was made for only seven of the historical sites—almost certainly sexual activity must have been occurring at a much greater proportion of the recorded localities. Finally, our survey work was not evenly distributed across the elevational range occupied by this species, but instead was biased for sites above 2500 m elevation.

When a species that occupies a broad elevational range undergoes population declines, it is probable that the elevational range occupied will contract as well. This effect can be noted in areas with only a few remaining populations (such as in the Medicine Bow Mountains of southeastern Wyoming).

Bufo boreas populations in the Southern Rocky Mountains have declined from historical levels, including in our survey area. In the Colorado Front Range this toad still appears to occupy much the same elevational range as it did when it was more common. In fact, our data include a new high elevation record and a low elevation record that matches historical low elevation occurrence. However, there may be some elevational range contraction in current breeding sites when compared with historical breeding sites.

Acknowledgments.—Great Outdoors Colorado funded 1994 survey work, and was administered by Rebecca Parmenter (U.S. Forest Service) and Tom Nesler (Colorado Division of Wildlife). Most of the 1994 field work was performed by Tamara Holmes, David Barrett, and Adam Walters. P. Stephen Corn commented on an early draft of this note.

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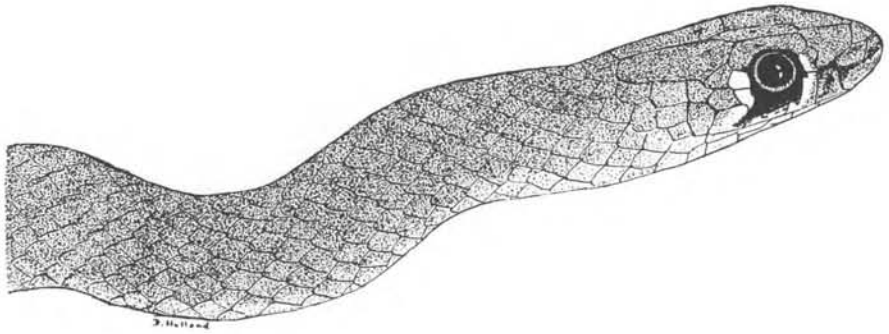
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Demansia psammophis (Yellow-faced Whip Snake). Illustration by Dan Holland.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 28, Number 1 (March 1997).

GYMNOPHIONA

SIPHONOPS HARDYI (Hardy's Caecilian): BRAZIL: ESPÍRITO SANTO: MUNICIPALITY OF MARECHAL FLORIANO: Alto Nova Almeida near Sítio Tres Marias (20°24'36"S, 40°49'26"W, ca. 680 m elev.). 11 September 1994. C. Zamprogno and M. Zamprogno. Coleção Zoológica da Universidad Federal do Espírito Santo (ZUFES 140348). Verified by M. Wilkinson. Known only from localities in the states of Rio de Janeiro and São Paulo, southeastern Brazil (Dunn 1942, Bull. Mus. Comp. Zool. 91:339–540). First record for the state; extends the distribution northward and is the first record for over 50 years.

Submitted by **CLAUDIO ZAMPROGNO** and **MARIA DAS GRAÇAS ZAMPROGNO**, Departamento de Biologia, Universidad Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil.

CAUDATA

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: TENNESSEE: CANNON CO: jct. Burt-Burgen and Hollow Springs Roads. 27 September 1996. B. T. Miller, J. L. Miller. Middle Tennessee State University (MTSU 315C). Verified by W. H. Redmond. Adult male captured on road during evening rain storm. County record that decreases distributional hiatus in the Eastern Highland Rim of middle Tennessee (Redmond and Scott 1996, Atlas of Amphibians in Tennessee. Austin Peay St. Univ. Misc. Publ. 12:1–89).

Submitted by **BRIAN T. MILLER** and **JOYCE L. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

EURYCEA LONGICAUDA GUTTOLINEATA (Three-Lined Salamander). USA: GEORGIA: WHITE CO: Skylake Private Residential Community, Chattahoochee National Forest, Sautee Trail, 4.16 km E Sautee Trail/Georgia Rt. 255 Spur (301) jct. (7.52 km ENE Helen). 26 October 1996. Michael G. Frick and Anne M. Lindsay. Savannah Science Museum (SSM 96.13761). Verified by John B. Jensen. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712). Specimen was caught crossing bituminous surfaced road at ca. 0130 h during light rain.

Submitted by **MICHAEL G. FRICK** and **ANNE M. LINDSAY**, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

EURYCEA LONGICAUDA LONGICAUDA (Longtail Salamander). USA: ALABAMA: WINSTON CO: Haleyville. N 1/2 Sec. 32, T9S, R10W. 5 October 1996. AUM 34301. Verified by Craig Guyer. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Alabama Agric. Exp. Sta., Auburn. 347 pp.).

Submitted by **BRIAN P. BUTTERFIELD, DANIEL R. FRENCH, SCOTT R. FEARS, MICHELLE D. HARGREAVES, ANGELA J. LEWIS, CHRISTINE D. ROBY, LEAH M. HOOD** and **JENNIFER R. ROBINSON**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

HEMIDACTYLIUM SCUTATUM (Four-Toed Salamander). USA: GEORGIA: WHITE CO: Skylake Private Residential Community, Chattahoochee National Forest, Sautee Trail, 4.64 km E Sautee Trail/Ga. Rt. 255 Spur (301) jct. (7.52 km ENE Helen). 26 October 1996. Michael G. Frick and Anne M. Lindsay. Savannah Science Museum (SSM 96.13762). Verified by John B. Jensen. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712). Specimen was caught crossing bituminous surfaced road at approx. 0200 h during light rain.

Submitted by **MICHAEL G. FRICK** and **ANNE M. LINDSAY**, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

ANURA

BUFO VARIEGATUS (Eden Harbour Toad): ARGENTINA: SANTA CRUZ: shores of Lago del Desierto and Río de las Vueltas, 49°05'S, 72°54'W, 420 m elev. 10–12 December 1996. Néstor G. Basso, Carlos A. Galliari, Gustavo R. Spinelli, and Jorge D. Williams. Verified by Gustavo Carrizo. MLP A 1281–84. Reproductive adults, juveniles and tadpoles were found in a shallow eutrophic limnotope fed by groundwater ("mallín"), surrounded by the temperate forest of lenga (*Nothofagus pumilio*). Adults and juveniles also were found at night crossing the road bordering the Río de las Vueltas, near Lago del Desierto. Tadpoles were observed forming aggregations of several individuals. *Bufo variegatus* is distributed in Chile in the Andean range of the *Nothofagus* forests, from Malleco (ca. 39°S) to the Magellanic channels (ca. 52°S) (Cei 1962, Batracios de Chile. Univ. Chile, Santiago. cviii+128 pp; Formas 1978, J. Herpetol. 12:243–246). The southernmost population of *B. variegatus* in Argentina was recorded from the western shores of Lago Belgrano, Perito Moreno National Park, Santa Cruz province, 47°48'S, 72°22'W, 950 m elev. (Biolé and Williams 1984, Neotropica 30(84):243–244). This discovery extends the distribution of the species 150 km southwards in the Argentinian Patagonian forest.

Submitted by **NESTOR G. BASSO**, Instituto de Limnología "Dr. Raúl A. Ringuelet," Casilla de correo 712, 1900 La Plata, Argentina, and **JORGE D. WILLIAMS**, Departamento Zoología Vertebrados, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina.

BUFO WOODHOUSII FOWLERI (Fowler's Toad). USA: ALABAMA: WINSTON CO: William B. Bankhead National Forest, ca. 1.5 km NE Adkins Cemetery. N 1/2 Sec. 16, T9S, R8W. 5 October 1996. AUM 34300. Verified by Craig Guyer. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Alabama Agric. Exp. Sta., Auburn. 347 pp.).

Submitted by **BRIAN P. BUTTERFIELD, DANIEL R. FRENCH, SCOTT R. FEARS, MICHELLE D. HARGREAVES, ANGELA J. LEWIS, CHRISTINE D. ROBY, LEAH M. HOOD** and **JENNIFER R. ROBINSON**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

HYLA CALLIPYGIA (Bocaina Treefrog). BRAZIL: MINAS GERAIS: Itamonte Municipality, 1800 m. 26 September 1992. M. R. Gomes and O. L. Peixoto. Universidade Federal do Rio de Janeiro (ZUFRJ 5275–76); Itatiaia Municipality, 1800 m, boundary between states of Rio de Janeiro and Minas Gerais. 26 September 1992. M. R. Gomes and O. L. Peixoto. (ZUFRJ 5248) and Universidade Federal Rural do Rio de Janeiro (EI 9326). Verified by S. P. de Carvalho e Silva. Previously known only from the state

of São Paulo (Bocaina Range and Campos do Jordão); extends range to the states of Minas Gerais and Rio de Janeiro. The Itatiaia record was based on males collected while calling from rocky crevices ca. 0.3 m deep.

Submitted by **M. R. GOMES**, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Cidade Universitária, Rio de Janeiro 21941-590, Brazil, and **O. L. PEIXOTO**, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, Seropedica, Rio de Janeiro 23851-970, Brazil.

HYLA CHRYSOSCELIS (Cope's Gray Treefrog). USA: WISCONSIN: WAUKESHA CO: city of Eagle, Center Sec. 22, T5N, R17E, at road jct. 67 and 59. 31 May 31 1996. M. G. Bolek. Milwaukee Public Museum (MPM 29589). Verified by Gary S. Casper. Frogs were identified by mating call and mean erythrocyte length which was compared to a known *H. versicolor* population (Matson 1990, Herpetologica 46:457–462). A statistically significant difference existed between the mean erythrocyte length of *H. chrysoscelis* (19.71 um) and mean erythrocyte length of *H. versicolor* (25.07 um, $p < 0.0001$, two sample *t* test). Documentation for *H. chrysoscelis* from the eastern part of the state is needed. Specimen extends the known range of this species in eastern Wisconsin and is the first definite record for Waukesha County (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 87 pp.).

Submitted by **MATTHEW G. BOLEK**, Department of Biological Sciences, University of Wisconsin Milwaukee, Milwaukee, Wisconsin 53201, USA.

HYLA CINERA (Green Treefrog). USA: TEXAS: ROCKWALL CO: Rockwall. 2 July 1996. D. Glaze. University of Texas Collection of Vertebrates (UTA Color Slide 21506, photographed by Dixon Glaze). Verified C. L. Stewart. New county record. (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CARL J. FRANKLIN**, Department of Herpetology, Dallas Zoo, 650 South R. L. Thornton Freeway, Dallas, Texas 75203, USA.

MELANOPHRYNISCUS STELZNERI DORSALIS (Redbelly Toad). ARGENTINA. MISIONES: Dept. Apostoles (27°51'S, 55°46'W). 15 February 1986. J. Soroka. Coleccion Herpetologica Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 43129–130). Verified by G. Carrizo. First record for the country. The subspecies was previously known from a few localites in Rio Grande do Sul, Brasil [Braun and Braun 1980, IHERINGIA. Ser. Zool. Porto Alegre (56):121–146]. Extend subspecies range 600 km NW from type locality (Torres, Rio Grande do Sul, Brazil), and is the northwesternmost record for the taxon.

Submitted by **JORGE ABEL CESPEDEZ**, Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, C.P. 3400, Corrientes, Argentina.

PHYSALAEMUS CENTRALIS (Central Dwarf Frog): BRAZIL: DISTRITO FEDERAL: LAGOA BONITA: Estação Ecológica de Águas Emendadas, Brasília-DF (ca. 15°35'S, 47°42'W). 7 October 1991. R. A. Brandão and G. M. R. Moreira. Museu Nacional (MNRJ 17424). Verified by J. P. Pombal, Jr. First record for the states of Goias and Distrito Federal. Original distribution was in the states of Mato Grosso and São Paulo, Brazil, and in northeastern Paraguay (Frost 1995, Amphibian Species of the World. Version 2/95. Electronic Manuscript. Herpetologists' League). This new record suggests that this species occurs continuously from the state of Mato Grosso, across the state of Goias, to the state of São Paulo. Probably occurs at some localities in Minas Gerais, in cerrado vegetation.

Submitted by **REUBER A. BRANDÃO, BRUNO A. DUAR, ADRIANA C. BRITO** and **ANTONIO SEBBEN,** Laboratório de Fisiologia Animal - CFS-IB, Universidad de Brasília, 70.910-900, Brasília-DF, Brasil.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: COLORADO: CHAFFEE CO: Davis Meadow (NE 1/4 Sec. 15, T13S, R78W; UTM Zone 13, UTME 405496, UTMN 4308990). 16 May 1996. Craig Fetkavich. Herpetological Ancillary Collection UCM 121 (audio tape recording). First record for county (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.). Verified by David Chiszar. This record was obtained during ongoing amphibian surveys conducted by the Pike/San Isabel National Forest and Colorado Division of Wildlife.

Submitted by **CRAIG FETKAVICH**, U. S. Forest Service, Pike/San Isabel National Forest, 1920 Valley Drive, Pueblo, Colorado 81008, USA; **LAUREN J. LIVO** and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

RANA CLAMITANS CLAMITANS (Bronze Frog). USA: TEXAS: FORT BEND CO: Brazos Bend State Park; 26.1 air km ESE Rosenberg. 8 March 1997. John H. Malone. Verified by James R. Dixon. TCWC 75129–30. County record; fills gap between Austin, Brazoria, and Harris counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). A juvenile specimen (TCWC 75129; 34 mm SVL) was collected at Site 30; located SW of Creekwood Lake; 27 m W on Big Creek washout trail. An adult female specimen (TCWC 75130; 78 mm SVL) was collected at Pilant Lake. Both animals were found during an amphibian breeding site survey conducted for the Texas Department of Parks and Wildlife in order to construct a long term amphibian monitoring program at Brazos Bend State Park. Numerous (>25) other individuals of this frog, both adult and juvenile, were observed from various sites at the park.

Submitted by **JOHN H. MALONE**, Department of Wildlife and Fisheries Science, Texas A&M University, College Station, Texas 77843, USA.

SCINAX SQUALIROSTRIS (Striped Snouted Treefrog). BRAZIL: DISTRITO FEDERAL: BRASÍLIA: ÁREA DE PROTEÇÃO AMBIENTAL DO CAFURINGA: Fazenda Santa Elisa (ca. 15°35'S, 48°02'W). 1 February 1995. R. A. Brandão, B. A. Duar, M. G. Zatz and M. A. Bagno. Museu Nacional (MNRJ 17420). Verified by J. P. Pombal, Jr. Original distribution was southwestern Brazil, southern Paraguay and Uruguay, and northeastern Argentina (Frost 1995, Amphibian Species of the World. Version 2/95. Eletronic manuscript, Herpetologists' League). First record for central Brazil; extends distribution to the north.

Submitted by **REUBER A. BRANDÃO, BRUNO A. DUAR,** and **ANTONIO SEBBEN,** Laboratório de Fisiologia Animal - CFS-IB, Universidad de Brasília, 70.910-900, Brasília-DF, Brazil.

SPEA BOMBIFRONS (Plains Spadefoot). USA: TEXAS: HALL CO: Caprock Canyons State Park, Caprock Canyon Trailway, 1 mi S and 9 mi W Estelline. 18 July 1996. F. D. Yancey, II. The Museum of Texas Tech University (TTU 11629). Verified by Clyde Jones. New county record; fills gap between Donley and Motley

counties, and helps define eastern margin of range in Texas Panhandle (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and The Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

SPEA INTERMONTANA (Great Basin Spadefoot). USA: IDAHO: NEZ PERCE CO: Salmon River, UTM Zone 11, 521918E, 5092777N (m)(NAD 27). 17 June 1995. Robin L. Llewellyn. Idaho Museum of Natural History (IMNH 1481). Verified by Charles R. Peterson. One adult was found dead along the Salmon River Road on Craig Mountain. New county record (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press, Moscow. 332 pp.).

Submitted by **ROBIN L. LLEWELLYN**, Department of Biological Sciences, Idaho State University, Campus Box 8007, Pocatello, Idaho 83209, USA.

SYRROPHUS CYSTIGNATHOIDES (Rio Grande Chirping Frog). USA: TEXAS: NUECES CO: 28°19'05"N, 98°33'40"W, within Corpus Christi city limits, Waldron Naval Air Landing Field. 1 September 1995. Travis W. Taggart and Richard Anderson. TCWC 75128 (alcoholic); Southeastern Louisiana University Tissue Collection (SLU cat. no. pending, frozen tissues). Verified by Brian I. Crother. Three adults found by day under discarded plywood at a dump. Fourteen adults collected at night while chorusing from laurel oaks, cattails, and from the tops of 1 m tall grass clumps. Represents third disjunct Texas population associated with a large city (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). The other Texas populations established outside of the Rio Grande valley are in Bexar (San Antonio) and Harris (Houston) counties.

Submitted by **TRAVIS W. TAGGART**, Department of Biological Sciences-SLU 736, Southeastern Louisiana University, Hammond, Louisiana 70402, USA.

TESTUDINES

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: GEORGIA: WHITE CO: Chattahoochee National Forest, Georgia Rt. 255 Spur (301), 0.16 km S Sautee Trail/Georgia Rt. 255 Spur (301) jct. (entrance to Skylake private residential community). 27 October 1996. Michael G. Frick and Anne M. Lindsay. Savannah Science Museum (SSM 96.13763). Verified by John B. Jensen. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712). Specimen was caught crossing road at ca. 1530 h.

Submitted by **MICHAEL G. FRICK** and **ANNE M. LINDSAY**, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

GRAPTEMYS GEOGRAPHICA (Common Map Turtle). USA: WISCONSIN: KENOSHA CO: Powers Lake on NE shore, NE part of Sec. 18, T1N, R19E. 18 August 1994. M. G. Bolek. Milwaukee Public Museum (MPM 29588). Verified by G. S. Casper. New county record Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 87 pp.). Six turtles were observed on the Kenosha County side of the lake and the specimen was captured for identification and voucher.

Submitted by **MATTHEW G. BOLEK**, Department of Biological Sciences, University of Wisconsin Milwaukee, Milwaukee, Wisconsin 53201, USA.

KINOSTERNON FLAVESCENS FLAVESCENS (Yellow Mud Turtle). USA: MISSOURI: CLAY CO: Kansas City North, near jct of 50th and Bristol Streets. 19 September 1993. Keith Gammon. KU Color Slide 11248. Verified by Joseph T. Collins. Specimen is alive at Lakeside Nature Center, Kansas City, Missouri, and will be deposited in the Bobby Witcher Memorial Collection at Avila College, Kansas City, Missouri, upon its death. Specimen is a female with a carapace length of 108 mm. County record; represents another locality as described by Smith and Blake from adjacent Ray Co. (1990, Herpetol. Rev. 21:40) near the Missouri River, and probably is due to an individual turtle being carried by flood waters. In fact, this record is temporally associated with the extreme flood conditions present in the Midwest during the summer of 1993.

Submitted by **KEVIN D. HOGAN**, Lakeside Nature Center, 5600 East Gregory Boulevard, Kansas City, Missouri 64132, USA, and **DONALD D. SMITH**, Division of Allergy and Rheumatology, University of Kansas Medical Center, 3901 Rainbow Boulevard, Kansas City, Kansas 66160, USA.

PSEUDEMYS CONCINNA SUWANNIENSIS (Suwannee River Cooter). USA: FLORIDA: TAYLOR CO: Econfina River, from U.S. Rt. 98 to ca. 2 km N of Gulf of Mexico. 29 October 1996. Dale R. Jackson. UF 105386 (specimen and 3 color slides). Verified by Paul Moler. On 21 April 1996, I observed from canoe ca. 2 dozen basking individuals, mostly immature animals between 90 and 200 cm estimated carapace length; a subadult female (plastron length 234 mm, CL 274 mm) was collected by basking trap on 29 October in the strongly tidally influenced lower river 4 km above the Gulf (NW 1/4 SW 1/4 Sec. 11, T5S, R4E). Probable presence in the river was first reported to me by M. A. Ewert based on 1960s sight records at U.S. Rt. 98. New drainage record (Jackson 1992, in P. Moler (ed.), Rare and Endangered Biota of Florida. Vol. 3. Amphibians and Reptiles, pp. 166–170. Univ. Press Florida, Gainesville; 1995, Chelonian Cons. Biol. 1:329–333) and first confirmed occurrence in any of the "small rivers" between the Aucilla and Suwannee. As such, this further reduces the conjectured disjunction between peninsular and panhandle populations of this species, which had been used by some to hypothesize separate specific identities for those populations (reviewed by Jackson 1995, *op. cit.*).

Submitted by **DALE R. JACKSON**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

STERNOTHERUS MINOR MINOR (Loggerhead Musk Turtle). USA: FLORIDA: TAYLOR CO: Econfina River, County Road 14A bridge at Shady Grove (NE 1/4, NE 1/4, Sec. 29, T2S, R7E). 27 October 1996. Dale R. Jackson. UF 105384–385 (9 specimens and color slides). Verified by Paul Moler. An adult male (carapace length 92 mm, plastron length 67 mm) and adult female (CL 90 mm, PL 71 mm) were collected in a sardine-baited hoop trap set on 26 October in the upper reaches of this small Gulf-draining blackwater river. Both specimens were much darker than conspecific turtles from Florida spring runs. Previously, on 21 April 1996, I observed a large adult basking on a branch ca. 6 km downstream of U.S. Rt. 98, ca. 34 straight-line km SW of the collection site and near the tidally influenced lower segment of the river; Fenholloway River at U.S. Rt. 27 (NE 1/4, NE 1/4, Sec 36, T4S, R8E). 7 October 1983. George M. Burgess et al. UF 104420. Immature (CL 63 mm, PL 44 mm). Verified by David Auth. These specimens not only represent new drainage records, but constitute the species' first confirmed occurrence in any of the small rivers between the Aucilla and Suwannee in Florida's "Big Bend" re-

gion; they thus help to close the geographic gap that previously appeared to separate panhandle from peninsular populations (Iverson 1977, Copeia 1977:502–517; Iverson and Etchberger 1989, Florida Sci. 52:119–144; Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.).

Submitted by **DALE R. JACKSON**, Florida Natural Area Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). USA: TEXAS: Floyd Co: UTM coordinates 14 307241E 3797536N. 18 July 1996. F. D. Yancey, II. The Museum of Texas Tech University (TTU 11632). Verified by Clyde Jones. New county record; fills gap between Hale and Motley counties (Dixon, 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and The Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

TRACHEMYS SCRIPTA ELEGANS (Red-Eared Slider) USA: OHIO: Mahoning Co: Lily Pond, Mill Creek Park. 23 February 1995. Raymond J. Novotny. Cleveland Museum of Natural History 6761. Verified by Timothy O. Matson. First county record. Conant [1951, Reptiles of Ohio. 2nd ed. (with revisionary addenda) Amer. Midl. Nat., Univ. Notre Dame, Indiana. 284 pp.]. This species has been observed at this site for at least 25 years (H. L. Vickers, 15 April 1970, "A Nature Diary," The Youngstown Vindicator). Female was observed laying eggs in lawn at Lily Pond during summer 1988; eggs were removed and hatched summer 1988, and most hatchlings were released at site. Female lived in captivity at nature center until death on above date. This species has been found at many localities outside of its range, Conant and Collins (1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co. Boston, Massachusetts. 450 pp.) Because of this breeding evidence in the Lily Pond and possibly at other lakes in Mill Creek Park, this should be considered an established colony.

Submitted by **RAYMOND J. NOVOTNY**, Ford Nature Center, Mill Creek Metropolitan Park District, 840 Old Furnace Road, Youngstown, Ohio 44511, USA.

SAURIA

ANOLIS CAROLINENSIS (Green Anole). USA: ALABAMA: Winston Co: William B. Bankhead National Forest, ca 1.5 km NE Adkins Cemetery. N 1/2 Sec. 16, T9S, R8W. 5 October 1996. AUM 34302. Verified by Craig Guyer. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Alabama Agric. Exp. Sta., Auburn. 347 pp.).

Submitted by **BRIAN P. BUTTERFIELD, DANIEL R. FRENCH, SCOTT R. FEARS, MICHELLE D. HARGREAVES, ANGELA J. LEWIS, CHRISTINE D. ROBY, LEAH M. HOOD,** and **JENNIFER R. ROBINSON**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

ANOLIS TRACHYDERMA (Roughskin Anole). PERU: Cusco: Canisea River, 250 m elev., 11°49'S, 72°47'W. 14 August 1996. Museo de Historia Natural Universidad Nacional Mayor de San Marcos, Lima (MUSM 16713, male; MUSM 16714, female). The male dewlap is larger than the female dewlap, and is orange with yellow on the anterior and posterior borders. The dewlap of the female is orange. This coloration is similar to that described for the species by Vanzolini [1972, Papéis Avulsos Zool. S. Paulo 26(8):95]. Both specimens were found sleeping on leaves 0.70–1.05 m above the ground. The previous northernmost locality in Peru for this anole was in the Utoquinia Region, Department Ucayali, on the border between Peru and Brazil (Avila-Pires 1995, Zool. Verh. Leiden 299:111).

Submitted by **VICTOR R. MORALES**, Department of Wildlife and Fisheries Sciences, and Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843-2258, USA.

COLOBODACTYLUS DALCYANUS (NCN). BRAZIL: SÃO PAULO: Parque Estadual Campos do Jordão, in montane forest in the Serra de Mantiqueira Range (22°45'S,45°33'W), ca. 1500 m. 14 February 1996. Ivan Sazima, Otavio C. Oliveira, and Marlies Sazima. Universidade Estadual de Campinas (ZUEC 01919). Verified by Marcio Martins. One unsexed specimen, 48 mm SVL, tail broken, 1.5 g body mass. First record from the state of São Paulo. Caught along roadside at 0930 h under a small rock. Extends the range of this species westward from previously known distribution (type locality in the Brejo da Lapa) on the NW flank of the Itatiaia massif on the border of the states of Rio de Janeiro and Minas Gerais [Vanzolini and Ramos 1977, Papéis Avulsos Zool., São Paulo 31(3):19–47].

Submitted by **PAULO ROBERTO MANZANI** and **IVAN SAZIMA**, Departamento de Zoologia, Instituto de Biologia, Universidade Estadual de Campinas, Campinas 13083-970, São Paulo, Brazil.

COPHOSAURUS TEXANUS TEXANUS (Texas Earless Lizard). USA: TEXAS: Floyd Co: Caprock Canyons State Park, Caprock Canyon Trailway, UTM coordinates 14 304470E 3790854N. 18 July 1996. F. D. Yancey, II. The Museum of Texas Tech University (TTU 11631). Verified by Clyde Jones. New county record; fills the gap between Briscoe and Crosby counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and The Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

GEHYRA MUTILATA (Stump-Toed Gecko). FRENCH GUYANA: town of Kourou. J. C. Massary and I. Ineich. March-April 1996. Muséum National d'Histoire Naturelle, Paris (MNHN 1996.4342-4355 and 1996.4371). Verified by G. Pasteur. First report for South America; previously known from Indian and Pacific Oceans (Indoaustralian Archipelago). Extralimital from India and Sri Lanka through Indochina to Japan, the Philippines, and Indonesia. The species is often commensal with humans and has recently expanded its range throughout much of the world. It was introduced and established in México and San Diego, USA, and also into New Zealand where it did not become established (see Bauer and Henle 1994, Das Tierreich: Teilbd. 109:88–94). Occurs in sympatry with *Hemidactylus mabouia* in scattered localities in the town of Kourou where populations have been established for several years. The species will certainly spread rapidly to other towns on the heavily inhabited littoral part of French Guyana.

Submitted by **IVAN INEICH** and **JEAN-CHRISTOPHE DE MASSARY**, Muséum National d'Histoire Naturelle, Laboratoire de Zoologie (Reptiles & Amphibiens), 25 Rue Cuvier, F-75005 Paris, France.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: LOUISIANA: CALCASIEU PARISH: Lake Charles, McNeese State University campus. June 1968. James D. Lane. Seale Museum of Louisiana, McNeese State University (SML 1454); McNeese State University campus. 22 September 1996. Nick Slay. SML 9304–09; The city of Lake Charles. Spring 1979. B. Ezell. SML 7447. All verified by Mark A. Paulissen. First parish records; expands the distribution of this species westward from Lafayette Parish as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.) and from St. Landry Parish as recorded by Vidrine and Hatler (1995, Herpetol. Rev. 26:155). It is unclear when this population was introduced into the University area. Regardless, it has since become very common throughout the city of Lake Charles and the surrounding communities (Williams, pers. obs.). AVOYELLES PARISH: Eola area. March 1963. W. Simpson and J. G. Walls. SML 271. Verified by Mark A. Paulissen. First parish record as mapped by Dundee and Rossman (*op. cit.*); expands the distribution of this species northeastward from Evangeline Parish as recorded by Boundy (1994, Herpetol. Rev. 25:128–129).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: BOSQUE CO: Valley Mills, ca 10 mi W of Clifton. 7 July 1996. C. J. Franklin and S. M. Franklin. University of Texas at Arlington Collection of Vertebrates (UTA-R 40734). Verified by C. L. Stewart. New county record. (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CARL J. FRANKLIN**, Department of Herpetology, Dallas Zoo, 650 South R. L. Thornton Freeway, Dallas, Texas 75203, USA.

HOMONOTA ANDICOLA (NCN). ARGENTINA: LA RIOJA: Las Chacritas, 33 km W Alto Jagüé, Department General Lamadrid. 10 February 1997. Sebastián E. Torres. Fundación Miguel Lillo, Tucumán, Argentina (FML 6101). Verified by Fernando Lobo. First record for La Rioja Province; extends range north 400 km (airline). Species was previously known only from the Uspallata region in Mendoza Province (Cei 1978, Publ. oc. Inst. Biol. an. Univ. nac. Cuyo 1:1–2).

Submitted by **SEBASTIAN E. TORRES**, **VIRGINIA ABDALA,** and **SONIA KRETZSCHMAR**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000, Tucumán, República Argentina.

LACERTA VIRIDIS (Green Lacerta). USA: KANSAS: SHAWNEE CO: Topeka, 4420 SW 23rd Street. 2 August 1996. Jerry Jones. KU Color Slide 11235. Verified by Joseph T. Collins. Species was originally documented as introduced via a commercial animal dealer in Topeka by Collins (1974, Amphibians and Reptiles in Kansas. First Ed. Univ. Kansas Nat. Hist. Mus. Pub. Ed. Ser. 1:1–283) and again by Collins (1983, Amphibians and Reptiles in Kansas. Second Ed. Univ. Kansas Nat. Hist. Mus. Pub. Ed. Ser. 8:1–356), based on specimens taken in 1973 and 1977, respectively. Because no documented vouchers were discovered after 1977, Conant and Collins (1991, Peterson Field Guide to Reptiles and Amphibians Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston. 450 pp.) did not consider this lizard established in the United States.

The specimen reported herein is the first collected in 19 years, and documents the continued presence of *L. viridis* in the Topeka area. The lizard was caught ca. 500 m from the source of the original introduced population, and is currently being maintained alive by Jim Gubanyi. Upon its death, the lizard will be deposited in the University of Kansas Natural History Museum, Lawrence.

Submitted by **JAMES GUBANYI**, 2501 Burnett Road, Topeka, Kansas 66614, USA, and **JOSEPH GUBANYI**, Concordia College, 800 North Columbia, Seward, Nebraska 68434, USA.

LIOLAEMUS FITZGERALDI (Lagartija del Aconcagua). CHILE: IV REGION—Coquimbo: Las Gualtatas, near copper mine Los Pelambres, 55 km west Illapel (31°38'S, 71°10'W). 6 January 1997. L. J. Avila and E. Soto. Herpetological collection, Orientación Zoología de Vertebrados, Departamento de Ciencias Naturales, Universidad Nacional de Río Cuarto, Argentina (ZV-UNRC 4066–68). Verified by R. A. Martori. First record for IV Región—Coquimbo (Veloso and Navarro 1988, Boll. Mus. Reg. Sci. Nat. Torino 6[2]:481–539; Nuñez and Jaksic, 1992. Bol. Mus. Nac. Hist. Nat. Chile, 43:63-91). The locality reported here is at ca. 3300 m elevation; extends range nearly 150 km N from type locality at Puente del Inca, Dpto. Las Heras, Mendoza (Argentina).

Submitted by **LUCIANO JAVIER AVILA**, Departamento de Ciencias Naturales, Universidad Nacional de Río Cuarto, Agencia Postal Nro. 3, C.P. 5800, Río Cuarto (Córdoba), Argentina (e-mail: lavila@exa.unrc.edu.ar), and **EDUARDO SOTO**, Zoología de Vertebrados, Facultad de Ciencias, Universidad de Chile.

LIOLAEMUS SAXATILIS (NCN). ARGENTINA: SAN LUIS: Dept. Coronel Pringles:10 km W La Toma (33°04'S, 65°38'W), Ruta Provincial 10, near Sierras del Rosario. 5 October 1996. Herpetological collection of Orientacisn Zoologma de Vertebrados, Departamento de Ciencias Naturales, Universidad Nacional de Rmo Cuarto, Argentina (ZV-UNRC 3968); same locality. 8 December 1996. ZV-UNCR 4022; 28 km SW La Toma (near Ruta Provincial 20). 8 December 1996. ZV-UNRC 4023–24. All collected by L. J. Avila, J. W. Priotto and M. Morando, and verified by Ricardo A. Martori. First province records; a westward extension of the known range ca. 75 km from type locality (Avila et al. 1992, Bol. Mus. Reg. Sci. Nat. 10[1]:101–111).

Submitted by **LUCIANO JAVIER AVILA**, **JOSE W. PRIOTTO,** and **MARIANA MORANDO**, Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Estafeta Postal 9, C.P. 5800, Rio Cuarto, Cordoba, Argentina. E-mail (LJA): lavila@exa.unrc.edu.ar

NOROPS PACHYPUS (Thick Anole). COSTA RICA: GUANACASTE PROVINCE: Guanacaste Conservation Area, Las Pailas Sector, E side of Laguna Jilgueros at the crest of Rincón de la Vieja Volcano, 1526–1537 m elev., 10°50'N, 85°22'W). 17 June 1995 and 11 August 1996. David T. Nicolson, Jason D. Johnson, and Kirsten E. Nicholson. University of Miami Costa Rican Expeditions (CRE 7612–7618, 10392). Verified by Jay M. Savage. Extends known range ca. 157 km airline NW of Alto del Roble and ca. 10 km N of Barba, Heredia Province (CRE 7094 collected by J. M. Savage and N. Scott; Savage and Villa 1986, Herpetofauna of Costa Rica, Contributions to Herpetology No. 3). We also have examined specimens of this taxon (previously identified as *Norops tropidolepis;* verified by Jay M. Savage) collected from Volcan Cacao, 1590–1600 m elev., 10°56'N, 85°27'W, on 3 and 24 August 1987 (MVZ 207349–51). These additional specimens extend the previous known range 176 km airline NW from Alto del Roble.

Submitted by **KIRSTEN E. NICHOLSON** and **DAVID T. NICOLSON**, Department of Biology, University of Miami, Coral Gables, Florida 33124, USA.

OPHISAURUS ATTENUATUS LONGICAUDUS (Eastern Slender Glass Lizard). USA: GEORGIA: BULLOCH CO: SR 1838, 6.4 km N SR 1838/Georgia Rt. 321 jct. (1.6 km N Bulloch-Bryan county line). 7 May 1994. Collector not recorded. Savannah Science Museum (SSM 96.13765). Verified by Robert A. Moulis. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712). Specimen was caught crossing SR 1838 at ca. 1630 h.

Submitted by **MICHAEL G. FRICK**, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

PHYLLODACTYLUS XANTI (Cape Leaf-toed Gecko). MÉXICO: BAJA CALIFORNIA SUR: Isla Pardo, one of five islands in a group collectively known as Islas Los Candeleros, located SW of Isla Danzante in the vicinity of Loreto (Crumpton 1991, Baja Explorer: Topographic Atlas Directory. ALTI Publishing, La Jolla, California; Williams 1988, Baja Boater's Guide: Volume II—Sea of Cortéz. H. J. Williams Publications, Sausalito, California. p. 151). 22 March 1996. L. Lee Grismer, Bradford D. Hollingsworth, Humberto Wong, and Michael R. Cryder. La Sierra University Photographic Collection (LSUPC L3026). Verified by Lester E. Harris. First record for Isla literature (Murphy and Ottley 1984, Ann. Carnegie Mus. Nat. Hist. 53:207–230). Specimen was found during the day beneath a pile of rocks on the cobblestone beach.

Submitted by **MICHAEL R. CRYDER**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, **HUMBERTO WONG**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

PODARCIS ERHARDII LIVADIACA (Erhard's Wall Lizard). GREECE: STEREA ELLADA: AETOLOACARNANIA PREFECTURE: NAFPACTIA CO: 2.3 km NE Stylia, 700 m elev. (38°30'19"N, 21°48'38"E). 28 November 1996. George Chiras and Basil P. Chondropoulos. Zoological Museum of University of Patra (ZMUP A-R 1375). Verified by E. Valakos. An adult male; 4–5 more individuals were observed basking on the banks of a road crossing a dense Hungarian oak (*Quercus conferta*) forest. *Podarcis erhardii* is a southern Balkan endemic species; in Greece it occurs in parts of the mainland and in the western and south Aegean islands. Prior to this discovery, there has been a complete lack of data concerning the species distribution in the central and western Sterea Ellada region. The nearest previous record was ca. 120 km NW in the Epirus region (Gruber 1986, *In* W. Böhme, ed., Handbuch der Reptilien und Amphibien Europus, pp. 25–49. Aula-Verlag, Wiesbaden). At the subspecies level, the known range of *P. e. livadiaca* covers only the eastern part of Sterea Ellada (Attiki and Evia Prefectures) and the eastern part of Peloponnisos region (Wettstein 1953, Sitz.-ber. Österr. Akad. Wiss. Wien 162:651–833; Chondropoulos 1986, Amphibia-Reptilia 7:217–235). This record extends considerably both the species and subspecies ranges, filling a very large distributional gap for this lizard in the western Greek mainland.

Submitted by **BASIL P. CHONDROPOULOS**, Section of Animal Biology, Department of Biology, University of Patra, 260 01 Patra, Greece, and **GEORGE CHIRAS**, Sarantaporou 38, 262 23 Patra, Greece.

SCINCELLA LATERALIS (Ground Skink). USA: ALABAMA: WINSTON CO: William B. Bankhead National Forest, ca 1.5 km NE Adkins Cemetery. N 1/2 Sec. 16, T9S, R8W. 5 October 1996. AUM 34303. Verified by Craig Guyer. New county record (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Alabama Agric. Exp. Sta., Auburn. 347 pp.).

Submitted by **BRIAN P. BUTTERFIELD**, **DANIEL R. FRENCH**, **SCOTT R. FEARS**, **MICHELLE D. HARGREAVES**, **ANGELA J. LEWIS**, **CHRISTINE D. ROBY**, **LEAH M. HOOD**, and **JENNIFER R. ROBINSON**, Department of Biology, Freed-Hardeman University, Henderson, Tennessee 38340-2399, USA.

SERPENTES

CROTALUS WILLARDI OBSCURUS (New Mexico Ridgenose Rattlesnake). USA: ARIZONA: COCHISE CO: Sec. 14, T22S, R32E. 24 October 1996. Sam W. Smith. AMNH 142597. Verified by Michael Douglas. State record for this federally threatened subspecies. Found on leaf litter in canyon bottom dominated by oaks, alligator bark juniper, and Mexican pinyon. Collected under permit to Andrew T. Holycross (U.S. Fish and Wildlife Service PRT676811 and Arizona Game and Fish Department SP648632) and euthanized under permit to the Arizona Game and Fish Department (U.S. Fish and Wildlife Permit PRT676811).

Submitted by **ANDREW T. HOLYCROSS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287-1501, USA, and **SAM W. SMITH**, 4338 East Elmwood Street, Tucson, Arizona 85711, USA.

ELAPHE OBSOLETA OBSOLETA (Black Rat Snake) USA: OHIO: MAHONING CO: Canfield Township: DOR on Turner Road, 1 mi N Palmyra Road. 4 July 1995. Raymond J. Novotny. Cleveland Museum of Natural History 6760. Verified by Timothy O. Matson. First county record; fills range gap between Trumbull County to N, Columbiana County to S, Portage County to W, and Lawrence County, Pennsylvania to E as depicted in Conant (1951, Reptiles of Ohio. 2nd ed. [with revisionary addenda], Amer. Midl. Nat., Univ. Notre Dame, Indiana. 284 pp.) and McCoy (1982, Amphibians and Reptiles in Pennsylvania. Carnegie Mus. Nat. Hist., Pittsburgh, Pennsylvania. 91 pp.).

Submitted by **RAYMOND J. NOVOTNY**, Ford Nature Center, Mill Creek Metropolitan Park District, 840 Old Furnace Road, Youngstown, Ohio 44511, USA.

ELAPHE OBSOLETA SPILOIDES (Gray Rat Snake). USA: GEORGIA: TIFT CO: S2516, 2.08 km S S2516/Georgia Rt. 35 (US Rt. 319) jct. (11.2 km NNE Tifton). 28 September 1996. J. Andrew Jackson. Savannah Science Museum (SSM 96.13764). Verified by Michael G. Frick. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Pub. 3:1–712). Specimen was caught crossing highway at ca. 1430 h.

Submitted by **J. ANDREW JACKSON**, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

HAEMORRHOIS* (= *COLUBER*) *DORRI (Boie's Racer). SENEGAL: SENEGAL ORIENTAL REGION: Bandafassi (12°32'N, 12°18'W). 28 December 1989. Jean-François Trape. Museum National d'Histoire Naturelle at Paris (MNHN-

1995.9693). Verified by Ivan Ineich. First regional record and second for Senegal. Extends range 260 km southward from the closest known locality at Bakel, Upper Senegal, where the type originated (Lataste 1888, Le Naturaliste, 10:227–228). This species is also known from Mali, Burkina-Faso, Ghana, and Togo (Villiers 1975, Les Serpents de l'Ouest Africain, Institut Fondamental d'Afrique Noire, Initiations et Etudes Africaines n °2, 3éme edition, Dakar, 195 pp.).

Submitted by **JEAN-FRANCOIS TRAPE**, Laboratoire de Paludologie, ORSTOM, P.O. Box 1386, Dakar, Sénégal.

LEPTOPHIS AHAETULLA MARGINATUS (Parrot Snake). URUGUAY: DEPARTAMENTO DE ARTIGAS: Arrocera San Pedro, 25 km W of Colonia Palma. Between October 1983 and January 1984. ZVC-R 4401, 4529–30, and MNHNM 3740. First vouchers for Uruguay, substantiating an earlier literature record of *Leptophis liocercus* (Wied, 1824) (= *Leptophis ahaetulla marginatus*) by Koslowsky (1898, Rev. Mus. La Plata 8:164, 191) (*contra* statement by Peters and Orejas-Miranda 1970, Bull. U.S. Natl. Mus. 299:viii + 347).

Submitted by **MELITTA D. MENEGHEL** and **FEDERICO ACHAVAL**, Seccion Zoologia de Vertebrados, Instituto de Biologia, Facultad de Ciencias, Tristan Narvaja 1674, Casilla de Correos 10.773, 11.200 Montevideo, Uruguay.

PORTHIDIUM HESPERE (Western Hognose Viper). MÉXICO: MICHOACAN: Municipality of Aquila: Playa Colola (18°18'00"N, 103°21'00"W, sea level) 4 November 1995. R. Nuñez-Pérez and C. Delgadol-Trejo. Facultad de Biología, Universidad Michoacana de San Nicolás de Hidalgo (FBH 0239). Verified by Gustavo Casas-Andreu. Adult female (245 mm SVL; 70 mm TL) collected at 2345 h on an *Acacia* tree. This species was known definitely only from the type locality, 19.2 airline km NE Tecomán, Municipality of Ixtlahuacán, Colima, and description was based on a single specimen (Campbell 1976, J. Herpetol. 10:151–160). Huacuz (1995, Serpientes del Estado de Michoacán, Master's Thesis, Univ. Nac. Autón. de México), recently reviewed the ophidiofauna of Michoacán, and predicted the presence of this snake in the state. First documented record for the state of Michoacán and extends its known range ca. 95 km SE of type locality.

Submitted by **JAVIER ALVARADO-DIAZ, DOLORES DEL C. HUACUZ-ELIAS** and **IRERI SUAZO-ORTUÑO**, Facultad de Biología, Universidad Michoacana, Apartado 35-A, Morelia 58000, Michoacán, México.

PSEUDOTOMODON TRIGONATUS (False Tomodon Snake, Culebra Enhebrada). ARGENTINA: CORDOBA: DEPARTAMENTO CALAMUCHITA: bridge over Guacha Corral Creek, 15 km W Río de los Sauces (town) (32°32'S, 64°36'W). 11 April 1993. L. J. Avila. Colección de Vertebrados Universidad Nacional de Río Cuarto (ZV-UNRC 2342); DEPARTAMENTO RÍO CUARTO: 2 km E El Chacay village (32°53'S, 64°50'W). 19 October 1991. R. Martori and L. Aun. ZV-UNRC 1607; Achiras (33°10'S, 64°59'W). 4 November 1990. L. J. Avila and P. Pettinicchi. ZV-UNRC 1213–15; Alpa Corral (32°52'S, 64°57'W). 14 March 1995. M. Arana. ZV-UNRC 3611. All verified by Ricardo A. Martori. First vouchered records from the province of Córdoba. Previous citations (Cei 1986, Mon. IV. Mus. Reg. Sci. Nat. Torino. 527 pp.; Cei 1993, Mon. XIV Mus. Reg. Sci. Nat. Torino. 949 pp.; Williams and Francini 1991, Boll. Mus. Reg. Sci. Nat. 9[1]:55–90) were unvouchered (Reati 1996, *In:* Biodiversidad de la Provincia de Córdoba. Di Tada and Bucher, eds. pp. 239–254).

Submitted by **LUCIANO JAVIER AVILA**, Departamento de Ciencias Naturales, Universidad Nacional de Río Cuarto, Agencia Postal 3, C. P. 5800, Río Cuarto (Córdoba), Argentina. E-mail: lavila@exa.unrc.edu.ar.

RAMPHOTYPHLOPS BRAMINUS (Braminy Blind Snake). FEDERATED STATES OF MICRONESIA: CAROLINE ISLANDS: POHNPEI STATE: Pohnpei Islands, Uh Municipality, Mwahnd Peidi Island, Station 56, 3–30 m elev. (Mwahnd Peidi Island is ca. 158°17'E, 6°40'N of the main island of Pohnpei.) 22 July 1995. Don Buden. First island record. MCZ 180888. Verified by Van Wallach. Closest locality is "Ponape, Caroline Islands" (McDowell 1974, J. Herpetol. 8[1]:1–57). McDowell's locality is unclear because "Ponape" (= Pohnpei) could refer to either the State or the island.

Submitted by **LESLIE A. THOMAS**, Center for Vertebrate Studies, Department of Biology, Northeastern University, Boston, Massachusetts 02115, USA.

REGINA GRAHAMII (Graham's Crayfish Snake). USA: LOUISIANA: CALCASIEU PARISH: 6.3 mi S and 3.6 mi E Lake Charles on Lincoln Road. 15 March 1972. R. LeBoeuf. Seale Museum of Louisiana, McNeese State University (SML 4953); 2 mi W jct. Louisiana Rt. 108 and Louisiana Rt. 27. 4 February 1973. M. Dugas. SML 5556; 10 mi E and 6 mi S Lake Charles. 27 February 1974. J. Dolan. SML 6196; 12 mi W and 6 mi S Lake Charles, Choupique Bayou area. 2 March 1974. P. Rider. SML 6285; 2 mi S of I-210 on Louisiana Rt. 14. 13 April 1985. T. Broussard. SML 8288; 0.5 mi N Sulphur. 28 March 1985. Smith and Nichols. SML 8354; 11 mi NW Vinton. 23 March 1991. H. Abner and R. Heiner. SML 9191; 1 mi W jct. of Louisiana Rt. 379 (Houston River Road) and Clairborne Street, Houston River Canal area. 17 March 1993. Avery A. Williams. SML 9303 (Specimen was collected while it was copulating in a flooded right-of-way clearing. Its mate escaped collection.); JEFFERSON DAVIS PARISH: 1 mi N and 1.7 mi E Hayes, Lorrain Park area. 24 March 1971. D. Fruge. SML 5144. All verified by Douglas A. Rossman. First parish records; extends distribution north from Cameron Parish as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.)

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

REGINA RIGIDA (Glossy Crayfish Snake). USA: LOUISIANA: CALCASIEU PARISH: 1 mi N and 0.9 mi E Bell City. 24 March 1972. D. Fruge. Seale Museum of Louisiana, McNeese State University (SML 4965); 0.8 mi N and 0.4 mi E Bell City. 22 June 1971. D. Fruge. SML 5154; 2 mi N Bell City. 31 March 1973. C. Hudson. SML 5522; 2 mi N Bell City. 31 March 1973. G. Bauer. SML 5581; 1 mi S jct. Lincoln Road and Nelson Road, Hippolyte Coulee area. 14 February 1974. D. Guillory. SML 6330; 2 mi N and 2 mi W Moss Bluff, Bunker Hill Canal area. 30 January 1986. Doyle, Ester, and Thompson. SML 8503; 1 mi N jct. Louisiana Rt. 378 and North Perkins Ferry Road, Moss Bluff area. 3 November 1987. Walther, Tietje, and Russo. SML 8688; NW of Westlake, 1 mi N jct. of John Stine Road and Myrtle Springs Road on May Street (two specimens collected from roadside ditches by neighborhood children using pellet guns). 30 March 1996. Avery A. Williams. SML 9301–02. All verified by Douglas A. Rossman; expands the distribution of this species in Calcasieu Parish from the single record mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **AVERY A. WILLIAMS**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

VIRGINIA VALERIAE (Smooth Earth Snake). USA: KANSAS: Miami Co: 0.5 km S & 4 km E of Fontana, border of SE 1/4 of SE 1/4 Sec. 6, and SW 1/4 of SW 1/4 Sec. 5, T19S, R24E. 28 April 1996. Eric M. Kessler. KU 223467. Verified by Joseph T. Collins. New county record (Collins 1993, Amphibians and Reptiles in Kansas, Univ. Press Kansas, Lawrence. xx + 397 pp.).

Submitted by **ERIC M. KESSLER**, 5624 Cherry, Kansas City, Missouri 64110, USA.

New Records for Texas Amphibians and Reptiles

KATHLEEN B. BLAIR
Department of Biology and Geosciences
West Texas A&M University
Canyon, Texas 79015-0808, USA
e-mail: kblair@wtamu.edu

DAVID CHISZAR
and
HOBART M. SMITH
University of Colorado Museum
Boulder, Colorado 80309-0218, USA
e-mail: hsmith@spot.colorado.edu

The following nine specimens represent new distributional records for amphibians and reptiles in Texas, and increase our knowledge of the biology of the herpetofauna of that state. WTAMU = herpetological collection at West Texas A&M University, Canyon, Texas.

Ambystoma tigrinum tigrinum (Eastern Tiger Salamander). USA: TEXAS: Angelina Co: 4.8 km N Lufkin, Rt. 81. 18 September 1993. Kyla A. Murdick. WTAMU 14934. Verified by Anthony I. Mazeroll. First county record (Dixon 1987).

Hyla chrysoscelis (Cope's Gray Treefrog). USA: TEXAS: Aransas Co: Fulton. 16 April 1992. J. Culwell. WTAMU 14473. Verified by Anthony I. Mazeroll. First county record (Dixon 1987). An adult 38 mm SVL, with spotted throat, irregular marks on dorsum, rear surface of thigh unmarked.

Rana blairi (Plains Leopard Frog). USA: TEXAS: Moore Co: Plum Creek behind camp. 22 October 1994. J. J. Rinne. WTAMU 14951. Verified by Anthony I. Mazeroll. First county record (Dixon 1987).

Xenopus laevis (African Clawed Frog). USA: TEXAS: Llano Co: Lake Buchanan. 10 April 1981. Stacey Foster. WTAMU 6266. Verified by Anthony I. Mazeroll. Not previously reported from the state (Dixon 1987). Taken by a student on a class trip for a field course, cataloged in that student's field notes, and there identified as *Gastrophryne,* an expected species, hence given no special attention at the time. No other details of discovery known.

Hemidactylus turcicus (Mediterranean Gecko). USA: TEXAS: Comal Co: Canyon Lake at Kelly Air Force Base Recreation Area. 11 November 1995. J. A. Jesko. WTAMU 15025. Verified by Anthony I. Mazeroll. First county record (Dixon 1987).

Coluber constrictor flaviventris (Eastern Yellowbelly Racer). USA: TEXAS: Hardeman Co: Rt. 1167, Medicine Mound Ranch. 16 May 1995. Kathleen B. Blair. WTAMU 15036. Verified by Anthony I. Mazeroll. First county record (Dixon 1987).

Elaphe guttata emoryi (Great Plains Rat Snake). USA: TEXAS: Wheeler Co: 6.5 km NE Shamrock. No date. Derl Brooks and H. H. Bailey. WTAMU 15006. Verified by Anthony I. Mazeroll. First county record (Dixon 1987).

Elaphe obsoleta lindheimerii (Texas Rat Snake). USA: TEXAS: Hardeman Co: Rt. 1167, Medicine Mound Ranch. 16 May 1995. Kathleen B. Blair. WTAMU 15035. Verified by Anthony I. Mazeroll. First county record (Dixon 1987).

Heterodon platirhinos (Eastern Hognose Snake). USA: TEXAS: Oldham Co: Boys Ranch Hog Farm, Boys Ranch. 9 July 1991. Eddie Taylor. WTAMU 14404. Verified by Anthony I. Mazeroll. First county record, at the western edge of the species' range (Dixon 1987).

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Dixon, J. R. 1987. Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.

New Records for Amphibians and Reptiles from Texas

HOBART M. SMITH
Department of EPO Biology, University of Colorado
Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

and
DAVID CHISZAR
Department of Psychology, University of Colorado
Boulder, Colorado 80309-0345, USA
e-mail: chiszar@cliper.colorado.edu

A review of amphibians and reptiles from Texas in the University of Kansas Museum of Natural History has revealed the following county records, as indicated by our updated copy of Dixon's (1987) summary, of six taxa, and a presumably erroneous record that may be of historical interest for one other taxon. Joseph Mendelson III kindly verified all except the material of *Scaphiopus*, which is unverifiable.

Bufo americanus charlesmithi (Dwarf American Toad). USA: TEXAS: Panola Co: Sabine River, N Carthage. 5 April 1961. Frank B. Cross. KU 70013.

Syrrophus marnockii (Cliff Chirping Frog). USA: TEXAS: Bandera Co: km W Medina. 4 May 1957. James R. Dixon. KU 60243. 21 km W Medina 4 May 1957. James R. Dixon. KU 60242. 9.7 km NM Medina, Keese Cave. 11 July 1974. No collector. KU 159614.

Scaphiopus holbrookii hurterii (Hurter's Spadefoot). USA: TEXAS: Dewitt Co: 8 km S Yoakum. 23 April 1963. C. M. Fleming. KU 186982. Serial sections of skull only (no body).

Sceloporus serrifer cyanogenys (Blue Spiny Lizard). USA: TEXAS: Hidalgo Co: Lower Rio Grande Valley National Wildlife Refuge, Sam Fordyce Tract. June 1992. Richard Courtemanche. KU 222526.

Salvadora grahamiae lineata (Texas Patchnose Snake). USA: TEXAS: Willacy Co: 6.3 km E Porfirio. 28 August 1992. Kelly J. Irwin. KU 222583.

Crotalus viridis viridis (Prairie Rattlesnake). USA: TEXAS: Coke Co: 9.7 km N Water Valley. 2 January 1959. Paul Anderson. KU 84554.

Gopherus berlandieri (Texas Tortoise). USA: TEXAS: Callahan Co: Putnam. 9 June 1926, 9 July 1926, 10 September 1927, 18 September 1927. No collector. KU 2674–5, 3003–9, 3011–2, 5037–9, and 6871. These specimens, from some 300 airline km to the north of the range limits of the species as now known, were obtained from A. J. Kirn, who lived near Somerset, Atascosa County, Texas, where the species is known to occur. Kirn collected many reptiles and amphibians in the county for several museums, through various specialists including E. H. Taylor and Howard K. Gloyd, and would not likely falsify data. Possibly these specimens were given to him with erroneous locality data, inasmuch as he did not record himself as collector.

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Dixon, J. R. 1987. Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station, Texas. 434 pp.

The Northern Alligator Lizard (*Elgaria coerulea*) from Nevada

JENS V. VINDUM
Department of Herpetology, California Academy of Sciences Golden Gate Park, San Francisco, California 94118-4599, USA

and

E. N. ARNOLD
Department of Zoology, Natural History Museum, London SW7 5BD, United Kingdom

Banta (1964) summarized the early herpetological works on reptiles of the Great Basin in the western United States. Although some of these works were fairly comprehensive (Linsdale 1940), no anguid species were reported from the state of Nevada. Banta (1965) anticipated the occurrence of *Elgaria coerulea* in the Lake Tahoe region of Nevada and *E. panamintina* in the Palmetto Mountains, Esmeralda County, Grapevine Mountains, Nye County, and Spring Mountains, Clark County. *Elgaria multicarinata* was introduced to the Las Vegas area (Stebbins 1985) and a voucher specimen exists for this region (Nevada: Clark Co: Las Vegas. 13 June 1959. G. Ferske. Marjorie Barrick Museum, University of Nevada, Las Vegas [MBM] 43). A second known specimen of *E. multicarinata* was recently seen in southern Nevada (Nevada: Clark Co: Lake Mead National Recreation Area, Boulder Beach Campground. 4 April 1993. W. Pratt [pers. comm. A. Heindl 1996]) but was not collected.

Herein we report on three unpublished records of naturally occurring *Elgaria coerulea* from northern Nevada. The identifications were verified by Christopher J. Bell (Museum of Paleontology, University of California, Berkeley).

NEVADA: Carson City Co: at the point where Clear Creek crosses US Rt. 50 (T15N, R19E Sec. 32). 1 July 1993. B. Cobb. MBM 7444. This specimen extends the range of *E. coerulea* to the eastern side of the Lake Tahoe basin.

NEVADA: Washoe Co: Sheldon Antelope Refuge, Badger Mountain, Badger Cabin. Summer 1960. O. V. Deming. MBM 447.

NEVADA: Washoe Co: Upper High Rock Canyon, 41°29'25.4"N, 119°29'53.8"W, SE 1/4 of SE 1/4 Sec. 4, T41N, R22E, 1754 m. 11 June 1996. E. N. Arnold and J. V. Vindum. CAS 201283. Upper High Rock Canyon is about 2 km in length with steep walls reaching heights of ca 100 m above the canyon floor. In most areas the base of the canyon is less than 50 m wide. The area surrounding the canyon and extending to the base of the canyon consists of sagebrush steppe. Aspen riparian forest is the dominant plant community along the length of the canyon floor. The specimen was found ca. 5 m from the creek bed in a small grassy glade between the riparian and sagebrush plant communities.

Based on Lais (1976), Stebbins (1985), and Brown et al. (1995), these two Washoe County specimens represent the third and fourth isolated populations of *Elgaria coerulea* found in the western Great Basin. The other two isolated populations are: 1) in the Warner Mountains (California: Modoc Co: Ft. Bidwell-Adel Hwy, Twelve Mile Creek at Oregon state line. 3 July 1934. H. S. Fitch. MVZ 17218-21; Fitch [1938] cited the locality as "Twelve-mile Creek, Modoc Co., Calif. at Nevada line"), and 2) in the Hart Mountains (Oregon: Lake Co: Desert Lake, Water Canyon, 22.5 km SE of Hart Mountain Wildlife Refuge Headquarters. 25 August 1954. C. Nelson. OS 2934. Oregon: Lake Co: about 91.4 m above the mouth of Water Canyon, W of Desert Lake, Hart Mountain National Wildlife Refuge. 8 July 1960. J. L. Richardson and T. Urbanek. OS 7673).

Although no late Pleistocene and Holocene fossil anguids have been found thus far in the Great Basin (Mead and Bell 1994), the four isolated populations suggest that *E. coerulea* was once more widely distributed in the western Great Basin. The current distribution seems now to be restricted to isolated populations in more mesic habitats.

Acknowledgments.—We thank T. A. Atkinson, C. J. Bell, D. B. Hardenbrook, A. L. Heindl, P. A. Medica, J. A. Rodriguez-Robles, and R. M. Storm for their assistance.

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The Cuban Green Anole, *Anolis porcatus*: A New Anole Established in Florida

WALTER E. MESHAKA, JR.
and
RONALD M. CLOUSE
Everglades Regional Collections Center
Everglades National Park, 40001 SR-9336
Homestead, Florida 33034-6733, USA
e-mail (WEM): walter_meshaka@nps.gov

BRIAN P. BUTTERFIELD
Department of Biology, Freed-Hardeman University
Henderson, Tennessee 38340-2399, USA

and
J. BRIAN HAUGE
Department of Curriculum and Teaching, Auburn University
Auburn, Alabama 36489, USA

Florida is colonized by nine anoline lizards: *Anolis carolinensis* (Cope 1900), *A. chlorocyanus* (Bartlett 1988; Butterfield et al. 1994), *A. cristatellus* (Schwartz and Thomas 1975), *A. cybotes* (Ober 1973), *A. distichus dominicensis* (King and Krakauer 1966), *A. d. floridanus* (Smith and McCauley 1948), *A. equestris* (Neill 1957), *A. garmani* (Wilson and Porras 1983), and *A. sagrei* ssp. (Garman 1887). Only *A. carolinensis* and, arguably, *A. d. floridanus* are native. Among the exotic species, two, *A. equestris* and *A. sagrei*, are native to Cuba (Schwartz and Henderson 1991). *Anolis equestris* exploits the canopy and large branches of trees (Collette 1961) and fits the crown giant ecomorph (Williams 1969), whereas *A. sagrei* lives closer to the ground (Collette 1961) and fits the trunk-ground ecomorph (Williams 1969).

The Cuban green anole (*Anolis porcatus*), widespread in Cuba and sympatric with the former two species (Schwartz and Henderson 1991), is associated with the trunk and canopy (Collette 1961) and fits the trunk-crown ecomorph (Williams 1969). Only one record exists of a colony of *A. porcatus* outside of Cuba. *Anolis porcatus* was introduced to a site in the Dominican Republic probably in the 1950s where it has since expanded its geographic range by approximately 2.2 km^2 per year (Powell et al. 1990). This species was not introduced to Hawaii (McKeown 1996) as previously reported (McKeown 1978). Here, we record the presence of *A. porcatus* in Florida and relate data on diet and habitat to its structural niche in the introduced site.

A series of 12 males, 5 females, and 1 juvenile (Everglades Series: EVER 302589–302594, 302938–302940, 302947–302955) of *Anolis porcatus* was collected from buildings and vegetation in North Miami, Dade County, Florida on the afternoon of 13 and 16 June and 12 July 1996. All specimens were stored in the Everglades Regional Collections Center, Everglades National Park, Homestead, Florida. A male (EVER 302955) and female (EVER 302593) from that series were identified as *A. porcatus* by R. W. Henderson. This colony is approximately five years old and younger than a nine-year old colony in South Miami (Ron and Stella St. Pierre, pers. comm.) for which we have observations (reports) but no records. Derivations of both colonies are unknown.

The mean snout length (SVL) of male *Anolis porcatus* (66.2 ± 6.47 mm SVL; range = 55–76) was significantly larger ($Z = 19.94$, $P < 0.000$) than that of females (55.6 ± 6.83 mm SVL; range = 48–65). Number of prey from which length could be measured was too small to compare between sexes; however, prey were generally small (4.04 ± 4.59 mm; range = 1–23; N = 21) and the largest two items, an *A. sagrei* (23 mm SVL) and scarab beetle (10 mm) were found in two large males (68 and 73 mm SVL, respectively). Including even potentially adventitiously ingested items such as stones and fruit, a wide range of prey categories (N = 24) were found in the diet of *Anolis porcatus* (Table 1). However, for all lizards, Levins' measure of niche breadth (Levins 1968) was narrow as measured by frequency of prey (0.28) and number of stomachs common to each taxon (0.34). Prey, typically found in vegetation (e.g., ladybird beetles, weevils, caterpillars, stinkbugs, parasitic wasps) or not restricted to the ground (e.g., ants), reflected the location of the lizards, which were captured and observed from 1.0–6.0 m above the ground. In light of its sympatry in North Miami with *A. equestris* and *A. sagrei*, the structural position of *A. porcatus* at this site was in keeping with that of Cuban populations.

TABLE 1. Diet of *Anolis porcatus* from North Miami Beach, Broward County, Florida, USA. Number of prey are followed in parentheses by number of stomachs with each prey category.

Taxa	Males (N = 12)	Females (N = 5)	Juveniles (N = 1)	Total
Araneida	1(1)	0	0	1(1)
Coleoptera	0	1(1)	0	1(1)
Coccinellidae	1(1)	0	0	1(1)
Curculiondae	1(1)	4(1)	0	5(2)
Scarabeidae	1(1)	0	0	1(1)
Dermaptera				
Forficulidae	0	1(1)	0	1(1)
Diptera	9(4)	2(2)	6(1)	17(7)
Tephritidae	1(1)	0	0	1(1)
Homoptera	2(2)	1(1)	0	3(3)
Hymenoptera	2(2)	0	0	2(2)
Cynipidae	0	0	2(1)	2(1)
Chalcoidea	0	0	1(1)	1(1)
Formicidae	7(5)	8(3)	0	15(8)
Lepidoptera				
Larvae	1(1)	0	0	1(1)
Neuroptera				
Chrysopidae	0	1(1)	0	1(1)
Trichoptera	4(1)	0	0	4(1)
Hemiptera	1(1)	0	0	1(1)
Pentatomidae	1(1)	0	0	1(1)
Gastropoda	0	0	1(1)	1(1)
Squamata				
Iguanidae	1(1)	0	0	1(1)
Skin	1(1)	0	0	1(1)
Fruits	2(1)	0	0	2(1)
Stones	1(1)	0	0	1(1)
Empty	2(2)	1(1)	0	3(3)

This record of *Anolis porcatus* increased to seven the number of species of reptiles (*Anolis equestris, A. sagrei, Gonatodes albogularis, Sphaerodactylus argus, S. elegans)* and amphibians (*Eleutherodactylus planirostris, Osteopilus septentrionalis)* native to Cuba that are now established as probable exotics in Florida. Five of these species (*A. equestris, A. porcatus, A. sagrei, E. planirostris, O. septentrionalis)* are sympatric at the North Miami site—a noteworthy dimension to the colonization process whereby many elements of a single community have successfully translocated to a new site. Broad diet, familiarity with sympatric species, and persistent colonies, increase the likelihood that *A. porcatus* will succeed in other parts of extreme southern Florida. However, the ubiquity of its predator, *A. equestris,* far more numerous in Miami than in Cuba (Orlando Garrido, pers. comm.), could hinder the success of *A. porcatus* in southern Florida. We are especially concerned about the future of *A. porcatus* in Florida. Ability to

persist and the potential for future range expansion by this species in Florida could have a substantial and negative impact on its native ecological analog (*A. carolinensis)* much as it has had on *A. chlorocyanus* in a comparable situation in Santo Domingo, Dominican Republic (Powell et al. 1990).

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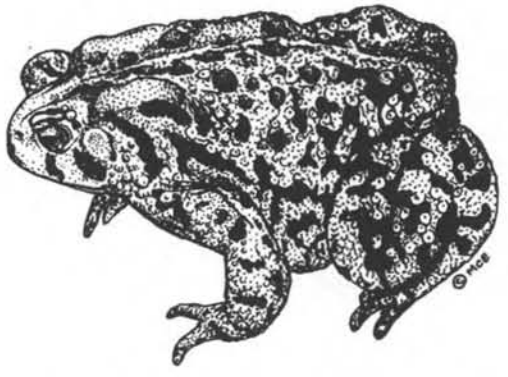
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Bufo americanus (American Toad). Illustration by Mark C. Erelli.

BOOK REVIEWS

A Complete Guide to Scientific and Common Names of Reptiles and Amphibians of the World, by Norman Frank and Erica Ramus, 1995. NG Publishing, Inc., Pottsville, Pennsylvania, 377 pp. ISBN 0-9641032-3-0. US $19.95 (softcover).

WILLIAM W. LAMAR
School of Sciences and Mathematics, The University of Texas at Tyler
3900 University Boulevard, Tyler, Texas 75799, USA
e-mail: 103223.306@compuserve.com

This book and two others (Sokolov 1988; Zhao et al. 1993) provide mute testimony to the burgeoning popularity of reptiles and amphibians around the world, not to mention the public's anxiety about scientific names. All three represent noble attempts at accomplishing a task that can only be described as thankless. Herpetologists and herpetoculturists are a rowdy and nonconsensual lot at best, and the some 10,000 species of herps, albeit sporting an impressive array of vernacular names, lack the stolid tradition with which the International Ornithologists' Union has managed to slap monikers on birds of the world. My brief foray into this contentious realm left me with the firm notion that only one kind of organism is suited to undertake naming the world's herps: the lemming.

The Frank and Ramus guide, which includes "12,000 species [and subspecies] organized taxonomically (by Order, Family, genus, species, plus subspecies for U.S. groups)," an index to genera, and an alphabetical index to common names, is by far the best book offered on the subject. That having been said, let me add that it is rife with errors of commission and omission, not to mention typographical blunders too numerous to cite. It is apparent that the authors were hampered not only by the formidable task but also by their lack of taxonomic training. Thus *Pliocercus elapoides* appears as the "Common False Coral Snake" or as the "Twin Coral Snake" under the genus *Urotheca*; species (...of *Anolis*, *Oxybelis*, and others) were omitted...one could continue.

An additional criticism, inescapable in books of this nature, is the abundance of cumbersome epithets. I have been accused of using flash cards at family reunions, so my credentials as a practitioner of common names are admittedly shaky. However comfortable I may be in the world of scientific nomenclature, I must confess to stark fear when contemplating the likes of the "Pulo Condore Bow-fingered Gecko." I struggle to contain my hysterics when I confront names like "Tumbo-Insel Screeching Frog," "Zong's Odd-scaled Snake," or "Pomugu Wrinkled Ground Frog." I get confused trying to visualize the "Thick Graceful Brown Snake" or the "Bearded Snake," and I feel intimations of British nobility when mouthing names like "Tilbury's Fringe Fingered Lizard" or "Palfreyman's Window-eyed Skink."

Levity aside, there are trenchant misnomers to be found: calling *Gymnophthalmus underwoodi* "Underwood's Spectacled Tegu" is a bit like calling *Draco volans* a pterodactyl. Of course, we routinely call them dragons, so perhaps I am being uncharitable. Let me repeat that this is a thankless task. Only fatigue and desperation could produce "Silverstone's Mushroomtongue Salamander," or the "Airstrip Caecilian" (its type locality), although I doubt I could invent names any better than the authors'. A more intimate knowledge of tropical geography might have presented a few more palatable names.

Frank and Ramus made every attempt to contact the scientific community and they used existing lists of common names wherever possible. But one must possess intimate knowledge of the field in order to weigh appropriately the systematic controversies that abound, and even established common name lists such as the one for the U.S. (Collins 1990) suffer from politics and ethnocentrism. Judging by the reference list, herpetocultural publications replete with names invented in the commercial animal trade were also consulted, a potentially dangerous practice.

The sad thing beneath the entire issue of common names is our collective fear of science and its nomenclature. It's an assailable stigma, but science lacks a publicist. Society routinely ingests Latin words like subpoena, oddities like xerox and kleenex, and even genera such as *Tyrannosaurus* and *Velociraptor*. Confronted with such an enormous list, it seems like it would be easier to stay with the existing scientific names. Should government or conservation agencies embrace this guide (perish the thought), scientists will have to purchase copies so they can look up the scientific names! If there is ever to be a workable and consensual common names list for herps, it will require the ongoing effort of a panel because the task remains...thankless.

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A Complete Guide to Scientific and Common Names of Reptiles and Amphibians of the World, by Norman Frank and Erica Ramus. 1995. N.G. Publishing, Inc. RD 3 Box 3709-A, Pottsville, Pennsylvania, 17901-9219, USA. 377 pp. US $19.95 + $3.00 p/h (outside USA $6.00). ISBN 0-9641032-3-0.

ERNEST A. LINER
310 Malibou Boulevard
Houma, Louisiana 70364-2598, USA

This 5 1/2 x 8 1/2 inch book is divided into three parts, an Index to Genera (11–19), a Taxonomic Section (23–261), and an Index to Common Names (265–369) of the reptiles and amphibians of the world. Species-level names are used except for U.S. taxa, which includes subspecies, thus comprising some 12,000 herps. The book is cross-referenced so that if the family, genus, species, or common name is known a given taxon can be located. The common name index is based on the assumption that the name you use is the one used in the book. This is a broad assumption inasmuch as common names exhibit little consistency. What is used in one area may not be used in another for the same animal. The authors have created common names for a large number of forms that have no English names.

As with any book of this type, it is outdated upon publication. Composition of genera and recognition of species change with increased information. Descriptions of new taxa occur frequently. This is what makes taxonomy such an exciting and evolving science. The U.S. and Canadian common names checklist (Collins 1990) and the recently-published Mexican checklist (Liner 1994) were utilized for North American taxa.

The inclusion of the generic index arranged alphabetically simplifies the location of where these taxa are in relation to their respective groups. The contents listing is helpful if you happen to know the family name for which you are looking, but I like the generic list better. The list would have been more useful if the describer and date of description of each genus was given. Although the authors do not indicate their cut-off date for inclusion of references, I found listings up through 1994.

For this review no effort was made to check out the accuracy of the taxonomic arrangements followed. I assume that this task was accomplished by the scientific reviewers listed in the acknowledgments. No statement is made about the criteria used to include or exclude a given taxon from the list, or to account for generic allocation of problematic species.

The authors state that they take credit or blame for this book. Typographic or spelling errors seem to be few for a work of such detail. A brief scanning of the pages revealed a missing date left on page 136. Among Mexican taxa, I noticed some duplicate listings: *Urotheca elapoides* Cope, 1860 and *Pliocercus elapoides* Cope, 1860; and *Barisia imbricata* Wiegmann, 1828 and *Gerrhonotus imbricatus* Wiegmann (no date). A careful check may turn up more errors of this type.

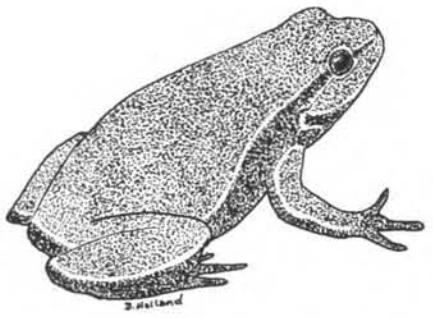
This book is not intended for the general layperson but for people interested in some form of herpetology, whether professional or amateur. The decision to put a common name on each and every species is an agonizing one. Many have no common name (at least not in English), while others have a multitude of names. The task of creating a meaningful common name is difficult. You are damned if you do and damned if you don't. Picking a single name for a taxon with a plethora of names is equally rough. You will not please everyone regardless of which name you choose and you cannot list all of them. As this book becomes more accepted, it can be periodically updated, as currently it is the most complete worldwide checklist of the herps. An impressive list of references (pp. 371–377) is given and I am sure others were consulted but not listed.

Although this book is not intended to be a coffee table item it is one that should be in every herpetologist's library. It is one that I will refer to often. The price is within the reach of most interested persons.

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COLLINS, J. T. (ed.). 1990. Standard common and current scientific names for North American amphibians and reptiles (3rd ed.). SSAR Herpetol. Circ. (19):1–41.

LINER, E. A. 1994. Scientific and common names for the amphibians and reptiles of México in English and Spanish—Nombres científicos y comunes en Ingles y Español de los anfibios y los reptiles de México. SSAR Herpetol. Circ. (23):1–113. Transl. by José L. Camarillo R.



Hyla femoralis (Pine Woods Treefrog). Illustration by Dan Holland.

The Herpetological Contributions of Wilhelm C. H. Peters (1815–1883). Introduction, biography, annotated bibliography, and synopsis of species by Aaron M. Bauer, Rainer Günther, and Meghan Klipfel. 1995. Society for the Study of Amphibians and Reptiles, 714 pages, 114 plates, 9 photos, maps, index. Clothbound US $75.00. ISBN 0–916984–35–4. Available from Robert D. Aldridge, SSAR Publications Secretary, Department of Biology, Saint Louis University, 3507 Laclede Avenue, St. Louis, Missouri 63103, USA.

P. E. VANZOLINI
Museu de Zoologia, Universidade de São Paulo
Caixa Postal 7172, São Paulo, Brazil

This book places in the hands of the working herpetologist the complete output of one of the most competent and prolific systematists ever, Wilhelm Peters of Berlin (1815–1883).

The Middle 19th Century witnessed an explosion of faunistic, and, by consequence, systematic knowledge. It was a time of intensive geographic exploration, both maritime and of the interior of the tropical continents, and the museums of the colonial powers grew commensurately. Their holdings were initially classified according to the canons of Linnaeus and early followers, but soon became the raw materials for the progress of systematic zoology. Wilhelm Peters was associated with the Berlin museum, one of the largest in Europe, from 1842 to his death in 1883. He occupied successively the positions of scientific assistant, curator, and director, but remained throughout essentially the curator of vertebrates.

The position of museum curator was in those days singularly active and diversified. There was very little, if any, specialization to zoological group or geographical area. It was the duty of the curator to structure, maintain, enlarge, and principally arrange the collections under his care, striving for completeness. This naturally involved research, but of an entirely unplanned character—the curator had simply to solve the problems posed by materials haphazardly received. This was the school of impromptu curatorship to which belonged, with greatness, Gabriel Bibron in Paris, George Albert Boulenger in London, and Wilhelm Peters in Berlin.

This type of curatorial activity unavoidably resulted in a mass of papers of circumstance: mostly accounts of collections donated, small and large, with the descriptions of new taxa, but also incidental items of anatomy, critiques of current literature, etc. In the beginning of his career, before a one-man, long expedition to East Africa (1842–1848), Peters, as a properly trained German zoologist, published nine papers: seven anatomical, one on a mite, and only one systematical. After his return from Africa, of 205 papers published eight referred to results of the expedition (including an important book), two dealt with reptilian systematics at the family level (Uropeltidae and Scincidae), and one with a South American lizard genus, *Cercosaura*. All the remainder are of the type I have called "of circumstance," determined by hazard, not by intent.

This involves no slight to the scientific quality of the papers. Men of talent, with a solid scientific foundation (Peters studied under the elder Reinhardt in Copenhagen and under Johannes Müller in Berlin), having at their command extensive collections and the full bibliographic resources of the time, had to produce good quality. In fact, much of the progress of systematic zoology followed from papers of such a type; the works of ensemble (e.g. the Erpétologie Générale, the British Museum Catalogues) were essentially compilations of work published piecemeal. Practically two thirds of the ca. 650 new forms (species, subspecies, and varieties) proposed as new by Peters are currently considered valid.

The only criticism I see that can be raised against Peters's professionalism is a flagrant disregard for geography. Many species, for instance, are described as "angeblich" (allegedly) from such or such a country. In one paper (1871b) Peters professes to be describing a collection made in the "Hochlande" (highlands) of Perú; the five localities actually cited are all Amazonian.

Circumstantial papers demand prompt publication. Peters had recourse mostly to the Monatsberichte of the Berlin (Prussian) Academy of Sciences, which could take at times as little as one week to publish a (suitably laconic) paper. This journal is not frequent in modern libraries. Additionally, it contains numerous occasions for doubts and uncertainties, especially when available solely in the form of a xerographic copy of a single article. It is thus a tremendous contribution to the practice of herpetology to publish in an organized facsimile form the voluminous corpus of Wilhelm Peters's herpetology, which covers literally all the field and all the world.

The apparatus of the book consists of 1) an Introduction, dealing mostly with the Berlin museum; 2) a biography of Peters; 3) an introduction to Peters's bibliography; and 4) a definitive, annotated list of Peters's herpetological papers, settling all doubts. This first part of the book is authored by Aaron M. Bauer, Rainer Günther, and Meghan Klipfel, who must be complimented for a careful and meticulous piece of work, never descending into preciosity.

The large number and diversified size of the papers to be reproduced caused the page size to be large, 28.0 x 21.5 cm, with narrow margins; even so, many of the papers had to be reduced for reproduction. Nothing, however, has interfered with readability. The plates, reproduced from gray lithographs, are of course not vivid, but quite usable.

This is all in all a superb piece of work, of immeasurable practical value and extremely high intellectual standards. One recognizes the tradition of the SSAR and the editorial hand of Kraig Adler.

Amphibians and Reptiles of New Mexico, by William G. Degenhardt, Charles W. Painter, and Andrew H. Price. 1996. Illustrations by Clay M. Garrett. Foreword by Roger Conant. University of New Mexico Press, Albuquerque. xix + 431 pp. cloth, US $35.00 plus shipping. ISBN 0-8263-1695-6.

JAMES R. DIXON
705 Inwood Drive, Bryan, Texas 77802, USA

Both amateur and professional herpetologists should buy this book. The book is concise, well written, and covers the subject matter of New Mexico Herpetology. Besides the usual foreword, written by Roger Conant, preface, and acknowledgments, the book has a number of major headings: A physiographic sketch of New Mexico; A brief history of herpetology of New Mexico; A checklist of amphibians and reptiles; A key to the tadpoles and salamander larvae; A key to the salamanders; A key to the frogs and toads; A key to the turtles; A key to the lizards; and A key to the snakes. Following each key, there is a discussion of the various families to which the organisms belong. Each family description is followed by species accounts. The first line of the species account contains the scientific name, followed by authorship, date, and common name. The next line directs the reader to a color plate for that

species. There are 123 color plates that are grouped in the center of the book. Within the species accounts, there are a series of topics that thoroughly explain the authors viewpoints on each species. First, there is a discussion of the type series, including the holotype; followed by a statement of the general distribution of the taxon along with its state distribution, Next is a description of the taxon, followed by sections of similar species, systematics, habitat, behavior, reproduction, food habits, and remarks. The end of each species account contains a detailed dot map showing the distribution of each taxon for the state. The description of the taxon's state distribution is somewhat redundant. The distribution dot maps are self expanatory.

Towards the end of the book are sections presenting amphibians and reptiles of questionable occurrence in the state; list of scientific and common plant names used in the text; list of museum symbolic codes; a glossary; literature cited, and an index. The very last page contains a conversion table for Metric/English units of measure.

As with all new publications, there are a few glitches. Fortunately, the authors discovered most of these and sent (at least to some of us) a list of the errors. Those herpetologists familiar with the New Mexico herpetofauna were quick to recognize a few of the major errors. However, before we could alert the authors, they were already on top of these mistakes, and were rapidly advising the book owners of the errors (Price et al. 1996). I commend the authors for their rapid review of their own work. For the purposes of this review, I will rephrase the errors by category. Citations: errors on pp. 65, 114, 116, 308, 315, 380, 387, 409, and according to the authors, one citation is missing from p. 382 ([Cope, E.D. 1875; Bull. USNM (1):1–104]). One spelling error on p. 370; oviducal = oviductal; transcription errors: pl. 99, 100, pp. 253, 254. The authors note that they did not define the acronyms "GAB and GBPS" on p. 203, the figure in Fig. 18a is incorrect. The ventral surface of the tail should contain transverse black bars. The scale in figure 2 should read "900–2200", not "2000–12500" and the contour intervals are 100m, not 500m. The order of color rectangles are incorrect in Fig. 3. They should be blue-green yellow and brown. The animal pictured on plate 82 is from Socorro County, and the one pictured on plate 84 is from Eddy County.

It is difficult to evaluate how current a book is with respect to its information content without knowing the time-line the authors used for non-inclusion of the literature. In this case, 1994 appears to be the latest entry used in the literature cited section. The authors cite Wright's (1993) synopsis of *Cnemidophorus* systematics, but failed to follow his synonym list for the southwestern United States taxa of *Cnemidophorus* in their New Mexico herpetofauna checklist; e.g., placement of *C. t. reticulariens* (*sic*, Wright = *reticuloriens*) as a synonym of *C. t. marmoratus*. The discussion of its systematics wasn't necessary (pp. 228–229). The use of various generic names, e.g., *Spea* vs. *Scaphiopus*; *Trionyx* vs. *Apalone*; *Opheodrys* vs. *Liochlorophis*; *Elaphe* vs. *Senticolis*; *Elaphe* vs. *Bogertophis*; *Nerodia* vs. *Thamnophis* (for *rufipunctata*), are choices authors are forced to make based upon the most current knowledge available, but may not be the correct ones. Depending upon one's point of view, some readers will be happy with the choices of names, others will not, but that is the nature of the "beast."

This book is not a field guide. It is of large size, 8" x 10", and a reference guide for the amphibians and reptiles of the state of New Mexico. A field guide is surely contemplated by the University of New Mexico Press as a follow-up to this reference.

All in all, this is an excellent book. All students of herpetology should own a copy. This book will be the standard reference for the New Mexico herpetofauna for many years. At $35.00 a copy, almost anyone can afford to purchase a copy.

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PRICE, A. H., C. W. PAINTER, AND W. G. DEGENHARDT. 1996. Corrigenda to *Amphibians and Reptiles of New Mexico*, by W. G. Degenhardt, C. W. Painter, and A. H. Price, published by the University of New Mexico Press, July, 1996. Herpetol. Rev. 27:173.

Geckoes, Biology, Husbandry, and Reproduction, by F. W. Henkel and W. Schmidt. 1995. Krieger Publishing Company, Malabar, Florida. xiv + 237 pp. Hardcover. US $49.50. ISBN 0-89464-919-1.

AARON M. BAUER
Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: abauer@king-kong.vill.edu

This guide to geckos and their care is a translation of the original German language edition published in 1991. It is divided into two primary sections, the first outlining the basic biology of geckos, their captive husbandry, and the materials and techniques of vivarium maintenance. The second section presents accounts of representative species divided by subfamily. Although some of the general biological information is out of date (e.g., the age and origin of geckos as a whole), most is accurate. The description of how gecko setae function, for example, is the only correct explanation I have ever seen in a popular work. Nonetheless, a few statements, such as those relating to the gliding ability of *Uroplatus* and the ability of *Teratoscincus* to breath through the skin, are not, as far as I know, supported by any published observations.

In Germany, vivarium keeping is both an art and a science. As might be expected, the sections dealing with captive care, behavior, and reproduction are especially authoritative. These are based largely, but by no means exclusively, on observations of *Phelsuma* spp. Details on vivarium construction and specifications are useful and the authors themselves are experts in this field. They present details for five general types of vivaria that, alone or in combination, will be appropriate for virtually all gecko species. Information is also provided about outdoor vivaria and free-ranging house geckos. There are short sections on raising feeder insects, breeding, and incubation. These are generally state-of-the-art. The section on diseases outlines common ailments, but the recent publication of a spate of reptile disease and parasite books renders the authors' citations outdated.

Although the book is not comprehensive, 43 genera and 76 species and subspecies are highlighted, as representatives of commonly kept (and some not so common) forms. Although most genera are represented by only one or two species, 13 forms of *Phelsuma* are detailed, reflecting the popularity of these colorful lizards in the pet trade. For each species highlighted the following categories are reviewed: distribution, habitat, size, characteristics, vivarium type, husbandry and reproduction, food, and similar species. Vivarium type and habitat are also summarized by genus in convenient tables for each subfamily.

There are several minor errors in this section. For example, *Lygodactylus picturatus* is ascribed to Peters 1896 (in fact the correct date is 1869), and the habitat description for *Pachydactylus oculatus* is not typical for that species. However, these issues do

not detract from the real value of the book: providing information pertinent to the keeping of geckos in the vivarium, with a primary concern for the captives' well-being.

The book is illustrated by 97 color photos and numerous line drawings. Although the photos are not outstanding, most are adequate portraits of terrarium specimens. Some could use cropping and one (on p. 149) appears to be printed upside down. If anything, the photos in the English version are somewhat clearer and brighter than in the German original. A corrected map, included as a separate insert in the original is incorporated in the translation, but with the original German labels.

The translation itself is generally accurate but in some places there are somewhat awkward literal translations of terms that have more appropriate English equivalents. Oddly, for a book published in the U.S., the translation is into British English. Metric measurements have not been converted and this may be problematic for many of the intended readers who will not be familiar with working in these units.

The literature cited section includes 148 entries. Apparently this section was not translated as terms such as "in Vorbereitung" (in preparation) are still present. Some errors in the original references have been carried over, such as Pregili for Pregill in the reference to Grismer (1988) and "C'ladistic" in Kluge (1987). New errors have been introduced, however, such as the all italics rendering of Bustard (1970), the missing "L" in Loveridge (1947), and the spelling *Stenodactylusz* in Remy and Remy (1990). Among other new errors, the genus *Eurydactylodes*, spelled correctly throughout in the German original, is uniformly misspelled as *Eurodactylodes* in the English version and Eocene is consistently misspelled as Eoscene. Most of the remaining spelling errors are minor and were carried over from the original German. These include some mistranslations in a table of Latin generic derivations, and some often misused specific epithets (e.g., *bibroni* instead of *bibronii*, *sauvagei* instead of *sauvagii*, *garnotti* instead of *garnotii*).

There are now many vivarium guides for lizards, and even a number directed specifically at geckos. One by Seufer (1991) also began life in Germany but was modified and expanded significantly before being published in the U.S. Although it covers much of the same ground as Henkel and Schmidt, only 29 taxa are highlighted, and there is uneven phylogenetic coverage, with only two species of diplodactylines covered. A recent book by Bartlett and Bartlett (1995) has an extensive section on U.S. native and introduced geckos and is geared more specifically towards an American audience. All of these books would be useful for the beginning gecko-keeper or enthusiast. However, Henkel and Schmidt's contribution is a must for anyone who is serious about keeping exotic geckos, including the more expensive and harder to obtain species. This book also does the best job of providing the nontechnical reader with an overview of the diversity among geckos. Although not cheap, this book would be a good investment for those who spend, or plan to spend, a large portion of their time and income on observing, breeding, and raising these fascinating lizards in captivity.

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Seufer, H. 1991. Keeping and Breeding Geckos. T.F.H. Publishing. Neptune City, New Jersey.

Chamäleons, Bunte Juwelen der Natur: Handbuch der Modernen Chamäleonologie, by Petr Necas. 1995. Bücher-Kreth, Frankfurt-am-Main. 259 pp. Hardcover. DM 68.— (approx. US $49.00). ISBN 3-930612-0-2-X.

AARON M. BAUER

Department of Biology, Villanova University
800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA
e-mail: abauer@king-kong.vill.edu

Chameleons are undeniably attractive animals, a fact that has not been lost on authors and publishers in recent years (e.g., Bartlett and Bartlett 1995; Le Berre 1995; Martin 1992; Schmidt et al. 1994). Petr Necas' contribution, *Chamäleons, Bunte Juwelen der Natur*, is the latest addition to the genre. Although it covers much of the same ground as its competitors, this book has some features to recommend it. Far more information is provided than in the competing works. In the general section on chameleon biology, especially detailed treatments are provided on topics such as the mechanism of tongue protrusion, hemipenial structure, and chameleons and human culture. Higher order systematics are reviewed and a list of recognized species is provided. The author follows the generic divisions of Klaver and Böhme (1986), recognizing six genera in the group.

Most of the remaining topics treated are related to husbandry and are similar to, though more detailed than, those in other chameleon books: behavior, reproduction, chameleons in captivity (an extensive section), terrarium set-up and requirements, and diseases. The second portion of the text presents accounts for 50 selected species. In comparison with other recent books, this provides the greatest breadth and balance of species coverage. Le Berre (1995) covers 30 species and the other authors fewer. Bartlett and Bartlett (1995) provide little information on species of *Brookesia, Rhampholeon* or *Bradypodion,* and Martin (1992) focuses on just four species in total.

Each species account provides Latin, German, and English names, a description (usually including a section on the significant sexual dimorphism characteristic of many species), "systematics and zoogeography" (essentially a review of any recognized subspecies and a statement of distribution), climate and biotope, biology and reproduction in captivity, and a numerically coded list of relevant literature. Although much information is presented, some of it is difficult to retrieve. Some text sections (e.g., that on terraria) are very long and do not have subheadings, and the presence of a detailed table of contents does not fully compensate for the lack of an index.

A short (eight page) glossary with more than 250 entries is included as an appendix and, in a significant departure from other books, 928 references are listed in the bibliography, facilitating further exploration of topics by the reader. Although not fully comprehensive, the bibliography has excellent coverage of works in English, German, French, Czech, and other languages and covers systematic and biological papers as well as those dealing with chameleons in captivity. This feature alone should make the book attractive to those with a serious interest in chameleons, even if they are unable to read the German text.

Illustrative material is variable in quality. The single computer-generated map is not well done and the line drawings are adequate at best. The 64 plates are grouped centrally, with 2–6 photos each. In total there are 250 color photos and five black and whites. The differing layouts of the plates break the monotony, but the wide borders around each photo result in a greater than necessary reduction of the smaller figures, and in some plates adjacent photo-

graphs are oriented at right angles to one another. Most photos feature head or body shots of chameleons, but others show x-rays, parasites, anatomical close-ups, terraria, eggs, postage stamps, *Dispholidus typus* (a chameleon predator), and a feeding sequence demonstrating the ballistic tongue of *Chamaeleo calyptratus*. The photo quality varies, but many do not have sufficient depth-of-field or are washed-out, and virtually all were taken in terraria with the back wall of the enclosure showing. In general, photo quality in competing books is superior. Bartlett and Bartlett (1995) provide mostly well-balanced and in-focus shots (along with a short section on photographing chameleons), Schmidt et al. (1994) present large, glossy photos of moderate quality, and Martin (1992) has some especially attractive close-ups.

Bunte Juwelen far exceeds its competition in price (all but Martin [1992] are relatively thin paperbacks selling for under $10.00). The fact that the book is written in German is an obvious drawback to most native English speakers. Nonetheless, it provides more information than the other titles combined, and its long list of references make it a generally valuable resource to those with a serious interest in chameleons. I recommend this publication to professional herpetologists on this account in particular. Its utility for amateurs and terrarium enthusiasts will depend largely on their facility in German and their level of sophistication. Those keeping only the more common and robust species may find the book overkill, but those who have or plan to obtain more specialized taxa may find the book of great use.

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Reptile Medicine and Surgery, by Douglas R. Mader, M.S., D.V.M. 1996. W.B. Saunders Co., Philadelphia, Pennsylvania. 536 pp., 653 black and white photographs and illustrations, 4 color plates. Hardcover. US $89.00. ISBN 0-7216-5208-5.

RONALD L. TREMPER
Center for Reptile & Amphibian Propagation
217 Upper Cibolo Creek Road, Boerne, Texas 78006, USA
e-mail: rtremper@texas.net

The popularity of amphibian and reptile keeping has been increasing in a geometrical fashion for the last decade with no end in sight. With tremendous numbers of animals being kept as pets, research subjects, and commercial breeding stock has come an equally large number of medical issues.

Twenty years ago, medical treatment of reptiles was basically done by trial and error, with an emphasis on errors. The thought of applying veterinary medicine to a frog or salamander was unheard of. Then came the pioneering atlas by Dr. Fredric Frye and a generation of exotic pet keepers began to have hope after many a health crisis was successfully resolved. This tradition has been carried on by Dr. Mader and the thirty contributing authors who have made *Reptile Medicine and Surgery* a reality.

Dr. Mader knows that his field is vast and expanding daily, and therefore, was wise to enlist his colleagues' experience in compiling the seven sections of this work. Although Mader wrote the largest portion of this book he also was responsible for editing each contributed chapter. The latter was a chore that, he confides, was wrought with a personal struggle to let stand statements or opinions that were in conflict with his own views. As a reviewer and experienced keeper of herptiles, I am pleased that these controversial topics and opinions were published. For instance, among veterinarians there is one camp that uses classical therapy based on empirical scientific findings and another that considers the principles of metabolic scaling to be the preferred approach. Dr. Mader has delivered both points of view and it is left to the clinician to choose.

The introduction (Section I) contains a recipe that one could follow to develop a herpetology-based clientele, as well as lists of regional herp societies. The husbandry review and zoonoses chapters provide useful background information and form a firm basis for the following sections.

The biology of chelonians, snakes, lizards and crocodilians (Section II) is well presented and throughout the book the use of illustrations and photos help to engage the reader and further clarify the text. In fact, I am sure that this book will be utilized in a number of teaching situations because of the long list of subjects that are competently covered.

Section III, entitled Special Topics, deals with the major categories of animal physiology, such as the heart, eyes, nerves, skin, diseases, microbiology and parasitology, nutrition, reproduction, and abnormalities. As a test of the book's organization, I randomly chose the topic of hemipenis prolapse as a point of inquiry. After inspecting the index, I found that this subject is listed and covered in detail by multiple chapter authors. It was somewhat bothersome to flip between pages 223 and 395 to find all of the information on my subject and to deal with duplicated information written by two different authors. Although this form of duplication occurs several times among the various chapters, I would rather be faced with this type of fault than with a lack of information.

Sections IV and V, Special Techniques and Procedures, and Differential Diagnosis by Symptoms, respectively, are geared for the vet, vet technician, or even the advanced hobbyist who has experiences treating his or her own animals. I have personally dealt with thousands of reptile medical cases during my career and can therefore attest to the fact that the group of subjects presented by Mader and his colleagues is relevant and accurate.

I can't say enough about the high quality of the photographs that clearly illustrate the most common manifestations of the condition discussed and aid the reader in diagnosing problems. I could not find a single photo caption that is incorrect. In addition, the use of mostly black and white photographs has made the book affordable. With full color, which was not necessary for this publication, the price of the book would have been $150–175, out of the price range for many private individuals and beginning veterinarians.

I found Section VI, Specific Diseases and Conditions, to be the most useful for not only the medical community but also for the tens of thousands of private herpetoculturists, who inevitably will encounter a health emergency. These chapters are well-written and comprehensive. Dr. Mader hoped that this book would become a ready reference for any dilemma and it is these "meaty" chapters that assist in forming a diagnosis, establishing a treatment plan,

and delivering drug doses with ease and confidence, that realize this goal.

The final section (VII) of *Reptile Medicine and Surgery* presents overviews of some of the newest areas of herp medicine and research. Despite the book's title, amphibians are afforded some 23 pages of valuable information, and discussions of blood chemistry, artificial lighting, and sea turtle medical care are provided. The all-important drug tables, which many of us will consult frequently to determine the right amount of medicine to give to our ailing captives, also falls in this section.

Reptile Medicine and Surgery teaches, guides, reviews, and most importantly, resolves the medical issues presented by these animals. No volume of this type can ever be complete, but in the fine tradition of Dr. Frye, the work of Doug Mader and his colleagues will long stand as an important contribution to the field.

The Garter Snakes: Evolution and Ecology. By Douglas A. Rossman, Neil B. Ford and Richard A. Seigel. 1996. University of Oklahoma Press, Norman, Oklahoma. 332 pp. 15 color plates. Hardcover. US $69.95. ISBN 0-8061-2820-8.

LANI P. LYMAN-HENLEY
Division of Science and Mathematics, Mississippi University for Women
Columbus, Mississippi 39701, USA
e-mail: lhenley@muw.edu

The authors of this book have set themselves a very tall order: an all-encompassing book on the genus *Thamnophis* written to appeal to professionals, students, and hobbyists. All of these audiences are certainly ripe for such a book, garter snakes being as ubiquitous as they are in both backyards and research laboratories. As a comprehensive overview of garter snake biology this book does an admirable job, especially in the face of the convoluted mess that garter snake taxonomy has been for so long. Unfortunately, few books aimed at such a diverse audience fully succeed, and I'm afraid that this book also falls short of its ambitious mission. Ironically, the problem primarily is in its very scholarly treatment of the aforementioned taxonomy of these snakes.

The book is organized in three sections: "Taxonomy and Evolution," "Ecology, Behavior and Captive Care," and "Species Accounts." Section I contains three chapters written by Rossman. Chapter 1, "Taxonomy and Relationships of Garter Snakes," is a thorough (but bland) discussion of the taxonomic history of the genus *Thamnophis*. This chapter also includes careful descriptions of morphological features of use in taxonomy that becomes a bit repetitive, especially regarding distinguishing between "superficially similar sympatric and parapatric species." Although this material is certainly important—we have been in dire need of an authoritative revision of the taxonomy of thamnophiine snakes for many years—I question it being the opening of the book. This is simply because it will be difficult reading for the less "taxonomically-sophisticated" (including the majority of the hobbyist audience) and may discourage such readers from continuing.

Chapter 2 is actually just tables of proposed garter snake names, in chronological order by their original name. It is an odd thing to have a chapter entirely sans narrative, and would seem to have been more appropriate as an appendix. Chapter 3 is a dichotomous key to the species and subspecies of *Thamnophis*. Again, somewhat odd content for a "chapter." The most glaring problem with this key is the gross error occurring at point 3 (the first option has no value listed). This is by far the most important typo among many still found throughout the book. My students tested the key using preserved specimens of several species of *Thamnophis* and found it difficult to use. The organization of the key includes some very precise features early on—e.g., numbers of maxillary teeth and ratios of facial scale measurements. It seems unlikely that anyone could be reasonably expected to follow this key without good calipers, a dissecting microscope, and preserved (occasionally skeletal) materials. Placing such fine details early on makes this especially problematic. It may have been more user-friendly to use the standard general-to-specific order for features where possible. We repeatedly found ourselves skipping ahead with known species and working backward through the key to follow the logic. All of these difficulties would be even worse with living specimens—let alone for users less familiar with keying out snakes. This seems to be the most salient example of the book serving its "technical" audience at the expense of other potential readers.

Section II includes chapters on ecology, behavior, and captive care, and is much more accessibly written for a "lay" audience. It begins with Chapter 4, "Ecology & Conservation of Garter Snakes: Masters of Plasticity", written by Seigel, in which garter snakes are roundly praised. It is pointed out that the majority of data on the genus is based on work involving a few species and populations, and that the review is therefore necessarily incomplete. Despite this caveat, it is a very thorough and comprehensive survey of the current state of information on the ecology of genus *Thamnophis*. Topics covered include Reproductive Ecology, Foraging Ecology, Population Ecology, Thermal Ecology, and Conservation.

Chapter 5 concerns the "Behavior of Garter Snakes." This chapter, written by Ford, opens with a nice treatise on the usefulness of Garter Snakes as Models for Studies of Behavior, followed by a section on Behavioral Capabilities focusing primarily on chemoreception. The sections on Foraging Behavior, Thermoregulatory Behavior, Antipredator Behavior, Orientation and Navigation, and Reproductive Behavior appear to be relatively comprehensive surveys. The sections on Habitat Selection, Hibernation, and Genetics & Evolution of Behavior are comparatively concise (but still good) reviews. The section on Learning indicates a special interest of the author, and is earmarked as an area in need of further attention. Given the quality and completeness of this chapter, it was quite a surprise to find the section on Aggregation to be lacking. The only type of aggregation mentioned is that of gravid females, despite the occurrence (and study of) several other manifestations of this phenomenon (e.g., Burghardt, 1983; Gillingham, 1987; Lyman-Henley & Burghardt, 1994—each of which also offers some review of the missing literature). This lacuna is especially disappointing given the opening lines of the chapter (quoted from Brattstrom, 1974) "Snakes may be the most asocial of reptiles (p. 90)." Studies into aggregation behavior are clearly the most direct window on snake sociality. Other than this oversight, the chapter is well written and concludes with a section on Future Studies, pointing out some lines of research that seem (to the author) in need of exploration.

Chapter 6 deals with Captive Maintenance of garter snakes. Also written by Ford, it is likely to be the most-read section of the book by hobbyists. It is on balance both well-done and thorough in scope, describing benefits and draw-backs to several different maintenance procedures. It is, however, certainly aimed at an audience assumed to be maintaining only a few snakes at a time, since some suggestions are rather time intensive—although it is noted that procedures for large lab populations are well documented for some species and suggested references are given. Personally, I found the short section on the treatment of snake mites surprisingly blase considering the devastation these organisms can wreak if infestations are allowed to become chronic. Oddly, the closing

section, The Future, doesn't really make any comments regarding the future.

The final section, III, consists of Species Accounts, jointly written. All species accepted by the authors (as detailed in Chapter 1) are covered in separate accounts that are in general quite good. Each account includes a unit on the taxonomy of the species, a range map, a unit on Life History and Ecology, and further units that vary somewhat depending on the information available for that species. All thirty species have a reference to at least one color plate, and a common name ascribed to them. For the most part, the species that are lacking in more detailed information are Mexican in origin. Of these, the only surprise is *T. melanogaster,* as there is now a rather extensive laboratory population maintained by several active researchers that seemingly would have allowed for more comments than are included here.

One assumes that for the most part some units are simply omitted given a lack of information. The account on *T. eques* specifically notes that "No literature on care of this species in captivity is available (p. 177)," and similar explicit comments in other accounts could have served as implicit research directions. Another point was the lack of any reference to the impact of the pet trade collection on populations of several species. It was noted that *T. radix* is a common pet store species, although my experience is that *T. sauritus, T. marcianus,* and brightly colored populations of *T. sirtalis* (e.g., the "Florida blue") are now regularly appearing on the reptile market. I have even occasionally seen specimens of *T. brachystoma, T. eques, T. cyrtopsis*, and *T. ordinoides* as well. Relatedly, one point in which I beg to differ is the opinion of the authors that *T. marcianus* is a particularly easy captive. Perhaps it is a population difference, but among my students, *T. marcianus* have been dreaded as charges due to their highly aggressive nature. Even *T. melanogaster* are preferred, being far less likely to actually bite.

The closing pages of the book contain a perfectly fine glossary, an index to scientific names, and the literature cited. There is no subject index, which could have been a useful inclusion for the student audience.

In all, Section I is written for professionals, and will likely be rather inaccessible to much of the potential audience of this book, as even the key requires materials beyond the scope of most people dealing with garter snakes. Sections II and III are written in a much more accessible style for a wider audience, and although it would be impossible to discuss every piece of research done on this wide-ranging and diverse genus, this book comes admirably close. Perhaps that captures my bottom line—"admirably close." It was with great enthusiasm that I accepted this review. As an active garter snake researcher for well over a decade now the very idea of this encyclopedic book was exciting to me. As such, perhaps I was overly disappointed by the various omissions (e.g., aggregation) of current literature. Despite its flawed key, occasional sins of omission, and uninviting price tag, I still highly recommend this book for coming so admirably close to the Herculean task of exhaustively documenting the genus *Thamnophis* for a broad audience.

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A Monograph of the Colubrid Snakes of the Genus *Elaphe* Fitzinger, by Klaus-Dieter Schulz. 1996. Koeltz Scientific Books, Koenigstein. 439 pp., 121 figs., 18 tables, 48 maps, 420 col. photos on 58 pls. Hardcover. ISBN 80-901699-8-8. Price DM 220 (ca. US $150).

V. WALLACH

Center for Vertebrate Studies, Biology Department
Northeastern University, Boston, Massachusetts 02138, USA
e-mail: vwallach@oeb.harvard.edu

This monograph treats eight New World and 32 Old World species of the genus *Elaphe sensu lato*. Written, illustrated, and photographed mainly by Schulz, there are four species accounts authored and one coauthored by A. Entzeroth. Illustrations were also provided by A. Gumprecht and T. Smith, with 1/4 the photographs contributed by more than 50 individuals. The book is beautifully executed on acid-free paper with a large type face. The first 75 pages deal with materials and methods, terminology, nomenclature, an expanded generic description, fossil records (with 80 references), geographic and elevational summaries, systematic species groups, distribution, natural history, reproduction, color variation, and husbandry. The species accounts cover 249 pages. A voluminous bibliography with 2810 references occupies 81 pages. Appendix I contains vernacular names of rat snakes in 40 languages. Appendix II lists the 613 preserved specimens examined from 16 institutions; 38 of the 40 species are mentioned (all but *rosaliae* and *vulpina*). The index is arranged by genus with species listed under the genera and subspecies listed under species, all in alphabetical order. As each binomial and trinomial combination is listed only once (under genus or species, respectively), it is inconvenient and time-consuming to find a name if only the original specific or subspecific epithet is known (as the species or subspecies names are not indexed). An index based on the species and subspecies names (with individual genera listed separately) would have been more useful as it is necessary to know all the generic synonyms of *Elaphe* (and their combinations) to locate a name in the index.

Each species account begins with scientific and vernacular names and contains a synonymy and sections on the type locality, holotype, description (color pattern), scutellation, distribution, natural history, husbandry and breeding, and literature. To economize space, references are numbered in the bibliography and listed only by number at the end of each account. When subspecies are recognized, the preliminary portion of the account contains all of the above sections except synonymy, type locality, and holotype; each subspecies account then follows with sections on synonymy, type locality, holotype, description, and distribution. Species accounts are 2–14 pages in length, with most species treated in 3–7 pages. Each account has a beautifully illustrated dorsal and lateral head view plus at least one dot range map. There are supplemental illustrations of head, head and anterior body, midbody pattern, or ventral pattern in 27 accounts. Each account concludes with a synopsis of the husbandry conditions necessary to maintain the species in captivity and available data on breeding behavior and habits.

The color plates are generally superb and contain 420 photos (usually arranged 8 on a plate). Thirty-seven of the 40 species are illustrated from life (*cantoris*, *leonardi*, and *perlacea* from paintings and preserved specimens only). In addition, there are 14 habitat photos, 24 of preserved specimens, and 27 of miscellaneous subjects. The photography is excellent and only about ten of the photos (from contributors) are not perfectly focused or are poorly composed.

The distribution maps are clear, legible, full-page dot maps (only a few well-known species have solidly shaded ranges as in field guides). National boundaries are outlined (sometimes even provinces or states), countries are labelled, type localities are indicated, and large cities and major rivers are also included. Multiple species or subspecies on a single map are depicted using different symbols. The first nine summary tables are most informative and useful, including data for each species on scale counts, dentition, elevation, distribution by country, prey preferences, and reproduction.

The typescript and proofreading are impeccable. I found only two misspelled words (p. 84: presubcocular; p. 215: seperated), two misspelled surnames (p. 27: Bachmeyer; p. 190: Lanzell), two misspelled place names (p. 284: Upsala; p. 297: Isla), and two misprinted years (1064, p. 111; 1833, legend pl. 1). Considering that the English version is a translation from the original German, the syntax and grammar are excellent. The main grammatical complaint is with the incorrect placement of commas (or absence of them when needed), and this error must be attrributable to the South African group that performed the translation (Herprint International). When referring to body coloration, "in" is consistently substituted for "on," there is frequent use of the adjectival form of a color (grayish, yellowish, greenish) in place of a noun, and occasionally an "s" is omitted on plural words or added on a singular noun. Temperment is often referred to with the terms "shy" or "shyness" when a reclusive or secretive nature is implied and "vicious" when irritable is more appropriate. The consistent capitalization of vernacular snake names and/or their consolidation into one word (as Ratsnake) is a minor irritation. The minor criticisms above are probably attributable to the original language of the book being German.

The major failing of this work is in the area of nomenclature and systematics. It is acknowledged that the author is an amateur and while he has undoubtedly compiled the most detailed, comprehensive, and profusely illustrated treatise ever on rat snakes, it is surprising that the scientific consultants (W. Böhme, N. Helfenberger, and M. Ruf) did not more carefully review the systematic sections. Presentation of the type concept and its ramifications is poor and definitions of holotype, syntype, paratype, lectotype, neotype, and *nomen substitutum* are inaccurate and misleading. The designation of a holotype (or any type for that matter) was not practiced until about 50 years ago. If no type has been designated (as in the older literature), all specimens upon which the description is based are syntypes and none may ever become a holotype, although a lectotype can be selected from the original syntypic series and holds the same status as the holotype. Also, a number of type locality restrictions are incorrectly cited or misconstrued, and sometimes a syntype or lectotype is referred to as the holotype. It was a common practice in earlier times to exchange one of a series of syntypes with other museums and the BMNH and MCZ did so for many specimens.

The standardized employment of a single "i" termination for patronyms, in my opinion, contravenes the spirit of the Code and original intent of the author. When the original orthography includes a "ii" ending, it should be preserved as such, and vice versa. This is unambiguously stated in the Code: Articles 31(a), 31(a)(iii), 32(b), 33(d), and 34(b). Thus, three species of rat snakes (*hodgsonii*, *jansenii*, and *schrenckii*) should have the "ii" endings.

In my opinion the most substantive error is the decision to regress a century in taxonomic enlightenment back to a Boulengerian concept by synonymizing the genera *Bogertophis*, *Gonyosoma*, and *Senticolis* with *Elaphe*. Not only is *Gonyosoma* a valid genus as diagnosed by Dowling (1958), but it also differs from *Elaphe sensu stricto* in having a chambered avascular tracheal lung. Besides *G. oxycephalum*, this lung structure is present in at least *G. cantoris* and *G. hodgsonii*. I am in agreement with the author that a genus should not be split until a comprehensive study has been accomplished. However, in the case of the New World rat snakes, it is just a matter of time before they are separated (as they represent a monophyletic clade) under the name *Pantherophis*, and I believe that both *Bogertophis* and *Senticolis* are justifiably distinct. *Bogertophis* possesses two derived features that separate it from all other New World species: absence of the left lung complex and a $2n = 40$ karyotype. All four genera could have been recognized and the title of the book changed to "*Elaphe* and kin" or "*Elaphe* and related rat snakes" without compromising the integrity of the work. This surely would have been an asset rather than a liability. The nomenclature in an important work such as this, which will be the standard for rat snakes for many years to come, will be followed blindly by those who are not specialists in colubrine systematics or who are ignorant of classification in general, resulting in confusion in the literature and hinderance of our understanding of colubrine systematic relationships. Ironically, Schätti's separation of *Hierophis* from *Coluber* is recognized even though a thorough revision of *Coluber* has yet to be completed.

Treatment of subspecies is based upon solid data or consensus of opinion, and with controversial names the author professionally discusses his reasons for the recognition or synonymy of taxa. Questionable systematic procedure involves relegating *Coluber enganensis* Vinciguerra to a subspecies of *E. subradiata*, and considering *E. laeta intermontanus* Woodbury and Woodbury (1942) as a more distinctive form of *E guttata* than *E. g. meahllmorum* Smith et al. (1994). Omissions include the genus *Tyria* Cope (1862), a substitute name for *Zamenis* Wagler, and one fossil species, *Elaphe longivertebrata* Szyndlar (1984). Also, *Elaphis rhombifer* Jan, 1863 is omitted from the synonymy of *E. moellendorffi*. Erroneous subsequent spellings (or typos) of *Elaphe* that were overlooked in the list of misspellings include *Elapho* Bleakney (1958), *Elaphus* Shrestha (1981), *Elahe* Mahendra (1984), and *Elapne* Murthy (1986).

The type locality star is omitted from Map 44 for the type of *E. o. spiloides*, perhaps intentionally because of the apparent taxonomic problem involved. However, designation of "La Nouvelle-Orleans" as the provenance in 1854 probably meant "within the vicinity of New Orleans," and neighboring Mississippi is well within the vicinity. Stanford University is not in San Francisco or related to the California Academy of Sciences, but former SU specimens are now in CAS (CAS-SU). The type of *Elaphe philippina* Griffin is in CAS. *Elaphis q. atra* and *E. q. interrupta* are dated Jan, 1867. Whereas *Coluber quater-radiatus* Gmelin is correctly allocated to the synonymy of *E. quatuorlineata*, *Coluber elaphis* Shaw antedates *E. scalaris* Schinz; since the *nomen oblitum* rule is no longer in effect, suppression of Shaw's name is necessary. The original illustration of *Coluber quatuorlineatus* Lacépède is on pl. 7.

A few errors are attributable to carelessness: the collector of the type of *B. rosaliae* is L. Diguet; the type locality of *E. enganensis* is Boea-Boea and Malakoni; *Coluber alleghaniensis* and *C. quadrivittatus* Holbrook were described in 1836; the description of *Elaphis* Bonaparte is dated 1834; *Callopeltis* was described by Fitzinger *in* Bonaparte (1834 *in* 1832–1841) and *Simus* was described by Fitzinger *in* Bonaparte (1838 *in* 1832–1841); *Compsosoma* and *Plagiodon* were described by Duméril (1853); the type of *Elaphe moellendorffi* is SMF 18476 (8056, 1a is the old Boettger no.). ZIL 3706 is the lectotype of *E. schrenckii*, as designated by Stejneger (1907). The type of *E. situla* is deposited in Stockholm (NHRM).

It is a pity that no identification key is included in this monumental work. With the details of scutellation, color patterns, and distribution presented by Schulz, it would not be very difficult to construct a workable key. For instance, an American key, an Indonesian key, and an Asian (perhaps southern and eastern) key could be compiled. In fact, Staszko and Walls (1994) constructed workable keys to the American and European species. Another omission is neglecting to mention dicephalic ratsnakes. Although the author discusses in detail various color anomalies (melanism, albinism, leucicism) of *Elaphe* and cases of twin specimens hatching from single eggs, he fails to mention that two-headed specimens are known in ten species (*climacophora*, *dione*, *guttata*, *longissima*, *obsoleta*, *quadrivirgata*, *quatuorlineata*, *rufodorsata*, *schrencki*, and *vulpina*). There are at least 30 references to dicephalic *Elaphe* (from 1926–1995), of which only five are listed in the bibliography.

The extensive bibliography is impressive and remarkable for its completeness of coverage of both the professional scientific literature and the amatuer husbandry and herp journals. Although I do not have access to many of the journals cited (*Bl. Aquar-Terrar., Elaphe, Herpetofauna, Herptile, Sauria, Snake Keeper*), in which mostly husbandry articles are present, I can comment on the high quality of the other works included. The coverage of taxonomic, systematic, ecological, and distributional publications is thorough and comprehensive. However, a casual search of my library revealed more than 50 omitted *Elaphe* references, dating from 1861–1995. Most surprising is the omission of the rat snake book by Staszko and Walls (1994), which was previously the most complete work on the group (including all species recognized by Schulz except *persica*).

My main criticism of the bibliography is inattention to details, especially of actual dates of publication (rather than title page dates), but also to author's initials, series and volume numbers, and publishers. From scanning the literature available to me, the errors are certainly minimal and some examples follow, the most critical relating to publication dates. The following numbered citations are correctly dated as follows: #101 (1968), #238 (1900), #329 (1902), #692 (1974), #1003 (1891), #1336 (1979), #1351 (1890), #1371 (1939), #1386 (1894), #1469 (1876), #1672 (1880), #1677 (1893), #1749 (1912), #1747 (1905), #1797 (1910), #2198 (1932), #2652 (1989), and #2764 (1994). Corrected series (s.), volume (v.), and numbers (n.) are as follows: #101 (v. 1966–67), #329 (v. 54), #1206 (v. 11), #1277 (n. 3), #1627 (s. 3, v. 2), #1630 (v. 11, n. 2), #1631 (s. 9, v. 7, n. 5), #1683 (v. 31, n. 25), #2046 (s. 7, v. 8), #2045 (s. 7, v. 1), and #2499 (v. 60). Corrected names and initials of authors include: #261 (E. G. Boulenger), #792 (W. Freedman), #1077–78 (R. Honegger), #1085 (B.-Q. Hu, M.-H. Huang, Z.-T. Xie, E.-M. Zhao, Y.-M. Jiang, Q.-Y. Huang, Y. Zong, and J.-F. Ma), #1170 (J. de Jongh), and #2172 (C. E. Shaw). Corrected publishers include: #1317 (SSAR), #2052 (Amphibia-Reptilia), and #2152 (Unpubl. Ph.D., Univ. So. California). A typo on #1134 is pp. 382–383. One author is cited under two surname variants, #407–408 (Carevskij) and #552 (Czarewsky), #943 is not a 2nd ed, merely a reprint, and #1757 is published by Ernest Bourdin and has 756 pp. The citation for Massalongo (1854) is omitted.

Notwithstanding all the nit-picking criticisms, I am duly impressed with the quality and thoroughness of this book. While the errors mentioned above may seem substantial, in reality they are miniscule compared to the massive volume of summarized information. An excellent resource for both the professional herpetologist and the amateur hobbyist, it is the *opus magnus* of rat snakes. This monograph belongs to the class of the best herpetological books, such as Campbell and Lamar's "Venomous Reptiles of Latin America" (1989), Ernst and Barbour's "Snakes of Eastern North America" (1989), Gloyd and Conant's "Snakes of the *Agkistrodon* Complex" (1990), Mitchell's "Reptiles of Virginia" (1994), and Palmer and Braswell's "Reptiles of North Carolina" (1995). It contains essentially the sum of our knowledge of these snakes, taken from the international academic and hobbyist literature, and including the author's unpublished records. Presented in an understandable and enjoyable reading style, it lacks the dryness of most technical writing. This book is clearly a labor of love; words cannot adequately describe the meticulous and superb effort that went into producing this beautiful and informative work. While it will not be (and is not intended to be) the last word on *Elaphe* and kin, it will remain the standard classical reference on the group, and hopefully will stimulate further research and collection of the poorly known species. As an indispensible guide to the world's rat snakes, no herpetological library will be complete without it. Although it is not inexpensive, the quality of the artwork and information content justify its high price. Unfortunately, due partly to inflation and the cost of color reproduction, superior monographic treatments today cost $100 or more.

LITERATURE CITED
(exclusive of references in Schulz 1996)

MASSALONGO, A. 1854. Saggio di un' erpetologia popolare Veronese. Gius. Antonelli, Verona. 56 pp.

SHRESTRA, K. T. 1981. Eco-geographic distribution of reptiles and need for their conservation. *In* T. C. Majupuria (ed.), Wild is Beautiful: Introduction to the Magnificent, Rich and Varied Fauna and Wildlife of Nepal, pp. 178–183. S. Devi, Gwalior.

STASZKO, R., AND J. G. WALLS. 1994. Rat Snakes: A Hobbyist's Guide to *Elaphe* and Kin. T.F.H. Publications, Neptune City, New Jersey. 208 pp.

PUBLICATIONS RECEIVED

Venomous and Poisonous Marine Animals: A Medical and Biological Handbook, edited by John A. Williamson, Peter J. Fenner, Joseph W. Burnett, and Jacquie F. Rifkin. University of New South Wales Press, Sydney. 1996. Hardcover. 504 pp. + 80 pages of color plates, US $130.00 (available from International Specialized Book Services, Inc., 5804 N.E. Hassalo Street, Portland, Oregon 97213-3644, USA). ISBN 0 86840 279 6.

This large book provides an extensive overview of venomous marine organisms and their toxins as well as the human injuries (and associated treatments) produced by contact, injection, or ingestion of these toxins. Although the emphasis is on Australian marine organisms, the coverage is worldwide in scope. The herpetological content is restricted to sea snakes and *Crocodylus porosus*. The latter is illustrated by a single photograph and mentioned in comparison of Australian shark and crocodile attacks/fatalities. Sea snakes are treated in a short (seven page) chapter and in passages in sections dealing with marine antivenoms, and venomous and poisonous marine animals of the Gulf of Oman and Japan. Nine photos in the color plate section are devoted to sea snakes, with bite victims' wounds figuring prominently.

1996 Herpetological Index, compiled by Breck Bartholomew. Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA. 1997. Softcover. 151 pp., US $20.00 (also available

on disk as a text file or EndNote database file for Macintosh or PC for $15.00 each).

This fourth annual compilation includes complete citations for 3743 herpetological publications taken from a wide variety of sources, including national, international, and regional herpetological journals and newsletters as well as herpetocultural magazines. The citations are indexed by author and subject (including taxonomic, geographic, and topical listings). Although most of the publications cited were published in 1996, older references that have been newly added to the compiler's database are also listed. Although the bibliography is not complete (herpetological citations from many general zoological journals are lacking, for example), it is an economical alternative to *Zoological Record*, the 1995/96 amphibian and reptile volumes of which referenced 4935 publications at a subscription cost of more than US $300.

Schildkröten — Krokodile — Brückenechsen [Turtles — Crocodilians — Tuataras], by Heinz Wermuth and Robert Mertens. Gustav Fischer Verlag, Villengang 2, D-07745 Jena, Germany. 1996. Hardcover. xxvii + 506 pp. ISBN 3-437-35048-X. DM 178.—(approx. US $120.00).

A reprint of the classic 1961 systematic review of the living non-squamate reptiles. The body of the book includes keys, complete synonymies, statements of distribution, and black and white illustrations (many taken from the original descriptions) of all of the turtles, crocodilians, and tuataras then recognized. All Latin names are fully indexed. The reprint itself is accompanied by a short postscript by Wermuth and by a more extensive commentary (with dual German-English text) by Fritz Jürgen Obst. The commentary incorporates a chronological list of the 117 turtles and four crocodilians described since 1961, a summary of major changes in the systematics of turtles, crocodilians, and tuataras, and extensive tables listing the names employed by Wermuth and Mertens and nine subsequent checklists and reviews. The tables serve as guide to the changes in turtle and crocodilian taxonomy over the last 35 years.

Handbook of Ethological Methods, Second Edition, by Philip N. Lehner. Cambridge University Press, 40 West 20th Street, New York, New York 10011-4211, USA. 1996. Hardcover. xix + 672 pp. ISBN 0-521-55405-5. US $ 69.95.

An expanded and updated version of the 1979 edition of this standard reference. The book begins with a conceptual model of animal behavior and includes major sections dealing with research design, data collection (methods and equipment), and data analysis. The section on statistical methods, in particular, has been expanded relative to the first edition and the data collection equipment chapter has been updated to reflect current technologies. The *Handbook* concludes with appendices on microcomputers in ethology, ethics in ethology, and guidelines for the use of animals in research. There is a 1000-entry reference list and the work is subject-indexed. Although a limited subset of the examples provided in the *Handbook* are herpetological, many of the methods are generally applicable to any group of study organisms.

Listado Preliminar de la Fauna Silvestre del Estado de Nuevo León, México, by Salvador Contreras-B., Fernando Gonzales-S., David Lazcano-V., and Alberto Contreras-A, editors. 1995. Consejo Consultivo Estatal para las Preservación y Fomento de la Flora y Fauna Silvestre de Nuevo León. Gobierno del Estado de Nuevo León, México. 152 pp., softcover. Price not given. ISBN 968-7644-001. Monterrey, Nuevo León.

This small book is, as the title suggests, a preliminary checklist of the mammals, birds, reptiles, amphibians, fishes, insects, arachnids, crustaceans, and mollusks of a remarkably diverse region of northeastern México. Although consisting largely of species lists, descriptive summaries of each faunal group are presented in both Spanish and English. Arturo Contreras and David Lazcano prepared the herp checklists (two chapters), and these occupy about 14 pages. Common names (in Spanish) accompany the scientific names for each species.

ERRATUM

In the paper by Hollingsworth et al. (1997. 28:26–28), we inadvertently omitted Table 1, shown below.

TABLE 1. Variation in eight meristic characters for *Sauromalus varius* from islas Roca Lobos and San Esteban. Upper figures = limits. Middle figure = mean. Lower figure = ± one standard deviation. n = sample size. See text for character acronyms and definitions and for a discussion on the male-female separation of dorsals.

Population	VENTRL	CAUDAL	BRACHL	DORSAL (Male)	DORSAL (Female)	FEMPOR	SUPRAL	INFRAL	ROSTRL
Isla	147–160	32–39	50–57	36–40	32–34	31–36	27–33	30–35	4–5
Roca Lobos	152.57	34.43	53.29	38.75	33.00	34.00	30.43	32.86	4.86
$n = 7$	4.32	2.37	2.75	1.89	1.00	1.53	2.15	1.95	0.38
				($n = 4$)	($n = 3$)				
Isla	145–166	30–36	53–61	32–41	28–41	30–38	24–32	30–37	4–6
San Esteban	153.16	32.68	56.05	37.00	35.00	34.26	28.87	33.59	4.71
$n = 19$	6.44	1.83	2.04	2.79	4.30	2.10	2.13	1.94	0.59
				($n = 10$)	($n = 9$)		($n = 16$)	($n = 17$)	($n = 17$)

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P.O. Box 249118
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Coral Gables, Florida 33124, USA

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University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

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Norfolk, Virginia 23529-0266, USA

Meetings
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486 Chandler Street
Worcester, Massachusetts 01602-2597, USA

1997 Local Meeting
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Seattle, Washington 98195, USA

Nominating
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COORDINATORS

Common and Scientific Names
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Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
P.O. Box 709
Tucson, Arizona 85702-0709, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

Information for Contributors

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3507 Laclede Avenue
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Herpetological Conservation
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Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: tyning@shaysnet.com

Advertising Manager
ELIZABETH A. JOHNSON
35 Eighth Street
Frenchtown, New Jersey 08825, USA
(908) 996-4056
E-mail: ejohnson@ptdprolog.net

Associate Editors

DANIEL D. BECK
Department of Biological Sciences
Central Washington University
Ellensburg, Washington 98926, USA
E-mail: beckd@cwu.edu

LEE A. FITZGERALD
Wildlife and Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
E-mail: Lfitzgerald@tamu.edu

DARYL R. KARNS
Biology Department
Hanover College
Hanover, Indiana 47243, USA
E-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
Biological Resources Division
Palm Springs Field Station
63500 Garnet Avenue
North Palm Springs, California
92258-2000, USA
E-mail: jeffrey_lovich@usgs.gov

BRIAN W. BOWEN
Dept. of Fisheries & Aquatic Sciences
University of Florida
7922 NW 71st Street
Gainesville, Florida 32653, USA
E-mail: bowen@icbr.ifas.ufl.edu

DEANNA H. OLSON
USDA Forestry Science Lab
3200 SW Jefferson Way
Corvallis, Oregon 97331, USA
E-mail: olsond@ccmail.orst.edu

Section Editors

Book Reviews
AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

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E-mail: Herpbooks@sisna.com

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106, USA

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
E-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo
Miguel Lillo 251
4000 Tucumán, Argentina
E-mail: postmaster@scro.untmre.edu.ar

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
E-mail: cwpaint@unm.edu

Natural History Notes
R. KATHRYN VAUGHAN
Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
E-mail: rkvaughan@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
E-mail: pstone@aix1.ucok.edu

Copy Editors: *Ellin Beltz, Anne M. Maglia, Jenny Pramuk, Martin J. Rosenberg, Christopher Sheil, Amy Sproston*

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

WWW: http://falcon.cc.ukans.edu/~gpisani/SSAR.html



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1997 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. All members and institutions receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Robert D. Aldridge, SSAR Treasurer, Department of Biology, Saint Louis University, St. Louis, Missouri 63103, USA. Fax: (314) 977-3658; e-mail: ssar@sluvca.slu.edu.

Future Annual Meetings

1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July (Theodore Pietsch, Chair).
1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).

Society for the Study of Amphibians and Reptiles
1997 Annual Meeting
together with
American Society of Ichthyologists and Herpetologists
and
The Herpetologists' League
26 June – 2 July 1997
University of Washington, Seattle, USA

Keynote Address: "Frogs, Unpredictability, Flexibility, and the Future," by Martha Crump (Northern Arizona University).

Symposium: "Nuclear DNA and the Evolutionary Genetics of Fishes, Amphibians and Reptiles." *Organizer*: Andrew M. Shedlock, University of Washington, FTR, Box 355100, Seattle, Washington 98195, USA; e-mail: shedlock@u.washington.edu.

Symposium: "Ecological Processes: Insights from Field Experiments and Natural History." This symposium celebrates the career and contributions of Margaret McBride Stewart in honor of her 70th birthday. *Organizer:* Kiisa C. Nishikawa, Department of Biological Sciences, Northern Arizona University, Flagstaff, Arizona 86011-5640, USA; e-mail: Kiisa.Nishikawa@nau.edu.

Symposium: "Comparisons and Current Uses of Phylogenetic Approaches to Ichthyology and Herpetology." *Organizer*: Mark Pyron, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA; e-mail: Pyron@uiuc.edu.

Symposium: "Chemical Ecology of Predator/Prey Relationships Among Fishes, Amphibians, and Reptiles." *Organizer*: Alicia Mathis, Department of Biology, Southwest Missouri State University, Springfield, Missouri 65804-0095, USA; e-mail: sam477f@vma.smsu.edu.

Symposium: "Life History and Ecology of Chelonians." *Organizer*: R. Bruce Bury, National Biological Service, 3080 SE Clearwater Driver, Corvallis, Oregon 97333, USA; e-mail: buryb@mail.cor.epa.gov.

Symposium: "Biosystematics, Behavioral Ecology, and Conservation of Iguanas." *Organizer:* William K. Hayes, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA; e-mail: whayes@ccmail.llu.edu.

Conservation Forum: Point-Counterpoint. "Sustainable Use of Amphibian and Reptile Resources." *Organizer:* C. Kenneth Dodd, Jr., SSAR Conservation Committee, 5222 NW 56th Court, Gainesville, Florida 32653, USA; e-mail: kdodd@nervm.nerc.ufl.edu.

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day in or near the University of Washington's Husky Union Building. Poster sessions will be held at the HUB.

Student Paper Awards: Seibert Prizes will be awarded to the two best student-presented papers at the meeting ($250 first prize, $150 second prize).

Multimedia Presentations: "Herps of the West" and "Amphibians of the Appalachians" by David Dennis and Eric Juterbock; "Herpetological Namesakes" by Kraig Adler and David Dennis.

Social Activities: General Reception at Seattle Aquarium, Auction, Salmon Barbecue, Graduate Student Reception, Banquet.

Live Exhibit: Live herps of the Pacific Northwest, sponsored by the Society for Northwestern Vertebrate Biology and the Pacific Northwest Amphibian and Reptile Consortium. As usual, a diverse array of animals will be available for viewing and photography.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Field Trips: Mount Saint Helens National Volcanic Monument and Snoqualmie Pass–Ellensburg.

Costs: Pre-registration US $120 regular, $60 student, $60 accompanying person. After March 15, costs are $145 regular, $75 student, and $75 accompanying person.

Further Details: Contact T. W. Pietsch, School of Fisheries, University of Washington, Box 355100, Seattle, Washington 98195-5100, USA. Tel. (206) 543-8923; e-mail: twp@fish.washington.edu. Meeting Announcement and Call for Papers were mailed to all U.S., Mexican, and Canadian members of SSAR in late November 1996. Other persons wishing to receive this information may do so by contacting Ted Pietsch at the address above. A World Wide Web page devoted to meeting information may be found at: http://artedi.fish.washington.edu/asih/asih97.html.

SSAR BUSINESS

SSAR Grants-in-Herpetology Committee Annual Report (1997)

Six awards of $500 each were made this year, as follows:

Conservation.—**Jennifer L. Mook**, Clemson University. Project title: "Determining paternity and genetic diversity of radiated tortoises (*Geochelone radiata*): utilizing randomly amplified polymorphic DNAs in the zoo."

Laboratory Research.—**Sharon Downes**, University of Sydney. Project title: "Effects of incubation environment on the vulnerability of scincid lizards to predation by snakes: a test of foraging theory and the ecological significance of phenotypic plasticity."

Field Research.—**Louise M. Armstrong**, University of Massachusetts. Project title: "Patterns and processes of speciation in desmognathine salamanders."

Travel.—**Maureen Kearney**, George Washington University. Project title: "Evolution of the Order Amphisbaenia based on evidence from fossil and recent forms."

Education.—**Matthew R. Chapman** and **Peter K. Ducey**, SUNY, Cortland. Project title: "Distribution and conservation of amphibians and reptiles in New York."

International.—**Sergius L. Kuzmin**, Russian Academy of Sciences. Project title: "Eastern range margin of the Semirechensk salamander (*Ranodon sibiricus*)."

1997 Grants-In-Herpetology Committee.—Dr. Carole L. Hom, University of California, Davis; Dr. Julian C. Lee, University of Miami (chair); Joseph Mendelson, III, University of Kansas; Janice Perry, Arizona-Sonora Desert Museum; Dr. Barbara Savitzky, Christopher Newport University; Dr. Kelly Zamudio, University of California, Berkeley.

NEWSNOTES

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due by 15 October 1997, with notification by 1 December 1997. Grantees are expected to complete their Academy visit by 15 September 1998. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

About Our Cover

There are nine species of snakes in the genus *Leptophis*, and they range, collectively, from México south to central Argentina. Nearly all are arboreal and diurnal, hunting for frogs, which constitute their primary prey. Parrot snakes, as they are called, are not considered venomous in the traditional sense, although their bite is known to cause symptoms of envenomation in humans (Minton 1978. Nat. Hist. 9:56–60).

During the 1940's, James A. Oliver published a series of papers and a generic revision of *Leptophis* (1948. Bull. Amer. Mus. Nat. Hist. 92:157–280), and his arrangement generally has been followed since. In fact, the only systematic novelties involving *Leptophis* subsequent to Oliver's monograph are the resurrection of *L. cupreus* (Peters and Orcés-V. 1960. Beitr. Neotrop. Fauna 2:139–141), the revalidation of *L. modestus* (Hoyt 1964. Copeia 1964:214–215; Mertens 1973. Stud. Neotrop. Fauna 8:141–154), and the description of *L. stimsoni* (Harding 1995. Trop. Zool. 8:221–226).

Brightly colored, alert, and graceful, parrot snakes are well known to people in rural Latin America. Frequently, their green coloration and tendency to gape defensively earn them a death sentence. This is unfortunate because parrot snakes are inoffensive creatures, often unwilling to bite when provoked. The snake depicted on the cover is *Leptophis ahaetulla*, with eleven races ranging from México to Argentina.

America lost one of its most outstanding herpetological artists on October 6, 1996, with the death of **Philip E. Sims**. His unique style—focusing on the symmetry and patterns of reptilian scales, skin, and especially eyes—immediately is recognizable and had won him widespread recognition among artists and herpetologists alike. His work hangs in several public galleries and he was awarded numerous prizes for his work. Phil grew up in Colorado, where he learned to appreciate reptiles under the guidance of his father, a high school biology teacher. He earned his bachelor's and veterinary medicine degrees at Colorado State University and later went on for a Master of Science degree in biomedical illustration. He generally painted in watercolors applied with airbrushes. The iridescent scales are created by applying acrylic paint and the edges are sharpened using colored pencils. The overall result is a stunning image, at once accurate natural history and fine art. Phil most often depicted snakes, which he felt were so unappreciated, despite his encounter with a 20-foot long reticulated python, an erstwhile patient, that had swallowed his arm up to the shoulder! His art studio was shared with many terraria filled with lizards and snakes. Although he was a practicing veterinarian, natural history art was increasingly occupying his time—at the time of his death he was spending three weeks out of four doing art—and his goal was to become a full-time artist. He had nearly completed a book, "Atlas of Comparative Reptile Anatomy," and planned to issue limited-edition prints of his artwork, in order to promote the conservation of these creatures he so deeply respected and enjoyed. Through the courtesy of his father, SSAR is honored to reproduce this drawing as a tribute to the memory of Phil Sims.



Separation and imaging of Sims's artwork is by **Jim Bridges** of Herpeto Inc., Hollywood, Florida, USA.

African Herpetofaunal Biodiversity Programme (AHBP)

The interim committee of the AHBP invites you to participate in an e-mail discussion (on the Afriherp-L list) of the mission, aims, and objectives of the AHBP. We also will discuss the possibilty of a workshop and election of a new committee to be held at the 3rd World Congress of Herpetology in Prague in August. This invitation is particularly directed toward everyone interested in the herpetofauna of Africa and its islands (including the Malagasy region).

For those of you who are not already subscribers to Afriherp-L, you can subscribe by sending a message to listproc@wcmc.org.uk with only the text "subscribe afriherp-l (your name)" in the body of the message. Remember to leave the subject line blank and to switch off your signature. To receive a copy of your own postings, set mail to "ack." You can also subscribe in digest form.

The AHBP Interim Committee consists of Michael Lambert (Chairman), Ivan Ineich (Deputy Chairman), Lynn Raw (General Secretary), Neil Burgess (Mapping Coordinator), Preston Hardison (Data Management Coordinator), and Craig Hassapakis and Martin Kundrat (Publicity and Public Relations Coordinators). For additional information contact: *Lynn Raw (using gdr@iafrica.com) P.O. Box 200 (also on raw@zoology.unp.ac.za) Merrivale 3291, South Africa. Tel. +27-331-431360.*

Carettochelys Studbook Information Needed

Information is needed for inclusion in a new American Zoo Association-approved studbook for the North American Region on currently living or historically held pig-nosed turtles, *Carettochelys insculpta*, also known as pitted shell turtles, Fly River turtles, or New Guinea plateless turtles. If you or your institution currently or historically held individuals of this species or received/used tissue, blood, or other samples, I would like to hear from you. Turtles that never reproduced or were turned over to a museum collection are valuable inclusions to studbooks. Likewise, if your institution would be interested in receiving a deceased pig-nosed turtle or a living specimen, I will include your interest in the studbook. All participants will receive a copy of the studbook when completed. Contact: *William H. Espenshade III, The Zoological Society of Philadelphia, 3400 West Girard Avenue, Philadelphia, Pennsylvania 19104-1196, USA. Tel. (215) 243-1100 ext. 3262; Fax (215) 243-5385; e-mail: WHE3@aol.com.*

NSF Grant for SIUC Collection

The 300,000-specimen Zoology collection at Southern Illinois University at Carbondale has received a two-year grant from the National Science Foundation to sustain the largest collection of fishes, amphibians, and reptiles in Illinois, Indiana, Missouri, and Kentucky. Ron Brandon (herpetologist) and Brooks Burr (ichthyologist) individually have managed the collections of herps and fishes until now. The grant will permit the hiring of a full-time collections manager. The collection is housed in a newly-opened 3500-square-foot Fluid Vertebrate Collection Center in SIUC's year-old Life Science III Building. For collection information contact: *Ronald A. Brandon, Departement of Zoology, Southern Illinois University, Carbondale, Illinois 62901, USA; e-mail: Brandon@Zoology.siu.edu.*

Herpetologist, The University of Kansas

The Natural History Museum and Department of Systematics & Ecology, The University of Kansas, invite applications for an open-rank position as a faculty-curator in herpetology. Successful applicant will serve as a museum curator in the Division of Herpetology and as a faculty member in the Department, will be able to teach reptile biology and other courses, direct undergraduate and graduate research, and have an active, specimen-based research program with potential for extramural funding. Preference will be given to individuals who specialize in reptile biology, conduct herpetological field studies, have a strong commitment to research and education at undergraduate and graduate levels, and show commitment to service to the discipline, and evidence of administrative skills and ability to interact with the public. Submit curriculum vitae; statements of (1) teaching philosophy, experience, and interests, including preferred courses to teach, (2) research interests, goals, and current research activities, and (3) curatorial philosophy and experience, including perceptions of the roles of systematic collections and museums in biological pursuits; 2 copies of selected publications or manuscripts; and names, addresses, voice and FAX numbers, and e-mail addresses of 3 persons to be contacted as references. Forward materials to Dr. Linda Trueb, Chair, Search Committee, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA. Review of applications will begin 01 September 1997 and continue until the position is filled. Position availability is contingent on budgetary approval. EO/AA Employer.

New Journal Announced

The IUCN/SSC/DAPTF/Regional Group for the Commonwealth of Independent States and the Institute of Ecology and Evolution of the Russian Academy of Sciences have launched a new journal, *Advances in Amphibian Research in the Former Soviet Union*. The journal will publish papers (in English) on all aspects of amphibian research by authors from the former Soviet Union as well as papers by foreign authors that concern amphibians within this territory. All topics of batrachology are desired, including systematics, distribution (including new records, maps, and atlases), ecology, behavior, conservation, morphology, evolution, paleontology, physiology, biochemistry, parasitology, genetics, and herpetoculture. For manuscript format requirements, subscriptions, or other information, contact: *Dr. Sergius L. Kuzmin, Editor, Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky Prospect, 33, Moscos 117071, Russia. Tel. (7095) 954-32-62; Fax (7095) 954-55-34; e-mail: sevin@glas.apc.org.*

Gopher Tortoise Council Awards

The Gopher Tortoise Council annually presents the J. Larry Landers Student Research Award to the best student research project concerning the biology of the gopher tortoise, *Gopherus polyphemus*, or any aspects of its sandhill community. Last year two awards were presented to Melissa Dills of Auburn University ("Coloniality in the gopher tortoise, *Gopherus polyphemus*") and Karl Studenroth ("A survey of the occurrence of *Gopherus polyphemus* on the campus of the University of Mobile"). Recent awards

have averaged $500. Students interested in applying should submit a concise description of their project with a detailed budget and a brief curriculum vitae to: *Bob Herrington, Research Advisory Committee, Department of Biology, Georgia Southwestern State University, Americus, Georgia 31709, USA.* Deadline for receipt of proposals to be considered for the 1997 award is 31 August 1997.

Iguanas of the West Indies Poster

The Fort Worth Zoo announces the publication of a beautiful new poster highlighting the conservation of iguanas of the West Indies. Featuring rare and exceptional color photographs of 14 of the 18 *Cyclura* and *Iguana*, this high-quality poster measures 20 x 26 in. and is printed on a heavy-duty paper stock suitable for framing. Produced to assist the IUCN/SSC West Indian Iguana Specialist Group in promoting the preservation of these endangered lizards, all proceeds from the sale of this poster will help to fund critical iguana research and conservation projects throughout the Caribbean. Posters can be obtained in the U.S. for $13.00 including postage and mailing tube; international orders are $16.00. Checks or money orders (in U.S. currency) should be payable to the Fort Worth Zoo. Mail requests to: *Rick Hudson, Fort Worth Zoo, 1989 Colonial Parkway, Fort Worth, Texas 76110, USA.*

REGIONAL HERPETOLOGICAL SOCIETIES

Slovenian Herpetological Society Formed

The Drustvo za gojenje in proucevanje plazilcev in dvozivk [Society for Breeding and Research of Reptiles and Amphibians] was founded on 7 September 1995 in Ljubljana, Slovenia. It is the first society of its kind in Slovenia. The Slovenian herpetofauna is very diverse for such a small area, but is still poorly known and needs to be thoroughly researched. Most of the Society members are young people with a special interest in herps. As the name states, we are involved in keeping, breeding, and research of reptiles and amphibians. Meetings are held once each month, with lectures, discussions, and field trips in the summer. We now have about 40 members. The Society recently published the first issue of their newsletter *Zelenec* (Zelenec is the Slovenian common name for the green lizard, *Lacerta viridis*, our largest lacertid). Currently, *Zelenec* is written in the Slovene language, but an English edition is planned for the future. The first issue features articles on reptiles and amphibians of Slovenia, matamata turtles, and keeping and breeding of chameleons (with emphasis on *C. calyptratus*). Regular columns include: Editorials, Field Reports, Herp News, and Advertisments. The second issue is scheduled to be published in Spring of 1997. It will be a "Madagascar special issue." Two issues of *Zelenec* are planned for 1997. The society's address is: *Drustvo za gojenje in proucevanje plazilcev in dvozivk, c/o Matjaz Rojc, Reska 9, 1000 Ljubljana, Slovenia; e-mail: matjaz.rojc@siol.net.*

Kansas Herpetology Award Established

The Kansas Herpetological Society has announced the establishment of the Suzanne L. & Joseph T. Collins Award for Excellence in Kansas Herpetology. The Award is established in recogntion of the scientific and artistic achievements of Suzanne L. Collins and Joseph T. Collins, whose life-long study and conservation of the native amphibians and reptiles of Kansas is amply demonstrated in their extensive and excellent writings and photography, both academic and popular, about these animals. The Award will be presented once each year on the occasion of the annual meeting of the Kansas Herpetological Society before its assembled membership. The Collins Award is funded by a trust in perpetuity, and will increase in amount each year through reinvestment. During its initial year the award will minimally be $700, and may be as much as $1000. The Collins Award recipient will be chosen by the Executive Council of the KHS or a committee approved and appointed by the Council. The first Collins Award will be presented at the Silver Anniversary Meeting of the KHS in Lawrence in November 1998. For further information, contact: *Karen L. Toepfer, 303 West 39th Street, Hays, Kansas 67601, USA; e-mail: fmkt@fhsuvm fhsu edu.*

MEETINGS

Meetings Calendar

25 June–2 July 1997—40th Annual Meeting, Society for the Study of Amphibians and Reptiles; 45th Annual Meeting of The Herpetologists' League; 77th Annual Meeting, American Society of Ichthyologists and Herpetologists. Hosted by the University of Washington, Seattle, Washington, USA. *Refer to meeting announcement in this issue for details.*

2–10 August 1997—Third World Congress of Herpetology, Prague, Czech Republic. Contact: Zbynek Rocek, Congress Director, Department of Paleontology, Geological Institute, Academy of Sciences, Rozvojová 135, 165 00 Praha 6 – Suchdol, Czech Republic. Tel. (++42-2) 24311421; Fax (++42-2) 24311578; e-mail: rocek@gli.cas.cz. *Refer to meeting announcement in* Herpetological Review *27(1):4–5, March 1996 for details.*

4–7 August 1997—IV Regional Latin American and Caribbean Meeting of the Crocodilian Specialist Group, Villahermosa, Tabasco, México. Hosted by the Autonomous University Juarez of Tabasco "UJAT" (and other institutions). Contact: Biol. Beatriz Figueroa Ocana, Av. Gregorio Mendez 2006, Col. Rovirosa, Villahermosa, Tabasco 86000, México. Fax: (91) (93) 54 38 54. ; e-mail: sarriago@tukan.ujat.mx or Dr. James Perran Ross, Executive Officer, Crocodilian Specialist Group, Florida Museum of Natural History, P.O. 117800, Gainesville, Florida 32611-7800, USA. Tel: (352) 392-1721; Fax: (352) 392-9367; e-mail: prosscsg@flmnh.ufl.edu.

13–14 September 1997—Mid-Atlantic Reptile Show, Maryland State Fairgrounds. Contact: Tim Hoen, P.O. Box 201, Jarrettsville, Maryland 21084, USA. Tel. (410) 557-6879; http://www.pythons.com/mars.html.

26–28 September 1997—Midwest Regional Animal Behavior Conference, The Ohio State University, Columbus, Ohio, USA. Co-sponsored by the Zoology and Entomology Departments. Con-

tacts: Dr. Patricia G. Parker (614-292-0378; fax 614-292-2030; parker.3@osu.edu) and Brian H. Smith (614-292-0465; fax 614-292-2180; smith.210@osu.edu). Visit the meeting's site at http://www.biosci.ohio state.edu/~zoology/MRABSC97//index.htm

3–5 October 1997—Second Annual Meeting of the Canadian Amphibian and Reptile Conservation Network and the 7th Annual Meeting of the IUCN/SSC Task Force on Declining Amphibian Populations in Canada (DAPCAN), Acadia University, Wolfville, Nova Scotia. Contact: Stan A. Orchard, Chairman, CARCN/RCCAR, 1745 Bank Street, Victoria, British Columbia, Canada V8R 4V7. Tel./Fax: (250) 595-7556; e-mail: sorchard@islandnet.com.

18–19 October 1997—First International Symposium on Snakebite. Zhanjiang, People's Republic of China. Contact: Organizing Committee of the First International Symposium on Snakebite, No. 2 Cunjin Road, Zhanjiang City, Guangdong Province 524037, People's Republic of China. Tel./Fax 0086-759-3316724.

18–19 October 1997—Snake Ecology for the 21st Century. Texas Herpetological Society Fall Symposium, Camp Tyler, Texas, USA. Contact: Neil B. Ford, Department of Biology, University of Texas at Tyler, Tyler, Texas 75799, USA. Tel. (903) 566-7249; e-mail: nford@mail.uttyl.edu.

25 October 1997—Conservation Ecology of the Amphibians of the Mid-Atlantic Region, Jug Bay Wetlands Sanctuary, Lothian, Maryland, USA. Contact: Karyn Molines, Conference Chair, Jug Bay Wetlands Sanctuary, 1361 Wrighton Road, Lothian, Maryland 20711, USA. Tel. (410) 741-9330; Fax (410) 741-9346; e-mail: cswarth@umd5.umd.edu.

25–26 October 1997—Fourth Annual Conference of the Association of Reptilian & Amphibian Veterinarians. Sheraton Astrodome, Houston, Texas, USA. Contact: Wilbur Amand, VMD, P.O. Box 605, Chester Heights, Pennsylvania 19017, USA. Fax (610) 892-4813.

October 1997—III Congreso Argentino de Herpetologia, Corrientes - Argentina Asociacion Herpetologia Argentina Contact: Blanca B.A. de Avanza/Maria E. Tedesco Organizing Committe - Departamento de Biologia Anatomia Comparada - Facultad de Ciencias Exactas y Naturales y Agrimensura. Universidad Nacional del Nordeste 9 de Julio 1449 - 3400 Corrientes, Argentina.

1–3 June 1998—Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests: An International Symposium. Hanoi, Vietnam. Contact: Natalia Ananjeva (St. Petersburg, Russia), e-mail: nbanorus@glas.apc.org.

June 1998—Highlands Conference on Plethodontid Salamanders. *Refer to announcement below for further details.*

1–5 September 1998—Third International Asian Herpetological Meeting, Almaty, Kazakhstan. To receive the First Announcement and Preliminary Registration Form, please contact one of the meeting organizers: Dr. Tatjana Dujsebayeva, Department of Biology, Kazakh State University, Al-Farabi Prospect, 71, Almaty, 480078, Kazakhstan; Tel. (3272) 472677, Fax (3272) 472609, e-mail: zool@plague.almaty.kz; Dr. Natalia Ananjeva, Department of Herpetology, Zoological Institute, Universitatskaja nab., 1, Saint-Petersburg, 199034, Russia; Tel. (812) 2180711, Fax (812) 2182941, e-mail: anb@zisp.spb.su; or Dr. Theodore Papenfuss, Asiatic Herpetological Research, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA; Tel. (510) 642-3567, Fax (510) 643-8238, e-mail: asiaherp@uclink2.berkeley.edu.

The Highlands Conference on Plethodontid Salamanders

The Highlands Conference on Plethodontid Salamanders will be held in June 1998 in Highlands, North Carolina (USA), and is sponsored by the Highlands Biological Station. This meeting will follow the tradition of the First (1972), Second (1982), and Third (1992) Conferences in exploring new directions in plethodontid research. The Conference will feature invited papers, evening poster sessions, and a Symposium. All interested are encouraged to participate. Future announcements concerning Conference dates, a call for papers, and registration information will be sent only to those on our mailing list. If you attended the 1992 Conference, and if your address has not changed, you will receive announcements automatically. To be placed on the mailing list, or to update your address, please send your name, address, and numbers (phone, FAX, e-mail) to: *Plethodontid Conference, Highlands Biological Station, P.O. Box 580 Highlands, North Carolina 28741, USA or send an e-mail message to Judy Hill (HBS Admin. Asst.) at: JHILL@wpoff.wcu.edu.*

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

The current contents of several herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Microevolutionary Change in *Nerodia*

Color pattern variation in Lake Erie island populations of *Nerodia sipedon* provide a classic example of microevolutionary change in which the effects of selection, gene flow, inheritance, and population history are unusually well understood. King and Lawson present a nice review of microevolution in the species in a recent paper in BioScience.

KING, R. B., AND R. LAWSON. 1997. Microevolution in island water Snakes. BioScience 47(5):279–286.

Habitat and Colonization

M'Closkey et al. studied the colonization of habitats by four species of phrynosomatid lizards (*Urosaurus ornatus, Sceloporus graciosus, S. undulatus*, and *Uta stansburiana*) to determine differences among the species in colonization, differences among habitat types in colonization, and the time trajectory of coloniza-

tion. Their study indicates there were significant habitat and census period differences in saturation.

M'Closkey, R. T., et al. 1997. Colonization and saturation of habitats by lizards. Oikos 78(2):283–290.

Crocodilian Evolution

Poe used published systematic data on crocodilians to test hypotheses of data set incongruence and phylogeny. Both molecular and morphological data sets were examined and comparisons yield interesting results.

Poe, S. 1996. Data set incongruence and the phylogeny of Crocodilians. Syst. Biol. 45(4):393–414.

Phenotypic Variation

Why some species exhibit remarkable variation among populations whereas closely related species are relatively uniform remains unclear. Summers et al. examined color variation in four species of dendrobatid frogs with different reproductive strategies. Their results suggest that strong sexual selection associated with female parental care may be a factor in the variation in *Dendrobates pumilio*.

Summers, K., et al. 1997. Phenotypic and genetic divergence in three species of dart-poison frogs with contrasting parental behavior. J. Hered. 88:8–13.

Phylogeny of Desmognathine Salamanders

Using both molecular and morphological data, Titus and Larson studied the phylogeny of desmognathine salamanders. Their results suggest that desmognathine evolution includes transformations in the direction of largest body sizes, lengthened larval periods, and greater use of aquatic habitats.

Titus, T. A., and A. Larson. 1996. Molecular phylogenetics of desmognathine salamanders (Caudata: Plethodontidae): a reevaluation of evolution in ecology, life history, and morphology. Syst. Biol. 45(4):451–472.

New *Boophis* from Madagascar

Glaw and Vences reviewed advertisement calls, morphology, diet, and reproductive characteristics of the *Boophis goudoti* group of Madagascan frogs. Their data revealed a new species, *Boophis rufioculis*, as well as other interesting aspects of the biology of these frogs.

Glaw, F., and M. Vences. 1996 (1997). Neue Ergebnisse zur *Boophis gudoti*-Gruppe aus Madagaskar: Bioakustik, Fortpflanzungsstrategien und Beschreibung von *Boophis rufioculis* sp. nov. [New results on the *Boophis goudoti*-group from Madagascar: Bioacoustics, reproductive strategies, and description of *Boophis rufioculis* sp. nov.]. Salamandra 32(4):225–242.

Heterochrony

Confusion exists with the current model and terminology of heterochrony because the model is explicitly limited to phylogenetic patterns (interspecific comparisons), but has been used for intraspecific comparisons. Because heterochrony may underlie all morphological variation and possibly is *the* developmental phenomenon producing all morphological change, it is important that descriptions of heterochronic patterns and processes be clear and precise over all levels of analysis. To this end, Reilly et al. discuss and clarify the previous model for heterochrony, reject some of the terminology and suggest alternatives, and then expand the model to include a new nomenclature for intraspecific heterochronic phenomena.

Reilly, S. M., E. O. Wiley, and D. J. Meinhardt. 1997. An integrative approach to heterochrony: the distinction between interspecific and intraspecific phenomena. Biol. J. Linn. Soc. 60:119–143.

Ecology of *Bombina bombina*

The Deutsche Gesellschaft für Herpetologie und Terrarienkunde recently published the proceedings of a symposium on the ecology and conservation of *Bombina bombina* in their journal *Rana*. The contents include 13 papers on the species' status and ecology. Listed here is the only title of the issue.

Krone, A., and K. -D. Kühnel. 1996. Die Rotbauchunke (*Bombina bombina*) Ökologie und Bestandssituation. Natur & Text, Rangsdorf, Germany. 132 pp.

Hemipene Terminology

Recent advances in the study of lizard hemipenes as a systematic character has introduced some confusion over hemipene terminology. Savage has published a paper intended to clarify definitions, resolve inconsistencies, and integrate the terminology applied to hemipenial variation for lizards and snakes into a broader scheme applicable to all squamates.

Savage, J. M. 1997. On terminology for the description of the hemipenes of squamate reptiles. Herpetol. J. 7(1):23–25.

Neural Control in Autotomized Tails

Most previous studies of tail autotomy in lizards have emphasized the energetic costs rather than the consequences for neural control of movement. Rumping and Jayne found that autotomized tails with one or more spinal segments moved longer and more vigorously than autotomized tails consisting entirely of regenerated (unsegmented) tissue.

Rumping, J. M., and B. C. Jayne. 1996. Muscle activity in autotomized tails of a lizard (*Gekko gecko*): a naturally occurring spinal preparation. J. Comp. Physiol. A. 179:525–538.

Asiatic Herpetological Research

Volume 7 of *Asiatic Herpetological Research* was recently published. This journal is recommended to anyone interested in any aspect of Asian herpetology. For more information write AHR, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA (e-mail: asiaherp@uclink.berkeley.edu).

Cedhagen, T. 1997. Anurans collected in West Malaysia. Asiatic Herpetol. Res. 7:1–5.

Chikin, Y. A. 1997. A catalogue of non-metrical variations in skull bones of *Vipera lebetina* (Reptilia, Viperidae). Asiatic Herpetol. Res. 7:6–18.

DAREVSKY, I. S., AND N. N. SZCZERBAK. 1997. A new gecko of the genus *Gonydactylus* (Sauria: Gekkonidae) with a key to the species of Vietnam. Asiatic Herpetol. Res. 7:19–22.

DAS, I. 1997. Rediscovery of *Lipina Macrotympanum* (Stoliczka, 1873) from the Nicobar Islands, India. Asiatic Herpetol. Res. 7:23–26.

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FU, J., AND R. W. MURPHY. 1997. Phylogeny of Chinese *Oreolalax* and the use of functional outgroups to select among multiple equally parsimonious trees. Asiatic Herpetol. Res. 7:38–43.

GOLDBERG, S. R., C. R. BURSEY, AND Q. A. TRUONG. 1997. Helminths of Tago's brown frog, *Rana tagoi* (Ranidae), from Japan. Asiatic Herpetol. Res. 7:44–47.

INGER, R. F., M. LAKIM, A. BJUN, AND P. YAMBUN. 1997. A new species of *Leptolalax* (Anura: Megophryidae) from Borneo. Asiatic Herpetol. Res. 7:48–50.

KHAN, M. S. 1997. Taxonomic notes on Pakistani snakes of the *Coluber karelini-rhodorachis-ventromaculatus* species complex: a new approach to the problem. Asiatic Herpetol. Res. 7:51–60.

KHAN, M. S., AND M. R. Z. KHAN. 1997. A new skink from the Thal Desert of Pakistan. Asiatic Herpetol. Res. 7:61–67.

LATHROP, A. 1997. Taxonomic review of the Megophryid frogs (Anura: Pelobatoidea). Asiatic Herpetol. Res. 7:68–79.

LAZELL, J., M. LAU, AND W. LU. 1997. A brief herpetological excursion to Wai Ling Ding, Wanshan Islands, South China Sea. Asiatic Herpetol. Res. 7:80–84.

MAMET, S., AND S. KUDRYAVTSEV. 1997. Captive propagation of the Mandarin rat snake (*Elaphe mandarina*) at Moscow Zoo. Asiatic Herpetol. Res. 7:85–86.

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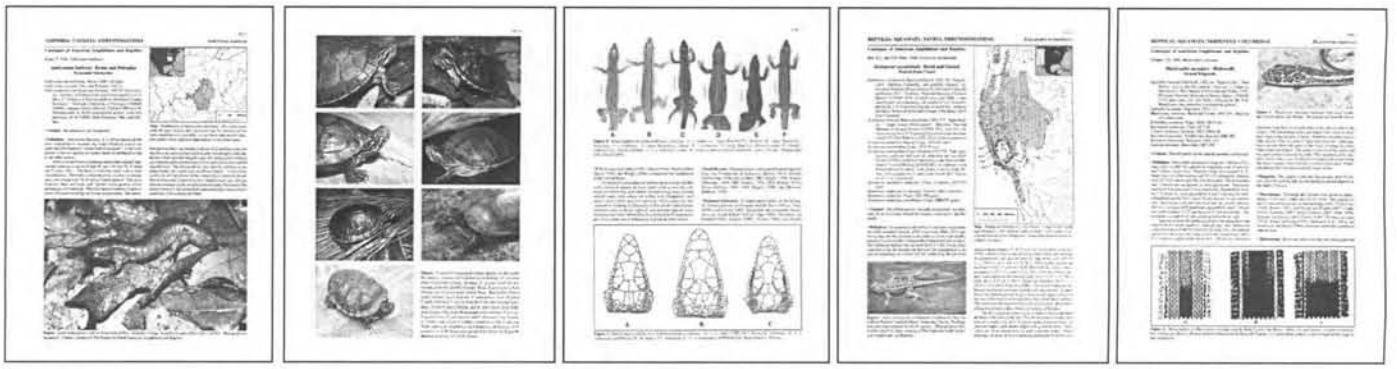
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Zeitschrift für Feldherpetologie

Westarp Wissenschaften recently published Volume 3 of *Zeitschrift für Feldherpetologie*. The papers in this volume cover a wide variety of field studies. The geographic coverage appears to be greater than for previous volumes in this series. More information about this journal may be obtained by writing Westarp Wissenschaften, Kirchstraße 5, D-39326 Hohenwarsleben, Germany (e-mail Westarp@t-online.de).

GÜNTHER, E. 1996. *Salamandra salamandra bernardezi* Wolterstorff, 1928 in Oviedo, Spanien: Ein Schwanzlurch als Stadtbewohner [*Salamandra salamandra bernardezi* Wolterstorff, 1928 in Oviedo, Spain: A tailed amphibian species inhabiting urban areas]. Zeitschr. Feldherpetol. 3(1/2):1–18.

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MUTZ, T., AND S. DONTH. 1996. Untersuchungen zur Ökologie und Populationsstruktur der Zauneidechse (*Lacerta agilis*) an einer Bahnlinie im Münsterland [Studies about ecology and population structure of the sand lizard (*Lacerta agilis*) at railway embankments in Münsterland, Western Germany]. Zeitschr. Feldherpetol. 3(1/2):123–132.

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KRONSHAGE, A. 1996. Beobachtungen an einer Kolonie der Geburtshelferkröte (*Alytes obstetricans*) im südwestfälischen Bergland (Nordrhein-Westfalen) [Observations on a colony of mid-wife toads (*Alytes obstetricans*) in the South Westphalian mountainous region (Northrhine-Westphalia). Zeitschr. Feldherpetol. 3(1/2):151–165.

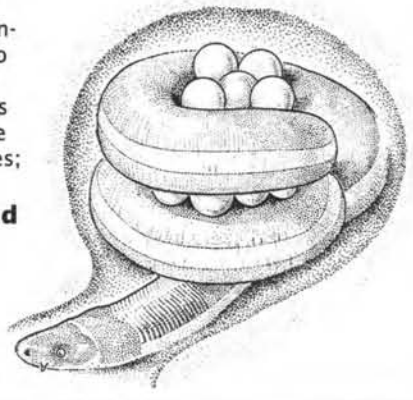
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LETTERS TO THE EDITOR

CITES: A Boon, Not a Boondoggle

RONALD I. ORENSTEIN
International Wildlife Coalition
1825 Shady Creek Court, Mississauga, Ontario, Canada L5L 3W2
e-mail: ornstn@inforamp.net

In his article on the dendrobatid trade, Gorzula (1996. Herpetol. Rev. 27:116–123) notes that "many scientists who claim to be affected by CITES have a less than adequate knowledge of the workings and purposes of the convention." Lamar's letter (1997. Herpetol. Rev. 28:10) in response to Gorzula displays just such an inadequacy. I am not a herpetologist, but I have had considerable experience with CITES, including attendance at CITES conferences since 1987, and I would appreciate an opportunity to clear up some of the misconceptions in Lamar's letter.

Lamar states that "CITES was never intended to be a conservation treaty." On the contrary, that is exactly what it was intended to be. The stimulus for CITES came directly from decisions taken by IUCN at meetings in the early 1960's to draft an international instrument to deal with the depradations of unregulated wildlife trade on a number of species, including spotted cats. The CITES Preamble states clearly "that international cooperation is essential for the protection of certain species of wild fauna and flora against overexploitation through international trade."

Lamar appears to be under the impression that listing decisions are made by the CITES Secretariat. This is not the case. The Secretariat, though it certainly has opinions on many issues before the Parties, is an administrative body. There is no such thing as a central council that decides listing issues. Instead, any individual Party (there are now 136 member states) can submit a proposal to add a species to either Appendix I or Appendix II, to delete a species, or to transfer it from one Appendix to another. This proposal is then voted on by the Conference of the Parties, normally at its conferences held roughly every two and one half years, with each country receiving one vote. A two-thirds majority is necessary to carry the proposal, which then enters into force ninety days after the vote.

In the case of the dendrobatid frogs, the Secretariat actually opposed the listing and asked the Parties to reconsider it after the vote was taken at the 1987 meeting. The Parties, however, refused to do so. As for the anguid lizard genus *Abronia*, there is no proposal pending to list this taxon, and CITES can hardly be held accountable for unfounded rumors.

Lamar also appears to be confused about the effect of CITES on domestic laws. CITES does not give countries power to pass domestic bans or restrictions on wildlife trade that they did not already possess. The power to pass such laws is a sovereign right. CITES merely recognizes, in Article XIV, that states signing the treaty retain the right to pass stricter laws than those necessary to carry out the treaty itself. If CITES were to disappear tomorrow, these laws would still stand, and in fact might become even more draconian. They would certainly be even less coordinated than they are now, when the CITES conferences at least provide an opportunity for country representatives to get together to discuss issues of common concern.

While I can understand the frustration some scientists may feel on having to deal with paperwork resulting either from CITES or from domestic wildlife laws, I cannot feel too sorry for the scientists Lamar refers to, who import collections into the United States without realizing that the species involved are listed as endangered under American law. The Endangered Species Act is not a secret document, any more than CITES is, and surely it is reasonable to expect importers to make the extra effort to find out what it says before bringing their specimens home.

CITES already recognizes the difference between scientific specimens and specimens in commercial trade. Appendix I species may not be traded for "primarily commercial purposes" but may be imported and exported, with the proper permits, for bona fide scientific research.

Finally, Lamar seems to view CITES as serving no greater function than to impede his research or the research of his colleagues. This short-sighted view ignores the beneficial effects of CITES on the conservation of many species, including reptiles such as sea turtles and crocodiles. These beneficial effects were recognized by an independent study of the effectiveness of CITES prepared in 1996 by the British firm Environmental Resources Management under contract to the Secretariat. CITES certainly has its flaws, but it has proven to be, on the whole, a highly beneficial and flexible instrument, and scientists would do far better working to improve its operation than carping at it from the outside. Certainly, before they express their opinions in print, they should at least make an effort to find out what the treaty is actually about.

Response to Orenstein

WILLIAM W. LAMAR
School of Sciences & Mathematics , The University of Texas at Tyler
3900 University Boulevard, Tyler, Texas 75799, USA
e-mail: wlamar@compuserve.com

It is obvious from his letter, deft and lawyerly, that Mr. Orenstein has garnered extensive knowledge of CITES, no doubt pursuant to his career. By contrast, my letter, written in a fit of pique 15 years in the making, displays considerable naiveté. For instance, I believed the various CITES officials who have told me and my colleagues the convention was a monitoring device rather than a conservation treaty. I didn't realize they, too, were confused. And I took seriously the CITES official who expressed interest in listing *Abronia*, forgetting that it remains hearsay until acted upon.

It is also obvious from his letter that Mr. Orenstein, like so many of those who decide on these issues, has never been on the receiving end of the process. The disclaimer that CITES has no effect on domestic laws is misleading. Look what happened when that local CITES office unilaterally decided that ALL fauna exported from their country required a (costly) CITES permit. At that point, their wishes—not even reflective of that country's governing body—effectively stymied local institutions and became doctrine to the universe, garnering backing from signatory countries (like the U.S., Canada, and Great Britain) whose legal systems bear no semblance to that of the initiating country. It is extraordinarily arrogant and ethnocentric, if well intended, to attempt to mate these unrelated systems. I would welcome Mr. Orenstein's "more draconian" alternative.

CITES of Honduras, responding belatedly to wanton commercial overharvesting of its herpetofauna, sought to list several pitviper species. They were competently advised that none of the suggested species, all common and unthreatened by trade, merited listing. They were also urged to look closely at the one spe-

cies they had excluded...a critically threatened endemic. Ignoring this, they proceeded with their plan.

Enter the Terciopelo, *Bothrops asper*, Central America's leading cause of snakebite and a creature so abundant it may rightly be considered a pest in many areas. Because of its listing by Honduras, you simply cannot imagine the problems encountered by one U.S. institution assisting a different Central American country that is establishing a reference collection. In order to send them a preserved Terciopelo, collected legally in that same country many years before the listing by Honduras, a "Certificate of Origin" must be obtained. Sounds easy until you try it. Of course, that also depends on the interpretations of the local USFWS office—this varies widely—but that's another story. The specimen in question has yet to make the trip back home. Anyone care to bet on its chances?

A proposed network of CITES-approved institutions pretended to ease this plan. Theoretically, any two such institutions could "traffic" more easily in museum loans, etc. In fact, many countries lack approved institutions, and in at least one case the governing authority of a country became incensed by the Secretariat's draconian procedures and declined to seek authorization. And who says the Secretariat lacks authority?

Orenstein's comments about the confusing array of non-to-slightly overlapping laws neatly dodge the issue. In fact the system is ill-coordinated, rife with pitfalls (by design?), and in need of repair. I resent the undercurrent in Orenstein's letter implying that scientists ignore positive conservation implications of the CITES treaty. In addition to generating the only solid data on which the conservation movement can rely, field biologists must witness the daily erosion not only of their careers, but also their passion—there are no truer conservationists on the planet.

I note that CITES' efficacy has been attested to by a firm under contract to...CITES. Since the Secretariat continues to duck responsibility under guise of respecting the autonomy of the 136 signatory countries, why not let EACH of them evaluate the efficacy of the treaty? That would be pretty chaotic—just like the morass scientists must deal with at present. Why not administer a test to all CITES and related officials worldwide to see how well they understand things? Orenstein has shown convincingly that CITES is all about conservation, so let's see an evaluation of how the areas it affects stack up in importance to the massive habitat destruction and internal harvesting that are depleting the species we can't even investigate. Perhaps all that money and effort could be better directed.

The crudeness of my first letter notwithstanding, I have received overwhelmingly positive response from the community. To those of you who were kind enough to have written me, I implore you to continue this dialogue, but publicly—those in power have tin ears. Maybe some day CITES will lose some of their clubbiness and seek the advice of APPROPRIATE scientists rather than expecting scientists to come to them. Oh yes, and one last thing—CITES doesn't impede my research and that of my colleagues—it virtually stops it.

POINTS OF VIEW

Scinax pedromedinai: An Unjustified Emendation of *Ololygon pedromedinae* Henle, 1991

KLAUS HENLE
Projektbereich Naturnahe Landschaften
Umweltforschungszentrum Leipzig-Halle GmbH
Permoserstr. 13, D-04318 Leipzig, Germany
e-mail: henle@rz.ufz.de

In 1991, Henle named a small species of hylid frog *Ololygon pedromedinae* in honor of Pedro Medina, the collector of the type material in the Departamento Madre de Dios, Peru. He included it in the *O. boulengeri* group. Without comment, Duellman and Salas (1991) listed the species as *O. pedromedinai*. When resurrecting the generic name *Scinax* for species formerly known as *Ololygon*, Duellman and Wiens (1992) listed the species as *S. pedromedinae*. In 1993, Duellman listed the species as *Scinax pedromedinai*, briefly stating that "The specific name was incorrectly spelled *pedromedinae* in the original description." Revising the genus *Scinax* from Amazonian Ecuador and Peru, Duellman and Wiens (1993) listed the species again as *Scinax perdomedinai*. In this publication, they justified the changed spelling of the specific name by pointing out that Pedro Medina is a man and thus the specific epithet must be masculine. To achieve this, they believed that the name must be mascularinized by emendating the name to pedromedinaus. As this action is not warranted and may contribute to nomenclatural confusion, I would like to briefly outline why this emendation has to be rejected.

The most common Latin endings of masculine words are indeed *-us* and *-is*. However, exceptions exist. For example, the Latin word for farmer, agricola, is masculine; its genetive is agricolae not agricolai. Medina is a widespread Latin name that was and still is very common in Italy, and the same rules for agricola apply to it. Whereas the emendation *-us* for a species name may be acceptable in cases in which it is derived from a non-Latin name (e.g., in *Hyla brongersmai*), such an emendation is definitely incorrect for cases derived from Latin names. For example, *Python sebae* is named in honor of the famous naturalist Seba, a man. The correct spelling for the large African python was never questioned. Meirte (1992) cites further similar cases. Clearly, the correct name of the taxon is *Scinax pedromedinae* (Henle 1991).

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ARTICLES

The Distribution of *Pituophis melanoleucus* and *P. vertebralis* in Northern Baja California, México

L. LEE GRISMER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
email: lgrismer@lasierra.edu

Klauber (1946), Welsh (1988), and Sweet and Parker (1990) recognized four subspecies of *Pituophis melanoleucus* distributed in Baja California as follows: *P. m. annectens* ranging throughout northwestern Baja California west of the Lower Colorado Valley Desert (Sweet and Parker 1990) to 42 km east (by Mexican Highway 1) of El Rosario (Grismer and Mahrdt 1996); *P. m. affinis* ranging throughout most of the Lower Colorado Valley Desert, westward to at least Paso de San Matías (Welsh 1988; Welsh and Bury 1984); *P. m. bimaris* (= *P. vertebralis* sensu Grismer 1994a) ranging from 43 km east (by Mexican Highway 1) of El Rosario (Grismer 1994a), southward throughout central Baja California to the Isthmus of La Paz (Sweet and Parker 1990); and *P. m. vertebralis* (= *P. vertebralis* sensu Grismer 1994a) ranging throughout the Cape Region (Sweet and Parker 1990). Grismer and Mahrdt's (1996) report on a specimen of *P. m. annectens* from 42 km east of El Rosario and Grismer's (1994a) report on a specimen of *P. vertebralis* (sensu lato) from 43 km east of El Rosario in a region of homogeneous habitat, indicated that these two species were likely to be sympatric.

Surprisingly, Sweet and Parker (1990), Grismer (1994a), and Grismer and Mahrdt (1996) overlooked a specimen of *Pituophis vertebralis* (USNM 37536) collected in 1905 from El Álamo in northwestern Baja California and reported on by Klauber (1946) as part of the type series of *P. melanoleucus bimaris*. Welsh (1988) reported on the specimen but did not comment on the fact that at the time, the two "subspecies," *P. m. annectens* and *P. m. bimaris*, overlapped for ca. 173 km with no sign of intergradation. El Álamo is a small town ca. 180 km north of the northernmost record of *P. vertebralis* (Grismer 1994a; Fig. 1). As noted by Stull (1940) and Klauber (1946) and confirmed here by examination of the specimen, USNM 37536 is an "undiluted" specimen, having all the diagnostic characteristics of *P. vertebralis* and none of those of *P. m. annectens* (Table 1). The inland areas between El Álamo and the next northernmost record for *P. vertebralis* at 43 km east of El Rosario lie along the foothills of the Sierra San Pedro Mártir, and with the exception of Rancho San José (Fig. 1), are difficult to access. Therefore, it is not too surprising that a museum search (CAS, LACM, MVZ, SDSNH, USNM; museum acronyms follow Leviton et al. 1985) revealed that no additional specimens of *P. vertebralis* have been collected in this intervening region within the last 90 years, even though *P. m. annectens* is known to be present (Klauber 1946). It is possible that the locality of USNM 37536 was mislabeled and the specimen actually was collected further south as was alluded to by Klauber (1946) in his reference to this specimen being "somewhat of an anomaly" in regard to its distribution. However, other evidence does not support this. The specimen was collected by Charles Nelson and Alfonso Goldman during their overland exploration of the Baja California peninsula from March, 1905 to February, 1906. Both reported being in El Álamo on 11–12 June 1905 (Goldman 1951:37; Nelson 1922:16), which is the collection date (11 June 1905) of USNM 37536 listed in their field catalogue. During this same period, they also collected *Callisaurus draconoides* (USNM 37642; 12 June 1905) at El Álamo, a species currently known from this locality (Grismer 1994b). These observations suggest that the entry into the Nelson-Goldman field catalogue was not erroneous.

Additional evidence for the validity of the locality of USNM 37536 comes from characteristics of the specimen itself. *Pituophis vertebralis* from the northern portion of its range, beginning in the vicinity of Bahía de Los Ángeles, often lack the reddish-orange coloration on the head and in the interspaces between the black, anterior, body blotches that is prominent and always present in specimens south of Bahía de Los Ángeles. Specimens from La-

TABLE 1. Distribution of discrete diagnostic charactersitics used to distinguish *Pituophis melanoleucus annectens*, *P. m. affinis*, and *P. vertebralis*. Data were taken from Klauber (1946) and Sweet and Parker (1990).

	affinis	*annectens*	*vertebralis*	El Álamo USNM 37536	Valle de Trinidad FMNH 1394
Blotches					
shape	biconcave	rounded	biconcave	biconcave	rounded
number on body	34-63	57-90*	34-51	33	60
number on tail	9-21	17-29	8-15	—	15
Anterior interblotch					
interspaces mottled (+) or unmottled (0)	+	+	0	0	+
Black subcaudal stripe					
present (+) or absent (0)	0	0	+	+	0
Anterior blotches black (+)					
or rusty brown (0)	0	+	+	+	+

* Sweet and Parker (1990) list the lower limit as 65 whereas 57 comes from Klauber (1946).

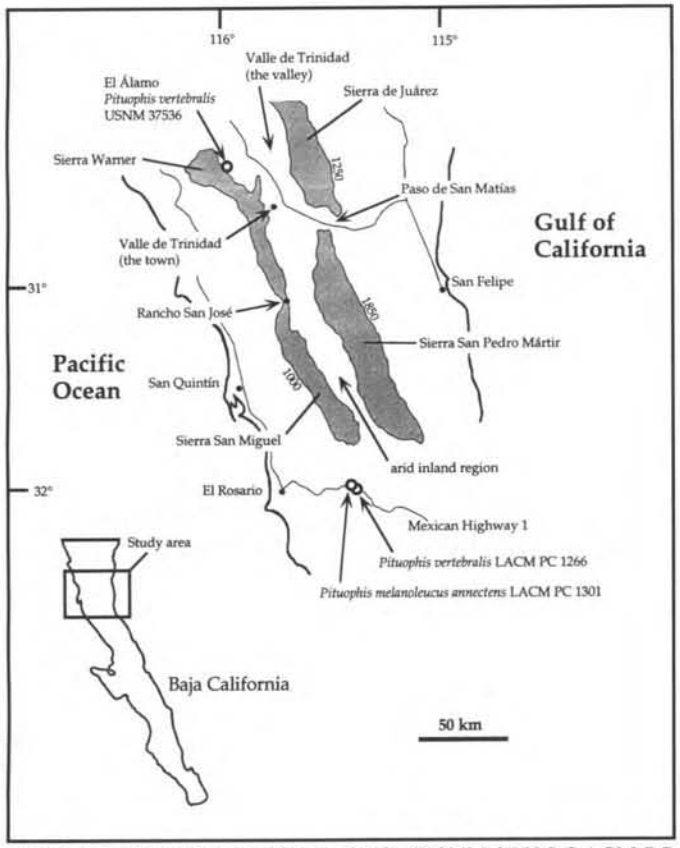


FIG. 1. Location of *Pituophis vertebralis* (USNM 37536; LACM PC 1266) and the southernmost specimen of *P. melanoleucus annectens* (LACM PC 1301) in northern Baja California, México in relation to major geographic features. Elevations are in meters.

guna Chapala (ca. 80 km northwest of Bahía de Los Ángeles) and northward lack this reddish-orange coloration, and the head and the interspaces between the anterior blotches are straw-colored. USNM 37536 also has a straw-colored head and anterior interspaces, indicating that it is at least from the northern portion of the distribution of *P. vertebralis*. (It should be noted that the reddish coloration in *P. vertebralis* is observable after many years of preservation).

Klauber (1946) was ambiguous in his suppositions concerning the possibility of intergradation between *Pituophis melanoleucus annectens* and *P. vertebralis*. He stated that it was "very doubtful" (p. 11) that the two taxa would intergrade, but that a specimen from Valle de Trinidad (FMNH 1394; = CNHM 1394) was "possibly" an intergrade (p. 28) between the two. Welsh (1988) and Sweet and Parker (1990) cited Klauber (1946:11) in stating that the two did not intergrade in northwestern Baja California. I have examined FMNH 1394 and find that it lacks the diagnostic characteristics of *P. vertebralis* but falls well within the range of the diagnostic characteristics reported for *P. m. affinis* and *P. m. annectens* (Table 1), and I suspect it may be an intergrade between these two forms. Welsh and Bury (1984) reported on a probable intergrade between *P. m. affinis* and *P. m. annectens* from 9.1 km east of Paso de San Matías. Additionally, I have made field observations on two putative intergrades between these two forms in the same region, and I currently am examining a large series of *Pituophis* from throughout Valle de Trinidad (on which I will report later), which also contains what appear to be intergrade specimens.

The ecogeography of other species also supports the presence of *Pituophis vertebralis* at El Álamo. Many xerophilic taxa occurring in the more arid, central regions of the peninsula are able to extend northward into cismontane, northwestern Baja California through a narrow, arid, inland zone lying immediately west of the Sierra San Pedro Mártir and east of the Sierra San Miguel (Fig. 1). The Sierra San Miguel runs parallel to the Sierra San Pedro Mártir for ca. 47 km where it converges in the north with the Sierra Warner. Together, these ranges comprise the southwestern margin of Valle de Trinidad and at which point the latter narrowly merges with the arid, inland regions to the south. The Sierra San Miguel buffers this zone from the maritime influence of the Pacific Ocean, which leaves much of coastal, northwestern Baja California cool, foggy, and windswept for much of the year. As such, many xerophytic plants of the more arid, southerly Vizcaíno Region extend into cismontane, northwestern Baja California through this corridor (Shreve 1936). Similar distribution patterns have been noted in birds (Short and Crossin 1967) and reptiles (Grismer 1994c; Welsh 1988). Reptiles that fit this general pattern are *Crotaphytus vestigium,* which extends northward to at least Rancho San José (Welsh 1988); *Gambelia copeii*, which extends northward into Valle de Trinidad and continues on into southern San Diego County (McGuire 1996); *Xantusia vigilis,* which extends northward to at least Mike's Sky Rancho (Welsh 1988); and *Chilomeniscus cinctus,* which ranges as far north as Valle de Trinidad (Welsh 1988). Welsh (1988) stated that the presence of *C. cinctus* in Valle de Trinidad may be indicative of its occurrence in sandy habitats of the southern Colorado Desert east of the Peninsular Ranges. It is more likely that this area is occupied instead by *Chionactis occipitalis*, as based on a specimen reported by Grismer (1989) from south of San Felipe, three specimens I observed in Paso de San Matías, and the fact that no specimens of *Chilomeniscus cinctus* have been collected from northeastern Baja California (Grismer 1994b).

Therefore, based on all the evidence presented above, the most logical conclusion is that *Pituophis vertebralis* occurs at El Álamo in the western end of Valle de Trinidad, and that it is probably sympatric with *P. melanoleucus annectens* for ca. 180 km along the western foothills of the Sierra San Pedro Mártir. Only additional collecting in this poorly explored area will reveal the geographic nature of the distribution of *P. vertebralis* (allopatric or continuous) in this portion of its range.

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Courtship Behavior Provides Additional Evidence for a Monophyletic *Pseudemys*, and Comments on Mesoamerican *Trachemys* (Testudines: Emydidae)

MICHAEL E. SEIDEL
Department of Biological Sciences, Marshall University
Huntington, West Virginia 25755, USA
e-mail: M043021@MARSHALL.WVNET.edu

and

UWE FRITZ
Staatliches Museum für Tierkunde
Forschungsstelle, Augustusstrasse 2, D-01067 Dresden, Germany

The southeastern United States has a rich diversity of aquatic turtles in the family Emydidae. Gaffney and Meylan (1988) assigned to the subfamily Deirochelyinae six closely related, and often sympatric genera (*Deirochelys*, *Graptemys*, *Malaclemys*, *Chrysemys*, *Trachemys*, and *Pseudemys*), from this region. However, relationships among these turtles have remained controversial. The generic arrangement of painted turtles (*Chrysemys*), sliders (*Trachemys*), and cooters and red-bellied turtles (*Pseudemys*) has had an especially eventful history that has variously seen them recognized as one, two, or three genera (see Seidel and Smith 1986, for a review). Recently, however, most authors have returned to Agassiz' (1857) concept of three genera following the broad-based analysis of Seidel and Smith (1986). This arrangement has received nearly universal acceptance (Ernst et al. 1994), but see Legler (1990). Phylogenetic relationships among these genera are currently being examined by nucleic acid analysis (Bickham et al. 1996; Starkey et al. 1995) and morphological comparisons (Seidel and Meylan, ms.). Observations of courtship behavior, summarized here, provide further evidence that species of *Pseudemys* (sensu stricto) constitute a single evolutionary lineage, separate from *Trachemys*, *Chrysemys,* or map turtles—*Graptemys* (Fritz 1991).

Despite their differences, *Pseudemys* and *Trachemys* possess many morphological and ecological similarities. Both are moderate-sized (200–450 mm carapace length) aquatic turtles with well developed basking habits. Their food preferences are similar but cooters and red-bellied turtles are more herbivorous than sliders, especially as adults. *Pseudemys* and *Trachemys* also share with *Chrysemys* and *Graptemys* an elaborate pattern of aquatic courtship involving "titillation" in which a male extends his forelimbs and vibrates his elongated claws near or against a female's eyes. Anecdotal or rudimentary evidence of this also has been observed in *Malaclemys* (Sachsse 1984) and juvenile *Deirochelys* (Krefft 1955).

Titillation courtship behavior tends to be stereotypic within species, but subtle differences in claw vibration or head movements may occur between species (Vogt 1993). The widespread presence of this behavior in the Deirochelyinae suggests that its absence or reduction in some species is a degenerate (derived) condition. It probably has "regressed" independently in at least two separate lineages, including map turtles (e.g., *G. geographica*: Vogt 1980; *G. ernsti*: Shealy 1976) and sliders (*T. scripta* sensu lato). Several authors have reported absence of titillation courtship in mesoamerican and South American sliders (Davis and Jackson 1973; Fritz 1990; Legler 1990; Medem 1975; Moll and Legler 1971; Pritchard and Trebbau 1984; Rosado 1967). This, along with morphological differences, has prompted some authors to propose that neotropical *Trachemys* be separated from *T. scripta* into one or more additional species (Fritz 1990, 1991; Seidel 1989; Vanzolini 1995; Ward 1984; Wermuth and Mertens 1977). It is noteworthy that residual titillation behavior may persist in these turtles in another form. One of us (UF) has made extensive observations on captive courtship behavior in *T. ornata venusta*[1] collected at Tlacotalpan, Veracruz, México. Over a period of seven years, six males used only intensive head-nodding motions when courting a female. However, on several occasions, males were observed vibrating their foreclaws at each other during apparent aggressive encounters. Male-male or juvenile interactions such as this have previously been viewed as courtship or play (Cagle 1955; Kramer 1989; Morris 1976; Petranka and Phillippi 1978), whereas they may actually represent displacement or threat gestures related to aggression. In any case, observations on *T. o. venusta* behavior further suggest that reduced titillation is a degenerate condition.

In most emydid turtles known to utilize foreclaw titillation, the male faces the female head-to-head and extends his forelimbs. This has been observed at least in *Chrysemys picta bellii* (Taylor 1933); *C. p. picta* (Ernst 1971); *Trachemys s. elegans* (Jackson and Davis 1972a; Molina 1992); *T. s. scripta* (Fritz 1991; Lovich et al. 1990); *T. s. troostii* (Fritz 1991); *T. stejnegeri*, *T. decussata*, *T. terrapen*, *T. decorata* (Seidel 1988, and pers. observ.); *Graptemys barbouri* (Wahlquist 1970); *G. ouachitensis*, *G. pseudo-geographica* (Ernst 1974; Vogt 1980, 1993); *G. flavimaculata* (Vogt,1978); *G. nigrinoda* (Vogt 1978; but see Lahanas 1982); and *Malaclemys terrapin* (Sachsse 1984).

A major variant of foreclaw titillation is seen in *Pseudemys*. In cooters and red-bellied turtles, the male does not approach the female from the front or face her during forelimb vibration; instead, he positions himself above the female, facing the same direction while extending his head and forelimbs down near her eyes and then vibrating his claws. This has been reported for *P. nelsoni* (Kramer 1986; Kramer and Fritz 1989), *P. concinna suwanniensis* (Jackson and Davis 1972b), *P. c. concinna* (Fahey 1987), *P. c.*

[1] Application of the name *T. ornata* here is the decision of U. Fritz.

hieroglyphica (= *concinna*) (Carpenter 1979), *P. c. mobilensis* (= *concinna*) (Cagle 1950), *P. c. floridana* (Obst 1985), *P. peninsularis* (White and Curtsinger 1986), and *P. texana* (Fritz 1989). Obst (1988) reported this variant in *P. rubriventris*, but that may be a reference to *P. nelsoni* because he treated the two forms as conspecific.

In all species of *Pseudemys* for which courtship behavior has been reported, the male vibrates his foreclaws toward the female from above; this behavior has not been reported for any other genus of deirochelyine. Therefore, this may be considered a shared derived character (synapomorphy) for the species of *Pseudemys*. This condition may have evolved more than 20 million years ago (Miocene) when *Pseudemys* presumably diverged from a basal ancestor related to *Trachemys*, *Graptemys*, *Malaclemys*, and/or *Chrysemys* (Fritz 1991; Seidel and Jackson 1990). It may have been an important step in maintaining reproductive isolation in an area of frequent sympatry. Species within *Pseudemys* appear to be closely related (Seidel 1994), but examination for subtle courtship differences within this genus could be informative. In conclusion, the authors would welcome communication from anyone who has observed courtship (in nature or captivity) of deirochelyine turtles not reported here. Observations of courtship in *P. rubriventris*, *P. gorzugi*, *P. alabamensis*, and *Deirochelys* would be especially interesting.

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FIG. 1. Juvenile Jamaican boa foraging for bats as they emerge from Windsor Great Cave. Photo by R. C. Gibson.

Observations on the Foraging Behavior of the Jamaican Boa, *Epicrates subflavus*

KENT A. PRIOR
Department of Biology, Carleton University, Ottawa, Canada K1S 5B6

and

RICHARD C. GIBSON
Department of Herpetology, Jersey Wildlife Preservation Trust
Les Augres Manor, Trinity, Jersey, Channel Islands, U.K. JE3 5BP

Documenting a snake species' diet and foraging behavior is often the first step in the development of an understanding of its ecology (Greene 1992). The significance of diet and foraging data lies in what they may convey regarding habitat use (Reinert et al. 1984), movement and activity patterns (King and Duvall 1990), reproductive ecology (Keenlyne and Beer 1973), and community structure (Gregory 1978). With respect to endangered species, this information may be particularly valuable (Greene 1994).

We report observations on the foraging behavior of free-ranging Jamaican boas (*Epicrates subflavus*). Regarded as "vulnerable" (Groombridge 1993), the endemic Jamaican boa persists in 8–9 isolated local populations occupying forested habitat distributed across the breadth of the island (Gibson 1995; Oliver 1982). As part of a pilot study of the species' behavioral ecology, we conducted fieldwork at Windsor on the northern periphery of the Cockpit Country, Trelawny, western Jamaica. Between 22 October and 11 November 1995 we searched for snakes daily in the surrounding wet limestone forest and coffee and banana fields. In the evening we surveyed the main entrance to Windsor Great Cave (150 cm wide by 200 cm high) and another large cave opening (ca. 10 m by 10 m) where boas have been reported foraging on emerging bats (R. Kerr, pers. comm., Vareschi and Janetzky, *in press*).

We visited Windsor Great Cave at 1750 h on 22 October and found a juvenile (95 cm SVL, 320 g) female boa hanging from vegetation growing on the cliff above the mouth of the cave. About two-thirds of her length was hanging straight down in the flight path of emerging bats. Her ventral or lateral surfaces faced the entrance (never the dorsal surface) and the head was cocked very slightly dorsally with the mouth closed (Fig. 1). Goodwin (1970) reported three species of bats (*Chilonycteris* [*Pteronotus*] *macleayi grisea, C.* [*Pteronotus*] *p. parnellii, Monophyllus r. redmani*), totaling many thousands, from this cave. Neither the snake nor the bats seemed disturbed by our presence and the use of dimmed headlamps. Over the next hour, the snake made many attempts to capture bats that were either emerging from, or re-entering the cave. We carefully searched the vegetation around the cave mouth but found no other snakes. At 1850 h we captured the boa for examination and temporary marking with paint. She was released at the capture location at 1000 h the following day.

We surveyed Windsor Great Cave each evening between 23 and 28 October but saw no other boas. On 29 October at 1825 h we found the same individual *E. subflavus*, again hunting for bats at the cave. We carefully monitored her foraging behavior for the next 1 h 45 min. Throughout the observation period she exhibited the same foraging posture we had witnessed the first evening. No tongue flicking was observed. When bats passed very close or actually collided with her, she actively attempted to capture them by swinging upward with her mouth open wide. Bat activity fluctuated over the period of our observation and this was reflected by the number of capture attempts made by the snake. During the first 40 min of observation she made 100 capture attempts (2.5 attempts/min), whereas she took 60 min to make the next 100 capture attempts (1.6 attempts/min). Despite making over 200 attempts she never captured a bat during our observation period. We visited both cave openings five more times, but saw no other boas.

During our fieldwork we made three additional observations relating to the foraging behavior and diet of Jamaican boas. On 27 October we found a fresh boa scat deposited on a rock pile located in wet limestone forest habitat. Upon close inspection, the scat appeared to be composed almost entirely of rat (*Rattus rattus*) hair. On the morning of 28 October we captured an adult (132 cm SVL, 920 g) female boa who was apparently foraging for rats in the home of a local resident. Finally, at 1500 h on 2 November we captured an adult (185 cm SVL, 2040 g) male boa in an overgrown banana field. The snake was perched 2 m off the ground in a sapling (2 cm DBH), with its head and neck in a typical "S-shaped" striking posture. We believe that the snake was waiting to ambush birds, which we noted had been feeding nearby on ripe bananas. We captured this snake and returned to the field station where it was force-fed a 10 g radio-transmitter. The snake was then released at the capture site at 1400 h the following day. We relocated this snake in forest habitat daily over the next eight days. On three of these days we found the snake in an ambush foraging posture coiled among terrestrial tank bromeliads (*Aechmea paniculigera*) on the forest floor or perched in a sapling (2 cm DBH) 1.5 m off the ground. Bird species that we commonly en-

countered in this habitat included *Saurothera vetula, Turdus aurantius*, and *Dendroica caerulescens*.

Bat predation by West Indian *Epicrates* boas has been documented on a number of occasions (e.g., *E. angulifer* and *E. inornatus*, Hardy 1957; Rodriguez and Reagan 1984, respectively) but rarely for the Jamaican boa (Vareschi and Janetzky, *in press*). However, according to residents of the Windsor area and other visiting researchers, it is a behavior that is not uncommon. Indeed, we have received reports of boa sightings in at least three separate cave systems (Windsor Caves, Trelawny; Green Grotto Caves, NW St. Ann; St. Clair Cave, N St. Catherine) and have observed boas at two of these locations ourselves.

Large permanent bat roosts represent predictable, high density, but localized prey sources, which at least three species of *Epicrates* exploit. It is therefore quite plausible that other members of the genus (e.g., *E. striatus*) also forage in this manner. Nevertheless, in the vicinity of Windsor Cave, Jamaican boas also appear to prey upon birds and rodents (Cruz and Gruber 1981) which, superficially, appear less reliable sources of prey than roosting bats. The relative costs and benefits of prey choice by Jamaican boas are unclear.

The ease with which boas may be observed foraging on bats suggests that these predator-prey systems could prove to be fruitful models for researching foraging theory. In addition, the susceptibility of such systems to human disturbance warrants further investigation of the importance of bat predation for endangered West Indian boas.

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Abnormalities in Embryos from a Wild American Alligator (*Alligator mississippiensis*) Nest

LOUISE HAYES-ODUM*

and

JAMES R. DIXON

Department of Wildlife and Fisheries Science, Texas A&M University
College Station, Texas 77843, USA

**Present address: Living Resource Center, 11833 Chimney Rock Road*
Houston, Texas 77035, USA
e-mail: hayesodu@tenet.edu

Congenital malformations in crocodilians have been summarized by Ferguson (1985) and include skeletal, visceral, color, CNS, and craniofacial anomalies, plus double yolks, twinning, and axial bifurcation/partial twinning. Abnormalities in crocodilian embryos may be due to the female (usually very young or old) producing damaged embryos or to incubation conditions such as extreme temperatures, unsuitable hydric or gaseous environments within the eggs, or the eggs not being oriented at the proper axis (Ferguson 1985).

While conducting a study on American alligator (*Alligator mississippiensis*) nests at the J. D. Murphree Wildlife Management Area, Jefferson Co., Texas, USA, for the purpose of correlating nest temperatures with resulting sex ratios, we discovered one nest with extremely high temperatures. An examination of the young from the nest revealed that all possessed externally visible deformities.

The nest was composed of common reed (*Phragmites communis*) and soil. Nest temperatures were monitored on an hourly basis from 30 June–22 July 1988, using a self-contained temperature recording device placed within the nest with a probe leading to the center of the nest cavity. The mean temperature recorded by the device during this period was 32.0°C, but the values for the individual temperatures, and the high and low temperatures were lost due to problems encountered when transferring the data into a computer. However, immediately before opening the nest to insert the temperature recording device, a Miller and Weber cloacal thermometer was slid into the unopened nest cavity and registered at 36°C. (The temperature recording device and cloacal thermometer were known to be accurate to the nearest 0.5°C of each other). Eight other nests being monitored during this study had mean temperatures ranging from 26.0–31.0°C and high temperatures of 30.0–32.5°C. The eggs were removed from the nest four days prior to the onset of hatching, and were numbered consecutively from top to the bottom of the nest in a clockwise direction. All eggs appeared normal externally with the exception of two rotten eggs (one with a concretion on the end of the shell and the other flat on one side). Several eggs began to hatch on 15 August 1988, and the remainder were opened the following day. Of 48 eggs, six were rotten, 19 contained early dead embryos (embryos too small to be seen), two contained late dead embryos (visible, usually 25 days of incubation or more), four contained full-term dead embryos (fully developed, but found dead when the egg was opened), and 17 contained full-term live embryos.

TABLE 1. Individual measurements (cm) on deformed *Alligator mississippiensis* hatchlings from 1988, Nest 7 at the J. D. Murphree Wildlife Management Area, Texas. UJAW (Upper Jaw): 1 = normal, 2 = deformed. LJAW (Lower Jaw): 1 = slight deformity, 2 = intermediate deformity, 3 = extreme deformity. Tail: 1 = straight, 2 = deformed; L = twisted to left, R = twisted to right. Mean value for UJAW = 1.8 (SD = 0.1); mean for LJAW = 1.5 (SD = 0.1).

Egg#	TL	SVL	UJAW	LJAW	SEX	LJAW	UJAW	DIR	TAIL	DIR
7-4	19.4	9.8	1.8	1.7	2	2	1		1	
7-5	18.8	9.6	1.7	1.5	2*	1	1		1	
7-6	14.7	7.9	1.7	1.5	2	2	2	R	2	L
7-8**					1	2	1		2	R
7-14	15.8	8.6	1.8	1.4	2	3	2	L	2	L
7-16	18.2	9.6	1.8	1.6	1	2	1		1	
7-19	14.2	8.1	1.5	1.2	2*	3	2	L	2	L
7-21	16.6	8.7	1.8	1.4	2	3	1		1	
7-22	19.8	9.9	1.9	1.4	1	2	1		1	
7-26	19.8	9.8	1.8	1.6	1	2	1		1	
7-32	18.7	9.6	1.8	1.6	1	2	1		1	
7-32A	17.2	8.8	1.8	1.5	2	3	1		2	L
7-34	19.8	9.6	1.8	1.6	1	1	1		1	
7-36	17.2	9.4	1.9	1.5	2*	3	1		2	L
7-38	18.8	9.8	1.7	1.5	2	2	1		2	L
7-40	19.6	9.8	2.0	1.5	2	3	1		1	
7-41	12.0	7.5	1.8	1.4	2	3	2	R	2	R
7-45	20.1	9.9	2.0	1.7	1	2	1		1	
7-46	18.6	9.5	2.0	1.7	2	3	1		2	L
7-47	18.9	9.3	1.9	1.7	2	2	1		1	

* undifferentiated or unable to determine due to poor condition.
** kept alive.

All full-term alligators had varying degrees of mandibular hypoplasia, an abnormally short lower jaw. Nine animals had caudal scoliosis, and four of these also possessed unilateral maxillary hypoplasia in which one side of the upper jaw was shorter than the other. Sixteen of the live hatchlings were sacrificed (one was kept alive), and these and the four full-term dead alligators were examined internally and had one of their gonads removed for histological confirmation of sex. The animals possessed normal looking thoracic and abdominal organs, and a thymus and all aortic arches were present and in appropriate locations. The most deformed individuals were females or were more "female-like" in terms of histological gonad appearance; they were runts and had all of the upper jaw and the most extreme lower jaw abnormalities. The gonads identified as male in this clutch were definitive, but some of those denoted as female were largely undifferentiated. Sex, degree and/or presence of jaw and tail deformities, direction that deformed tails or upper jaws were twisted, and measurements of total (TL), snout-vent (SVL), upper jaw (UJAW), and lower jaw (LJAW) lengths are listed in Table 1.

The alligator kept alive was a male (confirmed by the presence of a penis) with an intermediate mandibular deformity, normal maxillae, and a kinked tail. When he was several days old, he was placed in an outdoor enclosure with several yearling alligators. He exhibited normal behavior, with the exception of being slightly off balance when diving into the water. He fed well on an insect diet, but often was unsuccessful grabbing the prey on the first attempt due to the jaw abnormality. By 1990, the deformities had lessened in severity of appearance, his clumsiness in diving and feeding was no longer apparent, and he began feeding on young mice. The following year he began feeding on adult mice and had no difficulty in quickly swallowing them whole. In June 1994, he began bellowing. His growth was stunted and his total length was only 84.5 cm as of July 1996.

The type of anomalies present in the alligators, coupled with the temperature data, suggest that they were heat induced (Ferguson 1985). The females found in this nest had the most severe anomalies. Alligators have been found to have temperature sex determination displaying a female-male-female pattern with females occurring at the low and high temperatures (Lang and Andrews 1994). Hence, it is unclear why there were males in the nest, presumably exhibiting high temperature induced abnormalities, when all females might be predicted to occur. One possible explanation is that sex was determined prior to high nest temperatures. If the females were produced in the warmest portions of the nest, then these areas might be expected to overheat to a greater extent than the male producing areas, thus causing more severe deformities in the females.

We doubt that the most severely deformed alligators (those with a maxillary deformity) from this clutch would have been capable of surviving in the wild. They were the smallest (<16 cm TL), weakest individuals, and had caudal scoliosis and at least an intermediate degree of mandibular hypoplasia. Because the animal with the intermediate mandibular deformity and caudal scoliosis is thriving, it seems possible that such an individual could survive in the wild. However, due to its stunted growth, we think it unlikely that it will ever become reproductively active. The sacrificed specimens were deposited in the Texas A&M Wildlife Research Collection.

Acknowledgments.—The temperature measuring and recording device was designed for this project by students in the Texas A&M University Department of Engineering Technology under the supervision of R. Puckett. Thanks is extended to D. Owens for the use of his lab and supplies for the histological preparation and sharing his knowledge of histological techniques. T. Wibbels and H. Austin shared their time and expertise regarding histological identification of reptile gonads, and R. Robinson

examined the specimens at the macroscopic level. K. Wood assisted in taking the various measurements and recording associated data. R. A. Odum offered suggestions on the manuscript. Partial funding for this research was provided via a grant from the Texas Herpetological Society. All research was approved by the Texas A&M University Animal Welfare Committee and was conducted under the provisions of a Texas Parks and Wildlife Department scientific permit.

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TECHNIQUES

Scanning Electron Microscopy of High Resolution Casts for the Study of Tooth Surface Morphology in Snakes

KATE JACKSON
Museum of Comparative Zoology, Harvard University
Cambridge, Massachusetts 02138, USA
e-mail: kjackson@oeb.harvard.edu

Scanning electron microscopy (SEM) has been used to visualize detail in tooth surface morphology for studies of snake systematics (e.g., Jackson and Fritts 1995, 1996; Rasmussen 1975) and functional morphology (e.g., Kochva and Meier 1986; Mebs et al. 1994; Savitzky 1981). Although SEM allows the morphology of snake teeth to be examined at high magnifications, it has the disadvantage of being destructive; maxillae or individual teeth must be removed from the specimen, mounted on stubs, and sputter-coated with gold. The destructive nature of this technique limits its usefulness for the study of type or rare material and for studies involving large series of specimens.

The following technique was developed by Myers et al. (1995) for the study of mammalian taste papillae, but may be applied equally well to the study of snake teeth. Here, I will describe its use to make a high resolution cast of the grooved posterior fang of the brown tree snake (*Boiga irregularis*).

The mouth of a fluid-preserved specimen (*B. irregularis*, THF 9709) was blotted dry, and the left posterior fangs were exposed. A droplet of Reprosil hydrophilic vinyl polysiloxane impression material (light body) (Dentsply International Inc., Milford, Delaware 19963-0359, USA) was applied to the corner of the mouth (so as to completely cover the fangs) and allowed to dry (Reprosil is mixed with a catalyst immediately prior to application, and takes approx. 7 min to harden to a rubbery consistency). The solidified Reprosil impression was then peeled off the fangs and stored at room temperature for 24 h to allow for degassing. A cast of the fangs was made by filling the impression with Spurr's low viscosity embedding medium (firm mixture) (Bozzola and Russell 1992), using a $23G^3/_4$ hypodermic needle and a 1cc syringe. After the cast had been allowed to cure for 24 h at 70°C, the Reprosil impression was peeled off.

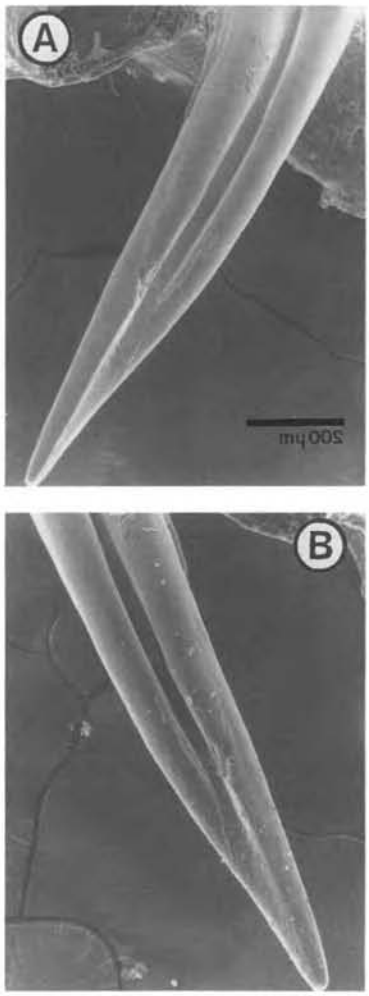


FIG. 1. SEM image of (A), the grooved posterior fang of *Boiga irregularis*, and (B) a high resolution cast of the same specimen.

For the purpose of comparison between cast and original fang, the left maxilla was later dissected out of the specimen. Both the cast and the original fang from which it was made were mounted on a stub, sputter-coated with gold, and examined using a JEOL 6400 scanning electron microscope at an acceleration voltage of 15 kV. The resulting SEM images of the original fang (Fig. 1A) and of the high resolution cast of the same fang (Fig 1B) are shown below. This technique has many potential applications beyond the study of snake teeth, and could be used for the non-destructive study of the surface morphology of any hard or soft tissue (e.g.. scales, hemipenes, etc.).

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Effective Predator Excluders for Turtle Nests

TERRY GRAHAM
Department of Biology, Worcester State College
Worcester, Massachusetts 01602, USA
e-mail: t1graham@mecn.mass.edu

In 1983, alarmed by the destruction of redbelly turtle *(Pseudemys rubriventris)* eggs by marauding mammals, I sought a means of physically "excluding" these predators from access to turtle nest chambers. The method of nest cage construction and installation that I describe has been extremely effective over the past 13 years.

Cages are made of black or dark green 1.2 cm x 2.5 cm vinyl-coated wire mesh that can be purchased in 30 m rolls about 45–50 cm wide. Using metal shears, wire sufficient to produce a one-piece rolled cylinder 50 cm in diameter is cut. The cut edges of the mesh are then fastened together with 1.2 cm stainless steel hog rings, forming an open-ended cylinder. Finally, another piece of mesh just large enough to fit the area of one open end is cut and hog-ringed into place. After this square top piece is ringed securely around the circular edge of the mesh cylinder, its four overhanging corners are bent downward out of the way. Smaller mesh is preferred for protecting the nests and retaining the young of smaller species (e.g., mud and musk turtles).



FIG. 1. Circular trench and trenching tool.

A circular imprint of the cage rim is obtained by placing the cage down over the nest, after first aligning the center of the cage with the nest. The cage is then pressed into the soil and twisted so as to leave a clear imprint of the perimeter. This imprint serves as a template for digging a circular trench 30 cm deep around the nest (Fig 1). A good trenching tool for this job is a small mattock (available in military surplus stores). Care must be exercised in digging to avoid disturbance to the cylinder of substrate containing the nest chamber. In sandy soils this digging can be accomplished in 10–15 min, but in gravelly or rocky soils the time required will be longer. Large rocks and tree roots can be especially troublesome and difficult to remove without disturbing the integrity of the nest chamber. It is sometimes impossible to remove them safely, so it is recommended that such obstacles be left in place and that the bottom edge of the cage be cut to fit over them. The mesh cage is lowered into the trench, which is then backfilled with loose soil to ground level. The surface soil around the cage can then be tamped down by stepping firmly on it all around. If excavation and cage installation are done properly, the depth, surface, and overall integrity of the nest will not be compromised.



FIG. 2. Completed cage installation; pair of steel cage extractors to the right.

The completed installation (Fig. 2) leaves about 20 cm of the cage exposed to act as an above-ground holding pen for emerged hatchlings. Young can be removed through the top if the mesh cover is first unringed along one side, and then folded back. Finding it somewhat difficult and time consuming to open cages, I devised cage removal tools that allow me to extract the intact cage from the ground. A pair of steel hooks, on the idea of stevedore's hooks, were fashioned from 0.7 cm rod (30 cm long) welded to the center of a 12 cm piece of heavier (1.8 cm) rod serving as a handle. The rod tip was then heated, hammered flat for about 3 cm, and bent in a "U" to form a hook. Gripping opposite edges of the cage top with two of these hooks, I am able to withdraw the cage from the ground by applying a steady, upward pull. In cases where cages refuse to budge, I pull on one hook until the cage is loosened and then pull alternately on each hook, rocking the cage back and forth out of the ground. Because the vinyl coating prevents the buried mesh from rusting, these cages can be stockpiled and reused.

Finally, if these nest cages cannot be checked frequently during the period of emergence, a shaded refuge for the young must be provided inside. A piece of burlap or other coarse fabric can be ringed to the side of the cage to block the midday sun. If this awning shades the center where the nest is situated, it may cool the nest and alter hatchling development, sex ratio, and emergence. Another approach might be to install a hatchling hiding box in each cage, but the simplest strategy is to check the cages frequently to prevent heat and dessication stress to emerged young.

Acknowledgments.—I thank Bob Alberghini for fabricating my cage extractors, and am indebted to Paul Lefrancois, Norman Bell, Andy Graham, Paul Metcalf, and Bruce Ericson for assembling and installing dozens of these cages over the past decade. Wire mesh for the cages was provided by the Massachusetts Division of Fisheries and Wildlife.

An Improved Technique for Formalin Fixation of Large Vertebrates

MICHAEL R. J. FORSTNER
CERC, Low Memorial Library
Columbia University, New York, New York, 10027, USA
e-mail: mrf20@columbia.edu

J. R. DIXON
Department of Wildlife and Fisheries Sciences
Texas A&M University, College Station, Texas, 77843, USA
e-mail: jrdixon@tamu.edu

and

D. E. STARKEY
Department of Animal Sciences
Texas A&M University, College Station, Texas, 77843, USA

While injection of formalin solution by hand-held syringe (Anderson 1965; Simmons 1987) is easy and effective, it can be both inefficient and laborious when preserving larger specimens. Turtles are especially difficult to prepare and they are often inadequately preserved because of the difficulty with injecting sufficient preservative into the body cavity. Turtles preserved using hand-held syringes seldom have everted penes and the head and limbs often remain tightly enclosed within the shell. We improved this method by using a modified garden sprayer for the pressurized injection of formalin (Fig. 1). Using our technique, the preservation of 173 previously frozen turtle specimens required only 4 h, an average of 3 min per turtle. We estimate the time required by manual injection would have approached 22 h. Our technique resulted in the successful eversion of nearly 80% of the penes and produced effective limb and neck extension in 95% of specimens.

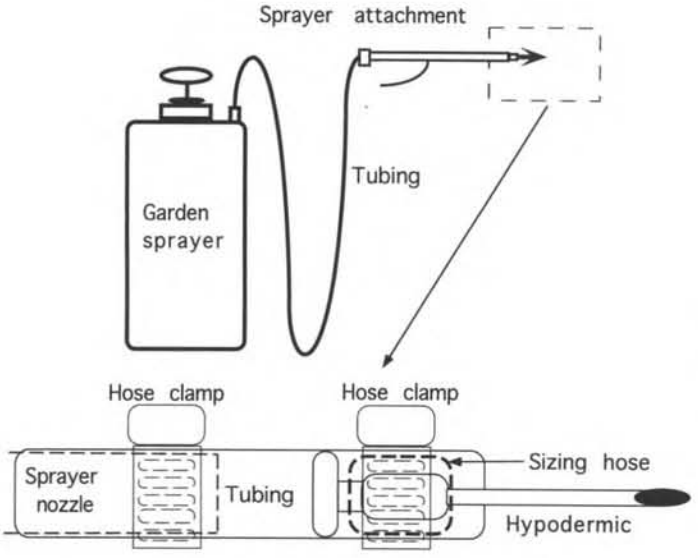


FIG. 1. Pressurized formalin injection sprayer. Dashed box provides alignment and assembly component detail for the hypodermic attachment.

The sprayer (Fig. 1) is available at most hardware stores; currently we use a Root:Lowell Heavy Duty Model (No. 1996) with a brass nozzle. Other materials required include tubing (Fisher 14-176 series), injection needles (stainless steel Fisher 14-825 series), and an assortment of hose clamps (Fisher 14-198 series). The needle assembly consists of clear, chemical-resistant, tubing (12–16") with an appropriate gauge needle inserted and clamped at one end. This assembly may require additional smaller-diameter tubing for accurately "sizing" smaller gauge needles and assuring a pressure-tight seal (Fig. 1). Assembly is straightforward: clean the sprayer tank with a hot water rinse, remove the nozzle from the sprayer delivery wand, and attach the hose assembly.

The entire apparatus can be modified from one gauge needle to the next in a few minutes. We have found that an assortment of hose and needle combinations, chosen to fit a variety of vertebrates, is most useful. The entire cost of the unit is less than US $50. All museum and field assistants must wear proper eye and clothing protection when using the formalin sprayer.

Acknowledgments.—We thank K. Vaughn, the staff of the Texas Cooperative Wildlife Collection, and S. K. Davis for their contributions to the development of this apparatus.

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Surgical Procedure for Radio Transmitter Implantation into Aquatic, Larval Salamanders

MARY ELLEN COLBERG*
California Department of Fish and Game, Cantara Program
2440 Athens Avenue, Redding, California 96001, USA

DALE F. DeNARDO
University of California, Berkeley, Office of Laboratory Animal Care
Northwest Animal Facility, Room 203, Berkeley, California 94720, USA

NORA A. ROJEK
and
JACK W. MILLER
California Department of Fish and Game, Cantara Program
2440 Athens Avenue, Redding, California 96001, USA

**Present address: P.O. Box 1353, Mount Shasta, California 96067, USA*

Radiotelemetry has become an important technique for studying species movements and, while externally-attached transmitters have been used on amphibians (Richards et al. 1994), our initial experiments with harnesses on *Dicamptodon tenebrosus* resulted in harness slippage and skin irritations. Transmitters have been implanted effectively in several amphibian species (Richards et al. 1994) and implantation methods for large aquatic salamanders have been described (*Cryptobranchus alleganiensis*; Stouffer et al. 1983). Here we describe the surgical method (modified from Stouffer et al. 1983) we used for larval *D. tenebrosus*, translocated to the upper Sacramento River from connecting tributaries in Siskiyou and Shasta counties, California, USA, and discuss factors affecting the incision healing rate of an aquatic salamander.

During May and June, 1995, 19 *D. tenebrosus* larvae (156–233 mm total length, 39.5–72.0 g) were captured; transmitter weight (2.5 g) was limited to < 6.5% of body weight. All 19 salamanders were implanted with SM1 transmitters (2.5 g, 8 mm x 10 mm 21 mm, AVM Instrument Co.) that had been potted in dental acrylic. Salamanders were anesthetized by submersion in a 0.01% solution of benzocaine. Anesthetized animals were then placed right side down in a foam-lined plastic tray saturated with 0.01% benzocaine solution. The foam lining kept the salamander's skin moist and prevented the animal from sliding during surgery. To keep the

skin moist and ensure continued anesthetization, several pieces of anesthetic-soaked cotton gauze were placed over the animal's body so that only the flank was exposed.

An 8–10 mm incision was made mid-laterally in the left flank to reduce the incision site's contact with substrate or moving limbs during normal locomotion while healing. To initiate the incision, a pinch of skin was raised with forceps from underlying muscle and cut cranio-caudally with sharp-tipped scissors. A small hole was then punctured through the muscle and peritoneal membrane using the tips of the closed scissors and widened by opening the scissors slightly. Lifting the muscle with forceps, we extended the incision with scissors, being careful to avoid any internal organs. Sterile cotton applicators were used to absorb fluid from the body cavity or to apply pressure to bleeding vessels.

Each transmitter was dipped in molten paraffin 3 times prior to implantation to create an inert surface and to reduce the possibility of an inflammatory response. Then each transmitter was soaked for 24 h in a 5% Chlorhexidine solution (Novisan, Fort Dodge) to ensure sterility, rinsed in sterile saline solution to remove the disinfectant, and placed within the coelomic cavity (parallel to the spine) with battery oriented anteriorly and helicoil antenna dorsally.

The muscle was closed by continuous suture of 4-O or 5-O polyglactin 910 (Vicryl, Ethicon) with a taper needle; suture material was soaked in 12.9% Benzalkonium chloride (Benz-all, Xttrium Laboratories) for ca. 24 h before surgery (to soften the thread) and rinsed in saline at time of use. The skin was closed using approximately 3 horizontal mattress sutures (ca. 2 mm wide and 2 mm apart) of 4-0 or 5-0 polyglactin 910 with a cutting needle. Skin sutures were not drawn as tightly as those in muscle tissue to prevent necrosis. The closed incision site was wiped clean with gauze. Mean surgery time per individual was 21 minutes.

While nonabsorbable 4-O silk suture material has been recommended because of its cost and handling characteristics (Boothe 1985), our earlier experiments with silk suture material resulted in severe fungal infection in *D. tenebrosus* unable to shed the sutures. Silk suture material causes greater tissue reaction (Boothe 1985) and a higher frequency of infection (Sugarman and Musher 1981) than nylon suture material. We used absorbable Polyglactin 910 sutures and found them to be compatible with larval salamanders.

To resuscitate animals, recovering individuals were placed in a 5-gallon bucket of cold spring water and the water was stirred and changed frequently to increase the exchange of oxygen and dilution of the anesthetic. Recovery time averaged 27 minutes and the total procedure (anesthesia, surgery, recovery) time per individual averaged 62 minutes.

Salamanders were then held in tubs for 10–20 days to monitor their behavior and to assure that the sutures remained intact; failing sutures were replaced immediately as described above. At the time of release, we remeasured weight and snout-vent length, documented incision status, and applied malachite green, an anti-fungal agent, to the incision site.

During June and July, 1995, nine of the salamanders were translocated to the upper Sacramento River and ten were released at their points of capture. Fourteen salamanders were recaptured between September and mid-October, 1995. Incisions in 8 of the 14 recaptured salamanders were completely healed (4 each from tributaries and river), 4 were partially healed (3 from tributaries and one from river), and two were not healed (both from tributaries). Incision healing time may be affected by water temperature. Higher metabolic rates and faster healing times are associated with higher temperatures in fish (Anderson and Roberts 1975) and snakes (Smith et al. 1988); larval *Dicamptodon* body temperatures are the same as the water temperature (Brattstrom 1963) and their metabolic and healing rates are assumed to increase with increasing water temperatures.

Our observations of individuals radiotracked for a few weeks during 1994–1995 indicate that these salamanders remain fairly sedentary in winter when water temperatures are colder. One individual, implanted with a transmitter in October, 1994, and maintained in cold spring water in the lab, took six months to heal. While healing time may have been influenced by the suture material (silk), it may also have been increased by cold water temperature and the animal's inactivity during winter. Most incisions healed within three months during summer. Individuals implanted with transmitters in the summer were more active, and the water temperature was also generally warmer; we recommend timing implant surgery for aquatic salamanders to correspond with the organism's most active season. Maintaining or releasing animals in waters at the higher end of the salamander's preferred temperature range may accelerate healing.

Acknowledgments.—We thank Kelly Kawsuniak for assistance with the surgery and Patrick Hendrix, Leslie Hubbard, Kelly Kawsuniak, Christine Sousa, and Vincent Whitman for assistance with the field work. Bruce Deuel, Mark Stopher, and Angela Stringer made editorial comments on earlier drafts of this manuscript. This study was supported by the California Department of Fish and Game as part of the Cantara Spill Natural Resource Damage Assessment.

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Bufo boreas halophilus (California Toad). USA: California: San Diego Co., Santa Margarita River. Illustration by Dan Holland.

A New Trap for the Live Capture of Large Lizards

TIFFANY M. DOAN
Department of Biology, University of South Florida
Tampa, Florida 33620, USA
e-mail: doan@chuma.cas.usf.edu

Large, wide-ranging lizards are often difficult to catch (Auffenberg 1978). Drift fence-pitfall trapping, the use of rubber bands, and noosing (Simmons 1987) may be ineffective for large lizards.

In a recent investigation (Doan, unpubl.), *Tupinambis teguixin* home range was studied in remote Peruvian rainforest. Although large wire mesh traps (e.g., Havahart™ and Tomahawk™) may be used to catch large lizards (King et al. 1994), it was not possible for me to transport large traps to the field. H. B. Sherman Traps, Inc. (P.O. Box 20267, Tallahassee, Florida 32316, USA; tel. 904-575-8727) constructed collapsible aluminum traps similar to Sherman™ mammal traps but composed of solid aluminum on three sides and expanded metal on one side (for viewing the contents of a closed trap), that measure 88.5 cm x 31.0 cm x 31.0 cm when in use and collapse to 88.5 cm x 31.0 cm x 5.0 cm for transport.

In the field I camouflaged the traps by laying green mosquito netting over the trap, tucking it underneath. Fallen branches and leaves were placed on top of the trap and inside on the spring door. I tried live and dead rats, hen eggs, canned cat food, and bananas as bait, but all captures of *T. teguixin* were made in traps baited with hen eggs. Cracked eggs were placed in wire mesh suspended in the back of the trap. When camouflaged and baited appropriately, this new trap was successful in capturing *T. teguixin* and did not appear to influence the possibility of recapture.

These new, collapsible Sherman traps are easy to transport and effective for catching large lizards. Incidental captures during my study included *Ameiva ameiva*, *Didelphis marsupialis* (common opossum), *Sylvilagus brasiliensis* (Brazilian rabbit), and *Proechimys* spp. (spiny rats). The mammals were captured with various bait types, demonstrating the potential of the new trap for studies where larger animals are sought and trap portability is important.

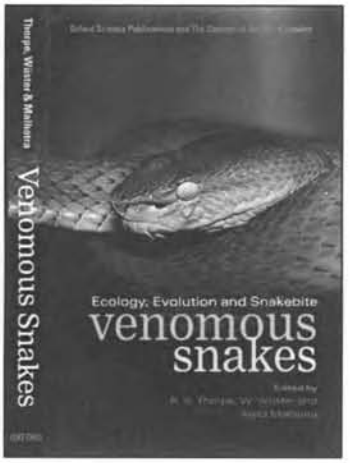
Acknowledgments.—I thank G. Phillips of H. B. Sherman Traps, Inc. for designing, building, and shipping the traps; without his help this study would not have been possible. I also thank C. Galvez-Durand and P. van Ipenburg for battling Peruvian customs to retrieve the traps, and H. Mushinsky for guidance and support.

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Venomous Snakes

Ecology, Evolution and Snakebite

R. S. Thorpe, W. Wüster, and Anita Malhotra (Eds.)

This is the first book to present a multidisciplinary approach to venomous snake research. As well as focusing on the medical aspects of snake venoms and the effects of snakebites, the book examines the evolution and ecology of venomous snakes that are so crucial in the search for snakebite antidotes. Symposium of the Zoological Society of London; No. 70. From a symposium held at the Zoological Society of London on 27–28 April 1995.

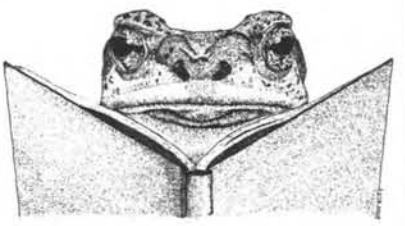
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HERPETOLOGICAL HUSBANDRY

Artificial Brooding of Salamander Eggs

TOMALEI J. VESS*

and

REID N. HARRIS**

Department of Biology, James Madison University
Harrisonburg, Virginia 22807, USA
e-mail: harrisrn@jmu.edu

*Present address: *Department of Zoology, Box 90325, Duke University*
Durham, North Carolina 27708-0325, USA
e-mail: tjv1@acpub.duke.edu

***Author to whom all correspondence should be addressed.*

Maternal brooding of salamander embryos has been shown to increase embryonic survival (Forester 1979; Harris et al. 1995; Salthe and Mecham 1974; Tilley 1972). However, a variety of different experimental protocols require that eggs be isolated from the brooding female. Experimental designs involving quantitative genetics (Falconer 1989) and kin discrimination (Waldman 1991) involve separating eggs from each female into groups of various sizes for rearing in order to remove the effect of "female brooding" from an experiment. In addition, it is impossible for one female to brood more than one isolated cluster of her eggs. Unfortunately, previous attempts at artificial brooding of salamander eggs have met with limited success. Forester (1979) removed brooding *Desmognathus ochrophaeus* and used an artificial brooding technique in the laboratory that yielded more than 90% mortality due to fungal infection within 28 days. In an attempt to increase the survival of four-toed salamander embryos, *Hemidactylium scutatum* (Caudata: Plethodontidae), in the absence of the brooder, we developed a novel method of artificial brooding.

Eggs were placed into 6 x 8 x 4 cm hard plastic containers containing a single layer of filter paper dampened with artificial pond water (modified Provosoli medium, no vitamins, not autoclaved: Wyngaard and Chinnappa 1982). All containers were covered with a hard plastic lid and coated with Parafilm to prevent desiccation of the eggs. Young embryos were maintained on a 24:0 h (light:dark) photoperiod at 16°C. This photoperiod was convenient for us because it allowed animal care to be scheduled at any time. When the neuromuscular system began to function, embryos were placed on a 14.5:9.5 h photoperiod at 18°C to mimic natural conditions. Container arrangements were systematically changed within the incubators to eliminate effects of temperature and light gradients.

Containers were checked under the dissecting scope to assess developmental stage and to check for fungus. Any infected eggs were teased away from the cluster and removed to reduce the likelihood of infection of the other eggs. All viable eggs were cleaned as follows. Eggs in their container were rinsed with a squirt jar containing artificial pond water (modified Provosoli medium), removed with a plastic spoon, and placed in a petri dish to be rinsed again. While the eggs were out of the container, the containers were rinsed and swabbed with 70% EtOH and rinsed five times with hot tap water. Fresh filter paper was placed in the container. The eggs were then spooned out of the petri dish, rinsed a third time while in the spoon, and placed gently on the fresh dampened filter paper. The petri dish and the plastic spoon were sterilized with 70% EtOH after each use. Containers were cleaned daily during the first third of the embryonic period, every third day in the second third of the embryonic period, and every seventh day in the last third of the embryonic period. As the embryos approached hatching, the cleaning scheme was modified to avoid premature hatching. The embryos were rinsed in their container with a squirt jar containing modified Provosoli and rolled daily. Eighty-two percent of the embryos survived 4–6 weeks to hatching (467 eggs hatched out of 570). We have had less experience raising eggs of *D. ochrophaeus* and *D. monticola* from the earliest embryonic stages with this method, but results obtained were comparable to those obtained for *H. scutatum*.

Acknowledgments.—We thank Carrie Carreno for help with raising embryos. This research was supported by National Science Foundation grant DEB 92-07186 to Reid N. Harris and Ivor T. Knight.

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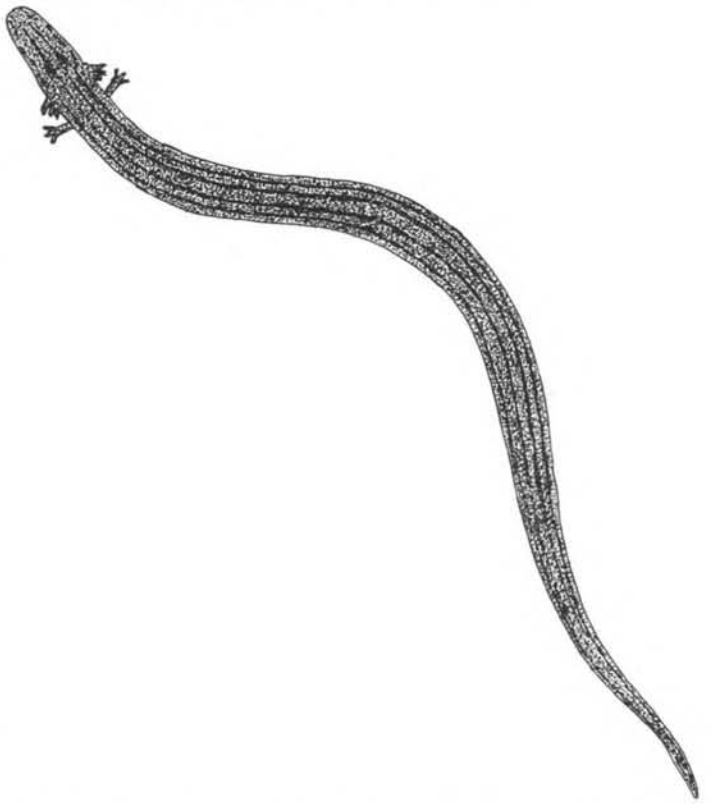
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Pseudobranchus striatus axanthus (Narrow-striped Dwarf Siren). Illustration by Dan Holland.

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in Volume 28, Number 1 (March 1997).

CAUDATA

AMBYSTOMA TIGRINUM MELANOSTICTUM (Blotched Tiger Salamander). **PREDATION**. Predators of salamanders in the Pacific Northwest are poorly known. Leonard et al. (1993. Amphibians of Washington and Oregon. Seattle Audubon Soc., Seattle. viii + 168 pp.) reported that aquatic salamanders may be eaten by other salamanders, garter snakes, and certain species of mammals and birds. On 13 March 1996 at ca. 1500 h PST, a mink (*Mustela vison*) was observed on the shore of a small pond adjacent to a second pond that is a known breeding site for *Ambystoma tigrinum melanostictum, A. macrodactylum columbianum,* and *Pseudacris regilla*. Both ponds are located on the south edge of the Washington State University campus in Pullman. Several minutes after diving into the water the mink reappeared, carrying a branchiate tiger salamander ca. 175–200 mm TL. The mink then disappeared into a den behind some small boulders carrying the salamander.

Submitted by **JULIE A. FRONZUTO**, Department of Zoology, Washington State University, Pullman, Washington 99164-4236, USA.

ANEIDES LUGUBRIS (Arboreal Salamander). **PREDATION.** There are few published records of predation on terrestrial salamanders. Antipredator defense mechanisms (e.g., noxious skin secretions, tail undulation), in addition to nocturnal, secretive habits, serve to protect these species from potential predator encounters (Brodie 1983. *In* N. S. Margaris, M. Arianoutsou-Faraggitaki, and R. J. Reiter (eds.), Plant, Animal, and Microbial Adaptations to Terrestrial Environments, pp. 109–133. Plenum Publ. Corp., New York). Herein we report the predation of an adult *Aneides lugubris* by a southern Pacific rattlesnake (*Crotalus viridis helleri*).

On 12 May 1975 at 0745 h a *C. v. helleri* (325 mm SVL, 19.5 g) was collected in Carroll Canyon on Carroll Canyon Rd, 0.6 km S El Camino Memorial Park, San Diego County, California, USA (T15S R3W NW1/4 Sec 10; 65 m elev.). The hillside vegetation was dominated by coast live oak (*Quercus agrifolia*). The rattlesnake was brought to the laboratory, caged, and on the following day a partially digested *A. lugubris* (81 mm SVL, 9.1 g) was found regurgitated. It appeared that the salamander was swallowed head first. It is not known if the salamander was active on the surface when encountered, or if regurgitation was the result of noxious skin secretions. This is the first published record of predation of *A. lugubris* by a snake.

The only previous record of predation is by the California scrub jay (*Aphelocoma coerulescens*) (Rubinoff 1996. Herpetol. Rev. 27:135). Colubrid snakes (*Diadophis punctatus, Contia tenuis, Thamnophis* spp.), frogs (*Rana aurora, R. catesbeiana*), and Jerusalem crickets (*Stenopelmatus* spp.) are known to eat *Ensatina* and *Batrachoseps* (Stebbins 1954. Univ. California Publ. Zool. 54:47–124), plethodontid salamanders sympatric with *A. lugubris*. Mahrdt (unpubl. field notes) observed an adult *Diadophis punctatus* from La Mission, Baja California Norte, México regurgitate a juvenile *A. lugubris* in March 1975.

We thank Steven P. Sandberg for collecting the specimen and Kent R. Beaman for commenting on the manuscript. A photograph of the *A. lugubris* was deposited at the San Diego Museum of Natural History.

Submitted by **CLARK R. MAHRDT** and **BENJAMIN H. BANTA**, Southwest Biological Associates, 9847 Willow Lane, Escondido, California 92029, USA.

BATRACHOSEPS ATTENUATUS (California Slender Salamander). **PREDATION.** On 2 April 1996 at ca. 0800 h I observed a California shrub jay (*Aphelocoma coerulescens*) predate the tail of a 50 mm SVL *Batrachoseps attenuatus*. The sky was clear, temperature was ca. 30°C, and it had rained the previous night. Predation occurred on Stanford University campus on a live oak-lined sidewalk bordered by mown grass and a parking lot. The shrub jay seized the salamander by the tail, which promptly abscised, and proceeded to swallow the wriggling appendage without further processing. The salamander continued ca. 7 m down the sidewalk to the observer where it was picked up, examined, and measured. Jaeger (1981. Am. Nat. 117:835–837) regarded birds as being inefficient predators on terrestrial salamanders. His conclusions were based on evidence that birds avoid feeding on aposematic species and their mimics (Brodie and Brodie 1979. Science 208:181–182), and that forest birds are most efficient at catching salamanders in dry periods when the prey items are scarce. Rubinoff (Herpetol. Rev. 27:135) observed predation by *A. coerulescens* on a diurnally active *Aneides lugubris*. It is possible that such events are only uncommon due to temporal separation in predator-prey activity cycles; *A. coerulescens* is diurnal and all salamanders in the region are typically nocturnal. *Aphelocoma coerulescens* are often abundant where they occur, aggressive, and opportunistic. Urban populations of the species are increasing, particularly in winter months (Marzluff et al. 1994. Stud. Avian Biol. 15:202–220) when many amphibians are breeding and most actively foraging. Predation by this avian species may place significant pressure on co-occurring amphibian populations and explain, in part, why so many amphibians in this region are active at night even in the winter when moisture is not a nocturnally-defined resource.

Submitted by **JAMIE KRISTINE REASER**, Center for Conservation Biology, Department of Biological Sciences, Stanford University, Stanford, California 94305 USA.

DESMOGNATHUS MONTICOLA (Seal Salamander). **OOPHAGY**. As part of a study of oviposition in *Desmognathus monticola* in Banks County in the Georgia Piedmont (USA) during 1995, I measured females that were attending clutches and counted their eggs. As the favored nesting site was horizontal crevices in wet cliffs, I captured each female by enticing her out with bait (Camp and Lovell 1989. Herpetol. Rev. 20:47). On 17 August 1995 I removed a 65 mm SVL female associated with a clutch of 14 eggs from a crevice that she shared with at least two other females attending clutches, as well as several males and non-attending females. Upon attempting to return her ca. 15 min later, I noted only 3 of her eggs remained, and an adult conspecific had its head among the remains of the clutch. I collected and preserved this specimen, a 67 mm SVL adult female with ova in an intermediate state of development. Dissection revealed the missing 11 eggs (mean diameter = 4.8 mm) in her stomach and esophagus. This is the first report of conspecific oophagy in this species, al-

though it has been reported for *D. ochrophaeus* and *D. fuscus* (Polis and Myers 1985. J. Herpetol. 19:99–107). This report also emphasizes the importance of attending female *Desmognathus* in protecting clutches from predation (Forester 1988. J. Herpetol. 12:537–541). The specimen will be deposited in the University of Georgia Museum of Natural History.

Submitted by **CARLOS D. CAMP**, Department of Biology, Piedmont College, Demorest, Georgia 30535, USA.

EURYCEA QUADRIDIGITATA (Dwarf Salamander). **COLORATION**. On 20 March 1995, I captured a xanthic *Eurycea quadridigitata* larva, along with numerous normally pigmented larvae, in a 1.5 ha pond cypress (*Taxodium ascendens*) swamp on Cecil Field Naval Air Station, Duval County, Florida, USA. In life, the dorsum and eyes of the larva were golden yellow, the venter translucent pink, the gills pink (due to presence of erythrocytes), and the anterior and posterior margins of each orbit bordered by patches of melanin. The larva was maintained in captivity through metamorphosis (21 mm SVL), then preserved in the vertebrate collections at Southern Illinois University at Carbondale (SIUC H-5193). To my knowledge, this is the second report of an abnormally pigmented *Eurycea quadridigitata* (Dyrkacz 1981. SSAR Herp. Circ. 11. 31 pp.).

This larva was collected while conducting amphibian surveys for the Jackson, Mississippi office of the U.S. Fish and Wildlife Service. I thank L. V. LaClaire for funding and R. A. Brandon for loaning me the Dyrkacz reference.

Submitted by **JOHN G. PALIS**, 529 North Main Street, Jonesboro, Illinois 62952, USA.

GYRINOPHILUS PORPHYRITICUS PORPHYRITICUS (Northern Spring Salamander). **PREY.** Many amphibians secrete noxious or toxic substances from their skin rendering them unpalatable to some predators. Among these is the red eft, the terrestrial juvenile stage of *Notophthalmus viridescens viridescens*, which produces neurotoxic tetrodotoxin (Duellman and Trueb 1994. Biology of Amphibians. McGraw-Hill Book Co., New York. xvii + 670 pp.; Wakely et al. 1966. Toxicon 3:195–203). We report predation upon a red eft by *Gyrinophilus p. porphyriticus*.

Gyrinophilus p. porphyriticus is typically found in cool springs, mountain streams, or in wet areas under rocks and logs (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin, Boston, Massachusetts, 450 pp.), but are known to wander large distances to more terrestrial habitats (Dunn 1926. The Salamanders of the Family Plethodontidae. Smith College, North Hampton, Massachusetts, 441 pp.; J. Secki and A. Queral-Regil, pers. obs.). This salamander is characteristically active and aggressive (Dunn 1926, *op. cit.*). Previous reports on the stomach contents of *G. p. porphyriticus* include earthworms, snails, spiders, fly larvae, ground beetles, millipedes, and crustacea (Smith 1913 *in* Dunn 1926, *op. cit.*). Predation by *G. p. porphyriticus* on salamanders (*Hemidactylium scutatum, Eurycea bislineata* and their larvae, *Desmognathus fuscus* and their larvae), a young wood frog (*Rana sylvatica*), and two larvae of its own species has also been reported (Wright and Haber 1922 *in* Dunn 1926, *op. cit.*). To our knowledge, there are no published accounts of predation upon *N. viridescens* by *G. porphyriticus*.

On 12 June 1995 at ca. 2200 h, we captured a female *G. p. porphyriticus* (110 mm SVL, 66.6 mm TL, 17.9 g) at Mountain Lake Biological Station, Giles County, Virginia, USA. During handling for measurements the following morning, the salamander regurgitated a red eft (20.43 mm SVL, 19.10 mm tail length). The red eft was partially digested but the characteristic red spots were distinguishable, making identification certain.

Studies of *N. v. viridescens* suggest that its toxicity is related to individual size of the eft (Brodie et al. 1974. Copeia 1974:506–511), which may explain the lack of ill effects on the spring salamander. Alternatively, some *G. p. porphyriticus* may not be affected by the neurotoxin produced by *N. v. viridescens*. Tetrodotoxin tolerance has apparently arisen in other predators of newts (Brodie and Brodie 1990. Evolution 44:651–659). *Notophthalmus v. viridescens* is known to be eaten by *Thamnophis sirtalis*, shrews (*Sorex* spp.), and some birds (E. D. Brodie, III, pers. comm.). Our observations suggest that tetrodotoxin tolerance may be more widespread among terrestrial predators than previously thought.

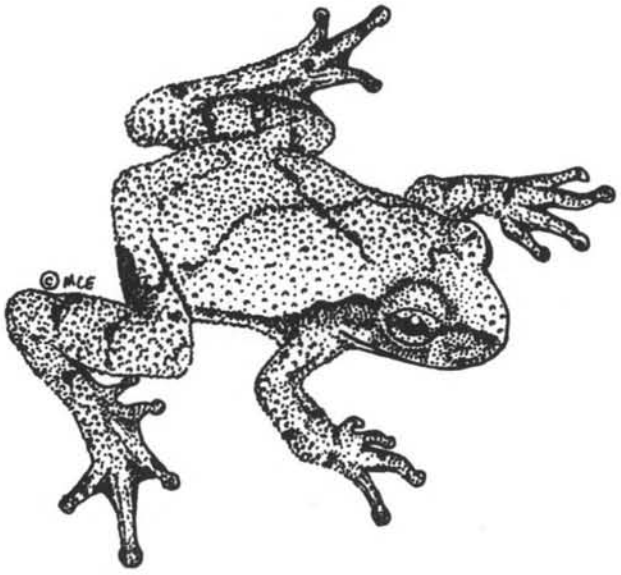
We thank R. B. King and E. D. Brodie, III for assistance with earlier drafts of this report.

Submitted by **JENNIFER A. SECKI**, Department of Biology and Mountain Lake Biological Station, University of Virginia, Charlottesville, Virginia 22903, USA, and **ALEJANDRO QUERAL-REGIL**, Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois 60115, USA.

TARICHA GRANULOSA (Roughskin Newt). **TOXICITY.** Three dead fledgling pied-billed grebes (*Podilymbus podiceps*) were discovered between 31 July and 7 August, 1996 floating on the surface of a pond in Pacific County, Washington, USA, along the North River 3.5 km E of Brooklyn. As each was discovered, it was retrieved and frozen. During necropsy a single, partially digested *T. granulosa* was found in each bird's stomach. A pathologic examination revealed severe pulmonary congestion and edema with no other gross or microscopic pathological findings. The grebes appeared in good condition and no parasites were noted. Brodie (Copeia 1968:307–311) demonstrated the susceptibility of birds to *Taricha* skin toxin in a laboratory environment. Isolation and identification of small amounts of tetrodotoxin is currently not practicable and E. D. Brodie, Jr. (pers. comm.) expected little toxin to be present in tissue samples. Brodie further commented that a grebe having eaten a newt would die within minutes, even before the newt was dead. Our observations strongly suggest mortality of wild pied-billed grebes due to ingestion of *T. granulosa*. One of the recovered *T. granulosa* was deposited in the University of Texas at Arlington Collection of Vertebrates (A-48993).

Submitted by **KELLY R. MCALLISTER**, **JEFF SKRILETZ**, and **BRIGGS HALL**, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, Washington 98501-1091, USA, and **MICHAEL M. GARNER**, Northwest ZooPath, 15326 Broadway Ave SE, Snohomish, Washington 98290-7042, USA.

TARICHA TOROSA (California Newt). **RESPONSE TO FIRE.** On 10 April 1996, a prescribed burn was ignited on a steep, south-facing hillside dominated by chamise (*Adenostoma fasiculatum*) on the Hastings Natural History Reservation, Carmel Valley, Monterey Co., California, USA. Scattered coast live oaks (*Quercus agrifolia*) grow along the lower reaches of this hillside. One large live oak on a SW exposure had an accumulation of 10–20 cm of leaves below the canopy that likely offered dry-season refugia for newts. This litter was ignited at ca. 1400 h and was still



Pseudacris crucifer (Spring Peeper). Illustration by Mark C. Erelli.



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burning at 1700 h when attempts were made to extinguish the flames, which were 5–10 cm high and moving ca. 1–5 cm/min. I noticed a pair of *Taricha torosa* moving over the unburned litter. They both appeared very shiny and wet and were moving rapidly (ca. 5 cm/sec). Each newt walked directly into the flame front and did not pause while walking through the burning leaves. The slime covering their bodies foamed up, resembling an egg meringue. Within 20–30 s they were through the flames and on the cool, black ashes of the litter. Upon close examination, the now crusty white coating easily wiped off their wet bodies. I did not observe any skin blisters and the skin color looked normal. The newts were returned to the forest litter and they continued to walk downhill. They did not stop or curl up but walked normally, proceeding at near-record newt speed. As they walked through patches of unburned grass, the leaves and litter removed almost all of the thin, white crust. They walked under a rotting log in dense litter and I did not follow them further.

Fires are frequent in central, coastal California where *T. torosa* is common. Foaming of the skin secretions would dissipate heat and may be a mechanism used by this species to escape wildland fires.

Submitted by **MARK R. STROMBERG**, Hastings Natural History Reservation, University of California, Berkeley, 38601 East Carmel Valley Road, Carmel Valley, California 93924, USA.

ANURA

BUFO AMERICANUS (American Toad). **REPRODUCTION**. In many anuran species with a male-biased operational sex ratio, alternative male mating strategies have been reported (Arak 1983. *In*. P. Bateson (ed.), Mate Choice. Cambridge Univ. Press, Cambridge,. 462 pp.). For prolonged breeders, such as *Rana catesbeiana*, satellite males have been described (Howard 1978. Evolution 32:850–871) and Arak (*op. cit.*) found that small males of the explosive breeders *Bufo bufo* and *R. temporaria* searched for females away from the communal spawn site. Here I report a new alternative mating behavior in the explosive breeder *B. americanus*.



FIG. 1. Small male *Bufo americanus* in contact with an amplectant pair.

This behavior was observed in Lincoln Pond on the E.N. Huyck Preserve, Rensselaerville, New York, USA (42°10'N, 74°10'W; ca. 550 m elev.). At 1700 h on 4 June 1996, two small males were seen in separate incidences sitting with their cloacal region against the cloacal region of females that were in amplexus with larger males (Fig. 1). During 10 min of observation, the small males called repeatedly and maintained contact with the females even when the amplectant pairs were moving. This form of matesneaking may be an alternative for males that have a low probability of winning contests against other males due to their smaller body size, since size-dependent mating has been described for *B. americanus* when male density is high (Gatz 1981. Anim. Behav. 29:1004–1012.).

This observation was made during research funded by a grant from the E.N. Huyck Preserve, Rensselaerville, New York. I am thankful for the opportunity to do research at this site. I thank Margaret Stewart and Jennifer Frank for reviewing this manuscript.

Submitted by **STEFAN K. KAMINSKY**, Department of Biology, State University of New York, Albany, New York 12222, USA.

HYLA CREPITANS (NCN). **PREDATION**. On 6 May 1992, at a small permanent pool 13 km (by road) S of Las Bocas village, going to Pueblo Nuevo de la Sierra, Municipio Colina, Estado Falón, north-midwestern Venezuela, 245 m elev., one of us (JMH) observed a giant water bug (total length 61.6 mm) (Belostomatidae, *Belostoma* sp.) that had captured an adult male *Hyla crepitans* (SVL 57.2 rnm) by its hindlimbs. The frog had a small wound near the anal opening on the posterior surface of the hind limb. When collected the frog was very weak and could not move its hindlimbs; it later died. The specimen is deposited in the Regional Collection of Reference, Centro de Investigaciones en Ecologia y Zonas Aridas (CIEZAH 321), Universidad Francisco de Miranda, Coro, Venezuela.

Although we did not observe the capture, we suspect that predation by giant water bugs is related to the frog's habit of calling on the surface of the water, thus attracting the attention of the predator as reported for other hylid frogs including *Hyla versicolor* and *Pseudacris crucifer* (Hindshaw and Sullivan 1990. J. Herpetol. 24:196–197).

Submitted by **ABRAHAM MIJARES-URRUTIA, ALEXIS ARENDS**, Centro de Investigaciones en Ecología y Zonas Aridas (CIEZA), Universidad Francisco de Miranda, Coro, Venezuela, and **JEAN-MARC HERO**, Department of Zoology, James Cook University, Townsville, Queensland 481 1, Australia.

LEPTODACTYLUS PENTADACTYLUS (Rana Ternero, Smoky Frog). **PREDATION**. Anurans possess a number of defense mechanisms that discourage predators, but the effectiveness of these mechanisms is rarely observed in the field. *Leptodactylus pentadactylus*, a large frog of Central America, emits loud shrieks when caught (Villa 1969. Rev. Biol. Trop. 15:323–329) perhaps to startle a mammalian predator into dropping it, or to attract caiman, which might prey on the predator, thus freeing the frog (Scott 1983. *In* D. H. Janzen (ed.), Costa Rican Natural History, pp. 405–406. Univ. Chicago Press, Chicago, Illinois). *Leptodactylus pentadactylus* also secretes leptodactylin, a neuromuscular block and a nervous system stimulant (Scott and Limerick 1983, *In* D. H. Janzen (ed.), Costa Rican Natural History, pp. 351–367. Univ. Chicago Press, Chicago, Illinois), which might deter predation. On 14 June 1992 I heard grunts from a southern river otter (*Lutra*

longicaudis) and found it digging deep under a *Pentaclethra macroloba* tree on the edge of the Research Swamp at the La Selva Biological Station, 32 m elev., Heredia Province, Costa Rica. I watched the otter from a distance of 3 m as it dug into a burrow of *L. pentadactylus*. At night I had frequently observed an adult *L. pentadactylus* just outside this burrow. At 1053 h I heard the loud squeal emitted by *L. pentadactylus* when seized by a predator. The otter rapidly swam out from under roots on the far side of the tree holding in its paws an adult *L. pentadactylus* with only one hindleg. The otter stuffed the frog into its mouth and severed the remaining leg at the body, it then appeared startled by my presence and swam to the far side of the tree where I could not see it. I heard loud crunching sounds for ca. 3 s after which the otter swam back into view. It was not holding the frog and I did not see the *L. pentadactylus* again, nor was it present outside its burrow that evening. I assumed the river otter had completely consumed the frog. I could detect no startle response by the otter when the frog screamed, nor any reaction by the otter to noxious skin secretions. After at least 10 min of vigorous digging to extract the frog from its burrow, the otter consumed the frog completely in less than 30 s.

Submitted by **WENDY E. ROBERTS**, Mountain Research Center, 408 Traphagen Hall, Montana State University, Bozeman, Montana 597173490, USA.

LYSAPSUS LIMELLUS (NCN). **PARASITISM.** *Lysapsus limellus* is restricted to the areas adjacent to the Paraguay and Parana rivers, from Rondonia and Matto Grosso (Brazil) to central Argentina. In Argentina *L. limellus* occurs in the provinces of Formosa, Chaco, Corrientes, Santa Fe, and north of Buenos Aires (Cei 1980. Amphibians of Argentina. Monit. Zool. Ital. (NS) Monog. 2:609 pp). They are extremely aquatic, occurring in semipermanent and permanent ponds. On 23 May 1994, as part of an investigation of the trematode guild structure in a natural population of *L. limellus,* we collected 14 frogs; 8 females (SVL 14–20 mm; mean 16.25; SD = 1.98) and 6 males (SVL 11–19 mm; mean = 15.67; SD = 1.98). These specimens were collected in a permanent pond 15 km NE of Corrientes Capital (27°28'S, 58°50'W), province of Corrientes, Argentina. Thirteen frogs (93%) were infected by trematodes: 1) adult parasites, *Catadiscus* aff. *propinquus* Freitas and Dobin 1956 localized in the large intestine, prevalence was 64%, intensities ranged from 1–13 (mean = 4.6, SD = 3.8/host, N = 41); and *Glypthelmis* aff. *vitellinophilum* Dobin 1958 localized in the small intestine, prevalence was 36%, intensities ranged from 1–12 (mean = 4.2, SD = 4.5/host, N = 21); 2) larval stages (metacercariae) Diplostomidae (aff. *Lophosicyadiplostomum* Dubois 1936), 1 localized in the kidney, prevalence was 57%, intensities ranged from 2–50 (mean = 31.3, SD = 16.2/host, N = 250); and Echinostomatidae (species 1), localized in the lung, prevalence was 21%, intensities ranged from 5–10 (mean = 6.7, SD = 2.9/host, N = 20). In general, the prevalence and mean intensity by trematodes was high. This high incidence of infection could be related to: 1) the type of host diet, 2) the abundance of definitive and intemmediate hosts, and 3) the limnological features of the habitat. The importance of the biotic or abiotic factors influencing the parasite community organization in amphibians has been reviewed by Aho (1990. *In* G. W. Esch, A. O. Bush, and J. M Aho (eds.), Parasite Communities: Pattems and Processes, pp. 157–195. Chapman and Hall, New York). It is likely that *L. limellus* is the principal intemmediate host for metacercariae Diplostomidae, considering the prevalence and intensity of these trematodes in most of the frogs we collected.

Submitted by **MONIKA I. HAMANN** and **ARTURO I. KEHR**, Centro de Ecologia Aplicada del Litoral, C.C. 140, (3400) Corrientes, Argentina.

RANA AURORA DRAYTONII (California Red-legged Frog). **BEHAVIOR.** This frog was recently listed by the U.S. Fish and Wildlife Service as Threatened (Fed. Reg. 23 May 1996. 61(101):25813–25833). Organizations wanting to create or modify wetlands may need to control movements of frogs to reduce incidental mortality during construction, or to prevent breeding attempts in unsuitable habitats. The Cambria Community Services District, in anticipation of federal protection, wanted to prevent red-legged frogs from breeding in four newly constructed sewage percolation ponds adjacent to San Simeon and Van Gordon creeks, San Luis Obispo County, California, USA. To exclude frogs, the District attached a 1.2 m high plastic barrier (Tensar Polygrid Windbreak) to the outside of a 1.8 m high chain-link fence surrounding the 6.8 ha compound during the summer of 1995.

In January 1996, two radio-tagged frogs (Rathbun and Murphey 1996. Herpetol. Rev. 27:187–189) that we had been following outside the compound near Van Gordon Creek appeared in the only percolation pond with water. During a night survey of the pond on 14 March, we saw or heard at least 10 adult frogs, and captured two calling males (No. 1, 94 g, 99 mm SUL [snout-urostyle length] and No. 2, 84.5 g, 95 mm SUL). We found three gaps in the frog barrier at ground level (associated with gates and pipes entering the compound) where the frogs could have entered; they also could have climbed or jumped over the barrier.

To determine if frogs could pass over the barrier, we designed a simple test. We built a three-sided plywood enclosure on the outside of the Tensar/chain-link fence, ca. 20 m from the watered percolation pond. The walls were buried ca. 15 cm and were ca. 1 m high. The enclosure was tightly attached to the fence so that there were no gaps, and the top was covered with one-inch mesh (2.5 cm) chicken wire to exclude predators. We left a gap between the chicken wire and the Tensar barrier of 45 cm; if the frogs made it to the top of the barrier they could easily go through the chain-link fence into the compound. The vegetation was cleared from the inside of the test enclosure, water dishes were provided, and cement construction blocks were put in for cover.

On 18 March at ca. 1500 h, we radio-tagged frog Nos. 1 and 2 and introduced them into the enclosure. We observed them for ca. 5 h. During this time, they jumped and clung to the barrier, but they did not get higher than ca. 30 cm. When we checked on 19 March at 1730 h, we found frog No. 1 in the watered percolation pond. On the night of 18 March we captured, radio-tagged, and released two adult females in the pond (No. 3, 167 g, 119 mm SUL and No. 4, 144 g, 113 mm SUL). In addition, we caught another male (No. 5, 99 g, 100 mm SUL); he was radio-tagged and released into the test enclosure on 20 March at 1200 h. At 1000 h on 21 March, frog No. 2 was back in the percolation pond, and at 1000 h the next day frog No. 5 was found in the pond. The three male frogs passed over the frog barrier within three days.

For operational reasons, the percolation pond was drained between 16–28 April 1996, when frog Nos. 1–5 were present. On 24 April we found the damaged radio of frog No. 1 at the base of the fence, inside the compound, suggesting that he was eaten by a predator. Radio contact with frog No. 2 was lost on 27 April. Frogs 3 and 5 were found dead and desiccated at the base of the fence on the inside of the compound on 2 May and 26 April. Female frog No. 4 left the pond on 24 April and was found outside the compound, near Van Gordon Creek, on 27 April.

We do not know whether the frogs that entered or left the compound passed through the ground-level gaps in the barrier or passed over it; our experiment demonstrated that they are able to climb or jump the Tensar/chain-link barrier from the outside. Based on frog mortality we documented, it is possible that *R. a. draytonii* was unable to climb the Tensar/chain-link barrier from the inside. Our experiment demonstrates the necessity of designing, testing, and installing barriers carefully, and the possibility that barriers may cause mortality.

We thank the Cambria Community Services District, San Simeon State Park, and California Department of Transportation for their support and cooperation. Brian Hatfield, Dan Holland, and Mark Jennings reviewed early drafts of the manuscript. This work was done under Permit No. 9593 from the California Department of Game and Fish.

Submitted by **GALEN B. RATHBUN, NORMAN J. SCOTT, JR.,** and **THOMAS G. MURPHEY**, National Biological Service, California Science Center, Piedras Blancas Research Station, San Simeon, California 93452-0070, USA.

RANA PRETIOSA (Spotted Frog). **PREDATION**. During climax metamorphosis anurans can neither swim as well as a tadpole nor leap as well as a frog, and are at increased risk of predation (Wassersug and Sperry 1977. Ecology 58:830–839; Arnold and Wassersug 1978. Ecology 59:1014–1022), yet predators actively foraging on transforming frogs are rarely observed in the field. On 6 August 1996 I watched three northern river otters (*Lutra canadensis*) feed on metamorphosing *Rana pretiosa* at Buck Lake, 2116 m elev. in the Northern Range of Yellowstone National Park, Park Co., Wyoming, USA. From 1621–1626 h the otters (one adult and two large juveniles) caught and consumed three transforming frogs. I observed the otters feeding on a rock ca. 10 m from shore. They caught the transforming frogs in the water within an 8 m radius of the rock, and returned to the rock to consume the frogs. Each metamorphosing frog had a long complete tail, hindlegs, and in one case forelegs; I estimated they were Gosner stages 41 or 42 (Gosner 1960, Herpetologica 16:183–190). The length of the transforming frogs was ca. 6–7 cm from snout to tip of tail; the only frogs of that size inhabiting alpine ponds of Yellowstone National Park are *R. pretiosa* (Koch and Peterson 1995. Amphibians and Reptiles of Yellowstone and Grand Teton National Parks, Univ. Utah Press, Salt Lake City. 188 pp.). After five minutes of feeding the otters stopped foraging and swam to another part of the lake. I searched the lake shore and found two otter latrines, one fresh and one several days old. The scat was black and mushy, and did not contain identifiable food items, neither fish bones nor the crayfish parts I have seen in otter scat. The lack of identifiable hard fish or crustacean components in their scat suggests the river otters may have been feeding exclusively on transforming frogs for several days. The partly ossified bones of metamorphosing frogs may not be apparent in scat.

Submitted by **WENDY E. ROBERTS**, Mountain Research Center, 408 Traphagen Hall, Montana State University, Bozeman, Montana 597173490, USA.

RANA PRETIOSA (Spotted Frog). **BEHAVIOR and REPRODUCTION**. On 2 February 1996, we (WPL and LAH) observed three *R. pretiosa* beneath a 5-6 cm layer of translucent ice completely covering a seasonal pond in a grazed pasture adjacent to Dempsey Creek, Thurston County, Washington, USA (T17N R3W Sec. 13) at 43 m elevation. We observed a gravid female swim a distance of 5 cm and nuzzle the bottom. We found a second female under the ice less than 2 m from the first frog. We presumed it dead because it was motionless and floating upside-down. When we removed it from beneath the ice, a male fell from its back, suggesting a pair in amplexus. All three individuals moved sluggishly when removed from the frigid (-0.5°C), shallow (9-14 cm) water. We (WPL and KRM) returned to the site at 1106 h on 4 February and observed another male *R. pretiosa* swimming beneath the ice for a distance of 0.5 m. The water temperature was 1.0°C. All four individuals were in breeding condition as evidenced by the prominent nuptial pads on the males' thumbs and the obviously distended abdomens of the females. These individuals were found in the same location where we (WPL and KRM) found 41 *R. pretiosa* egg masses between 23 February and 12 March 1995.

All surface water in the vicinity of the breeding pool is seasonal, drying in the early summer and refilling in the late fall. During the summer months *R. pretiosa* are found in a permanent emergent marsh 50–100 m from the breeding pond. At the Dempsey Creek site, *R. pretiosa* apparently undergoes seasonal movements between permanent summer habitat and ephemeral breeding habitat.

We thank Neal Wilkins and Port Blakely Tree Farm for allowing access and for other assistance in conducting field studies on *R. pretiosa* at the Dempsey Creek site.

Submitted by **WILLIAM P. LEONARD** and **LISA A. HALLOCK**, Washington Natural Heritage Program, Department of Natural Resources, P.O. Box 47016, Olympia, Washington 98504-7061, USA, and **KELLY R McALLISTER**, Wildlife Diversity Program, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, Washington 98504-7600 USA.

TESTUDINES

CHELYDRA SERPENTINA (Common Snapping Turtle). **REPRODUCTION**. Twinning is rarely reported in egg-laying reptiles (Aguilar and Casas-Andreu 1991. Herpetol. Rev. 22:98; Petch 1990. Herptile 15:13–16; Castano-Mora 1985. Lozania 52:1–5). Morever, eggs containing twin yolks or developing embryos rarely produce viable hatchlings. There are at least two exceptions (Petch 1990, *op cit.*; Kinkaid 1996. Herpetol. Rev. 27:26), both involving snakes. Twinning has been reported once in turtles (Castano-Mora 1995, *op cit.*) but has never been reported in the common snapping turtle.

As part of an experiment concerning temperature-dependent sex determination, I collected six clutches of snapping turtle eggs from Carrol and Whiteside Counties, Illinois, USA during June 1994. One egg contained two living embryos. This egg, at 10.54 g, was within the mass range of the other eggs in that clutch (8.97–12.4 g). This egg was laid on 5 June 1994 and incubated at ca. 26°C. Living twins hatched on 12 August 1994. The larger hatchling measured 29.1 mm carapace length (CL), 19.8 mm plastron length (PL), and weighed 8.0 g; the smaller measured 16.4 mm CL, 10.5 mm PL, and weighed 1.29 g (clutch mean: 31.6 mm CL, 20.7 mm PL, 9.65 g). The smaller turtle died within a few days of hatching, but the larger is still alive at almost two years post-hatching. This is the first known case of live twins being hatched from one egg in any species of turtle. Both turtles will be deposited in the University of Texas at Arlington Collection of Vertebrates.

Submitted by **DANIEL J. O'CONNELL**, Department of Biology, Box 19498, The University of Texas at Arlington, Arlington Texas 76019, USA; e-mail: oconnell@albert.uta.edu.

CHELYDRA SERPENTINA (Snapping Turtle). **REPRODUCTION.** The maximum reported clutch sizes from snapping turtles in Florida (USA) are only 20 and 21 eggs, both from the peninsular Florida subspecies, *C. s. osceola* (Iverson 1977. Herpetologica 33:205–212; Punzo 1975. J. Herpetol. 9:207–210). Here, we report several larger clutches from northwestern Florida (*C. s. serpentina*) as well as additional ones from *C. s. osceola*. A large female *C. s. serpentina* was observed laying 54 eggs (excavated for counting) in early May 1995 adjacent to a natural wetland in Tallahassee, Leon County (Bob Walker, pers. comm.). The ten largest clutches that we have recorded from *C. s. serpentina* during our ongoing studies of chelydrid nesting ecology along the lower Apalachicola River, Franklin County (Ewert and Jackson 1994. Florida Game and Fresh Water Fish Comm. Nongame Wildl. Prog. Final Rept. NG89-020), were 52, 51 (female maximum carapace length [CL] 320 mm), 46, 44(2), 43, 42(3), and 41.

The maximum known clutch size of *C. s. osceola* remains well below 50 eggs. From Dixie County in northern Florida we dissected 31 eggs (32 corpora lutea) from a female (278 mm CL) collected on 2 March 1979, and 30 eggs from a second female collected on 13 March 1988. Farther south, a female (274 mm CL) collected on 16 March 1988, just south of Lake Jessup in Seminole County, yielded 23 eggs. Another clutch of at least 23 eggs (UF 1090) was collected in 1930 in Alachua County. However, female *C. s. osceola* can grow considerably larger than indicated above; a series of large specimens collected in 1928–1929 from Lake Apopka (Orange County) includes three females (UF 53706, 65675, 53705) measuring 368, 352, and 348 mm CL. Given that female body size and clutch size in snapping turtles are correlated (Iverson et al. 1996. Herpetologica, *in press*; Yntema 1970. Am. Midl. Nat. 84:68–76), this suggests the potential for much larger clutches in *C. s. osceola* than are reported here.

Part of our research was supported by Nongame Wildlife Grant NG89-020, Florida Game and Fresh Water Fish Commission. We thank Woody Miley and Lee Edmiston of the Apalachicola National Estuarine Research Reserve and Isbon Teuton of the Florida Park Service for special help, Bob Walker for sharing his observations, and David Auth for providing data from Florida Museum of Natural History (UF) specimens. MAE also thanks Cory R. Etchberger for field assistance.

Submitted by **DALE R. JACKSON**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA, and **MICHAEL A. EWERT**, Department of Biology, University of Indiana, Bloomington, Indiana 47405-6801, USA.

GOPHERUS AGASSIZII (Desert Tortoise). **DIET.** On 2 August 1996 (0815 h) I observed an adult male *Gopherus agassizii* foraging on an isolated desert hill in Pinal County, Arizona, USA. Closer inspection of the food item revealed it to be a raptor pellet lying in the middle of a disarticulated turkey vulture (*Cathartes aura*) carcass. Verification that the actual food item was the vulture pellet was given by the presence of clumps of hair on the tortoise's beak and nose. The pellet was deposited in the University of Arizona herpetological collection (UAZ 50336).

Extensive literature exists on the diet of *G. agassizii*, which consists primarily of native and exotic grasses, forbs, flowers, and fruits (Grover and DeFalco 1995. Gen. Tech. Rep. INT-GTR316, Ogden, Utah: U.S. Dept. Agriculture, Intermountain Research Station. 134 pp.). Esque (1994. M.S. Thesis, Colorado State Univ., Fort Collins, USA. 243 pp.) and Hansen et al. (1976. Herpetologica 32:247–251) reported mammalian feces, hair, and bones; bird feathers; rocks and soil; reptile scales; and arthropods as small components of *G. agassizii* diets. This is the first reported observation of *G. agassizii* foraging on a raptor pellet. Ingestion of bones in the pellet may have provided supplemental minerals to the tortoise (Esque and Peters 1994. *In* Bury and Germano (eds.), Biology of North American Tortoises, pp. 105–111. Natl. Biol. Surv., Fish Wildl. Res. 13, Washington, D.C.).

I thank Jeffrey M. Howland for his comments on the manuscript.

Submitted by **ROY C. MURRAY**, Nongame Branch, Arizona Game and Fish Department, 2221 West Greenway Road, Phoenix, Arizona 85023, USA.

GOPHERUS POLYPHEMUS (Gopher Tortoise). **NESTING.** On 30 May 1996 at 1145 h, we observed an adult female gopher tortoise (straight line carapace length 293 mm, mass 4.3 kg) atop a recently disturbed pocket gopher (*Geomys pinetis*) mound (circumference 2.5 m) at Naval Air Station Cecil Field in western Duval County, Florida, USA. We probed the mound with the wire shaft of a survey flag and located five eggs approximately 16 cm from the top of the mound, laid in two layers with three eggs on the bottom. We recovered the eggs with soil and released the tortoise on the mound. After approximately five minutes, the tortoise left the mound and walked to a burrow 25.8 m east of the nest site. To the best of our knowledge, this is the first documented use of a *Geomys pinetis* mound as a nest site by *G. polyphemus*.

The burrow was located in disturbed sandhill habitat replanted with longleaf pine (*Pinus palustris*) in 1988 with an estimated canopy cover of 7%. The pocket gopher mound was located in an area of slash pine (*Pinus elliottii*) planted in 1954 with an estimated canopy cover of 38%.

Gopherus polyphemus prefers sandy unshaded areas as nesting sites (Hallinan 1923. Copeia 1923:11–20; Landers et al. 1980. Herpetologica 36:353–361) and in north Florida may nest primarily in or near burrow aprons (Diemer and Moore 1994. *In* Bury and Germano (eds.), Biology of North American Tortoises, pp. 129-137, U.S. Fish and Wildl. Serv., Fish and Wildl. Res. Rep. 13). Conversely, Smith (1995, Bull. Florida Mus. Nat. Hist. 37 Pt. 1(4):97-126) found few nests in or near burrow aprons in north Florida. Data presented here indicate *G. pinetis* mounds may provide alternative nesting sites when available. Researchers conducting surveys for *G. polyphemus* nests should include *G. pinetis* mounds in their sampling.

Submitted by **DEBORAH M. EPPERSON** and **LORI D. WENDLAND**, Florida Game and Fresh Water Fish Commission, Route 7, Box 440, Lake City, Florida 32055, USA.

MALACLEMYS TERRAPIN TERRAPIN (Northern Diamondback Terrapin). **PREDATION.** On 2 May 1996 an adult male *Malaclemys terrapin terrapin* was found near Milford Point in Milford, Connecticut, USA. This turtle was being attacked by at least two unidentified gulls (*Larus* sp.). A local resident interrupted this predation event and immediately brought the turtle to the Connecticut Audubon Coastal Center for potential rehabilitation. All four legs had been severed—the forelimbs at carpal level and the hind limbs slightly proximal to the tarsi, so that tibia and fibula were protruding. The tail had a slight laceration. Head, neck, and shell lacked any obvious injuries. The animal died 28 August 1996 after refusing food. The skeleton currently is retained by the Center for use in education programs. Klemens (1993. Amphibians

and Reptiles of Connecticut and Adjacent Regions. State Geol. Nat. Hist. Surv. Connecticut Bull. 112:1–318) reported that immature terrapins are eaten by a variety of vertebrate and invertebrate predators, but human activities are the prime cause of adult mortality. This may be the first documented case of bird predation on an adult *M. t. terrapin*.

Submitted by **GREGORY J. WATKINS-COLWELL** (e-mail: GJWC@aol.com) and **MATT BLACK** (e-mail: Milfordpt@aol.com), Connecticut Audubon Coastal Center, 1 Milford Point Road, Milford, Connecticut 06460, USA.

STERNOTHERUS ODORATUS (Common Musk Turtle). **MORTALITY.** The most common macrobiological source of mortality for turtles is predation by various large vertebrates (Ernst et al. 1993. Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C., 578 pp.). Mortality caused by invertebrates is rare but is known to occur in hatchling and juvenile turtles as a result of predation by decapod crustaceans and hemipteran insects (e.g., Stancyk 1982. *In* Bjorndal (ed.), Biology and Conservation of Sea Turtles, pp. 139–152. Smithsonian Inst. Press, Washington, D.C.; Gotte 1992. Herpetol. Rev. 23:80). Here we describe an apparent accidental case of adult mortality caused by a bivalve mollusk.

On 18 June 1996, a dead female *Sternotherus odoratus* (Kinosternidae; carapace length 62.4 mm) was found by M. Henderson in Salado Creek at Camp Tahkodah near Floral, Independence County, Arkansas, USA. The turtle's head was inside the closed shell of a living, gravid female *Ligumia subrostrata* (Unionidae; maximum shell length 73.2 mm; Fig. 1), apparently trapped at the point where the mussel's siphon emerges. We opened the mussel and found the turtle to be unmarked other than the neck being laterally compressed to a width of 2.4 mm by the margin of the mussel's shell. There was no mussel tissue in the turtle's mouth and no obvious damage to the soft tissues of the mussel. The apparent scenario is that the turtle was attracted to the siphon or other soft tissue and put its head (width = 14.3 mm) inside the open mussel, which then closed, resulting in the turtle either drowning or suffocating.

We thank H. Riley and B. Fouts for bringing the specimens to our attention, and J. Harris for identifying the mussel and for discussions on mussel biology.

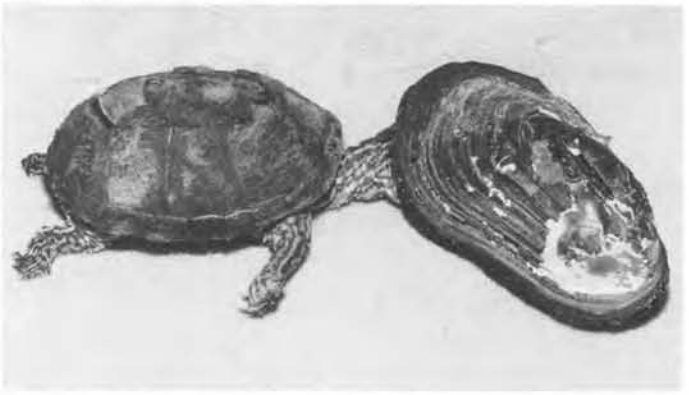


FIG. 1. A common musk turtle, *Sternotherus odoratus*, with its head trapped inside a pondmussel, *Ligumia subrostrata*.

Submitted by **MICHAEL V. PLUMMER** and **JOSEPH W. GOY**, Department of Biology, Box 2251, Harding University, Searcy, Arkansas 72149, USA.

SAURIA

CNEMIDOPHORUS LEMNISCATUS (NCN). **HERBIVORY.** On 16 April 1996 at 1130 h near Las Bocainas, on the road to Adícora, on the eastern coast of the Paraguaná Peninsula, Falcón, Venezuela, one of us (BC) observed two young *Cnemidophorus lemniscatus* eating petals of the flowers of the cactus *Opuntia wentiana*. The flowers were located at ground level; the lizard did not climb the cacti. Paulissen and Walker reported herbivory in *C. arubensis* from Aruba Island, *C. murinus* from Curacao Island, (both Netherlands Antilles) and *C. nigricolor* from Isla La Blanquilla, Venezuela (1994. J. Herpetol. 28:524–526). This is the first report of herbivory in a non-insular species of *Cnemidophorus*.

Submitted by **ABRAHAM MIJARES-URRUTIA**, Centro de Investigaciones en Ecología y Zonas Aridas (CIEZA), Universidad Francisco de Miranda, Apartado 7056, Coro 4101-A, Venezuela, **BORO COLVÉE**, Departamento de Ciencias Ambientales, Universidad Simón Bolívar, Sartenejas, Caracas, Venezuela, and **ALEXIS ARENDS R.**, Centro de Investigaciones en Ecología y Zonas Aridas (CIEZA), Universidad Francisco de Miranda, Apartado 7056, Coro 4101-A, Venezuela.

SCELOPORUS BICANTHALIS (Transvolcanic Bunchgrass Lizard). **PATTERNLESSNESS.** Usually all members of the *Sceloporus scalaris* and *S. aeneus* complexes (of the *S. scalaris* group) of México are marked with two paravertebral series of 6–9 more or less U-shaped dark spots between two distinct dorsolateral light lines 7–8 scale rows apart, and similar but smaller markings in a row between the dorsolateral and lateral light lines. The distinctness of the pattern varies from dull (especially in the *aeneus* complex) to bright (especially in the *scalaris* complex). However, some individuals of some of the included taxa are unicolor above and on sides, or with only faint evidence of the dorsolateral light lines. Unicolor individuals have long been known in populations of *S. s. scalaris* westward from the longitude of Guanajuato (Thomas and Dixon 1976. Southwest. Nat. 20:531) and Zacatecas (HMS, pers. obs.), as well as in *S. s. slevini* (Anderson 1972. J. Herpetol. 6:80), *S. s. unicanthalis* (HMS, pers. obs.), *S. a. aeneus* (Guillette and Smith 1985. Bull. Maryland Herp. Soc. 21:4) and *S. a. subniger* (Smith and Brandon 1971. J. Herpetol. 5:60). They are thought not to occur in *S. bicanthalis* (Guillette and Smith, op. cit.), *S. chaneyi* (Liner and Dixon 1992. Texas J. Sci. 44:426), *S. goldmani* (Smith 1939. Zool. Ser. Field Mus. Nat. Hist. 26:350–353), *S. s. scalaris* east of the longitude of Guanajuato (Thomas and Dixon, loc. cit.) or *S. s. samcolemani* (Liner and Dixon, loc. cit.).

Thus two patternless adult female *Sceloporus* of the *scalaris* group from La Molina, 3 mi E Perote, 8000 ft., Veracruz, are of special interest. They were taken 30 July 1955 along with four juveniles from the same locality, all now under the number UMMZ 112972. All have 2-2 canthals, thus eliminating *S. aeneus* from consideration, but both *S. s. scalaris* and *S. bicanthalis* occur nearby and both possess two canthals although neither is known elsewhere to exhibit patternlessness (except westward from Guanajuato in *S. s. scalaris*). However, that these six represent *S. bicanthalis* is assured by two facts. For one, UMMZ 172753, from nearby at 25 km E Perote on the road to Jalapa, is an adult male with the sharply defined, prominent black gular streaks, sublateral semeions and small size (37 mm SVL) typical of that species (gular streaks less prominent and less well defined, semeions on sides of abdomen, SVL greater at maturation, in *S. scalaris*). Secondly, the larger (48 mm SVL) of the two patternless females contains fully formed

eggs that lack shells, as is consistent with the known viviparity of *S. bicanthalis*. In the oviparous species *S. scalaris*, eggs in a comparable stage of development have a well developed shell, as exemplified by UMMZ 118556, from 2 mi SE Laguna Valderrama, 7800 ft., Zacatecas, 19 June 1957.

On these bases we add *S. bicanthalis* to the list of species of the *scalaris* group of *Sceloporus* in which patternlessness occurs. It remains unknown in the wide-ranging eastern component of *S. s. scalaris*, extending from Tamaulipas to Puebla and westward along the transvolcanic zone to (but not including) Guanajuato.

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biology, Sacred Heart University, Fairfield, Connecticut 06432-1000, USA; and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

SCINCELLA LATERALIS (Ground Skink). **PREDATION.** Although birds are often acknowledged as feeding on lizards (Pearson 1917. Birds of America, Doubleday & Co., New York), direct observations of predation are relatively rare under natural conditions. On 22 June 1996, we witnessed a barred owl (*Strix varia*) attack an adult ground skink as the lizard crawled through mixed leaf litter composed of deciduous hardwood leaves and pine needles. The weather was cloudy and the air was warm (27°C) and humid. Prior to attacking the lizard, the owl had perched on a narrow white ash (*Fraxinus americana*) limb 3.5 m above the litter surface for about 15 min. During this time, it alternately scanned the forest understory and ground surface, presumably searching for prey. At 1635 h, it cocked its head toward the ground and flew silently to the litter surface where it captured the ground skink in its talons. After eating the lizard on the ground, the owl flew to a nearby perch and resumed scanning the forest understory.

Barred owls have been reported to prey upon a variety of small herpetofauna (Ross 1989. Amphibians and Reptiles in the Diets of North American Raptors. Wisconsin Endangered Species Report 59), however lizards were not included among the prey listed. To our knowledge, the only previous record of avian predation on ground skinks was by Beane and Trail (1991. Herpetol. Rev. 22:99) who reported a pair of nesting bluebirds (*Sialia sialis*) feeding ground skinks to their young. Based on qualitative observations, ground skinks are extremely abundant in the leaf litter of the mixed mesophytic forest where the observations took place (a residential forested area west of the Devil's Millhopper State Geological Site, Gainesville, Alachua County, Florida, USA; Brooks 1967. Ecol. Monog. 37:71–87 for estimates of abundance in similar habitat). As such, it is possible that small lizards could form an important component in the diet of these non-passerine avian predators.

Submitted by **C. KENNETH DODD, JR.**, Biological Resources Division, U.S. Geological Survey, 7920 N.W. 71st Street, Gainesville, Florida 32653, USA, and **MARIAN L. GRIFFEY,** 5222 N.W. 56th Court, Gainesville, Florida 32653, USA.

XANTUSIA VIGILIS (Desert Night Lizard) and ***SCELOPORUS MAGISTER*** (Desert Spiny Lizard). **PREDATION and DIET.** Here, we report evidence of predation on *Xantusia vigilis* by *Sceloporus magister*. We collected a yearling female *S. magister* (71 mm SVL, mass = 13.6 g) on 24 July 1996, 5 km SE of Llano, Los Angeles County, California, USA (34°29'N, 117°46'W, elevation 1120 m). In the laboratory, on 29 July, the *S. magister* deposited a fecal pellet that contained part of a *Xantusia vigilis* body, including sections of dorsal and ventral integument and both hind limbs. Based on the knee-to-knee length of the prey specimen (14 mm) and a sample of living *X. vigilis* (N = 24) from the same locality, we estimate that the *Xantusia* prey would have measured 42 mm SVL and weighed 1.2 g when alive, and therefore was an adult.

Sceloporus magister and *X. vigilis* are abundant at this site, and commonly inhabit Joshua trees (*Yucca brevifolia*) throughout the western Mojave Desert. However, *S. magister* typically climbs Joshua trees and is a diurnal heliotherm and ambush predator, whereas the reclusive *X. vigilis* inhabits fallen branches and other debris, and is rarely observed in the open. This *S. magister* was perched in a Joshua tree when first observed. *Sceloporus magister* sometimes take shelter beneath fallen Joshua tree branches. Despite their common name, night lizards are apparently sometimes active during the day, beneath debris (Stebbins 1954, Amphibians and Reptiles of Western North America. McGraw-Hill, New York. 536 pp.). A daytime encounter beneath fallen Joshua tree branches seems to be the most likely explanation for this instance of predation.

Zweifel and Lowe (1966. Am. Mus. Novit. 2247:1–57) do not mention *S. magister* as a potential predator of *X. vigilis* at their study site, which was within 4 km of our collection site. Likewise, Parker and Pianka (1973. Herpetologica 29:143–152) do not mention *Xantusia* in their analysis of the diet of *S. magister* from the Mojave Desert.

Submitted **by MARC PERKINS, STEPHEN C. ADOLPH, STEPHEN GRANITE**, and **WENDY HEIN**, Department of Biology, Harvey Mudd College, Claremont, California, 91711, USA.

SERPENTES

CROTALUS CERASTES CERASTES (Mojave Desert Sidewinder). **LONGEVITY**. *Crotalus cerastes cerastes* is known to live in captivity up to 11.7 years (Snider and Bowler 1992. Longevity of Reptiles and Amphibians in North American Collections. Herpetol. Circ. No. 21. Society for the Study of Amphibians and Reptiles. 40 pp.). Here we report on a captive *C. c. cerastes* that is presently 28 years old.

In June 1968 Thomas Moisi collected a gravid *C. c. cerastes* from just east of Whitewater Canyon, Riverside County, California, USA. In September 1968 this snake gave birth to five offspring. Today, one of the offspring is still alive in the collection at California State Polytechnic University. This female *C. c. cerastes* is presently 629 mm SVL, 53 mm tail length, and 378 g. It has several tumors, but feeds regularly and apparently is still reproductive, producing unfertilized eggs in 1994 and 1995.

Submitted by **ROBERT H. GOODMAN, JR., GLENN R. STEWART**, and **THOMAS J. MOISI**, Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, California 91768, USA.

DENDRELAPHIS CALLIGASTRA (Northern Tree Snake). **DIET**. As is the case for the majority of Australia's snakes, the diet of *Dendrelaphis calligastra* is known only from dissection of a relatively small number of museum specimens (Shine 1991. Copeia 1991:120–131). These dissections revealed that the species preys on frogs (families Hylidae and Myobatrachidae) and lizards (families Scincidae and Gekkonidae).

While conducting fieldwork in rainforest near Paluma in northern Queensland, I caught an actively foraging *D. calligastra* (SVL

= 83 cm, tail length = 35 cm) at ca. 1200 h on a sunny day (25 September 1995). Examination of the snake revealed a prominent bulge, and palpation led to the snake regurgitating two microhylid frogs (*Sphenophryne robusta*). Both were almost completely intact, suggesting that they had been ingested recently, possibly on that day. This is the first record of *D. calligastra* preying on frogs of the family Microhylidae.

Submitted by **GEORDIE A. TORR**, Department of Zoology, James Cook University, Townsville, 4811, Australia.

DIADOPHIS PUNCTATUS VANDENBURGHI (Monterey Ringneck Snake). **DIET**. Ringneck snakes are known to prey on salamanders, small frogs, lizards, small snakes, slugs, and earthworms (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.). On 14 July 1996 (1921 h) we collected a male *Diadophis punctatus vandenburghi* (343 mm SVL, 9.5 g) on the Indian Creek trail in the Los Padres National Forest, Santa Barbara County, California, USA. During the 1.5 h hike back to our vehicles, the snake regurgitated a neonate two-striped garter snake (*Thamnophis hammondii*, 188 mm SVL, 5.0 g). To our knowledge this is the first report of a *D. p. vandenburghi* preying upon *T. hammondii*.

The *T. hammondii* was deposited in the Department of Biological Sciences collection at California State Polytechnic University, Pomona (CSPU Pomona 02245).

Submitted by **ROBERT H. GOODMAN JR.**, Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, California 91768, USA, and **DON TATE**, 527 West Alamar Avenue #50, Santa Barbara, California 93105, USA.

ELAPHE OBSOLETA LINDHEIMERI (Texas Rat Snake). **PREY**. At 2345 h on 29 July 1995 at Houma, Terrebonne Parish, Louisiana, USA, I found an *Elaphe obsoleta lindheimeri* (ca. 46 cm TL) at the top of a brick wall wedged along the mortar connections. The snake's body was bulging from having eaten a number of Mediterranean geckos, *Hemidactylus turcicus turcicus*, one of which was partially engulfed in its mouth. The snake was examined and released. The introduced *Hemidactylus* can usually be found on brick walls at night, and retreat under the molding in the upright mortar connections. Although young *E. obsoleta* are known to eat lizards, I am unaware of any reports of feeding on *H. turcicus*. Further, this note documents nocturnal foraging in an otherwise diurnal snake.

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

LAMPROPELTIS TRIANGULUM CELAENOPS (New Mexico Milk Snake). **MAXIMUM SIZE**. An adult female *Lampropeltis triangulum celaenops* collected in May 1996, 2 mi E of Eunice, Lea Co., New Mexico, USA measured 720 mm SVL and 119 mm tail length. This exceeds the previous record, 641 mm total length (Tennant, A. 1984. The Snakes of Texas. Texas Monthly Press, Austin. 561 p.), by 198 mm. The specimen is deposited in the University of New Mexico Museum of Southwestern Biology, Herpetology Division (MSB 60390). Thanks to Douglas Lynn for providing this specimen.

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, 87504, USA and **TOBY J. HIBBITTS**, 602 Hilltop Circle, Wylie, Texas 75098, USA.

MASTICOPHIS FLAGELLUM (Coachwhip). **PREY.** Feeding behavior in the genus *Masticophis* has been studied by Cunningham (1959. Herpetologica 15:17–19), Hamilton and Pollack (1956. Ecology 37:519–526), and Jones and Whitford (1989. Southwest. Nat. 34:460–467). *Masticophis flagellum* is known to take a wide variety of prey (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, Massachusetts. 336 pp.; Jones and Whitford, *op. cit.*). Here we report on the active pursuit of the lizard *Dipsosaurus dorsalis* and the finding of *Crotalus viridis* in the gut of *M. flagellum*, two prey not previously reported for this species.

On 7 August 1991 in the western Mojave Desert just north of Barstow (San Bernardino Co., California, USA), we observed a small *Masticophis flagellum piceus* (ca. 100 cm total length) moving slowly upslope while flicking its tongue many times within a few seconds. After the snake progressed forward several cm, it would raise its head 6–8 cm and rapidly and repeatedly strike (4–5 strikes observed seven times) its rostrum into the substrate. After each bout of striking, the snake would raise its head ca. 10–12 cm above the ground and observe the area it had struck. We observed this behavior for 11 min. After the seventh striking episode, the snake, while observing the substrate from the raised position, suddenly lunged forward, narrowly missing a desert iguana (*Dipsosaurus dorsalis*) that flushed from the area of the final striking episode. The lizard ran off with the snake in pursuit. After pursuing the lizard for ca. 5 m, the snake aborted the chase and returned to its previous foraging pattern. These observations occurred at about 1000 h and the air temperature was 40.5°C. The snake was engaged in active pursuit of a lizard at relatively high temperatures, in contrast to the change to sit-and-wait tactics at high temperatures noted by Jones and Whitford (*op. cit.*) in the Chihuahuan Desert.

On 25 April 1996 we found a small (ca. 45 cm TL) decomposing western rattlesnake (*Crotalus viridis oreganus*) in the esophagus of a road-killed adult (140 cm TL) male *Masticophis flagellum ruddocki*, on Mocal Road, 0.2 miles southeast of the junction with Crocker Springs Road, Kern Co., California. We do not know if the rattlesnake was taken alive or eaten as carrion (Cowles 1946. Herpetologica 3:121-122; Small et al. 1994. Herpetol. Rev. 25:28).

Submitted by **STEPHEN P. TABOR**, BioEnvironmental Associates, 4209 Landatos Ave, Bakersfield, California 93307, USA, and **DAVID J. GERMANO**, Department of Biology, California State University, Bakersfield, California 93311, USA.

REGINA ALLENI (Striped Crayfish Snake). **SIZE**. The record total body length for *Regina alleni* is 65.4 cm (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians, 3rd ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). On 1 July 1996, I caught a female *R. alleni* with a total body length of 70.5 cm (SVL = 53.7 cm). She weighed 141.0 g, was not gravid, and no prey items were evident from palping. The snake was captured in a minnow trap, which is part of a standard array of 20 traps. The array is located at Happy Creek Swale (Brevard County, Florida, USA) and is used as part of a long-term monitoring program for amphibians and reptiles of the Kennedy Space Center. Because

the animal is part of an ongoing study, it was given a cohort mark, photographed, and released at the point of capture. Photographs remain in possession of the author. Measurements were verified in the lab by Rebecca B. Smith

Submitted by **JEFFERY P. DEMUTH**, Department of Biological Sciences, Southeastern Louisiana University, Box 814, Hammond, Louisiana 70402, USA.

SONORA SEMIANNULATA (Ground Snake). **ANTIPREDATION.** A *Sonora semiannulata* 30 cm in total length, taken near Mesa, Arizona, USA, was introduced into a terrarium containing a *Micruroides euryxanthus* (Sonoran coral snake), 36 cm in total length, taken in Pinal Co., Arizona. The *Sonora* immediately began to explore the cage. Upon contacting the coral snake, the *Sonora* flung itself wildly as far as possible from the other snake. After a few moments the *Sonora* continued exploring the cage. Three times, as the coral snake detected the rear part of the *Sonora*'s body, it bit that part, but each time the *Sonora* freed itself by a quick jerk. The *Micruroides* eventually secured a firm bite on the *Sonora* about four cm posterior to its head. The *Sonora* thrashed about vigorously, but the coral snake entwined their bodies until they were in a tight ball. Other than a few muscle spasms on the part of both animals, no further movements occurred for several min. Then again the *Sonora* began to struggle violently, untangling itself and resorting to rapid twisting on its own axis. The coral snake nevertheless retained its hold, allowing itself to be dragged around, but was not, however, completely passive during this phase, gradually working its jaws toward the head of its prey by quick, jerky release of its grip and instant purchase of a new grip a short distance in advance. It thus worked its way to a point about 1.3 cm from the prey's head.

Now the *Sonora* executed a remarkable maneuver by gripping itself with its jaws about five cm back of its head, forming a complete loop. The *Micruroides* continued its grip-release-grip advancement over the head of the *Sonora* and around the loop onto its body, whereupon the *Sonora* released its grip upon itself and renewed its struggle to escape. The *Micruroides* continued undeterred its advancement toward the *Sonora*'s head, which again bit itself as before when the coral snake reached its neck. The predator was again "derailed" by the maneuver, and continued on to a third enactment of the scenario, briefly losing its grip before doing so. Upon the fourth enactment, the coral snake chewed violently on the prey's head as it reached that point, whereupon the *Sonora* released its grip upon itself. Instantly its entire head was engulfed by the coral snake, although the *Sonora* continued to writhe vigorously for several min. Only after ingestion of most of its body did the *Sonora* seem to weaken.

The looping behavior of the *Sonora* may be a widespread antiophiophagous resort not only in that genus but also in others that serve as prey for coral snakes and other ophiophages. Behavior similar to this has been observed (pers. obs.) in lizards preyed upon by snakes. Confined to cages, prey are unable to escape, but under natural conditions looping might sometimes be effective in disorienting predators so that prey can take advantage of being released or of having directed the predator to the prey's tail.

Submitted by **VERN VEER**, Denver Zoo, City Park, 2300 Steele Street, Denver, Colorado 80205-4899, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309, USA, and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309,USA.

TANTILLA HOBARTSMITHI (Southwestern Black-headed Snake) and ***TANTILLA NIGRICEPS*** (Plains Black-headed Snake). **COLORATION.** Reports of albinism in snakes are common in the herpetological literature. Hensley (1959. Michigan St. Univ. Biol. Ser. 1:135–159) reported albinism in 16 species, Dyrkacz (1981. Recent instances of albinism in North American amphibians and reptiles. SSAR Herp. Circ. 11:1–31) reported on 28 species, and Bechtel (1995. Reptile and Amphibian Variants Colors, Patterns, and Scales. Krieger Publ. Co., Malabar, Florida. xvii + 206 pp.) illustrated 27 species.

On 5 July 1996 we (BRT, JHG) collected an adult *Tantilla hobartsmithi* (SVL 154 mm, tail 57 rnm, 1.7 g), a partial albino with erythrophores (Dyrkacz, *op. cit.*). This snake was collected from a 18.9 L pitfall trap placed along a road in Guadalupe Canyon, ca. 1.1 rd km E the New Mexico/Arizona state line, Hidalgo Co., New Mexico, USA. In life the eyes and tongue were bright pink. The dorsal coloration was cinnamon (Color 39) and the ventral color was peach red (Color 94) (Srnithe 1975. The Naturalist's Color Guide. Am. Mus. Nat. Hist., New York). The specimen was deposited into the Division of Herpetology, Museum of Southwestern Biology, University of New Mexico (MSB 60389).

A search of the MSB collection yielded two additional partial albino *Tantilla*. MSB 26019 is an adult male *T. nigriceps* (SVL 177 mm, tail 52 mm). This specimen was collected on 11 May 1973 by S. Ivey, ca. 1 air mi N New Mexico Hwy 44 bridge over the Rio Grande, Sandoval Co., New Mexico. The specimen is completely pink in preservative with no differentiation of color on the dorsal or ventral surfaces. The eyes and tongue are pink. MSB 38536 is a juvenile (sex undetermined) *T. hobartsmithi* (SVL 87 mm, tail 26 mm) collected on 20 April 1980 by B. Pietruszka from 27 km N and 1.6 km E of Whites City (T22S R25E SW1/4 SS1/4 Sec 1), Eddy Co., New Mexico. The specimen is a pale straw-color in preservative. There is a small, faded, light-brown spot that covers the posterior edge of the parietals, and no differentiation of color on the dorsal or ventral surfaces is evident. It is likely that both preserved specimens have faded somewhat in preservative. This is the first report of albinism in the genus *Tantilla* (Dyrkacz, *op. cit.*).

We thank William G. Degenhardt and Toby J. Hibbitts for calling the MSB specimens to our attention.

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, USA, **BARNEY R. TOMBERLIN**, Hatari Invertebrates, P.O. Box 510, Portal, Arizona 85632, USA, and **JEFFREY H. GEE**, Captive Bred Wildlife Foundation, P.O. Box 515, Portal, Arizona 85632, USA.



Gyalopion quadrangulare (Desert Hooknose Snake). Illustration by Dan Holland.

TECHNIQUES

Use of Silt Fencing and Funnel Traps for Drift Fences

KEVIN M. ENGE
Florida Game and Fresh Water Fish Commission
Route 7, Box 3055, Quincy, Florida 32351, USA
e-mail: enge@freenet.fsu.edu

Drift fencing, commonly used to inventory herpetofaunal communities, typically biases against catching large snakes, turtles, and species with arboreal, fossorial, or sedentary habits (Campbell and Christman 1982; Dodd 1991; Gibbons and Semlitsch 1982). Whereas a variety of drift-fencing materials have been employed, most researchers use aluminum or galvanized valley (i.e., flashing) because it is readily available, relatively easy to install, self-standing, and durable. Proper installation of metal valley requires digging a trench, however, a difficult task in wetlands with unconsolidated substrates or standing water.

The Florida Game and Fresh Water Fish Commission (FGFWFC) has begun using a new drift-fencing material, silt fencing, to survey herpetofaunal communities in both hydric and terrestrial habitats. Silt fencing, a woven polypropylene material used to control sediment runoff at construction sites, is available from several suppliers in various widths and lengths with variable spacing for attached stakes. A 30.5 m long roll of silt fencing from a Tallahassee, Florida, supplier cost $27.50, 1/3 the cost of an equal length of 50.8 cm wide galvanized or aluminum valley. We used silt fencing of 91.4 cm width that came attached by heavy staples to 122 cm long wooden stakes placed at ca. 2.5 m intervals.

The woven material of silt fencing is permeable to water, which decreases pressure on the fence and minimizes trap displacement by flowing water deflected along the fence. Silt fencing can be installed in situations with flowing water, if the velocity and volume of the water is not too great. If installed across small streams, silt fences should be placed to allow some water to flow underneath the fence. If the flowing water carries a high sediment load, sediment accumulation along the upstream side of the fence may eventually render the fence ineffective.

Silt fences can be installed quickly in wetlands with soft substrates lacking large roots (e.g., muck) by sequentially pounding the stakes into the ground. The bottom edge of the silt fence should be held taut during installation; after installation, any sagging material along the top edge can be tightened by stapling it to an adjacent stake. Stakes should be sunk deep enough so that ca. 15 cm of the lower skirting of the silt-fencing material can be pushed below the surface of the substrate with a garden spade. Tamping along the fence with one's feet after the fence is installed seals up the trench.

In terrestrial habitats, or hydric situations with large roots or extensive root mats, silt fencing can be installed by the usual technique of digging a trench (see Corn 1994). Because silt fencing is much more flexible than valley, the depth and overall symmetry of the trench are not as critical as when installing valley. Subsurface roots or rocks also can be left intact with silt fencing without sacrificing the integrity of the fence. A guide rope to dig along helps while installing drift fences in standing water or in dense ground cover.

Typically, silt fences are not reused, especially if plant roots have grown through the buried portion of fencing. Silt fences used to sample wetland habitats for five months were removed and reused the following year before being discarded, however. No noticeable deterioration of silt fences occurred in studies lasting one year or more, but broken stakes had to be replaced occasionally.

The FGFWFC has used single 15 m long drift fences to sample hydric habitats and a three-fence array design, modified from Jones (1986) by the addition of single- and double-opening funnel traps, to sample both hydric and terrestrial habitats. Pitfall traps (e.g., 19-liter buckets) could be used along silt fences, although the flexible material of silt fencing would make proper placement of pitfall traps more difficult than along metal valley. Properly constructed and placed funnel traps will capture the same species, except for large turtles, as pitfall traps and are better than pitfall traps at capturing certain anurans and large snakes (pers. observ.). Funnel traps can function during high water levels, unlike pitfall traps.

Funnel traps are fashioned from 91.4 cm wide aluminum window screen fastened together with ordinary office staples, forming finished traps ca. 86 cm long. I typically use double-opening funnel traps 20 cm in diameter with funnel openings 5 cm in diameter and single-opening funnel traps 25 cm in diameter with a funnel opening 6 cm in diameter. Funnel traps are shaped into semicircles, so the flat side can fit tightly to the substrate. All traps are provided with sponges to help prevent desiccation of trapped animals.

Funnel traps typically are held in place along the fence by leaning shade covers over them. Shade covers consist of 41 x 41 cm squares of 6 mm thick masonite. Traps may be staked in place or even attached to the material of the fence to prevent displacement by flowing water or animals. In aquatic situations, I opt to keep traps tight to the substrate instead of suspending them along the water surface.

Drift-fencing studies using silt fencing and valley in comparable habitats produced similar trapping success, although arboreal lizards may have been less susceptible to trapping along silt fences because the woven material was climbed more readily. *Anolis carolinensis* commonly were observed climbing silt fences and hiding under shade covers, but they were not captured in proportion to their observed abundance.

Screen funnel traps along silt fences in Florida captured 21 frog, 18 salamander, one crocodilian, twelve turtle, ten lizard, and 32 snake species. Traps captured many aquatic species, including two species each of *Siren, Pseudobranchus*, and *Amphiuma*; three species of *Regina*; four species of *Nerodia*; *Farancia abacura*; and *Alligator mississippiensis* < 1 m long. If traps were placed tight to the fence and substrate, they efficiently sampled small animals, such as amphibian larvae and metamorphs, reptile neonates, *Acris* spp., *Gastrophryne carolinensis, Pseudacris ocularis, Eurycea quadridigitata, Scincella lateralis, Storeria occipitomaculata*, and *Tantilla relicta*. Immature individuals of large turtle species (i.e., *Apalone ferox, Chelydra serpentina, Deirochelys reticularia, Gopherus polyphemus, Pseudemys floridana, P. nelsoni*) and large snakes (e.g., *Agkistrodon piscivorus, Crotalus adamanteus, Drymarchon corais, Masticophis flagellum, Pituophis melanoleucus*) were captured occasionally. Species with arboreal (e.g., five *Hyla* spp., *Anolis carolinensis, Eumeces laticeps, Elaphe obsoleta, Opheodrys aestivus*) and fossorial tendencies (e.g., *Ambystoma talpoideum, A. tigrinum, Rana capito, Eumeces egregius*) also were captured, although some of the species, particularly hylids, were under-sampled. I was successful in trapping species infrequently seen in Florida, including *Hemidactylium scutatum, Pseudotriton montanus*, and *Agkistrodon contortrix*.

Silt fencing is more cost-efficient than valley for short-term studies because it is less expensive and requires less installation time.

Silt fencing may be more effective than valley during high water periods because of its greater height. Silt fencing also may prove more of an obstacle to large snakes or climbing animals than valley because of its greater height, although the woven material and presence of stakes on one side of the fence may make silt fencing easier to climb.

Acknowledgments.—I thank Kenneth Benfield, David Crowe, James Godwin, and Dirk Stevenson, who helped install drift fences and collect data, and the other FGFWFC biologists involved in implementing and administering drift-fencing surveys: Nancy Douglass, Douglas Runde, Stephen Stiegler, and Kristin Wood. The FGFWFC's Bureau of Nongame Wildlife and Bureau of Wildlife Management supported and funded this research, and various FGFWFC personnel reviewed earlier drafts of this manuscript. I thank Stephen Busack for editorial suggestions.

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A Bone Biopsy Technique for Determining Age and Growth in Sea Turtles

RUTHELLEN C. KLINGER
Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia 23062, USA
Present address: Department of Fisheries and Aquatic Sciences University of Florida, 7922 NW 71st Street, Gainesville, Florida 32653, USA
e-mail: REK@gnv.ifas.ufl.edu

ROBERT H. GEORGE
Aquatic Animal Medicine Consultants
6666 George Washington Memorial Highway
Gloucester, Virginia 23061, USA

and

JOHN A. MUSICK
Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia 23062, USA

Knowledge of the age of animals studied in the wild is necessary for accurate growth and life history studies. Techniques for determining age typically involve marking the animal with an internal chemical dye, external tattoo, tag, or by notching a body part; recaptures of marked animals allow researchers to document growth over a known time period.

Oxytetracycline, when injected into muscle tissue, will deposit in all calcified structures and fluoresce under ultraviolet light (Frost et al. 1961; Harris 1960). For age validation in fish, researchers have used cross sections of oxytetracycline-labeled otoliths (Beamish and Chilton 1982), dorsal spines and fin rays (Beamish and McFarlane 1983; Cass and Beamish 1983; Meunier and Pascal 1981), and vertebrae (Gruber and Stout 1983; Holden and Vince 1973; Smith 1984). Phalanges (Castanet 1985; Smirina 1972), flat bones (Castanet and Naulleau 1985) and femurs (Roberts et al. 1988) have been used in amphibians and reptiles. With the exception of studies using marked phalanges and fin rays, methods for age and growth determination require that the animal be sacrificed; this poses a problem in studies of endangered species. To address this limitation, we developed a non-lethal bone biopsy technique that removes a section of tetracycline-labeled humerus showing the fluorescent band and all growth layers (Klinger and Musick 1992).

From 1985 to 1990 fourteen *Caretta caretta* (59.1–96.2 cm straight-line carapace length) and two *Lepidochelys kempi* (55.0 and 68.2 cm SCL) were biopsied. The turtles were anesthetized with a combined solution of 10 ml Ketamine HCl (100 mg/cc) and 1 ml Acepromazine (10 mg/cc) [Fort Dodge Laboratories, Fort Dodge, Iowa, USA] by direct administration (at a rate of 20–30 mg/kg body weight) into the dorsal cervical sinus. Turtles became torpid within five to ten minutes and showed no evidence of discomfort or distress. The mid-ventral surface of either foreflipper was incised distal to the scapulo-humeral joint, and the triceps brachii and internal brachial muscles were separated to expose the humerus. Involuntary muscle contractions noted at initial incision ceased at the point of deep muscle separation. A Michelle Trephine bone corer (Miltex, Lake Success, New York, USA) was used to excise a 3 mm (for *L. kempi*) or 6 mm plug (for *Caretta*) from the flat ventral surface of the humerus just distal to the deltopectoral crest (see Zug et al. 1986). The incision was closed with non-absorbable nylon suture material and biopsied turtles were radiographed post-surgery.

Turtles were kept dry for 24 h (eyes moistened every hour) and then placed in shallow pools. Typically, sutures were removed after two weeks and the turtles were released into the wild after a one month recovery period. All but one loggerhead survived the operation and recovery period. One loggerhead that we biopsied survived the recovery period but was found dead on a North Carolina beach one month after its release. The exact cause of death for each of these turtles is unknown. Both *L. kempi* survived the biopsy procedure and were released.

Long term effects of the 1985 biopsy procedure are suggested by the condition of a single loggerhead recaptured in 1987 and 1988. Radiographs taken of the site of biopsy showed partial filling of the bone structure. When recaptured again in 1988, apparently healthy, radiographs showed the 1985 biopsy site to be completely filled in.

Bone biopsy is a useful tool for acquiring age and growth records of vertebrates without the undesirable consequences of lethal sampling. Although a licensed veterinarian is required to conduct the procedure, it is relatively simple and logistically feasible for most turtle monitoring programs. While sample size is limited, available recaptures of biopsied turtles suggest that this technique does not compromise the swimming behavior of these migratory animals.

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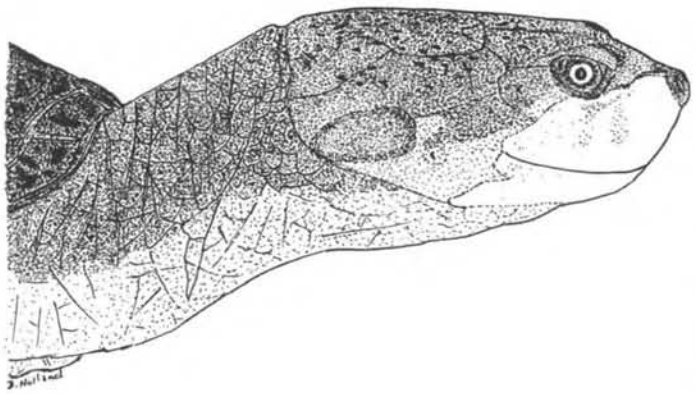
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Podocnemis vogli. Illustration by Dan Holland.

Use of a Non-Contact Temperature Reader for Measuring Skin Surface Temperatures and Estimating Internal Body Temperatures in Lizards

ALLISON C. ALBERTS

and

TANDORA D. GRANT

Center for Reproduction of Endangered Species
Zoological Society of San Diego, P.O. Box 551
San Diego, California 92112, USA
e-mail (ACA): aalberts@sunstroke.sdsu.edu
e-mail (TDG): 102625.2130@compuserve.com

Cloacal thermistor or thermocouple probes and temperature-sensitive implanted or ingested radiotransmitters have been used successfully to measure internal body temperatures of reptiles under field and captive situations (Avery 1982; Kenward 1987). Both methods are invasive and require capture and handling of animals. A new method that utilizes a non-contact temperature reader equipped with a laser-sighting device is gaining popularity, particularly within the zoo community (R. Hudson and J. Wines, pers. comm.). With this type of device, skin surface temperature can be read accurately from a distance of several meters (depending upon animal size) with little or no disturbance to daily activity patterns. While the non-contact temperature reader permits accurate measurement of skin surface temperature, it does not provide direct information about internal body temperature. We used a non-contact temperature reader in captive juvenile Cuban rock iguanas, *Cyclura nubila*, to develop a method for experimentally deriving the relationship between skin surface temperature and internal body temperature.

Mid-dorsal skin surface temperatures of 41 juvenile iguanas (mass range 120–850 g) were measured from a distance of 1 meter over 30 days during March and April, 1995. We used a Raytek Raynger™ PM non-contact thermometer equipped with an FDA class IIIa laser sighting device (accuracy rated to $\pm$ 1°C; Raytek, Inc., Santa Cruz, California, USA) to measure temperatures between 1200 and 1300 h each day. All individuals had been fed and allowed to bask for at least 30 minutes. Mean ambient temperature within the enclosure was 28.5 $\pm$ 0.2°C and five ceramic infrared heating elements distributed throughout the enclosure provided localized basking areas with temperatures up to 45°C. Mean skin surface temperature for the 41 juveniles was 35.2 $\pm$ 0.2°C.

In order to derive a formula for estimating internal body temperature, we characterized the relationship between body mass, skin surface temperature, and internal body temperature between October, 1995, and January, 1996, in 9 of the original group of 41 juveniles (mass range 210–1450 g). Each iguana was placed in a restraint directly under a ceramic heating element that had been allowed to cool to an ambient temperature of 27°C. After the heating element was again turned on, internal body temperature was monitored once per minute for the next 35 minutes by a thermistor probe inserted into the cloaca; mid-dorsal skin surface temperature was measured using the non-contact thermometer at the same time. The relationship between skin surface temperature (T_S) and internal body temperature (T_b) was determined by regression for each of the 9 juveniles over the period of linear temperature increase. A second regression equation describing how the slope of this relationship changed with each individual's body mass was then derived:

$$\text{Slope of } (T_S, T_b) \text{ relationship} = -0.0003(\text{mass}) + 0.926 \quad (1)$$

As expected, the slope of the (T_s,T_b) relationship (range 0.457–1.143) was shallower for animals with larger body mass due to their slower rate of heating compared to smaller animals.

Using equation (1), the slope of the (T_s,T_b) relationship can be determined for any juvenile *Cyclura nubila*, provided its mass is known. At any ambient temperature (T_a), the animal's estimated internal body temperature can be predicted from its skin surface temperature using the following equation:

$$\text{Estimated } T_b = (\text{slope of } [T_s,T_b] \text{ relationship})(T_s - T_a) + T_a \quad (2)$$

To examine the predictive accuracy of this method, we again took mid-day skin surface temperatures on 8 of the original group of 41 juveniles using the non-contact thermometer in January, 1996. At testing, the ambient temperature was 26.1°C. Immediately following measurement of skin surface temperature, each iguana was captured and its internal body temperature taken with a cloacal thermistor probe; predicted internal body temperatures differed from measured internal body temperatures by 1.7 ± 0.3°C (Table 1). Overestimates were slightly more common than underestimates (5 of 8 cases), but the magnitude of error was similar in both directions. These results suggest a fairly high degree of predictive ability for this technique, particularly given the limits of the non-contact temperature reader. Having validated this method, we predicted mean internal body temperature for the original 41 juveniles to be 33.8 ± 0.1°C.

TABLE 1. A comparison between measured and predicted internal body temperatures in 8 juvenile *Cyclura nubila*.

Mass (g)	T_s °C	(T_s,T_b)	Predicted T_b °C	Measured T_b °C	Predicted minus actual
115	27.8	0.891	27.6	25.0	2.6
500	36.1	0.776	33.9	32.3	1.6
750	33.4	0.701	31.2	30.0	1.2
1050	33.4	0.611	30.6	31.1	-0.5
1200	27.2	0.566	26.8	24.5	2.3
1450	30.0	0.491	28.0	26.1	1.9
1650	32.8	0.431	29.0	29.5	-0.5
1800	31.7	0.386	28.3	31.1	-2.8

This method of temperature estimation probably will work well for any juvenile *Cyclura* within our tested range of body masses and may be useful for approximating internal body temperatures for other iguanid lizards possessing similar surface area-to-volume ratios. When applied to a 6.65 kg adult, however, this method underestimated internal body temperature by 5.2°C. While it is possible empirically to generate an equation for how the slope describing the relationship between skin surface temperature and internal body temperature varies with body mass for lizards of any size, equation (1) is best applied only to iguanids with body masses of 1800 g or less.

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An Inexpensive Method for Creating Spaghetti Tags for Marking Trionychid Turtles

MICHAEL J. DRESLIK
Zoology Department, Eastern Illinois University
Charleston, Illinois 61920, USA
e-mail: cumjd1@uxa.ecn.bgu.edu

Marking techniques for turtles range from shell notching to tagging (Ferner 1979). Notching can cause infection and tags may be lost. Spaghetti tags—long, numbered strands of hollow pliable plastic inserted into an incision made in the turtle's carapace, and knotted at both ends to prevent loss—have been used successfully for marking trionychids. The main drawback in spaghetti tag use is the expense.

During the course of my study at Round Pond, Gallatin County, Illinois, USA, I devised an inexpensive method for making spaghetti tags. I purchased a three meter section of Romex wire containing eight differently colored wires within an outer sheath. After first stripping the outer sheath, I cut each of the eight wires into 10 cm lengths and removed the copper core, leaving only the colored plastic sheath. This produced 240 inexpensive tags and, by using one to four tags per turtle, a total of 4680 unique combinations can be produced. To insert the tags on the soft-shell turtles (primarily *Apalone spinifera*), I made a small incision in the perimeter of the carapace and threaded the unknotted end of the tag through. Next I square-knotted the portion fed through the incision, leaving about 1.5 cm between knots to allow for unrestricted growth. Finally, I removed the excess plastic sheath beyond the last knot.

Acknowledgments.—Funding for this project was provided by the Illinois Endangered Species Protection Board, Eastern Illinois Council on Faculty Research, Eastern Illinois Honor Program Undergraduate Research Award, the Chelonian Research Foundation, and the E.I.U. Graduate Summer Research Assistantship Award. I thank E. O. Moll for his insightful review of this manuscript, S. D. Busack for his thorough review, and J. R. Dreslik for aid in making tags.

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A Non-Invasive Method for Sustained Elevation of Steroid Hormone Levels in Reptiles

ROSEMARY KNAPP

and

MICHAEL C. MOORE
Department of Zoology, Arizona State University
Tempe, Arizona 85287-1501, USA
e-mail (MCM): michael.moore@asu.edu

Manipulating circulating levels of hormones is integral to many studies of behavioral endocrinology. Steroid hormone supplementation generally is achieved through single or repeated injections of the hormone when examining acute effects (Mason and Adkins 1976), or through chronic implants of crystalline hormone encased in Silastic® tubing (DeNardo and Sinervo 1994; Hews et al. 1994) or introduced in pellet form (Tokarz 1987) to determine longer-term effects. Injection utility is limited by a relatively short dura-

tion of hormone elevation, and implant utility is limited by stress effects of the surgery required to insert the implant. Our studies on the role of corticosterone in mediating agonistic behavior in male tree lizards (*Urosaurus ornatus*; Knapp and Moore 1995) required a method that would elevate plasma corticosterone levels for at least 24 h, but did not require surgery. We did not want the control animals to experience surgery-associated increases in corticosterone levels. Because reptilian skin and many of its secretions contain lipids (Mason 1992), we explored the feasibility of delivering corticosterone, a lipophilic molecule, transdermally. We report here an inexpensive, non-invasive and simple method of delivering exogenous corticosterone over a period of at least 24 h.

Our method involves the use of a dermal patch securely fastened to the skin of the animal. These dermal patches may also prove useful to investigators wishing to non-invasively elevate levels of a variety of compounds. In our laboratory, the patches have been used to elevate testosterone, progesterone (D. K. Hews, unpubl.), and estradiol (E. L. Lacy, unpubl.) levels in tree lizards. This method holds promise for elevating levels, in a non-invasive manner, of any lipophilic molecule that can cross the skin.

Dermal Patch Construction and Application.—The dermal patch is a piece of adhesive bandage secured to the back of the animal by means of a transparent dressing. Steroid dissolved in sesame oil is placed on the adhesive bandage, with a piece of vinyl electrical tape used to prevent leakage of the oil onto the dressing (Fig. 1). Sizes of patch components will differ with the size of the reptile; our adult male tree lizards (3–5 g) measured 50–60 mm snout-to-vent. Our dermal patches had three parts: (1) a 4 x 3 mm patch of gauze and backing from a Johnson & Johnson Sheer Band-Aid® (Junior size); (2) a 5 x 10 mm piece of vinyl electrical tape; and, (3) an 8 x 20 mm piece of Johnson & Johnson Bioclusive® transparent dressing (cut while still attached to its paper backing). We used Johnson & Johnson products because they worked; we assume that other comparable products could be used as long as the thickness of the gauze is similar. If using Johnson & Johnson products, use of a "Junior" size adhesive bandage is important, however, as the gauze from larger-sized bandages is too thick to hold its shape when cut into small pieces.

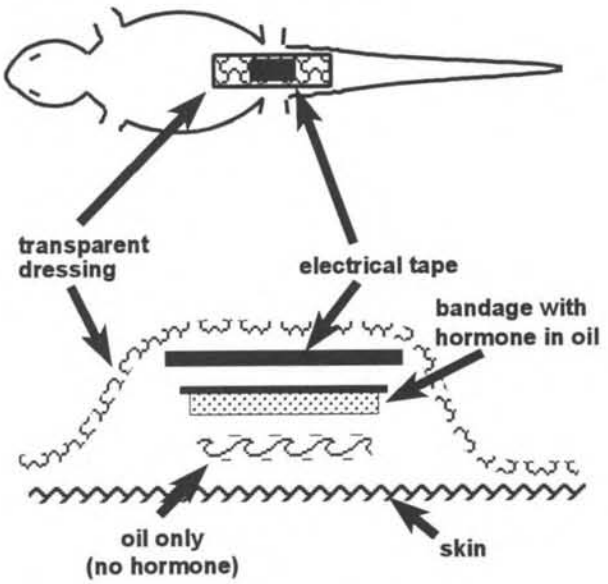


FIG. 1. Schematic drawing of a dermal patch.

Patches are assembled prior to application; to facilitate construction and transport, the adhesive portion of self-stick removable note paper (e.g., Post-It®) is taped, adhesive-side up, to the inside of the bottom of a petri dish dedicated to either hormone or control patches. Assembly has two stages. First, using forceps, a piece of vinyl electrical tape is placed adhesive-side up on the note paper and a piece of bandage (gauze-side up) is then placed on the electrical tape. Second, using the forceps, a piece of transparent dressing is peeled off its paper backing and placed adhesive-side up in a different location on the adhesive note paper. The previously assembled electrical tape-adhesive bandage portion of the patch now is pressed onto the transparent dressing, thereby also pressing the transparent dressing more firmly onto the note paper adhesive. The patch is now "face up" relative to how it will be placed on the animal. A pre-determined amount of sesame oil/hormone mixture is applied to the surface of the bandage, distributing the oil over the surface of the patch. The amount and concentration of the hormone mixture must be determined separately for each species and hormone in test runs to verify that the hormone levels produced in the animal are in the desired range.

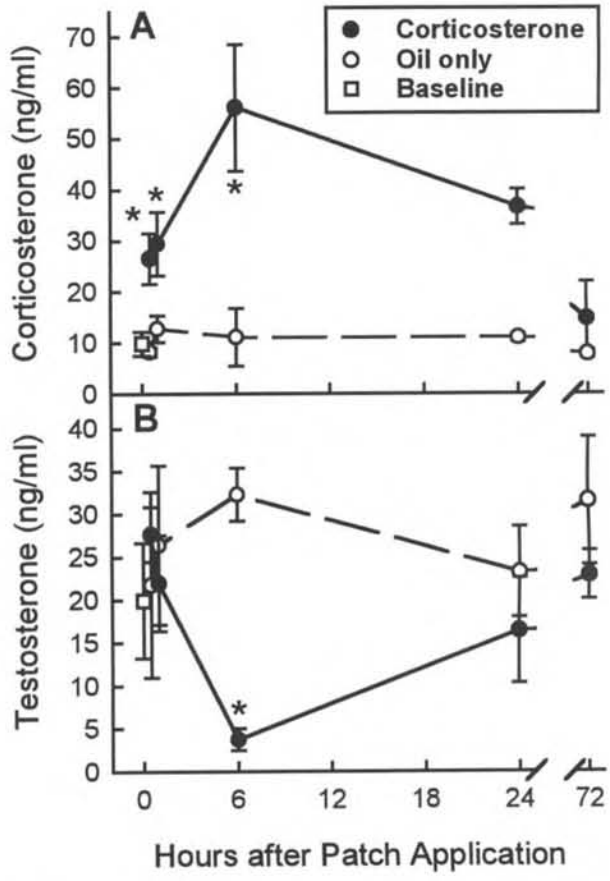


FIG. 2. Mean (± SE) plasma levels of corticosterone (A) and testosterone (B) following application of dermal patches; N = 4–8 for each mean. * = significantly different from oil group (Mann-Whitney U tests: $P < 0.05$).

Prior to placing the patch, we use a microcapillary tube to dab pure sesame oil (no steroid) in the area where the patch will go. This helps ensure contact between patch and skin, and may delay diffusion of steroid into the animal by providing a hormone-free zone across which the hormone must diffuse. We apply the patch along its long axis to the dorsal surface between the hind legs (Fig. 1). In this location the lizard cannot remove the patch, and such placement does not impede the male's social displays. The patch is removed from the petri dish and pressed firmly into place

using forceps. The transparent dressing's holding power comes from its overhang beyond the electrical tape; if necessary, additional pieces of transparent dressing may be used to ensure that the patch is attached securely.

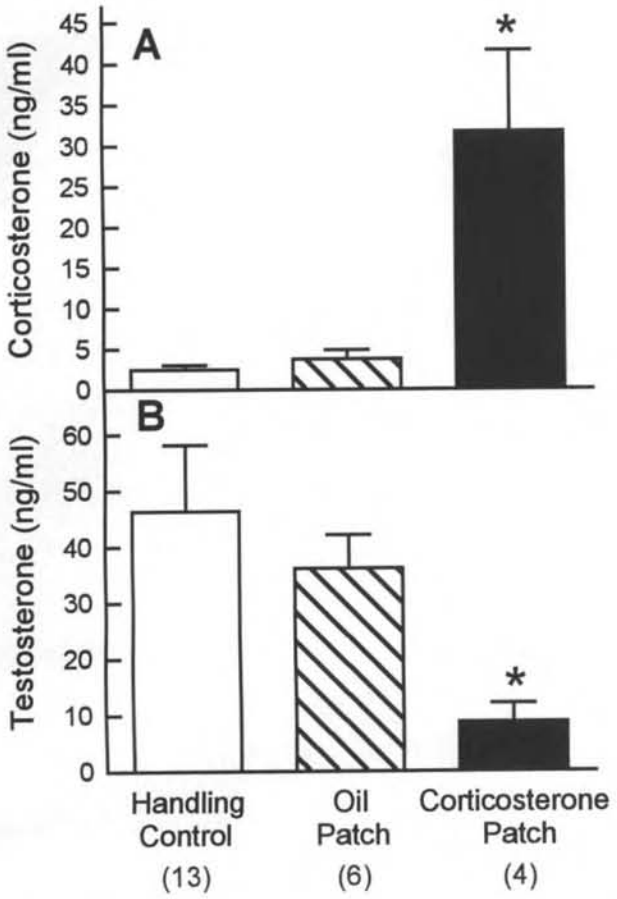


FIG. 3. Mean (± SE) plasma levels of corticosterone (A) and testosterone (B) in free-living male tree lizards 24 h following application of a dermal patch containing 13.5 μg corticosterone in sesame oil (Corticosterone Patch) or containing only oil (Oil Patch). Handling Control males did not receive a patch. Sample sizes are in parentheses below each treatment group; * indicates significantly different when compared with other treatment groups (Newman-Keuls tests: $P < 0.01$).

Time Course of Corticosterone Delivery.—Adult male tree lizards were housed individually in 40-liter glass tanks in the laboratory for 3–6 days to allow corticosterone levels to stabilize after the stress of initial handling (Moore et al. 1991). After the adjustment period, each male was given a dermal patch containing 4.5 μl of either corticosterone in sesame oil (10 μg corticosterone/μl oil; total = 45 μg), or sesame oil only. Blood samples were collected (orbital sinus) from five different subgroups of males 0.5, 1, 6, 24, and 72 h following application of the dermal patch, and from an additional subgroup of males that did not receive patches (to determine baseline hormone levels). Each male was bled only once. Plasma levels of corticosterone and testosterone were determined by radioimmunoassay following ether extraction and Celite chromatography according to methods in standard use in our laboratory (see Knapp and Moore 1995). We measured testosterone levels because glucocorticoids are known to suppress androgen levels (Tokarz 1987).

The dermal patches successfully delivered steroid over 24 h. Forty-nine of 51 patches remained attached for 24 h; six of 12 patches still were attached after 72 h. Males wearing dermal patches containing corticosterone had elevated plasma corticosterone levels when compared to control males at all time points between 0.5 and 24 h (Fig. 2A), but testosterone levels were significantly lower only at 6 h in males wearing patches containing corticosterone when compared to control males (Fig. 2B). At all times except 0.5 h, mean testosterone levels were lower in males wearing corticosterone patches than in males wearing patches containing only oil, although not significantly so.

Use of Dermal Patches in Free-Living Lizards.—An exploratory study demonstrated that these patches may be used for at least 24 h on free-living lizards. Dermal patches prepared the night before were applied to lizards captured by noosing and marked with a unique combination of paint marks. We used a lower concentration of corticosterone (3 μg corticosterone/μl oil) in this trial to obtain elevated circulating levels of plasma corticosterone more within physiological levels. Males received a patch containing 4.5 μl of either corticosterone in sesame oil (total = 13.5 μg corticosterone) or pure sesame oil and then were released after a total handling time of less than 10 minutes.

The following day we returned to the site to recapture marked males and collect blood samples as described above. Blood was also collected from additional males captured on the same days that blood samples were collected from males receiving patches. These additional males served as controls for handling involved with application of dermal patches and thus provided baseline hormone levels.

Dermal patches were successful on free-living animals; of 23 males receiving patches, we were able to resight 15 the following day (7 of 12 experimental and 8 of 11 control). All males resighted had the dermal patch still attached, but in four cases the patch appeared looser than when first applied. For those males from which we were able to collect sufficient blood samples, males wearing patches containing corticosterone had significantly higher plasma corticosterone and significantly lower testosterone levels than males wearing control patches or than those serving as handling controls (Fig. 3A and 3B, respectively, analyses of variance: both $P < 0.01$).

The dermal patches described here successfully elevated plasma corticosterone levels in laboratory-held and free-living lizards for at least 24 h. Manipulating the amount of corticosterone applied to the patch allows some control over the magnitude of the effect on plasma corticosterone levels. In each situation, animals receiving patches containing corticosterone exhibited significantly lower plasma testosterone levels than those males receiving patches containing only oil. However, the time at which testosterone levels were suppressed differed between laboratory-housed and free-living lizards (6 h and 24 h, respectively). This difference may reflect the fact that circulating levels of testosterone in laboratory-housed male tree lizards are usually lower than those of free-living males, even when corticosterone levels are not artificially manipulated (see Moore et al. 1991).

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An Inexpensive Chamber for Collecting the Excretory Products of Tadpoles

DAN COGĂLNICEANU

Bucharest University, Faculty of Biology, Department of Ecology
Splaiul Independentei 91-95, 76201 Bucharest, Romania
e-mail: danco@bio.bio.unibuc.ro

Many studies have considered the importance of anuran larvae in aquatic ecosystems (e.g., Leibold and Wilbur 1992; Seale et al. 1975) but their role remains insufficiently understood. While feeding preferences and growth rates have been documented (Duellman and Trueb 1986), virtually nothing is known about the rate of excretion. Through non-selective grazing and filtering (Sekar 1992; Viertel 1990), tadpoles significantly alter the structure of phytoplankton and periphyton and, consequently, the structure of the entire food-web. Portions of their fecal pellets reach the sediments, but some of their excretory products are dissolved or suspended in the water column. A chamber initially designed for use in the study of assimilation and excretion rates in mussels (Stanczykowska et al. 1975) was adapted for the study of the rate of excretion in tadpoles. This chamber allows determination of the amount of fecal material that eventually reaches the sediments.

The chamber can be constructed easily from a clean, empty plastic bottle (a) and a test tube (b) (Fig. 1). A hole is drilled in the cap of the bottle to fit the test tube firmly while not allowing water leakage. Access by the tadpole to the collection tube is restricted by a net (c) fixed on a plastic tube formed in a circle of appropriate size. Choice of the mesh size for the net depends on the size of the tadpoles used in the experiment; a 1–2 liter plastic bottle is well-suited for tadpoles of 2–3 cm in length. A similar device for smaller tadpoles can be assembled from a glass funnel fused to a test tube with silicone.

I have used up to 12 chambers at one time. Caps with fitted test tubes, and plastic rings with nets attached, are fitted to the chambers and aged tap water is added. Tadpoles used in the experiments should be housed individually and fed (*ad libitum*) daily, but not during the experiment. All experiments involve one weighed and/or measured tadpole per device and last from 6–24 h at the desired temperature. Time can be partitioned into 2–3 shorter periods to determine dynamics of the rate of excretion (e.g., three periods of 8 h/chamber instead of one 24-h period). Feces are collected in a previously weighed test tube and dried at 60°C for 72 h. Excess water can be removed easily before drying after the test tubes are centrifuged. At the end of the experiment, tadpoles are weighed and dried under the same conditions. Portions of the food used to feed the tadpoles can be dried also; these dried samples can be used for chemical analyses to estimate nutrient balance. A small plastic or metal device with pre-weighed food bound in agar (Taylor et al. 1995) can be added to the chamber. The rate of excretion thus can be estimated according to the feeding rate. Tadpoles near metamorphosis (Gosner [1960] stages 40–46) should not be used, since they have a low rate of excretion that eventually stops completely during the final stages of metamorphosis (Dauça and Hourdry 1983).

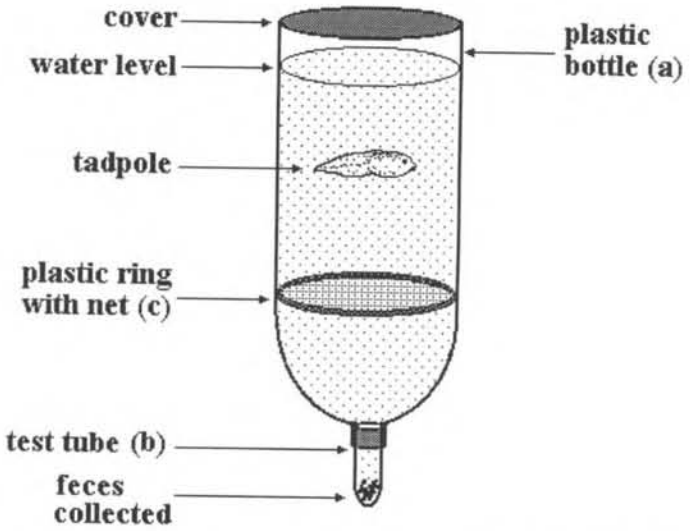


FIG. 1. The chamber used for studying the rate of excretion in tadpoles.

A preliminary study of excretion rates in *Pelobates fuscus* showed that the dry weight of the feces represented 19.7 ± 2.4% (range = 8–50%) of the dry weight of the tadpole. If loss of weight due to respiration is ignored, the dry weight of the feces represents almost one sixth of the initial dry weight of the tadpole. Tadpoles may accumulate sand in their guts; to avoid confounding the data, tadpoles should be kept in aquaria without any solid substrate several days prior to experimentation. The study of the rate of excretion in different species fed a variety of diets may contribute to a more complete understanding of the importance of tadpoles in aquatic communities.

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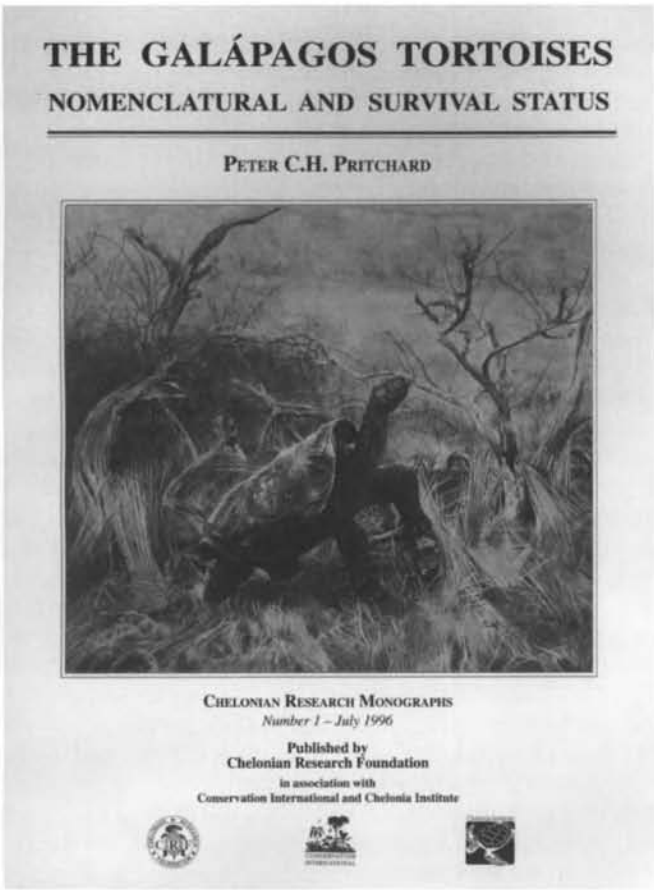
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HERPETOLOGICAL HUSBANDRY

A Safe Procedure for Mite Eradication

RICHARD R. MONTANUCCI
Department of Biological Sciences
Clemson University, Clemson, South Carolina 29634-1903, USA

Mites present serious health problems for captive squamate reptiles. The snake mite, *Ophionyssus* sp., for example, has been implicated as a vector for various disease organisms (Caimin 1948; Frye 1981; Marcus 1983). Mites can also consume significant quantities of blood from the host, leading to potentially life-threatening anemia (Mader 1989). Once established in a reptile cage, these ectoparasites can increase rapidly and spread to other cages (Mader, *op. cit.*).

The common chuckwalla, *Sauromalus obesus*, is a natural host for two species of mites: *Hirstiella pyriformis* and *H. trombidiiformis* (Mader et al. 1986; Werman 1980). Although high density mite infestations are likely to develop in captivity, free-living chuckwallas have been found occasionally with heavy mite loads (Hunter 1966; Werman, *op. cit.*).

Mahaney (1995) described a simple method of mite control in which masking tape was placed around the inside perimeter of cages housing San Esteban chuckwallas, *Sauromalus varius*. With only the center of the tape attached to the cage walls, the edges were free to trap mites to the adhesive.

A different, safe procedure is discussed here that involves substantial reduction of the mite population, followed by interception of gravid females and, thus, interruption of the life cycle at oviposition. This procedure was developed after several unsuccessful attempts (use of No-pest strips; washing lizards and cages) were made to control the lizard mite, *Hirstiella pyriformis*, in a group of common chuckwallas.

Seven chuckwallas were housed in three cages (154 x 69.5 x 56.5 cm). Cages 1 and 3 housed a pair of adult chuckwallas, while cage 2 contained a pair and a juvenile female. Mite infestations in cages 1 and 2 were judged to be moderate. At this infestation level, mites were visible on the lizards and several mites could be observed crawling on the cage walls and glass front at any time. Cage 3 had a heavy infestation where dozens of mites were observed on the chuckwallas, cage walls and glass at any time. Additionally, the lizards exhibited rubbing and scratching behavior (pruritus).

The eradication procedure was initiated on 20 April. The lizards were removed from the cages. The sand substrate was discarded, while the rocks used for shelters and basking sites were washed thoroughly with hot water and dishwashing detergent. Cage walls and glass were sponge-washed with warm water and detergent. After the entire cage was air-dried and visually determined to be free of mites, the cage walls were examined for small crevices which may become oviposition sites for mites. These were sealed with silicon sealant. The cage interior was simplified to a single shelter, a basking site comprised of several rocks, and newspaper substrate replaced the sand.

All seven chuckwallas then were washed with Rep-Rinse (Cal-Tex Naturals, Austin, Texas, USA), a non-toxic formulation containing purified water, docusate sodium, proprietary compound, and hendecenoic acid. A second washing was performed after four days. For thorough washing, a child's soft-bristled toothbrush was used to remove mites from between scales and a cotton Q-tip was used to swab the periorbital areas, tympanic recesses, involutions around the vent, and skin folds of the oral commissure. The chuckwallas were examined visually three days after the second washing and a few mites (larvae and deutonymphs) were observed on each. The assumption was made that the mites could not be removed totally from the chuckwallas, an assumption based on previous experiences that washing the lizards failed to remove all the mites. Additional washings could lead to undue stress (manifested by the lizards going off feed), and other potential problems developing later, such as skin fungus or necrotic dermatitis.

The mites depend on the chuckwalla for nutrition, but utilize its rocky retreats for protection of eggs, quiescent stages, and adults (Werman 1980). It was hypothesized that the mite population could be completely eradicated if gravid females and egg cases (ca. 2 mm oblong and tapered, whitish structures), could be found and destroyed. The next step in the procedure, therefore, was to intercept females as they matured and left the host to lay eggs. Cage inspections began one week after the lizards had received the second washing. With the simplified cage, egg cases were only found on the undersides of rocks at interfaces with other rocks or the floor. To destroy the female mites and their egg cases, the rocks were washed and the newspaper flooring was replaced on a twice-weekly schedule. All rock surfaces were sprayed thoroughly with a strong jet of cold water from a garden hose. The rocks were then sun-dried. Visual inspection confirmed efficacy in removing mites and egg cases from the rocks. The use of detergent at this point was deemed unnecessary. Any mites observed on the glass, cage walls or floor were removed with a paper towel dampened slightly with Windex® glass cleaner (S.C. Johnson & Son, Inc., Racine, Wisconsin, USA). This cleaner, because it is toxic, was used cautiously around the lizards.

The effects of this procedure became quickly obvious. Four to eight mites with egg cases were discovered in each cage during the first or second inspections. However, by 20 May, none was found in cages 1 and 3, while only three gravid mites were found in cage 2. On 31 May, no mites were found in cage 2, and thereafter, inspections were continued weekly until 28 June. At that time, it was judged that total eradication had been accomplished. This was confirmed by visual inspections of the cages on 10 August.

Using this procedure, it is possible to eliminate a serious mite infestation in about one month. Although follow up inspections continued over four weeks, it might be prudent to continue inspections for at least six weeks after apparent elimination of the mites. Two aspects of this procedure are of paramount importance. First, simplification of the cage environment reduces the number of potential ovipositional sites, greatly facilitating the discovery of mature female mites and egg cases. Second, the twice-weekly environmental cleaning schedule is imperative to intercept gravid mites, or at least to destroy eggs before hatching. Mites are capable of rapid reproduction; for example, the common snake mite, *Ophionyssus natricis*, lays up to 90 eggs at a time, and the interval between oviposition and hatching is about 30 hours (Mader 1989). Rep-Rinse was selected simply because it is a non-toxic formulation, but theoretically any other safe and recommended product could be used to achieve the initial reduction in number of mites on the host. The "masking tape method" described by Mahaney (1995) could probably not control mites since ovipositional sites remained in the lizards' environment. Mahaney's method is perhaps better regarded as one of containment that could be an important adjunct to this procedure by preventing gravid mites from dispersing and ovipositing on the exterior cage surfaces, and eventually reaching other cages.

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Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1990. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd ed., Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

RHYACOTRITON KEZERI (Columbia Torrent Salamander). **BEHAVIOR**. Courtship has not been reported in any species of *Rhyacotriton* (Leonard et al. 1993. Amphibians of Oregon and Washington. Seattle Audubon Society. viii + 168 pp.). On 18 March 1995, two male *R. kezeri* were observed in apparent combat, likely related to the courtship of a partially concealed female ca. 25 cm from the site. The smaller of the two males grasped the tail of the other with its mouth and maintained this hold for well over a minute. During that time the two twisted and rolled a distance of 10–15 cm. The salamanders then became aware of the observer's presence and immediately separated and retreated into the forest litter.

This observation was made on a small flat area above a sword fern ca. 10 m up from the bottom of a small, steep-sided, rocky ravine ca. 150 m from the Columbia River in T9N, R7W, sec. 12, Willamette Meridian, Washington, USA. Rain had fallen for the previous 12 h. Water was flowing at the bottom of the ravine. The air temperature was ca. 7°C. The site is in a dense mixed forest of alder, hemlock, spruce, Douglas fir, cedar, and big leaf maple.

Submitted by **WILLIAM G. KIRK**, HCR 63 Box 1311, Seaside, Oregon 97138, USA.

ANURA

BUFO HOUSTONENSIS (Houston Toad). **BEHAVIOR**. Juvenile *Bufo houstonensis* were studied at Bastrop State Park, Bastrop Co., Texas, USA from 7 June–15 July 1993. Observations were made during the morning (ca. 0900–1200 h), afternoon (ca. 1330–1530 h), and early evenings until dusk (ca. 1700–1930 h). Searches also were made at night (ca. 2100–2300 h). Climatic conditions included daily rain during the first two weeks and hot, humid weather the remaining four weeks.

Site 1 was a large (ca. 7.6 m wide at top), partly sunny ravine contiguous with a man-made, 4-ha lake located at the northeast end of the park. The soil at the bottom of the ravine was loose and sandy, with scattered debris that the toads used for cover. Metamorphosing toads emerged from a shallow extension of the lake continuous with the ravine. This area of the lake contained the largest concentration of juvenile toads within the study area (> 25 individuals observed at one time). The introduced fire ant (*Solenopsis invicta*), a known predator of juvenile *B. houstonensis* (Freed and Neitman 1988. Texas J. Sci. 4: 454–456), appeared to be absent from Site 1.

During the day, most juveniles at Site 1 were scattered throughout the bottom of the ravine, with a few found in drier sites at the top of the ravine, which was ca. 8–13 m from the lake shore. At dusk, a few individuals hopped down the side of the ravine toward the bottom. During the first two weeks, the toads were dispersed more widely throughout Site 1. Once the rains ceased, the toads became concentrated within the ravine closer to the lake. Toads were not found at the top of the ravine during the dry period.

At dusk, the young toads in the ravine either moved under cover objects or made small depressions in the sand. The toads formed depressions by moving their hindlimbs side to side, thrusting them out at a 45° angle from the body, and bringing them back to the normal position. This was repeated several times. Once settled, some toads did not move for periods of up to 25 minutes, then they moved 5–70 cm to a new site, and repeated the same movements. They would then remain immobile until dark. Other toads made only one depression and stayed in it until evening. The depressions made during the day were used for feeding, while the depressions made just before dusk were used for cover. We could not locate young toads at this site after dark indicating they may have burrowed into the loose soil.

Site 2 was an old dump area (ca. 0.1 ha) with five small, temporary rain-filled pools (ca. 15 cm deep) scattered throughout the area. The edges of the pools were covered primarily with pine needles, leaves, and grasses. Most of the site was flat with little vegetation or shade and dry, compact soil. This soil type appeared inconsistent with known habitat because *B. houstonensis* has difficulty burrowing into the densely packed soil (Bragg 1960. Southwest. Nat. 5:106). The pools at Site 2 dried up at the beginning of July.

The 15 juvenile *B. houstonensis* observed at Site 2 were dispersed more than those at Site 1. There were no concentrations of toads near pool edges as at Site I, although a few individuals were found around the edge of the site after the third week. During the rainy period, the toads were found throughout the site. However, when rains stopped and the surface soil dried, they disappeared from the area. Five toads were found in a ravine ca. 40 m southwest of Site 2. These toads may have originated from Site 2 because other temporary pools were not found nearby. Toads were not found at night at either site. The young toads at Site 2 may use the sandy soil available within the ravine for burrowing. Fire ant mounds were found at this site.

The absence of *S. invicta* within the ravines may play an important part in the survival of the young toads. If this is the case, toads metamorphosing within ravine areas have a better chance of survival than toads emerging from drier, upland areas. More research is needed to indicate whether ravines within *B. houstonensis* habitats are indeed critical to their survival.

Two types of feeding behavior were observed in *B. houstonensis* juveniles: sit-and-wait and active search. Sit-and-wait behavior involved digging into the sand as described above and waiting for prey. The toads would lunge out with their hind legs, scoop up the food item with their tongue, and ingest it.

Active search behavior consisted of hopping or crawling within a small area foraging for prey. The ants taken at this site were not *S. invicta*, but a smaller, inoffensive species. When a young toad would spot a moving object such as an ant, it oriented itself to face it, moved toward it, captured it, and ingested it. It then continued to forage for more food. An example of an aborted active search feeding behavior involved one toad that oriented toward a large worm, moved quickly up to it, but turned and hopped away just as quickly. The toad appeared to be attracted to the movement of the worm, but it may have been too big to ingest. The animal then resumed its active search for prey.

Juvenile *B. houstonensis* were found to be entirely diurnal. The toads were active during the morning until early evening, even during the hottest period of the day. The few young toads found at night, although alert, did not exhibit signs of movement or feeding behavior.

We extend our gratitude to Dede Armentrout for her help and support during the project. Thanks go to Gwilym Jones and John E. Cadle for comments and criticisms on the manuscript, and to Van Wallach for his continued support. Special thanks to Rhonda Roland Shearer whose enthusiasm and funding made this project possible.

Submitted by **LESLIE A. THOMAS**, Center for Vertebrate Studies, Department of Biology, Northeastern University, Boston, Massachusetts 02115, USA, and **JADE ALLEN**, 62 Greene Street, New York, New York 10012, USA.

TESTUDINES

ERETMOCHELYS IMBRICATA (Hawksbill Sea Turtle). **MORPHOLOGY.** We report the capture of 24 *Eretmochelys imbricata* in the Ogasawara (Bonin) Islands, Japan, from 1975 through 1995 (Table 1). Although *Chelonia mydas* (green turtle) rookeries are known from these islands, no nestings of *E. imbricata* have been reported. All 24 *E. imbricata* were caught by hand, hook and line, or spear in the coastal waters. Measurements are: mean standard straight length = 49.5 cm, SD = 14.8, range = 34.2–85.6 cm, N = 23; mean body weight = 20.1 kg, SD = 23.0, range = 3.8–81.0 kg, N = 22. Thirteen of these turtles were released with plastic flipper tags; none has been recaptured. Partially developed coral reefs around the islands provide habitat for this species. Blood samples were collected from the two most recently captured turtles for a DNA stock identification study.

Table 1. Straight carapace length (SCL), straight carapace width (SCW), and body weight (BW) of hawkbills captured in the Bonin Islands, Japan.

#	Date of Capture		SCL (cm)	SCW (cm)	BW (kg)
1	22 Jun.	1974	43.8	34.6	6.5
2	7 Apr.	1975	34.2	31.0	5.0
3	28 Sep.	1975	41.0	32.8	7.3
4	1 Aug.	1976	50.4	43.5	18.8
5	11 Oct.	1976	34.4	28.5	4.4
6	? ?	1976	40.2	35.6	6.5
7	14 Aug.	1977	–	–	19.5
8	20 Aug.	1977	51.2	42.6	16.8
9	28 Jul.	1980	34.2	28.3	3.8
10	30 May	1983	85.6	64.7	81.0
11	? May	1984	42.7	24.7	7.6
12	? ?	1984	38.2	31.5	5.5
13	20 Mar.	1985	38.7	30.9	5.2
14	1 Dec.	1985	45.5	35.8	9.3
15	17 Feb.	1986	43.0	34.2	8.8
16	? Apr.	1986	79.8	63.5	80.0
17	19 Jul.	1987	44.5	35.9	9.3
18	? ?	1987	60.5	44.3	32.5
19	? Apr.	1988	79.8	58.4	56.5
20	14 Jul.	1990	66.4	56.1	39.5
21	9 Feb.	1991	36.8	30.9	–
22	4 Mar.	1992	41.8	33.2	6.5
23	14 Jul.	1994	49.3	40.2	12.5
24	17 Mar.	1995	55.7	44.2	–

Submitted by **FUMIHIKO SATO, HIROYUKI TACHIKAWA**, Ogasawara Marine Center, P.O. Box 404, Chichijima, Ogasawara-mura, Tokyo, 100-21 Japan, **JOHNSON KIMURA** and **YOJI KURATA**, Tokyo Metropolitan Fisheries Experiment Station, Chichijima, Ogasawara-mura, Tokyo, 100-21 Japan.

CROCODYLIA

CAIMAN LATIROSTRIS (Broad-snouted Caiman). **NEW POPULATIONS and UNDESCRIBED HABITAT.** In the coastal regions of southeastern Brazil, the presence of *C. latirostris* often is associated with mangroves (IUCN 1982. The IUCN Amphibia - Reptilia Red Data Book. Part 1. IUCN. Gland. Switzerland; Vanzolini 1993. Papéis Avulsos Zool. 38:107–154). Until 1990, at least six isolated populations were known to occur along the coast in the state of São Paulo (Carretero et al. 1996. *In* Mateos and Mañosa (eds.), Memoria de Resultados del Segundo Viaje de Reconocimiento Científico a Regiones poco Conocidas del Parque Estadual Intervales, Estado de São Paulo, Brasil. Universitat Barcelona). In 1991, a population was reported from a flooded depression surrounded by lowland Atlantic rainforest close to the Serra de Paranapiacaba at Funil, Parque Estadual Intervales, 70 km from the Atlantic coast (Guix et al. 1992. Grupo Estud. Ecol. Ser. Doc. 4:38–94). Nevertheless, there are no reports of populations from any mountain zone of the Serra do Mar Chain, an area covered by hillside Atlantic rainforest.

From 1–12 August 1994, the population of *Caiman latirostris* in the Funil area was monitored, and a new population was found in the Alecrim region, also in Parque Estadual Intervales.

The Alecrim region is part of a V-shaped valley located in the southwest part of Parque Estadual Intervales (24°20'S, 48°15'W; 38,356 ha). This is traversed by the Pilões River (also called Rio Formoso by local people), and ranges from 70–1046 m. Vegetation formations include lowland Atlantic rainforest (between 70 and 100/150 m), and hillside Atlantic rainforest (between 100/150 and 1046 m); both mature and secondary forests occur in the area.

At the Alecrim site, adult and juvenile caimans were seen active (water temperatures of 19–28°C) by day and night in a lagoon formed in 1986 by the opening of a forest road which dammed a 1.5 m wide clear-water stream. The lagoon has a surface area of 400 m^2 and is situated at an elevation of 200 m. It is surrounded by old growth secondary Atlantic rainforest on the hillsides and is bordered by dense vegetation composed of *Merostachys* sp., bamboo (Poaceae), shrubs (e.g., *Miconia* sp., *Leandra* sp., Melostomataceae) and trees. The lagoon had no dense aquatic vegetation, but there were many fallen branches and trunks in the water, and the bottom was covered by thick leaf litter.

The maximum number of individuals seen simultaneously in the lagoon was 13, distributed as follows: 4 adults (size range 120–150 cm total length); 2 sub-adults (60–80 cm); and 7 juveniles (30–40 cm). Only juveniles and subadults were seen basking outside the water, on semi-submerged trunks. No individuals were found in the surrounding rivers and streams (total distance sampled: 7 km).

The Funil Region is part of a broad sedimentary valley (Vale do Ribeira) and is close to the hillsides of the Serra de Paranapiacaba, in the southeast part of Intervales. The main river is the Rio Felipe (also called Rio Braço Grande). Elevations range from 40 to 200 m. Vegetation consists of secondary lowland Atlantic and mature hillside Atlantic rainforests.

At the Funil site, juveniles and adults were active by day and night in two small lagoons (about 210 and 400 m^2, respectively; elevation 40 m). The first of these is within the Park and the second one is 17 km ESE from the former. Both were bordered by dense vegetation (e.g., *Chusquea bambusoides* [Poaceae], *Scleria* spp. [Cyperaceae], and small herbaceous plants). Another juvenile caiman was seen in a pool of 140 m^2 sited 24 km ESE from the first one and near a small township. The vegetation surrounding these lagoons was composed of successional shrubland with scattered trees and young secondary lowland Atlantic rainforest. Five individuals were observed at the Funil site, as follows: 2 adults, 2 subadults, and 1 juvenile.

No caimans were seen in the rivers and streams inside and outside the reserve (total distance sampled: 20 km). However, their presence was reported by local people one month before the expedition.

The presence of juveniles implies the presence of breeding adults at both Alecrim and Funil. Nevertheless, the number of adults detected was very low and it is possible that both populations are too small to survive by themselves, in the absence of connections to other nearby populations. The Alecrim and Funil localities are separated by 37 km straightline. The Funil population could be connected with others in the Ribeira Valley region, which is large (ca. 3000 km^2) and contains many rivers and streams suitable for caimans.

Caiman latirostris has long been known to occur in eutrophic lagoons and rivers surrounded by subtropical semi-deciduous forests within the Paraná basin (IUCN, *op. cit.*). However, the Atlantic rainforest of coastal Brazil is evergreen and the mountain streams and rivers are oligotrophic. In Alecrim, no open areas around the lagoon were available.

Finding *C. latirostris* in a small lagoon at 200 m altitude on a hillside covered by Atlantic rain forest is of special interest. First, it opens the possibility that the Serra do Mar coastal chain of mountains of eastern Brazil does not necessarily represent a barrier for the dispersion of this species. Second, the presence of a reproductive population in a new habitat confirms the great capability of this species to colonize both fresh and brackish waters in tropical and subtropical regions along a latitudinal gradient from 5° to 34° S (see also IUCN, *op. cit.*). Third, the conditions at these sites provide an interesting ecological context for analyzing the natural history traits of this species in the region.

Thanks are due to Fundação Florestal for logistic support and to William E. Magnusson (INPA) and Carlos Yamashita (IBAMA) for comments and suggestions in the earlier draft of the manuscript.

Submitted by **JUAN C. GUIX, XAVIER SANTOS, ALBERT MONTORI, GUSTAVO A. LLORENTE,** and **MIGUEL A. CARRETERO**, Departamento Biologia Animal (Vertebrats), Facultat de Biologia, Universitat de Barcelona, Av. Diagonal, 645, E-08028 Barcelona, Spain.

LACERTILIA

COSYMBOTUS CRASPEDOTUS (Frilly Gecko) and ***C. PLATYURUS*** (Flat-tailed Gecko). **GLIDING BEHAVIOR.** Gliding is distinguished from parachuting when the angle of descent is greater than 45° from the vertical (e.g., Norberg 1990. Vertebrate Flight, Springer-Verlag, Berlin; Oliver 1951. Am. Nat. 85:171–176). Using this criterion, the agamid *Draco* is classified as a glider, whereas the gekkonid *Ptychozoon* generally is considered to be a parachuting organism (e.g., Reyner 1981. Symp. Zool. Soc. Lond. 48:137–172; but see Heyer 1970. Herpetologica 26:317–319). Gekkonid lizards of the genus *Cosymbotus* have a lateral membrane from axilla to groin and a fringed tail. These features resemble those of *Ptychozoon* but are less developed. Smith (1935. The Fauna of British India Including Ceylon and Burma, Taylor and Francis, London) stated that the membrane of *Cosymbotus* might not function for parachuting or gliding. Cott (1940. Adaptive Coloration in Animals, Methuen and Co. Ltd., London, 508 pp.) suggested that the lateral membrane and tail fringe act as screens obliterating the shadow of body and tail.

On 25 December 1992, in a dipterocarpaceous forest near a trail in Forest Recreation Park, Penang Island, Malaysia, we found an adult female *C. craspedotus* (58 mm SVL) perching on a tree trunk at a height of about 7 m. We dislodged the gecko from its perch with the pliable tip of a long fishing rod. After parachuting straight down about 2 m, it suddenly stopped falling, and glided about 1.5 m in horizontal distance at about 60° from the vertical. When we tried to catch it in a net, it changed its direction and landed on the branch of another nearby tree at a height of about 4 m. During gliding, its membrane was extended laterally. When we prodded it again, it parachuted 1 m, glided 1 m at 45°, landed on the trunk of another tree at a height of 2 m, and climbed up 2 m. On the third capture attempt, it parachuted 1.5 m, glided 0.5 m at 45°, landed on the trunk of the first tree at a height of 2 m, and climbed up 3 m. After dislodging it again, the *C. craspedotus* parachuted 3 m, glided 3 m at 45°, and landed on the ground. There was no wind.

On 19 December 1995, we found an adult female *C. platyurus* (46 mm SVL) perching on the trunk of a rubber tree at a height of 9 m in a rubber plantation, near the Klong Plu Waterfall, Chang Island, Thailand. After dislodging this gecko, it parachuted straight down 6.5 m, changed its direction, glided 1.5 m horizontally, and landed on the same tree at a height of 1.5 m. The glide angle was almost 60° from the vertical, and its membrane was extended during gliding. There was no wind.

Our observations show these species do have the ability to glide and change direction while falling. All previous observations of *Ptychozoon* estimated glide angles of 45° or less (Russell 1979. Zool. J. Linn. Soc. 65:233–249). Our observations constitute the first confirmed records of gliding among gekkonids in natural habitats.

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Submitted by **MASANAO HONDA** and **TSUTOMU HIKIDA**, Department of Zoology, Faculty of Science, Kyoto University, Kitashirakawa, Sakyo, Kyoto, 606-01 Japan, **KUNIO ARAYA**, Graduate School of Human and Environmental Studies, Kyoto University, Yoshida, Sakyo, Kyoto, 606-01 Japan, **HIDETOSHI OTA**, Tropical Biosphere Research Centre and Department of Biology, University of Ryukyus, Nishihara-cho, Okinawa, 903-01 Japan, **JARUJIN NABHITABHATA**, Thailand Institute of Science and Technological Research, 196 Phahonyothin Road,

Chatuchak, Bangkok, 10900 Thailand, and **YONG HOI-SEN**, Department of Zoology, University of Malaya, Kuala Lumpur, 59100 Malaysia.

EMOIA IMPAR (Blue-tailed Pacific Copper-striped Skink). **REPRODUCTION.** The Pacific populations of copper-striped skinks, formerly referred to *Emoia cyanura*, recently were split into two species: *E. cyanura* and *E. impar* (Ineich 1987. Bull. Mus. natn. Hist. nat., Paris, 4è sér., section A, n° 2:491–494; Ineich 1987. Ph.D. Thesis, Université des Sciences et Techniques du Languedoc, Montpellier, 515 pp.; Ineich and Zug 1991. Copeia 1991:1132–1136) based on differences in coloration, scalation, and ecology; allozyme and DNA sequencing data (Guillaume et al. 1994. Copeia 1994:1042–1047; Bruna et al. 1995. Copeia 1995:981–983) have confirmed their distinctiveness.

Eggs, commonly laid underground, rarely are found for either species. In French Polynesia, where both species always occur syntopically, there are few field observations on the eggs and deposition sites for either species. A series of eggs and hatchlings (BMNH 1903.10.16.25) in The Natural History Museum are thus of particular value. The series consists of 14 freshly hatched juveniles (four of them melanistic), 136 full eggs, and 294 empty egg shells, all of which were found in an empty coconut shell (BMNH) with one of the three top "eyes" opened, probably by a rat attempting to eat the nut, and collected on 11 April 1903 by J. Nicoll at Tahiti Island, Tautira (Taravao Peninsula). All of the 14 hatchlings are *Emoia impar*. This series of eggs and hatchlings clearly demonstrates communal egg laying for *E. impar*. I suggest that *E. cyanura* and *E. impar* use different reproductive sites. We have always found both species in syntopy at all prospected localities, and their relative abundance varies between 30% to 70% according to elevation of the site. My studies of reproductive periodicity show that both species reproduce year around in French Polynesia, with a peak in reproductive activity from October to March (Ineich 1987, op. cit.).

I thank C. J. McCarthy (BMNH) for permitting examination of the material, and G. Zug and T. Schwaner for their comments on this note.

Submitted by **IVAN INEICH**, Muséum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles & Amphibiens), 25 rue Cuvier, F-75005 Paris, France, and Centre de l'Environnement, Antenne EPHE, BP 1013 Papetoai, Moorea, French Polynesia.

POLYCHRUS ACUTIROSTRIS (Bicho-preguiça). **REPRODUCTION.** The arboreal polychrotid lizard *Polychrus acutirostris* is distributed throughout tropical open vegetation formations of South America, ranging from the Paraguayan Chaco, through the central Brazilian Cerrado, to the Caatinga in northeastern Brazil (Vanzolini et al. 1980. Répteis das Caatingas. Academia Brasileira de Ciências, Rio de Janeiro. 161 pp.). The reproductive biology of *P. acutirostris* has been studied in the Caatinga (Vitt and Lacher 1981. Herpetologica 37:53–63), but no data are available regarding the time between oviposition and eclosion and the size of hatchlings. Herein we report on the development of a clutch of thirteen eggs laid in the lab on 1 Nov 1995, seven days after a gravid female *P. acutirostris* was collected in Cerrado vegetation surrounding Brasília (15°47'S, 47°55'W). The timing of oviposition agrees with data presented by Vitt and Lachner (*op. cit.*), that eggs are laid during the wet season, which in Brasília extends from October to April. The clutch was kept in a flask containing vermiculite, which covered the eggs and was kept moist. The first egg hatched on 29 Feb 1996, 114 days after oviposition. Four more eggs hatched the next day (01 Mar 1996), followed by seven eggs on 02 Mar 1996, and the last egg hatched on 03 Mar 1996. The timing of hatching agrees with the suggestion made by Vitt and Lachner (*op. cit.*) that eggs of *P. acutirostris* will hatch near the end of the rainy season. Data for 13 hatchlings: mean body mass = 0.9 g (SD = 0.1, range = 0.8–1.1, N = 13); mean SVL = 41 mm (SD = 1.4, range = 38–43); mean tail length = 70 cm (SD = 2.4, range = 65–75).

Submitted by **GUSTAVO LUEDEMANN, GUARINO RINALDI COLLI**, Departamento de Zoologia, Universidade de Brasília, 70910-900, Brasília, Distrito Federal, Brazil. e-mail (GRC): grcolli@guarany.cpd.unb.br, and **REUBER ALBUQUERQUE BRANDÃO**, Laboratório de Fisiologia Animal, Departamento de Ciências Fisiológicas, Universidade de Brasília, 70910-900, Brasília, Distrito Federal, Brazil.

MEDITERRANEAN REPTILES. PREDATION. We report data on the diet of two sympatric gull species at two Mediterranean sites to assess the effect of their predation on reptiles. The study was carried out from 1993–1995 at the Ebro Delta and the Chafarinas Islands. The Punta de la Banya (NE Spain: 40°37'N, 00°35'E Ebro Delta N.P.) is a flat peninsula of 2500 ha with a mosaic of salt marshes and small dunes dominated by psammophilous vegetation. The reptile community at this site is formed by *Psammodromus algirus* and *Malpolon monspessulanus*. The Chafarinas (Melilla SE Spain: 35°11'N, 3°46'35"E) are three small volcanic islands 4.5 km off the Moroccan Mediterranean coast. The reptilian community here is more speciose than at Punta de la Banya and is formed by *Trogonophis wiegmanni, Hemidactylus turcicus, Saurodactylus mauritanicus, Tarentola mauritanica, Chalcides ocellatus, Chalcides paralellus, Podarcis hispanica* and *Coluber hippocreppis*.

Two sympatric species of gulls breed at both sites: Audouin's gull (*Larus audouinii*) and the yellow-legged gull (*Larus cachinnans*). The diet of these species was studied by collecting the food regurgitated by chicks and adults when they were handled for banding. Observations also were made from a blind at the two sites in order to assess the predation of Audouin's gull on reptiles: 451 and 926 h were spent at the Ebro Delta and the Chafarinas Islands respectively (Audouin's gulls group size: mean ± SD = 41.04 ± 40.50, N [number of censuses] = 1419).

Table 1 shows the number of reptiles found in the regurgitated food samples collected from both species and colonies. Only two regurgitates of the yellow-legged gull in the Chafarinas Islands contained reptilian prey: one (collected on 5 April 1995) had one individual of *Trogonophis wiegmanii* (SVL = 143.6 mm) and the other (collected on 25 April 1995) contained two individuals of *Trogonophis wiegmanii* (SVL = 72.9 and 76.6 mm). Two interactions between gulls and reptiles were observed from the blind: on 24 April 1994 we recorded a capture and ingestion of an individual of *Chalcides ocellatus* by an adult Audouin's gull in the Chafarinas Islands, and on 3 June 1994 an adult Audouin's gull tried to capture an individual *Psammodromus algirus* without success in the Ebro Delta. However, of the 557 regurgitates identified from the blind (with 577 identified prey items) no reptilian prey were delivered during courtship or chick feedings. We collected 419 remains and 1227 pellets in the gull nesting colonies, but only a few reptilian remains were found; all of them were prey of the yellow-legged gull. In the Chafarinas Islands we found the remains of *Bufo mauritanicus* (probably from the nearby Moroccan coast, SVL = 103 mm) and a young *Coluber hippocreppis* (SVL = 633 mm). While in the Ebro Delta we found the remains of a young *Malpolon monspessulanus* (SVL = 530 mm).

Our results suggest that predation of Audouin's and yellow-legged gulls on reptiles was occasional, at least in these study sites.

We are grateful to Miguel Angel Carretero and an anonymous referee for valuable comments on an earlier draft of this paper and to Joan Carles Abella for his help in the field work. Robin Rycroft from SAL improved the English text. Research funds were provided by the Instituto para la Conservación de la Naturaleza ICONA.

TABLE 1. Percentage of occurrence of reptiles found in regurgitated food of Audouin's gull, *Larus audouinii* (= LAAU), and the yellow-legged gull, *Larus cachinnans* (= LACA). The breeding population of Audouin's and yellow-legged gulls are also shown for 1994.

	Ebro Delta		Chafarinas Is.		
	LAAU	LACA	LAAU	LACA	TOTAL
Breeding pairs	10.143	1.653	4.136	1.333	
No. regurgitates	315	186	315	295	1.111
No. of prey items	657	472	607	846	2.582
% occurrence of reptiles	0	0	0	0.23	0.002

Submitted by **MERITXELL GENOVART, DANIEL ORO, JACOB GONZÁLEZ-SOLÍS,** and **VITTORIO PEDROCCHI**, Departamento de Biologia Animal–Vertebrats, Diagonal 645, 08028 Barcelona, Spain.

AMPHISBAENIA

LEPOSTERNON INFRAORBITALE (Two-headed Snake). **REPRODUCTION.** Information regarding the laying, incubation and hatching of the eggs of amphisbaenians is sparse. This note describes the hatching of a clutch of eggs of *Leposternon infraorbitale* Berthold, 1859. It is probable this is the first observation of the actual hatching of amphisbaenian eggs; details also are given of the site where the eggs were collected.

Goeldi (1897. Zool. Jahrb., Abt. Syst. Geogr. Biol. Thiere, 10(5):640–676) reported a clutch of eggs of *Leposternon microcephalum* found in March near Rio de Janeiro, Brazil. They had been laid in a pile of bricks and tiles which was inhabited by ants of the genus *Camponotus*. However, the author only gave the dimensions of the eggs. Gans (1971. Bull. Am. Mus. Nat. Hist. 144:379–464) examined numbers of eggs in collections, mostly in a poor state of preservation.

On 20 February 1994, six eggs of *Leposternon infraorbitale* were found in the grounds of the Cacao Research Centre (Centro de Pesquisas do Cacau - Comissão Executiva do Plano da Lavoura Cacaueira, CEPEC-CEPLAC) in the town of Ilhéus on the south coast of the state of Bahia, Brazil (14°45'S, 39°13'W). One of the eggs was opened for species identification immediately after collection (Fig. 1). The specimens were deposited in CEPEC's zoological collections and at the Federal University of Rio de Janeiro (CZUFRJ).

The eggs were found in the ground beside a fallen tree in a cacao plantation. They were ca. 15 cm from the surface and covered in soil and decomposed wood. They measured ca. 60 x 25 mm, and were soft to the touch and yellowish-white in color. The eggs were kept in the laboratory at room temperature (24°C) in a receptacle measuring 27 x 20 x 15 cm, containing 10 cm of vermiculite and covered with plastic mesh. The eggs were moistened with water every two days.

Hatching occurred on 9, 10, and 11 March. The animals first opened a small hole in the shell, just large enough to put their heads out (Figs. 2 and 3); this they did for several hours, appearing and retreating but without leaving the shell. During this process the animals displayed geotropic behavior; they turned towards the soil with the apparent intention of burying themselves (Figs. 2 and 3), but then withdrew once more into the shell. When they finally emerged, general examination showed them to have an egg-tooth.

The five hatchlings measured 150–170 mm total length (mean TL = 160.0 mm, SD = 0.707) and weighed 9.0–12.5 g (mean mass = 10.75 g, SD = 1.458).

The egg opened for species identification was well developed, and still had its yolk. The embryo had a conspicuous eye, proportionally larger than in the adult animal (Fig. 1); this was also the case in the young after hatching, and has been observed in *L. microcephalum* (Gans 1971. Bull. Am. Mus. Nat. Hist. 144:379–464).

The eggs were laid and hatched during the summer rainy season; the same occurs in *L. wuchereri*, also from southern Bahia (Zamprogno et al. 1993. Resumos III Congresso Latino-Americano de Herpetologia, Campiñas (Brazil), p. 36).

We thank Fundação Butantan for financial support and CNPq (Brazilian National Research Council) for providing our grants (CJ and MMA). We thank A. J. S. Argôlo and Alasdair G. Burman for comments and criticisms.

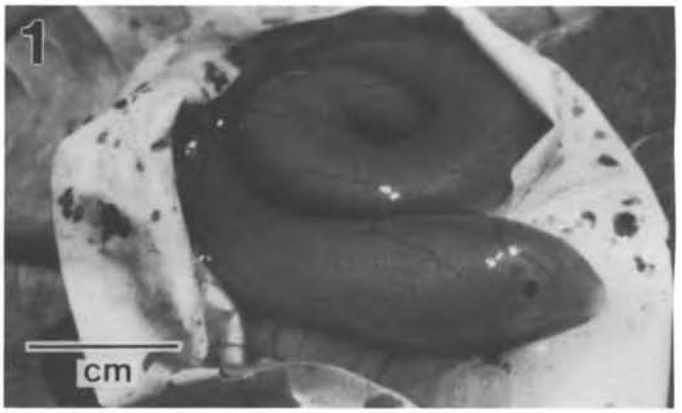


FIG. 1. Opened egg of *Leposternon infraorbitale* showing the appearance of an embryo one month before hatching.



FIG. 2. Hatching of a clutch of *Leposternon infraorbitale*.



FIG. 3. Young of *Leposternon infraorbitale* exhibiting geotropic behavior.

Submitted by **CARLOS JARED, MARTA M. ANTONIAZZI** and **SELMA M. ALMEIDA-SANTOS,** Instituto Butantan, Av. Dr. Vital Brazil, 1500, CEP 05503-900 - São Paulo, Brasil.

SERPENTES

BOTHROPS JARARACUSSU (Jararacussu). **PREY**. Few data are available on the feeding habits of *Bothrops jararacussu*, a large, heavy-bodied neotropical pitviper that reaches 2200 mm in total length (Campbell and Lamar 1989. The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp.). This pitviper feed on rodents and frogs (Amaral 1976. Serpentes do Brasil, Melhoramentos, São Paulo. 246 pp.), and juveniles use caudal luring to attract insectivorous prey such as frogs (Sazima 1991. Copeia 1991:245–248). Herein, we report on a legless lizard eaten by this pitviper. An adult male *B. jararacussu* (865 mm SVL; 140 mm tail; 370 g mass), was caught by a plantation worker on 27 October 1995 near the Sítio Três Marias, Marechal Floriano, Espírito Santo, eastern Brazil (20°22'S, 40°42'W), elevation 680 m. Gut content analysis revealed a whole anguid lizard, *Ophiodes striatus*, (200 mm SVL; 195 mm tail, 32 g mass) and a small, partially digested rodent (estimated mass = 8 g), both ingested head first. The lizard showed no signs of digestion and represented 39.3% of the total length of the snake. The lizard's tail was complete and intact despite the reputation of *O. striatus* for ready autotomy of its tail into several pieces when handled (its Portuguese name is "cobra de vidro," literally "glass snake"). Examination of the lizard revealed a 4 mm wound on the lower left neck, perhaps due to the envenomation bite. The snake and its prey are in the Coleção Zoológica da Universidade Federal do Espírito Santo (ZUFES).

We thank I. Sazima for critically reading the manuscript, A. Regiani for providing the pitviper, and the PICDT/CAPES for a graduate fellowship to CZ.

Submitted by **CLAUDIO ZAMPROGNO** and **MARIA DAS GRAÇAS ZAMPROGNO**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil.

PSEUDOBOODON LEMNISCATUS (Striped Ethiopian Mountain Snake) **REPRODUCTION and SIZE**. *Pseudoboodon* is a genus of medium-sized colubrids endemic to the highlands of Ethiopia and Eritrea. Until recently, there was believed to be only a single species, but Rasmussen and Largen (1992. Steenstrupia 18(3):65–80) revived a second species (*Pseudoboodon gascae*) from the synonymy of *P. lemniscatus* and described a third species, *P. boehmei*. There is no information on the reproduction of these two latter species, and the only information on reproduction in *P. lemniscatus* is that reported by Emmrich (1992. Walia 14:16–22), from Angenstein (pers comm.) who reported clutch sizes of 6–10 and hatchling sizes of 17–20 cm. I here present detailed data on reproduction in this species.

On 24 November 1991, a female *Pseudoboodon lemniscatus* (SVL 692 mm, total length [TL] 780 mm, mass 184 g) was collected crossing a road just after dark (1912 h, air temperature 17.5°C) in the grounds of the British Embassy, Addis Ababa (9°02'N 38°43'E, 2520 m). She was noticeably gravid and was housed in captivity. All food offered (small rodents and skinks) was refused and between 18–19 December 1991 she laid 12 eggs, between 1830 and 0600 h. She remained coiled around the eggs throughout the laying period, but left the eggs at 0700 h on 19 December and concealed herself under a tile in the cage. Her mass after laying was 130.8 g and the relative clutch mass = 0.319. The eggs were removed, separated into three groups (3, 4, and 5 eggs), and placed in damp soil in separate plastic tubs on the back of a refrigerator, where the temperature varied between 17–20°C. On 19 December the mean egg mass was 5.1 g (SD = 0.191, range = 4.8–5.3 g), mean length 30.25 mm (SD = 1.69, range = 28–34 mm), mean width 17.6 mm (SD = 0.616, range = 17–19 mm). During incubation, the tub with five eggs was knocked over and fell to the floor; all the eggs in it were then attacked by fungus and collapsed. On 8 April 1992 a small slit was seen in one of the remaining viable eggs. The eggs were weighed immediately; the mean mass of the seven remaining eggs was 8.77 g (SD = 0.958, range = 7.9–10.2 g), mean length 33.3 mm (SD = 1.43, range = 30.5–35.8 mm), mean width 22.5 mm (SD = 0.83, range = 21.7–23.8 mm). Between 8 and 16 April all seven eggs hatched. Mean total length of hatchlings was 188 mm (SD = 16.5, range = 172–225 mm), mean SVL 161 mm (SD = 16.3, range = 145–198), mean mass 2.28 g (SD = 0.678, range = 1.5–3.7 g). Incubation time thus varied between 111–119 days, but this may be unusually short due to the high incubation temperatures. In Addis Ababa soil temperatures at 30 cm vary from 10° to 17°C. All seven hatchlings were released in the grounds of the British Embassy. The female is still alive in the collection of David Brownlee (Newcastle, England) along with a male (collected 5 December 1991, also in the British Embassy, Addis Ababa; dimensions at capture: SVL 587 mm, TL 712 mm, mass 120 g).

The female produced a second clutch. Mating occurred during December 1993, a clutch of ten eggs were laid 28 January 1994; seven hatched on 16 May 1994 following 108 days of incubation at 29°C. Both snakes will be deposited in the collection of the British Museum (Natural History) upon death.

On 20 November 1993, a large female *P. lemniscatus*, TL 875, SVL 771 mm, mass 285.9 g, was killed at about 1600 h in the grounds of the British Embassy, Addis Ababa. Her oviducts contained 21 eggs measuring ca. 1.8 x 1.5 cm; the mass of all 21 eggs was 41 g (mean 1.95 g, eggs not weighed individually). The specimen and her eggs were placed in the collection of the Natural History Museum (Addis Ababa), specimen number NHAA (S) 1993.22.

On 6 June 1994, a hatchling *P. lemniscatus* (umbilical scar visible, TL 230 mm, SVL 205 mm) was collected under a rock at the Berek River, 30 km northeast of Addis Ababa (9°09'N, 38°57'E). This neonate was released after being photographed. Presuming this specimen hatched sometime during the previous month, we may conclude that under normal conditions, in central Shoa province (where Addis Ababa is located), egg-laying in *P. lemniscatus* occurs in December–January and hatchlings appear in May or June, coincident with the onset of the four-month rainy season, June–September.

Submitted by **STEPHEN SPAWLS**, P.O. Box 30056, Addis Ababa, Ethiopia.

The note below is being republished, as a corrected version, and originally appeared in volume 27, number 2 (June 1996).

SISTRURUS MILIARIUS BARBOURI (Dusky Pigmy Rattlesnake). **MAXIMUM SIZE.** In the spring of 1981, Mitchell Harris collected an adult male *Sistrurus miliarius barbouri* off Rt. 60 at a farm ca. 20 mi. west of Vero Beach, Indian River Co., Florida, USA. The specimen was given to the senior author, who maintained it in captivity from March 1981 until April 1993 (12 years, one month), when it died. We estimate the age of this snake to be ca. 20 years, because it was ca. 63.5 cm in length when caught in the wild. Its weight (on 23 July 1988) was 658 g. At its death, the specimen measured 73.8 cm total length (excluding rattle); in 1987, this snake had a live measurement of 80.3 cm in total length, a new maximum size for this race and the species. During the early part of its captivity, this specimen maintained only 2–3 rattle segments. However, despite repeated sheddings during the remainder of its life, these original segments wore down and the snake ceased adding any rattle segments. The specimen was preserved and deposited in the Florida State Museum of Natural History (UF-FSM 87590); color slides were deposited earlier (1987) at the Natural History Museum, The University of Kansas (KU Color Slides 7614-7615).

This specimen is the basis for the maximum size reported by Conant and Collins (1991. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **EMMETT SNELLINGS, JR.**, 88 Mcteer Drive, St. Helena Island, South Carolina 29920, USA, and **JOSEPH T. COLLINS**, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.

THAMNOPHIS ELEGANS VAGRANS (Wandering Garter Snake). **PARALYSIS.** On 3 August 1993 at 1100 h, a female *Thamnophis elegans vagrans* (SVL 454 mm; TL 586 mm) was found in 0.5 m high grasses along the bank of Coyote Creek, 1.5 km E Guadalupita, Mora County, New Mexico, USA. Inspection of the snake exposed seven scars (three ventral, four dorsolateral) devoid of scales. The largest (9 x 7 mm) was located mid-dorsally at the apex of the vertebral column, 121 mm anterior of the vent.

During locomotion, the snake dragged the posterior portion of its body. Stimulus anterior and posterior to the injury verified that there was no detectable voluntary muscular response posterior to the site of the vertebral injury (26.7% of SVL; 43.2% of TL). Involuntary response was observed when scratching of the skin induced contraction of tail muscles to the point where the tail would wrap around a finger.

Radiographs of the snake indicate the spinal column was severed and healed with a lateral misalignment (Fig. 1). The misalignment supports the assessment that the spinal injury caused paralysis. Since capture, the snake has fed regularly and grown to 513 mm SVL (656 mm TL) by November 1995. Defecation regularly follows feeding, although atypical bulging occurs both anterior and posterior to the spinal column injury, and cloacal control seems to be lacking.

Between 0800 and 1800 h on 20 August (17 d after capture), the female gave birth to three young measuring 103, 114, and 119 mm SVL. The smallest newborn died on 14 September at 106 mm without feeding, whereas the two larger individuals died on 9 December 1993 (155 SVL) and 7 February 1994 (183 SVL). Normal size ranges for *T. elegans* at birth were reported as 180–230 mm by Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America, 3rd ed. Houghton Mifflin Co., Boston, Massachusetts, 450 pp.) and 167–215 mm by Wright and Wright (1994. Handbook of Snakes of the United States and Canada. Vol. II. Comstock Publ. Assoc., Ithaca, New York. 565–1106 pp.), with the smallest recorded as 122 mm (Wright and Wright, *op. cit.*). Litter sizes range from 4–19 (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians, 2nd ed. Houghton Mifflin Co., Boston, Massachusetts 336 pp.) and 4–14 (mean 9.1) (Fitch 1985. Univ. Kansas, Mus. Nat. Hist., Misc. Publ. 76:1–76). Whether the spinal injury was related to the low litter number, small size of the young at birth, and their high mortality is speculative.

Scientific permit to SK was provided by the New Mexico Department of Game and Fish. We acknowledge Tim E. Robinson for the radiographs. Thanks to Robert D. Owen, Llewellyn D. Densmore, and Lorinda L. Gordon for reviewing the manuscript.

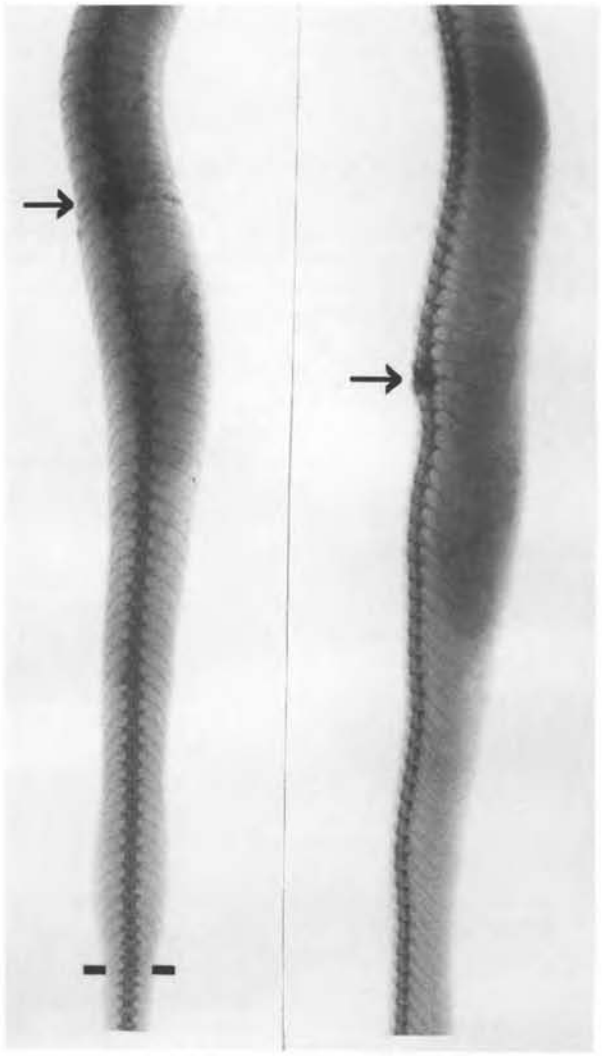


FIG. 1. Radiographs of female *Thamnophis elegans vagrans* indicating position of vertebral injury between the 44th and 45th precaudal vertebrae (arrows). The lateral view (right) shows a slight downward tilt across the fused vertebrae. Bars denote approximate position of vent (left, dorsal view).

Submitted by **STEPHEN KASPER**, Department of Biological Sciences and The Museum, Texas Tech University, Lubbock, Texas 79409, USA, and **STEPHANIE N. KASPER**, 4512 49th St., Lubbock, Texas 79414, USA.

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins, 1990, *Standard Common and Current Scientific Names for North American Amphibians and Reptiles, Third Edition*, Herp. Circ. 19:1–41; for México as it appears in Liner, 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*. Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al., 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985(3):802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen *only* when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*) to make sure you are not duplicating a previously published record.

Please submit any geographic distribution records in the **standard format only** to one of the Section Co-editors: Joseph T. Collins (USA & Canadian records only), Museum of Natural History—Dyche Hall, The University of Kansas, Lawrence, Kansas 66045–2454, USA; Jerry D. Johnson (México and Central America, including the Caribbean islands), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA; Hidetoshi Ota (all Old World records), Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-01, Japan; or Gustavo J. Scrocchi (South American records), Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina. Short manuscripts are strongly discouraged, and are only acceptable when data cannot be presented adequately in the standard format. **Submissions by e-mail are encouraged where possible**. Refer to inside front cover for e-mail addresses of section editors.

Recommended citation for new distribution records appearing in this section is: Marques, O. A. V., and G. Puorto. 1996. Geographic Distribution. *Chironius laevicollis*. Herpetol. Rev. 27:212.

CAUDATA

AMBYSTOMA LATERALE (Blue-spotted Salamander). USA: WISCONSIN: Menominee Co: ca. 30 m E jct. of Rt. VV and Sunrise Road, Center of Sec 23, T28N, R16E. 23 September 1996. Gary S. Casper. Verified by Robert W. Henderson. MPM Herpetology Collection 27982–983. New county record, filling gap in expected distribution (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Milwaukee Pub. Mus. 87 pp.). Two specimens found under logs at shore of small pond in oak woodland.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

AMPHIUMA MEANS (Two-toed Amphiuma). USA: FLORIDA: Franklin Co: St. Vincent Island, on Rattlesnake Slough Road north of Oyster Pond. 6 October 1995. Thomas E. Lewis. One specimen photographed, UF 104084. Verified by David Auth. Found alive in a tire rut, apparently after having been washed out of Oyster Pond when a water control structure failed during Hurricane Opal on 5 October 1995. First record for any Gulf Coast barrier island (Blaney 1971, Herpetologica 27(4):406–430).

Submitted by **D. BRUCE MEANS** and **THOMAS E. LEWIS**, Coastal Plains Institute, 1313 North Duval Street, Tallahassee, Florida 32303, USA, and St. Vincent National Wildlife Refuge, P.O. Box 447, Apalachicola, Florida 32329, USA.

NOTOPHTHALMUS MERIDIONALIS (Black-Spotted Newt). USA: TEXAS: McMullen Co: 27°37'48"N, 97°18'36"W. Adult male crossing Texas Rt. 16, S of Tilden, 15 m N Nueces River bridge in the rain at 2140 h. 31 August 1995. Travis W. Taggart and Richard Anderson. KU Color Slide 11223. Verified by James R. Dixon. County record; lends support for the records cited as questionable by Dixon (1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.) for Duval (USNM 15683, 14740) and Bexar (USNM 45400–45423) counties. Dixon (pers. comm.) never examined these specimens and they were not included in his map on the basis of their suspect locality.

Submitted by **TRAVIS W. TAGGART**, Department of Biological Sciences-SLU 736, Southeastern Louisiana University, Hammond, Louisiana 70402, USA.

ANURA

ASCAPHUS TRUEI (Tailed Frog). USA: OREGON: Wasco Co: Warm Springs Reservation, Wilson Creek, 3.7 km S Rt. 26, NE 1/16 of SW 1/4, Sec.36, T5S, R9E (UTM N4993850m, E609080m) upstream from jct. of road and Wilson Creek; unnamed tributary of the South Fork of the Warm Springs River, 3 km E of the Pacific Crest Trail, Center of the NE 1/4, Sec. 32, T7S, R9E (UTM N4975000m, E603760). 8 September 1995. Stacy N. Smith. Oregon State University Herpetological Collection Photographic Records (OS 11335–337). All verified by R. Bruce Bury. Three adults found at the South Fork of the Warm Springs River site, two adults also captured at this site in 1994. Four tadpoles and one adult captured at the Wilson Creek site. Three tadpoles and one adult also were captured 1.5 km downstream from the road crossing in 1994. First county records; Wilson Creek site is ca. 24 km SW of Hood River County locality, and the South Fork of the Warm Springs River site is ca. 14 km NE of the Marion County locality (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Press of Idaho, Moscow. 332 pp.).

Submitted by **STACY N. SMITH**, Environmental Services Northwest, 2134 Minute Court, Stone Mountain, Georgia 30087, USA.

BUFO CALIFORNICUS (Arroyo Toad). MÉXICO: BAJA CALIFORNIA: Arroyo San Simon, ca. 16 km SE San Quintin, 30°27'00"N, 115°51'00"W. 18 March 1995. Eric W. A. Gergus. LACM Color Slide PC1316. Verified by Brian K. Sullivan. At least seven males were seen calling along the margins of the arroyo. Extends range ca. 38 km S of nearest record at Río Santo Domingo (Price and Sullivan 1988, Cat. Amer. Amphib. Rept. 415:1–3).

Submitted by **ERIC W. A. GERGUS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287, USA, **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515, USA, and **KENT BEAMAN**, 1159 Iowa Avenue, Suites E and F, Riverside, California 92507, USA.

BUFO VALLICEPS (Gulf Coast Toad) USA: TEXAS: HARRISON CO: Karnack, 5.6 km E main entrance of Longhorn Army Ammunition Plant, near Harrison Bayou. 30 April 1996. Bradley C. Autrey and Ryan Daniel. Verified by Fred L. Rainwater. Stephen F. Austin State University Vertebrate Museum (SFAVM 4891). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). Individual was collected from a funnel trap located in a mesic hardwood area on the Longhorn Army Ammunition Plant.

Submitted by **ROBERT R. FLEET** and **BRADLEY C. AUTREY**, Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad) USA: COLORADO: LAS ANIMAS CO: pond on unnamed creek, 2.0 air mi due W of Las Animas/Baca County line, 0.9 air mi due S jct W Carrizo Creek. 3 June 1996. UNC-MNH Photographs 18–19. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **SCOTT BOBACK**, **ENOCH BERGMAN**, **CHAD MONTGOMERY**, **JUSTIN HOBERT**, **BEN HILL**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad). USA: TEXAS: HALE CO: 17.7 km W Petersburg. 2 June 1996. Ann M. Anderson, Warren C. Conway, and David A. Haukos. Museum of Texas Tech University (TTU-R-11633). Verified by Richard Monk. County record; several adult males were heard and seen calling at 0100 h in a flooded playa wetland. One individual was captured in dense vegetation. Extends range of the species northwest (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.) Fills hiatus in current known distribution of species—Swisher County to the north, Floyd County to the east, and Crosby and Lubbock counties to the south.

Submitted by **ANN M. ANDERSON**, **WARREN C. CONWAY**, and **DAVID A. HAUKOS**, Range and Wildlife Department, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad). USA: TEXAS: HOCKLEY CO: 8.1 km N Smyer. 2 June 1996. Ann M. Anderson and David A. Haukos. Museum of Texas Tech University (TTU-R-11634). Verified by Richard Monk. County record; several adult males were heard and seen calling after sunset in a flooded playa wetland. One individual male was captured by hand in dense vegetation. Extends range of the species northwest (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.)

Submitted by **ANN A. ANDERSON** and **DAVID A. HAUKOS**, Range and Wildlife Department, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79404, USA.

HYALINOBATRACHIUM CHIRRIPOI (Suretka Glass Frog). PANAMÁ: PROVINCIA DE DARIEN: DISTRITO DE PINOGANA: Parque Nacional Darién, Estación Pirre, Río Peresénico, 8°01'09"N, 77°43'57"W, elev. 90 m. 24 August 1994. Roberto Ibáñez D. Círculo Herpetológico de Panamá (CH 4048). Verified by Jay M. Savage. New country record. Although Frost ([as *Centrolenella*]1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.) and Auth (1994, Smithson. Herpetol. Info. Ser. 98:1–59) indicated that it was distributed from Costa Rica to Colombia, and Villa et al. ([as *Centrolenella*] 1988, Middle American Herpetology. Univ. Missouri Press, Columbia. 131 pp.) erroneously showed it as present in Panamá, this species was only known from localities in Costa Rica and Colombia ([as *Centrolenella*] Starrett and Savage 1973, Bull. So. California Acad. Sci. 72:57–78; [as *Centrolenella*] Hayes and Starrett 1980, Bull. So. California Acad. Sci. 79:89–96). Partially fills the gap between previous records and confirms its presence in Panamá.

Submitted by **ROBERTO IBÁÑEZ D.**, Smithsonian Tropical Research Institute, Apartado 2072, Balboa, Republica de Panamá, and **CESAR A. JARAMILLO**, Círculo Herpetológico de Panamá, Apartado 10762, Estafeta Universitaria, Panamá, Republica de Panamá.

HYLA CINEREA (Green Treefrog). USA: TENNESSEE: DYER CO: Chic (Tennessee) topographic quadrangle, Moss Island State Wildlife Management Area, ca. 1 km SW of jct. of Big Levee and Moss Island roads (35°57'23"N, 89°37'58"W), 76 m elev. August 1994. Carl Wirwa. Austin Peay State University Museum of Zoology (APSU Photograph Collection 05423). Verified by A. Floyd Scott. Adult captured in open area among patches of bottomland hardwoods, photographed and released. New county record (Redmond 1985, A Biogeographic Study of Amphibians in Tennessee. Doctoral Thesis, Univ. Tennessee, Knoxville. 290 pp.).

Submitted by **ALAN PETERSON** and **CARL WIRWA**, Tennessee Wildlife Resources Agency, Box 55 State Office Building, 225 Dr. Martin Luther King Drive, Jackson, Tennessee 38301, USA.

HYLA GRATIOSA (Barking Treefrog). USA: TENNESSEE: CHESTER CO: Henderson (Tennessee) topographic quadrangle, 2.5 mi S of Henderson at 1395 Memory Lane (35°24'04"N, 88°38'06"W), 141 m elev. 4 September 1993. Amy Peterson and Christie Peterson. Austin Peay State University Museum of Zoology Photograph Collection (APSU 05419). Verified by A. Floyd Scott. Adult captured on inside wall of house. A second specimen was captured by Alan Peterson thirteen months later crossing Memory Lane ca. 100 m N of the first capture site. New county record (Redmond 1985, A Biogeographic Study of Amphibians in Tennessee. Doctoral Thesis, Univ. Tennessee, Knoxville. 290 pp.).

Submitted by **ALAN PETERSON**, Tennessee Wildlife Resources Agency, and **JOHN KOONS**, Department of Natural and Physical Sciences, Jackson State Community College, Jackson, Tennessee 38301-3797, USA.

PHYLLOMEDUSA BICOLOR (Giant Monkey Frog): BOLIVIA: BENI: PROVINCIA VACA DIEZ: between Villa Vella and Cachuela Esperanza at ca. 5 km from Villa Vella. 20 February 1996. F. Guerra Serrudo and E. Perez Limache. Coleccion Boliviana de Fauna La Paz (CBF 2446-48). Verified by A. Schlüter. First record for Bolivia.

Submitted by **STEFFEN REICHLE**, Langwiesenstr. 26, D-70771 Leinfelden-Echterdingen, Germany; **FERNANDO GUERRA SERRUDO** and **EDDY PEREZ LIMACHE**, Coleccion Boliviana de Fauna, Casilla 8706, La Paz, Bolivia.

PSEUDACRIS TRISERIATA TRISERIATA (Western Chorus Frog). USA: WISCONSIN: ONEIDA CO: 0.25 mi SE jct. of Rt. G and Rt. 8/47, SW 1/4 of SE 1/4 of SW 1/4 Sec. 8, T36N, R9E. 2, 8, and 18 May 1996. Ron Eckstein. MPM Herpetology Audio Tape Collection (cat. no. pending). Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the

Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Wisconsin. 87 pp.); an additional record for northeast Wisconsin, where this species is rare and local.

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

SCAPHIOPUS COUCHII (Couch's Spadefoot). USA: NEW MEXICO: Cibola Co: Laguna Reservation, 0.4 km N and 1.6 km W of Mesita (SE 1/4 Sec. 11, T9N, R5W). 15 June 1996. S. E. Carr. KU Photograph Accession 6562. Verified by C. W. Painter. First record for county; extends range ca. 35 km NW from Valencia County in the Rio Puerco/Rio Salado drainage basin (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xx + 431 pp.).

Submitted by **STACEY E. CARR**, Department of Natural Resources, Pueblo of Laguna, P.O. Box 194, Old Laguna, New Mexico 87026, USA; and **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

TESTUDINES

CHRYSEMYS PICTA BELLII (Western Painted Turtle) USA: COLORADO: Bent Co: DOR, Rt 50, 0.9 mi W jct of County Road 28. 7 October 1996. UNC-MNH 213. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **ENOCH BERGMAN**, **BEN HILL**, **CHAD MONTGOMERY**, **JUSTIN HOBERT**, **SCOTT BOBACK,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

GRAPTEMYS GEOGRAPHICA (Common Map Turtle). USA: WISCONSIN: Shawano Co: 0.75 miles west of Morgan Road on Rt. A, W1/2 Sec. 32, T28N, R14E. 20 May 1996. Greg Bunker. MPM Herpetology Collection 27978. Verified by Robert W. Henderson. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Wisconsin. 87 pp.) Adult female killed on road near small tributary of the Red River (Wolf River watershed). Extends range ca. 22 km N of nearest locality in northern Waupaca County, also in Wolf River watershed (Vogt 1981, Natural History of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., Wisconsin. 205 pp.)

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

GRAPTEMYS KOHNII (Mississippi Map Turtle). USA: OKLAHOMA: Choctaw Co: Hugo Wildlife Management Area, NE 1/4, SE 1/4, Sec 13, T5S, R17E. 21 June 1994. David G. Smith. Oklahoma Museum of Natural History (OMNH 35453). Verified by Laurie J. Vitt. Adult collected in a mud puddle on a gravel road (old Oklahoma Rt. 93) ca. 4 km SE of One Creek entrance to Hugo Wildlife Management Area during midday. New county record (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman. 370 pp.).

Submitted by **DAVID G. SMITH**, Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA.

KINOSTERNON FLAVESCENS FLAVESCENS (Yellow Mud Turtle). USA: NEW MEXICO: Socorro Co: Bosque del Apache National Wildlife Refuge, Unit 11 pond, 2.4 km NNE Refuge headquarters. 11 July 1996. J. N. Stuart. University of New Mexico Museum of Southwestern Biology (MSB) 60412. Verified by C. W. Painter. First record for county; other confirmed records for Rio Grande Valley are from downstream of Caballo Dam (Dona Ana and Sierra counties) and an introduction in Sandoval County (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xx + 431 pp.). Specimen may be introduced because no other *K. flavescens* have been found at Refuge despite extensive trapping. Collected under U.S. Fish and Wildlife Service Special Use Permit No. 73627.

Submitted by **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

STERNOTHERUS ODORATUS (Common Musk Turtle). USA: INDIANA: Union Co: Whitewater State Park: extreme NE margin of Whitewater Lake, 39°37'23"N, 84°57'37"W. 9 August 1996. Matt Rail and Art Reber. UF 104530. Verified by David L. Auth. Specimen caught on trotline in 0.75 m of water. New county record (Minton 1997, Amphibians and Reptiles of Indiana. Second ed. Indiana Acad. Sci., Indianapolis. In press).

Submitted by **CAMERON A. YOUNG** and **JOHN B. IVERSON**, Joseph Moore Museum, Department of Biology, Earlham College, National Road West, Richmond, Indiana 47374, USA.

TRACHEMYS SCRIPTA SCRIPTA (Yellowbelly Slider). USA: VIRGINIA: Gloucester Co: 1.6 km E White Marsh, West Branch of Severn River. 24 June 1996. John A. Musick. USNM 509512. Verified by George R. Zug. Adult, non-gravid female (262 mm carapace length, 245 mm plastron length, 2581 g body mass) found adjacent to water-filled ditch on road. Extension of eastern part of range across York River, 16 km north of nearest record in City of Newport News. First record for the middle peninsula of Virginia and Gloucester County (Mitchell 1994, The Reptiles of Virginia. Smithsonian Inst. Press. 352 pp.).

Submitted by **JOSEPH C. MITCHELL**, Department of Biology and School of Continuing Studies, University of Richmond, Richmond, Virginia 23173, USA, and **JOHN A. MUSICK**, Virginia Institute of Marine Science, P.O. Box 1346, Gloucester Point, Virginia 23062, USA.

SAURIA

ANOLIS CAROLINENSIS CAROLINENSIS (Northern Green Anole) USA: TEXAS: Ellis Co: Bristol. 11 October 1996. Debbie M. Arnold. Navaro College 1996.10.11.1L. Verified by Tom Vance. New county record; partly fills hiatus of its western range. (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.; Vance 1992, Bull. Maryland Herpetol. Soc. 27(2):48–89; Vermersch 1992, Lizards and Turtles of South-Central Texas. Eakin Press, Austin. 170 pp.; Hibbitts and Hibbitts 1994, Herpetol. Rev. 25(1):35–36).

Submitted by **DEBBIE M. ARNOLD**, 403 Old Walnut, Ennis, Texas 75119, USA.

CROTAPHYTUS BICINCTORES (Mojave Black-collared Lizard). USA: ARIZONA: Maricopa Co: White Tank Mountains, NE end, access off of Bell Road. 16 April 1996. Bradford D. Hollingsworth and Erik W. A. Gergus. TNHC 53903. Verified by Jimmy A. McGuire. The White Tank Mountains lie 40 km west of

Phoenix, north of the Gila River, and represent the easternmost distribution of *C. bicinctores* in Maricopa County. The nearest distributional records include Wickenburg (UIMNH 74801) and the Gila Bend Mountains, a distance of 40 km to the NW and 55 km to the SSW, respectively (McGuire 1996, Bull. Carnegie Mus. Nat. Hist. 32:1–143).

Submitted by **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and **ERIK W. A. GERGUS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287, USA.

CROTAPHYTUS NEBRIUS (Sonoran Collared Lizard). USA: ARIZONA: PINAL CO: Sacaton Mountains, W of Rt. 387, access off of Hopi Road. 14 April 1996. Bradford D. Hollingsworth and Erik W. A. Gergus. TNHC 53904. Verified by Jimmy A. McGuire. First confirmed county record; specimen was collected on the W side of the Sacaton Mountains, which are divided by Rts. 10 and 387. Nearest distribution records include the Silver Bell Mountains (SDSNH 68648–49) and 20 mi SW of Phoenix in the Sierra Estrella (KU 14860), a distance of 70 km to the SSE and 55 km to the NW, respectively (McGuire 1996, Bull. Carnegie Mus. Nat. Hist. 32:1–143).

Submitted by **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and **ERIK W. A. GERGUS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287, USA.

EUMECES FASCIATUS (Five-lined Skink). USA: ILLINOIS: MCHENRY CO: Northern Roofing Company, Rt. 47, Huntley. 11 September 1996. Michael Abmbrogio. The Museum of Northern Illinois University (HDW-NIU 1621). Verified by Harlan Walley. Specimen found basking near skid of roofing insulation. New county record; fills gap between Cook and Lake counties to the east (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, Dekalb, Illinois 60115, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: GEORGIA: CHATHAM CO: Savannah historic district, Forsythe Park/Whittaker Street, 3.7 mi (6.2 km) W of Savannah River (Georgia-South Carolina state line). 29 September 1996. Michael G. Frick. Savannah Science Museum (SSM 96.13759–96.13760). Verified by John B. Jensen. Specimens caught in ivy on brick wall. New county record (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.; Williamson and Moulis 1994, Distribution of Reptiles and Amphibians in Georgia. Vols. 1–2. Savannah Science Museum Special Publication No. 3. Savannah Science Museum, Georgia. 912 pp.); probably an established population since individuals of different size classes have been observed.

Submitted by **MICHAEL G. FRICK**, Savannah Science Museum, 4405 Paulsen Street, Savannah, Georgia 31405, USA.

KENTROPIX STRIATA (Striped Kentropyx) VENEZUELA: ARAGUA: Maracay, El Limón, Estación de Fuana, 500 m. 25 November 1988. Ramón Rivero. Museo de la Estación Biológica de Rancho Grande, Maracay (EBRG 2308); ESTADO GUARICO: San Juan de los Morros, Las Acequias, 480 m. 13 April 1996. Marco Natera. EBRG 3255, 3256. Verified by Luis Fernando Navarrete. First record for the states of Aragua and Guárico, and northernmost localities in the Central Region of Venezuela [Gallenger and Dixon 1992, Boll. Mus. Reg. Sci. Nat. Torino 10(1):125–171; Avila-Pires 1995, Lizards of Brasilian Amazonia (Reptiles: Squamata). Zool. Verh. 299:529–535].

Submitted by **JESUS MANZAMILLA**, Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela, Apartado Postal 4579, Maracay 2101-A, Aragua, Venezuela, **RAMON RIVERO**, Museo de la Estación Biológica de Rancho Grande, El Limón, Aragua, Venezuela, and **MARCO NATRA**, Universidad Rómulo Gallegos, San Juan de los Morros, Guárico, Venezuela.

LIOLAEMUS PSEUDOANOMALUS (Tree Iguana). ARGENTINA: SAN JUAN: DEPARTMENT ULLUM: 12 km W San City on Loma de las Tapias Hill (31°29'S, 68°39'W). April 1995. Juan Carlos Acosta. March 1996. Victor Contreras. Herpetological Collection, Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina (IMCN-UNSJ 108 [juv] and 109 [hatchlings]). Verified by Luciano Javier Avila. Extends range ca. 67 km from Médanos Grandes, Department Caucete (Cei 1986, Mon. IV Mus. Reg. Sci. Nat. Torino. 527 pp.).

Submitted by **JUAN CARLOS ACOSTA** and **FERNANDO MURÚA**, Instituto y Museo de Ciencias Naturales, Universdad Nacional de San Juan, Avenida Libertador (Oeste) N° 315, C.P. 5400, San Juan, Argentina.

OPHIODES YACUPOI (Mboi-pepé, Yacupoi Worm Lizard) ARGENTINA: CORRIENTES, DEPARTMENT MBURUCUYÁ: Campo Nalda (28°08'S, 58°21'W). 16 October 1995. Enrique Laffont. Universidad Nacional del N.E. (UNNEC 04848); Rt. 86 W Mburucuyá (28°03'S, 58°11'W). 30 November 1995. Ruben Maletti and Carlos Alberto Saibene. UNNEC 04880. Both verified by Blanca Beatríz Alvarez. First record for province. Other Argentine provinces where species has been recorded are: Misiones (Gallardo 1966, Rev. Mus. Arg. de Cs. Nat. Zool. 9[6]:123–146) and Entre Ríos (Genise 1983, Bol. As. Herp. Arg. 1[3]:18). Cited also for Uruguay and Brazil (Peters and Donoso Barros 1970, Bull. U.S. Natl. Mus. 297:1–293).

Submitted by **SILVANA BEATRIZ MONTANELLI**, Parque Nacional Mburucuyá, C.C. N° 1 (3427) Mburucuyá, Corrientes, Argentina, and **JUAN CARLOS CHEBEZ**, Delegación Técnica Regional NEA, Avenida Victoria Aguirre 66 (3370) Pto. Iguazú, Misiones, Argentina.

PHRYNOSOMA MODESTUM (Roundtail Horned Lizard). USA: ARIZONA: GILA CO: Mohave Point, San Carlos Lake, San Carlos Indian Reservation, 9 km (airline) NE of Coolidge Dam. 1 April 1989. Amy Lynn Mayne. Arizona State University Photo Collection (ASU PC 001–002). Verified by M. J. Fouquette, Jr. New county record; extends range 48 km (airline) NW of Fort Thomas (Tanner 1958, Herpetologica 14:195).

Submitted by **PETER J. MAYNE**, 17510 North 85th Lane, Peoria, Arizona 85382, USA.

PHYLLODACTYLUS XANTI (Cape Leaf-toed Gecko). MÉXICO: BAJA CALIFORNIA SUR: Isla Pardo, one of five small islands in a group collectively known as Islas Los Candeleros located SW of Isla Danzante in the vicinity of Loreto (Crumpton 1991, Baja Explorer: Topographic Atlas Directory. ALTI Publishing, La Jolla, California; Williams 1988, Baja Boater's Guide: Volume II—Sea of Cortéz. H. J. Williams Publications, Sausalito, California). 22 March 1996. L. Lee Grismer, Bradford D. Hollingsworth, Humberto Wong, and Michael R. Cryder. La Sierra University Photographic Collection (LSUPC L3026). Verified by Lester E. Harris. First record for Isla Pardo (Murphy and Ottley 1984, Ann. Carnegie Mus. Nat. Hist. 53:207–230). The

specimen was found during the day beneath a pile of rocks on the cobblestone beach.

Submitted by **MICHAEL R. CRYDER**, Department of Natural Sciences, Loma Linda University, Loma Linda, California, 92350, and Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California, 92350, and Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, and **HUMBERTO WONG**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

SAUROMALUS ATER ATER (Espiritu Santo Chuckwalla). MÉXICO: BAJA CALIFORNIA SUR: Isla Pardo, one of five small islands in a group collectively known as Islas Los Candeleros, located SW of Isla Danzante in the vicinity of Loreto. Isla Pardo is the southernmost island found immediately across from Punta Candeleros (Williams 1988, Baja Boater's Guide: Volume II—Sea of Cortéz. H. J. Williams Publications, Sausalito, California). 22 March 1996. Bradford D. Hollingsworth, L. Lee Grismer, and Michael R. Cryder. La Sierra University Photographic Collection (LSUPC L3025). Verified by Lester E. Harris. First record for Isla Pardo, an island not previously mentioned in the herpetological literature (Murphy and Ottley 1984, Ann. Carnegie Mus. Nat. Hist. 53:207–230). Specimen is referred to *S. ater ater* based on its geographic proximity to the closest insular population of *Sauromalus* (Murphy and Ottley 1984, op. cit.) and was photographed and released on site.

Submitted by **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, **L. LEE GRISMER** and **HUMBERTO WONG**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, and **MICHAEL R. CRYDER**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA

UROSAURUS NIGRICAUDUS (Blacktail Brush Lizard). MÉXICO: BAJA CALIFORNIA SUR: Islas Las Islitas, Las Tijeras and Pardo, three of five islands known collectively as Islas Los Candeleros located SW of Isla Danzante in the vicinity of Loreto (Crumpton 1991, Baja Explorer: Topographic Atlas Directory. ALTI Publishing, La Jolla, California; Williams 1988, Baja Boater's Guide: Volume II—Sea of Cortéz. H. J. Williams Publications, Sausalito, California). 22 March 1996. L. Lee Grismer, Bradford D. Hollingsworth, Michael R. Cryder, and Humberto Wong. La Sierra University Photographic Collection (LSUPC L3022-24). Verified by Lester E. Harris. Specimens from all three islands were captured, photographed, and released on site. These are three new insular records for *U. nigricaudus* as well as three new islands not mentioned previously in the herpetological literature (Murphy and Ottley 1984, Ann. Carnegie Mus. Nat. Hist. 53:207–230). This constitutes one of four new herpetological records for Isla Pardo (Cryder et al. 1997, Herpetol. Rev. 28:50–51; Grismer et al. 1997, Herpetol. Rev. 28:51; Hollingsworth et al. 1997, Herpetol. Rev. 28:51), the largest (0.06 km^2) of the five islands.

Submitted by **HUMBERTO WONG** and **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, and **BRADFORD D. HOLLINGSWORTH** and **MICHAEL R. CRYDER**, Department of Natural Sciences, Loma Linda University, Loma Linda, California, 92350 USA and Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

SERPENTES

ATRACTUS TAENIATUS (Ground Snake) ARGENTINA: CORRIENTES: DEPARTAMENTO SANTO TOME: Santo Tome. (28°33'S, 56°02'W). 10 July 1995. L. Shoijet. Coleccion Herpetologica de la Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 04979, female). Verified by A. Giraudo. First province record (mentioned as probable by Williams and Francini 1991, Bol. Mus. Reg. Sci. Nat. Torino 9(1):61–62).

Submitted by **LAURA RAQUEL REY**, Centro Regional Productor de Suero Antiofidico, Departamento de Herpetologia, Ministerio de Agricultura, Ganaderia, Industria y Comercio, Avenida Costanera No. 255, (3400) Corrientes, Argentina, and **MARIA LUISA LIONS** Anatomia Comparada, Facultad de Ciencias Exactas y Naturales, UNNE, 9 Julio 1449, (3400) Corrientes, Argentina.

CHILOMENISCUS CINCTUS (Banded Sand Snake). MÉXICO: SONORA: Isla Tiburón, Arroyo Sausál, SW side of island. 31 October 1958. R. Felger. UAZ 23194. Verified by Peter A. Holm. A second specimen was collected by R. Felger on 1 May 1964 from the same locality (UAZ 23195). *Chilomeniscus stramineus* has also been reported from Isla Tiburón (Grismer 1994, Herpetol. Nat. Hist. 2(2):17–40), and is substantiated by three specimens of *C. stramineus* mislabeled as *C. cinctus* from El Tecomate on the northern end of Isla Tiburón (USNM 222051–53). In addition to Isla Cerralvo, this is the second reported instance where two species of *Chilomeniscus* occur on the same island (Powers and Banta 1974, J. Herpetol. 8:386–387).

Submitted by **HUMBERTO WONG**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

CROTALUS ENYO ENYO (Baja California Rattlesnake). MÉXICO: BAJA CALIFORNIA SUR: Isla Pardo, one of five small islands in a group collectively known as Islas Los Candeleros, located SW of Isla Danzante, 13.5 km south of Puerto Escondido (Crumpton 1991, Baja Explorer: Topographic Atlas Directory. ALTI Publishing, La Jolla, California; Williams 1988, Baja Boater's Guide: Volume II—Sea of Cortéz. H. J. Williams Publications, Sausalito, California). 22 March 1996. L. Lee Grismer, Bradford D. Hollingsworth, Humberto Wong, and Michael R. Cryder. La Sierra University Photographic Collection (LSUPC S757-62). Verified by Lester E. Harris. First record from Isla Pardo, an island not previously mentioned in the herpetological literature (Murphy and Ottley 1984, Ann. Carnegie Mus. Nat. Hist. 53:207–230). Specimen was found beneath rocks on crest of the island (ca. 100 m), and was photographed and released on site. It is noteworthy that this was one of four species of reptiles (see Cryder et al.; Hollingsworth et al.; Wong et al.; this volume) discovered on this extremely small island (ca. 0.06 km^2).

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA; **BRADFORD D. HOLLINGSWORTH**, and **MICHAEL R. CRYDER**, Department of Natural Sciences, Loma Linda University, Loma Linda, California, 92350 USA and Department of Biology, La Sierra University, Riverside, California 92515-8247 USA, and **HUMBERTO WONG**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

DIADOPHIS PUNCTATUS (Ringneck Snake). USA: NEW MEXICO: OTERO CO: N of Co. Rd. F-1, 1/2 km (air) W Pate Windmill (NE 1/4 Sec. 25, T25S, R12E), ca. 1500 m elev. 28 July 1996. Deborah Gordon. Laboratory for Environmental Biology, University of Texas at El Paso (UTEP 16438). Verified by C. S. Lieb.

Male, 425 mm SVL, 105 mm tail; 13.5 g weight; "ringless" pattern morph *of D. p. regalis* collected under a fallen yucca in open grassland. The specimen is apparently the second record for Otero County, and from a locality about 65 air km equidistant from all others in New Mexico (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico, Univ. New Mexico Press, Albuquerque, xix + 431pp).

Submitted by **DEBORAH J. GORDON**, Laboratory for Environmental Biology and Department of Biological Sciences, Universtiy of Texas at El Paso, El Paso, Texas 79968-0519, USA.

HETERODON NASICUS NASICUS (Plains Hognose Snake). USA: NEW MEXICO: CIBOLA CO: Laguna Reservation, 3.6 km N and 3.2 km E of Laguna, T10N, R5W, Sec. 27. 23 September 1996. S. E. Carr. University of New Mexico Museum of Southwestern Biology (MSB 60414). Verified by C. W. Painter. First record for county; extends range ca. 50 km W from Rio Grande Valley, Bernalillo County (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xx + 431 pp.).

Submitted by **STACEY E. CARR**, Department of Natural Resources, Pueblo of Laguna, P.O. Box 194, Old Laguna, New Mexico 87026, USA; and **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

HYDROPS TRIANGULARIS (Triangle Water Snake). BRAZIL: STATE OF PIAUÍ: Ribeiro Goncalves (7°32'S 45°14'W). Museu de História Natural Capão da Imbuia, Curitiba (MHNCI 2566). Verified by Sérgio A. A. Morato. Male (SVL 399 mm, tail 107 mm, dorsal rows 17-15-15, 156 ventrals, 58 subcaudals); represents first record for state of Paiuî and the River Parnaíba basin, and also is the most eastern record for the species.

Submitted by **RUBENS N. YUKI**, Universidade Federal do Paraná and Museu Paraense Emílio Goeldi, Postal Box 399, Belém, Para, Brazil, CEP 66017-970. E-mail: yuki@museu. goeldi.br

LAMPROPELTIS GETULA NIGRA (Black Kingsnake). USA: INDIANA: DECATUR CO: DOR 0.64 km N Decatur-Jennings County line on Ind. Rt. 3. 18 May 1996. Cameron A. Young. UF 104038. Verified by David L. Auth. New county record; ca. 18 km range extension NE from previous records (Minton 1997, Amphibians and Reptiles of Indiana. Second ed. Indiana Acad. Sci., Indianapolis. In press). This record corroborated by two more DOR *L. g. nigra* found on the same day: Jennings Co: 1.1 km S Sand Creek on Indiana Rt. 3, (UF 104037) and 1.1 km N Sand Creek on Indiana Rt. 3 (carcass not saved but verified by John B. Iverson).

Submitted by **CAMERON A. YOUNG** and **JOHN B. IVERSON**, Joseph Moore Museum, Department of Biology, Earlham College, National Road West, Richmond, Indiana 47374, USA.

LAMPROPELTIS TRIANGULUM GENTILIS (Central Plains Milk Snake). USA: COLORADO: BACA CO: AOR Co. Rd. VV, 1.6 mi E jct Co Rd. 27. 1 September 1996. UNC-MNH Photographs 20–21. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY, JUSTIN HOBERT, ENOCH BERGMAN, BEN HILL, SCOTT BOBACK,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

MASTICOPHIS FLAGELLUM TESTACEUS (Western Coachwhip). USA: COLORADO: ARAPAHOE CO: Aurora, 21901 Hampden Avenue, Colorado Grange Museum, Plains Conservation Center, crawl space. 12 May 1992. T. Arneill, L. Czupryna, and F. Blanchard. UCM Herpetological Photographic Collection 130–131. Verified by Richard L. Holland. First county record; known range extension of 55 airline mi NW of nearest record to the SE, in NE El Paso County (Hammerson 1982, Amphibians and Reptiles in Colorado. Colorado Div. Wildlife, Denver. 131 pp.).

Submitted by **FRAN BLANCHARD, T. ARNEILL,** and **L. CZUPRYNA**, Plains Conservation Center, 21901 Hampden Avenue, Aurora, Colorado 80013, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

PSOMOPHIS GENIMACULATUS (Spirit Ground Snake). ARGENTINA: FORMOSA: DEPARTAMENTO BERMEJO: Reserva Natural Formosa (24°18'S, 61°45'W). 29 June 1995. M. L. Lions and J. Cespedez. Herpetological collection of Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 04938). Verified by G. Scrocchi. First province record and second record for Argentina.

Submitted by **MARIA LUISA LIONS** and **BLANCA BEATRIZ ALVAREZ**, Compared Anatomy Division, Biology Department, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400 Corrientes, Argentina.

RAMPHOTYPHLOPS BRAMINUS (Braminy Blind Snake). CENTRAL AFRICAN REPUBLIC: Bangui: pk 5. 31 January 1996. Laurent Chirio. Museum national d'Histoire naturelle, Paris (MNHN 1996.6760). Verified by Van Wallach. First report for the country and for inland Africa. Previously only known from coastal areas of Africa (Nussbaum 1980, Herpetologica 36:215–221; Trape 1990, Bull. Soc. Herp. France 55:40–41).

Submitted by **LAURENT CHIRIO** and **IVAN INEICH**, Museum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles & Amphibiens), 25 rue Cuvier, F-75005 Paris, France. E-mail: ineich@cimrs1.mnhn.fr

RHINOCHEILUS LECONTEI TESSELLATUS (Texas Longnose Snake). USA: COLORADO: KIOWA CO: DOR, Rt. 287, 3.3 mi N jct Co. Rd. V. 5 September 1996. UNC-MNH 314. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **BEN HILL, ENOCH BERGMAN, CHAD MONTGOMERY, JUSTIN HOBERT, SCOTT BOBACK**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

SISTRURUS CATENATUS EDWARDSII (Desert Massasauga) USA: COLORADO: PROWERS CO: DOR, Rt 287 ca. 50 m N jct. Prowers/Baca County line. 21 August 1996. UNC-MNH 212. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **JUSTIN HOBERT, SCOTT BOBACK, CHAD MONTGOMERY, ENOCH BERGMAN, BEN HILL**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences,

501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

TROPIDOCLONION LINEATUM LINEATUM (Lined Snake) USA: COLORADO: CHEYENNE CO: DOR, Rt 287, 3.1 mi W jct Co Rd. 8. 5 September 1996. UNC-MNH 186. Verified by Hobart M. Smith and David Chiszar. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc.).

Submitted by **ENOCH BERGMAN, BEN HILL, CHAD MONTGOMERY, JUSTIN HOBERT, SCOTT BOBACK**, and **STEPHEN P. MACKESSY**, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

TYPHLOPS PORRECTUS (Slender Worm Snake). THAILAND: CHIANG MAI PROVINCE: Doi Pui (Pui Mtn., ca. 20 km NW of city of Chiang Mai in Doi Suthep Range), 18°50'N, 98°54'E, 1300 m. Thai National Reference Collection, Bangkok (TNRC 523–607). Verified by Van Wallach. Known from Pakistan, India, Bangladesh, Sri Lanka, and Myanmar (Hahn 1980, Das Tierreich 101:67; Khan 1988, Hamadryad 13:5); first record for Thailand. Extends known range eastward from Pyawbwe and Pegu (MCZ 3702), Myanmar by ca. 400 km.

Submitted by **MEREL J. COX**, 695/17 Pracharaj Road, Soi Pracharaj 19, Bangsue, Bangkok 10800, Thailand, and **JARUJIN NABHITABHATA**, Thailand Institute of Scientific and Technological Research, 196 Phahonyothin Road, Bangkhen, Bangkok 10900, Thailand.

Anuran Records from the Piedmont of South Carolina, USA

WILLIAM E. SNYDER
and
STEVEN G. PLATT
Department of Biological Sciences, Clemson University
Clemson, South Carolina 29634-1903, USA

Collecting in the piedmont of northwestern South Carolina has revealed several anuran distribution records based on comparisons with range maps of Martof et al. (1980), and localities listed in Chamberlain (1939) and Penny (1952). Voucher specimens were deposited in the Clemson University Vertebrate Collection (CUSC). Each specimen represents a county record. Identification was verified by Richard R. Montanucci unless otherwise stated.

Hyla cinerea (Green Treefrog). GREENWOOD CO: beaver swamp along Reedy Branch of Long Cane Creek at S. C. Rt. 112 bridge, ca. 5 km NW Bradley, Sumter National Forest. 21 August 1995. Steven G. Platt. CUSC 1266.

Hyla cinerea (Green Treefrog). ABBEVILLE CO: swamp along Mountain Creek ca. 0.25 km downstream from Parsons Mountain Lake Recreation Area, Sumter National Forest. 21 August 1995. Steven G. Platt. CUSC 1267.

Hyla cinerea (Green Treefrog). MCCORMICK CO: beaver swamp, Long Cane Creek Arm of Clark Hill Reservoir at jct. S. C. Rts. 28 and 8, ca. 13.3 km NW of McCormick. 2 September 1995. CUSC 1270.

Hyla cinerea (Green Treefrog). ANDERSON CO: Big Generostee Creek at S. C. Rt. 412, 1.5 km E jct. S. C. Rt. 187, ca. 6.5 km NW Starr. 12 July 1990. Amanda Billings. Verified by Tom Mann. CUSC 899.

These records of *Hyla cinerea* represent a significant range expansion in the Savannah River drainage, from the coastal plain north into the piedmont. It is unclear whether previous workers overlooked *Hyla cinerea* in these counties or a recent range expansion has occurred in response to major habitat alterations.

Hyla squirella (Squirrel Treefrog). EDGEFIELD CO: ditches at jct. S. C. Rts. 230 and 23, ca. 10.5 km W of Edgefield, Sumter National Forest. 25 August 1995. Steven G. Platt. CUSC 1268.

Hyla gratiosa (Barking Treefrog). EDGEFIELD CO: Forest Service Road 639 at Lick Fork Lake Campground, Lick Fork Lake Recreation Area, ca. 3 km S jct. S. C. Rts. 23 and 230, Sumter National Forest. 25 August 1995. Steven G. Platt. CUSC 1273.

Hyla gratiosa (Barking Treefrog). GREENWOOD CO: Verdery, S. C. Rt. 47, ca. 0.9 km W of jct. S. C. Rt. 10. 26 August 1995. Steven G. Platt. CUSC 1269.

Bufo terrestris (Southern Toad). MCCORMICK CO: Clarks Hill, abandoned homesite, U. S. Rt. 28, ca. 3.3 km S jct. S. C. Rt. 88. April 1994. William E. Snyder and Steven G. Platt. CUSC 1137.

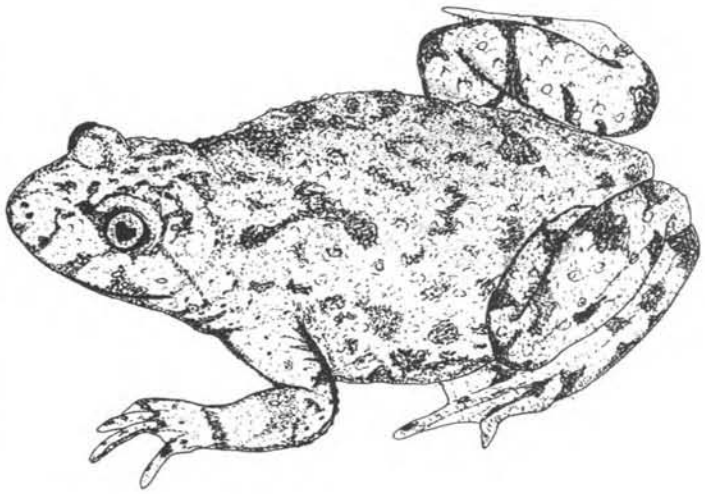
Acknowledgments.—Julian R. Harrison and Richard R. Montanucci reviewed an early draft of this manuscript. Stanlee Miller assisted with specimen preparation, and John Scavo, B. Anne Ditte, and Hong Liu assisted in fieldwork.

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Bombina bombina. Illustration by Dan Cogălniceanu.

BOOK REVIEWS

Contributions to West Indian Herpetology: A Tribute to Albert Schwartz, edited by Robert Powell and Robert W. Henderson. 1996. Society for the Study of Amphibians and Reptiles: 457 pp. Hardcover. US $60 plus shipping. ISBN 0-916984-37-0.

BRIAN I. CROTHER
Department of Biology, Southeastern Louisiana University
Hammond, Louisiana 70402, USA
e-mail: bcrother@selu.edu

The basis of this volume comes from an SSAR symposium held in 1994 in honor of Albert Schwartz (because I knew him well, I will use Al), who had passed away two years prior. Arguably, anyone working on West Indian biology (not just herpetology, although his greatest contributions were there) knew Al's work, and it is unfortunate such a volume in his honor was not done while he was alive. There is one now (and another on the way) and I think Al would have approved.

I said "basis" above because the book is more than a typical symposium volume in that it contains, besides the symposium papers, a list of all Al's herpetological publications, a checklist of West Indian amphibians and reptiles, and color plates. The checklist includes 622 species (up from 585 species in Schwartz and Henderson, 1991) with each annotated account containing general distribution information, type locality, the complete citation of the original description, and the best source of pertinent literature. This latter feature unfortunately appears to be restricted to species accounts in the *Catalogue of American Amphibians and Reptiles*. Thus, for example, in the accounts of the two *Bothrops* species one is not referred to Campbell and Lamar's (1989) work on venomous reptiles of Latin America. This is, however, a trivial criticism. A more serious criticism of the checklist is that the authors (Powell, Henderson, Adler, and Dundee) implemented new taxonomies without formal argumentation. The checklist put *Peltaphryne* in synonymy with *Bufo* (contrary to Pregill 1981) and synonymized the anguid genera *Sauresia, Wetmorena*, and four species of *Diploglossus* with *Celestus*. In addition, the changes to anguid taxa were done without reference to Savage and Lips (1993) who used formal arguments to revise the same genera. Savage and Lips (1993) retained *Sauresia* and *Wetmorena*, but put the same *Diploglossus* species in *Celestus*.

There are 71 color plates of living specimens, 33 of which are lizards (including two amphisbaenids), 23 snakes, 12 frogs, 2 turtles and 1 crocodilian. Most of the plates are 3.5" x 2.25" with a few smaller, but they are largely of good quality. Arguably, the standout is the gaudy *Anolis bahorucoensis*, but the gaping mouth of *Cyclura nubila* and the upright pose of *Mastigodryas bruesi* are also classic.

The book is divided into seven parts: 1) a preface with a forward (Schoener) and introduction (Powell and Henderson); 2) an Albert Schwartz section with personal commentaries from William Duellman, Richard Thomas, and Robert Henderson; 3) a West Indian herpetology section composed of a brief history, the checklist, and the color plates; 4) a section on Evolution, Systematics and Biogeography (8 papers); 5) Ecology and Behavior (12 papers); 6) Conservation (7 papers); and 8) additional abstracts from papers presented at the symposium (9 abstracts). Except for the preface and the personal remembrances, all the papers are summarized in French and Spanish (a nice touch). The literature cited is at the end of each paper and the index is devoted to scientific names.

The first two parts of the book are essentially personal accounts, stories and commentaries on the West Indies and Albert Schwartz. Some of the stories are quite entertaining, my favorite being Bill Duellman's account of Al laying out his first salamanders for fixing in formalin. The only paper in the third part gives a history of West Indian herpetology. This is not an easy task, but the authors cover a lot of ground in a short space and the chapter ends up providing a fine introduction to the subject.

The next three parts (four–six) contain a somewhat eclectic collection of research papers tied together by the fact they all were conducted in the West Indies or on West Indian organisms. The fourth part (evolution for simplicity) has papers on *Eleutherodactylus* (2 papers), *Osteopilus*, and *Sphaerodactylus* phylogeny, *Trachemys* biogeography, speciation in Jamaica, dispersal (or the lack thereof) between South America and the Lesser Antilles, and the origin of West Indian herpetofauna.

The fifth part (ecology and behavior) has a number of taxon-specific studies, including *Eleutherodactylus* (3 papers), *Osteopilus* (2), anoles (2), *Ameiva, Alsophis*, and *Epicrates* as well as two more general papers. One is on a rain forest food web in Puerto Rico and the other concerns spatial niche partitioning in a Hispaniolan lizard community. The sixth part (conservation) is comprised of papers concerning the species richness of the Exuma Cays, declining amphibians of Puerto Rico, sea turtle populations in Haiti, and several species-specific papers on *Cyclura collei, Epicrates monensis, Corallus hortulanus*, and *Crocodilus acutus*. The seventh part, the abstracts, contribute little to the volume and easily could have been omitted.

In general the contributions are all well written and edited (in my readings I found few errors). Among the 31 papers in this volume, I found two of more importance (for quite different reasons) than the others. One of the papers is on the origin of the West Indian herpetofauna (Hedges) and the other is on the documentation of declining amphibians in Puerto Rico (Joglar and Burrowes). Perhaps the most provocative, and what it provokes will depend on the reader, passage in the volume comes from Lazell's paper on speciation in Jamaica:

> "Real evolution frequently involves paraphyly, polyphyly, and parallelophyly. The symplesiomorphy of reproductive continuity may amalgamate and obliterate clades regardless of their ages. Dogmatic philosophies that attempt to codify 'relationship' while ignoring evolutionary realities are not of practical value for comprehending the real world—the world of lizards."

The paper by Joglar and Burrowes is significant because it adds documentation to a global phenomenon that is still in need of rising above the label of factoid. Yes, there is a task force addressing the problem, but that alone is not enough. The 1994 *Herpetologica* Points of View papers on the subject of amphibian decline carried a high level of uncertainty in their pages with regard to the decline's causes and even its reality. There is clearly a major disturbance (not counting habitat destruction) to which amphibians appear to be sensitive. Stebbins and Cohen (1995) suggest that chemicals may be involved in altering amphibian hormone levels and/or immune responses which in turn may affect development. Another possibility is that external agents (e.g., chemicals, UV radiation) may be opening up the amphibians to viruses which were previously non-lethal (Jay M. Savage, pers. comm.). Savage based his idea on the apparent stepping stone fashion in which amphibian populations are disappearing in Costa Rica. Regardless of the mechanism, studies like that of Joglar and Burrowes are important for localizing declining populations, and these populations

should become the focus of detailed work to at least get at secondary causes, if not the primary cause. In their conclusion, they hypothesize that similar declines are probably occurring in the Greater Antillean islands. I wonder what the frog populations are currently like at Al's favorite collecting sites of days gone by?

The one manuscript that is arguably the most contentious of all the studies in this volume, is Hedges' deliberation on the origin of the West Indian herpetofauna. The paper is an expansion of the Hedges et al. 1992 work in which an albumin immunological distance-based molecular clock was employed to test between dispersal and vicariance hypotheses for the origin of the herpetofauna. The conclusion in the 1992 paper and in this volume is the same: dispersal accounts for all the current West Indian herpetofauna, with the possible exception of *Eleutherodactylus* and *Cricosaura*, and he hedges on both of those decisions. For space considerations, I refer readers to two papers (Crother and Guyer 1996; Page and Lydeard 1994) that examine in detail different aspects of the Hedges et al. (1992) work and as such they also apply to the Hedges paper in this volume. To encapsulate, the two papers reject (for explicit reasons) the assertion that dispersal is the primary explanation for the origin of the West Indian herpetofauna.

There are a number of items in the Hedges paper in this volume worth discussing, but I will touch on only a few here and those are mostly items that do not overlap with Page and Lydeard (1994) and Crother and Guyer (1996). The representation of vicariance and dispersal models is uneven. The discussion of the proto-Antilles existence as questionable is askew. The existence of the Great Arc (= proto-Antilles) is not contested in the geological literature and is in fact important in dinosaur (and other vertebrates) exchange between North and South America (e.g., Gayet et al. 1992). The argument that the Dominican amber fossils are lower Miocene is unsubstantiated (see Poinar and Cannatella 1987; but see Grimaldi 1995). Hedges makes taxonomic judgements based on the immunological distance data, including the rejection of *Peltaphryne* (Pregill 1981) and the iguanian lizard classification of Frost and Etheridge (1989). The rejection of the latter is based on his conclusion that *Leiocephalus* is actually more closely related to *Crotaphytus* than to the South American lineages of *Stenocercus, Tropidurus*, or *Liolaemus* as suggested by Etheridge (1966), Frost (1987), Frost and Etheridge (1989), and corroborated by Pregill (1992). These are examples of a disturbing implication by Hedges that molecular data are inherently superior to morphological data. Interestingly, three studies in this volume (Anderson [*Osteopilus*], Lynch [*Eleutherodactylus*], and Kaiser [*Eleutherodactylus*]) disagree with Hedges' ideas on phylogeny.

Although the Hedges paper is a weak link in an otherwise fine volume, it should engender much discussion, but hopefully won't be blindly cited as THE explanation for the origin of the West Indian herpetofauna.

The handsomely jacketed volume (there are pictures of hand colored lithographs of *Chamaeleolis chamaelionides* and *Tropidophis maculatus* from Ramon de la Sagra's "Historia Fisica, Politica y Natural de la Isla de Cuba," Paris, 1838–1861) is worth the $60 (US). I highly recommend it not only for the reference information (history, checklist, Schwartz publications, color plates) but also for the broad array of interesting and sometimes arguably contentious studies. All in all, the editors (and authors) have done a fine job. Al would have appreciated it.

Acknowledgment.—I am grateful to Mary White for her comments on the review.

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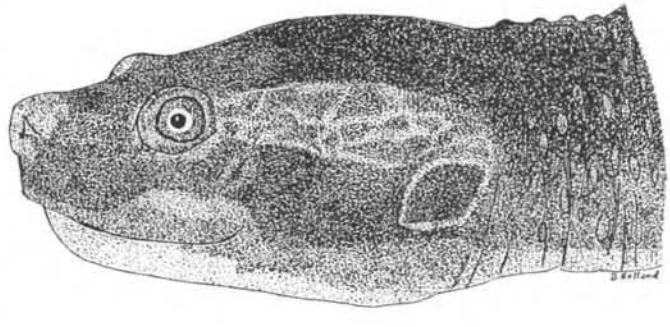
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Emydura australis. Illustration by Dan Holland.

Frog and Toad Calls of the Pacific Coast: Vanishing Voices. Carlos Davidson. 1995. Library of Natural Sound, Cornell Laboratory of Ornithology, 159 Sapsucker Woods Road, Ithaca, New York 14850, USA. E-mail: libnatsound@cornell.edu. Cassette Tape US $12.95, Compact Disc US $15.95.

WILLIAM P. LEONARD
Washington Natural Heritage Program
Department of Natural Resources, P.O. Box 47016
Olympia, Washington 98504-7016, USA
e-mail: bpmm490@wadnr.gov

In many parts of the world, there is an urgent need to document the distribution and abundance of amphibians. Sadly, the need for these data is driven in large part by the suspicion that many amphibian species are currently in decline. Nowhere does the amphibian decline problem seem more apparent than in the western United States and Canada, where seventeen species of frogs and toads reportedly have experienced declines (Stebbins and Cohen 1995). Fortunately, many groups are supporting efforts to assess the status of amphibian populations in portions of this region. As these groups gear up for this challenge, however, they often lack the resources to train persons interested in participating in survey efforts. *Pacific States Frog and Toad Calls: Vanishing Voices*, produced jointly by the Library of Natural Sound and the U.S. Forest Service, will serve as an important resource.

This guide presents recordings of the frog and toad calls of the North American Pacific Coast between northern Baja California and Alaska. The stated goal of the guide is to assist listeners to learn to identify the calls of the frogs and toads of the region. The CD (or cassette) contains recordings of twenty-five of the twenty-eight anurans known to inhabit the region; calls of *Ascaphus truei* (which is thought to be mute), *Pseudacris triseriata* (which barely enters the northeastern corner of British Columbia) and *Rana pretiosa* (see subsequent comments) have been omitted from the guide. The 63 minutes of recordings are organized into four parts: a reference section, a comparison of similar-sounding species, a test section, and longer recordings of selected choruses.

The recordings in the reference section are arranged in alphabetical order by family. This organization of calls facilitates comparing the calls of closely related species, and following along in *A Field Guide to Western Reptiles and Amphibians* (Stebbins 1985). The section includes thirty-nine different recordings, with at least one recording for each of the twenty-five species covered. Eight species are covered with additional recordings, illustrating subspecies differences, group choruses vs. individual calls, different call types (e.g., advertisement, release, alarm), and, in one instance, above-water and below-water calls.

Prior to a species' recording, Davidson gives the common and scientific name of the species, provides a phonetic description of the call, and describes the type(s) of calls that are to follow. The twenty-seven page booklet that accompanies the CD provides additional information on the calls, technical data for each recording, descriptions of calls, and breeding periods. The quality of every recording is exceptional. Davidson obviously went to great lengths to obtain and select the best available recordings.

Part two of the guide presents comparisons of the calls of similar-sounding species for three groups: bufonids (*Bufo alvarius, B. woodhousii, B. punctatus, B. microscaphus, B. californicus*, and *B. cognatus*), hylids (*Hyla cadaverina* and *H. regilla*), and ranids (*Rana boylii* and *R. muscosa*). This section will be of interest primarily to those living in the areas where there is an overlap in the ranges of the treated species.

The test section is divided into northern and southern test regions. The northern region includes coastal species occurring north of San Francisco, California and inland species north of the Sierra Nevada. The southern test section includes species occurring south of San Francisco and in the Sierra Nevada Range. In each of the two test sections, listeners are allowed to test their call recognition skills by listening to the call before Davidson reads the species name.

The final section contains five additional recordings chosen for their beauty. These recordings play for nine minutes without interruption. Chosen more for their musical quality than their potential to teach call identification skills, each is a welcomed part of the CD.

It is virtually impossible to publish a guide that will not rapidly be outdated in some regards because of systematic advances and changes in taxonomy. This CD is no exception. The on-going debate concerning *Hyla regilla/Pseudacris regilla* rears its head here. Davidson, like other authors, appears trapped in the middle of the taxonomic tug-of-war as to the rightful place of *regilla—Hyla, Pseudacris*, or some yet to be named genus (Cocroft 1994; Hedges 1986). Nonetheless, the most recent evidence suggests that *Hyla* is the most appropriate genus for *regilla*. A more significant problem concerns the recent revision of the *Rana pretiosa* complex (Green et al. 1996, and in press). The guide was completed just prior to the revision, which splits *R. pretiosa* into two species, *R. pretiosa* and *R. luteiventris*, both of which occur in the area covered by the guide. As a result, the guide identifies a recording of *Rana luteiventris* as *Rana pretiosa*, and lacks a recording of *Rana pretiosa*. This should not pose a significant problem to survey efforts, as the two species have similar sounding calls. Future editions should address these problems.

The guide achieves its goal in every regard. It will provide naturalists and herpetologists with an outstanding reference on frog and toad calls of the Pacific Coast of the United States and Canada. In addition to assisting with survey efforts, these recordings will almost certainly lead to an increased appreciation and awareness of the natural beauty of the frogs and toads of the Pacific Coast region.

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SSAR Committee Chairs and Coordinators

CHAIRPERSONS

Conservation
C. KENNETH DODD, JR.
National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
MARTHA L. CRUMP
Department of Biological Sciences, Box 5640
Northern Arizona University
Flagstaff, Arizona 86011, USA

Long Range Planning
ALAN H. SAVITZKY
Department of Biological Sciences
Old Dominion University
Norfolk, Virginia 23529-0266, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602-2597, USA

1997 Local Meeting
THEODORE W. PIETSCH
School of Fisheries
University of Washington
Box 355100
Seattle, Washington 98195, USA

Nominating
STEVE M. REILLY
Department of Zoology
107 Irvine
Ohio University
Athens, Ohio 45701, USA

Regional Society Liaison
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Resolutions
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Lawrence, Kansas 66045-2106, USA

Zoo Liaison
JEFF ETTLING
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Sedgwick County Zoo
5555 Zoo Boulevard
Wichita, Kansas 67212, USA

COORDINATORS

Common and Scientific Names
JOSEPH T. COLLINS, Coordinator
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
P.O. Box 709
Tucson, Arizona 85702-0709, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

Information for Contributors

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Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings. **Corresponding authors should include an e-mail address (if available); this will greatly facilitate communication with the editors.**

Originals of illustrative material (e.g., tables, photographs, or diagrams) should be submitted with the text, with appropriate precautions taken to ensure delivery without damage. Illustrations should be discussed in the text and numbered sequentially with Arabic numbers. References to illustrations should be placed in parentheses at the end of sentences. Original photographs should be submitted as black and white glossy prints. For further guidelines, authors should consult *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (6th edition, 1994, Council of Biology Editors, Inc., 11 South LaSalle Street, Suite 1400, Chicago, Illinois 60603, USA).

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E-mail: ssar@sluvca.slu.edu

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Herpetological Conservation
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Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: tyning@shaysnet.com

Advertising Manager
ELIZABETH A. JOHNSON
35 Eighth Street
Frenchtown, New Jersey 08825, USA
(908) 996-4056
E-mail: ejohnson@ptdprolog.net

Associate Editors

DANIEL D. BECK
Department of Biological Sciences
Central Washington University
Ellensburg, Washington 98926, USA
E-mail: beckd@cwu.edu

LEE A. FITZGERALD
Wildlife and Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
E-mail: Lfitzgerald@tamu.edu

DARYL R. KARNS
Biology Department
Hanover College
Hanover, Indiana 47243, USA
E-mail: karns@hanover.edu

JEFFREY LOVICH
U.S. Geological Survey
Biological Resources Division
Palm Springs Field Station
63500 Garnet Avenue
North Palm Springs, California
92258-2000, USA
E-mail: jeffrey_lovich@usgs.gov

DEANNA H. OLSON
USDA Forestry Science Lab
3200 SW Jefferson Way
Corvallis, Oregon 97331, USA
E-mail: olsond@ccmail.orst.edu

BRIAN W. BOWEN
BEECS Genetic Analysis Core
University of Florida
12085 Research Drive
Alachua, Florida 32615, USA
E-mail: bowen@icbr.ifas.ufl.edu

Section Editors

Book Reviews
AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: Herpbooks@sisna.com

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106, USA

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
E-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo
Miguel Lillo 251
4000 Tucumán, Argentina
E-mail: postmaster@scro.untmre.edu.ar

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
E-mail: cwpaint@unm.edu

Natural History Notes
R. KATHRYN VAUGHAN
Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
E-mail: rkvaughan@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
E-mail: pstone@aix1.ucok.edu

Copy Editors: *Ellin Beltz, Anne M. Maglia, Jenny Pramuk, Martin J. Rosenberg, Christopher Sheil, Amy Sproston*

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1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July (Theodore Pietsch, Chair).
1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).

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26 June – 2 July 1997
University of Washington, Seattle, USA

Keynote Address: "FROGS, UNPREDICTABILITY, FLEXIBILITY, AND THE FUTURE," by Martha Crump (Northern Arizona University).

Symposium: "NUCLEAR DNA AND THE EVOLUTIONARY GENETICS OF FISHES, AMPHIBIANS AND REPTILES." *Organizer*: Andrew M. Shedlock, University of Washington, FTR, Box 355100, Seattle, Washington 98195, USA; e-mail: shedlock@u.washington.edu.

Symposium: "ECOLOGICAL PROCESSES: INSIGHTS FROM FIELD EXPERIMENTS AND NATURAL HISTORY." This symposium celebrates the career and contributions of Margaret McBride Stewart in honor of her 70th birthday. *Organizer:* Kiisa C. Nishikawa, Department of Biological Sciences, Northern Arizona University, Flagstaff, Arizona 86011-5640, USA; e-mail: Kiisa.Nishikawa@nau.edu.

Symposium: "COMPARISONS AND CURRENT USES OF PHYLOGENETIC APPROACHES TO ICHTHYOLOGY AND HERPETOLOGY." *Organizer*: Mark Pyron, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA; e-mail: Pyron@uiuc.edu.

Symposium: "CHEMICAL ECOLOGY OF PREDATOR/PREY RELATIONSHIPS AMONG FISHES, AMPHIBIANS, AND REPTILES." *Organizer*: Alicia Mathis, Department of Biology, Southwest Missouri State University, Springfield, Missouri 65804-0095, USA; e-mail: sam477f@vma.smsu.edu.

Symposium: "LIFE HISTORY AND ECOLOGY OF CHELONIANS." *Organizer*: R. Bruce Bury, National Biological Service, 3080 SE Clearwater Drive, Corvallis, Oregon 97333, USA; e-mail: buryb@mail.cor.epa.gov.

Symposium: "BIOSYSTEMATICS, BEHAVIORAL ECOLOGY, AND CONSERVATION OF IGUANAS." *Organizer:* William K. Hayes, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA; e-mail: whayes@ccmail.llu.edu.

Conservation Forum: Point-Counterpoint. "SUSTAINABLE USE OF AMPHIBIAN AND REPTILE RESOURCES." *Organizer:* C. Kenneth Dodd, Jr., SSAR Conservation Committee, 5222 NW 56th Court, Gainesville, Florida 32653, USA; e-mail: kdodd@nervm.nerc.ufl.edu.

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Student Paper Awards: Seibert Prizes will be awarded to the two best student-presented papers at the meeting ($250 first prize, $150 second prize).

Multimedia Presentations: "HERPS OF THE WEST" and "AMPHIBIANS OF THE APPALACHIANS" by David Dennis and Eric Juterbock; "HERPETOLOGICAL NAMESAKES" by Kraig Adler and David Dennis.

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Further Details: Contact T. W. Pietsch, School of Fisheries, University of Washington, Box 355100, Seattle, Washington 98195-5100, USA. Tel. (206) 543-8923; e-mail: twp@fish.washington.edu. Meeting Announcement and Call for Papers were mailed to all U.S., Mexican, and Canadian members of SSAR in late November 1996. Other persons wishing to receive this information may do so by contacting Ted Pietsch at the address above. A World Wide Web page devoted to meeting information may be found at: http://artedi.fish.washington.edu/asih/asih97.html.

SSAR BUSINESS

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Lee Fitzgerald's move to Associate Editor creates a vacancy for Natural History Notes, where Lee handled hundreds of submissions over a three-year period. That role will now be assumed by Kathryn Vaughan (Texas A&M), who will handle the NHN submissions for lizards, amphisbaenians, crocodilians, and Sphenodontia. Future contributors to Natural History Notes should consult that section elsewhere in this issue for manuscript submission details.

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Continuing a successful tradition, the SSAR Student Travel Awards Committee proudly announces the Fourth Annual Frameable Art Silent Auction to be held at the 1997 SSAR meeting in Seattle. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

SSAR Student Travel Awards Call for Applications

Ten awards of $200 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author (or co-author, see below) of a paper or poster to be presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that states: he/she currently is an undergraduate or graduate student and that he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Student Travel Awards Committee are excluded from applying for a travel award. APPLICATIONS MUST BE POSTMARKED BY 15 MAY 1997.

About Our Cover: *Bothrops insularis*

About 30 species of pitvipers of the genus *Bothrops* currently are known, nearly two-thirds of them occurring in Brazil (including several endemics). Recent studies indicate that the traditional taxonomy and the phylogenetic affinities in the genus *Bothrops* still are poorly resolved. The threatened golden pitviper (or jararaca ilhoa), *Bothrops insularis*, probably a sister species of the mainland, widespread *Bothrops jararaca*, is endemic to the small island of Queimada Grande (43 ha), located about 30 km offshore from the city of Itanhaém, state of São Paulo, southeastern Brazil. It occurs in extremely high densities—up to 60 snakes may be found in a single day's field work—on trees, shrubs, and on the ground of the low Atlantic forest that covers most of the island. Primary prey are migratory passerine birds, although centipedes, anurans, lizards, amphisbaenians, and snakes occasionally are eaten. The venom is highly toxic, about five times more toxic to birds than that of *B. jararaca*. One of the few snakes in which intersexuality is known (probably the result of intensive inbreeding), *B. insularis* has a relatively small litter size, and the reproductive population is apparently decreasing. Sexual abnormalities in *B. insularis* were described and discussed by Hoge et al. (1959. Mem. Inst. Butantan 27:17–88) and more recently Duarte et al. (1995. Stud. Neotr. Fauna Environ. 30:1–13) provided a thorough review of its natural history.

A research team from the Instituto Butantan, the Universidade de São Paulo, and the Universidade Estadual de Campinas currently is carrying on a long-term study (begun in 1995, with monthly visits to the island) of the natural history and population biology of the golden pitviper. The principal aim of the study is to gather good field data to subsidize a future conservation program for this highly interesting and threatened pitviper.

Our cover photo was taken by **Marcio Martins**, a postdoctoral fellow at the Departamento de Zoologia of the Universidade Estadual Paulista at Rio Claro, and recently appointed a Professor at the Departamento de Ecologia Geral of the Universidade de São Paulo, at São Paulo, Brazil. He finished his Ph.D. in Ecology at the Universidade Estadual de Campinas in 1994 with a long term study focusing on the organization of a forest snake assemblage in Central Amazonia. Currently, Martins is writing a book and several articles on Amazonian snakes and other herps, participating in a herpetofaunal survey at Rondônia, southwestern Amazonian Brazil. He also is beginning a long-term study exploring how natural history traits (feeding habits, habitat use, reproduction, defense) evolved in pitvipers of the genus *Bothrops* (sensu lato), including participation in the study of *Bothrops insularis* described above. The photograph was taken in the morning inside a low forest on Queimada Grande Island in October 1996 with a Nikon F-301 camera, Nikkor 55mm f 1:2.8 micro lens at f11, shutter speed 1/125 s, and a Nikon SB-25 flash (in manual mode) with a SW-6 wide-flash adapter, using Fujichrome Provia ISO 100 film. The subject is an intersex, 730 mm total length, and was as little disturbed as possible before being photographed.

Separation and imaging of Martins' photograph is the work of **Jim Bridges** of Herpeto Inc., Hollywood, Florida, USA.

Award recipients will be notified by 1 June 1997 and award checks will be disbursed at the meeting. Requests for information on making donations and applications for awards should be sent to: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

Items Needed for SSAR Auction in Seattle

Once again, Joe Collins will be conducting the SSAR auction during the annual meeting at the University of Washington in June 1997. All proceeds from the auction go to the SSAR treasury, and help to continue the production of the diverse publications and services for which SSAR is known. Items of value as well as those that lend themselves to humor are always welcome. Joe is skilled at removing large quantities of cash from auction participants through the judicious use of beer and plastic. Auction items may be brought directly to the meeting or sent in advance (clearly marked "Herp Auction") to: *Ted Pietsch, School of Fisheries, 1140 Boat Street, University of Washington, Box 355100, Seattle, Washington 98195-5100, USA.*

NEWSNOTES

Southwestern Research Station Positions And Grants For 1997

VOLUNTEERS—Approximately 30 volunteer positions are open in 1997 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for Spring positions (March–May) should submit applications by February 15, Summer volunteers (June–August) by April 1, and Fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 1997. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396.*

Summer Course on Larval Amphibian Biology at Highlands Biological Station

A course on Larval Amphibian Biology will be taught at Highlands Biological Station June 2–13, 1997. Instructors are Richard Wassersug, Ray Semlitsch, Richard Bruce, and Travis Ryan. This is a lecture, laboratory, and field course addressing a variety of topics on the biology of amphibian larvae. Three semester hours credit at the advanced undergraduate/graduate level are available through either Western Carolina University or the University of North Carolina at Chapel Hill. For further information contact: *Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA. Tel. (704) 526-2602, FAX (704) 526-2797, e-mail: bruce@wcu.edu.*

Duellman Retires from The University of Kansas

William E. Duellman, long-time Curator of Herpetology at The University of Kansas Natural History Museum and Professor of Systematics and Ecology, retired on 13 December 1996. He served at KU for 37 years, producing numerous graduate students who have gone on to careers in systematic herpetology. Duellman, the world's preeminent authority on frogs and co-author (with Linda Trueb) of *Biology of Amphibians*, will continue to work on books, research papers, and other projects in his retirement. The SSAR recognized Duellman's important contributions to herpetology by hosting a symposium in his honor at the 1996 annual meeting.

New Journal

Amphibian & Reptile Conservation made its debut in the Fall of 1996. This new peer-reviewed journal is devoted to the worldwide preservation and management of amphibian and reptilian diversity. The journal will publish articles, notes, commentaries, and book reviews, and is intended for a wide audience. For subscription information or other details, contact: *Amphibian & Reptile Conservation, 2255 North University Parkway No. 15, Provo, Utah 84604-7506, USA.*

Data Requested for Nigerian Snakes

Luca Luiselli is conducting ecological studies of snakes from rainforests and mangroves of Port Harcourt (Rivers State) and Calabar (southeastern Nigeria), and would appreciate any field data collected by other workers on free-ranging snakes from those areas. The following data are especially useful: sex, snout-vent length, tail length, body mass, and any prey or reproductive data. All contributors will be acknowledged in resulting publications, and the entire series of papers on Nigerian snakes will automatically be sent. Contact: *Dr. Luca Luiselli, Dept. Animal and Human Biology, via Olona 7, 1-00198 Rome, Italy. Fax: **39-6-8411964.*

Captive Research Iguanas & Monitors Available

6.0 *Iguana iguana* (green iguana) and 0.0.8 *Varanus exanthematicus* (savanna monitor) are currently available for exhibition and non-terminal research from the Department of Zoological Research, National Zoological Park. Iguanas are 7 years old and monitors are approximately 4 years old. Animals offered are gratis to approved institutions and individuals, receive preshipment health screening, and are accompanied by individual histories. Shipping costs must be borne by receiving institutions. For further information, please contact: *Miles Roberts, Department of Zoological Research, National Zoological Park, Washington, D.C. 20008, USA; Tel: (202) 673-4749; FAX: (202) 673-4686; e-mail: nzpem030@sivm.si.edu.*

MEETINGS

Meetings Calendar

19 April 1997—All Florida Herpetology Conference, University of Florida, Gainesville, Florida, USA. Co-sponsored by the Florida Museum of Natural History and Gainesville Herpetological Society. Contact: David L. Auth, Division of Herpetology, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA. Tel. (352) 392-1721.

26 June–2 July 1997—40th Annual Meeting, Society for the Study of Amphibians and Reptiles; 45th Annual Meeting of The Herpetologists' League; 77th Annual Meeting, American Society of Ichthyologists and Herpetologists. Hosted by the University of Washington, Seattle, Washington, USA. *Refer to meeting announcement on page 1 of this issue for details.*

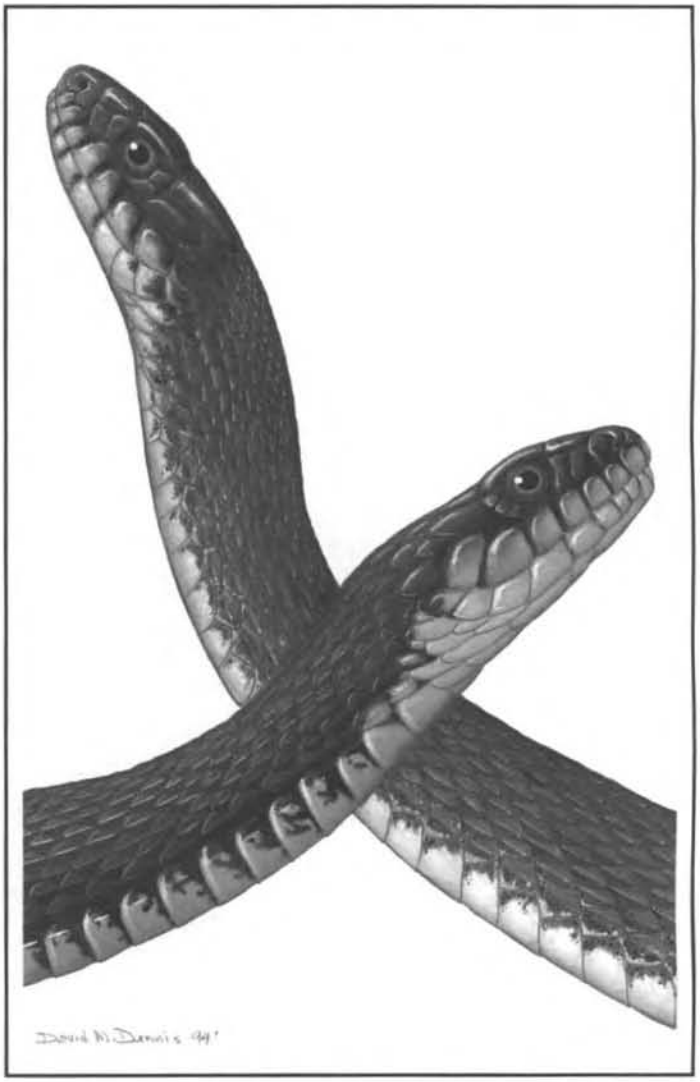
2–10 August 1997—Third World Congress of Herpetology, Prague, Czech Republic. Contact: Zbynek Roçek, Congress Director, Department of Paleontology, Geological Institute, Academy of Sciences, Rozvojová 135, 165 00 Praha 6 – Suchdol, Czech Republic. Tel. (++42-2) 24311421; Fax (++42-2) 24311578; e-mail: rocek@gli.cas.cz. *Refer to meeting announcement in* Herpetological Review *27(1):4–5, March 1996 for details.*

18–19 October 1997—First International Symposium on Snakebite. Zhanjiang, People's Republic of China. *Refer to meeting announcement on next page for details.*

1–3 June 1998—Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests: An International Symposium. Hanoi, Vietnam. *Refer to meeting announcement on next page for details.*

June 1998—Highlands Conference on Plethodontid Salamanders. Contact: Plethodontid Conference, Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA, or send an e-mail message to Judy Hill (HBS Admin. Asst.) at: JHILL@wpoff.wcu.edu. A more detailed announcement will appear in the June 1997 issue of *HR.*

1–5 September 1998—Third International Asian Herpetological Meeting, Almaty, Kazakhstan. *Refer to meeting announcement on next page for details.*



ENDANGERED WATER SNAKES: FULL-COLOR PRINT FOR FRAMING

The Society is pleased to offer a signed-and-numbered full-color print of two watersnakes (*Nerodia erythrogaster neglecta* and *N. sipedon insularum*) described by Roger Conant. The original watercolor, by the well-known natural history artist David M. Dennis, was originally published as the frontispiece in Murphy, Adler, and Collins (editors), "Captive Management and Conservation of Amphibians and Reptiles" (SSAR, 1994). These prints measure 9 1/2 x 12 inches (24 x 30 cm) and are personally signed by both Dr. Conant and Mr. Dennis. The edition is limited to only 450 copies. Proceeds from the sale of this print will go to conservation of these snakes.

Copies may be obtained for US$25 each plus $3 shipping from the SSAR Publications Secretary, Dr. Robert D. Aldridge, Department of Biology, Saint Louis University, 3507 Laclede Ave., Saint Louis, Missouri 63103, USA (*telephone*: 314-977-3916 or 977-1710; *e-mail*: ssar@sluvca.slu.edu; *fax*: 314-977-3658). Please make checks payable to "SSAR." Orders may be charged to MasterCard or VISA (provide account number and expiration date). A complete list of SSAR publications and membership information can be obtained on request from Dr. Aldridge.

Third International Asian Herpetological Meeting

The Third International Asian Herpetological Meeting will be held in Almaty, Kazakhstan from 1–5 September 1998. Preliminary plans call for the meeting to be organized around the following symposia: Paleoherpetology, Zoogeography of the Asian Herpetofauna, Conservation, Captive Breeding, Morpho-Functional Organization of Amphibian and Reptilian Integument, Molecular Taxonomy, as well as various symposia devoted to different herp groups (Salamandridae, Bufonidae, Agamidae, Varanidae, and Viperidae). The official language of the meeting will be English. To receive the First Announcement and Preliminary Registration Form, please contact one of the meeting organizers:

Dr. Tatjana Dujsebayeva, Department of Biology, Kazakh State University, Al-Farabi Prospect, 71, Almaty, 480078, Kazakhstan; Tel. (3272) 472677, Fax (3272) 472609, e-mail: zool@plague.almaty.kz.

Dr. Natalia Ananjeva, Department of Herpetology, Zoological Institute, Universitatskaja nab., 1, Saint-Petersburg, 199034, Russia; Tel. (812) 2180711, Fax (812) 2182941, e-mail: anb@zisp.spb.su.

Dr. Theodore Papenfuss, Asiatic Herpetological Research, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA; Tel. (510) 642-3567, Fax (510) 643-8238, e-mail: asiaherp@uclink2.berkeley.edu.

Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests

An international symposium—Biodiversity and Conservation of Amphibians and Reptiles of Tropical Forests—tentatively has been scheduled for 1–3 June 1998 at the Institute of Ecology and Biological Resources in Hanoi, Vietnam. All plenary lectures and contributed papers will be delivered in English. Posters may be in English, Vietnamese, Russian, German, or French. Plenary lectures are planned to address biodiversity and conservation of the herpetofauna of tropical forests of Vietnam, China, Laos, Indonesia, Philippines, Australasia, South and Central America, and Africa. For further details, contact: *Natalia Ananjeva (St. Petersburg, Russia), e-mail: nbanorus@glas.apc.org.*

1st International Symposium on Snakebite

To promote the study of emergency treatment of snakebite and to enhance international academic exchanges and cooperation, the 1st International Symposium on Snakebite will be held 18–19 October 1997 in the south coastal city of Zhanjiang, People's Republic of China. The symposium is jointly sponsored by the Asiatic Society of Preventing and Treating Snakebite and Zhanjiang Institute of Clinical Medicine. The deadline for submission of papers is 31 May 1997. To receive further information, contact: *Organizing Committee of the First International Symposium on Snakebite, No. 2 Cunjin Road, Zhanjiang City, Guangdong Province 524037, People's Republic of China. Tel./Fax 0086-759-3316724.*

"AMPHIBIANS OF HONDURAS" Color Slides Needed

Work on the book "The Amphibians of Honduras" by James R. McCranie and Larry David Wilson is in progress and will be published by the SSAR (probably in 1998). Any profits from the sale of the book will go to the Society. It is hoped that color slides of all species of amphibians known from the country (about 105 species) can be included in the book. Currently there are 15 species of non-endemics for which slides are needed.

If you have slides of any of the species listed below, please contact either of the authors (JRM: 10770 SW 164th Street, Miami, Florida 33157, USA; telephone 305-251-4270; fax 305-234-2320. LDW: Department of Biology, Miami-Dade Community College, Kendall Campus, Miami, Florida 33176, USA; telephone 305-237-2579; fax 305-237-0891). After information on slide availability is assembled, slides will be requested in late 1997. Unfortunately, no funds are available for the purchase of slides, but loans of needed slides (for one-time use) will be much appreciated and fully acknowledged in the book.

Species needed—*Gymnopis syntrema, Bolitoglossa occidentalis, B. striatula, Bufo haematiticus, Agalychnis calcarifer, A. moreletii, Hyla ebraccata, Plectrohyla glandulosa, Smilisca phaeota, Triprion petasatus, Eleutherodactylus biporcatus, E. mimus, E. rhodopis, E. rostralis,* and *Hypopachus barberi.*

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LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles. This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered amphibians and reptiles. Please direct all communications to the Section Editor.

USA: U.S. Fish and Wildlife Service: As of 12 April 1996, Australian populations of the saltwater crocodile (*Crocodylus porosus*) have been reclassified by the USFWS from endangered to threatened. Protective management strategies by the Australian government are in large part responsible for the saltwater crocodile's recovery and subsequent reclassification. The saltwater crocodile remains listed as endangered throughout the remainder of its range, except for Papua New Guinea, where the population never has been listed.

USA: U.S. Fish and Wildlife Service: As of 20 May 1996, the USFWS listed the California red-legged frog (*Rana aurora*) as Endangered under the U.S. Endangered Species Act. The State of California had previously listed the species as Special Concern under the state endangered species act. The largest remaining populations of red-legged frogs are found in three of California's coastal counties: Monterey, Santa Barbara, and San Luis Obispo. This region is also under some of the greatest development pressure. The red-legged frog was the first new listing of a species under the ESA since President Clinton signed the FY '96 budget bill that lifted the moratorium imposed by Congress on the listing of threatened or endangered species.

USA: Ohio: The State of Ohio has been strongly encouraged to implement an immediate statement of non-occurrence regarding the status of the wood turtle (*Clemmys insculpta*) in Ohio. Apparently, numerous specimens obtained by commercial collectors have been claimed as Ohio animals. The wood turtle is protected in most other states throughout its range. There are no verifiable records that any wild populations of wood turtles exist in Ohio or that any have in recent times. Statewide surveys conducted by Roger Conant in the 1920s and 30s failed to find a single wood turtle in Ohio. There are three isolated records of individual wood turtles being found in recent times (1948, 1952, and 1973) that are believed to represent captive and subsequently released or escaped individuals. Therefore, herpetologists and conservationists should be suspicious of any "Ohio" wood turtles offered for sale. For more information contact: *Daniel L. Rice, Chief Zoologist, Ohio Department of Natural Resources, Division of Natural Areas and Preserves, 1889 Fountain Square, Columbus, Ohio 43224, USA.*

USA: U.S. Fish and Wildlife Service: The United States has received proposals that proposed amendments to the appendices of CITES for the following species. These amendments, if submitted to CITES, would be considered at the tenth regular meeting of the Parties (COP10), June 9–20, 1997, Harare, Zimbabwe (Federal Register, Vol. 61, No. 168, 28 August 1996, pp. 44324–44342). 1) North American softshell turtles (*Apalone mutica, A. spinifera, A. ferox*) to Appendix II. All species are suggested as vulnerable to damming of rivers and loss of preferred habitat. All species are taken for human consumption and some animals enter the pet trade; 2) Map turtles (12 species of *Graptemys*) to Appendix II. Biologists who have studied seven of the species believe that populations have declined. At least four species are very popular in the pet trade. The USFWS believes that the combination of population vulnerability and international trade may qualify at least some of the species for inclusion under Appendix II; 3) Alligator snapping turtle (*Macroclemys temminckii*) to Appendix II. It is evident that the species has declined severely throughout much of its range. The primary causes of population decline appear to be degradation and damming of river systems and widespread commercial harvest for meat; 4) Gila monster and beaded lizard (*Heloderma* spp.) from Appendix II to Appendix I. Populations of both species are believed to be declining due to habitat degradation and local depletion by collectors for the pet trade. However, reliable data on wild populations are lacking; 5) Rattlesnakes (*Crotalus horridus, C. adamanteus*, and *C. atrox*) to Appendix II. Populations of *C. adamanteus* are declining due to loss of 90 percent of the original longleaf pine forest in the southeastern U.S. Populations of *C. horridus* have declined greatly over much of their original range and in many states only relict populations remain. The USFWS suggests that *C. atrox* should be proposed for listing due to its similarity of appearance to *C. adamanteus*; 6) Sail-fin lizards (*Hydrosaurus* spp., *Hypsilurus* spp., and *Physignathus lesuerii*) to Appendix II. These lizards are found in the southwestern Pacific region, including Australia, Philippines, eastern Indonesia, and New Guinea. Causes of decline vary for the different species but include loss of riparian forests (*Hydrosaurus* spp.), and general logging and habitat loss, as well as collection for the pet trade.

An update, issued by USFWS on 10 January 1997, indicates that the U.S. will propose action (as detailed above) for the following: all 12 species of *Graptemys, Malaclemys temminckii*, and *Crotalus horridus*.

European Union: As of 12 December 1996, the EU has adopted one of the most sophisticated and comprehensive wildlife trade laws in the world, entitled, "Council Regulation on the Protection of Species of Wild Fauna and Flora by Regulating Trade Therein." The EU is one of the largest legal wildlife markets for CITES-listed plants and animals in the world. Specifically, the new law requires member states to abide by all CITES regulations, establishes EU level bodies to provide enforcement, and imposes mandatory sanctions on member states who break the law. It also allows for control and monitoring of species not covered by CITES and provides stricter importation criteria than currently exists regarding an additional 25,000 species.

Sweden: A very unfortunate incident regarding 1000 Horsfields tortoises (*Testudo horsfieldi*) apparently took place in late October 1996. A shipment of 1000 tortoises was denied entry into Sweden because it lacked appropriate importation permits. Horsfields tortoises are not permitted to be imported into the European Union under existing wildlife trade laws. The Swedish authorities refused all offers by animal support groups to return the tortoises to their port of origin or other suggestions and apparently killed all the tortoises. This unfortunate incident brings up an issue that needs a policy solution. Although repatriation to native habitats is most likely not a viable alternative in these situations, it seems that captive breeding programs of rare species should be able to utilize these animals. Perhaps the issue deserves a response from the herpetological and conservation communities.

USA: U.S. Fish and Wildlife Service: The USFWS is proposing Endangered Species Act protection to conserve the remaining populations of the bog turtle (*Clemmys muhlenbergii*), which has seriously declined in the northeastern United States. The northern portion of the bog turtle's range, from New York and Massachusetts south to Maryland, would be designated Threatened. The southern population of the bog turtle, ranging from southern Virginia to northern Georgia, would be protected with a Threatened designation because its physical appearance is similar to the northern population.

The northern segment of the range has declined by 50 percent, mostly within the past 20 years. Illegal collection, primarily for the national and international pet trade, as well as loss and modification of the bog turtle's wetland habitat, have resulted in a reduction of the species' range and a decline in the size of remaining populations. Currently, bog turtles are known to remain at fewer than 200 sites in their northern range. Based on site habitat quality, only 35 of the 165 sites assessed may be capable of supporting a healthy bog turtle population in the future unless measures are taken to maintain or enhance bog turtle habitat.

For additional information or to provide comments, contact: *Carole Copeyon, Pennsylvania Field Office U.S. Fish and Wildlife Service, 315 South Allen Street, Suite 322, State College, Pennsylvania 16801, USA; tel. (814) 234-4090.*

USA: U.S. Fish and Wildlife Service: A diverse partnership of State, Federal, and private interests have joined together to help save the copperbelly water snake (*Nerodia erythrogaster neglecta*), an inhabitant of wetlands and bottomlands, and to protect its dwindling habitat. Landmark conservation agreements signed by three states, the Department of the Interior, and representatives of the coal mining and agriculture industries will keep the snake off the endangered species list in the southern part of its range in western Kentucky, southern Illinois, and southern Indiana.

USFWS has decided to list as threatened isolated remnant populations in the snakes's northern range, in northeastern Indiana, northwestern Ohio, and southern Michigan. Conversion of the snake's habitat in the north to roadways, building sites and agriculture continues to threaten these populations. It is estimated that these populations would vanish in the next 10–20 years without protection.

This snake historically ranged throughout much of the states of Michigan, Indiana, Illinois, Ohio, and Kentucky. However, loss of its habitat has reduced its range to pockets of remaining wetlands and bottomlands, which overlie coal fields in southern Indiana, southern Illinois, and western Kentucky. Today the largest number of copperbelly water snakes occurs in western Kentucky in 18 isolated populations. Only two of these are considered secure, with the others threatened by conversion of habitat to mining and cropland. In Indiana there are 13 populations, and five in Illinois.

KURT A. BUHLMANN
SSAR Conservation Committee

CURRENT RESEARCH

The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

The current contents of several herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Chelonian Research Foundation Publications

The Chelonian Research Foundation recently announced a new publication series, *Chelonian Research Monographs*. The first monograph was published earlier this year and reviews the current nomenclatural and population status of the Galápagos tortoises.

PRITCHARD, P. C. H. 1996. The Galápagos Tortoises: Nomenclatural and Survival Status. Chelonian Res. Monogr. (1):1–85.

The largest, and most recent issue of *Chelonian Conservation and Biology* is the journal's first Special Focus Issue. Appropriately this issue is devoted to the largest and most specialized turtle species in the world—the leatherback, *Dermochelys coriacea*. Articles are divided into four categories: nesting populations and conservation; biology and morphology; systematics and evolution; and translations.

BOULON, R. H., JR, P. H. DUTTON, AND D. L. MCDONALD. 1996. Leatherback turtles (*Dermochelys coriacea*) on St. Croix, U.S. Virgin Islands: Fifteen years of conservation. Chelonian Conser. Biol. 2(2):141–147.

BRONGERSMA, L. D. 1996. On the availability of the name *Dermochelys coriacea schlegelii* (Garman, 1884) as a species or subspecies of leatherback turtle. Chelonian Conserv. Biol. 2(2):261–265.

CAMPBELL, C. L., C. J. LAGUEUX, AND J. A. MORTIMER. 1996. Leatherback turtle, *Dermochelys coriacea*, nesting at Tortuguero, Costa Rica, in 1995. Chelonian Conserv. Biol. 2(2):169–172.

CHAN, E.-H., AND H.-C. LIEW. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956–1995. Chelonian Conserv. Biol. 2(2):196–203.

CHAVES, A., ET AL. 1996. Biology and conservation of leatherback turtles, *Dermochelys coriacea*, at Playa Langosta, Costa Rica. Chelonian Conserv. Biol. 2(2):184–189.

ECKERT, S. A., ET AL. 1996. Shallow water diving by leatherback turtles in the South China Sea. Chelonian Conserv. Biol. 2(2):237–243.

GIRONDOT, M., AND J. FRETEY. 1996. Leatherback turtles, *Dermochelys coriacea*, nesting in French Guiana, 1978–1995. Chelonian Conserv. Biol. 2(2):204–208.

GRIMES, K. 1996. Awakening. Chelonian Conserv. Biol. 2(2):306.

HUGHES, G. R. 1996. Nesting of the leatherback turtle (*Dermochelys coriacea*) in Tongaland, KwaZulu-Natal, South Africa, 1963–1995. Chelonian Conserv. Biol. 2(2):153–158.

LESLIE, A. J., ET AL. 1996. Leatherback turtle, *Dermochelys coriacea*, nesting and nest success at Tortuguero, Costa Rica, in 1990–1991. Chelonian Conserv. Biol. 2(2):159–168.

McDonald, D. L., and P. H. Dutton. 1996. Use of PIT tags and photoidentification to revise remigration estimates of leatherback turtles (*Dermochelys coriacea*) nesting in St. Croix, U.S. Virgin Islands, 1979–1995. Chelonian Conserv. Biol. 2(2):148–152.

Paladino, F.V ., et al. 1996. Respiratory physiology of adult leatherback turtles (*Dermochelys coriacea*) while nesting on land. Chelonian Conserv. Biol. 2(2):223–229.

Pritchard, P. C. H. 1996. Are leatherbacks really threatened with extinction? Chelonian Conserv. Biol. 2(2):303–306.

Rhodin, J. A. G., A. G. J. Rhodin, and J. R. Spotila. 1996. Electron microscopic analysis of vascular cartilage canals in the humeral epiphysis of hatchling leatherback turtles, *Dermochelys coriacea*. Chelonian Conserv. Biol. 2(2):250–260.

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Rostal, D. C., et al. 1996. Reproductive physiology of nesting leatherback turtles (*Dermochelys coriacea*) at Las Baulas National Park, Costa Rica. Chelonian Conserv. Biol. 2(2):230–236.

Spotila, J. R., et al. 1996. Worldwide population declines of *Dermochelys coriacea*: Are leatherback turtles going extinct? Chelonian Conserv. Biol. 2(2):209–222.

Steyermark, A. C., et al. 1996. Nesting leatherback turtles at Las Baulas National Park, Costa Rica. Chelonian Conserv. Biol. 2(2):173–183.

Suarez, A., and C. H. Starbird. 1996. Subsistence hunting of leatherback turtles, *Dermochelys coriacea*, in the Kai Islands, Indonesia. Chelonian Conserv. Biol. 2(2):190–195.

Wood, R. C., et al. 1996. Evolution and phylogeny of leatherback turtles (Dermochelyidae), with descriptions of new fossil taxa. Chelonian Conserv. Biol. 2(2):266–286.

Zug, G. R. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*, (Testudines: Dermochelyidae): A skeletochronological analysis. Chelonian Conserv. Biol. 2(2):244–249.

Exploiting Exploitation of Monitors

Shine and colleagues examined 166 water monitors *(Varanus salvator*), collected for their skins, to gain insight into several aspects of their biology. Diet, fat storage, size at maturity, and clutch size were among the data collected. The authors also discuss the harvesting of water monitors in Sumatra.

Shine, R., P. S. Harlow, and J. S. Keogh. 1996. Commercial harvesting of giant lizards: The biology of water monitors *Varanus salvator* in southern Sumatra. Biol. Conserv. 77:125–134.

Amphibian Declines

Fisher and Shaffer combined broad-scale field sampling with historical analysis of museum records to quantify amphibian declines in California's Great Central Valley. They provide new evidence implicating introduced predators as a primary threat. In addition, their historical approach provides a strategy for identifying declining amphibian communities that compliments more detailed, long-term monitoring programs and provides an assessment of the pattern of change that is a necessary prerequisite for the development of field experiments that test hypothesized mechanisms of change.

Fisher, R. N., and H. B. Shaffer. 1996. The decline of amphibians in California's Great Central Valley. Conserv. Biol. 10(5):1387–1397.

Blaustein et al. assessed DNA repair and resistance to solar radiation in eggs of the red-legged frog (*Rana aurora*), a species whose populations appear to be in decline. They found photolyase levels in *R. aurora* to be relatively high when compared with other amphibians and hatching success to be unaffected by UV-B radiation. The suggest that UV-B radiation is an unlikely cause for declining populations of red-legged frogs.

Blaustein, A. R., et al. 1996. DNA repair activity and resistance to solar UV-B radiation in eggs of the red-legged frog. Conserv. Biol. 10(5):1398–1402.

Another New Salamander for California

Despite its status as the most populous state in the U.S., California continues to yield new species of amphibians. Wake describes a recently-discovered species of *Batrachoseps* (*B. gabrieli*) from two small areas of the San Gabriel Mountains of southern California. Although a member of the attenuate clade of *Batrachoseps, B. gabrieli* is strikingly distinct relative to other species based upon genetic comparisons, with lineage separation estimated at 8 to 13 million years. This paper is the first of several in which Wake and colleagues will report on the systematics of *Batrachoseps*.



Batrachoseps gabrieli, a distinctive new plethodontid from southern California. Photograph by Mario Garcia Paris, courtesy of David B. Wake.

Wake, D. B. 1996. A new species of *Batrachoseps* (Amphibia: Plethodontidae) from the San Gabriel Mountains, Southern California. Contr. Sci. Nat. Hist. Mus. Los Angeles Co. 463:1–12.

Rana pretiosa Species Complex

Using allozymes and morphology, Green et al. examined several populations of the spotted frog (*Rana pretiosa*). This species was shown to exhibit isolation-by-distance, genetic subdivision, and speciation in association with its extensive northward range shift in postglacial times. The authors discuss the relationship between two morphologically cryptic species that make up the *Rana pretiosa* complex.

Green, D. M., et al. 1996. Postglacial range fluctuation, genetic subdivision and speciation in the western North American spotted frog complex, *Rana pretiosa*. Evolution 50(1):374–390.

Feeding Kinematics in *Salamandra salamandra*

Two recent studies by Reilly examine the feeding kinematics of *Salamandra salamandra*. The first paper discusses the lack of ontogenetic change in feeding kinematics in salamander larvae. The second study examines the evolution of terrestrial prey capture as it relates to aquatic feeding behavior and prey transport.

REILLY, S. M. 1995. The ontogeny of aquatic feeding behavior in *Salamandra salamandra*: Stereotypy and isometry in feeding kinematics. J. Exp. Biol. 198:701–708.

REILLY, S. M. 1996. The metamorphosis of feeding kinematics in *Salamandra salamandra* and the evolution of terrestrial feeding behavior. J. Exp. Biol. 199:1219–1227.

Evolution of Sexual Dimorphism in Southeast Asian *Rana*

There are a number of species of southeast Asian *Rana* that are characterized by an unusual suite of sexually dimorphic features and derived reproductive modes. These frogs lack the usual secondary sexual characteristics of ranid frogs. Phylogenetic analysis using morphological and molecular data indicate that a drop in androgen level and/or a shift in androgen sensitivity may have been involved in the evolution of male parental care and the loss of the common suite of secondary sexual characteristics. This study is an example of how emergent properties from phylogentic analysis can be used to formulate and test hypotheses of process and pattern of evolutionary change.

EMERSON, S. B. 1996. Phylogenies and physiological processes—the evolution of sexual dimorphism in southeast Asian frogs. Syst. Biol. 45(3):278–289.

Systematics of Australian Chelidae

Georges and Adams examined allozymes of 222 specimens from 55 populations of chelid turtles in Australia and Papua New Guinea. They determined that if the phylogentic species concept is adopted, there is support for recognition of 16 species of short-necked turtles in Australia. Currently only 10 are described.

GEORGES, A., AND M. ADAMS. 1996. Electrophoretic delineation of species boundaries within the short-necked freshwater turtles of Australia (Testudines: Chelidae). Zool. J. Linn. Soc. 118:241–260.

Snake Mitochondrial DNA Sequences

In sequencing two major tRNA gene clusters in snake mtDNA, Kumazawa et al. found a sequence of approximately 1.3 kb inserted between the genes for $tRNA^{Ile}$ and $tRNA^{Gln}$. The insert contains a control-region-like sequence and was found in snakes from several different families. In three snakes examined, they found a similar control-region-like sequence in the region surrounded by genes for cytochrome *b* and 12S rRNA. The authors suggest the duplicate state of the control-region-like sequences has long persisted in snake mtDNA.

KUMAZAWA, Y., ET AL. 1996. Gene rearrangements in snake mitochondrial genomes: highly concerted evolution of control-region-like sequences duplicated and inserted into a tRNA gene center. Mol. Biol. Evol. 13(9):1242–1254.

Revision of the Genus *Lacerta*

Mayer and Bischoff examined the morphology and karyotypes of several species of *Lacerta*. Based on their data, the authors recommend that the currently recognized subgenera *Zootoca, Omanosaura, Timon,* and *Teira* be elevated to full genera.

MAYER, W., AND W. BISCHOFF. 1996. Beiträge zur taxonomischen Revision der Gattung *Lacerta* (Reptilia: Lacertidae). Teil 1: *Zootoca, Omanosaura, Timon* und *Teira* als eigenständige Gattungen [Contributions to the taxonomic revision of the genus *Lacerta* (Reptilia: Lacertidae). Part 1: *Zootoca, Omanosaura, Timon,* and *Teira* as full genera]. Salamandra 32(3):163–170.

Ambystoma tigrinum Complex Revisited

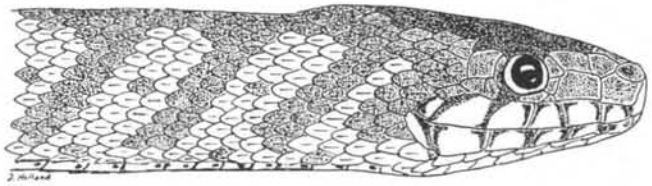
In a continuing quest to elucidate the phylogenetic relationships of the North American (U.S. and Mexican) tiger salamander complex, Shaffer and McKnight examined mtDNA sequence data derived from 840 base pairs of D-loop sequence. They suggest that the complex shows signs of abrupt lineage splitting less than 5 million years ago (younger than previous estimates based on allozymes and geology) and is characterized by generally low levels of differentiation among species. Recognition of monophyletic species is complicated by incomplete species boundaries (frequent hybridization between some very recently derived species) as well as by populations of nontransforming paedomorphic salamanders. They provisionally recognize eight primary lineages ("species") that only partially correspond to current taxonomy of this complex.

SHAFFER, H. B., AND M. L. MCKNIGHT. 1996. The polytypic species revisited: Genetic differentiation and molecular phylogenetics of the tiger salamander *Ambystoma tigrinum* (Amphibia: Caudata) complex. Evolution 50(1):417–433.

Basking Ecology of Razorback Musk Turtles

Basking razorback musk turtles (*Kinosternon carinatum*) were observed during replicated spotting-scope surveys in Mississippi and Louisiana. Razorbacks were seen more frequently and at more sites in the Pearl River drainage, and formed a higher proportion of the total number of turtles seen, than in the Pascagoula River drainage. Turtles usually basked in direct sunlight, often climbed high onto steeply angled branches of small diameter, and showed a propensity for basking on substrates not occupied by other species of turtles. Data for *K. carinatum* are compared with similar data for other kinosternid turtles.

LINDEMAN, P. V. 1996. Distribution, relative abundance, and basking ecology of the razorback musk turtle, *Kinosternon carinatum*, in the Pearl and Pascagoula River drainages. Herpetol. Nat. Hist. 4:23–24.



LETTERS TO THE EDITOR

CITES: Boon or Boondoggle?

WILLIAM W. LAMAR
School of Sciences and Mathematics, The University of Texas at Tyler
3900 University Boulevard, Tyler, Texas 75701-6699, USA
e-mail: 103223.306@compuserve.com

Regarding the excellent article by Gorzula on trade in dendrobatid frogs (Herpetol. Rev. 27:116–123), the issue of CITES-related problems and scientific activity begs amplification. I have never attended a CITES conference, but my colleagues have. We share the view that CITES and conservation authorities have been diffident towards the scientific community. While it may be true that CITES is, at its core, a monitoring effort, the fact remains that the treaty is varyingly, and frequently inappropriately, interpreted by each participating country. I disagree that this phenomenon be viewed as a separate matter, unrelated to CITES itself.

One country, for example, has prohibited export of a family of snakes simply because it appears on Appendix 2 of CITES. Another country decided that ALL exports of fauna (CITES and non-CITES alike), including museum loans, would require a $25 CITES permit, thereby effectively halting all scientific activity. Other examples abound.

Additionally, the inherent difficulty, expense, or even impossibility of obtaining CITES documentation has inadvertently created "black-market" status for many taxa named to the appendices. Thus, when *Vipera wagneri* was placed on the CITES list, its commercial value skyrocketed to US $1400 ... as predicted. Anguid lizards of the genus *Abronia* have also become costly collectors' items since their rumored impending CITES inclusion, precisely as predicted by Campbell and Frost in their 1994 revision (ironically, the very document that stimulated the interest of CITES). In examples such as this, the fact that CITES does not include means of protecting critical habitat is a detriment. I know of several cases in which scientists (myself included) have opted to remain silent regarding a species' critical status because CITES inclusion would only cause further harm.

While CITES was never intended to be a conservation treaty, it is my opinion that CITES officials and leading conservation organizations have chosen to ignore broad misinterpretations, perhaps on the premise that conservation by any means is justified. Also, if CITES is not a conservation treaty, then what is it? Far from simply monitoring wildlife "trade," its appendices carry restrictions. Presumably, a species deemed over-exploited would be advanced to a more exclusive appendix, or, that failing, the regional scientific authority would be called upon to make a special ruling before export could occur, thus rendering CITES an indirect conservation treaty. If such is not the case, then what exactly does CITES do?

Gorzula's explanation of oft-misunderstood terms is useful, but confusion remains. If, as he states, the CITES emphasis is on WILD populations, why all the monitoring of captive-bred transfers? Wouldn't they qualify as domestic? The term "trade" certainly is inappropriate, in spite of CITES' definition. Perhaps it should be changed to "traffic," as scientific activity hardly qualifies as trade when legitimately defined.

While there may be abundant reasons, as Gorzula states, for certain threatened or even endangered species not being included on CITES appendices, this has also added to a very confusing situation. I am aware of scientists who have meticulously and dutifully documented collections, complete with all requisite country-of-origin permits, only to arrive in the U.S., exhausted from the ordeal, and face legal action because a CITES Appendix II specimen is also U.S.A. Endangered. While CITES did not create this situation, they are part of it, and the often absurd lengths to which scientists must go to obtain their documentation helps lead to situations like that described above. Minimally, it would seem appropriate to tie Appendix status more closely to other lists bearing similar recommendations.

As Gorzula points out, CITES chose to ignore input from the scientific community regarding listing dendrobatids. Inasmuch as Gorzula's review supports the contention that listing these amphibians was premature, it would seem that the CITES secretariat should at least account for their reasoning. Who did they find to be more qualified than scientists to advise them?

Let's be candid about this, the world of conservation is basically about one thing: POWER. The scientific community has been penalized from the outset in this game because we lack the funds and the sort of lobby required in order to survive. If CITES and conservation authorities truly wish to clarify and refine the role of this cumbersome treaty, a good start would be to acknowledge some responsibility in this issue, advocate the critical work of the scientific community, use their considerable resources to educate the wayward regional management offices (or exclude them from the treaty), and begin to compile SEPARATE tabulations of scientific use of specimens instead of losing us in the blizzard of commercial trade data.

Scientific activity needs to be regulated separately in all countries, and CITES as well as conservation agencies could help to implement this. If, as Gorzula states, the total seven-year trade in dendrobatids would not fill a trash can, just think about the miniscule amount being used by the diminishing pool of scientists who provide the data used for CITES appendices and conservation organizations! We need a break, and it's long overdue.

REQUEST FOR SNAKE PHOTOGRAPHS AND REFERENCES

Whit Gibbons and Michael Dorcas are writing "Life History and Ecology of North American Aquatic Snakes" [negotiating contract with the University of Oklahoma Press] and plan to show examples of every color variant of species in the following genera: *Nerodia, Seminatrix, Regina*, and *Farancia*. Anyone willing to provide first-rate color slides on a temporary loan basis should contact Michael Dorcas by mail at Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29803, USA, or by e-mail at DORCAS@SREL.EDU. Any slides used will receive appropriate acknowledgment in the book.

We are also collecting all pertinent references for species of the aforementioned genera, and would appreciate receiving copies or citations of papers in press, unpublished Master's theses, or status reports. Copies should be sent to Dorcas at the address above.

A New Facsimile Reprint from the Society for the Study of Amphibians and Reptiles

LEOPOLD FITZINGER

NEUE CLASSIFICATION DER REPTILIEN

together with

ENTWURF EINER SYSTEMATISCHEN ANORDNUNG DER SCHILDKRÖTEN

LEOPOLD FITZINGER (1802–1884) IS ONE OF THE CLASSIC AUTHORS OF SYSTEMATIC HERPETOLOGY. FOR MOST OF HIS long career, he was a curator at the Naturhistorisches Museum in Vienna. His most important herpetological contribution was the naming of more than 70 genera that are in common and widespread use today. "Among the frogs we find such names as *Gastrotheca*, *Leptodactylus*, and *Pseudacris*; a salamander, *Salamandrina*, and the caecilian, *Ichthyophis*; several turtles, *Chelodina*, *Eretmochelys*, *Geochelone*, *Lepidochelys*, and *Psammobates*; and a large number of lizards, *Conolophus*, *Gonatodes*, *Mabuya*, *Psammodromus*, and *Stenodactylus*, and the snakes *Boiga*, *Chironius*, *Drymarchon*, *Elaphe*, *Lampropeltis*, *Malpolon*, *Psammophis*, and *Thamnophis*" (from the introduction by Robert Mertens).



Most of Fitzinger's generic names were proposed in just three of his publications: "Systema Reptilium," published in 1843 and reprinted by SSAR in 1973 (and still available: see below), and the two titles now being reprinted ("Neue Classification der Reptilien," published in 1826, and "Entwurf einer systematischen Anordnung der Schildkröten," 1835). In addition to these 70 generic names, Fitzinger designated type species (generotypes) for all genera of amphibians and reptiles recognized at the time, an action of critical importance in tying generic names to particular species. Moreover, other Fitzinger generic names have been resurrected recently — and others yet may be — as taxonomic revisions reveal new systematic arrangements.

***Specifications*:** 110 pages, one large foldout chart, portrait, 8.5 × 11 inches (21.6 × 28 cm), clothbound. To be published August 1997. ISBN 0–916984–41–9.

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INSTITUTIONAL PROFILE

Herpetology in the Puget Lowlands of Western Washington and Southwestern British Columbia

KEITH B. AUBRY
USDA Forest Service, Pacific Northwest Research Station
3625 93rd Avenue SW, Olympia, Washington 98512, USA

and

PATRICK GREGORY
Department of Biology, University of Victoria
Victoria, British Columbia, Canada V8W 2Y2

The Herpetological Collection at the University of Washington Burke Museum

The Thomas Burke Memorial Washington State Museum is located on the campus of the University of Washington in Seattle. Collections are curated by academic faculty jointly appointed to the Museum and the University. The Burke Museum is the Washington State museum of natural and cultural history, and is the only major natural history museum in the Northwest. The three divisions of Anthropology, Geology, and Zoology contain nationally renowned collections totaling over 3 million specimens, most of which are from the Pacific Northwest and Pacific Rim. The herpetological collection is part of the Zoology Division, which also includes curated collections of birds (over 60,000 specimens), mammals (41,000 specimens), spiders (75,000 specimens), butterflies (40,000 specimens), and other terrestrial invertebrates (30,000 specimens). The Museum also houses a Genetic Resources Collection that includes over 8000 specimens, mostly of avian tissues, stored at -80°C.

Prior to the establishment of the curated herpetological collection in 1985, the Museum housed several thousand unorganized and uncatalogued specimens, including an extensive series of garter snakes collected by W. B. Hebard in the 1940's. These specimens will be catalogued sometime in 1997. The current catalogue consists of over 2200 recently collected specimens, most of which are amphibians from western Washington. The curator is Dr. Keith B. Aubry, a research scientist with the USDA Forest Service. Dr. Aubry is an Affiliate member of the University faculty who curates the collection on a part-time basis. Virtually all of the specimens in the collection were preserved entire in formalin and are permanently stored in 70% ethanol. The collection is catalogued in digital form, which enables requests for information on holdings to be answered easily and quickly. The catalogued collection is available for use on site or by loan to researchers at other museums and educational institutions. Persons interested in viewing the herpetological collection should contact Keith B. Aubry by phone at (360) 753-7685, fax (360) 956-2346, or e-mail at kbaubry@aol.com.

There are several ongoing herpetological research projects being conducted in collaboration with faculty and students in the Wildlife Science Division of the College of Forest Resources, and with scientists at the Pacific Northwest Research Station of the USDA Forest Service. These include studies of amphibian communities in different structural stages of intensively managed forest stands; an experimental study of the effects on amphibians of varying the amount and pattern of green-tree retention in harvest units; an experimental study of the effects of introduced bullfrogs (*Rana catesbeiana*) on native red-legged frog (*Rana aurora*) populations; and a radio-telemetry study of the movement patterns of northwestern salamanders (*Ambystoma gracile*). The latter two studies are doctoral research projects being conducted by Michael Adams and Angela Stringer, respectively, under the direction of Dr. Stephen D. West. For more information on these projects, please contact Dr. West at the College of Forest Resources, (206) 685-7588.

The only other natural history museum in the Seattle area with a herpetological collection is the Slater Museum of Natural History at the University of Puget Sound in Tacoma, Washington, located about 30 min. south of Seattle. The Museum Director is Dr. Dennis R. Paulson, who can be reached at (206) 756-3798.

Herpetology at the University of British Columbia and University of Victoria

The last several years have seen a tremendous increase in the amount of herpetologically oriented research occurring at universities in British Columbia. Much of this growth has centered on the ecology of amphibians, especially in relation to anthropogenic disturbances of the landscape such as forestry. Despite a modest-sized native herpetofauna (17 species of amphibians, 12 of reptiles), there is much scope for research on these animals, including studies of their natural history in diverse environments. Most of the herpetological research in British Columbia is being done at the University of Victoria and the University of British Columbia.

Dr. Patrick Gregory has been doing herpetological research at the University of Victoria since 1973. The main focus of his work is the ecology and natural history of snakes, especially garter snakes, but he and his students also study various other species of amphibians and reptiles. Dr. Gregory's main current project is a long-term study of the population ecology of garter snakes at two sites in the British Columbia interior, begun in 1979. This study is beginning to yield significant data on longevity, growth, and frequency of reproduction in female snakes; it also has provided much data for recent work on geographic variation in reproductive traits of garter snakes. Other projects in various stages include: experimental analysis of the tradeoffs between feeding and thermoregulation in gravid snakes; a study of ontogenetic and size-related changes in diets of garter snakes; and manipulation of a rattlesnake den to minimize the impact of highway construction.

Dr. Gregory also has several graduate students and postdoctoral fellows working on a variety of projects. Heather Waye recently completed a Master's degree on the use of tail vertebrae from live snakes as a means of determining age of snakes for population studies. Master's students Lynn Norman and Christopher Shewchuk are studying the movement ecology of snakes (garter snakes and gopher snakes, respectively) using radiotelemetry. Trent Garner is doing a Master's degree on the occurrence of multiple paternity in garter snakes, using DNA fingerprinting. Pamela Rutherford has just begun a Ph.D. project on the costs of reproduction in alligator lizards.

Recently, Dr. Gregory's laboratory has become involved in more applied projects, such as studies of the effects of forestry practices on the distribution and abundance of amphibian species in northern Alberta; Master's students Patrick Garcia and Juanita Constible are undertaking that work. Postdoctoral fellows Dr. Robert St. Clair and Dr. Theodore Davis have begun similar studies in British Columbia on the rubber boa and western toad, respectively. All of these studies make use of radiotelemetry to determine patterns of habitat use by free-ranging animals. The work by Garcia and

Constible is being done in collaboration with Dr. Karl Larsen, a former student of Dr. Gregory's and now a faculty member at University College of the Cariboo in Kamloops, British Columbia.

Dr. Bradley Anholt is an experimental ecologist at the University of Victoria who uses anuran tadpoles as model organisms in some of his studies. Dr. Anholt is interested in the general question of how behavioral variation among individuals influences the dynamics of populations.

Most of the herpetological research at the University of British Columbia is being done in the Centre for Applied Conservation Biology and focuses mainly on amphibians. There are several major projects underway and only a glimpse of them can be given here. Drs. John Richardson and William Neill, aided by Karl Mallory, are conducting research on the natural history and demography of the Pacific giant salamander (*Dicamptodon tenebrosus*) at the northern limit of its range. The aim of the study is directed both at conservation of the species and at the more general question of how populations persist in fragmented landscapes. Dr. Neill's students are studying a number of other aspects of the ecology of these animals: Master's student Heather Ferguson is examining colonization of empty stream microhabitats and size-dependent movements of larvae; Master's student Barb Johnston is using radiotelemetry to study activity patterns, movements, home ranges, and habitat use of adults; and, undergraduate student Carolynn Stevenson is studying genetic relatedness among individuals at different spatial scales, using PCR analysis of satellite DNA.

Dr. Richardson also is collaborating with Dr. Fred Bunnell on a study of tailed frogs (*Ascaphus truei*) that has similar goals to the work on giant salamanders. Tanya Wahbe is completing her Master's degree with Dr. Bunnell on the habitat associations of larval tailed frogs and the influences of forestry practices on larval populations. Dr. John Carlson and his laboratory are lending their expertise in molecular genetics to complement the work being done on ecology and conservation of tailed frogs; in particular, they are examining genetic diversity among populations. Elke Wind is doing a Master's degree with Dr. Bunnell and Dr. Ann Chan-McLeod on the effect of forest fragmentation on wood frogs (*Rana sylvatica*) in north-central Alberta. Linda Dupuis is involved in a number of projects with Dr. Bunnell, including: the distribution and abundance of tailed frogs in British Columbia; the effects of various silvicultural treatments on amphibian communities in Sechelt; the importance to amphibian communities of riparian habitats along fish-free streams of managed stands and old-growth forests. Finally, Dr. Bunnell is working with Glenn Sutherland and Isabell Houde in a study of the persistence of amphibians in managed forests.

Other studies being done at the University of British Columbia include the following: relative abundance and habitat use of amphibians in wetlands and hydroriparian zones on Vancouver Island (Dr. Chan-McLeod); the effects of forest harvest on the habitat requirements of long-toed salamanders (*Ambystoma macrodactylum*) (Master's student Christine Ferguson with Drs. Tom Sullivan and Walt Klenner); the effects of aquatic toxicology on various amphibian species (Karen Pettit in the Dept. of Animal Science).

Clearly, there is no shortage of herpetological activity, especially of the ecological variety, at British Columbia universities. The most interesting aspect of all this, of course, is what people are actually finding. Unfortunately, space constraints do not permit a recounting of the results of all these various projects, so you'll have to keep on eye on the journals to learn that. Many thanks to Bill Neill, John Richardson, and Tanya Wahbe for providing information on goings-on at UBC.

POINTS OF VIEW

Subspecies and Classification

HOBART M. SMITH
Department of EPO Biology, University of Colorado
Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

DAVID CHISZAR
Department of Psychology, University of Colorado
Boulder, Colorado 80309-0345, USA
e-mail: chiszar@cliper.colorado.edu

and

RICHARD R. MONTANUCCI
Department of Biological Sciences, Clemson University,
Clemson, South Carolina 29634-1903, USA

We regard species as genetically discrete (i.e., separate and independent) populational entities, whereas subspecies are taken as genetically non-discrete (confluent) populational entities. That distinction we regard as axiomatic despite arguments to the contrary (e.g., Barton and Hewitt 1985).

The non-discrete nature of subspecies is evident from their definition as geographic segments of any given gonochoristic (bisexually reproducing) species differing from each other to a reasonably practical degree (e.g., at least 70–75%), but to less than totality. All subspecies are allopatric (either dichopatric [with non-contiguous ranges] or parapatric [with contiguous ranges], except for cases of circular overlap with sympatry); sympatry is conclusive evidence (except for cases of circular overlap) of allospecificity (separate specific status). Parapatric subspecies interbreed and exhibit intergradation in contact zones, but such taxa maintain the required level of distinction in one or more characters outside of those zones. Dichopatric populations are regarded as subspecies if they fail to exhibit full differentiation (i.e., exhibit overlap in variation of their differentiae up to 25–30%), even in the absence of contact (overlap exceeding 25–30% does not qualify for taxonomic recognition of either dichopatric populations or of parapatric populations outside of their zones of intergradation). Phenotypic adjustment to differing environmental conditions through natural selection is likely the primary factor in divergence of parapatric subspecies, and undoubtedly is involved in some dichopatric subspecies. The founder effect and genetic drift are involved more in the latter than in the former.

In spite of the objective validity of subspecies, they have been seriously questioned with increasing vigor for over 40 years, beginning most prominently with Wilson and Brown (1953; but see Wilson 1994). More serious threats have come in recent years from proponents of the newly propounded Phylogenetic and Evolutionary Species Concepts.

The inherent non-discrete nature of subspecies, combined with their long, justifiable history of acceptance as an essential part of biosystematics, has perforce been a problem in the context of phylogenetic inference that logically deals with discrete entities. The impasse has led to unjustified rationalizations in the form of either outright rejection of subspecies or of forcing them into a higher rank (species) for which they are fundamentally not qualified as here (and commonly) defined.

Proponents of the Evolutionary Species Concept dispose of subspecies, for the most part, by disregarding them completely as a component of the biotic classification system (Frost 1995; Frost et al. 1992; Simpson 1961; Wiley 1981, 1992; Wilson and Brown

1953). Typically, in the application of that concept, subspecies are examined critically for their distinctiveness, and those that do not rigorously qualify in that context are not accepted taxonomically.

By contrast, proponents of the Phylogenetic Species Concept have generally acted in concordance with the views espoused by Barton and Hewitt (1985), by elevating valid subspecies to species rank despite their non-discrete nature (Baum 1992; Cracraft 1992; Davis and Nixon 1992; Eldredge and Cracraft 1980; Nelson and Platnick 1981). Doing so leaves the term subspecies applicable only to minor geographic variation that usually would not be accepted as taxonomically significant, as, for example, clinal segments and pattern classes (e.g., Cracraft 1992:104). Were subspecies so relegated, we too would join Cracraft in rejecting them.

We hold that neither rationalization is justified or necessary. The rational policy is to continue to accept subspecies as a legitimate and essential part of biotic classification, but at the same time to exclude them from phylogenetic analyses that are logically limited to discrete, fully distinct entities. In that context, subspecies considerations cannot conflict in any way with species concepts and phylogenetic constructs based upon them. The subspecies category is already properly accommodated in the current edition of the International Code of Zoological Nomenclature, and its recognition, as in the past, is supported by biologists worldwide (Hawksworth et al. 1994).

The Rationale for Exclusion of Subspecies from the Phylogenetic Species Concept.—Current interpretation of phylogeny requires that, in phylogenetic classification, populations maintain evolutionary independence if they are to be recognized as taxonomically distinct units. Therefore, parapatric subspecies cannot be embraced in phylogenetic philosophy and practice because they have no phylogeny in the sense of a history of separate identity. On the contrary, dichopatric (= non-parapatric allopatric) populations may individually be regarded as full species, if sufficiently well differentiated (i.e., infallibly diagnosable, with fixed character differentiation), or, if not, as tertiary subspecies. Degrees of distinction (one or more characters) and the extent of intergradation differ widely in nature, and their interpretation in some cases inevitably results in subjective assessment of ranking that is equally inescapable in the application of any species concept. That fact is no argument against the validity of subspecies as nomenclatural entities, although it is a strong argument for excluding subspecies from phylogenetic analyses.

The Problems Created by Subspecific Exclusion from All Classification.—The emergence of a guiding phylogenetic (historical) philosophy in systematics was regarded by Frost et al. (1992:46) as "the biggest paradigm shift in systematics in the last 140 years."

There is good reason for universal acceptance of the basic tenets of the Evolutionary or Phylogenetic species concepts in proper contexts. It is critical, however, to recognize that these contexts are not all-inclusive. The common perception of classification as conforming with and representing phylogenetic hypotheses must be superimposed upon the even more basic responsibility of reflecting biodiversity. Systematics and classification therefore have two functions, here referred to as taxonomic and phylogenetic. It is not sufficient that classification only reflect phylogeny; it must also reflect biodiversity by accounting for all "kinds" of animals, and subspecies as well as species constitute "kinds."

The dual responsibility of classification to reflect both phylogeny and biodiversity has long been recognized (e.g., Simpson 1961:27–28). To limit the scope of these dual responsibilities of classification by exclusion of subspecies, through their distortion by elevation to species rank, or through abandonment, in order to reflect phylogeny at all classification levels, is unwarranted. Alternatively, having two classifications, one for each role (phylogenetic and biodiversal), would be chaotic.

Frost et al. (1992), in stating the case for Phylogenetic Classification, argued forcefully for abandonment of subspecies, and Frost later (1995) implemented his views in a novel way. So tempting has been that move toward simplicity that it has spawned widespread neglect of comprehensive studies of the geographic variation that often delineate subspecies. Thus two problems are constituted by subspecies in present contexts: their validity in the first place, and, if recognized at all, their integration within a phylogenetic system of classification.

Validity of Subspecies.—Despite arguments against admission of subspecies in taxonomy, that category has consistently proven useful and illuminating. Nevertheless, as pointed out by Frost et al. (1992), even such a staunch supporter as Mayr on occasion (1982) wrote deprecatingly about the nature and value of the subspecies category. In a more recent work, Mayr and Ashlock (1991:41) noted that "some of the best proofs of the occurrence of evolution have emerged from the study of polytypic species taxa. To convert the nominal species of all groups of animals into well-delimited polytypic species taxa is therefore one of the major tasks of taxonomy." Nevertheless, they (ibid.:53) remarked that the "new systematics" of today recognizes "the subspecies as a category, not as an evolutionary unit."

It is perfectly true that subspecies are not independent evolutionary units, as previously noted in the context of phylogenetic systematics. But, it is equally true that they are products of evolution and, where valid, are recognizably different taxonomic entities. To exclude valid taxonomic entities from classification misrepresents fact and neglects a level at which a major part of evolution is occurring at all times and at varying rates, although it is little studied, understood, and appreciated in most groups of animals. Such studies, however, "have provided the best available evidence for the process of allopatric speciation, the frequent origin of evolutionary novelties in peripherally isolated populations, and numerous intermediate stages in the evolutionary process, thus elucidating previously inexplicable discontinuities" (Mayr and Ashlock 1991:41).

The initial and most enduringly influential opponents of subspecies were Wilson and Brown (1953), who argued that "It is more informative to focus on the traits and not on the subspecies that might be concocted from them" (Wilson 1994:208). But, by 1994, Wilson (*loc. cit.*) later confessed that "Some populations can be defined clearly with sets of genetic traits that do change in a concordant, not a discordant manner. Furthermore, the subspecies category is often a convenient shorthand for alluding to important populations even when their genetic status is ambiguous."

Indeed, perhaps the most powerful argument against the validity of subspecies is that intraspecific geographic variation commonly involves several or more characters varying independently either kaleidoscopically or discordantly, in part due to selection pressures differing with each environmental variable. It is nevertheless true that consistent (at the 70% level or better) recognizability of subspecies is evident within some species. Occasionally only one character qualifies, but usually a suite is involved. In multivariate contexts, subspecies are definable by the suite of characters that explains the largest adequate percentage of the variance of the data-set, thus minimizing the "noise" produced by the variance of other characters. Hence the spectre of an infinite number of subspecies is in reality a delusion. Blanket rejection of subspecies, even on the basis of deficient or defective analysis, denies their possible, if not proven, validity, under the criteria here stated, as *consistently recognizable* geographic entities. Alterna-

tively, elevation of them to full species rank denies their non-discrete nature. Neither alternative is justified.

Although defense of subspecies has been dismissed by some phylogeneticists as old-fashioned and outmoded, the fact remains that comprehensive and objective studies of geographic variation, especially in widely distributed (but also some narrowly distributed) species, often reveals the presence of distinctive geographic segments that eminently qualify for taxonomic, even if not phylogenetic, recognition (e.g., Grismer et al. 1994; Taylor et al. 1994). Rejection of subspecies on grounds of phylogenetic incompetence, or difficulty of analysis, or of burdensome museum administration, is spurious and fails to recognize fact. We view the current popularity of disregarding subspecies as an uncritical attitude.

Rejection of subspecies as non-genetic ecotypes unless proved to be genetic adaptations is unwarranted, inasmuch as dichopatric species of any closely knit species group are subject to the same uncertainty. Parsimony dictates acceptance that allopatric populations that are phenotypically distinguishable at a taxonomic level have their differences genetically based unless or until proved otherwise.

Rejection of the subspecies concept inevitably leads in many instances to unjustified elevation to species rank of taxa that should rank as subspecies. Careful consideration of rank alternatives for different allopatric populations is severely discouraged if one of those alternatives no longer exists.

Although the subspecies category has on occasion been abused in the past, the same is true of the species and every other nomenclatural category. Abuses particularly exist where populations are subject to predominantly discordant geographic variation or linear clinal variation, when segments are nevertheless recognized taxonomically. A comprehensive (rather than piecemeal) study of geographic variation within the species should precede the delineation and naming of subspecies, or should be the ultimate test of subspecies that have been erected piecemeal. The use of multivariate statistical procedures can provide approaches that are reasonably objective and not dependent on preconceptions about taxonomic membership. Nonetheless, the discriminatory power of such methods depends critically on the quality of the characters being analyzed and, in addition, the adopted standard for level of differentiation required for taxonomic recognition. Multivariate analyses (Thorpe 1987) are useful techniques for substantiation of subspecific validity, with revival of the now generally neglected 75% (or similar) rule (idem:7).

The conclusion most emphatically is that subspecies, even on strictly *theoretical* grounds, are a vital component of taxonomic practice, should be retained as an acceptable option where warranted, merit inclusion in classification, and are properly accommodated in current rules of nomenclature. They are of importance not only in systematics but also in other theoretical disciplines such as biogeography and evolution itself.

In addition, from a *practical* point of view and quite apart from theoretical validity, the subspecies category is vital to balanced conservational, medical, nutritional, and other applied biologies. In such considerations, the recognition of geographical segments, particularly of widely distributed species, is of fundamental importance because they may represent differentiated gene pools that can be substantially different in important ways (e.g., Glenn and Straight 1985, 1987). Although the focus of phylogenetic systematics is properly on the established directions of genetic change, it would be tragic if that focus were allowed to lead to the abandonment of studies of intraspecific geographic variation that are of such vital importance in the understanding, assessment, and conservation of biodiversity.

In that context, Ryder (1986) proposed recognition of "evolutionarily significant units" (ESU), alternatively "evolutionarily significant populations" (ESP), where they exist among the subspecies of any given species. That concept was endorsed and expanded by Vane-Wright et al. (1991) and Vogler and DeSalle (1993), although the terms ESU and ESP, as applied by these authors, are inappropriate and misleading, as noted by Cracraft (1991); in reality they were dealing with "*conservationally*" significant units ("CSU"). Nevertheless the focus by these authors upon subspecies and their relative merit for conservation was thoroughly justified. Unfortunately, Cracraft (*op. cit.*), observing that in his opinion all ESU's are phylogenetic species, concluded that "Under this concept, subspecies have no special ontological [i.e., incipient species] status and can be abandoned."

As an example of the importance of subspecies in conservational considerations, *Sceloporus undulatus garmani*, an arenicolous, terrestrial, cursorial, striped subspecies with reduced semeions (ventral color patches) appears to have become extinct, or nearly so, in parts of its range on the plains of eastern Colorado. On the contrary, another, very different, larger, cross-barred subspecies with well-developed semeions, *S. u. erythrocheilus*, remains common on the eastern slopes of the Rocky Mountain foothills, where it leads a scansorial life on trees and, mostly, rocks. The two subspecies occur within a few kilometers of each other in some areas, but no intergradation occurs and even gross sympatry is possible. Different conservational measures may be required for these two subspecies, but they would be difficult or impossible to prescribe or implement if no subspecies were recognized. Entire subspecies populations could become extinct if attention were directed to the species as a whole, which could be regarded as basically healthy. In cases such as this, elevating the constituent subspecies to species rank does not always provide a solution. For example, in the case cited, there is a complete, although stepped, continuity between the two taxa: *S. u. garmani* intergrades to the south with *S. u. consobrinus*, the latter with *S. u. tristichus* to the west, and that in turn with *S. u. erythrocheilus* to the north—a typical circular approximation of range, if not overlap.

Although the practical constraints of conservation efforts may require restriction of attention to the species rank, elevation of subspecies as here and as commonly defined to species rank would be a disservice to limited conservational efforts aimed at preservation only of major genetic resources.

In defending the concept of subspecies, i.e., maintaining them in classification much as in the past, we do not see them as of universal existence among organisms. In many groups they appear never to have evolved, no doubt for various reasons, including extreme vagility. We merely insist that in some groups they are readily evident, and that where this is the case, they merit taxonomic recognition, serving as they do as vehicles for the development of testable hypotheses regarding the causes, proximate and ultimate, for variation and its geographic stabilization.

Integration With Phylogenetic Classification.—The second problem posed by recognition of subspecies in the era of phylogenetic emphasis is perhaps of relatively minor concern, since it can be resolved by context and requires no operational modification of long-established custom. Where the context and goals are strictly phylogenetic, subspecies obviously should be disregarded. Where the context and goals are taxonomic to the lowest level, subspecies should be recognized, as they have been over the past few decades. They are entities already incorporated into taxonomic and nomenclatural procedure, as indicated by the present edition of the International Code of Zoological Nomenclature and its predecessors as early as the 1905 Regles. Biologists worldwide also

reiterate their intent to maintain recognition of subspecies in the future (Hawksworth et al., 1994). The studies by Grismer et al. (1994) and Reichling (1994) demonstrate the compatibility of subspecies with phylogenetic systematics. There is no conflict, hence no need for exploration of alternative nomenclatural systems.

Intraspecific Taxonomic Derivation.—In the context of Phylogenetic Classification, as currently interpreted, "intraspecific phylogeny" approaches an oxymoron, and in effect has been widely so interpreted in recent discourses. Yet derivational patterns are commonly discernible among the subspecies of polytypic species, as noted by Thorpe (1987:3), who commented that intraspecific "patterns of geographic variation *can* [italics ours] be caused by both current ecological conditions and historical factors, i.e. phylogenesis." The evolutionary phenomena culminating with attainment of species rank are also involved in patterns of subspeciation. However, we suggest that intraspecific evolutionary patterns evident among subspecies be designated as taxogenetic (taxon-forming), rather than phylogenetic (derivational), in order to avoid what might be regarded as an oxymoronic application of the latter term.

Indeed, Olmstead's (1995) proposal for distinguishing "apospecies" (with one or more uniquely derived characters) and "plesiospecies" (with a unique combination of characters, none derived) can logically be extended to subspecies. Thus, "aposubspecies" (e.g., *Sceloporus undulatus erythrocheilus* with unique lip/throat reddish coloration; *S. u. belli*, with fused gular semeions) can be distinguished from "plesiosubspecies" (e.g., most other subspecies of *S. undulatus*).

Summary.—The nature and evolutionary implications of biodiversity is a central challenge of modern biology. To appreciate the full extent and significance of biodiversity, we assuredly need to recognize and have names for the discrete, unquestionably phylogenetically competent taxa belonging to the categories of species, genera, families, etc. We need also to recognize and have names for the non-discrete but genetically distinctive geographic segments of species, even if they are regarded as phylogenetically incompetent (i.e., derivationally non-committal). Both concerns are essential to analyses of diversity. It perforce follows that to pursue such analyses properly a comprehensive and unified system of nomenclature is essential. Our system must include all these groups, both discrete and non-discrete.

Subspecific nomenclature is more than a step in the study of natural variation. It is a tool for conveying information about major patterns of variation within species, flagging opportunities for causal analyses. A subspecies name draws attention to a geographic segment of a species that in some way is recognizably different, and beyond that, it provides information about diversity to a variety of disciplines from genetics and ecology to conservation biology. The study of intraspecific variation could go on without the use of subspecific nomenclature, but a tremendous lot of biotic diversity would be obscured and made almost inaccessible by the absence of names. Workers *will* fail to notice biological diversity without names.

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Publication in Non-Peer-Reviewed Outlets: The Case of Smith and Chiszar's "Species-Group Taxa of the False Coral Snake Genus *Pliocercus*"

LARRY DAVID WILSON
Department of Biology, Miami-Dade Community College
Kendall Campus, Miami, Florida 33176, USA

and

JAMES R. McCRANIE
10770 S.W. 164th Street, Miami, Florida 33157, USA

Because of the evolutionary and ecological importance of the mimetic relationships the members of the genus *Pliocercus* share with those of *Micrurus*, the appearance of a revision of the former genus should be a cause for celebration. On the contrary, however, the publication of the long paper "Species-group taxa of the false coral snake genus *Pliocercus*" by Hobart M. Smith and David Chiszar (1996) raises so many troubling issues for herpetologists, especially those specializing in systematics, that the impulse to celebrate is quickly stifled. The purpose of our paper is to examine these issues and to suggest means by which the members of the herpetological community can deal with them.

Circumventing peer review and its consequences.—The major issue associated with the appearance of Smith and Chiszar (1996) is one we have examined previously (McCranie and Wilson 1979). It involves the appearance of systematic research in outlets that do not utilize peer review. The Smith and Chiszar publication herein under review was published by Ramus Publishing, Inc., which also produces the herpetoculturist publication *Reptile & Amphibian Magazine*. Nowhere in the *Pliocercus* document is there any indication that anyone besides Erica Ramus, the editor and publisher, reviewed this work before its appearance in print. She is credited in the Acknowledgments for "... editing and masterminding publication of this review." No one who has worked on the systematics of *Pliocercus* in the past (e.g., Brian Crother, Harry Greene, Roy McDiarmid, Jay Savage) was sent a copy of the manuscript for review. As astounding as this lack of peer review may seem, it is even more so when one considers the breadth of the departure Smith and Chiszar have made in their taxonomic conclusions from those of the most recent prior revisers, Savage and Crother (1989). We are tempted to conclude that peer review was circumvented by Smith and Chiszar precisely because their conclusions differ so startlingly from those of other recent workers (Greene and McDiarmid 1981; Savage and Crother 1989; Wilson and Meyer 1985). In fact, our contention is that the issues and problems discussed in the remainder of this review are so serious that had this work been subjected to the normal course of peer review by qualified herpetologists, it would never have seen the light of publication day.

Our position is that scientific papers *must* be subjected to peer review, and that such is *especially critical* when the paper deals with systematics, including the naming of new taxa. We cite the following as a case in point concerning what can happen when peer review is eschewed. In 1992, Smith and Chiszar described a new genus and species of boid, *Boella tenella*, based on a specimen without locality data. These authors, however, reasoned it to have come from Oaxaca, México. Later the same year and in the same journal, Wallach and Smith (1992) demonstrated that the single known specimen upon which the new genus and species were based is actually a specimen of the well-known *Epicrates inornatus* of Puerto Rico. Both the latter lengthy paper and the original description would not have required publication if Smith and Chiszar had taken the obvious step during their research to run the undocumented specimen through some of the well-known keys to boids that exist in the literature. Wallach and Smith (1992) even point out that the specimen keys out to *E. inornatus* in Schwartz and Henderson (1985). More to the point, had the editor of the *Bulletin of the Maryland Herpetological Society*, Herbert S. Harris, sent the paper to Bob Henderson to review, the first paper would have headed for the "round file" and the second never would have been conceived. Such ill-conceived, poorly researched, and unreviewed work is a waste of limited publication resources available to herpetologists and all other scientists. That such waste is avoided is one of the reasons that peer review exists.

Given, however, that it is becoming increasingly easy to circumvent peer review in systematic and other types of research in herpetology, we strongly suggest that the major herpetological societies in this country make this burgeoning trend an agenda item for the next earliest business meetings and produce resolutions in opposition to this trend. This issue may be intransigent enough, moreover, that the matter should be presented to the International Commission on Zoological Nomenclature for a ruling.

Questionable systematics technique.—One of the most striking outfalls of the lack of peer review of the Smith and Chiszar *Pliocercus* revision is the major departure these authors make from accepted analytical procedure in systematics research. The accepted approach to building a classification and associated nomenclature is to gather data on a given allotment of specimens, survey the literature about the creature(s) being studied, analyze the data in some appropriate fashion, and construct a set of conclusions based on this analysis. The conclusions then are supposed to lead to a classification with phylogenetic meaning and an attendant nomenclature for the taxa recognized.

Smith and Chiszar certainly carried out the first step. They examined 516 specimens, collecting data on scalation and color pattern. These data, however, are subjected to an incredibly superficial (and, therefore, misleading) analysis confined to the work's introduction and consisting of, at most, six pages, which are also occupied by three distribution maps and one scale drawing. The survey of the literature appears to be reasonably complete (after all, this is one of Smith's fortes), but there is only limited discussion of the history of that literature, and the most important piece of literature on the systematics of *Pliocercus* prior to the one under review, Savage and Crother's (1989) revision, is dispensed with in the first sentence of the introduction. Otherwise, this important paper is referred to on p. 29 (information on status of holotype of *P. euryzonus*), p. 30 (reference to a range map for the lower Central American and South American populations), p. 34 (information on variation and range of Smith and Chiszar's concept of *P. dimidiatus*), and p. 84 (in connection with the discussion of anatomy of *Pliocercus*). As such, the arguments presented in Savage and Crother's work are not critically examined to indicate the need to depart from the established taxonomy. The bulk of the work consists of the taxonomic conclusions, which take the form of the classic account. For all practical purposes, their approach jumps from step 1 (gathering the data) to step 4 (erecting taxonomic conclusions), with only passing attention being given to step 2 (discussion of significance of prior literature) and step 3 (data analysis). Thus, we are asked to accept Smith and Chiszar's conclusions at *virtual face value*.

As a consequence, there is no analysis of character variation outside the context of the authors' taxonomic conclusions. The assumption is made on their part that character variation is only important if such variation is "taxonomically significant." Thus, the authors make the assumption that no other conclusions might derive from analysis of the same data set and, furthermore, that no

other analysis can be conducted on a given data set than the one they have conducted. The implication is: "Here's our analysis and conclusions: take them, or if you wish to leave them, do the work from scratch." Wilson and Meyer (1985) have discussed this procedural problem at length. Again, competent peer review would have easily exposed Smith and Chiszar's procedural anomalies.

The "cart before the horse" procedural anomaly.—The curious technique of data analysis has created for Smith and Chiszar the most serious flaw in their conclusions, which by itself should have kept this paper from being published in its present form. In the section entitled "The relation of mimicry to taxogeny in *Pliocercus*," they indicate that understanding the impact of mimicry on evolution in *Pliocercus* must await unraveling the taxonomy of the genus. Thus, they state (p. 77) that "... the absence of a basic understanding of the taxonomy of *Pliocercus* has been an insurmountable obstacle to a sound appraisal of the extent and nature of mimicry between that opisthoglyphous, mildly venomous genus and the sympatric, highly venomous, proteroglyphous genus *Micrurus*." They, however, at least in part, belie their own statement by adding that "Mimicry is ... a product of adaptive flexibility, which occurs at the sacrifice of phyletic stability. The extent to which each phenomenon has influenced phylogeny in *Pliocercus can be given meaningful consideration* [emphasis ours] only in the context of reasonably sound concepts of taxonomy in the genus, *heretofore lacking* [emphasis ours]." In our opinion, however, the reverse is the case. Reasonably sound concepts of taxonomy in *Pliocercus* can only be produced by meaningful analysis of the extent to which mimicry has influenced phylogeny in this genus. That Smith and Chiszar have not recognized this obligation is reflected not only in their statements, but in the organization of their work as well. The relatively short treatment (four and one-half pages) of mimicry follows the taxonomic section rather than preceding it. In addition, the discussion in this section is relatively superficial and uniformative, compared, for example, to treatments in Greene and McDiarmid (1981) and Savage and Crother (1989).

Given that we can now agree that mimicry does occur in *Pliocercus*, then such a relationship represents a selective agent for populations of *Pliocercus* and *Micrurus* alike and is indicative of the progress of coevolution. In most cases, snake systematists are at a loss to even posit the selective pressures impinging on the character variation they document. With *Pliocercus* and its venomous models, we have a comparatively easily understood system to study. Both genera exhibit brightly colored patterns that to a creature capable of color vision such as ourselves are obvious and require from us only eyes, paper, pencil, and some basic analytical skills to decipher. Smith and Chiszar, on the other hand, have the idea that a classification and nomenclature should be established first, that then can be used to unravel the mimetic relationships. Thus, they are mired in a hog wallow of misunderstanding. The hog, however, creates the wallow, not the reverse. The mimetic relationship between *Pliocercus* and *Micrurus* is surely one of the selective agents that has shaped the phylogeny of these snakes, which phylogeny we attempt to codify with our classifications and nomenclatures. The classifications and nomenclatures do not create the selective pressures. Nevertheless, working out the details of this mimetic relationship will occupy researchers for some time, given its complexity.

The deductive-inductive sleight of hand.—Smith and Chiszar's taxonomy of the genus *Pliocercus* depends on a curious attempt to pass off an invalid inductive argument as a valid deductive argument. In nonformal logic, a deductive argument is one in which if the premises are true, then the conclusion is necessarily true (Dreisback and Cavalier 1985). In an inductive argument, the claim is that if the premises are true, then the conclusion is probably, but not necessarily true (Driesback and Cavalier 1985). This is the logical conceit that forms the linchpin that fastens Smith and Chiszar's analysis to their conclusions.

In the introduction (pp. 17–18), the authors point out that "It was obvious at the outset that some of the populations with broad black rings (*P. dimidiatus* and *P. andrewsi*) seemed to maintain their integrity even where sympatry with narrow-ringed populations occurs. Yet in the absence of other differences, e.g., in scalation, no evidence short of documentation of breeding true (woefully lacking) could still the suspicion of polymorphism of a single species." They go on to say (p. 18) "Of critical significance, therefore, was the discovery in the course of this review that indeed one of the broad-ringed populations (here referred to as *P. bicolor*) possesses a unique feature of scalation, found in no other populations of the genus, but found in every one of its own populations: fusion of the rear infralabial ... with the adjacent, rear labiogenial." The integrity of this distinction is indisputable. So, the premise of this argument is true. Smith and Chiszar, however, go on to draw an important and disputable conclusion from this premise. They indicate (p. 20) that "The significance of the categorical distinction between the separate (A type, throughout most of the genus) and fused (B type, *P. bicolor* only) condition of the rear infralabial is that it provides *sound evidence* [emphasis ours] that pattern types can indeed be taxonomic indicators." This conclusion is not supportable in our opinion and makes of this an invalid inductive argument. Unfortunately, Smith and Chiszar attempt to make of it a valid deductive argument, as is indicated by what follows. These authors proceed to note that "Certainly conversion from the A type to the B type confers no isolating benefit of itself. But with its *assurance* [emphasis ours] that the distinct, homogeneous pattern-type named *P. bicolor* is a distinct species, the hypothesis *becomes reasonable* [emphasis ours] that at least some of the other, distinct, homogeneous pattern-types are also valid species *despite* [emphasis ours] the absence of known confirmatory scale differences." Finally, they conclude that "Thus we regard *P. euryzonus*, *P. psychoides*, *P. dimidiatus*, *P. wilmarai* and *P. andrewsi* as additional valid species, and the geographic variation in *P. elapoides* and *P. bicolor* itself takes on *taxonomically meaningful significance* [emphasis ours]."

Essentially what Smith and Chiszar are saying is that if they can link one scale variation, no matter how minor, to one of the pattern conditions in this genus, then some (why not all?) of the other pattern conditions in the genus can also be regarded as "taxonomically significant," i.e., have formal names applied to them. Thus, the invalid inductive argument is passed off as a valid deductive argument and used as the basis for a string of thus defenseless taxonomic decisions. The use of this logical fallacy by Smith and Chiszar as the sole criterion for departing from the Savage and Crother schema is illustrative of the extremes to which traditional systematics techniques can be pushed to justify whatever conclusions are most congruent with one's systematics philosophy.

Chimeric systematics-biogeographic philosophy.—Because of the predictive and self-corrective value of cladistic systematics, it is in an ascendant position relative to traditional evolutionary systematics. It is understandable, therefore, that in the interest of having their work published, some traditional systematists might resort to trying to create a chimera of the techniques and terminology of the two approaches to systematics. This is what Smith and Chiszar have done with their *Pliocercus* work.

In attempting to divine the nature of their technique, however, we are left to deciphering their conclusions, inasmuch as there is no methods section in the paper. Smith and Chiszar introduce the cladistic terms plesiomorphic and apomorphic on page 25, with

no indication how they arrived at such applications. The accepted norms of cladistic technique, including choice of outgroups, character-state determination and polarization, and cladogram construction and statistical analysis thereof are nowhere to be found. As such, there is no basis for the assignment of plesiomorphic or apomorphic status to any of the characters they examine. Furthermore, there is no support for designation of taxa as least, less, more, or most derived. As an extension, there is also no basis for their biogeographic discussion, especially the idea that the "taxogeny" of *Pliocercus* has been primarily shaped by three "dispersal events." The rambling house of cards Smith and Chiszar have constructed, thus, falls into a heap, leaving no basis for either their taxonomic or their biogeographic conclusions.

More in the continuing saga of the subspecies.—During the 1950's, the subspecies concept was discussed in detail, especially in the pages of the journal *Systematic Zoology.* Proponents and detractors jousted with one another for years. When the dust settled, adherents to both views still existed. In herpetology, however, the subspecies has been largely abandoned. The concept, however, has been given a sound drubbing by Wilson and Brown (1953), Savage and Heyer (1967), and Wilson and Meyer (1985). In their *Pliocercus* work, however, Smith and Chiszar have made extensive use of subspecies.

Their adherence to what we consider to be an outmoded systematics concept is defended in interestingly disparate fashion in two publications in the same issue of the *Bulletin of the Maryland Herpetological Society.* In one paper (Smith, Wallach, and Chiszar, 1995), the authors state that "We subscribe to a positive vision of the place of subspecies in zoological taxonomy, involving no conflict with the Phylogenetic Species Concept, partially on ground expressed by Smith and White (1956), and partially because of the importance of subspecies in considerations of conservation and protection. *Properly understood* [emphasis ours], they do constitute genetically unique populations, and as such, even if not effectively closed, merit as much concern and recognition as other genetically unique populations. Abandonment of such a long-accepted and *vital* [emphasis ours] category as subspecies is neither warranted nor necessary, even in a strictly phylogenetic classification, to which they can be regarded as an adjunct, without change of name or treatment" (p. 209).

Invocation of the subspecies concept is not necessary to express concern for the conservation and protection of the diversity of life. The definition of biodiversity, after all, includes diversity at all levels, genetic, specific, and ecosystemic (Wilson 1992). Biodiversity decline is an environmental problem that attacks all levels of the diversity of life on Earth.

The other defense is provided by Smith, Ramírez-Bautista, and Chiszar (1995), who state that "We suspect that much of the resistance in general to the recognition of subspecies is a product of *unwillingness to deal with the tedious detail involved in demonstrating their reality* [emphasis ours]. Other reasons exist, of course, but a reluctance to undertake or give credence to the value of the extraordinary effort required to demonstrate the existence of genetically distinct, reliably identifiable populations should not be under estimated or condoned" (p. 201). These statements border on being insulting to those biologists who have argued against the use of subspecies, implying that they are simply *too lazy* to underwrite the "extraordinary effort" necessary to "demonstrate their reality." Moreover, these layabouts are not even willing to acknowledge the value of such effort undertaken by others. This is not an argument likely to prove compelling to other workers.

The homoplagiarism tarantella.—There must have been some anxious moments in the respective offices of Smith, Chiszar, Ramus, and Harris as the reviewed work and Issue 2 of Volume 32 of the *Bulletin of the Maryland Herpetological Society* (BMHS) went to their respective presses. The Smith and Chiszar work includes an account of *Pliocercus wilmarai*, a taxon described in a paper by Smith et al. (1996), cited as in press! The latter work appeared in the above-mentioned issue of the BMHS. Fortunately, Smith and Chiszar narrowly missed committing homoplagiarism by two weeks. The BMHS issue is dated 30 June 1996 and the Smith and Chiszar work 15 July 1996. Although we suspect this instance was carefully orchestrated to avoid homoplagiarism, our experience has been that one should await the appearance of a new name in print *before* using it in a subsequent work. The obvious solution to this situation would have been to publish the original description of *P. wilmarai* in the work under review, crediting it to Smith, Pérez-Higareda, and Chiszar. Examples of this type of procedure are in Smith (1965) and Wilson (1987).

Taxogeny versus phylogeny.—Smith and Chiszar provide biology with a new term in this work, viz., taxogeny. On page 20, they attempt to explain the term in its adjectival form, as follows: "Another scale character of minor taxogenetic (a term introduced here to avoid usage of the term 'phylogenetic' in reference to subspecies, whereas 'taxogenetic' can be used in that context, although also embracing the restricted concept of 'phylogenetic') significance, although independently not diagnostically useful, are the extremes in number of ventrals and caudals, which diminish with populational derivation." As we write this review, we still feel at bay in our attempts to understand this statement, as well as the included definition. Apparently, Smith and Chiszar wish to "restrict" the use of the term "phylogenetic" to taxa other than subspecies and have invented the word "taxogenetic" to encompass the subspecies and all other taxonomic levels. Why this is necessary is not explained, except to provide a means to circumvent use of the word "phylogenetic." Why it is necessary to do so is not explained either. We suspect it is because the term phylogeny is usually defined as "the evolutionary development and history of a species or higher taxonomic grouping of organisms" (American Heritage College Dictionary 1993) and, thus, would not strictly involve consideration of the evolutionary history of subspecies. Thus, we now have a term for aficionados of subspecies to use to refer to the sum of evolutionary development. A slight broadening of the definition of the term phylogeny, if deemed really necessary, would have accomplished the same end, resulting in taxogeny being stillborn.

Summary.—The issues and problems in the Smith and Chiszar work discussed above are sufficient, we believe, to render their systematic conclusions and the resulting classification and nomenclature invalid. We suggest, therefore, that students of Latin American herpetology revert to the use of the Savage and Crother taxonomy, until such time as a suitably conducted systematic revision demonstrates that another taxonomy is justifiable. Circumventing peer review to allow appearance of systematic work of the caliber produced by Smith and Chiszar in the work under review is not likely to be viewed as either desirable nor acceptable by the herpetological community.

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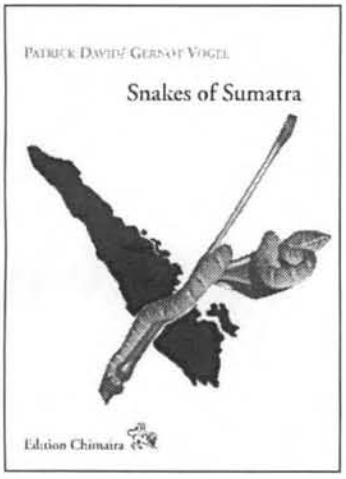
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ARTICLES

Neonate-Female Associations in *Xenosaurus newmanorum*: A Case of Parental Care in a Lizard?

JULIO A. LEMOS-ESPINAL
Laboratorio de Investigacíon en Conservacion
Universidad Nacional Autónoma de México, Campus Iztacala
Apartado Postal 314, Tlalnepantla, Edo. de México, México

GEOFFREY R. SMITH*
Department of Biology, Earlham College, Richmond, Indiana 47374, USA
e-mail: smithge@earlham.edu

and

ROYCE E. BALLINGER
School of Biological Sciences, University of Nebraska
Lincoln, Nebraska 68588, USA

**Author to whom all correspondence should be addressed.*

Post-hatching parental care has often been assumed to be nonexistent in squamate reptiles (e.g., Wesolowski 1994). However, recent studies have suggested limited parental care in some species of lizards (see Shine 1988 for review). Many of these examples concern egg brooding behavior where the female protects her clutch of eggs from desiccation or thermal extremes (Somma and Fawcett 1989; Vitt and Cooper 1985), or may remove spoiled eggs from the nest (Groves 1982; Somma 1989). Few reports exist of post-hatching parental care (e.g., Somma 1987).

In this note we report observations on an apparent case of extended post-partum parental care in the Mexican knob-scaled lizard (Xenosauridae:*Xenosaurus newmanorum*). *Xenosaurus newmanorum* is a viviparous species, with a gestation period of approximately 11–12 months, a biennial reproductive cycle, and a litter size of 1 or 2. Members of this species live in cracks in rock walls in a tropical cloud forest, and exhibit marked sexual dimorphism in head size and body size. We studied the natural history of *X. newmanorum* in a marked population in San Luis Potosí, México. Individuals were marked and measured approximately monthly from February 1994 to November 1995.

We observed adult female *X. newmanorum* living in cracks with neonates in the months of August, September, and October. This behavior differs from two other species of *Xenosaurus* that we have observed in the field (*X. grandis* and *X. rectocollaris*). Neonates of these species were found in close proximity to adult females, but we have never seen adults and neonates living together in the same crack. Ballinger et al. (1995) reported the solitary behavior of *X. grandis*, and the occurrence of male-female pairs in *X. newmanorum*. We have also observed solitary behavior in *X. rectocollaris*.

Six adult female *X. newmanorum* that were pregnant in the months of June and July were observed to live in the same crack with up to two hatchlings after parturition. Of 12 neonates observed between August and October (1994 and 1995), nine were living in the same crack as a female that was pregnant in the months of June and July. In three cases, one neonate was living with a single female in the crack. In three other cases, two neonates were living with a single female in the crack. In all the adult female-neonate pairs or groups, the adult female was always at the front of the crack, and the neonates were behind the adult females. Indeed, it was often necessary to check each crack occupied by an adult female carefully in order to see a neonate.

The association between neonates and adult females appears to be relatively long lasting. One marked adult female-neonate pair lasted from 26 August 1995 to 6 October 1995 (41 d). Another pairing between a marked pregnant adult female and a marked juvenile lasted from 27 May 1995 to 6 October 1995 (132 d). However, we did not observe the same associative behavior (i.e., female in front of juvenile in crack) with this larger juvenile (SVL = 78 mm, TL = 150 mm, BM = 7.0 g).

Neonates were never found in association with adult males during the study period, even though males were found in nearby cracks. However, male-female pairs of *X. newmanorum* can be found in the month of December. During the time that these male-female pairs form, pairs can be seen living in close proximity to other pairs, with up to three male-female pairs occupying cracks within a 1 m^2 area. Therefore, the lack of male-neonate pairs does not appear to be a function of solitary behavior in males, and also indicates that the female-neonate pairs are not simply random associations of adult lizards with young lizards.

Our observations on female-neonate associations suggest that they may have a basis in parental care, presumably an anti-predator function; however, this is only one of several possible explanations. Females may protect their offspring by placing themselves between potential predators and their offspring. Another possible explanation of the female-neonate positions (e.g., female on outside of neonate) may be that neonates can get farther into the crevice than the larger females. However, there does not appear to be an association between lizard size and crevice size in *X. newmanorum* (J. A. Lemos-Espinal, G. R. Smith, and R. E. Ballinger, unpubl. data). These observations should be seen as preliminary since we can only assume that the adult females and neonates are parent and offspring. However, it seems likely that they are mother and offspring since individuals have relatively small home ranges and are relatively sedentary. Recent experiments have suggested that some lizards may have the ability to discriminate their own offspring from unrelated juveniles (Bull et al. 1994), which, along with our observations, imply that post-hatching parent-offspring interactions in lizards may be more common than previously assumed.

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An Integrated Approach to the Study of the Diet of *Vipera aspis*

PAOLO SAVIOZZI
Via Vitricaia 49, 55057 Pontetetto (LU)-Italy

and

MARCO A. L. ZUFFI*
Museo di Storia Naturale e del Territorio, Università di Pisa
via Roma 103, 56011 Calci (PI)-Italy

**Author to whom all correpondence should be addressed.*

Diet and feeding ecology of snakes of the genus *Vipera* in Europe have been studied in detail in several areas of their range (Baron 1992; Bea et al. 1992; Luiselli and Agrimi 1991; Sebela 1980). Methods involved in studying food preference and diet of snakes usually involve analyses of stomach contents (e.g., Luiselli and Agrimi 1991; Shine 1986) or feces (Reinert et al. 1984); in only a few cases (Shine 1986) have stomach and fecal analyses been carried out at the same time.

In this note we present the results obtained from the analysis of both stomach contents and fecal matter from a *Vipera aspis* population (Monney 1990; Saviozzi 1994). This work was designed to compare the usefulness and precision of both methods when studying the diet of snakes.

The study area was at Arnino, 8 km SW of Pisa and 2 km E from the Ligurian coast, in the "Parco Naturale di Migliarino-S. Rossore-Massaciuccoli," western Tuscany, central Italy (43°39'45" N, 10°17'30" E). The 3.9-ha study site was largely cultivated. During 1990–1994, we obtained 30 meal samples from 76 captured specimens (48 females, 26 males, and 2 juveniles). A recent meal was determined by palpation of the ventral surface. Prey samples were obtained by forced regurgitation or with Kjærgaard's (1981) method. Fecal samples were collected within a few hours by holding the snake in captivity. Samples were preserved in 70% alcohol until examination and are now in the collection of ingesta of the Natural History Museum of the University of Pisa.

The identity of regurgitated prey items was determined using Toschi and Lanza (1959) and Toschi (1965) or by comparison with specimens preserved at the Museum. Mammal hairs from fecal samples were examined microscopically (Debrot et al. 1982). When necessary, hairs were compared to a reference collection at the Museum. Shapes and patterns of the cuticular scales varied greatly along each hair, but all these features were quite constant within the same taxon (Debrot et al. 1982). All the morphologically different hairs (different taxa) coming from a single fecal sample were examined. Isolated teeth were also used for identification, according to Chaline et al. (1974).

The 30 meal samples collected contained 33 identifiable prey items, of which 8.6% (N = 3) were lizards and 91.4% (N = 30) were mammals (Fig. 1). Among the latter, rodents constituted 84.4% (N = 25) and insectivores 15.6% (N = 5). The number of prey types (represented by genera) identified from the two methods (4 vs. 8) did not differ significantly (binomial test, $p > 0.05$; Siegel 1980). However, there was a significant difference in the number of prey items obtained from fecal analysis (23) compared to stomach contents (10) ($c^2 = 5.12$, 1 df, $p < 0.05$; Siegel 1980). These results suggest that stomach content analysis of field-captured snakes may underestimate prey diversity, especially if the sample sizes are small. Our failure to obtain lizard prey from fecal samples is likely attributable to the very low number of fecal samples from juvenile snakes—those most likely to feed on lizards.

The frequency of *V. aspis* with identifiable stomach contents ranges from 35% to 49% of the snakes examined (Luiselli and Agrimi 1991; Sebela 1980; Slip and Shine 1988). Fecal matter was present at similar frequencies in the intestinal tract of snakes that had not recently fed (Saviozzi 1994; Sebela 1980; Slip and Shine 1988). This relationship enabled us to verify not only the correct determination of prey taxa from stomachs using the most abundant hairs from fecal samples, but also to check if other prey types were present in the intestinal tract of the same specimen. We found as many as three prey species in a single snake. Evidence of prior meals may remain within the intestine for periods up to several weeks.

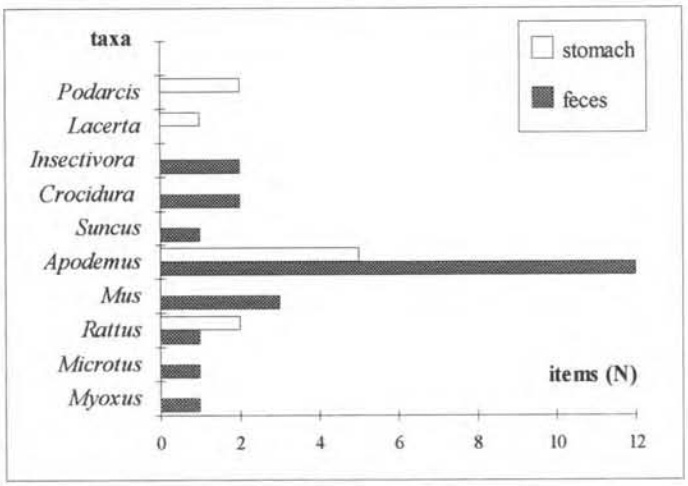


FIG. 1. Prey composition of *Vipera aspis*. Legend: Family Gliridae: *Myoxus* = *Myoxus glis*; Family Muridae: *Microtus* = *Microtus savii*; *Rattus* = *Rattus* sp.; *Mus* = *Mus domesticus*; *Apodemus* = *Apodemus sylvaticus* and *Apodemus* sp.; Family Soricidae: *Suncus* = *Suncus etruscus*; *Crocidura* = *Crocidura* sp.; Insectivora = Insectivora indeterminate; Family Lacertidae: *Lacerta* = *Lacerta viridis*; *Podarcis* = *Podarcis sicula*.

Ontogenetic variation in prey composition of *V. aspis* has been reported; reptiles are rare in the diet of adult snakes but comprise a higher percentage of prey taken by juveniles (Bea et al. 1992; Luiselli and Agrimi 1991). The types and frequency of prey taxa reflects geography, site characteristics, and faunal composition of the study area (Luiselli and Agrimi 1991; Monney 1990). However, it is evident that the temporal aspects of prey frequency, or the estimation of energy gain/loss ratio during feeding activity of a snake population, can be studied by analysis of the both stomach contents and fecal matter (Baron 1992; Luiselli and Agrimi 1991; Monney 1990; Shine 1986). Fecal analysis is time consuming. However, it may provide a more complete taxonomic sample of the prey consumed, especially in the case of small samples or when short-term studies are planned (Saviozzi 1994; Zuffi and Saviozzi, unpubl.).

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Blanding's Turtle Specimens from the Turner Farm Archaeological Site, North Haven, Maine

ARTHUR E. SPIESS
Maine Historic Preservation Commission
State House Station 65, Augusta, Maine 04333, USA
e-mail: shaspie@state.me.us

and

KRISTIN D. SOBOLIK
Department of Anthropology, Institute for Quaternary Studies
University of Maine, Orono, Maine 04469-5773, USA
e-mail: sobolik@maine.maine.edu

Animal bone remains from archaeological sites provide excellent data for determining past range and relative abundance of many vertebrate and invertebrate species (Graham and Mead 1987; Klein and Cruz-Uribe 1984; Semken and Falk 1987). Maine's coastal shell middens are a superb storehouse of information pertaining to hunting and fishing success by Native American inhabitants for the last few thousand years because the discarded shell neutralizes Maine's acidic soil and preserves bone (Spiess 1993). Many coastal shell middens have faunal evidence of occupation during all seasons of the year; thus we know that portions of the coast were not abandoned at any particular season (Sanger 1996).

The Turner Farm site is on North Haven Island, Maine, USA, which, when paired with Vinalhaven, forms the largest island land mass in Penobscot Bay (Fig. 1). The Turner Farm site contains the longest uneroded record of coastal habitation yet excavated in the northeastern United States (Bourque 1995), and the most detailed faunal record so far analyzed (Bourque 1995; Spiess and Lewis 1995, in press) with over 30,000 vertebrate specimens identified. Occupation at Turner Farm began about 5200 years ago with episodic use lasting until arrival of Europeans.

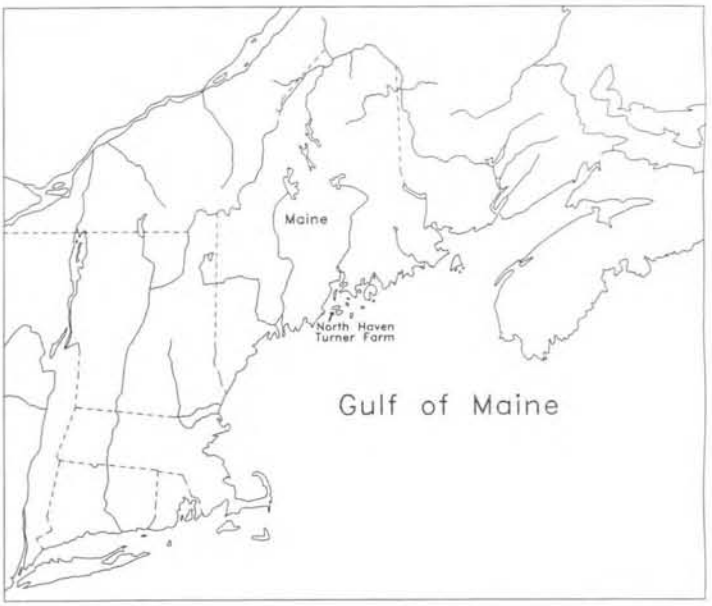


FIG. 1. Location of the Turner Farm Site.

Turtle bone from the site was identified using comparative material in the Faunal Laboratory at the University of Maine, Orono, and the use of an extensive turtle comparative atlas for archaeological identifications (Sobolik and Steele 1996). The majority of

bones were identified as carapace fragments from large and medium-sized snapping turtles (*Chelydra serpentina*) and one nuchal fragment of an emydid species, probably of the genus *Clemmys* (wood and spotted turtles). The most complete specimen (Fig. 2) is a large partial carapace reconstruction from 12 bones, identified as *Emydoidea blandingii* (Blanding's turtle). In addition, three other bones were also identified as belonging to *E. blandingii*.

The partial carapace reconstruction includes bones from the left second to the right sixth peripheral, plus fragments of three pleurals (Fig. 2). Eleven of these twelve bones were found in a single occupation layer ca. 4000 years old (catalogue number D-1158). The twelfth specimen (catalogue number C-252) was the left second peripheral recovered from disturbed "plowzone" deposits which overlie the site. The recovery of one bone from this individual from an upper stratum indicates that digging in the site, possibly by later prehistoric Native American inhabitants, disturbed and scattered the specimen.



FIG. 2. Reconstructed specimen of *Emydoidea blandingii*.

Publications documenting turtle remains from New England archaeological sites have not been common. French (1986) reports the first identification of *E. blandingii* from an archaeological context: site 17.22 on Hog Island, Muscongus Bay, Maine, from deposits dating sometime between 2500 and 500 years old. These remains include five reconstructed *E. blandingii* carapace fragments, which came from a turtle with an approximate carapace length of 22.5 cm. Eleven *E. blandingii* bones were also identified from a sample of 599 turtle bones from Concord Shellheap in Massachusetts from deposits radiocarbon dated to 4660 years old (Rhodin 1992, 1995).

Therefore, Turner Farm is the third archaeological site in New England from which *Emydoidea blandingii* has been recovered. Blanding's turtle is a common species in the Turner Farm deposits, more common than all other turtle species except for *Chelydra serpentina*. In discussing the disjunct distribution of the redbelly turtle, Rhodin (1992:29) comments that the faunal evidence "suggests at least partial extirpation at the hand of prehistoric man." His statement seems based upon the fact that the species was being harvested by Native Americans, and is no longer present near the few archaeological sites in Massachusetts where it has been found to occur. His sample, however, lacks internal time depth differentiation. With the Turner Farm sample of *E. blandingii*, we come to a different conclusion. The species was harvested by Native Americans, true, but it survived for at least 3500 years in the local herpetofauna. The most recent identification dates just before European contact (ca. 500 yrs B.P.). Rather than extirpation at the hands of Native American hunters and gatherers, the Turner Farm data seem to support the hypothesis that Blanding's turtle survived modest harvest pressure for millennia.

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The Occurrence of *Sauromalus varius* on a Satellite Islet of Isla Salsipuedes, Gulf of California, México

BRADFORD D. HOLLINGSWORTH
Department of Natural Sciences, Loma Linda University
Loma Linda, California 92350, USA
and
Department of Biology, La Sierra University, Riverside, California 92515, USA
e-mail: bholling@lasierra.edu

CLARK R. MAHRDT
Southwest Biological Associates
9847 Willow Lane, Escondido, California 92029, USA

L. LEE GRISMER
Department of Biology, La Sierra University, Riverside, California 92515, USA
e-mail: lgrismer@lasierra.edu

BENJAMIN H. BANTA
Southwest Biological Associates
9847 Willow Lane, Escondido, California 92029, USA

and
CHARLES K. SYLBER
Department of Biology, California State University
Fullerton, California 92634, USA

The genus *Sauromalus* is composed of the two continental species, *S. obesus* and *S. australis*, whose collective range is throughout the desert regions of the southwestern United States and northwestern México, including several islands in the Gulf of California (Murphy and Ottley 1984; Shaw 1945). Additionally, there are five insular endemics in the Gulf of California: *S. ater*, *S. hispidus*, *S. klauberi*, *S. slevini*, and *S. varius* (Murphy and Ottley 1984; Shaw 1945). One of these, *S. varius*, is known only from Isla San Esteban in the Midriff region (Fig. 1). Lowe and Norris (1955) reported *S. varius* from Isla Alcatraz off the coast of Sonora; however, Robinson (1972), Case (1982, 1983), and Grismer (1994) considered this a hybrid population resulting from aboriginal introductions and to be composed of a genetic cross involving *S. varius*, *S. hispidus*, and *S. obesus*. Lowe and Norris (1955) also reported *S. varius* from Isla Cholludo (an islet off the southern end of Isla Tiburón) based on a possible sight record from R. S. Felger of an individual entering a burrow. This report was followed by Soulé and Sloan (1966), Murphy (1983), and Murphy and Ottley (1984) although it was never verified.

We report here a new insular population of *Sauromalus varius* from a small, rocky, satellite island known as Isla Roca Lobos, lying 0.25 km west of Isla Salsipuedes, which represents a range extension of ca. 35 km due west of Isla San Esteban (Fig. 1). Isla Roca Lobos is approximately five ha in area and 20 m in elevation. It has xeric-adapted vegetation of the Central Gulf Coast phytogeographic region (Wiggins 1980) dominated by *Opuntia fulgida*, *O.* cf. *burrageana*, *Pachycereus pringlei*, *Stenocereus gummosus*, *Oligomeris linifolia*, *Atriplex barclayana*, *Nicotiana trigonophylla*, and *Physalis crassifolia*. *Sauromalus varius* is listed as an endangered species (Dodd 1980) and conservation and management plans are currently being implemented (Lawler and Jarchow 1986; Lawler et al. 1994). The chuckwallas on Isla Roca Lobos represent the second confirmed wild population of *S. varius* and should play a meaningful role in conservation efforts. However, in order for this population to be incorporated effectively into a management plan for *S. varius*, the morphological and genetic variation relative to the Isla San Esteban population should be understood adequately. The maintenance of small populations and the nature of their variation is of special interest because an understanding of such variation may help clarify the necessary levels of genetic diversity needed to maintain viable populations in the wild and in captive breeding programs. Therefore, the intent of this paper is to (1) compare the morphology of the Isla Roca Lobos lizards to that of Isla San Esteban, and (2) discuss the origin of this population. The results of a genetic study, currently in progress, will be reported elsewhere.

On 31 March 1994, two of us (CRM and BHB) discovered, captured, and released three adult female *S. varius* on the east side of Isla Roca Lobos in association with rock outcroppings. Three of us (BDH, CRM, and LLG) returned on 5 July 1995 and observed 14 adults, seven of which were captured and morphological data recorded (see below). Each lizard was photographed (LACM PC 1268–1274) and released.

Meristic counts follow the terminology of Shaw (1945) with some modifications (Table 1). These include (1) number of ventral scales between the gular fold and vent (VENTRL); (2) number of dorsal scales in a single head length measured from the

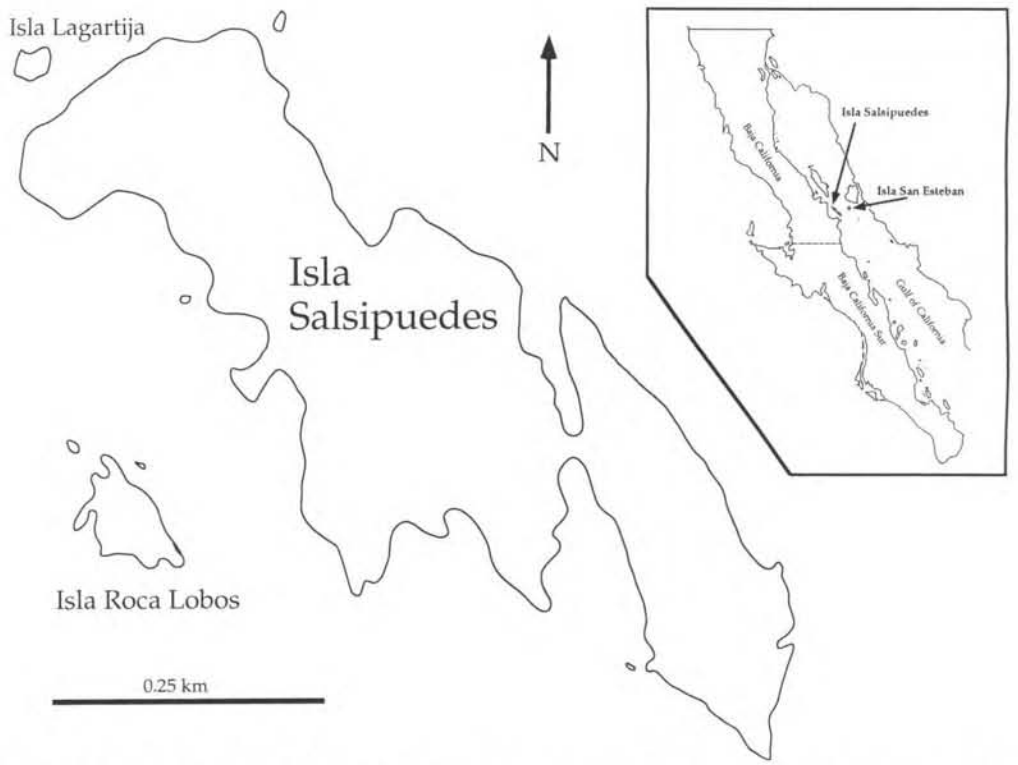


FIG. 1. Location of islas San Esteban, Salsipuedes, Lagartija, and Roca Lobos in the Gulf of California, México.

anterior margin of the external auditory meatus to the tip of snout (DORSAL); (3) number of caudal scales in an annulus two head lengths posterior to the vent (CAUDAL); (4) number of brachial scales encircling the thickest part of the upper arm (BRACHL); (5) total number of femoral pores (FEMPOR); (6) total number of supralabial scales (SUPRAL); (7) total number of infralabial scales (INFRAL); and (8) number of rostral scales differentiated from the adjacent supralabials by being slightly larger (ROSTRL).

Student *t*-tests (95% confidence interval) run on StatView SE v.1.03 (Feldman et al. 1988) compared the seven individuals from Isla Roca Lobos to 19 museum specimens from Isla San Esteban (Appendix I) for each meristic character. The populations were tested for sexual dimorphism and interpopulational differences. A principle component analysis (PCA) run on Bio∑tat II (Pimentel and Smith 1985) was performed using six of the eight meristic characters (Fig. 2) and 16 of the 19 individuals from Isla San Esteban. The three excluded individuals could not be scored for rostrals, supralabials, and infralabials. Dorsals were excluded from the PCA due to significantly different means ($P < 0.05$) between males and females. In order to include dorsal counts, the analysis would have to have been split according to sex, lowering the overall sample size, and affecting the statistical reliability of the results. Rostrals were excluded because they were not normally distributed.

The degree of morphological variation in the Isla Roca Lobos population was similar to that of *Sauromalus varius* from Isla San Esteban (Fig. 2; Table 1). Student *t*-tests revealed no significant differences between the mean of the meristic counts for the two populations (Table 1). In addition, no significant sexual dimorphism was detected, with the exception of the dorsal scale counts for the Isla Roca Lobos population. This character was therefore compared for each sex between the two populations and no significant differences were observed (Table 1).

The PCA was consistent with the *t*-tests, indicating broad overlap between the two populations (Fig. 2). In fact, the sample from Isla Roca Lobos displayed as much variation as that found in the Isla San Esteban population (Fig. 2; Table 1) with 76.1% of this variation being distributed over the first and second principal component axes (Fig. 2). The dispersion along the first principal component axis (61.7%) is primarily the result of the variation in ventral scale counts.

The lack of morphological divergence between these two populations suggests that the Isla Roca Lobos population may have had a recent origin. We believe it is unlikely that the presence of *Sauromalus varius* on Isla Roca Lobos represents a natural colonization because of the island's geographic location. Isla Salsipuedes lies between islas San Esteban and Roca Lobos (Fig. 1) and would more than likely serve as a barrier to direct overwater dispersal. No evidence of chuckwallas was found on Isla Salsipuedes or an additional satellite island (Isla Lagartija) lying 0.25 km to the north. The nearest chuckwalla population is that of *S. hispidus* on Isla San Lorenzo Norte (= Isla Ánimas), which is part of the same geological block as Isla Salsipuedes and its satellite islands (Gastil et al. 1983). Based on these factors, the presence of *S. varius* on Isla Roca Lobos is best characterized as anomalous and is likely the result of a human introduction. There are numerous proposed cases of introductions of *Sauromalus* onto small islands. The most notable involves the sea-faring Seri Indians who were known to eat chuckwallas obtained during long, sea turtle hunting expeditions (Bahre 1983; Case 1982; Felger and Moser 1985; Malkin 1962). Grismer (1994) proposed that chuckwallas had been transported and released onto smaller, near-shore islands because small island size would facilitate their recapture.

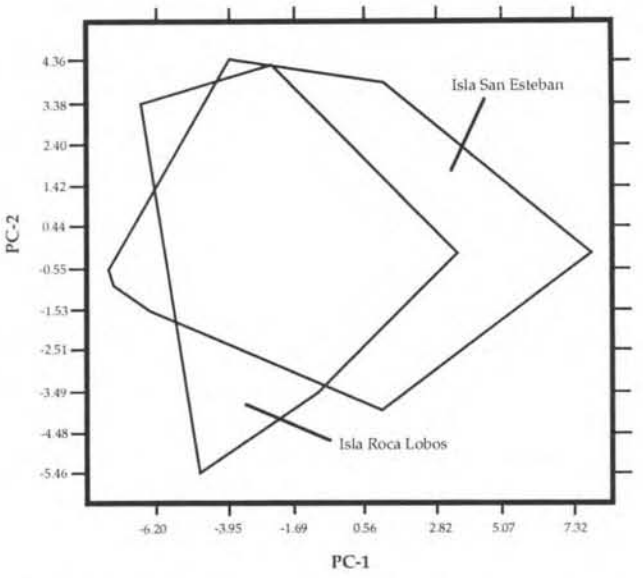


FIG. 2. Principal componant analysis (PC1 and PC2) accounting for 76.1% of the observed variation.

Another, less publicized means of colonization, is by way of the experimental relocation of chuckwallas by scientists into non-native areas (e.g., Case 1982; Sylber 1985). It remains a possibility that the Isla Roca Lobos population represents an experiment to explore the effects of colonization and subsequent evolution of an insular population.

Although we do not condone the practice of introducing species into areas in which they do not naturally occur, especially fragile and sensitive insular ecosystems, this particular introduction may actually contribute to the conservation of *Sauromalus varius*. Its presence on Isla Roca Lobos could prove important to this species' survival. Close monitoring may allow biologists to determine the minimum number of animals necessary to prevent inbreeding depression in wild and captive populations.

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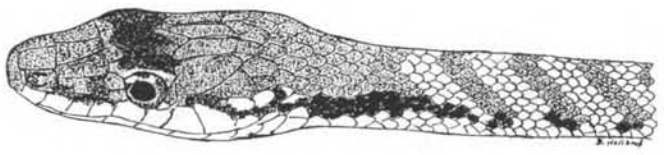
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APPENDIX I
Specimens Examined

Sauromalus varius.—MÉXICO: SONORA: Isla San Esteban (CAS 47971, 50774, 50796, 55049, 93023, 100388; SDSNH 3852-53, 6862-64, 25424, 35410, 46402, 46404-7, 49228). BAJA CALIFORNIA: Isla Roca Lobos (LACM PC 1268-1274).



Lip-Flaring in Thamnophiine Snakes and its Possible Association with Feeding on Soft-bodied, Sticky Prey

ALAN DE QUEIROZ
Section of Ecology and Systematics
Cornell University, Ithaca, New York 14853, USA
Current Address: University Museum and Department of EPO Biology
University of Colorado, Boulder, Colorado 80309, USA
e-mail: dequeiro@stripe.colorado.edu

Responses to predators often involve the use of traits that originally evolved as feeding adaptations (Greene 1988). In snakes, biting and discharging the gut contents are obvious examples of this phenomenon (Greene 1988). Here I consider a more subtle potential example in thamnophiine snakes. Specifically, I report lip-flaring as a response to a perceived predator in the northwestern garter snake, *Thamnophis ordinoides*, and note that the distribution of this behavior among thamnophiine species suggests a connection to feeding on soft-bodied, sticky prey.

While collecting *Thamnophis ordinoides* in the vicinity of Requa, Del Norte Co., California, USA on 19 June 1987, I observed three individuals of this species showing lip-flaring behavior when handled. This behavior consisted of dorsolateral movement of the supralabial scales and underlying tissue (hereafter referred to as the "lip") on both sides of the head.

About one month later, I recorded the behavior of 25 *T. ordinoides* (including the three just mentioned) under controlled conditions in an environmental chamber at Cornell University in Ithaca, New York. The 25 snakes included 17 from the Requa site, seven from Crescent City, Del Norte Co., California, and one from the junction of Lobster Creek and the Rogue River, Curry Co., Oregon, all collected 18–19 June 1987. While in captivity, snakes were individually housed in plastic shoeboxes, kept on a 14L:10D light cycle, and fed earthworms and/or fish. The trials took place between 1030 and 1100 h EDT at a temperature of 24.5°C. For each trial the snake was held at midbody and then tapped lightly five times on the head. Immediately following this procedure, I closely examined the snake for lip-flaring. Seven of the 25 snakes (one from Crescent City and six from Requa) showed distinct lip-flaring, i.e., with the distortion of the dorsal outline of the head readily apparent. Five other snakes showed slight lip-flaring, including two that flared only the right lip. Broken down by sex, five of 16 females, one of five males, and one of five individuals that were not sexed showed distinct lip-flaring. Nine of the 25 snakes have been preserved as vouchers (CU 11819–11825, 12461, and 12463), including two that flared the lips (CU 11819 and 11823).

Certain individuals are apparently more prone than others to flare the lips. Of the 17 snakes examined carefully for the behavior both in the field and in the lab, the three that flared the lips at the time of capture were a subset of the six that showed the behavior in the lab trials reported above. Furthermore, in subsequent lab trials on these same 17 snakes (de Queiroz 1992), four of five that flared the lips were ones that had shown this behavior in the earlier trials.

Among thamnophiine snakes, lip-flaring occurs commonly in *Storeria occipitomaculata* (Gosner 1942; A. de Queiroz, pers. obs.) and has been reported in one case in *Virginia valeriae* (Conant 1938). I have also observed distinct lip-flaring in two *Thamnophis sirtalis* from Tompkins Co., New York. I have not observed distinct lip-flaring in extensive field and lab observations of 14 other

species of *Thamnophis* (de Queiroz 1992) and know of no other reports of this behavior in the considerable body of work on thamnophiine antipredator behavior (e.g., Arnold and Bennett 1984; Godley 1982; Herzog et al. 1992; Scudder and Burghardt 1983).

At least among thamnophiines, there appears to be an association between lip-flaring and feeding on prey that are sticky and soft-bodied (i.e., lack a hard skeleton). *Thamnophis ordinoides* feeds primarily on earthworms and slugs (Fitch 1941; Gregory 1978, 1984), *S. occipitomaculata* seems to eat slugs almost exclusively (Gilhen 1984; Semlitsch and Moran 1984; also see references in Rossman and Myer 1990), and *V. valeriae* feeds largely on earthworms (Ernst and Barbour 1989 and references therein). Although *T. sirtalis* feeds on a wide variety of prey, in New York earthworms make up the majority of its diet (Hamilton 1951). Assuming that the above species are the only four thamnophiines that flare the lips, current hypotheses of phylogenetic relationships among thamnophiine genera (Robin Lawson, pers. comm.) and among species of *Thamnophis* (de Queiroz and Lawson 1994) suggest four independent originations of the behavior. This and the fact that the majority of thamnophiine species do not feed primarily on soft-bodied prey (Arnold 1981; Mushinsky 1987; Rossman et al. 1996) suggest that the association between lip-flaring and diet is not due to chance. Of course, attributes that are correlated with diet, rather than diet per se, might be the cause of the association (for example, with the exception of *T. sirtalis*, all of the above species are small). Also, it does not appear that lip-flaring and a diet of soft-bodied, sticky prey necessarily occur together. For example, the behavior does not seem to be present in *T. brachystoma* and *T. butleri*, which are both earthworm specialists (Rossman et al. 1996), and it does occur in some snakes and other squamates (e.g., the Asian lycodontine *Cyclocorus*—Ron Crombie, pers. comm.; some agamids—Greene 1988) that do not feed on such prey.

Whether lip-flaring is used in feeding is unknown; thus explanations for the possible association of lip-flaring and diet are purely speculative. Hobart Smith (pers. comm.) has suggested that certain kinds of soft-bodied prey (such as earthworms) might be more easily swallowed without using the teeth. In this case, flaring the lips might function to move the teeth out of the prey's path down the throat. Although in lip-flaring, the maxillae do not seem to move in complete concert with the lips (thus, lip-flaring exposes the teeth), it may be that the maxillae do move dorsolaterally to some extent. Another possible explanation is that pulling the lips away from the maxillae might help remove mucus from the teeth. In any case, I am speculating here that lip-flaring in response to predators occurs only following initial selection of the trait for some feeding function.

The possibility of a causal relationship between lip-flaring and feeding on soft-bodied, sticky prey is presented here as conjecture based on suggestive, but by no means definitive, comparative evidence. Verifying the evolutionary association requires observations of many more taxa, and support for the proposed explanation of such an association requires functional studies of the feeding mechanics of the species in question.

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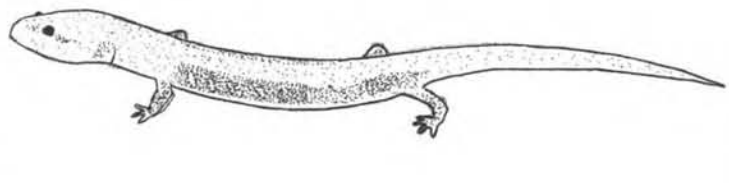
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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in volume 27, number 2 (June 1996).

CAUDATA

AMBYSTOMA CALIFORNIENSE (California Tiger Salamander). **BURROWING ABILITY.** It is assumed that ambystomatid salamanders are generally poor burrowers and rely upon accessible rodent burrows for estivation habitats (see Semlitsch 1983. Can. J. Zool. 61:616–620). During an 18 February 1996 nocturnal survey for adult California tiger salamanders at a site ca. 2.25 km southeast of Calero Reservoir, Santa Clara County, California, USA, I observed an adult male *Ambystoma californiense* successfully dig through the plugged entrance of a valley pocket gopher (*Thomomys bottae*) burrow. The observation was made on a rainy night between 2131 and 2300 h. The salamander was first observed with its muddied head inserted into a pocket gopher mound. The salamander was then removed, examined, sexed, and placed back in its original position. Subsequent examinations at 15-min intervals revealed the salamander was able to successfully find the burrow entrance and then dig through the mound plug into the pocket gopher burrow. The salamander's digging efforts were aided by a constant steady rainfall, which materially softened the exposed soil of the pocket gopher mound. This observation is significant because it indicates that California tiger salamanders have the ability to burrow out of or into normally closed pocket gopher burrows given sufficiently moist soil conditions. Thus, potential estivation habitat for this salamander is not limited by the surface activities of California ground squirrels (*Spermophilus beecheyi*) or valley pocket gophers in keeping their burrows open at critical times of the year.

My thanks to Norman J. Scott, Jr. for reviewing the manuscript. Permits to conduct salamander surveys were provided by the California Department of Fish and Game.

Submitted by **MARK R. JENNINGS**, National Biological Service, California Science Center, Piedras Blancas Field Station, P.O. Box 70, San Simeon, California 93452-0070, USA, and Research Associate, Department of Herpetology, Califomia Academy of Sciences, Golden Gate Park, San Francisco, Califomia 94118-9961, USA.

PLETHODON CINEREUS (Redback Salamander). **PREDATION.** On 5 June 1993, we observed a *Turdus migratorius* (American robin) at the Mountain Lake Biological Station, Giles Co., Virginia, USA, with an adult *P. cinereus* in its beak. The bird flew ca. 30 m, settled to the ground, and began to peck vigorously at the wiggling, autotomized tail of the salamander. The salamander was less than a meter from the bird. When we approached, the bird flew off. The salamander died within the hour, presumably from injuries suffered while being carried by the bird. Although our intrusion prevented us from observing the culmination of the event, the bird was clearly distracted by the autotomized tail.

Avian predation is not believed to be an important factor in the population dynamics of terrestrial salamanders (Hairston 1980. Am. Nat. 115:354–366). With the exception of the eastern hermit thrush (*Hyloccichla guttata faxoni*), which has been observed feeding *P. cinereus* to its young, salamanders are not mentioned in the diets of thrashers, towhees, and thrushes that forage in the forest litter (Bent. 1964. Life Histories of North American Thrushes, Kinglets and their Allies. Dover Publ., Inc., New York; Hairston 1980, *op. cit.*).

Submitted by **THOMAS L. D. FENSTER**, 4103 Sheridan Street, University Park, Maryland 20781, USA, and Mountain Lake Biological Station, Route 1, Box 105a, Pembroke, Virginia, USA; and **CHARLES B. FENSTER**, Department of Plant Biology, University of Maryland, College Park, Maryland 20742-5815, USA.

PLETHODON DUNNI (Dunn's Salamander). **CANNIBALISM.** Cannibalism has been documented in many amphibians, including several families of salamanders (Crump 1992. *In* Elgar and Crespi, eds. Cannibalism: Ecology and Evolution Among Diverse Taxa, pp. 256–276. Oxford Univ. Press, New York). However, relatively little is known about cannibalism in terrestrial amphibians. Only anecdotal reports of cannibalism in *P. dunni* exist (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. Univ. of Idaho Press, Moscow, Idaho. 332 pp.). Herein we report cannibalism of juvenile *P. dunni* by adults under natural conditions.

During Fall 1995 at Fall Creek (Lincoln Co., Oregon, USA, 10 km W Alsea; 360 m) in the Coast Range we stomach flushed 21 adult *P. dunni* and found juvenile *P. dunni* in two (9.5%) gravid females . The first female (SVL 54.5 mm, mass 5.1 g, collected 14 October 1995) regurgitated a juvenile conspecific (SVL 20.6 mm, mass 0.12 g). The second female (SVL 71.4 mm, mass 5.64 g, collected 11 December 1995) also regurgitated a juvenile (SVL 28.5 mm, mass 0.51 g).

The large size difference that exists between juvenile and adult *P. dunni* may promote cannibalism . Cannibalistic individuals may find that conspecifics provide a food source that is easily assimilated and may increase growth and enhance reproduction.

Submitted by **JOSEPH M. RIESECRER, MICHAEL T. ANDERSON, DOUGLAS P. CHIVERS, ERICA L. WILDY, JILL DEVITO, ADOLFO MARCO, ANDREW R. BLAUSTEIN, JOSEPH J. BEATTY**, and **ROBERT M. STORM**, Department of Zoology, Oregon State University, Corvallis, Oregon 97331, USA.

PLETHODON VEHICULUM (Western Red-backed Salamander). **HABITAT.** Nussbaum et al. (1983. Amphibians and Reptiles of the Pacific Northwest, Univ. Press of Idaho, Moscow. 332 pp.) and Stebbins (1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.) reported that *P. vehiculum* is chiefly an inhabitant of moist forests but is generally not associated with sites as wet as those preferred by *P. dunni*. Leonard et al. (1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Washington. 168 pp.) reported that *P. vehiculum* is found associated with free water in Washington but provided no details regarding their use of specific aquatic habitats. The following observations demonstrate that *P. vehiculum* is associated with rocky seeps, springs, and small streams in the northern Puget Trough and Cascade Range foothills of Washington. Furthermore, the absence of *Plethodon dunni* and *Rhyacotriton* in these areas (McAllister 1995. Northwest Fauna 3:81–112) raises the possibility that *P. vehiculum* may shift habitat to more aquatic sites in response to reduced competition from other salamanders.

During Winter 1995–1996, I visited two springs at Fort Lewis Military Reservation, Pierce County, Washington, USA (T18N, RlE, W1/2 S22). Both springs are situated at the base of a steep bluff vegetated by a mature Douglas-fir (*Pseudotsuga menzeisii*) and western red cedar (*Thuja plicata*) forest. During a 45-min search on 29 December 1995, I observed 14 *P. vehiculum* in wet gravel where the spring emerges. As salamanders were uncovered, each attempted to escape by rapidly wriggling through the interstitial spaces in the gravel. On 5 January 1996, I collected two adults (Univ. Mich. FS 07653) and two hatchlings (Univ. Mich. FS 07655) in a 30-min search along a spring-fed creek ca. 1.5 km north of the site visited on 29 December. Both adults were found under rocks in the stream bed and when exposed one dived into the water and swam ca. 15 cm before seeking cover under rocks ca. 6 cm beneath the water's surface. Two hatchlings (15 mm SVL) were found beneath a rock in wet sand on the stream edge. *Dicamptodon tenebrosus* was the only other vertebrate found inhabiting these springs and streams.

Similar observations have been made elsewhere in the northern Puget Sound Basin and in the foothills of the Cascade Range of western Washington. On 8 April 1994, I collected 20 *P. vehiculum* in a 30-min search of a rocky seep at the base of a steep, forested ravine in Olympia, Thurston County, Washington (T18N, R2W, NE1/4 S15). R. A. Nussbaum (pers. comm.) reported a seep in the Green River Gorge, King County, Washington, contained the highest relative abundance of *P. vehiculum* that he has ever observed. An association with rocky seeps has also been reported in the Cascade foothills of Pierce County (Slater. 1936. Mt. Rainier Nat. Pk. Nature Notes 14(4); L. L. C. Jones, pers. comm.).

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Submitted by **WILLIAM P. LEONARD**, Washington Natural Heritage Program, Department of Natural Resources, P.O. Box 47016, Olympia, Washington 98504-7016, USA.

ANURA

RANA PRETIOSA (Spotted Frog). **BEHAVIOR and REPRODUCTION.** On 23 September 1990 we (WPL and NPL) observed 25 adults, 12 metamorphs, and 2 advanced tadpoles of *R. pretiosa* during a 2.5-h search in a ca. 30 x 35 m fen situated at 1679 m in the Cascade Mountains, Chelan County, Washington, USA (UTM Zone 10, E672,579.4 N5,376,868.0 m). Adults behaved similarly upon our approach—diving into the water from the bank and taking cover in a thick layer of organic detritus. On 26 May 1991 we (WPL and NPL) returned to find both the fen and the surrounding conifer forest covered by ca. 2 m of snow. Only a ca. 1.5 x 2.5 m pool at the inlet channel was free of snow and ice. As we approached we observed ca. 8 *R. pretiosa* dive below the surface and swim out of sight beneath the snow pack covering the remaining surface of the fen. In this same pool, we observed a pair of *R. pretiosa* in amplexus sitting among sedges (*Carex nebrascenisis*) in ca. 5 cm deep water. The pair never moved from its original position despite our descending the steep, 2 m high snow bank and approaching within ca. 0.3 m. No eggs were observed, indicating that oviposition had not begun. Given both the depth and complete coverage of the surrounding forest with snow, these individuals had surely overwintered in the fen.

On 23 May 1992 between 1056 and 1130 h, we (WPL, RMS, PEP) again visited this site and found the forest surrounding the pond covered by ca. 1 m of snow. We found two ca. 200 m^2 areas of the fen to be snow and ice free—one at the inlet channel at the east end and one around the outlet channel at the west end. At the eastern side of the fen we observed ca. 20 males floating fully exposed at the surface and 35 freshly deposited egg masses in a ca. 4 m^2 area vegetated by sedges in 20–25 cm deep water. The water temperature at the oviposition site was 7.5°C. A conspicuous churning of water was caused when a male appeared to amplex another male; upon contact, the second male jumped up, apparently stimulating the entire congregation of males to jump about in a burst of short leaps. On two occasions, the males were heard calling as a group for ca. 7–12 sec followed by prolonged quiescent periods. The calls consisted of a series of 5–7 rapid, weak notes and were first thought to be a woodpecker tapping on a tree in the adjacent forest. A second breeding congregation of ca. 20 males and a pair in amplexus was found on the north side of the east pool. This group was also among sedges in 5–10 cm of water.

These observations demonstrate that *R. pretiosa* overwinter in breeding ponds in the Cascade Mountains in Washington, thus enabling breeding to commence as soon as a small portion of the breeding pond is free of snow and ice. This behavior would appear to provide a significant reproductive advantage to populations of *R. pretiosa* at high elevations in the Cascade Mountains where the snow-free period may last for as little as three months.

Submitted by **WILLIAM P. LEONARD**, Washington Natural Heritage Program, Department of Natural Resources, P.O. Box 47016, Olympia, Washington 98504-7016, USA, **NICHOLAS P. LEONARD**, 223 Foote Street NW, Olympia, Washington 98502, USA, **ROBERT M. STORM**, 1623 SW Brooklane, Corvallis, Oregon 97333, USA, and **PATRICIA E. PETZEL**, Linn-Benton County Community College, Albany, Oregon 97321, USA.

RANA PRETIOSA (Spotted Frog). **TOE CLIPPING EFFECTS.** Toe-clipping has been the most widely employed technique for marking individual amphibians since Bogert (1947. Am. Mus. Novit. 1355:1–24) introduced the method. Recently there has been considerable concern worldwide regarding ethical and survivorship implications of toe-clipping (Halliday 1994. Froglog 10:2–3). There is, however, a paucity of direct evidence indicating that toe-clipping causes mortality. The dearth of such reports may stem from biologists' reluctance to report findings that indicate their work impinges on the life of their subjects and, as a result, potentially biases their data (Reaser 1995. Froglog 12:1–2).

The study most often cited as evincing a causal relationship between toe-clipping and amphibian mortality (Clark 1972. Copeia 1972:182–185) does not provide substantive data (Reaser 1995, *op. cit.*). Two studies do, however, illustrate sub-lethal effects of toe-clipping that could influence amphibian survivorship and fitness: Underhill (cited by Honegger 1979. Int. Zoo Yb. 19:4–22) documented weight loss in leopard frogs following toe amputation; Golay and Durrer (1994. Amphibia-Reptilia 15:81–96) reported that in 18% of the natterjack toads they mark-release-recaptured, toe-clipping resulted in metastatic infection and necrosis, sometimes involving the entire limb.

As part of a multi-year study of *Rana pretiosa* in the Great Basin, we individually marked, following the scheme of Donnelly (1989. Ecol. Monogr. 59:207–221), 122 *R. pretiosa* within a multi-pool complex of Indian Creek, Nye Co., Nevada, USA on 26 July 1994. With the aid of finger-nail clippers, one to two toes were excised per animal just above the toe base. Toe-nail clippers were cleaned with isopropyl alcohol following each excision. The frog wounds were treated with anti-bacterial ointment, and animals were immediately released at the point of capture. Frogs were observed by RED for a total of 47.5 h over the 10-day period between 29 July–8 August 1994. The frogs did not exhibit any signs of infection and no mortality was detected. However, inflammation in several of Golay and Durrer's (*op. cit.*) toads was not evident until at least one month following surgery.

On 26 July 1995 and 30 July 1995 four frogs marked in 1994 were recaptured by JKR at this site. On 26 July 1995 a fifth frog that had been marked at the Indian Creek site was located 5 km away. Individual marks were easily distinguished on these frogs and the clipped toes were well-healed, without scarring. Comparison of SVL and weights between capture dates indicated that three frogs showed marked growth, while two frogs were measured (possibly due to observer bias) slightly smaller than original size (3.8 to 6.9 cm,4.5 to 37g;4.0 to 5.8 cm,4.0 to 20 g; 3.5 to 5.7 cm, 4.0 to 15.0 g; 6.5 to 6.4 cm, 30 to 28 g; 7.0 to 6.5 cm, 34 to 31 g). All recaptured frogs were female; the two heaviest frogs appeared gravid.

Two unmarked females (5.7 cm, 10.5 g; 5.8 cm, 22 g) were found in the ditch with the fifth recaptured frog. One toe was excised for skeletochronological analysis from all three frogs and the animals were immediately released. The nail clippers were again treated with alcohol, but anti-bacterial ointment was not applied. On 9 August 1995 the three frogs were recaptured within the ditch. The recently clipped toe of the frog originally marked in 1994 was slightly red and inflamed to twice its normal width (Fig. 1). The wound had healed over, and the animal otherwise appeared in good health; it measured 6.5 cm and 34 g and was still appeared gravid. Both of the other frogs had well-healed toes without signs of infection. These frogs grew by 0.3 cm/11.5 g and 0.4 cm/1 g. An attempt to recapture the frogs on 14 September 1995 failed.

For birds it is widely held that mortality due to capture and marking is acceptable as long as it does not exceed one percent of the sample. However, determining actual rates of mortality is impossible unless marked individuals are followed consistently for extended time. In this study, fewer than one percent of the animals marked showed signs of infection and no mortality was detected. The acceptability of these findings should be part of the decision-making process employed by anyone considering toe-clipping as marking strategy.

In evaluating amphibian population trends, especially in instances of suspected decline, we must be able to interpret the influence of study on the target organisms. Regardless of how cautious and concerned biologists are, it is not valid to assume that animals are not impacted by those who study them. Controlled studies need to be undertaken on the effects of toe-clipping on amphibians. However, accounts such as reported here can lend substantial information to the general debate on toe-clipping, especially if these reports are amassed for a variety of species. We encourage herpetologists to report observations of the effects of any marking scheme on amphibians. Because marking methods vary greatly, authors should clearly state the procedures followed.

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FIG. 1. Inflammation response following toe clipping in a *Rana pretiosa*.

Submitted by **JAMIE KRISTINE REASER** and **ROBERT ELIAS DEXTER**, Center for Conservation Biology, Department of Biological Sciences, Stanford University, Stanford, California 94305, USA, and the Smithsonian Institution/ Man and the Biosphere Biological Diversity Program, 3123 International Center, 1100 Jefferson Dr., SW, Washington, District of Columbia 20560, USA.

RANA PRETIOSA (Spotted Frog). **VAGILITY**. *Rana pretiosa* has traditionally been considered a highly aquatic species that is much more closely associated with water than other ranids (Dumas 1966. Copeia 1966:60–74). *Rana pretiosa* requires aquatic habitats for breeding, feeding, hibernation, and escape from predators (Licht 1986. Amer. Midl. Nat. 115:239–247; Morris and Tanner 1969. Great Basin Nat. 29:45–81; Turner 1960. Ecol. Monogr. 30:251–278). Biologists have theorized that since *R. pretiosa* is so dependent upon aquatic habitats, it is unlikely that individuals travel far from water (Bissonette and Larson 1991. Utah Coop. Fish Wildl. Res. Unit Misc. Rep. 91:1–20), althoughTurner (*op. cit.*) found that *R. pretiosa* will occasionally move short distances (tens to hundreds of meters) overland. *Rana pretiosa* studied by Carpenter (1954. Copeia 1954:197–200) and Turner (*op. cit.*) wandered within a limited region (tens to thousands of square meters), generally returning to the vicinity of initial capture. Marked *R. pretiosa* in Hollenbeck's (1976. J. Colorado-Wyoming Acad. Sci. 8:72–73) study did not exhibit behavior indicative of a restricted home range.

As part of a three-year study of *R. pretiosa* in the Great Basin, 122 individuals were uniquely marked by toe-clipping within a 400 m, multi-pool complex of Indian Creek, Nye Co., Nevada, USA on 26 July 1994. Four marked animals were recaptured at the same location one year later. A fifth frog (6.5 cm, 31 g, F) was recaptured 26 July 1995 in a water-filled, roadside ditch 5 km straight-line distance upstream from the point of original capture. Two unmarked *R. pretiosa* (5.8 cm, 22 g, F; 5.7 cm, 10.5 g, F) and approximately 50 *Spea intermontana* metamorphs were also present. Average ditch depth was 15 cm, maximum depth was 30 cm. Water temperature was 23°C, and air temperature was 27°C. Sagebrush dominated the site. Straight-line distance to the ditch from Indian Creek was 0.5 km.

The 5 km travelled by the recaptured frog far exceeds previous records. In a mark-recapture study of *R. pretiosa* in Yellowstone National Park during 1953–1959, Turner (*op. cit.*) found that maximum movement between successive captures was 1260 m straight-line distance between 16 September 1954 and 5 August 1955. Other emigrations, ranging from 375–1250 m were also recorded. Maximum rates of movement ranged from an average of 61.5 to 186 m/day. At Jackson Hole, Wyoming, in Grand Teton National Park between July and August 1951, Carpenter (*op. cit.*) discovered that marked *R. pretiosa* moved an average of 1.5 straight-line m/per day (N = 91) with an average maximum of 6.0 straight-line m/per day. The maximum total distance a frog moved was 44.4 straight-line m in a 148-day period (3.3 m/day). Hollenbech (*op. cit.*) found that movements of *R. pretiosa* adults to and from breeding areas ranged from 41–443 straight-line meters; the most rapid movement being 8.9 m/day. Generously assuming 210 days of activity, the recaptured frog that moved 5 km would have travelled an average of 23.8 straight-line m/day.

Carpenter (*op. cit.*) believed that extreme downstream movements might be accounted for by swift currents displacing animals after heavy rains. Nye County, Nevada did experience intensive snow-melt flooding in 1995 and animals from the Indian Creek site might have been carried downstream into regions that are usually dry. However, the 5 km frog was found upstream, making its movement even more remarkable. The region of study is very sparsely populated, and it is extremely unlikely that the frogs reached the ditch with human assistance. It is plausible that *R. pretiosa* take advantage of "wet years" by dispersing into potentially colonizable regions, across a landscape that is usually too dry to be inhabited. Small, ephemeral creeks in 1995 may have served as corridors for movements between Indian Creek and the ditch. One other site, an isolated pooled seep, that was frogless in 1994 was found to be occupied by a single *R. pretiosa* in 1995 (6.3 cm, 24 g, M). This site was at 6 km and 7 km straight-line distance from the nearest source populations to the north and south, and was loosely connected to the two sites by ephemeral seeps and creeks (dry in most of 1994, wet to midsummer in 1995) within a sagebrush matrix.

These observations are important because they demonstrate that amphibians can move extreme distances within harsh environments and that sink habitats (sensu Pulliam 1988. Am. Nat. 132:652–661) may serve as "stepping stones" to facilitate the movement of animals to colonizable source habitats. Sink habitats with permanent water supply could also act as refugia when "wet year" dispersing frogs are stranded by the drying landscape.

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Submitted by **JAMIE KRISTINE REASER**, Center for Conservation Biology, Department of Biological Sciences, Stanford University, Stanford, California 94305, USA.

TESTUDINES

CLEMMYS INSCULPTA. (Wood Turtle). **REPRODUCTIVE BEHAVIOR.** The normal position of the sexes during mating in freshwater turtles is male plastron to female carapace with male above the female (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 576 pp.). Plastron to plastron mating position seldom has been reported. Tronzo (1993, Herpetol. Rev. 24:149) observed mating in *C. insculpta* on 11 October 1992 in Pennsylvania during which the male grasped the female in a plastron to plastron position with the male below. He surmised that moving the pair from land to water and tapping on the male's carapace may have influenced the male's movements and his unusual position. At 1125 h EDT on 23 April 1995 a mating pair of *C. insculpta* was observed on the bottom in clear, shallow (ca. 25 cm) water in 15 Mile Creek, Green Ridge State Forest, Allegany County, Maryland, USA. The male was above the female in normal position but the female was on her back so that the plastrons of the two turtles were in contact. The male had clasped the female around her carapacial margin with all four feet and was heard thumping his shell against hers several times during the observation period (1 h 3 min). Biting of and around the female's head occurred frequently. The male took a breath three times but the female was not allowed to reach air in the time observed. Copulatory intromission was not discernible, as the turtles were not disturbed. Except for the plastron to plastron position, these observed mating behaviors are similar to those described in detail by Kaufmann (1992, Herpetol. Monogr. 6:1–25). Our observation establishes that this behavior is natural and that the interference with a mating pair by Tronzo (*op. cit.*) may not have been a major factor in causing the plastron-to-plastron mating position that he observed.

Submitted by **JOSEPH C. MITCHELL**, Department of Biology and School of Continuing Studies, University of Richmond, Richmond, Virginia 23173, USA, and **ROBERT F. MUELLER**, Rt. 1, Box 250, Staunton, Virginia 24401, USA.

CLEMMYS INSCULPTA (Wood Turtle). **ECTOPARASITES.** Parasitic interactions between *Clemmys insculpta* and the turtle leeches *Placobdella parasitica* and *P. ornata* have been previously documented (Brewster and Brewster 1986. Herpetol. Rev. 17:48; Farrell and Graham 1991. J. Herpetol. 25:1–9; Hulse and Routman 1982. Herpetol. Rev. 13:116–117; Koffler et al. 1978. J. Herpetol. 12:571–572; Siddall and Desser 1992. Can. J. Zool. 70:123–128). We report additional instances of parasitism by *Placobdella parasitica* and *Placobdella ornata* on *Clemmys insculpta*.

On 3 June 1994 an adult female wood turtle (CL = 203.55 mm, CW = 146.05 mm, PL = 193.40 mm, mass = 1050 g) was captured in Pontiac County, Québec, Canada. Although completely healed, both of the turtle's front feet had been amputated and the anterior left side of the carapace had been mutilated. This turtle was parasitized by 4 or 5 brood size *Placobdella parasitica* on the integument adjacent to the femoral scute, in the right posterior limb socket. On 8 June 1994 the gravid turtle was recaptured

and 10 *Placobdella parasitica* (ROMIZ I 3277) were collected. Of those, two *P. parasitica* were found on the integument anterior to the left posterior limb. The remaining eight leeches consisted of a single brood located below the neck, immediately posterior to the gular scutes. On 15 June 1994 the turtle was once again recaptured on land. One *P. ornata* (ROMIZ I 3281) was found on the left posterior limb of the turtle.

On 9 June 1994 an adult female *C. insculpta* (CL = 196.15 mm, CW = 140.40 mm, PL = 192.35 mm, mass = 1000 g) was captured as it basked. A thorough examination of the turtle yielded two *P. ornata* (ROMIZ I 3288) in the left posterior axial area. One leech was firmly attached to the integument anterior to the limb, while the other was affixed to the foot.

On 22 June 1994 a gravid female wood turtle (CL = 198.05 mm, CW = 137.9 mm, PL = 190.90 mm, mass = 925 g) was caught while leaving a nesting site. A *P. ornata* was found on the fifth marginal scute, to the right of the nuchal.

Seventeen adult and one juvenile *C. insculpta* were captured as they basked on 2–4 May 1995, shortly after emergence from hibernation in Sutton County, Québec, Canada. Adult and juvenile *P. ornata* parasitized 22% (4/17) of the turtles. However, broods of *P. parasitica* were found on 50% (9/17). In all, 55% (10/17) of the wood turtles were parasitized by at least one of the leech species. Parasites were encountered almost exclusively in the posterior axial area, with 94% found on the posterior limbs, limb sockets, or tail. The exception was a brood of *P. parasitica* located below the neck and posterior to where the left gular scute joins with the integument. The turtle host had its left limb amputated, as was the case with the turtle from Pontiac County with a brood in the gular region. Measurements for adult turtles (N = 16) are given as mean ± SD (range) and were as follows: CL = 189.67 ± 10.02 mm (171.55–204.85 mm), CW = 140.09 ± 7.18 mm (126.85–151.50 mm), PL = 174.31 ± 6.71 mm (158.90–183.75 mm), mass = 970.62 ± 131.20 g (700–1200 g).

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Submitted by **RAYMOND A. SAUMURE** and **J. ROGER BIDER**, Department of Natural Resource Sciences, McGill University, 21111 Lakeshore Road, Ste-Anne-de-Bellevue, Québec, H9X 3V9, Canada. E-mail (RAS): xpib@musicb.mcgill.ca.

CLEMMYS MARMORATA (Western Pond Turtle). **TERRESTRIAL HABITAT USE.** The western pond turtle (*Clemmys marmorata*) is a highly aquatic species. It is known to utilize terrestrial habitats for dispersal, egg-laying, and/or overwintering (Holland and Bury, *in press*. *In* Pritchard and Rhodin (eds.), Conservation Biology of Freshwater Turtles Vol. 2, Chelonian Research Monographs). Here we report on a highly atypical instance of terrestrial habitat use by this species.

On 26 September 1993 at a second-order drainage in interior San Luis Obispo County, California, USA, we located 19 *C. marmorata* in a crevice in a granitic rock face immediately adjacent to a small (<40 m^2) pool (Fig. 1). The crevice was 95 cm long, 81–92 cm deep, angled at ca. 30° from the lowest to highest part, 20° from front to back, and oriented approximately W/SW. The lowest part of the crevice was ca. 15.3 cm above the surface of the pool. Eighteen animals (six males, four females, eight juveniles) were removed, weighed, measured, marked, and returned to the crevice. Mean carapace length (CL) was 99.7 mm (range 81.3–131.4), which was not significantly different (T-test, p = 0.21) from an additional 15 animals collected in this drainage on the same day (mean CL = 108.9 mm, range 54.4–140.7). Animals collected from the crevice were torpid, and all but two had their eyes closed and limbs retracted when first discovered.

On 18 September 1994, we returned to the site and discovered two juvenile turtles in the same crevice. These animals were 70.7 and 85.7 mm CL, and neither had been previously captured. The water level was 35.9 cm below the lowest portion of the crevice. On 9 September 1995 the crevice was checked and no turtles were observed. The site was revisited on 1 October 1995 and again no turtles were observed.

Western pond turtles typically seek refuge from predators by hiding in the most inaccessible microsites in the aquatic habitat. These include areas under rocks, logs, submerged and emergent vegetation, in undercut banks and occasionally in the substrate. Between 1980 and 1995 the senior author has collected by hand, marked, and released > 7000 individual *C. marmorata*. In less than 10 instances (0.14%) turtles were found above the standing water line, and in all cases they were within 20–25 cm horizontal distance and 5 cm vertical distance of the water's edge. The situation described above is unusual in that not only were turtles aggregated, but that they were well removed from the water both in elevation and distance.

The crevice may have provided both a thermal and predation refugium. Turtles in this drainage have been observed moving to and from the water in early fall, presumably responding to decreasing pool size and possible changes in prey abundance. Orientation of the crevice was such that during the late summer months only late afternoon sun would impinge on the opening, and would not penetrate any distance back into the rock. Thus, turtles would have been sheltered from temperature extremes both in the aquatic and terrestrial habitats. The size of the crevice would preclude removal of turtles by the primary predators on adults in this area, specifically grey fox, black bear, and coyote.

Observations of this type have not been repeated despite frequent checking of similar or potentially similar (e.g., downed logs near the watercourse) microsites in this and several other drainages between 1993 and 1995.



FIG. 1. Crevice in rock face (arrow) utilized by 19 *Clemmys marmorata* on 26 September 1993. Photo taken 18 September 1994.

Submitted by **DAN C. HOLLAND**, Camp Pendleton Amphibian & Reptile Survey, 334A East Fallbrook, Fallbrook, California 92028, USA, and **ROBERT H. GOODMAN, JR.,** Biological

Sciences Department, Califomia State Polytechnic University–Pomona, 3801 West Temple Avenue, Pomona, California 91768, USA.

GEOCHELONE GIGANTEA (Aldabra Giant Tortoise). **PREDATION**. On 9 December 1994, a feral cat (*Felis catus*) was killed during a feral goat (*Capra hircus*) control effort on the island of Grande Terre, Aldabra Atoll, Republic of Seychelles. The cat was an adult male, and had the remains of four giant tortoise hatchlings in its stomach. The remains included three heads and thirteen legs, among various other body parts.

Feral cats are known to be predators on giant tortoise (*Geochelone elephantopus*) hatchlings in the Galapagos (MacFarland et al. 1974. Biol. Conserv. 6:118–133), and are major predators of hatchling green sea turtles (*Chelonia mydas*) on Aldabra (Seabrook 1989. J. Zool., Lond. 219:83–88). However, there are no records of feral cats preying on *G. gigantea* hatchlings. Mean clutch sizes for *G. gigantea* on Grande Terre range between 4.0 (±0.6) and 6.1 (±0.5). Tortoises rarely lay more than one clutch annually, and most do not lay every year (Swingland and Coe 1978. J. Zool., Lond. 186:285–309). This single predation event by a feral cat may have accounted for an entire two-year reproductive output of a giant tortoise.

Of the 12 feral cats killed and examined during this project (September 1993–April 1994 and November 1994–May 1995), 10 cats contained the remains of native reptiles. Giant tortoise hatchlings were found in the single cat; three cats contained the remains of green sea turtle (*C. mydas*) hatchlings; and six cats had eaten skinks (*Cryptoblepharus boutonii*) and/or geckos (*Phelsuma abotti abotti* and *Hemidactylus mercatorius*).

Submitted by **RAYMOND E. RAINBOLT**, Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, Oregon 97331, USA.

LEPIDOCHELYS KEMPII. (Kemp's Ridley Turtle). **FEEDING on INSECTS.** The diets of juvenile, subadult, and adult *Lepidochelys kempii* have been described in several works (Burke et al. 1993. Copeia 1993:1176–1180; Burke et al. 1994. Fish. Bull. 92:26–32; Carr 1942. Proc. New England Zool. Club 21:1–16; DeSola and Abrams 1933. Copeia 1933:10–12; Dobie et al. 1961. Copeia 1961:109–110; Hardy 1962. Cheasapeake Sci. 3:217–220; Lutcavage 1981. M.S. thesis, College William and Mary, Gloucester Point ,Virginia; Lutcavage and Musick 1985. Copeia 1985:449–456; Shaver 1991. J. Herpetol. 25:327–334; Smith and List 1955. Amer. Midl. Nat. 53:115–125). In some of these reports, crabs were the main food item consumed. Investigation of the dried gut contents of a subadult ridley (Auburn University Museum of Paleontology 3086; straight-line carapace = 28.5 cm) found dead on the north shore of Dauphin Island, Mobile County, Alabama, USA in July of 1988 revealed mostly insects. The remains of at least ten grasshoppers (*Shistocera americana*), a dytiscid beetle (*Cybister fembricolatus*), a coreid (*Acanthocephala* sp.), and a pentatomid were identifiable. Additional items eaten were a bryozoan (*Membranipora* sp.), a small mollusk (*Crepidula* sp.), an echinoderm (possibly a sea urchin), a limited amount of unidentified crab parts, and unidentified fish and bird bones, and feathers.

Other than the report by Shaver (*op. cit.*) of a predaceous diving beetle (a dytiscid) and feathers in stomach contents, this is the only report that identifies any of the consumed insects below the family level. This report also provides additional documentation of the ingestion of birds by *L. kempii*.

Because the turtle's carcass was found on the north shore of Dauphin Island, this suggests that it was foraging in relatively shallow and calm waters. It had ingested benthic organisms but evidently was surface feeding on insects which were presumably blown out onto the surface of the water from the coast of mainland Alabama and/or from Dauphin Island. The small amount of fish and bird bones in the turtle's gut indicates that it is unlikely that the insects were indirectly ingested by consuming a fish and/or a bird that had previously eaten them. Additionally, the grasshopper remains were largely intact, suggesting that they had not been earlier ingested by another predator. These data suggest that the diet of *L. kempii* is more diversified than previously thought.

I thank Wayne Clark for his assistance in the identification of the insects, Debbie Folkerts and George Folkerts for their help in identifying the other invertebrate taxa, and Laurie Shepard, then employed by the Department of Biology at the University of South Alabama in Mobile, for providing the skeletal remains of the ridley and the food contained therein.

Submitted by **JAMES L. DOBIE**, Department of Zoology and Wildlife Science, Auburn University, Alabama 36849-5414, USA.

CROCODYLIA

ALLIGATOR MISSISSIPPIENSIS (American Alligator). **REPRODUCTION.** During 1992 at Brazos Bend State Park, Fort Bend Co., Texas, USA, we observed some unusual phenomena relating to American alligator reproduction. There were two peaks in breeding-related behaviors in 1992, and nesting coincided with the time of the second peak of breeding behavior. This is the first report of more than one peak in breeding-related behaviors within the same year, and of breeding behavior and nesting occurring at the same time in any American alligator population. The courtship and breeding period for *A. mississippiensis* typically lasts ca. two months, and the time between ovulation and nesting is 3–4 weeks (Magnusson et al. 1989. *In* Ross [ed.]., Crocodiles and Alligators, pp. 118–135. Facts On File, New York). At Brazos Bend State Park, courtship and breeding peaked first on 11 May. The first bellow signaling the onset of mating behavior had been heard six weeks earlier. All mating behavior declined after mid-May, and the first nest was found on 17 June. On 18 June there was an intense, sudden onset of bellowing, grouping behavior (especially in pairs), and possible copulation. This second peak lasted through 21 June and abruptly ended.

A total of 21 nests were discovered at Brazos Bend State Park during 1992. Four were devoid of eggs though they physically resembled nests containing eggs. One incomplete nest (sometimes known as a false nest) was discovered in close proximity to a completed nest containing eggs. False nests are different from the fully formed nests without eggs, in that they are unfinished, and often found near a completed nest with eggs. Three nests without eggs were built on 17, 23, and 30 June. The fourth nest without eggs was discovered in a remote area of the park on 15 July; the date it was constructed is unknown. The earliest known nests with eggs were completed 30 June–1 July.

Two of the nests without eggs belonged to mature females whose nesting had been monitored since 1986. One of these nests was built too close to a hiking trail, and we destroyed it due to public safety concerns. The female rebuilt the nest twice, and each time it was destroyed. Three of the nests without eggs were actively defended. The other female built a nest, guarded it for ca. 24 h, then appeared to lose interest and did not respond when the nest was approached by us.

Fully formed nests without eggs have not previously been reported, but in 1990 at Lake George in north-central Florida, ca. 15 such nests were discovered (F. Percival, pers. comm.). These nests were restricted to the northern portion of the lake, and no other eggless nests were found at water bodies being monitored within a 48–64 km radius that year. Nesting took place one week earlier than usual, but there were no abnormal water levels or other unusual conditions discerned which might adversely affect nesting (F. Percival, pers. comm.).

We examined max/min daily temperatures from March–July 1992 to check for any extreme or aberrant patterns, because Joanen and McNease (1979. Proc. Southeast. Assoc. Game Fish Comm. 33:15–19; 1989. Amer. Zool. 29:987–998) found that March–May ambient temperatures were associated with time of nesting. Daily and monthly temperature patterns were compared to long-term data, but there was no apparent correlation between temperature, the second peak of courting, or the occurrence of nests without eggs.

Lance (1984. *In* Webb et al., Wildlife Management: Crocodiles and Alligators, pp. 409–415; Surrey Beatty and Sons, Pty Ltd, New South Wales) listed several environmental factors known to affect reproduction in crocodilians. Water level was one factor that might have influenced mating peaks and/or nesting without eggs being laid. At Brazos Bend State Park, there was flooding from 31 December 1991 to 14 March 1992, with water levels in some areas being 1.2–1.5 m above normal. Separate water bodies were joined by the flooding, resulting in the formation of one large body of water over much of the Park.

Although the proximate cause of the second peak of courting and why females constructed nests without eggs remains elusive, we feel that unusual flooding in 1992 could be related to the phemonena.

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Submitted by **LOUISE HAYES-ODUM, TONI HILL-KENNEDY, LORENA BAILEY, DEBORAH COWMAN,** and **PATRICIA REIFF,** Department of Space Physics and Astronomy, Rice University, Houston, Texas 77251, USA and **DENNIS JONES,** Brazos Bend State Park, Needville, Texas 77461,USA.

Present address for LH: Living Resource Center, 11833 Chimney Rock Road, Houston, Texas, 77035, USA. Present address for DC: Department of Wildlife and Fisheries Sciences, Texas A & M University, College Station, Texas, 77843, USA.

LACERTILIA

ANOLIS SAGREI (Brown Anole). **SAUROPHAGY.** Here we report two observations of interspecific saurophagy by adult male brown anoles (*A. sagrei*) on hatchlings of the green anole (*A. carolinensis*). This type of interaction has been previously documented under laboratory conditions (Gerber 1991. Fourth *Anolis* Newsletter, pp. 49–53, Smithsonian Inst., Washington, D.C.), in which predation of juvenile green anoles by adult brown anoles was significantly more frequent than was predation of juvenile brown anoles by adult green anoles or intraspecific predation by either species.

On 13–16 September 1989, 15 adult male brown anoles and 15 adult male green anoles were collected from a one hectare woodlot in Belle Glade, Palm Beach County, Florida, USA and preserved (UTKVZC 05340–05369). Brown anoles and green anoles were found in sympatry at this site and hatchlings of both species were also present on the date of the collection. The anoles were dissected to determine if any juvenile anoles had been taken as prey items. The stomach of one brown anole (UTKVZC 05365; SVL 52 mm) contained a recently consumed hatchling green anole (UTKVZC 05370; SVL 24 mm).

Interspecific predation by a brown anole on a green anole hatchling was observed 14 July 1995 on a dredge spoil island located along the Intracoastal Waterway in the Indian River ca. 4 km N of Ft. Pierce, St. Lucie County, Florida. A hatchling green anole (ca. 20 mm SVL) was captured by hand and gently tossed onto leaf litter beneath an adult male brown anole (SVL 60 mm) perched in a head down position 66 cm above the ground on the trunk of an Australian pine tree (38 cm DBH). The brown anole adjusted its position slightly when the hatchling landed, but the hatchling remained motionless. Thirty-five seconds later the hatchling moved slightly. Immediately thereafter, the brown anole dropped onto the hatchling, took it in its jaws, then returned to within 10 cm of its original position on the tree trunk and consumed the hatchling. After completely consuming the hatchling, the brown anole was noosed, placed into a cooler with ice, then placed in a freezer within four hours. The next day, the brown anole was dissected to confirm the presence of the hatchling, and preserved with the hatchling remaining in the stomach (UFMNH 101601; both specimens verified by David Auth).

To the best of our knowledge, these observations are the first published records of predation by brown anoles on green anole hatchlings in the field. The previous laboratory observations (Gerber, *op. cit.),* together with the field observations reported here, suggest that predation of juvenile green anoles by adult brown anoles could be an important factor in this interaction between a native North American anole and a recently introduced Caribbean species.

Submitted by **TODD S. CAMPBELL** and **GLENN P. GERBER**, Department of Ecology and Evolutionary Biology, University of Tennessee, 569 Dabney Hall, Knoxville, Tennessee 37996, USA. E-mail (TSC): tcampbel@utkux.utcc.utk.edu.

CNEMIDOPHORUS BURTI STICTOGRAMMUS (Giant Spotted Whiptail). **DIET.** T. P. Maslin and party collected several *Cnemidophorus burti stictogrammus* from scrubland habitat in Sonora, México during field trips in 1967 and 1970; these specimens were deposited in the University of Colorado Museum (UCM). We removed and identified stomach contents from these specimens. Three lizards were collected 80 km N Hermosillo along Hwy 15 on 26 July 1967 (UCM 35424, male, SVL = 127 mm; UCM 35428, female, SVL = 118 mm; UCM 35433, male, SVL = 70 mm); two were collected 45 km W Santa Ana along Hwy 2, elev. 580 m, on 24 July 1970 (UCM 42047, male, SVL = 124 mm; UCM 42048, female, SVL = 78 mm). At the first site (N of Hermosillo), the two 100+ mm SVL lizards consumed very large caterpillars (20 mm long) and large scarab beetles (>10 mm long); these comprised the majority of the volume of prey these two lizards consumed even though they both ate many termites (Table 1).

In addition, UCM 35424 also contained unidentifiable plant material (constituting about 10% of the volume of its stomach contents). The small specimen from the first site contained only two small spiders and four small insects. At the second site (W of Santa Ana), both lizards consumed primarily ants and termites (Table 1). However, ants comprised the majority of the volume of prey consumed because UCM 42048 consumed 45 ants (mostly winged adults) and 7 termites, and UCM 42047 consumed 20 very large (15 mm long) ants and 21 small (3.5 mm long) termites. Four of the five lizards contained nematodes (presumably parasites).

TABLE 1. Diet of *Cnemidophorus burti stictogrammus* in Sonora, México. Site 1 was 80 km N Hermosillo (99 prey items from 3 lizards); site 2 was 45 km W Santa Ana (99 prey items from 2 lizards). "No. in Sample" refers to the number of the prey taxon in the stomachs of the lizards from that site.

	SITE 1		SITE 2	
	No. in Sample	No. Lizards Consuming	No. in Sample	No. Lizards Consuming
C. Arachnida (spiders)	3	1	1	1
C. Insecta				
Orthoptera				
Mantidae (mantises)			1	1
Acrididae (grasshoppers)	2	1		
Isoptera (termites)	65	2	28	2
Coleoptera (beetles)				
Chrysomelidae	3	1		
Scarabaeidae	3	2		
Tenebrionidae	1	1	1	1
Unidentified beetles	2	1		
beetle larvae	6	2		
Lepidoptera (caterpillars)	11	2		
Hymenoptera (ants)	2	2	67	2
Insect Pupae	1	1	1	1
Plant Material	present	1		

Submitted by **MARK A. PAULISSEN**, Department of Biological and Environmental Sciences, McNeese State University, Lake Charles, Louisiana 70609, USA, and **JAMES M. WALKER**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

EUMECES MULTIVIRGATUS (Many-lined Skink). **CLUTCH SIZE.** On 16 June 1993, at Avalon Lake, Eddy County, New Mexico, USA we discovered nine *E. multivirgatus* hatchlings with an attending adult female under a large conglomerate rock (ca. 70 cm diam) on damp, sandy soil. The nest chamber extended downward at a slight angle to a depth of ca. 15 cm, ending in an expanded chamber at the bottom. The opening was ca. 4 cm in diam.

The female measured 66.3 mm SVL, 36.3 mm tail, and weighed 41.0 g. The nine hatchlings ranged in SVL from 25.1–27.1 mm (mean = 26.28, SD = 0.72) and in mass from 0.2–0.5 g (mean = 0.41, SD = 0.07). No egg shells were found. All specimens were preserved and deposited at the University of New Mexico Museum of Southwest Biology (MSB 56179-188).

For 16 published records, clutch size ranged from 3–7 (mean = 3.5) (Smith 1946. Handbook of Lizards. Cornell Univ. Press, Ithaca, New York. 557 pp.; Maslin 1957. Proc. U.S. Natl. Mus. 116:296; Mecham 1967. Southwest. Nat. 12:104; Van Devender 1975. Southwest. Nat. 20:279). Toby J. Hibbitts (pers. comm.) observed a clutch of seven eggs laid by a female collected April 1994 in Crockett County, Texas. Thus, our find exceeds the previous maximum clutch size by two eggs.

Submitted by **MARK W. DOLES**, National Biological Service, Guam National Wildlife Refuge, P.O. Box 8134, MOU-3, Dededo, Guam 96912, USA, **CHARLES W. PAINTER**, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, USA, and **L. WILLIAM GORUM**, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

KENTROPYX CALCARATA (NCN). **BEHAVIOR.** During a herpetofaunal survey of the Noel Kempff Mercado National Park (Departamento Santa Cruz, Bolivia), *Kentropyx calcarata* were observed on vegetation and fallen trees along the banks of the Paucerna and Itenez or Guapore Rivers. According to Ávila-Pires (1995, Lizards of Brazilian Amazonia (Reptilia: Squamata) Zoologische Verhandelingen, Leiden 299:1–706), *K. calcarata* "is a forest inhabitant, usually found in open, sunny places . . ." (p. 522).

On 14 December 1995, six individuals were observed near Campamento Las Torres (13°39.308'S, 60°48.710'W). To elude collectors, the lizards would run from one tree to another, and even over the water surface. Their ability to run on water is apparently due to the velocity they attain, because they have no obvious morphological characteristics to enhance this behavior. The longest over water distance observed was 4.5 m; other distances varied from 1.5–2 m. Apparently this is a normal behavior for this species, because many park guards referred to "a lizard walking on the water" before we made our observations.

Kentropyx calcarata was also observed walking underwater along submerged tree trunks. One animal escaped under water in this manner.

Two specimens were collected and deposited in the Museo Noel Kempff Mercado (NKR 843–844) of the Universidad Gabriel Rene Moreno in Santa Cruz de la Sierra, Bolivia.

Submitted by **GUSTAVO J. SCROCCHI**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Argentina, and **LUCINDO GONZALES**, Herpetología, Museo de Historia Natural Noel Kempff Mercado, Casilla N° 2489, Santa Cruz, Bolivia.

MABUYA FRENATA (NCN). **CANNIBALISM.** Although cannibalism among lizards is reported for a number of species of different families (e.g., Diong 1994. Herpetol. Rev. 25:2526; Germano and Williams 1994. Herpetol. Rev. 25:26–27; Rocha 1992. Herpetol. Rev. 23:60 and included references), its incidence is low and may be regarded as opportunistic carnivory (Polis and Myers 1985. J. Herpetol. 19:99–107).

During a study of the rock-dwelling skink *Mabuya frenata* from December 1993 to December 1994 in the Municipality of Valinhos, São Paulo State, southeastern Brazil (22°56'S; 46°55'W), we examined the stomach contents of 239 individuals, two of which contained remains of conspecifics. In the first case, the stomach of a gravid female (84.6 mm SVL, 13.0 g) collected on 26 June 1994 contained a portion of a tail (20.3 mm long) of another adult and no other items. As the owner of that tail may have been too large to be swallowed, this meal could have resulted from an agonistic encounter with no predatory intentions (Vitt 1981. J. Herpetol. 15:454–457). In the second case, another adult female (80.6 mm SVL, 10.4 g) collected on 27 June had the partially digested anterior portion of a newborn individual in its stomach, with no other items present. With the exception of this individual, all of 12 other females collected during that month were gravid, indicating this occurrence of cannibalism coincided with the reproductive season. Moreover, that female showed signs of having given birth recently, which raises the possibility of it having either preyed upon its own progeny or swallowed a stillborn after aborting.

On 23 November 1994, one of us (DV) observed one adult (sex not determined) carrying an apparently dead juvenile crosswise in its jaws while moving up a large boulder. Eventually, it stopped and attempted to swallow its prey, repeatedly changing its hold

on the limp body. After failing this attempt, it carried the body some additional distance along the rock surface and tried again to swallow it. It repeated the process a few more times without success, until it detected the observer's presence and disappeared from view carrying its prey. In October 1993, one of us (DV) made another field observation of an adult carrying a smaller conspecific in its mouth. This time, the prey lizard was being carried by the hind portion of the body and the size difference between predator and prey was less pronounced.

Like other *Mabuya* species, *M. frenata* feeds primarily on arthropods, but is a generalist and opportunistic forager (Vrcibradic 1995. Master's thesis, Universidade Estadual de Campinas, Campinas, São Paulo, Brazil, 72 pp.). We are not aware of any published reports of cannibalism within the genus *Mabuya*, though some Brazilian species are known to prey occasionally on other small lizards (Vitt and Blackburn 1991. Copeia 1991:916–927; Vitt 1995. Occ. Pap. Oklahoma Mus. Nat. Hist. 1:1–29; Vrcibradic and Rocha 1995. Herpetol. Rev. 26:129–131). This suggests that a juvenile conspecific may be viewed as just another potential prey by those skinks, and occasional cannibalism may represent opportunistic foraging in this species.

We thank the Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior (CAPES) for the post-graduate fellowship to D. Vrcibradic and to the Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq) for a research grant (Process N° 300819/94-3) to C. F. D. Rocha).

Submitted by **DAVOR VRCIBRADIC** and **CARLOS FREDERICO DUARTE ROCHA**, Setor de Ecologia, Departamento de Biologia Animal e Vegetal, Instituto de Biologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, 20550-019, Rio de Janeiro, RJ, Brazil.

UROSAURUS MICROSCUTATUS (Small-scaled Lizard). **TESTIS CYCLE**. The purpose of this note is to report on a histological examination of testes from 13 *U. microscutatus* from southern California, USA. Specimens were examined from the Natural History Museum of Los Angeles County (LACM) 27380, 53630, 97828,97830, 122066,123399, and San Diego Natural History Museum (SDSNH) 504, 505, 714, 48269, 57390, 57394, 57453. All were from San Diego County except for SDSNH 57390 and 57394 which were from Imperial County. Mean SVL was 43 mm + 4 SD mm (range = 38–49 mm). The left testis was removed and embedded in paraffin for histological examination. Sections were cut at 5 µm and stained with hematoxylin followed by eosin counterstain. Four males collected in March were undergoing sperm formation (spermiogenesis). In two of these March males, spermiogenesis was just beginning indicated by groups of metamorphosing spermatids and small sperm clusters. Spermiogenesis was more advanced in the other two March males. The seminiferous tubules were lined by clusters of sperm behind which were several rows of metamorphosing spermatids. Seven males collected in April, one in May, and one in June were all undergoing spermiogenesis. The smallest spermiogenic male measured 38 mm SVL. It appears spermiogenesis begins earlier in the *U. microscutatus* testis cycle than it does in the related *Urosaurus ornatus* from Arizona (Asplund and Lowe 1964. J. Morph. 115:27-34) in which testes were in recrudescent condition during March (spermatogonia and spermatocytes predominate, spermatozoa are absent); spermiogenesis was in progress in *U. ornatus* samples from June.

I thank Robert L. Bezy (Natural History Museum of Los Angeles County) and Gregory K. Pregill (formerly of the San Diego Natural History Museum) for permission to examine *U. microscutatus*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA.

SERPENTES

AGKISTRODON CONTORTRIX CONTORTRIX (Southern Copperhead). **PREY.** Although predation on lepidopteran larvae by *Agkistrodon c. contortrix* is well known (Fitch 1960. Univ. Kansas Publ. Mus. Nat. Hist. 13:85–288; Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex: A Monographic Review. SSAR, Oxford, Ohio. 614 pp.), few authors have identified such prey to species (Brown 1979. Brimleyana 1:113–124; Palmer, pers. comm. in Gloyd and Conant, *op. cit.*, p.129).

On 2 July 1995 an *A. c. contortrix* was collected on a ranch in Williamson Co., Texas, USA. The specimen was a male with a SVL of 743 mm, tail length of 105 mm, and mass of 399.6 g. On 7 July 1995 this snake excreted the exoskeletons of ca. 14 catalpa sphinx moth larvae, *Ceratomia catalpae* (Sphingidae).These caterpillars sometimes feed in large numbers on the broad leaves of the catalpa tree. The number of larvae consumed by this snake and the lack of other prey traces in its feces indicate that this individual was actively foraging for *Ceratomia catalpae* immediately prior to capture.

Submitted by **ADAM C. WALTERS, DAVID T. ROBERTS**, Department of Herpetology, Dallas Zoo, 621 East Clarendon Drive, Dallas, Texas 75203, USA, and **CHARLES V. COVELL JR.,** College of Arts and Sciences, University of Louisville, Louisville, Kentucky, 40292, USA.

AGKISTRODON CONTORTRIX MOKASEN (Northern Copperhead). **BICEPHALY.** Axial bifurcation has been reported for numerous species of snakes (Cunningham 1937. Axial Bifurcation in Serpents, Duke Univ. Press, Durham, 117 pp.; Smith and Perez-Higareda 1988. Bull. Maryland Herpetol. Soc. 23:139–153; Wallach 1995, Herpetol. Rev. 26:127–129). In the genus *Agkistrodon*, bicephalic (or prodichotomous, Smith and Perez-Higareda, *op. cit.*) specimens are known for *A. blomhoffii* (Inukai 1929. Trans. Sapporo Nat. Hist. Soc. XI, 1:21–24; Nakamura 1938. Mem. College Sci., Kyoto Imperial Univ. ser. B 14:171–191) and *A. piscivorus* (Johnson 1901. Trans. Wisconsin Acad. Sci. Arts Lett. 13:223–236). Strecker (1926. Contrib. Baylor Univ. Mus. 6:10) noted that a captive female *A. contortrix* from Pennsylvania bore a two-headed neonate but provided no other information. Here we describe the first verified bicephalic specimen of *A. contortrix*.

On 10 September 1990 a bicephalic, neonate *A. contortrix* (USNM 498503) was killed in an urban yard (collector unknown) near Charlottesville, Albemarle County, Virginia, USA, and brought to MF. The specimen is a 176 mm snout-vent length female and bears two distinct heads that are joined at the neck immediately posterior to the cranium (Fig. 1). The left head was partially crushed and the body partially severed near the tail when the snake was killed. An X-radiograph revealed that the left head is attached to the primary vertebral axis and that the right head joins the vertebral column five vertebrae posterior to the skull. Four to five vertebrae separate the right skull from the primary vertebral column. Both heads were apparently fully functional at birth without any obvious deformities. There were also no deformities in the vertebral column posterior to the bifurcation at the

neck. This is the first description of a bicephalic specimen of *A. contortrix* (Gloyd and Conant. 1990. Snakes of the *Agkistrodon* Complex, SSAR Contrib. Herpetol. 6).

We are grateful to Tracy Tuberville of the Savannah River Ecology Laboratory for taking the X-radiographs.

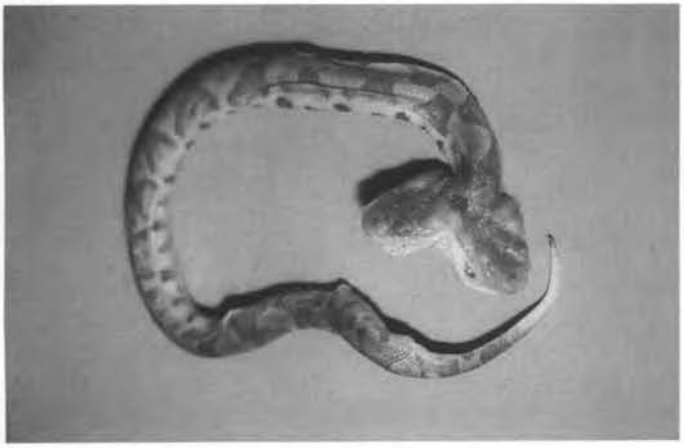


FIG. 1. Bicephalic neonate *Agkistrodon contortrix* from Charlottesville, Albemarle County, Virginia, USA.

Submitted by **JOSEPH C. MITCHELL**, Department of Biology and School for Continuing Studies, University of Richmond, Richmond, Virginia 23173, USA, and **MIKE FIEG,** Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, Virginia 24482, USA.

AGKISTRODON PISCIVORUS CONANTI (Florida Cottonmouth). **BROOD DEFENSE.** Brood defense, or the guarding of offspring by one or both parents, is virtually unknown in *Agkistrodon piscivorus* (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex: A Monographic Review. SSAR, Oxford, Ohio. 614 pp.). Wharton (1966. Copeia 1966:154–155) described two instances in which *Agkistrodon piscivorus conanti* females were found in close proximity to their broods and did not disperse when approached. Wharton regarded this as "guarding behavior." No other accounts of such behavior have been reported to our knowledge.

On 22 August 1995 a large adult female *Agkistrodon piscivorus conanti* was found in a cypress swamp ca. 20 miles east of Gainesville in Alachua County, Florida, USA. The specimen was lying at the entrance to a hollow chamber formed by mud, vegetation, and cypress knees. Lying on and around the female were seven neonates. Upon prodding with a field hook, the adult and most of the neonates retreated into the chamber; however, when one of the neonates was touched with the hook the female came back out and oriented toward the hook. The neonate was then picked up and slowly taken away from the chamber entrance. The female quickly followed, tongue-flicking the young snake and hook repeatedly and appearing increasingly agitated. Finally, the neonate fell off the hook and immediately retreated past the female and into the chamber. The female remained at the entrance, oriented toward the hook.

The site was revisited on 25 August 1995. The female was again observed at the entrance to the chamber with two neonates, and similar behavior ensued. This account strongly suggests defense of young by a female *Agkistrodon piscivorus conanti* over an indefinite period of time; however, further investigation under controlled conditions will be necessary to further document this phenomenon.

Submitted by **ADAM C. WALTERS** and **WINSTON CARD**, Department of Herpetology, Dallas Zoo, 621 East Clarendon Drive, Dallas, Texas 75203, USA.

COLUBER (= MASTICOPHIS) MENTOVARIUS (Tropical Racer). **PREDATION**. At 1300 h on 29 January 1996, we observed an adult male *Coluber (= Masticophis) mentovarius* attempting to consume a juvenile *Boa constrictor*. We made this observation at the Volcan Cacao field station, a site located on the Pacific slope and part of the Guanacaste Conservation Area in Guanacaste Province, Costa Rica. The area surrounding the field station is a mixture of abandoned pasture, secondary forests, and mature primary forest at 1130 m elevation.

The *Coluber* (SVL = 155 cm, weight = 550 g) had grasped the *Boa* (SVL = 50 cm, weight = 66 gm) at midbody and had begun to swallow the posterior 1/4 of the boa's body (Fig. 1). In response, the boa had wrapped the anterior half of its body around the neck of the *Coluber*. This was done in the pattern of an overhand knot so that the *Coluber* was unable to complete the swallowing action. It appeared that the constrictive coil of the boa made it impossible for the *Coluber* to breathe. Furthermore, the boa bit the *Coluber* near its constricting loop. This positioning of the two snakes appeared to be a stalemate. We then captured the two animals for photographic evidence. They remained in this "stalemate" position for ca. 30 min, after which we separated them. This observation represents a novel potential prey item for *Coluber mentovarius* and an unusual antipredator behavioral response by *Boa constrictor*.

We thank the Organization for Tropical Studies for logistic support, students on OTS #96-1 for measurements of specimens, and Jeremy Fox for comments on this note. During this work, M. Laska was supported by a Louis G. Bevier University Fellowship.



FIG. 1. Attempted predation of a juvenile *Boa constrictor* by a *Coluber mentovarius*.

Submitted by **CRAIG GUYER**, Department of Zoology and Wildlife Science, Auburn University, Auburn, Alabama 36849, USA, and **MARK S. LASKA**, Department of Biological Sciences, Rutgers University, Piscataway, New Jersey 08855-1059, USA.

HETERODON NASICUS KENNERLYI (Mexican Hognose Snake). **MAXIMUM SIZE.** On 25 September 1995, in the Animas Valley ca. 60 air km S of Animas, Hidalgo County, New

Mexico, USA (31°25'39.15"N 108°50'40.05"W), we (BRT, JPB) collected an adult female *H. nasicus kennerlyi* with the following measurements; 668 mm SVL, 760 mm TL, and 312.2 g. This exceeds the maximum TL of 656 mm reported by Werler (1951 in Boundy 1995. Bull. Chicago Herp. Soc. 30:109–122). The specimen is MSB 59954 in the Division of Herpetology, University of New Mexico.

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, USA, **BARNEY R. TOMBERLIN**, P.O. Box 510, Portal, Arizona 85632, USA, and **JENS PETTER BRASTAD**, Isveien 22, 1390 Vollen, Norway.

LAMPROPELTIS GETULA NIGER (Black Kingsnake) **DIET.** Adult *Lampropeltis getula* are known to feed on a variety of prey (Ernst and Barbour 1989. Snakes of Eastern North America. George Mason University Press, Fairfax, Virginia. 282 pp). Although prey types are commonly listed for kingsnakes, there is a paucity of information on specific size of food items utilized in nature. Here we report on predation of two species of snakes by a first year *L. getula niger*.

In 1990 the Clinch River Environmental Studies Organization (CRESO) started a population study of kingsnakes on a 60-ha area located in Anderson County, Tennessee, USA along the Clinch River in the Valley and Ridge physiographic province of eastern Tennessee. On 5 June 1995 we captured a 353 mm (SVL = 304 mm) male *L. getula niger* beneath a cover board located in old field habitat. The kingsnake regurgitated two snakes: a 155 mm *Storeria dekayi wrightorum* (midland brown snake) and a 240 mm *Carphophis amoenus amoenus* (eastern worm snake). Both snakes appeared to have been eaten recently. The three snakes together weighed 16.5 g and the post-regurgitation weight of the kingsnake was 11.5 g.

Out of 290 kingsnake captures, we have recorded only one other case of unforced regurgitation of a food item. On 15 September 1993 a 655 mm (SVL = 570 mm) female *L. getula niger* regurgitated a *Blarina brevicauda* (short-tailed shrew). The snake had a pre-regurgitation weight of 69 g and a post-regurgitation weight of 58.1 g.

We thank the U.S. Department of Energy/Waste Management and Technology Development Division for financial support.

Submitted by **JOHN G. BYRD** and **LEANNE N. JENKINS**, Department of Biology, Clinton High School, Clinton, Tennessee 37716, USA.

OXYBELIS FULGIDUS (Green Vine Snake). **FEEDING BEHAVIOR.** *Oxybelis fulgidus* is a long, slender colubrid with a pointed head and long tail. Adult length can reach up to 200 cm. This snake is diurnal, arboreally and terrestrially. Although commonly associated with closed forest, it is often observed in open areas. Available data indicate that *O. fulgidus* feeds on lizards (*Ameiva* spp., *Anolis* spp.) and birds (piprid, *Volatina* spp.) (M. Martins, ms.; Zimmerman and Rodrigues 1990. *In* A. Gentry (ed.), Four Neotropical Rainforests, pp. 426–454. Yale Univ. Press, New Haven, Connecticut; Guyer 1994. *In* L. A. McDade et al. (eds.), La Selva: Ecology and Natural History of a Neotropical Rain Forest, p. 382. Univ. Chicago Press, Illinois). It forages in low vegetation or on the ground, where its coloration is effective at concealment.

On 9 November 1995, we observed an *O. fulgidus* foraging for two species of teiid lizards, *Ameiva ameiva* and *Kentropyx calcarata,* in reserve 1401 of the INPA/Smithsonian "Biological Dynamics of Forest Fragments Project" north of Manaus, Brazil. All observations were made from within a man-made clearing in primary forest where the camp facilities are located. These two lizard species are commonly associated with natural forest gaps and therefore also around camps. During three morning hours, we observed five strikes by one juvenile *O. fulgidus* (43 cm SVL, 54 cm TL, 150.5 g). Of these five attempts, three were successful. During the observation period, it moved in the heavy understory and among fallen branches around the edge of the clearing, never entering the clearing. Predatory behavior included a body S-coil, head and neck enlargement, and lunging and striking at moving prey. The size of prey captured was ca. 8 cm SVL.

During the first 45 min of observation, the snake struck twice at young individuals of *A. ameiva* (ca. 8 cm SVL each), and succeeded in both attempts. Five minutes later, the snake struck again, this time at two fighting individuals of *A. ameiva,* attempting to bite the larger one (15 cm SVL). Both lizards escaped, and after a few seconds the larger one came back to face the snake, which remained still. The snake avoided direct confrontation, and the lizard moved away. As the frequency of passing lizards decreased, the snake moved to another perch 6 m away, in a group of fallen branches where a *Kentropyx calcarata* (10 cm SVL) was foraging atop a decaying log. Perceiving the predator's presence, the lizard stopped, and started displaying aggressively towards the snake. Before the snake was able to strike, the lizard fled. After 20 min, the snake captured another juvenile *A. ameiva* (SVL ca. 7 cm). The snake bit the lizard laterally, and used mouth movements to swallow it headfirst as it did with the first two prey.

After this last strike, the snake moved to another perch 3 m away where another *K. calcarata* was foraging. The lizard never came within striking distance. During the next 25 min, the snake positioned itself for two more strikes at two medium-sized *A. ameiva* adults (15 cm SVL). In both instances, the lizards noticed the snake before it was within striking distance. They confronted the snake, and while facing it attracted the snake's attention by shaking their tail. Both lizards stopped displaying after several minutes. During these two encounters, several smaller *A. ameiva* were foraging nearby, but never moved within striking distance. After the second encounter, the snake made its last observed strike at a small juvenile *A. ameiva*, without success.

These observations confirm the sit-and-wait foraging mode of *Oxybelis fulgidus* (M. Martins, unpubl.). Although we did not observe successful predation on *Kentropyx calcarata*, this species has been recorded in the diet of *O. fulgidus* (WAF, pers. obs.).

Submitted by **WAGNER A. FISCHER** and **CLAUDE GASCON**, Ecologia/INPA, CP 478, 69011-970 Manaus, Amazonas, Brazil.

REGINA ALLENI (Striped Crayfish Snake). **PREDATION.** Little information is available on natural predators of *Regina alleni*, an aquatic natricine endemic to peninsular Florida and southern Georgia (Ernst and Barbour 1989. Snakes of Eastern North America. George Mason Univ. Press, Fairfax, Virginia, 282 pp.). Here we report predation on *R. alleni* by a largemouth bass (*Micropterus salmoides*).

On 20 September 1995 between 1330–1400 h, a recreational angler caught a 299 mm standard length *M. salmoides* from a creek emptying into the north side of Lake Manatee reservoir in Manatee County, Florida, USA. The site of capture was ca. 300

m upstream of the lake, where the creek is about 10 m wide. The fish was taken using a 70 mm, dark green, plastic worm fished slowly on the bottom within 1 m of the vegetation bordering the shore, in water about 0.5 m deep. The belly of the fish was visibly distended, and upon dissection, a 330 mm SVL, female *R. alleni* (UF 101061) was recovered from the stomach. The snake showed no signs of digestion, suggesting it had been eaten recently. No other prey were present in the stomach; however, a water hyacinth leaf, crayfish shell fragments, and scales and vertebrae from another natricine snake (probably *Thamnophis* sp.) were found in the intestine.

Godley (1980. Ecol. Monogr. 50:411–436) considered wading birds such as the great blue heron (*Ardea herodias*) and the great egret (*Casmerodius albus*) to be important predators of adult *R. alleni*, especially in shallow marshes, but also described predation by greater sirens (*Siren lacertina*), kingsnakes (*Lampropeltis getula*), cottonmouths (*Agkistrodon piscivorous*), river otters (*Lutra canadensis*), and raccoons (*Procyon lotor*) (Godley 1982. Florida Field Natur. 10:31–36). Ernst and Barbour (*op. cit.*) suggested that alligators (*Alligator mississipiensis*) may also prey on *R. alleni*. Interestingly, fishes previously have not been suggested as potential predators of *R. alleni*, despite the large size and generalized, carnivorous habits of some species. Large *M. salmoides* feed primarily on fish and crayfish, and secondarily on other small vertebrates and large invertebrates (Carlander 1977. Handbook of Freshwater Fishery Biology. Iowa State Univ. Press, Ames, Iowa. 431 pp.). Because *M. salmoides* is abundant throughout Florida and Georgia, it may be a common predator of *R. alleni*.

We thank Walter Szelistowski for donating the specimens and sharing capture data, Gregg Sakowicz for providing information about bass feeding habits, and Steve Godley for improving the manuscript.

Submitted by **WILLIAM A. SZELISTOWSKI** and **PETER A. MEYLAN**, Department of Biology, Eckerd College, St. Petersburg, Florida 33711, USA.

REGINA SEPTEMVITTATA (Queen Snake). **REPRODUCTION.** We collected a gravid female *Regina septemvittata* (435 mm SVL, 581 mm TL) from Twelve Mile Creek in Pickens Co., South Carolina, USA on 29 August 1994. This female gave birth to five live offspring on 30 August 1994, and weighed 37.9 g after parturition. No attempt was made to sex the neonates, but all were measured on 1 September 1994. Mean (± SD) SVL, TL, and mass of neonates were 147.6 ± 2.3 (range = 145–150 mm), 205.8 ± 4.5 (range = 201–21 1 mm), and 2.92 ± 0.12 (range = 2.76–3.05 g), respectively. Relative clutch mass (clutch mass / female mass plus clutch mass) was 0.278. The female and neonates were released on 2 September 1994. Our report compliments that of Arndt (1994. Herpetol. Rev. 25:168) who noted that a female collected in Barnwell Co., South Carolina gave birth to nine young on 15 August. Martof et al. (1980. Amphibians and Reptiles of the Carolinas and Virginia. Univ. North Carolina Press, Chapel Hill, 264 pp.) reported litter size ranging from 5–23. In Kentucky, Branson and Baker (1974. Tulane Stud. Zool. Bot. 18:153–171) reported litter sizes of 8–17 with an average of 12.8. For newborns from ten litters (N = 128) from throughout the range, with sexes combined, mean SVL (± SD) and mass were 177 ± 14.6 (range = 134–210 mm) and 3.28 ± 0.48 (range = 2.40–4.22 g), respectively. Parturition dates ranged from 4 August to 10 September.

We thank Joy Schmertman for assistance with measuring snakes and Richard Montanucci for comments on the manuscript.

Submitted by **LANCE W. FONTENOT**, Terra Consulting Group, 8900 Anselmo Lane, Baton Rouge, Louisiana 70810, USA, and **STEVEN G. PLATT**, Department of Biological Sciences, Clemson University, Clemson, South Carolina 29634-1903, USA.

SYMPHOLIS LIPPIENS (Banded Burrowing Snake). **DIET.** This secretive and fossorial snake is endemic to western México. Little is known about its life history. A DOR male specimen (SVL = 436 mm, tail = 34 mm) was found on Hwy 9, 4.2 mi. E Alamos, Sonora, México at 1900 h on 27 September 1991. Two coleopteran larvae were removed from the stomach. Gene Hall identified them as *Cotinus* or *Euphoria*; Scarabaeidae, Cetoniinae. *Cotinus* is the metallic "fig beetle" that feeds on figs, fruits, bleeding tree sap, etc., as adults. *Euphoria* is a fancy June beetle about which little is known. The larvae of both are probably soil/root feeders.

Submitted by **HOWARD E. LAWLER** and **THOMAS R. VAN DEVENDER**, Department of Herpetology and Ichthyology, and Research Department, Arizona-Sonora Desert Museum, Tucson, Arizona 85743, USA.

TANTILLA NIGRICEPS (Plains Black-Headed Snake). **MAXIMUM SIZE and SIZE VARIATION.** On 12 May 1993, a female *Tantilla nigriceps* (SVL = 329 mm, TL = 390 mm; MSB 56035) was collected by Travis Perry and Natalie Runyan in Soccoro Co., New Mexico, USA, on New Mexico Highway 304, 17.7 km N of the junction with U.S. Highway 60. This exceeds the size record of a male (SVL = 320 mm, TL = 384 mm) collected by Hutchins and Myers in Cochise Co., Arizona (Boundy 1995. Bull. Chicago Herp. Soc. 30:109–122.) The next largest specimen in the MSB collection was a female (MSB 16937, TL = 371 mm, SVL = 302 mm) from Bernalillo Co., New Mexico.

All intact *T. nigriceps* specimens at the Museum of Southwestern Biology (N = 133) were measured and examined for sexual dimorphism and geographic variation in TL, SVL, and proportional tail length (PTL = tail length/total length). Small sample size precluded the inclusion of specimens collected outside of New Mexico. All data sets met the assumptions of ANOVA.

Males and females differed significantly with respect to SVL ($t = 2.67$, $df = 131$, $p < .0085$) and PTL ($t = -9.12$, $df = 131$, $p < .001$). Males and females did not differ significantly with respect to TL.

For analysis of geographic variation in size and PTL, specimens were divided into two regions—(1) eastern New Mexico, and (2) central and western New Mexico—based on the natural pattern of distribution of the species in New Mexico (Degenhardt et al. 1996. The Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque, New Mexico. 431 pp.). These two regions roughly correspond to the Pecos and Rio Grande drainages, divided by the Guadalupe, Sacramento, Manzano, and Sandia mountain ranges. Central and western specimens were combined due to the small sample of western individuals. A randomized block two-way ANOVA did not show a significant interaction between locality and sex with respect to TL, SVL, or PTL. Each sex was analyzed separately for variation between the eastern and central-western regions.

Males from the central-west region were significantly larger for TL, SVL, and PTL than males from the eastern region (see Table 1). Although females from the central-western region were also larger, on average, than those from the eastern region, the differences were not statistically distinguishable for SVL or TL ($t = -1.49$, $df = 46$, $p < .14$; $t = -1.35$, $df = 46$, $p < .0.18$). In

TABLE 1. Measurements of New Mexico *Tantilla nigriceps*. Regions describe general areas of distribution in New Mexico. Values are sample sizes followed by means (standard deviations in parentheses). All measurements are in mm, except PTL. Significantly larger means ($p < .05$) are denoted by bold type.

	Males TL	Females TL	Males SVL	Females SVL	Males PTL	Females PTL
Region	N: mean (SD)	N: mean (SD)	N: mean (SD)	N: mean (SD)	N: mean (SD)	N: mean (SD)
Combined	76: 220 (52.9)	57: 260 (79.8)	76: 172 (41.4)	57: **212** (65.9)	76: **22** (2.3)	57: 18 (2.0)
Central-west	40: **236** (43.7)	39: 270 (74.4)	40: **185** (33.6)	39: 221 (61.5)	40: 21 (2.0)	39: 18 (2.0)
Eastern	29: 207 (55.07)	9: 231 (89.8)	29: 160 (43.4)	9: 186 (73.1)	29: **22** (2.6)	9: **20** (1.9)

contrast to the pattern of body size, females from the eastern region exhibited larger PTL than females from the central-western region, and this difference was statistically significant (see Table 1). However, this pattern may be an artifact of sample size as there were only nine female specimens from the eastern region available for analysis.

In conclusion, males from the central-western region were larger than eastern males. Central-western females were also larger than their eastern conterparts but this difference was not statistically significant. Males had significantly greater tail to body ratios in the eastern region but not in the central western region. This suggests that there may be significant geographic variation in sexual dimorphism in this species.

Submitted by **TRAVIS W. PERRY** and **GRECHEN HAUER**, Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

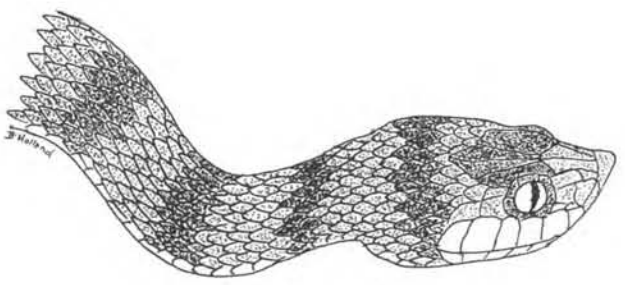
THAMNOPHIS PROXIMUS RUBRILINEATUS (Redstripe Ribbon Snake). **REPRODUCTION.** On 18 April 1995, Colorado River Municipal Water District (CRMWD) personnel captured two gravid female *T. proximus rubrilineatus* on the Colorado River, 9.3 km ENE of Doole, Texas, USA. Each snake was measured, weighed, scale clipped for identification, and retained until parturition. Snake #965 measured SVL 503 mm, tail 184+ mm, mass 32.0 g, and had five embryos detected by palpation. Snake #966 measured 504 mm, tail 193 mm, mass 45.0 g, and had nine embryos. Litter sizes range between 4 and 36 for this species (Bowers 1967. Southwest. Nat. 12(2):200; Clark 1974. Herpetologica 30:372–379; Collins 1974. Amphibians and Reptiles of Kansas. Univ. Kansas Mus. Nat. Hist., Publ. Ed. Series No. 1; Fitch 1970. Reproductive Cycles in Lizards and Snakes. Misc. Publ. 52, Univ. Kansas Mus. Nat. Hist. 247 pp.; Smith 1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28(1); Tinkle 1957. Ecology 38:69–77; Wright and Wright 1957. Handbook of Snakes of the United States and Canada. Comstock Publ. Assoc., Ithaca, New York).

On the morning of 3 August between 0800 h and 1200 h, snake #966 gave birth to four healthy and one dead (deformed: spinal anomaly) neonates. Several infertile masses were also expelled during birth. On 9 August, another neonate was born dead. Measurements of the four live neonates were: TL range = 225–236 mm (mean = 232.3; SD = 4.3); SVL range = 158–168 mm (mean = 164.3; SD = 3.9); tail length range = 67–69 mm (mean = 68.0; SD = 1.0); and mass range = 1.6–1.9 g (mean = 1.7; SD = 0.1). In addition to the neonates, five non-fertile masses totalling 1.9 g were expelled during parturition. After parturition on 3 August, female #966 weighed 46.4 g. Her weight on 9 August, following birth of the remaining (dead) neonate, was 43.2 g. The total litter mass, excluding the non-fertile masses, was 9.8 g and the relative clutch mass (RCM = ratio of total litter mass to postpartum female mass + total litter mass) was 0.185.

On 7 August between 0830–1130 h, female #965 gave birth to three neonates and four infertile masses. Of the three fully developed neonates, one was born dead. Their measurements were: TL range = 215–231mm (mean = 225.7; SD = 7.5); SVL range = 163–168 mm (mean = 164.7; SD = 2.4); tail length range = 52–68 mm (mean = 61.0; SD = 6.7); and mass range = 1.6–2.0 g (mean = 1.8; SD = 0.2). The four non-fertile masses totaled 2.0 g. After parturition, female #965 weighed 53.7 g. The total litter mass excluding the non-fertile masses was 5.3 g and the RCM was 0.090, which is unusually low. Both of these RCM's (0.185 and 0.090) are low when compared to a range (0.233–0.370) of other colubrid RCM's previously reported (Plummer 1992. Copeia 1992:1096–1098; Seigel and Fitch 1984. Oecologia (Berl.) 61:293–301; Thornton and Smith 1995. Herpetol. Rev. 26:102–103; Thornton and Smith, in press, Herpetol. Rev.; Tucker and Camerer 1994. Herpetol. Rev. 25:28–29). The timing of both of these births is comparable to that reported previously for this species.

Immediately following birth, all the neonates sloughed their skins. The adult females and six viable young were returned to the capture site and released. We thank the CRMWD for funding and facilities. Collections were made under the authority of the Texas Parks & Wildlife Department Scientific Permit No. SPR-790-208 to CRMWD.

Submitted by **OKLA W. THORNTON, JR.**, and **JERRY R. SMITH,** Colorado River Municipal Water District, HCR 82 Box 4B, Leaday, Texas 76821, USA.



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GYMNOPHIONA

CAECILIA MARCUSI (Villa Tunari Caecilian): BOLIVIA: BENI: Provincia Yacuma, 5 km S Totaizal (14°54'S, 66°19'W). 10 February 1995. S. Reichle. Verified by A. Schlüter. Coleccion Boliviana de Fauna, La Paz (CBF 2504). Primary forest at ca. 200 m. Coloration in life: dorsal dark violet, ventral light violet. First department record; northwestward range extension (airline) of ca. 250 km (Duellman 1993, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 21:312).

Submitted by **STEFFEN REICHLE**, Langwiesenstr. 26, D-70771 Leinfelden-Echterdingen, Germany, and **JÖRN KÖHLER**, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany.

CAUDATA

AMBYSTOMA MACULATUM (Spotted Salamander). USA: WISCONSIN: Douglas Co: small pond at jct. Summer Road and Minnesuing Road, SW 1/4 NW 1/4 Sec. 16, T46N, R11W. 16 June 1996. Gary S. Casper, Lacey Klucas. Verified by Robert W. Henderson. MPM 27967. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 87 pp.) Dead larvae taken from egg mass. Photographs taken of egg mass and included larvae (MPM Photo 535). Extends range ca. 30 km W of localities mapped by Vogt (1981, Natural History of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 205 pp.)

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: WISCONSIN: Douglas Co: wetland SE jct. Anderson Road and Francis-Willard Road, NE 1/4 NW 1/4 Sec. 17, T46N, R10W. 17 June 1996. Gary S. Casper, Lacey Klucas and Noa Martinsen. Verified by Robert W. Henderson. MPM 27960. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 87 pp.) Individual found in sphagnum moss hummock. Vouchers also taken from three other localities in Douglas County in township T46N R11W (MPM 27961–63). Extends range ca. 30 km W of localities mapped by Vogt (1981, Natural History of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 205 pp.)

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

ANURA

ACRIS CREPITANS CREPITANS (Northern Cricket Frog). USA: GEORGIA: Monroe Co: Lake Juliette, ca. 0.5 km NE jct. Rum Creek Drive and Ga. Rt. 18. 20 May 1996. J. B. Jensen. Verified by Joshua Laerm. University of Georgia Museum of Natural History (UGAMNH 25012). New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712).

Submitted by **JOHN B. JENSEN**, Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

BUFO ARENARUM (Common Toad). ARGENTINA: CHACO: Resistencia City (27°27'S, 58°58'W). 6 October 1995. Jorge A. Céspedez. Verified by Blanca Beatriz Alvarez. Colección Herpetológica de la Facultad de Ciencias Exactas y Naturale y Agrimensura. (UNNEC 4355–4356). First province record; extends range of species 100 km from record in the northern part of Santa Fé province (Gallardo and Varela de Olmedo 1992, Fauna de Agua Dulce de la Republica Argentina 41:1–116), and represents the northernmost record for the species in the central portion of its range.

Submitted by **JORGE ABEL CESPEDEZ**, Compared Anatomy, Biology Department, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400, Corrientes, Argentina.

BUFO PUNCTATUS (Red-spotted Toad). USA: TEXAS: Floyd Co: Caprock Canyons Trailways State Park, UTM coordinates 14-304470E, 3790854N. 25 June 1996. F. D. Yancey II and K. J. Roberts. Verified by Clyde Jones. The Museum, Texas Tech University (TTU 11624). New county record; fills gap between Briscoe and Garza counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

HYLA CHRYSOSCELIS/VERSICOLOR (Gray Treefrog). USA: MINNESOTA: Otter Tail Co: Sec 19, T34N, R38W. 8 August 1996. Eric Thiss. Verified by Jonathan A. Campbell. UTACV-A 48269. New county record (Oldfield and Moriarty 1994, Amphibians and Reptiles Native to Minnesota. Univ. Minnesota Press, Minneapolis. 237 pp.).

Submitted by **BRICE P. NOONAN**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA.

HYLA SENICULA (Corcovado Treefrog). BRAZIL: MINAS GERAIS: Barão de Cocais (19°56'S, 43°28'W). 14 November 1991. R. N. Feio and L. B. Nascimento. Museu Nacional do Rio de Janeiro (MNRJ 17788–17789, two males). Barão de Cocais. January 1992. R. N. Feio and L. B. Nascimento (MNRJ 17790–17794, four males, one female). Caeté: Lagoa do Cabral (20°00'S, 43°40'W). 8–9 January 1992. L. B. Nascimento (MNRJ 17795–17796, two males). Peçanha (18°30'S, 42°35'W). 1 February 1992. L. B. Nascimento and T. Ballstaedt (MNRJ 17797–17815, 19 males). Guãnhaes (18°46'S, 42°58'W). 31 October 1992. L. B. Nascimento (MNRJ 17816–17836, 21 males). All verified by José Perez Pombal, Jr. Published distribution of the species is coastal region of the states of Rio de Janeiro and Espirito Santo in southeastern Brazil (Frost 1985, Amphibian Species of the World. A Taxonomic and Geographical Reference. Allen Press, Inc., and The Association of Systematics Collections, Lawrence, Kansas, 732 pp.) First documented records for the state of Minas Gerais, occurring in four municipalities; extends distribution ca. 400 km from the coastal region of Brazil.

Submitted by **ULISSES CARAMASCHI**, Departamento de Vertebrados, Museu Nacional do Rio de Janeiro, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Rio de Janeiro, Brazil, and **CARLOS ALBERTO GONÇALVES DA CRUZ**,

Departamento de Biologia Animal, Universidade Federal Rural do Rio de Janeiro, 23851-970 Seropédica, Rio de Janeiro, Brazil.

KALOULA PULCHRA PULCHRA (Malaysian Narrowmouth Toad). CHINA: GUANGDONG PROVINCE: Nan Ao Island: Hou Zhai Zhen. 25 July 1996. Yang Si-Chang. Verified by Jose Rosado. MCZ 125851 and South China Normal University Department of Biology 15308. Sixth species of anuran documented for this island [Li and Pan 1995, Chinese Amphibian Biogeography. Herpetol. Ser. (8):125–130] on the Tropic of Cancer 117°E.

Submitted by **JAMES LAZELL** and **WENHUA LU**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA. E-mail: wenhua@uriacc.uri.edu.

PSEUDACRIS TRISERIATA MACULATA (Boreal Chorus Frog) USA: COLORADO: Crowley Co: pond W side of County Road 27, 4.2 mi S of Lincoln County Road D. 4 June 1996. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 278 and UNC-MNH photograph 13. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

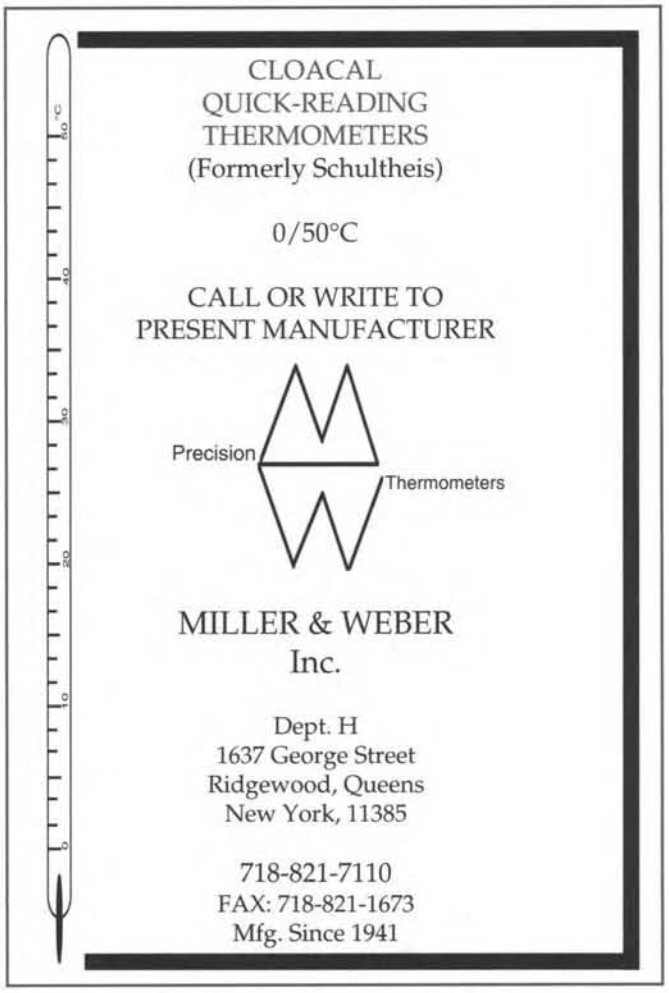
Submitted by **ENOCH BERGMAN, SCOTT BOBACK, BEN HILL, JUSTIN HOBERT, CHAD MONTGOMERY** and **STEPHEN P. MACKESSY,** Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

RANA BROWNORUM (Brown's Leopard Frog). MÉXICO: QUINTANA ROO: Municipio Othón P. Blanco, 3.5 km N of La Unión (17°56'N, 88°51'W). 6–7 April 1992. Alicia Pérez Nuñez. Verified by Edmundo Pérez Ramos. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC 7477–7479); an adult female (MZFC 7478) found in a tree hollow and two juveniles collected on the shore of a small stream in a tropical rain forest. First state record; extends range ca. 327 km SE airline from the closest known locality at 41 mi W Xicalango, Campeche [Sanders 1973. J. Herpetol. 7(2):87–92]. Lee (1980, Univ. Kansas Mus. Nat. Hist. Misc. Publ. 67:1–75) previously reported *Rana pipiens* from the Península de Yucatán but never mentioned *R. berlandieri brownorum*. Hillis (1983, Syst. Zool. 32:132–143) recognized the specific status of *R. brownorum*.

Submitted by **GEORGINA SANTOS-BARRERA, FERNANDO MENDOZA-QUIJANO**, and **ALICIA PÉREZ-NUÑEZ**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, C. P. 04510, Distrito Federal, México.

RANA CATESBEIANA (Bullfrog). USA: COLORADO: Crowley Co: Olney Springs, pond at Olney Springs State Wildlife Area. 14 May, 24 July 1996. Justin Hobert, Enoch Bergman, Chad Montgomery, Ben Hill, Scott Boback. UNC (Univ. Northern Colorado) MNH (formerly CSTC) 157, 270 (numerous others seen); Ordway Reservoir, 4 km N Ordway. 21 July 1996. David Chiszar. UCM 57795. All verified by Todd Gleeson. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

Submitted by **JUSTIN HOBERT, ENOCH BERGMAN, CHAD MONTGOMERY, BEN HILL, SCOTT BOBACK** and **STEPHEN P. MACKESSEY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA; **RICHARD L. HOLLAND**, Science Department, Boulder High School, 1604 Arapahoe Avenue, Boulder, Colorado 80302, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado, 80309-0218, USA.



RANA CATESBEIANA (Bullfrog). USA: TEXAS: Sherman Co: cattle tank 1.45 km S and 0.6 km W of Coldwater Creek Bridge on Tex. Rt. 119, 36°14'48"N, 101°49'50"W, 1065.3 m elev. 20 May 1996. T. J. LaDuc, K. and J. Lunt, and S. Waddell. Verified by R. G. Webb. UTEP 16274 (9 tadpoles). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **KALEB C. LUNT**, HCR3 Box 47, Sunray, Texas 79086, USA.

RANA SPHENOCEPHALA UTRICULARIA (Southern Leopard Frog). USA: TEXAS: Van Zandt Co: FM Road 47, 6.6 km NE Wills Point. DOR. 17 June 1996. C. J. Franklin and R. L. Gutberlet, Jr. University of Texas at Arlington Collection of Vertebrates (UTA A-48128); FM Road 47, 8.8 km NE Wills Point. AOR. 18 June 1996. C. J. Franklin and R. L. Gutberlet, Jr. UTA A-48129. Both verified by C. L. Stewart. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo and Aquarium, Reptile Department, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA, and **RONALD L. GUTBERLET JR.**, Department of Biology, The University of Texas at Arlington, Arlington, Texas 76019, USA.

SPEA INTERMONTANA (Great Basin Spadefoot). USA: OREGON: KLAMATH CO: dry lodgepole pine forest 0.2 km east of Yoss Creek. NE 1/4 Sec. 14, T32S, R9E. 21 August 1996. Richard S. Nauman. Verified by William P. Leonard. UMMZ 217118. New county record; westward range extension of ca. 30 km (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Press of Idaho, Moscow. 332 pp.). Specimen was caught at the mouth of a rodent tunnel in a low cut bank of a dirt road.

Submitted by **RICHARD S. NAUMAN**, Chiloquin Ranger District, Winema National Forest, 38500 Highway 97 North, Chiloquin, Oregon 97624, USA, and **THOMAS LOSSEN** and **KEVIN PFEIFER**, 1807 SE 48th, Portland, Oregon 97215, USA.

ZACHAENUS PARVULUS (Rio Bug-eyed Frog). BRAZIL: SÃO PAULO: Picinguaba (44°52'W, 23°22'S), Ubatuba Municipality. 9 November 1995. A. A. Giaretta. Verified by I. Sazima. Museu de História Natural da UNICAMP (ZUEC 9548). New state record; southernmost known locality (Cochran 1955, Frogs of Southeastern Brazil. U.S. Natl. Mus. Bull. 206:1–423). Individuals found from 100 to 850 m asl.

Submitted by **ARIOVALDO A. GIARETTA** and **RICARDO J. SAWAYA**, Univ. Est. de Campinas, Inst. Biol., Dep. Zool. CP 6109, 13083-970, Campinas, São Paulo, Brazil.

TESTUDINES

ACANTHOCHELYS PALLIDIPECTORIS (Chaco Sideneck Turtle). PARAGUAY: ÑEEMBUCU: Paso Lengá, 7 km SE Pilar City (26°52'S, 58°23'W). 15 September 1992. A. Giraudo and R. Miatello. Verified by Mario R. Cabrera. Herpetological collection of PROBBAS, Consejo Nacional de Investigaciones Científicas y Técnicas, Corrientes, Argentina (CFA 85, carapace and plastron of adult). First definite record for Paraguay; extends range ca. 100 km airline east from the nearest known population in Resistencia, Argentina. *Acanthochelys pallidipectoris* was known only from the Argentine Chaco in Santa Fé, Formosa, Salta and Chaco provinces (Freiberg 1945, Phisys 20:19–23; Ernst 1983, Cat. Am. Amphib. Rept. 325.1; Waller 1988, Amphib. Reptil. (Conserv.) 1:93–98; Richard and De la Fuente 1992, Acta Zool. Lilloana 41:360). Ernst (*op. cit.*) indicated its possible occurence in Paraguay based on a mention of "*Platemys spixii*" by Schenkel (1901, Verh. Naturforsch. Ges. Basel 13:142–199), a synonym of *Acanthochelys pallidipectoris* (Rhodin et al. 1984, Copeia 1984:780–786). However, the site mentioned by Schenkel (*op. cit.*), "Apalue," cannot be found on any maps available to me.

Submitted by **ALEJANDRO R. GIRAUDO**, Becario de CONICET, Instituto Nacional de Limnologia, José Maciá 1933, 3016, Santo Tomé, Santa Fe, Argentina.

CHRYSEMYS PICTA BELLII (Western Painted Turtle) USA: COLORADO: LAS ANIMAS CO: pond S side of County Road 72.5 (along Two Butte Creek), 1.0 mi W Baca/Las Animas County line. Verified by Hobart M. Smith and David Chiszar. UNC-MNH photographs 15–16. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

Submitted by **SCOTT BOBACK, SHELLEY LINK, CHAD MONTGOMERY, JUSTIN HOBERT, ENOCH BERGMAN, BEN HILL** and **STEPHEN P. MACKESSY,** Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

CLEMMYS MUHLENBERGII (BOG TURTLE). USA: NORTH CAROLINA: MITCHELL CO: 3.1 km SW Bakersville. 12 August 1996. Elizabeth Hunter. Verified by Jeffery C. Beane. North Carolina State Museum of Natural Sciences (NCSM 96-8-19; DWH 96.20). New county record; fills gap between the nearest records from Avery County (Palmer and Braswell 1995, Reptiles of North Carolina. Univ. North Carolina Press. Chapel Hill. xii + 412 pp.) and Yancey County (Herman 1986, Herpetol. Rev. 17:50).

Submitted by **DENNIS W. HERMAN**, North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27603, USA, **ELIZABETH HUNTER**, Route 3, Box 99-D, Bakersville, North Carolina 28705, USA, and **CHRIS MCGRATH**, North Carolina Wildlife Resources Commission, 315 Morgan Branch Road, Leicester, North Carolina 28748, USA.

TRIONYX SPINIFERUS PALLIDUS (Pallid Spiny Softshell). USA: TEXAS: GARZA CO: Double Mountain Fork of Brazos River, just W bridge-crossing of Farm Road 669 (S Post) 33°00'46"N, 101°24'14"W, 739.7 m elev. 20 May 1996. R. W. Axtell and R. G. Webb. Verified by C. S. Lieb. KU Color Slide 11234. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **ROBERT G. WEBB**, Laboratory for Environmental Biology, The University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **RALPH W. AXTELL**, Department of Biological Sciences, Southern Illinois University at Edwardsville, Edwardsville, Illinois 62026, USA.

SAURIA

AMEIVA UNDULATA (Rainbow Ameiva). MÉXICO: QUERÉTARO: Municipality of Landa de Matamoros, Tangojo, 24 km SE of Landa de Matamoros (21°05'N, 99°05'W), 460 m elev. 19 May 1995. Ulises Padilla García. Verified by Adrián Nieto Montes de Oca. Laboratorio de Zoología, Universidad Autónoma de Querétaro (BUAQ 86, formerly UPGH 102). Adult male found in tropical deciduous forest. First state record; extends range ca. 30 km SSW from the closest known locality in the Xilitla region, San Luis Potosí (Echternacht 1971, Univ. Kansas Mus. Nat. Hist. Misc. Publ. 55:1–86).

Submitted by **ULISES PADILLA GARCÍA**, Laboratorio de Zoología, Universidad Autónoma de Querétaro, Centro Universitario S/N, Colonia Centro, Apartado Postal 184, C. P. 76017, Querétaro, México, and **FERNANDO MENDOZA QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, C. P. 04510, Distrito Federal, México.

ANOLIS CAROLINENSIS (Green Anole). USA: TEXAS: TOM GREEN CO: San Angelo. 2 July 1996. J. F. Husak. Verified by T. C. Maxwell. Angelo State Natural History Collection (ASNHC 12887). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JERRY F. HUSAK**, Department of Biology, Angelo State University, San Angelo, Texas 76909, USA.

DIBAMUS BOGADEKI (Bogadek's Blind Skink). CHINA: HONG KONG TERRITORY: Chau Kung To (Sunshine Island), ca 9 km WSW Victoria. 8 July 1996. P. Lynch. MCZ 181758. Verified by Michael Lau. Fourth known specimen and third known island. In addition to the type-locality, Hei Ling Chau (Darevsky 1992, Asiatic Herpetol. Res. 4:8), this species occurs on Shek Kwu Chau (Zhao and Adler 1993, Herpetology of China, SSAR:

Plate 27E; MCZ 177136, 179502), ca 20 km SW Victoria. All of these islands are threatened by either destructive development or consumption for reclamation projects elsewhere.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA. E-mail: wenhua@uriacc.uri.edu

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Concho Co: Eden. 24 September 1994. R. Rodgers and K. Pfluger. Angelo State Natural History Collection (ASNHC 12883). Tom Green Co: San Angelo. 8 March 1990. Shannon Jones. Angelo State natural History Collection (ASNHC 12676). Both verified by T. C. Maxwell. New county records for this introduced species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JERRY F. HUSAK**, Department of Biology, Angelo State University, San Angelo, Texas 76909, USA.

LAEMANCTUS SERRATUS SERRATUS (Serrated Casquehead Iguana; Lemacto Coronado). MÉXICO: QUERÉTARO: Municipality of Landa de Matamoros, Tangojo, 24 km SE of Landa de Matamoros (21°05'N, 99°05'W), 580 m elev. 19 May 1995. Ulises Padilla García. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de Mexico (MZFC 7360 juv male); 25 July 1995. Ulises Padilla García (MZFC 7527, adult female) and Laboratorio de Zoología, Universidad Autónoma de Querétaro (BUAQ 098, adult male). All verified by Adrián Nieto Montes de Oca. Specimens were found in tropical subdeciduous forest and represent the first records for Querétaro, extending the range ca. 30 km SSW from the closest known locality at Xilitla, San Luis Potosí [Taylor 1949, Univ. Kansas Sci. Bull. 33(2):169–215; McCoy 1968, Copeia 1968:665–678].

Submitted by **ULISES PADILLA GARCÍA**, Laboratorio de Zoología, Universidad Autónoma de Querétaro, Centro Universitario S/N, Colonia Centro, Apartado Postal 184, C. P. 76017, Querétaro, México, **WALTER SCHMIDT BALLARDO** and **FERNANDO MENDOZA QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, C. P. 04510, Distrito Federal, México.

PHRYNOSOMA CORNUTUM (Texas Horned Lizard). USA: TEXAS: Hall Co: Caprock Canyons Trailways State Park, UTM coordinates 14-345566E, 3820296N. 26 June 1996. F. D. Yancey, II and K. J. Roberts. Verified by Clyde Jones. The Museum, Texas Tech University (TTU 11626). New county record; fills gap between Briscoe and Childress counties (Dixon 1987, Amphibians of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

PHYLLOPEZUS POLLICARIS PRZEWALSKYI (Brazilian Gecko). ARGENTINA: FORMOSA: Departamento Matacos: Ingeniero G. N. Juarez (23°54'S, 61°46'W). 25 February 1991. R. Aguirre, B. B. Alvarez, A. Hernando, M. Tedesco. Coleccion Herpetologica de la Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 1002); Tte. Gral R., M. Fraga (23°45'S, 62°08'W), same date and collectors (UNNEC 1004). Verified by A. Hernando. First province records, extend range 150 km NNW of previous records in Chaco Province, Argentina. [Cei 1993, Monogr. XI, Mus. Reg. Sci. Nat. Torino: 1–949; Alvarez B. 1988, Rev. Asoc. Cs. Nat. Lit. 19(1):79–89] and 180 km NE of previous record in Salta Province (Cruz et al. 1994, Herpetol. Rev. 25:161).

Submitted by **BLANCA BEATRIZ ALVAREZ**, Catedra de Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

PHYLLOPEZUS POLLICARIS PRZEWALSKYI (Brazilian Gecko). PARAGUAY: DEPARTAMENTO PARAGUARI: Chololo (25°30'S, 57°W). 3 March 1989. M. Culzzoni and B. Alvarez. Verified by A. Hernando. Coleccion Herpetologica de la Universidad Nacional del Nordeste, Corrientes, Argentina (UNNEC 1005). First department record (Aquino et al. 1996, in Colec. Flora y Fauna Mus. Nac. Hist. Nat. Parag., Ed. O. Romero Martinez,1996:331–400).

Submitted by **MERCEDES CULZZONI**, Division de Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Asuncion. San Lorenzo, Paraguay, and **BLANCA BEATRIZ ALVAREZ**, Catedra de Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

STENOCERCUS MARMORATUS (Spotted Whorltail Iguana). ARGENTINA: SALTA: Santa Victoria Department: Baritú National Park, Cuesta Los Coloraditos (22°34'S, 64°38'W). 9 September 1981. Omar Pagaburo and Enrique Terán. Verified by Gustavo J. Scrocchi. Herpetological collection from the Instituto de Herpetología, Fundación Miguel Lillo, Tucumán (FML 01130–01131, 4 specimens). First record for country; Cei (1993, Reptiles del Noroeste, Nordeste y Este de la Argentina. Herpetofauna de las Selvas Subtropicales Puna y Pampas. Mus. Reg. Sci. Nat. Torino, Monogr. 14:1–949) does not mention this species for Argentina. Collected in Yunga habitat, this population is sympatric, not syntopic, with *S. roseiventris*. Fritts (1974, San Diego Soc. Nat. Hist. Mem. 7:86 pp.) commented that this species inhabited Andean slopes between 2700 and 3350 m, in Cochabamba Department, Bolivia. The locality reported here is at ca. 1600 m elevation and extends range 1500 km to the south from type locality at Cochambamba.

Submitted by **FÉLIX B. CRUZ**, **GUSTAVO J. SCROCCHI**, and **SILVIA A. MORO**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, (4000) Tucumán, Argentina.

STENOCERCUS PECTINATUS (Whorltail Iguana). ARGENTINA: CORDOBA: Departamento Rio Cuarto: Laguna Oscura (33°53'S, 64°42'W). 10–28 October 1993. L. Cardinale and P. Vignolo. Verified by Ricardo Martori. Herpetological collection of Zoologia de Vertebrados, Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Cordoba, Argentina (ZV-UNRC 2553, 2555, 2745). First department record, 320 km S of the previous record for the province.

Submitted by **LISANDRO CARDINALE** and **PABLO VIGNOLO**, Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Estado Postal Nro. 9, C. P. 5800, Rio Cuarto, Cordoba, Argentina.

UROSAURUS ORNATUS WRIGHTI (Northern Tree Lizard). USA: COLORADO: Routt Co: Pagoda Cemetery. 3 August 1996. H. M. Smith. Verified by Richard L. Holland. UCM 57800. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.), and the easternmost limit of range known in the state.

Submitted by **HOBART M. SMITH** and **DAVID CHISZAR,** University of Colorado Museum, Boulder, Colorado 80309-0218, USA; and **JAN J. ROTH**, Sundance Research Institute, 417 Breeze Street, Craig, Colorado 81625, USA.

UROSTROPHUS GALLARDOI (Steppe Iguana). BOLIVIA: TARIJA: borders of Tarija river, entry to Salinas coming from Potrerillos, Reserva Natural de Flora y Fauna de Tariquia (21°56'41.5"S, 64°19'9.6"W), 870 m. 24 October 1995. Gustavo Scrocchi. Verified by Fernando Lobo. Coleccion Boliviana de Fauna, La Paz, Bolivia (CBF 1731). First department record; second record from Bolivia where it was only known from Santa Cruz de la Sierra (Etheridge and Williams 1991, Bull. Mus. Comp. Zool. 152(5):317–361).

Submitted by **SEBASTIAN ENRIQUE TORRES**, Instituto de Herpetologia, Fundacion Miguel Lillo, Miguel Lillo 251, 4000, Tucuman, Republica Argentina.

SERPENTES

ARIZONA ELEGANS ELEGANS (Kansas Glossy Snake). USA: TEXAS: Floyd Co: 4 mi. S, 1 mi W Quitaque, UTM coordinates 14-304470E, 3790854N. 25 June 1996. F. D. Yancey, II and K. J. Roberts. Verified by Clyde Jones. The Museum, Texas Tech University (TTU 11625). New county record; fills gap between Briscoe and Crosby counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

CHIRONIUS LAEVICOLLIS (Brazilian Cipó). BRAZIL: SÃO PAULO: BAHIA: Ubaitaba (14°18'S, 39°20'W, 0–100 m elev.). 1 August 1994. G. Brisolla. Verified by Francisco L. Franco. Instituto Butantan (IB 55468). This species is found in the Atlantic Forest, along the southeastern coast of Brazil from the state of Espirito Santo and Minas Gerais to Santa Catarina. (Dixon et al. 1993, Revision of the Neotropical Snake Genus *Chironius* Fitzinger (Serpentes, Colubridae). Mus. Reg. Sci. Nat. Monogr. XIII, 280 pp.). The northern limit of its range was reported as Santa Leopoldina, ES (20°06'S, 40°32'W) (Dixon et al., *op. cit.*, p. 137). First documented record for the state of Bahia; extends distribution northward.

Submitted by **OTAVIO A. V. MARQUES** and **GIUSEPPE PUORTO**, Laboratório de Herpetologia, Instituto Butantan. Avenida Vital Brazil, 1500, CEP 05503-900, São Paulo, São Paulo, Brazil.

DRYADOPHIS MELANOMUS VERAECRUCIS (Olive Lizard Eater). MÉXICO: HIDALGO: Municipality of Tenango de Doria, 3 km W Tenango de Doria way to El Texme (20°20'09"N, 98°15'97"W), elev. 1065 m. 29 June 1995. Roberto C. Monroy Ibarra and Fernando Mendoza Quijano. Verified by Adrián Nieto Montes de Oca. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC 7759). Adult female found near small stream in cloud forest. First record for state of Hidalgo; extends range ca. 16 km SE from the closest known locality at Zacualpan, Veracruz (Stuart 1941, Univ. Michigan Mus. Zool. Misc. Publ. 49:1–106).

Submitted by **ROBERTO C. MONROY IBARRA, SOL DE MAYO MEJENES LOPEZ**, and **FERNANDO MENDOZA QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, C. P. 04510, Distrito Federal, México.

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). USA: TEXAS: Roberts Co: 7.56 km (by road) NE jct US Rt. 60 and Tex. Rt. 282 (in Miami) on US Rt. 60, 35°44'05"N, 100°34'30"W, 810.8 m elev. 19 May 1996. T. J. LaDuc, D. I. Lannutti, and J. D. Johnson. Verified by C. S. Lieb. UTEP 16270. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **DOMINIC I. LANNUTTI** and **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **JERRY D. JOHNSON**, Biology Department, El Paso Community College, El Paso, Texas 79998, and Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

EPICRATES CENCHRIA MAURUS (Rainbow Boa; Boa Tornasol). VENEZUELA: ESTADO MERIDA: 1 km from Alcabala de Puente Victoria on road from Mérida to Santa Cruz de Mora. 16 May 1988. Jesús Molinari and Juan Luis Concepción. Colección de Anfibios y Reptiles, Laboratorio de Biogeografía, Escuela de Geografía, Universidad de Los Andes (ULABG) 2051; Laguna de Caparú, 25 km SW Mérida, 900 m elev. 12 November 1992. Pascual Soriano. ULABG 3926 (photograph and shed skin). Both verified by Pascual Soriano. First records for the state of Mérida and the Venezuelan Andes (Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela, Caracas, Ediciones de la Biblioteca 28:64–66). These specimens were previously reported as *Epicrates cenchria cenchria* by La Marca and Soriano (1995, Herpetol. Rev. 26:109). Further examination of ventral scale counts and color pattern indicate that they represent *E. cenchria maurus*.

Submitted by **ROBERTO CASADO B.**, Universidad de Los Andes, Facultad de Ciencias, Ecología Animal, La Hechicera, Apartado Postal 71, Mérida 5251, Venezuela, and **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales y Ambientales, Escuela de Geografía, Apartado Postal 116, Mérida 5101-A, Venezuela.

HETERODON NASICUS (Western Hognose Snake). USA: COLORADO: Douglas Co: Roxborough State Park. July 1987. Cecilia A Travis. Verified by Alan de Queiroz. UCM Color Slides 127–128. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

Submitted by **CECILIA A. TRAVIS**, Roxborough State Park, 4751 North Roxborough Drive, Littleton, Colorado 80125, USA, and **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

HYDROPS TRIANGULARIS (Triangle Water Snake). BRAZIL: MARANHÃO: Arari (03°28'S, 44°47'W). 23–24 November 1985. D. F. Moraes Jr. Verified by José Perez Pombal Jr. Museu Nacional do Rio de Janeiro (MNRJ 4497). First documented record for state of Maranhão in northeastern Brazil; extends range ca. 240 airline km SE of record from Colônia Nova, state of Pará, Brazil (Cunha and Nascimento 1978, Ofidios da Amazonia. X. As cobras da região leste do Pará. Museu Paraense Emilio Goeldi, Publ. Avulsas 31:218 pp.); easternmost record for South America. According to Roze (1957, Acta Biologica Venezuelica 2:51–95), identified as *Hydrops triangularis triangularis*, a subspecies restricted to the eastern part of the Amazonian basin; the present locality record, in the Mearim River drainage, is isolated from the Amazonian basin.

Submitted by **HUSSAM ZAHER** and **ULISSES CARAMASCHI**, Departamento de Vertebrados, Museu Nacional do Rio de Janeiro, Quinta da Boa Vista, 20940-040 Rio de Janeiro, Rio de Janeiro, Brazil.

HYPSIGLENA TORQUATA DESERTICOLA (Desert Night Snake) USA: IDAHO: Butte Co: Idaho National Engineering Laboratory, Crater Butte: UTM Zone 12: 326464.127 E, 4829086.369 N. 23 June 1995. Sarah L. Cooper. Verified by Charles R. Peterson. Idaho Museum of Natural History (IMNH 1481–82). Three individuals caught in a drift fence array; two were collected. New county record (Nussbaum et. al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press., Moscow. 332 pp.); represents range extension of over 50 miles for this species, which had not been detected on INEL in the past 20 years despite repeated herpetological surveys and projects. Drift fences have been shown to be an effective means of capturing secretive and/or nocturnal herpetofauna on the INEL.

Submitted by **SARAH L. COOPER**, Department of Biological Sciences, Idaho State University, Campus Box 8007, Pocatello, Idaho 83209, USA.

HYPSIGLENA TORQUATA JANI (Texas Night Snake). USA: TEXAS: Roberts Co: 2.09 km (by road) NW jct Tex. Rt. 283 and Tex. Rt. 283 (ca. 4.34 road km NW Miami), 35°42'00"N, 100°40'38"W, 859.5 m elev. 18 May 1996. T. J. LaDuc, D. I. Lannutti, and J. D. Johnson. Verified by C. S. Lieb. UTEP 16285. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **DOMINIC I. LANNUTTI** and **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **JERRY D. JOHNSON**, Biology Department, El Paso Community College, El Paso, Texas 79998, and Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

HYPSIGLENA TORQUATA LOREALA (Mesa Verde Night Snake). USA: COLORADO: Garfield Co: 1.6 km E Parachute, base of Naval Oil Shale Reserve. 30 June 1995. John A. Rybak. UCM Herpetological Photograph No. 129. Verified by Richard L. Holland. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

Submitted by **JOHN A. RYBAK**, 177 Sagemont Circle, Parachute, Colorado 81635, USA; **LAUREN J. LIVO**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

IMANTODES GEMMISTRATUS (Central American Tree Snake). MÉXICO: QUERÉTARO: Municipality of Landa de Matamoros, Tangojo, 24 km SE of Landa de Matamoros (21°05'N, 99°05'W), 550 m elev. 7 March 1995. Ulises Padilla García. Verified by Adrián Nieto Montes de Oca. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC 7547). Juvenile collected in tropical deciduous forest. First state record; extends range ca. 122 km SE of the closest known locality, 33 mi S Tampico, Veracruz [Reese 1971, J. Herpetol. 5:67–69].

Submitted by **ULISES PADILLA GARCÍA**, Laboratorio de Zoología, Universidad Autónoma de Querétaro, Centro Universitario S/N, Colonia Centro, Apartado Postal 184, C. P. 76017, Querétaro, México, and **FERNANDO MENDOZA QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, C. P. 04510, Distrito Federal, México.

LAMPROPELTIS CALLIGASTER CALLIGASTER (Prairie Kingsnake). USA: TEXAS: Rains Co: County Road 1480 near Sabine River Authority Headquarters, ca. 5 km S Hermits Cove. AOR. 17 June 1996. R. L. Gutberlet, Jr. and C. J. Franklyn. Verified by C. L. Stewart. University of Texas at Arlington Collection of Vertebrates (UTA-R 39883). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **RONALD L. GUTBERLET JR.**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA, and **CARL J. FRANKLIN**, Dallas Zoo and Aquarium, Reptile Department, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA.

LAMPROPELTIS GETULA (Common Kingsnake) USA: COLORADO: Las Animas Co: within vertical crevice in bluffs on S side of West Carrizo Creek, ca. 50 m E jct County Road 22.1. 1 August 1996. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 279 (shed skin). First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.). Specimen is an intergrade between *L. g. splendida* and *L. g. holbrooki*.

A second specimen (partial carcass; UNC-MNH 3280) was found at the following location: Otero Co: side creek at jct West 5th and Maple Streets in La Junta. 1 August 1996. The occurrence of *L. getula* in eastern Colorado has been somewhat speculative, since the only other record was also from the town of La Junta (Hammerson 1986, Amphibians and Reptiles in Colorado. Publ. Colorado Division of Wildlife), raising the possibility of an introduction. This second record from La Junta suggests that the population is indeed natural, and the Las Animas record, at a very remote rural locality, confirms the natural presence of this snake in Colorado.

Submitted by **SCOTT BOBACK, SHELLEY LINK, ENOCH BERGMAN, BEN HILL, CHAD MONTGOMERY, JUSTIN HOBERT** and **STEPHEN P. MACKESSY,** Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

LAMPROPELTIS TRIANGULUM CELAENOPS (New Mexico Milk Snake) USA: NEW MEXICO: Grant Co: 10 mi W Silver City (Mangas Valley, Sec. 20, T18S, R16W). May 1961. Dale A. Zimmermann. Verified by Stanley P. Fields. Western New Mexico University (WNMU 45). New county record; extends range ca. 145 km NNE and 122 km NW from nearest records (Degenhardt et al. 1996, Amphibians and reptiles of New Mexico. Univ. New Mexico Press. xix + 431 pp).

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P. O. Box 25112, Santa Fe, New Mexico 87504, USA, and **RANDY D. JENNINGS**, Department of Natural Sciences, Western New Mexico University, Silver City, New Mexico 88062, USA.

LEPTOPHIS MEXICANUS SEPTENTRIONALIS (Tamaulipan Parrot Snake). MÉXICO: QUERÉTARO: Municipality of Landa de Matomoros, Tangojo, 24 km SE de Landa de Matomoros

(21°05'N, 99°05'W), 450 m elev. 18 May 1995. Ulises Padilla García. Verified by Adrián Nieto Montes de Oca. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC 7548). A juvenile caught near the shore of the Moctezuma River in tropical deciduous forest; first state record and extends range ca. 102 km S of the closest known locality at Gustavo Garmedia (15 km N Ciudad Valles), San Luis Potosí by Mancilla and Schmidt (1995, Herpetol. Rev. 26:156).

Submitted by **ULISES PADILLA GARCÍA**, Laboratorio de Zoologia, Universidad Autónoma de Querétaro, Centro Universitario S/N, Colonia Centro, Apartado Postal 184, C. P. 76017, Querétaro, México, and **FERNANDO MENDOZA QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, C. P. 04510, Distrito Federal, México.

LEPTOTYPHLOPS DULCIS DULCIS (Plains Blind Snake). USA: TEXAS: Cottle Co: Matador Wildlife Management Area. 15 June 1995. Janelda E. Chavez. WTAMU 15030-1. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press. 434 pp.).

Submitted by **KATHLEEN B. BLAIR** and **JANELDA E. CHAVEZ**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

MASTICOPHIS FLAGELLUM TESTACEUS (Western Coachwhip). USA: TEXAS: Hansford Co: 0.64 km (by road) N jct. Tex. Rt. 15 and FM 1573 on Tex. Rt. 15, 36°16'13"N, 101°35'51"W, 1028.7 m elev. 16 May 1996. D. I. Lannutti and T. J. LaDuc. Verified by R. G. Webb. UTEP 16291. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **DOMINIC I. LANNUTTI** and **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **JERRY D. JOHNSON**, Biology Department, El Paso Community College, El Paso, Texas 79998, and Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

OPHEODRYS VERNALIS (Smooth Green Snake). USA: WISCONSIN: Green Co: Brooklyn Wildlife Area, Sec. 1, T4N, R8E. 12 April 1996. Alan Crossley. Verified by Robert W. Henderson. MPM 27976. New county record (Casper 1996, Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 87 pp.) Specimen discovered after controlled burn. Falls within range gap between Winnebago County, Illinois [Olson 1956, Copeia 1956:188–191; Smith 1961, Illinois Nat. Hist. Surv. Bull. 28, Art. 1] and the vicinity of Madison, Wisconsin (Vogt 1981, Natural History of the Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 205 pp.)

Submitted by **GARY S. CASPER**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 West Wells Street, Milwaukee, Wisconsin 53233, USA.

RHINOCHEILUS LECONTEI TESSELATUS (Texas Longnose Snake). USA: TEXAS: Roberts Co: 1.29 km (by road) NW jct Tex. Rt. 283 and Tex. Rt. 282 on Tex. Rt. 283 (ca. 3.54 road km NW Miami), 35°42'00"N, 100°40'13"W, 850.4 m elev. 18 May 1996. T. J. LaDuc, D. I. Lannutti, and J. D. Johnson. Verified by C. S. Lieb. UTEP 16269. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **DOMINIC I. LANNUTTI** and **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **JERRY D. JOHNSON**, Biology Department, El Paso Community College, El Paso, Texas 79998, and Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

SIBYNOMORPHUS LAVILLAI (LaVilla's Tree Snake). ARGENTINA: SANTIAGO DEL ESTERO: Departamento Copo: Pampa de los Guanacos (26°14'S, 61°49'W). 12 December 1995. A. Hernando, M. Lions and R. Aguirre. Verified by L. Rey. Coleccion Herpetologica de la Universidad Nacional del Nordeste, Corrientes, Argentina. (UNNEC 4571–73, 4575, 4941–42). First province record [Scrocchi et al. 1993, Rev. Brasil. Biol. 53(2):197–208].

Submitted by **MARIA LUISA LIONS** and **BLANCA BEATRIZ ALVAREZ**, Catedra de Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

SIBYNOMORPHUS VENTRIMACULATUS (Boulenger's Tree Snake). ARGENTINA: CORRIENTES: Departamento Ituzaingo: Colonia Liebig (27°55'S, 55°50'W). 22 April 1996. M. Chatellenas. Verified by L. Rey. Coleccion Herpetologica de la Universidad Nacional del Nordeste, Corrientes, Argentina. (UNNEC 4881). First province record [Scrocchi et al. 1993, Rev. Brasil. Biol. 53(2):197–208].

Submitted by **MARIA LUISA LIONS** and **BLANCA BEATRIZ ALVAREZ**, Catedra de Anatomia Comparada, Departamento de Biologia, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

SISTRURUS CATENATUS EDWARDSII (Desert Massasauga). USA: NEW MEXICO: Otero Co: White Sands National Monument, 0.8 km NW of headquarters (DOR). 16 April 1988. T. L. Brown and J. N. Stuart. University of New Mexico Museum of Southwestern Biology (MSB 53336). Torrance Co: 5.3 km S of Estancia (DOR). 3 August 1986. M. A. Williamson. MSB 51881. Both verified by C. W. Painter. First records for counties and for the Tularosa and Estancia closed basins, respectively (Degenhardt et al. 1996, Amphibians and Reptiles of New Mexico. Univ. New Mexico Press, Albuquerque. xx + 431 pp.).

Submitted by **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA; and **TED L. BROWN**, Vector Control Program, New Mexico Environment Department, 525 Camino de Los Marquez, Santa Fe, New Mexico 87502, USA.

STENORRHINA DEGENHARDTII (Degenhardt's Scorpion-eating Snake). BELIZE: CAYO: "Cuxta Bani," upper Raspaculo River, Maya Mountains (88°47'30"W, 16°48'45"N), elev. 440 m. 12 January 1991. P. J. Stafford. Verified by Jonathan A. Campbell. Photographed and released; color slides deposited at The Natural History Museum (BMNH), London (NHM Photo Ref. Nos. T11851–T11855). Originally published in error as *Stenorrhina freminvillii* (Stafford 1991, Bull. British Herpetol. Soc. 38:10–17). New snake for Belize, extending range northeast ca. 120 km from the Sierra de Santa Cruz highlands of east-central Guatemala.

Submitted by **PETER J. STAFFORD**, Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom.

TANTILLA NIGRICEPS (Plains Black-Headed Snake). USA: TEXAS: Roberts Co: 17.70 km (by road) NW jct Tex. Rt. 283 and Tex. Rt. 282 on Tex. Rt. 283 (ca. 19.95 road km NW Miami), 35°49'41"N, 100°47'38"W, 890.0 m elev. 18 May 1996. T. J. LaDuc, D. I. Lannutt, and J. D. Johnson. Verified by C. S. Lieb. UTEP 16284. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

Submitted by **DOMINIC I. LANNUTTI** and **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **JERRY D. JOHNSON**, Biology Department, El Paso Community College, El Paso, Texas 79998, and Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

TANTILLA OOLITICA (Rim Rock Crowned Snake). USA: FLORIDA: Monroe Co: Vaca Key, City of Marathon, under board on Aviation Boulevard. 13 April 1996. John Decker. Verified by David L. Auth. Florida Museum of Natural History (UF Photograph 103789). Island range extension beyond Grassy Key, except for questionable Key West specimen.

Submitted by **KENNETH L. KRYSKO**, Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32608, USA, and **JOHN DECKER**, 5926 Thomas St. #18, Hollywood, Florida 33021, USA.

THAMNODYNASTES CHAQUENSIS (Chaco Coastal House Snake). PARAGUAY: ÑEEMBUCU: 5 km E Pilar City (26°52'S, 58°23'W), 15 September 1992, A. R. Giraudo and V. Riveros. 26 March 1993. Verified by Sara Bergna. Herpetological collection of PROBBAS, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Corrientes, Argentina (CFA 87, adult female; CFA 381, adult male). First record for Paraguay. Species was recently described by Bergna and Alvarez (1993, Facena 10:8–15) and was only known from north of Santa Fé province and east of Formosa and Chaco provinces.

Submitted by **ALEJANDRO R. GIRAUDO**, Becario de CONICET, Instituto Nacional de Limnologia, José Maciá 1933, 3016, Santo Tomé, Santa Fe, Argentina.

THAMNOPHIS CYRTOPSIS CRYTOPSIS (Blackneck Garter Snake) USA: COLORADO: Otero Co: ca. 100 m E County Rt. 109, 1.5 mi S jct. David Canyon Road. 29 May 1996. Verified by Hobart M. Smith and David Chiszar. UNC-MNH Photograph 14. First county record (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

Submitted by **SCOTT BOBACK, CHAD MONTGOMERY, JUSTIN HOBERT, ENOCH BERGMAN, BEN HILL** and **STEPHEN P. MACKESSY,** Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, Colorado 80639, USA.

THAMNOPHIS CYRTOPSIS CYRTOPSIS (Western Blackneck Garter Snake). USA: COLORADO: Otero Co: 0.5 km S Mile Marker 41, Rt. 109, 15.5 km N Bent County line, 1300 m. 21 July 1996. Bryon Shipley, Clint Henke and Tim Morris. Verified by Richard L. Holland. UCM 57799. First preserved specimen (Livo et al. 1996, Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.).

Submitted by **BRYON SHIPLEY, CLINT HENKE** and **TOM MORRIS**, Department of Herpetology, Denver Zoo, City Park, 2300 Steele Street, Denver, Colorado 80205-4899, USA; and **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

THAMNOPHIS MARCIANUS MARCIANUS (Checkered Garter Snake). USA: TEXAS: Hansford Co: 5.95 km (by road) W Spearman on Tex. Rt. 759, 36°11'55"N, 101°08'06"W, 940.9 m elev. 19 May 1996. T. J. LaDuc. Verified by R. G. Webb. UTEP 16272. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Univ. Press, College Station. 434 pp.).

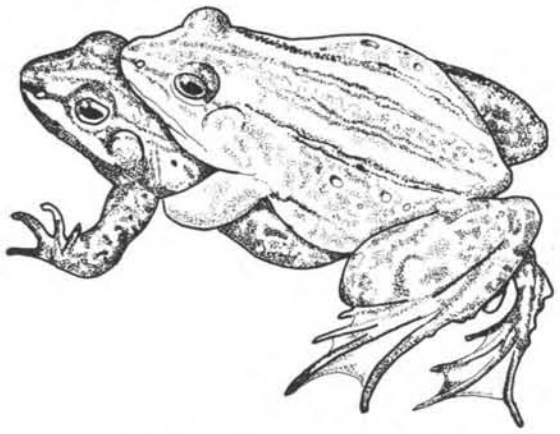
Submitted by **DOMINIC I. LANNUTTI** and **TRAVIS J. LADUC**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, and **JERRY D. JOHNSON**, Biology Department, El Paso Community College, El Paso, Texas 79998, and Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

THAMNOPHIS PROXIMUS (Western Ribbon Snake). USA: TEXAS: Hardeman Co: 14.5 km E Quanah, Rt. 1167. 30 September 1995. Janelda E. Chavez. WTAMU 15008. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press. 434 pp.).

Submitted by **KATHLEEN B. BLAIR** and **JANELDA E. CHAVEZ**, Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

VIRGINIA STRIATULA (Rough Earth Snake). USA: TEXAS: Van Zandt Co: FM Road 47, 1.8 km NE of Wills Point. AOR. 18 June 1996. C. J. Franklin and R. L. Gutberlet, Jr. Verified by C. L. Stewart. University of Texas at Arlington Collection of Vertebrates (UTA R-39849). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **CARL J. FRANKLIN**, Dallas Zoo and Aquarium, Reptile Department, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA, and **RONALD L. GUTBERLET JR.**, Department of Biology, The University of Texas at Arlington, Arlington, Texas 76019, USA.



Rana arvalis in amplexus. Illustration by Cristina Staicu.

New Records of Reptiles from the State of Paraná, Brazil

JULIO CESAR DE MOURA-LEITE
and
SÉRGIO AUGUSTO ABRAHÃO MORATO
Museu de História Natural Capão da Imbuia
Departamento de Zoológico, Prefeitura Municipal de Curitiba
R. Prof. Benedito Conceição, 407
82810-080, Curitiba, Paraná, Brazil

and
RENATO SILVEIRA BÉRNILS
Alameda Santos, 2384, apt. 52
01418-200, São Paulo, São Paulo, Brazil

Bibliographical data on the herpetofauna from the state of Paraná, Brazil, are scarce. Besides the species lists of Boettger (1905) and Bérnils and Moura-Leite (1990), data are available only from systematic revisions of genera and/or groups of species. However, previous herpetological collections fail to have significant samples of reptiles from Paraná. During the last thirteen years, a detailed survey on the herpetofauna of the Paraná has been conducted by us, resulting in significant enhancement of distributional maps for several species. All records are based on specimens deposited in the herpetological collection of the Museu de História Natural Capão da Imbuia (MHNCI) at Curitiba, State of Paraná. Identifications of snakes, lizards, and turtles were verified by Marcos Di Bernardo (Museu de Ciencias e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul), and the amphisbaenid by José Duarte de Barros Fiho (Universidade Federal do Rio de Janeiro).

TESTUDINES

Phrynops williamsi (Williams' Side-necked Turtle). Capitão Leônidas Marques Municipality: Iguaçu River. 26 March 1993. E. S. Grando, Jr. and A. P. Barreto. MHNCI 6095; Nova Prata do Iguaçu Municipality: Salto Caxias, Iguaçu River. January 1991. S. Zamith. MHNCI 3923, MHNCI 4432; Pinhão Municipality: Segredo Power Plant, Iguaçu River. August 1987. M. V. Segalla. MHNCI 3121.

AMPHISBAENIA

Cercolophia robertii (NCN). Campo Mourão Municipality. 1990. Collector unknown. MHNCI 3473.

LACERTILIA

Ameiva ameiva (Green Ameiva). Centenário do Sul Municipality: Taquaruçu Power Plant, Paranapanema River. February 1992. L. A. Silva. MHNCI 4985; Lupionópolis Municipality. 21 April 1989. L. A. Silva. MHNCI 2912; Santa Inês Municipality. 10 May 1992. L. A. Silva. MHNCI 4987.

Pantodactylus quadrilineatus (NCN). Arapoti Municipality. August 1990. S. A. A. Morato. MHNCI 3355; Jaguariaíva Municipality. September 1990. S. A. A. Morato. MHNCI 3401.

Teius oculatus (Green Lizard). Jaguariaíva Municipality: Chapada de Santo Antônio. 3 May 1991. J. T. W. Motta. MHNCI 4103; Ponta Grossa Municipality: 25 October 1990. F. Iung. MHNCI 3422.

Tropidurus itambere (Rock Lizard). Arapoti Municipality: Perdizes River. 30 June 1991. S. A. A. Morato and R. S. Bérnils. MHNCI 4115, MHNCI 4116; Jaguariaíva Municipality: Pesqueiro. 18 October 1986. S. Larocca and F. C. Zanella. MHNCI 1350; Tibagi Municipality: Guartelá. 13 February 1994. M. C. Córdova. MHNCI 6560.

SERPENTES

Apostolepis dimidiata (NCN). Arapoti Municipality: Fábrica de Papel. March 1991. M. B. M. Rocha and S. A. A. Morato. MHNCI 3950. Campo Mourão Municipality. January 1993. P. H. Labiak. MHNCI 6009; Centenário do Sul Municipality. 15 July 1991. L. A. Silva. MHNCI 2528; July 1989. L. A. Silva. MHNCI 3086; 15 December 1992. V. A. Morais and L. A. Silva. MHNCI 5891; Colombo Municipality. 1992. Collector unknown. MHNCI 6459; Jaguariaíva Municipality. 1989. Collector unknown. MHNCI 2746; Lupionópolis Municipality. 1989. Collector unknown. MHNCI 2915.

Atractus maculatus (NCN). Campo Largo Municipality: Três Córregos. 1991. Collector unknown. MHNCI 4818.

Atractus taeniatus (NCN). Apucarana Municipality. October 1987. Collector unknown. MHNCI 2108, MHNCI 2123; Cascavel Municipality. 1990. J. Gomes. MHNCI 4850; Francisco Beltrão Municipality. April 1986. Collector unknown. MHNCI 501; Pato Branco Municipality: Bairro Brasília. 15 February 1988. S. Bedin. MHNCI 2274; Pinhão Municipality: Reserva. 28 September 1991. E. Grando, Jr. MHNCI 5012; Pinhão Municipality: Jordão River. 24 November 1991. F. C. Straube, B. L. Reinert and F. Zanella. MHNCI 5090; Santo Antônio do Sudoeste Municipality. 11 October 1994. Collector unknown. MHNCI 7007, MHNCI 7008.

Chironius flavolineatus (Liana Snake). Arapoti Municipality. March 1991. Collector unknown. MHNCI 4110; Jaguariaíva Municipality. 1989. Collector unknown. MHNCI 2741, MHNCI 3347; Palmeira Municipality: Santa Rita Farm. 5 May 1985. F. C. Straube and F. A. Sedor. MHNCI 204; Palmeira Municipality: Witmarsum. 5.VI.1991. Collector unknown. MHNCI 4446; Ponta Grossa Municipality: Alagados. 25 July 1991. F. Iung. MHNCI 4567; Ponta Grossa Municipality: Vila Velha. 29 March 1984. R. S. Bérnils. MHNCI 719; Porto Amazonas Municipality: PR 427 Road. 15 September 1984. K. N. Suzuki. MHNCI 3456.

Chironius multiventris (Liana Snake). Guaraqueçaba Municipality: Superagui Island, Barranco Branco. 30 April 1993. D. R. Vianna and W. Nicolack. MHNCI 6160; Guaraqueçaba Municipality: Tagaçaba. August 1993. P Scherer-Neto. MHNCI 6381; Guaratuba Municipality: Arraias. November 1956. W. Martins. MHNCI 454; Morretes Municipality. March 1989. E. Brandão. MHNCI 2572.

Ditaxodon taeniatus (NCN). Ponta Grossa Municipality: Vila Velha. 20 October 1992. F. Iung, H. Garcia and R. Oliveira. MHNCI 5827; 5 December 1992. F. Iung and L. Daru. MHNCI 5924.

Eunectes notaeus (Yellow Anaconda). Foz do Iguaçu Municipality: Itaipu Power Plant, Paraná River. 1992. Sent from Itaipu Binacional. MHNCI 2434.

Hydrodynastes gigas (Big Flat Snake). Guaíra Municipality: Paraná River. November 1987. Sent from Itaipu Binacional. MHNCI 2777.

Imantodes cenchoa (Blunthead Tree Snake). Guaraqueçaba Municipality: Tagaçaba. June 1985. D. Schause. MHNCI 1015; Piraquara Municipality: Volta Grande. 1983. R. J. Hertel. MHNCI 243.

Leptodeira annulata (Banded Cat-eyed Snake). Astorga Municipality. 21 May 1991. Collector unknown. MHNCI 4317.

Leptophis ahaetulla (Parrot Snake). Foz do Iguaçu: Itaipu. 17 September 1986. A. R. Neves, Jr. MHNCI 3871; Guaíra Municipality: Sete Quedas. October 1982. J. J. Bigarella. MHNCI 632, MHNCI 633; Nova Prata do Iguaçu Municipality: Salto Caxias. 11 February 1988. I. V. Schwartz. MHNCI 2246.

Liophis meridionalis (NCN). Lapa Municipality. 12 November 1986. R. Vergennes. MHNCI 1451; Ponta Grossa Municipality: Vila Velha. 27 March 1984. J. C. Moura-Leite and J. T. Motta. MHNCI 707; 8 May 1993. D. Schiesinsky and M. Staveski. MHNCI 6368.

Phalotris tricolor (NCN). Centenário do Sul Municipality. December 1991. L. A. Silva. MHNCI 4876.

Pseudoboa nigra (NCN) Apucarana Municipality. 1994. G. C. Machado. MHNCI 7370.

Rhachidelus brazili (Black Snake). Astorga Municipality: Bairro Itaipu. 25 May 1990. Collector unknown. MHNCI 3488. Cruzeiro do Oeste Municipality. June 1986. M. F. Santos. MHNCI 446; Maringá Municipality. February 1987. Collector unknown. MHNCI 2734; Toledo Municipality. 1 February 1993. Collector unknown. MHNCI 6000; 16 March 1994. Collector unknown. MHNCI 6639.

Simophis rhinostoma (False Coral Snake). Campo Largo Municipality. 1990. Collector unknown. MHNCI 3359; Sengés Municipality. January 1988. C. S. Macedo. MHNCI 2342.

LITERATURE CITED

BÉRNILS, R. S., AND J. C. MOURA-LEITE. 1990. A contribuição de André Mayer à História Natural do Paraná. III. Répteis. Arq. Biol. Tecnol. 33(2):469–480.

BOETTGER, O. 1905. Reptilien aus dem Staate Parana. Zool. Anz. 29(11):373–375.

Distribution of *Nerodia taxispilota* and *Nerodia rhombifer* in Alabama, USA

ALLEN L. GOSSER*
LEE F. KENNAMER
and
JAMES L. DOBIE
Department of Zoology and Wildlife Science
Auburn University, Auburn, Alabama 36849–5414, USA

**Present Address: Department of Fisheries and Wildlife, Utah State University, Logan, Utah 84322-5210, USA*

Nerodia taxispilota
(Brown Water Snake)

ESCAMBIA COUNTY: An individual *Nerodia taxispilota* was observed by JLD and Dent Williams in 1992 adjacent to a tributary of Little River in Claude D. Kelly State Park (CDKSP), 3.1 km S of Uriah (not on the boundary between Monroe and Baldwin counties as indicated by Mount [1975, Reptiles and Amphibians of Alabama. Publ. Alabama Agr. Exp. Sta., Auburn, 347 pp.]). Two other specimens (AUM 33645 and 33647) were collected at base of Little River Lake spillway in CDKSP in 1993 and 1994.

COUNTY LINE BETWEEN MONROE AND BALDWIN COUNTIES: Three specimens (AUM 33682, 33683 and 33690) were found in Little River between Benack Bridge (located S of Mineola on an unmarked, paved county road) and Chrysler Bridge (located S of Chrysler on Ala. Rt. 59) in 1993 and 1994. Searches for *N. taxispilota* at the confluence of Little River and the Alabama River west of Tensaw in Baldwin yielded no specimens. A snake from Mt. Vernon, a locality within the Mobile Bay drainage in Mobile County, was considered by Halton (1931, Alabama Geol. Surv. Nat. Hist. Mus. Pap. 11:1–145) to be "in every way an intermediate between *rhombifera* and *taxispilota*." The identity of that snake cannot be determined because the number of dorsal scale rows was 31, a figure within the range of dorsal scale row counts for both *N. taxispilota* and *N. rhombifer* (Mount 1975, *op. cit.*).

Nerodia rhombifer
(Diamondback Water Snake)

Although no *Nerodia rhombifer* were seen in CDKSP, in Little River, or in the Alabama River west of Tensaw, this species does occur in the Mobile Bay drainage as indicated by Mount and Schwaner (1970, Herpetologica 26:76-82) and as depicted on maps in Mount (1975, *op. cit.*) and Conant and Collins (1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp). The presence of *N. taxispilota* and *N. rhombifer* in the Mobile Bay drainage indicates the probable sympatry of the two species. Topographic maps show that some tributaries of the Mobile and Peridido River drainages (the latter also contains *N. taxispilota*) are separated by a distance of less than one km. During periods of high water, *N. taxispilota* could have migrated from a tributary of the Perdido River into one of the Mobile Bay drainage.

The identity of the AUM specimens was verified by Craig Guyer.

New Distributional Records of Reptiles from Western and Trans-Pecos Texas, USA

TROY D. HIBBITTS
and
MARLA P. HIBBITTS
Biology Department, University of Texas at Arlington, Box 19498
Arlington, Texas 76019, USA

and
TOBY J. HIBBITTS
610 Hilltop Circle, Wylie, Texas 75098, USA

The herpetofauna of western and Trans-Pecos Texas is well documented for most species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, Texas. 434 pp), making new distributional records for this region scarce and significant.

In this note, we list nine new county records for western and Trans-Pecos Texas, filling distributional gaps for six species and documenting range extensions for three species of reptiles (Dixon 1987, *op. cit.*). These specimens were collected by or donated to the authors during Summer field work between 1993 and 1995. Verification of specimen identification was by Jonathan A. Campbell.

LACERTILIA

Eumeces multivirgatus (Many-lined Skink). CROCKETT CO: ca. 10 km SSE of Barnhart. April 1994. UTA-R 36889. Specimen provides further documentation of a southwestern Texas plains population previously known from neighboring Reagan, Irion, and Pecos counties.

Hemidactylus turcicus (Mediterranean Gecko). TERRELL CO: Sanderson. 5 June 1994. UTA-R 36893. Fills distributional gap between Pecos, Brewster, and Val Verde counties. *H. turcicus* should be expected in most of the towns of the Trans-Pecos.

Scincella lateralis (Ground Skink). TERRELL CO: ca. 30 km S of Sheffield, Chandler Ranch. March 1993. UTA-R 36888. Second record from county west of the Pecos River. Specimen was collected in an isolated pocket of oaks along Independence Creek.

SERPENTES

Coluber constrictor (Racer). BREWSTER CO: 18.9 km S of Alpine on Tex. Rt. 118. July 1993. UTA-R 36887. First record for Brewster County, extending the range of this species in the Davis Mountains highlands of the Trans-Pecos southeast ca. 50 km from the vicinity of Davis Mountains State Park. Specimen has eight infralabials, characteristic of the subspecies *C. c. oaxaca* and *C. c. mormon*.

Crotalus viridis (Western Rattlesnake). REAGAN CO: 2.4 km S jct Farm Road 2600 on Farm Road 33. 2 June 1994. UTA-R 36891. Fills distributional gap along the southeastern edge of the species range in Texas.

Heterodon platirhinos (Eastern Hognose Snake). MENARD CO: 6.6 km S jct Farm Road 1773 on US Hwy 83. 13 May 1995. UTA-R 38345. New county record from the western edge of the species distribution in West-Central Texas.

Lampropeltis getula (Common Kingsnake). REAGAN CO: 10.1 km S jct. Farm Road 33 on Tex. Rt. 137. 2 June 1994. UTA-R 36892. New county record.

Lampropeltis triangulum (Milk Snake). CROCKETT CO: ca. 16 km SE of Barnhart; captive hatched from gravid female collected at above location on 16 May 1994. UTA-R 38339. New county record, apparently an intergrade between the subspecies *L. t. annulata* and *L. t. celaenops*.

Leptotyphlops dulcis (Texas Blind Snake). CROCKETT CO: 6 km SE of Barnhart. May 1994. UTA-R 36890. New county record.

Acknowledgments.—We thank David Gibson and Brian Box for collecting assistance. We also thank John Davis for the donation of the *Scincella* specimen. Funding for travel expenses was provided in part from a grant from the University of Texas at Arlington chapter of Phi Sigma.

County Records for Reptiles and Amphibians in Missouri Found in the Vertebrate Museum at Southeast Missouri State University

RICK ESSNER
and
A. J. HENDERSHOTT
Southeast Missouri State University
One University Plaza
Cape Girardeau, Missouri 63701, USA

The county records listed below are based on maps appearing in Johnson (1987, The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. 368 pp.) and subsequent records published in the Missouri Herpetological Association Newsletters. All specimens were verified by John Scheibe except where noted.

Hyla chrysoscelis/Hyla versicolor (Gray Treefrog). BUTLER CO: Sec. 15, T26N, R7E. 11 August 1994. Rick Essner. SEMO 211. MADISON CO: Sec. 18, T32N, R6E. 6 October 1995. Neal Young. SEMO 441.

Chrysemys picta (Painted Turtle). PERRY CO: Beihle, Sec. 18, T34N, R11E. 16 September 1995. Rick Essner. SEMO 465.

Sceloporus undulatus hyacinthinus (Northern Fence Lizard). MADISON CO: Sec. 18, T32N, R6E. 8 October 1995. Neal Young. SEMO 440.

Lampropeltis getula holbrooki (Speckled Kingsnake). MADISON CO: St. Francis River at Rt. E bridge. Sec. 18, T32N, R6E. 6 October 1995. Neal Young. SEMO 439.

Opheodrys aestivus (Rough Green Snake). CAPE GIRARDEAU CO: Sec. 32, T31N, R14E. July 1993. John Scheibe. Verified by Ronald A. Brandon. SEMO 291.

Virginia valeriae elegans (Western Earth Snake). BUTLER CO: Wapapello Training Site, Sec. 15, T26N, R7E. 20 July 1995. R. Essner and A. J. Hendershott. SEMO 426.

BOOK REVIEWS

Frogs, by David Badger, photography by John Netherton. 1995. Voyageur Press, Stillwater, Minnesota. 144 pp. Hardcover. US $29.95. ISBN 0-89658-233-7.

RONALD ALTIG
Department of Biological Sciences, Mississippi State University
Mississippi State, Mississippi 39762, USA
e-mail: rga2@Ra.MsState.edu

I am excited by the notoriety that frogs enjoy, but I am amazed at the number of books produced without apparent regard for "doing something differently." Even though current research produces some snazzy results that would make great popular prose, the author, with a continual string of quotations that I found aggravating, often follows the paths of Carr, Cochran, Dickerson, Goin, Oliver, Mertens, and others. These folks made great contributions, but the information is old, and an informed lay-person, for whom the book was written, needs newer, less redundant information. Promotion of current research and the people who do that work would have been much more valuable. It takes immense talent and knowledge to render scientific terminology into regular English (I still debate whether this art can be learned), and few persons have the ability to do this and still maintain accuracy. Examples include: frogs secrete mucus (not mucous); I do not believe the United States imports eatable frogs from New Zealand (unless they are cultured bullfrogs and therefore let us be accurate); I find it unlikely that *Mantella* (Madagascar) avoids predation by mimicking dendrobatids (Neotropics); cold-blooded is an old and inaccurate term; and no frog is buxom from my viewpoint. The apparent attempt to illustrate the impact that frogs have had on literary writings and the reason for attempting this did not work well in my readings of the book.

The photographs, their reproduction, and the general construction of the book are quite good, but I must badger the author and Voyageur Press just a little bit—*Agalychnis callidryas* is a handsome frog, but every object I see, including the month of December 1995 on my wall calendar and eight times, counting the cover, in this book seems to sport this frog. If the blue seduction of *Dendrobates azureus* also can be avoided, I would prefer really

knockout photographs of frogs of an evidently lesser kind. Also, I have no aversion to well-staged photographs, but *Eleutherodactylus planirostris* is never going to encounter a Venus-fly trap without human help. A frog that hangs from a limb by its armpit probably is not a happy fellow, and I do not want to see multiple versions of the same photographs in the same book, even if one of them (a floating *Bombina* photographed from the bottom) offers a unique view. Featuring four photographs of a *Leptopelis* (Old World hyperoliid) within the account of a *Centrolenella* (= old name; one photo; New World centrolenid) gives an incorrect suggestion of their relatedness among "glass frogs" and emphasizes the dangers of common names. Conversely, with the large influx of non-herpetologists into the sampling arena because of the declining amphibian dilemma, it has been argued that common names may have a better utility (i.e., they do not change when the generic or species names are changed) than systematic nomenclature, but it seems to me that this author also generated new common names. The de novo generation of the name *vulvosa* (I think for *favosa*, a synonym) sounds a little too Freudian.

Maybe I should not review anything just before final exams! The readable text and the many, high-quality color illustrations in this book will serve the very basic neophyte rather well. After discussion of general subjects, 50 species from around the world are treated in more detail. It just bothered me that the book falls among a crowd when it could have stood upright as a singular model with more work and even a quick outside review before the press was turned on.

The Dangerous Snakes of Africa—Natural History; Species Directory; Venoms and Snakebite, by Stephen Spawls and Bill Branch. 1995. Ralph Curtis Books, P.O. Box 183, Sanibel Island, Florida 33957, USA. 192 pp., 120 color photos, 93 maps. Hardcover. US $39.95.

JOHN E. SIMMONS
Natural History Museum, University of Kansas
Lawrence, Kansas 66045-2454, USA
e-mail: jsimmons@kuhub.cc.ukans.edu

Approximately 90 of the 400 species of snakes in Africa are venomous. Of these, only about 30 species are known to have fatal bites. However, a considerable number of deaths from snakebite occur each year on the continent. The "official figure" of approximately 4000 deaths per year is thought to be a gross underestimate—the authors of this volume believe the actual total to be much higher.

The intended audience for this book is the general reader and members of the medical community who need to identify dangerous snakes and cope with snakebite. The text thus provides a mixture of snake natural history and information about venoms and the treatment of bites. Nevertheless, this book will be useful to herpetologists who need to identify venomous species and learn more about venoms.

One thing that becomes obvious on reading the text is how little really is known about the natural history of most African snakes. Some accounts are very short, such as *Atractaspis battersbyi*, which is known from only two specimens. The introduction includes a plea to readers to document and publish field observations on African snakes.

Not all of the snakes included in this volume are really dangerous, e.g., *Homoroselaps dorsalis*. This is one of the smallest snakes in Africa, at a maximum length of 300 mm, but it is included because other members of the genus are considered dangerous. Also included is the African rock python (*Python sebae*), which "is non-venomous [but] can grow large enough to inflict a serious bite."

Six pages are devoted to basic instructions on how to identify snakes, and what field information is needed for successful treatment of a venomous snakebite. The distribution of African venomous snakes occupies three pages, and species descriptions take up 130 pages. The species accounts are organized by family. Each section begins with anything from a few sentences describing the worldwide range of the family to more detailed discussions of family level taxonomy (e.g., sea snakes).

Both scientific and common names (in English) are provided for each species. Illustrations include a distribution map and color photo. Sometimes more than one photograph is included to show geographic variation, e.g., the northern and southern variants of *Homoroselaps lacteus*; color phases of *Naja nigricollis*; patterned and patternless *Causus rhombeatus*. The majority of the photos are good to excellent, and most show the snakes on natural backgrounds. A few photographs are of preserved specimens. There are drawings of head shapes and body patterns where appropriate.

The information in the section on identification varies from one account to another, but may include size, colors, and scale counts. Some descriptions are quite detailed. Distinguishing characteristics are given to help confirm the identity of the particular species. Brief descriptions of subspecies (referred to in the text as "races"), with notes on distribution, are provided as appropriate. Notes on the distinguishing characteristics of similar species found in Africa are also included.

Behavioral information includes when the species is active, when bites are most likely to occur, and notes on aggressive behavior. The known distribution of each species is outlined, and one or more range maps are provided for each account. Habitat and natural history information, when available, are briefly summarized, including diet, reproduction, and relative abundance.

The section on venoms and bites includes total venom yield (if known), toxicity, and a brief review of symptoms and progression of envenomation. Published case histories of bites are cited. The section on treatment of bites varies quite a bit from one account to another. It includes information on the availability of anti-venom and recommended first aid and medical procedures. For some snakebites, treatment recommendations are fairly minimal (concerned mostly with infection); for more dangerous snakes, detailed clinical procedures are presented.

There is an extensive section on snakebite (22 pages). It begins with a discussion of snakebite occurrence in Africa, followed by more detailed descriptions by region (North, Southern, Central, and West Africa). There are tips for avoiding snakebite, a discussion of African snake venom types and components, and a section titled "What Happens When a Snake Bites?" with appropriate photographs. The section on treatment of snakebite begins with a list of nine things not to do when confronting this emergency. The use of a pressure bandage is recommended, in contrast to current procedures for North American venomous snakebites. The terms *anti-serum* and *anti-venom* are used synonymously. Most of this section is directed towards physicians needing guidance on the medical treatment of snakebite. It includes diagnosis, when to administer anti-venom, and how to administer it. A table of available anti-venoms with addresses of suppliers is provided, as well as a section on "Use of Anti-serum by a Layperson." This includes what to carry by way of a field kit and how to determine whether or not to administer anti-venom.

Appendix I is a checklist of dangerous African snakes, with occurrence indicated in seven geographic regions. Species are listed on the checklist only by their common English name, rather than by scientific name. Appendix II is a list of "Institutions Dealing with African Snakes." This curious compilation lists only 18 zoos, museums, and universities worldwide. Only one institution (California Academy of Sciences) is listed for the U.S. There is also a list of six doctors "with a particular interest in African snakebite," again with just one entry (Findlay Russell) for the United States. It is not clear why this appendix is so short. If expanded, it would be much more useful.

The bibliography on African snakebite runs just over five pages (mostly case histories). A bit over one page is devoted to the topic of "Further Reading on African Snakes," a reflection of just how few books there are on this topic. The glossary runs three pages, and contains simple, easy-to-understand definitions of the medical terms used in the snakebite treatment sections.

Given that the intended audience for this book is non-herpetologists and medical workers, it still contains a lot of information useful to anyone interested in African snakes. The color photographs, distribution maps and notes, and information on venoms make it a worthwhile reference. The species accounts are well-designed for ready information retrieval, and the text is crisp and clear throughout. Although I found myself wishing that references to the natural history and systematics of the snakes were included, given the primary audience for which this book is designed, the authors have done an excellent job of compiling a large amount of needed information in a very readable and attractive book.

Amphibian Biology, Volume 2: Social Behavior, edited by Harold Heatwole and Brian Sullivan. 1995. Surrey Beatty & Sons Pty, Ltd., xi + 419–710 pp. (pagination continued from Volume 1). Hardcover. AUS $75.00 (approx. US $60.00). ISBN 0-949324-60-4.

MOLLY R. MORRIS
Department of Biology, Montgomery College
Rockville, Maryland 20850, USA
e-mail: 75112.1662@compuserve.com

Amphibian Biology is a five-part series reviewing physiological and evolutionary topics in amphibian biology. Intended as a companion to *Biology of the Reptilia*, the series aspires to be the most authoritative source of information on amphibians available. Volume Two covers the social behavior of amphibians and includes seven chapters, ranging from the very broad, empirically rich topics of female choice and mating system structure in amphibians, to the more specific analysis of aggression and territoriality in salamanders.

Chapter One, by Tim Halliday and Miguel Tejedo, examines intrasexual selection and alternative mating behaviors in urodeles and anurans. The authors stress that the evolution of sex-related characters cannot be understood purely through the study of sexual interactions, but must embrace life history and physiological variables as well. This important point is exemplified in a section on sexual dimorphism, in which the interactions between factors other than competitive behavior are examined. Most of the sections in this chapter provide comprehensive theoretical and empirical reviews. I found the theoretical review of alternative mating strategies incomplete, however, as it barely mentions the contributions of game theory. In addition, portions of this chapter are difficult to read due to the use of terms that are not clearly defined. Overall, however, this chapter provides an excellent review of an extensive field.

Chapter Two, by Brian Sullivan, Michael Ryan, and Paul Verrell, also reviews a broad field: the empirical and theoretical literature of female choice and mating system structure. The authors highlight the role that amphibians have played in demonstrating female choice, and point out the limitations of using amphibians to test predictions of the different models for the evolution of female preference. Their review of mating system structure follows the traditional ecological classification system (Emlen and Oring 1977), which they suggest facilitates comparison with prior work. It is curious, however, that studies that consider variability in female behavior, which are now prevalent in the ornithological literature, either do not exist or were not reviewed here.

Chapter Three, by Martha Crump, reviews parental care in amphibians. The review of the empirical literature in this chapter is impressive, and includes an extensive table in the appendix which summarizes the modes of parental care within Amphibia. The evolution of parental care is examined from both historical and adaptive perspectives, and although I felt that the theoretical review was comprehensive, I was surprised by the lack of studies that have examined the evolution of parental behaviors in a phylogenetic context (although see Weygoldt 1987).

Chapter Four, by Andrew Blaustein and Susan Walls, is titled "Aggregation and Kin Recognition." This chapter sets out to cover abiotic and biotic factors that influence associations among amphibians, but focuses most of its attention on the mechanisms and potential benefits of kin recognition. In Chapter Five, Carl Gerhardt and Joshua Schwartz examine behavioral and acoustic interactions between species that reduce the efficiency of intraspecific communication as well as the potential effects of hybridization on the evolution of homogamy. Their review of hybrid zones and hybridization between broadly sympatric species suggests that studies of anurans will continue to play an exciting role in unraveling the mechanisms of speciation. Chapter Six presents a detailed description of territoriality in a few species of salamanders, compared to territoriality in frogs. While it appears that much more data are needed to determine the extent of territoriality in salamanders, Alicia Mathis and colleagues present enough intriguing examples to suggest that studies of this ecologically diverse group could provide valuable insights into the evolution of territoriality. Finally, in Chapter Seven, Lynne Houck and Sarah Woodley examine the physiological mechanisms that underlie reproductive behaviors. They do an excellent job of putting the limited data (16 species) into a theoretical perspective. The intriguing case in which corticosterone levels increase without depressing androgen levels, possibly tied to explosive and highly opportunistic mating bouts (Orchinik et al. 1988), highlights the exciting possibilities for future work in this area.

On a mundane note, I had three complaints concerning editing and production of the book. First, the subject index is very limited and thus not very useful, which is an unfortunate shortcoming for a review series. Second, the format used to delineate the various subcategories within the text (different fonts) is confusing once you reach the third sublevel. And finally, the quality of the black and white photographs is not the best, which is really too bad as some of the shots (such as direct developing young emerging from dorsal pouch in *Gastrotheca ovifera*) are spectacular.

In summary, this book is likely to be the best current source of information on amphibian social behavior. Although not as comprehensive as the behavioral volume in *Biology of the Reptilia*, the reviews of the subjects covered in this book are for the most

part complete. Most of the chapters do a good job of presenting the empirical literature within current theoretical context. Many of the chapters suggest interesting directions for future studies, which should be very valuable for graduate students initiating research projects using amphibians. However, only a few of the chapters mention, and even then indirectly, the need for studies that address the evolution of amphibian social behavior in a phylogenetic context. Studies of the social behavior of many organisms are now being considered in this context, and yet the lack of these kinds of studies throughout all of the chapters (with the exception of work by Ryan et al. 1990, Ryan and Rand 1993a and b discussed in Chapter Two) was quite striking. This is not a criticism of the book so much as a comment on the field of amphibian biology. This volume is dedicated to Kent Wells, who has made numerous contributions to the study of behavioral ecology of amphibians, including the now classic 1977 paper "The Social Behaviour of Anuran Amphibians" in *Animal Behaviour*. In this paper, Wells pointed out patterns of similarity in the social behavior of anurans from widely divergent families and suggested a need for an evolutionary framework for understanding the relationship between social behavior and ecology in anurans. It is obvious from the literature cited in this book that some aspects of the social behavior of anurans have now been studied extensively. And yet, with all of the intriguing variation these works have uncovered, the hypotheses that Wells set forth in 1977 in relation to patterns of reproduction, mate-acquisition tactics, and modes of male-male competition, remain untested in a phylogenetic context.

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Lizards of Brazilian Amazonia (Reptilia: Squamata), by T. C. S. Ávila-Pires. 1995. Zoologische Verhandelingen, Leiden, vol. 299:1–706. ISBN 90–73239–40–0. Prices: softcover Hfl. 114 (about US $72), clothbound Hfl. 167 ($104). Available from Universal Book Services, Warmonderweg 80, 2341 KZ Oegstgeest, The Netherlands.

KRAIG ADLER
Cornell University, Division of Biological Sciences
Seeley G. Mudd Hall
Ithaca, New York 14853-2702, USA
e-mail: kka4@cornell.edu

Why does the Amazon Basin support greater terrestrial biodiversity than any other comparable area? Is it explained by the dynamic cycles of dominance by savanna and rain forest communities that have continued to alternate at least since the beginning of the Quaternary Period? Is it the result of the middle Miocene Amazon Sea which divided the continent into three separate land areas, from which the present fauna is now derived? These, among other questions, continue to fascinate tropical biologists who will welcome Teresa C. S. Ávila-Pires' extraordinary compendium as an exemplar of the very sort of basic information needed to resolve these and other fundamental questions. The book was published by the Nationaal Natuurhistorisch Museum in Leiden, under the editorship of Marinus S. Hoogmoed.

Lizards are the best known reptiles in Amazonia, yet knowledge of their systematics, distribution, and ecology is still fragmentary for most species. Ávila-Pires, a former staff member at the Museu Paraense Emílio Goeldi in Belém, near the mouth of the Amazon River, has produced an exhaustive monograph of the 89 species of lizards (in 40 genera and nine families) found in Brazilian Amazonia, a region primarily of tropical rain forest that covers about one fourth of the entire continent. Two of these species are actually species complexes, each composed of both bisexual and parthenogenetic forms. The account for each species includes a synonymy, a full list of specimens examined (with localities, museum records, collectors, and dates of collection), a diagnosis, a detailed description (with drawings of the head and feet, often from several views), coloration, habitat, natural history (ecology, behavior, feeding habits, and reproduction), distribution (with spot map, including the range outside of Amazonia, if any), and remarks on taxonomy, geographic variation, questionable earlier records, etc. There is a key to species, an extensive discussion of zoogeography, and a 19-page bibliography. Finally, there are 100 color photographs depicting 76 species, some of them illustrated in color for the first time. The materials on which this book is based were drawn from 35 museums, including all of the relevant collections throughout the world, but one. Regrettably, the authorities of the Museu de Zoologia da Universidade de São Paulo refused access to its extensive collection. This is a disservice to science.

Six new species (*Stenocercus fimbriatus, Lepidoblepharis hoogmoedi, Leposoma osvaldoi, L. snethlageae, Tretioscincus oriximinensis, Tupinambis longilineus*) and one new subspecies (*Anolis nitens tandai*) are described in this book. Several taxonomic changes are made, one of which is of particular interest because it involves the names of two well-known species that are common in the commercial trade. Ávila-Pires shows that the taxa long known as *Tupinambus nigropunctatus* and *T. teguixin* instead should be called *T. teguixin* and *T. merianae*, respectively. The most common skink in Amazonia, until now referred to as *Mabuya bistriata,* should be called *M. nigropunctata*, and the former name replaces *M. ficta*. The zoogeographic analysis of species distributions, using Rosen's Parsimony Analysis of Endemicity method, supports the division of Amazonia into eastern and western faunas as well as the recognition of southwestern and Guianan groups, but rejects the hypothesis that Amazonia was covered with a continuous savanna during recent times.

The errors in the key (page 21), between couplets 59 and 62, have been noted on an inserted errata slip in the first printing (940 copies), but have been corrected in the second printing (514 copies), together with some typographical errors in the text. Contrary to rumor, the book is still in print.

From my point of view there are very few deficiencies. Nowhere is Brazilian Amazonia exactly defined or mapped. For a book of this size, there is surprisingly little cross indexing, making it inconvenient to move from one section of the book to another (for example, from the key or color photographs to the relevant text description) without consulting the index. There are relatively few misspellings, omissions, or other errors (a missing piece in

the bibliography inadvertently has Merrem mixed up with Mertens). The color photographs are uneven in quality, as might be expected since most were taken in the field, but several of them should have been lightened in printing to reveal additional details of scutellation. Representatives of three genera are depicted in black and white only, and there is no photograph at all of the monotypic *Amapasaurus tetradactylus*; a photograph of a preserved specimen would have been of some value since this species is unknown to most herpetologists.

Despite these minor imperfections, Ávila-Pires' book is a major contribution to our knowledge of Neotropical lizards and, in turn, to our understanding of Amazonian biodiversity. This book will be the standard on the topic for many years to come, and against which hoped-for volumes on the other groups of Amazonian herpetofauna will be compared. It is a high standard indeed.

Reptiles of Washington and Oregon, edited by Robert M. Storm and William P. Leonard, with contributions by Herbert A. Brown, R. Bruce Bury, David M. Darda, Lowell V. Diller, Charles R. Peterson, and Robert M. Storm. 1995. Published by the Seattle Audubon Society, Trailside Series. Hard and soft cover. i–xiii + 176 pp. ISBN 0-914516-12-4. US $16.95 (soft cover).

RONALD A. NUSSBAUM
Division or Reptiles and Amphibians, Museum of Zoology
The University of Michigan, Ann Arbor, Michigan 48109-1079, USA
e-mail: nuss@umich.edu

This attractive field guide, appropriately dedicated to the memory of Murray L. Johnson, is a companion volume to the Audubon guide to the "Amphibians of Washington and Oregon" published in 1993. The format is much the same as the amphibian volume, with the same amount of detail in the species accounts, and with equally high quality illustrations.

After the Table of Contents, publisher's Preface, Introduction, and Acknowledgment, the book begins with a checklist of the reptiles of Washington and Oregon (one notes the curious non-alphabetical order of state names in the title, checklist, and elsewhere). The checklist emphasizes common names, and uses the names suggested in Circular No. 19, published in 1990 by the Society for the Study of Amphibians and Reptiles. Prior to the species accounts, there are brief sections on an "Overview of Reptiles," "Notes on Turtles," "Notes on Lizards," and "Notes on Snakes" which parallel the order of the subsequent species accounts. The intention of the book, stated in the first sentence of the Introduction, is to "help teachers, students, naturalists, professional field biologists and lay-persons to identify the reptiles of Washington and Oregon" (again, state chauvinism is evident). In this, the book surely succeeds without question.

Nomenclature follows the "most recent and widely accepted common and scientific names," and binomials are followed by the name, or names, of the author(s) who described the species. In this respect, the guide is more accurate than the preceding amphibian guide, wherein "Good" is credited with describing a salamander that was described by Baird and Girard. The list of reptiles for the two states is up-to-date and differs from the previous list presented by Nussbaum et al. (1983) only in that the name for the Oregon form of the aquatic garter snake has changed from *Thamnophis couchi* to *T. atratus* and *Pituophis melanoleucus* has reverted to *P. catenifer*. Neither of these changes is proposed in the field guide, but instead follow the suggestions of cited authors. The former change is probably warranted, but the latter was done without supporting data and may or may not be justified. Other taxonomic changes proposed in the recent literature, e.g., elevating *Coluber constrictor mormon* to species rank, were not accepted.

Although the species names used are current, recent changes in supraspecific nomenclature are not always followed. For example, the various iguanian species are listed under the family "Iguanidae," in contrast to the revision of Frost and Etheridge (1989). It it unclear whether this was done because of disagreement or ignorance of the literature. For the intended audience, it will make little difference.

In general, the overview and notes sections on reptiles, turtles, lizards, and snakes are accurate and provide condensed and useful information. The section on turtle notes, perhaps because of the paucity of native species, concentrates on introduced species and draws on information regarding species that do not occur in the two states covered by the book. Remarks about the historical biogeography of turtles in the Pacific Northwest are unsupported and perhaps counterintuitive. One unfortunate aspect of the "notes" sections is the suggestion that particular groups are more-or-less adapted than are other groups..."lizards have better adaptations for living on land than salamanders" (p. 14)...a viewpoint that does not survive logical analysis.

Another problem with the overviews presented in the book is undocumented assertions. For example (p. 15): "fall can be a stressful time for hatchlings [lizards] hibernating for the first time, and this age group often suffers high mortality during the winter." One wonders what is "stressful" for a lizard and where are the data that prove winter mortality is higher for hatchlings than for older lizards. Similarly, it is inaccurate to suggest that courtship and reproduction in snakes involves combat when this form of male-male aggression has never been documented for most species of snakes, and clearly does not exist in many species. Garter snakes are among the most commonly encountered snakes in Oregon and Washington, and there is no evidence that male-male aggression is part of the mating system of that group of species. These few criticisms are, however, not very serious when balanced against the overall high quality of the volume.

The species accounts include sections on "Description," "Similar Species," "Distribution" (accompanied with a small range map with state and county boundaries showing the distribution in shading), "Habits and Habitat," and "Remarks." The descriptions are brief and include the critical identifying characteristics in bold print. For the most part, these descriptions, always on the left facing page, are accurate, and, along with the color photographs on the right facing page, will easily facilitate species identification. Subspecies are addressed in the "Remarks," including information on their identification and distribution. Geographic ranges of subspecies are not included on the distribution maps.

The other sections in the species accounts are brief and to the point. Most useful in these sections are comments about the current population status and legal protection of various species. Notes on life history and ecology are for the most part correct, but here again there are some instances of unwarranted statements and assumptions. For example, the statement that male side-blotched lizards are territorial is unsubstantiated for northern populations, and there is evidence that their social system may be one of dominance hierarchies rather than territoriality (Nussbaum and Diller 1976).

The color photographs in the book are spectacular, and they alone are worth the price of the book. One could quibble about background representation: *Gambelia wislizenii* (p. 61) and *Phrynosoma douglassii* (p. 66) are not likely to be encountered on rocks, but the artistic license is not really distracting, and the photos are always relevant.

Following the species accounts is a table contrasting the characteristics of garter snakes in the two states and three figures illustrating characteristics of certain groups of reptiles. These are followed by a list of general references and a selected bibliography. A glossary of important terms and county maps of "Washington and Oregon" end the book.

This is a welcome addition to the literature on the herpetofauna of the Pacific Northwest. The editors, contributors, and publishers are to be congratulated for producing this compact and useful book.

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Phylogenetic Systematics of Crotaphytid Lizards (Reptilia: Iguania: Crotaphytidae), by Jimmy A. McGuire. 1996. Bulletin of Carnegie Museum of Natural History, No. 32. 143 pp. 52 figures (including 12 color photographs). US $27.50 plus $1.50 shipping and handling ($2.00 for non-U.S. addresses). Available from Carnegie Museum of Natural History, Office of Scientific Publications, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213-4080, USA.

This revision of the collared and leopard lizards combines data sets from osteology, squamation, allozymes, soft tissues, color pattern, life history, and behavior. McGuire recognizes 12 extant species and confirms the monophyly of *Crotaphytus* and *Gambelia*. Taxonomic accounts and dot distribution maps are presented for each species.

Amphibians of Oregon, Washington and British Columbia: A Field Identification Guide, by Charlotte C. Corkran and Chris Thoms. 1996. Lone Tree Publishing. Softcover, 175 pp. US $16.95 (CDN $21.95). ISBN 1-55105-073-0. Available from the publisher in Canada (#206, 10426 81st Avenue, Edmonton, Alberta, Canada T6E 1X5) or the U.S. (16149 Redmond Way, #180, Redmond, Washington 98052, USA).

As the title suggests, this small book emphasizes field identification. This is accomplished by numerous color photographs of larval and adult amphibians and their egg masses. Illustrated identification keys are presented for eggs (for both western and eastern portions of the book's coverage area), hatchling salamanders, larval and metamorphosed salamanders, hatchling and larger tadpoles, and adult frogs and toads. A table compares features of species likely to be confused with others; this is accompanied by color photographs that depict important field markings. Suggestions for finding and observing amphibians in the field, including seasonal considerations, are offered. Instructions for conducting field surveys are also presented.

Biology and Conservation of Sea Turtles, revised edition, edited by Karen A. Bjorndal. Smithsonian Institution Press, Washington. 1995. Paperback. 615 pp. ISBN 1-56098-619-0. US $29.95 + $3.25 postage and handling.

This comprehensive overview of sea turtle biology, based on the contributions to a 1979 conference, was first published in 1982. The revised edition incorporates all of the original 64 chapters plus a short (45 pages) section on recent advances in sea turtle biology and conservation. The latter is divided into 14 contributions, each serving to encapsulate recent results in active areas of sea turtle research. Although not exhaustive, these additional chapters cite the pertinent recent literature and present a perspective on the field 16 years after the original contributions were first presented.

Venomous Snakes of North America (videocassette), written and narrated by Scott Shupe. 1996. Natural History Educational Co., P.O. Box 469, Cadiz, Kentucky 42211, USA. Tel. (502) 924-9107. 30 minutes. US $24.95.

Presumably intended for elementary through high school students, this educational video concentrates on venomous snakes of the southeastern United States: eastern diamondback and canebrake rattlesnakes, water moccasin, copperhead, etc. Informative narration accompanies video footage of snakes in their natural environment.

Atlas of Amphibians in Tennessee, by William H. Redmond and A. Floyd Scott. Miscellaneous Publication No. 12, The Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA. 1996. Softcover (spiral bound), 94 pp. ISBN 1-880617-05-6. US $8.00 (include. shipping and handling).

An up-to-date account of the distribution, taxonomy, and known habitat requirements of the 21 species of frogs and 45 species of salamanders occurring in Tennessee, featuring dot distribution maps for each taxon. Also included are short sections dealing with the history of herpetology in Tennessee, the physiography, climate, soils, drainage, vegetation, and ecological regions of the state, and questionable and erroneous reports of amphibians from Tennessee. An extensive literature cited section and comprehensive index to scientific and common names follow the text and maps.

Bibliographie der Gürtelechsen und Schildechsen (Reptilia: Sauria: Cordylidae & Gerrhosauridae) [Bibliography of the Girdled Lizards and Plated Lizards], by Klaus Adolphs. Squamata Verlag, Pastor-Hochhard-Str. 8, D-53757 Sankt Augustin, Germany. 1996. Softcover, 255 pp. ISBN 3-9805086-0-9. DM 39,80 (approx. US $27.00) + postage.

An extensive bibliography of the Cordylidae and Gerrhosauridae covering the period from 1758 to 1995. More than 1000 references are cited, each with an annotation as to the taxa discussed and the topics covered. Also included are a current classification/checklist of girdled and plated lizards and an index to the authors cited by taxon.

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Editor *(Name and Complete Mailing Address)*

Robert W. Hansen
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CHAIRPERSONS

Conservation
C. KENNETH DODD, JR.
National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
MARTHA L. CRUMP
Department of Biological Sciences, Box 5640
Northern Arizona University
Flagstaff, Arizona 86011, USA

Long Range Planning
LYNNE D. HOUCK
Department of Ecology & Evolution
University of Chicago
940 East 57th Street
Chicago, Illinois 66037-1455, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602-2597, USA

1996 Local Meeting
LINDA TRUEB
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Nominating
STEVE M. REILLY
Department of Zoology
107 Irvine
Ohio University
Athens, Ohio 45701, USA

Regional Society Liaison
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Resolutions
GEORGE R. PISANI
Department of Biological Sciences
University of Kansas
Lawrence, Kansas 66045-2106, USA

Zoo Liaison
JEFF ETTLING
Department of Herpetology
Sedgwick County Zoo
5555 Zoo Boulevard
Wichita, Kansas 67212, USA

COORDINATORS

Common and Scientific Names
JOSEPH T. COLLINS, Coordinator
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
P.O. Box 709
Tucson, Arizona 85702-0709, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

Information for Contributors

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Department of Zoology
223 Bartram Hall
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Department of Biology
Saint Louis University
3507 Laclede Avenue
St. Louis, Missouri 63103-2010, USA
E-mail: ssar@sluvca.slu.edu

Immediate Past President
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Department of Biological Sciences
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The University of Kansas
Lawrence, Kansas 66045-2454, USA

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Department of Natural Sciences
Avila College
Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
Aldo Leopold Wilderness Research Institute
P.O. Box 8089
Missoula, Montana 59807, USA

HERPETOLOGICAL REVIEW

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: 71061.150@compuserve.com

Section Editors

Book Reviews
AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: Herpbooks@sisna.com

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106, USA

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
E-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo
Miguel Lillo 251
4000 Tucumán, Argentina
E-mail: postmaster@scro.untmre.edu.ar

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
650 South R.L.Thornton Freeway
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
E-mail: cwpaint@unm.edu

Natural History Notes
LEE A. FITZGERALD
Dept. of Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
E-mail: LFitzgerald@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
E-mail: pstone@aix1.ucok.edu

Advertising Manager
ELIZABETH A. JOHNSON
35 Eighth Street
Frenchtown, New Jersey 08825, USA
Tel. (908) 996-4056
E-mail: ejohnson@ptdprolog.net

Copy Editors
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All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

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Future Annual Meetings

1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July (Theodore Pietsch, Chair).
1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).

1997 Annual Meeting
Society for the Study of Amphibians and Reptiles
40th Annual Meeting
together with
American Society of Ichthyologists and Herpetologists
and
The Herpetologists' League
26 June – 2 July 1997
University of Washington, Seattle, Washington, USA

The University of Washington in Seattle (the "Emerald City"), situated in the verdant Pacific Northwest, will host the combined annual meetings of SSAR, HL, and ASIH. The Greater Seattle area is considered one of the most beautiful in the United States, and offers residents and visitors alike nearly unparalleled access to a variety of social, recreational, and outdoor activities.

Keynote Address: The keynote address will be given by Martha Crump, HL's Distinguished Herpetologist for 1997.

Symposium: "NUCLEAR DNA AND THE EVOLUTIONARY GENETICS OF FISHES, AMPHIBIANS AND REPTILES." *Organizer*: Andrew M. Shedlock, University of Washington, FTR, Box 355100, Seattle, Washington 98195, USA; e-mail: shedlock@u.washington.edu.

Symposium: "ECOLOGICAL PROCESSES: INSIGHTS FROM FIELD EXPERIMENTS AND NATURAL HISTORY." This symposium celebrates the career and contributions of Margaret McBride Stewart in honor of her 70th birthday. *Organizer:* Kiisa C. Nishikawa, Department of Biological Sciences, Northern Arizona University, Flagstaff, Arizona 86011-5640, USA; e-mail: Kiisa.Nishikawa@nau.edu.

Symposium: "COMPARISONS AND CURRENT USES OF PHYLOGENETIC APPROACHES TO ICHTHYOLOGY AND HERPETOLOGY." *Organizers*: Mark Pyron, Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Illinois 61820, USA; e-mail: Pyron@uiuc.edu. Robert E. Espinoza, Department of Biology, University of Nevada, Reno, Nevada 89557-0015, USA; e-mail: espin_r@unr.edu.



Photo by Brian Walsh.

Symposium: "THE CHEMICAL ECOLOGY OF PREDATOR/PREY RELATIONSHIPS: FISHES, AMPHIBIANS, AND REPTILES." *Organizers*: Alicia Mathis, Department of Biology, Southwest Missouri State University, Springfield, Missouri 65804-0095, USA; e-mail: sam477f@vma.smsu.edu; Debra Lancaster, Department of Biology, Whatcom Community College, Bellingham, Washington 98226, USA. Brian Wisenden, CEEB, T. H. Morgan School of Biological Sciences, University of Kentucky, Lexington, Kentucky 40506, USA; e-mail: brian@CEEB.uky.edu.

Workshop: "NOMENCLATURE FOR NOVICES." *Organizer:* Carl J. Ferraris, Jr., Department of Ichthyology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, USA; e-mail: ferraris@cas.calacademy.org.

Contributed Paper and Poster Presentations: There will be several concurrent sessions each day in or near the University of Washington's Husky Union Building. Poster sessions will be held at the HUB.

Student Paper Awards: Seibert Prizes will be awarded to the two best student-presented papers at the meeting ($300 first prize, $200 second prize).



The tailed frog (*Ascaphus truei*), a Pacific Northwest endemic, is the only member of the ancient family Ascaphidae. This species should be encountered on the Mt. Saint Helens field trip. Specimen from Ellis Creek, Pacific Co., Washington. Photo by William Leonard.

Multimedia Presentations: "HERPS OF THE WEST" and "AMPHIBIANS OF THE APPALACHIANS" by David Dennis and Eric Juterbock; "HERPETOLOGICAL NAMESAKES" by Kraig Adler and David Dennis.

Social Activities: General Reception at Seattle Aquarium, Auction, Salmon Barbecue, Graduate Student Reception, Banquet.

Live Exhibit: Live herps of the Pacific Northwest, sponsored by the Society for Northwestern Vertebrate Biology and the Pacific Northwest Amphibian and Reptile Consortium. As usual, a diverse array of animals will be available for viewing and photography.

Symposium: "LIFE HISTORY AND ECOLOGY OF CHELONIANS." *Organizers*: R. Bruce Bury, National Biological Service, 3080 SE Clearwater Driver, Corvallis, Oregon 97333, USA; e-mail: buryb@mail.cor.epa.gov; and David J. Germano, Department of Biology, California State University Bakersfield, 9001 Stockdale Highway, Bakersfield, California 93311-1099, USA; e-mail: dgermano@academic.csubak.edu.

Workshop: "PRESERVATION AND CURATION OF EARLY LIFE HISTORY STAGES OF FISHES, AMPHIBIANS, AND REPTILES." *Organizers:* Alexandra M. Snyder, MSB Division of Fishes, University of New Mexico, Albuquerque, New Mexico 87131-1091, USA; e-mail: amsnyder@unm.edu; and Darrel E. Snyder, Larval Fish Laboratory, Colorado State University, Fort Collins, Colorado 80523, USA; e-mail: desnyder@picea.cnr.colostate.edu.

Vendors: Books, carvings, jewelry, t-shirts, and equipment of interest to herpetologists.

Field Trips: ***Mount Saint Helens National Volcanic Monument*** (led by Charlie Crisafulli) to examine recovery of amphibian populations since the 1981 volcanic eruption. This trip will provide an opportunity to see salamanders and frogs in one of the most fascinating landscapes found anywhere in the Pacific Northwest. The ***Snoqualmie Pass–Ellensburg*** field trip will be led by Herb Brown and Bill Leonard. It will begin in the shrub-steppe habitats near Ellensburg to search for reptiles and then work back towards Seattle, stopping in Ponderosa pine forests and at the summit of Snoqualmie Pass. Field trip cost $15/person. Address questions about field trips to Bill Leonard (e-mail: bpmm490@wadnr.gov).

Venue: All paper and poster sessions will be held at the University of Washington campus.

Costs: Pre-registration $120 regular, $60 student, $60 accompanying person. After March 15, costs are $145 regular, $75 student, and $75 accompanying person.

Accommodations: 800 dorm rooms have been reserved for the meetings. A six-night package, including breakfast and lunch (all you can eat!) is available for $224 per person (double occupancy) or $296 per person (single). A list of nearby hotels and motels is available on the meeting Web page (see below) or by contacting Dikmen Travel.

Student Travel Grants: Ten travel grants of $200 each will be available for SSAR student members. Refer to details elsewhere in this issue of *HR*.

Travel Arrangements: The official travel agency for the 1997 meetings is Dikmen Travel, Inc., 1127 Pine Street, Suite 150, Seattle, Washington 98101, USA. Tel. (206) 447-9535, ext. 309 or (800) 234-5636; fax (206) 628-3509; e-mail: fdikmen@webtravel.com. The recommended airport is Sea-Tac Airport, ca. 15 miles south of the UW campus in Seattle. Shuttle service to area hotels and the University is available at the airport from Super Shuttle.

Family Activities: Seattle offers many family activities near UW, including visits to the UW Burke Museum, Seattle Aquarium, Woodland Park Zoo, and the Pike Place Market. Downtown Seattle offers a wide variety of shopping opportunities. Also available are ferry rides out of the Port of Seattle.

Climate: The campus of the University of Washington lies close to sea level. Summer days are usually in the upper 60s to lower 70s F and dry, but nights can be expected to drop to about 60 F. While western Washington usually experiences a summer drought, some rainfall in late June and early July would not be unusual.

Collecting Permits: Scientific collection permits are required for taking of all amphibians and reptiles in Washington. Requests and/or questions should be sent well in advance of the meeting to: *Steve Dauma, Enforcement Division, Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091, USA*.

Further Details: Contact T. W. Pietsch, School of Fisheries, University of Washington, Box 355100, Seattle, Washington 98195-5100, USA. Tel. (206) 543-8923; e-mail: twp@fish.washington.edu. Meeting Announcement and Call for Papers will be mailed to all U.S., Mexican, and Canadian members of SSAR in late November 1996. Other persons wishing to receive this information may do so by contacting Ted Pietsch at the address above. A World Wide Web page devoted to meeting information may be found at: http://artedi.fish.washington.edu/asih/asih97.html.



Plethodon vandykei (Van Dyke's salamander) is a seep- or stream-dwelling plethodontid restricted to three areas of Washington. Specimen from Mt. Saint Helens, Washington. Photo by William Leonard.

SSAR BUSINESS

1996 Annual Meeting: Lawrence, Kansas

The 39th annual meeting of SSAR occurred from 24–29 July, 1996 in Lawrence, Kansas. The University of Kansas, with Linda Trueb chairing the local committee, served as host to 398 attendees. Most of the meeting's events took place in the Kansas Union and the Natural History Museum.

The unofficial opening of the meetings, the annual meeting of the SSAR Board of Directors, took place on 24 July between 1005–1755 h. Unfinished business forced the Board to reconvene on 26 July from 1210–1320 h. In attendance for most of the Board meeting were Elected Officers: Lou Guillette, Henry Mushinsky, Karen Toepfer, Ellen Censky, Paul Moler, Jim Bogart, Don Forester, Jan Caldwell, Al Savitzky, Lyndon Ardell Mitchell; Appointed Officers and Editors: Bob Aldridge, Rich Seigel, Bob Powell, Joe Collins, Kraig Adler, Tom Tyning, Stephen Corn; Committee Chairs and Coordinators: George Pisani, Marty Crump; Members: Tom Fritts, Eric Juterbock, Douglas Taylor. Others attended to make presentations throughout the day. A summary of business conducted was presented at the Business Meeting (see below).

Presentations

The meetings officially began at 0900 h on 25 July in the Woodruff Auditorium with opening remarks and announcements from Linda Trueb. She introduced SSAR President Lou Guillette who called the meetings to order and announced the initiation of a "mentoring" program which was implemented at these meetings and consisted of informal student-mentor lunches. The next to take the podium was Leonard Krishtalka, Director of the Natural History Museum, University of Kansas, who welcomed SSAR members to the University. Zybnek Rocek was then introduced. He provided a preview for prospective attendees of the Third World Congress of Herpetology in Prague in 1997. He also announced that he had registration packets for the Prague meeting and these would be available throughout the meetings. The final address at the morning session was the Plenary address given by Michael J. Tyler (University of Adelaide, Australia) and entitled "New drugs from old frog skins."

A total of 191 presentations were made in 13 sessions and 3 symposia between 1300 h on 25 July and 1130 h on 29 July. The symposia were "A Tropical Natural History: Essays in Honor of William E. Duellman," "Diversity of Approaches to Amphibian and Reptilian Systematics," and "Population Status and Conservation of Amphibians." In addition, a workshop on Herpetological Collections: Funding, Growth, and Management was conducted along with tours of the new fluid collections facilities on 29 July. The Conservation Forum: Point-Counterpoint— "Relocation, Repatriation, and Translocation: Viable Options or Halfway Technologies"— was also held the morning of 29 July.

Immediate Past-President Al Savitzky called to order the 39th Annual Business Meeting of the SSAR at 1532 h on Monday, 29 July, in Alderson Auditorium of the Kansas Union. He noted first that since he was filling in for President Guillette, and Immediate Past-Secretary Eric Juterbock was filling in for Secretary Censky, it should be clear to everyone that the coup had been successful!

Savitzky relayed several items from President Guillette. Mentor lunches were established for this meeting; senior herpetologists made themselves available for lunch with students who signed up in advance. Although organized after we had gotten to Lawrence, these were very successful. Marty Crump reported at the Board Meeting for the Committee on International Cooperation, and suggested that SSAR should become significantly involved in same. Other business that Savitzky reported included: the SSAR Board approved $4000 for student travel to the Third World Congress in Prague, August 1997, as well as being part of the three-society grant application to NSF for additional funds; and, the Board is supporting the development of a booklet listing grants and awards available to herpetologists, this being compiled by Joan Milam.

The timing of the Business Meeting required that Juterbock report for many of the officers. The Society is in fine financial shape (see report elsewhere), and the Board approved a 1997 budget of $183,050. The *Journal of Herpetology* reports record submissions, with the down side being an increase in the lag time, a problem that the Board is addressing. *Herpetological Review* also faces the same situation; it and the *Catalogue of American Amphibians and Reptiles* have had some editorial changes during the year. *Contributions to Herpetology* will publish "Gecko Fauna of the USSR and Contiguous Regions," by N. N. Szczerbak and M. L. Golubev, in December 1996, and "Biology of the Reptilia, v. 19," edited by C. Gans and A. Gaunt, and "Lizards of Iran," by S. C. Anderson, in 1997. *Facsimile Reprints in Herpetology* will publish Stejneger's "Herpetology of Japan" in 1996 and Fitzinger's "Neue Classification der Reptilien" in 1997. *Herpetological Circulars* will publish No. 25, "Standard Common and Current Scientific Names for North American Amphibians and Reptiles, 4th edition" and No. 26, "Lineages of Zoo Herpetologists in the United States," by W. Card and J. B. Murphy, during the next year. In early 1997, *Herpetological Conservation* will issue No. 1, "Amphibians in Decline," edited by D. Green.

The Conservation Committee is investigating the production of a conservation brochure; Chair Ken Dodd asked that suggestions regarding content should be sent to him. Grants-in-Herpetology and the Kennedy Award are announced elsewhere, as are the Resolutions, which were read by John Moriarty; the resolutions were adopted unanimously by the membership. David Auth noted that the Seibert Award competition was extremely competitive this year; there were 31 students entered (see announcement below). The Student Travel Committee awarded three $200 travel awards this year; their silent auction of materials from 20 donors netted $1922.

Nominations for election to SSAR office for 1997 were announced. President-elect: Darrel Frost and Justin Congdon; Secretary: Ellen J. Censky; Treasurer: Robert Aldridge; Director (Class of 1999): David Sever and Wayne Van Devender; Director (Regional Societies): Dale Belcher, Charles W. Painter and John Moriarty.

Social Program

Special events and social programs were numerous and well-attended. The welcoming social, held in the Kansas Union Ballroom on the evening of the 24th took on special significance as it honored some of our premier herpetologists: Roger Conant, Henry S. Fitch, Hobart M. Smith, Robert C. Stebbins, and Ernest E. Williams. Conant, Fitch, and Smith were in attendance. The rain held off and the weather cooled down for the SSAR barbeque which was held at Clinton Lake on Friday, 26 July. Students were treated to a social on Saturday which featured not only snacks and beverages, but also a reprint scavenge.

The SSAR Student Travel Awards Auction, with scheduled viewing and silent bidding for one day only, on the fifth floor of the Kansas Union, was extended for a second day. This activity,

organized and conducted solely by students, has proven to be a very successful endeavor at raising money for student travel to meetings. Also on the fifth floor, The Jayhawk Room housed the numerous exhibitors and vendors selling books, t-shirts, art work, and research equipment, among other things. A Herpetological Art Exhibit was displayed throughout the meetings in the Kansas Union Gallery. A prize of $100.00 was presented to Dale Johnson as best entry for her drawing of a marbled salamander. The live animal exhibit, prepared by members of the Kansas Herpetological Society, featured herps of the region and provided photo opportunities between Saturday and Monday. "Snakes in Kansas," another live exhibit, was also available for daily viewing in the Natural History Museum.

For the bibliophiles in the crowd, a special book exhibit opened to coincide with the SSAR Meeting. The spectacular exhibit, entitled *"Slithy toves: Herpetological Books in Kansas"* (Department of Special Collections in the Spencer Research Library), displayed about 80 illustrated books spanning five centuries (16th–19th centuries). In addition, a roundtable on Herpetological Book Collecting was held. This special discussion group included Kraig Adler, Aaron Bauer, Adrian Crane, Ronald Javitch, Ernie Liner, and Richard Wahlgren, and convened to offer advice to those interested in book collecting.

The traditional events, the SSAR Auction and the Multimedia Presentation, were not a disappointment. The Auction, with many items donated and long-time auctioneer Joe Collins at the helm, progressed into the wee hours of the night and raised over $4,000.00. Later in the week, a full house viewed the multimedia presentations: "Herps of the West" and "Amphibians of the Appalachians" by David Dennis and Eric Juterbock, and "Namesakes of North American Amphibians and Reptiles" by Kraig Adler and David Dennis. Other slide shows included "Exotic Places, Exotic Herps," an event organized by graduate students to provide an opportunity to share their field experiences with fellow students, and the SSAR President's Travelogue, which featured presentations by William Lamar and Lou Guillette.

Some members were able to partake in tours of the Fitch Natural History Reservation on 29 July and received the special treat of being guided by Henry Fitch and George Pisani.

—Respectfully submitted by Ellen J. Censky, SSAR Secretary, and J. Eric Juterbock.

About Our Cover: *Phrynohyas resinifictrix*

Among the frogs of the family Hylidae, *Phrynohyas resinifictrix* is one of only three species known to utilize water-filled tree cavities for egg deposition and development. The genus *Phrynohyas*, described by Fitzinger in 1843, includes five species of robust anurans ranging collectively from northern México to Argentina. The species *P. resinifictrix* was only recently re-discovered, having long been thought to be conspecific with the ubiquitous and well-known *P. venulosa*. Like its congeners, *P. resinifictrix* is large (up to 76 mm), and bears a thick, probably toxic, glandular skin festooned with big, rounded tubercles.

A denizen of the great equatorial forests from French Guiana and Brazil westward to Colombia, Ecuador, and Peru, this impressive amphibian seems to occur in low densities, perhaps a single male per several hectares. Seldom descending to the ground from the tree cavities in which they live and breed (is it a glider?), this species may produce in excess of 1000 eggs at a time. The male's honking, barklike call, one to three notes long, is amplified by its tree hole. Typically, finding this frog requires a painstaking nocturnal stalk, a considerable climb, and insertion of the hand or arm into the stagnant, murky ooze in which these creatures live.

The specimen on the cover is an adult male, seen *in situ* as it emerged from its lair near the Ucayali River, Department of Loreto, Peru. It was photographed in late afternoon, using available light with a Pentax LX 35mm camera, 20mm lens, and Fujichrome Velvia film. The photographer is **William W. Lamar**, Adjunct Professor of Biology at the University of Texas in Tyler. A connoisseur of remote rainforests, Lamar has spent over twenty years in the neotropics. He worked for many years on Colombian crocodilians and turtles with renowned authority Federico Medem. Author of numerous herpetological publications, and co-author (with Jon Campbell) of the immensely popular book, *The Venomous Reptiles of Latin America*, Bill is a Research Associate at two of our best museums: The Collection of Vertebrates at the University of Texas at Arlington, and the Natural History Museum at the University of Kansas. Currently involved in long-range projects in Peru and Costa Rica, Lamar, with colleagues George Gorman and George Ledvina, also runs GreenTracks, Inc., an ecotour company providing natural history trips to the tropics for both specialists and the general public.

Separation and imaging of Lamar's photograph is the work of **Jim Bridges** of Herpeto Inc., Hollywood, Florida, USA.

1996 SSAR Resolutions

Honoring Outgoing SSAR Officers and Editors

WHEREAS the following individuals have given freely of their time, skills, insight, and knowledge to the Society for the Study of Amphibians and Reptiles in this past year; and,

WHEREAS they have been therefore instrumental in advancing the Society's goals and furthering its growth as an international scientific society; and,

WHEREAS SSAR is dependent upon the generosity of these persons and those who have gone before them, and is greatly indebted to them for their fine efforts in its behalf;

THEREFORE, be it

RESOLVED that the Society for the Study of Amphibians and Reptiles urges these persons not to ride off into the sunset, but rather to continue to be available, with or without official titles, as resources to guide those who follow; and,

RESOLVED FURTHER that the Society offers its most sincere thanks to the following persons who have served in these capacities:

WAYNE VAN DEVENDER—CAAR Section Editor and Chair, 1995 Local Committee
ALAN H. SAVITZKY—President
DAVID M. GREEN—Director
GREGORY K. PREGILL—Director
STEVE REILLY—Chair, 1995 Nominating Committee
ROBIN ANDREWS—Member, 1995 Nominating Committee
STEVEN BEAUPRE—Member, 1995 Nominating Committee
WILLEM ROOSENBURG—Member, 1995 Nominating Committee

RALPH AXTELL—*Herpetological Review* Section Editor
HENRY MUSHINSKY—*Journal of Herpetology* Associate Editor
JIM PETRANKA—*Journal of Herpetology* Associate Editor

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 July 1996 at its Annual Business Meeting.

Thanking The Local Committee

WHEREAS a majority of the people at the Meeting were products of, or influenced by, the KU Herpetology Program; and,

WHEREAS some of those people still seem to be on speaking terms with their mentor, who successfully assembled them for a group mug shot; and,

WHEREAS the quaint alcohol regulations of the Kansas Union tested the adaptive ability of the Society's talented members to define a new optimal foraging strategy at the auction; and,

WHEREAS the selection of dormitory and paper sites has done much to improve the cardiovascular fitness and test the critical thermal maximum of participants; and,

WHEREAS the lack of firmness in dormitory beds has created a new class of herpetologists, hereafter to be referred to as posturally challenged; and,

WHEREAS the opportunity to visit with and benefit from the wisdom and experience of those distinguished herpetologists, who so kindly gave us their time is deeply appreciated; and,

WHEREAS overall this meeting of the Society has been without incident, a tribute both to the organizational skills of the Local Committee and to the advancing placidity of our members,

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles extends its most sincere thanks to the 1996 Local Committee and others whose assistance contributed to the success of this meeting: Linda Trueb (Co-Chair), William E. Duellman (Co-Chair), Patricia Burrowes, Joseph T. Collins, Luis A. Coloma, Cathy Dwigans, Sarah E. Haines, Rafael Joglar, Brad Knauss, John Lee, Anne Maglia, Dan Meinhardt, Joe Mendelson III, Malcolm Neeley, Jeff Parmelee, George Pisani, Jenny Pramuk, Analia Pugener, Eric Rundquist, Nancy Schwarting, Christopher Sheil, Helio da Silva, John Simmons, Amy Sproston, Yuan Wang, Erik Wild, and CellularOne Digital Network.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 July 1996 at its Annual Business Meeting.

Honoring Robert Gordon

WHEREAS Robert Gordon was an exceptionally valued friend and mentor to many in the herpetological community; and,

WHEREAS Robert Gordon devoted much time and effort to advancing the goals and stature of the Society for the Study of Amphibians and Reptiles in its formative years; and,

WHEREAS Robert Gordon's death in June 1996 has saddened his many friends and associates;

THEREFORE, be it
RESOLVED that the SSAR hereby expresses its sense of loss of a friend and colleague, and expresses its condolences to the Gordon family.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 29 July 1996 at its Annual Business Meeting.

Herp Art Winners

A Herpetological Art Exhibit was held at the SSAR annual meeting in Lawrence. It was a particularly well-displayed show, with about 30 pieces of art vying for recognition. Judges David Dennis and Kraig Adler announced the following results:

1st Prize ($100)—Dale Johnson, University of Florida; color pencil drawing of a marbled salamander (*Ambystoma opacum*).

Honorable Mentions—Erik Wild, University of Kansas; watercolor drawing of a glass frog (*Centrolene geckoideum*). John Lokke, University of Nebraska at Omaha; series of pencil drawings depicting the decline of the timber rattlesnake (*Crotalus horridus*) in Nebraska.

Kennedy Student Award Committee Annual Report—1996

The Kennedy Award Committee has completed its work for Volume 29 of the *Journal of Herpetology*. The Committee has selected "Ecology and Energetics of Three Sympatric Rattlesnake Species in the Sonoran Desert" by Daniel D. Beck (29:211–223) as the best student-authored paper. Mr. Beck carried out this work as a doctoral candidate in the Department of Ecology and Evolutionary Biology at the University of Arizona. The research was mentored by Charles H. Lowe and was partially supported by the Graduate Student Program Development Fund of the University of Arizona. Daniel Beck currently resides in the Department of Biological Sciences, Central Washington University, Ellensberg, Washington, USA.

Ten manuscripts were in competition this year. The Committee noted the high quality of the submitted papers. Committee members were Robin Andrews (Virginia Polytechnic Institute & State University), David Duvall (Arizona State University), Robert E. Gatten, Jr. (University of North Carolina), Terry D. Schwaner (Southern Utah University), and Ken R. Marion (Chair, University of Alabama at Birmingham).

Seibert Award Winners for 1996 Announced

The fifth annual Seibert Awards were presented at the 39th Annual Meeting of the SSAR in Lawrence. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). The awards recognize outstanding student presentations at the annual meeting. There were 31 presentations eligible.

The winners.—J. R. Mendelson, III (First Award), Natural History Museum and Department of Systematics and Ecology, University of Kansas ("Taxonomy of the Mexican toads referred to *Bufo cavifrons* and *Bufo cristatus*"); Paul T. Andreadis (Second Award–tie), Ecology and Evolutionary Biology, University of Tennessee ("Circadian and lunar influences on feeding activity of

water snakes"); John R. Lee, (Second Award–tie), Department of Zoology, University of Georgia and Savannah River Ecology Laboratory ("Spatial ecology of cottonmouths (*Agkistrodon piscivorus*) in South Carolina: activity ranges, movement rates, and overwintering sites").

Honorable Mention (in no particular order).—M. J. Komoroski, Savannah River Ecology Laboratory ("Relationships of lipids to ovum size in the mole salamander, *Ambystoma talpoideum*"); B. Moon, Department of Biology, University of Michigan ("The effects of different prey movements on the duration and force of constriction by gopher snakes"); G. M. Correa, Departamento de Biologia, Pontificia Universidad Catolica del Ecuador ("Behavior, vocalization and reproductive characteristics of *Colostethus awa* and *C. machalilla* (Anura: Dendrobatidae)").

The judges were Oscar Flores-Villela, co-chair (UNAM), David Auth, co-chair (Florda State Museum, Gainesville), David Chiszar (University of Colorado), Anna Graybeal (University of Texas at Austin), James Dixon (Texas A&M University), Neil Ford (University of Texas at Tyler), Hinrich Kaiser (Universität Würzburg).

Name Guide for Group Photo

Persons who bought the SSAR group photo at the Lawrence meeting may obtain an identification guide by sending a stamped, self-addressed envelope to: *George R. Pisani, Biological Sciences, University of Kansas, Lawrence, Kansas 66045-2106, USA.*

Items Needed for SSAR Auction in Seattle

Joe Collins will be conducting the SSAR auction during the annual meeting at the University of Washington in June 1997. All proceeds from the auction go to the SSAR treasury, and help to continue the production of diverse publications and services for which SSAR is known. Items of value as well as those that lend themselves to humor are always welcome. Joe is skilled at removing large quantities of cash from auction participants through the judicious use of beer and plastic. Auction items may be brought directly to the meeting or sent in advance (clearly marked "Herp Auction") to: *Ted Pietsch, School of Fisheries, 1140 Boat Street, University of Washington, Box 355100, Seattle, Washington 98195-5100, USA.*

SSAR Student Travel Awards Fund-Raiser: 1996 Results and Call For 1997 Donations

The SSAR Student Travel Awards Committee (SSAR STAC) conducted the Third Annual SSAR Student Travel Awards Frameable Art Silent Auction and presented the Second Annual SSAR Student Travel Awards at the SSAR meeting in Lawrence, Kansas. The winners were Laura Monti, Debra Moore, and Rick Owen. Congratulations to all. The SSAR STAC wishes to thank the following for their donations to the Third Annual Frameable Art Silent Auction: Kraig Adler, Robert Aldridge (SSAR), Mark Bailey, Bern and Betty Bechtel, Janalee Caldwell, Joe Collins, David Dennis, Bill Duellman, Stephen Goldberg, Carole Hom, John Jensen, University of Kansas Herpetology Division, Michael J. Lanoo, Ernie Liner, Anne Meylan, Mark and Louise Mills, Ramus Publishing, David Scott, Jeffrey Tamplin, Linda Trueb, Laurie Vitt, and Richard Vogt. The Third Annual Frameable Art Silent Auction raised over $1900 for students attending and presenting papers at the 1997 meeting in Seattle. On behalf of SSAR and the SSAR STAC Chairman, John R. Lee, thanks to all who helped, including Joe Mendelson, Mark Mills, Jeff Demuth, Jenny Pramuk, Susan Lee, and Karen Toepfer. Continuing a successful tradition, the SSAR STAC proudly announces the Fourth Annual Frameable Art Silent Auction to be held at the 1997 SSAR meeting in Seattle. Preferred donations include herp-related photos, line drawings, prints, paintings, plates, engravings, or anything frameable, if not already framed. If you are interested in donating an item (tax deductible for U.S. residents), please contact: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

SSAR Student Travel Awards Call for Applications

Ten awards of $200 each are available. An applicant for a travel award must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author (or co-author, see below) of a paper or poster to be presented. An applicant must include in the application package: 1) a letter signed by his/her major advisor or department chair that states: he/she is currently an undergraduate or graduate student and that he/she is not completely funded for travel from another source; 2) an official copy of the poster or paper abstract to be presented; 3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Student Travel Awards Committee are excluded from applying for a travel award. APPLICATIONS MUST BE POSTMARKED BY 15 MAY 1997. Award recipients will be notified by 1 June 1997 and award checks will be disbursed at the meeting. Requests for information on making donations and applications for awards should be sent to: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

HR's Techniques Editor Resigns

Stephen D. Busack, having served as our first-ever section editor for Techniques during the last two years, has resigned due to the demands of a new position. Effective 1 November 1996, he became Director of Research and Collections at the North Carolina State Museum of Natural Sciences (102 North Salisbury Street, Raleigh, North Carolina 27603, USA). A new museum building, scheduled for opening in late 1999, is under construction at a cost of ca. $31 million. We thank Steve for his service to colleagues and to SSAR, and wish him well in his new position. Authors of techniques manuscripts should send these directly to the editor.

Announcement of SSAR International Cooperation Project (ICP): A Call for Help

Anyone who has carried out herpetological research in a developing country no doubt has felt the frustration expressed by colleagues in that country regarding the inaccessibility of scientific resources. Scientists often are hesitant to publish because they don't have access to the literature—they fear their study may already have been done! Commonplace field supplies such as flagging tape and waterproof paper are either unavailable locally or are too expensive to order from the U.S.

In August 1995, Alan Savitzky, then-President of SSAR, appointed me as Chair of a one-year International Cooperation Committee. Other committee members included Oscar Flores, Tyrone Hayes, and Ted Papenfuss. Our charge was to consider the appropriate nature of international services that could be provided by SSAR. I presented our suggestions to the SSAR Board at the annual meeting in Lawrence, Kansas, on 24 July 1996. Members of the Board were enthusiastic about the ideas, and President Lou Guillette asked if I would coordinate efforts to get an international cooperation program underway. I have agreed to do so, but I need your help.

I propose that, through the International Cooperation Project (ICP), we as a society reach out a collective hand to our international colleagues. The more people involved, the more successful the project will be. Below is a description of various aspects of the proposed project, as we currently envision it, followed by a call for your help. Let's show that SSAR is truly an international society.

ICP Currently Consists of Six Aspects

1. *Internet Service.*—George Pisani (U. Kansas) manages the SSAR web site at http://falcon.cc.ukans.edu/~gpisani/SSAR.html. As part of ICP, George will provide a page on the web site of special interest to non-U.S. herpetologists.

2. *SSAR Grants-In-Herpetology (GIH).*—One grant will be earmarked each year for a non-U.S. applicant from a country where herpetological research historically has been underfunded, and where alternative sources of funding are difficult to secure. Successful proposals must meet the same high standards currently required of all proposals. At the SSAR Board meeting in Lawrence, the Board authorized additional funds for the SSAR Grants-in-Herpetology program.

3. *International Sponsorship.*—As part of ICP, SSAR will establish an International Membership Fund. Donations to the Fund will be used to defray the SSAR membership dues of non-U.S. institutions and/or individuals eligible to apply for GIH funding as above. Donations may be designated as being in support of a particular institution or individual if desired. The SSAR Board has agreed to make ICP-donated international institutional memberships available at the individual amount (currently $40) instead of the usual institution rate (currently $70) as a Society contribution, thus allowing more memberships to be purchased from the Fund. In this way we hope to provide *Journal of Herpetology* and *Herpetological Review* to libraries that otherwise could not afford these publications.

4. *Graduate Program Information.*—Non-U.S. students who wish to come to the U.S. to do graduate study often have difficulty choosing an appropriate institution to match their interests and finding out how to apply. The goal of this aspect of ICP will be to gather information regarding U.S. graduate programs in herpetology (which herpetologists are working at which institutions and where to go for specific emphases), application procedures (e.g., required GRE's and language exams, transcripts, letters of recommendation), and estimated costs of graduate work and potential financial assistance. These materials will be distributed to potential international students and interested institutions.

5. *Funding Source Information.*—All of us are experiencing greater difficulty securing funds for our research as funding agencies have less to offer. Non-U.S. herpetologists often have even greater difficulty securing funds for their research because even less money is committed to research by their own countries. Some U.S. agencies not only are willing to fund research projects submitted by non-U.S. scientists, but actually encourage and prefer such proposals, especially in the field of conservation. The goal of this aspect of ICP will be to write a pamphlet that provides information on how and where non-U.S. researchers can apply for these funds. Availability of this pamphlet will be announced on the SSAR web site and in *Herpetological Review*, and will be distributed to interested persons and institutions.

6. *Preparation of Grant Proposals.*—The SSAR Board authorized an allocation of funds to begin the Committee's work. These funds will be used to pay for postage, long distance phone calls, and faxes associated with organizing the project. In order to expand the project, we need to secure outside funding. Thus, the most time-consuming aspect of ICP at this point will be preparation of grant proposals to be submitted to appropriate agencies and foundations. The project to be included in the first round of proposals involves distribution of donated library materials (journals and reprints) and surplus/gently-used laboratory and field supplies to institutions in Latin America that have expressed need for such items. We plan to initiate the distribution project in Latin America, and later expand to other geographical areas. In the future, proposals may be written to cover expenses for exchange programs and for courses and workshops.

So, How Can You Get Involved?

Every SSAR member is encouraged to become involved in ICP. At this point, the major ways you can help are: 1. Donate to the International Membership Fund, which will provide SSAR memberships to international colleagues and institutions. We will announce details of this program at a later date. 2. Volunteer to coordinate one of the following major projects: a) Graduate Program Information, b) Funding Source Information, c) Distribution Project (library material and supplies)—although this program will not begin until outside funding has been secured, we need to organize the project, d) Preparation of Grant Proposals. The coordinators for these four major projects will join me as members of the ICP committee. 3. Volunteer to help (i.e., work with the coordinator—#2 above) on one or more of the four major activities listed in #2 above.

PLEASE get involved. If you are interested in either helping with or coordinating a major project of ICP, please contact me as soon as possible so that we can form the Committee and begin to work.

MARTHA L. CRUMP
Department of Biological Sciences
Northern Arizona University
Flagstaff, Arizona 86004, USA
Tel. (520) 527-0720; Fax (520) 523-7500
e-mail: PETERF@NAUAX.UCC.NAU.EDU

NEWSNOTES



Third World Congress of Herpetology 2–10 August 1997, Prague, Czech Republic

The Second Announcement, which includes the Call for Papers and Registration Forms, was published in July and since then, it has been distributed to all respondees to the First Announcement. By the end of September, about 980 persons were preliminarily registered, both neo- and paleoherpetologists, from 71 countries. The Congress will include a rich social program, activities for accompanying persons, 12 possibilities for professional excursions, and three post-Congress tours (including one to Central Asia). The Second Announcement is still available, on request, from the Congress Secretariat (Third World Congress of Herpetology, Congress Secretariat, c/o Czech Medical Association J.E. Purkyne, P.O. Box 88, Sokolovska 31, CZ-120 26, Praha 2, Czech Republic; Fax: ++42-2-24216836; E-mail: LON@CZECHMED.ANET.CZ). Preliminarily registered persons receive the Announcement automatically.

The Congress is open to anybody who works in any field of herpetology or is interested in herpetology. The deadline for submitting abstracts is December 31, 1996 (postmarked). Abstracts sent after this date will be accepted only for poster presentations, but there is no guarantee that they will be included in the printed abstracts or will be distributed to delegates. There are no program limits except that all contributions must present new information.

Message from the Secretary-General

It is time to think about candidates for membership on the Executive Committee and the International Herpetological Committee for the World Congress of Herpetology. Nominations can be advanced either by individuals or affiliated organizations, as appropriate. Our constitution states that "All nominations for membership of these Committees must be received by the Secretary-General at least four months prior to a Congress and must be seconded either by any two members of either the Executive or International Herpetological Committees, or, in the case of the International Herpetological Committee, by the governing body of an Affiliated Organization." I shall be pleased to receive any and all nominations by **MARCH 31, 1997**.

The Travel Subsidy Committee will have many deserving applicants for funding to help defray costs of attending the Congress in Prague. Funds for this purpose are extremely limited, despite efforts to raise additional support. I urge both individuals and societies to consider donating to this important fund. It is to the advantage of all present, and to our science in general, to have as widely representative a body of participants in the Congress as possible. Donations to the Travel Subsidy Fund can be sent to Roger A. Avery, Treasurer, World Congress of Herpetology, Department of Zoology, University of Bristol, Woodland Road, Bristol BS8 1UG, United Kingdom. Thank you!

MARVALEE H. WAKE
Secretary-General, World Congress of Herpetology
Department of Integrative Biology, 3060 VLSB
University of California, Berkeley, California 94720-3140, USA

WCH III Mini-Symposium

As part of the proceedings of the 3rd WCH, the following one-day symposium has been proposed: "Africa—The Neglected Continent: Biodiversity and Biology of the African Herpetofauna." Convenor: *Dr. W. R. Branch, Curator Herpetology, Port Elizabeth Museum, P.O. Box 13147, Humewood 6013, South Africa. Tel. 041 561051; Fax 041 562175; e-mail, pemwrb@zoo.upe.ac.za.*

Africa remains the neglected continent. Containing the majority of the world's poorest countries, indigenous research is severely curtailed by financial constraints, regional conflicts, and a deteriorating infrastructure. Pressure from the burgeoning human population has led to land-use conflicts and has resulted in widespread habitat destruction. The rapid decline of mega-mammals preoccupies world and African conservation bodies, with the consequent neglect of the herpetofauna. The diverse and largely unique herpetofauna remains relatively unknown and unmapped. The aims of the proposed symposium are to: synthesize existing knowledge on the composition, distribution, and biology of the continent's herpetofauna; to identify and prioritize areas and taxa in need of study and conservation; and to stimulate international collaboration between herpetologists and other interested groups.

Anyone interested in participating in this symposium is asked to contact the convenor (address and contact numbers listed above) as soon as possible. Due to limited time, talks should review aspects of relevance to the broad theme of the symposium.

Southwestern Research Station Positions And Grants For 1997

VOLUNTEERS—Approximately 30 volunteer positions are open in 1997 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 1997. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax: 520-558-2396.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin March 15, 1997, through September 1997. Five-day week; salary $210/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. tel. and fax: 520-558-2396.*

Garter Snake Book Correction

Purchasers of *The Garter Snakes: Evolution and Ecology* (University of Oklahoma Press, 1996) by Rossman, Ford, and Seigel, need to be aware of a typesetter's error on page 41 that affects the key. In couplet 3 the first line reads "Maxillary teeth$^3\leq$" and it should read "Maxillary teeth$^3\geq$27"—the number was omitted and the sign reversed. The authors regret the inconvenience, but the error was beyond their control.

Graduate and Post-Graduate Research Grants

The Biological Research Station of the Edmund Niles Huyck Preserve offers grants (max. = $2500) to support biological research which utilizes the resources of the Preserve. Among the research areas supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2000 acre Preserve is located on the Helderberg Plateau, 30 miles southwest of Albany, New York. Habitats include northeast hardwood-hemlock forests, conifer plantations, old fields, permanent and intermittent streams, 10 and 100 acre lakes, and several waterfalls. Facilities include a wet and dry lab, library, and houses/cabins for researchers. Deadline = 1 February 1997. Application material: *Dr. Richard L. Wyman, Executive Director, E.N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, New York 12147, USA.*

Summer Course on Larval Amphibian Biology at Highlands Biological Station

A course on Larval Amphibian Biology will be taught at Highlands Biological Station June 2–13, 1997. Instructors are Richard Wassersug, Ray Semlitsch, Richard Bruce, and Travis Ryan. This is a lecture, laboratory, and field course addressing a variety of topics on the biology of amphibian larvae. Three semester hours credit at the advanced undergraduate/graduate level is available through either Western Carolina University or the University of North Carolina at Chapel Hill. For further information contact: *Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741, USA. Tel. (704) 526-2602, FAX (704) 526-2797, e-mail: bruce@wcu.edu.*

Kaplan Named U.S. Professor of the Year

SSAR member Robert Kaplan, a professor of biology at Reed College (Portland, Oregon), was selected as a 1996-97 U.S. Professor of the Year by the Carnegie Foundation for the Advancement of Teaching. Kaplan is the first winner from the Pacific Northwest in the history of the national awards program. He was chosen from among nearly 600 nominees from throughout the country. Kaplan received his award, which included a $5,000 cash prize, at a reception in Washington, D.C. on October 10.

Kaplan is well known to herpetologists for his many publications on the developmental biology and ecology of frogs and salamanders. Much of his research is carried out in collaboration with his undergraduate students. In addition to teaching, research, and other professional duties, Kaplan is working with public school teachers to design a hands-on biology curriculum for elementary and middle school students.

SSAR congratulates Bob Kaplan for this singular achievement.

MEETINGS

Meetings Calendar

13–18 January 1997—IUCN Northern Indian Ocean Marine Turtle Workshop, Bhubaneswar, Orissa, India. Contact: Dr. Priyambada Mohanty-Hejmadi, Vice Chancellor, Sambalpur University, JYOTIVIHAR, Sambalpur 768019, Orissa, India (tel. 91-663-430158; fax 91-674-481418) or Dr. Pamela Plotkin, Drexel University, Department of Bioscience & Biotechnology, 32nd and Chestnut Streets, Philadelphia, Pennsylvania 19104, USA (tel. 215-895-1436; fax 215-895-1273; e-mail: Plotkipt@post.drexel.edu).

29–30 January 1997—Federal and International Scientific Permits: A Workshop for Natural History Museums and Collectors. Presented by the San Diego Natural History Museum and co-sponsored by the Association of Systematics Collections. San Diego, California, USA. Contact: Director, Collections Care and Conservation, San Diego Natural History Museum, P.O. Box 1390, San Diego, California 92112, USA; tel. (619) 232-3821, ext. 226; fax (619) 232-0248; e-mail: LIBSDNHM@CLASS.ORG.

24–26 April 1997—Association of Systematics Collections (ASC) Annual Meeting. Atlanta, Georgia, USA. Theme: "The Collections-Based Mission of Natural History Collections." Contact: ASC, 1725 K Street NW, Suite 601, Washington, D.C. 20006-1401, USA; WWW: http://www.ascoll.org/ or e-mail: asc@ascoll.org.

25 June–2 July 1997—40th Annual Meeting, Society for the Study of Amphibians and Reptiles; 45th Annual Meeting of The Herpetologists' League; 77th Annual Meeting, American Society of Ichthyologists and Herpetologists. Hosted by the University of Washington, Seattle, Washington, USA. *Refer to meeting announcement in this issue for details.*

2–10 August 1997—Third World Congress of Herpetology, Prague, Czech Republic. Contact: Zbynek Rocek, Congress Director, Department of Paleontology, Geological Institute, Academy of Sciences, Rozvojová 135, 165 00 Praha 6 – Suchdol, Czech Republic. Tel. (++42-2) 24311421; Fax (++42-2) 24311578; e-mail: rocek@gli.cas.cz. *Refer to meeting announcement in* Herpetological Review *27(1):4–5, March 1996 for details.*

CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

The current contents of several herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Advances in Zoo Herpetology

Clay Garrett and David Chiszar recently edited a special issue of *Zoo Biology* which focuses on advances in zoo herpetology.

SCHUETT, G. W. 1996. Fighting dynamics of male copperheads, *Agkistrodon contortrix* (Serpentes, Viperidae): Stress-induced inhibition of sexual behavior in losers. Zoo Biol. 15(3):209–221.

BURGHARDT, G. M., B. WOOD, AND R. ROSSCOE. 1996. Problem of reptile play: environmental enrichment and play behavior in a captive Nile soft-shelled turtle, *Trionyx triunguis*. Zoo Biol. 15(3):223–238.

COOPER, W. E., JR., C. S. DEPERNO, AND S. F. FOX. 1996. Prey chemical discrimination and strike-induced chemosensory searching in lizards: their absence in a crotaphytid lizard (*Crotaphytus collaris*) and a proposal for research in zoos. Zoo Biol. 15(3):239–253.

GARRETT, C. M., et al. 1996. Comparison of chemosensory behavior and prey trail-following in the varanoid lizards *Varanus gouldii* and *Heloderma suspectum*. Zoo Biol. 15(3):255–265.

KARDONG, K. V. 1996. Evolution of aging: theoretical and practical implications from rattlesnakes. Zoo Biol. 15(3):267–277.

FERGUSON, G. W., et al. 1996. Indoor husbandry of the panther chameleon *Chamaeleo [Furcifer] pardalis*: effects of dietary vitamins A and D and ultraviolet irradiation on pathology and life-history traits. Zoo Biol. 15(3):279–299.

REICHLING, S. B., AND W. H. N. GUTZKE. 1996. Phenotypic consequences of incubation environment in the African elapid genus *Aspidelaps*. Zoo Biol. 15(3):301–308.

VALLARINO, O., AND P. J. WELDON. 1996. Reproduction in the yellow-bellied sea snake (*Pelamis platurus*) from Panama: field and laboratory observations. Zoo Biol. 15(3):309–314.

LILLYWHITE, H. B. 1996. Husbandry of the little file snake, *Acrochordus granulatus*. Zoo Biol. 15(3):315–327.

JACOBSON, E. R. 1996. Metabolic scaling of antibiotics in reptiles: basis and limitations. Zoo Biol. 15(3):329–339.

MORRIS, P. J., L. A. JACKINTELL, AND A. C. ALBERTS. 1996. Predicting the gender of subadult Komodo dragons (*Varanus komodoensis*) using two-dimensional ultrasound imaging and plasma testosterone concentration. Zoo Biol. 15(3):341–347.

Thermoregulation

Thermal ecology of four species of *Varanus* occupying a range of habitats and climatic regions is compared to assess the efficacy of methods for evaluating the extent to which animals exploit their thermal environments. Several indices of thermoregulation are evaluated and discussed.

CHRISTIAN, K. A., AND B. W. WEAVERS. 1996. Thermoregulation of monitor lizards in Australia: an evaluation of methods in thermal biology. Ecol. Monogr. 66(2):139–157.

Snake Life History

Richard Shine uses multivariate analysis to examine life-history evolution in 103 species of Australian snakes. Two separate analyses were conducted: one treated each species as an independent unit and the other based on independent phylogenetic contrasts. Path coefficients from the two types of analyses were similar in magnitude, and highly correlated with each other, suggesting that most interspecific patterns among traits may reflect functional association rather than phylogenetic conservatism.

SHINE, R. 1996. Life-history evolution in Australian snakes: a path analysis. Oecologia 107:484–489.

Shine and Richard Seigel survey clutch-size variance among snakes, finding that the coefficient of variation did not vary significantly with maternal body size or over time within single populations. Further, clutch-size variances did not differ between viviparous and oviparous snakes, but were dependent upon allometric relationships involving maternal body size and the relationship between clutch size and body size.

SHINE, R., AND R. A. SEIGEL. 1996. A neglected life-history trait: clutch-size variance in snakes. J. Zool. 239:209–223.

Crocodilian Biology

Two recent papers by Kate Jackson and colleagues examine differences between crocodiles and alligators. In one paper the morphology of integumentary sense organs (ISOs), found in Crocodylidae and Gavialidae but not Alligatoridae, was studied using light microscopy and scanning and transmission electron microscopy. Possible functional interpretations of ISOs are discussed. A second paper studied the ability of crocodylids and alligatorids to discriminate between hyper- and hypo-osmotic salinities. The authors discuss differences in salinity discrimination as well as the historical biogeography of the Crocodilia.

JACKSON, K., D.G. BUTLER, AND J.H. YOUSON. 1996. Morphology and ultrastructure of possible integumentary sense organs in the estuarine crocodile (*Crocodylus porosus*). J. Morph. 229:315–324.

JACKSON, K., D.G. BUTLER, AND D.R. BROOKS. 1996. Habitat and phylogeny influence salinity discrimination in crocodilians: implications for osmoregulatory physiology and historical biogeography. Biol. J. Linn. Soc. 58:371–383.

Facultative Paedomorphosis

Whiteman et al. studied a montane population of *Ambystoma tigrinum nebulosum*, and measured the adult growth rate and body condition across three growing seasons to assess the relative costs and benefits of each morph. Their results suggest that paedomorphs should have decreased fitness relative to metamorphs, primarily because metamorphs can move into the best habitats for growth. The net fitness effects of morph-specific differences in dispersal depend on whether there are trade-offs with other life history traits.

WHITEMAN, H. H., S. A. WISSINGER, AND W. S. BROWN. 1996. Growth and foraging consequences of facultative paedomorphosis in the tiger salamander, *Ambystoma tigrinum nebulosum*. Evol. Ecol. 10:433–446.

Costa Rican Tadpoles

Karen Lips and Jay Savage present a key to distinguish among the described tadpoles of Costa Rican frogs and toads, summarize the reproductive modes present in this group, and present a bibliography of the published illustrations of those tadpoles.

LIPS, K. R., AND J. M. SAVAGE. 1996. Key to the known tadpoles (Amphibia: Anura) of Costa Rica. Stud. Neotrop. Fauna & Environm. 31:17–26.

Forest Management and Amphibian Ecology

Questions about the compatibility of timber harvest practices and conservation of biological diversity are largely driven by concerns that habitat quality for many species may be degraded in intensively managed forest landscapes. DeMaynadier and Hunter reviewed the literature on relationships between common forest harvesting practices and the distribution and abundance of amphibians. The authors also discuss problems commonly encountered in the experimental design and measurement of forest amphibian populations and outline several aspects of amphibian–forest relationships in need of future research.

DEMAYNADIER, P. G., AND M. L. HUNTER, JR. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. Environ. Rev. 3:230–261.

Systematics and Snakebite Treatment

The importance of a sound and explicit taxonomic framework to toxinological and clinical research and the production and use of antivenoms is discussed in a recent paper by Wüster and McCarthy. Using two species complexes as examples, the authors explore the implications of taxonomic developments for toxinology and clinical science.

WÜSTER, W., AND C. J. MCCARTHY. 1996. Venomous snake systematics: implications for snake bite treatment and toxinology. *In* C. Bon and M. Goyffon (Eds.), Envenomings and Their Treatments, pp. 13–23. Fondation Marcel Mérieux.

Molecular Systematics

Forstner et al. use mtDNA sequence data to re-examine the hypothesis of an anguimorph origin for snakes. Their results affirm earlier studies suggesting that the suborder Serpentes arose within the lizard clade and that snakes are clearly allied with anguimorph lizards (e.g., varanids). Blind snakes (Leptotyphlopidae and Typhlopidae) represent extant ancestral lineages but do not appear to be sister groups. Molecular evidence supports a fossorial or nearly fossorial origin for limblessness in snakes.

FORSTNER, M. R. J., S. K. DAVIS, AND E. ARÉVALO. 1995. Support for the hypothesis of anguimorph ancestry for the Suborder Serpentes from phylogenetic analysis of mitochondrial DNA sequences. Mol. Phyl. Evol. 4(1):93–102.

Corallus enydris (tree boa) has an extremely wide mainland distribution from southern Costa Rica to southeastern Brazil, and is one of only two boines to occur in the Lesser Antilles. Henderson and Hedges apply mtDNA sequence data to examine relationships among geographic units. These data confirm the monophyly of *C. enydris*, and reveal that the Lesser Antillean populations cluster with the southern mainland samples (e.g., Guyana, Peru, southeastern Brazil) rather than the geographically closer northern samples (e.g., Trinidad). The results suggest a recent Guianan-Amazonian origin of West Indian populations.

HENDERSON, R. W., AND S. B. HEDGES. 1995. Origin of West Indian populations of the geographically widespread boa *Corallus enydris* inferred from mitochondrial DNA sequences. Mol. Phyl. Evol. 4(1):88–92.

Reeder examines the North American phrynosomatid radiation from a molecular perspective. A cladistic analysis of mtDNA sequence data was largely incongruent with recent morphology-based analyses. The sand lizards (*Callisaurus, Cophosaurus, Holbrookia,* and *Uma*) together with *Petrosaurus, Phrynosoma, Urosaurus,* and *Uta* form a natural group. All species of *Sceloporus*, except *S. variabilis* and *S. chrysostictus*, formed a clade.

REEDER, T. W. 1995. Phylogenetic relationships among phrynosomatid lizards as inferred from mitochondrial ribosomal DNA sequences: substitutional bias and information content of transitions relative to transversions. Mol. Phyl. Evol. 4(2):203–222.

LETTERS TO THE EDITOR

Current Subspecific Names for Western *Thamnophis sirtalis*

SEAN J. BARRY
Section of Evolution and Ecology and The Rowe Program in Genetics
University of California, Davis, California 95616, USA
e-mail: sjbarry@ucdavis.edu

MARK R. JENNINGS
National Biological Service, California Science Center
Piedras Blancas Research Station
P.O. Box 70, San Simeon, California 93452, USA
and
Research Associate, Department of Herpetology
California Academy of Sciences
San Francisco, California 94118, USA
e-mail: mark_jennings@nbs.gov

and
HOBART M. SMITH
Department of Environmental, Population, and Organismal Biology
University of Colorado, Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

The taxonomy of the western subspecies of *Thamnophis sirtalis* has been resolved and well-accepted for 45 years (cf. Fox 1951). However, Boundy and Rossman (1995) suggest that the senior name for the San Francisco Peninsula *T. sirtalis* (currently named *T. s. tetrataenia*) is *T. s. infernalis*, and that *T. s. tetrataenia* should be suppressed. They suggest further that the subspecies known currently as *T. s. infernalis* (the California red-sided garter snake) should be united with *T. s. concinnus* (the red-spotted garter snake), a disjunct subspecies, but they present no systematic evidence to justify such a union.

In our view, adoption of the arrangement proposed by Boundy and Rossman will result in major and unwarranted disruption of western garter snake taxonomy. Further, the impact of this new arrangement on the conservation efforts on behalf of *T. s. tetrataenia* (the endangered San Francisco garter snake) is potentially disastrous. Well over half of the 125+ citations of "*T. s. tetrataenia*" since 1951 have appeared in the conservation literature, and this snake appears under only that name in all of the

numerous government documents concerned with endangered wildlife. To change the subspecific designation to "*T. s. infernalis*" after so many years of stability is to invite serious confusion in the lay, conservation, and governmental communities, particularly because that name is in current usage for another form.

Accordingly, Barry and Jennings (*in press*) have petitioned the International Commission on Zoological Nomenclature to conserve the accepted usage and suppress the changes proposed by Boundy and Rossman (1995). The notice of the receipt of this petition appeared on 28 June 1996 as Case 3012 in the *Bulletin of Zoological Nomenclature*, Volume 53 Part 2, page 77. Under Article 80 of the Code, previous accepted usage is to be maintained until the Commission ruling has been published. We offer this special notice of the petition because the nomenclature proposed by Boundy and Rossman has already been used in at least one further publication (Rossman et al. 1996). In light of the great potential for confusion if the Boundy and Rossman names continue to be used, we remind workers who cite the names for the San Francisco garter snake, the California red-sided garter snake, and the red-spotted garter snake that they should maintain the established, pre-1995 nomenclature, as required by Article 80 of the International Code of Zoological Nomenclature, until the ruling of the Commission is published.

LITERATURE CITED

BARRY, S. J., AND M. R. JENNINGS. *In press*. *Eutaenia sirtalis tetrataenia* Cope in Yarrow, 1875 and *Coluber infernalis* Blainville, 1835 (currently *Thamnophis s. tetrataenia* and *T. s. infernalis*, Reptilia: Serpentes): proposed conservation of the subspecific names by the designation of a neotype for *T. s. infernalis*. Bull. Zool. Nomencl.

BOUNDY, J., AND D. A. ROSSMAN. 1995. Allocation and status of the gartersnake *Coluber infernalis* Blainville, *Eutaenia sirtalis tetrataenia* Cope, and *Eutaenia imperialis* Coues and Yarrow. Copeia 1995(1):236–240.

FOX, W. 1951. The status of the gartersnake *Thamnophis sirtalis tetrataenia*. Copeia 1951(4):257–267.

ROSSMAN, D. A., N. B. FORD, AND R. A. SEIGEL. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman. xx + 332 pp.

Corrigenda to *Amphibians and Reptiles of New Mexico*, by W. G. Degenhardt, C. W. Painter, and A. H. Price, published by the University of New Mexico Press, July, 1996

ANDREW H. PRICE
Texas Parks and Wildlife Department
4200 Smith School Road, Austin, Texas 78744, USA

CHARLES W. PAINTER
Endangered Species Program, New Mexico Department of Game and Fish
P.O. Box 25112, Santa Fe, New Mexico 87504, USA

and

WILLIAM G. DEGENHARDT
Department of Biology
The Unviersity of New Mexico, Albuquerque, New Mexico 87131, USA

We have discovered a number of unfortunate errors in our book since its publication. Although most are of an editorial nature and insufficient to detract substantially from the overall quality of the book, there are enough to warrant the issuing of a corrigenda. The University of New Mexico Press has elected not to do so; therefore, we have taken it upon ourselves. Following are the errors we believe are noteworthy:

p. 12 The correct citation for the Roundtail Horned Lizard is *Phrynosoma modestum* Girard *in* Baird and Girard, 1852.

p. 65 The reference to Smith et al. (1995a) in line 9, column 1 should be Smith et al. (1995b).

p. 83 The photographic reference should be to plate 23.

p. 114 The reference by Christiansen and Iverson (1993) in lines 7–8, column 2 should read "Christiansen and Iverson (in press)."

p. 116 The reference by Christiansen and Iverson (1993) in lines 7–8 and 11–12, column 2 should read "Christiansen and Iverson (in press)."

p. 127 Figure 18a is incorrect; it should be as follows:



Figure 18a

p. 154 The correct citation for the Roundtail Horned Lizard is *Phrynosoma modestum* Girard *in* Baird and Girard, 1852.

p. 203 The acronyms "GAB" and "GBPS" in Table 2 are not defined. GAB = granular scales around the body, measured at midbody; GBPS = granular scales between the paravertebral stripes.

p. 204 The lefthand column heading should read "vertebral," not "veterbral."

Fig. 2 The scale should read "900–2200," not "2000–12500," and the contour intervals are 100 m, not 500 m.

Fig. 3 The order of the color rectangles should be blue-green-yellow-brown, not blue-yellow-brown-green.

Pl. 82 The animal pictured is from Socorro County, not Otero County.

Pl. 84 The animal pictured is from Eddy County, not Otero County.

Pl. 99 & 100 The legends for these two photographs have been transposed; plate 99 is a *Salvadora deserticola* and plate 100 is a *Salvadora grahamiae*.

p. 238 Substitute "*Liochlorophis*" for "*Opheodrys*" in line 10, column 2.

p. 315 Insert "a" following "1853" in line 18, column 1.

p. 370 Read "oviductal" instead of "oviducal."

p. 370 Under the definition of the word 'paralectotype,' read "syntypic" or "type" instead of "syntopic."

p. 380 The reference by Christiansen and Iverson is in press.

p. 382 The following reference, cited in the *Masticophis flagellum* account, is missing: Cope, E.D. 1875. Checklist of North American Batrachia and Reptilia; with a systematic list of the higher groups, and an essay on geographical distribution. Based on the specimens contained in the U.S. National Museum. Bull. U.S. Natl. Mus. (1):1–104 p.

p. 387 The paper by Ford and Cobb (1992) is cited incorrectly; the correct reference is: "Timing of courtship in two colubrid snakes of the southern United States. Copeia 1992(2):573–577."

p. 393 Under the reference by Iverson (1981), remove the word "group" contained within the parentheses, and insert the abbreviation "Bot." following "Zool." in the name of the periodical.

p. 409 The citation by H.M. Smith (1937) should have the word "synopsis" substituted for the words "new subspecies."

The EMBL/EBI Reptile Database

PETER UETZ
European Molecular Biology Laboratory (EMBL)
Meyerhofstr. 1, D-69117 Heidelberg, Germany
e-mail: uetz@embl-heidelberg.de

and

THURE ETZOLD
European Bioinformatics Institute (EBI)
Hinxton Hall, Cambridge CB10 1RQ, UK
e-mail: etzold@ebi.ac.uk

Several million species of living organisms inhabit the Earth. Among them are about 8000 reptiles. Several attempts have been made to put some order into this vast diversity, most notably by the series "Das Tierreich" which was published originally by the German Zoological Society. Besides listing all animal species, the "Tierreich" also aimed to list all synonyms for a given taxon, an indispensable feature in order to avoid complete confusion among the several scientific names most species have received since their first description. For example, the recent list of Australian and Oceanian geckos by Bauer (1994) revealed more than 800 different names for about 170 geckos of this region!

Species:
Vipera monticola
Synonyms:
1953 Vipera latastei montana Saint Girons
1954 Vipera latastei monticola Saint Girons
Subspecies:
Distribution:
Morocco (Haut Atlas)
Comment:
References:
Schleich, H.H., Kästle,W., Kabisch, K. (1996)
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Koeltz, Koenigstein, 627 pp.

FIG. 1. Sample entry from species database.

A comprehensive taxonomy of reptiles and amphibians is the basis for both systematic and all other aspects of herpetology, hence it should be widely available and constantly up-to-date. In contrast to books and journals these two criteria are only met by electronic databases on the Internet. To our knowledge there is no online database on reptile species available so far. The only comprehensive Internet database on vertebrate species to date is an online version of the venerable *Mammal Species of the World* (Wilson and Reeder 1993). For this reason we set up a prototype database which is based on the Sequence Retrieval System (SRS), originally developed for the access of DNA and protein sequence data over the internet (Etzold et al. 1996).

The aim of the database is the collection and dissemination of taxonomic data on all living reptiles. For this purpose the database is split into two parts, a species database and a database on higher taxa. Currently the **species database** contains about 7600 species, of which about 6300 have some information on distribution associated. More than 3000 species entries contain references to more detailed sources (which in most cases also include pictures). An entry consists of six data fields, although additional fields may be added later (Fig. 1).

The species entries currently contain little information apart from some data on the distribution of particular species. Hence, we welcome submission of such data (including detailed descriptions) from the herpetological community. For the time being, only data that have been published regularly will be entered until a scientific advisory board has been established that might review direct submissions. Technically, it is no problem to include pictures and distribution maps as well, although the short-term goal of the database is a text-based catalog of all reptile taxa.

Entries of the **higher taxa** database (Fig. 2) are similar to the species entries:

ID:
Taxon:
Tropidurinae
Synonyms:
1843 Tropidurinae Bell
1843 Ptychosauri Fitzinger
1843 Steirolepides Fitzinger
1843 Heterotropides Fitzinger
Category:
Subfamily
Up:
Tropiduridae
Status:
valid
Description:
premaxillary spine not overlapped by nasals
parietal table not Y- or V-shaped
no labial blade or coronoid
splenial extending anteriorly no more than 1/6 length of precoronoid length of mandible
anterior process of interclavicle poorly developed or absent
interparietal scale enlarged
no preanal pores
nasal concha fused to roof of nasal chamber
nasal vestibule relatively short and straight
bisulcate, weakly to strongly bicapitate hemipenes
Comment:
Bell's Tropiduridae seems to have priority over Fitzinger's Steirolepides, Ptychosauri, and Heterotropides
Reference:
Frost, D.R. & Etheridge, R.E. (1989)
A Phylogenetic Analysis and Taxonomy of Iguanian Lizards (Reptilia: Squamata). Univ. Kansas Mus. Nat. Hist. Misc. Publ. 81

FIG. 2. Higher taxon sample entry.

The higher taxon database is currently under development and not yet available to the public. We expect release in January 1997. It will allow automatic reconstruction of taxonomic hierarchies by means of the "Up" data field, e.g., all lower taxa of a family or all higher taxa pertaining to a species.

The database can be accessed easily on the World Wide Web. A form allows for quick searching of different data fields (e.g., species or distribution). Logical combinations are possible (e.g., "*Tantilla*" OR "*Coluber*" combined with "USA" OR "Mexico" searches for all *Tantilla* and *Coluber* species in both Mexico and the USA).

Alternatively, the database can be browsed via hierarchically organized web pages starting with a taxonomic overview (subclasses, orders, suborders). From there, infraorders/superfamilies, families, and genera can be accessed. Clicking on a single genus

eventually activates the search engine and retrieves all species of a particular genus.

A major advantage of the SRS system is its ability to be linked to other databases. So far, we have implemented a link to the GenBank DNA sequence database. Thereby, it is possible to search for all species of, say, *Anolis* and list all available sequence data alongside. In the future it is expected that other areas of biology will be made available as databases as well. It can easily be conceived that databases of taxonomy and molecular biology, and eventually of morphology, ethology, and other disciplines will be flexibly intertwined as they deserve to be from a biological viewpoint.

In the long run, newly described species should be entered into the database in addition to regular publication. We encourage herpetological journals to adopt a policy similar to molecular biology journals, requiring parallel submission of manuscripts to the journal and primary data to the database. (Note that many molecular biology journals do not print DNA sequence data anymore but refer readers to an accession number in a public DNA database.) For instance, *Herpetological Review* might ask authors for submission of new distribution data to the database before publication. The database would then also serve as a public repository for all these data.

The database should be considered as an experiment for the time being. We are well aware of the fact that the data are incomplete, and some may be outdated or even wrong. The success and usability therefore depend on the contributions of external experts. In particular, we are seeking specialists interested in serving as coordinators (or "reviewers") for higher taxa. Additional information for contributors may be found on our web page.

We are in great debt to people who provided species lists or other information, in particular Petr Neças (Chamaeleonidae), Klaus Adolphs (Gerrhosauridae, Cordylidae), Hermann Seufer (Gekkonidae), Wolfgang Bischoff (Lacertidae), and Adam Britton (Crocodylia). Drs. Stephen Brown, Wolfgang Wüster, and Scott Moody made helpful comments on this note.

The EBI Reptile database:

http://www.embl-heidelberg.de/~uetz/LivingReptiles.html

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INSTITUTIONAL PROFILE

The Early Collections and Curators, Division of Reptiles and Amphibians, Museum of Zoology, University of Michigan

ARNOLD G. KLUGE
Museum of Zoology, University of Michigan
Ann Arbor, Michigan 48109-1079, USA

A large number of amphibians and reptiles had accumulated in the Museum of Zoology by the time the Division of Reptiles and Amphibians was officially recognized in 1917 (H. T. Gaige 1920; Rogers 1956; Ruthven 1920). Actually, the history of the Museum's collections can be traced to June 21, 1837[1] when the Michigan State Legislature budgeted for a Cabinet of Natural History, renamed the Museum of Natural History in 1881 (Ruthven 1910). Among the earliest specimens acquired by the University was a *Bufo americanus* (UMMZ 20), contributed by Professor Abram Sager in 1837, from the southeast part of the state. As early as 1863, there were 81 amphibian entries representing 212 specimens, and 290 reptile entries representing 336 specimens (Winchell 1864:17). Many of these early specimens were part of the Trowbridge Collection, which was donated by the Smithsonian Institution in 1859. Much of that collection was obtained by Lieutenant William Petit Trowbridge, a University of Michigan professor, while in the United States Army during his tour of duty along the Pacific Coast, from San Diego to Puget Sound (1853–1856). Other significant early sources of materials were the Beal-Steere collections, which were made by Professor Joseph Beal Steere in South America and the Orient during his trip around the world in 1870–1875 (Winchell 1871, 1873) and subsequent expeditions in 1879 and 1887–1888 (F. M. Gaige 1932; Rogers 1956). Although most of the early catalogued amphibian and reptile material is no longer available, there are some interesting exceptions. For example, there remain two well preserved *Ambystoma tigrinum* (UMMZ 150) collected by W. J. Beal in 1857 from Lenawee County, Michigan, and two *Nerodia sipedon* (UMMZ 38) in equally good condition, collected by R. Frazer on May 2, 1858, from Ann Arbor. Unfortunately, very few of the Division's Trowbridge and Beal-Steere specimens can be located. In addition to the actual catalogues in which amphibians and reptiles are registered, details of the early accessions were published in University of Michigan, Museum of Zoology (1861) and Winchell (1864, 1866, 1867, 1868, 1870, 1871, 1873).

[1] The Museum of Comparative Zoology at Harvard University and the Peabody Museum of Natural History at Yale University were founded in 1852 and 1866, respectively (Guthe 1937).

Many science faculty had responsibility for the Museum collections in the early years, including Asa Gray (1838), Abram Sager (1842–1855), Alexander Winchell (1855–1873), Mark W. Harrington (1873–1876), Joseph B. Steere (1876–1894), Jacob E. Reighard (1894–1895), Dean C. Worcester (1895–1898), Herbert E. Sargeant (1898–1903), and Charles C. Adams (1903–1906). Alexander G. Ruthven (1906–1936) was the first professionally trained herpetologist to curate the amphibians and reptiles. He was ably assisted early in his curatorship by Helen Thompson (1912–1918) and Crystal Thompson (1914–1918), who were friends, but not related by birth (Fig. 1). Helen Gaige (née Thompson) was given an official curatorial title in 1919, a position she held until her retirement in 1945. More recent Divisional Curators (Figs. 2–4) were Norman E. Hartweg (1934–1964), Charles F. Walker (1947–1975), and Donald W. Tinkle (1965–1980). Other notable students of amphibian and reptile biology on the University of Michigan faculty, but who did not hold curatorships in the Division, include Reeve M. Bailey, Frank N. Blanchard, William R. Dawson, Carl Gans, Howard K. Gloyd, Nelson G. Hairston, George W. Nace, Laurence C. Stuart, and Frederick H. Test.



FIG. 1. A University of Michigan Museum of Zoology field trip to Schoolcraft County, Michigan, July–August, 1915. Crystal Thompson, Frederick M. and Helen T. Gaige, and Alexander G. and Florence H. Ruthven, from left to right. Crystal Thompson, Helen T. Gaige, and Alexander G. Ruthven curated the amphibian and reptile collections in the Museum of Zoology in the early part of this century, 1914–1918, 1912–1945, and 1906–1936, respectively.

Alexander Grant Ruthven is an extremely important figure in the history of the Division of Reptiles and Amphibians, as he is for the Museum of Zoology and the University of Michigan (Van de Water 1977). The large numbers of specimens acquired by the Division in the early part of this century were due to his field work and particular interest in the study of geographic variation with statistical methods, which led him to emphasize the acquisition of large local samples. He personally led 18 expeditions from the Museum of Zoology (F. M. Gaige 1930), which included major field excursions to the Porcupine Mountains, Ontonagon

County (1904), and Isle Royale (1904 and 1905), Michigan, Clay County and Palo Alto County, Iowa (1907 and 1909), Vera Cruz, México (1910), northeastern Nevada (1912), the Davis Mountains, Texas (1913 and 1915), the Santa Marta Mountains, Colombia (1913), Richland County, Illinois (1913), the Demerara River, British Guiana (1914), and the Pisgah Forest Reserve, North Carolina (1915). "To him museum collections and data were one of the essential tools for deciphering the course and much of the mechanism of evolution, and a *sine qua non* for the construction of a systematics that could aspire to an accurate presentation of taxonomical relationships" (Rogers 1956: 1503). In 1913, the Board of Regents of the University renamed the Museum of Natural History as the Museum of Zoology and appointed Ruthven as its first Director. Division of Reptiles and Amphibians, the official name for the collection of amphibians and reptiles in the Museum, stems from Ruthven (1917:6), although it has not been applied consistently (e.g., Ruthven 1920; H. T. Gaige 1920). It was with Ruthven's considerable effort, beginning in 1918, that funds were secured for the present Museums Building (Fig. 5), which opened in 1928 (Ruthven 1929). Although Ruthven resigned the directorship of the Museum of Zoology and accepted the presidency of the University in 1929, he did not give up his curatorship until 1936. Ruthven was a prolific researcher, with 160 authored or co-authored professional papers bearing his name. He was among the first to publish in the Museum's *Occasional Papers* (1913) and *Miscellaneous Publications* (1922), journal series which he initiated. Ruthven et al.'s (1912, 1928) "The Herpetology of Michigan" continues to serve as a model for state field guides, and his published doctoral thesis, "Variations and Genetic Relationships of the Garter-Snakes," remains a classic study of geographic variation (Ruthven 1908).



FIG. 2. Norman E. Hartweg, Curator (1934–1964), Division of Reptiles and Amphibians, University of Michigan Museum of Zoology.



FIG. 3. Charles F. Walker, Curator (1947–1975), Division of Reptiles and Amphibians, University of Michigan Museum of Zoology.



FIG. 4. Donald W. Tinkle, Curator (1965–1980), Division of Reptiles and Amphibians, University of Michigan Museum of Zoology.

All natural history acquisitions were registered in the same number series early in the Museum's history, and those nine bound volumes are now stored in the Museums Library security cage. In 1916, four separate vertebrate catalogues were initiated, each beginning with number 52001. Volume 11 started the amphibian and reptile series, which lasted until 1975 when volume 21 was completed, and when the Division switched to TAXIR, a mainframe computer database management system. The Division now uses FoxPro in a distributed computing environment to manage electronically all aspects of its collection records. During the last five years, collection growth has averaged more than 4400 specimens per annum. According to the most recent annual report (1994–1995), the Division's holdings have grown to more than 209,000 numbered lots, which represent nearly 400,000 specimens.

That significant herpetological research has been done at the University of Michigan from a very early date is indicated by the fact that of the two Doctor of Philosophy degrees first awarded by the University, in 1876, one was to William Henry Smith for his thesis entitled "The zoology of Anoura and Caecilia." Smith went on to publish his doctoral research (1877), as well as other works dealing with the herpetofauna of Michigan and Ohio (1879, 1882). According to Ruthven et al. (1928:185), Smith's Michigan catalogue (1879) was based in part on the specimens in the University of Michigan Museum. From the time of Alexander



FIG. 5. West end of the reptile range, Division of Reptiles and Amphibians, University of Michigan Museum of Zoology, at the completion of the new Museums building, 1928.

Ruthven well over 50 Ph.D. students have received their degrees under the guidance of curators in the Division of Reptiles and Amphibians.

Further details concerning the Division of Reptiles and Amphibians are available by the World Wide Web: http://www.ummz.lsa.umich.edu/herps/herpdiv.html. These include bibliographies for past curators, H. T. Gaige, N. E. Hartweg, A. G. Ruthven, C. Thompson, D. W. Tinkle, and C. F. Walker, a list of students earning Ph.D. degrees whose major professor was a Curator in the Division, annual reports, and various policy statements pertaining to the use of specimens and other materials in the Division's care.

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ARTICLES

Daily Movements of Male *Phyllomedusa bicolor* in Brazil

SELVINO NECKEL DE OLIVEIRA
Departamento de Ecologia
Instituto Nacional de Pesquisas da Amazonia - INPA
C. P. 478, 69011-970 Manaus, Amazonas, Brasil

Calling sites of many anuran species are usually in close proximity to ponds or streams (Zimmerman and Rodrigues 1990). Little is known, however, concerning the location of daily retreat sites of arboreal species. These sites must certainly be sufficiently moist to prevent desiccation (Duellman and Trueb 1986) and offer some protection against predation. Neotropical frogs of the genus *Phyllomedusa* are arboreal and nocturnal. During breeding periods, males can be observed on perches near ponds and streams (Zimmerman and Rodrigues 1990). *Phyllomedusa bicolor*, the largest species in this genus, exhibits the common behavior of calling from perches, although it can be seen occasionally on the forest floor (pers. obs.). As with most anurans, no information exists as to the daily retreat sites of this species.

The objectives of this study were 1) to identify diurnal retreat sites of calling males of *P. bicolor*; 2) to measure the distance of the retreat site to the calling site; and 3) to compare distance traveled on the forest floor to distance in shrubs and trees.

Observations and marking of individuals were performed 23–30 May 1994 in the Adolfo Ducke Reserve, ca. 25 km north of Manaus, Amazonas, Brazil (3°8'S, 60°4'W). The reserve measures 100 km^2, and is covered in humid tropical rainforest not subjected to annual flooding (Kahn and Castro 1985). Work was carried out at four distinct sites within the reserve: one small pond (5 m wide by 11 m long) located close to a stream, and three ponds (0.3–3 m wide by 24–33 m long) formed by wheel ruts along an access road. Ponds were visited at night and nine males and one female were encountered at these sites and used in this study. All animals were measured (SVL) and weighed. To identify retreat sites of calling males and measure distance traveled from the calling perch to the retreat site, a small spool of fine nylon thread was attached to each calling male. Spools were encased in plastic and attached dorsally to males in a backpack fashion. The loose end of the thread was then tied to the perch and the animal was replaced on the perch where it had been calling. The female was replaced on the same branch where it had been taken. The entire apparatus weighed less than 3.5 g (ca. 4–7% of male body weight).

Retreat sites were identified by visiting the sites on mornings following nocturnal markings. The thread was followed for each marked animal and retreat sites identified. The distance between the retreat site and the calling perch (or observation locale for the female) was estimated by measuring the thread along its entire path. The proportion of the total distance that was traveled on the ground and above ground was calculated by following the thread.

Mean weight for males was 68 g (± 9 g), and mean SVL was 105.9 mm (± 4.4 mm). The lone female weighed 98 g and measured 115 mm. Overall daily movement distance varied considerably among males from 6.5–46.6 m (mean 26.1 ± 10.7 m) (Table 1). Distance traveled on the forest floor was highly variable (mean 8.3 ± 7.0 m) as was that on vegetation (mean 17.8 ± 8.1 m). Only two males did not travel on the forest floor. The lone female traveled 17.3 m on the forest floor and 21.3 m on vegetation.

Exact retreat site location was identified for only five males and the female. For the other marked animals, the thread could be seen in the tree, but I was unable to follow it entirely to the animal. The retreat site for these individuals was estimated by measuring the thread until it disappeared in the canopy. Therefore, the mean height of the retreat sites is an underestimation. Retreat site height for males varied from 1.5–9.0 m (mean 6.3 ± 2.6 m). The height of the female's retreat site was 5.3 m. All retreat sites were on small branches less than 1 cm in diameter.

Because of the loss of spools, only two males were observed on consecutive nights. Both animals used the same retreat site on both nights and the same route to get there.

TABLE 1. Daily movements (in m) of male *Phyllomedusa bicolor* from calling sites to retreat sites. Data for a single female also are included. Individuals 1 and 2 were observed on two consecutive nights and the values are reported here. An asterisk denotes males for which the exact retreat site could not be located. Values for these individuals were estimated on the position of the thread in the canopy.

	Distance Travelled					
	Forest Floor		Vegetation		Total	Retreat site
	m	%	m	%	m	m
male 1	16.7	59.6	11.3	40.3	28.0	1.5
	18.3	60.2	12.1	39.8	30.4	1.5
male 2*	8.5	39.5	13.0	60.5	21.5	7.0
	8.5	39.5	13.0	60.5	21.5	7.0
male 3*	12.1	26.0	34.5	74.0	46.6	5.5
male 4*	2.0	6.9	27.3	93.1	29.3	7.0
male 5	3.0	16.2	15.5	83.8	18.5	7.0
male 6*	17.5	44.9	21.5	55.1	39.0	9.0
male 7	4.0	15.7	21.5	84.3	25.5	7.0
male 8	0.0	0.0	6.5	100.0	6.5	8.0
male 9	0.0	0.0	20.0	100.0	20.0	9.0
mean for males	8.3	31.8	17.8	68.4	26.1	6.3
female	17.3	44.7	21.3	55.3	38.7	5.3

Male *P. bicolor* were encountered resting on small branches high up in the vegetation during the day as suggested by Duellman and Trueb (1986). During daily resting, anurans must escape predation and prevent desiccation. Because *P. bicolor* individuals possess lipid glands in the epithelium whose secretions protect the animal from desiccation (Blaylock et al. 1976), this species probably can withstand unfavorable conditions better than others. My observations that two males used the exact same retreat sites suggests that these sites are not chosen randomly and that "good" sites are reused by the same individual. Schlesinger and Shine (1994) showed that the nocturnal lizard *Oedura lesueurii* was highly selective in its choice of diurnal retreat sites, behavior that decreases exposure to predation and allows thermoregulation.

The long distance traveled on the forest floor by individuals of *P. bicolor* remains to be explained. This species has very large toe pads and therefore would be expected to spend most of its time off the ground. The slow-moving behavior of this species and its relatively poor jumping ability (pers. obs.) may make a route to retreat sites that includes forest floor travel plausible.

Daily movement of anurans has been related to feeding, predator avoidance, reproduction, and physiological maintenance (Bayliss 1994; Breden 1987; Dole 1965; Woolbright 1985). Some species have been observed to migrate long distances in search of food, as shown for *Rana pipiens* (40–160 m; Dole 1965), *Bufo bufo* (45–75 m; Gittins 1980), and *B. marinus* (mean = 141 m per night; Bayliss 1994). Daily movements related to reproductive behavior are generally much shorter, as seen for *R. pipiens* (0–32 m; Dole 1965) and *Eleutherodactylus coqui* (3.0–4.5 m; Woolbright 1985). In this study, daily movements of *P. bicolor* suggest that individuals remain in close proximity to vocalization sites. However, few of the above-mentioned species are truly arboreal, and therefore comparisons of daily movements should be made with caution.

Acknowledgments.—This study was performed during the field course "Ecology of a Tropical Rainforest" offered by the Ecology Department of the National Institute for Amazonian Research. I wish to thank W. Magnusson, R. Vogt, and C. Gascon for their supervision and suggestions. A. S. B. De Faveri, A. Carvalhaes, and students from the Graduate Program in Ecology at INPA are thanked for helpful discussions and suggestions (G. Mourão, C. C. Durigan, J. Maco Garcia, M. A. Freitas, M. Gordo, and U. Galatti).

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Interclutch Interval and Egg Aggregations in the Tropical House Gecko, *Hemidactylus mabouia*

BRIAN C. BOCK
Fundación Natura, AA 55402
Bogotá, Colombia

Present address: U.S. Man and the Biosphere Program
OES/ETC/MAB, Suite 107, SA-44c
United States Department of State, Washington, D.C. 20522-4401, USA
e-mail: bbock@state.gov

Hemidactylus mabouia produces clutches of two eggs, which are deposited in crevices and under debris (Dixon and Soini 1986; Rivero 1978; Vitt 1986). Aggregations of up to 60 *H. mabouia* eggs have been interpreted as evidence for communal nesting in this species (FitzSimons 1943). In northeastern Brazil, Vitt (1986) encountered gravid *H. mabouia* throughout the year, some of which contained both vitellogenic follicles and oviductal eggs, implying that females may be capable of producing numerous clutches per year. Here I present additional data which suggest that annual fecundity in *H. mabouia* may be high, as well as evidence that some aggregations of eggs in this species are the result of repeated use of the same oviposition site by individual females, rather than communal nesting.

Hemidactylus mabouia occurs in association with human settlements throughout much of the Amazon basin (Dixon and Soini 1986; Kluge, 1969; Sánchez et al. 1995; Vitt 1986). This study was conducted in the town of La Pedrera, Amazonas Department, Colombia, located on the Caquetá river near the border with Brazil (1°18'S, 69°33'W). Unlike Vitt's (1986) Brazilian study site, this area lacks a well defined dry season, with average monthly rainfalls of at least 135 mm throughout the year (Duivenvoorden and Lips 1993). *Hemidactylus mabouia* is a good colonizer (Kluge 1969; Lawson et al. 1991; Meshaka et al. 1994) and probably dispersed to La Pedrera via cargo flights from Leticia. It apparently has not yet spread to any other nearby human settlements along the Caquetá river.

I encountered four aggregations of *H. mabouia* eggs while renovating an abandoned house in La Pedrera (Table 1). In one case, I encountered only intact eggs, but the other groups contained both incubating eggs and shell fragments from eggs that presumably had already hatched. It was possible to estimate the number of eggs that had already hatched in one of these aggregations. All aggregations were found during the months of September and October, but this should not be considered as evidence for seasonal nesting at this site. Rather, these months were periods of more intensive work on the house renovations. Juvenile *H. mabouia* were seen in the house throughout the year.

Eggs sizes (mean egg length = 9.8 mm, SD = 0.49; mean egg width = 8.7 mm, SD = 0.43; N = 14) were comparable to those reported for this species from other neotropical sites (Dixon and Soini 1986; Schwartz and Henderson 1991; Vitt 1986), but smaller than those reported from South Africa (FitzSimons 1943). I rolled intact eggs from each aggregation into pieces of tissue paper and enclosed them in inflated plastic bags. The eggs experienced ambient indoor temperatures which fluctuated between 25°C and 32°C. The bags were checked daily and any newly emerged

hatchlings were removed, measured, and released. Hatchling sizes (mean SVL = 23.4 mm, SD = 1.07; mean tail length = 25.3 mm, SD = 1.78; N = 18) were comparable to those reported for this species from other neotropical sites (Dixon and Soini 1986; Hoogmoed 1973; Schwartz and Henderson 1991; Vitt 1986), but smaller than those reported from South Africa (FitzSimons 1943).

TABLE 1. Summary of information on the four aggregations of *Hemidactylus mabouia* eggs encountered in this study. In two cases, shell fragments were too small to permit an accurate estimation of the number of eggs that had already hatched.

Group	Location	Number of eggs: estimated already hatched	found still incubating	to eventually hatch
1	in a cavity created within a wooden beam by termite activity	25	3	2
2	in a crevice under a flat rock	0	6	6
3	among coals and ashes in an abandoned stove	?	7	7
4	among coals and ashes in an abandoned stove	?	4	3

Two eggs from the smallest aggregation hatched on the same day and the third egg failed to hatch. In the other three groups, eggs also tended to hatch nearly simultaneously in pairs. The interval between hatching of pairs of eggs within these groups was approximately 16 days, or some multiple thereof (Fig. 1). The emergence of hatchlings in pairs suggests that female *H. mabouia* usually lay both eggs of a given clutch together. The regular periodicity of hatching of pairs of eggs within groups also suggests that females in this population produce clutches on average every 16 days and that they tend to return to the same oviposition site for successive clutches. In only one instance did a pair of eggs hatch out of synchrony with the other eggs with which they were associated (group 3b, Fig. 1). This probably resulted from true communal nesting (i.e., from a second female laying in a site where another female had already deposited several clutches).

Although the total incubation period for *H. mabouia* eggs in this population is not known, the maximum period between encountering an egg and its hatching in this study was 71 days. Dixon and Soini (1986) reported an encounter-to-hatching time for a *H. mabouia* egg in Perú of at least 77 days. Thus, with an interclutch interval of 16 days, any aggregation of up to ten incubating eggs could conceivably have all been laid by a single female. Larger aggregations of eggs in this species probably represent the occurrence of both communal nesting and repeated use of the same nesting site by individual females, as has been demonstrated also in *Ptyodactylus hasselquistii* (Werner 1986).

Hemidactylus mabouia appears to reproduce throughout the year, both at La Pedrera and at more seasonal sites (Butterfield et al. 1993; Vitt 1986). Thus, a female with a 16-day interclutch interval could conceivably lay up to 46 eggs annually. The aggregation of 28 eggs and egg shells documented by this study may well have been the result of repeated use of the same oviposition site by a single female rather than of communal nesting. Although

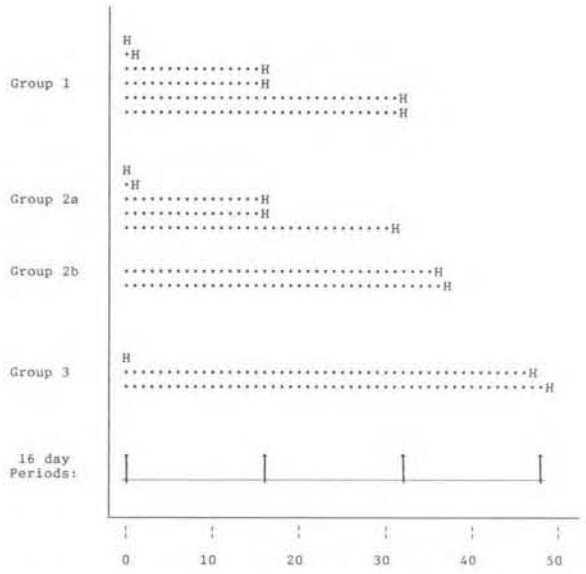


FIG. 1. Pattern of hatching (H) in the aggregations of *Hemidactylus mabouia* eggs, beginning with the day the first egg in each group hatched. Intervals of 16 days are indicated by the arrows. Eggs in group 3a were probably laid by one female and those in group 3b by another female at the same site.

H. mabouia may occasionally nest communally, not all aggregations of viable eggs and hatched egg shells should be interpreted as such. The pattern of inter-hatching intervals exhibited by the aggregations of eggs in this study suggests that when there is an abundance of oviposition sites, female *H. mabouia* may prefer to lay repeatedly in sites not in use by other females.

Three adult specimens of *H. mabouia* were deposited as vouchers (ICN 7252-54) in the collections of the Museo de Historia Natural, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá.

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Pseudacris crucifer: An Iowa Case History Study of an Amphibian Call Survey

TERRY J. VANDEWALLE
Biology Department, Des Moines Area Community College
Bldg. 4, 2006 South Ankeny Boulevard, Ankeny, Iowa 50021, USA
e-mail: TVandew925@aol.com

KRISTI K. SUTTON
Department of Biology, Olin Hall
Drake University, Des Moines, Iowa 50311, USA
e-mail: Pangaea@aol.com

and

JAMES L. CHRISTIANSEN
Department of Biology, Olin Hall
Drake University, Des Moines, Iowa 50311, USA
e-mail: JC7291R@acad.Drake.edu

Surveys for calling amphibians have become increasingly popular in recent years. Most North American programs are located in northern and eastern portions of the continent, where anurans call during their breeding season. In 1991, the Iowa Department of Natural Resources' (DNR) Wildlife Diversity Program initiated an annual Frog and Toad Survey to update species distribution maps and provide data for a long-term study on amphibian population trends. As of 1994, 69 of Iowa's 99 counties had at least one survey route. Survey participants are provided with an audio tape of the calls of Iowa anurans, and a copy of *The Salamanders and Frogs of Iowa* (Christiansen and Bailey 1991). Volunteers develop a route, consisting of five or more likely breeding sites within a single county. Observers are instructed to visit each site once during each of three time periods: 1–28 April, 7 May–4 June, and 13 June–10 July. Upon reaching a site, participants are to listen for five minutes after anurans begin calling and record all species heard. The present study is an examination of the benefits and difficulties associated with data from the Iowa Frog and Toad Survey based on our follow-up studies of reports of *Pseudacris crucifer* in central Iowa. It also reports a large range extension for the species in Iowa.

Since 1991, *P. crucifer* has been reported by survey participants from five central Iowa counties where the species was previously unknown. These include: the Des Moines River drainage counties of Boone and Hamilton; Marshall County in the Iowa River drainage; Sac County in the Raccoon River Drainage; and Ringgold County on the Iowa-Missouri border (Fig. 1). These locations range from 100–200 miles west of the previously known Iowa range of *P. crucifer* (Fig. 1). In April and May 1995, the authors visited these localities during peak calling time to verify the presence of *P. crucifer*. Aural surveys were conducted at each location on nights when the species was heard calling elsewhere. All anuran species heard calling at each location were recorded, and a single voucher specimen of each species was usually collected. The specimens were deposited in the Drake University Research Collection under DNR Permit # SC-255-9501.

The follow-up studies and collections verified the presence of *P. crucifer* at two locations in Boone County, but failed to support the existence of the species in Marshall, Ringgold, Hamilton, and Sac counties (Fig. 1, Table 1). While the possibility exists that *P. crucifer* is present at some of these sites, we believe that our multiple site visits reduce the risk of not detecting an extant population. Of the sites at which *P. crucifer* was found to be absent, only the Ringgold and Marshall County sites were visited a single time (Table 1), and the Ringgold County visit was under ideal conditions when the species was calling elsewhere. The Ringgold County site was isolated well away from a major water course and four other species were heard calling there (Table 1). It is more likely that an extant population was not detected at the Marshall County site. It is located close to the Iowa River and was visited in mid-April on a night when air temperatures were low (4–7°C).

The discovery of *P. crucifer* in Boone County suggested that they may be found farther north in the Des Moines River valley, and as such, we extended the survey north into Webster County. *Pseudacris crucifer* was subsequently found at two locations in that county along the Des Moines River (Fig. 1). The Boone and Webster County locations are new county records and constitute a significant northwestward extension of the previously known range in Iowa (Christiansen and Bailey 1991). Additionally, Fig. 1 shows a new locality established for this species in Appanoose County, where neither Iowa Frog and Toad Survey participants nor previous surveys had found them.

This study demonstrates one of the most valuable aspects of the DNR survey, that of calling attention to previously unknown localities. While *P. crucifer* was not found at all of the locations, by following leads provided by the DNR survey, we were able to extend the known range of the species approximately 100 miles northwest in the Des Moines River drainage, and slightly over 100 miles west of all previously known Iowa *P. crucifer* populations. The study also illustrates some apparent problems with volunteer-based surveys. Other authors have also addressed the advantages and disadvantages of calling surveys (Bishop et al. 1996; Scott and Woodward 1994).

The potential for species misidentification arises when relatively untrained individuals provide locality records without expert, specimen, or photographic verification. It is clear from at least one instance that an observer confused the call of *P. crucifer* with that of *Acris crepitans*. The authors visited the Sac County sites with the volunteer observer and asked the observer to identify the *P. crucifer* call. The call identified by the observer turned out to be that of *A. crepitans*. A specimen was subsequently collected and shown to the observer. It is also likely that some observers may have confused the call of *P. crucifer* with that of *Pseudacris triseriata*, because *P. crucifer* and *P. triseriata* are heard calling in a mixed chorus on the species identification tape sent to volunteers. Many participants in the survey are elderly, and evidence suggests that for those who have lost the upper range of

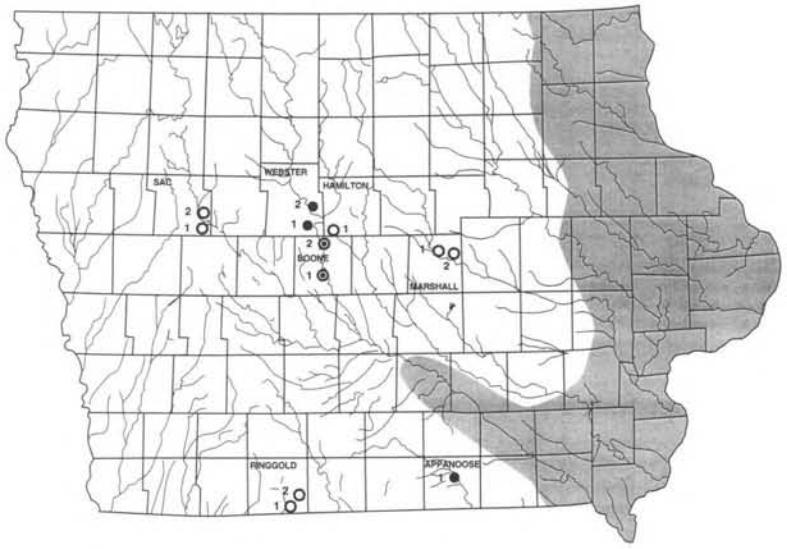


FIG. 1. Reported localities and previously known range of *Pseudacris crucifer* in Iowa. Open circles = localities reported by Iowa Frog and Toad Survey participants for which repeated visits failed to yield evidence of *P. crucifer*. Open circles with centered dots = localities reported by Iowa Frog and Toad Survey participants that yielded *P. crucifer* and prompted further studies of the Des Moines River valley. Closed circles = new *P. crucifer* localities discovered during the present study. Shaded area = known range of *P. crucifer* at the time of Christiansen and Bailey (1991).

their hearing, only *P. triseriata* can be heard on the DNR tape, and possibly in the field. The potential for inter-observer variation is illustrated by the Hamilton County site. *Pseudacris crucifer* was reported from the site by an observer in 1994, but another pair of observers have not reported the species during surveys of the same site from 1991–1994.

At a time when amphibian populations are thought to be declining worldwide, annual regional surveys, such as the Iowa DNR Frog and Toad Survey, are an inexpensive way of collecting information regarding anuran distribution and relative abundance. All calling amphibian surveys suffer from statistical problems similar to those experienced by ornithologists in programs such as the North American Breeding Bird Survey. Currently, the North American Amphibian Monitoring Program is attempting to develop a statistically defensible means of detecting changes in

TABLE 1. Summary of *Pseudacris crucifer* data from the Iowa Department of Natural Resources Frog and Toad Survey and the present study (1995 survey).

County	Site	Month/Year *P. crucifer* reported in DNR Survey	Presence/Absence of *P. crucifer* in 1995 Survey	Number of site visits in 1995 Survey	Sympatric species in 1995 survey
Boone	1	May 1993	Present *	1	*Pseudacris triseriata*
Boone	2	April/May 1991–94	Present *	1	*Pseudacris triseriata*
Hamilton	1	April 1994	Absent	2	*Pseudacris triseriata*
Marshall	1	April 1991–94	Absent	1	*Pseudacris triseriata*
Marshall	2	April 1991–94	Absent	1	*Pseudacris triseriata*
Ringgold	1	April 1994	Absent	1	*Pseudacris triseriata* *Bufo americanus* *Acris crepitans* *Hyla chrysoscelis* *Rana catesbeiana*
Ringgold	2	April 1994	Absent	1	*Bufo americanus*
Sac	1	June 1991	Absent	4	*Bufo americanus* *Acris crepitans* *Hyla chrysoscelis* *Rana pipiens*
Sac	2	June 1991	Absent	4	*Bufo americanus* *Acris crepitans* *Hyla chrysoscelis* *Rana pipiens*
Webster	1	N/A	Present *	1	*Bufo americanus*
Webster	2	N/A	Present *	1	*Pseudacris triseriata*

* New County Record

anuran distributions and populations. Volunteers trained to identify anuran calls are essential to these programs, and the present study clearly shows the value of their work. It also shows the need for verification by professionals.

Accuracy of data obtained from the Iowa DNR survey could be increased with improvement in three areas. At present, volunteers are not provided with any formal training in identifying anuran calls. Implementing an annual or biannual training program would increase observer accuracy, help with volunteer recruitment efforts, and may keep volunteers active from year to year. Improving the species identification tape may also increase observer accuracy. Most species on the tape are heard calling in mixed choruses of two or three species. Changing the tape so that species are heard individually would help observers identify specific calls. Lastly, species are often reported from outside their known range. Verification of the most reliable of these reports by professional herpetologists may lead to the discovery of previously unknown breeding sites, as demonstrated by the present study.

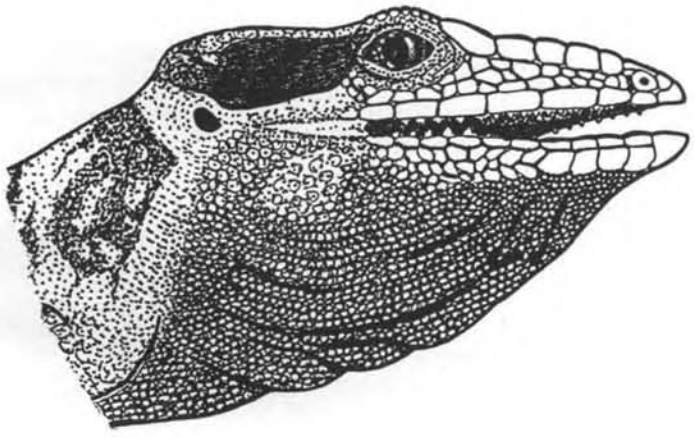
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Anolis darlingtoni, holotype, MCZ 38251. Haiti: Roche Croix, Massif de la Hotle. Illustration by J. Lazell.

Regurgitation by the American Alligator

ROBERT H. CHABRECK
School of Forestry, Wildlife and Fisheries
Louisiana Agricultural Experiment Station
Louisiana State University Agricultural Center
Baton Rouge, Louisiana 70803, USA

The presence of gastroliths in stomachs of American alligators (*Alligator mississippiensis*) has been a subject of much discussion. Non-food items such as wood, glass, plastic, and stones are often ingested incidental to prey capture (Kellogg 1929, Neill 1971). Some items also may be deliberately ingested and retained in the stomach as gastroliths (Brazaitis 1969, Peaker 1969). Cott (1961) believed that gastroliths retained in the stomach of the Nile crocodile (*Crocodilus niloticus*) functioned as ballast that made it easier for the animals to remain submerged. Some writers believed that gastroliths served as grinding tools in the stomach and aided in digestion (Grenard 1991; Neill 1971).

Large amounts of non-food items and other undigestible material such as hair and scales have been found in alligator stomachs and have lead some writers to believe that the items accumulated in the stomach because of the inability of alligators to regurgitate. McIlhenny (1935) believed that everything consumed by *A. mississippiensis* including hair, scales, and feathers, plus wood and other foreign substances, was eventually digested and stated that nothing is rejected through the mouth. Evans (1970) discussed secondary poisoning of *A. mississippiensis* associated with a nutria (*Myocastor coypus*) control program and stated that alligators were unable to regurgitate even if an emetic was included with the poison.

During 1991 and 1992 while conducting an investigation of alligator movement and survival using radio telemetry, I documented regurgitation by *A. mississippiensis*. Radio collars were placed on 140 juvenile *A. mississippiensis* from 1.2–1.5 m total length (TL). The alligators were released in a freshwater marsh ca. 40 km southwest of New Orleans, Louisiana, USA. The radios had a normal signal pulse rate of 55–60 beats per minute and were equipped with a mortality sensor that increased the pulse rate to 100–110 beats per minute if the radio was motionless for a 24-h period.

During the study, mortality signals were received from 26 radios, and the radio collars were located with a directional antennae. All radio collars were recovered, and most were found on the bottoms of shallow ponds. The cause of mortality was cannibalism in 23 of 26 cases. Rootes and Chabreck (1993) reported that cannibalism is common in *A. mississippiensis*, and even adult alligators are occasionally taken as prey by larger alligators. Cannibalism was confirmed by the presence of tooth marks on the plastic portions of the radio units and nutria hair or other material commonly found in alligator stomachs imbedded in the collar. One alligator, 1.2 m TL, with a radio collar attached was recovered from the stomach of a 2.1 m TL male alligator taken during a harvest program in September 1991 (Addison 1993).

In all 23 cases, the radio collar remained in the stomach until digestion of the alligator was complete, then the radio collar was regurgitated. The radio collar could not be excreted with fecal material because of the size of the radio unit. The minimum diameter of the radio unit was 6 cm, which was almost twice the diameter of the small intestine of the largest alligator (3.2 m TL) taken during the harvest program. Radio collars were recovered within 24 h after the mortality signal was received, and no alligator remains were found attached to any of the collars. The amount

of time for the cannibalized alligator to be digested could not be determined because the time of predation was unknown. The radios transmitted at a normal pulse rate within the stomach of the predator, and the mortality sensor was not activated until the radio collar was regurgitated.

Stomachs of some wild alligators contain an abundance of undigestible items (Delany and Abercrombie 1986, Wolfe et al. 1987), and the animals must periodically regurgitate to move material that can not be digested. The ability of *A. mississippiensis* to regurgitate undigestible items is important for keeping intestinal space available for large prey items.

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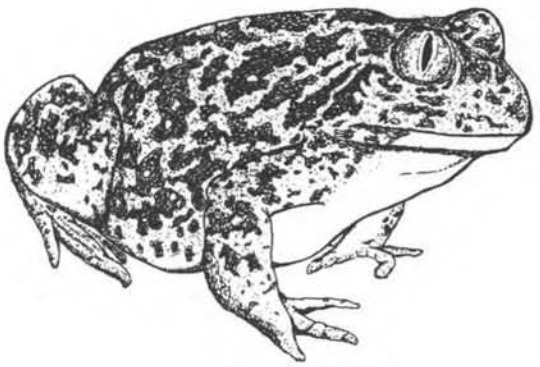
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Pelobates syriacus balcanicus. Illustration by Dan Cogălniceanu.

TECHNIQUES

The Use of PVC Pipes to Capture Hylid Frogs

CYNTHIA A. MOULTON*
North Carolina Cooperative Fish and Wildlife Research Unit
National Biological Service, North Carolina State University
Raleigh, North Carolina 27695, USA

W. JAMES FLEMING
North Carolina Cooperative Fish and Wildlife Research Unit
National Biological Service, North Carolina State University
Raleigh, North Carolina 27695, USA

and

BRENDAN R. NERNEY
The Chelsea School, Silver Spring, Maryland 20910, USA

**Present address: Department of Natural Sciences*
Castleton State College, Castleton, Vermont 05735, USA

Drift fences, pitfall traps, and spotlighting have long been used for amphibian censusing (Campbell and Christman 1982). Hylid frogs, however, can climb out of pitfall traps, climb over drift fences, and may escape visual detection because of their densely vegetated habitat (Dodd 1991, Jones 1986, Greenberg et al. 1994). Anecdotal accounts have reported treefrogs in PVC pipe or bamboo stalks, and we explored the use of PVC pipes for treefrog population assessments. Field studies in 1993 and 1994 addressed the following questions:

1. If a number of pipes were placed in randomly selected wetland habitat sites, would treefrogs use them as resting/hiding spots during the day?
2. Would it be possible to capture enough treefrogs in the PVC pipes to conduct mark-recapture population analysis?
3. Would different species, sizes and age classes of treefrogs use the pipes?
4. What design configuration would maximize trapping success?

Unless otherwise indicated, we used 1 m sections of opaque white PVC pipe (2 cm inside diameter) inserted upright in the ground. Frogs are not restrained or restricted in these pipes; they may climb freely in and out of the hollow opening at the top. During trapping sessions, we checked all pipes daily (between 0700 and 1700 h). When extremely overcast days and/or thick vegetative cover impaired visibility inside the pipe, we ran a flashlight along the outside of the pipe to see if a frog had taken refuge inside.

Trapping was conducted at the Pocosin Lakes National Wildlife Refuge (PLNWR), Washington County, North Carolina, USA, for 21 trapping days per site from June through August, 1993. Paired PVC pipes were placed at 10 m intervals along 250 m of ditch habitat, 1 and 2 m from the water's edge. At three of the 10 sites, we also placed ten 1 m length, 5 cm inside diameter, PVC pipes. We also surveyed each site twice per trapping session for nighttime frog calling. Night surveys entailed visiting each site (at least 30 minutes after sunset) for a 10 minute period. Each calling species was assigned a category of abundance as single (one individual), few (at least 2 but no more than 3), several (more than 3 individuals, with each call distinguishable from the other), or abundant (chorus; so many frogs calling that individual calls could not be distinguished).

From June through September, 1994, we conducted 12 trapping sessions totaling 33 trapping days at each of 9 sites. Pipes were set in an 80 point grid (9x9, excluding the middle point) around a round cattle trough (which served as an artificial breeding pool). Points were 1 m apart, with 2 pipes placed at each point. Along the ditch nearest to each trough (within 100 m), paired pipes were set at 1 m intervals for 25 m. Because we heard *H. femoralis* chorusing from a small natural breeding pond in June, we also set 50 pipes 1 m apart along the edge of this pond, and checked these pipes for 10 2-day trapping sessions.

In 1993, 62 individuals of 3 species (*Hyla cinerea*, *H. femoralis*, and *H. squirella*) were found in the PVC pipes. All frogs were of adult size (21 to 51 mm svl). Most captures occurred in the 2 cm diameter PVC, with only 2 of 133 total captures in the 5 cm diameter PVC. A definite relationship exists between call survey and PVC trap results. Where we heard a species calling, we caught that species in the pipes.

In 1994, we captured 78 individual *H. femoralis*, with 210 recaptures. We also caught newly emerged *H. femoralis* (8 mm SVL) and *Pseudacris ocularis* (15 mm SVL) in PVC pipes. We trapped between zero and six individuals per trough site per day, yet consistently trapped between four and eight frogs at the natural breeding pond site. After determining whether the pipe was in vegetative cover, partial cover, or no cover, we registered no significant difference in capture rates among the three categories of cover ($P<0.05$; $X^2=3.75$). Captures occurred in pipes without vegetative cover 109 times, in partially covered pipes 104 times, and in pipes covered by vegetation 70 times.

Using PVC pipes to trap adult and newly-emerged treefrogs for quantitative field studies appears to be a useful way to monitor hylids, and possibly other frogs as well. Site placement was important to our study. The only trough site where frogs were neither captured nor heard calling was located within 500 m of the natural breeding pond. However, hylids occupied and were trapped successfully at artificial breeding pool sites >1500 m from this natural pond. When designing field studies, the following criteria should be considered:

1. Pipes should be arranged near natural or artificial breeding areas.

2. Distances between pipes at small ponds or artificial pools should be small. Pipes may be placed further apart in large wetlands where breeding activity is more widespread. We recommend a 1–5 m interval to facilitate trapping and recapture success at small sites, and a 10 m (or more) interval at large sites.

3. Trapping sessions should be 2 or 3 days. Longer sessions increase site disruption, do not add significant numbers of individuals to the data set, and are more likely violate the assumption of a "closed population" necessary for some types of analyses.

Using PVC pipes to "trap" treefrogs eliminates trap mortality and allows movement for breeding and foraging activity. This trapping method is inexpensive and easy to use, set up and store. By using PVC pipes to trap treefrogs, quantitative field studies may serve to supplement call surveys, to assess effects of experimental treatments (e.g., pesticide applications), and to monitor population trends.

Acknowledgments.—We thank Cheryl Kelley and Kristen Lehman for their assistance in trapping and David Kitts for sharing his general knowledge of habitat on PLNWR and help in site selection. Many thanks go to Herman Berkhoff, Joe Phelps, and Paris Trail for recounting their experiences of finding treefrogs in pipes and bamboo. Kenneth H. Pollock, George Barthalmus, and Harold Heatwole provided useful guidance for the study design. Harold Heatwole and James D. Nichols kindly reviewed this manuscript.

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Evaluation of a Radio-Belt for Ranid Frogs

GALEN B. RATHBUN

and

THOMAS G. MURPHEY

Piedras Blancas Research Station, California Science Center
National Biological Service, San Simeon, California 93452-0070, USA
e-mail (GBR): galen_rathbun@nbs.gov

Although biologists have developed numerous ways of marking anurans (Heyer et al. 1994), there are relatively few reports regarding the performance of radio-tags attached successfully to frogs and toads (e.g., van Gelder et al. 1986). Because of the delicate nature of frog skin, most efforts to attach radios have involved harness devices made of plastic (silicon) tubing (Jon Loman, pers. comm.) or latex rubber straps and bands (Richards et al. 1994). We developed a simple waist-belt made of aluminum ball or beaded chain (size #3, Ball Chain Manufacturing Co., 471 South Fulton Avenue, Mt. Vernon, New York 10550, USA; tel. 914/664-7500; or Bead Industries, 110 Mt. Grove Street, Bridgeport, Connecticut 06605, USA; tel. 203/334-4124) to attach radio transmitters to free-ranging, adult California red-legged frogs (*Rana aurora draytonii*). The chain lacks sharp edges, is flexible, and rolls or slides easily over the skin, thus conforming to the contour of the frog with little friction.

We use gloss black enamel spray paint to reduce reflection of the shiny chain; flexibility is restored with gentle twisting after the paint is dry. Devcon two-ton epoxy serves to cement a #3 aluminum chain connector to the tip of a radio transmitter (model BD-2G, 8 mm wide x 6 mm deep x 17 mm long, 12 cm long whip antenna, 1.8 g without attachment, battery life about 140 days; Holohil Systems Ltd., 112 John Cavanagh Rd., Carp, Ontario, Canada K0A 1L0, tel. 613/839-0676). To accomplish this, we file a small hole in the back of the connector, clean the connector and transmitter attachment site with fine steel wool, and then apply epoxy and allow it to flow through the hole, being careful to prevent the inside of the connector from being fouled. We apply the epoxy in two stages; a small amount to position the connector followed by a larger amount to ensure a strong bond. Our radio-tag weighs about 2.0 g, but smaller assemblies weighing as little as 1.0 g (with a battery life of about 20 days) can be fabricated.

Two people are needed to radio-tag a frog: one to hold the animal, the second to fit the belt. To obtain a good fit, we slip representative chain/connector belts of different sizes, each labeled with the number of balls in the chain, over the extended rear legs of a

frog until we find the one that fits best. A perfect fit occurs when the belt slides snugly over the extended legs, and slightly compresses the upper leg muscles as it slips onto the waist. Once the belt of best fit is determined, the correct number of balls is cut from a painted length of chain, and a transmitter is attached. The fully assembled radio-belt is then slipped over the extended legs, making sure that the smoothest side of the transmitter faces the frog's skin (Fig. 1). The tagging process, from capture to release, takes about five minutes.

We release the frogs with the transmitter riding on the dorsum, but when they are recaptured the transmitter is often on the ventrum; transmitter position does not appear to affect the frogs. Because of corrosion and wear, a new chain is always fitted when frogs are recaptured for transmitter replacement. When the physical condition of a frog changes due to an increase or decrease in rear leg muscle mass, one or two balls are added to, or subtracted from, the belt to achieve an optimal fit. Belts too loose are sometimes shed, while those too tight sometimes cause indentations and small sores on the skin.

With an "H"-style receiving antenna (Telonics, Mesa, Arizona 85204, USA) connected to our radio receiver (model TX1000S, Wildlife Materials, Carbondale, Illinois 62901, USA), and under near-ideal field conditions, we routinely obtained a signal range of about 100 m when a frog was on land. Below clear, fresh water we usually received a signal from a distance of about 5 m.

We deployed 89 transmitters on 47 (24 males and 23 females) individual *Rana aurora draytonii* in coastal arroyos and lagoons of northern San Luis Obispo County, California, USA, from July 1992 through November 1995. Snout-urostyle lengths of these individuals ranged from 83 mm to 127 mm (three individuals were in the 80–89 mm size-class, 15 individuals in each of the 90–99 mm and 100–109 mm classes, 12 in the 110–119 mm class, and two in the 120–129 mm range). Twenty-two individuals were tagged once, 12 twice, 7 three times, 5 four times, and 1 five times. The 47 frogs were radio-tagged a total of 4155 days with a mean of 88.4 days/individual (SD = 73.2, range = 13–296).

We found about six cases where small (1–2 mm diam) skin sores developed from the chain belt passing over the sides of the waist. Early in the study we maintained a captive frog with skin sores; healing without a belt attached took two days. When subsequent cases of skin sores arose, we added one or two balls to the replacement chain and released the frogs. We recaptured some of these individuals and found that their wounds had healed in less than 14 days. We also assessed weight change between initial radio-tagging and recapture in 16 frogs. Two males and a female lost 2.0, 4.0, and 5.0 g after 42, 63, and 60 days, respectively. Average weight loss was 3.0% of mean initial weight. Five males and eight non-gravid females gained an average of 7.9 g over a mean of 61.6 days (SD = 19.5, range = 21–118). The average weight gain was 7.2% of their mean initial weight. These data suggest that the radio-belt did not significantly affect the frogs' weight.

Transmitter failure.—We lost radio contact with 23 frogs before the predicted exhaustion of their transmitter batteries. We recaptured seven of these with intact radio-belts, but dead transmitters. Water leakage probably caused the failure of some of these radios. The fate of the 16 missing radio-belts or frogs is unknown—the radio-belts may have been shed in salty lagoon water and lost due to signal attenuation, or the frogs may have left the study area after being ingested by herons or egrets. It is also possible that the frogs evaded recapture and are still in the population carrying failed transmitters. We believe it is unlikely that they traveled beyond the study area on their own.

Belt loss.—We recovered 24 functioning transmitters that had been shed by frogs; the belts failed in four of these early in the study while we were experimenting with different types of epoxy and chain. The remaining 20 radio-belts were recovered intact; some had tooth marks, suggesting raccoons or some other predator had removed the frogs from their belts. One intact radio-belt was found in a tree on a red-shouldered hawk roost. However, not all belt losses were due to predation; ten of the 23 frogs, identified by passive integrated transponder (PIT) tags, were recaptured. We speculate that these frogs shed their belts over their extended rear legs while moving through dense vegetation.

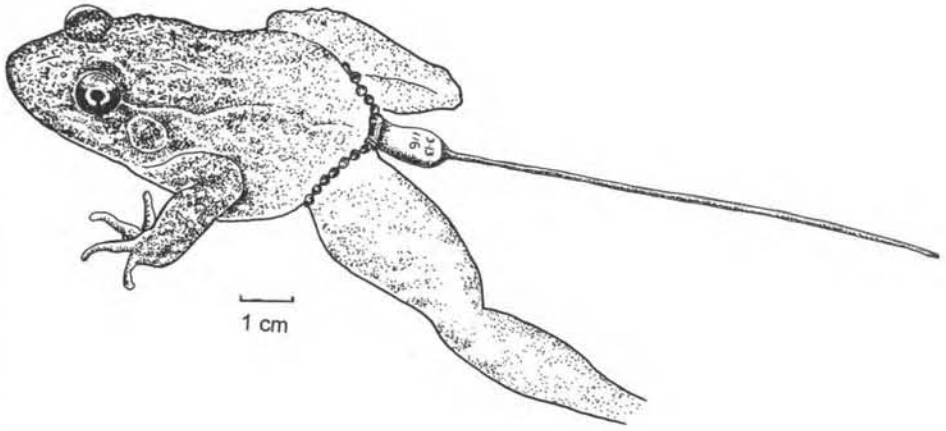


FIG. 1. Beaded chain radio-belt applied to an adult *Rana aurora draytonii*.

In any species, attaching radios with collars or belts has its risks (see Chapter 5 in Kenward 1987). During our study, we found four radio-tagged frogs dead in February and March when bulrushes send new growth up through the water column. In two cases, the frogs probably drowned when underwater bulrush shoots became threaded between the belt and the frog. We suspect the same happened to a third frog, but it was too decomposed to determine cause of death. The fourth frog had a broken mandible associated with a deep cut, suggesting that its death was unrelated to the radio-tag assembly. Despite these mortalities, we believe that attaching radios to large ranid frogs using a ball or beaded chain belt is relatively safe and effective, and represents an improvement over other radio-tagging techniques reported in the literature.

Acknowledgments.—We are grateful for the support of the California Department of Parks and Recreation and the California Department of Transportation. We thank San Simeon State Park and the Cambria Com-

munity Services District for permission to work on their properties. This work was done under permit from the California Department of Fish and Game. We appreciated the cooperation of the Ball Chain Manufacturing Company and Bead Industries. Fred Anderka of Holohil Systems provided helpful technical advice. We benefited from the comments of several reviewers of this paper, especially Norman J. Scott, Jr. and Samuel S. Sweet.

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Note added in press.—We have confirmed that significant radio-belt loss and frog mortality may occur in bulrushes. In late September 1996, we radio-belted eight frogs in a pond dominated with bulrushes. Within 16 days one frog was lost to natural predation, two shed their belts among bulrush stems, and two died from entanglement on bulrush shoots. We removed the radio-belts from the three remaining frogs.

The "Skink Scooper:" A Device for Catching Leaf Litter Skinks

BAYARD H. BRATTSTROM
Department of Biology, California State University
Fullerton, California 92634, USA

In a study of a community of small, leaf litter and grass dwelling skinks in an Australian sclerophyll forest (Brattstrom, *in prep.*), my success at capturing live skinks by hand was only about 15%. Because frustration often leads to creative solutions, I discovered a method that raised my capture success for these small skinks to 95%.

The "Skink Scooper" is a square or rectangular, tan or brown, plastic waste basket or garbage can; brighter colors may startle the skinks. Square plastic pails with handles can be substituted. Baskets should have sufficient lips around them to facilitate holding. When a skink is sighted, the basket is held 15–30 cm away from the skink. With the other hand, leaf litter and, hopefully, the skink are brushed quickly into the basket (Fig. 1); then leaves can be removed carefully, leaving the skink at the bottom. Transfer the skink directly into a bag or pick it up in your hands. Not only was this method more effective than hand capture, but fewer specimens wound up with broken tails.

The basket technique was also used against small cliffs in gullies to catch one species (*Carlia storri*) that ran along the surface of the cliff. This species would drop to the ground or escape over the top edge of the cliff. By placing the basket below the lizard, and gently brushing the lizard downward, the lizard, more often than not, fell into the basket. With this basket technique, I was able to catch hundreds of skinks an hour where only a few captures an hour were possible with the hand grab.

Baskets can also be used to catch falling geckos; arboreal lizards (such as *Diporiphora australis*) that feed in small shrubs and drop to the ground to escape can also be caught in the basket during mid-drop.



FIG. 1. Drawing showing use of the Skink Scooper.

Struts for Collapsible Funnel Traps

TERRY GRAHAM
Department of Biology, Worcester State College
Worcester, Massachusetts 01602, USA
e-mail: t1graham@mecn.mass.edu

and

ARTHUR GEORGES
Applied Ecology Research Group and Centre for Freshwater Ecology
University of Canberra, P.O. Box 1
Belconnen, A.C.T. 2616, Australia
e-mail: georges@aerg.canberra.edu.au

Installing commercially available turtle hoop traps to steel fence posts driven into the substrate works reasonably well for shallow water, but is cumbersome and does not allow deep water sets. Legler (1960) described the use of a homemade funnel trap supported by four aluminum hoops; long wooden dowels (one on either side) with screw hooks kept his traps erect. Legler's technique has been used successfully in Australia (Georges, unpubl.), and we adapted it for setting hoop traps in deep water.

Inexpensive 3/4 inch (1.9 cm) white PVC pressure pipe was first cut to length (approx. 5 cm longer than the trap) and then a 1.5 cm deep notch was cut and filed into each end to grip the hoops of the trap. With the pipe slightly longer than the trap, tension (evidenced by a slight bowing of the pipe) helped keep the pipe tightly coupled to the trap ends. Once in place, the pipe on either side was secured to the center hoop by a nylon cable tie. This tie kept the pipes positioned during trap erection and also prevented their loss if the notched ends slipped off the hoops; the pipe was slipped out of the cable tie during disassembly and in-

serted back through it during reassembly. A refinement of pipe attachment which further reduces accidental pipe loss involves pipe insertion through the end mesh of the trap and the tie so that the entire strut is located inside the trap (R. Saumure, pers. comm.). Finally, braided nylon cord was tied firmly to the top of the center hoop and a short way (ca. 5 cm) up this cord a piece of styrofoam insulation (15 x 8 x 8 cm) was tied to keep these round-bottomed traps upright. A 20 x 15x 10 cm piece of foam was tied to the top (surface) end of the cord to serve as a buoy for trap retrieval. White pipe made traps more visible underwater and allowed us to adjust trap position.

With these modifications (Fig. 1), the standard commercial trap can be set up and taken down quickly. If traps are set at depths preventing entrapped turtles access to air, they must be tended on a frequent schedule to prevent drowning. The maximum permissible interval between trap checks will depend on prevailing temperature, but for most summer applications traps should not be left unattended for more than 90 minutes.

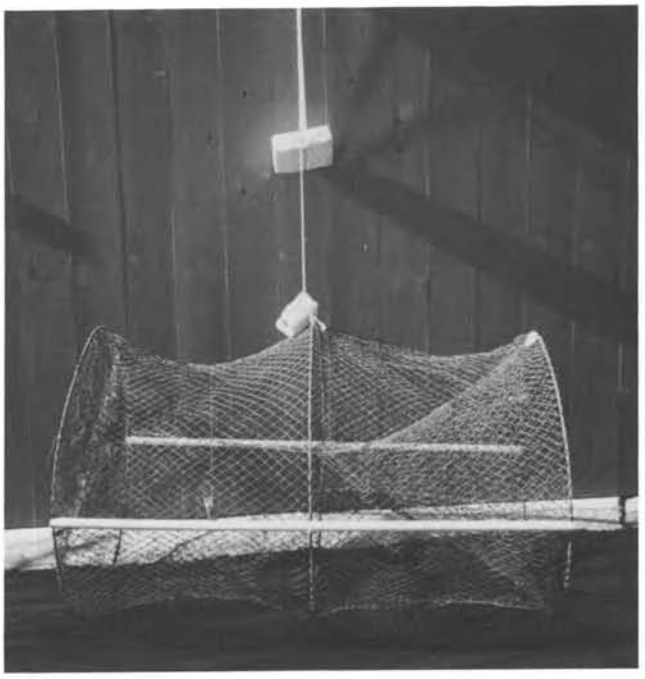
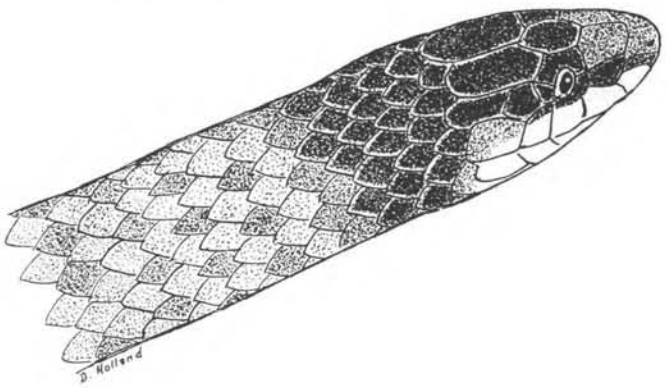


FIG. 1. Aquatic funnel trap modified for placement in deep water.

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Effectiveness of Aquatic Funnel Traps for Sampling Amphibian Larvae

GEOFFREY R. SMITH*
and
JESSICA E. RETTIG
Kellogg Biological Station, 3700 East Gull Lake Drive
Hickory Corners, Michigan 49060, USA

Present Address: Biology Department, Earlham College, Richmond, Indiana 47374, USA. E-mail: smithge@earlham.edu

As increased attention is focused on studying amphibian populations, techniques that allow for rapid assessment of amphibian population status are needed (see Heyer et al. 1994). The use of aquatic funnel traps for the collection of amphibian larvae (Calef 1973; Shaffer et al. 1994) and adults (Griffiths 1985; Richter 1995) has been suggested. In this note, we describe three designs for aquatic funnel traps and present observations on the effectiveness of each.

DESIGN 1: This trap is made from a section of PVC pipe (5 cm diameter, 25–30 cm long), two plastic funnels of half-pint (4 oz) capacity, and a rubber band of appropriate length and width. The funnels are inserted into each end of the PVC pipe and held in place by the rubber band (Fig. 1). Traps are secured by attaching them to stakes driven into the ground. Funnel ends may become dislodged overnight because of rubberband slipping, but we solved this problem by filing notches into the funnels. Notches allow a much tighter fit of funnel ends to PVC pipe. Another solution is to permanently attach a funnel to one end and allow only one funnel to be removable. The cost of this trap is about US$2.00–4.00.

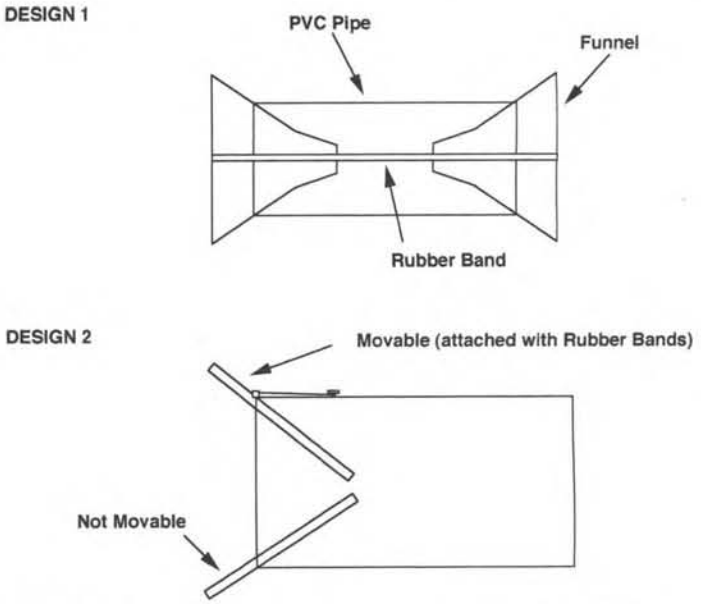


FIG. 1. Two aquatic funnel trap designs used for capturing amphibian larvae. See text for details.

DESIGN 2: Actually an ichthyoplankton sampling device for capturing fish larvae (Werner 1968), this trap resembles terrestrial funnel traps except that only one end is open, and it is made of 1/8 in. thick, clear acrylic (Fig. 1). The dimensions of our trap were 30.5 cm x 15.2 cm x 15.2 cm, with the guides being 45.6 cm

x 15.2 cm. We used IPS Weld-On #16 Cement for Acrylic Sheet (IPS Corporation, Gardena, California, USA) to glue the trap together. One of the two "guides" is left moveable (to facilitate removal of larvae) and should be able to be held in place by friction and a small rubberband. These traps are attached to anchors and floats and can be placed anywhere in the water column. The cost is US$10.00–15.00 per trap (depending on trap size and type of materials used).

DESIGN 3: This design requires a 2-liter plastic soft drink bottle and waterproof tape and is nearly identical to the design described by Griffiths (1985). The spout end of the bottle is cut off, reversed to form a funnel, and reattached to the bottle with tape. Holes are punched into the bottle to allow water to enter, and facilitate sinking. Traps were attached to floats. The cost of this trap would be < US$1.00.

We tested the capture ability of each trap at the Kellogg Biological Station Experimental Pond complex, placing traps in the ponds for a specific period of time, often 12 h overnight (2000–0800 h EDT). DESIGN 2 and 3 traps were placed in the center of the ponds at depths between 30 and 50 cm (1–2 m above the pond bottom), whereas DESIGN 1 traps were generally placed 1–2 m from the pond edge at a depth of 20–40 cm (resting on pond bottom).

All traps captured at least one tadpole, and trap effectiveness appeared to depend on time of year; fewer tadpoles were captured late in the season (Table 1). The most effective (numbers of tadpoles caught) were DESIGN 1 traps placed in the shallows, followed by DESIGN 2 traps placed in the middle of the ponds. DESIGN 3 traps did not catch many tadpoles, but they were tested late in the season, and their effectiveness may have been underestimated.

TABLE 1. Number of tadpoles caught per trap for each of three trap designs. Individual trap results separated by commas. Dash means that no trap of that type was placed. X indicates a failed trap.

	DESIGN 1		DESIGN 2		DESIGN 3	
	w/light	w/o light	w/light	w/o light	w/light	w/o light
June 28	51, 0	0, 0	14, 15	—	—	—
July 3	17, 0, X	1, 0, 0	—	—	—	—
July 5	1, 0, X	1, 0, X	—	—	—	—
July 10	—	—	3	1	1, 2	0

Neither DESIGN 1 nor DESIGN 2 was effective for catching aquatic adult red-spotted newts (*Notophthalmus viridescens*).

Glow sticks greatly increased the effectiveness of DESIGN 1 traps. When lighted and unlighted DESIGN 1 traps were placed within 2 m of one another, the lighted trap caught several tadpoles whereas the unlighted trap caught none. Lightsticks also increased captures in DESIGN 2 and DESIGN 3 traps. Care should be taken to ensure non-toxic light sources are used. Lightsticks available commercially are rather expensive (≈ US$2.00 each) and cost may limit the number of traps that can be used per night, or the number of nights that lightsticks can be used.

Our results suggest that these trap designs may be effective for collecting tadpoles to study natural growth rates. Placing traps in several habitat types and microhabitats would allow for the study of habitat and microhabitat use patterns by amphibian larvae in natural aquatic systems. We have no data on how effective these traps are at quickly assessing amphibian diversity (only one species was captured: *Rana catesbeiana*).

Ease of construction, low cost, and repeatability of construction render these funnel traps an excellent sampling technique for aquatic amphibian larvae.

Acknowledgments.—The comments of S. Busack greatly improved the manuscript. We thank G. Mittelbach for allowing us access to the KBS Experimental Pond Complex. Fish larvae trap construction and J.E.R. were supported by an NSF Research Training Grant at the Kellogg Biological Station, Michigan State University.

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HERPETOLOGICAL HUSBANDRY

Captive Reproduction of the Mexican Acaltetepon, *Heloderma horridum*

AMAYA GONZALEZ-RUIZ

ENRIQUE GODINEZ-CANO

and

ISAAC ROJAS-GONZALEZ

Universidad Nacional Autónoma de México Campus Iztacala
Jefatura de Biología, Apartado Postal 314
Tlalnepantla 54090, México, México
e-mail (EG): egodinez@servidor.unam.mx

Heloderma horridum has been succesfully maintained in captivity for decades. Captive specimens have been recorded as early as 1908 (Perry-Richardson and Ivanyi 1995), while captive reproduction was first reported in 1982 (Anstanding 1988). A review of the *Inventory of Live Reptiles and Amphibians in Captivity* (Slavens 1984–1994) revealed that over 50 institutions housed this species, with over 150 specimens represented. For this same period, only 18 reproductions were reported. Perry-Richardson and Ivanyi (1995) list 291 specimens maintained in captivity since 1908. A total of 40 reproductions are listed begining in 1983, with 111 hatchlings produced. We are documenting here the first captive reproduction of *Heloderma horridum* in México.

The "Laboratorio de Herpetología–Vivario" (located on the UNAM campus Iztacala in México City) received two *Heloderma horridum* from different sources in 1985. The sexes of both animals were unknown. On 5 August 1985 we observed courtship behavior and mating for the first time. No further activity was observed until a single egg was laid on 17 October 1986. It was artificially incubated until it began to decompose, when it was discarded. After this, no reproductive activity was observed for another four years.

TABLE 1. Hatching data for *Heloderma horridum* offspring. NA = natural absorption of yolk sac; C = yolk sac removed.

Hatch Date	Yolk Sac Presence	Hatch Weight (grams)	Juvenile Weight November 1995
November 29	+ (NA)	40.50	141.8
November 29	+ (NA)	42.16	161.1
December 02	+ (C)	21.40	124.6
December 02	—	43.11	131.1
December 02	+ (C)	41.41	133.5
December 06	+ (C)	37.26	—
December 08	+ (C)	42.19	—
December 10	+ (C)	—	—
December 15	+ (C)	27.69	—

The animals were hibernated during the winter of 1990–1991 for three months at a temperature of 23–26°C, a technique we have continued to use. On 24 May 1991 copulation was again observed. Motile sperm was found on the enclosure substrate. Courtship and mating were observed for five days until the pair were separated to avoid injury to the female. Three months later the pair were reintroduced, and courtship was again observed on 17 June 1992. No oviposition occurred from these matings.

From 26–28 April 1993, courtship and mating were again observed. On 26 July 1993, fifteen eggs were found buried in a sand nest at a depth of 18 cm. The eggs were removed from the enclosure, weighed (range 38.3–44.0 g), and artificially incubated at 29°C and 95–100% relative humidity. After six months the eggs showed no signs of development and were opened. There was no apparent embryonic development.

In April 1994 courtship was again observed. On 3 July 1994, eleven eggs were found on top of the soil in a corner of the enclosure. The eggs were removed and incubated at 29°C, 90–95% relative humidity in plastic boxes containing agrolite. Each box was opened daily and aired, but the eggs were not moved from their original position. Two eggs began to collapse and turned a yellowish color; when opened, one showed no embryonic development while the other had an advanced dead embryo. On 29 November the first hatchling emerged. By 15 December nine babies had emerged from the eggs (see Table 1 for data). Six of the young had trouble absorbing their yolk sac. They started showing signs of decline so the yolk sacs were removed with catgut. Four of these individuals died within the following two months. Necropsy of these four animals revealed that death was due to extensive septicemia originating in the yolk sac. The five surviving individuals, including two which had yolk sacs removed, are a year old at the time of writing, and are doing well.

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Nocturnal Nesting by Captive Varanid Lizards

STEVE IRWIN

Queensland Reptile and Fauna Park
Glasshouse Mountains Tourist Route
Beerwah, Queensland, Australia 4519

KELSEY ENGLE

Queensland Reptile and Fauna Park
Glasshouse Mountains Tourist Route
Beerwah, Queensland, Australia 4519

and

BRIAN MACKNESS

School of Biological Sciences
University of New South Wales, NSW, Australia 2052
e-mail: 100252.3452@compuserve.com

There are few observations of varanid egg deposition recorded, even in detailed studies of reproduction of individual species (e.g., Carter 1992; Cowles 1930). The few observations where egg deposition has been seen, have largely been made during daylight hours. Bom and Bom (1989) observed captive *Varanus exanthematicus microstictus* nesting in the morning. A number of largely anecdotal records of varanids nesting are also presumed to be diurnal,

given the lack of any specific reference to the observation being carried out at night (e.g., Auffenberg 1983; Biswas and Kar 1981; Branch and Erasmus 1982; Deraniyagala 1957; Fleay 1960; Gaulke 1989; Riley et al. 1985; Smith 1931; Worrell 1963).

Varanid lizards are normally considered to be diurnal (Cogger et al. 1983) although some nocturnal activity, exclusively associated with feeding, has been recorded (Greer 1989). Christian (1977) recorded *V. glebopalma* foraging for food during the first couple of hours after sunset while Fyfe (1979, 1980) recorded *V. tristis* feeding near lights outside a building. A recent record of nocturnal activity of *V. spenceri* by Valentic (1995) may be due to retreat site disturbance.

Nocturnal nesting by captive varanids has been reported in several species: *V. varius* (Horn 1991), *V. exanthematicus* (Bayless and Huffaker 1992; Bayless and Reynolds 1992; Bayless 1994), and *V. albigularis* (Duinen 1983). Horn (pers. comm.) has observed nocturnal nesting in *V. varius* on three other occasions, as well as crepuscular laying in *V. salvator* and *V. mertensi*.

In this note, we report observations of nocturnal nesting in four species of captive varanids (*V. giganteus, V. indicus, V. keithhornei* Wells and Wellington 1985 (= *V. teriae* Sprackland 1991), *V. mertensi*) at the Queensland Reptile and Fauna Park, Beerwah (pers. obs.). Irwin et al. (in press) developed a strategy for the detection of egg-laying based on feeding behavior. This involves restricting food to suspected gravid females so that they are left hungry enough to eat a similar sized food portion the following day. As the animal approached the time of egg-deposition, her interest in food decreases with a corresponding decline in the amount being eaten. This has enabled a more effective targeting of observations and has resulted in multiple instances where nocturnal egg deposition has been witnessed. All nocturnal nesting episodes have been confirmed by direct observation or collection of eggs for incubation the next morning. One instance of nocturnal nesting by *V. giganteus* has been videotaped.

The four species that have been observed nesting at night have very different ecologies and distributions. *Varanus giganteus* frequents rocky outcrops, escarpments, and dry sandy country (Horn and Visser 1988; King et al. 1989; Pianka 1982); *V. indicus*, the mangrove and closed forests of northern Australia (Cogger et al. 1983); *V. keithhornei*, the canopy of forests in Cape York (Irwin 1994); and *V. mertensi* in a variety of habitats across northern Australia (Schürer and Horn 1976; Shine 1986). Nesting activities for these four species has only been observed at night. Four other species of varanids (*V. acanthurus, V. gouldii, V. spenceri,* and *V. varius*), which also have bred at the Park, have not been observed nesting at night.

This does not mean that nocturnal nesting by this second group of species does not occur. Rather, nesting activities, whether diurnal or nocturnal, are difficult to observe owing to cryptic behaviors, and can only be confirmed by the procedure outlined in Irwin et al. (in press).

While three of the varanids that nested at night are on public display, *V. keithhornei* specimens are permanently off-display and therefore their nocturnal nesting is not an aberrant response to human disturbance or interaction. This is further supported by the fact that courtship, mating, and agonistic behaviors are all undertaken during daylight hours. Given that all varanids are kept in open pits (except *V. keithhornei*, which is in a temperature controlled environment), and that the nesting has occurred in many different months and under diverse climatic conditions, it is unlikely that the nocturnal nestings have been triggered by environmental stimuli.

The recognition that *V. varius* nests both diurnally and nocturnally bears careful consideration. King and Green (1993) suggest that "egg-laying occupies a few hours." Horn (pers. comm.) has observed some varanids taking over ten hours to deposit a clutch. These extended laying periods may be associated with animals that are either infertile or in poor health (Horn, pers. comm.). Consequently, nocturnal nesting may occur as a result of an extended egg-deposition begun during the day. Alternatively, diurnal nesting may occur in a nocturnal-nesting species engaging in an extended nocturnal egg-deposition episode.

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NATURAL HISTORY NOTES

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CAUDATA

AMBYSTOMA CALIFORNIENSE (California Tiger Salamander). **BURROWING ABILITY.** It is assumed that ambystomatid salamanders are generally poor burrowers and rely upon accessible rodent burrows for estivation habitats (see Semlitsch 1983. Can. J. Zool. 61:616–620). During an 18 February 1996 nocturnal survey for adult California tiger salamanders at a site ca. 2.25 km southeast of Calero Reservoir, Santa Clara County, California, USA, I observed an adult male *Ambystoma californiense* successfully dig through the plugged entrance of a valley pocket gopher (*Thomomys bottae*) burrow. The observation was made on a rainy night between 2131 and 2300 h. The salamander was first observed with its muddied head inserted into a pocket gopher mound. The salamander was then removed, examined, sexed, and placed back in its original position. Subsequent examinations at 15-min intervals revealed the salamander was able to successfully find the burrow entrance and then dig through the mound plug into the pocket gopher burrow. The salamander's digging efforts were aided by a constant steady rainfall, which materially softened the exposed soil of the pocket gopher mound. This observation is significant because it indicates that California tiger salamanders have the ability to burrow out of or into normally closed pocket gopher burrows given sufficiently moist soil conditions. Thus, potential estivation habitat for this salamander is not limited by the surface activities of California ground squirrels (*Spermophilus beecheyi*) or valley pocket gophers in keeping their burrows open at critical times of the year.

My thanks to Norman J. Scott, Jr. for reviewing the manuscript. Permits to conduct salamander surveys were provided by the California Department of Fish and Game.

Submitted by **MARK R. JENNINGS**, National Biological Service, California Science Center, Piedras Blancas Field Station, P.O. Box 70, San Simeon, California 93452-0070, USA, and Research Associate, Department of Herpetology, Califomia Academy of Sciences, Golden Gate Park, San Francisco, Califomia 94118-9961, USA.

PLETHODON CINEREUS (Redback Salamander). **PREDATION.** On 5 June 1993, we observed a *Turdus migratorius* (American robin) at the Mountain Lake Biological Station, Giles Co., Virginia, USA, with an adult *P. cinereus* in its beak. The bird flew ca. 30 m, settled to the ground, and began to peck vigorously at the wiggling, autotomized tail of the salamander. The salamander was less than a meter from the bird. When we approached, the bird flew off. The salamander died within the hour, presumably from injuries suffered while being carried by the bird. Although our intrusion prevented us from observing the culmination of the event, the bird was clearly distracted by the autotomized tail.

Avian predation is not believed to be an important factor in the population dynamics of terrestrial salamanders (Hairston 1980. Am. Nat. 115:354–366). With the exception of the eastern hermit thrush (*Hyloccichla guttata faxoni*), which has been observed feeding *P. cinereus* to its young, salamanders are not mentioned in the diets of thrashers, towhees, and thrushes that forage in the forest litter (Bent. 1964. Life Histories of North American Thrushes, Kinglets and their Allies. Dover Publ., Inc., New York; Hairston 1980, *op. cit.*).

Submitted by **THOMAS L. D. FENSTER**, 4103 Sheridan Street, University Park, Maryland 20781, USA, and Mountain Lake Biological Station, Route 1, Box 105a, Pembroke, Virginia, USA; and **CHARLES B. FENSTER**, Department of Plant Biology, University of Maryland, College Park, Maryland 20742-5815, USA.

PLETHODON DUNNI (Dunn's Salamander). **CANNIBALISM.** Cannibalism has been documented in many amphibians, including several families of salamanders (Crump 1992. *In* Elgar and Crespi, eds. Cannibalism: Ecology and Evolution Among Diverse Taxa, pp. 256–276. Oxford Univ. Press, New York). However, relatively little is known about cannibalism in terrestrial amphibians. Only anecdotal reports of cannibalism in *P. dunni* exist (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. Univ. of Idaho Press, Moscow, Idaho. 332 pp.). Herein we report cannibalism of juvenile *P. dunni* by adults under natural conditions.

During Fall 1995 at Fall Creek (Lincoln Co., Oregon, USA, 10 km W Alsea; 360 m) in the Coast Range we stomach flushed 21 adult *P. dunni* and found juvenile *P. dunni* in two (9.5%) gravid females . The first female (SVL 54.5 mm, mass 5.1 g, collected 14 October 1995) regurgitated a juvenile conspecific (SVL 20.6 mm, mass 0.12 g). The second female (SVL 71.4 mm, mass 5.64 g, collected 11 December 1995) also regurgitated a juvenile (SVL 28.5 mm, mass 0.51 g).

The large size difference that exists between juvenile and adult *P. dunni* may promote cannibalism . Cannibalistic individuals may find that conspecifics provide a food source that is easily assimilated and may increase growth and enhance reproduction.

Submitted by **JOSEPH M. RIESECRER, MICHAEL T. ANDERSON, DOUGLAS P. CHIVERS, ERICA L. WILDY, JILL DEVITO, ADOLFO MARCO, ANDREW R. BLAUSTEIN, JOSEPH J. BEATTY**, and **ROBERT M. STORM**, Department of Zoology, Oregon State University, Corvallis, Oregon 97331, USA.

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NATURAL HISTORY NOTES

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CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). **COMMUNAL NESTING.** Communal nesting by marbled salamanders is infrequent and typically includes fewer than three females. Of 72 nests observed by Graham (1971. Ph.D. Diss., Rutgers Univ.), only nine (12.5%) were communal and included the clutches of two (N = 7), three (N = 1), and seven (N = 1) females; 16 (5.5%) of 292 nests observed by Petranka (1990. J. Herpetol. 24:229–234) contained eggs of two females and three (1.0%) contained eggs of three females.

I observed communal nesting by marbled salamanders on 6 and 12 October 1995 at a semi-permanent, 15 x 19 m, man-made pond in the Hoosier National Forest, Crawford County, Indiana, USA. The pond is within a second-growth pine-hardwood forest. Approximately 15% of the clay-mud base is sparsely covered with herbaceous vegetation; the remainder is bare mud sparsely covered with fallen leaves. When these observations were made, half the basin was covered with water, leaving a 2 m wide band of mud above the water level. Nests were considered communal if clutches in adjacent depressions constructed by females were indistinguishable, the number of eggs was two or more times greater than the average of single nests (mean = 110 eggs), or nests contained eggs in varying stages of development.

Of 29 nests found, 12 (41.4%) were single-female nests containing 51–169 eggs, nine (31.0%) contained 163–319 eggs of two females, four (13.8%) contained 323–413 eggs of three females, one (3.4%) contained 514 eggs of four females, two (6.9%) contained 771 and 796 eggs of seven females, and one (3.4%) contained 1813 eggs of 16 females.

Marbled salamanders typically nest beneath cover such as leaf litter, logs, roots, rocks, or vegetation (Graham, *op. cit.*; Jackson et al. 1989. Can J. Zool. 67:2277–2281; Noble and Brady 1933. Zoologica 11:89–132; Petranka, *op. cit.),* or in crayfish or small mammal tunnels (King 1935. Ohio J. Sci. 35:4–15). Nests are generally concentrated in areas with high total cover (Jackson et al., *op. cit.).* The Crawford County pond is devoid of accumulated leaf litter from previous years except at the basin edge. Only four nests were found in this zone, the remainder were located at middle or lower elevations where leaf litter was absent when females oviposited. Females may have been forced to nest communally due to the paucity of cover. Most nests were partially or completely exposed until covered with freshly fallen leaves. Although females may have oviposited simultaneously in some nests, embryos in several communal nests ranged from Harrison stage 19 to 37 (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill, New York, pp. 131–132), suggesting that later arriving females may have used eggs of preceding females as cover.

Only three nests (10%), all communal, had a single female in attendance. Nest attendance, which increases embryo survival, is typically much higher than that observed at the Crawford County pond (e.g., 87.4%, Jackson et al., *op. cit.;* 75.5%, Petranka, *op. cit.).* Estimates of embryo mortality in five communal nests ranged from 0–90%. The largest communal nest was exposed to direct sunlight for one hour each morning. On 12 October, temperatures in this nest varied from 22°C at the bottom to 27°C at the top immediately after exposure to the sun, suggesting that high temperatures may have contributed to high (ca. 90%) embryo mortality (Anderson 1972. Herpetologica 28:126–130).

I thank J. Sean Doody for commenting on the manuscript.

Submitted by **JOHN G. PALIS**, Rural Route 1, Box 258, Tell City, Indiana 47586, USA.

AMPHIUMA TRIDACTYLUM (Three-toed Amphiuma). **COLORATION.** A mottled *Amphiuma tridactylum* was brought to Northeast Louisiana University Museum of Zoology by an anonymous person during summer 1988. The specimen (NLU 70638) measured 34 cm SVL, pigmentation varied from dark brown to black circular blotches of assorted sizes with a leucistic body color (Fig. 1). The origin of the specimen is unknown, however it is believed to have been collected in Louisiana.



FIG. 1. Adult mottled (left) and albino (right) *Amphiuma tridactylum* from Louisiana.

A second specimen, an albino, was collected 20 July 1992 in a ditch approximately 8 rd km S of Thibodaux, in Lafourche Parish, Louisiana, USA, by Terry P. Guidroz. This specimen (NLU 70488), 243 cm SVL, lacks all pigmentation except for the coloration of its blood vessels and pink eyes (Fig. 1).

Although albinism has been reported for this species (Cagle 1947. Copeia 1947:210), and in the family Amphiumidae (Palmer and Braswell 1980. Brimleyana 3:49–51) and in other amphibians (Dyrkacz 1981. SSAR Herpetol. Circ. 11:131), this is the first published account of mottled coloration and second report of albinism for this species.

Submitted by **STEVEN G. GEORGE**, U.S Army Engineer Waterways Experiment Station ER-A Vicksburg, Mississippi 39180, USA.

ANEIDES LUGUBRIS (Arboreal Salamander). **PREDATION.** On 7 February 1994 at ca. 1130 h PST near Berkeley, Alameda Co., California, USA, after ca. 50 mm of rain I observed a California scrub jay (*Aphelocoma coerulescens*) attacking a juvenile *Aneides lugubris*. The jay carried the salamander from branch to branch, occasionally holding it down and hammering at it with a woodpecker-like motion. The time involved and the ineffectiveness of the feeding method suggest that *A. lugubris* is not common in the diet of *A. coerulescens*. The salamander's nocturnal habits make interactions with the scrub jay unusual. Mottland (1993. Unpubl. Master's thesis, Stanford University) reported a lack of records for *A. coerulescens* predation on amphibians. Marzluff et al. (1994. Stud. Avian Biol. 15:202–220) indicated that *A. coerulescens* populations are increasing in urban areas, especially during the winter months when *Aneides lugubris* is most active. An aggressive, opportunistic feeder, *A. coerulescens* is able to exploit new food resources, including amphibians.

I thank Jamie Reaser, Steve Rottenborn, and Alan Launer for their assistance.

Submitted by **DANIEL RUBINOFF**, Department of Environmental Science, Policy, and Management, 201 Wellman Hall #3112, University of California, Berkeley, California 94720-3112, USA.

CRYPTOBRANCHUS ALLEGANIENSIS ALLEGANIENSIS (Hellbender). **COLORATION.** Hellbenders are usually described as having a yellowish-brown to black dorsal coloration (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). However, reports of red *Cryptobranchus* are persistent in the herpetological literature. Holbrook (1842. North American Herpetology, 2nd Ed., Vol. 5, p. 99, J. Dobson, Philadelphia) described a red specimen from Buncombe County, North Carolina, USA, as a separate species, *Menopoma fusca*; Grote (1877. Amer. Assoc. Adv. Sci. Proc. 24:255–257) considered them a color variant; Reese (1903. Pop. Sci. Monthly 62:526–531) postulated that females became red "as a secondary sexual character, for the attraction of the males;" and Nickerson and Mays (1972. The Hellbenders: North American "Giant Salamanders." Pub. Biol. Geol. 1:vii+106 pp., Milwaukee Public Museum Press) described a reversible and "rather dramatic color change from an olive-brown background to a rather bright orange," which they considered a response to light and temperature cues. They reported that only one of almost 2000 Ozark hellbenders (*C. a. bishopi*) maintained this unusual background coloration.

On 24 May 1994, one of us (MJK) photographed a live adult *C. a. alleganiensis* with red coloration in Big Walker Creek, Giles Co., Virginia, USA. We observed, but did not photograph, a second large adult with similar red coloration and other reddish hellbenders have been observed at this locality in previous and subsequent years. One retained this coloration under various thermal and light conditions for a week in captivity, at which time it was released.

The color of the individual photographed (Univ. Georgia Mus. Nat. History 24860a,b: Eastman Kodak Color Film 5297 ISO 200), as matched to a Munsell soil color chart (Munsell Soil Color Charts, 1992 rev. ed., Macbeth Division of Kollmorgen Instrument Corp, Newburgh, New York) varied from 2.5YR7/8 (light red) on the innermost portions of the lateral folds to 10R3/3 (dusky red) on the dorsal surface. This coloration is similar to that depicted for *Menopoma fusca* in Holbrook (*op. cit.*, plate 33), which was 2.5YR5/8 (red) on the dorsum and 2.5Y8/8 (yellow) on the venter.

Our observations permit us to discriminate among several of the hypotheses previously offered for this coloration: 1) the observations were made outside the autumnal breeding season (Bishop 1943. Handbook of Salamanders. Comstock Publ. Co., New York) so it is unlikely that the bright coloration functions as a secondary sexual attractant; 2) the animals were outside the range of *Menopoma fusca,* as proposed by Holbrook (1842, *op. cit.).* Recent molecular investigations identify *C. a. alleganiensis* as a single taxon (Meckle et al. 1977. Copeia 1977:1016–1023; Routman 1993. Copeia 1993:407–416), further evidence against the existence of a red species of hellbender; 3) the coloration has been maintained for several days under various thermal and lighting regimes, suggesting that the color change is not a direct response to these conditions. We cannot rule out the possibility that the specimens we observed were simply color variants.

Alternatively, we suggest that the red coloration may be an indication of chronic physiological stress. This hypothesis is consistent with the observations of both Nickerson and Mays (*op. cit.*) and of Grote (*op. cit.*) who mentions that a hellbender that escaped from a tank was found three weeks later and had "changed color very decidedly, becoming a reddish-brown." As additional support for this hypothesis, we have not found sub-adult hellbenders in Big Walker Creek despite several searches, and adults are not active there in the summer months. Cold, rock-strewn streams are considered characteristic hellbender habitat; as a result of nearby deforestation and highway maintenance, however, the large pools in this area of Big Walker Creek are heavily silted. If our hypothesis is correct, the occurrence of reddish individuals in this creek may indicate that the hellbenders are physiologically stressed, possibly due to increased water temperature and decreased oxygen levels associated with sedimentation.

Recently, *C. alleganiensis* has been listed as a species of special concern in Virginia (Virginia Dept. of Game and Inland Fisheries, Richmond) and hellbenders are in decline elsewhere (e.g., in tributaries of the Ohio River; see Pfingsten 1990. Herpetol. Rev. 21:48–51). It would be useful to determine the relationship between chronic stress and coloration in *Cryptobranchus,* and to investigate additional areas to determine if this reddish coloration is prevalent in hellbender populations inhabiting degraded sections of streams.

MJK's travel was supported by the U.S. Department of Energy, contract DE-AC09-76SR00-819 with the Savannah River Ecology Laboratory and the University of Georgia.

Submitted by **JOHN E. FAUTH, BRYANT W. BUCHANAN, SHARON E. WISE,** and **STEPHANIE M. WELTER**, Mountain Lake Biological Station, Route 1, Box 105A, Pembroke, Virginia 24136, USA, and **MARK J. KOMOROSKI**, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

DESMOGNATHUS QUADRAMACULATUS (Blackbelly Salamander). **REPRODUCTION.** Two modes of egg deposition occur in *Desmognathus* species: laying eggs singly in monolayers (e.g., *D. monticola*; Organ. 1961. Ecol. Monogr. 31:189–220) and laying eggs in grape-like clusters (e.g., *D. fuscus, D. ochrophaeus;* Martof and Rose. 1963. Am. Midl. Nat. 69:376–425). Organ (*op. cit.*) and Pope (1924. Am. Mus. Novit. 153:1–15) reported that *D. quadramaculatus* attach their eggs singly to the undersides of rocks, stones, or other support structures in small clusters that resemble those of *D. monticola*. The eggs appear as a monolayer when attached to flat surfaces and often as bilayers when attached to concave or irregular surfaces. Each egg is suspended individually from a rock or other support structure by a short elastic pedicel that is about 3 mm long and 1.5 mm in diameter.

We observed a single egg mass and an associated *D. quadramaculatus* female at each of two sites in western North Carolina, USA: between Whim Knob and the Heintooga Overlook in the Great Smoky Mountains National Park, Swain Co., and from the Ball Creek watershed of the Nantahala Mountains, Coweeta Hydrological Laboratory, Macon Co. In both cases eggs were laid in large ovoid masses rather than in monolayers. Each mass contained single eggs attached to the rock as well as several clusters consisting of 2–8 eggs that were attached to a common base and twisted about each other to form a common stalk. Trauth (1988. Southwest. Nat. 33:234–236) also observed *D. brimleyorum* egg masses with both single eggs and grape-like clusters of eggs in the same mass. Several *D. monticola* masses that we observed at the Nantahala site were laid in monolayers and all eggs were attached individually to rocks as described by Pope (1924, *op. cit.*). These observations suggest that the mode of egg deposition in *D. quadramaculatus* is more variable than in other *Desmognathus*; females in some populations attach all eggs individually to rocks or other support structures to form a monolayer, while females in other populations appear to attach their eggs both singly and in grape-like clusters within the same clutch.

Submitted by **CHARLES K. SMITH**, Department of Biology, High Point University, High Point, North Carolina 27262, USA, and **JAMES W. PETRANKA** and **REBECCA BARWICK**, Department of Biology, University of North Carolina, Asheville, North Carolina 28804-3299, USA.

DESMOGNATHUS WELTERI (Black Mountain Salamander). **REPRODUCTION.** We are unaware of any published accounts of the eggs or mode of egg deposition for this species. We observed four clutches on the following dates: 8 July 1995 (2), 10 July 1993 (1), and 3 August 1994 (1) along Martin's Fork near Hensley's Settlement in Cumberland Gap National Historic Park, Bell County, Kentucky, USA. All nests were found inside packs of leaves and flood debris on logs or islets in the main stream channel and were 5–20 cm above the level of the stream surface. Each egg was suspended by a transparent pedicel that varied from 4–12 mm long. Pedicels were attached to and twisted about each other so that the eggs of each clutch formed a grape-like cluster similar to that produced by *D. fuscus* and *D. ochrophaeus* (Martof and Rose. 1963. Amer. Midl. Nat. 69:376–425). The diameters of the outer egg capsules of 10 eggs from one clutch averaged 4.5 mm (range = 4.4–4.6 mm). Three of the four clusters were accompanied by females that averaged 66 mm SVL (range = 60–70 mm). Number of eggs per clutch varied from 18 to 33 and averaged 26. Based on the developmental stages of eggs in July 1995 samples, we estimate that eggs were laid no earlier than the first or second week of June.

Submitted by **CHARLES K. SMITH,** Department of Biology, High Point University, High Point, North Carolina 27262, USA, and **JAMES W. PETRANKA** and **REBECCA BARWICK**, Department of Biology, University of North Carolina, Asheville, North Carolina 28804-3299, USA.

DICAMPTODON COPEI (Cope's Giant Salamander). **METAMORPHOSIS and PREDATION.** Only three metamorphosed *Dicamptodon copei* have been reported (Nussbaum 1976. Misc. Publ. Mus. Zool. Univ. Michigan 149:1–94; Jones and Corn 1989. Northwest. Nat. 70:37–38). This paper reports three additional confirmed sightings of metamorphosed *D. copei* within Olympic National Park, Washington, USA, and documents evidence of *Thamnophis sirtalis* as a natural predator of metamorphosed *D. copei.*

On 1 August 1994, a large *T. sirtalis* was found basking on a trail in N. Fork Quinault drainage (SE1/4 NW1/4 Sec. 10 T24N R8W). The location was on a steep WSW slope, 1300 m, in an old growth stand. The snake was noticeably swollen and was forced to regurgitate a metamorphosed *D. copei* 11. 5 cm SVL. Its mottled pattern was identical to previous wild-caught metamorphosed adults. The specimen was not collected because of the advanced stage of decomposition. A photograph of the specimen is deposited in the herpetological collection at the University of Washington's Burke Museum (UWBM 2223).

On 30 August 1994 at 1300 h a metamorphosed adult *D. copei* was discovered at N1/2 Sec. 14 T24N R7W, E. Fork Quinault, (L. Welch, pers. comm.). The animal was photographed, but not measured, and its color pattern was the same as the above specimen. We verified the identification by examination of the photo.

On 5 May 1995 a dead, metamorphosed *D. copei* was found by D. Wiedemeier on the banks of an unnamed tributary of Solleks River at 610 m (NE1/4 T25N RlOW; UTM). The specimen measured 157 mm TL, 90.4 mm SVL, and weighed 19.6 g. It was partially decomposed and did not preserve well. The color pattern was similar to the above specimens. The specimen was examined by S. Horton and verified by L. Jones.

Submitted by **PATRICK LOAFMAN**, 2302 Place Road, Port Angeles, Washington 98363, USA, and **LARRY JONES,** Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, Washington 98512, USA.

PLETHODON CINEREUS (Redback Salamander). **BROODING BEHAVIOR.** Female *Plethodon cinereus* lay and brood their eggs within decaying logs and under logs and stones (Bishop 1943. Handbook of Salamanders. Comstock Publ. Co., Ithaca, New York. 555 pp.), remaining with them through hatching (Bachmann 1964. Maternal Behavior of the Red-backed Salamander, *Plethodon cinereus.* Ph.D. thesis, Univ. Michigan, Ann Arbor). Aggressive defense of eggs and/or nest sites is part of the brooding behavior (Bachmann 1984. Herpetologica 40:436–443; Highton and Savage 1961. Copeia 1961:95–98). This is the first report of relocation of an egg cluster by *P. cinereus.*

On 14 July 1991, I found a female *P. cinereus* attending a clutch of nine eggs within a decaying hemlock (*Tsuga canadensis*) log at the Toft Point Natural Area near Baileys Harbor, Door Co., Wisconsin, USA (T30N R28E Sec. 15). The log crumbled apart when I attempted to roll it over, partly exposing the salamander encircling her egg mass. The salamander remained motionless until I disturbed a small piece of wet wood to which the egg mass was attached. The female then picked up the egg mass in her

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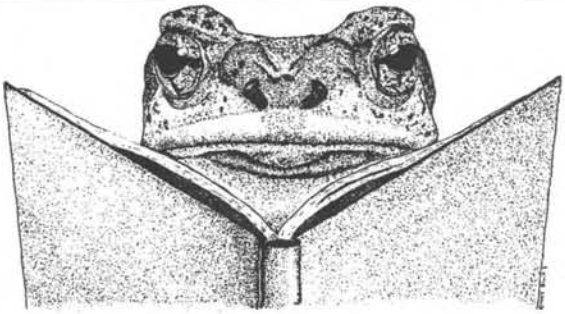
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mouth, freeing it of the pedicle, and carried it into a crevice deeper in the log. One or two eggs were held in the mouth with the remainder of the clutch projecting in front of the salamander.

Similar behaviors have been observed in at least one other plethondontid. Van Denburgh (1898. Proc. Am. Phil. Soc. 37:139–141) described a captive *Ensatina eschscholtzii* that "moved the eggs from place to place in the jar, holding them always in the crook of its tail," and Kessel (1954. Wasmann J. Biol. 12:133–134) reported a wild *E. eschscholtzii* that carried an egg cluster in its mouth when disturbed.

Field studies were funded by the Cofrin Arboretum and Natural Areas Program of the University of Wisconsin-Green Bay. I appreciate R. G. Jaeger's comments on this manuscript.

Submitted by **DREUX J. WATERMOLEN**, Bureau of Environmental Analysis and Review, Wisconsin Department of Natural Resources, P.O. Box 7921, Madison, Wisconsin 53707-7921, USA. E-mail: waterd@dnr.state.wi.us.

PLETHODON IDAHOENSIS (Coeur d'Alene Salamander). **SNAKE PREDATION.** Other than reports of attempted avian predation (Wilson and Simon 1985. Herpetol. Rev. 16:111), and possible predation by an insect (Staub 1995. Herpetol. Rev. 26:199), no information has been published on predators of *Plethodon idahoensis.* On three occasions (described herein) we have palped this species from red-sided garter snakes *(Thamnophis sirtalis parietalis*). On 24 July 1986 in the Kootenai River Gorge, Lincoln Co., Montana, USA, we retrieved a 2.5 cm *P. idahoensis* tail tip from a fresh road-killed snake (39.5 cm SVL). On 8 June 1987 we palped a neonate *P. idahoensis* (1.8 cm SVL) from an immature *T. s. parietalis* (18.9 cm SVL) above the W shore of Lake Koocanusa, Lincoln Co., Montana, USA. On 16 June 1991 we palped another neonate (2.0 cm SVL) from an immature snake (21.0 cm SVL) found along the North Fork St. Joe River, Shoshone Co., Idaho, USA. Snakes and prey from the Montana sites were deposited in the Charles R. Conner Museum (CM 90-1, 90-2), Washington State University, Pullman. Our observations occurred during field surveys conducted for the USDA Forest Service and the Natural Heritage Programs of Idaho and Montana.

Submitted by **ALBERT G. WILSON, JR.**, Spokane Falls Community College, Department of Mathematics, Science, and Computing, Spokane, Washington 99204, USA, and **EVELYN M. WILSON,** College of Veterinary Medicine, Washington State University, Pullman, Washington 99164, USA.

ANURA

BUFO MARINUS (Giant Toad). **ARBOREAL BEHAVIOR.** On 20 February 1992 just north of Tacuato, Península de Paraguaná, Estado Falcón, Venezuela, we observed two *Bufo marinus* perched in a 5 m high Cuji tree (*Prosopis juliflora*). These individuals were in a natural hole at the base of a large fork ca. 2.5 m above ground; a third specimen was observed on the following night while perched on a limb ca. 1 m above ground.

Arboreal behavior has been reported in species of the *B. typhonius* group (Duellman 1978. Misc. Publ. Nat. Hist. Univ. Kansas 65:1–352; Duellman and Schulte 1992. Copeia 1992:162–172; Hoogmoed 1986. *In* Z. Rocek (ed.), Studies in Herpetology, pp. 147–150. Charles Univ., Prague). This is the first record of arboreal behavior in *B. marinus*.

We thank J. Aranguren, J. Hero, A. Martino, V. Medialdea, and R. Wingfield for their support. This project is partially supported by Fundacite-Falco (S1-9112-030 to AAR and AUM) and Proyecto Bufo, Covenant SCIRO-IVIC (to ML). Our thanks to W. E. Duellman and C. W. Painter who made comments on an earlier manuscript.

Submitted by **ABRAHAM MIJARES-URRUTIA,** Centro de Investigaciones en Ecología y Zonas Aridas, Universidad Francisco de Miranda, Apartado 7506, Coro 4101-A, Venezuela, **MARGARITA LAMPO**, Centro de Ecología, Instituto Venezolano de Investigaciones Científicas, Apartado 21827, San Martin, Caracas 1020-A, Venezuela, and **ALEXIS ARENDS R.**, Centro de Investigaciones en Ecología y Zonas Aridas, Universidad Francisco de Miranda, Apartado 7506, Coro 4101-A, Venezuela.

BUFO PARACNEMIS (Kururu Guazu, Sapo Buey, Sapo Rococo). **DIET.** *Bufo paracnemis* is a common frog in the Chacoan region of Argentina where it can be found in Jujuy southward to Córdoba and Santa Fe flats; Corrientes, Entre Rios, and Misiones (Cei 1980. Amphibians of Argentina. Monitore Zoologico Italiano (NS) Monog. 2:609). On 9 November 1994, between 2100–2300 h, we collected five specimens (3 males 102.5–119.5 mm SVL; 1 female 170.0 mm SVL; 1 juvenile 79.1 mm SVL) from an open area 15 km N of Corrientes Capital (27°28'S, 58°50'W) Corrientes State, Argentina. An analysis of the stomach contents taken from the males and the single female indicated that the most frequently taken prey items were coleopterans (N = 85; 73% [Scarabaeidae 95.3%; Curculionidae 3.5%; Cerambycidae 1.2%]), hymenopterans (mostly ants, N = 14; 12.1%), hemipterans (N = 7; 6.3%), orthopterans N = 5; 4.3%), and millipedes (N = 5; 4.3%).

The volume (in cm^3) of the items were coleopterans 5.5, hymenopterans 0.18, hemipterans 0.11, orthopterans 0.31, and millipedes 0.17. Coleopterans and hemipterans were present in all stomachs, hymenopterans and orthopterans in three, and millipedes in two. The diet of the four *B. paracnemis* studied was dominated numerically and volumetrically by coleopterans. *Bufo paracnemis* is considered a nocturnal active forager.

Submitted by **MARTA I. DURE** and **ARTURO I. KEHR**, Centro de Ecología Aplicada del Litoral, C.C. 291, (3400) Corrientes, Argentina.

BUFO TERRESTRIS (Southern Toad). **EGG TOXICITY.** Toxicity of toad (*Bufo* spp.) eggs to other anurans has been documented previously (Licht 1968. Herpetologica 24:93–98; Phisalix 1922. Masson et Cie. vol. 2). However, past reports were based on intraperitoneal injection of toad eggs into *Rana pipiens* and *R. temporaria*. On 23 March 1995, while checking pitfall traps surrounding an ephemeral pond on Eglin Air Force Base, Okaloosa County, Florida, USA (T1N, R25W, Sec. 28), I observed fatal toxicity of southern cricket frogs (*Acris gryllus*) by the eggs of southern toads.

Southern toads, entrapped while immigrating to the pond, deposited long strings of eggs in the shallow water within four of the forty-seven 18.9-liter buckets placed every 10 m along the outside of a cloth drift-fence. Large numbers (>30 individuals) of southern cricket frogs were found dead in each of the four buckets containing toad eggs. All cricket frogs found in other buckets containing adult toads, but no eggs, were alive. Death was assumed to be relatively quick based on the fact that healthy cricket frogs, after falling in, usually cling to the sides of the bucket above the water line and are easily capable of climbing out (pers. obs.).

In addition, no live or dying individuals were found in the four contaminated buckets. Cricket frogs are active throughout the day (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida. Part Three: The Amphibians. Windward Publ, Miami, Florida, 191 pp.), and it is likely that some of the frogs were caught just shortly before trap-checking at approximately 0930 h CST.

Besides being repelling to predators by unpalatibility (Licht 1967. Toxicon 5:141–142), egg toxicity may benefit toads by discouraging other anurans from depositing their eggs nearby, thus lessening larval competition for food. In addition, the affected water surrounding the eggs may provide a chemical barrier that repels potential amphibian predators such as newts.

This observation was made in conjunction with a rare-amphibian study supported by the U.S. Department of Defense Legacy Program. I thank Dale R. Jackson for reviewing the manuscript.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

BUFO WOODHOUSII* and *B. AMERICANUS (Woodhouse's Toad and American Toad). **VOCALIZATION.** Advertisement vocalizations of anurans function as premating isolating mechanisms by selectively attracting conspecific mates (Blair 1941. Genetics 26:398–417). The absence of vocalizations in individuals within a chorus would greatly decrease the chances of those individuals obtaining mates, except in instances of satellite behavior. Herein I report the lack of any audible vocalizations in four male toads attempting to vocalize.

On 13 June 1993 two *B. woodhousii* were observed attempting to vocalize at the Auburn University Northern Fisheries Annex ponds in Lee County, Alabama, USA. Each toad was observed for ca. 15 minutes. Both exhibited the typical upright vocalization posture, subsequent lung inflation, and gular sac extension. No audible vocalizations were detected during ca. 10 attempted vocalizations. One partially submerged toad caused vibratory ripples to form along the water's surface while attempting to vocalize. Release vocalizations were not produced when the thoracic region was clasped between the forefinger and thumb. Both toads were marked for future identification. Four days later, one of the two individuals was found at the same locality vocalizing normally.

On 8 March 1994 one *B. americanus* attempting to vocalize was observed in a flooded pasture off St. Rt. 147, 4.8 km N Jct. US Hwy. 280 /147 in Chambers County, Alabama. No audible advertisement vocalization was detected. Release call vocalizations were barely audible although normal release vibrations were exhibited. This individual and a nearby calling male were collected and housed in a 36-liter terrarium. Approximately 22 h later, these individuals were exposed to conspecific advertisement call playbacks in an attempt to elicit vocalizing behavior. Attempts at audible vocalization were unsuccessful in the non-calling male and normal vocalization was elicited in the other. Subsequent exposures to call playbacks in an attempt to elicit vocalization in these individuals were unsuccessful.

On 16 February 1995 a single *B. americanus* was observed at Chambers County Public Fishing Lake, Alabama. This individual also lacked an audible advertisement vocalization and release call. Release vibrations appeared normal. This specimen was sacrificed and dissection of the gonads revealed no detectable abnormalities. The larynx, testes, and Bidder's organs were removed and preserved in Bouin's solution for future morphological analyses.

I thank Mary T. Mendonça and James L. Dobie for their assistance in dissection.

Submitted by **CHRISTOPHER J. LEARY**, Department of Zoology and Wildlife Science, Auburn University, Auburn, Alabama 36849-5414, USA.

EUPSOPHUS EMILIOPUGINI (NCN). **AGGRESSIVE BEHAVIOR.** Aggressive behaviors in anurans include inflation of the lungs, elevation of the body, opening of the mouth, vocalizations, and jumps (Duellman and Trueb 1986. Biology of Amphibians, McGraw Hill, New York. 620 pp.). Because these behaviors are seldom observed, there are only scattered reports. Among the frogs of the family Leptodactylidae, aggressive behavior has been reported among members of the subfamilies Leptodactylinae (*Leptodactylus ocellatus, L. pentadactylus*) (Villa 1969. Rev. Biol. Trop. 15:323–329; Vaz-Ferreira and Gehrau 1975. Physis 34:114); Ceratophrinae (*Lepidobatrachus llanensis, Ceratophrys ornata*) (Barrio 1963. Physis 24:143–148), and Telmatobiinae (*Caudiverbera caudiverbera*) (Veloso 1977. Herpetologica 33:434–442). Here we describe the aggressive behavior of *Eupsophus emiliopugini,* a member of the subfamily Telmatobiinae, which is endemic to the temperate *Nothofagus* forests of southern Chile (Formas 1989. Proc. Biol. Soc. Washington 102:568–576).

Aggressive behavior was observed under laboratory conditions (18°C). Recordings of the vocalizations were made at 19 cm/sec on a Uher 4000 report IC portable tape recorder and a Uher microphone. The audiospectrograms were made with a Kay Elemetric audiospectrograph model using the 85-8000 Hz frequency scale and the narrow (45 Hz) band filter. Oscillograms were made with a model 564 Tektronic oscilloscope. Specimens and tapes were deposited in the amphibian collection of the Instituto de Zoologia, Universidad Austral de Chile.

During the course of a field study of *E. emiliopugini,* we collected 53 adults from four localities in southern Chile (12 specimens from La Picada 41°4'S, 72°26'W, 8 specimens from Rio Lenca 41°37'S, 72°40'W, 15 specimens from Puntra 47°7'S, 73°49'W, and 18 specimens from Yaldad 43°7'S, 73°43'W). All were captured during the breeding season (September to December). The specimens collected at Puntra (12 adult males and 3 adult females) were transported to the laboratory and maintained in a plastic container together with 5 specimens of *E. calcaratus* collected at the same locality. On 22 September we heard some unusual sounds emanating from the box. When the box was opened, one of us (JRF) observed 4 adult males of *E. emiliopugini* with their mouths open and bodies elevated. When each of the animals was tapped on the head, it inflated its lungs, elevated the body further, and emitted a loud cry with the mouth open. This behavior was elicited 3–7 times in each specimen by tapping on the head or dorsum.

The description of the cry of *E. emiliopugini* is based on 17 cries produced by the four males (46.7–50.6 mm SVL) observed in the laboratory at 18°C and recorded immediately after being tapped. The cry consisted of a single note in 12 cases, although secondary notes were detected in 5 cases. The structure of the primary note is modulated and the presumed harmonics are well differentiated. The intervals between presumed harmonics average 317.7 (range 308–319) Hz. The mean duration is 0.98 (range 0.35–1.81) sec. The fundamental frequency ranges between 200 and 340 Hz, and dominant frequency ranges between 3230 and 6250 Hz (Fig. 1). The cry is pulsatile, and the pulses are more concentrated in the middle of the cry (Fig. lc). Each pulse starts

with maximum amplitude and gradually decreases throughout (Fig. 1d).

When the cry of *E. emiliopugini* is compared with its advertisement call (Fig. 1b) some major differences are obvious. The advertisement call is characteristically composed of two notes. Both are similar in duration (mean = 0.20 ± 0.027 sec.) and have 27 pulses (mean) per note. The fundamental frequency ranges from 63–83 Hz and the dominant frequency ranges from 729–1320 Hz (Formas 1989, *op. cit.*). The cry of *E. emiliopugini* is emitted out of water with the mouth open, whereas the advertisement call is produced with the mouth closed while the males are partially submerged.

Submitted by **J. RAMON FORMAS**, Instituto de Zoología, Universidad Austral de Chile, Casilla 567-Valdivia, Chile, and **VICTOR POBLETE**, Instituto de Acustica, Universidad Austral de Chile, Casilla 567-Valdivia, Chile.

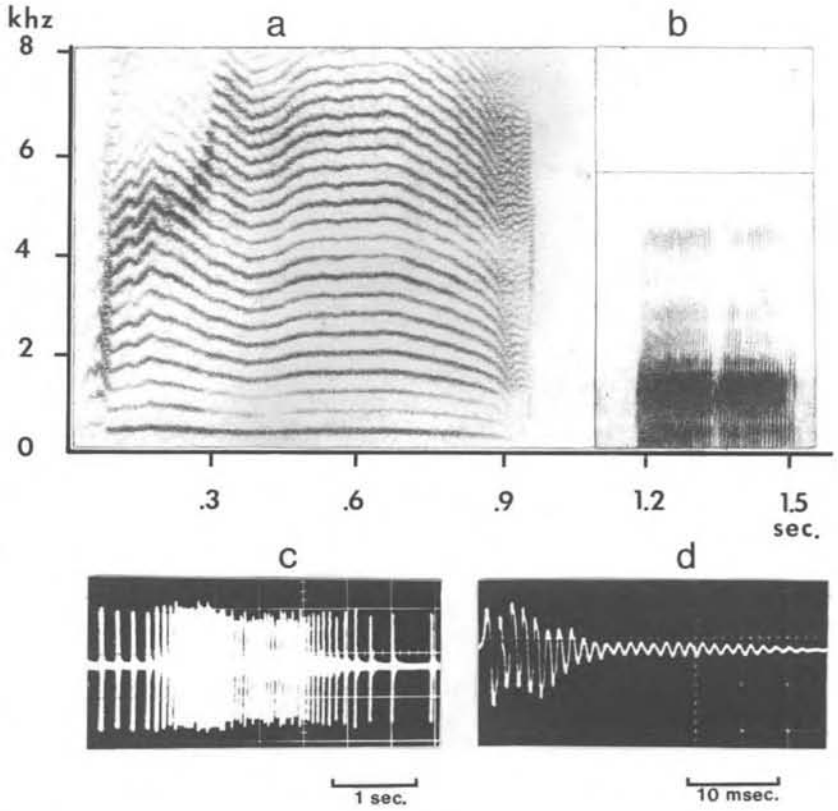


FIG. 1. Aggressive vocalizations and advertisement calls of male *Eupsophus emiliopugini*. Refer to text for details.

HYLA FEMORALIS (Pine Woods Treefrog). **PREDATION.** Anuran larvae and adults are preyed upon by many species of vertebrates as well as a host of aquatic invertebrates (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill, New York. 670 pp.). Prominent among the invertebrate predators are dytiscid beetles (Allen 1967. Pan-Pacific Ent. 43:113–117; Hinshaw and Sullivan 1990. J. Herpetol. 24:196–197) and odonate larvae (Caldwell et al. 1980. Oecologia 46:285–289; Heyer et al. 1975. Biotropica 7:100–111). Spiders are also known to take anurans (Bastos et al. 1994. Herpetol. Rev. 25:118; Goin 1943. Proc. Florida Acad. Sci. 6:143–154; Groves and Groves 1978. Bull. Maryland Herp. Soc. 14:44–46; Neill 1948. Herpetologica 4:158).

On 27 July 1995, I collected a *Hyla femoralis* tadpole from One Shot Pond, a temporary pond located on the Katharine Ordway Preserve-Carl Swisher Memorial Sanctuary, Putnam Co., Florida, USA. At time of collection a spider was feeding on the tadpole. The spider later was identified as a juvenile *Dolomedes* sp. (Pisauridae), likely *Dolomedes triton*. The spider maintained its grasp on the tadpole for approximately two minutes following dip net capture of both individuals. After the spider released the tadpole, both were placed in 10% buffered formalin. The tadpole apparently had been bitten prior to collection. It did not struggle when dropped into the preservative and digestion of the tissue immediately surrounding the bite already had begun. The location of the spider's bite was visible on the tail musculature of the tadpole just posterior to the body (Fig. 1). The tadpole had a body length of 11.7 mm and a total length of 27.8 mm (Altig 1970. Herpetologica 26:180–207) and was in Gosner stage 40 (Gosner 1960. Herpetologica 16:183–190). The combined cephalothorax-abdomen length of the spider was 10.1 mm.

Fishing spiders of the genus *Dolomedes* are known to prey upon recently transformed frogs as well as adults of species with small body size (Bastos et al., *op. cit.;* Neill, *op. cit.*). *Dolomedes* is also known to prey upon tadpoles (Foelix 1982. Biology of Spiders. Harvard University Press, Cambridge, Massachusetts. 304 pp.). To my knowledge, this is the first account of *Dolomedes* feeding on a *Hyla femoralis* tadpole. Although fishing spiders will eat tadpoles, their significance as tadpole predators, compared to other invertebrates such as dragonfly larvae and predaceous diving beetles, is unknown and in need of further study.

I thank D. A. Johnson for drafting Fig. 1 and G. B. Edwards for identifying the spider.

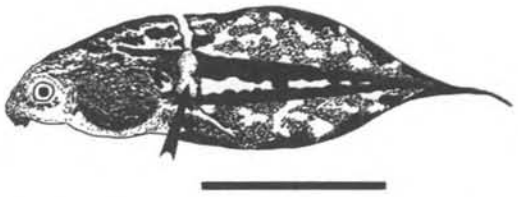


FIG. 1. *Hyla femoralis* tadpole showing spider bite location (arrow). Scale bar = 10 mm.

Submitted by **STEVE A. JOHNSON**, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA.

MIXOPHYES FASCIOLATUS (Great Barred Frog). **TADPOLE PREDATION.** Observations of predation on tadpoles in the wild are rare, yet each observation adds to our limited knowledge of the ecology of amphibian communities. At 1215 h on 19 February 1995, at the Mount William branch of upper Cattle Creek in the rainforest of Eungella National Park, east-central Queensland, Australia (148°36'10"E, 21°01'48"S), we observed the predation of a *Mixophyes fasciolatus* tadpole (ca. 40 mm total length) by an azure kingfisher (*Alcedo azurea*). The kingfisher spent a few minutes perched on a stump about 70 cm above a slow-flowing pool, before it dived into the pool and caught a tadpole. The bird then flew to a nearby perch and swallowed the tadpole head first, showing no indication that the tadpole was distasteful.

We have often observed kingfishers along the streams, and tadpoles of *M. fasciolatus* and other species are common in many of the slow-flowing pools, suggesting that predation events of this type may be frequent. While many studies have concentrated on tadpole predation (Alford, *in press*. *In* R. Altig and R. W. McDiarmid (eds.), Biology of Anuran Larvae. Univ. Chicago Press, Chicago, Illinois), few have considered the effect of birds as predators. Birds are known to readily feed on tadpoles (Beiswenger 1981. Copeia 1981:459–460; Black 1970. Bull. Oklahoma Ornith. Soc. 3:33–34; Crump and Vaira 1991. Herpetologica 47:316–321), and kingfishers, by their aquatic predatory nature and habitual proximity to water bodies, are potentially significant predators of tadpoles. Because this type of predation has been rarely documented for pond tadpoles and perhaps never recorded for stream-dwelling tadpoles (Barker and Vestjens 1989. The Food of Australian Birds. Vol. 1—Non-passerines. CSIRO Division of Wildlife and Ecology, Lyneham, A.C.T.), the extent of this type of predation remains unknown.

Submitted by **E. E. BOLITHO** and **R. W. R. RETALLICK**, Department of Zoology, James Cook University, Townsville, Queensland 4811, Australia.

PHYLLOMEDUSA DISTINCTA (Leaf-frog). **PREDATION.** Phyllomedusine frogs generally display green dorsal coloration that may function as concealment. The vivid colors often present on concealed surfaces and flanks of these frogs may warn potential predators about the presence of skin toxins (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill, New York. 670 pp.), or they may produce a startle effect by sudden changes in body shape and color patterns (Endler 1986. *In* Feder and Lauder (eds.), Predator-Prey Relationships, pp. 109–134. Univ. Chicago Press, Chicago and London).

Leaf-frogs and their predators were studied at the Atlantic Forest Reserve of the Parque Estadual de Carlos Botelho (24°12'S, 47°55'W, 60 m elev.), Sete Barras, São Paulo, southeastern Brazil. Observations were made at a pond (ca. 20 m x 7 m) adjacent to a lawn with a few trees and small shrubs. Aquatic vegetation was sparse and concentrated at the pond edges. The surrounding vegetation is tropical rainforest. Climate is wet-mesothermic.

On 13 November 1991 (1100 h; 24.5°C), I observed a water snake, *Liophis miliaris*, ingesting a clutch of *Phyllomedusa distincta* eggs enclosed in a leaf of a shrub (Melastomataceae), ca. 50 cm above the water surface. The snake introduced its head into the upper part of the clutch, thereby forcing open the glued leaf, after which it ingested about half of the eggs. With my approach the snake fled. The snake returned after 70 min and started to ingest another clutch in the same manner. Again, my approach caused the snake to flee.

In the study area, *L. miliaris* is the most commonly observed snake, and accounted for 8 of 15 sightings of snakes around the pond. This snake has variable habits and a generalist diet (Michaud and Dixon 1989. Herpetol. Rev. 20:39–41), hunting in or at the edge of water. It rarely climbs in vegetation. Due to its abundance, *L. miliaris* probably is an important predator of *P. distincta* eggs.

On 11 December 1991 (31°C; 0945 h), I observed the colubrid snake *Chironius exoletus* seizing a male *P. distincta* on a tree branch at the edge of the pond. The snake tried to ingest the prey headfirst, but the frog firmly grasped the branch with its hindlegs. After about 5 min, the snake pulled the leaf-frog from the branch and, with its head raised, began ingestion, which took ca. 25 min. During the next hour, the snake did not show any sign of discomfort [see Sazima (1974. J. Herpetol. 8:376–377) for a report of *Phyllomedusa rohdei* being regurgitated by snakes]. In my study area, individuals of *C. exoletus* are common at the pond edges, where they hunt for frogs in the vegetation. This species accounted for 4 of 15 sightings of snakes around the pond. While I observed one *C. exoletus* investigating bromeliads on a tree, a treefrog jumped from there and fled to the pond and, in spite of the tree's height (ca. 4 m), the snake made its way to the ground searching for the frog, flicking its tongue. *Chironius exoletus* may be an important predator of *P. distincta* adults as these frogs remain in torpor (*sensu* Blaylock et al. 1976. Copeia 1976:283–295) on the vegetation during the day and have no efficient escape movements (pers. obs.).

I am grateful to A. J. Cardoso for guidance during my M. Sc. dissertation. I also thank C. F. B. Haddad, I. Sazima, A. Abe, and P. S. Oliveira for valuable suggestions, the Conselho Nacional de Desenvolvimento Científico e Tecnológico for financial support (proc. 130337/90-0) and the Instituto Florestal de São Paulo for permission to study in the Parque Estadual de Carlos Botelho.

Submitted by **LUCIANO MENDES CASTANHO**, Depto. de Zoologia, UNESP, Caixa Postal 199, C~P 13506-900, Rio Claro, SP, Brasil.

RANA SAKURAII (Brown Stream Frog). **ENDOPARASITES.** *Rana sakuraii is* known only from Honshu Island, Japan where it occurs from Kanto to Kinki Districts (Maeda and Matsui 1990. Frogs and Toads of Japan. Bun-Ichi Sogo Shuppan Co., Ltd. Tokyo, Japan, 207 pp.). In this note we report on an examination of the gastrointestinal tracts from 5 *R. sakuraii* collected on Tanzawa Mountain, ca 700 m elev., (35°22'N, 139°04'E), Kanagawa Prefecture, Honshu Island, Japan, 14 April 1993; N = 5, mean SVL = 47 mm ± 3.6 SD, range 42–51 mm. Frogs were deposited in the herpetology collection of the Natural History Museum of Los Angeles County (LACM 141210–141214).

The body cavity was opened by a longitudinal incision from throat to vent. The esophagus, stomach, small and large intestine were removed and examined separately using a dissecting microscope. Each parasite was removed and identified using a glycerol wet mount.

The endoparasite fauna of *R. sakuraii* consisted of the cosmocercid nematode, *Cosmocerca japonica* (prevalence: number infected individuals/number individuals examined = 80%; mean intensity: mean number helminths per infected host = 2; infection site: small and large intestines) and the acanthocephalan, *Acanthocephalus lucidus* (prevalence = 60%; mean intensity = 1; infection site: small intestine). All our findings represent new host records. Helminths were deposited in the U.S. National Parasite Collection, Beltsville, Maryland 20705, USA: *Cosmocerca japonica* USNPC 85334; *Acanthocephalus lucidus* USNPC 85335.

We thank Tatsuo Ishihara (Hakone Woodland Museum, Hakone) for the collection of *R. sakuraii*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Valley Campus, 147 Shenango Avenue, Sharon, Pennsylvania 16146, USA, and **HAY CHEAM**, Department of Biology, Whittier College, Whittier, California 90608, USA.

TESTUDINES

TRACHEMYS SCRIPTA ELEGANS (Red-eared Slider) **REPRODUCTION.** I report the largest known clutch for *Trachemys scripta elegans* and one of the largest known for the Emydinae (*sensu* Ernst and Barbour 1984. Turtles of the World. Smithsonian Inst. Press, Washington, D.C., 313 pp.). The female (250 mm plastral length, 3125 g gravid body mass) was collected crossing the Illinois River Road, near Pohlman Slough in Calhoun Co., Illinois, USA (NE1/4 Sec. 15, T13S, RlW) on 16 June 1995. The largest clutch reported range-wide for this species (excluding tropical races) is 25 eggs (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C., 578 pp.). The clutch reported herein is equivalent to the largest clutch reported for tropical races (Moll and Moll 1990. *In* J. W. Gibbons (ed.), Life History and Ecology of the Slider Turtle, pp. 152–161. Smithsonian Inst. Press, Washington, D.C.). Among other Emydinae, only *Pseudemys nelsoni* (31 eggs/clutch) and *P. rubriventris* (35 eggs/clutch) have been reported to lay larger clutches. Clearly, this is an exceptionally large clutch for *T. s. elegans* which has been reported to lay between 2 and 23 eggs per clutch (Ernst et al. 1994, *op. cit.*)

The 30 eggs averaged 12.09 g mass (range = 8.71–13.51 g, SD = 1.04 g), 35.9 mm long (range = 35.0–40.1 mm, SD = 1.12 mm), and 23.9 mm wide (range = 21.2–25.0 mm, SD = 1.14 mm) shortly after induced oviposition (Ewert and Legler 1978. Herpetologica 34:314–318). After 70 days of incubation at ambient temperatures ranging between 22.1 and 34.6°C, 29 of the eggs hatched. Hatchlings averaged 9.30 g mass (range = 7.92–10.26 g, SD = 0.53 g), 32.4 mm carapacial length (range = 30.9–34.2 mm, SD = 0.78 mm), 31.3 carapacial width (range = 29.0–33.1 mm, SD = 1. 11 mm), and 31.1 mm plastral length (range = 29. 6–32. 6 mm, SD = 0.87 mm) .

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program Pool 26, 4134 Alby Street, Alton, Illinois 62002, USA.

LACERTILIA

ANOLIS SCRIPTUS (Silver Key Anole). **ENDOPARASITES.** *Anolis scriptus* occurs on the Bahama Islands and the Turks and Caicos Islands (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies. Descriptions, Distributions, and Natural History. University of Florida Press, Gainesville, 720 pp.). We know of no published reports on the endoparasites of *A. scriptus*. The purpose of this note is to report on an examination of gastrointestinal tracts from 25 *A. scriptus*. Specimens were borrowed from the Museum of Natural History, University of Kansas (KU) (mean snout-vent length (SVL) = 56.8 mm ± 5.4 SD, range = 45-68 mm). Specimens were collected during 1961–1976. Seven (KU 247798–247799; 247808; 247815; 247817; 247822; 247829) were from North Caicos (71°80'W, 21°90'N); thirteen (KU 247832–247834; 247848; 247873; 247924–247925; 247932; 247934; 247939–247942) were from Middle Caicos (71°60'W, 21°50'N); five (KU 247944–247946; 247950–247951) were from East Caicos (71°30'W, 21°40'N).

The body cavity was opened and the gastrointestinal tract was removed by cutting across the anterior esophagus and the rectum. Esophagus, stomach, small intestine, and large intestine were examined using a dissecting microscope. The only parasites present were nematodes which were removed and identified using a glycerol wet mount.

Five species were present: *Abbreviata* sp. (larvae only) (prevalence: number infected individuals/number individuals examined = 4%, mean intensity: mean number nematodes per infected host = 4.0); *Moaciria alvarengai* (prevalence = 16%, mean intensity = 1.0); *Parapharyngodon cubensis* (prevalence = 12%, mean intensity = 1.7); *Physaloptera squamatae* (prevalence = 44%, mean intensity = 4.1); *Spauligodon caymanensis* (prevalence = 4%, mean intensity = 34.0). *Anolis scriptus* is a new host record for the above five nematode species. All nematodes previously have been found in other Caribbean anoles; however, *M. alvarengai* is known previously only in the skink, *Mabuya maculata* from Fernado de Noronha, Brazil (3°51'S, 32°25'W) (Baker 1987. Mem. Univ. Newfoundland Occas. Pap. Biol. 11:1325). Nematodes were deposited in the U.S. National Parasite Collection, (USNPC), Beltsville, Maryland 20705, USA: *Abbreviata* sp. 85445; *Moaciria alvarengai* 85446; *Parapharyngodon cubensis* 85447; *Physaloptera squamatae* 85448; *Spauligodon caymanensis* 85449.

We thank William E. Duellman (Museum of Natural History, University of Kansas) for permission to examine *A. scriptus*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Valley Campus, 147 Shenango Avenue, Sharon, Pennsylvania 16146, USA, and **LESLIE N. AJIMINE**, Department of Biology, Whittier College, Whittier, California 90608, USA.

CNEMIDOPHORUS MURINUS RUTHVENI. (Bonaire Island Whiptail Lizard). **SEEDS IN DIET.** On Bonaire, Netherlands Antilles, 10–44% (depending on site) of the annual diet of *Cnemidophorus murinus* consists of fruit from a variety of plant species (Dearing and Schall 1992. Ecology 73:845–858). The fruit of the shrub, *Erithalis fruticosa* (Rubiaceae), is among the most commonly eaten. As *C. murinus* is exceptionally abundant on the island (Bennett and Gorman 1979. Oecologia 42:339–358), the whiptail lizards could play an important role in the dispersal of the seeds of *E. fruticosa*, provided the seeds can tolerate passage through the gut of the animals.

I compared the germination success of *E. fruticosa* seeds removed from mature fruits still on the shrubs to that of seeds extracted from feces found in the natural habitat of the lizards. In a single morning in January, I visited the Karpata site of Dearing and Schall (ibid). At this site, fully 60% of the diet of *C. murinus* consists of the fruits of *E. fruticosa* during the autumn and winter rainy season. I collected mature fruit from ten shrubs as well as sun-dried feces found lying on the ground surface and tops of rocks used as perches by the lizards. After extracting the seeds of *E. fruticosa* from both fruit and feces, the seeds were planted in a standard germination medium used in horticulture (1:1 vermiculite and perlite). The medium was kept moist and the flats were placed under full-spectrum Vitalites™ kept on 24 h per day in a room set at 28°C. I planted 150 seeds taken from feces in one 27 x 40 cm flat, and another 150 seeds from the fruits in another similar flat.

Seedlings emerged from the medium from 30 to 61 days after planting. No additional seedlings emerged during the next 30 days, after which the medium was discarded. Six seedlings emerged from seeds harvested directly from the fruits, and eight from those removed from feces (4 and 5% germination success). There was no significant difference in germination success for the two groups (G-test, $P > 0.05$).

Although many taxa of animals have been identified as important seed dispersers, few data are available on potential seed dispersal by herbivorous lizards (Iverson 1985. J. Herpetol. 19:292–293). For example, little is known about the tolerance of seeds within the fruit for passage through the digestive tract of a lizard. Iverson (ibid.) found that seeds of *Coccoloba uvifera* (Polygonacae) that passed through the gut of *Cyclura* had slightly higher germination success than control seeds removed from fruits; this suggests that being consumed by a lizard might actually facilitate germination of some seeds. The results presented here show that at least some of the seeds of *E. fruticosa* survive both passage through the gut of *C. murinus* as well as some unknown period of time lying on the surface of the ground and rocks on Bonaire island. Also, the results hint that passage through the lizards' alimentary tract does not facilitate germination because a similar percentage of seeds from the fruit and feces produced seedlings.

The research was funded by a grant from the Whitehall Foundation.

Submitted by **JOS. J. SCHALL,** Department of Biology, University of Vermont 05405, USA.

SERPENTES

AGKISTRODON PISCIVORUS LEUCOSTOMA (Western Cottonmouth). **CARRION FEEDING.** At 1640 h CST on 7 June 1994, Larry Wood and I observed carrion feeding by a cottonmouth, *Agkistrodon piscivorus leucostoma*, at the Chickasaw National Wildlife Refuge, 15 km NW Ripley, Lauderdale Co., Tennessee, USA. We came upon a large individual, ca. 100–110 cm in total length, stretched on the road, feeding on a snake. On closer examination, it was obvious that the cottonmouth was eating a road-killed snake whose body was dried and flattened and showed the marks of having been run over. It appeared to be a colubrid, probably a *Nerodia* sp. We approached the cottonmouth, photographed it, whereupon it moved through the gravel to a flooded ditch beside the road and disappeared into the water. We could not verify how the snake found and began feeding on the roadkill, as it had swallowed a substantial part of the carrion before we arrived.

Gloyd and Conant (1990, Snakes of the *Agkistrodon* Complex: A Monographic Review, pp. 238–239, SSAR) indicate that this subspecies occasionally eats "insects and carrion." Wharton (1966. Copeia 1966:149–161) noted *A. piscivorus* feeding on fish dropped from heron nests, and Berna and Gibbons (1991, Herpetol. Rev. 22:130–131) observed an *A. p. piscivorus* attempt to eat a dead *Nerodia erythrogaster erythrogaster*. This observation is further indication of the opportunistic foraging behavior of this snake (Keiser 1993. Herpetol. Rev. 24:34; Studenroth 1991. Herpetol. Rev. 22:60).

I am indebted to Bill Redmond and Floyd Scott for encouraging me to prepare this note, and to Floyd Scott for assistance. Ray Burkett kindly reviewed the manuscript.

Submitted by **PAUL B. HAMEL**, USDA Forest Service, Southern Research Station, Southern Hardwoods Lab., P.O. Box 227, Stoneville, Mississippi 38776, USA.

COLUBER VIRIDIFLAVUS (European Whip Snake). **CANNIBALISM.** Reports of snakes feeding on eggs of their own species are exceptional in free-ranging individuals. The European whip snake *Coluber viridiflavus* occasionally feeds on snakes (Duron et Acolat 1957. Ann. Sci. Univ. Besançon 6:179–183), but only one record of cannibalism involving a large male (130 cm total length) feeding on a young conspecific (60 cm total length) has been reported from the field (Naulleau 1984. Rev. Fr. Aquar. 1984:32–35).

We found a large male (144 cm total length, 106 cm SVL, 407 g) killed on the road on 9 July 1995 (C.E.B.C., Forest of Chizé, Road N° D53, 46°07N 0°25W, Département des Deux Sèvres, west central France) with three snake eggs in its stomach and one in its intestine. The eggs were in good condition indicating that they had recently been ingested. They were identified as belonging to *Coluber viridiflavus*, based upon their general appearance, shape, and size. The mean egg length (3.92 ± 0.32 cm, N = 4) was similar to mean egg length (4.30 ± 0.58 cm, N = 53) obtained from clutches of 8 females (ANOVA, $F_{1,52} = 1.68$, $P = 0.183$). In addition, *Coluber viridiflavus* is the only large snake species laying eggs between mid-June and early July in our study area (the second largest oviparous snake, the Aesculapian snake *Elaphe longissima*, lays eggs between late July and early August). The accidentally killed male was found 15 m from a communal nesting site used by female whip snakes (Capula and Luiselli 1995. Herpetol. Rev. 26:38–39). We have regularly found vitellogenic female *C. viridiflavus* sheltered under slabs at the entrance of the nesting site, and also have caught adults males and observed mating at the same place. Apparently males can exploit nesting sites not only for mating but also to feed on eggs of their own species.

Submitted by **LAURENT SCHMIDLIN**, **XAVIER BONNET**, and **CHRISTIAN TEGE**, Centre d'Etudes Biologiques de Chizé, Centre National de la Recherche Scientifique, 79360 Villiers en Bois, Deux Sèvres, France.

CROTALUS DURISSUS (Neotropical Rattlesnake) **PREY.** Although rodents are the predominant prey of *Crotalus durissus*, these pitvipers are also known to feed to a lesser extent on birds and lizards (Salomão et al. 1995. Stud. Neotrop. Fauna Environ. 30(2):101–106; Vanzolini et al. 1980. Répteis da Caatinga, pp. 68 and 110. Acad. Bras. Ciênc.) Here we report the lizard, *Ameiva ameiva* as prey of an adult *C. durissus*. The snake is a female (Instituto Butantan (IB) 15935; 743 mm SVL) from São Paulo, Brazil (21°12'S and 50°25'W) captured on 19 January 1954 (summer). Its stomach contents showed the presence of ventral and dorsal scales, as well as the feet of *A. ameiva*, ingested head first. The total length of the lizard (400 mm) was estimated from the size of bones and scales.

We thank H. Ferrarezzi and M. T. U. Rodrigues for the identification of the lizard and discussions, O. A. V. Marques for the suggestion to prepare the manuscript, M. G. Salomão for comments and translation into English, and F. C. Costa for final revision.

Submitted by **SELMA MARIA ALMEIDA SANTOS** (to whom correspondence should be addressed) and **VALDIR JOSÉ GERMANO**, Laboratório de Herpetologia, Instituto Butantan, Av. Dr. Vital Brazil, 1500, Butantã, São Paulo - 05503-900, Brazil.

CROTALUS EXSUL LORENZOENSIS (San Lorenzo Island Rattlesnake). **ARBOREAL BEHAVIOR.** On 7 July 1995 at ca. 2200 h, in an arroyo on the southwest side of Isla San Lorenzo Sur, Baja California, México, an adult *Crotalus exsul lorenzoensis*

was observed active on the ground near the margins of an elephant tree (*Bursera microphylla*). When approached, the snake climbed into the lower branches of the tree and ascended to a height of 2.0 m above the substrate, eventually coming to a rest and coiling in the upper branches. This behavior suggests that this population is partially arboreal in its habits. Similar arboreal tendencies have been observed in the insular rattlesnakes *C. enyo cerralvensis* (McGuire 1991. Herpetol. Rev. 22:100) and *C. catalinensis* (L. Grismer, pers. comm.). A total of three *C. exsul lorenzoensis* were observed within the arroyo, two of which had degenerate rattles. It is of interest that *C. catalinensis* also lacks a rattle. These species' arboreal tendencies and the loss of a rattle may be linked to the predation of birds or other arboreal animals (Grismer, pers. comm.).

Submitted by **BRADFORD D. HOLLINGSWORTH,** Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and **ERIK MELLINK,** Centro de Investigación Científica y de Educación Superior de Ensenada, B.C., Apdo. Postal 2732, Ensenada, Baja California, México.

CROTALUS HORRIDUS (Timber Rattlesnake). **REPRODUCTIVE PHENOLOGY.** Estimates of parturition dates for *Crotalus horridus* in nature, based on the finding of postpartum females with premolt neonates, range from early August to early October. Between 1969 and 1990, I found postpartum females with litters from 9 August to 16 October with latest known parturition on 3 October. The years of 1991 and 1992 represented extremes in active season temperatures and provided records both earlier and later than previously observed (Martin 1992. *In* J. A. Campbell and E. D. Brodie, Jr. (eds.), Biology of the Pitvipers, pp. 259–277. Selva, Tyler, Texas).

Female *C. horridus* usually stay with their young 7–10 days and neonates usually molt within 8–16 days of birth (Martin 1992, *op. cit.*); thus, the timing of parturition can be estimated within a week to 10 days when a postpartum female is present with a litter of premolt neonates. Most of the observations in this note were made in the northern portion of the Blue Ridge physiographic region from the Catoctin and South Mountain complex in Maryland southward to Shenandoah National Park in Virginia (USA). Additional observations were made at two sites located on the Allegheny Plateau in central Pennsylvania and northern West Virginia (USA).

Parturition dates in 1992, a year with an unusually cool, wet growing season, were 4–6 weeks later than those in 1991 when the growing season was much longer, hotter, and drier than usual. The earliest parturition occurred between 31 July and 3 August 1991 as a female was found pregnant on 30 July and postpartum with young on 4 August. The latest birthing probably occurred shortly after 10 October 1992 as a pregnant female was found on that date accompanied by a postpartum female with a litter apparently born within a day.

In 1992 at a high elevation Allegheny Plateau site located in Grant Co., West Viriginia, pregnant females entered hibernation carrying unborn young (Table 1) just as they had done in 1989. Neither those females nor young from the 1989 and 1992 cohorts

TABLE 1. Significant observations of *Crotalus horridus* litters with postpartum females and near-term pregnant females are shown for the years 1991, 1992, and 1994 (reproduction was low in 1993 and no significant observations were made). The date of observation is followed by the number of litters and the number of pregnant females. An asterisk indicates the pregnant females returned to the overwintering den for parturition and two asterisks indicate the pregnant females entered hibernation without birthing. Temperature departures from the mean for Shenandoah National Park Headquarters at Luray, Virginia for the April–September period were +1.7°C in 1991, –1.1°C in 1992, and 0.0°C in 1994.

Site location and elevation	1991 # litters/ # pregnant females		1992 # litters/ # pregnant females		1994 # litters/ # pregnant females	
Virginia: Warren Co., 450 m	4 August	1:0	31 August	1:1	18 August	0:1
Virginia: Warren Co., 525 m	4 August	0:0	31 August	0:2	18 August	1:1
Virginia: Page Co., 700 m	19 August	0:6	18 September	1:7	31 August	2:4
Virginia: Rappahannock Co., 777 m	—	—	10 October	1:1	15 September	0:0
Virginia: Madison Co., 850 m	1 September	7:2	3 October	1:5	17 September	3:0
Virginia: Greene Co., 965 m	30 August	0:1	3 October	0:0	17 September	3:0
	4 September	1:0	—	—	27 September	1*:0
Maryland: Washington Co., 400 m	6 August	1:0	10 September	2:4	29 August	1:0
West Viriginia: Jefferson Co., 400 m	14 August	2:1	19 September	2:3	21 August	1:6
West Viriginia: Grant Co., 1070 m	31 August	7:1	28 September	0:2	16 September	0:5
	—	—	15 October	0:0**	25 September	1*:0
Pennsylvania: Centre Co., 475 m	8 August	1:9	—	—	—	—

have been found. Significantly, in 1994, a year in which active season temperatures were near normal, at least one pregnant female seen at a birthing rookery in mid-September at the Grant Co. site, as well as a female from a high elevation Blue Ridge site, returned to overwintering dens for parturition at the time when ingress was in progress in late September (Table 1).

Submitted by **W. H. MARTIN**, Route 3, Box 804, Harpers Ferry, West Viriginia 25425, USA.

CROTALUS HORRIDUS (Timber Rattlesnake). **CLIMBING.** While tracking timber rattlesnakes (N = 12) during a telemetry study in Nacogdoches County, Texas, USA, we captured an immature female *C. horridus* (75.4 cm SVL, 173.5 g WT) on 1 April 1993 and implanted a transmitter subcutaneously. On 10 August 1993 we located the snake 3.5 m above ground on small limbs (1 cm diam) of an 11 cm DBH American hornbeam (*Carpinus caroliniana*). On 18 August 1993 the snake was found 52 m from the previous location on the ground. Nine months later, 5 May 1994, we found the same snake 7 m up in a tangle of greenbriar (*Smilax* sp.) and small limbs of a 40 cm DBH willow oak (*Quercus phellos*). The next time we found the snake, 10 May 1994, it was found in small tertiary limbs 9 m above ground in the same tree, which is much higher than ever reported for this snake species.

The size of the rattlesnake was probably an important factor in its ability to climb. Rudolph (1990. Wilson Bull. 102(1):14–22) found that smaller *Elaphe obsoleta* were more adept climbers than larger ones, so it is not surprising that the only rattlesnake we observed climbing was the smallest in the study (snakes ranged in size from 75.4 cm SVL, 173.5 g to 137.2 cm SVL, 2654 g). We did not find evidence of a bird nest or flood waters in the immediate vicinity of the climbing snake which might cause this unusual behavior.

We thank Fred L. Rainwater, Paul D. Klawinski, and Bob R. Fleet for constructive comments on an early draft of this note.

Submitted by **DANIEL SAENZ, SHIRLEY J. BURGDORF, D. CRAIG RUDOLPH,** and **C. MICHAEL DURAN**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA. In cooperation with the College of Forestry, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA.

CROTALUS LEPIDUS (Rock Rattlesnake). **AQUATIC BEHAVIOR.** On 5 August 1995 at ca. 1700 h, MST, I observed aquatic behavior in *Crotalus lepidus* at the South Fork Negrito Creek (NW 1/4 of SW 1/4 Sec. 32, T8S, R17W, elevation ca. 2141 m), Catron County, New Mexico, USA. Here, the creek flows through a rocky, sheer-sided canyon 73 m deep, where several *C. lepidus* were observed. I observed a *C. lepidus* (40 cm TL) submerged in a 1 m deep, 2 m x 3 m pool; air temperature was approximately 35°C while the water was approximately 16°C. The snake was lying on a rock ledge under 0.5 m water adjacent to the central, deepest portion of the pool. The snake was completely submerged with its head and anterior portion of body elevated and suspended over the deeper water. Numerous small fishes also were in the pool swimming in the deep water. It appeared the rattlesnake could have been foraging for these fish. After observing the snake for several minutes I disturbed it while attempting to catch it. The snake swam to the surface and then across to the edge of the pool. I subsequently was unable to find it.

Crotalus lepidus swims well, although aquatic behavior in rattlesnakes is rare (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley. 1533 pp.). The aquatic behavior I observed may be attributable to either thermoregulation or foraging. *Crotalus lepidus* is mostly diurnal but seeks cool shelter during the hottest part of the day (Ernst 1992. Venomous Reptiles of North America. Smithsonian Inst. Press., Washington. 236 pp.). Cool water could offer such a shelter. Unlike most rattlesnakes, *C. lepidus* tends to rely on vision for foraging and feeds mostly on exothermic prey, particularly lizards (Ernst 1992, *op. cit.*). Conceivably, fish may provide a locally common food source for a visual predator such as *C. lepidus*, although predation on fish has never been documented for this species.

Submitted by **JENNIFER K. FREY**, Museum of Southwestern Biology and Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA. E-mail: jkfrey@unm.edu.

ELAPHE OBSOLETA OBSOLETA (Black Rat Snake). **RESPONSE TO FIRE.** Immediate and long-term effects of fire on snakes are not well known, although many snakes evolved in fire-maintained habitats, and prescribed burning is widely used by wildlife managers. It is generally thought that reptiles burrow to escape fire, but few direct observations have been published. We describe behavior of two radio-telemetered *Elaphe o. obsoleta* in response to a prescribed burn in the Ouachita National Forest, Arkansas, USA.

On 28 March 1993, U.S. Forest Service staff burned 312 ha of mature shortleaf pine (*Pinus echinata*) forest and clearcut regeneration. Two adult female *E. o. obsoleta* (SVL 120 cm and 108 cm) were monitored during the burn. Each snake contained a surgically-implanted temperature-sensitive transmitter.

Snake 1:—Snake 1 was located moving through the regeneration area at 1020 h, with a body temperature of 26.2°C. By 1145 h the snake had traveled 16 m ahead of the advancing fire, into a forested ephemeral drainage. At 1217 h it entered a cavern beneath an unvegetated 6-m slab of rock under trickling water. We began minute-by-minute telemetric monitoring of the snake's body temperature at 1325 h, along with air temperature 1 cm above ground ("surface temperature") near the rock slab. From 1325 h to 1402 h surface temperature rose from 23.8°C to 32.0°C as flames approached within 2 m of the snake's position. By 1520 h surface temperature fell to 19.3°C. From 1325 h to 1520 h the snake's body temperature remained between 15.7°C and 16.9°C, rising to 18.0°C only twice. Body temperature thus remained cool and constant despite the rise in surface temperature.

Snake 1 was subsequently tracked for 14 months and behaved normally. Radiotracking data showed no evidence of attraction or aversion to the burned area. Snake 1 was located within the burned area 17 of 26 times (65.4%) in 1993 after the fire, while in 1992 (before the fire) it was found in this area 23 of 31 times (74.2%) ($X^2 = 0.19$, df = 1, $P = 0.66$).

Snake 2:—Snake 2 was located at 1115 h in pine forest 500 m from Snake 1. Topography was level, with no drainages within 100 m. Body temperature was 26.0°C; surface temperature was 25.4°C. The snake was entering a log it had occupied as a retreat site on multiple previous occasions. One hour after the fire, the log was found destroyed, but the snake was located underground 13.5 m away, in root caverns of a charred stump. Its body temperature stayed between 10.7°C and 13.3°C from 1628 h to 1657 h. Surface temperature at 1628 h was 26.4°C. While the snake's

behavior was not observed directly, it apparently moved from a favored retreat site and took refuge in cool insulated caverns.

The snake was still in these caverns on 8 April, had moved to a new site by 11 April, and was found high in a tree cavity on 17 April. On 25 April it was found dead on a road 150 m from the tree, crushed by a vehicle. The snake's movement prior to its death, however, suggested it suffered no harm from the fire.

Snakes are often assumed to survive fire by moving underground, but few published observations confirm this. Jackson (1976. Herpetologica 32:359–361) showed *E. o. spiloides* to be more arboreal than *E. o. obsoleta*, and suggested that in southeastern pine forests lacking rocky caverns they may climb trees to escape fire. Our observations show that in a region featuring both fire-dependent pine forest and rocky soil, *E. o. obsoleta* can find refuge from fire underground.

Fire often benefits vertebrates by improving foraging habitat or increasing prey populations. Mushinsky (1985. Herpetologica 41:333–342) showed that snake populations can benefit from fire. Direct and long-term effects of fire on snakes presumably vary with foraging requirements, shelter-seeking behavior, predation pressure, and nature of the fire (Friend 1993. Biol. Conserv. 65:99–114). Our finding that Snake 1 showed no long-term attraction or aversion to burned areas supports the idea that multiple factors may influence their suitability.

We thank G. Bukenhofer, R. Masters, W. Montague, and K. Smith for critiques of the manuscript. Funding was provided by Ouachita National Forest, Southern Forest Experiment Station, Poteau Ranger District (Ouachita N.F.), and Arkansas Audubon Society Trust. We thank W. Montague and Poteau Ranger District fire crews for their kind cooperation.

Submitted by **JAMES H. WITHGOTT**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (present address: Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA) and **CHARLES J. AMLANER**, Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809, USA.

HETERODON PLATIRHINOS (Eastern Hognose Snake). **MORTALITY.** On 2 November 1994 I captured an adult female *Heterodon platirhinos* (66.5 cm TL, 270 g) near Searcy, White County, Arkansas, USA. She contained six firm masses approximately the size and shape of oviductal eggs (ca. 18 x 31 mm) in the posterior part of her body. After capture, I released her into a 7 x 15 m outdoor enclosure containing diverse microhabitats including hibernacula, several other *H. platirhinos*, and toads, *Bufo woodhousii*, for food. The other *Heterodon* were long-term residents of the enclosure where they successfully foraged, reproduced, grew, matured, and overwintered. After emergence from hibernation in early April 1995, the snake with the masses appeared healthy despite the now firmer composition of the masses. However, through spring and early summer 1995, she gradually lost weight, became emaciated, and eventually died on 2 July. Autopsy revealed five firm oviductal eggs (total weight = 35 g) and a hardened intestinal fecal mass (weight = 20 g) anterior to the eggs. The weight of the dead snake was 133 g. Assuming no change in mass of the eggs or fecal mass, she had lost 82 g or 38% of her body weight since capture. The eggs exhibited no gross signs of embryonic development.

Egg retention is the norm in oviparous squamates (Shine 1985. *In* Gans and Billett (eds.), Biology of the Reptilia, Vol. 15, pp. 605–694. Wiley-Interscience, New York); nevertheless, deaths of female snakes associated with abnormal retention of eggs or embryos have been reported (e.g., Fitch 1970. Univ. Kansas Mus. Nat. Hist., Misc. Publ. 52:1–247; Plummer 1992. Copeia 1992:1096–1098). Because the time of capture of the snake (2 November) was at least two months after the latest known time of oviposition for this species (Platt 1969. Univ. Kansas Publ., Mus. Nat. Hist. 18:253–420), the retention of eggs was likely abnormal at the time of capture. She probably did oviposit successfully before capture as the average clutch size for a *H. platirhinos* of her size is 22 eggs (Platt, *op. cit.*). Because the anteriormost hardened fecal mass did not increase in size over a period of eight months after capture and because her body weight gradually decreased until death, probably she did not feed after the time of capture, despite the availability of toads. Was the cessation of feeding related to egg retention? Egg retention may have physically prevented feeding via intestinal blockage as evidenced by the hardened fecal mass—immediately anterior to the eggs—which did not move either posteriorly in the body or relative to the eggs from 2 November 1994 to 2 July 1995. Egg retention also could have suppressed the feeding response as commonly occurs in gravid snakes (Murphy and Campbell 1987. *In* Seigel et al. (eds.), Snakes: Ecology and Evolutionary Biology, Macmillan Publ. Co, New York). Because this evidence is anecdotal and circumstantial, it should be interpreted with caution. Nevertheless, these observations suggest the possibility that abnormal prolonged egg retention in snakes may directly or indirectly interfere with feeding and may become a source of mortality.

Submitted by **MICHAEL V. PLUMMER**, Department of Biology, Box 2251, Harding University, Searcy, Arkansas 72143, USA.

NINIA SEBAE SEBAE (Red Coffee Snake). **REPRODUCTION.** On 1 January 1995, two snake eggs were found 3 km SSW of the Belize Zoo about 0.2 km W of the road intersection at La Democracia (near 17°20'20"N, 88°33'45"W), Belize District, Belize. The eggs were in a small earthen cavity under a log. The white leathery shell of each egg was very clean and no development could be discerned by candeling, indicating they were recently laid. The eggs measured 16 x 9 mm and 18 x 8 mm. After collection they were maintained on moist paper towels at an average temperature of near 25°C until hatching. During incubation the eggs increased in size, measuring 24 x 11 mm and 26 x 10 mm prior to hatching. On 6 March 1995, one egg was opened and a dead *Ninia sebae* removed (UTEP 15964). The snake measured 119 mm in total length. The second egg hatched on 10 March. The snake measured 123 mm in total length and weighed 1.0 g. (UTEP 15991). Incubation periods were at a minimum 65 and 69 days. The eggs were collected in Belize under authority of permit CD/6013/94(41).

Submitted by **JAN BOHUSLAVEK,** Department of Biological Sciences, The University of Texas at El Paso, El Paso, Texas 79968, USA.

REGINA RIGIDA (Glossy Crayfish Snake). **BEHAVIOR.** On 2 March 1995, a pair of *Regina rigida* were found submerged amongst heavy aquatic vegetation in a shallow portion of a borrow pit. This species is commonly found throughout much of southeastern Georgia in similar habitat, hidden in such vegetation, leaf litter, or mud during the daylight hours (pers. obs.). However, on this occasion these specimens were found actively swimming at 1155 h on a bright sunny day. Upon closer examination, it was found that the smaller individual (male, SVL = 28.7 cm; TL = 37.8 cm) was clearly biting the larger specimen (female, SVL = 35.1 cm; TL = 45.2 cm) about midway down the

body. This behavior was assumed to be associated with courtship, although copulation was not observed. No mention of biting was made by Ford (1982, Herpetol. Rev. 13:72) in discussing the courtship of a related species, *R. septemvittata*. However, biting during courtship in other species of snakes is known to occur (Gillingham 1979. Copeia 1979:319–331; Tinkle 1951. Copeia 1951:77–78).

Submitted by **ROBERT A. MOULIS** and **GERALD K. WILLIAMSON,** Savannah Ogeechee Canal Museum and Nature Center, 681 Fort Argyle Road, Savannah, Georgia 31419, USA.

SORDELLINA PUNCTATA (NCN). **DIET**. The single species of the genus *Sordellina* is reported mainly from the Atlantic Forest in southern Brazil (Hoge and Romano 1976/77. Mem. Inst. Butantan 40/41:63–70). *Sordellina punctata* averages 400–600 mm in total length and seems to be aquatic and diurnal (pers. obs.). This snake displays morphological features related to aquatic habits, including dorsal placement of eyes and nostrils. Although published information states that "this snake lives in fields not far from water and woods, hunting for frogs on which to feed" (Amaral 1978. Serpentes do Brasil, Melhoramentos/Univ. São Paulo, 246 pp.), no substantiated data on food of *S. punctata* are available. Here I report on gut contents of one snake found in the wild and four specimens housed in the collection of the Instituto Butantan (IB) in São Paulo.

One adult female *S. punctata* (SVL = 500 mm, tail = 130 mm) was found in the morning of 4 October 1995, resting on the ground within restinga scrub at the Estação Ecológica Juréia-Itatins, São Paulo (24°25'S, 47°14'W). Upon capture it disgorged remains of a giant earthworm (Glossoscolecidae). An adult male (IB 40285, SVL = 430 mm, tail = 105 mm), contained one semi-digested earthworm. Estimated prey/predator mass ratio for the two above snakes was 0.3 and 0.05 respectively. Feeding both on small and large prey is common for most snakes (Arnold 1993. *In* Seigel and Collins (eds.), Snakes: Ecology and Behavior, pp. 87–115. McGraw Hill, New York). Additionally, two snakes (IB 22936 and IB 41071) had earthworm setae (probable from Glossoscolecidae) in their hindgut. Glossoscolecid earthworms are surface active during and after rainfall (pers. obs.), some species being partly aquatic (G. Righi, pers. comm.). Two captive *S. punctata* ate small fish and tadpoles (I. Sazima, pers. comm.; pers. obs.).

I thank I. Sazima for reading the manuscript and G. Righi for information, and identification of the earthworm prey.

Submitted by **OTAVIO A. V. MARQUES,** Laboratório de Herpetologia, Instituto Butantan, 05503-900 São Paulo, São Paulo, Brazil.

THAMNOPHIS RUFIPUNCTATUS. (Narrow-headed Garter Snake). **MAXIMUM SIZE**. On 11 September 1995, in the San Francisco River near Pleasanton, Carton County, New Mexico, USA, we captured an obviously emaciated adult female *T. rufipunctatus* with the following measurements: 880 mm SVL, 235 mm TL, 1115 total length, and 176 g. This exceeds the maximum total length of 953 mm reported by Boundy (1994. Herpetol. Rev. 25:126–127). The specimen is MSB 59509 in the herpetology collection at the University of New Mexico.

Submitted by **CHARLES W. PAINTER**, Endangered Species Program, New Mexico Department of Game and Fish, P.O. Box 25112, Santa Fe, New Mexico, USA, and **TOBY J. HIBBITTS**, 602 Hilltop Circle, Wylie, Texas 75098, USA.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 27, Number 2 (June 1996).

CAUDATA

AMBYSTOMA CALIFORNIENSE (California Tiger Salamander). USA: CALIFORNIA: San Mateo Co: 368 Albion Avenue, Woodside, 400 feet (122 m) elev. 14 October 1962. Galen B. Rathbun. Verified by Jens V. Vindum. CAS 197631 (freeze dried juvenile specimen). New county record that extends the historic range of this salamander north along the San Francisco peninsula, some 8.5 km northwest from th well-known population at Stanford University, Santa Clara County (Barry and Shaffer 1994. J. Herpetol. 28:159–164). The salamander was originally collected for a high school science project and a detailed locality tag was still attached to the specimen when it was recovered some 32 years later in the home of Dr. Rathbun's parents. The specimen was originally taken from the vicinity of an old sag pond, but the source population is apparently now extinct due to the loss of breeding ponds from subsequent housing developments in the region (pers. observ.).

Submitted by **MARK R. JENNINGS**, National Biological Service, California Science Center, Piedras Blancas Field Station, P.O. Box 70, San Simeon, California 93452–0070, USA, and Research Associate, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118–9961, USA.

BATRACHUPERUS PERSICUS (Persia Mountain Salamander). IRAN: ARDABIL PROVINCE: 45 km SE Khalkhal, Delmadeh village, ca. 37°36'N, 48°31'E. 1500 m elev. 5 September 1991. H. G. Kami and M. Khoshchin. MMTT 2122–2128, ZMGU 75; Yeilogh-e-Sarasi. 1 August 1991. M. Khoshchin. MMTT 2121. GILIAN PROVINCE: Fuman area, shaft, ca. 21 km SW Rasht, 37°14'N, 49°18'E, 12 m below sea level (15 m above Caspian Sea). Autumn 1991. K. Nostati. MMTT 2129. MAZANDARAN PROVINCE: 70 km E Gorgan, Shirabad Cave, ca. 36°58'N, 55°2'E, 400 m elev. 8 July 1993. Baluch, H. G. Kami, Parsa. Field No. 1–12, Baluch collection in Tehran University (5 juveniles, 7 larvae collected). Easternmost record for species. MAZANDARAN PROVINCE: Shirabad Cave. Rahmani, Naghghash, Darianabard. Juvenile and adult specimens; two alive in Zoological Collection, Gorgon University (cat. no. pending).

Submitted by **HAJI GHOLI KAMI** and **EBRAHIM VAKILPOURE**, Department of Biology, Faculty of Sciences, Agricultural Sciences and Natural Resources of Gorgan University, Iran.

GYRINOPHILUS PALLEUCUS (Tennessee Cave Salamander). USA: GEORGIA: Walker Co: ca. 2 km W Kensington in Chattanooga Valley. 16 September 1995. K. A. Buhlmann, J. P. Demuth, C. A. Hobson, K. Huffines, A. Padgett, K. Padgett, and M. A. Pilgrim. Verified by Jeremy F. Jacobs. Four larval salamanders were observed and one was collected (USNM 497687) in a shallow, gravel-bottomed, permanent stream within a large cave (name withheld due to sensitive nature of the cave). *Gyrinophilus palleucus* was first reported from Georgia by Cooper (1968, J. Alabama Acad. Sci. 39:182–185) based on a specimen from Harrisburg Cave, Pigeon Mountain, Walker County, Georgia. No additional specimens have been reported from Georgia, and recent

publications (Frost 1985, Amphibian Species of the World: A Taxonomic and Geographic Reference. Allen Press, Lawrence, Kansas. 732 pp.; Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.; Williamson and Moulis 1994, Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Special Publ. No. 3, Savannah, Georgia, Vol. 2, 712 pp.) have not included Georgia in the range of *G. palleucus*. This specimen confirms the presence of *G. palleucus* in Georgia, extending the range in the state ca. 19.5 km northward from Harrisburg Cave, on the eastern side of Pigeon Mountain, to the new locality near the eastern slope of Lookout Mountain, and thus supports extending the range of *G. palleucus* eastward from northeastern Alabama into the Pigeon/Lookout Mountain area of northwestern Georgia. Other populations of *G. palleucus* should be expected in this area.

Submitted by **KURT A. BUHLMANN**, University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA, and **ADDISON H. WYNN**, Department of Vertebrate Zoology, National Museum of Natural History, Washington, D.C. 20560, USA.

SIREN INTERMEDIA NETTINGI (Western Lesser Siren). USA: LOUISIANA: TERREBONE PARISH: Houma, 1.3 mi (2.09 km) SW jct. La Rt. 24 on Savanne Road, or 1.1 mi (1.77 km) NE jct. La Rt. 311 on Savanne Road. 1 January 1996. Bryan Butcher and Tia Butcher. Ernest A. Liner Collection (EAL 5240, 19 specimens); same location as above. 2 January 1996. Ernest A. Liner, Bryan Butcher and Tia Butcher. EAL 5242 (15 specimens). All verified by Harold A. Dundee. First records for the parish; extend the range from St Charles (25 mi, 40.23 km), Ascension (25 mi, 40.23 km), and Assumption (25 mi, 40.23 km) parishes to the east and north and St. Mary Parish (35 mi, 56.32 km) to the west of the previous locations as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **BRYAN BUTCHER, TIA BUTCHER,** 104 Mike Street, Houma, Louisiana 70360, USA, and **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

ANURA

BUFO ARENARUM (Common Toad) ARGENTINA: CHACO: Resistencia City (27°27'S, 58°58'W). 6 October 1995. Jorge A. Céspedez. Verified by Blanca Beatriz Alvarez. Colección Herpetológica de la Facultad de Ciencias Exactas y Naturales y Agrimensura. (UNNEC 04355 y 04356). First province record; extends the range of this species 100 km from the latter record in the north of Santa Fé province [Gallardo and Varela de Olmedo 1992, Fauna de Agua Dulce de la Republica Argentina. (41):1–116] and represents the northernmost record for the species in the central portion of its range.

Submitted by **JORGE ABEL CÉSPEDEZ**, Compared Anatomy, Biology Department, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de julio 1449, 3400, Corrientes, Argentina.

BUFO BOREAS (Western Toad). USA: ALASKA: Montague Island, Patton Bay, (59°57'N, 147°30'W). Fully metamorphosed toad, 24 mm SVL, captured, photographed, released 9 September 1991. Verified by Bruce Wing. Since 1988 numerous ADF&G personnel have observed toads on Montague Island with its maritime climate and coastal vegetation. Tasnuna River, (61°02'N, 145°07'W). Large adult, 65 mm SVL, captured, photographed, released 25 August 1992. Verified by Bruce Wing. The Tasnuna River capture site is separated from Prince William Sound by a nearly continuous glacial expanse along the crest of the Chugach Mountains. Only two obvious migratory corridors from the coast exist: up swift, turbid Copper River, or up Lowe River from Valdez, over Marshall Pass, and down upper Tasnuna River. Currently three glaciers (Childs, Miles, and Allen) terminate on Copper River. Another (Heney) has recently retreated a short distance from the river. If ancestral toads migrated up Copper River after the last period of extensive glaciation they presumably would have crossed some combination of these glaciers. A route up Lowe River from Valdez represents a shorter migration, but requires crossing treeless 550 m Marshall Pass. Regardless of migratory pathways, the climate of Tasnuna River drainage today is significantly harsher than the coastal climate of Prince William Sound. The Tasnuna River specimen represents the westernmost mainland record and northernmost record to date (Hodge 1976, Amphibians and Reptiles in Alaska, the Yukon and Northwest Territories. Alaska Northwest Publ. Co., Anchorage. xi + 89 pp). Voucher photographes, locality maps and field notes of the senior author have been deposited in the herpetological collections (AB 91-16, Patton Bay, Montague Island, AB 92-21, Tasnuna River) of NOAA, NMFS, Alaska Fisheries Science Center, Auke Bay Laboratory, 11305 Glacier Highway, Juneau, Alaska 99801, USA, under the curatorship of Bruce Wing. The herpetological collection of the junior author, formerly held at Tongass Historical Society Museum in Ketchikan, Alaska, was transferred to Auke Bay Laboratory in 1993.

Submitted by **MICHAEL WIEDMER,** Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, Alaska 99518, USA and **ROBERT PARKER HODGE**, 181 Raft Island, Gig Harbor, Washington 98335, USA.

BUFO BUFO (Common European Toad). IRAN: MAZANDARAN PROVINCE: Ghorogh Jungle, 25 km E Gorgan, ca 36°54'N, 54°44'E, 140 m elev. 25 April 1995. Dariush Samadi. ZMGU 74. Easternmost record for species; extends distribution 150 air km NE Sari (Eislet and Schmidtler 1973, Ann Naturhistor Mus. Wien 77:215–20; Tuck 1974, Herpetol. Rev. 5:107).

Submitted by **HAJI GHOLI KAMI** and **EBRAHIM VAKILPOURE**, Department of Biology, Faculty of Sciences, Agricultural Sciences and Natural Resources of Gorgan University, Iran.

BUFO WOODHOUSII WOODHOUSII (Woodhouse's Toad). USA: TEXAS: FLOYD CO: Caprock Canyons Trailways State Park, UTM coordinates 14 304523E 3790798N. 5 June 1996. F. D. Yancey, II and K. J. Roberts. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 11556). New county record; fills gap between Hale and Motley counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

CENTROLENE BUCKLEYI (Ranita Verde de Labio Blanco). VENEZUELA: ESTADO MÉRIDA: Municipio Miranda: stream in road Piñango to Timotes (vía Latafayez), 2625 m elev. 11 June 1988. Abraham Mijares, Juan García, Hans-Peter Reinthaler, Doris Lussner, and Enrique La Marca. Colección de Anfibios y Reptiles, Instituto de Geografía, Universidad de los Andes (ULABG

2096-2100); Municipio Rangel: Páramo La Corcovada, region of Mucubají, near Hotel Los Frailes, 3050 m elev. 7 June 1989. Juan García and Enrique La Marca. ULABG 2644; Quebrada Los Aranguren, in trail San Rafael de Mucuchíes-Los Aranguren, 2920 m elev. 16 July 1989. Hans-Peter Reinthaler and Enrique La Marca. All verified by Daniela Abele and Coralee Castillo. First voucher specimens for Municipios Miranda and Rangel in Estado Mérida, and records of altitude for the species. The nearest previously known locality was Mérida, in Municipio Libertador.

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101–A, Venezuela.

EUPSOPHUS CALCARATUS (Ground Frog). ARGENTINA: NEUQUEN: Huiliches Dept: Lanin National Park, shore of Lake Tromen near Malleo River, 1000 m elev. 22 March 1982. M. I. Christie. MACN 36.557. Verified by J. R. Formas. RIO NEGRO: Bariloche Dept: Nahuel Huapi National Park, northwest shore of Lake Fonck, 750 m elev. 1 March 1995. C. Ubeda. MACN 36.556. Verified by J. R. Formas; Bariloche Dept: Nahuel Huapi National Park, west end Lake Martin, 510 m elev. 27 February 1982. M. I. Christie. MACN 36.555. CHUBUT: Cushamen Dept: Lago Puelo National Park, trail to Los Hitos, north shore Lake Puelo, 3 km S and 6 km W Lago Puelo Town, 250 m elev. 24 January 1996. C. Ubeda. MACN 36.554. New record for Argentina. Formas and Vera (1982, Proc. Biol. Soc. Washington 95(3):594–601) revalidated *E. calcaratus*, previously reported only from Chile. Previous reports of Argentine *Eupsophus* (Cei 1980, Amphibians of Argentina. Monitore Zool. Ital. (N.S.) Monogr. 2; Gallardo 1987, Anfibios Argentinos: Guia para su identificacion. Lib. Agropecuaria S.A., Buenos Aires. 98 pp.) include only *E. roseus*. In Argentina, *E. roseus* is also present in Neuquen Province, but its presence in Rio Negro Province needs confirmation.

Submitted by **MIGUEL I. CHRISTIE**, Sociedad Nataturalista Andino Patagonica, Villegas 369, Bariloche, 8400, Argentina, and **CARMEN UBEDA**, Centro Regional Universidad Bariloche, Universidad Nacional del Comahue, Unidad Postal, Universidad, Bariloche, 8400, Argentina.

HYLA ARBOREA (European Treefrog). GREECE: NORTHERN SPORADES: Island of Skopelos, outskirts of Panormos (on the west coast of the island). 21 June 1995. Johnny Johnsen. Verified by Wolfgang Böhme. Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK 61476). First record for Skopelos and for the archipelago of the Sporades [Werner 1938, Zoologica 35(94):1–117; Grillitsch and Tiedemann 1984, Ann. Naturhist. Mus. Wien 86B:7–28]. On the Aegean islands, *H. arborea* seems to be rather sparsely distributed, with the nearest published island occurrences on Thasos, Lesbos, Chios, Evvia, Tinos, Naxos and Milos [Werner 1938, *op. cit.*; Daan 1967, British J. Herpetol. 3(12):312–313; Broggi 1978, Salamandra 14(4):161–171; Hingley and Castle 1991, Herptile 16(2):75–80]. But the record from Milos is based on a voice record, and Beutler and Frör (1980, Mitt. zool. Ges. Braunau 3(10/12):255–290) question the very old records from Tinos and Naxos. On other Aegean islands, *H. arborea* occurs on Crete (widespread and abundant), Kos and Rhodes (common) [Calabresi 1923, Boll. Mus. Zool. Anat. Comp. 38:1–16; Zavattari 1929, Arch. Zool. Ital. 12/13:161–166; Wettstein 1931, Ann. Naturhist. Mus. Wien 45:159–172; Tortonese 1948, Arch. Zool. Ital. 33:379–402; Wettstein 1953, Sber. österr, Akad. Wiss., Math.-Naturw. Kl., Abt. 1, Wien 162(9/10):651–833; Wettstein 1967, British J. Herpetol. 3(12): 313–314; Strijbosch 1984, Lacerta 42(4):62–71; Sowig 1985, Salamandra 21(4):252–262; Stugren and Lydaták 1986, Zool. Abh. Mus. Tierk. Dresden 42(4):57–64]. *Hyla arborea* is widely distributed in mainland Greece. Stugren and Lydaták (1986, *op. cit.*) have redefined *H. a. kretensis* from Crete to be characterized by possessing a red spot on the upward branch of the lateral stripe and red coloration on the back of the front limbs. The specimen from Skopelos does not have this red coloration and seems to belong to the nominate subspecies.

Submitted by **HENRIK BRINGSØE**, Esthersvej 7, DK-4600 Køge, Denmark.

PELOBATES SYRIACUS (Syrian Spadefoot) GREECE: PELOPONNISUS: Achaia Prefecture: marshes and wet meadows between the village of Metochi and the lake of Lamia in the area of the Strofilia Wood, 38°04'N, 21°22''E, ca. 0 m elev. 12 September 1995. G. Chiras and B. P. Chondropoulos. Verified by A. Dimitropoulos. Zoological Museum of University of Patra (ZMUP A-R 1366–1367, recently metamorphosed; 1368, adult female). Range in Greece seems to be discontinuous within the northern and central parts of the mainland. To the south, in the Peloponnisos region, *P. syriacus* was previously known from only two records (Bohme 1975, Senck. biol. 56:199–202; Bringsøe 1994, Ann. Musei Goulandris 9:349–374), which lie in mountainous areas 107 and 42 km (direct line distances) SE and ENE of our recorded locality, respectively. The present record is the first for lowland and coastal Peloponnisos.

Submitted by **BASIL P. CHONDROPOULOS**, Section of Animal Biology, Department of Biology, University of Patra, 260 01 Patra, Greece, and **GEORGE CHIRAS**, Sarantaporou 38, 262 23 Patra, Greece.

PELOBATES SYRIACUS (Syrian Spadefoot). IRAN: MAZANDARAN PROVINCE: Bandar-e-Turkmen, ca. 36°53'N, 54°4'E, 20 m below sea level. 28 March 1991. H. G. Kami. Kami Collection No. 144 (deposited in Zoological Museum of Tehran University). Easternmost record for species; second record for Province. Extends range eastward to Caspian coast, 170 km from 14 km W Babolsar (36°41'N, 52°29'E). [Tuck 1971, Bull. Maryland Herpetol. Soc. 7:51; Eise Mus. Wien 77:182–184; Anderson 1978, Herpetol. Rev. 9(1):21].

Submitted by **HAJI GHOLI KAMI** and **EBRAHIM VAKILPOURE**, Department of Biology, Faculty of Sciences, Agricultural Sciences and Natural Resources of Gorgan University, Iran.

PHYLLOMEDUSA TARSIUS (Rana Lemur). VENEZUELA: ESTADO BARINAS: Municipio Pedraza, Reserva Forestal de Caparo, "entrada de Pica 8," near Estación Cachicamo, 50 m elev. Colección de Anfibios y Reptiles, Instituto de Geografía, Universidad de Los Andes (ULABG 3973). 12 May 1995. Carlos Gottberg. First museum documented record for Venezuela (La Marca 1992, Cuadernos Geográficos 9:70–72); a single specimen of this species, from "Estado Bolívar, Venezuela" had been previously pictured in Duellman and Trueb (1986, Biology of Amphibians. McGraw Hill, New York. 670 pp.). Most probably, it belongs to a series deposited in the Herpetological Collection of the University of Kansas Museum of Natural History (KU) with the numbers KU 167189–16200, coming from "Bolívar, 13 km S, 1 km E Puente Cuyuní, 140m," which would be the nearest previously known locality. This is the first record for the state of Barinas, and the northernmost record for the taxon.

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101–A, Venezuela.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: COLORADO: MONTROSE CO: 2.5 km W Oak Grove (N 1/2 Sec. 3, T48N, R10W) in flooded pool adjacent to the Montrose and Delta Canal. 21 May 1996. J. Kehmeier, C. Wagner, and L. J. Livo. UCM 57780. Verified by H. M. Smith. First record for county (Livo et al. 1996 Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Colorado Herptol. Soc. 22 pp.). Several additional localities for this species in Montrose County were reported during aural surveys on 21 May 1996, including: 5 km W and 2 km N Oak Grove (SE 1/4 Sec. 28, T49N, R10W) by JK, CW, and LJL; 6 km W and 6 km N Oak Grove (NE 1/4 Sec. 16, T49N, R10W) by JK, CW, and LJL; and 6 km W and 7 km N Oak Grove (SW 1/4 Sec. 9, T49N, R10W) by John Alves, Greg Policky, and David Chiszar. These surveys were conducted as part of a Colorado Division of Wildlife amphibian and reptile workshop coordinated by John Alves.

Submitted by **JON KEHMEIER, CRISTI WAGNER,** and **LAUREN J. LIVO,** Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526-2097, USA.

RANA CAMERANI (Caucasus Frog). IRAN: CHAHAR MAHAL BAKHTIARI PROVINCE: Daymeh Spring, 20 km E Kouhrang, 32°26'N, 50°6'E, 2060 m elev. 28 July 1994. H. G. Kami and Parsa; 25 km from Gandoman (60 km to Lordegan [Sulgan River]), ca. 31°30'N, 50°50'E, 1580 m elev. 29 July 1994. H. G. Kami and Parsa; around Chaghakhor Lake, ca. 31°52'N, 50°56'E, 2060 m elev. 30 July 1994, H. G. Kami and Parsa. Field Nos. 1–10, Baluch Collection in Tehran University, 10 specimens. All records are southernmost for Iran.

Submitted by **HAJI GHOLI KAMI** and **EBRAHIM VAKILPOURE**, Department of Biology, Faculty of Sciences, Agricultural Sciences and Natural Resources of Gorgan University, Iran.

RANA MACROCNEMIS PSEUDODALMATINA (Iranian Brusa Frog). IRAN: ARDABIL PROVINCE: 45 km SE Khalkhal, Yeilagh-e-Sarasi, Delmadeh village, ca. 37°36'N, 48°31'E, 1500 m elev. 5 September 1991. H. G. Kami and M. Khoshchin. MMTT 2135–2136. Westernmost record in Iran. MAZANDARAN PROVINCE: Daraz nou, 24 air km SW Gorgan, ca. 36°5'N, 54°8'E, 2644 m elev. 5 August 1994. H. G. Kami and M. Firouznia. Deposited in Department of Environment, College in Karaj (cat. no. pending). Record elevation in Iran.

Submitted by **HAJI GHOLI KAMI** and **EBRAHIM VAKILPOURE**, Department of Biology, Faculty of Sciences, Agricultural Sciences and Natural Resources of Gorgan University, Iran.

RANA PALUSTRIS (Pickerel Frog). USA: LOUISIANA: AVOYELLES PARISH: Yellow Bayou at Simmesport. 26 March 1994. Michael Milliet. Ernest A. Liner Collection (EAL 5229, 1 specimen). Verified by Harold A. Dundee. Fills distributional gap from West Feliciana Parish and Rapides Parish, being intermediate and a new parish record as mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

TESTUDINES

APALONE SPINIFERA PALLIDA (Pallid Spiny Softshell). USA: LOUISIANA: ALLEN PARISH: Calcasieu River, ca. 5 km S of Rt. 26 near Oberlin. 11 July 1995. Deposited at the University of Canberra, Australia (UC 0340). Verified by Brian I. Crother. New parish record; eggs collected from river sandbars and hatched in the laboratory.

Submitted by **J. SEAN DOODY**, Applied Ecology Research Group, University of Canberra, P.O. Box 1, Belconnen, ACT 2616, Australia, and **RICHARD E. ANDERSON** and **CLIFF S. RICHARDSON**, Department of Biological Sciences, Southeastern Louisiana University, SLU 814, Hammond, Louisiana 70402, USA.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). CANADA: ONTARIO: ESSEX CO: East Sister Island, Lake Erie (UTM 17TLS 457 304). 16 July 1992. Raymond A. Saumure and David Kraus. Verified by Ross MacCulloch. ROM Kodachrome Slide 26940. First record from island and furthest record from mainland (King 1987, J. Herptol. 21:65–67). Found in a shallow pond formed due to the high water level of Lake Erie during 1992.

Submitted by **RAYMOND A. SAUMURE**, Department of Natural Resource Sciences, McGill University, 21111 Lakeshore Road, Ste-Anne-de-Bellevue, Quebec, H9X3V9, Canada.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: TEXAS: FLOYD CO: 2 km E Barwise. 22 September 1995. James T. Anderson and Ann M. Anderson. The Museum of Texas Tech University (TTU 11494). Verified by Frank Yancey. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.) Turtle was located in a flooded playa wetland which had been previously dry for two months.

Submitted by **JAMES T. ANDERSON** and **ANN M. ANDERSON**, Department of Range, Wildlife, and Fisheries Management, Texas Tech University, MS 2125, Lubbock, Texas 79409-2125, USA.

EMYDOIDEA BLANDINGII (Blanding's Turtle). USA: INDIANA: WAYNE CO: ca. 3.1 mi NNE Williamsburg in Greensfork River, Green Township, NW 1/4 NW 1/4 Sec. 28, T18N, R14E, 100 m downstream from Sec. 21. 20 February 1996. A. McConaha, M. McConaha and D. McConaha. Verified by Joseph T. Collins. Photographed (UF 103394, 3 slides); also photographed for The Palladium Item, Richmond, Indiana, 6 March 1996 (evening edition); released at capture site. Extralimital record; ca. 47 km southeast of nearest known extralimital locality in Delaware County, Indiana, ca. 92 km due east of extralimital locality in Marion County, Indiana, and ca. 138 km southeast of the nearest record from the continuous range for the species in Wabash County, Indiana (Minton 1996, Amphibians and Reptiles of Indiana. Second ed. Indiana Acad. Sci., *in press*). Possibly an introduction, although its record size (female, 274 mm maximum carapace length; 268 mm maximum plastron length; 2550 g body mass; previous record, 273 mm carapace length in Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.) and remote location argue that it might be a natural relict.

Submitted by **JOHN B. IVERSON**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA.

GRAPTEMYS BARBOURI (Barbour's Map Turtle). USA: FLORIDA: GADSDEN CO: Ochlockonee River, 5.3 km straight-line distance S of U.S. Rt. 27 bridge. 26 May 1993. R. L. Cailteux and J. J. Nordhaus. Verified by David L. Auth. UF 91087. First record outside of the Apalachicola River drainage. A juvenile *G.*

barbouri (CL = 45.9 mm; PL = 35.5 mm; mass = 11.5 g) also was collected by electrofishing in the Ochlockonee River, 0.8 km straight-line distance S of U.S. Rt. 27 bridge. On 1 June 1994, Daniel A. Dobbins collected a basking *G. barbouri* (CL = 53.4 mm, PL = 46.7 mm, mass = 30.1 g) at Stoutamire Landing, 4 km straight-line distance SW of Fla. Rt. 20 bridge along the Liberty/Leon County line (UF 91086). The first two collecting locales are ca. 7.4 river km apart and upstream of Lake Talquin, a 3200-ha reservoir, whereas the third locality is downstream of Lake Talquin. During the Pleistocene, this species may have ranged eastward into the Suwannee River drainage (Jackson 1975, Herpetologica 31:213–219), but it is thought to now be confined to large and medium-sized rivers emptying into Apalachicola Bay. The mouths of the Apalachicola and Ochlockonee rivers are separated by >100 km of shoreline, primarily beach. Brackish coastal marshes between river mouths provide effective barriers to Graptemys (Wood 1977, J. Herpetol. 11:415–421). The source of these *G. barbouri* may have been Telogia Creek, the principal western tributary of the Ochlockonee River, which approaches within 0.6 km of the Apalachicola River drainage and appears to have been once a tributary of the Apalachicola River, although the disparity in fish faunas between the two river systems indicates long-term physiographic independence (Gilbert 1987, Brimleyana 13:25–54). If this species is not indigenous to the Ochlockonee River, it was introduced by humans. This species is not commonly kept in captivity because Florida prohibited commercial trade >15 years ago, although Florida allows the personal possession of two *G. barbouri*. The first two collecting sites are just W of Tallahassee, and three major highway crossings occur in the vicinity. There is only one highway crossing within 5 river km of the site of the third specimen, which was found downstream of the Jackson Bluff dam constructed in 1929 to form Lake Talquin. The small size of these specimens indicates that reproduction is occurring, because the release, survival, and subsequent recapture of three such specimens are unlikely.

Submitted by **KEVIN M. ENGE, RICHARD L. CAILTEUX**, and **JEFFERY J. NORDHAUS**, Florida Game and Fresh Water Fish Commission, Route 7, Box 3055, Quincy, Florida 32351, USA.

GRAPTEMYS PULCHRA (Alabama Map Turtle). USA: MISSISSIPPI: Noxubee Co: Noxubee River, 29.3 river km upstream of Alabama border, NW 1/4 Sec. 4, T13N, R18E. 16 August 1994. T. C. Majure, R. L. Jones, and C. L. Knight. Adult male and juvenile. Mississippi Museum of Natural Science (MMNS 298502986). Clay Co: Tibbee Creek, 4.5 river km upstream of confluence with Catalpa Creek, SE 1/4 Sec. 33, T17S, R7E. 21 August 1995. T. C. Majure, R. L. Jones, and C. L. Knight. Adult male. MMNS 3235. Both verified by T. L. Vandeventer. Confirms presence of species in Tombigbee River system within Mississippi (Ernst et al. 1994, Turtles of the United States and Canada. Smithsonian Inst. Press, Washington, D.C. 578 pp.)

Submitted by **ROBERT L. JONES, TERRY C. MAJURE,** and **CHARLES L. KNIGHT**, Mississippi Department of Wildlife, Fisheries, and Parks, and Museum of Natural Science, 111 North Jefferson Street, Jackson Mississippi 39201, USA.

KINOSTERNON ODORATUM (Common Musk Turtle). USA: TEXAS: Rains Co: Lake Tawakoni near the Sabine River Authority Headquarters; shell at the edge of the lake, ca. 5 km S of Hermits Cove. 10 December1995. R. L. Gutberlet, Jr. and C. L. Stewart. Verified by J. A. Campbell. University of Texas at Arlington Collection of Vertebrates (UTA-R 39816). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M University Press, College Station, 434 pp.)

Submitted by **RONALD L. GUTBERLET, JR.** and **CAROL L. STEWART**, Department of Biology, the University of Texas at Arlington, Arlington, Texas 76019, USA.

STERNOTHERUS CARINATUS (Razorback Musk Turtle). USA: LOUISIANA: Terrebonne Parish: Houma. 3 June 1981. Ernest A. Liner. Ernest A. Liner Collection (EAL 4803, 1 specimen). Verified by Harold A. Dundee. First record for the parish; extends the range south 43 mi (77.2 km) from that mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

PSEUDEMYS TEXANA (Texas River Cooter). USA: TEXAS: Brazos Co: Lake Placid, 60 km S Bird Pond Road and 1 mi E Rock Prairie Road, E of Texas Rt. 6. Caught in minnow trap along N-S Dam on east end of lake. 17 March 1996. Mitchell A. Lockwood. Verified by James R. Dixon. Texas Cooperative Wildlife Collection (TCWC 72432, juvenile). New county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **R. KATHRYN VAUGHAN** and **MITCHELL A. LOCKWOOD**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258, USA.

TRACHEMY SCRIPTA ELEGANS (Red-eared Slider). USA: SOUTH CAROLINA: Pickens Co: landlocked arm of the former Seneca River adjacent to athletic practice field, Perimeter Road, ca. 0.75 km SW of jct. S.C. Rt. 93, Clemson University Campus, Clemson. 7 September 1995. Steven G. Platt. Verified by Stanlee Miller. Campbell Museum (CUSC 1278). Eight turtles captured in three trap nights. Other turtles, both juveniles and adults observed basking. Appears established at this site. Population is believed to have originated from released pets. State record. *Trachemys scripta elegans* not previously reported as established in South Carolina. *Trachemys scripta scripta* present 75 km S in Abbeville County (Martof et al. 1980, Amphibians and Reptiles of the Carolinas and Virginia. Univ. North Carolina Press, Chapel Hill. 264 pp.).

Submitted by **STEVEN G. PLATT,** Department of Biological Sciences, Clemson University, Clemson, South Carolina 29634-1903, USA, and **WILLIAM E. SNYDER**, Center for Ecology, Evolution, and Behavior, and Department of Entomology, S-255 Agricultural Science Building, University of Kentucky, Lexington, Kentucky 40546-0091, USA.

LACERTILIA

ANOLIS SAGREI (Brown Anole). USA: FLORIDA: Franklin Co: St. George Island, private residence in 600 block of West Bayshore Drive. 25 July 1995. Woodard Miley II. Verified by David Auth. UF 103501. New county record and first record for a northern Gulf of Mexico barrier island (Wilson and Porras 1983, Univ. Kansas Mus. Nat. Hist. Spec. Publ. 9). Apparently, this population was founded when a large number of potted plants were imported for landscaping from near Clearwater in central Florida, in a manner similar to the mode of establishment of the population at Barnacle Bay Mini-Golf course in Panama City Beach (Means 1990, Herpetol. Rev. 21:96). Woody Miley and local residents reported that in summer 1995 *A. sagrei* was very abundant on the property (about 25 individuals seen), but on 27 May 1996 we were able to find only three individuals. One specimen of the green anole (*A. carolinensis*) was also seen. Additional specimens

were not collected because the population apparently suffered some mortality during the cold and long-lasting winter of 1995–1996. Significantly, some individuals obviously survived the cold winter (temperatures to 7°C) as well as saltwater that overwashed St. George Island from Hurricane Opal on 3 October 1995.

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

EUMECES LATICEPS (Broadhead Skink). USA: LOUISIANA: TERREBONNE PARISH: Houma. 26 April 1969. Ernest A. Liner. Ernest A. Liner Collection (EAL 2347, 1 specimen); Houma. 5 March 1969. Jerry Gautreaux. EAL 2354 (1 specimen); Houma. 5 May 1973. Steve Pizollata. EAL 3611 (1 specimen); Houma. 5 May 1974. Jerry Gautreaux and Maurice Prosperie. TCWC 71393 (1 specimen); Houma. 5 December 1982. Ernest A. Liner. All verified by Harold A. Dundee. First records for the parish; extend the range 15 mi (24.1 km) south from that mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.)

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

EUMECES OBSOLETUS (Great Plains Skink). USA: TEXAS: FLOYD CO: Caprock Canyons Trailways State Park, UTM coordinates 14 305689E 3794462N. 4 May 1996. F. D. Yancey, II and K. J. Roberts. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 11534). New county record; fills gap between Hale and Motley counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

GEKKO GECKO (Tokay Gecko). USA: FLORIDA: LEON CO: Tallahassee, 1300 block between Milton and Jackson Streets. Photograph of adult taken in late summer 1994 by Robert Dahlstrom. Verified by David Auth. UF 103506. Photographs of two young individuals taken in summer 1995 by Robert Dahlstrom. Verified by David Auth. UF 103507. New county record and first record of a breeding population outside of south peninsular Florida. During five successive springs (1992–1996), I heard vocalizations (first since winter on 12 April 1994, 30 March 1995, and 22 April 1996) from at least one large individual from trees and walls of the same house, indicating that one adult gecko has survived at least four successive winters, including the very cold and long winter of 1996. On 25 April 1996, I saw a large individual on my house at the same time that I heard another individual vocalizing about 75 m away. Throughout the month of May 1996, I heard two different geckos vocalizing from two different houses. Local residents said that tenants of a duplex on Milton Street released at least two *Gekko gecko* for pest control about 1990 or 1991. The discovery of two recently-hatched young in the summer of 1995 attests to successful natural reproduction in this species at a latitude of 30°N. Apparently a small breeding population is established.

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

HEMIDACTYLUS GARNOTTII (Indo-Pacific Gecko). USA: TEXAS: DALLAS CO: Dallas. Specimen captured inside herpetarium at the Dallas Zoo; one other was found but not captured. 16 February 1996. Carl J. Franklin. Verified by Ron Gutberlet. The University of Texas at Arlington Collection of Vertebrates (UTA R-39756). New state record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). This lizard has established itself inside the herpetarium; several adults and hatchlings have been observed and collected. However, this species was never intentionally acquired by the Dallas Zoo and probably arrived with plants purchased from Florida.

Submitted by **CARL FRANKLIN**, Dallas Zoo and Aquarium, Reptile Department, 621 East Clarendon Drive, Dallas, Texas 75203, USA, and Department of Biology, Box 19498, The University of Texas at Arlington, Arlington, Texas 76019-0498, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: FLORIDA: FRANKLIN CO: City of Apalachicola: Fish market at 12th Street and Avenue E (U.S. Rt. 98). One specimen collected 27 May 1996 by Thomas Evans and D. B. Means. Verified by David Auth. UF 103502. Residents of Apalachicola claimed they have seen the Mediterranean Gecko on buildings around town (e.g., Apalachicola Times Building, 265 North Water Street) since at least 1991. Woodard Miley II first reported the fish market occurrence to me in March 1996. The specimens reported here verify that this species survived the cold winter of 1995–1996. New county record and first record for the city of Apalachicola; this record helps close the gap in the northeastern Gulf coastal distibution of this species between Panama City and Tampa (Nelson and Carey 1993, Northeast Gulf Sci. 13(1):53–58).

Submitted by **D. BRUCE MEANS**, Coastal Plains Institute, 1313 North Duval Street, Tallahassee, Florida 32303, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: LOUISIANA: ST. TAMMANY PARISH: adult male captured on the window of a building at the KOA campground on Rt. 433 near Slidell. 21 May 1996. Verified by Richard L. Holland. Slides of specimen in University of Colorado Museum Photographic Collection (UCM 122–126). Species was previously known from only four parishes in the state, including two parishes south of Lake Pontchartrain (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.). Parish record; extends known range to the north of Lake Pontchartrain.

Submitted by **GREGORY J. WATKINS-COLWELL**, Connecticut Audubon Coastal Center, 1 Milford Point Road, Milford, Connecticut 06460, USA, **KELLIE A. WATKINS-COLWELL**, St. Joseph Medical Center, 128 Strawberry Hill Avenue, Stamford, Connecticut 06904, USA, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

OPHIOMORUS PUNCTATISSIMUS (Greek Snake Skink). GREECE: STEREA ELLADA: Prefecture of Aitolia and Akarnania: Province of Nafpaktia: ca. 2 km SE of Palaiopyrgos village, 38°28'57"N, 21°51'47"E, ca. 480 m elev. 9 July 1995. D. P. Papandropoulos and B. P. Chondropoulos. Verified by E. Valakos. Zoological Museum of University of Patra (ZMUP A-R 1375). The species is hitherto known from eastern part of central Greece (Sterea Ellada), Peloponnisos (except its northwestern part) and the island of Kythira (Bischoff 1981, pp. 366–372. In Bohme (ed.), Handbuch der Reptilien und Amphibien Europas, Band 1, Akad. Verlagsges., Wiesbaden; Bringsøe 1985, Ann. Musei Goulandris 7:271–318; Chondropoulos 1986, Amphibia-Reptilia 7:217–235). First record for the whole western part of the central and northern Greek mainland, extending range by ca. 118 km

(direct line distance) WSW of the nearest known limit of distribution in the region of Sterea Ellada (Malesina village, Fthiotida Prefecture) as recorded by Bischoff (*op. cit.*). Because *O. punctatissimus* is distributed only in SW Turkey and Greece, our record also constitutes a western extension of the entire range of the species.

Submitted by **BASIL P. CHONDROPOULOS**, Section of Animal Biology, Department of Biology, University of Patra, 260 01 Patra, Greece, and **DIMITRIS P. PAPANDROPOULOS**, Zaimi 21, Rio, 265 00 Patra, Greece.

PETROSAURUS REPENS (Shortnose Rock Lizard). MÉXICO: BAJA CALIFORNIA SUR: Cañon de Los Reyes, 37 km north of La Paz. L. Lee Grismer and Clark R. Mahrdt. Verified by Bradford D. Hollingsworth. LACM PC 1326. Several specimens were observed on 16 and 17 October 1994 crawling on the steep, rocky walls of the canyon. This extends its distribution southward ca. 63 km through the Sierra de La Giganta (Jennings 1990, Cat. Amer. Amphib. Rept. 496.1–496.3) and brings it to within ca. 55 km of its closest relative *P. thalassinus* of the Cape Region (Jennings, *op. cit.*).

Submitted by **L. LEE GRISMER,** Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, and **CLARK R. MAHRDT,** Southwestern Biologists, 9847 Willow Lane, Escondido, California, 92092, USA.

SCELOPORUS CHANEYI (Chaney's Spiny Lizard). MÉXICO: TAMAULIPAS: 0.5 km SE summit Sierra La Gloria off La Pena-Valle Hermoso Road, 21.1 km N jct. with La Pena-Miquihuana Road, elev. 3018.3 m. On fallen pine needles and in low *Ceanothus* at edge of meadow. 1 September 1986. J. F. Copp, D. E. Breedlove, R. R. Riviere and B. R. Anderson. CAS 165250–2. Verified by Richard L. Holland. First record for the state of Tamaulipas (Liner and Dixon 1992, Texas J. Sci. 44:422); previously known only from closely adjacent Nuevo Leon in the vicinity of Sierra Pena Nevada.

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biology, Sacred Heart University, Fairfield, Connecticut 06432-1000, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

SCELOPORUS SCALARIS SCALARIS (Highlands Bunch Grass Lizard). MÉXICO: NAYARIT: Ocote airstrip, 2119 m, 21°03'N 104°14'W. 18–19 July 1983. Timothy W. Houseal. TCWC 61714. New state record and a known range extension northwestward of 130 km from the vicinity of Tapalpa, 2256 m, Jalisco (Smith and Hall 1974, Great Basin Nat. 34:103); ten critically conformant specimens are available (UTA 4018–22, 4815–18, 11786). Verified by Richard L. Holland.

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biology, Sacred Heart University, Fairfield, Connecticut 06432-1000, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA.

SCELOPORUS SCALARIS UNICANTHALIS (Smith's Bunch Grass Lizard). MÉXICO: DURANGO: 21 air km S and 12 air km W Teneraca, 2040 m. 27 November 1970. Robert G. Webb. UTEP 7408–10 (29, 31, 34 mm SVL); near Huazamota on trail to Santa Teresa (Nayarit). 13 August 1897. Edward W. Nelson and Edward A. Goldman. USNM 46626 (47 mm SVL). All are immatures, but they provide the first records for Durango (Smith and Hall 1974, Great Basin Nat. 34:103) and a northward range extension of about 150 km on the west slopes of the Sierra. Those from Teneraca were found in a hilly, grassy area with scattered oak and pine, and small rock outcrops; one *Anolis nebulosus* was obtained at the same time and place. Substantiated by UTEP 7417 from nearby northern Nayarit (previously recorded in Nayarit only from the extreme south, *loc. cit.*), 1 air km S and 27 air km E Huajicori, 1465 m, 3 December 1970, Robert G. Webb. All verified by Richard L. Holland. The other two subspecies in Durango occur only on eastern slopes—*S. s. slevini* in the extreme north, *S. s. scalaris* in central and southern parts.

Submitted by **ROBERT G. WEBB**, Department of Biological Sciences, University of Texas at El Paso, El Paso, Texas 79968-0519, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0315, USA; and **GREGORY J. WATKINS-COLWELL**, Department of Biology, Sacred Heart University, Fairfield, Connecticut 06432-1000, USA.

TROPIOCOLOTES LATIFI (Latifi's Sand Gecko). IRAN: FARS PROVINCE: Shiraz Mountains around Salt Lake, ca. 29°36'N, 52°33'E, 1495 m elev. 26 March 1996. Zahra Mottaghi. Zoological Museum of Gorgan University (ZMGU 100).

Submitted by **HAJI GHOLI KAMI** and **EBRAHIM VAKILPOURE**, Department of Biology, Faculty of Sciences, Agricultural Sciences and Natural Resources of Gorgan University, Iran.

UTA STANSBURIANA STEJNEGERI (Desert Side-blotched Lizard). USA: TEXAS: Floyd Co: Caprock Canyons Trailways State Park, UTM coordinates 14304503E 3790783N. 9 May 1996. F. D. Yancey II and K. J. Roberts. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 11536). New county record; fills gap between Briscoe and Crosby counties, and helps define western limit of this taxon in the Texas panhandle (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

AMPHISBAENIA

RHINEURA FLORIDANA (Florida Worm Lizard). USA: GEORGIA: Lanier Co: Patten's Seed Company, ca. 5 mi N of Lakeland. 10 April 1974. J. A. Payne. Verified by Joshua Laerm. University of Georgia Museum of Natural History (UGAMNH Photo 24899). New state record (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.) for this previously recognized Florida endemic. Extends its known range ca. 75 km N of northernmost locality in Florida (Meylan 1984, Herpetol. Rev. 15:23–24). Individual was collected from a sapling pecan tree planting hole. Specimen was donated to Gerald E. Cosgrove, pathologist at Oak Ridge National Laboratory, who has since deceased. His collection was later donated to the San Diego Museum of Natural History, but the specimen was apparently lost prior to being cataloged.

Submitted by **JOHN B. JENSEN** and **JERRY A. PAYNE**, Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029, USA.

SERPENTES

CROTALUS ATROX (Western Diamondback Rattlesnake). USA: TEXAS: HALL CO: Caprock Canyons Trailways State Park, UTM coordinates 14325866E 3809386N. 9 May 1996. F. D. Yancey. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 11535). New county record; fills gap between Briscoe and Childress counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

CROTALUS VIRIDIS VIRIDIS (Prairie Rattlesnake). USA: TEXAS: ANDREWS CO: 14 km N Andrews. 22 May 1960. Tinkle. The Museum of Texas Tech University (TTU 1468); 6 km SW Andrews. 30 June 1960. McGregor and Patterson. TTU 1821; 30 km SW Andrews. 28 May 1961. Tinkle. TTU 2506; 25 km SW Andrews. 2 June 1961. Tinkle. TTU 2588; 7 km S Rt. 115 on Rt. 181. 9 May 1962. B. Hutchison. TTU 3189. All specimens verified by Clyde Jones. New county records; fill gap between Yoakum and Terry counties to the north, and Winkler and Ector counties to the south (Dixon 1987, Amphibians and Reptiles of Texas). Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

DIADOPHIS PUNCTATUS ARNYI (Prairie Ringneck Snake). USA: TEXAS: KENT CO: 3.2 km S Clairemont. 5 May 1968. Don and David Forester. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 4450). New county record; helps define the range of this subspecies in Texas. Also, may aid in clarifying possible zone of contact with *D. p. regalis* (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

DRYMARCHON COUPERI (Eastern Indigo Snake). USA: GEORGIA: LIBERTY CO: St. Catherine's Island. August 1983. John Couper. Verified by Frank van Breukelen. UCM Color Slide 114. First confirmed record for any of Georgia's barrier islands, although a sighting has been reported for Sapelo Island (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. No. 2; range map for *D. couperi* annotated by J. T. Collins, pers. comm. 1996).

Submitted by **JOHN COUPER**, University of Wisconsin, Madison, Wisconsin 53706, USA, Gwen Murdock, Missouri Southern State College, Joplin, Missouri 64801, USA, **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309, USA.

GYALOPION CANUM (Western Hooknose Snake). USA: TEXAS: GARZA CO: Justiceburg Wildlife Management Area, 5 km N and 15 km E Justiceburg. 17 June 1993. F. D. Yancey, II. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 11528). New county record; defines western margin of the northern portion of the range of this species in Texas (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II,** Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

HYDROPHIS TORQUATUS DIADEMA (West Coast Blackhead Sea Snake). CAMBODIA: TONLE SAP: Km 9. Collected by fishermen in nets and given to F. d'Aubenton. February 1962. Museum national d'Histoire naturelle, Paris (MNHN 1963. 743–744). Verified by Arne Rasmussen. New country record. First determined as *Hydrophis* sp. with a precise description of both specimens (Saint Girons 1972, Mem. Mus. natn. Hist. nat., ser. A, tome 74:1–170) and later as *Hydrophis mamillaris* in MNHN collections by R. Roux. Previously known only from Meklong (bight of Bangkok) on the west side of the Gulf of Thailand to Koh Chang Island on the east side of the Gulf of Thailand and considered as particularly abundant at the mouths of the Meklong and the Chanthaburi rivers (Smith 1926, British Mus. (Nat. Hist.), London. xvii + 130 pp.; Taylor 1965, Univ. Kansas Sci. Bull. 45(9):609–1096). Collecting data do not permit a determination as to whether these specimens correspond to established populations, migratory populations, or just to isolated individuals (Saint Girons, *op. cit.*).

Submitted by **IVAN INEICH**, Museum national d'Histoire naturelle, Laboratoire de Zoologie (Reptiles & Amphibiens), 25 rue Cuvier, F-75005 Paris, France.

LIOCHLOROPHIS (=OPHEODRYS) VERNALIS (Smooth Green Snake). USA: COLORADO: MESA CO: Colbran, in town park (NE 1/4 Sec. 35, T9S, R95W). 20 May 1996. L. J. Livo and David Chiszar. UCM 57782. First record for county (Livo et al. 1996. Colo. Herptol. Soc. 22 pp.). Verified by Roseanne Humphrey.

Submitted by **LAUREN J. LIVO**, Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526-2097, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

MASTICOPHIS FLAGELLUM TESTACEUS (Western Coachwhip). USA: TEXAS: FLOYD CO: Caprock Canyons Trailways State Park, UTM coordinates 14 304503E 3790783N. 23 May 1996. F. D. Yancey, II and K. J. Roberts. Verified by Clyde Jones. The Museum of Texas Tech University (TTU 11537). New county record; fills gap between Briscoe and Crosby counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **FRANKLIN D. YANCEY, II** and **KRISTIE JO ROBERTS**, Department of Biological Sciences and the Museum, Texas Tech University, Lubbock, Texas 79409-3191, USA.

PHILODRYAS AESTIVUS SUBCARINATUS (Brazilian Green Racer). ARGENTINA: CORDOBA: DEPARTMENT RIO CUARTO: Rio Cuarto (Ba. Universidad, Las Higueras, 33°06'S, 64°18'W). 24 July 1995. Collector unknown. Verified by Ricardo A. Martori. Herpetological collection of Orientacion Zoologia de Vertebrados, Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Argentina (ZV-UNRC 3639). First departmental record, second record in Cordoba province, and a westward extension of the known range ca. 50 km from previous citation (Corbella, Bol. AHA 5(1–2):11–12).

Submitted by **LUCIANO JAVIER AVILA**, CONICET—Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Est. Post. 9, C.P. 5800, Rio Cuarto (Cordoba), Argentina.

REGINA SEPTEMVITTATA (Queen Snake). USA: GEORGIA: BALDWIN CO: Champion Creek, 3.4 km N Lake Laure Road and St. Rt. 22. 26 September 1993. Gregory B. Lacy. Verified by Den-

nis Parmley. Georgia College (DCP-GC 3784). Adult female captured in a minnow trap in Champion Creek below Lake Laurel. First county record; fills a central Georgia distribution gap (Williamson and Moulis 1994, Savannah Sci. Mus. Spec.Publ. No. 3).

Submitted by **GREGORY B. LACY**, Department of Biological and Environmental Sciences, Georgia College, Milledgeville, Georgia 31061, USA.

RHINOBOTHRYUM LENTIGINOSUM (Coral Falsa). VENEZUELA: ESTADOS BOLÍVAR: Km 88, Carretera el Dorado–Santa Elena de Uairén. 8 August 1983. Luis Duque. Verified by Celsa Señaris. Museo de Ciencias Naturales de Caracas (MCNC–6387, female). First record of this snake and second species of the genus cited for Venezuela. Captured in tropical rain forest at night [Pons 1965, Kasmera, 2(1):99–103; Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela, UCV. 343 pp.; Lancini 1979, Serpientes de Venezuela. Verlag Armitano. 262 pp.; Lancini and Kornacher 1989, Die Schlangen von Venezuela. Verlag Armitano. 381 pp.].

Submitted by **CESAR R. MOLINA R.**, Curator of Herpetology, Museo de Ciencias Naturales de Caracas, Calle Comercio, sector Peaje, Las Acacias, Caracas, D.F., Venezuela, and **GILSON A. RIVAS F.**, Museo de Historia Natural La Salle, Assistant Section Herpetology, P.O. Box 1930, Caracas, 1010–A. Venezuela.

THAMNOPHIS EQUES (Mexican Garter Snake). USA: NEVADA: Clark Co: Lake, opposite Ft. Mohave, Arizona. 8 April 1911. Junius Henderson. Verified by David Chiszar. University of Colorado Museum (UCM 104). First state record (Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Second ed. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.) and further substantiation of the presence of this species at one time in the vicinity of the southern tip of Nevada and adjacent Arizona (Rosen and Schwalbe 1988, Rept. Arizona Game and Fish Dept. to the U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 50 pp.). The somewhat ambiguous locality description apparently refers to part of the (dammed?) Colorado River as there is no town called "Lake" in the area.

Submitted by **ALAN DE QUEIROZ** and **HOBART M. SMITH**, University Museum and Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA.

TYPHLOPS ATER (Irian Worm Snake). INDONESIA: BALI: Near Samur under a stone in a yard next to a wood carving factory. 5 December 1994. Harold A. Dundee. Verified by Jeff Boundy. TU 23529. The species is known from eastern Java in the Idjen Highlands, which are ca. 10 km from Bali, and in many islands to the east of Bali (Brongersma 1934, Contributions to Indo-Australian Herpetology. E. J. Brill, Leyden.). Java is separated from Bali by ca. 2 km of ocean and *T. ater*, like many typhlopids, is easily transported amid the roots of plants.

Submitted by **HAROLD A. DUNDEE**, Tulane Museum of Natural History, Belle Chasse, Louisiana 70037-3098, USA.

VIRGINIA STRIATULA (Rough Earth Snake). USA: LOUSIANA: St. Mary Parish: Morgan City. 10 March 1971. Robert P. Blereau. Ernest A. Liner Collection (EAL 2587, 1 specimen); 24 March 1976. Blair Hardin. EAL 4037 (1 specimen). Verified by Harold A. Dundee. Extends range southward ca. 34 mi (54.7 km) from that mapped by Dundee and Rossman (1989, The Amphibians and Reptiles of Louisiana, Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

Northern Range Expansion of the Brown Anole (*Anolis sagrei*) in Florida and Georgia

TODD S. CAMPBELL
Department of Ecology and Evolutionary Biology
University of Tennessee, 569 Dabney Hall
Knoxville, Tennessee 37996-1610, USA

The brown anole, *Anolis sagrei*, a native of Cuba and the Bahamas, was first recorded in North America in the Florida Keys by Garman (1887). Oliver (1950) and Bell (1953) document its arrival in the major seaports of south Florida during the 1940s. Based on museum records and numerous geographic distribution papers, this species had become firmly established in most large urbanized areas of peninsular Florida south of Gainesville by 1980 (reviewed in Godley et al. 1981 and Lee 1985), and has since been found in the Florida panhandle (Means 1990), in Louisiana (Thomas et al. 1990; Platt and Fontenot 1994), and in Texas (Dixon 1987; King et al. 1987). This species continues to move northward and establish peripheral populations in north Florida and south Georgia. Brown anoles have been present in Valdosta, Georgia since 1987 (Echternacht et al. 1995). They were recently found in central Georgia as far north as Tifton, and on the east coast as far north as Brunswick and St. Simons Island (Campbell and Hammontree 1995).

Herein I report six additional county records in northern Florida that fill gaps in the geographic range of this recent invader between populations in northern peninsular Florida (Funk and Moll 1979; Godley et al. 1981; Lee 1985; Stevenson and Crowe 1992; Wygoda and Bain 1980) and recent records in north Florida and south Georgia (Campbell and Hammontree 1995; Echternacht et al. 1995). I also provide additional records for four south Georgia counties, show that previously reported Georgia populations are surviving over winter, and provide additional evidence of vehicular transport.

FLORIDA

Hamilton County: Quality Inn (formerly Holiday Inn) at the jct. of I-75 and Fla. Rt. 143, one mile southwest of Jennings. 13 April 1995. Todd Campbell. Verified by A. C. Echternacht. University of Florida Museum of Natural History (UFMNH 101611). Adult male collected from shrubbery (*Ilex vomitoria*) near the main building. New county record. Population size estimated to be ca. 30 individuals in April and May 1995 and more than 50 individuals in July 1995. The former hotel manager was familiar with this species and stated that brown anoles occur at her residence and other residential areas near the hotel. Green anoles (*A. carolinensis*) were found throughout the hotel grounds, while *A. sagrei* were found only near the main building and pool.

Columbia County: Lake City, Holiday Inn at the jct. of I-75 and U.S. Rt. 90. 22 May 1995. Todd Campbell. Verified by A. C. Echternacht. UFMNH 101604. Adult male collected from landscaping shrubs near the hotel office. New county record. Population size estimated to be in the upper hundreds or low thousands. This species is abundant throughout the hotel grounds and is clearly an established breeding population. Brown anoles were first observed at this hotel by me during a five-month stay in 1991. The current hotel manager was familiar with this species and stated that brown anoles have been present at his nearby residence for at least two years. Green anoles are also present at this hotel site in large numbers.

BAKER COUNTY: Econolodge at the jct. of I-10 and Florida Rt. 121, two miles south of MacClenny. 13 April 1995. Todd Campbell. Verified by A. C. Echternacht. UFMNH 101609–101610. Adult male and adult female collected near the pool. New county record. Population size estimated to be ca. 20 individuals, found only to the south and west of the hotel office and by the pool. This could represent a recent colonization event, as the population is small and none was seen by the author during a two-week stay in 1991. Green anoles are also present at this site.

PUTNAM COUNTY: Downtown Palatka, Holiday Inn on U.S. Rt. 17 on the west bank of the St. Johns River. 22 May 1995. Todd Campbell. Verified by A. C. Echternacht. UFMNH 101605–101606. Adult male and adult female collected from landscaping timbers near the pool. New county record. Population size estimated to be over 100 individuals. This is very likely an established breeding population.

FLAGLER COUNTY: Downtown Bunnell, City Hall building complex on U.S. Rt. 1. 22 May 1995. Todd Campbell. Verified by A. C. Echternacht. UFMNH 101602–101603. Adult male and adult female collected from shrubbery near the City Hall building. New county record. Population size estimated to be at least 100 individuals, found throughout the City Hall grounds. This is clearly an established breeding population, and one city employee familiar with this species stated that brown anoles are present in large numbers throughout the city of Bunnell.

VOLUSIA COUNTY: Bethune Beach, at Bethune Beach County Park on U.S. A1A (Atlantic Avenue) ca. 20 km south of New Smyrna Beach. 31 May 1995. Todd Campbell. Verified by A. C. Echternacht. UFMNH 101607. Adult male with severe scoliosis collected from saw palmetto (*Serenoa repens*) near shoreline. New county record. This record is located between records to the south in Brevard County (Cochran 1990) and those to the north near Jacksonville (Lee 1985) and St. Augustine (Meylan 1977). Numerous in isolated saw palmetto clumps and on a boardwalk along the shoreline of Mosquito Lagoon. This specimen is just one member of an extremely large, contiguous population known to be present since 1989 (pers. obs.), members of which are found at nearly every residential, commercial, and resort property in the New Smyrna Beach area between Ponce Inlet and Canaveral National Seashore.

VOLUSIA COUNTY: Canaveral National Seashore at the Turtle Mound Archaeological Site, ca. 15 miles south of New Smyrna Beach. 30 May 1995. Todd Campbell. Verified by A. C. Echternacht. UFMNH 101608. Adult male collected from natural vegetation along the shore of Mosquito Lagoon. Additional Volusia County record and first Canaveral National Seashore record. Brown anoles are found along edges of natural vegetation in Canaveral Natural Seashore at most of the beach-side boardwalks and parking areas along U.S. A1A, on the Mosquito Lagoon side of the park between the park entrance and Eldora, and on dredge spoil islands associated with the Intracoastal Waterway within Mosquito Lagoon. The fact that landscaping vegetation is not utilized in the park is strong evidence that Brown anoles are reaching the park exclusively on recreational vehicles. Urban areas directly north of this park (e.g., New Smyrna Beach and Bethune Beach) are heavily infested with brown anoles. Tourists and residents travelling from Orlando (also heavily infested) regularly seek this National Seashore because of its secluded beaches. Brown anoles reach dredge spoil islands either by riding on boats that have been stored on land or by riding on the firewood piles transported on these boats by overnight campers. Every overnight camper interviewed on these islands in 1995 stated that they stored their boat on a trailer on land, transported their own firewood, lived in areas infested with brown anoles (usually Orlando), and often found both *A. carolinensis* and *A. sagrei* on their boat and wood piles at home. A gravid female *A. sagrei* was found on a camper's wood pile in spring 1995, during which a large group of boat-campers utilized the island. Prior to that day, this island had been extensively surveyed for *A. carolinensis* as part of an ongoing research project, but no *A. sagrei* had been found. In fact, nearly every spoil island along the Intracoastal Waterway in the Indian River south of Melbourne contains dense populations of *A. sagrei* (pers. obs.). Given the above, it seems inevitable that this species will eventually reach many natural areas of Florida regardless of their degree of isolation.

GEORGIA

LOWNDES COUNTY: Valdosta, Holiday Inn at the jct. of I-75 and U.S. Rt. 84. 3 July 1995. Todd Campbell. Verified by A. C. Echternacht. University of Georgia Museum of Natural History (UGAMNH 24868). Collected adult male in a shrub near hotel office. The second population documented for Valdosta (Echternacht et al. 1995). More than 50 were observed during a brief search of the hotel grounds. This hotel is directly across the street from the Best Western hotel where the first record from Valdosta was obtained (Echternacht et al. 1995). The Best Western brown anole population has expanded to the trailer campground immediately to the west of that hotel.

TIFT COUNTY: Tifton, Holiday Inn at the jct. of I-75 and U. S. Rt. 82. 27 April 1995. Todd Campbell. Verified by A. C. Echternacht. UGAMNH 24871. Adult female collected from landscape shrubs near the main building. The second record for Tifton (Campbell and Hammontree 1995), however, only one individual was observed (and collected) at the first Tifton site in 1994, and no brown anoles were found at that site in April 1995, so this record may represent the sole population occurring in this county at this time. More than 20 were observed in shrubs near the office, restaurant, and pool. Likely represents a recently established population, as no brown anoles were observed during a thorough search of the hotel grounds in August 1994. Green anoles were numerous at this hotel on this date and in August 1994.

CAMDEN COUNTY: Kingsland, Best Western at the jct. of I-95 and Ga. Rt. 40. 4 July 1995. Todd Campbell. Verified by A. C. Echternacht. UGAMNH 24870. Adult male collected from landscape shrubs near the main building. The second record for Camden County (Campbell and Hammontree 1995). The population consists of at least 100 individuals. Of the four major hotels at this intersection, this is the only one supporting brown anoles, whereas all four support large *A. carolinensis* populations.

GLYNN COUNTY: Brunswick, HoJo hotel at the jct. of I-95 and U. S. Rt. 341. 4 July 1995. Todd Campbell. Verified by A. C. Echternacht. UGAMNH 24869. Adult male collected from landscape shrubs near the main building. The third record for Glynn County (Campbell and Hammontree 1995). The population consists of hundreds of individuals on the properties of this hotel, the Budgetel hotel and the Cracker Barrel restaurant, which are separated only by parking areas containing landscaped islands. The owner was familiar with this species and indicated that brown anoles have been present for over two years. Green anoles are also present at all of the hotels in this complex.

Vehicular rafting and transport in ornamental vegetation were first hypothesized by Godley et al. (1981) to explain the rapid dispersal of this species. Evidence of vehicular rafting was seen at Interstate rest stops and welcome centers along both I-75 and I-95. These facilities accommodate vehicles travelling in only one direction: northbound or southbound. These facilities usually lie across the interstate from one another, are constructed at the same time and are planted with similar vegetation. During surveys in 1994 and 1995 in north Florida and south Georgia, *A. sagrei* individuals were usually present at northbound rest areas and welcome centers (Campbell and Hammontree 1995), whereas they were never present at facilities servicing only southbound traffic. If lizards were traveling mainly on potted landscaping vegetation from Florida, one would expect to find *A. sagrei* at both northbound and southbound facilities with equal frequency, but this is not the case. This evidence, along with that from Canaveral National Seashore and from spoil islands along the Intracoastal Waterway, give weight to the hypothesis that *A. sagrei* are being transported on recreational vehicles and boats in numbers suitable for the establishment of viable populations at remote sites.

Acknowledgments.—I thank the many hotel and restaurant owners, rest stop employees, campground hosts, city employees, the staff at Canaveral National Seashore and many others (the names being too numerous to mention here) who allowed me to prowl about their property searching for lizards.

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BOOK REVIEWS

Pythons of the World. Vol. 1. Australia, by David G. Barker and Tracy M. Barker. 1994. Advanced Vivarium Systems, Inc., Lakeside, California, xviii + 171 pp. US $59.95 (cloth bound), US $39.95 (softcover).

BILL BRANCH
Port Elizabeth Museum, P.O. Box 13147, Humewood 6013 Eastern Cape, South Africa
e-mail: pemwrb@zoo.upe.ac.za

During the last five years there has been a massive explosion in the field of reptile and amphibian husbandry (herpetoculture), with the appearance of numerous glossy magazines, new dealers, expos, and exposés. The term herpetoculture makes me cringe and sounds like something out of a clinical pathology textbook and I must be frank and admit that I don't like the word, or some commercial aspects of its world. Nonetheless, I do like this book and it goes a long way to assuage my fears about the topic.

Announced as the first of a series by the authors on pythons of the world, this book covers the 21 python species and subspecies known from Australia. Printed on high-quality glossy paper throughout, the middle 80 pages are given over to a superb collection of color photographs. In another context, or if taken by lesser photographers, 197 color photographs of only 21 taxa would rightly be considered excessive. Certainly, if the rationale is simply to document a bit of variation and habitat, it is too much. However, this book is a labor of love and one of its aims is to generate similar feelings in the audience. In such a spirit, I found very few photographs I would have left out.

The individual taxa are described in detail in standardized format under the headings: Type locality, Other common names, Description, Sex determination, Size, Distribution, Habitat, Food, Breeding, Eggs, Hatchlings, and Comments. Each account also includes a line drawing of the head, a generalized distribution map, and tables for egg and hatchling measurements and a chronology of reproductive events. Five appendices give annotations for the figures, details of relative clutch weights, a map of Australia, position of internal organs in a diamond python, and a python reproduction questionnaire. The final five pages include a glossary and a comprehensive bibliography.

A minor failing is the lack of keys, or useful explanation of diagnostic features for identification of the different taxa. The almost draconian Australian regulations make legal acquisition of the continent's herpetofauna all but impossible. Therefore, many trade specimens derive second or third hand from successful breeding programs begun with specimens initially obtained illegally and often without provenance. Specimens need to be accurately identified if they are to be used in breeding programs designed to maintain, not contaminate, genetic purity.

A failing of many popular husbandry books is the superficial, and often antiquated science, particularly systematics. Boid systematics has seen more upheaval in recent years than most other squamate groups, and it is doubtful whether the dust has finally settled into bedrock foundation. The literature is often obscurely placed, and is usually caged in esoteric jargon. It is no easy task to keep on top of it, either in access or philosophy. It is, therefore, very satisfying to see how comprehensively and accurately the authors have covered this difficult field. In many species accounts the authors make informative comments on taxonomic controversies, in simple and lucid terms, and they are not over-awed

from giving their own, reasoned opinion (e.g., *Liasis fuscus*, p. 30, and *Morelia bredli*, pp. 44-45). They also make a pertinent comment on the valueless taxonomic importance of the increasing number of captive-bred intrageneric hybrids.

Elsewhere (p. 133), in their treatment of races in carpet pythons, the authors fully face the contentious nomenclatural 'anarchy' of Wells and Wellington (1984, 1985). It was probably an easier move for non-Australians, but still required strong stomachs. Morals count for nothing in nomenclatural priority, and the names proposed by Wells and Wellington, despite their often crass and plagiarized roots, still have to be used. In this particular case, however, one name is acceptable for other reasons; *Morelia spilota mcdowelli*, revived by the authors for the coastal carpet python, is named for a true, gentle giant of herpetology, Sam McDowell.

The authors stress their personal philosophy that efficient, concerned captive breeding programs (CBP) benefit wild populations by relieving exploitation on them, and their own results ably demonstrate that all python species are amenable to captive husbandry, albeit that the long-term captive maintenance of diamond pythons remains so elusive. However, rare and protected pythons command very high market prices, and therefore stimulate attention from the 'less-than-honest' fringe. During the last 30 years the legal export of Angolan dwarf pythons for a CBP has been allowed only twice, and involved only six specimens that went to South Africa (4) and Germany (2). Even then, some of the adults and progeny were supposed to remain the property of the Namibian authorities. Despite this, a large shipment of *Python anchietae* recently turned up in the United States, shipped via West Africa and ostensibly legally obtained in Angola (during a period when the country was gripped by a violent and dirty civil war). The Namibian authorities know that most, if not all, were smuggled from Namibia. This increased smuggling took place in the face of successful, and well publicized CBPs at several Texas zoos.

I have discussed elsewhere (Branch and Griffin, *in press*) how the very successes of high profile CBPs may stimulate illicit trade and attract the unwanted attention of dishonest collectors. Obviously, the zoos and curators initiating CBPs do so for genuine reasons, and are rigorous in ensuring they obey moral imperatives and import and export regulations. However, whether CBPs help conserve endangered species, or unintentionally stimulate excess illegal attention, remains an ethical dilemma. It will therefore be a genuine tragedy, and no small irony, if the very enthusiasm and expertise that this book displays, generates such a commercial demand that it threatens the very species that it so beautifully celebrates.

I have only two personal frustrations. The first is that I was only given the soft-cover edition—it is already suffering excessive use. Too many colleagues simply 'ogle' the superb photographs. The second is that it preempts a book I always wanted to write myself. Fortunately I never did, and the dream is now redundant thanks to the photographic, literary, and husbandry skills of Dave and Tracy Barker. I wish them well with the remaining volumes in the series.

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The Reptiles of Virginia, by Joseph C. Mitchell. 1994. Smithsonian Institution Press, Washington, D.C. 20560, USA. ISBN 1-56098-356-6, 352 pp. US $40.

CARL H. ERNST
Department of Biology, George Mason University
Fairfax, Virginia 22030, USA
e-mail: cernst@gmu.edu

This is the first volume of an intended two volume series covering the herpetology of Virginia. A second volume on amphibians is in preparation.

The slant of the book is, admirably, biodiversity and conservation of the 62 species of reptiles (23 turtles, 9 lizards, 30 snakes) known to occur within the boundaries of the Commonwealth of Virginia. The meat of the book is composed of accounts of each reptile species. These accounts include subsectional discussions covering systematics (current usage), description, morphology, coloration and pattern, sexual dimorphism, juveniles, confusing species, geographic variation (it is refreshing to see acknowledgement that two subspecies of the timber rattlesnake exist in the southeastern United States), etymology of scientific names, distribution, biology, miscellaneous remarks (often historical), and conservation and management of the species. The subsection covering the biology of the reptile is generally the longest in each account, and includes condensed comments on habitats, activity periods, prey and feeding behavior, predators, and reproduction with emphasis on data from Virginia. Data presented are generally well referenced. Although adequate, the various topical discussions presented in the biology subsection are somewhat shallow, and could have been greatly expanded. The descriptive portions of the species accounts are good, and those on juveniles are very helpful (juvenile descriptions are often neglected or inadequate in state herpetologies). The distribution discussion is brief, but maps showing both the species range in Virginia and the United States are included. Unvouchered records marked on the Map of Virginia are listed in the text. Here a problem arises, as some county records have been missed, and many records listed as unvouchered, particularly in northern Virginia, are represented by vouchered specimens in collections (D'Alessandro and Ernst 1995).

Other supporting chapters in the book include a brief introduction; materials and methods, explaining how original data were collected; history of reptile studies in Virginia; physiographic regions and climate of Virginia; natural habitats and reptile communities; biogeography, including the effects of human activities on reptile distribution patterns within the Commonwealth; conservation of Virginia's reptiles; venomous snakebite; and a checklist and comments on systematics. Separate keys are included for identifying turtles, lizards and snakes, and there are good black and white drawings of pertinent features referenced in these keys. Also included are short presentations on the characteristics of the Class Reptilia and all orders and families of reptiles living in Virginia. The last chapter in the book covers erroneous (5 species), problematic (3) and introduced (7) species. Included among the erroneous species is the American alligator, *Alligator mississippiensis*, whose northern limits along the East Coast are often mistakenly stated to be the Dismal Swamp in southeastern Virginia, when in reality the species does not naturally range north of the southern portions of Albemarle Sound, North Carolina. An adequate glossary explaining the biological terms used in the text and a Literature Cited section referencing all papers mentioned in the text are present. An index to scientific and common names ends the book, while a good Table of Contents begins it.

The book is well illustrated with 63 excellent color plates showing various reptilian habitats and some, but not all, of the 62 reptile species. Only 31 species are found among the color plates (11 turtles, 5 lizards, 15 snakes), although some species are included several times: the bog turtle, *Clemmys muhlenbergii* (2 plates); red-bellied turtle, *Pseudemys rubriventris* (2); slider, *Trachemys scripta* (6); stinkpot, *Sternotherus odoratus* (3); milk snake, *Lampropeltis triangulum* (3); northern water snake, *Nerodia sipedon* (2); copperhead, *Agkistrodon contortrix* (3); and timber rattlesnake, *Crotalus horridus* (4). Two maps are also given covering the counties and selected independent cities, and the physiographic provinces of Virginia. Eight tables addressing various topics are scattered throughout the book.

The book has a hard cover with an adequate binding and good quality paper. The print is large and easy to read. The dust jacket is colorful and attractive, showing three species and a cypress swamp habitat.

Although a few problems have been mentioned above, Dr. Mitchell is to be congratulated for a job well done. This book is recommended to anyone interested in the herpetology of the Middle Atlantic Region, and Virginia in particular. I look forward to the future volume covering Virginia's amphibians.

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Guide to the Frogs of the Iquitos Region, Amazonian Peru, by Lily O. Rodríguez and William E. Duellman. 1994. Univ. Kansas Publications, Natural History Museum. Special Publication No. 22. 80 pages. US $19.95. ISBN 0-89338-047-4.

JAIME E. PÉFAUR
Ecología Animal, Facultad de Ciencias
Universidad de Los Andes, Mérida, Venezuela 5101

This guide to the anurans of an Amazonian region of Peru appears at a time when the subject of biodiversity seems to pervade all fields of biology. Amazonia is, by far, the place with the greatest biodiversity in the world, expressed at all organizational levels of organic matter, e.g., fungi, ferns, trees, butterflies, bats, and of course frogs. However, this region of South America is facing devastating destruction by deforestation, which reaches an annual rate of 0.4% in Peru to 1.2% in Venezuela—that is, in less than five decades there will be immense prairies instead of the luxurious forests of today.

Biologists attempting to record the biota of the Amazon face several difficulties, ranging from logistics to classification. Thus, I applaud the goals of University of Kansas Publications to initiate a series of guides to the plants and animals of the Iquitos Region. I am sure that this will be a most important contribution to the knowledge of Amazonian biota.

The *Guide* begins with biographical sketches of the authors and a preface. Eleven pages are dedicated to an Introduction, with statements about worldwide, South American, and Amazonian diversity of anurans, the biology of frogs, the vocalization of male frogs in an eco-ethological context, and the breeding behavior of Iquitos frogs. Information on how the guide should be used, scientific names, and anatomical, ecological, and ethological terminology (86 terms) complete this section of the book.

Sixty-seven pages make up the "Guide to the Frogs" chapter. Here 112 species are carefully described, with three paragraphs devoted to each taxon under the headings "identification," "similar species," and "natural history." The authors present diagnostic characters clearly. Working at my lab, I selected the cases of *Hyla punctata*, for its wide Amazonian distribution, and *Leptodactylus pentadactylus*, a very well known large frog but easily confused with other large *Leptodactylus*, to test Rodríguez and Duellman's diagnostic characters. I readily separated the target species from those of similar appearance.

The next section, "Selected References," is an annotated bibliography of nine references—including five by Duellman and two by Rodríguez. Two important references, of particular significance with respect to the topic of the *Guide* have been omitted: Duellman and Salas (1991) and Rodríguez et al. (1993).

A section of color plates finishes up the book. Of the 112 described species, only one, *Eleutherodactylus aaptus*, is not illustrated. Most pictures were taken by the junior author, and all show the principal traits of the frogs, although pictures of *Ceratophrys cornuta, Phyllomedusa vaillanti, Eleutherodactylus altoamazonicus*, and *Vanzolinius discodactylus* could be improved for the next edition. I know of no other guide to South American vertebrates (other than birds) that has so many color pictures of such excellent quality. To my knowledge, the only comparable publication could be *Frogs of Boracéia* (Heyer et al. 1990). However, their publication is aimed at herpetologists and could not be seen as a general guide, although it has been of great importance helping researchers at many South American universities in their studies. Unfortunately, the plates in Rodríguez and Duellman are not firmly bound—with the normal reading use of the book, plates 2 to 11 fell out of my copy.

The only map of the Iquitos region provided appears inside the back cover. This is a close-up of the Iquitos region of Peru. This book does not contain a general map of Peru, not even as an insert in the Iquitos map. Such a map, showing the boundaries of Iquitos, as a Departamento of Peru, would place the area in context for the general reader and provide an appropriate backdrop against which the anuran diversity of the region could be appreciated.

The Guide appears designed mainly for a non-technical audience. This is supported by the section on the construction of scientific names, a need for a layman, but not for someone with at least an elementary biology background; on the other hand, in the description of every species there is a section on tadpole morphology and natural history that is very complete and far too technical for non-specialists.

I anticipate that this guide will be successful. The time is right for its appearence; its presentation is appealing, the price is fair, the information is provided by authorities, and the need for it is great. Everyone traveling to the Peruvian Iquitos region should carry a copy of this small book to help them enjoy and appreciate the local frogs. Every herpetologist wishing to know or to work with Amazonian frog communities should have this guide to help confirm identifications.

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RODRÍGUEZ, L. O., J. H. CÓRDOVA, AND J. ICOCHEA. 1993. Lista Preliminar de los Anfibios del Peru. Publ. Mus. Hist. Nat. Univ. Nac. Mayor San Marcos (Ser. A), 45:1–22.

PUBLICATIONS RECEIVED

Australian Frogs (computer information disk), by Ross Sadlier and Martyn Robinson. Australian Museum, Sydney. 1996. AU $15.00 + AU $1.50 ($2.00) postage and handling (available from Mail Order Shop, Australian Museum, 6 College St., Sydney, NSW 2000, Australia—credit card orders accepted).

This is one of a series of information disks put out by the Australian Museum on a variety of topics in Australian natural history. The interactive program comes on a single 3.5" disk and after installation (about 5 minutes on a 486 machine) occupies approximately 3 MB. The program runs under Windows (3.1 or later) and requires a PC with at least a VGA screen set for 256 colors. In all about 70 pages of text and 40 color photographs are included. Information may be accessed under the major headings: frog diversity, disappearing frogs, lifecycle, frogfacts, habitat diversity, things to do, about this disc, and about the Australian Museum. A complete checklist of Australian frogs is included, but photos and text refer only to representative or particularly noteworthy taxa. Addresses for 23 herpetological associations and study groups in Australia are also provided, as are capsule summaries of the research interests of each of the scientific departments of the Australian Museum. There is an index and a search option, and both photos and text can easily be printed out. Although aimed at interested amateurs and the general public, this program serves as an excellent introductory short course on Australian amphibians, even for professionals who may not be familiar with the fauna.

Geographic Distributions of the Amphibians and Reptiles of Wisconsin, by Gary S. Casper. Milwaukee Public Museum, Wisconsin. 1996. Softcover. 87 pp. ISBN 0-89326-200-5. US $10.00 + $3.00 shipping and handling (available from Milwaukee Public Museum, 800 W. Wells St., Milwaukee, Wisconsin 53233, USA).

This short book is an interim report of the Wisconsin Herpetological Atlas Project and presents maps depicting species distribution, by county, in Wisconsin. New county records since the publication of Vogt's *Natural History of Amphibians and Reptiles in Wisconsin* (1981) are mapped and the associated publications and voucher specimens are cited. In all 461 new county records are presented for the 55 species of amphibians and reptiles inhabiting the state. Each species map is accompanied by a short paragraph with notes about distribution and/or status of the associated taxon.

New Zealand Frogs and Reptiles, by Brian Gill and Tony Whitaker. David Bateman, Ltd., Auckland. 1996. Softcover. 112 pp. ISBN 1-86953-264-3. NZ $24.95 (approx. US $17.50).

This is an updated version of Gill's 1986 book, *Collins Handguide to the Frogs and Reptiles of New Zealand*. Species accounts are provided for 59 species (plus six recently extinct forms), up from the 43 forms covered a decade ago. Accounts are brief (description, size, distribution, habitat, habits, and notes) and are illustrated by color photos. Keys are provided as is a short list of suggested readings. Although too superficial to provide much introduction to the biology of the New Zealand herpetofauna, the book provides a convenient introduction to the species and is the only popular work to incorporate all of the country's many new and resurrected species (plus one genus).

Okoboji Wetlands: A Lesson in Natural History, by Michael J. Lannoo. University of Iowa Press, Iowa City, Iowa. 1996. 156 pp. Cloth (US $29.95) or softcover ($14.95). ISBN 0-87745-532-5 (cloth) or 0-87745-533-3 (softcover).

Lake Okoboji in northwest Iowa is a region of wetlands renowned for its rich animal life. Lannoo combines historical field records and other reports with more recent work to track changes in the composition and abundance of the fauna. Extensive natural history information on frogs and salamanders is presented (in addition to material on birds, mammals, and fish). A thorough discussion of larval eastern tiger salamanders (*Ambystoma t. tigrinum*) includes diagrams of normal and cannibal morph skulls and dentition. Several brief essays provide fascinating details of commerical harvesting of leopard frogs (*Rana pipiens*) at the turn of the century; one source estimates the take by just three men at ten million frogs from Okoboji in the winter of 1905-06. Lannoo makes the case for conserving these wetlands and their inhabitants and offers specific management strategies for doing so.

Interpretive Atlas of Texas Lizards, by Ralph W. Axtell. 1986–1996, *et seq*. Privately published by and available from the author (Ralph W. Axtell, 2814 Rock Hill Road, East Alton, Illinois 62024, USA). Individual accounts available separately. Cost: US $0.10/page + postage and handling.

The most recent installment (number 16) in this series is *Phrynosoma cornutum*, the Texas horned lizard. This account totals 52 pages in addition to a detailed range map. Of particular interest to students of *Phrynosoma* is Axtell's support for a change in the type locality for *P. cornutum*, and his delimitation of the natural range of this species in east Texas, an area where extensive introductions have occurred.

ERRATA

In the Natural History Note by William E. Magnusson that appeared in the March 1996 issue of HR (27:21), a typesetting error resulted in the incorrect spelling of the lizard genus *Neusticurus*.

Also, we inadvertently left out complete locality coordinates for the *Hemidactylus turcicus* range extension reported by Proudfoot and McCoid in the June 1996 issue (27:87). Locality data should have read: USA: TEXAS: Kenedy Co: 26°46'20"N, 97°42'20"W.

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Translations
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Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

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DAVID L. HARDY, SR.
3905 Old Sabino Canyon Road
Tucson, Arizona 85750, USA

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DON C. FORESTER
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Towson, Maryland 21204, USA

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Originals of illustrative material (e.g., tables, photographs, or diagrams) should be submitted with the text, with appropriate precautions taken to ensure delivery without damage. Illustrations should be discussed in the text and numbered sequentially with Arabic numbers. References to illustrations should be placed in parentheses at the end of sentences. Original photographs should be submitted as black and white glossy prints. For further guidelines, authors should consult *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (6th edition, 1994, Council of Biology Editors, Inc., 11 South LaSalle Street, Suite 1400, Chicago, Illinois 60603, USA).

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Department of Zoology
223 Bartram Hall
University of Florida
Gainesville, Florida 32611, USA

President-elect
HENRY R. MUSHINSKY
Department of Biology
University of South Florida
Tampa, Florida 33620-5150, USA

Secretary
ELLEN J. CENSKY
Section of Amphibians and Reptiles
Carnegie Museum of Natural History
Pittsburgh, Pennsylvania 15213, USA

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P.O. Box 626
Hays, Kansas 67601-0626, USA

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Immediate Past President
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Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
National Biological Survey
4512 McMurray Avenue
Fort Collins, Colorado 80525-3400, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: 71061.150@compuserve.com

Section Editors

Techniques
STEPHEN D. BUSACK
National Fish & Wildlife Forensics Lab
1490 East Main Street
Ashland, Oregon 97520, USA
E-mail: steve_busack@mail.fws.gov

Book Reviews
AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: Herpbooks@sisna.com

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
E-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetología
Fundación Miguel Lillo
Miguel Lillo 251
4000 Tucumán, Argentina
E-mail: postmaster@scro.untmre.edu.ar

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Amphibians & Reptiles
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
E-mail: cwpaint@unm.edu

Natural History Notes
LEE A. FITZGERALD
Dept. of Wildlife & Fisheries Sciences
Texas A&M University
College Station, Texas 77843-2258, USA
E-mail: LFitzgerald@tamu.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
E-mail: pstone@aix1.ucok.edu

Advertising Manager
ELIZABETH A. JOHNSON
35 Eighth Street
Frenchtown, New Jersey 08825, USA
Tel. (908) 996-4056

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

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The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1996 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. All members receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Karen L. Toepfer, SSAR Treasurer, P.O. Box 626, Hays, Kansas 67601–0626, USA. Telephone: (913) 623-4258; Fax: (913) 625-8890; e-mail: fmkt@fhsuvm.fhsu.edu.

Future Annual Meetings

1996 — University of Kansas, Lawrence, Kansas, USA, 24–29 July (Linda Trueb, Chair).
1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July (Theodore Pietsch, Chair).
1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).

SSAR BUSINESS

SSAR Grants-in-Herpetology

Proposals are now being accepted for the 1997 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include in-situ behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

6. INTERNATIONAL. Proposals may address needs in any of the above five categories, but applicants must be from countries where herpetological research has historically been underfunded, and where alternative sources of financial support are scarce or nonexistent

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be members of the SSAR with the exception of those applying for support of regional herpetological society

About Our Cover: *Hynobius retardatus*

Although widely distributed in eastern Asia, salamanders of the genus *Hynobius* (family Hynobiidae) are most highly differentiated in Japan. Stejneger (1907. Bull. U.S. Nat. Mus. 58:1–577) listed only five species of this genus in the territory now belonging to Japan, but the number has increased to about 16 (Matsui 1996. Natural History of the Amphibia. Univ. Tokyo Press), and others await description. *Hynobius retardatus*, the Ezo salamander, is the northernmost member of the genus, and is endemic to Hokkaido, the northern main island of Japan. Adults are about 60–85 mm SVL, with individuals from higher elevations tending to be larger. The slender tail is slightly longer than the body.

Ezo salamanders uniquely possess a shallow vomerine tooth series and a small number of chromosomes ($2n = 40$), in contrast to deeper U- or V-shaped vomerine tooth series and a larger number of diploid chromosomes ($2n = 56$ or 58) in other Japanese *Hynobius* (Matsui et al. 1992. Herpetologica 48:408–416). Because of these unique characteristics, among others, this species has been placed in its own genus, *Satobius*, by some authors (Adler and Zhao 1990. Asiatic Herpetol. Res. 3:37–45).

Ezo salamanders breed in spring, from early April to late May; in higher localities, the breeding season begins as late as early July. Many individuals are found aggregating in marshes and ponds at this time. Most of these are males waiting for the arrival of females. When a female arrives and begins to spawn (depositing a pair of egg sacs on submerged dead leaves), males attempt to pull eggs from her cloaca as quickly as possible. The males are preoccupied with egg sacs and pay little attention to the female. Males embrace the egg sacs until they have finished releasing sperm. The large number of males actively seeking to fertilize a single female's spawn results in a spectacular competition. Each egg sac contains 35–50 eggs, and larvae hatch within 30–40 days. Some larvae metamorphose 40–50 days after hatching, but others take considerably longer—up to 1–2 years post-hatching. A neotenic population of *H. retardatus* was reported from Lake Kuttarush over 70 years ago (Sasaki 1924. J. Coll. Agricult. Hokkaido Imp. Univ. 15:1–36), but all subsequent searches of this lake have failed to confirm this finding.

The salamander on the cover is an adult male *Hynobius retardatus*, photographed in a tank near the breeding site at Teshikaga. It was photographed with a Mamiya RB67 camera, using a standard 90 mm lens and a flash unit. The photographer is **Norio Maeda**, co-author with **Masafumi Matsui** of *Frogs and Toads of Japan* (1989. Bun-ichi Sogo Shuppan, Tokyo). Maeda's dream was to publish a book of art, rather than of science, using photographs of Japanese frogs that he had been accumulating for more than ten years. Few publishers, however, agreed with his plan, partly because books of a similar genre were already available. After discussions with Maeda, Matsui agreed to prepare taxonomic text for some of Maeda's photographs and consulted with a publisher about the prospects for a book whose focus was mainly taxonomic. New photographs were systematically accumulated within a short period, and the book was completed, albeit in a fairly different form from what Maeda first intended. Maeda's dream, however, is going to be partly realized with the publication of a photo book of frogs and toads of the world; he is now very busy in its preparation. Maeda is also a co-author of a CD book on songs of Japanese birds and frogs, and his photographs are popular inclusions in many books that picture Japanese amphibians and reptiles.

This cover commemorates the re-issuance this month by SSAR and the Herpetological Society of Japan of Leonhard Stejneger's long-out-of-print, classic monograph *Herpetology of Japan and Adjacent Territory*. Matsui provides a new introduction to the reprint, noting that Stejneger's 156 species today represent 180 taxa.

Separation and imaging of Maeda's photograph is the work of **Jim Bridges** of Herpeto Inc., Hollywood, Florida, USA.

projects. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 1996 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) BACKGROUND AND OBJECTIVES of the proposed project. (B) METHODS of carrying out the project. (C) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). (D) BRIEF RESUMÉ of the applicant or project coordinator. (E) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed five pages excluding resumé and budget.

Applicants must designate to which of the five categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than 31 DECEMBER 1996 to be considered. Please include office and home phone numbers, as well as fax number and e-mail address if available. It is often necessary to contact applicants quickly. Failure to meet the guidelines may result in elimination of a proposal from consideration. The awards will be announced by 1 April 1997. Successful applicants will be expected to submit a written report of the results of this support within a reasonable amount of time after the project year is completed. They are also encouraged to submit the results of research projects for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Julian C. Lee, Chair, SSAR Grants-in-Herpetology, Department of Biology, P.O. Box 249118, University of Miami, Coral Gables, Florida 33124, USA. Tel. (305) 284-6420; fax (305) 284-3039; e-mail: jlee@umiami.ir.miami.edu.*

Applicants must include a statement indicating that they "will comply with all applicable permit regulations, and adhere to all appropriate animal care guidelines in the course of conducting funded projects."

Grants-in-Herpetology Donors

Financial contributions by SSAR members, institutions, and other benefactors support this program significantly and can increase the number and/or size of awards. Your tax-deductible (for U.S. residents) contribution to this program will directly benefit meritorious research and education in herpetology. Contact the Treasurer of SSAR for additional information on contributing to the Grants-in-Herpetology Program. If you are employed by an organization that will match donations made to nonprofit organizations, please notify your employer that you have made a donation to the Grants-in-Herpetology Program.

Annual Report (1996) Grants-in-Herpetology Committee

Five awards of $500 each in four categories were made this year, as follows:

Conservation.—**Jeff Demuth**, Southeastern Louisiana University. Project title: "A test of the effects of incubation temperature on sex determination and peformance of hatchling gopher tortoises (*Gopherus polyphemus*)."

Laboratory Research.—**Erik W. A. Gergus**, Arizona State University. Project title: "Effects of post-Pleistocene xerification on the population genetic structure of the tree frogs *Hyla regilla* and *H. cadaverina* in Baja California, México."

Laboratory Research.—**Wendy H. Wente**, Indiana University. Project title: "Sensory basis of background color matching in a color-polymorphic treefrog: implications for the evolution of assortive mating within an interbreeding population."

Field Research.—**S. Rebecca Yeomans**, University of Georgia. Project title: "Tests of the parental investment in care hypothesis in chelonians."

Travel.—**Todd Campbell**, University of Tennessee. Project title: "An experimental analysis of the interaction between a native anole (*Anolis carolinensis*) and an introduced anole (*A. sagrei*) using dredge spoil islands."

1996 Grants-in-Herpetology Committee: Kelly Zamudio, University of Washington; Dr. Barbara Savitzky, Christopher Newport University; Dr. Randy Jennings, Western New Mexico University; Dr. Carole L. Hom, University of California, Davis; Janice Perry, Arizona-Sonora Desert Museum; Dr. Julian C. Lee, University of Miami (chair).

Third World Congress of Herpetology Travel Awards and Donations

The American Society of Ichthyologists, the Herpetologists' League, and the Society for the Study of Amphibians have applied to the National Science Foundation for a joint Conference Travel Grant. The funds are to assist graduate students and young professional herpetologists to travel to the Third World Congress of Herpetology in Prague, Czech Republic 2–10 August 1997. We are requesting 21 travel awards of $1428 each. NSF's decision on funding will not be known until after 1 January 1997. We are therefore soliciting proposals at this time to be submitted BEFORE 1 January 1997. Awards will be restricted to graduate students, post-doctoral fellows, and young professionals (35 years or less in age) who are members of one of the above herpetological societies and who are US citizens (necessary for NSF awards).

Those applying should submit: 1) a statement of their present academic or employment status (e.g., Graduate Student at the University of Illinois; Assistant Professor of Zoology at the University of Tennessee); 2) an abstract of a talk or poster that they plan to present at the Congress; 3) a statement of their need of assistance, from their supervisor or department head; 4) a letter confirming participation in the program or other indication of inclusion, if possible. Applications will be judged by a committee of three (one representative from each society). Send applications to World Congress Travel Grant, c/o Margaret M. Stewart, President of ASIH, Department of Biological Sciences, State University of New York at Albany, Albany, New York 12222, USA. Women and minorities are urged to apply.

At present, any travel awards are contingent on funding by NSF of the proposed travel grant. However, organizations and individuals are encouraged to send additional donations for this purpose. Checks should be made out to ASIH, earmarked for World Congress Travel Awards, and sent to the above address. The selection committee will award all funds received.

Information about the Congress can be found on their World Wide Web page (www.gli.cas.cz) or their mail server (wchsource@gli.cas.cz; see March 1996 *Herpetological Review*).

NEWSNOTES

Collins Honored as Kansas Wildlife Author Laureate

A proclamation passed by the Kansas state legislature and signed April 10, 1996 by the governor installed long-time SSAR member and editor Joseph T. Collins as Kansas Wildlife Author Laureate, the first person to hold this position in Kansas. This honor was in recognition of Collins' efforts to educate the people of Kansas about their plant and animal heritage through publication of numerous books and articles. SSAR congratulates Joe on this unique achievement.



Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 1996, with notification by 1 December 1996. Grantees are expected to complete their Academy visit by 15 September 1997. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

A Call for a New International Congress of Zoology

We are seeking responses concerning the feasibility of a New International Congress of Zoology, possibly to be convened in Athens, during 1999 or 2000. Seventy years after the First Zoological Congress in Paris in 1889, the XVIth Congress in Washington recommended the discontinuation of the congresses, because the feeling that zoology has split into too many unrelated fields.This was criticized by the last (XVIIth) Congress in Monte Carlo in 1972, but to no avail. The alternatives proposed (like ICSEB) did not live up to the expectations.

One of the most painful results of the discontinuation of the congresses was the general depreciation of zoology in the academic world as such, and the frequent use of dissimulating its name under a plethora of more fashionable euphemisms. The widely circulated "Systematics Agenda 2000" emphasizes our present incapacity to scientifically describe a zoological biodiversity which suddenly appears to be one order of magnitude larger than envisaged back in the 1970's. A critically depleted and weakened community of zoological systematists cannot live up to the task of investigating and protecting the heritage of the animal world.

Thirty years after the last congress, zoology at the end of this century is different. There are many developments which cut across the narrow specialities and which have to be appreciated by an international forum. Confined to the pages of specialized journals, these important developments often did not reach the attention of peers in other zoological specialities. It would be important to inform our colleagues about the newly discovered phyla and classes, the new concepts of vertebrate evolution, the biology of clonal animals, present views on the Protozoa, etc. A sample of subjects of wider implications are sociobiology, cladistics, molecular taxonomy, modern epigenetic embryology, the new vision on the Cambrian revolution, neocatastrophism, vicariance zoogeography, cryopreservation, and cloning. This is indeed a different zoology from that which ended with a whimper in Monte Carlo.

We are ready to try to bring forward again the rich and unifying aspects of zoology and to reassert its general global, human, and philosophical role. For this we need the support of the zoological diaspora. Please communicate your opinion to the correspondents below, and more important, suggestions and personal commitments to participate in the organization of our next congress.

Dr. F. D. Por, Hebrew University of Jerusalem, Department of Evolution, Systematics and Ecology, POB 91904, Jerusalem, Israel. E-mail: POR@VMS.HUJI.AC.ILI

Dr. Rosa M. Polymeni, Department of Biology, Section of Zoology, University of Athens, POB 15784, Athens, Greece. E-mail: rpolime@atlas.uoa.gr.

MEETINGS

Meetings Calendar

14–22 October 1996—4th Latin American Congress of Herpetology, University of Chile, Santiago de Chile, Chile. Contact: Dr. Alberto Veloso, Depto. de Ciencias Ecologicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile; e-mail: veloso@abello.dic.uchile. For registration within the U.S. and Canada, please contact: Rafael de Sá, Department of Biology, University of Richmond, Richmond, Virginia 23173, USA; e-mail: desa@urvax.urich.edu.

27–30 November 1996—IV Reunion Nacional de Herpetologia, Universidad Autónoma del Estado de Morelos, Cuernavaca, Morelos, México. Contact: María Guadalupe Bustos Zagal, Lab. de Herpetología, Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Morelos, Av. Universidad 1001, Chamilpa 62210, Cuernavaca, Morelos, México. Tel. (73) 29 70 29; fax (73) 29 70 56; e-mail: bustos@cib.uaem.mx.

12–13 December 1996—XII Reunion de Comunicaciones Herpetologicas and Annual Meeting of the Asociacion Herpetologica Argentina, Universidad Nacional de Rio Cuarto, Cordoba, Argentina. Contact: Liliana Aun, Comision Organizadora XII RCH, Universidad Nacional de Rio Cuarto, Estafeta Postal 9, 5800 — Rio Cuarto, Argentina. E-mail: rmartori@unrccc.edu.ar.

13–18 January 1997—IUCN Northern Indian Ocean Marine Turtle Workshop, Bhubaneswar, Orissa, India. *Refer to meeting announcement below for details.*

2–10 August 1997—Third World Congress of Herpetology, Prague, Czech Republic. Contact: Zbynek Rocek, Congress Director, Department of Paleontology, Geological Institute, Academy of Sciences, Rozvojová 135, 165 00 Praha 6 – Suchdol, Czech Republic. Tel. (++42-2) 24311421; Fax (++42-2) 24311578; e-mail: rocek@gli.cas.cz. *Refer to meeting announcement in* Herpetological Review *27(1):4–5, March 1996 for details.*

IUCN Northern Indian Ocean Marine Turtle Workshop

A regional workshop, under the auspices of the IUCN/SSC Marine Turtle Specialist Group and sponsored by the U.S. National Marine Fisheries Service and the Convention on Migratory Species, will be held in Bhubaneswar, Orissa, India, from 13–18 January 1997. The objectives of this workshop are to develop a regional conservation strategy for marine turtles, improve networking and communication among marine turtle researchers and managers, and train researchers and managers. Country representatives from the region will present current information regarding the status of sea turtle populations within the region. The workshop is open to anyone who wishes to attend. For more information contact: *Dr. Priyambada Mohanty-Hejmadi, Vice Chancellor, Sambalpur University, JYOTIVIHAR, Sambalpur 768019, Orissa, India (tel. 91-663-430158; fax 91-674-481418) or Dr. Pamela Plotkin, Drexel University, Department of Bioscience & Biotechnology, 32nd and Chestnut Streets, Philadelphia, Pennsylvania 19104, USA (tel. 215-895-1436; fax 215-895-1273; e-mail: Plotkipt@post.drexel.edu).*

1st Annual Meeting of the Working Group on Amphibian and Reptile Conservation in Canada and 6th Annual Meeting of the IUCN/SSC Task Force on Declining Amphibian Populations in Canada (DAPCAN)

These meetings will be held at the University of Calgary, Calgary, Alberta, 5–7 October 1996. This year's program will include a symposium on "The Conservation of Reptile Populations in Canada" and a workshop on "Herpetological Atlasing." All those who received the last issue of *The Boreal Dip Net* newsletter will already be on our mailing list and can expect to receive an invitation to these meetings. If you are not already on our mailing list and would like to receive the Call for Papers and Registration Forms please contact: *Stan Orchard, National Co-ordinator, 1745 Bank Street, Victoria, British Columbia, CANADA, V8R 4V7. Telephone/Fax: 604-595-7556. E-mail: sorchard@islandnet.com. Messages can also be left at the Royal British Columbia Museum at 604-387-3649.*

North American Amphibian Monitoring Program 3rd Annual Meeting

A meeting to present, evaluate, and discuss amphibian monitoring techniques for North America.

Location: The meeting site will be Planet-wide, located on the Internet via the World Wide Web at the following mirrored locations:

National Biological Service - Inventory and Monitoring http://www.im.nbs.gov/naamp3/naamp3.html
Environmental Protection Agency - New England http://www.
National Biological Service - Northern Prairie Science Center http://www.npsc.nbs.gov/naamp3/naamp3.html

Date: 14 November 1996

Registration Fee: None! Housing Fee: None!

Sessions: Papers will be presented in electronic format (HTML documents), complete with graphics, tables, and E-mail links to the authors. Participants can query authors directly using simple electronic forms. These electronic forms send E-mail back to the author. The author answers the question and both the original and the answer are posted back at the bottom of the paper within a day of the author's reply.

Meeting participants can watch the meeting evolve over a period of several weeks as questions and answers are posted. The meeting will remain active at all 3 sites for a period of 3 months and will remain indefinitely at the NBS Inventory and Monitoring site as an archive of the meeting. The meeting will emphasize the following:

New Techniques – Descriptions of potentially useful new monitoring techniques.

Evaluations and Validations of Proposed Techniques – Following NAAMP II, a number of techniques were proposed as potentially useful in developing region-wide monitoring programs. Papers will focus on the statistical validation and evaluation of amphibian monitoring techniques and discuss their relevance to proposed regional monitoring networks.

International Models – Summaries and evaluations of amphibian monitoring protocols and programs from outside of North America.

Reports on Calling Surveys – Progress reports from state and provincial coordinators on the status and experience of creating a regional calling surveys network.

Forum on the NAAMP Process – Online (NOT real time) discussions on the health and direction of AMP will be launched through a series of essays.

Field Trips: Hot links to Participating Agency Web Sites!

Further information may be obtained by visiting the AMP Web site: http://www.im.nbs.gov (click on amphibians) or contact: *Sam Droege, National Biological Service, Inventory and Monitoring Section, Laurel, Maryland 20708-4038, USA. Tel. 301-497-5849; fax: 301-497-5784; e-mail: frog@nbs.gov.*

OBITUARY

Robert Edward Gordon (1925–1996)

KRAIG ADLER
Cornell University, Division of Biological Sciences
Seeley G. Mudd Hall, Ithaca, New York 14853, USA
e-mail: kka4@cornell.edu

Robert E. Gordon, who served as President of the Society for the Study of Amphibians and Reptiles in 1971, died of cardiac arrest in La Grange, Georgia, on June 2nd. He was 70 years old.

Bob served SSAR in a number of important roles over many years. In 1967, the year in which the society changed its name from The Ohio Herpetological Society to SSAR, a symposium was held at the tenth anniversary meeting in Columbus, entitled "The Biology of Salamanders," which Bob organized and moderated with his usual skill and wit. He chaired the committee that rewrote the society's Constitution in 1970, a brilliant document which, once a few key points were established, in fact says very little more—the entire Constitution is only four pages in length—so as not to constrain innovation. During his year as president of SSAR, he completely overhauled and regularized the committee system and was intimately involved in the ongoing discussions with the Herpetologists' League concerning possible merger with SSAR.

His formal research career began at the University of Georgia, where, in 1950, he completed a master's degree under the celebrated ecologist Eugene P. Odum. His thesis concerned the life history and ecology of the then little-known green salamander (*Aneides aeneus*), research that was conducted in western North Carolina at Highlands Biological Station. Bob's long association with Highlands began in 1948 when he was an undergraduate at Emory University. The thesis was published in 1952, in the *American Midland Naturalist*, and constitutes Bob's most important published work, for his unusual talents for university administration were soon to be recognized. His doctoral work was conducted under the chairmanship of Fred R. Cagle at Tulane University, whose active laboratory then included a number of budding herpetologists pursuing master's or doctoral degrees: Paul K. Anderson, Don R. Boyer, Allan H. Chaney, Richard Etheridge, Richard M. Johnson, Howard K. Suzuki, Donald W. Tinkle, and Robert G. Webb, plus Ernest A. Liner and J. Whitfield Gibbons who were informally associated with the group. Bob's thesis, a detailed study of the demography of the green anole (*Anolis carolinensis*) was, unfortunately, never published, but it is still frequently cited. He received his Ph.D. in 1956. After a short stint as an assistant professor at Northeastern Louisiana State University, Bob joined the biology faculty at the University of Notre Dame in 1958, where he spent the rest of his professional career. Bob's research publications (1949–1968) dealt with the life histories and ecology of plethodontid and ambystomatid salamanders, the behavioral ecology of the rainbow snake, and homing behavior of salamanders.

At Notre Dame, Bob quickly ascended the ranks. He became Head of the Department of Biology in 1964 at the age of 39, Associate Dean of Science three years later, and finally, from 1971 until the year before his retirement from the faculty in 1990, was Vice President for Advanced Study (combining the roles of dean of the graduate school and head of all sponsored research on campus). Although he had many opportunities for advancement elsewhere, Bob was totally devoted to Notre Dame, despite the fact that all posts higher than his were (and still are) held by priests of the Congregation of the Holy Cross. Those were heady days at Notre Dame, under the 35-year-long presidency of Theodore M. Hesburgh, who was widely regarded as among the most enlightened and inspirational university leaders of this century. Bob was one of the most active and trusted members of the Hesburgh Administration, and on his retirement Notre Dame paid tribute to him with an honorary LL.D. degree, an honor almost never bestowed on the university's own faculty. Despite his administrative duties, Bob taught courses and even supervised several graduate students, among them Ronald Gratz, Julian R. Harrison, James A. MacMahon, David H. Snyder, Nicholas J. Sullivan, and J. Kerwin Werner.

In addition to his SSAR activities, Bob served numerous other organizations. He was President of the American Institute of Biological Sciences in 1976, President of the Board of Trustees of *Biological Abstracts* in 1978, and in 1989 was Chairman of the Board of Directors of the Council of Graduate Schools. In many respects he followed the interests of his mentor, Fred Cagle, by going into administration and in having a deep interest in scientific communication, documentation, and editing. He was Editor-in-Chief of the *American Midland Naturalist* (1958–1964) which is published by Notre Dame, Executive Secretary of the Council of Biology Editors beginning in 1963 (he received their Medal for Excellence in 1972), and served for a long time on both the Science Information Council of the National Science Foundation and its counterpart, the Council on Biological Science Information which advises the National Academy of Sciences.



If there are two kinds of people—squirters and sponges—as Bob often remarked, then he was a jet spray. Bob Gordon was the archetypal "Type A" personality: outgoing, extremely hard-working, involved in many activities simultaneously, and highly self-motivated. Although born in New York City (June 20, 1925), he moved to Georgia at an early age and developed the most wonderful Southern drawl, with a cadence and musical quality to it that was charming and sometimes even mesmerizing. As a faculty colleague at Notre Dame during the late 60s and early 70s, I, too, became enthralled by the Gordon charisma and only once, I think, could bring myself to say "no" to him: when he wanted me to request on my NSF grant one of those surplus U.S. Army amphibious vehicles—the ones often called "ducks"—for him to go surfing over land and water at the Notre Dame Biological Station, which he had developed in northern Wisconsin.

He was the consummate raconteur and an incredibly effective leader who could defuse the most tense situation more deftly than anyone I know. He had a contagious enthusiasm for science—his interests were broad, including botany and geology, but focused on ecology, behavior, and biogeography—that he carried into retirement in Georgia on a 6-acre plot of dry uplands pine woodlands. Almost every letter would bring news of his latest observations, with student-like exuberance, on the abundant local lizards, including his beloved anoles, or some rare interloper like a scarlet kingsnake. He had long had an interest in amphibians and reptiles on stamps and wrote a regular column on the subject for *Biophilately*. In 1977, he co-authored a booklet on herp and fish stamps, and in retirement he had been actively working on a comprehensive guide to the herp stamps of the world.

Bob Gordon is survived by his wife of 48 years, Catherine (Buddy to all their many friends), and two daughters, Claire and Martha Lee, and their families. His legacy to Notre Dame, to biological science in America, and to herpetology is great. We will miss him very much.

INSTITUTIONAL PROFILE

Herpetology at the Carnegie Museum of Natural History

ELLEN J. CENSKY
Section of Amphibians and Reptiles, Carnegie Museum of Natural History
4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213, USA
e-mail: censkye@clpgh.org

On June 1, 1996, the Section of Amphibians and Reptiles, Carnegie Museum of Natural History celebrated its 100th anniversary. In those first one hundred years the collection has grown to a size of over 195,000 specimens. Judged on the criteria of size and diversity of collection, and number of type specimens the collection ranks among the ten most important in the United States.

History.—During the first three decades the Section was staffed by part-time volunteer curators. While Section collection and research activity was sporadic, the museum did purchase significant collections from various parts of the world including Brazil, Bolivia, and the Bahamas. In addition, the museum mounted its own expedition to the Isle of Pines, Cuba in the early 1900's. The first herpetologist employed full-time by the museum was M. Graham Netting, who started in 1926 and continued as Curator-in-charge until 1955. Netting's interest in his early years focused on systematics and distribution of Neotropical amphibians and reptiles, and he made numerous collecting trips to the Caribbean and northern South America. Later his attention shifted to the Appalachian region, and these collections became the nucleus of our large eastern United States holdings.

After 1950, Netting became increasingly involved in museum administration, and was replaced by Grace L. Orton, who had joined the staff in 1945. Orton resigned in 1950 to be replaced the following year by Neil Richmond. Richmond's first activity was to complete a survey of Pennsylvania amphibians and reptiles, a project which Netting had initiated in the 1930's. He later turned his attention to the systematics of the blindsnake family Typhlopidae, and participated in four expeditions to the Bahamas. Richmond left the Section in 1974.

Clarence (Jack) McCoy joined the Section in 1964. His research interest in the reptiles of Central and South America led to a series of expeditions to those areas (1964–1988). Building on the base of the Neotropical collections established under Netting's tenure, the Latin American resources of the Section continued to grow. While McCoy continued to work in Latin America throughout his career, his emphasis switched in 1974 to systematics and ecology of turtles. He built one of the largest collections of freshwater turtles in the world. C. J. McCoy passed away in July 1993.

Ellen Censky joined the staff of the Section in 1979 as Collection Manager. Shortly after receiving her Ph.D. in 1994, she was promoted to Assistant Curator-in-charge. Her geographic area of research has been the Caribbean and central South America, and her research interests lie in behavioral ecology of lizards, Caribbean zoogeography, and systematics of *Ameiva*.

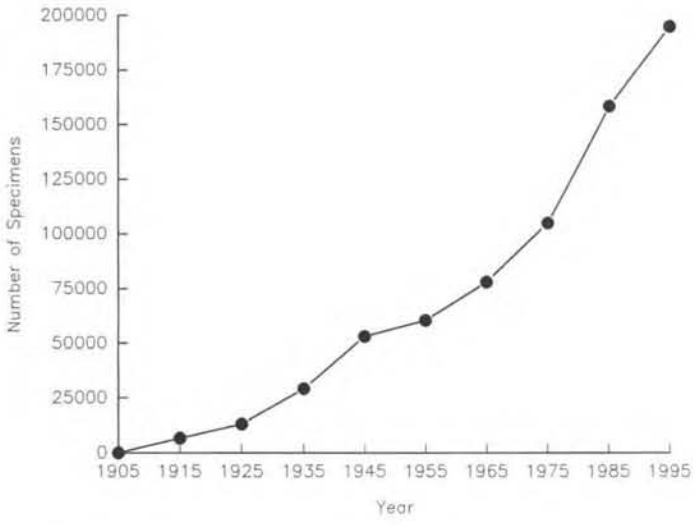
The newest member of the Section is John J. Wiens, who joined the staff as Assistant Curator in 1995. Wiens received his Ph.D. from the University of Texas at Austin in 1995. His research interests are the systematics of reptiles and amphibians, phylogenetic methodology, and morphological evolution.

In addition to the two full-time curators, the Section currently has a split-time Preparator/Collection Manager position (Stephen P. Rogers) and a part-time Curatorial Assistant (Bonnie Isaac).

Collections.— The area best represented in the collection is the United States with 75% of the collection of U.S. origin. The local area from which we have the most complete collection is the Appalachians, reflecting 100 years of collecting and acquisition. These collections include recent large donations of Virginia amphibians and reptiles from Joseph Mitchell and Christopher Pague, salamanders from Barry Valentine, and eastern U.S. amphibians from James Fowler. Of course, the Pennsylvania collection is the most extensive in existence.

In addition to the U.S. collections, we have extensive collections from various other parts of the world, including South America, the Caribbean, Africa, and Asia. The earliest South American collections include the Haseman Brazilian Expedition (1907–1910), Colombian specimens from H. H. Smith, collections from the museum expedition to Venezuela (1929–1930), and Bolivian specimens purchased between 1913–1922. In more recent years, emphasis has shifted to southern South America (Chile, Argentina, Paraguay, Uruguay), and Central America (México,

Collection Growth at Carnegie Museum of Natural History, Section of Amphibians and Reptiles



Belize, Guatemala). The extensive Caribbean collection was established with the Worthington Bahamian collection (1909) and the museum's expedition to the Isle of Pines (1912). It continued to grow with six expeditions to the Bahamas (1942–1976), Coleman J. Goin's gift of Jamaican frogs, extensive donations (including many types) by Albert Schwartz, and recent research by Censky.

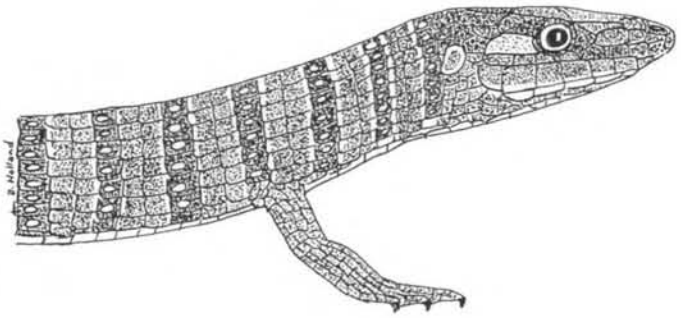
The collection from Spain, assembled and donated by Stephen D. Busack (Research Associate) is the largest Spanish collection in the United States and constitutes our largest European holdings. The African continent is well represented with both historical and recent collections. The largest collections (>500 specimens in each) are from Cameroon, South Africa, Namibia, Benin, Nigeria, and Morocco. There are smaller collections from most other African countries.

Our Philippine collection was founded early in the history of the museum with the purchase of part of the E. H. Taylor Collection which was rich in type material. More recent acquisitions from Luzon and Marinduque (Hahn Collection) have added to the strength of the Philippine collection. The India collection is more recent in origin. During the past 15 years, Research Associate Carl Gans (representing CMNH) has been conducting a joint herpetological survey with the National Museum of Natural History, New Delhi, which has generated a large collection of Indian amphibians and reptiles. Gans also has recently donated a large collection of skeletons to the Section.

The turtle collection is unique in its potential as a systematic resource. It consists of over 26,000 specimens, including more than 3500 skeletons and a long series of hatchlings incubated at known temperatures. Collections from Richard Vogt, Edward Moll, and Michael Ewert form the nucleus of the turtle collection. The type collection in the Section consists of 2236 specimens in 440 taxa.

The section's library, recently named *The C.J. McCoy Memorial Library*, was established in 1914 by the purchase of the reprint collection of Albert C. L. G. Günther, late keeper of Zoology in the British Museum (Natural History). It is rich in 19th century European literature, and contains over 900 bound volumes including all major and many minor herpetological journals. It also contains over 23,000 reprints (all computerized).

The collection, which now consists of over 195,000 specimens, was computerized in 1979. A taxon listing, including the number of specimens of each species housed at Carnegie Museum of Natural History, can be obtained from the Herpetological Combined Museum Listings and can be accessed through the California Academy Gopher at cas.calacademy.org. To receive further information about the collections, please contact Ellen J. Censky (e-mail: censkye@clpgh.org) or John J. Wiens (e-mail: wiensj@clpgh.org).



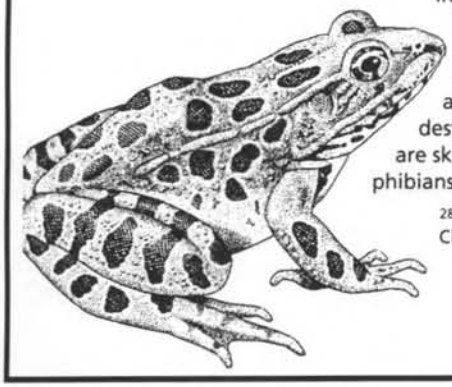
"An excellent, informative book full of wonders and delights."
—*The Times Higher Education Supplement*

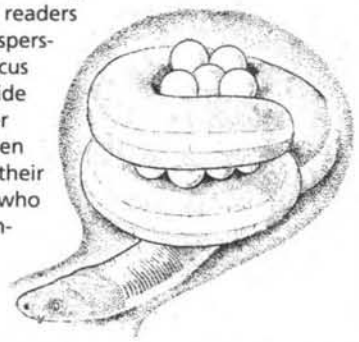


A Natural History of Amphibians

Robert C. Stebbins and Nathan W. Cohen

This is a book for all readers who want to learn about amphibians, the animal group that includes frogs, toads, salamanders, and caecilians. It draws on many years of classroom teaching, laboratory experience, and field observation by the authors. Robert Stebbins and Nathan Cohen lead readers on a fascinating odyssey as they explore some of nature's most interesting creatures, interspersing their own observations throughout the book. The authors focus our attention on the "natural history" of amphibians worldwide and emphasize their interactions with their environments over time: where they live; how they reproduce; how they have been affected by evolutionary processes; what factors will determine their destinies over time. Through the experienced eyes of the authors, who are skilled observers, we come to see and understand the place of amphibians in the natural world around us.





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CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

The current contents of several herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Mertensiella

The Deutschen Gesellschaft für Herpetologie und Terrarienkunde e.V. has published two more volumes of *Mertensiella*. The first of these consists of a single paper on Nile monitors in Gambia. The second volume contains eleven papers discussing the ecology and conservation of *Hyla arborea*.

LENZ, S. 1995. Zur Biologie und Ökologie des Nilwarans, *Varanus niloticus* (Linnaeus 1766) in Gambia, Westafrica. Mertensiella (5):1–256.

GEIGER, A., ed. 1996. Der Laubfrosch *(Hyla arborea* L.): Ökologie und Artenschutz. Mertensiella (6):1–200.

Contents of this issue are:

BORGULA, A. 1996. Langjährige Bestandesentwicklung einer kleinen Metapopulation des Laubfrosches (*Hyla arborea* L.) in der Schweiz. Mertensiella (6):7–26.

TESTER, U. AND C. FLORY. 1996. Zur Bedeutung des Biotopverbundes beim Schutz des Laubfrosches (*Hyla arborea* L.). Mertensiella (6):27–39.

STUMPEL, A.H.P. AND B.H.J.M. CROMBAGHS. 1996. Verbreitung und Situation des Laubfrosches (*Hyla arborea* L.) in den Niederlanden. Mertensiella (6):41–56.

MANZKE, U. AND R. PODLOUKY. 1996. Der Laubfrosch *Hyla arborea* L. in Niedersachsen und Bremen – Verbreitung, Lebensraum, Bestandssituation. Mertensiella (6):57–72.

MEIER, E. 1996. Bestansentwicklungen des Laubfrosches (*Hyla arborea* L.) in der westfälischen Bucht. Mertensiella (6):73–93.

BITZ, A., S. BLUM, H. SCHADER AND R. THIELE. 1996. Natur- und artenschutzrelevante untersuchungen am Laubfrosch (*Hyla arborea* L.) in Rheinland-Pfalz. Mertensiella (6):95–116.

GÜNTHER, R. 1996. Verbreitung und Lebensräume des Laubfrosches (*Hyla arborea* L.) in den Bundesländern Mecklenburg-Vorpommern, Sachsen-Anhalt, Brandenburg, Thüringen und Sachsen. Mertensiella (6):117–125.

GROSSE, W. -R. 1996. Vorkommen, Gefährdung und Schutz des Laubfrosches in Sachsen-Anhalt – Grundlagen für ein Artenhilfsprogramm. Mertensiella (6):127–148.

BERNINGHAUSEN, F. 1996. Erfolgreiche Laubfroschwiederansiedelung seit 1984 im Lankreis Rotenburg, Niedersachsen. Mertensiella (6):149–162.

PASTORS, J. 1996. Ergebnisse zweier Wiederansiedelungsprojekte des Laubfrosches (*Hyla arborea* L.) in Wuppertal – eine Langzeitstudie. Mertensiella (6):163–180.

MANZKE, U. 1996. Vorschläge zur Vorgehensweise einer Laubfroschkartierung auf regionaler Ebene. Mertensiella (6):181–195.

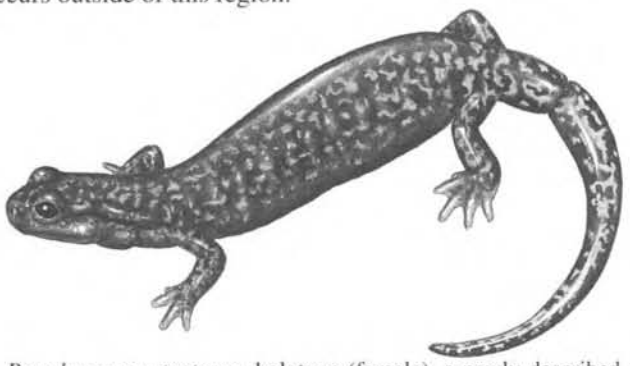
Pleurodire Phylogeny

Araripemys is one of the three oldest pleurodires known for which the skeletal morphology can be completely described. Meylan took advantage of the completeness of the *Araripemys* specimens in preparing his redescription of *A. barretoi*. The data were incorporated into a phylogenetic analysis of pelomedusid (*sensu lato*) turtles. The results of the phylogenetic analysis suggest that there are four distinct clades in the Pelomedusidae.

MEYLAN, P. A. 1996. Skeletal morphology and relationships of the early Cretaceous side-neck turtle, *Araripemys barretoi* (Testudines: Pelomedusoides: Araripemydidae), from the Santana formation of Brazil. J. Vert. Paleontol. 16(1):20–33.

Salamander Biology

In an important contribution to our understanding of plethodontid diversity in southwestern México, Adler describes five new species of *Pseudoeurycea* from the Sierra Madre del Sur of Guerrero. Surveys conducted earlier in this century in the areas south of the Río Balsas had revealed a rich herpetofauna with high levels of endemism, but the salamander fauna was notably sparse with only a single species of *Pseudoeurycea* then recorded. Adler discusses the biogeography of the eight known species of salamanders from western Guerrero and notes that only *P. bellii* occurs outside of this region.



Pseudoeurycea teotepec, holotype (female), a newly-described species from Guerrero, México. From a water color by David M. Dennis.

ADLER, K. 1996. The salamanders of Guerrero, Mexico, with descriptions of five new species of *Pseudoeurycea* (Caudata: Plethodontidae). Occas. Pap. Nat. Hist. Mus. Univ. Kansas (177):1–28.

The largest known breeding migration of the flatwoods salamander (*Ambystoma cingulatum*) was monitored over a 22-year period. Nightly migrations of 200–300 adults in 1970–1972 had dwindled to less than one individual per night in 1990–1992. Means et al. discuss the possible natural and anthropogenic causes of the decline with special consideration of the effects of slash pine silviculture.

MEANS, D. B., J. G. PALIS, AND M. BAGGETT. 1996. Effects of slash pine silviculture on a Florida population of flatwoods salamander. Cons. Biol. 10(2):426–437.

Dawley and Crowder compared vomeronasal organ data through multiple regression by using total body size, sex, and season as variables that may influence vomeronasal organ volume in *Plethodon cinereus*. Their results indicate that total body size and sex significantly affect vomeronasal organ volume. During the sum-

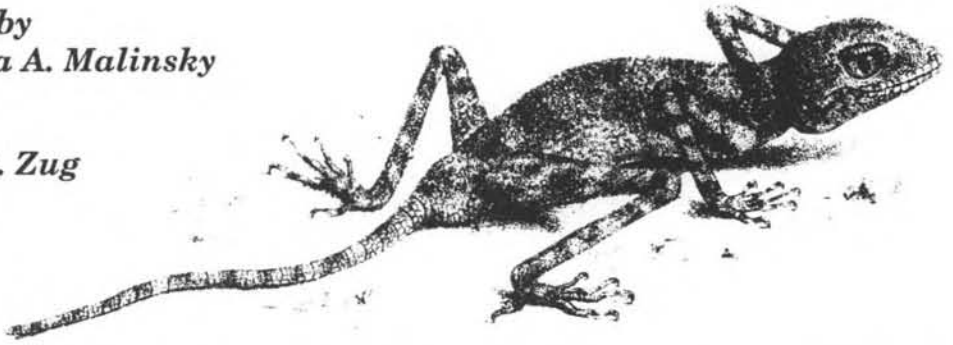
A New Book from the Society for the Study of Amphibians and Reptiles

Gecko Fauna of the USSR and Contiguous Regions

by Nikolai N. Szczerbak and Michael L. Golubev

Translated from the Russian by Michael L. Golubev and Sasha A. Malinsky

Editorial supervision by Alan E. Leviton and George R. Zug



SZCZERBAK AND GOLUBEV'S BOOK, FIRST published in Russian in 1986, is the only comprehensive monograph on the Palearctic gecko fauna. **The book's scope is the entire gecko fauna of the former Soviet Union and related species in surrounding regions including Mongolia, western China, Afghanistan, and Pakistan through the entire Middle East to eastern Europe and northern Africa.** The genera covered are *Agamura, Alsophylax, Bunopus, Carinatogecko, Crossobamon, Eublepharis, Tenuidactylus* (equivalent to the Palearctic *Cyrtodactylus*), *Teratoscincus,* and *Tropiocolotes.* The deserts of Central and Southwest Asia have a large and diverse gecko fauna and this book covers 53 species (75 taxa including subspecies). The authors have had extensive experience with these geckos, both in the field and the laboratory, and much of their original data is given in this book. **The English translation has been corrected by Michael Golubev and updated by him with references to the recent literature (1986–1996).**

The book's contents include a review of previous work and a discussion of the relationships among genera. The taxonomic accounts cover all aspects of systematics and general biology: type locality, karyotype, synonymy, diagnosis, description of holotype, color and pattern, reproduction and growth rates, variation (ontogenetic, sexual, geographic), ecology and behavior (daily and seasonal activity patterns, natural predators, temperature relations, shedding, diet), and conservation. There are detailed lists of locality records and point locality distribution (or "spot") maps for each species. Keys are provided to genera, species, and subspecies. The book is extensively illustrated and includes **24 color photographs of geckos**.



• Professor Szczerbak, director of the Zoological Museum, Ukrainian Academy of Sciences in Kiev, is the author of several outstanding books on the herpetology—and especially on the desert lizards—of the former Soviet Union. Dr. Golubev, Szczerbak's former doctoral student, is a well-known specialist on geckos. He emigrated to the United States in 1993 and now lives in Seattle, Washington.

GECKO FAUNA OF THE USSR AND CONTIGUOUS REGIONS

***Specifications*:** 230 pages, 8 color plates (24 photos), 98 black-and-white figures (maps, graphs, and numerous photos of animals and their habitats), keys, bibliography, index. Format 7 × 10 inches (18.0 × 25.5 cm). Clothbound with dust jacket. To be published December 1996. ISBN 0–916984–39–7.

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SSAR members *before publication*	US$35	In USA	add US$3
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mer, both male and female *P. cinereus* have larger vomeronasal organs than at any other time during the year. The authors also discuss the functional significance of their findings.

DAWLEY, E. M., AND J. CROWDER. 1995. Sexual and seasonal differences in the vomeronasal epithelium of the red-backed salamander (*Plethodon cinereus*). J. Comp. Neurol. 359:382–390.

Turtle Conservation

Heppell et al. critically examined the population level effects of headstarting with a series of deterministic matrix models for yellow mud turtles (*Kinosternon flavescens*) and Kemp's ridley sea turtles (*Lepidochelys kempii*). Their results show that management efforts focused exclusively on improving survival in the first year of life are unlikely to be effective for long-lived species such as turtles. Proportional sensitivity analysis of stage-based matrix models indicated that annual survival rates for subadult and adult turtles are most critical; small decreases in the survival of older turtles can quickly overcome any potential benefits of headstarting.

HEPPELL, S. S., L. B. CROWDER, AND D. T. CROUSE. 1996. Models to evaluate headstarting as a management tool for long-lived turtles. Ecol. Appl. 6(2):556–565.

Herbivorous Frogs?

Rana hexadactyla is unique among anurans in that plants make up a large proportion of its diet. Das recently published a paper comparing the morphology of the gastrointestinal tract of *R. hexadactyla* to seven sympatric anurans. In a second paper Das examined the seasonal and ontological shifts in the diet of this unusual frog.

DAS, I. 1995. Comparative morphology of the gastrointestinal tract in relation to diet in frogs from a locality in south India. Amphibia-Reptilia 16:289–293.

DAS, I. 1996. Folivory and seasonal changes in diet in *Rana hexadactyla* (Anura: Ranidae). J. Zool., Lond. 238:785–794.

Snapping Turtle Systematics

Phillips et al. investigated relationships among the four currently recognized subspecies of *Chelydra serpentina* using RFLP of mtDNA and protein electrophoresis. Although allozyme variation among the four subspecies was limited, the mtDNA data presented support the species-level distinctness of *C. s. rossignonii* and *C. s. acutirostris* from each other and from a *C. s. serpentina–C. s. osceola* complex. The recognition of three *Chelydra* species is discussed.

PHILLIPS, C. A., W. W. DIMMICK, AND J. L. CARR. 1996. Conservation genetics of the common snapping turtle (*Chelydra serpentina*). Cons. Biol. 10(2):397–405.

Climate Model for Predicting Distribution

In order to predict the potential distribution of *Bufo marinus* in Australia, Sutherst et al. gathered temperature and moisture-related data from the known range of the species in the Americas. These data were used to set parameters for their CLIMEX model. Once the parameters had been determined and checked, the CLIMEX model was used to predict the potential distribution of *B. marinus* in Australia. In addition to the results, the techniques used in this paper could prove useful to other conservation programs.

SUTHERST, R. W., R. B. FLOYD, AND G. F. MAYWALD. 1995. The potential geographical distribution of the cane toad, *Bufo marinus* L. in Australia. Cons. Biol. 9(6:294–299.

The Snake

Since 1969 the Japan Snake Institute has been publishing the journal *The Snake*. As the title suggests, this journal publishes general papers on all aspects snake biology as well as medical papers on snake venoms and snakebite. *The Snake*, now in its 27th volume, consists of two issues per year. Subscriptions to the journal cost US$20.00/year. For more information write: The Japan Association of Snake Research, Yabuzuka-honmachi, Nittagun, Gunma Prefecture 379-23, Japan.

AKRAM, S. M., AND J. I. QURESHI. 1995. Snakes of Faisalabad, Punjab, Pakistan. Snake 27(1):25–29.

HUANG, G.-W., M. NAKAMURA, AND T. KOSUGI. 1995. Relationship between concentration of crude venom from *T. flavoviridis* in the circulating blood and the appearance of DIC in rabbits. Snake 27(1):31–41.

ISOGAWA, K. 1995. Comparative observations on dorsal scales of shed skins of the genus *Agkistrodon* (Viperidae, Crotalinae) from far East Asia. Snake 27(1):7–11.

JANEIRO-CINQUINI, T. R. F., E. C. FARIAS, AND F. F. LEINZ. 1995. Relation between the quantity of abdominal fat and the reproductive state of the snake *Bothrops jararaca*. Snake 27(1):21–24.

NISHIMURA, M. 1995. Body mass loss in habu, *Trimeresurus flavoviridis*, without water supply in biotron. Snake 27(1):13–20.

NOBUSAKA, R., E. NAKAMOTO, S. MISHIMA, AND Y. SAWAI. 1995. Note on the reproduction of Hyan, *Calliophis japonicus japonicus* (Guenther). Snake 27(1):57–59.

OTA, H. 1995. Book Review: Endoglyphs and Other Major Venomous Snakes of the World: A Checklist. Snake 27(1):65–67.

ROBERTS, D. T., AND S. H. HAMMACK. 1995. Captive reproduction and husbandry of the speckled forest-pitviper *Bothriopsis taeniata* (Wagler) at the Dallas Zoo. Snake 27(1):53–55.

TAN, N. -H., K. B. MOHAMAD NOR, K.- M. CHIN, AND G. PONNUDURAI. 1995. Cross-reactivity of Malayan pit viper (*Calloselasma rhodostoma*) and lance-headed pit viper (*Trimeresurus*) antivenoms against Malaysian pit viper venoms. Snake 27(1):43–48.

TORIBA, M., AND K. HIRABAYSHI. 1995. Growth and reproduction of Burmese green pit viper, *Trimeresurus erythrurus* in captivity. Snake 27(1):1–5.

VENKATESWARLU, T., J. G. PATTANAYAK, S. C. NAHAR, AND A. MOHAPATRA. 1995. On the collection of snakes from Mahandai Estuary (Orissa, India). Snake 27(1):49–52.

YOKOYAMA, F., M. MASUMITU, AND H. YOSHIDA. 1995. A method for distinction of sex of habu, *Trimeresurus flavoviridis*. Snake 27(1):61–63.

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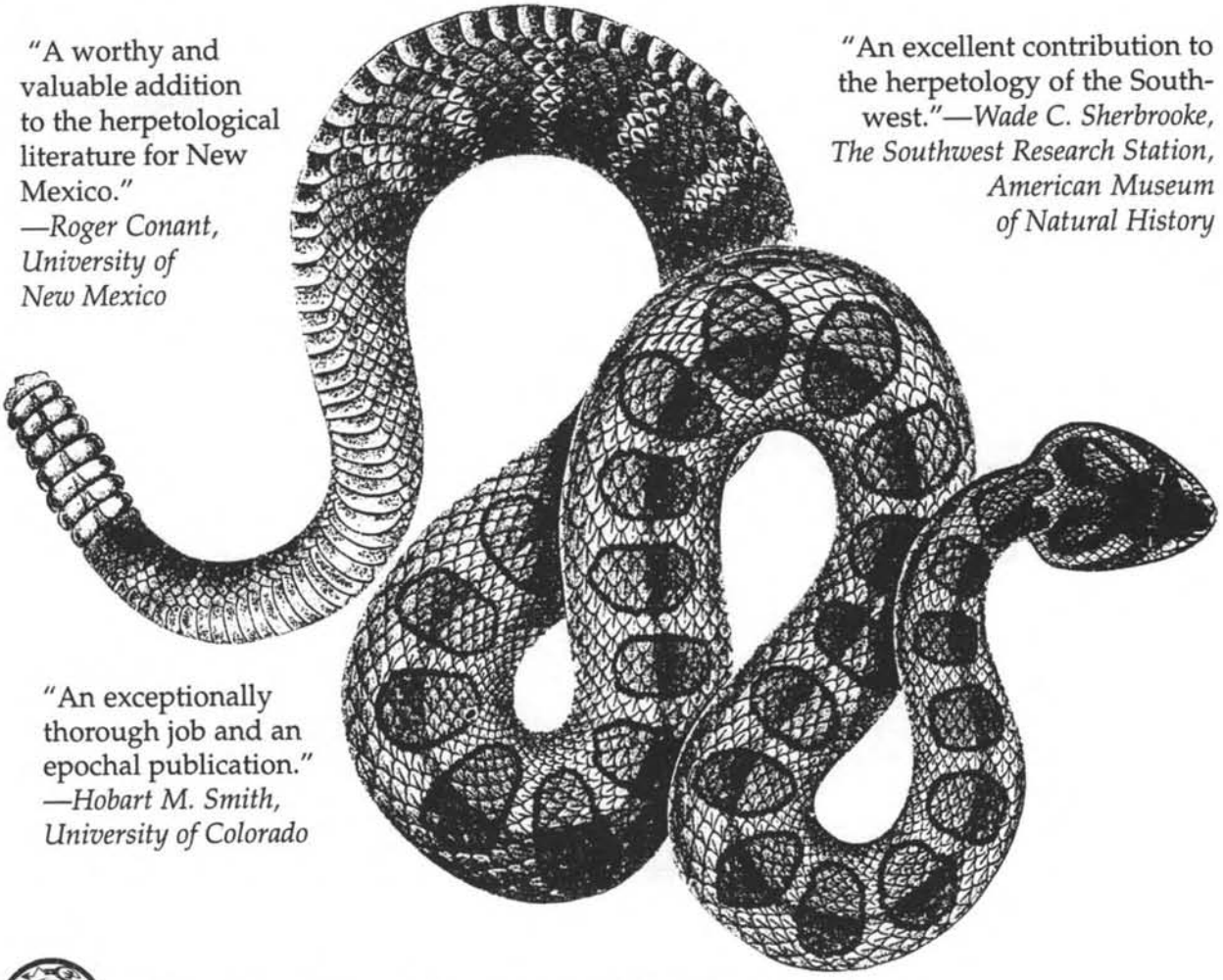
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ARTICLES

The Trade in Dendrobatid Frogs from 1987 to 1993

STEFAN GORZULA
Biosphere Consultants
614 West Main Street, Newbern, Tennessee 38059, USA

The inclusion of the dendrobatid frog genera *Dendrobates* and *Phyllobates* (*sensu* Frost 1985) on Appendix II of CITES has been criticized by a number of biologists (Bringsøe 1992; Campbell and Frost 1994; Mrosovsky 1988; Myers and Daly 1993; Pickett 1987). The process by which dendrobatids were added to the CITES appendices was initiated by Dutch and Surinamese participants at the 62nd Meeting of the Species Survival Commission (SSC) the IUCN held in Caracas, Venezuela, from 23–27 April 1987. Three proposals were put forward: the Republic of Suriname requested the inclusion of all members of the genus *Dendrobates* on Appendix II; the Netherlands requested the inclusion of all members of the genus *Phyllobates* on Appendix II; the Netherlands requested the inclusion of *Dendrobates altobueyensis* on Appendix I.

The supporting statements duplicated each other *verbatim* so that they appear to have been written by the same author or authors. The SSC requested reviews and advice from Charles Myers (USA), Marinus Hoogmoed (Netherlands), Stefan Gorzula (Venezuela), and Stephen Edwards (IUCN, Switzerland). Based on their responses, the IUCN recommended rejection of the proposals (IUCN 1987). Nevertheless, the Sixth Meeting of the Conference of the Parties to CITES, held in Ottawa, Canada, in July 1987 voted in favor of including both genera on Appendix II.

The listing of these two genera has been controversial since its inception. Arguments against the listing have expressed concern about scientific recommendations being ignored, the decision being influenced by politics, and the listing being unnecessary anyway (Bringsøe 1992; Campbell and Frost 1994; Mrosovsky 1988; Myers and Daly 1993; Pickett 1987). Supporters of the listing have been more cautious, implying that if there are any doubts then leave them on (Colwell 1994; Hoogmoed 1992; Jones 1994).

Nine years have passed since the Ottawa meetings. Given such a high level of polemic, I decided it would be useful to examine the extent of legal trade in specimens of dendrobatid frogs. This paper reviews the CITES trade data for dendrobatid frogs from 1987 to 1993.

Data documenting international trade in dendrobatid frogs were supplied by the World Conservation Monitoring Centre (WCMC), Cambridge, England. The WCMC, under contract from the CITES Secretariat, processes and stores all trade data supplied by Signatories to the Convention. Data were compiled from individual country reports.

The WCMC data consisted of a data base with 11 columns: the year that the trade occurred; the CITES Appendix of the species (in this case all species are in Appendix II); the species of dendrobatid frog; the type of material (live, bodies, specimens, or unspecified); the country of import; the country of export or re-export; the country of origin (if a re-export); the quantity imported; the quantity exported; the purpose of the shipment (e.g., commercial trade); and the source (taken from the wild, bred in captivity, confiscated). Due to delays in reporting by some countries, trade data for 1993 were considered incomplete (Lorraine Collins, pers. comm.).

The WCMC data were listed in such a way that for each individual shipment it could be determined whether that shipment was reported by the exporting country, by the importing country, or by both. However, the WCMC considered that some shipments would have been listed twice (once as an import only and once as an export only). Thus, the reported trade of 422 shipments consisting of 16,932 frogs and 200 g of scientific material was undoubtedly an overestimate of the true level of reported international trade. In an attempt to reduce this source of error, a computerized data base was prepared. Shipments were cross-matched by year, by importing and exporting countries, by species, and by quantity. Where, for example, the United States reported imports of 272 *D. tinctorius* from Suriname in 1992, these were considered to be the same 200 + 72 *D. tinctorius* reported exported as two shipments to the United States in 1992 by Suriname. In this way, the WCMC data were reduced to 394 shipments consisting of 15,779 frogs and 200 g of biological material.

The most recent checklist of CITES (Schouten 1992) follows Frost (1985) and does not use the more recent generic allocations of Myers (1987) and Zimmermann and Zimmermann (1988). The WCMC list generally follows Schouten (1992) with the exception that the WCMC places *Epipedobates azureiventris* in *Dendrobates* rather that in *Phyllobates*. I have used the generic and specific names exactly as they have appeared in the original sources.

A total of 15,779 individual dendrobatid frogs and 200 g of biological material were reported as traded internationally during the seven-year period from 1987 to 1993. Confiscated live frogs and specimens accounted for 1.1%. Bodies and specimens (excluding 200 g of material) made up 3.2%. Live wild-caught dendrobatids represented 82.6% and live captive-reared frogs 13.1% of the reported trade.

Only three consignments, totaling 173 dendrobatids frogs, were listed as seized. Dutch customs officials confiscated 13 live frogs and 150 "bodies" in 1989. Both shipments originated in Nicaragua. United States customs confiscated 10 "bodies" (source unknown) in 1992. These data suggest either that illegal trade is negligible or that it is not being detected.

There were 28 shipments of "bodies" and "specimens" comprising 502 frogs and 200 g of biological material. Twenty shipments were recorded as "for scientific purposes." The United States imported 3 bodies from Costa Rica, 42 from Ecuador, 1 from Guyana, and 383 + 200 g from Panama. Austria imported 14 bodies and Swaziland 4 from Ecuador, Germany 43 and Netherlands 10 from Costa Rica, and the United Kingdom 1 from Panama. A single *Dendrobates leucomelas* was exported from Venezuela to the Czech Republic. The annual trade figures for live dendrobatids are given in Table 1. There was a drop in international trade during 1990 and 1991. Captive-reared dendrobatids apparently took more of the market share in 1992 and 1993.

Twenty-six species of the 53 species of *Dendrobates* and *Phyllobates* listed in the most recent CITES checklist (Schouten 1992) were not registered in international trade. Four species (*D. tinctorius, D. pumilio, D. auratus*, and *D. trivittatus*) accounted for 94% of the trade in wild-caught dendrobatids identified to specific level. Such a strong bias towards a few species is less marked in captive-reared dendrobatids where the "top four" species (*D. auratus, D. tinctorius, D. tricolor,* and *P. vittatus*) make up only 66.5% of the trade.

TABLE 1. The annual primary trade (excluding re-exports) in wild-caught (Wild) and captive-reared (Captive) dendrobatid frog species from 1987 to 1993.

Species	Source	1987	1988	1989	1990	1991	1992	1993	Total
D. anthonyi	Wild	6	—	—	—	—	—	—	6
D. anthonyi	Captive	—	—	—	—	—	4	—	4
D. arboreus	Wild	—	—	—	1	9	36	—	46
D. auratus	Wild	77	204	285	4	47	550	158	1325
D. auratus	Captive	—	6	25	20	—	180	373	604
D. azureiventris	Captive	—	—	—	—	—	—	25	25
D. azureus	Captive	—	2	20	10	—	67	10	109
D. bassleri	Captive	—	—	8	—	—	—	—	8
D. bilinguis	Wild	—	—	3	—	—	—	—	3
D. espinosai	Wild	10	—	—	—	—	—	—	10
D. fantasticus	Captive	—	—	—	—	—	36	8	44
D. femoralis	Captive	—	20	—	—	—	—	—	20
D. fulguritus	Wild	—	—	—	—	—	8	—	8
D. granuliferus	Wild	—	11	3	—	—	—	—	14
D. granuliferus	Captive	—	—	—	—	—	6	—	6
D. histrionicus	Wild	10	—	222	—	—	25	—	257
D. leucomelas	Captive	—	29	—	—	—	17	10	56
D. minutus	Wild	5	—	—	10	10	8	—	33
D. pumilio	Wild	782	522	600	4	38	527	196	2669
D. pumilio	Captive	—	8	—	20	—	—	24	52
D. quinquevittatus	Wild	—	—	10	—	—	—	—	10
D. quinquevittatus	Captive	—	20	21	30	—	19	26	116
D. speciosus	Wild	5	—	5	2	18	48	—	78
D. tinctorius	Wild	500	997	150	534	350	735	625	3891
D. tinctorius	Captive	—	40	—	20	16	114	89	279
D. tricolor	Wild	26	—	15	—	—	—	—	41
D. tricolor	Captive	—	64	87	—	6	43	60	260
D. trivittatus	Wild	350	380	55	245	100	—	71	1201
D. trivittatus	Captive	—	—	33	—	—	10	—	43
D. truncatus	Captive	—	—	—	—	—	—	11	11
Dendrobates sp.	Wild	250	367	1218	75	64	323	—	2297
Dendrobates sp.	Captive	—	19	5	5	10	31	—	70
P. bicolor	Wild	—	—	—	—	—	30	—	30
P. bicolor	Captive	—	—	—	—	10	48	4	62
P. lugubris	Wild	—	3	—	—	—	23	—	26
P. lugubris	Captive	—	—	—	—	—	13	3	16
P. terribilis	Captive	—	31	—	30	—	20	—	81
P. vittatus	Wild	—	2	15	—	—	—	—	17
P. vittatus	Captive	25	25	54	—	—	21	28	153
Phyllobates sp.	Wild	—	1020	—	50	—	—	—	1070
Phyllobates sp.	Captive	—	—	—	—	—	53	—	53
Total Wild		2021	3506	2581	925	636	2313	1050	13032
Total Captive		25	264	253	135	42	682	671	2072
Total all sources		2046	3770	2834	1060	678	2995	1721	15104
% captive-reared		1.2	7.0	8.9	12.7	6.2	22.8	39.0	13.7

There is no evidence that any breeding stocks for eight of the species of dendrobatid frogs that figured in the international trade in captive-reared specimens were ever imported legally to the non-range producer nations during the period 1987–1993. These species, with the total numbers traded given in parenthesis, are: *D.(sic) azureiventris* (25), *D. azureus* (109), *D. bassleri* (8), *D. fantasticus* (44), *D. femoralis* (20), *D. leucomelas* (56), *D. truncatus* (11), and *P. terribilis* (84).

Sixteen countries reported exporting live dendrobatid frogs. Table 2 shows the yearly exports from the eight countries where dendrobatid frogs occur in the wild (A) and from eight countries where dendrobatid frogs do not occur naturally (B). With regard to the United States, a feral population of *Dendrobates auratus* occurs on the island of Oahu, Hawaii (Silverstone 1975). Suriname is the most important source of wild-caught dendrobatids and the Netherlands and Germany are the most important sources of cap-

TABLE 2. The yearly exports (including re-exports) from 1987 to 1993 of dendrobatids by: A, countries with wild populations of dendrobatids (Range countries) and B, countries without wild populations of dendrobatids (Non-range countries). Countries have been ranked in decreasing order of total exports.

A. Range country	1987	1988	1989	1990	1991	1992	1993	Total
SURINAME	850	2404	205	870	450	735	696	6210
NICARAGUA	810	700	700	—	9	793	340	3352
PERU	250	114	1430	—	—	—	—	1794
PANAMA	35	20	15	41	122	662	14	909
COSTA RICA	24	42	213	—	55	98	—	432
COLOMBIA	—	226	—	—	—	25	—	251
ECUADOR	52	—	18	—	—	—	—	70
FRENCH GUIANA	—	—	—	34	—	—	—	34
Total A	2021	3506	2581	945	636	2313	1050	13052
B. Non-range country	1987	1988	1989	1990	1991	1992	1993	Total
NETHERLANDS	25	58	195	25	10	202	128	643
GERMANY	—	29	59	—	6	140	279	513
UNITED STATES	—	61	89	30	26	232	—	438
HUNGARY	—	—	—	—	—	133	252	385
GERMANY (EAST)	—	—	114	60	—	—	—	174
SWITZERLAND	—	65	—	—	—	—	—	65
DENMARK	—	60	—	—	—	—	—	60
SLOVAK REPUBLIC	—	—	—	—	—	—	12	12
Total B	25	273	475	115	42	707	671	2290

tive-reared specimens. In Table 2, the total number of dendrobatids exported from non-range countries (2290) is higher than the total number of captive-reared specimens (2072) given in Table 1. This is due in part to the inclusion of re-exports of 120 wild-caught dendrobatids by the Netherlands, re-exports of 85 wild-caught dendrobatids by the United States, and re-exports of 8 captive-reared and 25 wild-caught dendrobatids by Germany. The remaining discrepancy involving 20 frogs was caused by Panama reporting 20 specimens of *D. pumilio* as captive-reared.

Table 3 (column 3) seems to suggest that the countries with wild populations of dendrobatids are more effective in reporting exports to the WCMC than the non-range countries. However, there are two notable exceptions. Peru exported 1794 dendrobatids in 9 shipments. None were reported to the WCMC; they were detected from the trade data of the importing nations (Germany, Netherlands, and United States). The Netherlands reported only 8 of its 63 export and re-export shipments to the WCMC.

Table 3 (column 5) also shows that the range countries tended to export more frogs per shipment (65.9) than the non-range countries (13.9). One explanation is that most of the exports by the range nations would be to major distributors, whereas the shipments from non-range nations would include many sales and exchanges between specialist breeders and institutions such as zoos.

The effectiveness of individual countries in reporting imports to the WCMC can be examined from Table 4 (column 3). Compliance with CITES requires export or re-export permits and/or certificates to be provided for Appendix II species, but does *not* require the issuance of import permits. Thus, imports would be more difficult to monitor than exports. Therefore, it is strange that the Netherlands has been more effective at reporting its imports (61.0%) than its exports (12.7%).

If the European Community (EC) countries (Belgium, Denmark, Germany, Netherlands, Spain, United Kingdom) are treated as a group (Table 4) the domestic market is of similar size to that of the United States. There are six members of the EC (France, Greece, Ireland, Italy, Luxembourg, Portugal) that apparently did not import or export any dendrobatid frogs from 1987 to 1993. However, there are three very important geopolitical anomalies that should be pointed out. First, French Guiana is an Overseas Department of France. Thus, any dendrobatids that were shipped to mainland France would not require CITES documentation. Secondly, Ireland is not a Party to CITES and therefore cannot issue CITES export permits and certificates. Finally, customs controls between EC nations were eliminated in January 1994.

The reported "purposes of export" on the 363 CITES export permits and/or certificates issued by the 16 exporting countries indicate that the majority of shipments (206) and dendrobatid frogs (11,674) were traded commercially (Table 5). The mean number of frogs/shipment for the shipments where the purposes of export were not reported (55.8%) is very similar to the mean number of frogs/shipment for the shipments where the purposes were reported as commercial trade (56.7%). This suggests that most, if not all, of these shipments were commercial.

Whereas figures are available for analyzing international trade, the magnitude of domestic trade and its trends can be examined only indirectly. From 1991 to 1993, the British Dendrobatid Group Newsletter (Numbers 4 through 18) published an extensive bibliography on dendrobatid frogs and mantellas. The dendrobatid bibliography listed 476 articles from scientific journals, popular magazines, and newsletters. In addition, 36 popular articles were published in the BDG newsletters. The non-scientific literature included many articles on the husbandry and captive rearing of

dendrobatids. Popular magazines that published five or more articles about dendrobatids are: Aquarien-Terrarien Zeitschrift (19), Aquarien Magazin Stuttgart (21), Aquarium Den Haag (10), Aquarium Wuppertal (5), Aquarium Aqua Terra (6), British Dendrobatid Group Newsletter (36), Dendrobatidae Nederland Magazine (53), Herpetofauna Weinstadt (15), International Society for the Study of Dendrobatid Frogs Newsletter (28), Bulletin of the International Society for the Study of Dendrobatid Frogs (5), Lacerta (30), Nordisk Herpet. Foren. (6), Salamandra (11), and Sauria (10). The numbers of non-scientific articles grouped into five-year periods are: 9 (1971/75); 31 (1976/80); 59 (1981/85); 111 + 1 book (1986/1990); 90 + 2 books (1991/92). These figures suggest that interest in dendrobatids among herpetoculturists is increasing.

In Europe there are at least three amateur groups organized *exclusively* for the study and rearing of dendrobatid frogs and mantellas. The British Dendrobatid Group was founded in 1989 and had 85 members in 1993. The Nederlandse Doelgroep Dendrobatidae was formed in 1988 and had 350 members in 1991. The Nordic Dendrobatid Society of Sweden began in 1991 and had 40 members by 1993. In Germany most dendrobatid enthusiasts belong to the Deutsche Gesellschaft Herpetologie und Terrarienkunde Arbeitsgruppe Anuren.

Herpetoculturists appear to be successful at breeding captive dendrobatids and mantellas. In 1991, British Dendrobatid Group members bred *Colostethus trinitatis, Dendrobates auratus, D. leucomelas, D. pumilio, D. ventrimaculatus* (= *D. quinquevittatus*), *D. tinctorius, D. truncatus, Epipedobates tricolor, E. azureiventris, Phobobates bassleri, Phyllobates vittatus, Mantella aurantiaca, M. crocea,* and *M. madagascariensis*. In 1990, members of the Deutsche Gesellschaft Herpetologie und Terrarienkunde Arbeitsgruppe Anuren bred *Colostethus elachyhistus, C. trinitatis, Dendrobates arboreus, D. auratus, D. azureus, D. granuliferus, D. leucomelas, D. pumilio, D. "quinquevittatus," D. speciosus, D. tinctorius, D. variabilis, Epipedobates anthonyi, E. boulengeri, Phyllobates tricolor, P.(sic) trivittatus, P. vittatus, Mantella aurantiaca,* and *M. crocea*. Neither *D. variabilis* nor *E. boulengeri* appear in Table 1.

Table 6 lists the dendrobatid frogs and mantellas kept by a group of British, Dutch, French, German, and Swedish hobbyists. It is interesting that they recognize distinct color varieties within at least three species (*Dendrobates auratus, D. pumilio,* and *D. tinctorius*). One hobbyist (Skillcorn 1993) reports that his frogs have produced hybrids *between* "*D. tinctorius* French Guyana (*sic*)" and "*D. auratus* West Coast." From a separate source in 1991, I also heard of the existence of *D. azureus/D. tinctorius* hybrids. Such occurrences suggest that there may already be recognizable varieties of captive dendrobatids which are not found in the wild.

The captive rearing of dendrobatids by hobbyists should not be regarded as simply keeping brightly-colored frogs in a terrarium. It is an expensive pastime that requires a substantial financial outlay. Dendrobatid frogs command rather high prices. The reports by Draper and Burnham (1992) about "Dutch Frog Day" in September 1992 and by Peaker (1991) about Dutch Frog Day in May 1991, as well as a price list circulated by a Dutch dealer in August 1991, give a range of retail prices for individual live dendrobatid frogs. The most expensive species was *Dendrobates azureus*

TABLE 3. The minimum number of shipments made by exporting nations between 1987 and 1993 (Total shipments), the number of shipments reported by export nations to WCMC (Shipments reported), the percentage of exports reported by these exporting nations to WCMC (% exports reported), the total number of dendrobatid frogs exported (Number of dendrobatids), and the mean number of dendrobatid frogs per shipment (Frogs/shipment). Countries have been separated into range and non-range countries and then ranked in decreasing order of the total number of dendrobatids exported.

Country of export	Total shipments	Shipments reported	% exports reported	Number of dendrobatids	Frogs/ shipment
SURINAME	77	73	94.8	6210	80.6
NICARAGUA	27	16	59.3	3352	124.1
PERU	9	0	0.0	1794	199.3
PANAMA	46	27	58.7	909	19.8
COSTA RICA	28	20	71.4	432	15.4
COLOMBIA	3	0	0.0	251	83.7
ECUADOR	7	5	71.4	70	10.0
FRENCH GUIANA	1	0	0.0	34	34.0
Total A	198	141	71.2	13052	65.9
NETHERLANDS	63	8	12.7	643	10.2
GERMANY	42	33	78.6	513	12.2
UNITED STATES	35	27	77.1	438	12.5
HUNGARY	9	9	100.0	385	42.8
GERMANY (EAST)	8	4	50.0	174	21.8
SWITZERLAND	5	3	60.0	65	13.0
DENMARK	2	2	100.0	60	30.0
SLOVAK REPUBLIC	1	1	100.0	12	12.0
Total B	165	87	52.7	2290	13.9
Totals A + B	363	228	62.1	15342	42.3

quoted from US$56 to US$72. Next were *D. tinctorius* with prices from US$32 to US$68, depending on the color morph being sold. Medium-priced species included *Colostethus brunneus* and *Dendrobates quinquevittatus* at US$45 each, *Epipedobates azureiventris* at US$36, and *Phyllobates vittatus* at US$31. At the bottom of the range were *Dendrobates auratus* (US$9 to US$31), *D. leucomelas* (US$12 to US$40) and *Epipedobates tricolor* (US$9 to US$27). Tadpoles of all species were quoted at around US$9 each. All prices were calculated from current currency exchange rates.

The "Dutch Frog Days" are held at least twice each year. Davies and Davies (1991) mention that more than 600 dendrobatids were on sale at the September 1991 event. Given the previous figures, the total retail value of the dendrobatids offered for sale was in the order of US$25,000. Peaker (1991) reports that at the May 1991 "Dutch Frog Day" there were sellers from Belgium, Germany, and Holland. Buyers came from Belgium, Germany, Holland, the United Kingdom, and the United States. Peaker also noted that "some breeders had individual CITES certificates available." This observation is rather strange since CITES Management Authorities do not usually issue documents where the details of the importer are left blank for the exporter to fill in when he or she finds a buyer. Such an action, if correctly reported, would not be in compliance with the treaty.

Many scientists who claim to be affected by CITES have a less than adequate knowledge of the workings and purposes of the Convention. CITES is a dynamic treaty and its original text has been both qualified and clarified by nearly 200 Resolutions made at the nine Conferences of the Parties (held every two years from 1976 to 1994) as well as at the 1977 Special Working Session. Any biologist with an interest in international wildlife trade issues should study a reference text (e.g., Wijnstekers 1992) and routinely read journals and newsletters such as *TRAFFIC Bulletin, Endangered Species UPDATE,* and *Traffic USA*.

CITES has nothing to do with the use of wild fauna and flora within a member nation. CITES has nothing *whatsoever* to do with habitat protection within a member State. Many species of fauna and flora threatened with extinction *are not included* in CITES and *should not be included* in CITES. Red Data Book and similar endangered species listings and CITES appendices are not synonymous.

The acronym CITES stands for the **Convention on International Trade in Endangered Species of Wild Fauna and Flora**. The three words "International," "Trade," and "Wild" are the essence of the treaty. Many authors inadvertently omit the word "Wild" (Bringsøe 1992, Campbell and Frost 1994, Jones 1994, Myers and Daly 1993, Pickett 1987). This suggests that many editors and reviewers also are not familiar with the full text of CITES.

CITES does not prohibit scientific collection. Article VII, paragraph 6, even provides an exemption for "non-commercial loan, donation or exchange between scientists or scientific institutions registered by a management authority of their State." The fact that individual countries are making it more difficult for foreign

TABLE 4. The minimum number of shipments received by importing nations between 1987 and 1993 (Total shipments), the number of shipments reported by importing nations to WCMC (Shipments reported), the percentage of imports reported by these importing nations to WCMC (% exports reported), the total number of dendrobatid frogs imported (Number of dendrobatids), and the mean number of dendrobatid frogs per shipment (Frogs/shipment). Countries have ranked in decreasing order of the total number of dendrobatids imported. The last row gives the data for the European Community after subtracting the imports between member nations.

Country of import	Total shipments	Shipments reported	% exports reported	Number of dendrobatids	Frogs/ shipment
UNITED STATES	146	71	48.6	7888	54.0
NETHERLANDS	41	25	61.0	3363	82.0
GERMANY	55	25	45.5	1258	22.9
BELGIUM	6	0	0.0	850	141.7
UNITED KINGDOM	17	8	47.1	819	48.2
JAPAN	26	17	65.4	412	15.8
DENMARK	11	8	72.7	243	22.1
CANADA	17	2	11.8	176	10.4
SWEDEN	23	23	100.0	151	6.6
AUSTRALIA	2	1	50.0	39	19.5
USSR	8	0	0.0	35	4.4
SWITZERLAND	2	0	0.0	30	15.0
SPAIN	1	1	100.0	25	25.0
AUSTRIA	2	2	100.0	20	10.0
unknown	3	0	0.0	14	4.7
CZECH REPUBLIC	1	0	0.0	12	12.0
FINLAND	2	0	0.0	7	3.5
TOTAL	363	183	50.4	15342	42.3
EUROPEAN COMMUNITY	111	57	51.4	6175	55.6

TABLE 5. The reported "purposes of export" on the CITES export permits and/or certificates from 1987 to 1993, where: "Zoos" = zoos; "Trade" = commercial trade; "Scien." = scientific; "Pers." = personal; "Breed." = breeding in captivity or artificial propagation; "No/rep." = not reported. The numbers of dendrobatid frogs are given in parentheses.

Country	Zoos	Trade	Scien.	Pers.	Breed.	No/rep.	Total
COLOMBIA	—	2 (226)	—	—	—	1 (25)	3 (251)
COSTA RICA	—	5 (123)	20 (255)	—	—	3 (54)	28 (432)
DENMARK	—	2 (60)	—	—	—	—	2 (60)
ECUADOR	—	2 (18)	—	—	—	5 (52)	7 (70)
FRENCH GUIANA	—	1 (34)	—	—	—	— (34)	1
GERMANY	3 (26)	37 (477)	2 (10)	—	—	—	42 (513)
GERMANY (EAST)	—	6 (114)	—	—	—	2 (60)	8 (174)
HUNGARY	—	—	—	—	—	9 (385)	9 (385)
NETHERLANDS	20 (174)	29 (363)	—	8 (36)	—	6 (70)	63 (643)
NICARAGUA	—	22 (2243)	2 (9)	—	—	3 (1100)	27 (3352)
PANAMA	—	3 (110)	35 (671)	4 (11)	—	4 (117)	46 (909)
PERU	—	7 (1534)	—	1 (10)	—	1 (250)	9 (1794)
SLOVAK REPUBLIC	—	—	—	—	1 (12)	—	1 (12)
SURINAME	—	76 (6180)	—	—	—	1 (30)	77 (6210)
SWITZERLAND	—	—	—	—	—	5 (65)	5 (65)
UNITED STATES	12 (138)	14 (192)	6 (98)	—	—	3 (10)	35 (438)
Totals	35 (338)	206 (11674)	65 (1043)	13 (57)	1 (12)	43 (2218)	363 (15342)
Percentages	9.6 (2.2)	56.7 (76.1)	17.9 (6.8)	3.6 (0.4)	0.3 (0.1)	11.8 (14.5)	
Frogs/shipment	9.7	56.7	16.0	4.4	12.0	55.8	

TABLE 6. The reported incidence of dendrobatid frogs and mantellas among a sample 69 European hobbyists in June 1993 (source confidential), where: *C.* = *Colostethus; D.* = *Dendrobates; P.* = *Phyllobates; M.* = *Mantella.*

Species and/or variety reported as reared	Number of persons	Percentage of sample
None kept or none reported	23	33.3%
C. brunneus	4	5.8%
C. inguinalis	1	1.5%
C. talamancae	1	1.5%
C. trinitatis	9	13.0%
D. anthonyi	1	1.5%
D. auratus (variety unspecified)	28	40.6%
D. auratus (blue)	1	1.5%
D. auratus (green)	1	1.5%
D. auratus (Hawaii)	1	1.5%
D. azureus	10	14.5%
D. bassleri	3	4.4%
D. fantasticus	1	1.5%
D. granuliferus	1	1.5%
D. histrionicus	2	2.9%
D. lehmanni	4	5.8%
D. leucomelas	18	26.1%
D. pumilio (variety unspecified)	4	5.8%
D. pumilio (Bastimentos form)	1	1.5%
D. pumilio (Bocas form)	1	1.5%
D. reticulatus	3	4.4%
D. tinctorius (variety unspecified)	6	8.7%
D. tinctorius (5 forms)	1	1.5%
D. tinctorius (Aprouges yellow)	1	1.5%
D. tinctorius (Bakhuis)	1	1.5%
D. tinctorius (Brazilian)	1	1.5%
D. tinctorius (French Guiana)	12	17.4%
D. tinctorius (gray)	1	1.5%
D. tinctorius (orange)	1	1.5%
D. tinctorius (Tafelberg)	2	2.9%
D. tinctorius (white)	2	2.9%
D. tinctorius (yellow-back)	3	4.4%
D. tricolor	18	26.1%
D. truncatus	23	33.3%
D. ventrimaculatus (= *quinquevittatus*)	9	13.0%
P. azureiventris	2	2.9%
P. bicolor	2	2.9%
P. lugubris	2	2.9%
P. terribilis	1	1.5%
P. vittatus	6	8.7%
M. aurantiaca	11	15.9%
M. betsileo	1	1.5%
M. cowani	8	11.6%
M. crocea	10	14.5%
M. haraldmeieri	1	1.5%
M. madagascariensis	10	14.5%
M. pulchra	3	4.4%
M. viridis	2	2.9%

scientists to carry out independent work is a separate issue, and may have more to do with external institutions obtaining the more direct and exclusive benefits of such activities (Huber and Gorzula 1986).

Species on Appendix II are those "which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival" (Article II, paragraph 2a) and "other species which must be subject to regulation in order that trade in specimens of certain species referred to in subparagraph (a) of this paragraph may be brought under effective control" (Article II, paragraph 2b). "Trade" is the "export, re-export, import and introduction from the sea" (Article I, subparagraph c). An animal "specimen" means alive or dead animals and any recognizable parts or derivatives (Article I, subparagraph b). Article IV, paragraph 2, requires that export permits shall only be granted for Appendix II species when "a scientific authority of the State of export has advised that such export will not be detrimental to the survival of the species."

In the case of wild-caught dendrobatids, it is important to put the trade figures into perspective. As a very crude illustration, the total number of dendrobatid frogs legally exported from the range countries over a seven-year period would not have filled a large trash can! Do we believe that this level of trade was detrimental to the survival of dendrobatids in Central and South America?

Finally, the total retail value on the domestic markets of the importing nations of *all* wild-caught dendrobatids shipped between 1987 and 1993 would have been less than US$500,000. Based upon my experiences with the international wildlife trade, I doubt whether even one third of that amount would have entered the economies of the producer nations. However, the export of dendrobatids from a country such as Suriname, with a human population of about 420,000 and a per capita national product 14% of that of the United States, could be of marginal significance to its economy.

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Correlation of Leatherback Turtle and Jellyfish Occurrence

GILBERT S. GRANT
Department of Biological Sciences, University of North Carolina Wilmington, North Carolina 28403, USA
grantg@uncwil.edu

HOWARD MALPASS
Topsail Turtle Project, P.O. Box 2663 Surf City, North Carolina 28445, USA

and

JEAN BEASLEY
Topsail Turtle Project, P.O. Box 2663 Surf City, North Carolina 28445, USA

Sightings of numerous leatherback turtles (*Dermochelys coriacea*) in association with, and feeding on, cabbagehead jellyfish (*Stomolophus meleagris*) during a brief time period (May and June 1990 and 1991) within 300 m of the beach at North Topsail Beach, Onslow County, North Carolina, USA (Grant and Ferrell 1993) suggested a seasonal relationship. No peak seasonal pattern of leatherback occurrence in North Carolina waters was evident in the review by Lee and Palmer (1981). However, in a summary of publicly reported sightings between 1989 and 1992, leatherback abundance was highest in May and June (Epperly et al. 1995a).

This paper presents nearly simultaneous survey data for both leatherback turtles and cabbagehead jellyfish to more accurately assess the duration of abundance of both species and determine the extent of co-occurrence in nearshore waters along the North Carolina coast.

Aerial censuses were conducted along the 41.6 km coastline of Topsail Island, North Carolina, 20 April–13 July 1992, 20 April–22 June 1993, 2 May–11 July 1994, and 3 May–7 July 1995. Two transects parallel to the shoreline, about 500 m and 1000 m offshore, were flown in a Cessna 172 along the entire length of Topsail Island. Turtles seen on either side of the aircraft, up to about 250 m, were counted. Flight altitude varied from about 150 m to 220 m and flight speed was 140–150 km/hr (see Marsh and Sinclair 1989, for evaluation of aerial survey techniques). Observers reported all turtle sightings, while we verified and recorded all sightings on data sheets. Censuses were conducted between 1000 and 1600 h for 35–55 min on days with good visibility and light winds. Time of day, glare, and time of high tide had no significant impact on the observed densities of turtles in a study conducted by Marsh and Sinclair (1989).

Two types of cabbagehead jellyfish censuses were concurrently undertaken. From 2.0–4.7 km of the beach of North Topsail Beach were walked on the day of the aerial surveys in 1992 and 1995. All beached jellyfish were counted and removed from the beach to avoid counting the same ones on a later census. Because jellyfish were not removed the day before a given beach count, the numbers reported actually sample more than one day. However, most counts were made at about weekly intervals. Strong on-shore winds would probably increase the numbers of beached jellyfish. However, no significant storm systems occurred during the census periods.

The second jellyfish census area was a 200 m x 40 m transect strip observed from Salty's Pier in 1992 and from all six piers on Topsail Island in 1995; all were made on the day of the aerial turtle surveys. All jellyfish seen in the water within 20 m on either side of the distal 200 m of the pier(s) were counted. Qualitative estimates of jellyfish were made from the piers in 1993 and

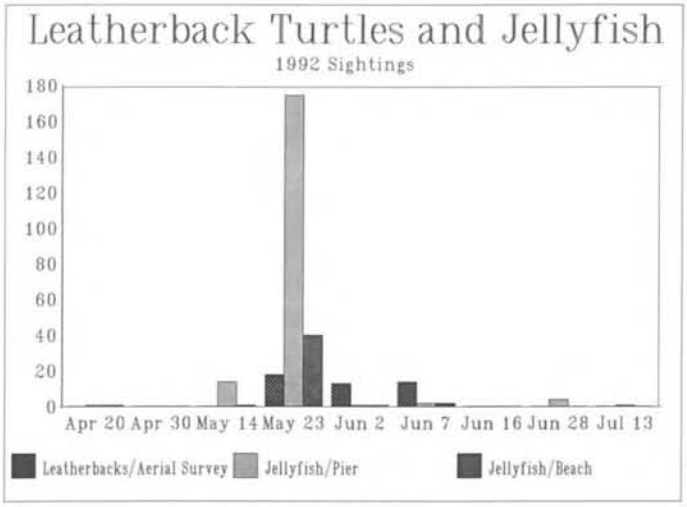


FIG. 1. Leatherback turtle and jellyfish censuses on Topsail Island, North Carolina during 1992.

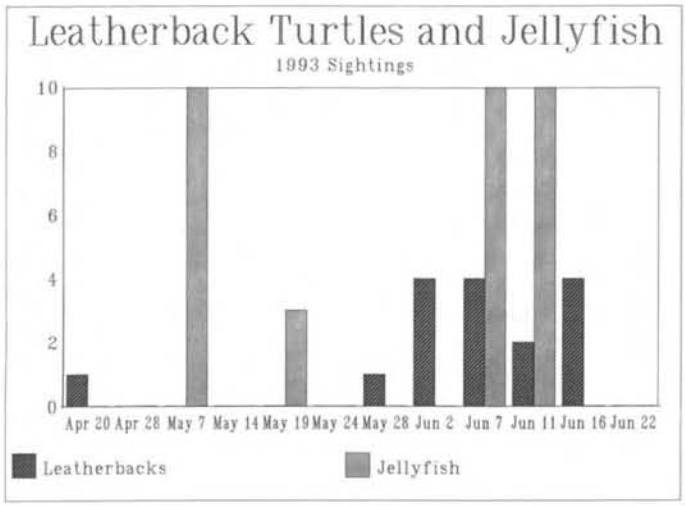


FIG. 2. Leatherback turtle and jellyfish censuses on Topsail Island, North Carolina during 1993.

1994. Relative numbers of jellyfish were ranked on a 0 (none) to 10 (abundant) scale during the 1993 and 1994 surveys.

A total of 45 leatherback turtles was sighted on three (23 May, 2 June, and 7 June) of the 9 censuses in 1992 (Fig. 1). Forty (88.9%) of the leatherbacks counted during the surveys were on the near-shore transect (500 m). Twenty-two of these were <500 m offshore; some were sighted just offshore of the breakers. Only 3 (7.7%) leatherbacks were sighted >1000 m offshore. Leatherback numbers in 1992 were highly correlated with jellyfish numbers (both pier and beach surveys). Sixteen leatherbacks were sighted during aerial surveys in 1993 and the correlation with jellyfish abundance was less pronounced (Fig. 2). Eleven leatherbacks were counted during censuses in 1994 and the correlation with jellyfish abundance was not strong (Fig. 3). Only 6 leatherbacks were counted during the 1995 surveys. The 1995 jellyfish surveys from the piers revealed two small peaks in May. However, daily jellyfish abundance varied tremendously from one pier to the next, even though any one pier survey was completed within 15 minutes of the next (Fig. 4). No beached jellyfish were found during the 1995 surveys. The average number of leatherbacks sighted per survey dropped tremendously from 1992 to 1995 (Fig. 5). The apparent decrease may be due to a number of factors including declining populations, different cohorts during different years, and movement further offshore.

Maximum water depth in the survey area was about 10 m. Thus, all leatherbacks were seen in water 2–10 m deep. Such shallow water movements have been reported inside bays along the Gulf coast of Florida (Yerger 1965) and off the Texas coast (Leary 1957).

We saw turtles as much as 1–2 m below the surface. Some turtles were probably missed due to deeper submergence. Therefore, the numbers of turtles reported are minimum counts. The two parallel transects sampled an area about 1.0 km wide and 41.6 km long (length of Topsail Island), for a total area of 41.6 km^2. Leatherback density ranged from 0–34.6/100 km^2 along Topsail Island. Thompson (1984) reported a spring density of 0.02–2.99 turtles/100 km^2 (all species) between Cape Hatteras, North Carolina, and Key West, Florida. Keinath et al. (1987) reported spring densities of 0–57.5 turtles/100 km^2 (all species) for the lower Chesapeake Bay, Virginia. Densities as high as 30.48 turtles/100 km^2 (all species) have been observed in Core Sound, North Carolina (Epperly et al. 1995b). Leatherback density off the eastern coast of Florida was estimated to be 3.2 x 10^{-3} /km^2 to 0.01 turtles/km^2 (Fritts et al. 1983) and density estimates in waters of the northeastern United

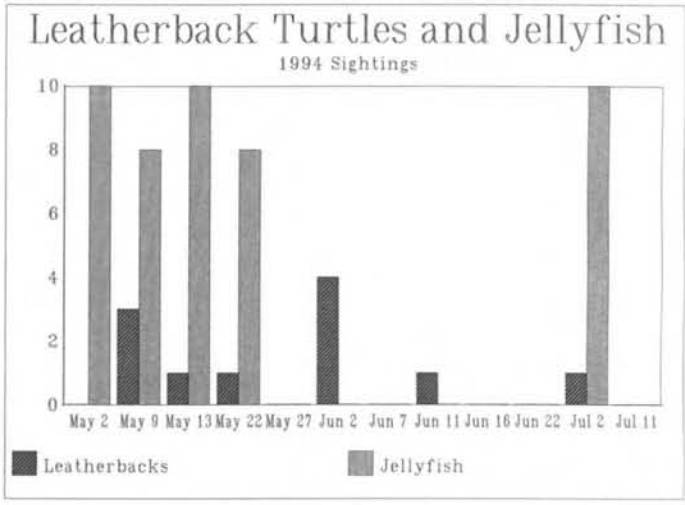


FIG. 3. Leatherback turtle and jellyfish censuses on Topsail Island, North Carolina during 1994.

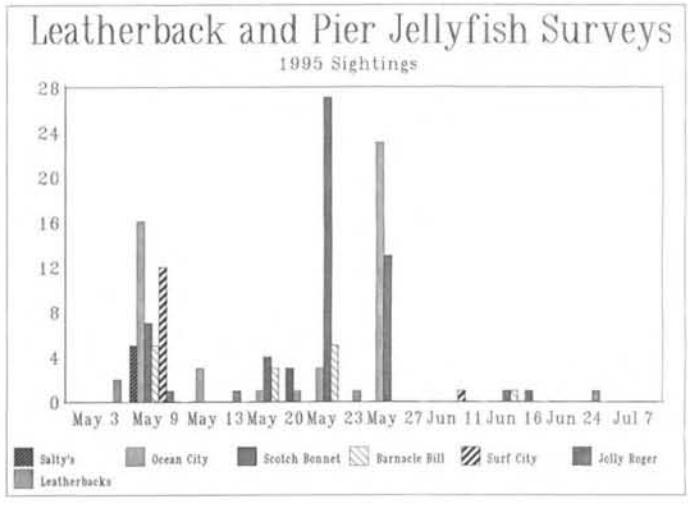


FIG. 4. Leatherback turtle and jellyfish censuses on Topsail Island, North Carolina during 1995.

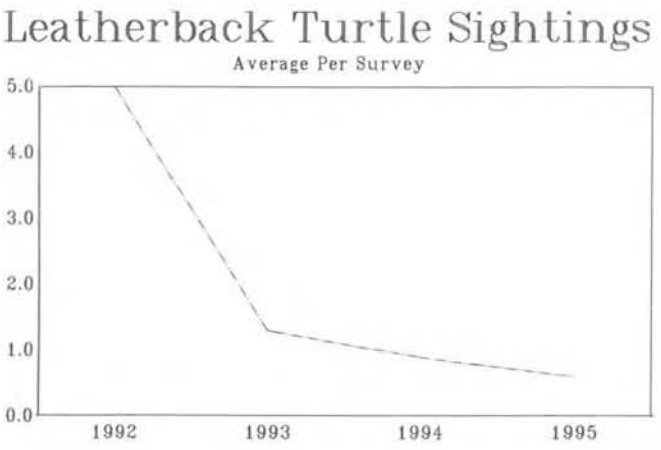


FIG. 5. Mean number of leatherback turtles per survey from 1992–1995.

States ranged from 2.09 x 10^{-3} to 2.16 x 10^{-2} /km^2 (Shoop and Kenney 1992).

Short-term abundance of leatherback turtles was documented by Knowlton and Weigle (1989) along the coast of Florida between Daytona Beach and Cape Canaveral. They counted 168 leatherbacks in mid-February 1988. Their next census (16 March 1988) in the same area revealed no leatherbacks. Large numbers (40) were stranded along the Georgia coast in April 1991 (Georgia Sea Turtle Stranding Network 1991). Leatherback numbers in North Carolina (this study; Epperly et al. 1995a) peaked in May and early June. Leatherback sightings peaked in Cape Cod Bay, Massachusetts, in August and September (Prescott, 1988). Most leatherbacks sighted by Shoop and Kenney (1992) off the coast of the northeastern United States occurred during the summer (defined by them as 21 June–20 September). Large numbers seen for a brief time interval in February off Florida, April off Georgia, May–June off North Carolina, and August–September off Massachusetts suggest that a portion of the population may regularly move north along the east coast of the United States during this time of the year.

Peak numbers of leatherback turtles within 1 km of the shoreline in this study were correlated with peak jellyfish numbers in 1992 but not other years when jellyfish appeared to be patchily distributed. Leary (1957) observed about 100 leatherbacks within a dense school of cabbagehead jellyfish near the Texas coast.

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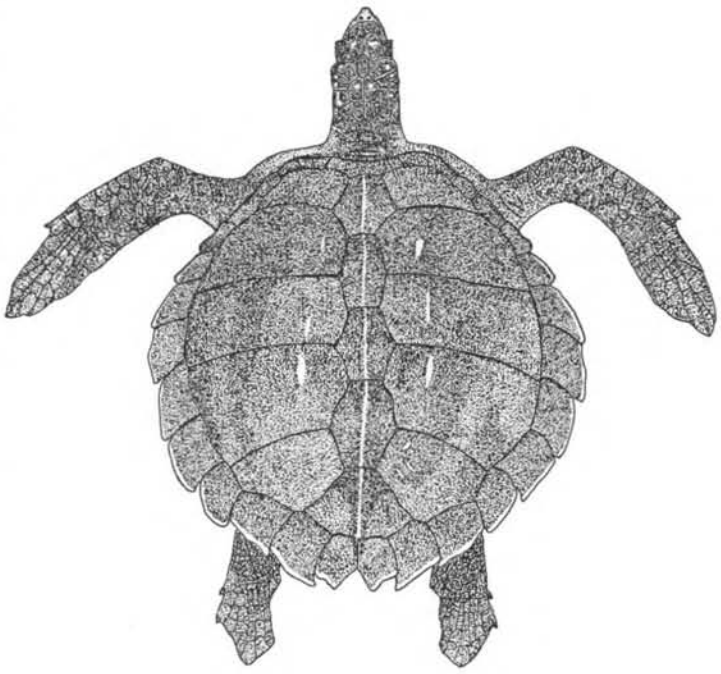
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Lepidochelys olivacea (Leatherback Turtle). Illustration by Dan C. Holland.

Home Range Size of the Hellbender (*Cryptobranchus alleganiensis*) in Missouri

CHRIS L. PETERSON
Division of Science and Mathematics, Cottey College
Nevada, Missouri 64772, USA

and

ROBERT F. WILKINSON
Department of Biology, Southwest Missouri State University
Springfield, Missouri 65804, USA

Knowledge of patterns of activity and use of space is important for understanding the natural history of a species (Weatherhead and Hosak 1989). Size, shape, and overlap of home range have been related to food density, metabolic needs, population density, and territoriality (Alberts 1993; Brown and Orians 1970; Schoener 1968; Simon 1975). Also, knowledge of home range is important to predict the effects of environmental disturbance on a species (Hill and Grossman 1987). The hellbender (*Cryptobranchus alleganiensis*) has declined in numbers or been extirpated in portions of its range due to human activities (Nickerson and Mays 1973; Trauth et al. 1992; Williams et al. 1981). The only published information on home range of hellbenders was provided for a population in western Pennsylvania (Hillis and Bellis 1971). However, nearly half of the estimates of home range size were based on two observations of an individual, and no individual was captured more than five times. We were interested in determining size of home range of hellbenders in Missouri based on numerous recaptures.

The study site was an 80 m long section of Niangua River, Missouri, USA. Maximum depth was 1.5 m. Along the southern bank, gravel extended 5–10 m into the river. Along the northern shore, areas of silt extended 3–5 m into the river. Large rocks were numerous in the center of the site. Bedrock was present at the downstream end with few large rocks. At the upstream end, gravel extended to midstream with bedrock and a few large rocks on the northern side. We sampled the site 33 times between 15 August 1989 and 31 January 1990 by turning rocks during daylight and catching hellbenders by hand. All rocks were repositioned whether or not they sheltered a hellbender. The mean and maximum intersample periods were 5.5 and 23 days.

The first time a hellbender was captured, it was anesthetized in a weak tricaine (3-aminobenzoic acid ethyl ester, Sigma Co.) solution, branded on the venter with a unique number, sexed, and measured for snout-vent length (SVL). It was then returned to the rock where captured. For all subsequent captures of a marked individual, the brand was noted, and the individual was immediately released under the rock where captured. The location of each rock that sheltered a hellbender was mapped. A brick with a number was placed beside the rock to identify it.

Home range size was estimated by determining the size of a minimum area convex polygon (MCP; Mohr 1947). Jenrich and Turner (1969) reported that the MCP method can have large bias if the number of observations is small. However, with enough observations, home ranges estimated by the MCP method should approximate the true home range (Schoener 1981). We did not determine the home range of any hellbenders captured fewer than 14 times. However, three individuals captured more than 15 times were found only under a single rock, and two individuals were captured under only two rocks. We assigned a home range size of zero square meters to the former three and determined a mean activity radius (MAR) to estimate a circular home range (Hayne 1949) for the latter two. A MAR was calculated for hellbenders captured by Hillis and Bellis (1971).

TABLE 1. Home range size for hellbenders captured 14 or more times.

Home Range (m^2)	SVL (cm)	No. Times Captured	Time Interval (days)	No. Rocks Used as Shelter
		Females, N = 14		
0.0*	30	33	169	1
0.0*	32	33	169	1
0.4	28	31	159	3
1.8*	28	16	67	2
3.2	32	33	169	4
6.6	31	32	169	3
12.7	32	15	148	5
13.9	34	22	91	6
34.2	32	20	74	4
44.8	34	32	169	3
54.8	30	25	169	8
60.3	29	18	88	3
79.9	32	32	169	7
82.4	32	33	169	7
		Males, N = 12		
0.0*	31	25	118	1
1.7	27	14	101	3
25.2*	31	22	112	2
41.0	29	32	169	5
61.6	31	20	77	6
73.2	32	30	169	8
80.1	30	16	54	6
80.9	35	33	169	4
97.7	29	14	59	8
121.1	28	19	74	9
177.1	28	28	155	10
211.4	30	32	169	13

* Hellbenders for which a minimum convex polygon could not be constructed. A mean activity radius was calculated to estimate the home range size for the two hellbenders captured under only two rocks.

Twenty-five adult females and 25 adult males were captured at least once. No juveniles were captured. Twenty-four hellbenders were captured nine or fewer times (19 were captured fewer than 5 times). The remaining 26 hellbenders were captured 14 or more times (Table 1). Five individuals were captured in all 33 samples, including two females each captured only under a single rock. Eighteen of the individuals in Table 1 were captured on the first day of sampling. Twelve hellbenders captured during the first sample were also captured during the last sample.

For females, average home range size was 28 m^2 (SE = 8.2). Median home range size was 13 m^2. If the three females caught under only one or two rocks (indicated by asterisks in Table 1) were deleted from the analysis, average home range size would be 36 m^2. For males, average home range size was 81 m^2 (SE = 18.7). Median home range size of males was 77 m^2. If the two males captured under only one or two rocks were deleted, average home range size would be 95 m^2. A Mann-Whitney U-test indicated that males had a significantly larger home range than did females ($U = 126$, $0.05 > P > 0.02$). There was no significant

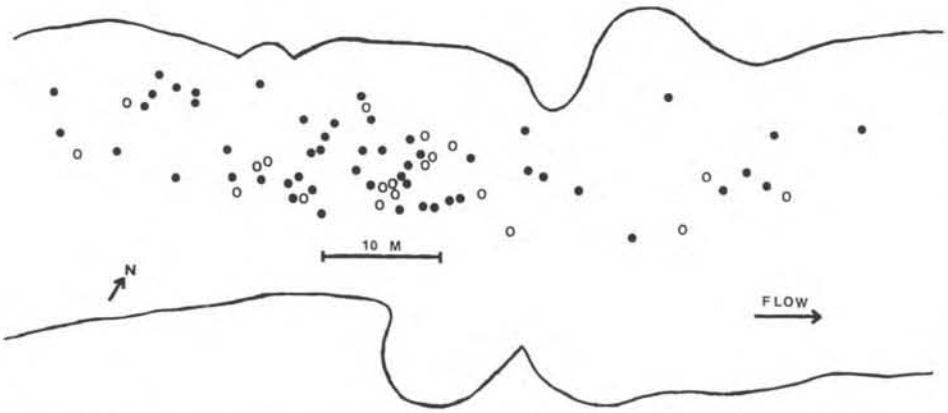


FIG. 1. Study site in Niangua River, Missouri. Dots indicate rocks used as shelter by hellbenders throughout the study. Open circles indicate rocks where hellbenders were captured during the first sample.

product-moment correlation between SVL and home range size for females (r = 0.20) or males (r = -0.12) or between home range size and number of times captured for females (r = 0.04) or males (r = 0.31).

There was considerable overlap in home ranges of both male and female hellbenders. All but three of the hellbenders in Table 1 sheltered at least once under a rock in the 10-m section indicated in Fig. 1. Also, some rocks served as shelter for more than one hellbender at different times. Thirty rocks were used by one hellbender only, 18 by two hellbenders, 10 by three hellbenders, six by four hellbenders, three by five hellbenders, four by six hellbenders, and one rock was used by seven hellbenders. However, we never observed more than one individual under the same rock during a sample. Only six captures of hellbenders were made away from shelters, and each such capture was made during September when breeding occurs (Peterson 1988; Peterson et al. 1989a).

Hillis and Bellis (1971) reported an average home range size of 346 m^2 (median = 113 m^2) for 73 hellbenders and found no significant difference in the MAR between sexes. We calculated only three home ranges as large as the median home range estimate of Hillis and Bellis (1971). The smaller estimates of home range we calculated may have been due in part to a smaller study area (80 m x 25 m compared to 220 m x 70 m) and the possibility that home ranges overlapped our upstream or downstream borders. However, we believe the major difference in estimates is due to the methods of calculating home range: circular versus MCP in a basically linear habitat. Also, Hillis and Bellis (1971) may have calculated home ranges for transients because only 13 of the 73 hellbenders were captured more than three times.

Coatney (1982) determined an elliptical home range size of 90 m^2 for seven Ozark hellbenders based on nocturnal telemetry over a period of at most two weeks. Again, our estimates are generally smaller, despite presumably greater disturbance of hellbenders due to capture by hand rather than telemetry. This may be due to the nocturnal habits of hellbenders and a tendency to return to a "home rock" at dawn (Coatney 1982). Perhaps this was the case with the three hellbenders we caught only under the same rock. However, because their diet is mostly crayfish (Nickerson and Mays 1973; Peterson et al. 1989b), hellbenders may be predominantly sit-and-wait predators.

We found considerable overlap in home ranges. Coatney (1982) thought that hellbenders with overlapping ranges avoid being in the area of overlap simultaneously, and rarely has more than one hellbender been found under the same rock except during the breeding season (Hillis and Bellis 1971; Nickerson and Mays 1973; Peterson 1988; Smith 1907). We have observed vigorous defense of shelters in aquaria by both sexes, and males similarly defended shelters containing eggs in natural habitats (Peterson 1988; Smith 1907). Hillis and Bellis (1971) also reported defense of a shelter, but stated that hellbenders were very opportunistic in occupying a cover rock recently vacated by another hellbender. Our data of multiple use of a rock by different hellbenders support their observation. We hypothesize that active defense in a home range is limited to a shelter.

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Addenda to Checklist of Scientific and Common Names of Mexican Amphibians and Reptiles

ERNEST A. LINER
310 Malibou Boulevard
Houma, Louisiana 70364-2598, USA

The following corrections and additions apply only to Liner's Checklist (1994) as published (cut-off date, 30 September 1993). New Mexican taxa described in 1994 and 1995 are omitted and reserved for inclusion in a contemplated second edition. Changes include minor errors of commission and misspellings, and shifts in taxonomic status. Previously overlooked Mexican taxa or proposals of new taxa (with suggested common names) are marked with an asterisk.

A new species, *Gerrhonotus aquayoi* (Contreras-Arquieta 1989), published in a resumen is not a valid description by present standards and is excluded. The book by Golay et al. (1993) is omitted as some changes in the status of Mexican forms are not documented.

I have been asked often why several taxa in the checklist have been elevated to species status. This was done on the basis of papers by Frost and Hillis (1990) and Collins (1991). Collins (1991) provided a list of U.S. forms—distinct at the species level in his opinion—camouflaged as subspecies. Some of these forms occur in México as well. The following Mexican taxa were elevated to specific rank: *Bufo microscaphus californicus, Kinosternon flavescens arizonense, Pseudemys concinna gorzugi, Cnemidophorus burti xanthonotus, Crotaphytus insularis vestigium, Holbrookia lacerata subcaudalis, Sceloporus graciosus vandenburgianus, Uta stansburiana stejnegeri, Arizona elegans occidentalis* and its subspecies, *Coluber constrictor mormon, Masticophis bilineatus lineolatus, Micrurus fulvius tener* and its Mexican subspecies, *Pituophis melanoleucus catenifer* and its Mexican subspecies, and *Tantilla rubra rubra*.

The following corrections are noted (page number from the original publication precedes the correction):

p. 3—Table corrections are Testudines 31 ssp. instead of 32; Sauria 241 ssp. instead of 242; Totals of taxa 1537, of subspecies 581.

p. 12—*Ensatina e. eschscholtzii* (= Monterey instead of Monterrey).

p. 12—*Ensatina e. klauberi* (= *E. klauberi* by Frost and Hillis 1990).

p. 21—*Eleutherodactylus terestes* (=*teretistes*).

p. 35—*Trachemys scripta grayi* (alphabetically should follow *T. s. elegans*).

p. 36—*Abronia kalaina* (not recognized, synonym of *A. fuscolabialis*, Campbell and Frost 1993).

p. 36—**Abronia leurolepis* Campbell and Frost 1993...Smoothback Arboreal Alligator Lizard (Dragoncito Espaldasuave).

p. 36—**Abronia smithi* Campbell and Frost 1993...Smith's Arboreal Alligator Lizard (Dragoncito de Smith).

p. 37—*Anniella pulchra nigra* (delete, not member of Mexican fauna).

p. 38—*Cnemidophorus*. Two interrelated papers (Wright 1993; Wright 1994—hereafter abbreviated W-1993, W-1994) have altered the entries under this genus.

p. 38—*C. alpinus* (not recognized, synonym of *C. costatus costatus*, W-1993:80).

p. 39—*C. bacatus* (not recognized, synonym of *C. tigris aethiops*, W-1993:81, W-1994:258).

p. 39—*C. burti xanthonotus* (*xanthonotus* not separate species, p. 43; W-1993:81, W-1994:257).

p. 39—*C. burti griseocephalus* (*griseocephalus* transferred from *costatus* to *burti* W-1993:79, W-1994:257).

p. 39—*C. canus* (not recognized, synonym of *C. tigris tigris*, W1993:81, W-1994:258).

p. 39—*C. catalinensis* (not recognized, synonym of *C. tigris aethiops*, W-1993:81, W-1994:257).

p. 39—*C. celeripes* (not recognized, synonym of *C. tigris rubidus*, W-1993:81, W-1994:258).

p. 40—*C. estebanensis* (not recognized, synonym of *C. tigris gracilis*, W-1993:81, W-1994:258).

p. 40—**C. grahamii* Baird and Girard 1852 (new entry, replaces *C. tessellatus*, W-1993:56, W-1994:258)...Graham's Whiptail Lizard (Huico de Graham).

p. 40—*C. gularis* (all subspecies, except *colossus* and *gularis*, transferred to *septemvittatus*, *C. s. rauni* omitted, W1993:80, W-1994:257).

p. 41—*C. hyperythrus* (only three subspecies recognized: *beldingi, hyperythrus,* and *pictus*; the five other subspecies listed as synonyms of *C. h. beldingi*, W-1993:78, W-1994: 257); *C. h. denheimae* (= *danheimae*).

p. 41—**C. i. chihuahuae* Wright and Lowe 1993...Chihuahua Striped Whiptail (Huico de Chihuahua).

p. 41—**C. i. cienegae* Wright and Lowe 1993...Cuatro Cienegas Striped Whiptail (Huico de Cuatro Cienegas).

p. 42—*C. martyris* (not recognized, synonym of *C. tigris gracilis*, W-1993:81, W-1994:258).

p. 43—*C. tigris dickersonae* (not recognized, synonym of *C. t. tigris*, W-1993:81).

p. 43—*C. t. nigroriens* (not recognized, synonym of *C. t. variolosus*, W-1993:81, W-1994:258).

p. 43—*C. tigris punctatus* (not recognized, synonym of *C. t. tigris*, W-1993:81, W-1994:258).

p. 43—*C. tigris punctilineatus* (not recognized, synonym of *C. t. tigris*, W-1993:81, synonym of *C. t. gracilis*, W-1994:258).

p. 43—*C. tigris reticuloriens* (not recognized, synonym of *C. t. marmoratus*, W-1993:81, W-1994:258).

p. 43—*C. tigris vandenburghi* (not recognized, synonym of *C. t. rubidus*, W-1993:81, W-1994:258).

p. 43—*C. tigris vividus* (not recognized, synonym of *C. t. stejnegeri*, W-1993:81, W-1994:258).

p. 45—*Crotaphytus collaris dickersonae* (= *C. dickersonae*, Montanucci, Axtell and Dessauer 1975).

p. 57—*Phrynosoma douglassii* (= *douglasii*, Hammerson and Smith 1991) .

p. 61—**Sceloporus clarkii uriquensis* Tanner and Robison 1959 (recognized by Tanner 1987)...El Fuerte Basin Spiny Lizard (Vejore de Bolson de El Fuerte).

p. 61—*Sceloporus formosus* (suggested change in common name to Green Swift, since Emerald Spiny Lizard also applied to *S. taeniocnemis*, p. 66; Emerald Swift and Green Spiny Lizard are unavailable as having been previously applied to the extralimital *S. malachiticus*).

p. 62—*Sceloporus gadovae* (= *gadoviae*).

p. 63—*Sceloporus magister monserratensis* (delete, listed as species on p. 64).

p. 64—**Sceloporus nelsoni barrancorum* Tanner and Robison 1960 (recognized by Tanner 1987)...Nelson's Barranca Spiny Lizard (Lagartija Espinosa de Barranca).

p. 64—*Sceloporus occidentalis biseriatus* (delete, not member of Mexican fauna).

p. 66—**Sceloporus smaragdinus* Bocourt 1873 (previously omitted, see Stuart 1971)...Chiapan Malachite Spiny Lizard (Lagartija Espinosa Malaquita de Chiapas).

p. 72—*Agkistrodon bilineatus* and *A. b. bilineatus* (author's name, Gunther, should be in parentheses).

p. 73—*Arizona o. noctovaga* (= *noctivaga*).

p. 74—*Cerrophidion* (Spanish common name for genus not indicated, Nauyacas de Montana is suggested).

p. 78—*Crotalus intermedius* and *C. i. intermedius* (correct authorship should be Troschel, in Müller 1865).

p. 83—*Eridiphas s. narcosensis* (= *marcosensis*).

p. 86—*Hypsiglena t. nuchalata* (delete, not member of Mexican fauna).

p. 96—*Nerodia rufipunctatus* (= *rufipunctata*).

p. 96—*Porthidium nasutum* (author's name, Bocourt, should be in parentheses).

Acknowledgments.—My thanks are extended to Herndon G. Dowling for bringing the *Cerrophidion* oversight to my attention, Hobart M. Smith for his comments on *Sceloporus* corrections, Harold A. Dundee for his editorial help, and my reviewers Breck Bartholomew, James R. Dixon, Robert W. Hansen, and Robert G. Webb for their help in improving this paper and catching errors I did not.

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Relative Priority of Names for Members of the Eastern and Central Spotted Whiptail Lineages of the Lizard Genus *Cnemidophorus* in North America

HOBART M. SMITH
Department of EPO Biology, University of Colorado
Boulder, Colorado 80309-0334, USA
e-mail: hsmith@spot.colorado.edu

JAMES R. DIXON
Department of Wildlife & Fisheries Sciences, Texas A & M University
College Station, Texas 77843-2258, USA

HUGH K. MCCRYSTAL
9140 West Henry Street
Tucson, Arizona 85746, USA

and

DAVID CHISZAR
Department of Psychology, University of Colorado
Boulder, Colorado 80309-0345, USA

The important reviews of classification, phylogeny, and distribution of the members of the genus *Cnemidophorus* by Wright (1993, 1994) recognize three, largely parapatric lineages of spotted whiptail lizards in the *sexlineatus* species group. The eastern group contains *C. gularis*, the western group *C. burti* and *C. costatus*, and the central group a species referred to as *C. septemvittatus*.

It is the first and fourth names to which attention is here directed. The name *C. gularis* Baird and Girard (1852) is the earliest by far of all names applied to these groups. The names proposed for taxa in the central group all have long been thought to have appeared simultaneously in a work by Cope (1892b): *C. septemvittatus*, p. 40; *C. gularis scalaris*, p. 47; *C. g. sericeus*, p. 48; and *C. g. semifasciatus*, p. 49. That work appeared about May 4, when reprints were printed; mailing of the journal as well as reprints no doubt took place within a few days of that date.

On the contrary, Cope (1892a) had earlier (March 1, 1892) published descriptions of two (*C. g. scalaris*, *C. g. semifasciatus*) of the four treated in the later review (1892b); *C. septemvittatus* and *C. g. sericeus* were not mentioned in the earlier work.

The first article is essentially an abstract or notice, the likes of which Cope as editor then of the *American Naturalist* frequently contributed in advance of his own, more elaborate subsequent publications elsewhere. Nevertheless the characterizations provided in this notice for both *C. g. scalaris* and *C. g. semifasciatus* are without question adequate for nomenclatural availability under Art. 12(a) of the 1985 edition of the International Code of Zoological Nomenclature (hereinafter the "Code"): "To be available every new scientific name published before 1931 must... have been accompanied by a description or a definition of the taxon that it denotes, or by an indication."

The pertinent text in Cope (1892a) follows: "The first modification [in a series of geographical variants] is seen in the appearance of pale spots in the interval between stripes, a character which partly defines the *C. gularis* B. & G. These spots are greatly enlarged in the *C. gularis scalaris* Cope, joining the stripes and breaking up the ground color into spots.... Returning to *C. g. scalaris*, the dark spots may be confluent transversely, forming a transversely banded form. This transverse banding commences at the posterior extremity of the body.... [p. 1136] When the color pattern consists of rows of oblong black spots on a dark ground the form *C. g. semifasciatus* Cope is produced."

The relationships of the various taxa denoted by these five species-group names (*gularis*, *scalaris*, *semifasciatus*, *septemvittatus*, *sericeus*) have been differently interpreted by different workers over the past several decades. Some regard all as subspecies of *C. gularis*, whereas others recognize as many as three species, the names for which (excluding *C. gularis*) hitherto have depended on the relative priorities of the four names supposedly published simultaneously by Cope (1892b).

With the discovery of the earlier descriptions (Cope 1892a), it is obvious that *scalaris* and *semifasciatus* have priority over *septemvittatus* and *sericeus*. Although *scalaris* (p. 1135) has page priority over *semifasciatus* (p. 1136), and *septemvittatus* (p. 40) over *sericeus* (p. 48), nomenclatural priority is established in each case by application of the "Principle of the First Reviser." In brief, according to that Principle (Art. 24(a) of the Code), "If two or more names,... published on the same date,... are considered to be synonyms,... their relative precedence is determined by the first reviser.... The first author to have cited together such names... has determined the precedence of the chosen name...." Essentially the same information was given in the 1961 edition of the Code.

No reviser has ever dealt with the two names as proposed by Cope (1892a). On the basis of frequency of usage, we here assign priority to *scalaris* over *semifasciatus* whenever those taxa are regarded as synonyms at either specific or subspecific levels.

Only two names proposed by Cope in the later review (1892b) actually are new, among those considered here: *septemvittatus* and *sericeus*. The relative priority of these particular two names has never been assigned. On the basis of frequency of usage, we here select *septemvittatus* over *sericeus*.

As unsettled as the taxonomy of this group has been in the past, the authority of the automatic provisions of the Code is a welcome anchor adaptable to whatever arrangement will be dictated by future research. No appeal for arbitration is justified.

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TECHNIQUES

A New Device for Capturing Small and Medium-Sized Lizards by Hand: The Lizard Grabber

BRIAN W. WITZ

Department of Biology, University of South Florida
Tampa, Florida 33620, USA

Present address: Department of Biology, Nazareth College
4245 East Avenue, Rochester, New York 14618, USA
e-mail: bwwitz@naz.edu

Capturing lizards with the assistance of sling shots and rubber-band guns, or simply by shooting large rubber bands launched from the fingers is described by Conant and Collins (1991). However, they preferred capturing lizards with a noose, because the chance of injury is reduced considerably with this method. Noosing is a useful technique that can be quite successful when mastered, but it is not without its problems. Many saurologists find that slipping a noose over the head of a lizard is difficult because lizards either become startled or attempt to bite the thread as it approaches their head. Because it is difficult to cinch the noose tightly around the lizard's body or neck, many individuals escape.

An automobile mechanic's bolt retriever may be modified to function as a "lizard grabber." I have used this lizard grabber to capture *Cnemidophorus sexlineatus*, *Anolis sagrei*, *A. carolinensis*, and *Sceloporus undulatus*. Lizards wider than 20 mm at the pelvic girdle cannot be captured with the lizard grabber as described herein, but additional modifications will increase its applicability.

The basic device may be purchased at any automotive parts store or in the automotive section of many department stores. These tools are available in a variety of lengths. The device I used had a total length of 60 cm. The unmodified device consists of a tightly-

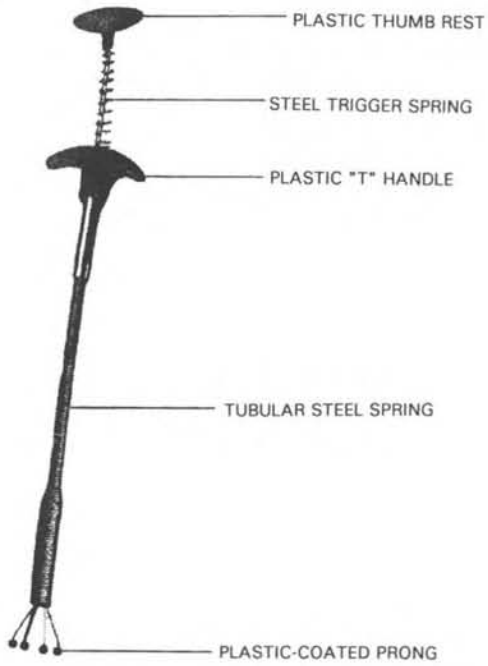


Fig. 1. The Lizard Grabber ("loaded" state). Total length of the device is ca. 60 cm.

wound, tubular steel spring, ca. 500 mm long, capped with a plastic "T" handle that is attached to the spring with a steel collar (Fig.1). The outside diameter (OD) of the spring is 5 mm along most of its length; the distal 50 mm is expanded to ca. 8 mm OD. A hollow aluminum rod (3 mm OD), capped with a plastic thumb rest, runs through the center of the steel spring and extends ca. 60 mm beyond the "T" handle. This 60 mm length of aluminum rod is enclosed within a 10 X 50 mm steel trigger spring which, when the device is not loaded, rests in a slightly compressed state between the "T" handle and the thumb rest cap. Four spring-loaded, aluminum prongs are attached to the distal end of the aluminum rod. When the device is not loaded, the prongs remain collapsed inside the expanded distal end of the tubular steel spring.

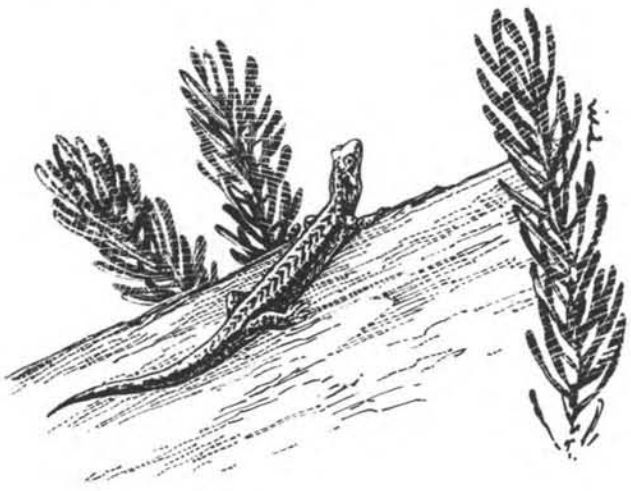
Two modifications of the basic device are necessary. To prevent injury to lizards, the first modification involves coating the sharp tips of the aluminum prongs with liquid plastic. The prongs should be held in an expanded state by squeezing the trigger in a vice or wood clamp, and then dipped in liquid plastic and allowed to dry for several hours. I suggest using two coatings. As purchased, the "Grabber's" trigger spring tension can be sufficient to injure some lizards. If this spring is shortened by cutting and removing 1–2 coils, the spring tension will be reduced.

Using the lizard grabber, an investigator can capture an unsuspecting lizard from behind, an advantage over the noose which must be slipped over the lizard's head. I approach lizards from behind and position two of the plastic-coated prongs anterior to, and two posterior to, the hind limbs. All four prongs must be placed close to the lizard's body. When the thumb rest is released, the prongs grab the pelvic girdle firmly, with minimal chance of escape or injury to the lizard.

Acknowledgments.—The lizard grabber was used during my doctoral dissertation research project at the University of South Florida. Funding, in part, was provided by grants from Sigma Xi and the University of South Florida Center for Urban Ecology. Thanks to H. R. Mushinsky and E. D. McCoy for their guidance throughout my graduate career, and to MaryJo A. Witz for proofreading the manuscript.

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Desmognathus wrighti (Pygmy Salamander). USA: North Carolina: Clingman's Dome. Illustration by Tim Manolis.

Mist Netting: Adapting a Technique from Ornithology for Sampling Semi-Aquatic Snake Populations

WILLIAM I. LUTTERSCHMIDT
and
JACOB F. SCHAEFER
Department of Zoology, University of Oklahoma
Norman, Oklahoma 73019, USA

Mist nets, used by ornithologists to entangle birds, are expensive due to the design and use of cotton or nylon shelf strings creating hammocks in the net (Bub 1991). We describe a snake "mist net" that works similarly but is made from an inexpensive black polypropylene netting sold as protective fruit-tree netting at most garden centers. A 28 X 28 ft. (8.5 X 8.5 m) Bird-X® (Dalen Products, Inc., 11110 Gilbert Drive, Knoxville, Tennessee 37932, USA) net with a 5/8 X 3/4 inch (1.58 X 1.91 cm) mesh size costs approximately US $30.00 and provides enough material to make ca. 45 "mist nets." The polypropylene material lasts over repeated field use, thus adding to its cost efficiency.

We cut the netting into 1.5 X 1.0 m sections and folded it twice to triple the netting's thickness; the net now measured 1.5 X 0.3 m. The netting was suspended between two wooden poles (1.5 cm diameter, 100 cm length) and placed in the stream, river, or lake perpendicular to the shore line (Figs. 1a and 1b); half of the netting was submerged. Snakes that commonly swim along the stream or river bank (a natural drift fence) swim into the netting and become entangled. Snakes may be released from the netting by untangling or cutting the snake free. Freeing venomous snakes (e.g., *Agkistrodon piscivorous*) takes longer and can become tedious.

An enclosure (Figs. 1c and 1d) can also be constructed and baited with frogs, minnows, or other fish (e.g., centrarchids). Bait placed between the overlapped layers of netting will not sink or wash away. We found baited enclosures (also placed perpendicular to the stream bank) to have greater trapping success than single nets.

We used this trapping technique on seven sampling nights and at five different localities. We collected 13 snakes representing three species (*Nerodia rhombifer*, *Nerodia erythrogaster*, *Agkistrodon piscivorous*) during 20 trap-nights for an overall trapping success of 65% (Table 1).

This netting technique provides an additional and alternative method for sampling semi-aquatic snakes and offers a few advantages. First, the netting is easy to transport because it can be folded and bound with rubber-bands; 20–30 nets will easily fit in a nap-sack. While wooden poles offer some difficulty, transport is still considerably easier than funnel or minnow traps. Although funnel and/or minnow traps have provided much success in snake trapping (e.g., Fitch 1951, 1987; Keck 1994), funnel traps are bulky due to their construction from hardware cloth, and commercial minnow traps (although more portable) are expensive. Due to the circular design and diameter (19 cm) of minnow traps, snakes may only encounter a limited trap-area. Snake nets extended 1.5 m from the shoreline, thus increasing the trap area and the probability of a snake encountering the trap.

This new trapping technique is not without a disadvantage. Due to the netting's mesh size, this technique may be limited to catching larger snakes, just as minnow traps are limited to catching smaller snakes due to the size of their entrance hole (3–4 cm). Mean body mass and SVL for nine of the snakes we captured in

TABLE 1. Locality, date, trapping success, and species caught for each of the seven sampling nights. All localities are in Oklahoma, USA.

Sample	Locality (Date)	Number of Snakes	% Trapping Success	Species
1	Stream, Cleveland Co. (5/94)	7 (4 traps)	175	*N. rhombifer*
2	Farm Pond, Marshall Co. (7/94)	0 (2 traps)	0	
3	Farm Pond, Marshall Co. (7/94)	0 (3 traps)	0	
4	Fobb Bottom, Marshall Co. (8/95)	2 (3 traps)	66	*N. rhombifer* *N. erythrogaster*
5	Fobb Bottom, Marshall Co. (8/95)	1 (4 traps)	25	*N. rhombifer*
6	Cucumber Creek, Eagle Fork, LaFlore Co. (9/95)	3 (2 traps)	150	*A. piscivorous*
7	Cucumber Creek, beaver pond, LaFlore Co. (9/95)	0 (2 traps)	0	

Total trap-nights = 20. Total number of snakes captured = 13. Total trapping success = 65%.

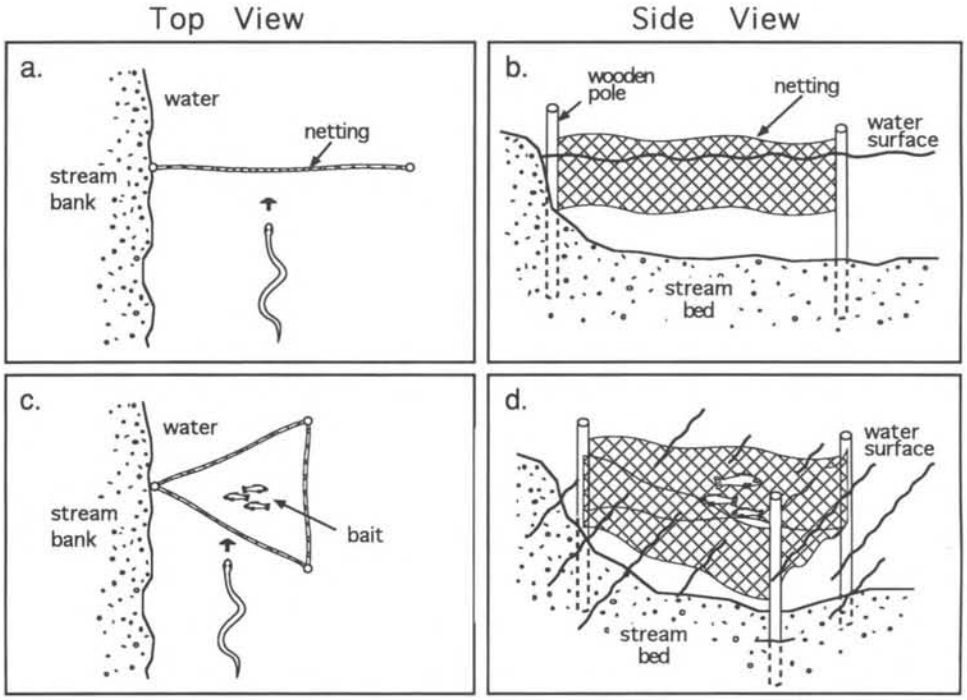


FIG. 1. Top and side views of the single snake net (a and b) and of the snake net enclosure (c and d).

snake nets were 391.4 g (SE = 52.42) and 69.0 cm (SE = 23.01), respectively. Juveniles and smaller semi-aquatic snake species may not be sampled with the netting we used. However, this technique may still prove valuable for the collection of smaller snakes upon finding netting with appropriate mesh hole size. When sampling snakes for census work, we suggest using several trapping and collecting techniques to include all size classes. One of these techniques may include snake netting.

Acknowledgments.—We thank Philip W. Lienesch for field assistance and Coral McCallister-Blanchard for help with figure illustration. We also thank Richard D. Durtsche, Victor H. Hutchison, Philip W. Lienesch, and Glenn A. Marvin for comments and suggestions regarding this manuscript.

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Purification of High Quality DNA from Shed Skin

JAMES BRICKER
Department of Biology, Trenton State College
Hillwood Lakes, CN 4700, Trenton, New Jersey 08650-4700, USA
e-mail: bricker@trenton.edu

LAURETTA M. BUSHAR
Department of Biology, Beaver College
450 South Easton Road, Glenside, Pennsylvania 19038, USA
e-mail: bushar@beaver.edu

HOWARD K. REINERT
Department of Biology, Trenton State College
Hillwood Lakes, CN 4700, Trenton, New Jersey 08650-4700, USA
e-mail: hreinert@trenton.edu

and

LARRY GELBERT
Department of Molecular Genetics and Cell Biology, Bristol Meyers Squibb Co.
Route 206 and Provinceline Road, Lawrenceville, New Jersey 08648, USA
e-mail: Gelbert#m#_Lawrence_M#d#.PRILVMS2@ms

Molecular analyses utilizing genomic DNA have revolutionized studies of systematics, ecology, evolution, and population genetics. Identification of restriction fragment length polymorphisms, DNA sequence disparities, and DNA fingerprints have been used to distinguish among individuals, populations, species, and higher taxa (e.g., Burke and Bruford 1987, Densmore et al. 1994, Parker and Whiteman 1993, and Vladychenskaya et al. 1993). While these techniques have proven extremely useful, sample collection often involves invasive techniques such as collection of blood by cardiac puncture (Sooter 1955; Dessauer 1970; Branch 1973; Cooper and Jackson 1981) or from the caudal vein (Reinert and Bushar 1991). In some cases it is necessary to sacrifice animals to obtain tissue for these analyses, and none of these approaches is ideal for working with neonates or endangered species. Shed snake skins provide a safe, non-invasive source of DNA.

While techniques for isolating DNA from skin samples have been described in the past (Knight et al. 1992), those utilizing proteinase digestion suffer from the long digestion period, as well as the possible degradation of the DNA which could occur during long incubations at elevated temperatures. Here we describe a modification of the protocol of Boom et al. (1990) which allows for the purification from shed skins of genomic DNA suitable for molecular analysis. The entire procedure can be completed in less than 3 hours and without an extended incubation period.

Shed skins from the timber rattlesnake, *Crotalus horridus*, and the corn snake, *Elaphe guttata*, were collected and stored at -20°C or -80°C prior to DNA purification. A 0.25 g sample is quick frozen on dry ice, transferred to a food processor (e.g., Black and Decker Handy Chopper HC20 type 3) containing 2 to 3 g of crushed dry ice, and processed by repeated ten-second bursts until skin and dry ice are reduced to powder. The powdered skin is then transferred to a loosely capped tube and repeatedly heated at 65°C for 3–5 minutes and mixed for 5–10 seconds until the color turns from grayish- to brownish-black, indicating that the CO_2 has sublimed. This step prevents the production of carbonic acid which could result in hydrogen cyanide gas formation during incubation of the homogenate in L6 buffer (see below).

The cell homogenate is then incubated in 3 ml of L6 buffer (Boom et al. 1990) for 30 minutes at 37°C, followed by centrifugation at 3000 X g for 5 minutes at room temperature (~20°C) to remove insoluble materials. In cases in which the homogenate is excessively viscous, 1.5 ml of TE, pH 8.0, may be added to the sample prior to centrifugation, and the centrifugation time increased to 10 minutes. L6 buffer is made by combining 120 g guanidine thyocyanate (Sigma Chemical Co.) in 100 ml 0.1 M Tris-HCl, pH 6.4 (heated to 65°C, shaking until dissolved), and then adding 22 ml 0.2 M EDTA, pH 8.0 and 2.6 g Triton X-100 (Sigma Chemical Co.). The buffer should be prepared in a fume hood and all wastes collected in 10 N NaOH to prevent hydrogen cyanide generation.

Following centrifugation, the supernatant is transferred to a clean, sterile tube; the volume of the supernatant is increased to 3 ml with TE buffer (10 mM Tris-HCl [pH 8.0]; 1 mM EDTA). Three ml of phenol: chloroform: isoamyl alcohol (49.5:49.5:1) is added to the supernatant and the resulting suspension is mixed on a rocking platform for 5 minutes. After mixing, the suspension is centrifuged at 3000 X g for 5 minutes at room temperature (~20°C). The supernatant is then transferred to a clean, sterile tube. The supernatant is subjected to a second extraction by the addition of an equal volume of chloroform:isoamyl alcohol (24:1) followed by mixing and centrifugation as described above. The resulting supernatant is transferred to a clean, sterile tube.

The DNA is then precipitated by the addition of 2 volumes of ice-cold ethanol, cooled for 10 minutes on dry ice (or at least 30 minutes at -20°C), and pelleted by centrifugation at 3000 X g for 15 minutes at room temperature (~20°C). The DNA pellet is then air dried for 10 minutes at room temperature (~20°C) and dissolved in 500 µl TE, pH 8.0. The DNA is re-precipitated by the addition of 50 µl of 5M NaCl followed by 1 ml of ice-cold ethanol, mixed by inverting several times, and cooled for 10 minutes on dry ice (or at least 30 minutes at -20°C). The DNA is pelleted by centrifugation at room temperature (~20°C) in a microcentrifuge for ten minutes. The DNA pellet is air dried for 10 minutes at room temperature (~20°C) and then dissolved in 100 µl H_2O.

We have successfully used this protocol to purify DNA from 31 shed skins representing 3 adult and 28 neonate *C. horridus* and 2 adult *E. guttata*. DNA concentrations and purities were measured by spectrophotometry; A_{260}/A_{280} ratios of 1.95 were obtained for DNA extracted from shed skin, with up to 100 µg of DNA obtained from 0.25 g aliquots of shed skin. Purity and quality of DNA isolated from shed skins was sufficient for amplification of microsatellite loci in *C. horridus* using the polymerase chain reaction (Villarreal et al., *in press*). This technique provides a useful alternative to traditional methods used to purify DNA for molecular analysis.

Acknowledgments.—We thank A. Knight and M. Culver for helpful discussion and M. Ortega-Nanos for technical assistance. This work was supported by a grant from the Pennsylvania Wild Resource Conservation Fund in cooperation with the Pennsylvania Fish and Boat Commission.

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NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in volume 27, number 2 (June 1996).

CAUDATA

AMBYSTOMA OPACUM (Marbled Salamander). **COMMUNAL NESTING.** Communal nesting by marbled salamanders is infrequent and typically includes fewer than three females. Of 72 nests observed by Graham (1971. Ph.D. Diss., Rutgers Univ.), only nine (12.5%) were communal and included the clutches of two (N = 7), three (N = 1), and seven (N = 1) females; 16 (5.5%) of 292 nests observed by Petranka (1990. J. Herpetol. 24:229–234) contained eggs of two females and three (1.0%) contained eggs of three females.

I observed communal nesting by marbled salamanders on 6 and 12 October 1995 at a semi-permanent, 15 x 19 m, man-made pond in the Hoosier National Forest, Crawford County, Indiana, USA. The pond is within a second-growth pine-hardwood forest. Approximately 15% of the clay-mud base is sparsely covered with herbaceous vegetation; the remainder is bare mud sparsely covered with fallen leaves. When these observations were made, half the basin was covered with water, leaving a 2 m wide band of mud above the water level. Nests were considered communal if clutches in adjacent depressions constructed by females were indistinguishable, the number of eggs was two or more times greater than the average of single nests (mean = 110 eggs), or nests contained eggs in varying stages of development.

Of 29 nests found, 12 (41.4%) were single-female nests containing 51–169 eggs, nine (31.0%) contained 163–319 eggs of two females, four (13.8%) contained 323–413 eggs of three females, one (3.4%) contained 514 eggs of four females, two (6.9%) contained 771 and 796 eggs of seven females, and one (3.4%) contained 1813 eggs of 16 females.

Marbled salamanders typically nest beneath cover such as leaf litter, logs, roots, rocks, or vegetation (Graham, *op. cit.*; Jackson et al. 1989. Can J. Zool. 67:2277–2281; Noble and Brady 1933. Zoologica 11:89–132; Petranka, *op. cit.),* or in crayfish or small mammal tunnels (King 1935. Ohio J. Sci. 35:4–15). Nests are generally concentrated in areas with high total cover (Jackson et al., *op. cit.).* The Crawford County pond is devoid of accumulated leaf litter from previous years except at the basin edge. Only four nests were found in this zone, the remainder were located at middle or lower elevations where leaf litter was absent when females oviposited. Females may have been forced to nest communally due to the paucity of cover. Most nests were partially or completely exposed until covered with freshly fallen leaves. Although females may have oviposited simultaneously in some nests, embryos in several communal nests ranged from Harrison stage 19 to 37 (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill, New York, pp. 131–132), suggesting that later arriving females may have used eggs of preceding females as cover.

Only three nests (10%), all communal, had a single female in attendance. Nest attendance, which increases embryo survival, is typically much higher than that observed at the Crawford County pond (e.g., 87.4%, Jackson et al., *op. cit.;* 75.5%, Petranka, *op. cit.).* Estimates of embryo mortality in five communal nests ranged from 0–90%. The largest communal nest was exposed to direct sunlight for one hour each morning. On 12 October, temperatures in this nest varied from 22°C at the bottom to 27°C at the top immediately after exposure to the sun, suggesting that high temperatures may have contributed to high (ca. 90%) embryo mortality (Anderson 1972. Herpetologica 28:126–130).

I thank J. Sean Doody for commenting on the manuscript.

Submitted by **JOHN G. PALIS**, Rural Route 1, Box 258, Tell City, Indiana 47586, USA.

AMPHIUMA TRIDACTYLUM (Three-toed Amphiuma). **COLORATION.** A mottled *Amphiuma tridactylum* was brought to Northeast Louisiana University Museum of Zoology by an anonymous person during summer 1988. The specimen (NLU 70638) measured 34 cm SVL, pigmentation varied from dark brown to black circular blotches of assorted sizes with a leucistic body color (Fig. 1). The origin of the specimen is unknown, however it is believed to have been collected in Louisiana.



FIG. 1. Adult mottled (left) and albino (right) *Amphiuma tridactylum* from Louisiana.

A second specimen, an albino, was collected 20 July 1992 in a ditch approximately 8 rd km S of Thibodaux, in Lafourche Parish, Louisiana, USA, by Terry P. Guidroz. This specimen (NLU 70488), 243 cm SVL, lacks all pigmentation except for the coloration of its blood vessels and pink eyes (Fig. 1).

then mixed with the stomach contents by gently massaging the belly; contents are removed by inverting the animal, retracting the tube an additional 2–3 cm (estimated distance from the hind wall of the stomach to the distal end of the sternum), and applying gentle pressure from the rear to the front of the stomach. The stomach contents are then collected in a plastic container; food becoming lodged in the mouth or pharynx is easily removed with forceps. This procedure is repeated 3–6 times for each animal and is stopped when the expelled water contains no plant items.

To test the efficiency of this procedure, one yearling and 13 hatchling iguanas were sacrificed, and the remaining stomach contents were analyzed after the procedure had been used. An average of 83.2%of all stomach contents (range 32–100 %) was recovered, and all species present in the stomach were detected in 13 of 14 cases. We did not consider it necessary to sacrifice larger animals to test the efficiency of the method.

Using this technique, we have been able to recover remains of 125 species of plants (Molina 1991; Rivas 1990). Stomach washing was performed on 365 iguanas ranging in size from hatchling (70 mm SVL, 12 g) to adult (up to 450 mm SVL, 4500 g). No animals died during the treatment although, in early attempts, some animals appeared weak after the maneuver. Many iguanas previously "stomach-washed" were recaptured in subsequent years and showed no ill effects.

This method provides a safe and easy way to study the dietary habits of large lizards. Because water is poured into the tube, no water pressure is applied to the animal gut, and no pump or syringe is needed. Although we used this method only for green iguanas, we believe it could be used with other lizards of comparable size; it was also used successfully with hatchling spectacled caiman (*Caiman crocodilus*) (Escalona, pers. comm.).

Acknowledgments.—We thank Thomás Blohm for the use of his ranch facilities, and the Wildlife Conservation Society (WCS) for financial support. Carlos Coronel allowed us to sacrifice some iguanas at his ranch. Gustavo Hernandez provided useful comments on the application of the technique. P. T. Andreadis, G. M. Burghardt, D. Truett, A. S. Rand, J. Thorbjarnarson, and A. E. Echternacht also provided useful comments and editorial suggestions.

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NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword which best describes the nature of their note (e.g., Reproduction, Longevity, Morphology, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send three copies of manuscripts, double-spaced, directly to the appropriate section coeditor (addresses on inside front cover): Lee A. Fitzgerald (lizards, amphisbaenians, crocodilians, Sphenodontia); Charles W. Painter (amphibians); or Paul A. Stone (snakes, turtles). Authors are encouraged to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a text-only version of the file.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1990. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd ed., Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113). KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

ANURA

LITORIA FALLAX (Eastern Dwarf Treefrog). **REPRODUCTION.** McCoid (1993. Herpetol. Rev. 24:16–17) reported this introduced species as occurring island-wide on Guam, Mariana Islands, in association with wetlands. In the native range, neither Cogger (1988. Reptiles and Amphibians of Australia, 5th ed., Reed Books, Pty. Ltd., NSW, 688 pp.) nor Frith and Frith (1987. Australian Tropical Reptiles and Frogs, Tropical Australia Graphics, Queensland, 70 pp.) mentioned reproductive periodicity. Although calling males have been heard year-round on Guam after heavy showers, successful reproduction during the dry season (December–May) may be tied to episodic rainfall. Successful reproduction is probably seasonal in ephemeral bodies of water as tadpoles and froglets have only been observed during the rainy season. On Guam, many wetlands are ephemeral and tend to contract or disappear during the dry season.

Size at maturity is ca. 30 mm SVL and at metamorphosis, froglets are 11–13 mm SVL. At metamorphosis, froglets are brown dorsally, but turn green at they grow. Maximum known size on Guam is ca. 40 mm SVL.

Michael Ritter aided in field work and Rebecca Hensley reviewed a version of this manuscript. Portions of this study were supported by the Endangered Species Conservation Program, Project E4 (to Guam).

Submitted by **MICHAEL JAMES MCCOID**, Division of Aquatic and Wildlife Resources, P.O. Box 2950, Agana, Guam 96910, USA. Current Address: Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&M University, Kingsville, Texas 78363, USA.

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog). **MAXIMUM SIZE.** Maximum body size for *O. septentrionalis* is 140.0 mm SVL (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern North America, 3rd ed., Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). This maximum figure is cited from a previous record (Wright and Wright 1949. Handbook of Frogs and Toads of the United States and Canada, Comstock Publ. Assoc., Ithaca, New York. 640 pp.). However, the 140.0 mm SVL record of Wright and Wright (*op. cit.*) is not present in their series of specimens and they "recall none over 4 inches" (101.6 mm SVL). Wright and Wright (*op. cit.*) state that the maximum length of 5.5 inches SVL (printed as 130.0 mm instead of 139.7 mm) is an approximation for females which they made from their series. I have been unable to find records approaching this size in the literature. Consequently, the status of maximum size in this species has been unclear. Here, I present the maximum size record for *O. septentrionalis*. In June 1993, an individual was captured on a hotel in Sebring, Highlands Co., Florida, USA and sold to a local petshop. I purchased the frog from the petshop within one week of its arrival, at which time it measured 155.0 mm SVL. A visit with hotel employees corroborated the story of its origin. It was kept in captivity and fed mice, other treefrogs, conspecifics, roaches, and anoles, until it died on 24 October 1994. At the time of death, it was determined to be a female and measured 165.0 mm SVL. After one week in 10% formalin, it measured 155.0 mm SVL and was deposited as USNM 337559. Large female *O. septentrionalis* are not rare; I have examined females ≥100.0 mm across its geographic range. However, because clutch and egg size increase with an increase in body size in this species (Meshaka 1994. Unpubl. Ph.D. dissertation, Florida International Univ., Miami), gigantic females can greatly contribute to the colonization process as founders of new colonies such as at Sebring where the colony is unlikely to be older than five years.

Males are smaller than females in this species (Duellman and Schwartz 1958. Bull. Florida State Mus. 3:181–324; Meshaka, *op. cit.*) and are mature at 27.0 mm SVL (Meshaka, *op. cit.*). The maximum body size of males is reported to be 112.0 mm SVL from a skeleton of an individual that originated from Key West (Mittleman 1950. Herpetologica 6:20–24) but it lacks verification (Duellman and Crombie 1970. Cat. Amer. Amphib. Rept. 92.1–92.4; R. Crombie, pers. comm.). Records of 89.0 mm SVL (Conant 1975. A Field Guide to Reptiles and Amphibians of Eastern North America, 2nd ed., Houghton Mifflin Co., Boston, Massachusetts. 429 pp.) and 90.0 mm SVL (Conant and Collins, *op. cit.*) approximate the 3.5 inches SVL (88.9 mm) presented in both field guides (J. T. Collins, pers. comm.) and are similar to a preserved male of 88.5 mm SVL (Mittleman, *op. cit.*). Records of large males are noteworthy because of their rarity. From >1500 males I examined from Florida and the West Indies, only two individuals exceed 75.0 mm SVL. The first (85.0 mm SVL in 10% formalin) was collected on 16 July 1993 from a house in Lake Placid, Highlands Co., Florida, USA (USNMFS 217671). The second (83.0 mm SVL) was collected in January 1967 in Tabajo, Baracoa, Guantanamo, Cuba (no other data), and stored in the museum of Instituto de Ecologia y Systematica de Academia de Sciencia de Cuba, La Chata, Ciudad de Havana, Cuba. If the well-developed sexual dimorphism in body size is enforced in the ecology of males, then only unusual conditions would produce large males in the wild. In this regard, Mittleman's (*op. cit.*) 112 mm SVL record is at least plausible, even if exceedingly rare. I thank Luis Moreno, curator of reptiles and amphibians at La Chata, for kindly allowing me to examine specimens in June 1994.

Submitted by **WALTER E. MESHAKA, JR.**, Museum, Everglades National Park, 40001 SR-9336, Homestead, Florida 33034-6733, USA.

RANA CATESBEIANA (Bullfrog). **RECORD SIZE.** The largest *Rana catesbeiana* reported is 20.3 cm SVL (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America, Houghton Mifflin Co., Boston, Massachusetts. 450 pp.); the Oklahoma record is 17.8 cm (Black and Sievert 1991. A Field Guide to Amphibians of Oklahoma, Oklahoma Dept. Wildl. Cons., Oklahoma City). Here we report a new Oklahoma and North American record SVL for *R. catesbeiana*.

The female bullfrog was found by John Lake on 3 May 1995 along Bishop Creek in Norman, Cleveland Co., Oklahoma, USA (T9N, R2W, NE1/4 of SW1/4 Sec 32). Body mass and mean SVL were 908.6 g and 20.42 cm (SE = 0.06, N = 4). The SVL was measured from the tip of the snout to the posterior edge of the vent with the frog placed on its back. The mean SVL was determined from independent measurements by four herpetologists. This reduced possible biases in individual measuring techniques and provided a measure of dispersion (standard error) for SVL. All measurements were made to the nearest millimeter with large calipers.



FIG. 1. Record-sized *Rana catesbeiana* from Cleveland Co., Oklahoma.

Body size >20 cm SVL in *R. catesbeiana* is rare. The largest of 2000 bullfrogs from an introduced population in southeastern Arizona measured 20.1 cm SVL and ca. 800 g (C. Schwalbe, pers. comm.). Such body size in natural populations may be more rare. Lance Fontenot (pers. comm.) sampled bullfrog populations from Louisiana and South Carolina and found maximum SVL of 18.1 (N = 70) and 15.9 (N = 79) cm, respectively. Howard (1981. Ecology 62:303–310) measured 283 bullfrogs in Michigan over a four-year period and observed a maximum SVL of 17.2 cm. A study in Missouri (where bullfrogs may be morphologically more similar to Oklahoma populations than those from Michigan) showed a maximum SVL <18.0 cm for 288 individuals (Moyle 1952. M.S. Thesis, University of Missouri, Columbia).

The frog is being maintained on live exhibit; upon death the specimen and a photograph (Fig. 1) will be deposited in the her-

petological collection of the Oklahoma Museum of Natural History (OMNH, collector's number VHH-95-001).

We thank Katie Meier and Dick Durtsche for their measurements of SVL, Coral McCallister-Blanchard for photo processing, and John Lake for donating the specimen to the University of Oklahoma.

Submitted by **WILLIAM I. LUTTERSCHMIDT, GLENN A. MARVIN**, and **VICTOR H. HUTCHISON**, Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA.

RANA CATESBEIANA (Bullfrog). **PREDATION.** The diet of *Dolomedes triton*, the six-spotted fishing spider, includes many insects and small fish (Carico 1973. Bull. Comp. Zool. 144(7):435–488), but the inclusion of *Rana* tadpoles in the diet of these spiders has not been widely documented. Of 625 prey items identified by Zimmermann and Spence (1989. Oecologia 80:187–194) only one was an amphibian (female spider, *Rana sylvatica* tadpole). In lab studies (Bleckmann and Lotz 1987. Anim. Behav. 35:641–651), *D. triton* was observed capturing *Bufo bufo* tadpoles and juvenile *Xenopus laevis* (2–3 cm SVL).

On 24 May 1994, between 2100 and 2230 h, a gravid female *D. triton* was captured in the process of feeding on a *R. catesbeiana* tadpole at a small farm pond 3 mi. S. of Jacksonville, and 1 mi. E. of AL Hwy 21 on Longshore Drive, Calhoun Co., Alabama, USA. The spider was hanging from a partially submerged metal structure by the hindmost pair of legs, while grasping the tadpole at the water's surface with the two anterior pairs of legs. The tadpole was ca. 60 mm TL. The tadpole had well developed hind legs but no visible forelimbs. The cephalic region of the tadpole was necrotic, presumably indicating the point of attack.

Because *D. triton* feeds on small fish and insects it seems logical that it would also include tadpoles as part of its diet. The importance of tadpoles to the diet of *D. triton* is not known. The only records of *D. triton* predation on ranids have been by females which may indicate that due to sexual size dimorphism only females are large enough to include *Rana* tadpoles in their diet.

Submitted by **C. PAUL ROGERS**, Department of Biology, Jacksonville State University, Jacksonville, Alabama 36265-9982, USA.

RANA PRETIOSA (Spotted Frog). **PREDATION.** The distribution and abundance of *Rana pretiosa* have declined sufficiently throughout the southern extent of its range to warrant listing under the U.S. Endangered Species Act as a Candidate 1 species (Fed. Reg. 1994). Most remaining populations of *R. pretiosa* in the southern portion of its range (e.g., the Great Basin) are small and isolated. Therefore predation, although a natural factor and unlikely to have induced the observed declines, could be a serious threat to the persistence of this species in the region. This note documents predation on *R. pretiosa* by the wandering garter snake, *Thamnophis elegans vagrans*.

More than 100 h of observations of *R. pretiosa* behavior were made between 21 June and 10 August 1994 at a 400 m early seral stage meadow/spring complex consisting of 17 distinct pools along a permanent creek in the Toiyabe National Forest, Nye Co., Nevada, USA. The pools ranged in length from 3.1–22.8 m, width from 1.2–3.3 m, and depth from 0.1–0.6 m. The pools were 60–90% covered in rooted vegetation (e.g., *Potamogeton foliosis* and *Ranunculus aquaticus*) and contained dense populations of native fish (e.g., *Rhinichthys osculus* and *Catostomus tahoensis*). Cattle moved through the site, grazing heavily for a period of less than one week during the observation period. *Rana pretiosa* density (3.4 frogs/m^2) at this site is the greatest known in Nevada. The density of *T. e. vagrans* was estimated at 0.2 snakes/m^2. Snakes (19.5–51.0 cm SVL, 26.1–69.3 cm TL) were always present at the site during diurnal visits and appeared to be hunting consistently. On 21 June 1994 at 0745 h, JKR observed a *T. e. vagrans*, ca. 65 cm TL, in the process of consuming a *R. pretiosa*, ca. 5.0 cm SVL. The frog was totally consumed in five minutes and the snake seemed little alarmed by human presence. On 26 July 1994 at 0900 h (air 30°C, water 13°C) we found a dying male frog (5.0 cm SVL, 9.5 g) spread out on floating vegetation at the edge of a pool. The frog's right rear leg was dislocated and had multiple fractures. The frog died within moments of observation. The conjecture that injury was caused by snake attack is supported by another observation, made at a different pool later that same morning. At 1147 h (air 35°C, water 15°C) we observed the tail of a submerged snake twisting and thrashing through vegetation at the water surface. Close examination revealed that the snake had a medium-sized frog by one rear leg and was rapidly spinning itself and the frog. Unfortunately, the snake was startled and released the frog. Both were caught and measured. The snake measured 27 cm SVL, 38 cm TL, 16 g; and the frog, a male, measured 4.0 cm SVL, 7.5 g.

Several other potential predators of frogs (e.g., common raven, black-crowned night heron, badger, and coyote) occurred at, or were observed within range of, the site but were never seen hunting frogs either during diurnal or nocturnal observation periods. The absence of introduced trout at this site may be a significant factor in the frog population's persistence; historical frog locations in nearby drainages now stocked with fish apparently support few or no frogs.

A three-year study of *R. pretiosa* in progress at this site indicates that mortality of young individuals is high (RED and JKR, in prep.). Based on our observations, snake predation is likely the most significant cause of natural mortality, both directly through consumption and indirectly through attack-invoked injury. Because the frog population at this site is likely the source for subpopulations under favorable dispersal conditions and is one of very few sources for individuals if regional reintroduction programs are established, high mortality deserves special concern, even if the causative agents are natural.

Funding for studies of the spotted frog in Nevada was provided to JKR through a Stanford University Department of Biological Sciences Graduate Research Fellowship and to RED through Stanford University Undergraduate Research Opportunities. We thank the Toiyabe National Forest for permitting research at this site and the Nevada Biodiversity Initiative for logistical support. We are grateful to Alan E. Launer for commenting on the manuscript.

Submitted by **JAMIE KRISTINE REASER** and **ROBERT ELIAS DEXTER**, Center for Conservation Biology, Department of Biological Sciences, Stanford, California 94305, USA.

CAUDATA

EURYCEA CIRRIGERA (Southern Two-lined Salamander). **NEST SITE.** *Eurycea cirrigera* prefers to attach its eggs to the undersurface of submerged rocks, logs, and aquatic plants (Mount 1975. The Reptiles and Amphibians of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama, 347 pp.) in fast flowing wa-

ter (Martof et al. 1980. Amphibians and Reptiles of the Carolinas and Virginia. Univ. of North Carolina Press. Chapel Hill, 264 pp.). During April and May of 1995 in Poplar Cove Spring at the University of Mississippi Biological Field Station in Lafayette Co., Mississippi, USA, seven clutches of *E. cirrigera* eggs (mean = 53 eggs/clutch) were found, each with an attending female. Three of these clutches (mean = 67 eggs/clutch) were typically attached to the undersurface of a log in fast flowing (mean flow rate = 0.168 m/sec), highly oxygenated (approximately 8.0 ppm 0_2) water at 15°C. In contrast, the other four clutches (mean = 43 eggs/clutch) were found buried and unattached to a substrate in detrital sediment of low oxygen concentration (approximately 3.0 ppm 0_2). These latter clutches were buried just below the sediment surface under ca. 0.02 m of slow flowing (mean flow rate = 0.024 m/sec) water at 18°C. This nest site location and lack of ova attachment is atypical for this species. The distinct differences in nest site selection among females at this site may reflect alternative reproductive strategies, which may result in developmental and life history traits not previously considered for this species.

I thank R. Austin, R. Holberton, F. Zaidan (Univ. of Mississippi), and S. Marshall for their assistance in preparing this note.

Submitted by **JEREMY L. MARSHALL,** Biology Department, University of Mississippi, University, Mississippi 38677, USA.

TESTUDINES

CARETTA CARETTA (Loggerhead Sea Turtle). **NESTING FREQUENCY**. For loggerhead sea turtles, a record number of seven nests in one season has been observed twice in Georgia (Lenarz et al. 1981. Herpetol. Rev. 12:9; J. I. Richardson, pers. comm.). These events occurred in 1979 and 1990.

On both the east and west coasts of Florida, USA, the most nests reported for a loggerhead during a nesting season has been six (Dodd 1988. Synopsis of the Biological Data on the Loggerhead Sea Turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wild. Serv. Biol. Rept. 88(4) 110 pp.; LeBuff 1990. The Loggerhead Sea Turtle in the Eastern Gulf of Mexico. Caretta Res., Inc. Sanibel, Florida. 216 pp.). On Key Island, located south of Naples, on Florida's southwest coast, seven nests were documented for two individual turtles (tagged PPV921 and QQN240) in 1991 and 1992 (Table 1).

From 1985 to 1994, 207 multiple nesting loggerheads were observed on Key Island. Internesting periods of 10 and 11 days were the most frequently recorded intervals. Of the 472 internesting intervals recorded (range = 9–70 days), 36% were 10 or 11 days. Most longer intervals are probably due to the fact that only 5.9 km of the entire 12 km length of the island is patrolled nightly. Consequently, many turtles with internesting intervals between 18 and 70 days (N = 151) may not have been seen when they returned to nest on this beach or an adjacent one. Hence, the actual percentage of 10 and 11 day intervals is probably higher than 36%.

As 10 and 11 day intervals occur frequently, it is possible that PPV921 may have nested eight times in 1991. Similarly, QQE490 and QQE502 may have nested seven times (Table 1). QQE502's last observed nesting was on 17 July, a month prior to the end of the nesting season on this coast. Although only two nests were recorded for PPJ735 and PPJ780, the intervals between nests were within the 74–66 day range of the other turtles which were observed or suspected to have nested seven times. Thus, these turtles could have nested other times without our knowledge.

This report documents seven nests in a season by loggerhead sea turtles on the southwest coast of Florida. The data also suggest that, while seven nests in one season by loggerheads is certainly not a common event, such occurrences may be more frequent than existing records indicate.

TABLE 1. Nesting intervals and dates for Key Island loggerheads.

Tag no.	First nest	Intervals	Last nest	Days	Nests
PPV921	20 May 1991	13,12,10,9,9,21	2 Aug	74	7
QQN240	15 May 1992	14,12,11,11,9,11	22 July	68	7
QQE490	16 May 1991	14,12,21,9,10	21 July	66	6
QQE502	22 May 1994	13,11,10,10,12	17 July	57	6
QQE531	23 May 1991	12,22,20,14	29 July	68	5
PPJ735	16 May 1992	70	31 July	70	2
PPJ780	26 May 1992	66	31 July	66	2

I thank my predecessor, Ron Mezich, for keeping accurate records in the early years and to approximately 40 interns whose efforts over the years have made the Key Island monitoring project possible. I also appreciate James I. Richardson's advice and comments.

Submitted by **DAVID S. ADDISON**, Environmental Protection Division, The Conservancy, 1450 Merrihue Drive, Naples, Florida 33942, USA.

HYDROMEDUSA MAXIMILIANI (Maximilian's Snake-necked Turtle). **EPIZOIC COMMENSAL.** Two specimens of the South American chelid turtle *Hydromedusa maximiliani* in the collection of the United States National Museum of Natural History (USNM) were found to have clusters of temnocephalid turbellarian worms (Platyhelminthes: Turbellaria: Temnocephalida) and their encapsulated eggs attached to their shells. The first specimen (USNM 208284), collected 29 December 1977 at Reserva Biologica Nova Lombardia near Santa Teresa, Espirito Santo State, Brazil by Ronald I. Crombie, Maria C. Duchene, W. Ronald Heyer, and Francisca C. do Val, had clusters of encapsulated eggs attached to the anterior surface of the right bridge and the underside of the adjacent fifth marginal and on both femoral scutes. The second specimen (USNM 208681), collected 13 December 1977 2 km NE of Alto do Soberbo near Teresopolis, Rio de Janeiro State, Brazil by Crombie, Duchene, and Heyer, had adult worms attached to both bridges and dense clusters of eggs widely distributed on all posterior plastron scutes. Absence of worms on the dorsal surface of the carapace may be possibly explained by the species' habits of basking and traveling overland. Both turtles were taken from streams in primary forest between 1930 and 2200 h.

Temnocephalids compose an order of tropical and subtropical, freshwater, ectocommensal or parasitic, tentacled, flatworms that usually encapsulate on the exoskeletons of crustaceans or the shells of mollusks, but have been occasionally found attached to the shells of turtles (Barnes 1987. Invertebrate Zoology, 5th ed., Saunders College Publ., Philadelphia, Pennsylvania, 893 pp.). *Temnocephala brevicornis* has been previously found on a South American snake-necked turtle, *Hydromedusa tectifera*, from Uruguay (Cordero 1946. Com. Zool. Mus. Hist. Nat. Montevideo

2[34]:1–12). The worms attached to the two *H. maximiliani* also appear to be *T. brevicornis*, representing a new host record for the worm. The only other epizoic commensal reported from this turtle genus was the barnacle *Balanus improvisus* from an Argentine *H. tectifera* (Frazier 1986. Proc. Biol. Soc. Washington 99:472–477).

We thank Ronald I. Crombie for calling our attention to the infested turtles, and W. Ronald Heyer for permission to examine them and his field notes.

Submitted by **CARL H. ERNST,** Department of Biology, George Mason University, Fairfax, Virginia 22030, USA, and **JEFFREY E. LOVICH**, National Biological Service, Palm Springs Field Station, 63-500 Garnet Avenue, P.O. Box 2000, North Palm Springs, California 92258-2000, USA.

MALACLEMYS TERRAPIN TERRAPIN (Northern Diamondback Terrapin). **REPRODUCTION** and **NEST PREDATION.** Information on clutch size and rate of nest predation of northern diamondback terrapins along the Connecticut and New York coasts of Long Island Sound has been limited to infrequent observations of small samples of isolated individuals. Klemens (1993. Amphibians and Reptiles of Connecticut and Adjacent Regions. State Geol. Nat. Hist. Surv. Connecticut Bull. 112:1–318) reported a diamondback terrapin collected from Fairfield, Connecticut, USA containing 12 eggs, a nest in Westport, Connecticut containing 13 eggs, three clutches in Rye, New York containing 8, 11, and 15 eggs, and eleven clutches from the Jamaica Bay Wildlife Refuge, New York with a mean clutch size of 14.9 eggs.

During a population study of *Malaclemys terrapin terrapin* in 1994, a relatively large nesting site was discovered adjacent to a tidal creek along the Neck River in Madison, Connecticut. The nests were concentrated in a flat, sandy area (30 x 100 m) approximately 10 m from the creek. Sparse vegetative cover consisted of several bayberry bushes (*Myrica pennsylvanica*), poison ivy (*Rhus radicans*), and beach grass (*Ammophila breviligulata*). The area was bordered by a large expanse of *Spartina* salt marsh. Ten female *M. t. terrapin* were captured and measured during the 1993–1994 nesting seasons [mean carapace length (SLC) = 183.1 mm; SD = 7.43, mean plastron length (SLP) = 164.6 mm; SD = 7.14]. Maximum nesting activity was observed at high tide during the early daylight hours of 1–5 July 1994. From 1–31 July 1994, 33 nests were located. Clutch sizes were determined by excavating nests and counting eggs, and counting shells from nests opened by predators. Clutches ranged from 4 to 16 eggs with a mean clutch size of 9.6 (N = 33; SD = 3.58). Predators destroyed the entire clutch in each of the 33 nests (316 eggs). Numerous footprints throughout the area and bite patterns in the egg shells suggested that raccoons (*Procyon lotor*) were the only predators. They exhumed all eggs from each nest, consumed the contents, and discarded the shells within a few centimeters of the nest hole, often in a neat pile.

The observed mean clutch size (mean = 9.6) of this Connecticut population is similar to the mean clutch size (mean = 9.2, N = 237) reported by Burger (1977. Am. Midl. Nat. 97: 444–464) in a two-year study of a population of *M. t. terrapin* along the southern coast of New Jersey. Clutch sizes have been reported to be slightly lower in the southern subspecies. Hildebrand (1932. Zoologica. 9:551–563) noted that the "usual number" of eggs laid at one time by *M. t. centrata* x *M. t. terrapin* in captivity was eight. Burns and Williams (1972. J. Herpetol. 6:238–239) found that captive *M. t. pileata* produced a mean clutch size of 8.5 (N = 11) in Louisiana. Seigel (1980. Trans. Kansas Acad. Sci. 83:239–246) reported a mean clutch size of 6.7 (N = 14) for a population of *M. t. tequesta* on the Atlantic coast of Florida. The present findings in Connecticut provide further evidence that the diamondback terrapin produces larger average clutch sizes in the northern part of its range.

Field work was performed by Matthew Aresco, Marcy Klattenberg, and Beth Lapin. This study was supported by a grant from the Phillips Petroleum Environmental Partnership (PEP).

Submitted by **MATTHEW J. ARESCO,** Department of Zoology and Wildlife Science, Auburn University, Alabama 36849-5414, USA.

PODOCNEMIS UNIFILIS (Yellow-headed Sideneck). **NESTING.** *Podocnemis unifilis* is a medium to large pelomedusid turtle widely distributed throughout the Orinoco and Amazon River basins in South America. The species is of considerable importance as human food during the dry season, with both eggs and turtles being consumed or sold in large quantities throughout the species' range (Johns 1987. Oryx 21:25–28; Mittermeier 1978. Oryx 14:222–230). Commonly referred to as the tracajá in Brazil, nests of this species have been widely reported as shallow holes dug in sandy or loamy substrates along rivers and streams (Foote 1978. Herpetologica 34:333–339; Thorbjarnarson et al. 1993. J. Herpetol. 27:344–347).

Tracajá are known to inhabit streams and lakes in flooded forest, or *várzea*, in the Brazilian Amazon, including in the Mamirauá Ecological Station (MES), Amazonas, Brazil, located 30 km upstream of the town of Tefé. The MES consists of extensive lake and marsh habitat interspersed with forest (low and high *restinga* forest) in a broad floodplain at the confluence of the Amazon (Solimoes) and Japura Rivers (Ayres 1993. As Matas de Várzea do Mamirauá. CNPq, Brasilia. 123 pp.). Tracajá are known to inhabit regions of extensive *várzea*, but were tacitly assumed to migrate into riverine habitats for nesting in sandy beach substrates.

On 28 September 1994, while searching for nests of black caiman (*Melanosuchus niger*), we located a nest of *P. unifilis* on a floating mat of vegetation and organic matter (Fig. 1) in a small lake (Lago Sanguesuga; S 02° 58.96', W 64° 55.57') within the MES. The nest was made in organic soil composed principally of partly decomposed leaves, in the elevated root mat of a fallen tree (*Symmeria paniculata*; Polygonaceae; "Carauaçu"). The water level of the lake had fallen so that the organic mat, which would float during periods of high water, was resting on the lake bottom. The nest was found approximately one month before the average annual minimum water level is attained at MES.

The nest cavity was 65 cm above the bottom of the organic mat, but 15 cm below the mat's highest point, and had been recently opened by a predator (probably *Tupinambis nigropunctatus*). Three eggs remained in the nest cavity, and the remains of 19 others were scattered up to 5 m from the nest. The mean size of the three entire eggs was: 3.83 cm (length), 3.04 cm (diam), and 20.9 g. All three eggs in the nest cavity were opaque on their upper halves, translucent below, suggesting that they had been laid within two weeks of our finding them. The nest cavity was 17 cm deep and 13 cm wide.

According to a local informant (Sr. Revolver, pers. comm.), it is not unusual for tracajá to nest in similar substrates within the *várzea*. However, the sympatric *P. sextuberculata* and *P. expansa* were reported to always nest in sandy beaches along rivers. *Peltocephalus dumerilianus*, which lay much larger eggs (Pritchard and Trebbau 1984. The Turtles of Venezuela. SSAR Contrib. Herpetol. 2:1–403), are also reported to use fallen tree root mats

as nesting sites in flooded forest habitats (Medem 1983. Lozania 41:1–12.).

We thank M. Ayres for providing us with the opportunity to work in the Mamirauá Ecological Station, and Sr. Revolver for his work as a guide and assistant. Funding for the work was provided by CNPq, the British Overseas Development Agency (ODA), WWF-England, and the Wildlife Conservation Society.



FIG. 1. Nest site of *Podocnemis unifilis* in the root mat of a fallen tree. Remains of one egg sit atop the root mat. The opened nest cavity is just below and to the left of the egg.

Submitted by **JOHN B. THORBJARNARSON,** Wildlife Conservation Society, Bronx, New York 10460, USA, and **RONIS DA SILVEIRA,** Sociedad Civil de Mamirauá, Tefé, Amazonas, Brazil.

TERRAPENE CAROLINA CAROLINA (Eastern Box Turtle). **HABITAT.** On 3 September 1994 at Buckeye Creek Cave in Greenbrier Co., West Virginia, USA, we discovered an adult *Terrapene c. carolina* 75 m in from the cave entrance (measured from the large boulder just inside the cave). The turtle was observed on the edge of the cave stream, facing away from the stream with the posterior edge of the carapace and hind legs slightly submerged. We photographed the turtle to document its occurrence in the cave, but did not handle it or determine the sex. One photograph was deposited in the Ohio State University Museum of Biological Diversity Vertebrate Collections and another was sent to the West Virginia Department of Natural Resources. The turtle may have crawled, swam, or washed into the cave at the main entrance where the stream enters the cave and is shallow and cobble-strewn. A detailed description of Buckeye Creek Cave can be found in Dasher and Balfour (1994. West Virginia Speleological Survey Bulletin 12. 236 pp.).

Our account of *T. c. carolina* in Buckeye Creek Cave appears to be the first for this species, as well as for any turtle, in a West Virginia cave. Garton et al. (1993. West Virginia Speleological Survey Bulletin 11. 107 pp.) reported no occurrences for any turtles in West Virginia caves; however, Dearolf (1956. Proc. Pennsylvania Acad. Sci. 30:201–210) listed *T. c. carolina* from a Tennessee cave. Considering the lack of records for box turtles in caves and the time of year we made the observation, this box turtle occurrence should be considered accidental, but it does add *Terrapene c. carolina* to the Buckeye Creek Cave fauna.

We thank J. Condit for loaning us literature, G. Turner for kindly allowing us access to the cave, J. D. Williams and E. R. Garton for providing information about Buckeye Creek Cave, D. L. Claussen for providing a reprint concerning hibernation, and two anonymous reviewers for making helpful comments.

Submitted by **WILLIAM J. POLY**, Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901-6501, USA, and **ROBERT A. NOGGLE**, Department of Philosophy, Florida International University, North Miami, Florida 33181, USA.

LACERTILIA

ANOLIS CAROLINENSIS CAROLINENSIS (Green Anole). **NECTAR FEEDING.** During the summer and fall of 1994 two different types of hummingbird feeders were maintained at my home. I noted that one of the feeders was frequented by green anoles which are common in my yard whereas the other was not, even though both were on an outdoor patio ca. 3 m apart with the same "nectar" used in both. Upon close, quiet observations the anoles were seen to drink the nectar. On three occasions the red nectar was observed on the jaws of the anoles. At least three different anoles frequented the feeder. The placement of the feeders was switched and the anoles switched with them inasmuch as both were easily accessible by the same routes. Feeder use by anoles corresponded to feeder shape: a flower-shaped feeder was frequented while a flat feeder with holes was avoided. Bartlett (1995. Reptiles 2(5):48–65) stated that though "the green anole is primarily an insectivorous species, it may lap at nectar, pollen and tree sap, and may even consume an occasional brightly colored flower petal." To my knowledge, nectar feeding by anoles from hummingbird feeders has not been reported.

Submitted by **ERNEST A. LINER,** 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

CHAMAELEO CHAMAELEON (Common Chameleon). **DIET.** The common chameleon is broadly distributed in the southern regions of the Mediterranean basin (Hoofien 1964. Israel J. Zool. 13(2):136–138; Pasteur and Bons 1960. Trav. Inst. Sci. cherif. 21:1–132; Werner 1971. Bull. Brit. Mus. (Nat. Hist.) 21(2):213–256), but it has been introduced in several other geographic regions, including Portugal, Canary Islands, Sicily, and Malta (Bruno 1986. Tartarughe e sauri d'Italia. Giunti editore, Milano, 255 pp.). On Malta Island the species was introduced some 100 years ago, and its scattered populations are endangered mainly because of unrestricted collection for the pet trade (Corbett 1989. Conserva-

tion of European Amphibians and Reptiles. Cristopher Helm, London, 274 pp.). Biological data on chameleon populations from Malta are lacking and this note provides information on the food habits of this introduced taxon.

Data were obtained from free-ranging specimens captured during two seven-day surveys in June 1994 and late August 1994. Additional information came from field observations (U. Agrimi, Istituto Superiore di Sanità, Rome) during August 1990 in the same area where our research was carried out. All observations were made in the vicinity of Sliema, one of the main towns of Malta Island. The study site was a dry and sunny grassy area with patches of stone and acacia bushes. The chameleons were relatively common, and often climbed about 1 m above the ground. To study their diet, we collected fecal pellets of chameleons held in small cages until defecation. We did not collect feces from the environment. Feces were examined under a dissecting microscope and prey items were identified to the lowest taxon possible.

Table 1 summarizes the dietary data obtained during this study. Feces from 34 chameleons (18 males, 12 females, and 4 young) were collected, while stomach contents of two males, one female, and one juvenile found killed by cars provided additional prey items. Therefore, data given here include prey from both feces and stomach contents. The great majority (87.9%) of the 58 prey items identified were arthropods. Orthoptera and Cicadidae were the most frequently consumed prey. Small individuals of these prey taxa were the only prey observed in young chameleons (specimens <60 mm SVL). Juveniles and subadults of the Maltese lizard *Podarcis filfolensis* were occasionally preyed on by adult chameleons (especially by males).

We thank Umberto Agrimi who provided us with very useful information about chameleons in his care and showed us the study area. An earlier draft of this manuscript was critically reviewed and improved by Massimo Capula and Lee A. Fitzgerald.

TABLE 1. Prey items consumed by *Chamaeleo chamaeleon* around Sliema, Malta Island. Data were obtained from analysis of fecal pellets from 34 individuals and dissection of stomachs from 4 specimens found dead in the field.

Prey Type	Number in feces	Number in stomachs
Reptilia		
Podarcis filfolensis	6	2
Arthropoda		
Dermaptera	2	—
Orthoptera	13	1
Cicadidae	25	3
Cimicomorpha	3	—
Lepidoptera	4	—

Submitted by **LUCA LUISELLI**, Department of Animal and Human Biology, The University "La Sapienza," via Alfonso Borelli 50, I-00161 Rome, Italy, and **LORENZO RUGIERO**, via Domenico Cimarosa 13, I-00198 Rome, Italy.

EUMECES FASCIATUS (Five-lined Skink). **ENTRAPMENT.** On 1 August 1994, we found a hatchling *E. fasciatus* (0.264 g; 2.4 cm SVL length; 3.7 cm TL) dangling from a spider's web on the US 70 bridge over 2nd Creek, Rowan County, North Carolina, USA. The web was triangular and measured 16 x 8 cm. The lizard was alive, but unable to escape. Silk was tightly wrapped around it preventing free movement even after the lizard was removed (Fig. 1). Approximately 1.0 cm of the lizard's tail was broken and was wrapped separately in the web. The lizard was emaciated and its belly was dark brown, probably due to overexposure to the sun. Our best guess was that it had been trapped in the web for no more than a day. A mature male spider (Theriididae: *Achaeranea*) with a body length (tip of abdomen to tip of cephalothorax) of 3 mm and leg length (Leg I) of 14 mm was found in the web about 2.0 cm from the hatchling.

Comb-footed and widow spiders (Family Theriididae) are known to prey on small lizards (Blondheim and Werner 1989. Brit. Herpetol. Soc. Bull. 30:26–28; McCormick and Polis 1982. Biol. Rev. 57:29–58; Neill 1948. Herpetologica 4:158; D. Formanowicz, pers. comm.); this is the first record of *E. fasciatus* as a victim. Because hatchling lizards are small, they easily may be trapped in spider webs, which are not only extremely strong and adhesive, but are also placed in locations where lizards are apt to run or fall. Once caught, struggling further entangles the lizard, making escape nearly impossible. In this case, the nearby spider could not have captured the lizard because mature male *Achaeranea* do not construct webs, but it still could have eaten the lizard.

We thank James Wagner for identifying the spider and E. D. Brodie III for his helpful comments.

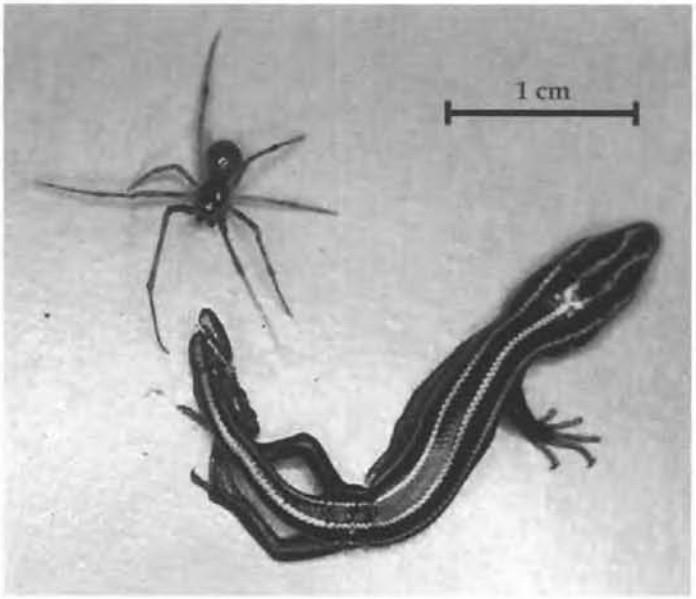


FIG. 1. The entrapped skink and the nearby male spider. The lizard's hind limbs and left forelimb are immobilized, held in place by silk wrapped around its body and tail. The distal portion of the tail is broken off and bound by silk to the rest of the tail.

Submitted by **STEPHANIE M. WELTER**, Center for Ecology, Evolution, and Behavior, University of Kentucky, 101 T. H. Morgan Building, Lexington, Kentucky 40506-0225, USA, and **JOHN E. FAUTH**, Department of Biology, College of Charleston, 66 George Street, Charleston, South Carolina 29424-0001, USA.

PACHYDACTYLUS BIBRONII (Bibron's Gecko). **PREDATION.** Seven left dentaries, seven right dentaries (maximum length 16.04 mm), two left maxillae, four right maxillae (maximum length 13.63 mm), and a single frontal bone (11.01 mm length, 11.14 mm across parietal border) belonging to a minimum of seven large gekkonid lizards were recovered from disso-

ciated pellets of the Cape eagle owl, *Bubo capensis*. Pellets were collected by W. R. Branch and D. Vlok on 8 April 1994 beneath a roost among large jumbled granite boulders at the base of the Ploegberg, Richtersveld National Park, Northern Cape Province, South Africa. Patterns of skin coosification on the frontal and on the prefrontal process of the maxillae allowed determination of at least these elements to species. Some dentaries, however, could also belong to the very similar species *Pachydactylus laevigatus*, which occurs in sympatry with *P. bibronii* throughout large portions of the Northern Cape and western Namibia. All of the elements measured appear to be from adult geckos, and the largest bones are comparable with those of animals >100 mm SVL. Twelve fragmented small mammal skulls were also recovered from the pellets. This species of owl is typically a hunter of mammals (Maclean 1985. Robert's Birds of Southern Africa, 5th ed. John Voelcker Bird Book Fund, Cape Town. 848 pp.), and lizards have rarely been recorded from its diet (Gargett and Grobler 1976. Arnoldia (Rhodesia) 8(7):1-7). This appears to be the first confirmed record of *P. bibronii* in the diet of a South African owl.

Submitted by **AARON M. BAUER,** Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085-1699, USA, and **WILLIAM R. BRANCH**, Department of Herpetology, Port Elizabeth Museum, P.O. Box 13147, Humewood 6013, South Africa.

PHRYNOSOMA CORONATUM BLAINVILLII (San Diego Horned Lizard). **GROWTH**. *Phrynosoma coronatum blainvillii* were marked and released from April 1990 to October 1991 on two 1 ha study sites in southern California, USA. The first study site was located at TlS R3W S10 SW1/4 in Redlands, San Bernardino Co., and the second at T4S R4W S24 SW1/4 on the University of California's Motte Rimrock Reserve, Perris, Riverside Co. Recaptures of eight individuals (four adults and four hatchlings) permitted calculation of growth rates. Daily growth [reported in mm snout-vent length (SVL)/day] between recaptures was calculated for each individual then averaged for hatchlings and adults, separately. Individuals >75 mm SVL were considered adults, those between 75 mm and 50 mm SVL were considered juveniles, and <50 mm SVL were considered hatchlings.

Phrynosoma c. blainvillii hatched during a short period from late July to early August, and ranged from 27–31 mm SVL when first captured. One male hatchling was recaptured twice with an increase of 0.345 and 0.200 mm/day at 13 and 15 days between measurements, respectively. Another male hatchling was recaptured once (16 days between measurements) and grew 0.375 mm/day. Two female hatchlings were recaptured once, each with 13 days between measurements; one grew 0.0769 mm/day and the other 0.154 mm/day. Overall mean growth of hatchlings was 0.230 mm/day (SD = 0.133; N = 4). One hatchling measured 47 mm SVL on 1 October 1990 before its first winter.

Juvenile growth was not calculated because no individuals were recaptured. Two juveniles, however, were captured following what was thought to be their first winter: a male measuring 50 mm SVL was captured in February 1991 and a female measured 66 mm SVL in May 1990.

Mean growth for adult horned lizards was 0.105 mm/day (SD = 0.169; N = 4). One male was recaptured once 32 days after initial capture and grew 0.125 mm/day. Two other males were recaptured twice; one of these grew 0.493 and 0.0541 mm/day at 345 and 74 days between measurements, respectively, and the other was recaptured at 230 and 55 days between measurements with no measurable growth and growth of 0.127 mm/day, respectively. One female was recaptured three times during the study at 68, 324, and 49 days between measurements with growth of 0.0400 mm/day detected only during the first interval.

I thank B. H. Brattstrom for his many helpful discussions of the natural history of the San Diego homed lizard as well as his review of this manuscript. The California Department of Fish and Game kindly provided a Memorandum of Understanding (issued to BHB) to legally conduct research on *P. c. blainvillii.*

Submitted by **STEPHEN B. HAGER**, Department of Biological Science, California State University, Fullerton, Fullerton, California 92634, USA. Present Address: Department of Biology, New Mexico State University, Las Cruces, New Mexico 88003-0001, USA

PHRYNOSOMA CORONATUM BLAINVILLII (San Diego Horned Lizard). **CONSERVATION**. On 8 August 1994, while conducting surveys on Marine Corps Air Station (MCAS) El Toro, Orange Co., California, USA, I found a dead *Phrynosoma coronatum blainvillii* that apparently died of exposure or dehydration after the horns on its head became entangled in an erosion control blanket. The lizard pushed its head through the mesh of the blanket, but was unable to extricate itself or to continue through the mesh. The blanket was installed along the Foothill Transportation Corridor adjacent to the northeast border of MCAS El Toro. The installation of erosion control blankets is often required on slopes during and after construction projects. *Phrynosoma c. blainvillii* is a federal Category 2 species (being considered for listing as threatened or endangered under the Federal Endangered Species Act of 1973, as amended) and a California Species of Special Concern (California Department of Fish and Game designation) primarily due to loss of habitat throughout its historic range and planned development. The construction of linear transportation corridors through miles of horned lizard habitat may have a substantial impact on the populations of horned lizards in the vicinity. The placement of erosion control blankets along each side of these transportation corridors may act as an additional (if not more formidable) barrier to horned lizard movements. Considering the potential impact the use of erosion control blankets may have on *P. c. blainvillii,* it is recommended that alternative erosion control measures be assessed for feasibility along transportation corridors throughout the species' range.

I thank Barbara Wilson from MCAS El Toro for permitting me to disseminate this information and Thomas E. Olson for reviewing a draft of the manuscript.

Submitted by **BRIAN M. LEATHERMAN,** Dames and Moore, 6 Hutton Centre Drive, Suite 700, Santa Ana, California 92707, USA.

TROPIDURUS TORQUATUS (NCN). **HOME RANGE**. The home range of an individual is the area where it normally lives, excluding migrations, emigrations, or unusual erratic wanderings (Brown and Orians 1970. Ann. Rev. Ecol. Syst. 1:183–199). *Tropidurus torquatus* is a terrestrial, heliophilous lizard, abundant in "Restinga" environments in southeastern Brazil. Here, I present home range data for this species. I conducted this study in July 1993 at the Reserva Florestal da Companhia Vale do Rio Doce (19°10'S; 40°00'W, 50 m elev., 1500 mm annual rainfall),

Linhares municipality, Espirito Santo State, Brazil. *Tropidurus torquatus* was studied in a habitat locally called "Nativo," characterized by white sandy soil, low sparse shrubs, and patches of bromeliads and grasses. Inside a 50 x 100 m study plot, the lizards were captured (pitfalls with drift fences and noosing), measured, sexed, marked with paint, and released at their original positions. Individual lizards were precisely located on the plot according to a system of X,Y coordinates. To locate marked individuals I slowly walked inside the plot searching for them with binoculars. The positions of known lizards were marked with flags. To estimate home range I used the convex polygon method. I considered for analysis only those individuals with three or more positions.

Tropidurus torquatus showed sexual size dimorphism, with males being larger (mean = 71.6 ± 3.7 (SD) mm; N = 6) than females (mean = 58.2 ± 2.6 mm; N = 17) (t-test, t = 9.66; $p < 0.001$); similarly, males (mean = 15.0 ± 1.7 g; N = 6) were heavier than females (mean = 7.6 ± 1.3 g; N = 18) (t = 11.38; $p < 0.001$). Juveniles ranged in size from 30.7 to 62.1 mm (N = 39). The size of the home range of males was different from that of females and juveniles (ANOVA $F_{2,13} = 12.56$; $p = 0.001$). Males occupied larger areas (mean = 57.9 ± 18.0 m^2; N = 4) than females (mean = 11.8 ± 11.4 m^2; N = 6) (Tukey 46.07; $p = 0.001$) and juveniles (mean = 17.5 ± 16.3 m^2; N = 6) (Tukey 40.35; $p = 0.003$). Juveniles' home ranges were not significantly greater than those of females (Tukey 5.72; $p = 0.79$). The home range ratio (male/female) was 4.8.

Individuals of *T. torquatus* occupied fixed areas. The mean home range size of both sexes at this site was smaller than that known for other *Tropidurus* species (Stamps 1983. *In* R. B. Huey et al., eds., Lizard Ecology, pp. 169–204. Harvard Univ. Press, Cambridge, Massachusetts), but follows the pattern of males using larger areas than females. A voucher specimen from the population is housed at the Museu de História Natural da UNICAMP (ZUEC 1774).

I thank the Companhia Vale do Rio Doce and Fundação MB for logistic support, C. F. Rocha for suggestions on field methods and this note, and A. Teixeira for helping with data analysis. L. A. Fitzgerald and anonymous reviewers improved an earlier draft. CNPq provided financial support (Process -132314/92-4).

Submitted by **ARIOVALDO A. GIARETTA**, Departamento de Zoologia, Instituto de Biologia, Universidade Estadual de Campinas, 13081-970, Campinas, São Paulo, Brasil.

SERPENTES

CHIONACTIS OCCIPITALIS ANNULATA (Colorado Desert Shovelnose Snake). **PREDATION** and **DIURNAL ACTIVITY.** On 22 July 1984, 16.7 km east of the junction of Interstate 8 and Highway 98 and 0.3 km south of Highway 98, Imperial Co., California, USA in the Yuha Basin (NE 1/4 SEC 19, T17S, RIIE; 110 m elev.), Bruce Barry discovered two adult *Chionactis occipitalis* impaled on an ocotillo, the apparent prey of a loggerhead shrike (*Lanius ludovicianus*). The habitat at the site is characterized as creosote bush scrub. At the time of the observation (1048 h; air temperature 32°C) one snake appeared to have been recently killed and measured 39.4 cm total length and was impaled 3.5 cm behind the snout. The second individual was desiccated. Both snakes were impaled about two meters above the ground and found intact with no evidence of mutilation. The site was visited for nearly 1.5 h and shrikes were not seen in the vicinity at this time.

This record represents the first record of a passerine bird preying upon *C. occipitalis* and apparent mid-summer diurnal activity of *C. occipitalis*, or perhaps seasonal crepuscular hunting of the loggerhead shrike. Impaled nocturnal prey (scorpions and solpugids) have been observed in the desert of Baja California (Clark and Frohlich 1982. Pan-Pacific Ent. 58:164).

We thank Kent R. Beaman and Michael A. Patten for their helpful comments on the manuscript.

Submitted by **CLARK R. MAHRDT** and **BENJAMIN H. BANTA**, Southwest Biological Associates, 9847 Willow Lane, Escondido, California 92029, USA.

ELAPHE OBSOLETA OBSOLETA (Black Rat Snake). **FORAGING.** An observation of predation by a radio-tagged *E. o. obsoleta* on brown-headed nuthatch (*Sitta pusilla*) nestlings may help explain patterns of avian nest predation by semi-arboreal snakes and adaptive responses of breeding birds. On 29 May 1993 at 1500 h a female *E. o. obsoleta* (97 cm SVL) implanted with a motion-sensitive radio transmitter was located in a clearcut in the Ouachita National Forest, Arkansas, USA. The snake was beneath a log 1.5 m from a post oak (*Quercus stellata*) snag containing a cavity nest of *S. pusilla* 1.7 m above ground. The nest contained at least three nestlings nearly ready to fledge.

Adult nuthatches were making frequent feeding visits to the nest, when at 1603 h rain began, temperature fell 10°C, and the birds ceased their visits. At 1619 h the snake emerged and attempted to climb the snag, which was devoid of bark at its base and smooth to the touch. It abandoned the attempt after 30–45 s and retreated to the log.

At 2024 h (1 min past sunset) the snake attempted to climb the barkless portion of the snag, but descended after 7 min. It began another climb at 2034 h, struggling 3 min on the smooth surface and extending only 85 cm. At last it secured a grip on a slab of bark and moved upward. Upon reaching the cavity the snake ingested the nestlings, the posterior half of its body hanging outside the cavity. At 2131 h it emerged, climbed up 1.5 m, then descended to the ground. At 2234 h the snake was still moving. The next day at dawn the snake was located in grass 4.1 m from the snag. At 0940 h it began a move of 70 m, then entered a cavity 3 m high in a snag and remained there at least 27 h.

Our observation was typical in that most accounts of avian nest predation by *E. obsoleta* report predation on cavity-nesting species rather than open-nesters (Withgott 1994. M.S. thesis, Univ. Arkansas, Fayetteville. 147 pp.). In addition, *E. obsoleta* often attack nests in the latter part of the nestling stage (Neal et al. 1993. Wildl. Soc. Bull. 21:160–165; Withgott, *op. cit.*), a pattern also noted for *Pituophis melanoleucus* (Eichholz and Koenig 1992. Southwest. Nat. 37:293–298).

By climbing the nest snag at dusk, the snake we observed was able to avoid harassment by nuthatches defending the nest and was able to lessen its vulnerability to diurnal predators such as hawks.

The snake's difficulty gripping the snag's smooth, barkless surface is of interest. Had the entire trunk lacked bark, it seems likely the snake could not have reached the nest. Birds nesting in such smooth-surfaced snags may possess some degree of protection from predation by climbing snakes. Withgott (*op. cit.*) found in experiments with *E. o. obsoleta* that climbing ability decreased sharply with increasing trunk smoothness. Several woodpecker species at our study site preferred barkless snags as nest sites (Withgott, *op. cit.*). Such nest-site selection may be an adaptive response to the threat of nest predation by semi-arboreal snakes.

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Submitted by **JAMES H. WITHGOTT***, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA, and **CHARLES J. AMLANER**, Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809, USA. *Present address: Department of Ecology & Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

FARANCIA ABACURA (Mud Snake). **DEATH FEIGNING.** Incidents of death feigning have been reported for a number of snake species, including xenodontine colubrids (Carpenter and Ferguson 1977. *In* C. Gans and D. W. Tinkle (eds.), Biology of the Reptilia, Vol. 7. pp 335–554. Academic Press, New York; Gehlbach 1970. Herpetologica 26:24–34). Since those reviews, additional species have been reported to letisimulate (e.g., Tryon and Guese 1984. Herpetol. Rev. 15:108). Davis (1948. Copeia 1948:208–211) observed a juvenile *Farancia abacura* feign death in captivity and included the following description: "The specimen...when annoyed by poking or patting with the hand, persistently thrust its head under the coils of the body and elevated the tail...with the conspicuously colored underside uppermost. Additional molesting caused the snake to turn over on its back, thus exhibiting the entire brilliantly colored underside. The animal would lie quietly in this position...." Davis (*op. cit.*) noted that it was remarkable that death feigning had not been reported previously for *F. abacura*, especially by Meade (1946. Sci. Mon. 63:21–29), who apparently handled over one hundred individuals. Here we report observations of death feigning in *F. abacura* in captivity, and attempt to reveal why the behavior has not been observed in adults.

On 3 August 1994 a gravid female (SVL = 110.5 cm , mass = 611.2 g) *F. abacura* was captured (by RAF) following a heavy rain along the Pascagoula River near Vancleave, Mississippi, USA. We housed this snake until she deposited 24 eggs, 14 of which hatched in the laboratory 11–16 September. The eggs were placed in moist vermiculite and incubated at a constant temperature (30°C). On day 42 of incubation the snakes began to hatch, with the last snake hatching on day 47.

Shortly after emergence, gentle handling would cause the snakes to roll up their tails, as reported by Davis (*op. cit.*). If further provoked (e.g., when picked up, or when lightly tapped on the dorsum) the snakes would thrash once or twice, empty their cloacal contents, and turn over, remaining motionless (Fig. 2). If harassed while in this position, the snakes would often crawl away on their dorsum, keeping the brightly colored ventrum visible at all times. The snakes (mean = 17.54 ± 1.087 cm SVL, mean = 4.40 ± 0.841 g, N = 14) feigned death in a variety of positions, from curled up to relatively straight, and righted themselves within four minutes, if left alone. All 14 snakes were harassed at least once, and all feigned death.

Apparently, death feigning has not been observed in adult *F. abacura* (the individual Davis observed was 29.8 cm (TL). One of us (JSD) has captured and handled several adult *F. abacura* without inducing the behavior. We thus conclude that either (1) there is an ontogenetic loss in the behavior, or (2) the behavior is difficult to induce in adults. We tested these ideas in an attempt to explain the apparent absence of the behavior in adults.

The timely arrival of a road killed barred owl (*Strix varia*) prompted us to perform a mock predation event. Owls and hawks are ophiophagus (Earhart and Johnson 1970. Condor 72:251–264), and probably represent a significant threat to adult mud snakes.

The same adult female mud snake was placed on the floor of the laboratory. One of us held the owl over the snake, brushing the talons and feathers against the snake's dorsum. The action of the owl's talons were simulated by grabbing the snake repeatedly at mid-body and near the head. After approximately one minute of harassment, the snake everted its cloaca, discharging its contents on and around itself (Fig. 2). It then thrashed its tail, and began turning it over. Finally it made a tight coil with its head hidden, and twisted over on its back, exposing its entire ventral surface (Fig. 2). The snake remained motionless for several minutes. It may be worth noting that the juvenile snakes did not hide their heads, as did the adult.

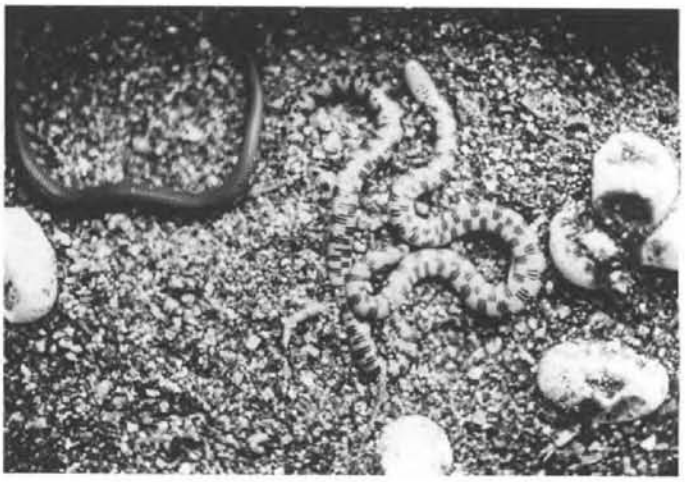


FIG. 1. Neonate *Farancia abacura* feigning death.

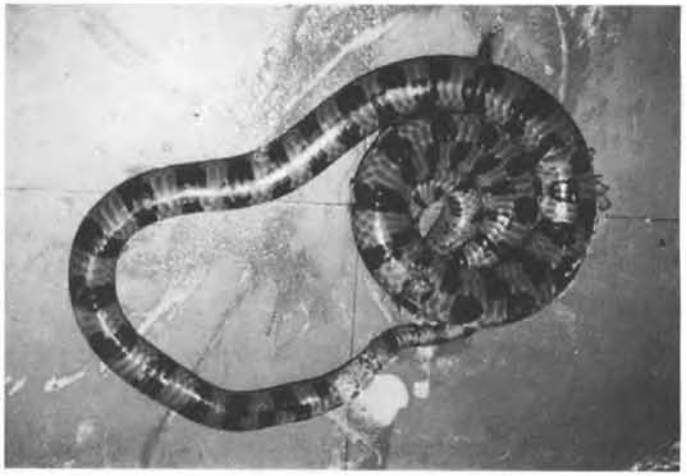


FIG. 2. Adult female *Farancia abacura* feigning death. Note the cloacal discharge.

Tryon and Guese (*op. cit.*) considered the failure of hatchling *Lampropeltis alterna* to death feign to be the result of an absence of odors or other natural stimuli from natural (versus unnatural) predators. To test whether or not the snake recognized the owl as a predator (i.e., by olfaction) or simply responded to increased molestation, the snake was harassed 3 days later by hand. Within one minute similar death feigning behavior resulted. Thus, we were able to confirm that death feigning can be induced in adult *F. abacura* without any specific olfactory cues. It appears that adult *F. abacura* require a greater degree of "molesting" than juvenile snakes based on this report, hence the lack of documented

death feignings induced by capturing and handling. It is possible that *F. abacura* does not perceive enough threat while enduring capture and passive handling to elicit the death feigning response.

Apparently, in several species of snakes known to feign death, only some individuals exhibit the behavior (Gelbach, *op. cit.*; Tryon and Guese, *op. cit.*), indicating the possibility that death feigning is a polymorphic trait. It should be noted that while all 14 provoked snakes in this study feigned death, they were full siblings, and thus represent a limited sample size. Additionally, death feigning in the adult female might be expected since her progeny possessed the behavior. The possibility remains that it is merely difficult to induce death feigning due to the lack of sufficient stress (e.g., as produced in attempted predation encounters) necessary to induce the behavior. Further manipulations involving more individuals under more natural conditions might help clarify whether this behavior is ubiquitous within the species.

Submitted by **J. SEAN DOODY, ROBERT J. BRAUMAN, JEANNE E. YOUNG,** and **RICCARDO A. FIORILLO**. Department of Biological Sciences, Southeastern Louisiana University, Box 814, Hammond, Louisiana 70402, USA.

LAMPROPELTIS TRIANGULUM NELSONI (Milk Snake). **PREDATION.** The majority of hawks feed mainly on birds, rodents, batrachians, reptiles, and insects (Bent 1961. Life History of North American Birds of Prey. Dove Publ., pp. 147–292). Records of predation by raptors on *Lampropeltis triangulum* are scarce (Williams 1988. Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*. Milwaukee Publ. Mus., 176 pp.).

On 2 February 1992 we observed a gray hawk (*Buteo nitidus*) on the banks of the Huaynamota River near Sabinos Ranch, 21°40'N, 104°33'W, 70 km N of the city of Tepic, Nayarit, México. The area is located in the foothills of the Sierra Madre Occidental, with a tropical deciduous forest and a hot dry climate. We observed the gray hawk with binoculars as it attempted to pick something up between two big rocks. Within two minutes it caught a small serpent and carried it to an 8 m tall tree, where it began to eat it. The gray hawk was shot by a local "huichol." We had the opportunity to dissect it, and found it had eaten a young *L. t. nelsoni*, 18 cm total length. The bird, a young male, was deposited in the Bird Collection (#18124) and the snake in the Herpetological Collection (#8140), both of the Instituto de Biología, UNAM, in México City.

We thank Gustavo Casas for the identification of the snake and comments on the manuscript, William López-Forment for revision of the manuscript in English, Alejandro Landín for his assistance in the field, and the helicopter service of the Comisión Federal de Electricidad (CEF) for transportation to the Huaynamota River.

Submitted by **MARCO A. GURROLA-HIDALGO** and **NOEMI CHAVEZ C.**, Escuela de Ciencias UAEM, Instituto de Biología UNAM, Depto. de Zoología, Apdo. Postal 70-153, CP 04510, México, D.F., México.

NERODIA ERYTHROGASTER TRANSVERSA (Blotched Water Snake). **REPRODUCTION.** On 25 August 1994, Colorado River Municipal Water District (CRMWD) personnel set minnow traps along the shoreline adjacent to the emergency spillway at Ballinger Municipal Lake (BML), formerly Lake Moonen, Runnels Co., Texas, USA. On 26 August, between 0900 and 0930 h, three *Nerodia erythrogaster* were captured [2 adults (male and female), 1 juvenile]. The adult female was gravid and estimated by palpation to contain 15 embryos. We retained the snake for observation.

Between 0845 and 0930 h on 17 September 1994, the female (SVL 866 mm, tail 170+ mm, mass 350 9) gave birth to 14 neonates and four infertile masses. Litter sizes are 5–25 for this species (Barton 1948. Herpetologica 4:198; Conant 1949. Copeia 1949:1–15; Diener 1957. Herpetologica 13:202–211; Wright and Wright 1957. Handbook of Snakes of the United States and Canada. Comstock Publ. Assoc., Ithaca, New York). Diener (*op. cit.*) suggested a mean litter size of 12 (range 5–21 ova) for a sample of five individuals.

Of the 14 neonates born in our lab, 8 were males and 6 were females. Measurements of the 8 neonate males were: TL range = 247–276 mm, mean = 260.9 mm, SD = 9.1; mass range = 5.0–6.2 g, mean = 5.4 9, SD = 0.4; neonate females: TL range = 244–277 mm, mean = 258.8 mm, SD = 10.2; mass range = 4.7–6.0 g, mean = 5.3 g, SD = 0.4; overall litter measurements were: SVL range = 185–214 mm, mean = 197.8 mm, SD = 7.8; tail length range = 56–69 mm, mean = 62.4 mm, SD = 4.3; mass range = 4.7–6.2 g, mean = 5.0 g, SD = 0.4. After parturition the adult female weighed 248 g. The total litter mass (excluding the infertile masses) was 75.5 g and the relative clutch mass (RCM = ratio of total litter mass to postpartum female mass + total litter mass) was 0.233. This compares to a RCM of 0.300 for *Nerodia rhombifer* (Plummer 1992. Copeia 1992:1096–1098), 0.259 for *Regina grahami* (Thornton and Smith 1995. Herpetol. Rev. 26:102–103), and 0.295 for 22 species of viviparous colubrids (Seigel and Fitch 1984. Oecologia (Berl.) 61:293–301). All the neonates sloughed immediately after birth. Diener (*op. cit.*) reported that in the southern part of the range of *N. erythrogaster*, mating occurs from early April through May. Assuming a three-month period of gestation (Betz 1963. Copeia 1963:692–697), ovulation of this *N. erythrogaster* probably occurred in late June. The adult female and all viable young were released at the capture site.

We thank the Colorado River Municipal Water District for funding and facilities. Collections were made under the authority of the Texas Parks & Wildlife Department Scientific Permit No. SPR-790-208 to CRMWD. James R. Dixon reviewed an earlier version of this manuscript.

Submitted by **OKLA W. THORNTON, JR.**, and **JERRY R. SMITH**, Colorado River Municipal Water District, HCR 82, Box 4B, Leaday, Texas 76851, USA.

NERODIA VALIDA (Pacific Water Snake). **PREY**. *Nerodia valida* is a scarcely known snake of the west coast of mainland México and the Cape Region of Baja California Sur. Only general data on its diet have been reported (Stebbins. 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.). Our observations were made on 14 August 1994, along Arroyo Boca de la Sierra in the Sierra de la Laguna, Baja California Sur, México (23°24'N, 109°49'W; 300 m elev.). It was the first sunny day after some rain, so the arroyo carried water and the first ponds of the year were formed. We walked 3 km along the arroyo at 1200–1400 h and 1500–1600 h.

We observed in the water and on sandy banks >500 adult *Bufo punctatus*, 80% of which were in amplexus. We also observed 27 individuals of *Nerodia valida*. Nineteen were juveniles <20 cm TL and 8 were adults. Two were swallowing a pair of toads in amplexus, and another was engorged and appeared to have eaten

other pair of toads. A fourth adult *N. valida* was pursuing another pair of toads.

It is remarkable that the male toads did not release their embrace despite the immediate risk of being eaten. Large breeding aggregations are characteristic of anurans living in subtropical desert areas (Wells. 1977. Anim. Behav. 25:666–693) and, apparently in these cases the toads were compromised between the opportunity to breed when conditions were favorable, and avoiding predation.

Submitted by **MA. CARMEN BLAZQUEZ**, Centro de Investigaciones Biologicas del Noroeste, Apdo. 128, La Paz, Baja California Sur 23000, México.

SEMINATRIX PYGAEA PYGAEA (Black Swamp Snake). **PREDATION.** On 31 January 1995 at Lake Woodruff National Wildlife Refuge in central Florida, USA, a nine-banded armadillo (*Dasypus novemcinctus*) was observed preying on a black swamp snake. The time was late afternoon (ca. 1630 h) and the surface temperature was ca. 15°C. The snake was 18.5 g in mass, 26.5 cm SVL and, though still alive when captured, was mutilated from midbody to tail due to the armadillo's mastication. The event took place in a mesic-hydric semi-deciduous (hammock) forest in an area of saturated, mucky soil.

Armadillos feed mainly on insects but also consume some reptiles. Breece and Duci (1985. *In* G. G. Montgomery (ed.), The Evolution and Ecology of Armadillos, Sloths, and Vermilinguas: Symposium on the Evolution and Ecology of Xenarthra, pp. 419–427. Smithsonian Inst. Press, Washington, D.C.) reported that small reptiles and amphibians were the only vertebrates found in stomach contents of 50 adult armadillos from Alabama.

In the southeastern U.S., armadillos (*D. novemcinctus*) may ingest more reptiles during winter than other seasons (Fitch et al. 1952. J. Mammal. 33:21–27). For example, Breece and Duci (*op. cit.*) found that in the winter season *Anolis carolinensis* constituted 24% by volume of ingested matter while the yearly average was only 3%. One hypothesis for this discrepancy between winter and overall feeding is that cool weather may make reptiles slower and therefore easier for armadillos to capture. Our observation is consistent with this hypothesis.

Submitted by **ALEXANDER D. AYCRIGG, TERENCE M. FARRELL,** and **PETER G. MAY**, Department of Biology, Stetson University, DeLand, Florida 32720, USA

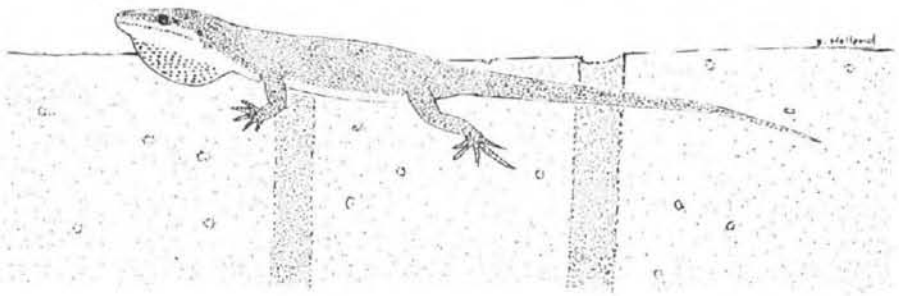
SISTRURUS MILIARIUS BARBOURI (Dusky Pigmy Rattlesnake). **MAXIMUM SIZE.** The reported maximum size for this race, the largest of the species, is 80.3 cm (31 1/2 inches) (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America, Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

In the spring of 1981, Mitchell Harris collected an adult male *Sistrurus miliarius barbouri* off Rt. 60 at a farm ca. 30 mi west of Vero Beach in Osceola Co., Florida, USA. The specimen was given to the senior author, who maintained it in captivity from March 1981 until April 1993 (13 years, one month), when it died. We estimate the age of this snake to be ca. 20 years, because it was ca. 63.5 cm (25 in.) in length when caught in the wild. Its weight (on 23 July 1988) was 23.2 ounces (658 g). At its death, the specimen measured 73.8 cm (29 in.) SVL and 9.4 cm (3.7 in.) tail length, for a total length of 83.2 cm (32.8 in.), a new maximum size for this race and the species. During the early part of its captivity, this specimen maintained only 2–3 rattle segments. However, despite repeated sheddings during the remainder of its life, these original segments wore down and the snake ceased adding any rattle segments. The specimen was preserved and deposited in the Florida State Museum of Natural History, Gainesville (UF-FSM 87590); color slides were deposited earlier (1987) at the Natural History Museum, The University of Kansas, Lawrence (KU Color Slides 7614-7615).

EMMETT SNELLINGS, JR., 88 Mcteer Drive, St. Helena Island, South Carolina, USA, and **JOSEPH T. COLLINS**, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.

THAMNOPHIS SIRTALIS PICKERINGII (Puget Sound Garter Snake). **FORAGING** and **ARBOREALITY**. On 16 July 1995, between 1300 and 1500 h, we observed three individuals of *Thamnophis sirtalis pickeringii* actively climbing in willow (*Salix* sp.) branches between 0.5 and 2.0 m above the surface of a shallow lake in Dupont, Pierce Co., Washington, USA (NW1/4 S36, T19N, R1E). We watched one individual for 1.5 h and observed it hunting and feeding upon newly metamorphosed Pacific tree frogs (*Pseudacris regilla*) that were clinging to leaves and branches. We saw it take at least three small *P. regilla* as it moved rapidly through the branches. The *Thamnophis* appeared to take the small frogs on the fly as they attempted to leap away. Periods of active hunting lasted 30–60 s, between which, the snake laid motionless in the willows basking, partially concealed by leaves and branches. The individual moved in a horizontal diameter of approximately 1.5 m, and remained between 1.5 and 2.0 m above the water during the 1.5 h of observation.

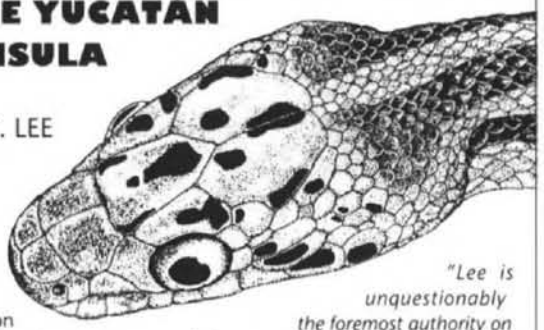
Submitted by **WILLIAM P. LEONARD**, Washington Natural Heritage Program, P.O. Box 47016, Olympia, Washington 98504-7016, USA, and **NICHOLAS P. LEONARD**, 223 Foote St. NW, Olympia, Washington 98502, USA.



Anolis carolinensis (American Anole). Illustration by Dan C. Holland.

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These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins, 1990, *Standard Common and Current Scientific Names for North American Amphibians and Reptiles, Third Edition*, Herp. Circ. 19:1–41; for México as it appears in Liner, 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*. Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author—curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al., 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985(3):802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full—spell out state names—no abbreviations).

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Please submit any geographic distribution records in the **standard format only** to one of the Section Co-editors: Joseph T. Collins (USA & Canadian records only), Museum of Natural History—Dyche Hall, The University of Kansas, Lawrence, Kansas 66045–2454, USA; Jerry D. Johnson (México and Central America, including the Caribbean islands), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA; Hidetoshi Ota (all Old World records), Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-01, Japan; or Gustavo J. Scrocchi (South American records), Instituto de Herpetologia, Fundacion Miguel Lillo, Miguel Lillo 251, 4000 Tucuman, Argentina. Short manuscripts are strongly discouraged, and are only acceptable when data cannot be presented adequately in the standard format. **Submissions by e-mail are encouraged where possible**. Refer to inside front cover for e-mail addresses of section editors.

Recommended citation for new distribution records appearing in this section is: Painter, C. W., and C. M. Milensky. 1993. Geographic Distribution. *Crotalus tigris*. Herpetol. Rev. 24:155–156.

CAUDATA

DESMOGNATHUS AENEUS (Seepage Salamander). USA: GEORGIA: Stephens Co: Panther Creek at Panther Creek Road, Chattahoochee National Forest, 8.8 km NNW of Toccoa. 5 May 1994. Carlos D. Camp and R. Dale Payne. Verified by Joshua Laerm. University of Georgia Museum of Natural History (UGAMNH 24874). Small creek in deciduous cove forest at ca. 270 m elev. New county record; range extension of ca. 15 km (Harrison 1992, Cat. Amer. Amph. Rept. 534:1–4).

Submitted by **CARLOS D. CAMP** and **R. DALE PAYNE**, Department of Biology, Piedmont College, Demorest, Georgia 30535, USA.

NOTOPHTHALMUS VIRIDESCENS LOUISIANENSIS (Central Newt). USA: ILLINOIS: Kane Co: SE 1/4 Sec. 24 T41N, R8E, marsh along Elgin Road, Elgin. April 1985. Peter L. Meserve. Verified by Thomas Near. HDW-NIU 1609. Documents county record of Garman (1892, Illinois Lab. Nat. Hist. Bull. 3(13):356) for which no vouchers exist, and fills gap between DeKalb and Cook County records (Smith 1961, Bull. Illinois Nat. Hist. Serv. 28:1–298).

HARLAN D. WALLEY, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA.

PLETHODON SERRATUS (Southern Redback Salamander). USA: GEORGIA: Jasper Co: Ocmulgee River at Ga. Rt. 16, Oconee National Forest, 16.5 km W of Monticello. 5 March 1994. Carlos D. Camp, R. Dale Payne, and Jeremy L. Marshall. Verified by Joshua Laerm. University of Georgia Museum of Natural History (UGAMNH 24872–873). Deciduous hillside at ca. 200 m elev. New county record; eastward range extension of ca. 30 km (Camp 1986, Georgia Jour. Sci. 44:136–146).

Submitted by **CARLOS D. CAMP**, **R. DALE PAYNE**, Department of Biology Piedmont College, Demorest, Georgia 30535, USA, and **JEREMY L. MARSHALL**, Department of Biology, University of Mississippi, University, Mississippi 38677, USA.

ANURA

PHRYNOHYAS MESOPHAEA (NCN): BRASIL: BAHIA: Município de Lauro de Freitas: Jardim Aeroporto (12°55'S, 39°15W). 5 October 1994. M. A. de Freitas. Verified by J. P. Pombal Jr. Museu Nacional (MNRJ 17442). First record for northern part of state of Bahia; extends previous geographic distribution to the north (Duellman 1971, Univ. Kansas Nat. Hist. Mus. Occ. Pap. 4–21) mentions *Phrynohyas mesophaea* from the state of Bahia at Santa Cruz. This reference is unclear, because it could be Santa Cruz da Vitoria or Santa Cruz Cabrália. Both sites are relatively close to each other, but 500 km S of this new record. According to Frost (1995, Amphibian Species of the World. Version 2/95. Electronic manuscript maintained under the auspices of the Herpetologists' League), this species is restricted to the Atlantic Forest of southeastern Brasil. However, the holotype is from the state of Rio Grande do Sul in southern Brasil (Frost, *op cit.*). To our knowledge, *Phrynohyas mesophaea* occurs along the Atlantic Forest from Rio Grande do Sul to Reconcavo Baiano in the state of Bahia.

Submitted by **REUBER A. BRANDÃO**, **MARCO ANTÔNIO DE FREITAS**, and **ANTÔNIO SEBBEN**, Laboratório de Fisiologia Animal-CFS/IB, Universidade de Brasília, 70 910-900, Brasília/DF-Brasil.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: MINNESOTA: Dodge Co: wet cow pasture S of Zumbro River, NE 1/4 Sec. 14, T105N, R16W. 30 May 1995. Terry VanDeWalle. Verified by James L. Christiansen. Bell Museum of Natural History (MMNH 13493). New county record (Oldfield and Moriarty 1994, Amphibians and reptiles native to Minnesota. Univ. Minnesota Press, Minneapolis. 237 pp.). Specimen was collected during a search for *Acris crepitans* in southeastern Minnesota conducted for the Minnesota County Biological Survey; no *A. crepitans* were found.

Submitted by **TERRY J. VANDEWALLE**, Biology Department, Des Moines Area Community College, Ankeny, Iowa 50021, USA, and **CHRISTOPHER D. VAN GORP**, Department of Biology, Drake University, Des Moines, Iowa 50311, USA.

RANA CAPITO (Gopher Frog). USA: TENNESSEE: Coffee Co: Hill Chapel Road, NE section of Arnold Engineering and Devel-

opment Center (AEDC), (35°24'15"N 86°3'40"). 12 July 1993. B. T. Miller and T. Casey. Verified by A.F. Scott. Middle Tennessee State University (MTSU 72A). Juvenile specimen (36 mm SVL) captured while road-cruising during a rainstorm. NE section of AEDC is characterized by low relief with many temporary and variably-sized bodies of water, including hardwood swamps (e.g., Sinking Pond, Westall Swamp). Specimen represents the first record for state and most inland record for the species (Redmond 1985, A Biogeographic Study of Amphibians in Tennessee. Doctoral Thesis, Univ. Tennessee, Knoxville. 290 pp.; Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). A disjunct population of *Rana capito* has been reported in Shelby County, Alabama (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Auburn University, Alabama. 347 pp.; Guthrie 1985, Herpetol. Rev. 16:31.), ca. 225 km southwest of AEDC, and the closely related *Rana areolata* occurs within the coastal plain of western Tennessee (Redmond 1985, *op. cit.*) less than 200 km west of AEDC.

Submitted by **BRIAN T. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA, and **DAVID L. CAMPBELL**, The Nature Conservancy, 50 Vantage Way, Suite 250, Nashville, Tennessee 37228, USA.

RANA CLAMITANS MELANOTA (Green Frog). USA: MISSOURI: Macon Co: South 61 Training Area, Missouri National Guard Macon Area Training Site, W of study plot 18, ca. 4 km NW Excello, 39°39'28"N, 92°30'53"W. 26 June 1994. Angelo P. Bufalino. Verified by A. Floyd Scott. Austin Peay State University Museum of Zoology (APSU 5428). Specimen caught by hand in cattail-filled pond. New county record (Powell, Johnson, and Parmerlee 1993, Missouri Herpetol. Assoc. Newsl. (6):7–26).

Submitted by **ANGELO P. BUFALINO,** The Center for Field Biology, Austin Peay State University, Clarksville, Tennessee, 37044, USA.

TESTUDINES

APALONE FEROX (Florida Softshell). USA: ALABAMA: Mobile Co: Adjacent to lake on Viaduct Street, 0.12 km E U.S. Rt. 43 and 1.36 km S jct. U.S. Rt. 43/State Rt. 158, T3S, R1W. 1989. S. McGee. AUMP 3580 (adult male). Viaduct Street (DOR). August 1993. J. L. Dobie, C. J. Leary, and J. Golden. AUMP 1808–09 (juveniles). All verified by Robert H. Mount. First county record (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Agric. Exp. Sta. Auburn Univ. vii + 347 pp.; Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Edition. Houghton Mifflin, Boston. xviii + 450 pp.).

Submitted by **JAMES L. DOBIE** and **CHRISTOPHER J. LEARY**, Department of Zoology and Wildlife Science, Auburn University, Alabama 36849-5414, USA, and **JEFFREY GOLDEN**, 201 4th Street North, Pell City, Alabama 35125, USA.

GRAPTEMYS OUACHITENSIS OUACHITENSIS (Ouachita Map Turtle). USA: ALABAMA: Mobile Co: east side Grand Bay, NW of confluence with Raft River, SW 1/4 Sec. 3, T3S, R1E. 18 June 1992. J. L. Dobie, C. J. Leary, and A. E. Davis. AUM 33782. Adult female. Verified by Robert H. Mount. Only specimen known from the Mobile Bay drainage (Mount 1975, The Reptiles and Amphibians of Alabama. Publ. Agric. Exp. Sta. Auburn Univ. vii + 347 pp.). The animal may have been released or moved down the Tennessee-Tombigbee Waterway subsequent to its completion in 1985.

Submitted by **JAMES L. DOBIE** and **CHRISTOPHER J. LEARY**, Department of Zoology and Wildlife Science, Auburn University, Alabama 36849-5414, USA, and **AUBREY E. DAVIS**, The Nature Conservancy of Georgia, 600 Dekalb Street, Apartment H-5, Auburn, Alabama 36830, USA.

LACERTILIA

EUMECES LATICEPS (Broadhead Skink). USA: MISSOURI: Macon Co: South 61 Training Area, Missouri National Guard Macon Area Training Site, ca. 100 m S of study plot 22, ca. 2.1 km NW Excello, 39°39'02"N, 92°29'29"W. 10 August 1994. Angelo P. Bufalino. All verified by A. Floyd Scott. Austin Peay State University Museum of Zoology (APSU 5431), 12 August 1994 (APSU 5430), 13 August 1994 (APSU 5429). Specimens caught in drift-fence array; new county record (Powell, Johnson, and Parmerlee 1993, Missouri Herpetol. Assoc. Newsl. (6):7–26).

Submitted by **ANGELO P. BUFALINO**, The Center for Field Biology, Austin Peay State University, Clarksville, Tennessee, 37044, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Kenedy Co: 26°46'20"W. 29 December 1995. Glenn Proudfoot. Verified by K. Vaughan and deposited at TCWC. New county record (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M University Press, College Station. 434 pp.) that fills in a distributional gap in extreme south Texas.

Submitted by **GLENN PROUDFOOT** and **MICHAEL JAMES MCCOID**, Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&M University, Kingsville, Texas 78363, USA.

LIOLAEMUS BIBRONI (NCN). ARGENTINA: SAN JUAN: Department Calingasta: Arroyo de las Cabeceras, Reserva Estratosferica Natural El Leoncito, 2800–3000 m. January 1993. Eduardo Haene-Sofia Heinonen. Verified by Ricardo A. Martori. Herpetological collection of Museo Argentino de Ciencias Naturales "Bernardino Rivadavia." MACN 35389 (adult male). This voucher represents a new province record, confirms presumed distribution in this area and extends known range at least ca. 100 km N from previously cited localities (Cei 1986, Mon IV. Mus. Reg. Sci. Nat. Torino. 527 pp.).

Submitted by **LUCIANO JAVIER AVILA**, CONICET–Departamento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Estado Postal 9, C. P. 5800, Rio Cuarto (Cordoba), Argentina. E-mail: luciano@unrccc.edu.ar.

SCELOPORUS MAGISTER CEPHALOFLAVUS (Orangehead Spiny Lizard). USA: UTAH: Emery Co: E side Utah Rt. 24, W Green River (city), 0.5 mi S jct U.S. Rt. 6. 15–16 June 1969. Harry L. Taylor. UCM 57431–3. Grand Co: E bank of Green River (river), 19 air km (28 river km) S Green River (city) boat ramp. 12 June 1988. Richard L. Holland. UCM 112–3 slide collection (color). Both verified by Lauren Livo. First county record for Grand County (Tanner 1955, Great Basin Nat. 15:32) where the lizards were exceptionally abundant and easily caught by hand (far different from behavior observed elsewhere within the range of the species). First unambiguous record for Emery County; Tanner (*loc. cit.*) cites "Green River" in Emery County but without clarification whether the river or city was intended, leading Stebbins (1985, Peterson Field Guide to Western Reptiles and

Amphibians. Houghton Mifflin Co., Boston. 336 pp.) to ignore the locality and to map the range for the subspecies with a more southerly northern range limit. These two new records extend the range, as depicted by Stebbins, some 100 km northward.

HARRY L. TAYLOR, Department of Biology, Regis University, Denver, Colorado 80221, USA; **RICHARD L. HOLLARD**, 1855 Garland Land, Boulder, Colorado 80304, USA; **ROSANNA L. HUMPHREY** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309–0315, USA.

SERPENTES

BOA CONSTRICTOR CONSTRICTOR (Boa, Tragavenado). VENEZUELA: ESTADOS MERIDA: DISTRITO SUCRE: Alcabala La Victoria (71°35'W, 8°25'N), 51 km SW Merida, road from Merida to Tovar. 4 January 1995. Roberto Casado and Samanta Zoltan. Verified by Enrique La Marca. Coleccion de Anfibios y Reptiles, Instituto de Geografia, Universidad de Loa Andes (ULABG 3933, cranium only). Adult male (everted hemipenis) found DOR, 1800 mm TL; 1 km SW of Estanques (71°31'W, 8°27'N), road from Merida to Tovar. 19 June 1985. Jaime Pefaur. Verified by Jaime Pefaur. Coleccion de Vertebrados, Facultad de Ciencias, Universidad de Los Andes (CVULA IV 3929). First state records and first Venezuelan Andean localities for the species (Lancini and Kornacker 1989, Die schlangen von Venezuela, Ed. Armitano, Caracas: 82–86).

Submitted by **ROBERTO CASADO B.**, Universidad de Los Andes, Facultad de Ciencias, Ecologia Animal, La Hechicera Merida 5251, Apartado Postal 71, Venezuela, and **SAMANTA ZOLTAN**, Residencia La Floresta, Torre D, Apartamento 6–2, Pedregosa Sur, Merida, Estado Merida, Venezuela.

ERIDIPHAS SLEVINI (Baja California Night Snake). MEXICO: BAJA CALIFORNIA SUR: Arroyo Los Burros at jct. with dirt road from La Purisima to San Juanico, 26°9'54", 112°14'51"W. 29 July 1995. Eric Mellink. Verified by Leek Grismer. LACM PC 1322, SLV = 200 mm. Species was known only from the central-eastern and southern parts of the Peninsula of Baja California, associated with the Sierras de la Asamblea, de la Giganta and de la Laguna (Grismer 1994, The Evolutionary and Ecological Biogeography of the Herpetofauna of Baja California and the Sea of Cortes. Doctoral Dissertation. Loma Linda University, Riverside, California. 677 pp.). This is the first record of the species in the western part of the peninsula. Specimen was found in the dry bed of a rocky wash coming down to the west side of the Sierra de la Giganta, over the Magdalena plains. The nearest known locality lies about 65 km to the east (Grismer, *op. cit.*).

Submitted by **ERIC MELLINK**, Centro de Investigación Científica y de Educación Superior de Ensenada, Apartado Postal 2732, Ensenada, Baja California, México.

FICIMIA PUBLIA (Blotched Hooknose Snake). MÉXICO: JALISCO: MUNICIPALITY OF LA HUERTA: Rancho Cuixmala, Carretera Federal 200, 3 km NW of Emiliano Zapata (19°22'44"N, 104°59'09"W). 6 July 1995. Andres Garcia and Marciano Valtierra. Museo de Zoologia, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico (MZFC 7768). Verified by Fernando Mendoza. First record for the state of Jalisco and a range extension northwestward of ca. 612 km (airline) along the Pacific coast from records reported in central Guerrero [Hardy 1975, J. Herpetol. 9:133–168; Hardy 1980, Cat. Amer. Amph. Rept. (254):1–2.].

Submitted by **ANDRES GARCIA** and **MARCIANO VALTIERRA-AZOTLA**, Fundacion Ecologica de Cuixmala, A.C. Avenida Cometa 2910, C. P. 44520, Guadalajara, Jalisco, México.

GRAYIA THOLLONI (Thollon's Water Snake). SENEGAL: CAP-VERT REGION: Sebikotane, 14°45'N, 17°08'W. 1963. R. P. Berhaut. Verified by Ivan Ineich. Museum National d'Histoire Naturelle at Paris (MNHN 1964. 145). Second record for Senegal (Trape and Mane 1995, Herpetol. Rev. 26:156) and third record for West Africa W of Nigeria (Hughes 1983, Bonn. zool. Beitr. 34:311–356; Dunger 1972, Nigerian Field 37(1):21–38). Specimen was previously erroneously determined as *Grayia smithii* on the MNHN register by Villiers who gave "North Nigeria to Lake Tanganyika" as distribution for the species (Villiers 1975, Les Serpents de l'Ouest Africain. Institut Fondamental d'Afrique Noire, Init. Etudes Afr. n°2:1–195, 3rd ed.). This new locality is situated 130 km (airline) NW of the previous northwesternmost known locality.

Submitted by **OLIVER PAUWELS**, Museum National d'Histoire Naturalle, Laboratoire de Zoologie (Reptiles et Amphibiens), 25 rue Cuvier, F–75005 Paris, France, or Koninklijk Museum voor Midden-Africa, Vertebrate Section (Herpetology), Steenweg op Leuven, B–3080 Tervuren, Belgium.

HETERODON PLATIRHINOS (Eastern Hognose Snake). USA: OKLAHOMA: TEXAS CO: near Eva. 15 October 1995. Kirie Willimon. Verified by John E. Simmons. KU Color Slides 11225–227. Second record for county; extends range ca. 30 mi WNW of previous record for county (Webb 1970, Reptiles of Oklahoma. Stovall Mus. Publ. No. 2. xi + 370 pp.). Corroborates old (1927) record from adjacent Morton County, Kansas (Collins and Collins 1991, Reptiles and Amphibians of the Cimarron National Grassland, Morton County, Kansas. Publ. U.S. Forest Serv., Elkhart, Kansas. vii + 60 pp.).

Submitted by **KIRIE WILLIMON**, Cimarron National Grasslands, P. O. Box 300, Elkhart, Kansas 67950, USA, and **JOSEPH T. COLLINS**, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.

MICRURUS LEMNISCATUS (Coral Snake). BRAZIL: RIO DE JANEIRO: MUNICÍPIO DE BARCELOS. 1 February 1993. J. Toledo. Instituto Butantan (IB 7708), 7 January 1935. IB 9269; 30 August 1935. IB 9314; 4 November 1935. IB 9359; 28 January 1937. IB 9674; Fazenda Carnará. 11 December 1953. H. F. Toledo. IB 15744; 24 April 1954. IB 16095; MUNICÍPIO DE MACAÉ. 10 June 1984. A. L. Duarte. IB 48231; MUNICÍPIO DE CABO FRIO, Salinas Perinas. 24 December 1961. Hofmann. IB 21085; MUNICÍPIO DE CAMPOS. 8 June 1947. J. Baptista. IB 11088; 10 November 1975. IB 40418. BAHIA: MUNICÍPIO DE ALAGOINHAS. 10 May 1989. Laboratório de Animais Peçonhentos, Universidade Federal da Bahia (UFBA/LAP 389); MUNICÍPIO DE BRUMADO, Bairro de Catiboaba. 24 November 1978. W. Tschudim. IB 40173; MUNICÍPIO DE BUERAREMA. 23 August 1989. Centro de Pesquisas do Cacau (CEPEC 709); MUNICÍPIO DE CAMACÃ. 19 January 1990. CEPEC 901; MUNICÍPIO DE CAMAÇARI. 18 January 1990. UFBA/LAP 403; MUNICÍPIO DE CANAVIEIRAS. June 1990. CEPEC 1036; MUNICÍPIO DE CANDEIAS. 31 September 1990. UFBA/LAP 578; MUNICÍPIO DE CATU. 13 July 1990. UFBA/LAP 567; MUNICÍPIO DE ESPALANDA. 22 October 1985. Epenflora. IB 48952; MUNICÍPIO DE FEIRA DE SANTANA. 16 February 1989. Laboratório De Animais Peçonhentos, Universidade Estadual de Feira de Santana (UEFS/LAP 77–78); MUNICÍPIO DE GUANAMBI. 1 April 1987. Secretaria de Saúde de

Guanambi. IB 51541; 14 January 1988. Prefeitura de Guanambi. IB 51756; MUNICÍPIO DE ITUAÇU. 4 June 1990. UFBA/LAP 431; 22 June 1990. UFBA/LAP 575; MUNICÍPIO DE LIVRAMENTO DO BRUMADO, Fazenda Ronacado. 6 May 1968. P. C. Meira. IB 28527; MUNICÍPIO DE MATA DE SÃO JOÃO. 1 April 1990. UFBA/LAP 436; MUNICÍPIO DE POÇÕES, Mina São Félix de Amianto, Vila Bom Jesus. 7 March 1968. S. A. de Mineracão de Amianto. IB 28218–219; MUNICÍPIO DE ACÚ DA TORRE, Praia do Forte. 18 January 1990. O. A. V. Marques. IB 53658; MUNICÍPIO DE SALVADOR. 8 November 1966. M. Soares. IB 26705; 26 March 1982. Pe. E. Veiga. IB 44273; 29 June 1984. Centro de Informacões Antiveneno da Bahia. IB 46397–398; 16 April 1986. P. Koenik. IB 46592; 18 June 1986. C. A. Fonseca. IB 51587; 26 March 1990. UFBA/LAP 412; MUNICÍPIO DE SANTO AMARO. 11 August 1924. Posto Ophídico. IB 3208; MUNICÍPIO DE SIMÕES FIHO. 3 March 1992. Transpim. IB 54862; MUNICÍPIO DE TEIXEIRA DE FREITAS. 22 January 1981. Coop. Agríc. Cotia. IB 44177, 44.179; 8 February 1985. IB 44172; 29 January 1992. CEPEC 1573; 6 April 1992. CEPEC 1678. SERGIPE: MUNICÍPIO DE ARACAJU. 26 September 1985. J. R. Sobrinho. IB 51257; 27 November 1986. Petrobrás. IB 53075; ALAGOAS: MUNICÍPIO DE MANIMBÚ. October 1952. C. Buarte. Museu de Zoologia, Universidade de Sáo Paulo (MZUSP 2943–44); MUNICÍPIO DE QUEBRANULO. 13 August 1993. A. R. Melgarejo. Centro de Estudos e Pesquisas Biológicas, Universidade Catolica de Goiás (CEPB 2312). PERNAMBUCO: MUNICÍPIO DE RECIFE. 17 February 1995. R. Brannad. IB 55677. PIAUÍ: MUNICÍPIO DE PARNAGUÀ. 15 February 1979. F. Rodrigues. IB 42524.

All verified by William Lamar. These records were never previously published and the occurrence of this taxon in northeastern Brazil was questionable without reliable museum vouchers (Campbell and Lamar 1989, The Venomous Reptiles of Latin America. 425 pp.). These specimens reveal a coastal Atlantic distribution for this snake from Rio de Janeiro to Paraíba (with some exceptions owing to the extensive fragmentation of the Atlantic Forest), and west to Piauí (ecotone Cerado-Caatinga).

Submitted by **LUCIANA LYRA CASAIS E SILVA**, Laboratório de Herpetologia, Instituto Butantan, Avenida Vital Brazil 1500, Butantan, 05504-900, São Paulo, São Paulo, Brazil.

SIBON ANNULIFERUS (Western Snail-eating Snake). MÉXICO: JALISCO: MUNICIPALITY OF LA HUERTA: Reserva de la Biosfera Chamela-Cuixmala, Carretera Federal 200, 4 km NW of Emiliano Zapata (19°27'26"N, 104°57'56"W). 23 July 1995. Marciano Valtierra and Guillermo Nogueira. Museo de Zoologia, Facultad de Ciencias, Universidad Nacional Valtierra and Guillermo (MZFC 7766). Another specimen found in the same area (19°24'59"N, 104°58'33"W). 28 July 1995. Narciso Sandoval. MZFC 7767. Both verified by Fernando Mendoza. These records extend range along the coast ca. 37.5 km (airline) NW of locality in Barra de Navidad (Kofron 1988, Amphibia-Reptilia 9:145–168.).

Submitted by **ANDRES GARCIA** and **MARCIANO VALTIERRA-AZOTLA**, Fundacion Ecologica de Cuixmala, A. C. Avenida Cometa 2910, C.P. 44520, Guadalajara, Jalisco, México.

SONORA SEMIANNULATA (Ground Snake). MÉXICO: BAJA CALIFORNIA SUR: SIERRA DE SAN FRANCISCO: 1 km south of San Francisco de la Sierra, 27°35'12"N, 113°0'59"W. 31 July 1995. Eric Mellink. Verified by Lee Grismer. LACM PC 1323, SVL = 336 mm. Locality lies within the distribution given by Grismer (1994, The Evolutionary and Ecological Biogeography of the Herpetofauna of Baja California and the Sea of Cortes. Doctoral Dissertation. Loma Linda University, Riverside California. 677 pp.), but is the first record from the high reaches of a mid-peninsula Sierra; all other known mid-peninsular localities for this snake are in passes between mountain ranges. The nearest ones are ca. 23 km to the south along the road from San Ignacio to Las Virgenes between the Sierras of San Francisco and San Pedro; the next nearest locality is ca. 172 km to the north between Sierras de la Asamblea and San Borjaa (Grismer, *op. cit.*). Specimen was found at noon, crawling over an open spot, while heading for rock cover.

Submitted by **ERIC MELLINK**, Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Apartado Postal 2732, Ensenada, Baja California, México.

THAMNOPHIS ELEGANS VAGRANS (Wandering Garter Snake). USA: WYOMING: PARK CO: Shoshone National Forest, between E and W summits of Beartooth Pass, 44°58'40"N, 109°27'10"W on Beartooth Plateau, 10,440 ft (3182 m). 6 July 1998. P. Hendricks and C. Pidgeon. Idaho Museum of Natural History Photofile (IMNHP 001). Verified by Charles R. Peterson. First state record in alpine habitat (Baxter and Stone 1985, Amphibians & Reptiles of Wyoming. Second ed. Publ. Wyoming Fish and Game Dept. 137 pp.; Koch and Peterson 1995, Amphibians and Reptiles of Yellowstone and Grand Teton National Parks. Univ. Utah Press, Salt Lake City. 188 pp.). Adult (38 cm SVL) basking on pocket gopher burrow ca. 500 feet (155 m) above and 1 mi (1.6 km) beyond treeline. Only snake seen in alpine during residency at the pass from 13 July–10 August 1983, 29 June–12 August 1984, 8 June–18 July 1987, 8 June–30 July 1988, 13 June–5 August 1989. Sighting occurred during the hot and dry summer of the nearby Greater Yellowstone Ecosystem fire.

Submitted by **PAUL HENDRICKS**, Montana Natural Heritage Program, 909 Locust Street, Missoula, Montana 59802, USA.

THAMNOPHIS SIRTALIS PARIETALIS (Red-sided Garter Snake). USA: MISSOURI: MACON CO: South 61 Training Area, Missouri National Guard Macon Area Training Site, gravel road along W edge of South 61 Training Area, ca. 3.7 km NW Excello, 39°39'04"N, 92°30'49"W. 27 June 1994. Angelo P. Bufalino. Verified by A. Floyd Scott. Austin Peay State University Museum of Zoology (APSU 5427). Caught on gravel road; new county record (Powell, Johnson, and Parmerlee 1993, Missouri Herpetol. Assoc. Newsl. (6):7–26). Specimen was caught on the western edge of the intergradation zone for *T. s. sirtalis* and *T. s. parietalis* (Johnson 1987, The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City. 368 pp.).

Submitted by **ANGELO P. BUFALINO**, The Center for Field Biology, Austin Peay State University, Clarksville, Tennessee 37044, USA.

New Records for Amphibians and Reptiles from Texas

FLAVIUS C. KILLEBREW
Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA
e-mail: fkill@wtamu.edu

KATHLEEN B. BLAIR
Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA
e-mail: kblair@wtamu.edu

DAVID CHISZAR
University of Colorado Museum, Boulder, Colorado 80308-0215, USA

and

HOBART M. SMITH
University of Colorado Museum, Boulder, Colorado 80308-0215, USA

The following account completes our coverage of the notable new distributional information on the herps of Texas represented in the herpetological collection of West Texas A & M University (WTAMU). First county records are based on Dixon (1987), supplemented by records published in *Herpetological Review*, where our previous contributions derived from WTAMU material have appeared. All identifications were verified by Anthony I. Mazeroll. Adam and Laine Chiszar kindly aided greatly in handling the many hundred specimens examined in our review.

Of special significance are range extensions for *Chrysemys picta bellii, Graptemys kohnii, Pseudemys concinna metteri, Sternotherus odoratus, Cophosaurus t. texanus, Crotalus v. viridis*, and *Nerodia r. rhombifer*. The numerous records for turtles (12 species vs 14 for all other herp species) reflects a long period of emphasis on turtle distribution and natural history by FCK and his students. Most of the WTAMU collection is a product of class efforts over a period in excess of thirty years.

Ambystoma tigrinum tigrinum (Eastern Tiger Salamander). USA: TEXAS: Bell Co: Outside of Belton, near Leon River. 25 October 1994. James H. Kreimeyer. WTAMU 14978-80 (larvae).

Bufo debilis insidior (Western Green Toad). USA: TEXAS: Castro Co: 3.2 km NW Hart, Rt. 168. 19 June 1985. Donita G. Sewell. WTAMU 14603.

Bufo woodhousii woodhousii (Woodhouse's Toad). USA: TEXAS: Nolan Co: Country Club Lake. 14 April 1986. R. L. Cavitt. WTAMU 14952.

Rana sphenocephala utricularia (Southern Leopard Frog). USA: TEXAS: Refugio Co: near Austwell. 16 April 1992. John Shields. WTAMU 14638.

Apalone spinifera guadalupensis (Guadalupe Spiny Softshell). USA: TEXAS: Guadalupe Co: Lake McQueeny. 20 April 1990. Flavius C. Killebrew and Dan Porter. WTAMU 13145.

Chelydra serpentina serpentina (Common Snapping Turtle). USA: TEXAS: Childress Co: Lake Childress, Childress. 24 February 1987. Matt Craig. WTAMU 10766. Gray Co: W of Pampa. 25 June 1966. Robert A. Norman. WTAMU 6.

Chrysemys picta bellii (Western Painted Turtle). USA: TEXAS: Llano Co: Lake Buchanan. April 1981. Flavius C. Killebrew. WTAMU 7417. Possibly complements the nearby isolated and questionable record noted on the distributional map for this species in Conant and Collins (1991). There is no conclusive evidence that any self-sustaining population of the species exists in central Texas.

Chrysemys picta dorsalis (Southern Painted Turtle). USA: TEXAS: Gregg Co: Sabine River near Longview. October 1980. Ichthyology/Entomology classes. WTAMU 6773.

Graptemys kohnii (Mississippi Map Turtle). USA: TEXAS: Hardeman Co: Malcolm Bottoms farm, 4.9 km NW Quanah. 15 August 1982. Fred Kinnaman. WTAMU 8495. Extends the known range about 320 km along the Red River, or 121 km northwest of Throckmorton County.

Kinosternon flavescens flavescens (Yellow Mud Turtle). USA: TEXAS: Crockett Co: 39 km N Ozona. 26 September 1971. Collector not recorded. WTAMU 1169.

Pseudemys concinna metteri (Missouri River Cooter). USA: TEXAS: Grayson Co: Lake Texoma. 5 October 1980. Entomology/Ichthyology classes. WTAMU 6770. Juniper Point, Lake Texoma. 23 September 1983. Flavius C. Killebrew. WTAMU 14976-7. Hansford Co: near Spearman. 8 December 1978. Flavius C. Killebrew. WTAMU 5528. All verified by Anthony I. Mazeroll. A westward range extension of some 500 km in a tributary of the North Canadian River.

Pseudemys texana (Texas River Cooter). USA: TEXAS: Guadalupe Co: Cuero, Guadalupe River. 23 May 1985. Flavius C. Killebrew. WTAMU 10775. Seguin Water Supply Lake. 22 June 1989. Dan Porter and Flavius C. Killebrew. WTAMU 13182. Guadalupe River near San Antonio. 15 March 1984. Collector unknown. WTAMU 13898. Lake Placid. 7 April 1990. K. Brewer and Flavius C. Killebrew. WTAMU 14008-10.

Sternotherus carinatus (Razorback Musk Turtle). USA: TEXAS: Gregg Co: Sabine River near Longview. 1 October 1980. Flavius C. Killebrew and Eric Surat. WTAMU 6182.

Sternotherus odoratus (Common Musk Turtle). USA: TEXAS: Gregg Co: Sabine River near Longview. 2 October 1980. Flavius C. Killebrew. WTAMU 6602. Hardeman Co: Talbert Creek, 8 km S Quanah. 24 November 1981. Fred Kinnaman. WTAMU 7913. Extend the known range about 320 km westward in a Red River tributary.

Terrapene ornata ornata (Ornate Box Turtle). USA: TEXAS: Hardeman Co: dirt road 3.2 km N Rudolph Livingston farm. 21 June 1982. Fred Kinnaman. WTAMU 8479-81. Malcolm Bottoms farm, 4.9 km NW Quanah. 15 August 1982. Fred Kinnaman. WTAMU 8492-5, 8531. Rt. 287 10.13 km E jct. Rt. 6. 18 March 1992. Robyn Richmond. WTAMU 14631. 4.9 km S Rt. 287 10.13 km E jct. Hwy 6. 16 April 1992. Stewart Knight. WTAMU 14974.

Trachemys scripta elegans (Red-eared Slider). USA: TEXAS: Childress Co: Childress Lake, Childress. 24 February 1987. Matt Craig. WTAMU 10767. Donley Co: 14.24 km NW Hedley, Rt. 207. 10 October 1969. K. Brown. WTAMU 2741. Hardeman Co: Rudolph Livingston Farm, Grosbeck Creek. 30 October 1982. Rudolph Livingston. WTAMU 8476. Mills Co: P. K. Caraway Ranch, 5.44 km E jct. Rt. 16 and 3023. 21 April 1977. Dennis

Chance. WTAMU 3235. 22 April 1977. Herpetology Class. WTAMU 3076.

Cophosaurus texanus texanus (Texas Earless Lizard). USA: TEXAS: Aransas Co: Mustang Island. 23 April 1987. Derl Brooks. WTAMU 10280. DeWitt Co: Beard's farm, Schroeder Community, Fannin road. 3 August 1985. T. Foote. WTAMU 13302. A range extension southeastward of ca. 160 km.

Coluber constrictor flaviventris (Eastern Yellowbelly Racer). USA: TEXAS: Moore Co: 0.8 km W Lake Meredith. 28 October 1987. Teresa Smith. WTAMU 13050.

Crotalus atrox (Western Diamondback Rattlesnake). USA: TEXAS: Collingsworth Co: Campbell Ranch, 22.4 km S Wellington. 1 April 1990. Jerry Davis. WTAMU 13585. Parmer Co: Farwell. 17 October 1981. Randy Geries. WTAMU 7326, 7329, 7333-5. Joel McKinney. WTAMU 7087. Roberts Co: Killebrew Ranch. 8 October 1977. Burgi Lehmann. WTAMU 5862. 40 km N Pampa, Rt. 70. 30 September 1989. Derl Brooks. WTAMU 14333.

Crotalus viridis viridis (Prairie Rattlesnake). USA: TEXAS: Foard Co: 11.2 km N Crowell, near old farmhouse. 22 October 1983. Tom Adams. WTAMU 9423-4. Grayson Co: Lake Texoma. 5 October 1980. Ichthyology class. WTAMU 6557. Parmer Co: 27.2 km W Friona, Rt. 2013. 29 April 1929. Tabitha Childs and Gigi Spring. WTAMU 6768. 8 km W and 3.2 km S Bovina, on Rt. 2290. 7 October 1983. Scott Rundell. WTAMU 9467. Extends the known range of the species eastward along the Red River about 160 km.

Elaphe guttata emoryi (Great Plains Rat Snake). USA: TEXAS: Carson Co: Alibates Canyon, Lake Meredith. 21 April 1981. R. Walsh and T. James. WTAMU 6409. Ochiltree Co: Gibner Ranch, 16 km N Spearman on FM 760. 21 August 1978. Flavius C. Killebrew. WTAMU 5587. Scurry Co: 3.22 km S Snyder, Rt. 280. 22 May 1989. D. Porter and M. Craig. WTAMU 14086.

Elaphe obsoleta lindheimerii (Texas Rat Snake). USA: TEXAS: La Salle Co: 41.6 km SE Cotulla. No date, no collector recorded. WTAMU 14325-6.

Nerodia erythrogaster transversa (Blotched Water Snake). USA: TEXAS: Roberts Co: Killebrew Ranch. 8 October 1977. Derl Brooks. WTAMU 3977.

Nerodia rhombifer rhombifer (Diamondback Water Snake). USA: TEXAS: Lavaca Co: 1.6 km W Hallettsville. 11 July 1982. Jay Long. WTAMU 8762. Mills Co: P. K. Caraway Ranch. 23 April 1977. D. Chance and P. K. Caraway. WTAMU 3195. Moore Co: Bonito Creek, Lake Meredith. April 1979. J. Bertl. WTAMU 6481. Potter Co: 14.8 km N Amarillo, FM 1912. 29 April 1972. WTAMU 6549, 6551. 16 km N Amarillo. 29 April 1972. B. Benson. WTAMU 2895. Randall Co: Currie Ranch. 3 October 1981. R. McDowell. WTAMU 7429. A western range extension of about 40 km in the central part of the state panhandle.

Pituophis catenifer sayi (Bullsnake). USA: TEXAS: Gillespie Co: Fredericksburg. June 1987. Dale Brodbeck. WTAMU 11060. Grayson Co: Juniper Point, Lake Texoma. 22 September 1981. Flavius C. Killebrew. WTAMU 8614, 14975.

Thamnophis sirtalis parietalis (Red-sided Garter Snake). USA: TEXAS: Lipscomb Co: 1.6 km S Darrouzett. 1 October 1989. Gene Hay. WTAMU 14336.

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New Records of Amphibians and Reptiles from the Cumberland Plateau in Dade County, Georgia

JOSHUA LAERM

ERIC BROWN

and

KATHERINE BARKER

Museum of Natural History and D. B. Warnell School of Forest Resources
University of Georgia, Athens, Georgia 30602, USA
e-mail (JL): laerm@museum.ent.uga.edu

Williamson and Moulis (1994) summarized known distributional records of amphibians and reptiles of Georgia. However, comprehensive documentation for many species is still lacking from many counties and several physiographic provinces.

From 7 August 1994 to 30 April 1995, pitfall surveys for shrews (Insectivora: Soricidae) were conducted at ten localities on the Cumberland Plateau, Dade County, Georgia, USA. Sixteen species of amphibians and reptiles were trapped incidentally. Included were four species previously unreported from the Cumberland Plateau of Georgia, which we report on here. All specimens were obtained by Eric Brown and identifications verified by M. E. McGhee and Carlos Camp. All specimens are deposited in the herpetological collections of the University of Georgia Museum of Natural History.

Ambystoma talpoideum (Mole Salamander). Dade Co: Pigeon Mountain Wildlife Management Area, Rape Gap. 14 August 1994. UGAMNH 24865. Fills distribution gap between nearest record in Jackson County, Alabama (Mount 1975), ca. 60 km to the southwest, and nearest record in Bartow County, Georgia (Williamson and Moulis 1994), ca. 85 km to the southeast. To our knowledge, the present record, the single specimen from Bartow County, and five specimens from two localities in Newton County (Williamson and Moulis 1994) are the only records from Georgia north of the Fall Line.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). Dade Co: Pigeon Mountain Wildlife Management Area, Dickson Gulf. 14 August 1994. UGAMNH 24861. Fills distributional gap between nearest locality in Jackson County, Alabama, 35 km to the west (Mount 1975) and Murray, Gordon, and Floyd counties, Georgia, approximately 65 km east and southeast.

Scaphiopus holbrookii holbrookii (Eastern Spadefoot). Dade Co: Pigeon Mountain Wildlife Management Area, Dickson Gulf. 14 August 1994. UGAMNH 24862–24863; Pigeon Mountain Wildlife Management, Rape Gap. 4 February 1995. UGAMNH 24864.

Mount (1975) reported records from the Cumberland Plateau of Jackson County, Alabama, ca. 20 km to the west. Nearest Georgia records are from Whitfield County, 45 km east-southeast (Williamson and Moulis 1994).

Virginia valeriae valeriae (Eastern Earth Snake). DADE CO: Pigeon Mountain Wildlife Management Area, Rape Gap. Two specimens taken, one each on 14 August 1994 and 8 October 1994. UGAMNH 24866–24867. Mount (1975) reported records from the Cumberland Plateau of Jackson County, Alabama, ca 15 km to the west. Nearest Georgia records include Murray County, ca. 70 km to the east, and Floyd County, ca. 85 km south (Williamson and Moulis 1994).

Additional species recovered from the pitfalls include the following: *Bufo americanus, Rana catesbeiana, Aneides aeneus, Eurycea cirrigera, Eurycea lucifuga, Gyrinophilus porphyriticus, Plethodon dorsalis, Plethodon glutinosus, Sceloporus undulatus, Eumeces fasciatus, Carphophis amoenus,* and *Diadophis punctatus*. These species are documented from numerous records in Dade County (Williamson and Moulis 1994) and adjacent regions of the Cumberland Plateau in Alabama (Mount 1975).

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WILLIAMSON, G. K., AND R. A. MOULIS. 1994. Distribution of Amphibians and Reptiles in Georgia. Savannah Sci. Mus. Spec. Pub. 3:1–712.

BOOK REVIEWS

A Fieldguide to the Amphibians and Reptiles of Madagascar (Second Edition), by Frank Glaw and Miguel Vences. 1994. Privately published by the authors (Klosterstr. 124, 50931, Köln, FR Germany), printed by Moos Druck, Leverkusen and FARBO, Köln. Soft cover. 480 pp., 552 figs., 448 color plates, 503 (unnumbered) distribution maps. ISBN 3-929449-01-3. US $75.00 (DM 88.00).

RONALD A. NUSSBAUM
and
CHRISTOPHER J. RAXWORTHY
Department of Herpetology, Museum of Zoology
University of Michigan
Ann Arbor, Michigan 48109-1079, USA

The title of this much improved second edition is somewhat misleading, because included are numerous photographs of plants (14), invertebrates (51), and birds (24); and much of the latter half of the book (pp. 353–399) is devoted to mammals and freshwater fishes. Compared to the first edition, which was published in 1992, the coverage is more complete and there are fewer mistakes. However, this second edition is far from error-free, and many of the faults of the first edition are perpetuated, the most important of which are the uneven treatment of amphibians and reptiles and the inclusion of material that will be of no value to most readers (e.g., oscillograms of frog calls) or is otherwise inappropriate for a field guide (formal description of new taxa).

The introductory section includes brief overviews of climate, biogeography, flora and fauna, and conservation issues. Also included in the introduction are three maps indicating the nature reserves in Madagascar, important localities, and biogeographic zones. After the introduction there is a two-page historical overview of herpetological research in Madagascar, which mainly concerns the rate of discovery of new species.

The following systematic sections are unbalanced, in that 36 pages of preliminary information about frogs (characters, measurements, skeletal features, reproductive diversity, egg and tadpole identification) are given, and only two such pages are devoted to reptiles, and even less to mammals and fishes. In addition, Appendix 5 is 23 pages of sonagrams and oscillograms of frog calls. This frog bias, indicated also by the beautiful cover photo of a *Boophis luteus*, undoubtedly reflects the interests of the authors, both of whom are pursuing Ph.D.s in programs centered around frog biology and systematics.

The sections that include the species accounts also give short summaries for each family and genus. Keys or determination tables are present for genera and species. Species accounts of frogs include subheadings for distribution, description, habits, call, eggs and tadpoles, and similar species. The reptile accounts are much abbreviated and contain no subheadings other than a diminutive "Distribution:" at the beginning of most accounts. For both frogs and reptiles, with a few exceptions (e.g., *Hemidactylus*), known specific localities and references documenting the localities are listed. Range maps are presented for most species, which consist of small outline maps of Madagascar with type localities indicated by a star and other localities by a dot. The distributions of a few reptiles are indicated by shading rather than dots, and in these cases the type localities are not indicated, perhaps because they are unknown. No reason is given for this deviation from dot maps. The maps are either placed individually near the corresponding species account (frogs) or are grouped (up to 20 maps) on a single page placed reasonably close to the relevant species accounts (reptiles and other groups).

Four new subgenera of *Mantidactylus* are described in the guide along with 11 new species and 2 new subspecies of frogs (*Boophis* and *Mantidactylus*). Additional taxonomic changes include elevation of *Boophis sibilans* (formerly a subspecies of *B. albipunctatus*) to species rank, resurrection of *Mantella cowani* and *Mantella pulchra* from synonymy of *Mantella madagascariensis* (these resurrections were already generally recognized), and rearrangement of various species groups of frogs. The authors also designate several frog lectotypes. No new reptile taxa are named, but *Lygodactylus septemtuberculatus* is placed in the synonymy of *L. miops* and *Calumma hilleniusi* is elevated from a subspecies of *C. brevicornis* to species rank. *Furcifer balteatus* is transferred from the *Calumma parsoni*-group to the *Furcifer bifidus*-group, the *Calumma boettgeri*-group is disbanded and placed within the *Calumma nasuta*-group, and informal species groups of *Brookesia* and Madagascan *Phelsuma* are named.

A 30-page section on mammals follows the reptile accounts. The mammal species accounts are short and limited to brief descriptions and notes on distribution, habitats, and status. Most of the distribution maps for lemurs consist of shaded areas rather than dots, but dot maps are used for the remaining mammals (carnivores, bats, tenrecs, shrews, rodents). Type localities are not indicated on the maps. In addition to several black-and-white photographs of mammals, there are 61 color plates, mostly of lemurs, some of them mislabeled according to a list of errata on p. 7.

After mammals there is a 19-page section on freshwater fishes which includes keys to families, cichlids, cyprinodonts, *Rheocles*, and eleotrids. In addition to very brief accounts of families and some species, there is a short section on introduced species and a list of marine families and species known to enter freshwater habi-

tats of Madagascar. A few black-and-white and 15 color photographs of fishes are included. No range maps are given for fishes.

Seven appendices follow the accounts of fishes. The first includes descriptions of four new subgenera of *Mantidactylus*. The second summarizes taxonomic changes published elsewhere and in the field guide since 1992 when the first edition was published. The third appendix is a summary of the field guide in English, German, and French and includes mainly a description of the taxonomic changes and new information that is presented. The fourth, which is mislabeled "Appendix 3," is a list of species and subspecies of amphibians and reptiles of Madagascar, including the original name and author, date of publication, type locality, museum where the types reside, and the current name. The fifth appendix is a set of 119 sonagrams and 126 oscillograms of frog calls. The sixth is a list of references grouped into sections on amphibians and reptiles (598 references), mammals (182), fishes (69), other groups (39), and personal communications (11); each reference is numbered and arranged alphabetically by author and date. The seventh is a gazetteer of localities and a locator grid-map (each grid cell being 0.5° x 0.5°), which includes six pages of about 600 localities listed alphabetically. Unfortunately, the page headings for Appendix 7 read "Appendix 6: references," an obvious printing error.

Following the appendices is a systematic index to all species, indicating the page number of the account, and, where relevant, the number of the color plate or figure pertaining to the species.

The book is attractively produced on good quality, 100% recycled paper in the same size and format as the first edition. However the binding is extremely fragile, and certainly will not survive long under field conditions. The printing quality, while generally good, is unclear or faint in places (usually only two or three words are affected). The traces in some of the sonagrams are barely visible. The standard text print is rather small, and the print size in the keys, determination tables, sections documenting localities of reptiles, and some of the maps is irritatingly small, especially in dim light. Elderly users and visually impaired readers will have trouble reading these sections.

Given that English is not the first language of either author, the text is remarkably free of grammatical and spelling errors and is eminently readable, even delightful in places. That is not to say the text is error-free; some typos and/or syntax anomalies occur, but in large these errors are not distracting.

Other errors of significance occur, however, and these are numerous enough that the authors (Glaw, in litt.) are planning to produce a supplement which will include a large set of errata and perhaps some new information. The errors include mislabeling or misnumbering of photographs and color plates, misplaced dots on range maps, missing information that was readily available in the literature and in museums, and errors of fact in the text.

The book is reasonably well organized and easy to use. The species accounts are condensed and standardized, deviating from form only when a new frog species is described. References to literature in the text are indicated by numbers in brackets that correspond to a citation in Appendix 6. Three improvements in organization would have been to place the distribution maps of the reptiles next to the corresponding species accounts, as was done with the frogs; closer positioning of photographs and species accounts; and an alphabetical arrangement of supraspecific taxa in the accounts.

The introductory material is useful but rather vague in places. For example, in a section on climate, the authors indicate that Madagascar is usually subdivided into Domains based largely on climate, but they give no citations for the climatic data nor any indication of who first proposed the Domains. Their discussion of biogeography is brief and non-illuminating. It is not very useful to say that the "distribution patterns of amphibians and reptiles" are "roughly in agreement" with the climatic domains. The authors indicated (p. 14) that biogeographic "zonation" (Domains ?) would be referred to in the distribution sections of the species accounts, but we found no such references in the accounts. In effect, there is no biogeographic analysis of amphibians and reptiles in the guide. The reviews of the historical geology and the origin and character of the fauna and flora of Madagascar in the Introduction are interesting but unbalanced and not properly documented. No references are given for the too brief section on historical geology, and many of the statements of fact about the biotae are unreferenced. The numerous photographs of plants, invertebrates, and birds in the Introduction will be of only passing interest to herpetologists and distracting to some readers. The section on conservation is packed with valuable information, but again, too few references. How, for example, do the authors know that 50% of the rain forest in Madagascar was destroyed between 1950 and 1985? The authors discuss exploitation of species popular in the pet trade, but give no press to the numerous, poorly known species that are known from only one or few specimens, some of which haven't been seen in decades.

The authors consider their book a field-guide, and four sources of information are provided for species determination: species descriptions, illustrations, character determination tables, and keys. However, many genera are not completely illustrated or lack character tables, and the largest herpetological genus in Madagascar, *Mantidactylus* (56 species), has no identification key. Sonagrams and oscillograms are also provided for many amphibian species, although it seems unlikely that most readers will ever use them to aid species identification.

The amphibian keys use a combination of characters which are either almost impossible to determine on live frogs (e.g., webbing formula, tympanum/eye ratio, tibiotarsal articulation point, vomerine teeth), or require live frogs (e.g., coloration characters that do not preserve in fixative and call characteristics). Therefore using these keys will sometimes require recording calling males (during a breeding period which may be short), photography of natural coloration, and preparation of museum specimens.

The keys themselves do not appear to have been carefully checked against the determination tables, resulting in discrepancies. As an example, for the frog genus *Boophis*, the finger webbing formula used in the first key couplet requires that *Boophis tephraeomystax, B. microtis,* and *B. opisthodon* do not have external finger webbing 3e(0-2), but the determination table describes these species as having finger webbing 3e(1). Discrepancies also exist between the species descriptions and determination table, and the species descriptions and the identification key. For example, the foot webbing of *Boophis tephraeomystax* is either 4i(1) in the description, or absent in the determination table. Other *Boophis* species, such as *B. microtympanum, B. laurenti*, and *B. williamsi*, are described in the species descriptions as having a "trace of webbing between fingers 3 and 4," but if the reader chooses the first key couplet condition "no or nearly no webbing between the external fingers" correct identification is impossible using this key. These types of errors make species identification time consuming, extremely frustrating, and considerably increase the risk of misidentification.

Because there is no *Mantidactylus* key, the determination table for this genus provides the main method for species identification. However, many of the most difficult species can not be identified using this table alone such as *Mantidactylus aerumnalis*

and *M. opiparis; M. curtus, M. ulcerosus, M. alutus,* and *M. biporus; M. eiselti* and *M. thelenae; M. asper* and *M. spinifer; M. luteus* and *M. plicifer; M. tornieri* and *M. depressiceps*. The species descriptions usually provide further information under the section "similar species"—but not always, and some of the most difficult groups of frogs cannot be identified using this guide. For example, on page 129 we are told that species determination for the *M. wittei* complex "is very difficult, if not impossible," and "very difficult" for the subgenus *Brygoomantis* (page 167). For this latter group of frogs, the authors have opted to present the work of previous researchers, rather than deal with these significant identification problems. Ironically, although the main focus of this second edition is still amphibian identification, we suspect that most readers are going to have major difficulties when trying to use this book, both in the field and in a museum environment.

For the reptiles, because the species descriptions are so short, and many species are not well illustrated, identification is heavily dependent on using keys. Most of these keys have been taken from the literature, and typically use characters based on preserved museum material. However, original keys have also been included for some groups such as *Amphiglossus, Lygodactylus*, and *Phelsuma*. These new keys provide a valuable summary of a diverse literature, but suffer somewhat from the poor choice of characters. In the *Phelsuma* key, the first couplet uses characters (femoral pore counts and total length measurements) that are not shown by females, juveniles, or individuals with damaged or regenerating tails; while in the *Amphiglossus* key the first couplet character requires either a skeletal preparation or x-ray examination (to make a presacral vertebrae count). This poor choice of characters means that accurate field identification of many of the reptile groups will be extremely difficult using the keys in this guide.

Although the range maps are useful, they must be viewed with caution, because, according to the authors, most localities are taken from the literature and the identifications of the voucher specimens usually were not verified. The confusion of collecting sites that exist in the literature will also contribute significant errors to some of these distribution maps (many Malagasy localities share identical or very similar names). In addition, we already know these maps are very incomplete, based on the large number of new distribution records that the Zoology Department (University of Antananarivo), and the Museum of Zoology (University of Michigan) have been accumulating since 1989.

The quality of the figures and color plates is highly variable. Most of the color plates are good to exceptionally good, but there are poor ones, and many of the black-and-whites are of poor quality. A large portion of the photographs were borrowed and acknowledged, and a significant number of them are mislabeled or misreferenced. For examples, color plate 176, referenced on p. 235 as *Brookesia nasus* and labeled the same, is actually a photograph of an African *Rhampholeon*; Fig. 504 is labeled *Liopholidophis lateralis,* but is actually *L. stumpffi*; Figs. 508 and 509 are referenced on p. 343 as "*Stenophis* sp. 2 Domergue, in press," but 508 is a black and white of *Ithycyphus oursi* and 509 is *Stenophis betsileanus*, both properly labeled. Most of the key illustrations are reproduced from other works, and the quality of reproduction is good to poor. An example of poor quality key illustrations are those of the chameleons taken from Brygoo's monographs.

The usefulness of the sections on mammals and freshwater fishes is questionable because of their brevity, and the authors admit that these sections will never compete with field guides devoted to these subjects (at the same time as Glaw and Vences guide was published, an excellent guide to the lemurs was published by Mittermeier et al. 1994). The authors included these sections as a "service," but they will only service those owners who can't afford other literature or who are only very generally interested in the vertebrate fauna of Madagascar. Most herpetologists probably would have preferred that the space be used for expanded and more detailed accounts of the herpetofauna, especially the reptiles. The two most popular groups, and also those most likely to be seen by visitors, are the chameleons and the day geckos. And yet the quality of the photographs and information presented about these diurnal reptiles does not measure up to that given for frogs, the group which includes the greatest number of species that are unlikely to be encountered by visitors.

The authors have done professional herpetologists a service by providing details of frog reproductive biology, sonagrams (Appendix 5), and information regarding original and current names (Appendix "3" = 4), however, this extra material will probably never be used by the average owner of this guide. Professionals will also find the gazetteer in Appendix 7 of use, but, for the precision needed in scientific work, it will still be necessary to use maps, GPS devices, and more detailed Madagascar gazetteers such as the one published by the United States Board on Geographic Names (1989) which includes 35,000 localities with coordinates.

It is a bit startling to see the publication of new subgenera, species, and subspecies in a field guide, especially one that is privately published by the authors. Glaw and Vences seem to be aware of the controversial nature of describing new taxa in privately published and unreviewed books and journals as they attempt to justify their actions in the Introduction. Many of the new species discovered in Madagascar (by Glaw, Vences, and others) have been recently described either in non-technical, non-peer reviewed, pet-keeping magazines; non-peer reviewed amateur journals; or journals with a very limited peer review process. The advantages of such sources for publication are obvious: rapid publication, and without the burden of having to convince reviewers that the newly described taxa are valid. For example, many professional journals would probably not accept papers describing new subgenera in the manner of those established for *Mantidactylus* by Glaw and Vences in their field guide, because they presented no evidence that these groups form monophyletic clades. Their diagnoses (Appendix 1) are purely phenetic and include ecological data, conditions which almost assure paraphyly in large groups such as *Mantidactylus*. Furthermore, it appears they rather uncritically accepted information from the literature in defining these taxa and may not have verified the diagnostic characters for every included species. Given the primitive state of systematics of Madagascan frogs, establishment of these four subgenera of *Mantidactylus*, and the additional seven by Dubois (1992), seems premature, and will likely cause confusion later on. Furthermore, the formal naming of subgenera (why not use informal species-groups?) serves no real purpose other than perhaps assuring authorship should it ever be decided that the subgenera, or parts of them, deserve generic rank.

The authors mentioned that Boulenger is the champion among the early describers of Madagascan frogs in the sense that he has the highest number of named species that are still valid. Glaw and Vences would do well to take a lesson from their own writings. History will judge them not by how many taxa they have described, but by the quality of their work and how well it stands the test of time.

Other than the changes mentioned above, the field guide generally follows the nomenclature of recent revisions and is up-to-date. Two exceptions are the unexplained decision not to use the name Opluridae (Frost and Etheridge 1989) for the Madagascan

iguanians, and their rejection of the modification of boine snake classification presented by Kluge (1991), in which *Acrantophis* and *Sanzinia* are placed in the synonymy of *Boa*. Glaw and Vences's reasons to reject Kluge's classification, by making a comparison to iguanian classification, and claiming that changing the taxonomy would cause confusion in the "worldwide conservation administration" are not convincing, and probably reflect Glaw and Vences's disregard for cladistic principles, as is suggested by their naming of phenetic subgenera.

As Glaw and Vences wrote in the preface, if they were typically German (like Helmut and Kurt, two German students with whom Glaw and Vences draw comparisons to themselves), and waited until the knowledge of the Madagascan herpetofauna was complete before attempting to produce such a book, they would never have been able to start. Perhaps more than anyone else, Glaw and Vences are acutely aware of the limitations of their field guide.

Despite the errors, unbalanced subject matter, uneven quality of figures, problems using the guide to identify species, the questionable procedure of taxonomic revision in an unreviewed and privately published book, incompleteness, and its almost immediate antiquation (many more species of amphibians and reptiles will certainly be described over the next few years), this is a useful book, and the authors are to be admired for the enormous amount of work that went into its production.

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Revision of the Neotropical Snake Genus *Chironius* Fitzinger (Serpentes, Colubridae). J. R. Dixon, J. A. Wiest, Jr., and J. M. Cei. 1993 (actual publication date is 15 January 1995). Monografie XIII. Museo Regionale di Scienze Naturali – Torino. 279 pages, 6 composite (3 each) color plates. Hardcover. Approx. US $80 + shipping. ISBN 88-86041-05-5.

LAURIE J. VITT

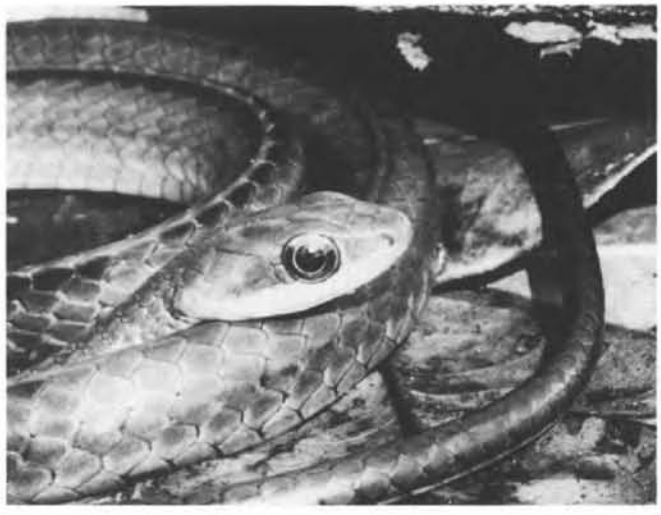
Oklahoma Museum of Natural History and Department of Zoology
University of Oklahoma, Norman, Oklahoma 73019, USA

In many areas of the New World tropics, snakes in the genus *Chironius* are among the most abundant diurnal snakes. Nevertheless, for field herpetologists, they can be among the most difficult to find and once found, they can be even more difficult to capture. Because many localities contain several species, all of which appear superficially identical, capture and scale counting is the only way to confirm identification and in some instances that even fails given the available keys prior to Dixon et al. I have always viewed these snakes as herpetologist watchers, as they most certainly capture and integrate images of every continuously moving object in their field of vision. If the object is not food, the snakes slide away, equally agile on ground or in vegetation. I suspect that a vast majority of individuals are never seen simply because they have detected the presence of a herpetologist (clearly not differentiating "herpetologist" from all the other potentially threatening moving objects) long before the herpetologist is within his/her own snake detection range. Luckily for persistent herpetologists, the headlight is not part of the evolutionary history of *Chironius*. Consequently, as they sleep on vegetation, having been convinced by their evolutionary past that they are safe from most predators, they can easily be detected and captured. A vast majority of *Chironius* that I have found were captured at night and I have always been amazed at how "rare" they appear to be during the day.

In their revision of the genus *Chironius*, Dixon et al. begin by carefully reviewing the history of the genus name and the confusion in early literature. Linnaeus (1758) first described three of the currently recognized species under the genus *Coluber*. Even though the genus name *Chironius* was first used in 1826 by Fitzinger, it was not until the 1920s that *Chironius* became widely used. The authors recognize 20 taxa.

Twenty tables of morphological data precede species accounts providing the basis for what follows. The amount of work that went into compiling and summarizing those data, based on examination of 2978 specimens, is simply overwhelming. Whether one agrees or not with Dixon et al.'s taxonomy, the data are made available for all future workers in a concise and clear format. Furthermore, where significant variation exists within taxa, additional tabular data are provided so that the reader has access to data on which taxonomic decisions were based.

The key is straight forward and relatively easy to use as snake keys go. The authors have carefully avoided using color characters for those species in which there is geographic or ontogenetic variation and this should reduce confusion and hopefully will force non specialists to work their way through the keys rather than guessing identity based on color and pattern.



Chironius fuscus from the Rio Xingu, approximately 60 km SE Altamira, Pará, Brazil (1987). Photo by L. J. Vitt.

Following the tables and key are systematic accounts, first for each species and where applicable, with subspecies embedded. The systematic accounts are thorough, following standard format and including figures of relevant taxonomic characters (e.g., hemipenes, color patterns) and black and white photographs where appropriate. The distribution maps are spot locality maps so we

know where the material for descriptions was collected. Each account describes in detail variation that has been observed in the specimens examined providing the reader the opportunity to make critical identification decisions when key characters are ambiguous.

The life history accounts for each species provide an incredible amount of useful information that typically does not appear in taxonomic accounts and demonstrates how much data can be collected from individual museum specimens. We learn that *Chironius* are primarily frog eaters, and indeed, most of their diet consists of typically nocturnal species (hylids, leptodactylids, the lizard *Hemidactylus mabouia*). The important point is that the assemblage of natural history data compiled in this publication has the potential to generate numerous testable hypotheses about the ecology and behavior of these fascinating snakes. The data themselves suggest interesting questions that would not be asked otherwise. As environments throughout the world are being heavily impacted by man our only ammunition is real data on the organisms that comprise biodiversity on a local level. Lack of this information as development decisions are being made is akin to building a legal defense with no evidence.

Also within the life history accounts are behavioral observations that not only are extremely accurate but also suggest numerous hypotheses that could spawn additional research. We even learn the ecto and endo parasites to which these snakes are hosts.

The life history accounts clearly showcase the value of museum specimens in general (see also Greene 1986, 1994). With modern comparative methods (e.g., Harvey and Pagel 1991; Brooks and McLennan 1991) one could potentially reconstruct the evolutionary history of diet, reproductive characteristics (e.g., clutch and egg size), or examine the coevolution of host and parasites in *Chironius* (given a well supported phylogeny).

In the character summary on p. 24, Dixon et al. argue that the large eyes (and presumably keen eyesight) are adaptations for finding frogs and other prey that move "quickly and erratically." An alternative hypothesis is that large eyes and keen eyesight (which must have evolved early in the lineage) originally arose as an adaptation to detect and escape from predators and secondarily serves well for capturing fast moving prey. The data presented on diet suggest to me that *Chironius* are searching for prey that are typically inactive during the day and adds credence to the alternative notion that large eyes and keen vision may have arisen for predator avoidance rather than prey capture. As more diet data are collected and analyzed, it may be possible to test these competing hypotheses by examining the topology of diets on an independently derived cladogram for the genus.

The discussion of interspecific relationships and zoogeography (some 35 pages) is fascinating and should catch the attention of researchers working with a variety of organisms. Dixon et al. construct a phylogeny based on shared derived morphological characters, which, by their own admission, is only as good as the quality of the characters. It was not entirely clear to me why the phylogeny was constructed "by hand," given the numerous cladistic analyses packages available (e.g., *PAUP*, Swofford 1991; *MacClade*, Maddison and Maddison 1992). They then review Cenozoic history concentrating on Central and South America to set the stage for an interpretation of the historical zoogeography of *Chironius*. On page 222, Dixon et al. present the earlier phylogenetic hypothesis against a geological time frame and support their construct with published data on the history of the Amazon and surrounding regions. The authors indicate that their scenario is speculative, which is of course clear in reading it. However, the historical scenarios are interesting in themselves, and if taken as potentially testable hypotheses, should serve well to generate further discussion and research. Some alternative hypotheses are not considered, and I refer the reader to the section on zoogeography (p. 599) of the recent book on Amazonian lizards by Avila-Pires (1995) for an insightful discussion of these.

A brief summary of taxonomic changes makes it easy for the reader to determine what is new and two appendices, one of specimens not examined, the other of specimens examined, will direct interested systematists to the material on which this study was based.

At the end of the book is a series of color plates which, when coupled with the fact that no other tropical snakes have 10 or 12 dorsal scale rows, should make it ridiculously easy for anyone to immediately determine whether or not the snake that is chewing up their arm is a *Chironius* (as opposed to a *Philodryas*, for example!). More importantly, the color variation shown for all of the *Chironius* for which photographs were used clearly indicates the importance of key morphological characters in the identification of these snakes.

Overall, the errors and ambiguities are minimal and easily resolved. Tables are at first confusing because subspecies are listed in alphabetical order without the abbreviation for the genus, or, when subspecies exist, spelling out of the specific epithet. The reader has to turn to species accounts to determine which are species and which are subspecies. For example, under *monticola* are *m. cochranae, m. foveatus, m. multiventris,* and *m. septentrionalis,* in that order. In fact, *m. cochranae, m. foveatus, m. multiventris* and *m. septentrionalis* are subspecies of *C. multiventris,* not of *C. monticola.* More careful formatting in the first table could have avoided this confusion.

The word "oviducal" is used incorrectly throughout for "oviductal." This error somehow entered the life history literature prior to 1970 and still appears in some papers published by major scientific journals. "Oviductal" refers to things (usually eggs) in the oviduct, there is no structure called an "oviduc" (Smith et al. 1989).

In the *Definition* of the genus *Chironius* on p. 19, I would have added the descriptor "thin-bodied" or "streamlined" as all members of the genus are exactly that. Even the *Description* on the same page fails to mention the fact that all species are long and slender. Indeed, it is not until p 236 that we learn that these snakes have "...attenuated bodies, relatively long tails...."

Not all frog names are up to date. For example, "*Hyla rubra*" is now *Scinax rubra* (Duellman and Wiens 1992).

Color plates are not listed in the Table of Contents.

The use of quotes with periods and commas is incorrect throughout. Terminal quotes belong outside of the periods or commas, not inside, regardless of whether the periods or commas are part of the quote (Anonymous 1972, p. 39).

I have no doubt this will be a classic and should be on the shelves of all serious herpetologists working in the tropics. The combination of detailed species accounts, accurate distribution maps, discussion of variation, and summaries of morphological and life history data make this a particularly thorough and valuable contribution to tropical herpetology. Systematists can feel comfortable identifying their specimens (if the authors haven't already done their work for them), cladists can play with the data and possibly combine them with molecular characters, and ecologists and behaviorists interested in these snakes should not be bogged down with identification problems if this book is used properly. Moreover, the zoogeography section contains enough testable ideas to keep biogeographers interested in snake evolution busy for years to come. This is a "must buy" book for any serious tropical herpetologist.

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Amphibian Biology—Volume 1, edited by Harold Heatwole and George T. Barthalmus. 1994. Surrey Beatty and Sons: 418 pp. Hardcover. US $92 plus shipping. ISBN 0-949324-54-X .

STANLEY HILLMAN
Department of Biology, Portland State University
Portland, Oregon 97207, USA
e-mail: STAN@sbii.sb2.pdx.edu

This volume serves as a review of the integumentary system of amphibians. It will be the first volume in a series to deal with various aspects of amphibian biology in a corollary fashion to *Biology of the Reptilia*.

The preface to the series by Harold Heatwole reviews past and present attempts at reviewing amphibian biology and correctly recognizes a gap in both coverage and currency. The clear comprehensive coverage of Moore's *Physiology of the Amphibia* stood as foundation for reviewing the literature and delineating significant gaps in our understanding. These various volumes are now 20–30 years out of date.

The preface to volume 1 by Heatwole and George Barthalmus delineates the unique position the amphibian integument plays in their biology. Besides interfacing in mechanical ways with the environment there are significant mass fluxes of gases, water, and salts. In conjunction there are numerous glands with a plethora of chemicals unmatched in any vertebrate group.

Chapter 1 by Harold Fox nominally covers the structure of the integument. In reality, most of the chapter deals with aspects of development of the dermis and epidermis. The chapter is short. Fox has already published a series of reviews on the amphibian integument throughout the 1980's and this chapter is an update of those reviews. I feel this is a shortcoming since a comprehensive review is not present in this chapter.

Chapter 2 by Michael Warburg, Dina Lewinson, and Mira Rosenberg nominally covers the ontogenesis of the amphibian integument. The actual coverage is an in-depth analysis of larval-metamorphic changes in two species, *Pelobates syriacus* and *Salamandra salamandra*. The chapter is well written and reasonably well illustrated. The micrographs are clear though not crisp.

Chapter 3 by Sally Frost-Mason, Randall Morrison, and Kenneth Mason covers pigmentation. There is a major emphasis on development and biochemistry of the pigments. There is an attempt to correlate structure and function but with little regard for the work of others. For instance the discussion of chromatophore units in *Hyla* fails to acknowledge the contributions of Hans Nielsen in this genus. There is no synthesis of the biologic role of color in amphibians.

Chapter 4 by Uri Katz and Wolfram Nagel is on the biophysics of ion transport across the skin. Unlike the preceding three chapters there is no attempt to deal with developmental or ontogenetic changes. The authors are clear that this chapter is not a comprehensive review and provide references for those interested. A lucid, organized presentation of both sodium and chloride transport is presented. I was left wanting more on the regulation of these transport processes.

Chapter 5 by Dan Stiffler is on the role of cutaneous acid-base electrolyte exchange in organismic pH regulation. This is a narrow topic, but the information presented is comprehensive and state of the art. There is a consistent attempt to deal with mechanism and control.

Chapter 6 by Bob Parsons is on the effects of skin circulation on water exchange. Again a narrow but significant topic given the role of the skin in water uptake. The chapter is well written and provides a comprehensive picture with regulation as a unifying perspective.

Chapter 7 by Gary Malvin is on the cardiovascular regulation of cutaneous gas exchange. The topic is narrow, the review focussed, and regulation is emphasized. There is an excellent balance of theory and data.

Chapter 8 by David Booth deals with the effect of unstirred layers on gas exchange. Unstirred boundary layers develop around the surface of any object in a fluid. Whether they significantly influence cutaneous gas exchange or impact the biology of amphibians is still conjectural. The chapter is well written and provides a good theoretic framework.

Chapter 9 by Vittorio Erspamer is on bioactive secretions. This chapter is the foundation and tour de force of the book. The chapter represents 40% of the book and contributes to the decision to dedicate the whole volume to Dr. Erspamer. The chapter is a fascinating compilation of the biogenic amines, bioactive peptides and alkaloids found in amphibian skin. The characterization, phylogenetic distribution and physiologic effects of these substances on a variety of preparations are presented. This chapter alone would make the book a worthwhile reference. The potential evolutionary and ecological questions this synthesis opens up are exciting.

Chapter 10 by Lynne Houck and David Sever is on the role of skin in reproduction and behavior. This chapter represents the nominal bridge to the second volume of this series on social behavior. The emphasis of this chapter is on how integumentary structures interface with behavior to impact reproductive success and then how their phyletic distribution can be used to infer their evolution. The role of pheromones and chemical signals in reproductive behavior, territorial interactions and as anti-predator events are comprehensively reviewed. I very much enjoyed the synthetic attempt to cover various levels of biologic organization in this chapter.

Chapter 11 by George Barthalmus is on the biologic roles of skin secretions. The actual coverage is an analysis of skin glands in *Xenopus* as they relate to predatory defense, microbial defense and reproduction. Though the focus is narrow and not reflective of the title, the data are interesting and well presented.

The book suffers from a major flaw, there are significant gaps in the topics covered. A book whose aim is to be the definitive reference on the amphibian integument and not deal with topics like the regulation of and differences in the rate of water exchange across the integument seems very myopic. Some of the most significant discoveries in amphibian integumentary biology, like reduced evaporative water loss in certain arboreal species, are not mentioned or described. This is an editorial decision and not the responsibility of the authors. Couple this to the titles of many chapters not reflecting the narrow perspective presented indicate to me an abdication of editorial responsibility of a volume whose goal is to rival *Biology of the Reptilia*.

Despite the narrow perspective of many chapters and the gaps in topic coverage, what is presented is first rate and professional. The book will serve as an excellent reference for the topics covered. Whether every biologist interested in amphibians will need a personal copy is problematic. Clearly this volume should be in every school's research library.

Pleistocene Amphibians and Reptiles in North America, by J. Alan Holman. 1995. Oxford University Press, New York, and Clarendon Press, London. 243 pp. Hardcover. US $65.00. ISBN 0-19-508610-4.

JAMES D. GARDNER
Department of Biological Sciences and
Laboratory for Vertebrate Paleontology
University of Alberta, Edmonton, Alberta, T6G 2E9 Canada

With its climatic fluctuations and alternating glacial and interglacial episodes, the Pleistocene Epoch surely qualified as a time of environmental crisis. In North America numerous genera and some families of large mammals went extinct during this interval (e.g., Martin 1984), as did many genera of birds (e.g., Steadman and Martin 1984). The fate of amphibians and reptiles during the Pleistocene, however, is less well-appreciated. *Pleistocene Amphibians and Reptiles in North America*, the first comprehensive treatment of North American Pleistocene herpetofaunas, attempts to address this situation. J. Alan Holman is well-qualified to tackle such a project, because since the late 1950's he has been actively involved in the study of North American Cenozoic herpetofaunas.

The main body of this book consists of eight chapters. Following the brief introductory chapter (pp. 3–4), chapters two (pp. 5–20) and three (pp. 21–28) summarize, respectively, the North American Pleistocene and history of the North American pre-Pleistocene herpetofauna, from the Late Cretaceous to Pliocene. Although some might question the relevance of pre-Pleistocene amphibians and reptiles in a book devoted explicitly to Pleistocene herpetofaunas, I applaud Holman's desire to present the latter in an historical context. All too frequently we tend to view populations or taxa in isolation, forgetting that they are part of an historical continuum.

Chapter Four (pp. 29–81) is an annotated, systematic checklist of the 230 nominal species of North American Pleistocene amphibians and reptiles. Familial and generic accounts are concise; each briefly describes the general appearance, habitats, and geographic range of extant members in North America. Abbreviated, generalized osteological diagnoses are also presented for each family. Accounts are complemented by illustrations of 43 extant species with Pleistocene records.

Our understanding and interpretations of taxa known as fossils depend absolutely on our ability to reliably identify these taxa. It is thus fitting that the fifth chapter (pp. 82–98) briefly describes the skeletal elements that are commonly used to identify Pleistocene amphibian and reptilian taxa (e.g., ilia for anurans and trunk vertebrae for snakes) and each of these element's taxonomically more useful attributes. Descriptions in this chapter are illustrative; persons seeking detailed osteological diagnoses for particular taxa will have to delve into the primary literature. Illustrations of bones from 53 species with Pleistocene occurrences depict all of the key features reviewed in this chapter. Holman repeatedly advises would-be Pleistocene paleoherpetologists to make extensive use of comparative extant collections and develop an appreciation for patterns of variation within and among taxa. This advice is applicable to systematists in general, regardless of their group(s) of interest.

Chapter Six (pp. 99–179) is the core of this volume: it reviews 170 Pleistocene sites (three in Canada; the remainder in the lower 48 states), grouped under eight geographical regions, that have yielded amphibian or reptilian fossils. Accounts for each site include a brief description of its location and sedimentology, inferred depositional environment and age, and relevant comments and references. Accounts for more important sites—e.g., typically those with diverse faunas—also include a faunal list. Each regional section ends with a systematic checklist of its known Pleistocene species, cross-referenced by sites. This summary of known North American Pleistocene herpetofaunas will be useful to (and welcomed by) workers in many fields.

Chapter Seven (pp. 180–199) compares region-by-region how, if at all, the geographic ranges of amphibians and reptiles changed through the Pleistocene. Chapter Eight (200–211) first assesses the validity of the 17 nominal species and three nominal subspecies of currently recognized North American Pleistocene amphibians and reptiles (Holman concludes that 12 species and two subspecies are valid), then examines patterns of extinctions. To my knowledge, there is nothing particularly revolutionary nor contentious in either of these interpretive chapters. Compared to large mammals and birds, North American Pleistocene herpetofaunas were surprisingly stable, with only about 5.4% of species becoming extinct. Further, herpetofaunas in unglaciated areas also tended to stay put, suggesting that taxa readily adapted to long term climatic changes and associated biotic perturbations. Holman summarizes contemporary explanations for the stability of the North American Pleistocene herpetofauna, but he does not commit himself to any one theory. As he sagely observes, until we acquire a deeper understanding of how modern amphibians and reptiles respond to environmental changes, our explanations for the resiliency of the North American Pleistocene herpetofauna will remain speculative.

Given Holman's recent work on Pleistocene amphibians and reptiles from Europe (e.g., Holman 1992, 1993; Holman et al. 1990), I was surprised that he did not take the opportunity to compare the Pleistocene herpetofaunas of North America and Europe. If such comparisons are feasible they may prove most interesting, because the timing and rates of extinction between Pleistocene mammals on the two continents show intriguing differences (Martin 1984).

A reference list of 265 articles, followed by general, site, and taxonomic indices complete this book. Unfortunately, the general index appears to belong, at least in part, to a different book.

In total, 43 pen-and-ink drawings are presented: five of these are maps; the remainder depict extant species and bones from species with known Pleistocene occurrences. About one-quarter of the species reported from the Pleistocene, including most holotypes of Pleistocene species, are figured. Most of the figures in this book have been taken from other published sources and, thus, are of varying styles and quality.

Holman's goal in *Pleistocene Amphibians and Reptiles in North America* is to examine "the Pleistocene amphibians and reptiles of the North American continent (excluding Mexico) with emphasis on their ecological relationships and patterns of evolution and extinction" (p. 4). Holman has also directed his book at a more general scientific audience. Within these parameters, I feel that Holman's book adequately accomplishes its objectives. Aside from some typographical errors and the above-mentioned problem with the general index (surely the publisher's blunder), I have only one concern about this book. Although I can sympathize with the dilemma of trying to present a balanced account satisfactory to both specialists and novices, I feel that in some instances Holman catered to the latter audience too much. Specifically, some discussions were overly simplified and supporting documentation was often sparse. For example, in the overview of the North American pre-Pleistocene herpetofauna several fossil taxa were omitted (e.g., the extinct Albanerpetontidae and the enigmatic latest Cretaceous frog *Theatonius*). Further, although several papers (e.g., Tihen 1964; Estes 1970; Hutchison 1992) are relevant to the discussion in Chapter Three, Holman cited only Estes and Baez's (1985) paper. Such sparse documentation is annoying, because it needlessly complicates the task of tracking down pertinent references. I must temper my comments at this point, by acknowledging that this book alerted me to several papers, relevant to my own work, of which I was previously unaware.

In conclusion, I was generally pleased with *Pleistocene Amphibians and Reptiles in North America*. This book is an up-to-date, readily accessible summary of our current understanding of North American Pleistocene herpetofaunas. As such, it stands as both an invaluable reference and a source of potential ideas for future research.

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Note added in press: J. A. Holman and the publisher have just informed me that, aside from a few advance copies, all copies of *Pleistocene Amphibians and Reptiles in North America* have been rebound with the correct general index.—*JDG.*

Snakes of the United States and Canada: Keeping Them Healthy in Captivity: Volume 2 Western Area, by John V. Rossi and Roxanne Rossi. 1995. Krieger Publishing Co., Malabar, Florida. 342 pp., 106 color photographs. Hardcover. US $69.50. ISBN 0-89464-808-X.

LANI LYMAN-HENLEY

Division of Science & Mathematics, Mississippi University for Women Columbus, Mississippi 39701, USA

Despite the growing popularity of snakes as pets, there is a definite shortage of books dealing with the husbandry of native species. Much of the information available to people interested in keeping snakes—whether professionally or as interested laypersons—deals with a few well-known types (e.g., corn snakes) or exotics (e.g., pythons). With this problem in mind, I recommend this book to anyone interested in the husbandry of native snakes of western North America, be they laboratory researchers or mothers dealing with the snake Junior insists on bringing home. This book contains a wealth of information and is a worthwhile book for herpetoculture. However, with that "bottom line" assessment, there are a great many (mostly minor) flaws that I hope can be remedied in later editions.

One theme raised frequently in this book concerns the herpetoculture of native species as a means of preservation and building a knowledge base. The authors rightly point out that methods that work for four or five well-known genera don't necessarily apply to the other 50. The argument is brought up in favor of keeping various native species, including the less flashy ones, since the discovery that a population or species is in danger may not leave time to discover proper requirements for its protection (including captive propagation). The Rossis also tread on the controversial topic of relaxing regulations regarding captive maintenance and breeding—a topic that tends to arouse heated debate. They return to this discussion in several individual accounts regarding protected species.

Although the contents list four separate parts, this book is really organized into two distinct sections. Part I (Keeping Snakes: General Care) deals with various aspects of snake biology and husbandry, while Parts II, III, and IV are all species accounts. Part II deals with the majority of Western species, Part III with venomous species, and Part IV with assorted subspecies that are more thoroughly treated in Volume I.

In general, the editing of Part I could have been much better. There are enough grammatical errors and misspellings to be annoying. Anthropomorphic language is frequently used (i.e., a snake being "bored with the same food item") and odd terminology is common (i.e., "pop the snake," referring to everting the hemipenes). The writing itself is also occasionally awkward and the organization sometimes seems haphazard as topics are often repeated in different sections. A few specific examples include a "Summary" section that has the same heading level as the section it is summarizing and tables that list snakes in alphabetical order by common name only. Although the individual accounts do include scientific names, it would be helpful to include these in the

tables as well. Many laypersons may prefer this alphabetical approach, but it should be consistent throughout the book. The citation format is also inconsistent. Likewise, the tone of the book often changes abruptly. At points there is the assumption of a large technical and medical knowledge on the part of the reader, while in other places the writing is extremely elementary, leading to a difficulty in assessing the target audience for this book. This is especially true with the medical portions of the book where the first author, himself a DVM, too often writes as if reptile-familiar veterinarians are available everywhere (which is sadly still far from true). At times it is unclear which treatments require the aid of a veterinarian and those which may be accomplished by the educated layperson.

Most of the information contained in this book appears to be well-researched and sound, but there are a few subjects which do not seem quite up to par. Despite their laudable approach of tailoring husbandry to particular species' needs, the authors make several comments to the contrary. A place this repeatedly comes up involves diet. The authors suggest training captive snakes of most species to feed upon domestic mice, if necessary by scenting them with natural prey items. This seems to be counter to their aim of species-specific husbandry and catering more to the amateur snake-keeper with limited funds and limited access to natural prey items. Another example involves group housing of snakes. It is stated that snakes should not be housed together outside of breeding seasons, at one point making the statement that "juveniles of all species do better alone" (p. 60). I can however think of several studies suggesting the opposite among natricine snakes alone, and in personal experience I have found no better way to stimulate poor feeders than to place them in a group of similar-sized conspecifics.

Another element I have some disagreement with concerns hibernation/brumation/winter cool-down. Cool-down using the area's naturally occurring winter climate is recommended, but the authors need to better describe what problems and conditions to avoid in natural "brumatoriums." An unusually cold night can be quite devastating even to a local species if it is not housed in a suitably insulated place. The Rossis also seem to be under the impression that "artificial brumation" does not allow for any activity on the part of the snake, especially regarding drinking, which is simply false. Other questionable claims include the assertion that no snakes should be cooled in groups, and that two months is thought to be the minimum time for cool-down.

A few other particular statements also raise an eyebrow, some of which I will list here in example. The suggested "humane" killing of rodents by placing them in small airtight jars may surprise many animal care committees, and comments regarding hybrid vigor and the detriments of reduced gene flow (in favor of releasing some captive snakes) are bound to displease some ecologists. I found the suggestion to cover neonate water bowls with a lid with a hole in it dangerously reminiscent of a trap that could easily drown entrants. Two topics that needed more description or literature support were the suggestion that tail stripes could be used to sex snakes and something called "Cage Complacency Syndrome."

A topic not touched upon which may be of use would be methods of marking individuals for identification. This was odd given their emphasis on thorough record keeping, an extremely positive and a most helpful suggestion for anyone keeping several snakes.

Many of the problems of Part I, notably, both the writing quality and literature citations, are largely resolved in Parts II–IV. The photographic plates are nice, though it would be helpful if the text entries referred to the appropriate plate and vice versa. Each entry is a fairly complete description of the species in question, though it would not replace a good field guide. It is clear that the authors attempt to keep up with the current usage of names, but it would also be helpful if they included prior names and key citations on which their naming decisions are based. They do comment on nomenclatural problems in the section on garter snakes, a group in particular systematic flux.

Each entry in Parts II and III (and a few in Part IV) includes a summary box with a range map, species name (common and scientific), a "Maintenance Difficulty Index," average size, food, cage size, substrate, ventral heat, UV light, temperature range, and special considerations. The sections on food through temperature range serve as a quick reference to general housing requirements tailored to the particular species and are elaborated upon in the text. It is often unclear whether snakes benefit from UV light, but the authors cite evidence for or against its use in particular species."Special Consideration" includes any warnings regarding diet, likely parasitism, behavioral tendencies, etc. This is also where venomous or protected species are noted. The Maintenance Difficulty Index operates on a useful 5-point scale, with 1 being easiest and 5 most difficult (there are a very few 5+ animals described, such as the spotted leafnose snake, *Phyllorhynchus decurtatus*), but the scale probably does not need to be described in every entry.

There are consistent reports on known sensitivities to antibiotics or anti-parasite drugs, as well as species tendencies toward various health problems. A useful recipe for "Swamp Tea" (an acidic, swamp-like water made with tea) is given in the Graham's crayfish snake (*Regina grahamii*) account. This may have been better placed in the Housing section of Part I with other such maintenance details.

Several species with populations in danger are discussed in detail. Protected snakes are noted (including states in which they are protected), and the authors state that they do not suggest private collection of these animals (although the previously noted opinions regarding legal captive propagation are usually reiterated). In light of the great care taken to describe such predicaments, I was surprised to find the San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) not listed as being protected despite its inclusion on the Federal Endangered Species list.

The bias towards switching every possible species to feeding upon domestic mice again rears its head, to the point where Food entries in the summary boxes almost invariably include "mice," thereby no longer reflecting the animals' natural diet.

Part III deals with venomous species, and opens with some guidelines to safety procedures and additional housing suggestions, as well as a disclaimer that the authors believe that no venomous snake should be handled except in the case of medical emergency. They also are careful to warn of venom toxicity and known fatalities in the individual accounts, and repeat their warning against handling venomous snakes despite seemingly calm dispositions. Part IV includes very brief summaries of species treated more completely in Volume I.

Despite its many small faults, I still recommend this book because of the paucity of herpetoculture references for native American species. Unfortunately, the high price will make it less attractive to those interested amateurs who would benefit most from it. I am always on the lookout for such practical and useful books to recommend to "budding herpetologists," and I even learned a few new tricks from this one. I was personally pleased by the entire section devoted to garter snakes, including a reference to a longevity record for coast garter snakes (*Thamnophis elegans*

terrestris) which was set by a snake of mine. I plan on keeping my copy of this book handy to help deal with the frequent calls I receive from students, mothers, and neighbors asking not only for identification but also for information on "how to keep it."

A Field Guide to Reptiles and the Law, by John P. Levell. 1995. Serpent's Tale Books, Excelsior, Minnesota. 240 pp. Softcover. US $29.95. ISBN 1-885209-03-7. Available from Zoo Books, 464 Second St., Excelsior, Minnesota 55331, USA.

JOHN MORIARTY
Hennepin Parks, 3800 County Road 24
Maple Plain, Minnesota 55359, USA

A Field Guide to Reptiles and the Law is an up-to-date guide to the state and U.S. laws effecting reptiles and amphibians. Levell's book covers CITES, the U.S. Endangered Species Act, and miscellaneous federal regulations, but the majority of the book deals with state regulations. Listings of state endangered and threatened species are accurate and current. The book also covers state regulations on commercial and non commercial harvest, importation of native and exotic species, and some unique regulations. One of the main things the state section reveals is the lack of regulations in many states.

One example is my state, Minnesota. It is illegal to possess or collect endangered and threatened species without a special permit. This protects five-lined skinks, Blanding's turtles, and wood turtles. There are commercial regulations and licenses for snapping turtles and frogs (there is no definition of "frogs" in state regulations, so by default it includes all anurans). The commercial and non-commercial taking of snapping turtles requires a 10-inch minimum carapace width. Frogs can not be sold as bait between March 31 and May 16 (the closed season for bass) and only northern leopard frogs and bullfrogs can be taken for purposes other than bait (biological supply trade). The taking of other species of frogs for the pet trade or other uses appears to be unregulated. There are 30 species, including all of the snakes, that have no protection and an additional 17 species with only partial protection. The Minnesota Department of Natural Resources doesn't even have the authority to regulate most amphibian and reptile species.

Minnesota's regulations are similar to many states where there is a good endangered species law (except for North Dakota, Utah, West Virginia, and Wyoming), poorly written commercial turtle rules, a wide open bait frog law, and little or no protection for the rest of the species. There are a number of states that ban the commercial trade of native amphibians and reptiles, but do not allow for the trade of captive bred specimens. There should be a permitting system that would allow trade in captive bred amphibians and reptiles, as is commonly found with many bird and mammal species.

The most complete reptile and amphibian regulations are found in Maryland. Maryland has a good threatened and endangered species law, well written native species laws including taking, importation, commercial trade, and captive maintenance regulations. If you live in Maryland send your Department of Natural Resources (DNR) a thank you note. If you live in another state you might consider sending your DNR a copy of this book.

There are a number of "interesting" laws found in the book. One of these is Kansas's taking law under which one can take unprotected amphibian and reptile species (68 of 97 species) by firearms (except machine guns), bows, crossbows, traps, deadfalls, snares, nets, dogs, and poison. I always thought Kansas had a wealth of herpetologists because of the reputation of KU, but I guess it is because of the thrill of going on a toad hunt with the ol' 12 gauge. Many other states have equally absurd taking laws, while other states don't appear to prohibit any method of taking.

In Massachusetts there is an extensive listing of non-native species that can be imported. Part of the list includes pythons and boas (Boidae) stating that a permit is needed except for common boa (under nine feet), green tree python, Colombian rainbow boa, sand boas, ball python, reticulated python (under eight feet), and African rock python (under eight feet). The next line says all other members of the family Boidae are exempt except (permit required) emerald tree boa. Simply put, the only boids needing permits are emerald tree boas, reticulated and African rock pythons over eight feet, and common boas over nine feet. What did emerald tree boas ever do to Massachusetts? What makes a big Burmese python and anaconda exempt? Discrepancies in various exemptions can be found in many state regulations. I wonder why a state agency would even try to regulate a non-native species that is not dangerous to humans or the environment.

Levell has done a good job dealing with the various agencies and an excellent job biting his tongue for not making any commentary about many of the laws. I was disappointed that there was not a summary that picked out the best pieces of the different laws for a proposed model state amphibian and reptile statute.

This book highlights the fact that most states do not have the laws necessary to protect native amphibians and reptiles. Conservation-minded herpetologists should use this book to start the process of revising their state's regulations, because without some controls on the taking and trade of amphibians and reptiles, long-term conservation will be difficult. Protecting habitat without protecting the animals that live there will not help conservation.

Amphibians and Reptiles Native to Minnesota, by Barney Oldfield and John J. Moriarty. 1994. University of Minnesota Press, 2037 University Avenue Southeast, Minneapolis, Minnesota, 55455-3092, USA. 237 pp., US $25.95. Hardcover. ISBN 0-8166-2384-8.

ERIK RUSSELL WILD
Natural History Museum and Department of Systematics and Ecology
The University of Kansas, Lawrence, Kansas 66045-2454, USA
rosco@falcon.cc.ukans.edu

Increasing concern over worldwide declines in amphibian populations and the growing interest of non-specialists in herpetology has created a need for updated accounts of state and regional herpetofaunas. The 50th anniversary of the publication of Breckenridge's *Reptiles and Amphibians of Minnesota* (1944) is appropriate timing for the publication of Oldfield and Moriarty's contemporary treatment, *Amphibians and Reptiles Native to Minnesota*.

Amphibians and Reptiles Native to Minnesota is organized in a manner similar to most state or regional guides. There are 11 non-numbered chapters, the first eight of which make up one-fourth of the book. These chapters introduce the state of Minnesota ("History of Herpetology in Minnesota;" "Habitats"), the field of herpetology ("Observing, Studying, and Photographing Amphibians and Reptiles;" "Conservation;" "Common Amphibian and Reptile Problems"), and identification ("Amphibian and Reptile Identification") with a checklist and keys to the native species. The majority (three-fourths) of the book is comprised of three chap-

ters of species accounts ("Amphibians;" "Reptiles;" "Species of Possible Occurrence") of the 48 species that occur in the state, plus six species that could possibly occur there.

The first chapter provides a thorough synopsis of the history of herpetology in Minnesota. This chapter is followed by a description of the major aquatic and terrestrial habitats where amphibians and reptiles can be found in the state, including color photographs of the habitats and a handy table listing the species that occur in each. One unfortunate oversight here is the absence of a discussion (or map as provided by Breckenridge, 1944) of the major physiographic provinces of the state. Little is mentioned regarding the western prairie and eastern forest ecotone that bisects the state and which may explain the limits of some species distributions. Next, the authors include a chapter on methods, techniques, and strategies of observing and studying amphibians and reptiles. This section, written at an introductory level, adds little information not found in other such guides except for idiosyncrasies of herping in Minnesota and a unique and informative section on photography that will benefit even specialists. The quality of the 115 color photographs throughout the book are testament to Oldfield's photographic expertise. An important theme introduced in the next chapter, and continued throughout the book, is an emphasis on conservation of reptile and amphibian populations. In this vein, the authors give the official status of each species as threatened, endangered, or of special concern; unfortunately, they do not define what these labels mean in Minnesota. Nevertheless, the authors' efforts to instill a conscience toward amphibians and reptiles in the general public should be applauded. They devote an entire chapter to "Common Amphibian and Reptile Problems" (an unfortunate title because the chapter does not deal with problems that amphibians and reptiles face, but problems that people have with them) that anticipates the most popular questions of the general public. This chapter should prove useful not only to the layperson directly, but also to the non-specialist biologist who has to address these concerns and educate the public.

Chapters 6–8 set up the remainder of the book which comprises the species accounts. Chapter six, "Amphibian and Reptile Identification," explains how to use the book and the format and approach to the species accounts. This chapter is followed by a comprehensive list of species including current specific, subspecific, and common names. The next chapter introduces the authors' innovative circular keys. One starts at the center and moves sequentially toward the periphery according to dichotomous choices of features (although there is one trichotomous choice in the turtle key) until identification is achieved. The keys are essentially the traditional written dichotomous keys but in diagrammatic representation and so are much easier to use, especially when tracing backwards to examine alternative choices. I anticipate that these keys will be popular with non-specialists and young, budding herpetologists. The accompanying line drawings (Figures 1–6) are clear but hidden on the backside of the last key and so are of limited usefulness. A much better location would have been in the spaces surrounding the keys themselves or in the species accounts near the appropriate discussion in the text. It seems that for the level that the book was written there should be many more simple, labeled line drawings showing the parts of a generalized frog, salamander, turtle, etc., and explicitly showing comparisons of diagnostic features discussed in the text; there are some things that not even the best photographs can achieve.

The chapters "Amphibians" and "Reptiles" introduce their respective classes with good, general treatments of morphology, physiology, reproduction, and ecology written with a sophistication just above the rest of the book. This is followed by a useful description of each of the families represented in Minnesota. Each species account includes five subsections: Description, Distribution, Habitat, Life History, and Remarks. The descriptions are sufficient, clear, and emphasize diagnostic characters. The authors make appropriate comparisons that are consistent with the circular keys. The general distribution of each species in North America is described along with a more detailed explanation of the range and habitat in Minnesota. In the upper left corner of a left page of each account is a map of Minnesota with the counties delineated. The amphibian maps are green whereas the reptile maps are brown; this, along with the consistent placement on the page, make them easy to find when thumbing through the book. The presence of a species in a particular county is indicated by a dot. To the authors' credit, they distinguish between sightings/literature records and vouchered records. Furthermore, the vouchered records are identified as pre- or post-1960 (the significance of 1960 was not mentioned). This will provide a sense of the validity of a species' occurrence in a county or acknowledge the need for better documentation. With the growing concern for decline in amphibian populations, these maps will be very useful in recognizing a reduction in a species' range over the past 34 years (e.g., see map for the Great Plains toad). However, the authors fail to emphasize this virtue in the text. The authors efficiently incorporate new, relevant information and emphasize, when available, data particular to Minnesota. For example they include the unusual event "... reported in Minnesota in which a Snapping Turtle killed an adult Trumpeter Swan." Likewise, they emphasize the ability of species to deal with difficult environmental conditions (long cold winters) in the northern extreme of their range such as freeze tolerance in the gray treefrog, Cope's gray treefrog, and the wood frog, and they report unusual winter activity like a painted turtle seen under the ice or a milk snake active in late November. Each species account has at least one, but usually several, color photographs of excellent quality that clearly depict important features and geographic and ontogenetic variation consistent with the discussion in the text.

I found few technical errors in the book: on page 96 the authors discuss the two variants of the northern leopard frog and state that they differ by a "single gene" which, in modern terms, probably means allele; and the Aleksiuk citation in the common garter snake account is spelled differently than that in the Literature Cited. The amphibian accounts by Moriarty tend to be shorter than those for the reptiles by Oldfield, and at times it seemed that Moriarty stopped short of a complete explanation or that something had been left out. The tadpole descriptions are so brief as to be of little use, and it is a shame that Oldfield did not apply his photographic skills to amphibian larvae. These criticisms notwithstanding, the species accounts are well illustrated, organized, and written. Thus, the authors' principal objective of providing contemporary accounts and enabling identification of Minnesota's amphibians and reptiles has been achieved.

The last chapter, "Species of Possible Occurrence," discusses six species in neighboring states for which there is reason to expect them in Minnesota. These brief one-page accounts include a short description of the species and its habitat, a discussion of the potential range, and a large color photograph of the organism. The book ends with a 75-word glossary, which seems sufficient to cover most of the technical terms of the book, a list of resources, including reference books and herpetological organizations, and 277 literature citations.

In general, Oldfield and Moriarty provide an interesting and readable introduction to the amphibians and reptiles of the Land

of 10,000 Lakes. The text was not written for the professional herpetologist, but anyone interested in amphibians and reptiles in Minnesota should refer to this book. The authors' novel contributions of a synopsis of Minnesota literature, innovative circular keys, new geographical records, fresh personal observations, and excellent photographs make it unique among other regional guides. Add to this clear writing and a low price and you have an exceptional source for the growing populace of Minnesotans interested in herpetology. This book should play an important role in encouraging awareness and appreciation of amphibians and reptiles in this conservation-minded state.

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BRECKENRIDGE, W. J. 1944. Reptiles and Amphibians of Minnesota. University of Minnesota Press, Minneapolis. 398 pp.

Amphibian and Reptile Species of Special Concern in California, by Mark R. Jennings and Marc P. Hayes. 1994. Published by the Inland Fisheries Division, California Department of Fish and Game, Rancho Cordova, California. iii + 255 pp., 6 tables, 49 figures, and 5 appendices. Softcover. US $20.00 (plus $2.50 s/h and $1.55 sales tax for California residents). Available from California Department of Fish and Game, Natural Heritage Division, 1416 Ninth Street, Sacramento, California 95814, USA. Tel. (916) 327-5957.

HARTWELL H. WELSH, JR.
USDA Forest Service, Pacific Southwest Research Station
1700 Bayview Drive, Arcata, California 95521, USA

This is an impressive effort that was seven years in the making. Under a contract from the California Department of Fish and Game that began in 1988, the authors assembled pertinent data on the status of 81 potentially threatened species or subspecies of the total 130+ taxa of reptiles and amphibians occurring in California. Their effort is the fourth in a series of reports commissioned by the department (it was preceded by reports on the birds, mammals, and fish), examining species of special concern in California. The California Department of Fish and Game deserves credit for its proactive stance in initiating this series (despite an adverse political climate). This is a commendable effort to promote the conservation of the rich biotic heritage of the state. Few state game departments in the U.S. have made such a conscientious effort to investigate and inform the public about the status of their native non-game species, let alone their herpetofauna. The only comparable work of which I am aware is *The Action Plan for Australian Reptiles* (Cogger et al. 1993), a comprehensive national effort commissioned by the Australian Nature Conservation Agency.

The quality of the final product demonstrates that the authors were a good choice for the task. This document is impressive in scope and thoroughness, and it sets a high standard for other responsible natural resource agencies to follow in this era of declining biotas. In addition to using all the usual sources of readily available information (scientific literature, localities and archival records from pertinent state and national museums, unpublished field notes, field surveys, and site visits) the authors mailed extensive questionnaires to 127 individuals with particular knowledge of individual species, and conducted interviews or exchanged letters with another 90 individuals to inquire on specifics about selected taxa.

The information is well organized into 48 individual accounts with brief descriptions of each taxon (species or subspecies), taxonomic remarks, distributions (with maps), life history and habitat information, status reviews, and management recommendations. Although pertinent current literature is extensively cited, the authors have not attempted to be thorough. Life history and habitat information is intentionally limited to that which is necessary to understand the threats to a given taxon. Nonetheless, this often amounts to an extensive review of what is known about the life history of a particular species. While the report summarizes the current status (as of 1993) of a majority of native species, it does not include those species already listed as threatened or endangered under either the state or federal Endangered Species Act (e.g., *Gopherus agassizii, Gambelia sila, Ambystoma macrodactylum croceum*). The focus is on prevention of decline, through examination of the status and the nature of current or potential threats to those taxa that may now be, or could potentially become, candidates for listing.

The distribution maps are worthy of some discussion. They depict major river drainages and county boundaries with coded symbols for all known localities. The authors have coded each locality as extant based on verified sighting or museum record, or extinct based on verified sighting or museum record. While it may seem somewhat risky to assume extirpation at a previously known site (especially for a small cryptic species like *Phrynosoma m'calli* or a secretive snake like *Lampropeltis zonata parvirubra*), the authors have used the conservative criteria of multiple visits over a ten year period, or evidence of habitat alterations clearly detrimental to a given species (e.g., draining of aquatic habitats or the replacement of native vegetation with a subdivision) to establish absence. These are sound and reasonable criteria for demonstrating absence and an essential methodological element for monitoring population status over time.

The authors concluded that 33 of the 81 potentially "at risk" taxa they examined did not warrant listing at this time. However, the remaining 48 taxa reviewed warranted listing at some level, with species requiring aquatic habitats at greatest risk. Such a conclusion is hardly a surprise for a state whose citizens have fought over water since the original human inhabitants were relegated to marginal habitats or extirpated. This report should be very useful in helping state resource agencies focus their limited resources for conservation where they can do the most good.

The text and maps are complimented in many accounts by black and white line drawings of the subject taxon from the works of Robert C. Stebbins, the premier illustrator of California's herpetofauna. The extensive, and relatively up-to-date, bibliography is the most comprehensive ever compiled and readily available in one place for California's herpetofauna and it alone constitutes a great resource for those interested in this fauna.

The two localities for *Plethodon elongatus* in Mendocino County designated with question marks are in fact errors. These sites were confused with two localities from further north as a result of a data transfer glitch between the source and the state's natural diversity data base. This and other minor mistakes could have been prevented had species experts been asked to review the final accounts. Overall though, and particularly given the amount of detail, errors are few. This report is a welcome addition to the literature on the conservation biology of North American reptiles and amphibians.

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COGGER, H., E. CAMERON, R. SADLIER, AND P. EGGLER. 1993. The Action Plan for Australian Reptiles. Australian Nature Conservation Agency, GPO Box 636, Canberra, ACT 2601.

PUBLICATIONS RECEIVED

Conservation Genetics: Case Histories from Nature, edited by John C. Avise and James L. Hamrick. 1996. Chapman & Hall, New York. Hardcover, 512 pp. US $69.95. ISBN 0-412-05581-3. Available from International Thomson Publishing, 7625 Empire Drive, Florence, Kentucky 41042, USA. Fax (606) 525-7778; e-mail: order@chaphall.com.

Avise and Hamrick have produced a highly readable treatise on the application of molecular genetic information to conservation biology. Nineteen principal authors contributed to this volume, covering an array of subjects from endangered cetaceans to plants. The lone herp-oriented chapter, "Conservation Genetics of Marine Turtles," (authored by Brian Bowen and Avise) will be of greatest interest to herpetologists, although marine turtle researchers will likely find this familiar territory. Perhaps more valuable will be the discussions in other chapters of issues such as reduced gene flow, genetic subdivisions within species, and the implications for conservation strategies—both biological and political. Other chapters offer a regional or ecosystem perspective by comparing genetic features among diverse taxa that occur in the same area.

Amphibian Populations in the Commonwealth of Independent States: Current Status and Declines, edited by Sergius L. Kuzmin, C. Kenneth Dodd, Jr., and Mikhail M. Pikulik. 1995. Pensoft Publishers, Moscow and Sofia. Softcover, 159 pp. US $25 + $4 s/h. ISBN 954-642-007-7. In English, with abstracts in English and Russian. Available from Dr. Lyubomir D. Penev, PENSOFT Publishers, 1 Chekhov Street 208 #6, 1113 Sofia, Bulgaria. Fax: 359-2-736188; e-mail: pensoft@infolink.infotel.bg.

This is a collection of 22, mostly short, papers concerning amphibian populations in the former Soviet Union, produced in response to the worldwide amphibian decline. Original data are presented on the distribution, life histories, morphology, and biochemistry for several species. Seven families are represented: Salamandridae (*Salamandrella, Triturus*); Ranidae (*Rana*); Pelobatidae (*Pelobates*); Bufonidae (*Bufo*); Discoglossidae (*Bombina*); Hylidae (*Hyla*); and Pelodytidae (*Pelodytes*).

Self-Assessment Color Review of Reptiles and Amphibians, by Fredric L. Frye and David L. Williams. 1995. Iowa State University Press, Ames. Softcover, 192 pp. US $34.95. ISBN 0-8138-2990-9. Available from Iowa State University Press, 2121 South State Avenue, Ames, Iowa 50014-8300, USA. Tel. (800) 862-6657; Fax (515) 292-3348.

This is a collection of photographs—most in color—accompanied by informational text that present >250 case studies. The book is targeted primarily as a source of continuing education for veterinarians, though advertised as also useful for herpetologists and pet owners. Illustrations depict specific unidentified conditions, which the reader is asked to identify or recommend a course of treatment. The cases depicted range from common conditions that most herpetoculturists would recognize to the more unusual or rares ones that few veterinarians will have seen.

Care and Breeding of Panther, Jackson's, Veiled and Parson's Chameleons, edited by Philippe de Vosjoli and Gary Ferguson. 1995. Advanced Vivarium Systems, Inc., Santee, California. Softcover, 128 pp. US $12.00.

This is another addition to the highly popular series of small books targeting the burgeoning population of herpetoculturists. In this volume, various experts on the husbandry of *Chameleo* (sensu lato) offer tips for successful maintenance and reproduction of these fascinating lizards. Natural history summaries are provided by way of introduction for each of the four species covered—*C. pardalis, jacksonii, calyptratus,* and *parsonii.*

Turtle Islands: Balinese Ritual and the Green Turtle, by Charles Lindsay. 1995. Takarajima Books, New York. Hardcover, 124 pp., 90 color photographs. US $39.95. ISBN 1-883489-10-5. Available from Takarajima Books, 200 Varick Street Suite 507, New York, New York 10014, USA. Tel. (212) 675-1944; Fax (212) 255-5731.

Author-photographer Charles Lindsay chronicles the relationship between the people of Bali and the green sea turtle (*Chelonia mydas*). This turtle occupies a prominent place in religion and mythology—indeed, Balinese (Hindu) religious practice requires the sacrifice of turtles. Increasingly, commercial exploitation is taking a toll on turtle populations. Lindsay captures all of this in colorful, if distressing, detail.

Turtles, by Anita Baskin-Salzberg and Allen Salzberg. 1996. Franklin Watts, New York. Hardcover. 63 pp. US $20.95. ISBN 0-531-20220-8. Available from Franklin Watts, Sherman Turnpike, Danbury, Connecticut 06813, USA. Tel. (800) 621-1115.

A book for budding turtle enthusiasts, written by people who actually know something about turtles. Basic turtle facts—distribution, size, longevity, physical characteristics, and even a brief fossil history—are presented. Excellent color photographs offer a view to the diversity of turtles. Conservation problems facing turtles are discussed, and young readers are encouraged to become active in helping solve these problems.

ERRATUM

In the range extension for *Desmognathus aeneus* published in the December 1995 issue (Livingston et al., Herpetol. Rev. 26:207), the name of the first collector was misspelled. The first South Carolina specimen of this species was collected by a group that included D. A. Jackan (not D. Jackson as previously listed).



Graptemys kohnii (Mississippi Map Turtle). Illustration by Dan C. Holland.

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CHAIRPERSONS

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National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
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Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
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Department of Biological Sciences, Box 5640
Northern Arizona University
Flagstaff, Arizona 86011, USA

Long Range Planning
LYNNE D. HOUCK
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University of Chicago
940 East 57th Street
Chicago, Illinois 66037-1455, USA

Meetings
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Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602-2597, USA

1996 Local Meeting
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Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Nominating
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Department of Zoology
107 Irvine
Ohio University
Athens, Ohio 45701, USA

Regional Society Liaison
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Cleveland, Ohio 44106-7080, USA

Resolutions
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Lawrence, Kansas 66045-2106, USA

Zoo Liaison
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5555 Zoo Boulevard
Wichita, Kansas 67212, USA

COORDINATORS

Common and Scientific Names
JOSEPH T. COLLINS, Coordinator
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
3905 Old Sabino Canyon Road
Tucson, Arizona 85750, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

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Department of Zoology
223 Bartram Hall
University of Florida
Gainesville, Florida 32611, USA

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Department of Biology
University of South Florida
Tampa, Florida 33620-5150, USA

Secretary
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Section of Amphibians and Reptiles
Carnegie Museum of Natural History
Pittsburgh, Pennsylvania 15213, USA

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Herpetological Review

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rwh13@csufresno.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: 71061.150@compuserve.com

Section Editors

Techniques
STEPHEN D. BUSACK
National Fish & Wildlife Forensics Lab
1490 East Main Street
Ashland, Oregon 97520, USA
E-mail: steve_busack@mail.fws.gov

Book Reviews
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E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: Herpbooks@sisna.com

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
HIDETOSHI OTA
Tropical Biosphere Research Center
University of the Ryukyus
1 Senbaru
Nishihara-cho, Okinawa 903-01, Japan
E-mail: ota@sci.u-ryukyu.ac.jp

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Geographic Distribution
GUSTAVO J. SCROCCHI
Instituto de Herpetologia
Fundacion Miguel Lillo
Miguel Lillo 251
4000 Tucuman, Argentina
E-mail: herpetol@untmre.edu.ar

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Amphibians & Reptiles
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA

Natural History Notes
CHARLES W. PAINTER
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA
E-mail: cwpaint@unm.edu

Natural History Notes
LEE A. FITZGERALD
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131, USA
E-mail: leefitz@unm.edu

Natural History Notes
PAUL A. STONE
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, USA
E-mail: pstone@aix1.ucok.edu

Advertising Manager
ELIZABETH A. JOHNSON
35 Eighth Street
Frenchtown, New Jersey 08825, USA
Tel. (908) 996-4056

Regional Herpetological Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

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Society for the Study of Amphibians and Reptiles

WWW: http://falcon.cc.ukans.edu/~gpisani/SSAR.html



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

Annual Dues and Subscriptions: Annual membership dues for the year 1996 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. All members receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with Visa or MasterCard (account number and expiration date must be provided). Payment should be sent to: Karen L. Toepfer, SSAR Treasurer, P.O. Box 626, Hays, Kansas 67601–0626, USA. Telephone: (913) 623-4258; Fax: (913) 625-8890; e-mail: fmkt@fhsuvm.fhsu.edu.

Future Annual Meetings

1996 — University of Kansas, Lawrence, Kansas, USA, 24–29 July (Linda Trueb, Chair).
1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July (Theodore Pietsch, Chair).
1998 — University of Guelph, Guelph, Ontario, Canada, 16–22 July (James P. Bogart, Chair).

SSAR BUSINESS

HR Staff Changes

Due to a continuing increase in submissions to Natural History Notes, a new section editor position has been added to help spread the work load. Paul Stone has joined our staff, and will handle all Natural History Note submissions concerning snakes and turtles. Charles Painter will continue to handle all manuscripts concerning amphibians, and Lee Fitzgerald will cover lizards, amphisbaenians, crocodilians, and Sphenodontia. Contributors should send Natural History Note manuscripts to the appropriate section editor. Stone's address is: *Paul A. Stone, Department of Biology, University of Central Oklahoma, 100 North University Drive, Edmond, Oklahoma 73034, USA; e-mail: pstone@aix1.ucok.edu.*

Other staff changes include the addition of Hidetoshi Ota and Gustavo Scrocchi as new section editors for Geographic Distribution. Ota will handle all submissions concerning records for the Old World (Eurasia, Africa, Oceania, Indian Ocean Islands), while Scrocchi will cover South American records. Joseph Collins will continue to process records for Canada and the U.S., and Jerry Johnson will handle reports for México and Central America. Ota's address: *Hidetoshi Ota, Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-01, Japan; e-mail: ota@sci.u-ryukyu.ac.jp.* Scrocchi's address: *Gustavo J. Scrocchi, Instituto de Herpetologia, Fundacion Miguel Lillo, Miguel Lillo 251, 4000 Tucuman, Argentina; e-mail herpetol@untmre.edu.ar.*

HR's long-time section editor for Recent Population Changes, Ralph Axtell, is stepping down to pursue other things (lizards, mainly). We thank Ralph for his many years of dedicated service to his colleagues and wish him well. Authors of Recent Population Changes manuscripts should send these directly to the Editor.

Publications Needed for SSAR Graduate Student Reprint & Book Scavenge

Reprints and other publications are needed for the 1996 SSAR student reprint scavenge. The graduate student social is greatly enhanced by the opportunity for students to acquire various herpetological literature. Now would be a good time to disseminate those extra reprints you have cluttering your office. Anyone wishing to donate items in advance may send them to: *Jeff Parmelee, Graduate Student Social Committee, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA.*

Items Needed for SSAR Auction

Joe Collins will be conducting the SSAR auction during the annual meeting at the University of Kansas in July 1996. All proceeds from the auction go to the SSAR treasury, and help to continue the production of diverse publications and services which has made the SSAR the largest professional herpetological society in the world. Items of value as well as those that lend themselves to humor are always welcome. Joe is skilled at removing large quantities of cash from auction participants through the judicious use of beer and plastic. Anyone wishing to donate auction items in advance should send them directly to: *Joseph T. Collins, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.*

About Our Cover

Interest in the herpetological fauna of the Indian Ocean island of Madagascar has surged in recent years. High levels of endemism, prominent radiations in several groups (especially frogs, geckos, and chameleons), and relict taxa have drawn the attention of many researchers. The publication of the first edition of a field guide to Madagascan herps (Glaw and Vences, 1992) stirred further interest. In this issue of *Herpetological Review*, Ron Nussbaum and Chris Raxworthy, who together have made a number of important contributions to our knowledge of the Madagascar herpetofauna, offer a detailed review of the second edition of the Glaw and Vences field guide.

Frogs of the genus *Boophis* are endemic to Madagascar and, together with the monotypic *Aglyptodactylus*, represent the subfamily Rhacophorinae on this island. Most *Boophis* are tree dwellers, and all have enlarged tips on fingers and toes. Thirty-six species are currently recognized, but this is definitely not the sum total. Since 1990, thirteen new species and two subspecies have been described, and others await description. The very first Malagasy frog described and named in the literature was *Boophis goudoti*, a large species which is sometimes eaten by the local people. This frog was described by Johann Jakob von Tschudi in 1838, and by 1870, only eight additional species had been added to the list. Herpetologists today are describing new species at a rate higher than ever before. In 1990, about 150 species of frogs were known from Madagascar, but evidence suggests that this figure could possibly double by the year 2000.

Herp photographers will be hard-pressed to find a more photogenic group of animals than the Malagasy *Boophis* species. The specimen on the cover is an adult female *Boophis erythrodactylus* (Guibé 1953), collected by Frank Glaw at Mandraka during the 1994-95 summer season. The red toe and finger disks are diagnostic for this species. Males call from vegetation next to fast flowing brooks and the tadpoles live in rapids. Specimens of *B. erythrodactylus* and *B. mandraka* can secrete a strong-smelling fluid when touched, the function of which presumably is to enable frogs to identify conspecifics (Blommers-Schlösser 1979. Bijd. Dierkunde 49(2):261-312) and perhaps serves a defensive function as well.

One advantage of photographing amphibians and reptiles, as opposed to mammals and birds for example, is that the photographer can very often manipulate the subject. As such, the specimen on the cover was positioned on a plant set up in the foyer of a hotel in Antananarivo. Frank Glaw provided flashlight illumination by which to focus, and **Marius Burger** shot away on Fujichrome 100 ASA film using a 35mm SLR Minolta X700 camera, a 100mm Minolta lens (1:2 macro function) and a small flash unit.

Marius is a research assistant in the Scientific Support Services section of Eastern Cape Nature Conservation in South Africa. Herpetology constitutes a relatively minor part of his duties, but he does chase after these animals whenever the opportunity arises. He says that visiting places like Madagascar can be both exciting and quite frustrating if you are a herp fanatic—particularly when you are not permitted to collect specimens, be it for the museum pickle pots or to take home as pets. Fortunately, there exists the option of capturing specimens on film. Burger's photos have been featured in a number of publications, mostly in books on Southern Africa herpetology. Quite a few of his pictures appear in the Glaw and Vences field guide reviewed in this issue.

Society for the Study of Amphibians and Reptiles 1996 Annual Meeting

Dates: 24–29 July 1996
Place: The University of Kansas, Lawrence, Kansas, USA

Keynote Address: "New Drugs from Old Frog Skins," by Michael J. Tyler (University of Adelaide).

Symposium: "A Tropical Natural History: Essays in Honor of William E. Duellman." *Organizer:* John D. Lynch (The University of Nebraska).

Symposium: "Diversity of Approaches to Amphibian and Reptilian Systematics." Participants restricted to graduate and post-doctoral students. *Organizers:* Daniel J. Meinhardt and Joseph R. Mendelson III. *Contact:* Joseph R. Mendelson III, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA; Tel. (913) 864-3439; Fax (913) 864-5335; E-mail: sapo@falcon.cc.ukans.edu.

Symposium: "Population Status and Conservation of Amphibians." Sponsored by the US DAPTF. *Contact:* Michael J. Lannoo, Muncie Center for Medical Education, Indiana University School of Medicine, MB209, Ball State University, Muncie, Indiana 47306, USA; Telephone: (317) 285-1050; Fax: (317) 285-1059; E-mail: 00mjlannoo@bsuvc.bsu.edu.

Workshop: "Herpetological Collections: Funding, Growth, and Management." *Contact:* John E. Simmons, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA; Tel. (913) 864-3342; Fax (913) 864-5335; E-mail: jsimmons@kuhub.cc.ukans.edu.

Conservation Forum: "Relocation and Reintroduction of Amphibians and Reptiles: Viable Options or Half-way Technology?" *Organizer*: C. Kenneth Dodd, Jr. (National Biological Service).

Oral and Poster Sessions: Several concurrent sessions each day.

Student Paper Awards: Seibert Prizes to be awarded to the two best student-presented papers at the meeting ($250 first prize, $150 second prize).

President's Travelogue Slide Shows: Profusely illustrated lectures of exotic amphibians and reptiles and their habitats. "Ice Cool Herps: New Zealand's Herpetofauna," by Louis J. Guillette (University of Florida); "From the Pacific to the Amazon, a Natural look at Northwest South America," by William Lamar (The University of Texas at Tyler); "Herps of South Asia," by Indraneil Das (Madras Crocodile Bank Trust).

Multimedia Presentations: "Herps of the West" and "Amphibians of the Appalachians" by David Dennis and Eric Juterbock; "Herpetological Namesakes" by Kraig Adler and David Dennis.

Declining Amphibians: Annual board meeting of the IUCN/SSC Declining Amphibian Populations Task Force.

Social Activities: Welcoming Social (honoring Roger Conant, Henry S. Fitch, Hobart M. Smith, Robert C. Stebbins, and Ernest E. Williams), Auction, Barbecue Picnic, Graduate Student Social (including herpetological trivia quiz with prizes).

Art and Photographic Exhibit: Featuring herpetological art and photographs.

Rare Book Exhibit: A special exhibit, "The Slimy Toeth," by Sally Haines in the Spencer Research Library, featuring 16th and 17th century books dealing with herpetology.

Live Exhibit: Amphibians and reptiles from Kansas, presented by the Kansas Herpetological Society.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

Costs: Preregistration $125 regular, $90 student; late registration fee after 1 June $170 regular, $125 student; companion (social only) preregistration $30, after 1 June $50. Lodging in dormitory: $100 person/5-day package (double occupancy; includes breakfast each day and 3 dinners) and $140 person/5-day package (single occupancy; includes breakfast each day and 3 dinners). Buffet lunch provided at meeting site—$30 for 5 days.

Further Details: Meeting Announcement/Call for Papers was mailed to all North American members of the SSAR in March 1996, and is available upon request from Cathy M. Dwigans, Academic and Professional Programs, Continuing Education, The University of Kansas, Lawrence, Kansas 66045, USA; Tel. (913) 864-3284; Fax (913) 864-5074. Chairperson of Local Committee: Linda Trueb, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA; Tel. (913) 864-3342; Fax (913) 864-5335. E-mail: Trueb@kuhub.cc.ukans.edu.

NEWSNOTES

Lacerta Now on the Internet

The Nederlandse Vereniging voor Herpetologie en Terrariumkunde, publisher of the journal *Lacerta*, has become the first European herpetological society to establish a presence on the Internet. The society may be found at: http://www.xs4all.nl/~lacerta and may be contacted via e-mail at lacerta@xs4all.nl. Manuscripts should continue to be sent by mail rather than electronically.

The society's web page provides a cumulative index to volumes 36–50 (1972–1992) of the journal *Lacerta*, an index to volumes 51–53, summaries (in English) of all papers published in recent issues, and a newsgroup with information on local activities and links to other sites.

North American Amphibian Monitoring Program (AMP) Documents Now Available

The question of the extent, existence, and impact of declines in amphibian populations is a contentious one. In the face of few statistically designed regional surveys, the controversy can only continue, undermining local and national efforts to implement amphibian conservation programs.

The AMP group was formed in response to this need. The group aims to develop solid, statistically defensible regional surveys of amphibians throughout North America. The process of developing those recommendations has not been a simple one. Monitoring methodology for amphibians, while based on countless hours of field time, innovative designs, and published within numerous papers, largely lacks the statistical evaluation and validation investigations necessary to assess their relative merits. In two years time and two international meetings the AMP group has published a preliminary set of documents.

Those documents present a set of recommendations for calling survey implementation. Calling surveys have had sufficient statistical investigations to warrant making a set of recommendations. However, for aquatic surveys, terrestrial salamanders, and atlas projects the group has not set any recommendations for implementation. Rather, we present the merits of techniques applicable for regional surveys and outline what further information will be needed to evaluate them.

We invite researchers and conservationists to participate in the ongoing evaluations of these techniques. The best way to get involved is to become part of the electronic network of AMP. You can do so by sending a message to:

listproc@rana.im.nbs.gov
in the BODY (not the subject line) put the following:
subscribe amp <your name>

Those interested in starting calling amphibian surveys in their state can contact Sam Droege at the address below. All AMP documents are available via the World Wide Web at: http://www.im.nbs.gov; by anonymous ftp site: ftp.im.nbs.gov (in directory /pub/naamp); or by mail from: *Sam Droege, National Biological Service, 12100 Beech Forest Road, Laurel, Maryland 20708-4038, USA; e-mail: frog@nbs.gov; tel. (301) 497-5840; fax (301) 497-5784.*

Holbrook Receives Posthumous Honor

John Edwards Holbrook (1794–1871), author of *North American Herpetology*, was inducted into the South Carolina Hall of Science and Technology on March 8, 1996 in ceremonies held at the University of South Carolina in Aiken. Mr. James L. Knight, Curator at the South Carolina State Museum, presented the award, including the Ernest E. Just Medallion for the Biological Sciences. Dr. Nat B. Frazer, Associate Director of the Savannah River Ecology Laboratory, accepted the award on behalf of the herpetological community. The medallion will be placed in the South Carolina Hall of Science and Technology Research and Display Room in the Academic Center of the Midlands Technical College, Airport Campus, South Carolina.

Staff Herpetologist Position

The Seminole Nation needs a herpetologist to work and live on the reservation located in the Everglades, near Clewiston, Florida, USA. This person will be responsible for developing and curating live reptile and amphibian exhibits, providing educational programs and lectures, and training guides in accurate herpetological interpretation. This person may become involved in captive breeding programs and assist with monitoring and managing reptiles and amphibians on the reservation.

Experience in captive maintenance and breeding, exhibit development, interpretation and working with the public, teaching and field work is required.

Salary begins at $8–10/hour plus a house on the reservation and is based on experience and training. A minimum one-year commitment is preferred.

Please send inquiries or resumes to: *Mr. Jimmie McDaniel, Seminole Tribe of Florida, HC-61, Box 46, Clewiston, Florida 33440, USA. Tel. (800) 949-6101; fax (813) 983-9396.*

Graduate Student Research Assistantship

A graduate research assistantship in stream/amphibian ecology is available for an M.S. candidate starting in Fall 1996. The research will focus on the effects of timber harvest on the distribution and abundance of stream amphibians (tailed frog and Idaho giant salamander) in northern Idaho. For additional information, contact: *Kirk Lohman, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844, USA. E-mail: klohman@uidaho.edu. Tel. (208) 885-7203.*

Project Bog Turtle

Growing concern over the future of the bog turtle (*Clemmys muhlenbergii*) throughout its range has prompted the North Carolina Herpetological Society to establish Project Bog Turtle. Even though bog turtles are protected in every state where they occur, destruction of wetland habitats and collection for the pet trade continues.

Project Bog Turtle emphasizes local involvement in designing management and conservation strategies for the bog turtle and its habitat. The goal is to preserve habitat through direct contact with landowners, and state and federal agencies to prevent the need to place this animal on the U.S. Endangered Species List. Current

activities include bog restoration, population monitoring, and telemetry studies of movement.

Project Bog Turtle is seeking funds for research and restoration projects and development of programs designed to actively involve landowners in conservation efforts. Tax deductible (for U.S. residents) donations may be sent to: *Project Bog Turtle, N.C. Herpetological Society, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA.*

Carnegie Museum of Natural History Collection Study Grants in Herpetology

The Carnegie Museum of Natural History is pleased to announce a new grant to support herpetological research by graduate students and foreign scientists. The grant is intended to defray the costs of transportation and lodging associated with visiting and using the collection. The Carnegie's herpetological collection contains more than 195,000 preserved specimens, including one of the largest collections of turtles, and extensive holding from the West Indies, México, South America, Spain, Africa, India, and the Philippines. Applicants should send the following, in duplicate: (1) a description of the proposed research (including its expected significance and the justification for visiting the Carnegie), not to exceed two pages; (2) literature cited; (3) budget; (4) CV. Students should also arrange for two letters of recommendation to be sent. Awards will be made twice a year. Deadline for application materials are 15 April and 15 November. Send applications to *Collection Study Grants in Herpetology, Section of Amphibians and Reptiles, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213-4080, USA*. For more information contact *John Wiens (wiensj@clpgh.org; 412-622-5520; fax 412-622-8837) or Ellen Censky (censkye@clpgh.org; 412-622-3258).*

Zoo and Aquarium Directory

The 1995-96 Consortium of Aquariums Universities and Zoos Directory was published on 31 October 1995. The 159-page document contains valuable information for all zoo and aquarium professionals and includes listings of Species Survival Plan Coordinators and other important AZA (American Zoo and Aquarium Association) information. Network members from 25 countries have submitted information about their current activities, including field projects occurring in 75 countries. The directory is available at US$ 20 from *CAUZ Network Coordinator Donna Hardy, Department of Psychology, California State University, Northridge, California 91330, USA*. The URL on the World Wide Web is http://www.fhcrc.org/~ialwww/CAUZ/CAUZ.html.

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

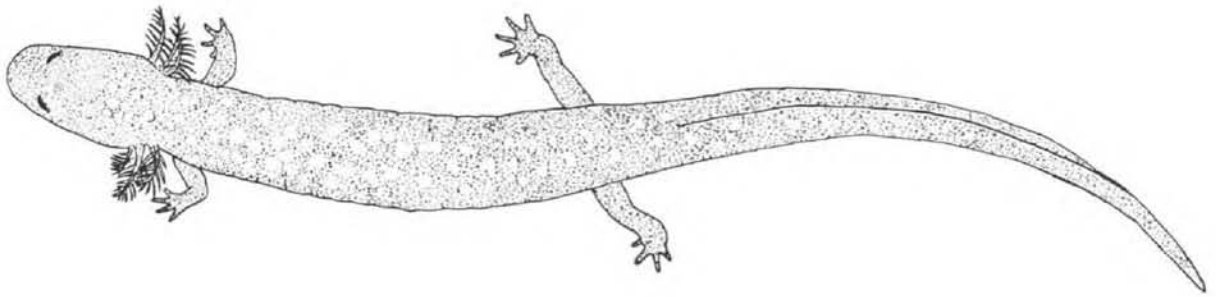
Proposals are due on 15 October 1996, with notification by 1 December 1996. Grantees are expected to complete their Academy visit by 15 September 1997. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

SENIOR HERPETOLOGISTS TO BE HONORED AT SSAR MEETING IN JULY

Roger Conant, Henry S. Fitch, Hobart M. Smith, Robert C. Stebbins, and Ernest E. Williams will be honored by the SSAR during its meeting at The University of Kansas in July 1996 (for details about the meeting, see *Herpetological Review*, 26(4):165–166, December 1995). These senior colleagues have had unusually productive careers and, indeed, they remain active.

The Welcoming Social, on the evening of Wednesday, July 24th, in the Kansas Union Ballroom, has been designated in their honor and **they plan to attend** to greet their many friends. This will be a unique opportunity for junior colleagues and students to meet these major figures in the field of herpetology.



A New Facsimile Reprint from the Society for the Study of Amphibians and Reptiles

HERPETOLOGY OF JAPAN
by LEONHARD STEJNEGER

With a New Introduction by MASAFUMI MATSUI

STEJNEGER'S BOOK, "HERPETOLOGY OF JAPAN AND ADJACENT TERRITORY," IS A recognized herpetological classic. It is "still the only complete treatment of the herpetology of Japan, and even today is an indispensable reference book" (from the new introduction). **Its geographic coverage is far greater than modern Japan and includes Taiwan, Korea, Manchuria, and adjacent coastal China, as well as easternmost Siberia.** Stejneger treats 156 species of amphibians and reptiles (13 salamanders, 36 frogs, 31 lizards, 62 snakes, and 14 turtles), including all marine species, and for each provides a complete synonymy, detailed descriptions of typical specimens, a discussion of variation, habitat, distribution, and a list of specimens with localities. Each species is illustrated, usually with multiple figures. There is an extensive, annotated bibliography, a gazetteer of localities, and an index.



Leonhard Stejneger (1851–1943), late curator of amphibians and reptiles at the National Museum of Natural History in Washington, was one of America's leading herpetologists. He authored many careful taxonomic studies on amphibians and reptiles from many parts of the world and wrote several other books, including "Poisonous Snakes of North America" (1895), "Herpetology of Porto Rico" (1904), and a series of checklists of the North American herpetofauna (1917–1943, with Thomas Barbour). Stejneger visited Japan three times and part of this book is based on his own field observations.

Masafumi Matsui (Kyoto University) provides commentary on Stejneger's work in Japan and updates his species names to current nomenclature. Matsui shows that Stejneger's 156 species today represent 180 taxa.

HERPETOLOGY *of* JAPAN

Specifications: 684 pages, portrait, map, 35 plates, 409 text figures, keys, index. Format 6 × 9 inches (15.5 × 23 cm). Clothbound. To be published September 1996. ISBN 0–916984–38–9.

Prices:	***Shipping:***
SSAR members *before publication* . . US$45.	In USA . . . . add US$3.
Institutions and Non-members . . . . . US$58.	Non-USA . . . add US$5.

Send orders to: Dr. Robert D. Aldridge, SSAR Publications Secretary, Department of Biology, Saint Louis University, 3507 Laclede Avenue, Saint Louis, Missouri 63103, USA (*telephone*: area code 314, 977–3910 or –3916; *fax*: 314, 977–3658; *e-mail*: ssar@sluvca.slu.edu). Make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks (include an additional amount to cover bank conversion charges) or by International Money Order. Orders may be charged to MasterCard or VISA (provide account number and expiration date). SSAR membership details and a complete list of Society publications can be obtained on request to Dr. Aldridge.

MEETINGS

Meetings Calendar

13–19 June 1996—76th Annual Meeting, American Society of Ichthyologists and Herpetologists, together with the 44th Annual Meeting of The Herpetologists' League, New Orleans, Louisiana, USA. Hosted by the University of New Orleans. Deadline for receipt of abstracts 1 April 1996. Contact: Bob Cashner, ASIH Local Committee Chair, Dept. Biological Sciences, University of New Orleans, New Orleans, Louisiana 70148, USA. Tel. (504) 286-6741; fax (504) 286-6121; E-mail RCCBS@UNO.EDU.

19–23 June 1996—Annual Meeting, The Society for the Study of Evolution and Society of Systematic Biologists. Washington University, St. Louis, Missouri, USA. SSB Symposium: "Morphological Data in Phylogenetic Analysis: Recent Progress and Unresolved Problems" (John Wiens, Organizer). Contact: Michael Ryan, Department of Zoology, University of Texas, Austin, Texas 78712, USA. Tel. (512) 471-5078. Meeting Web page at http://bio650.wustl.edu.

27–29 June 1996—20th Anniversary Meeting, International Herpetological Symposium. Sheraton Fiesta Hotel, San Antonio, Texas, USA. Focus on the herpetofauna of Madagascar and vicinity. Keynote speaker: W. Ronald Heyer. Banquet speaker: William W. Lamar. Contact: Davis Hulmes, 361 Van Winkle Avenue, Hawthorne, New Jersey 07506, USA. Tel. (201) 427-0768.

24–29 July 1996—39th Annual Meeting, Society for the Study of Amphibians and Reptiles. Hosted by The University of Kansas, Lawrence, Kansas, USA. *Refer to meeting announcement in this issue for details.*

1–5 August 1996—2nd International Conference on the Biology and Conservation of the South Asian Amphibians and Reptiles, University of Peradeniya, Sri Lanka. Contact: Anslem de Silva, Conference Director, Faculty of Medicine, University of Peradeniya, Sri Lanka. Tel. 94-08-88130; Fax 94-08-32572; e-mail: Anslem@Med.Pdn.ac.lk.

20–24 August 1996—2nd International Symposium and World Congress on the Preservation and Conservation of Natural Science Collections: "Natural Science Collections—A Resource for the Future." St. John's College, Cambridge, U.K. Contact: Chris Collins, Natural Sciences Congress '96, Geological Conservation Unit, Department of Earth Sciences, Downing Street, Cambridge, CB 2 3EQ, U.K. Tel. (0223) 62522; fax (0223) 60779.

24–27 August 1996—3rd Annual Conference of the Association of Reptilian and Amphibian Veterinarians, Saddlebrook Resort, Tampa, Florida, USA. Deadline for receipt of abstracts 15 April 1996. Contact: Wilbur Amand, VMD, P.O. Box 605, 1 Smithbridge Road, Chester Heights, Pennsylvania 19017, USA. Fax (215) 387-2165.

14–20 October 1996—4th Latin American Congress of Herpetology, University of Chile, Santiago de Chile, Chile. *Refer to meeting announcement below for details.*

2–10 August 1997—Third World Congress of Herpetology, Prague, Czech Republic. Contact: Zbynek Rocek, Congress Director, Department of Paleontology, Geological Institute, Academy of Sciences, Rozvojová 135, 165 00 Praha 6 – Suchdol, Czech Republic. Tel. (++42-2) 24311421; Fax (++42-2) 24311578; e-mail: rocek@gli.cas.cz. *Refer to meeting announcement in* Herpetological Review *27(1):4–5, March 1996 for details.*

Fourth Latin American Congress of Herpetology

The 4th Latin American Congress of Herpetology (4th CLAH) will be held at the University of Chile, Santiago de Chile, Chile, 14–20 October 1996. The official languages of the 4th CLAH will be Portuguese and Spanish. However, English and other languages will be accepted in workshops and poster presentations but they need to have an abstract in one of the official languages. For registration and additional information please contact: Dr. Alberto Veloso, Depto. de Ciencias Ecologicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile; e-mail: veloso@abello.dic.uchile. For registration within the U.S. and Canada, please contact: Rafael de Sá, Department of Biology, University of Richmond, Richmond, Virginia 23173, USA; e-mail: desa@urvax.urich.edu.

LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles. This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered herps. We are in need of more information especially on the State and Province level. Please send pertinent information to the Section Editor.

USA: Minnesota: Minnesota has issued draft revisions to its list of Endangered, Threatened, and Special Concern Species. The main changes from the previous official list include the elevation of the massasauga (*Sistrurus catenatus*) and the northern cricket frog (*Acris crepitans*) to Endangered and the timber rattlesnake (*Crotalus horridus*) to Threatened. The rattlesnake listings are significant in that they bring the status of these animals from bounty hunted to protected in seven years. The finalized, official list was expected at the end of March 1996. Submitted by John J. Moriarty, Suburban Hennepin Regional Park District, 12615 County Road 9, Plymouth, Minnesota 55441-1248, USA. For further information contact: *Richard J. Baker, Natural Heritage and Nongame Research Program, Minnesota DNR, Box 7, 500 Lafayette Road, St. Paul, Minnesota 55155-4007, USA. Tel. (612) 297-3764.*

USA: U.S. Fish and Wildlife Service: On 21 March 1996, the Office of Scientific Authority (OSA) issued a statement concerning the Proposed Rule to Export Box Turtles (*Terrapene*) from the United States in 1996 (Federal Register, vol. 61 [FR 61], no. 23, February 2, 1996, pp. 3894–3898). Specifically, the statement declares that the export quota of box turtles from Louisiana and the entire United States will be zero (0) in 1996. The Proposed Rule had requested information from the public and professional biologists on the proposal by Louisiana to export Gulf Coast box turtles (*Terrapene carolina major*) and three-toed box turtles (*T. c. triunguis*) in 1996. All box turtle species had previously been added to the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix II list at the Ninth Meeting of the organization in 1994. This listing was made based on documented long-term population declines in the United States. According to USFWS figures, approximately 26,000 *T. carolina* were exported from the U.S. in both 1992 and 1993 and 22,000 were exported in 1994 (FR 61). Louisiana's authorized export quota for 1995 was 9750 box turtles (FR 61), and by the end of 1995, 6115 box turtles had been exported of an estimated 13,300 harvested in the state (OSA, 21 March 1996). The deci-

sion by OSA to impose a zero export quota was made in response to numerous communications by scientists, conservation biologists, and the public who stated and agreed that the risk of serious population decline was great and that not enough information was available on the Louisiana populations to determine a sustainable level of harvest. In addition, available data from other turtle studies (e.g., Congdon et al. 1993, Conservation Biology 7:826–833) strongly suggest that the harvest of long-lived animals, in which the adults may take 10–20 years to reach maturity, coupled with relatively low fecundity, may not be sustainable. In conclusion, OSA believes that further scientific information on Louisiana's wild turtle populations and the implementation of a management plan will be necessary before future export quotas may be determined.

Section Editor's comment: I thank Allen Salzberg and Heather Kalb for constantly providing new information concerning this issue. I also find it encouraging that many persons took the time to respond to the Request for Information and Comment by the Office of Management Authority to convey their viewpoints and scientific information.—KAB

IUCN/SSC Re-Introduction Specialist Group

The IUCN/SSC Re-introduction Specialist Group (RSG) is a disciplinary group (as opposed to most Species Survival Commission (SSC) Specialist Groups which deal with a single taxonomic group). The RSG promotes the re-establishment or reinforcement of self-sustaining populations of plants and animals in the wild. The RSG has prepared official IUCN Re-introduction Guidelines, available upon request (see below). The RSG has an international network of members, publishes a bi-annual newsletter (*RE-INTRODUCTION NEWS*), and has a growing database of re-introduction projects worldwide. Persons involved in re-introduction efforts or those wishing more information may contact the RSG: *Pritpal S. Soorae, Technical Project Officer, IUCN/SSC Re-introduction Specialist Group, c/o African Wildlife Federation, P.O. Box 48177, Nairobi, Kenya. Tel. (254)-2-710367 or e-mail: awf.nrb@tt.gn.apc.org.*

Saltwater Crocodiles in Australia Stage Comeback; Reclassified as Threatened

Rebounding from the effects of habitat loss and commercial exploitation, Australia's population of saltwater crocodiles (*Crocodylus porosus*) is being reclassified by the U.S. Fish and Wildlife Service from endangered to threatened, a less restrictive designation under the U.S. Endangered Species Act. Protective management strategies by the Australian government are in large part responsible for the crocodile's recovery. The Service said it is also issuing a special rule allowing the importation into this country of skins of these crocodiles as well as Nile crocodiles (*Crocodylus niloticus*), also listed as threatened, if certain requirements are met.

The saltwater crocodile was listed as endangered throughout its range (except the Papua New Guinea population which has never been listed) in 1979 because of severe habitat loss and the species' near extirpation due to illegal harvest to supply the international demand for products made from crocodiles.

"The remarkable recovery and reclassification of the saltwater crocodile demonstrates the effectiveness and flexibility of the U.S. Endangered Species Act," said Acting Service Director John Rogers. "Following the initial listing, habitat protection, trade restrictions, and the Australian state and federal governments' aggressive captive-breeding and ranching programs combined to bring back the species."

The reclassification to threatened status and the adoption of a special rule allowing commercial trade under certain conditions does not end trade controls for the species. The saltwater crocodile, along with the Nile crocodile, remains listed as an Appendix II species under the 130-nation conservation treaty, the Convention on International Trade in Endangered Species (CITES). This category allows commercial trade with appropriate export permits, issued by the country of origin, ensuring that such trade does not deplete wild populations.

The United States and other CITES member nations have been concerned about the commingling of legal and illegal crocodilian skins, especially in intermediary countries (those countries reexporting skins and products). At the ninth meeting of the Conference of Parties, held in Ft. Lauderdale, Florida, in November 1994, the CITES member nations adopted a crocodilian skin-tagging resolution. This resolution recommended the use of export tags by countries of origin (range countries) and administrative tracking measures in intermediary countries.

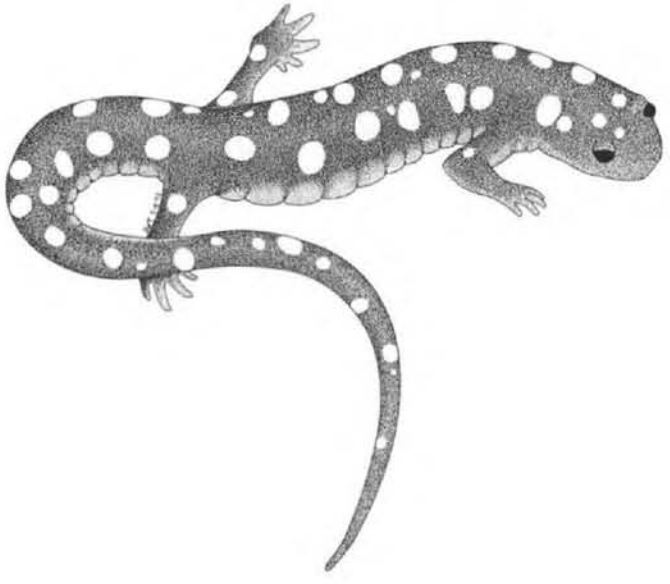
Provisions of the special rule established with this reclassification action are designed to support the tagging and tracking practices in the CITES resolution. Most CITES member nations trading in crocodilian skins and products implement the tagging and tracking practices properly. The special rule establishes procedures to prohibit such trade from any country not in compliance with the resolution.

"By allowing a controlled trade in legally harvested saltwater and Nile crocodile skins, meat, and products, we hope to provide other countries with incentives for conserving the species," Rogers said.

The saltwater crocodile is one of the world's largest reptiles, growing longer than 20 feet and weighing several hundred pounds. It ranges in coastal waters throughout Southeast Asia.

—Source: U.S. Fish and Wildlife Service.

KURT A. BUHLMANN
SSAR Conservation Committee



Ambystoma maculatum (Spotted Salamander). Illustration by Jeffrey W. Tamplin.

INSTITUTIONAL PROFILE

The University of Kansas: A Long-time Center of Herpetological Research and Training

LINDA TRUEB
and
WILLIAM E. DUELLMAN
Natural History Museum and Department of Systematics and Ecology
The University of Kansas, Lawrence, Kansas 66045-2454, USA

Sprawling over a wooded hill, Mount Oread, in the City of Lawrence (population 80,000), The University of Kansas (KU) is the academic home to more than 1200 faculty and 25,000 students. Denizens of the hill enjoy a wide range of scholarly interests and extracurricular activities, not the least of which is supporting the Jayhawk basketball team. However, herpetology at KU preceded basketball. The tradition of herpetological research at the university began with the founding of KU in 1866. One of the first four faculty members was Francis H. Snow. Although best known as an entomologist, Snow was in charge of the Cabinet of Natural History. He took students in the field throughout the state and other regions to collect specimens of plants and animals and survived a rattlesnake bite in the process. Later, as chancellor of the university, Snow was instrumental in convincing the state legislature to appropriate funds for the construction of the Natural History Museum. The museum was needed to house the accumulated collections and to be a showplace for the acclaimed Panorama of North American Wildlife prepared by the famous naturalist-explorer Lewis Lindsay Dyche, for whom the building is named. Snow also founded the State Biological Survey; most of the early herpetological specimens in the collections were acquired by personnel associated with that organization.

In 1908, Edward H. Taylor entered the university as an undergraduate; he participated in many field trips in Kansas and adjoining states and even managed to contract malaria on the plains. Upon his graduation in 1912, Taylor took a position in the Philippines, where he made extensive herpetological collections and became Director of the Bureau of Science in Manila. He returned to join the faculty of The University of Kansas in 1926. During his tenure, Taylor had an active group of graduate students. Notable among them were David M. Dunkle, Claude W. Hibbard, Hobart M. Smith, and Wilmer W. Tanner. In 1932, Taylor and Smith began a series of expeditions to Mexico. This event set a tempo for research in neotropical herpetology at KU and initiated a life-long career for Smith. During Taylor's tenure, research emphasized morphology, systematics and faunistic studies, such as the checklists of Mexican amphibians and reptiles (with Smith) and reviews of the herpetofaunas of Costa Rica and Thailand. Among the classic systematic studies were Smith's exhaustive treatise on *Sceloporus,* and Taylor's work on *Eumeces* and his monograph on caecilians.

In 1947, the university acquired a tract of 590 acres 7 miles northeast of Lawrence. This tract became the Natural History Reservation. The following year Henry S. Fitch joined the faculty as an assistant professor and superintendent of the reservation. Thus began nearly half a century of research on the biota of this mixed prairie and woodland area locally known as the "snake farm," resulting in some of the most thorough autecological studies ever completed on reptiles, e.g., Fitch's work on the blue-tailed skink (1954) and the copperhead (1963).

As the collections in the Natural History Museum grew, so did the curatorial staff. Taylor was named the first curator in herpetology in 1946; when he retired as curator in 1954, the herpetological collection contained more than 40,000 specimens. Between 1954 and 1959, John M. Legler was acting curator. By the time William E. Duellman became curator in 1959, the collection had grown to more than 51,000 specimens. In 1968, Joseph T. Collins was appointed as a technician in herpetology and ichthyology; in 1988 he relinquished his position in herpetology to work in various other capacities in the museum. Linda Trueb became the second curator in herpetology in 1975, and John E. Simmons was appointed collection manager in 1981.

Since 1960, the herpetological collections have grown steadily to the present number of 278,000 specimens. Most of the new material was acquired in the traditional way—through field work by the curators, staff, and students, principally in Latin America. However, the single largest accession (63,000 specimens) was the West Indian collection assembled by the late Albert Schwartz.

In addition to the usual alcoholic specimens, the KU collection contains a large numbers of amphibian larvae and skeletons, especially of anurans. Other important material associated with preserved voucher specimens includes color transparencies, tape recordings of anurans, histological preparations, and frozen tissues. Thanks to support from the National Science Foundation, in the last decade the entire collection has been checked for identifications and accuracy of data before an electronic hierarchical data base was established. The growth of the collections resulted in major space problems, which were relieved by the completion in the fall of 1995 of a new wing solely for the storage of alcoholic specimens.

The collection is widely used by the herpetological community. During the past five years, answers to 261 queries have resulted in the dissemination of 116,834 records of specimens and 324 loans of 11,205 specimens to investigators throughout the world. Within that same period, 144 visitors spent 659 days working in the collection.

In addition to curatorial facilities and collection storage, the Natural History Museum has histology and molecular laboratories, and photographic and sound-analysis facilities. The Division of Herpetology is equipped with a wide range of optical and computer equipment. A major asset is the herpetology library containing more than 3000 bound volumes and 27,000 reprints.

In addition to their curatorial responsibilities, Duellman is Director of the Center for Neotropical Biological Diversity, and Trueb is Scientific Editor of the museum publications. Nearly all of Duellman's research has dealt with aspects of the neotropical herpetofauna, ranging from a monograph on the hylid frogs of Middle America (1970) to the biology of the herpetofauna in Amazonian Ecuador (1978) and the evolution of marsupial frogs (in preparation). Working with specialists in other taxonomic groups in the neotropical biological diversity program, he is attempting to synthesize patterns of distribution of the neotropical biota. Trueb's research is focused on the morphology of amphibians and has ranged from detailed studies on the skulls of casqueheaded hylid frogs and the phylogeny of pipoid frogs (1988) to the relationships of the Lissamphibia (1991) to present endeavors on the integration of data from living and fossil taxa in a phylogenetic study of archeobatrachians. Duellman and Trueb combined efforts to produce the only existing compendium on amphibians, *Biology of Amphibians* (1986; reprinted in paperback in 1994). In his capacity as collection manager, Simmons has taken an active

role in the conservation of natural history collections, and is involved in several projects focused on the assessment, care, and maintenance of fluid-preserved specimens and natural history collection management.

A select number of herpetologists are research associates in the Division of Herpetology. These include Ana María Báez (Argentina), Carl Gans (USA), William W. Lamar (USA), John D. Lynch (USA), Michael J. Tyler (Australia), Alberto Veloso M. (Chile), and the late Werner C. A. Bokermann (Brazil).

Like other curators in the Natural History Museum, Duellman and Trueb have half-time academic appointments as professors in the Department of Systematics and Ecology. Duellman teaches courses in Biogeography and Reptile Biology, and with Trueb, Amphibian Biology. Trueb also teaches courses in Evolutionary Morphology and Scientific Illustration. Henry Fitch, Professor Emeritus, continues to provide limited guidance to students.

The University of Kansas has maintained a strong graduate program in herpetology. Graduate students have come from throughout the USA, including Puerto Rico, as well as many foreign countries—Argentina, Brazil, Burma, Chile, Colombia, Ecuador, Germany, India, Mexico, Peru, Venezuela, and Zambia. Doctoral dissertations by students in the Natural History Museum have reflected a wide variety of research carried out in many parts of the world. These include ecological studies such as reproductive strategies of tropical frogs (Martha L. Crump, 1974), population biology of the brown soft-shelled turtle (Michael V. Plummer, 1975), and foraging ecology of garter snakes (Richard A. Seigel, 1984). Biogeographic studies include the ecobiogeography of the herpetofauna of the Yucatan Peninsula (Julian C. Lee, 1977), late Pleistocene herpetofauna of Puerto Rico (Gregory K. Pregill, 1979), and biogeography of lizards in the Samoan Islands (Terry D. Schwaner, 1979). Systematic studies varied from the systematics of *Rhadinaea* (Charles W. Myers, 1970) and phylogenetic relationships among iguanian lizards (Darrel R. Frost, 1985) to molecular studies such as systematics of New World *Rana* (David M. Hillis, 1985) and phylogenetic relationships among desmognathine salamanders (Tom A. Titus, 1992). Also, numerous undergraduate students have carried out research in herpetology; among these are Pere Alberch, Neil B. Ford, Kevin R. Toal III, and John J. Wiens.

Present graduate student dissertation research includes the population biology of the Puerto Rican frog *Eleutherodactylus cooki* (Patricia A. Burrowes), the phylogenetic relationships among toads of the genus *Atelopus* (Luis A. Coloma), phylogenetic relationships of megophryine frogs (Anne Maglia), heterochrony and miniaturization in anurans (Daniel J. Meinhardt), systematics and biogeography of toads of the *Bufo valliceps* group (Joseph R. Mendelson III), dentition and feeding in frogs (Jeffrey R. Parmelee), phylogenetic relationships of casque-headed treefrogs (Helio da Silva), and developmental osteology and phylogenetic relationships of ceratophryine frogs (Erik R. Wild).

In 1974, the Kansas Herpetological Society was founded in Lawrence by Joseph T. Collins and Eric Rundquist. This organization has grown to 260 members, many of whom participate in an annual meeting and numerous field trips that are designed to increase knowledge of occurrence and abundance of amphibians and reptiles in Kansas. Members provide voucher specimens for the Natural History Museum; these and other accumulated data are documented in the Newsletter of the Society and have provided distributional data for the three editions of *Amphibians and Reptiles in Kansas* by Joseph T. Collins.

The diversity of research by staff and students in the Division of Herpetology has resulted in 233 publications in the past decade. These are distributed to herpetologists worldwide; currently 402 persons are on the mailing list. The staff at KU have long taken active roles in herpetological societies. Both Edward H. Taylor and Linda Trueb served as presidents of the American Society of Ichthyologists and Herpetologists; William E. Duellman was president of the Herpetologists' League, and Joseph T. Collins was president of the Society for the Study of Amphibians and Reptiles. The annual meeting of the American Society of Ichthyologists and Herpetologists was held at KU in 1965, as was the combined annual meeting of the Herpetologists' League and the Society for the Study of Amphibians and Reptiles in 1977. All of us at The University of Kansas look forward to hosting the annual meeting of the Society for the Study of Amphibians and Reptiles in 1996.



Hobart Smith (left), University of Kansas alumnus, and Henry Fitch (right), Professor Emeritus at KU. Both will be honored at the 1996 SSAR Annual Meeting. Photo by Larry Miller, courtesy of Joseph T. Collins.

CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

The current contents of several herpetological publications can now be found on the World Wide Web. At present, more than 20 publications are being listed. The Web site address is:

http://www.sisna.com/users/Herpbooks/Contents.html

Systematics

Ctenoblepharys adspersa is a highly derived arenicolous lizard that inhabits the sandy coast of central Peru. Etheridge recently examined this species and its relationship to others in the subfamily Liolaeminae. In addition to a redescription of *C. adspersa*, a taxonomic history of the genus is presented.

ETHERIDGE, R. 1995. Redescription of *Ctenoblepharys adspersa* Tschudi, 1845, and the taxonomy of Liolaeminae (Reptilia: Squamata: Tropiduridae). Am. Mus. Novit. (3142):1–34.

Ctenosaura

Gunther Köhler recently published several papers on the spiny-tailed iguanas of the genus *Ctenosaura*. In addition to field studies, Köhler described two new species. The papers listed below are a selection of his recent work; other papers are available.

KÖHLER, G. AND K. KLEMMER. 1994. Eine neue schwarzleguanart der gattung *Ctenosaura* aus La Paz, Honduras [A new species of the genus *Ctenosaura* from La Paz, Honduras]. Salamandra 30(3):197–208.

KÖHLER, G. 1995. Eine neue art der gattung *Ctenosaura* (Sauria: Iguanidae) aus dem südlichen Campeche, Mexico [A new species of the genus *Ctenosaura* from southern Campeche, Mexico]. Salamandra 31(1):1–14.

KÖHLER, G. 1995. Freilanduntersuchungen zur morphologie und Ökologie von *Ctenosaura bakeri* und *C. oedirhina* auf den Islas de la Bahia, Honduras, mit bemerkungen zur schutzproblematik [Field studies on morphology and ecology of *Ctenosaura bakeri* and *C. oedirhina* on the Islas de la Bahia, Honduras, with notes on conservation status]. Salamandra 31(2):93–106.

Physiology of Digestion

The digestive physiology and energy requirements of eating were examined in two species of snake. Both *Crotalus cerastes* and *Python molurus* fast for long periods between meals and undergo rapid physiological change after eating. Secor and colleagues examined these changes and the energy budget associated with digestion in two recent papers.

SECOR, S. M., E. D. STEIN, AND J. DIAMOND. 1994. Rapid upregulation of snake intestine in response to feeding: a new model of intestinal adaptation. Am. J. Phys. 266 (Gastrointest. Liver Physiol. 29):G695–G705.

SECOR, S. M., AND J. DIAMOND. 1995. Adaptive responses to feeding in Burmese pythons: pay before pumping. J. Exp. Biol. 198:1313–1325.

Amphibian Declines

In previous studies Blaustein and colleagues have examined the possible role of UV-B irradiation and a fungus in the decline of amphibians in the Pacific Northwest (USA). Recently Kiesecker and Blaustein presented evidence of synergistic effects of these two factors on the mortality of amphibian embryos.

KIESECKER, J. M., AND A. R. BLAUSTEIN. 1995. Synergism between UV-B radiation and a pathogen magnifies amphibian embryo mortality in nature. Proc. Nat. Acad. Sci. 92(24):11049–11052.

Anuran Vertebral Morphology

During the last five years the Morphology Research Group of St. Petersburg State University (Russia) has published several papers on anuran vertebral morphology. The group's research interests include form transformation during ontogeny and phylogeny, significance of variability and anomalies for evolution, morphogenetic mechanisms determining normal and abnormal development, methods of analysis of variability, and bioindication.

Some recent publications from the group are listed below. Reprints can be obtained by writing: Morphology Research Group, Department of Vertebrate Zoology, Faculty of Biology and Soil Science, St. Petersburg State University, Universitetskaya nab. 7/9, 199034, Russia, or e-mail: Irene@isav.usr.pu.ru. The group is seeking collaborators and reprints of morphological studies.

DANILOV, I. G. 1995. Analysis of variability of the vertebral column in some Palearctic ranids. Abstracts, 8th O.G.M. of S.E.H., Bonn, Germany, 23–27 August 1995, p.48.

KOVALENKO, E. E. 1992. The anomalies of the vertebral column in Anura. St. Petersburg University Press, 142 pp. [In Russian]

KOVALENKO, E. E. 1994. The variability of anuran sacrum: structure analysis in the whole spectrum of its possibility. ICVM-4 Abstracts. J. Morphol. 220(3):362.

KOVALENKO, E. E. 1994. The compound sacrum in individual variability of common platanna (*Xenopus laevis*). Russian J. Herpetol. 1(2):172–178.

KOVALENKO, E. E., AND I. G. DANILOV 1994. Rare variants of abnormal structure of the vertebral column in Anura. Vestn. S. Pb. Univ., Ser. 3 Biologia, No. 3, pp. 10–24. [In Russian]

KOVALENKO, E. E., AND S.E. DANILEVSKAYA 1993. On unique forms of anomalous sacral structure in tailless amphibians. Russian J. Herpetol. 1(1):30–36.

KOVALENKO, E. E., AND T. A. BORDUKOVA 1995 The variance of the sacrum form in ontogeny of common platanna *Xenopus laevis* (Anura: Pipidae). Vestn. S. Pb. Univ. Ser. 3 Biologia, No. 2, pp.18–31. [In Russian]

MALASHICHEV, Y. B. 1995. Qualitative variability analysis of the sacro–coccygeal part of the vertebral column in some *Bombina* species. Abstracts. 8th O.G.M. of the S.E.H., Bonn, Germany, 23–27 August 1995, pp. 82–83.

Intraspecific Venom Evolution

Venom composition within snake species can show considerable geographic variation. The underlying causes of this phenomenon have never been explained. Daltry et al. examined the venom of the southeast Asian pit-viper *Calloselasma rhodostoma* in relation to diet, gene flow, and phylogeny and found that geographic differences in diet were closely associated with differences in venom composition. The other two factors appeared not to be related to venom composition.



Calloselasma rhodostoma. Photo courtesy of Wolfgang Wüster.

DALTRY, J. C., W. WÜSTER, AND R. S. THORPE. 1996. Diet and snake venom evolution. Nature 379(6565):537–540.

New Publication Series

The Oklahoma Museum of Natural History has begun an Occasional Papers series. The inaugural paper, by Laurie J. Vitt, examines the ecology and interrelationships of 13 carnivorous lizard species in the semiarid caatinga of Brazil. For more information about the series, or to obtain copies, write to: Oklahoma Museum of Natural History, 1335 Asp Avenue, Norman, Oklahoma 73019–0606, USA.

VITT, L. J. 1995. The ecology of tropical lizards in the caatinga of northeast Brazil. Occ. Pap. Oklahoma Mus. Nat. Hist. (1):1–29.

Russian Journal of Herpetology

Russian Journal of Herpetology is an international, multidisciplinary journal and publishes articles covering both basic and applied research on recent and fossil amphibians and reptiles. All aspects of herpetology including systematics, distribution, speciation, phylogeny, morphology as well as behavior, ecology, and toxinology of amphibians and reptiles will be presented.

Of particular emphasis is the conservation of species of amphibians and reptiles, their associations and habitats. Although much attention is given to fundamental research, papers devoted to breeding in captivity and propagation of amphibians and reptiles will be welcomed and presented in a special part of the journal.

The ultimate aim of the journal is to provide an effective medium for communication of the latest and best scientific information from the expanding, interdisciplinary, and international scientific community focusing on new methods and ideas in progress and to promote cooperation between Russian and foreign scientific and commercial organizations.

Subscription Information: One volume per year, in two issues. Subscription price for 1996: US$ 84 (for libraries), US$ 44 (for individuals), US$ 75 (Supporting Membership).

Because of the difficulty in sending money to banks in Russia, the Museum of Vertebrate Zoology will handle membership fees for the journal. Checks for membership in this society and subscription to the journal should be made out to RJH and mailed to: *Russian Journal of Herpetology*, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA. Checks must be in $US drawn on a bank with an office in the USA. International money orders (such as issued in Japan) can be accepted.

Because of the difficult economic situation in Russia, the Russian Herpetological Society cannot survive without foreign memberships. The journal is provided free of charge to herpetologists in the former USSR. There are now less than 100 foreign members in the society. Each issue of RJH costs about $3000 to produce. If you are associated with a museum or university, perhaps you can ask your library to subscribe.

Contents of Volume 2 are:

SCHNEIDER, H., AND E. M. EGIASARYAN. 1995. The mating call of the green toad, *Bufo viridis viridis* (Anura, Amphibia), in Kazakhstan. Russian J. Herpetol 2(1):1–4.

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POINT OF VIEW

Tail and Hand Waves: A Come-on for Predators?

WILLIAM E. MAGNUSSON
Coordenação de Pesquisas em Ecologia
Instituto Nacional de Pesquisas da Amazônia
Caixa Postal 478, 69011-970 Manaus AM, Brasil
e-mail: bill@cr-am.rnp.br

Werner (1995) noted that tail waving has a long history of description in the literature, and in the same issue, Bedford (1995) describes tail waving in *Carlia*. Tail waving has been assigned a role in prey capture (Perez-Mellado 1994) and has been suggested as a tactic to divert predator attacks from the head region (e.g., Fitch 1954; Vitt and Cooper 1986). Here, I would like to advance a third hypothesis that is a more likely reason for the evolution of the trait, even though it may have acquired secondary functions.

Movement attracts the attention of visual predators (Cushing 1939; Gluesing 1983). It is so notable that many species of active lizards appear to have abandoned crypsis entirely, at least in the males, and developed bright coloration which is presumably important in sexual interactions. Sit-and-wait species usually have flash colors which are used only during courting or territorial interactions. Tail waving to distract a predator from the head obviously would only be of benefit after detection by the predator. Attracting the predator so that it could bite your tail would seem a rather unlikely adaptation. Species that show ontogenetic shifts in tail color (e.g., Vitt and Cooper 1986) may show ontogenetic differences in activity (e.g., Fitch 1954).

Most lizards that use tail waving do so in the intervals between bouts of walking or running. I suggest that this has evolved as a stimulus for predators. Not only are moving lizards easily detected by predators, they are also essentially blind during movement due to the relative motion of the background (see review in Fleishman 1986). I have observed yellow-faced whip snakes (*Demansia psammophis*) stalking copper-tailed skinks (*Ctenotus taeniolatus*) in Australia and their ecological equivalents, *Mastigodryas boddaerti* and *Cnemidophorus lemniscatus* in Brazil. In each case, the snake follows the lizard while it is moving and remains motionless while the lizard is motionless. The lizards are attentive and appear to be scanning for predators while stationary. My own experience stalking lizards, feral buffaloes, and kangaroos convinces me that the tactic is effective.

It would obviously be advantageous for the lizard to maintain movement, which would keep the predator in motion, while maintaining the head motionless so that it can detect movement. That is exactly what waving the tail between bursts of walking or running does. Neither of the two wide-foraging lizards mentioned above has a flexible tail, but *C. lemniscatus* waves one, or occasionally both forelegs while maintaining the head immobile. A similar behavior has evolved, presumably independently, in the agamid *Amphibolurus barbatus*. In contrast to amphibians (Bavetz 1994), the lizards do not wave their legs when feeding.

This hypothesis requires further investigation but I believe that it is a viable alternative to hypotheses that suggest that the tail is mainly a food gathering or an expendable diversionary organ.

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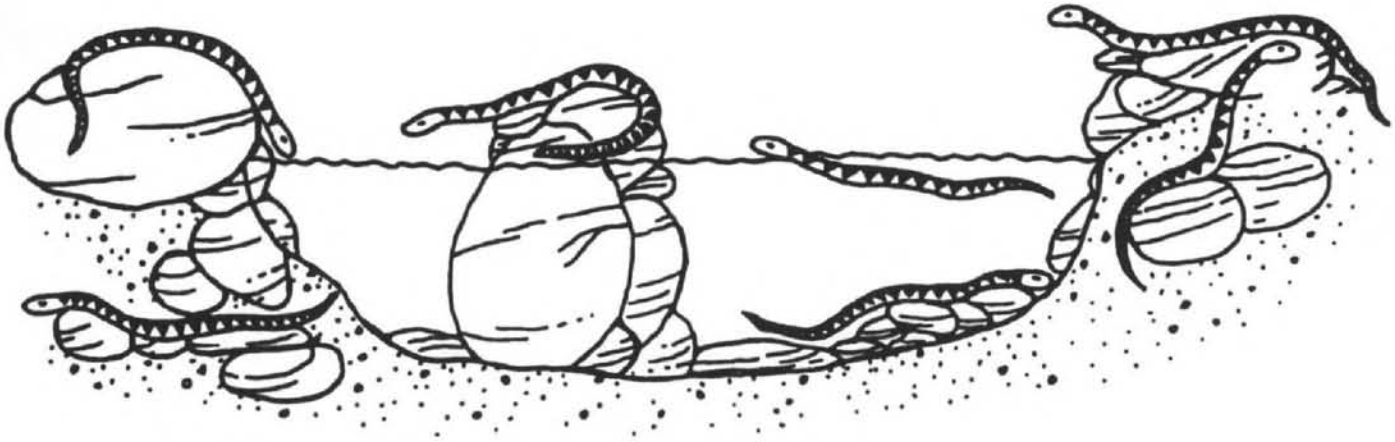
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ARTICLES

The Effects of a Dam on Breeding Habitat and Egg Survival of the Foothill Yellow-legged Frog (*Rana boylii*) in Northwestern California

AMY J. LIND
HARTWELL H. WELSH, JR.
and
RANDOLPH A. WILSON*
Pacific Southwest Research Station, USDA Forest Service
1700 Bayview Drive, Arcata, California 95521, USA

**Present address: Rocky Mountain Research Station, USDA Forest Service*
Southwest Forest Science Complex, 2500 South Pine Knoll
Flagstaff, Arizona 86001-6381, USA

Although the debate continues on the relative roles of natural fluctuations and anthropogenic influences in recently observed amphibian population declines (Blaustein 1994; McCoy 1994; Pechman et al. 1991; Pechman and Wilbur 1994; Travis 1994), many species are clearly demonstrating local extinctions and large-scale declines (Blaustein and Wake 1990; Blaustein et al. 1994b; Fellers and Drost 1993; Hayes and Jennings 1986; Jennings 1988). Causes of these declines can be placed in two broad categories: direct habitat degradation (Blaustein et al. 1994b), and more nebulous large-scale environmental changes and contamination (e.g., airborne pollutants, acid precipitation, ultraviolet radiation) (Blaustein et al. 1994a; Dunson and Wyman 1992; Fellers and Drost 1993; Hagstrom 1977; Harte and Hoffman 1989).

Dams and water diversion projects have been proposed as causes of declines of many native frogs (Hayes and Jennings 1986; Jennings 1988; Moyle 1973), but the effects of these projects have not been quantitatively evaluated. Water diversions also have been implicated in region-wide declines of anadromous fish in the Pacific Northwest (Moyle and Williams 1990; Nehlsen et al. 1991) and are documented to adversely affect riverine macroinvertebrates (Petts 1984). Impacts to fish include loss and degradation of habitat because of reservoir filling and downstream changes in river morphology along with detrimental off-season and fluctuating water releases (Burt and Mundie 1986; Petts 1984). A recent petition to list the arroyo southwestern toad (*Bufo microscaphus californicus*) as endangered indicated that impoundments associated with dam construction have caused a 40% loss in the original habitat of this toad. In addition, it was suggested that habitat quality downstream of dams has been severely compromised by changes in water temperatures, riparian vegetation, and habitat stability (Federal Register 1993). Our study provides information on both direct and indirect effects of a dam on the foothill yellow-legged frog (*Rana boylii*) in a northwestern California river system.

Rana boylii is generally found in association with stream riffles that have rocky substrates and partly shaded banks (Hayes and Jennings 1988; Moyle 1973; Zweifel 1955). This frog ranges from northern Baja California, Mexico (Loomis 1965) to central Oregon, west of the Sierra Nevada and Cascade crests. *Rana boylii* is currently listed as a Species of Special Concern in California (Laudenslayer et al. 1991) and is also a candidate for Federal listing (Federal Register 1994). The most notable declines are in southern California and the west slope drainages of the Sierra Nevada and southern Cascade Mountains (Jennings and Hayes 1994; Leonard et al. 1993).

Our objectives were: (1) to describe the changes in *Rana boylii* breeding habitat in a dammed river prior to and some years following dam construction, and (2) to document the effects of the timing of water releases from the dam on the reproductive ecology of this population.

Our study took place on the main stem of the Trinity River, in Trinity County, California, USA, and covered the 63 km of river from Lewiston Dam (near Lewiston, California) downstream to the confluence with the North Fork Trinity, near Helena, California (elevation 420–550 m). Construction of two dams, an upper (Trinity) and a lower (Lewiston), was completed in 1963. At Helena, this river drains an area of 2968 km^2. Before dam construction the river had an average yearly (water year; Oct–Sept) discharge of 1.2 million acre-feet at Lewiston. During the four years of our study, the yearly discharge ranged from 270,800 to 367,600 acre-feet at Lewiston. The basin surrounding our study reach is 52% public land (USDA Forest Service and USDI Bureau of Land Management) and 48% privately owned. Land use activities within this watershed include logging and associated road building, recreation, and widely scattered home construction. Portions of river channel and adjacent areas were mined in the early to mid-1900's.

Since 1984, the USDI Fish and Wildlife Service, in cooperation with the USDI Bureau of Reclamation (the dam administrator), has been conducting a flow evaluation study on the main stem of the Trinity River. Water has been released at varying levels above base flow (8.5 m^3/sec [cms]), each spring in order to facilitate migration of wild and hatchery-raised anadromous fish and to permit evaluation of fish habitat availability and changes as a function of discharge. The timing of these high flow releases has been influenced by many factors, though efforts have been made to mimic historical flow release patterns (Trinity River Restoration Program 1994).

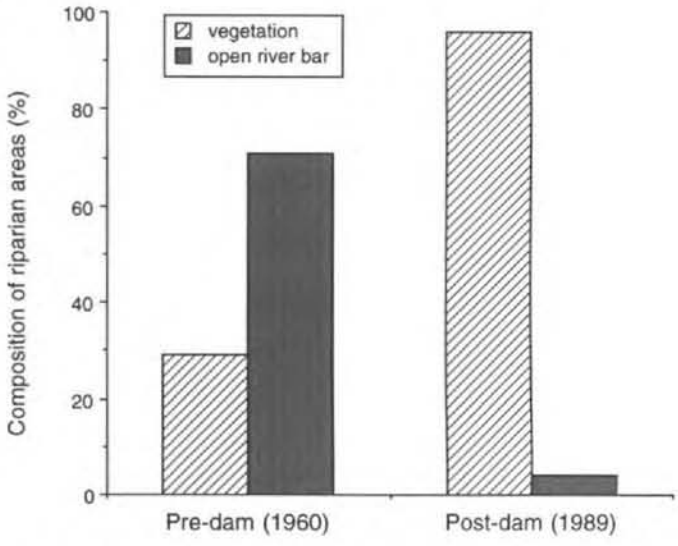


FIG. 1. Riparian habitat composition before (1960) and 26 years after (1989) construction of Trinity and Lewiston Dams on the main stem Trinity River. Estimates were derived from GIS analysis of aerial photographs.

A geographical information system (GIS) was used to analyze amount and distribution of riparian habitats prior to and following construction of the dams. Aerial photographs taken before (1960) and 26 years after (1989) the construction of the dams were used to derive estimates of the areal extent of four riparian habitats: (1) unvegetated rocky areas, (2) willow stands, (3) wil-

low/alder mixed stands, and (4) alder/cottonwood stands. We used U.S. Geological Survey (USGS) records of flow releases at Lewiston and in an undammed tributary stream within our study area, Grass Valley Creek, California, to determine the timing and magnitude of discharges during our study. Values for discharge at Helena (the lower end of our study area) were derived by extrapolating tributary flows from Grass Valley Creek to the drainage area between Lewiston and Helena.

Field surveys of all potential breeding habitat were conducted from 1991–1994 along the study reach described above. Designation of potential breeding habitat was based on literature accounts of suitable habitat (Fuller and Lind 1992; Hayes and Jennings 1988; Kupferberg, in press; Zweifel 1955) and our experience with this species in other drainages in northwestern California. Potential breeding habitat, for riverine environments, was defined as low-velocity (0.0–0.21 m/sec), shallow water (8–40 cm), with rocky substrates, adjacent to sparsely vegetated, gravel/cobble bars (hereafter referred to as bars). Bars are formed through the natural meandering process of rivers and are areas of repeated sediment deposition and erosion; usually they occur on the inside of meander bends (Leopold et al. 1964). We sampled only those bars (= sites) that were at least 10 m long and composed of coarse gravel (>32 mm diam: Platts et al. 1983) or larger substrates. Many of the bars are no longer geomorphologically active because of decreased flows. In these cases, only the sparsely vegetated portions of bars were surveyed and the heavily vegetated and steeply sloped portions were omitted because of poor habitat quality. In 1993 and 1994, we also surveyed several "bank feathering" restoration projects that were within our study reach. These feathering projects are designed to restore river bars to their historic form. Through removal of riparian berms and encroaching vegetation, river banks are mechanically recontoured to form a gentle slope and provide shallow, low water-velocity habitats (Trinity River Restoration Program 1994).

Several surveys were conducted throughout the breeding and rearing season of *Rana boylii* on the main stem Trinity River in 1991–1994 (Table 1). Two surveys were conducted each spring in 1991–1993 and one in 1994. Twenty-five to 33 natural bars were surveyed each year. In addition, one bank-feathering project was surveyed in 1993 and five more were surveyed in 1994. Surveys were timed to coincide with the peak of breeding activity each year, if possible, and were carried out from late April through

TABLE 1. *Rana boylii* reproductive ecology on the main stem Trinity River, between Lewiston and Helena, in northwestern California, 1991–1994.

Year	Survey Type	Survey Dates	Km	# Sites	# With Egg Masses	Total # Masses	# Masses /Km
1991	Initial	May 2–14	62.8	47	4	7	0.1
	Potnl Breed Sites	May 15–24	22.5	31	7	31	1.4
	Post-high flow	Jun 4–6	—	7	0	0	—
	Post-high flow	Jun 7–14	—	7	1	3	—
	Post-high flow	Jun 17–21	—	7	1	1	—
	Larvae (egg sites)	Jul 31–Aug 30	—	7	(2)[1]	—	—
	Larvae (other sites)	Jul 31–Aug 30	62.8	47	(11)	—	—
1992	Potnl Breed Sites	Apr 28–May 7	16.1	25	3	7	0.4
	Potnl Breed Sites	May 26–Jun 4	16.1	25	10	28	1.7
	Post-high flow	Jun 25–26	—	10	0	0	—
	Larvae (egg sites)	Jul 28–29	—	10	(3)	—	—
1993	Subset Potnl Breed	Jun 9–Jun 28	—	13	0	0	—
	Potnl Breed Sites	Jul 7–Jul 15	22.5	34[2]	0	0	0.0
	Larvae	Aug 30–Sept 1	22.5	34	(8)	—	—
1994	Potnl Breed Sites	Jun 1–Jun 9	22.5	39[3]	11	24	0.9
	Monitoring Site	Apr 15–Nov 14	—	1	1	2	—

1. ( ) = larvae only found at this site.
2. Includes one recently completed bank feathering restoration project site and two natural sites not surveyed in previous years.
3. Includes five recently completed bank feathering restoration project sites not surveyed in previous years; 10 of 24 egg masses were laid at these sites.

June. At least one mid-summer survey (late July/early August) was conducted to search for larvae. We also conducted at least one survey at known breeding sites, immediately following high-flow releases from the dam to track egg mass survival. In 1993, high-flow releases from Lewiston Dam in April were followed by a long period of rain and natural high flows from tributary input in May and early June; as a result we surveyed substantially later than in other years. At each bar site, egg masses, juveniles, and adult frogs were counted. The length of each bar was measured by pacing so that estimates of frogs and egg masses per linear meter of habitat could be derived. We also examined historical locality records for *Rana boylii* to qualitatively assess the distribution of this species in the Trinity Basin prior to dam construction on the main stem.

Water releases since construction of the dams have been 10–30% of pre-dam flows, based on both total yearly volume and magnitude of periodic high flows (Trinity River Restoration Program 1994; USGS records 1991–1994). Within our study area, vegetation covered less than 30% of the pre-dam riparian area and more than 95% of the post-dam area. Open bars made up 70% of the pre-dam riparian area and only 4% of the post-dam area (Fig. 1). This constitutes a loss of 94% of bar habitat, and potential breeding habitat for *Rana boylii*. Encroachment by riparian vegetation has resulted in the development of stable sandy berms, forcing the river into a narrower and deeper channel that lacks habitat complexity. Other changes seen along the main stem Trinity include loss of seasonally flooded marshes and high-flow side channels, filling of pools with fine sediments, lowered water temperatures, and riffle sedimentation (Petts 1984).

Historical records (Bury 1967; Museum of Vertebrate Zoology, University of California at Berkeley) demonstrate that *Rana boylii* occurred on the main stem Trinity and in many tributary streams, though relative abundance could not be gauged from these records. Initial surveys indicated that there were few *Rana boylii* in the upper portion of our study area and that the lower section had more potential breeding habitat due to the more natural flow conditions created by tributary streams; subsequently we surveyed only the lower 22.5 km. Of the 25–39 bar and bank feathering sites searched, 7–10 had egg masses annually. Total egg mass counts over four years ranged from 21–31 annually in 22.5 km (Table 1).

During the four years we tracked breeding relative to the tim-

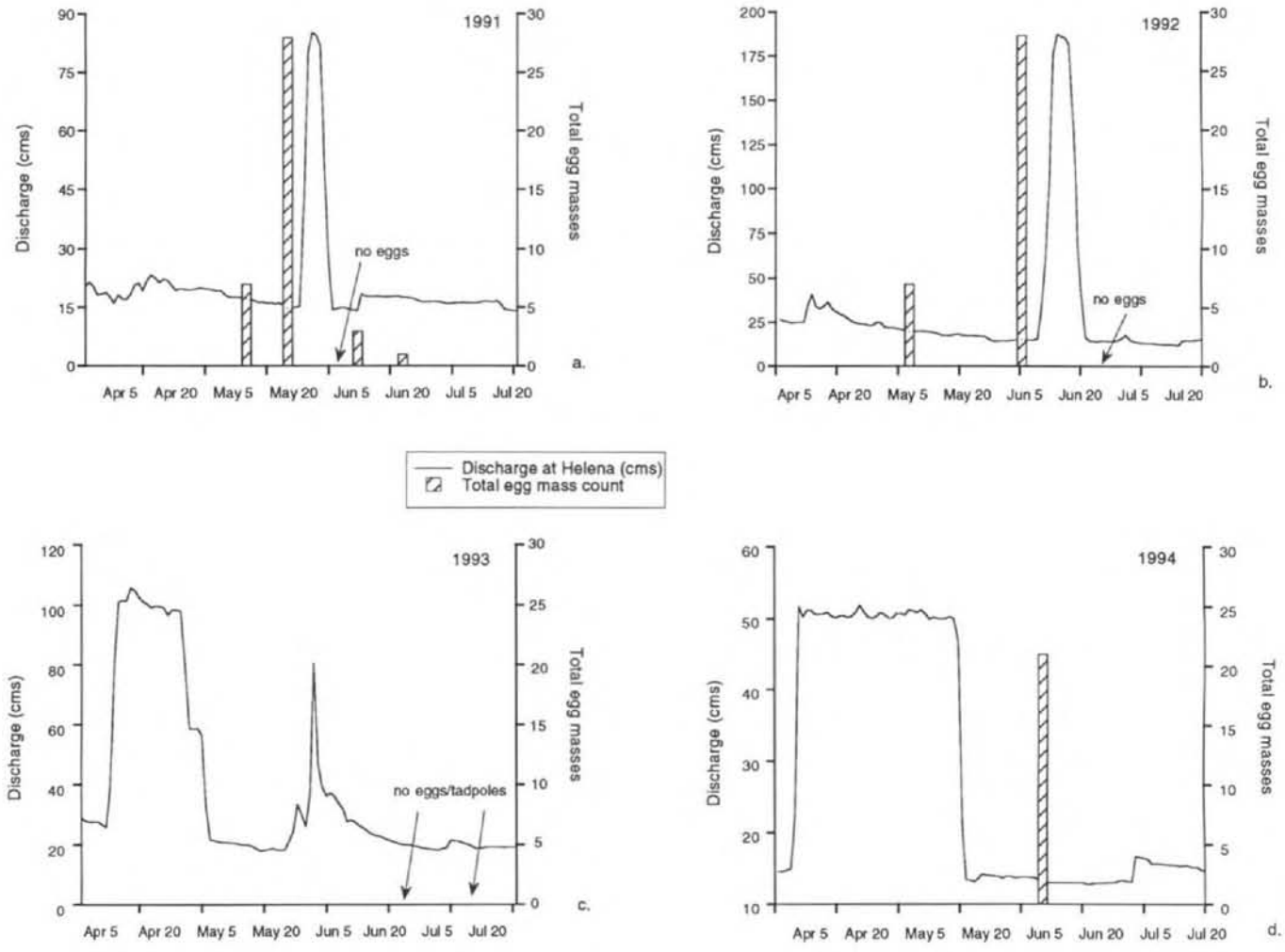


FIG. 2. Chronology of foothill yellow-legged frog (*Rana boylii*) breeding and egg mass abundance as documented by river shoreline surveys, and discharge (in cubic meters per second [cms]) of the main stem Trinity River at Helena for (a) 1991, (b) 1992, (c) 1993, and (d) 1994.

ing and magnitude of flow releases on the main stem, we found significant negative impacts in 1991 and 1992 and undetermined impacts in 1993 and 1994. In 1991 and 1992, all egg masses laid before high flow releases were lost (Table 1, Fig. 2a & b). In 1991, three egg masses were laid at one site after the largest flow release, and a second flow increase from 14 to 18 cms eliminated two of the three (Fig. 2a). Mid-summer surveys of breeding sites indicated that larvae survived after the high flows only at sites where egg masses had hatched prior to high-flow releases. In 1991, three to four larvae were found at two of the seven known breeding sites. Of the 10 known 1992 breeding sites, three sites had one larvae each and three sites had two, eight, and fifteen larvae. In 1993 we found no egg masses or larvae during spring surveys, though surveys were conducted later than in previous years. However, we did find larvae at several sites during mid-summer surveys. We do not know whether these larvae were missed during spring surveys or whether they moved into the main stem from unsurveyed tributary streams. The only year in which a substantial proportion of egg masses and larvae appear to have survived to metamorphosis was 1994. High-flow releases were earlier in 1994, and most breeding activity occurred after these releases (Fig. 2d). At one site visited biweekly through late October 1994, all life stages were seen, though no more than two metamorphic individuals were seen on any given day.

Though downstream effects of dams can be quite variable, several changes appear consistent across most dammed systems. For example, peak flood flows are decreased and year-round flows are typically lower (Ligon et al. 1995; Williams and Wolman 1984). Sediment concentrations and suspended sediments decrease substantially for many miles downstream and bed material typically becomes more coarse (Ligon et al. 1995; Williams and Wolman 1984). In general, the areal extent of riparian vegetation increases below dams as a result of reduced flows and lack of scouring floods; this was the case on the Trinity (Fig. 1, Petts 1984). In addition, riverine species experience direct habitat loss as a result of reservoir filling. Brode and Bury (1984) documented a potential loss of more than 50 km of stream habitat for *Rana boylii* inhabiting the area of a proposed dam and reservoir.

On the Trinity River, two aspects of the dams are having significant impacts on the *Rana boylii* population. First, river morphology has changed significantly since flows became controlled in 1963, and as a result a significant amount of breeding habitat has been lost (Fig. 1). Data from a comparably-sized undammed river fork in the same system (the South Fork Trinity) demonstrated that both the number of potential sites and the total number of egg masses were substantially higher on this fork than in our main stem study area. We found 548–730 egg masses annually, at 81–87 sites in 15 km during three years of surveys from 1992–1994 on the undammed fork (unpublished data). The second factor is the timing of high-flow releases from the dam. In at least two of the last four years, entire cohorts of *Rana boylii* were lost along our main stem study reach because of unseasonal high flow releases (Fig. 2). Kupferberg (in press) demonstrated that survival of *Rana boylii* egg masses in a natural river was dependent on channel morphology and timing of egg deposition, during both increases and reductions in flows.

Other dam-related factors that may influence the breeding ecology of *Rana boylii* in this river are water temperature, exotic species, and changes in prey base. To accommodate fisheries requirements, water temperatures are kept artificially low (relative to pre-dam conditions and present conditions on other local rivers) using higher than normal releases in mid-summer; this may retard development of eggs and larvae (Duellman and Trueb 1986).

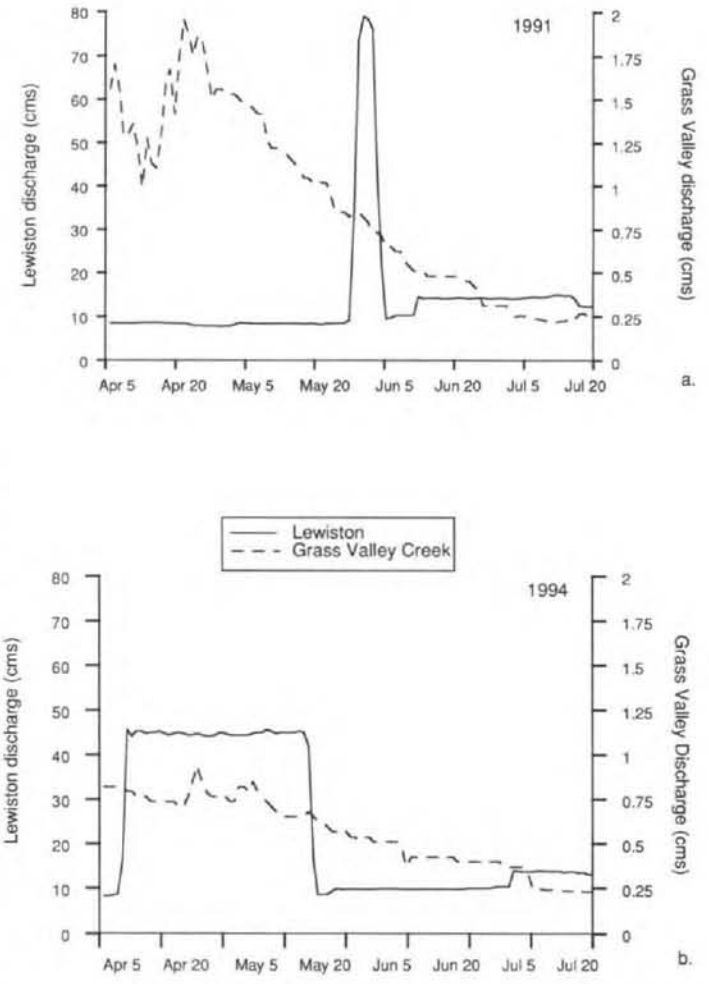


FIG. 3. Discharge (in cubic meters per second [cms]) hydrographs for the main stem Trinity River at Lewiston, and Grass Valley Creek, a tributary to the main stem below Trinity and Lewiston dams for (a) 1991 and (b) 1994.

Bullfrogs (*Rana catesbeiana*), a suspected predator on many native western ranids (Hayes and Jennings 1986; Moyle 1973), are present in the main stem Trinity (pers. obs.). Controlled flows and lack of winter flooding may actually increase suitable habitat for this exotic frog by providing stable pool areas with established aquatic vegetation. Changes in macro-invertebrate prey composition and abundance have been documented in many dammed river systems (Petts 1984) and these changes may affect native amphibians.

We believe the negative impacts we have identified on the main stem Trinity River can be reduced with thoughtful management. Habitat loss is a critical problem and *Rana boylii* has responded to "bank feathering" restoration projects within one year of construction. Ten of the 24 egg masses found in 1994 surveys were at restoration sites. However, we do not know whether frogs using these newly created habitats are additions to the breeding population or whether the frogs have moved into these areas simply because they are more suitable than what is currently available on the river.

Timing of high flows is more difficult to address because we do not know what environmental or other cues frogs use to ini-

tiate breeding. The timing of amphibian breeding is thought to be influenced by factors such as temperature and day length, which directly affect hormonal cycles (see Duellman and Trueb 1986 for a review). Metter (1961) speculated that for western toads (*Bufo boreas boreas*) breeding in riverine systems, timing and volume of run-off may also influence timing and location of breeding. An Asian stream-breeding frog, *Buergeria buergeri*, is known to decrease its breeding activity during heavy rainfall and high stream flows (Fukuyama and Kusano 1992). On the main stem Trinity, releases usually have been timed to mimic *average* predam patterns of spring run-off events. Using average conditions to determine flow schedules may or may not be consistent with environmental conditions in a given year. For example, if a threshold temperature or water level is required before frogs can initiate breeding and these conditions occur in April because of local climatic shifts, frogs may initiate breeding. If high-flow releases then occur in May of that year, egg masses or larvae are likely to be lost. Compare the discharge from an undammed tributary within the watershed to controlled discharges from Lewiston dam for the same time period in 1991 and 1994 in Figure 3. The tributary stream reflects the natural environmental conditions. In 1991 (and 1992, not shown), high flow releases from the dam occurred much later than the natural flow regime demonstrated by the tributary and in 1994 timing was similar between the main stem and the tributary. Note that 1994 was the only year in which we believe that a substantial portion of larvae survived to metamorphosis. A more appropriate strategy for *Rana boylii* and, we suspect, for most species that have evolved in stochastically fluctuating riverine environments, would be to base real-time changes in flow releases on current environmental conditions (e.g., if it is raining, release more water). Understanding the interactions between environmental factors (both natural and artificial) and frog breeding ecology is critical for managing water releases to reduce impacts on frogs and other species existing in dammed river systems.

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Prey of the Introduced *Bufo marinus* on American Samoa

GILBERT S. GRANT
Department of Marine and Wildlife Resources
P.O. Box 3730, Pago Pago, American Samoa 96799, USA

Present address: Department of Biological Sciences,
University of North Carolina, Wilmington, North Carolina 28403, USA
e-mail: grantg@uncwil.edu

The giant cane or marine toad, *Bufo marinus*, is native to Central and northern South America (Zug and Zug 1979) but has been widely introduced to islands in the West Indies, the Pacific, Australia, and New Guinea (reviewed by Zug et al. 1975). In many areas it was introduced primarily to control sugar cane insect pests and has apparently been fairly successful in some areas in reducing damage to this crop (Wolcott 1937).

Bufo marinus was introduced from Hawaii to Tutuila Island (14°20'S, 170°43'W), American Samoa, in 1953 and the population was estimated to be over 2 million by 1976 (Amerson et al. 1982). Toads occur island-wide on Tutuila, have colonized neighboring Aunu'u Island, but do not presently occur on the nearby islands of Tau, Ofu, and Olosega, nor on Savaii and Upolu of Western Samoa.

Marine toads have catholic tastes (Alexander 1965; Hinckley 1963; McCoid 1994; Zug et al. 1975). The purpose of this study was to examine the food habits of marine toads in two different habitats on Tutuila, American Samoa.

On Tutuila Island, 26 toads were collected in suburban and park areas in the village of Tafuna and 28 were collected in secondary forest and primary rainforest (forest) of Amalau and Olovalu Crater near Futiga. Toads were collected from 24 October 1992 to 13 July 1994 and always 2–4 h after sunset to allow some time for foraging by the toads. Collected toads were immediately placed in plastic bags and frozen until processing.

Table 1. Mean (standard deviation) snout-vent lengths (SVL), jaw width (JW), and body mass minus stomach contents (BM) for 54 *Bufo marinus* in two habitats on Tutuila, American Samoa. Probabilities based on unpaired t- test.

	Combined N = 54	Suburban/Park N = 26	Forest N = 28	P
SVL (mm)	97.2 (13.9)	88.5 (11.9)	105.4 (10.2)	0.000
JW (mm)	36.9 (5.5)	33.8 (4.9)	39.8 (4.3)	0.000
BM (g)	90.6 (41.8)	68.0 (29.9)	111.6 (37.0)	0.000

Table 2. Mean (standard deviation) weight of entire contents, animal contents, and plant/grit contents from stomachs of *Bufo marinus* from two habitats on Tutuila, American Samoa. Probabilities based on t- tests.

	Suburban/Park N = 26	Forest N = 28	P
Entire contents (g)	2.3 (1.8)	4.7 (3.2)	0.001
Animal contents (g)	1.3 (1.7)	2.9 (2.1)	0.004
Plant/grit contents (g)	1.0 (1.2)	1.8 (1.9)	0.058

Intact toads, entire stomach contents, animal content of stomachs, and plant/grit content of stomachs were weighed to the nearest 0.1 g on a triple-beam balance. Snout-vent length (SVL) and maximum width of the jaws was measured with dial calipers to the nearest 0.1 mm. Animal prey were identified to the lowest possible taxonomic level and quantified.

Forest toads were longer, had wider gapes, and weighed more than suburban/park toads (Table 1). In addition, the stomachs of forest toads contained twice as much food by mass as did those of suburban/park toads. Animal contents, but not plant/grit contents, of the stomachs were significantly greater in forest toads (Table 2).

Toads in both habitat types took a wide variety of prey (Table 3). Nearly one half of the prey taken by forest toads was millipedes, whereas suburban/park toads took more moths, caterpillars, and beetles. The largest centipede taken was 51 mm long. Termites, geckos, and dog food were also eaten by toads in suburban/park habitats (P. Craig, B. Grant, P. Trail, pers. comm.), but the latter two items were not found in the stomachs of this study. Nearly equal numbers of animal prey were found in suburban/park toads (227) as in forest toads (217). Because the animal con-

tents in stomachs weighed twice as much in forest toads, individual prey items taken were substantially larger, on average. Toads took substantial quantities of plant material. Eighteen (69.2%) of suburban/park toad stomachs and 20 (71.4%) of forest toad stomachs contained plant material. Many very small arthropods were found among the vegetation in some toad stomachs. Two pieces of plastic wrap measuring 4 cm x 2 cm and 3 cm x 2 cm were found in one forest toad.

Zug et al. (1975) reported that *B. marinus* in rainforest habitats of New Guinea were both longer and heavier than savannah toads, a finding similar to that reported here. The body size differences reported in savannah and rainforest toads was attributed to the greater quantity and quality of food taken by rainforest toads (Zug et al. 1975). The size differences observed in American Samoan toads may be attributed to prey quality and quantity, sex ratio differences in the populations, or increased mortality rates in the suburban/park population. Unfortunately, I did not sex toads collected in this study. Zug and Zug (1979) showed that in neotropical populations females attained larger body size than males and that sex ratios varied in different populations. Some populations had twice as many males as females; others had twice as many females as males. Increased mortality rates were likely in the Samoan suburban/park habitat due to the presence of street lights and roads. Surface water for breeding was available in both Samoan habitats. Thus, the size differences are probably not due to differential recruitment rates.

Samoan forest toads consumed twice the quantity and animal content as did the suburban/park toads. Prey diversity was much greater in New Guinea toads (Zug et al. 1975) than Samoan toads, probably due to decreased prey diversity on small, distant islands. *Bufo marinus* is known to consume a wide variety of prey, including geckos, other toads, arthropods, vegetable matter, dog and cat food, and discarded pork spare ribs (Alexander 1965; Hinckley 1963; McCoid 1994; Zug et al. 1975; this study).

Many small arthropods (especially beetles and true bugs, Table 3) were found among some of the plant material in toad stomachs. Perhaps these arthropods were taken incidental to feeding on plant material, or conversely, the taking of plant material was

TABLE 3. Animal prey of 54 *Bufo marinus* in two habitats on Tutuila, American Samoa (N = sample size, NS = number of individuals with a particular prey item; NP = number of prey eaten).

	Suburban/Park (N = 26)				Forest (N = 28)			
Prey Types	NS	%	NP	%	NS	%	NP	%
Mollusca								
Snails*	7	9.0	16	7.0	5	7.0	6	2.8
Slugs	0	0	0	0	4	5.6	4	1.8
Arthropoda								
Scorpionida	1	1.3	1	0.4	0	0	0	0
Araneida	1	1.3	1	0.4	1	1.4	1	0.5
Isopoda	1	1.3	1	0.4	0	0	0	0
Diplopoda	9	11.5	24	10.6	17	23.9	96	44.2
Chilopoda	2	2.6	2	0.9	2	2.8	5	2.3
Orthoptera	6	7.7	11	4.8	0	0	0	0
Dermaptera	11	14.1	19	8.4	5	7.0	5	2.3
Hemiptera	3	3.8	6	2.6	2	2.8	2	0.9
Coleoptera	17	21.8	54	23.8	11	15.5	31	14.3
Lepidoptera	11	14.1	77	33.9	12	16.9	36	16.6
Diptera	1	1.3	1	0.4	1	1.4	1	0.5
Hymenoptera	6	7.7	12	5.3	11	15.5	30	13.8
Miscellaneous**	2	2.6	2	0.9	0	0	0	0

* includes 2 *Ostodes strigatus* and 20 *Subulina octona*.
** includes a fish scale 12 mm long and the tibia of *Rattus* sp.

incidental to the taking of small arthropods. The presence of a *Rattus* sp. tibia and a fish scale in toad stomachs is probably best attributed to incidental take while feeding on arthropods associated with carrion. Prey taken by neotropical populations of toads varied from one locality to the next and probably reflects the seasonal and habitat abundance of prey (Zug and Zug 1979).

Zug et al. (1975) reported toad densities 10 times greater in savannah habitats. I made no attempt to quantify densities. However, on Tutuila, American Samoa, population densities of *B. marinus* are highest in lowland areas with mowed lawns and villages and lowest in upland villages and forests (Amerson et al. 1982).

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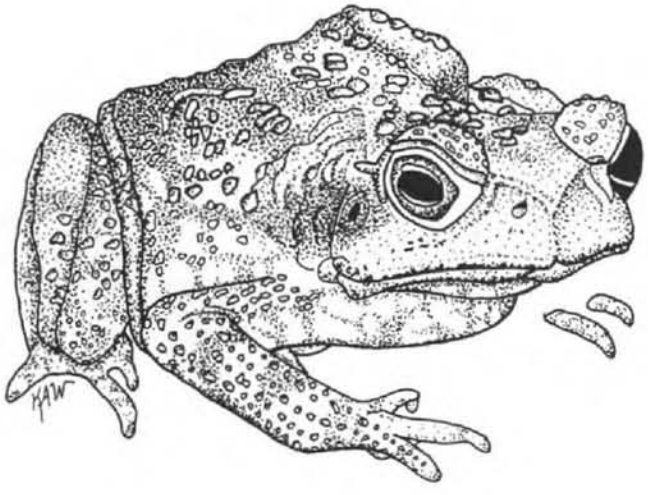
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Bufo marinus (Cane or Marine Toad). USA: Puerto Rico: Caribbean National Forest. Illustration by Karen A. Wilson.

Cnemidophorus tigris Does Not Occur on Isla San Benito, Baja California, México

L. LEE GRISMER
Department of Biology, La Sierra University
Riverside, California 92515-8247, USA
e-mail: lgrismer@polaris.lasierra.edu

and

BRADFORD D. HOLLINGSWORTH
Department of Natural Sciences, Loma Linda University
Loma Linda, California 92350, USA
and
Department of Biology, La Sierra University
Riverside, California, 92515-8247, USA

The three most recent checklists concerning species composition of the Pacific islands of Baja California have reported *Uta stellata* and *Cnemidophorus tigris* as occurring on Isla San Benito (Bostic 1975; Grismer 1993; Wilcox 1980) although prior lists (Savage 1967; Van Denburgh 1905; Van Denburgh and Slevin 1914; Zweifel 1958) do not include these species. Despite the reports of Bostic (1975), Wilcox (1980) and Grismer (1993), no museum specimens from Isla San Benito exist.

Isla San Benito is a remote archipelago of three small islands totaling 6.6 km^2 in area and lying 31 km due west of Isla de Cedros. Along with Islas Natividad and Cedros, Isla San Benito comprises the westernmost extension of the Vizcaíno Peninsula off the west coast of central Baja California (see Grismer et al. 1994 for a map). On 10–14 July 1995, we and four others visited these islands to collect *Uta* and record field body temperatures of *Cnemidophorus tigris*. We visited all three islands of Isla San Benito on 11 July, searching for seven hours between 0900 and 1600. During this period, we observed hundreds of *U. stellata* but no *C. tigris*. Air and substrate temperatures ranged from 18.5°C and 39.2°C, respectively, at 1100 h to 28.3°C and 48.0°C, respectively, at 1500 h under sunny skies. We believe that these temperatures and weather conditions were well within the parameters at which *C. tigris* should have been active in this part of its range. This is based on the fact that we found *C. tigris* active on sunny days on Isla de Cedros on 10 and 12–13 July 1995 at air temperatures of 23.9–30.0°C and substrate temperatures of 34.0–43.6°C. Two lizards collected from Isla de Cedros during this period had body temperatures of 37.7°C and 39.9°C. Additionally, on 14 July, we found *C. tigris* abundant during an overcast day on Isla Natividad from 0925 to 1500 h. During this period, air temperatures ranged from 21.5–24.4°C and substrate temperatures ranged from 28.9–33.0°C. These temperatures were well below the highest ambient temperatures reported three days earlier from Isla San Benito yet on Isla Natividad, *C. tigris* were active and had body temperatures ranging from 28.9–31.9°C (N = 4). We believe this is strong evidence indicating that if *C. tigris* were present on Isla San Benito, it would have been active and observed. Additional negative evidence comes from the fact that there are no specimens of *C. tigris* from Isla San Benito catalogued in any of the museums we checked (CAS, CM, LACM, MVZ, SDSNH, USNM; museum acronyms follow Leviton et al. 1985; these museums were consulted because they have a history of receiving material from this portion of México) although there were a total of 434 specimens of *Uta stellata* from CAS, LACM, SDSNH, and USNM. It seems logical that during the collection of 434 *U. stellata* from these three small islands over the last 90 years at least one specimen of *C. tigris* would have been collected if the species were present.

The first report of *Cnemidophorus tigris* from Isla San Benito comes from Bostic (1975). This was presented in an unfinished guide to the natural history of north central Baja California and the adjacent islands that was poorly circulated due to Bostic's death while the book was in galleys. In it he stated that the only two species of reptiles "recorded" from Isla San Benito are *Uta stellata* and *C. tigris*. He went on to give a general description of how living lizards in the field can be distinguished by their respective behaviors but never actually states having seen *C. tigris*. Wilcox (1980), apparently having never visited the island, followed Bostic's (1975) report as did Grismer (1993), who followed both Bostic (1975) and Wilcox (1980). This report should serve as a caution to others compiling area checklists in that all taxa should be confirmed with either an institutional specimen or verified institutional photograph.

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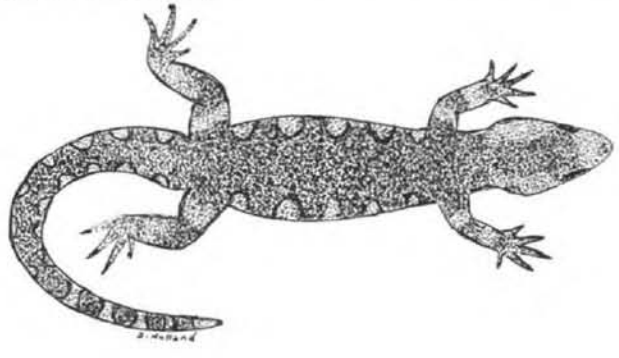
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Additional Evidence for Rotenone Hazards to Turtles and Amphibians

MICHAEL JAMES MCCOID
Caesar Kleberg Wildlife Research Institute, Campus Box 218
Texas A&M University, Kingsville, Texas 78363, USA

and

PHILLIP W. BETTOLI
Tennessee Cooperative Fishery Research Unit
Tennessee Technological University, Box 5114
Cookeville, Tennessee 38505, USA

Rotenone, a biodegradable piscicide, is commonly used in fisheries management to sample, eradicate, or alter populations of fishes. A recent article (Fontenot et al. 1994) reviewed the known hazards of rotenone to aquatic reptiles and amphibians and suggested that impacts on these non-target organisms have been poorly documented. We herein present information on two separate instances where rotenone has impacted components of a herpetofauna.

As pointed out by Fontenot et al. (1994), larval amphibians may be particularly susceptible to rotenone treatment. In early 1974, African clawed frogs (*Xenopus laevis*) were discovered in a series of ponds in the upper Santa Clara River drainage, northern Los Angeles Co., California, USA. Efforts, including chemical eradication, were undertaken in spring 1974 to eliminate this perceived threat to nearby populations of the federally endangered unarmored three-spine stickleback (*Gasterosteus aculeatus williamsoni*) (St. Amant 1975). Several of these ponds were treated with "various chemicals at extremely high concentrations" (St. Amant 1975) with the result being the extirpation of *X. laevis* tadpoles. Adult *X. laevis* were unaffected, emigrated from the ponds, recolonized, and reproduced again later that spring. Although St. Amant (1975) did not specify the chemical agent(s) or the concentrations used in the abortive eradication procedure, a subsequent study (Zacuto 1975) identified the chemical as rotenone. Zacuto (1975) recognized the treated ponds as breeding areas for native amphibians (*Pseudacris regilla* and *Bufo boreas*) and while rotenone-targeted *X. laevis* was temporarily eliminated, it is also likely that sympatric tadpoles of native amphibians were also locally extirpated.

Hazards to freshwater turtles are less well documented than hazards to amphibians. Fontenot et al. (1994) speculated that turtles using buccopharyngeal, cloacal, or dermal aquatic respiration might be more susceptible to rotenone poisoning than those species that do not. At least some kinosternids and trionychids (see references in Fontenot et al. 1994) secondarily employ these respiratory mechanisms. A study, conducted between 1980 and 1986, used rotenone applications to partially assess fish community changes in a reservoir following aquatic vegetation removal (Bettoli et al. 1993). The 8100 ha reservoir (Lake Conroe, Montgomery Co., Texas, USA) was eutrophic, shallow (maximum depth 23 m), and harbored populations of turtles, including *Kinosternon subrubrum*. During the last two weeks of May of each year, six coves (total surface area 6.7 ha) were isolated with block nets and treated with rotenone (3 mg/L of 5% active ingredient, tradename Noxfish). During the first and second day of the standard three-day pickup period for fishes following treatment at each cove, it was noticed that dead or dying *K. subrubrum* were occasionally seen. At three of the six coves (maximum depths 2.4–5.5 m) during 1980–1981, we estimated that 10+ dead or dying *K. subrubrum* were observed around the periphery of each cove (60+ total). Dead turtles were seen on the bottom in water < 1 m

depth or lying on the bank. No information on turtles was recorded at the remaining three coves. Water visibility in the coves was reduced because outboard motors and airboats disturbed bottom sediments while thoroughly mixing rotenone in the water column. No other dead species of turtles or amphibians were recorded during 1980–1981. Estimated tallies for dead turtles from 1982–1986 were not recorded.

Although it appears that rotenone killed *K. subrubrum* in Lake Conroe, we have no way to estimate the impact on the local populations. Pre-treatment population densities are unknown, recolonization rates from adjacent untreated areas are unknown, and because *K. subrubrum* tends to sink when dead (pers. obs.) and are obscured by turbidity in deeper waters, total mortality cannot be estimated. Additionally, effects of rotenone may be enhanced in peripheral, shallower sections of treated areas, perhaps resulting in higher mortality rates. Rotenone treatments applied along shorelines may circumscribe escape routes for aquatic organisms and treatment levels of rotenone in shallow water will result in initially higher rotenone concentrations. If calculations for rotenone applications are based on the total volume of water to be treated, then, because of application techniques (aerial and/or subsurface), organisms will die sooner in shallow vs. deeper waters (pers. obs.).

It is clear that some non-target species are unintentionally vulnerable to rotenone treatments. Resolution of this problem, as suggested by Fontenot et al. (1994), may lie in a better understanding of the distributions and habitat uses of non-target species, their susceptibility to rotenone, and a more judicious application of toxicants such as rotenone.

Acknowledgments.—We thank Richard Noble (North Carolina State University) for facilitating this paper and Lance Fontenot for encouragement. A review of this paper was kindly done by Rebecca Hensley.

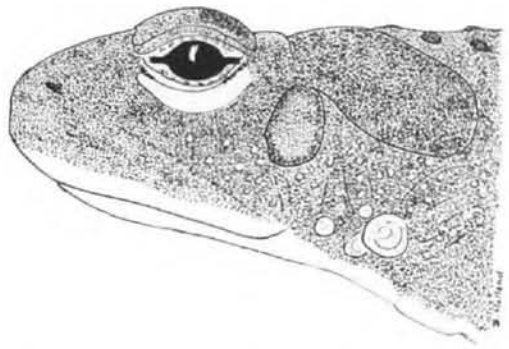
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Bufo alvarius (Sonoran Desert Toad). USA: Arizona: Pima Co., Hickiwan. Illustration by Dan C. Holland.

TECHNIQUES

A Harmless Technique for Sexing Hatchling Lizards

PETER S. HARLOW
School of Biological Sciences, AO8
The University of Sydney, 2006, NSW Australia

Both genotypic and temperature-dependent sex determination are known to occur in the agamid lizards (Viets et al. 1994). During a survey of sex determining mechanisms in the Australian Agamidae it became necessary to devise a harmless technique for sexing the hatchlings. Probing, and various techniques for everting the hemipenes, were tried and a simple, harmless and accurate technique was devised.

The recently hatched lizard is restrained either by cooling briefly in a refrigerator, or with the assistance of a second person, and laid belly-up (head to the left) under a low power (6–10X) dissecting microscope. The shaft of one dissecting needle is firmly held anterior and parallel to the cloaca, and a second is held at an angle of about 20–30° and used to gently evert the left hemipene by a forward rolling pressure on the lizard's left lateral tail base. For a 50 mm SVL hatchling this pressure should begin about 8 mm posterior to the cloaca, and for a 23 mm hatchling about 4 mm. In females, the cloaca will gape and a tiny gland-like structure may be seen on each side; in males, the left hemipene will be easily everted. The hemipene is bilobed, and much larger then the female structures. Although hemipene size varied slightly among male clutch mates, all lizards sexed were in one of these two categories; no intermediates were ever seen (Fig 1.).

I have used this technique to sex 715 hatchling agamids (ranging from 0.4 g to 5 g in mass) from 12 species in eight genera. Representatives of each species have been preserved for museum specimens and, upon dissection, hatchlings with hemipenes had ellipsoid gonads and no oviducts, whilst lizards without hemipenes had more disk-like, flattened gonads and clear oviducts. However, morphological differences were sometimes ambiguous so histology on 37 hatchlings was used to verified sex. Laparoscopy of 17 lizards and dissection of a further 72 individually marked lizards between 4 months and 2 years of age were also used to verify my original sex diagnosis. Females develop visible ovarian follicles after about 4 months of age in one species (*Physignathus lesueurii*); these and the oviduct are clearly seen on dissection or by laparoscopy. Testes from similar aged animals are "sausage-like" ellipsoids, and no oviducts are visible.

Among 126 agamids sexed as live hatchlings by the above technique that also had their gender subsequently verified by histology, laparoscopy, or by dissection over the three years of this study, only three (2.4%) were misdiagnosed. Two males were wrongly diagnosed as females, and one female was wrongly identified as a male. This last record was probably a data-recording error as the lizard had no evidence of hemipenes on later dissection. These three misdiagnosed specimens were from the first year of the study, and the male misdiagnosis probably resulted from not applying enough pressure to the tail base. It is important to have both males and females available when first attempting this technique. With experience, most hatchlings could be sexed correctly by visual comparison of the relative width of the tail base; in males it is slightly wider than in sibling females.

When 38 male *P. lesueurii* initially sexed at hatching were again sexed using this technique at three months of age, I could evert hemipenes in only 28 lizards (74%), and then only with difficulty. Subsequent dissection and verification by histology revealed no change of gender, but only my inability to evert the hemipenes in older animals. After death, the hemipenes were easily everted by injection of preservative into the tail 15 mm from the cloaca. This increasing difficulty to evert hemipenes with increasing age has also been reported in varanids (Hairston and Burchfield 1992) and pythons (Barker and Barker 1994) and is presumably due to increasing musculature in the tail.

With experience, this simple technique takes only a few seconds for each lizard and is completely harmless. A low power microscope is necessary only for the smaller species, but the extra magnification available allows only slight pressure to be applied to the tail base before the hemipene is easily seen without being fully everted. This technique may well work in other lizard families without tail autotomy (Chamaeleontidae, Iguanidae, Varanidae, etc.), and the accumulated data from many species may help explain the puzzling dichotomy of sex determining mechanisms within the lizards.

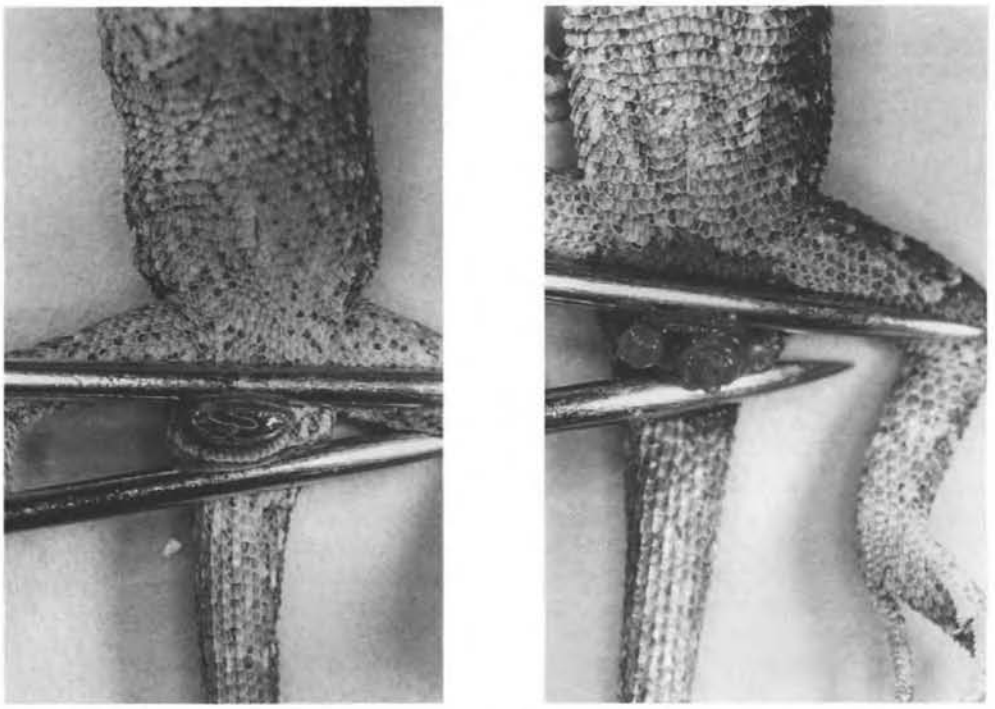


FIG. 1. Sexing hatchlings of the agamid lizard *Amphibolurus nobbi*. These lizards are 0.5 g and 26 mm SVL. (A) female, (B) male showing everted left hemipene and partially everted right hemipene.

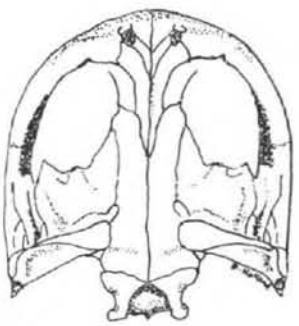
Acknowledgments.—I thank J. Stewart for teaching me the art of interpreting gonad histology, M. Ricketts for photography, and R. Shine for comments on the manuscript.

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Crytobranchus allegheniensis (Hellbender). Illustration by Dan C. Holland.

A Non-Flushing Stomach Wash Technique for Large Lizards

JESÚS ANTONIO RIVAS[1]
CESAR RAMÓN MOLINA[2]
and
TITO MANUEL ÁVILA[2]
Universidad Central de Venezuela, Instituto de Zoología Trópical, Caracas, Venezuela
Present addresses: [1] Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee 37996-0900, USA; and [2] Fundación Museo de Ciencias, Centro de Apoyo Adolfo Ernts, Calle El Comercio, Las Acacias, Venezuela

Stomach flushing has been proved useful in the study of lizard diets, but techniques have varied from one study to another (Henle 1989a; James 1990; Legler and Sullivan 1979; Shine 1986). We carried out a study of food habits in green iguanas (*Iguana iguana*) at Hato Masaguaral (a cattle ranch), Guárico, Venezuela (8°34'N, 67°35'W), and present the technique we used to recover stomach contents without killing or injuring the animals.

An iguana's mouth may be opened by gently pulling down the lower jaw, and then kept open by insertion of a metal ring (25 mm diameter, covered with several layers of masking tape to avoid damage to the teeth). Clear plastic tubes (8–15 mm diameter, depending upon animal size), with ends sanded to avoid cutting the stomach wall, may then be lubricated with vegetable oil and, while holding the animal's head in a vertical position, gently introduced through the ring into the throat. The tube is inserted past the initial resistance of the throat and until further resistance is met (a distance of about 60% snout-vent length), and then the tube is slowly backed out a distance of 1–2 cm, depending upon the size of the animal. The tube is then filled with water until the water level rises above the height of the mouth. The water in the tube is

then mixed with the stomach contents by gently massaging the belly; contents are removed by inverting the animal, retracting the tube an additional 2–3 cm (estimated distance from the hind wall of the stomach to the distal end of the sternum), and applying gentle pressure from the rear to the front of the stomach. The stomach contents are then collected in a plastic container; food becoming lodged in the mouth or pharynx is easily removed with forceps. This procedure is repeated 3–6 times for each animal and is stopped when the expelled water contains no plant items.

To test the efficiency of this procedure, one yearling and 13 hatchling iguanas were sacrificed, and the remaining stomach contents were analyzed after the procedure had been used. An average of 83.2%of all stomach contents (range 32–100 %) was recovered, and all species present in the stomach were detected in 13 of 14 cases. We did not consider it necessary to sacrifice larger animals to test the efficiency of the method.

Using this technique, we have been able to recover remains of 125 species of plants (Molina 1991; Rivas 1990). Stomach washing was performed on 365 iguanas ranging in size from hatchling (70 mm SVL, 12 g) to adult (up to 450 mm SVL, 4500 g). No animals died during the treatment although, in early attempts, some animals appeared weak after the maneuver. Many iguanas previously "stomach-washed" were recaptured in subsequent years and showed no ill effects.

This method provides a safe and easy way to study the dietary habits of large lizards. Because water is poured into the tube, no water pressure is applied to the animal gut, and no pump or syringe is needed. Although we used this method only for green iguanas, we believe it could be used with other lizards of comparable size; it was also used successfully with hatchling spectacled caiman (*Caiman crocodilus*) (Escalona, pers. comm.).

Acknowledgments.—We thank Thomás Blohm for the use of his ranch facilities, and the Wildlife Conservation Society (WCS) for financial support. Carlos Coronel allowed us to sacrifice some iguanas at his ranch. Gustavo Hernandez provided useful comments on the application of the technique. P. T. Andreadis, G. M. Burghardt, D. Truett, A. S. Rand, J. Thorbjarnarson, and A. E. Echternacht also provided useful comments and editorial suggestions.

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NATURAL HISTORY NOTES

The Natural History Notes section is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword which best describes the nature of their note (e.g., Reproduction, Longevity, Morphology, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send three copies of manuscripts, double-spaced, directly to the appropriate section coeditor (addresses on inside front cover): Lee A. Fitzgerald (lizards, amphisbaenians, crocodilians, Sphenodontia); Charles W. Painter (amphibians); or Paul A. Stone (snakes, turtles). Authors are encouraged to include a 3.5-inch disk containing pertinent files along with hard copy submissions. Indicate disk format (e.g., Macintosh, Windows), word processor name and version used to create the manuscript file, and include a text-only version of the file.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1990. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd ed., Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113). KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

ANURA

LITORIA FALLAX (Eastern Dwarf Treefrog). **REPRODUCTION.** McCoid (1993. Herpetol. Rev. 24:16–17) reported this introduced species as occurring island-wide on Guam, Mariana Islands, in association with wetlands. In the native range, neither Cogger (1988. Reptiles and Amphibians of Australia, 5th ed., Reed Books, Pty. Ltd., NSW, 688 pp.) nor Frith and Frith (1987. Australian Tropical Reptiles and Frogs, Tropical Australia Graphics, Queensland, 70 pp.) mentioned reproductive periodicity. Although calling males have been heard year-round on Guam after heavy showers, successful reproduction during the dry season (December–May) may be tied to episodic rainfall. Successful reproduction is probably seasonal in ephemeral bodies of water as tadpoles and froglets have only been observed during the rainy season. On Guam, many wetlands are ephemeral and tend to contract or disappear during the dry season.

Size at maturity is ca. 30 mm SVL and at metamorphosis, froglets are 11–13 mm SVL. At metamorphosis, froglets are brown dorsally, but turn green at they grow. Maximum known size on Guam is ca. 40 mm SVL.

Michael Ritter aided in field work and Rebecca Hensley reviewed a version of this manuscript. Portions of this study were supported by the Endangered Species Conservation Program, Project E4 (to Guam).

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors *must* adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (as it appears in Collins, 1990, *Standard Common and Current Scientific Names for North American Amphibians and Reptiles, Third Edition*, Herp. Circ. 19:1–41), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author — curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al., 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985(3):802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full — spell out state names — no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen *only* when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*) to make sure you are not duplicating a previously published record.

Please submit any geographic distribution records in the **standard format only** to the Section Co-editors, Joseph T. Collins (USA & Canadian records only), Natural History Museum—Dyche Hall, The University of Kansas, Lawrence, Kansas 66045–2454, USA, or Jerry D. Johnson (the rest of the world), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA. Short manuscripts are strongly discouraged, and are only acceptable when data cannot be presented adequately in the standard format.

Recommended citation for new distribution records appearing in this section is: Painter, C. W., and C. M. Milensky. 1993. Geographic Distribution. *Crotalus tigris*. Herpetol. Rev. 24:155–156.

CAUDATA

AMBYSTOMA TALPOIDEUM (Mole Salamander). USA: GEORGIA: WALKER CO: Crockford-Pigeon Mountain Wildlife Management Area, ca. 50 m S jct. Atwood Point Road and McCutchens Spring Road, 625 m (2050 feet) elev. (34°41'35"N, 85°22'33"W). 2 September 1995. John B. Jensen. Verified by Raymond D. Semlitsch. UF Photograph 101002. New county record (Williamson and Moulis 1994, Savannah Sci. Mus. Spec. Publ. 3:1–712) and probable range-wide maximum elevation record (R. Semlitsch, pers. comm.). Individual was found under a log within a drying sinkhole pond basin at the top of Pigeon Mountain.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

AMBYSTOMA TIGRINUM TIGRINUM (Eastern Tiger Salamander). USA: VIRGINIA: ISLE OF WIGHT CO: 1.5 km NW Wills Corner, 20 m elev. 3 March 1992. K. A. Buhlmann. Several newly hatched larvae and 12 egg clusters were observed in a natural sinkhole pond. Two larvae were collected, preserved, and deposited in the Virginia Museum of Natural History (VMNH 6911). Verified by J. C. Mitchell, C. A. Pague, and R. L. Hoffman. One adult, sex unknown, was observed at the same pond on 2 February 1994 by C. S. Hobson. New county record; only the third confirmed breeding site in Virginia (Pague and Buhlmann 1991, Eastern Tiger Salamander, Virginia's Endangered Species. McDonald and Woodward Publ., Blacksburg).

Submitted by **KURT A. BUHLMANN**, University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA, and **CHRISTOPHER S. HOBSON**, Virginia Department of Conservation and Recreation, Division of Natural Heritage, 1500 East Main Street, Suite 312, Richmond, Virginia 23219, USA.

BOLITOGLOSSA PORRASORUM (NCN). HONDURAS: ATLÁNTIDA: S slope of Cerro Búfalo, Cordillera Nombre de Dios, 1580–1680 m elev. (15°39'N, 86°48'W). 16–18 February 1995. J. R. McCranie and J. C. Rindfleish. USNM 344784–88; ridge above Quebrada de Oro, Cordillera Nombre de Dios, 980 m elev. (15°38'N, 86°47'W). 13 February 1995. J. R. McCranie and J. C. Rindfleish. USNM 344783. All verified by L. D. Wilson. Extends range ca. 60 airline km NE of records from 2.5 airline km NNE La Fortuna, Departamento de Yoro, Honduras (McCranie and Wilson 1995, Herpetologica 51:131–140) and 0.8 km N and 1.5 km E Cerro San Francisco, Departamento de Atlántida, Honduras (Holm and Cruz D. 1994, Herpetologica 50:15–23, as *Bolitoglossa* sp.).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.

EURYCEA CIRRIGERA (Southern Two-lined Salamander). USA: OHIO: DARKE CO: Wayne Twp: unnamed tributary of the Stillwater River. 27 September 1995. W. J. Poly. Five juveniles and three adults (Southern Illinois University at Carbondale H-5049, H-5050, H-5051) were preserved; two other adults and several juveniles were also captured. Verified by R. A. Brandon. Stream is on the E side of the river and is bounded by Seibt, Kelch, Barnes, and St. Peters roads. It is depicted as intermittent on the USGS 7.5' Versailles, Ohio topographic map, but flows all year due to spring inflows and is intermittent only from near its origin at St. Peters Road to where it is nearest Kelch Road. Not recorded previously from Darke County (Pfingsten and Downs 1989, Ohio Biol. Surv. Bull. New Series Vol. 7(2) xx + 315 pp. + 29 pls.), although it has been recorded from the bordering counties of Shelby, Miami, Montgomery, and Preble. Abundance at this locality seems to have declined during the past 15 years (pers. obs.), possibly due, in part, to encroaching siltation and embedding of the substrate from upstream agricultural and bovine impacts. The lower half of the stream's length remains unaffected thus far. Janice and Gene Oliver allowed me to collect on their property.

Submitted by **WILLIAM J. POLY**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901-6501, USA.

NOTOTRITON BARBOURI (NCN). HONDURAS: ATLÁNTIDA: Ridge above Quebrada de Oro, Cordillera Nombre de Dios, 1210 m elev. (15°38'N, 86°47'W). 13 February 1995. J. R. McCranie and J. C. Rindfleish. Verified by L. D. Wilson. USNM 339712. New departmental record; extends range ca. 60 airline km NE of record from 2.5 airline km NNE La Fortuna, Departamento de Yoro, Honduras (McCranie and Wilson 1995, Herpetologica 51:131–140).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.

OEDIPINA GEPHYRA (NCN). HONDURAS: ATLÁNTIDA: S slope of Cerro Búfalo, Cordillera Nombre de Dios, 1580 m elev. (15°39'N, 86°48'W). 18 February 1995. J. R. McCranie and J. C. Rindfleish. Verified by L. D. Wilson. USNM 343462. Second known locality and new departmental record; extends range ca. 60 airline km NE of record from 2.5 airline km NNE La Fortuna, Departamento de Yoro, Honduras (McCranie et al. 1993, Proc. Biol. Soc. Washington 106:385–389).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.

ANURA

ACRIS CREPITANS BLANCHARDI (Blanchard's Cricket Frog). USA: TEXAS: Hardeman Co: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67451–54). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

BUFO TERRESTRIS (Southern Toad). Previously (1993. Herpetol. Rev. 24:64), I reported a range extension based on the following localities and specimens. USA: LOUISIANA: Sabine Co: 10 km N Lake Hornbeck. 6 July 1929. AMNH 32662–63; Calcoasieu Co: 10 km N Lake Charles. 5 July 1929. AMNH 32648. Specimens collected by C. E. and M. D. Burt. Subsequent to my report, it was brought to my attention by Harold Dundee that the reported specimens actually represent juvenile *Bufo fowleri*, and I concur.

Submitted by **ERIK W. GERGUS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287-1501, USA.

BUFO WOODHOUSII WOODHOUSII (Woodhouse's Toad). USA: TEXAS: Armstrong Co: 44 km SW Claude. 3 August 1958. Tinkle. Texas Tech University Museum (TTUM) 1163; 44 km SW Claude. 18 June 1959. Tinkle. TTUM 999; 44 km SE Claude. 19 July 1960. McGregor, Patterson, and Gerald. TTUM 1970; 38 km SW Claude. 25 July 1957. Tinkle and Mitchell. TTUM 158. Garza Co: Justiceberg. 8 October 1957. Wallis. TTUM 348; 32-45 km S Ralls. 17 April 1958. Tinkle, Powell, and Philpott. TTUM 476; 12 km N Post. 28 April 1972. Pearson. TTUM 6109; 11 km W Post. 30 May 1960. Tinkle. TTUM 1515; 13 km N Post. 5 October 1974. D. K. Dean. TTUM 8105. King Co: 8 km ESE Guthrie. 3 August 1960. Tinkle, Dana, and Woodard. TTUM 2069. Hall Co: 10 km W Lakeview. 12 May 1962. Tinkle, Woodard, Schumake, and Couch. TTUM 2994. All verified by Richard Monk. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.) and fills gaps of distribution ranges north centrally.

Submitted by **ANN M. ANDERSON** and **JAMES T. ANDERSON**, Department of Range, Wildlife and Fisheries Management, Texas Tech University, MS 2125, Lubbock, Texas 79409-2125, USA.

BUFO WOODHOUSII WOODHOUSII (Woodhouse's Toad). USA: TEXAS: Hardeman Co: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67446–50). New county record; fills gap between Childress, Cottle, Foard, and Wilbarger counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

ELEUTHERODACTYLUS MAUSSI (NCN). VENEZUELA: Estado Sucre: Península de Pario, Cerro el Humo, Vía Las Melenas, 1150 m. 10 May 1993. John Latke. Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay (MIZA 14/336); NW Las Melenas, 800–900 m. September 1991. Martin Vestergaard. Museo de la Estación Biológica de Rancho Grande, Maracay. EBRG 2386; Cerro el Humo, 17 August 1992. Ramón Rivero and A. Bermudez. EBRG 2498. Estado Yaracuy: Sierra de Aroa: Hacienda El Jaguar, 15 km NW Aroa. 16 April 1990. Ramón Rivero. EBRG 2759, 2781; Parque Nacional Yurubí, Guayabito, Río Guayabito. 8 February 1984. Ildemaro Gonaález. Museo de Ciencias Naturales Guanare (MCNG 1487–1489, 2410–2412). All specimens verified by Richar Visbal, except MIZA 14/336, MCNG 1487–1489 and 2410–2412 which were verified by Enrique La Marca. First record for the states of Yaracuy and Sucre; westernmost and easternmost localities, respectively, for the species (Rivero 1961, Salientia of Venezuela; La Marca, 1992, Catálogo Taxonómico, Biogeográfico y Bibliográfico de las Ranas de Venezuela).

Submitted by **JESUS MANZANILLA**, Museo del Instituto de Zoología Agrícola de la Universidad Central de Venezuela, Maracay, Aragua, Venezuela, **RAMON RIVERO**, Museo de la Estación Biológica de Rancho Grande, El Limón, Aragua, Venezuela, and **MICHAEL SCHMID**, Human Genetics, Koelli Kersstrasse 2, 8700 Wusburg University, West Germany.

HYLA CINEREA (Green Treefrog). USA: TEXAS: Hidalgo Co: 7 mi S Alamo. 11 August 1992. Kelly J. Irwin. Verified by John E. Simmons. KU 222408. County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp).

Submitted by **KELLY J. IRWIN**, Department of Wildlife & Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258, USA, and **JOSEPH T. COLLINS**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA.

PHYLLOMEDUSA SAUVAGI (Spotbelly Monkey Frog). ARGENTINA: CORRIENTES: Departamento de Bella Vista (28°29'S, 59°02'W). 10 November 1980. J. Formes. Verified by Gustavo Carrizo. Colección Herpetológica del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 33.333, 33.791). Species was described by Boulenger 1882 (Cat. Batr. Sal. Brit. Mus. pp. 429) from Oran, Salta, Argentina. First province record; extends range of species 50 km E of previous record (Cei 1980, Mon. Zoo. Ital. (N.S.) Monogr. (2):1–597).

Submitted by **JORGE ABEL CESPEDEZ**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

PHYSALAEMUS RIOGRANDENSIS (NCN). ARGENTINA: SANTA FE: Municipality of Santa Fe (31°30'S, 60°45'W). 15 December 1982. M. Gutierrez Marquez. Verified by Gustavo Carrizo. Colección Herpetológica del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 33.988). First province record; extends the range of this species 250 km SW from Goya, Corrientes Province, Argentina (Céspedez, et. al. 1995, FACENA 11: *in press*) and represents the farthest inland record for the species in the southern portion of its range.

Submitted by **JORGE ABEL CESPEDEZ**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

PLEURODEMA TUCUMANA (Side-spotted Toad). ARGENTINA: CHACO: Departamento Almirante Brown: Taco Pozo (25°36'S, 63°16'W). 5 December 1972. M. Soroka. Verified by Gustavo Carrizo. Colección Herpetológica del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN 33.800). Species was described by Parker [1927 Ann. Mag. Nat. Hist. 9(20):468] from the community of Tapia, Tucuman, Argentina. First province record; extends range of species 100 km NE from former records in central Argentina (Cei 1980, Mon. Zoo. Ital. (N.S.) Monog. (2):1–597).

Submitted by **JORGE ABEL CESPEDEZ**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

PSEUDACRIS TRISERIATA MACULATA (Boreal Chorus Frog). USA: COLORADO: Kiowa Co: pond in ditch on W side of Co. Rd. 109, 0.1 mi. S jct. Co. Rd. T. 3 September 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 105 and UNC-MNC Photographs 1–2. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **STEPHEN P. MACKESSY, RON DONOHO, JUSTIN HOBERT, CHAD MONTGOMERY,** and **KEVIN WALDRON**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

RANA BLAIRI (Plains Leopard Frog). USA: TEXAS: Hockley Co: 5 km W Levelland. Summer 1973. Moore. TTUM 6655; near Levelland. July 1972. Moore. TTUM 6549–6550. All verified by Richard Monk. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **ANN M. ANDERSON** and **JAMES T. ANDERSON**, Department of Range, Wildlife and Fisheries Management, Texas Tech University, MS 2125, Lubbock, Texas 79409-2125, USA.

RANA CATESBEIANA (Bullfrog). USA: TEXAS: Garza Co: 14 km S Post. 14 April 1976. P. W. Sattler and T. Tandy. TTUM 8521. Verified by Richard Monk. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **ANN M. ANDERSON** and **JAMES T. ANDERSON**, Department of Range, Wildlife and Fisheries Management, Texas Tech University, MS 2125, Lubbock, Texas 79409-2125, USA.

RANA CATESBEIANA (Bullfrog). USA: TEXAS: Hardeman Co: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67406, 67445). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

RANA CHALCONOTA (Coppercheek Frog). INDIA: GREAT NICOBAR: Galathea National Park. 11 March 1994. Centre for Herpetology, Madras Crocodile Bank Trust Collection (ID/AN 50–51); Shompen Hut. 17 March 1994. ZSI A8745–A8747; Kopen Heat. 19 March 1994. ID/AN 77 and 92. Indraneil Das and Satish Bhaskar. Verified by Anurup Sarkar and Shyamal Chanda. All examples were collected by hand from edges of ephemeral pools, where they were found perched on overhanging vegetation. New record for the Nicobars (see Sarkar 1990, Rec. Zool. Surv. India 86:103–117) and for the Republic of India (Dutta 1992, Hamadryad 17:1–13). Species is known from peninsular Thailand, the Malay Peninsula (including Singapore), Sumatra, the Mentawei Islands, Borneo, Java and Sulawesi (Inger 1966, Fieldiana Zool. n.s. 52:1–402; van Kampen 1923, The Amphibia of the Indo-Australian Archipelago. E. J. Brill, Leiden. xii + 304 pp.). White stripe below the eye extends to the edges of the upper labial, diagnostic of the subspecies *raniceps* (see Inger, *op cit.*). The new record, across the Great Channel from Achin Head in Sumatra, is an extension of range by ca. 180 km and is the westernmost record for the species.

Submitted by **INDRANEIL DAS**, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram 603 104, Tamil Nadu, India.

RANA SYLVATICA (Wood Frog). USA: WISCONSIN: Dane Co: Mazomanie State Wildlife Area, Sec. 32, T9N, R6E. 1 June 1995. P. B. Wolter. Verified by R. W. Hay. Milwaukee Public Museum (MPM 27950). New county record, documenting occurrence across the Wisconsin River from the nearest Sauk County record plotted by Vogt (1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus., 205 pp.), although Mossman and Hine (1985, Wisconsin's Frog and Toad Survey-1984. Wisconsin Endangered Res. Rep. 16:1–16. Wisconsin Dept. Nat. Res., Madison) reported calling males in the same general vicinity.

Submitted by **PETER B. WOLTER**, Wisconsin Department of Natural Resources, Room 118, 1681 Second Avenue South, Wisconsin Rapids, Wisconsin 54495, USA, and **DREUX J. WATERMOLEN**, Wisconsin Department of Natural Resources, P. O. Box 7921, Madison, Wisconsin 53707-7921, USA.

SCINAX SQUALIROSTRIS (Stripesnout Treefrog). ARGENTINA: BUENOS AIRES: Partido de Mar Chiquita, Celpa (37°42'56"S, 57°23'15"W). 17 January 1994. P. Bellagamba and L. Vega. Verified by Jorge Williams. Herpetological Collection, Vertebrate Laboratory, Departamento de Biología, Universidad Nacional de Mar del Plata (UNMdP 0606–09). First county record (Cei 1980, Monitore Zool. Ital. (N.S.) Monogr. 2:609 pp). The four adults were collected from the axillae of the leaves of *Eryngium* sp. in a wet depression between coastal sand dunes; extends the range of this frog 220 km S from nearest known locality in Libres del Sur, Partido de Chascomús (Gallardo 1974, Anfibios de Ios Airededores de Buenos Aires. EUDEBA, Buenos Aires. 213 pp.).

Submitted by **LAURA E. VEGA** and **PATRICIO J. BELLAGAMBA**, Vertebrados, Departamento de Biología, Universidad Nacional de Mar del Plata, Funes 3350, 7600 Mar del Plata, Argentina

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: TEXAS: Crosby Co: 14 km S Crosbyton. 14 April 1976. P. W. Sattler. TTUM 9410 and 9412. Verified by Richard Monk. Earliest date of first county record (Blair and Killebrew 1995, Herpetol. Rev. 26:154) and (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **ANN M. ANDERSON** and **JAMES T. ANDERSON**, Department of Range, Wildlife and Fisheries Management, Texas Tech University, MS 2125, Lubbock, Texas 79409-2125, USA.

TESTUDINES

APALONE MUTICA (Smooth Softshell). USA: OHIO: Clermont Co: Ohio Township, 2 mi N New Richmond, Pond Run Creek, 83 m from the Ohio River at Mile 452 (38°59'00"N, 84°17'30"W). 13 July 1995. Katherine A. McCafferty. Verified by John W. Ferner. Cincinnati Museum of Natural History (CMNH 4443). New county record (Zemko 1974, The Accuracy and Distribution of Turtles in Ohio. Master's Thesis, Miami University, Oxford, Ohio. 98 pp.).

Submitted by **KATHERINE A. McCAFFERTY** and **ADAM M. MANN**, Department of Biology, Thomas More College, 333 Thomas More Parkway, Crestview Hills, Kentucky 41017-3248, USA.

APALONE MUTICA MUTICA (Midland Smooth Softshell). USA: TEXAS: McCulloch Co: Colorado River and confluence with Salt Creek, 9.3 km ENE Doole. 13 September 1994. J. R. Smith and Chuck Brown. Verified by J. R. Dixon. Texas Cooperative Wildlife Collection (TCWC 71168). Brown Co: Colorado River, 2.4 mi ESE of Winchell on Crowder Ranch. 1030 h. 24 July 1995. Coll. J. R. Smith. Turtle found in riffle of river. Verified by J. R. Dixon. Texas Cooperative Wildlife Collection (TCWC 72199). New county records filling distributional gap between Concho and San Saba counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **J. R. SMITH, CHUCK BROWN,** and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: TEXAS: Hardeman Co: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67194). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

TRACHEMYS SCRIPTA ELEGANS (Red-eared Slider). USA: TEXAS: Hardeman Co: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67408). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). USA: TEXAS: Hardeman Co: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67201). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

AMPHISBAENIA

AMPHISBAENA MERTENSII (NCN). ARGENTINA: CORRIENTES: Departamento Capital Corrientes: (23°28'S, 58°50'W). 13 March 1993. Blanca B. Alvarez. Colección Herpetológica Corrientes, Universidad Nacional del Nordeste, Corrientes, Argentina (CHC-UNNE 842); Departamento Saladas: San Lorenzo (28°08'S, 58°46'W). 15 October 1990. Pedro Galfrascoli (CHC-UNNE 4337); Departamento Santo Tomé: Gobernador Virasoro (28°03'S 56°01'W). 23 May 1991. Ramon Schneider (CHC-UNNE 538); CHACO: Departamento 1 de Mayo: Puerto Tirol (27°22'S, 59°05'W). 26 May 1990. Sara Bergna. (CHC-UNNE 4338, 4339); FORMOSA: Departamento Laishi: Presidente Irigoyen (26°10'S, 58°45'W). 11 September 1991. Sara Bergna (CHC-UNNE 573). All verified by R. Montero. New province records; extend range of species 400 km WNW of previous documented records (Cei 1993, Monogr. XIV, Mus. Reg. Sci. Nat. Torino:1–949; Montero 1994, Bol. Asoc. Herp. Argen. 10(1):43–46).

Submitted by **BLANCA BEATRIZ ALVAREZ**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

AMPHISBAENA PRUNICOLOR PRUNICOLOR (NCN). ARGENTINA: CORRIENTES: Departamento San Martin: La Cruz (29°11'S, 56°40'W). 15 February 1994. L. Lions, J. Cespedez, and R. Aguirre. Verified by R. Montero. Colección Herpetológica Corrientes, Universidad Nacional del Nordeste, Corrientes, Argentina (CHC-UNNE 804–805). First province record; extends range 200 km SW of nearest records in Misiones Province, Argentina (Cei 1993, Monogr. XIV, Mus. Reg. Sci. Nat. Torino:1–949; Montero 1994, Bol. Asoc. Herp. Argen. 10(1):43–46).

Submitted by **BLANCA BEATRIZ ALVAREZ**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

LACERTILIA

ANISOLEPIS LONGICAUDA (Longtail Lizard). PARAGUAY: DEPARTAMENTO ITAPUA: Isla Yacyreta (27°21'S, 56°20'W). 25 August 1994. M. L. Lions and R. Aguirre. Verified by J. M. Cei. Colección Herpetologica Corrientes, Universidad Nacional del Nordeste, Corrientes, Argentina (CHC-UNNE 878, 889, 891, 915, 918, 922, 1325–1329). First department record; southernmost record from Paraguay.

Submitted by **MARIA LUISA LIONS** and **BLANCA BEATRIZ ALVAREZ**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

EUMECES OBSOLETUS (Great Plains Skink). USA: COLORADO: LINCOLN CO: two neonates in pitfall on W side of Co. Rd. 43 ca. 2.1 mi S jct. Rt. 94; LINCOLN CO: young adult under rock on E bank Sandy Creek 100 m W of bridge on Co. Rd. 29, 2.2 mi S jct. Rt. 94. Both 9 September 1995. Both verified by Hobart M. Smith and David Chiszar. UNC-MNH Photographs 3–6. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **RON DONOHO, JUSTIN HOBERT, CHAD MONTGOMERY,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

HEMIDACTYLUS FRENATUS (House Gecko). USA: TEXAS: GALVESTON CO: Port of Galveston, Pier 19. 19 November 1988. Stephen F. Austin State University Vertebrate Museum (SFAVM 4885, juv. male). P. D. Klawinski and D. Saenz. Verified by James R. Dixon. This lizard was collected at about same location from which *Cyrtopodium scabrum* was first reported in the United States [Selcer and Bloom 1984, Southwest. Nat. 29(4):499–500]. We made approximately seven subsequent collecting trips to Pier 19 during 1989 and 1990 and did not find another *Hemidactylus frenatus* specimen; new county record and is one of the earliest catalogued records for the United States.

Submitted by **DANIEL SAENZ**, Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas 75962, USA (in cooperation with the College of Forestry, Stephen F. Austin State University, Nacogdoches, Texas 75962, USA), and **PAUL D. KLAWINSKI**, Department of Biology, University of Texas at Arlington, Arlington, Texas 67019, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: LOUISIANA: WEST FELICIANA PARISH: Francis Hotel On The Lake on U.S. Rt. 61 in St. Francisville, 30°47'7.6"N, 91°22'36.4"W. UMMZ 210737–738. 27 May 1995. ST. TAMMANY PARISH: abandoned drive-in theater between Slidell and Lacombe, N side U.S. Rt. 190, 30° 17' 57.2"N, 89° 48' 33.6"W. UMMZ 210780. 26 May 1995. Russell L. Burke, Daniel A. Erickson, Ashley T. Mattoon. Both verified by A. G. Kluge. West Feliciana Parish is a new parish record for this species; a large population was observed there. St. Tammany Parish locality is close by the town of Hickory, which is the previously reported site for that parish (Dundee and Rossman 1989, Amphibians and Reptiles of Louisiana. Louisiana State Univ. Press, Baton Rouge. 300 pp.; H. A. Dundee, pers. comm.).

Submitted by **RUSSELL L. BURKE**, School of Natural Resources and Environment, University of Michigan, Ann Arbor, Michigan 48109-1115, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: TEXAS: CROCKETT CO: Ozona. 28 April 1991. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 69069); COLEMAN CO: O. H. Ivie Reservoir, Kennedy Recreation Park, Elm Creek Village, 13.7 km SW Voss. 12 September 1994. J. R. Smith. Specimen captured in trailer house. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 71169). New county records representing significant range extensions for this introduced species (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **J. R. SMITH** and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA; and **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

LIOLAEMUS OLONGASTA (NCN). ARGENTINA: SAN JUAN: Zonda Department, 23 km W San Juan city (31°31'S, 68°26'W) on side slope and dry bed of De la Ciénaga River in Zonda Valley. December 1994. Fernando Murúa. Verified by Luciano Javier Avila. Herpetological collection of Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Argentina [IMCN-UNSJ 100 (male) and 101 (female)]; extends range ca. 40 km from population in the southern region of the Bolsón de Matagusanos, Jáchal Department, San Juan Province (Etheridge 1993, Boll. Mus. Reg. Sci. Nat. Torino, vol. 11, No. 1, pp. 137–199).

Submitted by **JUAN CARLOS ACOSTA, FERNANDO MURÚA** and **GRISEL ORTIZ**, Instituto y Museo de Ciencias Naturales, Universidad Nacional de San Juan, Avenida Libertador (Oeste) No. 315, C. P. 5400, San Juan, Argentina.

LIOLAEMUS WIEGMANNI (NCN). PARAGUAY: ISLA YACYRETA: Cerro Ybycui (27°26'S, 56°24'W). 10 September 1994. Aguirre R. y. Cespedez J. Verified by J. M. Cei. Colección Herpetologica Corrientes, Universidad Nacional del Nordeste, Corrientes, Argentina (CHC-UNNE 890). First island record; extends range 150 km ENE from nearest record in Corrientes, Argentina (Tedesco et al. 1992, FACENA 9:117–122)

Submitted by **BLANCA BEATRIZ ALVAREZ** and **MARIA LUISA LIONS**, Compared Anatomy Division, Biology Departament, Facultad de Ciencias Exactas y Naturales, Universidad Nacional del Nordeste, 9 de Julio 1449, 3400 Corrientes, Argentina.

NOROPS PURPURGULARIS (Middle American Anole). HONDURAS: ATLÁNTIDA: S slope of Cerro Búfalo, Cordillera Nombre de Dios, 1630-1760 m elev. (15°39'N, 86°48'W). 15–17 February 1995. J. R. McCranie and J. C. Rindfleish. Verified by L. D. Wilson. USNM 344806-17. Extends range ca. 60 airline km NE of only previous records for the species from 2.5 airline km NNE La Fortuna, Departamento de Yoro, Honduras, and 0.4–1.0 km N and 0.1 km W–2.1 km E Cerro San Francisco, Departamento de Atlántida, Honduras (McCranie et al. 1993, J. Herpetol. 27:386–392).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.

PHYLLODACTYLUS XANTI (Cape Leaf-toed Gecko). MÉXICO: SONORA: Isla Dátil. 6 October 1995. L. Lee Grismer. Verified by Bradford D. Hollingsworth. LACM PC 1327. Adult

male found at 0915 h within rock crack at base of talus slope in northeastern-facing arroyo; first report of this species from Isla Dátil (Murphy and Ottley 1984, Ann. Carnegie Mus. 53:207–230). A hatchling was also found in the same locality, suggesting that this is a viable population and not a chance overwater dispersal from nearby Isla Tiburón.

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

SAUROMALUS ATER ATER (Espíritu Santo Chuckwalla). MÉXICO: BAJA CALIFORNIA SUR: Isla Ballena, an islet off the west coast of Isla Espíritu Santo. 27 July 1995. Bradford D. Hollingsworth and L. Lee Grismer. Verified by Chris Mattison. LACM-PC 1325. First record for Isla Ballena (Murphy and Ottley 1984. Ann. Carnegie Mus. 53:207–230). This specimen was photographed and released on site.

Submitted by **BRADFORD D. HOLLINGSWORTH**, Department of Natural Sciences, Loma Linda University, Loma Linda, California 92350, USA, and **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

SERPENTES

AGKISTRODON CONTORTRIX LATICINCTUS (Broad-banded Copperhead). USA: TEXAS: Mills Co: Rt. 84, 13.5 km E of Goldthwaite. 11 May 1991. J. R. Dixon. Specimen found DOR. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 69070). New county record; fills hiatus in distribution (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

AGKISTRODON CONTORTRIX MOKASEN (Northern Copperhead). USA: INDIANA: Dearborn Co: Bright, ca. 0.1 km E jct. of Stateline and Jamison Roads. September 1992. Chris Griffith. Verified by John W. Ferner. Cincinnati Museum of Natural History (CMNH Color Slide HP023; KU Color Slides 11221–223). New county record (Minton 1972, Indiana Acad. Sci. Monogr. 3:1–346). Currently alive in captivity in the author's collection. Specimen to be deposited in the CMNH collection upon its death. Since September 1992, additional specimens have been reported from this locality by the collector.

Submitted by **PETER D. STRIMPLE**, Reptile Research and Breeding Facility, 5310 Sultana Drive, Cincinnati, Ohio 45238, USA.

AGKISTRODON PISCIVORUS LEUCOSTOMA (Western Cottonmouth). USA: TEXAS: Blanco Co: 7.2 km W & 0.8 km S jct. FM Rt. 3347 & FM Rt. 962 off FM Rt. 3347 on trib. to White's Creek. 8 October 1995. Cathy Arveson. Verified by James R. Dixon. TCWC 72204. Adult male. New county record; fills gap between Burnet, Llano, and Kendall counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **R. KATHRYN VAUGHAN** and **GEORGE D. BAUMGARDNER**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258, USA.

ARIZONA ELEGANS ELEGANS (Kansas Glossy Snake). USA: COLORADO: Kiowa Co: DOR Rt. 287 at jct. Co. Rd. V. 21 June 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 101. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **JUSTIN HOBERT, RON DONOHO, CHAD MONTGOMERY, KEVIN WALDRON**, and **STEPHEN P. MACKESSY,** Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

ARIZONA ELEGANS ELEGANS (Kansas Glossy Snake). USA: COLORADO: Crowley Co: AOR Rt. 96 0.1 mi W jct. Co. Rd. 28. 23 September 1993. Verified by Hobart M. Smith and David Chiszar. UNC-MNH photographs 9–10. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **JUSTIN HOBERT, BRANDON QUINN, RON DONOHO, CHAD MONTGOMERY, KEVIN WALDRON** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

COLUBER CONSTRICTOR FLAVIVENTRIS (Eastern Yellowbelly Racer). USA: COLORADO: Crowley Co: DOR Co. Rd. 10, 8.6 mi N jct. Rt. 96. 21 July 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 103. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **JUSTIN HOBERT, RON DONOHO, CHAD MONTGOMERY, KEVIN WALDRON** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

DIADOPHIS PUNCTATUS ACRICUS (Key Ringneck Snake). USA: FLORIDA: Monroe Co: Lower Florida Keys, No Name Key, Key Deer National Wildlife Refuge, on unnamed sand road 0.2 km SSE of jct. with Old State Road 4A (North Watson Blvd), 1.6 km from W side of island and elevated concrete bridge connected to Big Pine Key. Photographed and released at 1930 h (Florida threatened subspecies), crossing road through a patch of tropical hardwood hammock surrounded by pineland. 19 September 1995. C. Scott. Verified by D. L. Auth. UF Color Slide 100941. New island record. Previously recorded from Big Pine Key and Middle and Little Torch Keys in the Lower Keys (Lazell 1989, Wildlife of the Florida Keys: A Natural History. Island Press, Washington, D.C. and Covelo, California. 250 pp).

Submitted by **DAVID L. AUTH** and **CHRIS SCOTT**, Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611, USA.

DIADOPHIS PUNCTATUS ARNYI (Prairie Ringneck Snake). USA: COLORADO: Bent Co: DOR Rt. 101, 0.1 mi S jct. Co. Rd. T. 7 July 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 102. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY, KEVIN WALDRON, JUSTIN HOBERT, RON DONOHO,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

ERIDIPHAS SLEVINI SLEVINI (Slevin's Night Snake). MÉXICO: BAJA CALIFORNIA SUR: Rancho La Presa: 108 km N La Paz. 16 July 1988. L. Lee Grismer. Verified by Bradford

D. Hollingsworth. LACM PC 1318. Found at 2100 h crawling on a graveled hillside; fills in a distribution gap through the Sierra de La Giganta of 237 km from La Paz to Loreto (Ottley and Tanner 1978, Great Basin Nat. 38:406–410).

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

GYALOPION CANUM (Western Hooknose Snake). USA: TEXAS: Coleman Co: Maintenance Shop, lab floor; 35.9 km S and 24.3 km W of Coleman. 5 July 1988. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 69134); CRMWD Stacy Dam Shop, 16.9 km SW of Voss. 3 July 1989. J. R. Smith. Specimen found in open at west end of shop. Verified by Kathryn Vaughan. TCWC 67527; CRMWD Maintenance Shop near O. H. Ivie Reservoir Dam, 16.9 km SW of Voss. 3 June 1995. D. J. Strengths and G. Laws. Specimen found under a rock. Verified by Kathryn Vaughan. TCWC 72195. Although catalogue locality entries vary somewhat, each specimen is from the same location; new county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **J. R. SMITH** and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA; and **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

IMANTODES CENCHOA (Blunt-headed Tree Snake, Dormideira). BRAZIL: SÃO PAULO: Peruibe: Estação Ecológica da Juréia-Itatins (24°25'S, 47°14'W). 16 November 1994. M. Messias. Verified by G. Puorto. Instituto Butantan (IB 55813). First record from Atlantic Forest of southeastern Brazil. Species is distributed from the Isthmus of Tehuantepec region of México through Central America and South America to Paraguay and Bolivia (Peters and Orejas-Miranda 1970, Bull. U.S. Nat. Mus. 297:133). In Brazil, this snake is found in western and northern sections (Amaral 1978, Serpentes do Brasil, Melhoramentos/ Universidade de São Paulo, 2 ed., São Paulo 246 pp.).

Submitted by **OTAVIO A. V. MARQUES**, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brasil, 1500, CEP 05503-900, São Paulo, SP, Brasil.

LAMPROPELTIS GETULA NIGRITA (Black Desert Kingsnake). MÉXICO: SONORA: Isla San Pedro Nolasco, ca. 16 km off adjacent coastline immediately N of Bahía de San Carlos. 7 October 1995. L. Lee Grismer. Verified by Bradford D. Hollingsworth. La Sierra University Herpetology Collection (LSUHC 1313). A complete freshly shed skin was found at 0830 h on the eastern face of the island, one-third of the way up to the crest; first record of a snake from Isla San Pedro Nolasco (Murphy and Ottley 1984, Ann. Carnegie Mus. 53:207–230). Specimen is identified here as the subspecies *L. g. nigrita* based on its absence of a dorsal pattern and the darkness of the shed. *Lampropeltis g. nigrita* from the adjacent mainland is also solid black (Blaney 1977, Tulane Stud. Zool. Bot. 19:47–103.

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: TEXAS: Willacy Co: Lower Rio Grande Valley National Wildlife Refuge, 2.5 mi E jct. County Roads FM 498 and FM 1420, Willamar Tract. 18 July 1992. Kelly J. Irwin and Martin Bray. Verified by Joseph T. Collins (KU Color Slide 11224). County record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp).

Submitted by **KELLY J. IRWIN**, Department of Wildlife & Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258, USA, and **SUZANNE L. COLLINS**, School of Education, University of Kansas, Lawrence, Kansas 66045, USA.

MASTICOPHIS LATERALIS LATERALIS (California Striped Racer). MÉXICO: BAJA CALIFORNIA SUR: Cañón de Los Reyes, 37 km north of La Paz. 16 October 1994. Clark R. Mahrdt and L. Lee Grismer. Verified by Robert L. Bezy. LACM PC 1319. Found at 2200 h crawling along the edge of a rocky arroyo; extends distribution southward ca. 225 km through the Sierra de La Giganta from Arroyo La Sanca, and brings species to within ca. 55 km of its close relative, *M. aurigulus* of the Cape Region (Grismer 1994, Herpetologica 46:66–77).

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, CA 92515-8247, USA and **CLARK R. MAHRDT**, Southwestern Biologists, 9847 Willow Lane, Escondido, California, 92092, USA.

MICRURUS CORALLINUS (Coral Snake). BRAZIL: Bahia: Municipio de Simões Fiho, Estação Ecológica de Cotegipe. 24 June 1994. D. F. Sampaio. UFBA/LAP 829. Rio Grande do Norte: Município de Nísia Floresta, EFLEX-IBAMA. 19 March 1992. C. E. Barreto. UFBA/LAP 828. Both verified by William Lamar. These are the first records of this species for NE Brazil; extend known range over 900 km N of closest published locality [Illhéus 1992, História Natural de *Micrurus corallinus* (Serpentes, Elapidae). 80 pp.].

Submitted by **LUCIANA LYRA CASAIS E SILVA**, Laboratório de Herpetologia, Instituto Butantan, Ave. Vital Brazil 1500, 05504-900, São Paulo, São Paulo, Brazil, and **TANIA BRAZIL NUNES**, Laboratório de Animail Peçonhentos, Departamento de Zoologia, Instituto de Biologia, UFBA, Campus Universitário de Ondina, 40170-210, Salvador, Bahia, Brazil.

MICRURUS LEMNISCATUS (Coral Snake). ARGENTINA: Provincia de Corrientes: Empedrado. 12 November 1993. L. Rey. Museu de Zoologia—Universidade de São Paulo (MZUSP 10813). Provincia de Misiones: Azara. 9 October 1967. Ministério de Assistencia Social. Museo Argentino de Ciencias Naturales (MACN 2403, ex-CENAI); Apostoles. 17 October 1969. MACN 3043; 23 May 1994. R. Repetto. MZUSP 10821. All verified by Jack W. Sites Jr. These are the first records of *Micrurus lemniscatus* for Argentina and they agree well with the description of *M. l. carvalhoi*. The closest localities are in the Brazilian state of Paraná and in northern Paraguay [Jorge da Silva 1995, Molecular Systematics and Evolution of Venom in the South American Triad (*Micrurus*) Coral Snakes. Ph.D. dissertation. 226 pp.]. The region of Corrientes and Missiones are located between the Rio Paraná and Rio Uruguay Basins. Elevations are between 100 and 500 m. In Argentina this form has been misidentified as *M. frontalis mesopotamicus*; they are sympatric in the Mesopotamia region (NJS, pers. obs.).

Submitted by **NELSON JORGE DA SILVA, JR.**, Centro de Estudos e Pesquisas Biológicas, Universidade Católica de Goiás. Ave. Unviersitária, 1440 - Setor Universitário, 74605-010, Goiânia, Goiás, Brazil, and **DIONEI JOSÉ DA SILVA**, Universidade Estadual do Mato Grosso, Campus de Alta Floresta, Caixa Postal 324, 75580-000, Alta Floresta, Mato Grosso, Brazil.

OPHEODRYS AESTIVUS MAJALIS (Rough Green Snake). USA: TEXAS: McCULLOCH CO: FM 765, 4.5 km W Elm Grove. 15 May 1991. J. R. Dixon. Specimen found DOR. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 68737); Colorado River, 9.3 km ENE Doole. 18 April 1995. Chuck Brown. Verified by Kathryn Vaughan. TCWC 72187. Specimen found under rock in grassy river channel. New county record; fills distributional hiatus between San Saba and Concho counties (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **OKLA W. THORNTON, JR., CHUCK BROWN** and **J. R. SMITH**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA; and **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA.

NERODIA RHOMBIFER RHOMBIFER (Diamondback Water Snake). USA: TEXAS: HARDEMAN CO: Copper Breaks State Park, Pease River, 20.9 km S Quanah. 6 July 1990. J. R. Dixon. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 67521, 67524). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **JAMES R. DIXON**, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843, USA; and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

NERODIA HARTERI PAUCIMACULATA (Concho Water Snake). USA: TEXAS: MITCHELL CO: Spade Ranch, Pecan Crossing of Colorado River, 17.7 km NW of Silver. 14 June 1995. J. R. Smith and Chuck Brown. Verified by J. R. Dixon. Texas Cooperative Wildlife Collection (TCWC 72197). Specimen captured in minnow trap. River discharge ca. 80 CFS. New county record extending the range of this species approximately 24 km upstream of E. V. Spence Reservoir (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.). Texas Permit No. SPR-0790-208.

Submitted by Submitted by **J. R. SMITH, CHUCK BROWN** and **OKLA W. THORNTON, JR.**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

PHYLLORHYNCHUS DECURTATUS (Western Leafnose Snake). MÉXICO: BAJA CALIFORNIA: Bahía de San Luis Gonzaga. 30 July 1986. L. Lee Grismer. Verified by Bradford D. Hollingsworth. LACM PC 1321. Found at 2100 h crawling on the top of a boulder in Arroyo de Rumbaugh; extends range southward ca. 200 km from 80 km north of San Felipe (McCleary and McDiarmid 1993, Cat. Amer. Amph. Rept. 580). Specimen is a female with 25 subcaudals, 33 dorsal body blotches and six caudal blotches, all of which fall within the range of *P. d. perkinsi* and *P. d. decurtatus*. It also has 184 ventrals which is diagnostic of *P. d. perkinsi*. However, its dorsal blotches are as wide or wider than the interspaces, which is similar to *P. d. decurtatus*. It is believed that this specimen is an intergrade between these two subspecies and demonstrates the continuous distribution of this species throughout the Baja California peninsula.

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

PITUOPHIS MELANOLEUCUS ANNECTENS (San Diego Gopher Snake). MÉXICO: BAJA CALIFORNIA: Km Marker 97, 42 km south (on Mex. Rt. 1) of El Rosario. 5 October 1994. L. L. Grismer and C. R. Mahrdt. Verified by Robert L. Bezy. LACM 1301. Extends known range S by 18.5 km [Grismer 1994, Herpetol. Nat. Hist. 2(1):51–106]. Grismer (*op. cit.*) elevated *P. m. vertebralis* to species status (*P. vertebralis*) based on the discovery of the northernmost specimen (LACM PC 1266) 19.5 km S of the southernmost *P. melanoleucus* (LACM 1265) and the fact that these specimens exhibited no signs of intergradation. This new specimen (LACM PC 1301) closes that gap to 1 km, indicating that these two species are probably sympatric, supporting their recognition as separate species. Sweet and Parker (1990, Cat. Amer. Amph. Rept. 474.1–474.8) noted that *P. m. annectens* has 65–106 dark, dorsal blotches and *P. vertebralis* (=*P. m. bimaris*) north of the Isthmus of La Paz has 34–46. However, Klauber (1946, Trans. San Diego Soc. Nat. Hist. 11:1–40) noted that *P. m. annectens* from Baja California have 57–90 dorsal blotches and those from the United States have 56–102 (Klauber 1947, Bull. Zool. Soc. San Diego 22:1–83). LACM PC 1301 has 53 dorsal blotches which falls outside the range of both species but is close to that of *P. m. annectens*. It has other characteristics absent from *P. vertebralis* but present in *P. melanoleucus* such as the absence of a dark subcaudal stripe and large, light-colored, regular blotches on the nape enclosed in black. It should be noted that Grismer (*op. cit.*) mistakenly listed LACM PC 1265 and 1266 as occurring 68.5 km and 98 km S by road of El Rosario, respectively. Instead, the localities should have read Km Marker 68.5 and Km Marker 98 south (on Mex. Rt. 1) of El Rosario, which occurs at Km Marker 55, 55 km S of San Quintín.

Submitted by **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California, 92515-8247, USA, and **CLARK R. MAHRDT**, Southwestern Biologists, 9847 Willow Lane, Escondido, California 92092, USA.

PITUOPHIS RUTHVENI (Louisiana Pine Snake). USA: LOUISIANA: CALCASIEU PARISH: S of Lake Charles and E of jct. of Tank Farm Road and Elliot Road on Mackerel Drive. 2 September 1988. Avery A. Williams and Andy Boutilier. Seale Museum of Louisiana, McNeese State University (SML 9291); JEFFERSON DAVIS PARISH: ca. 6 mi NW Jennings. November 1966. Edward C. Bush. SML 1274. Both verified by James R. Dixon and are first records for respective parishes. Discovery of these specimens extends the Louisiana range southward (Dundee and Rossman 1989, Amphibians and Reptiles of Louisiana. Louisiana State Univ. Press, Baton Rouge, 300 pp.). Prior to this report, Dundee and Rossman (*op. cit.*) cited the southernmost Louisiana distribution as Beauregard Parish based on literature records. With the addition of these two parish records, the distribution of this species in southwest Louisiana is extended and clarified.

Submitted by **AVERY A. WILLIAMS** and **JAMES E. CORDES**, Division of Science, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

RHINOCHEILUS LECONTEI TESSELLATUS (Texas Longnose Snake). USA: COLORADO: CHEYENNE CO: DOR Rt. 287 0.1 mi S jct. Co. Rd. C. 12 August 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 104. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **KEVIN WALDRON, CHAD MONTGOMERY, JUSTIN HOBERT, RON DONOHO,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

SISTRURUS CATENATUS (Massasauga). USA: COLORADO: El Paso Co: DOR Shear Rd., 0.8 mi W jct. Whittemore Rd. 22 May 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH 100. Recent county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.). This species is threatened by habitat conversion and persecution in much of its range; the most recent previous record in El Paso County was in 1987 or 1988 as reported by Pegler et al. (1995. Herpetol. Rev. 26:47). This specimen indicates that the Massasauga still occurs in (at least) limited numbers in eastern El Paso County. As it has been extirpated from much of its range nationwide, this species is probably deserving of protected status in Colorado.

UNC museum records dating from 1882 indicated the presence of this species in Baca County, Colorado, as follows: USA: COLORADO: Baca Co: no further data. This specimen was collected by Mr. A. E. Beardsley in 1882 and entered as accession number 96-265 in the "Colorado State Normal College" Museum Register 3. This would represent a new county record and a considerable range extension to the south in Colorado (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.); unfortunately the specimen no longer exists in the UNC-MNH collection.

Submitted by **STEPHEN P. MACKESSY, JUSTIN HOBERT, RON DONOHO, CHAD MONTGOMERY,** and **KEVIN WALDRON**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

TANTILLA NIGRICEPS NIGRICEPS (Plains Blackhead Snake). USA: COLORADO: Kiowa Co: floating on board in water-filled cistern on E side of Co. Rd. 109, 0.5 mi N jct. Rt. 96. 16 September 1995. Verified by Hobart M. Smith and David Chiszar. UNC-MNH photographs 7–8. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc.).

Submitted by **CHAD MONTGOMERY, KEVIN WALDRON, JUSTIN HOBERT, RON DONOHO,** and **STEPHEN P. MACKESSY**, Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, USA.

THAMNODYNASTES HYPOCONIA (Cateye Coluber). ARGENTINA: BUENOS AIRES: Partido de Mar Chiquita, Parque Lago (37°45'20"S 57°26'40"W). 10 September 1994. F. Gonzalez. Verified by Jorge Williams. Herpetological Collection, Vertebrate Laboratory, Departamento de Biología, Universidad Nacional de Mar del Plata (UNMdP 610). First county record (Cei 1993, Mus. Reg. Sci. Nat. Torino Monogr. 14:949). Adult male captured in coastal sand dunes with grass cover; extends range 125 km S from nearest known locality in Punta Médanos, Partido Urbano de la Costa (Williams and Scrocchi 1994, Ofidios de Agua Dulce de la República Argentina. Vol. 42 Reptilia, Fasc. 3 Ophidia Lepidosauria. PROFADU-CONICET, La Plata. 55 pp).

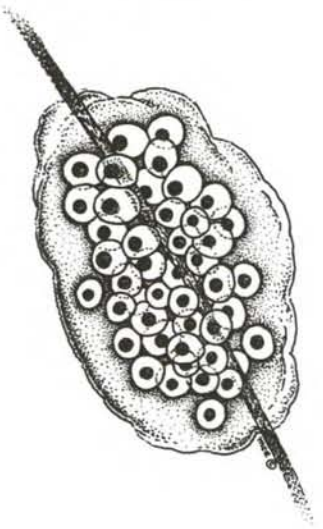
Submitted by **PATRICIO J. BELLAGAMBA** and **LAURA E. VEGA**, Lab. Vertebrados, Departamento de Biología, Universidad Nacional de Mar del Plata, Funes 3350, 7600 Mar del Plata, Argentina.

THAMNOPHIS PROXIMUS RUBRILINEATUS (Redstripe Ribbon Snake). USA: TEXAS: Howard Co: 10.1 km ESE Coahoma on county road, 1.3 km E of FM 821. 24 May 1995. O. W. Thornton and J. R. Smith. Verified by Kathryn Vaughan. Texas Cooperative Wildlife Collection (TCWC 72194). Specimen found DOR. New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **OKLA W. THORNTON, JR.** and **J. R. SMITH**, Colorado River Municipal Water District, Environmental Recreation Division, Ivie Reservoir Field Office, HCR 82, Box 4B, Leaday, Texas 76888, USA.

UNGALIOPHIS CONTINENTALIS (Isthmian Dwarf Boa; Boilla). HONDURAS: ATLÁNTIDA: ridge above Quebrada de Oro, Cordillera Nombre de Dios, 990 m elev. (15°38'N, 86°47'W). 13 February 1995. J. R. McCranie and J. C. Rindfleish. Verified by L. D. Wilson. USNM 344819. Second recorded Honduran specimen and new departmental record; extends range ca. 180 airline km N of previous Honduran record of La Montañita, Departamento de Francisco Morazán (Wilson and Meyer 1985, The Snakes of Honduras. 2nd ed. Milwaukee Pub. Mus., Milwaukee, Wisconsin. x + 150 pp.).

Submitted by **JAMES R. McCRANIE**, 10770 SW 164th Street, Miami, Florida 33157-2933, USA.



Ambystoma maculatum (Spotted Salamander) egg mass. Illustration by Mark C. Erelli.

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Vagility and the Florida Distribution of the Cuban Treefrog (*Osteopilus septentrionalis*)

WALTER E. MESHAKA, JR.
Museum, Everglades National Park, 40001 SR-9336
Homestead, Florida 33034-6733, USA

The Cuban treefrog is a large, primarily mesophytic forest-dwelling hylid of the West Indies (Duellman and Schwartz 1958; Meshaka 1994a; Myers 1950). It is the only native hylid in Cuba and is sympatric with no other Caribbean hylids throughout its West Indian range (Schwartz and Henderson 1991). Assistance by humans has in recent times facilitated establishment of the Cuban treefrog on Ramey Air Force Base in Puerto Rico and on isolated islands of the Lesser Antilles (Powell et al. 1992; Schwartz and Henderson 1991; J. D. Lazell, Jr., pers. comm.). Shortly after being recorded in Miami (Schwartz 1952) dispersal of the Cuban treefrog through mainland Florida was rapid (Wilson and Porras 1983), and ecological versatility enabled it to successfully colonize natural and disturbed habitats (Dalrymple 1988; Duellman and Schwartz 1958; Meshaka 1994a).

By providing opportunity to disperse, vagility is a correlate of successful colonization for many species (Ehrlich 1989) and testable in the pattern of dispersal. Here, I present the historical and present-day distribution of the Cuban treefrog in Florida, interpret the pattern of its dispersal in light of its vagility, and compare my findings with the dispersal patterns of other colonizing species of reptiles and amphibians.

Dispersal of the Cuban treefrog through Florida took place in a temporal and spatial scattershot pattern. Most of its presently known northern range limits (Fig. 1) were realized by the mid 1970s (Table 1). Within 20 yrs of the Miami record (Schwartz 1952), it had dispersed northward to central Florida (and in two cases the panhandle) and mostly to sites that were distant from one another. Moreover, radiation was discontinuous in that dispersal to extreme sites often preceded dispersal to sites close to its source area of Miami. The rapid but discontinuous dispersal to presently recognized boundaries supports the assertion that the Cuban treefrog is vagile as predicted for successful colonizing species (Ehrlich 1989) and that, more so than by natural means, humans were the primary agent of its dispersal through Florida.

Similar patterns of dispersal are documented for other colonizing species for which humans have played the primary role in dispersal. For example, mechanized transport of equipment (military and otherwise) resulted in the successful dispersal of *Hemidactylus frenatus* in the Pacific Islands (McKeown 1978), *H. turcicus* in Texas (Davis 1974), and isolated dispersal events of *H. mabouia* and *H. garnotii* to sites in Everglades National Park (Meshaka, unpubl. data). Air traffic was a mode of dispersal for *Hyla squirella* to the Bahamas (Crombie 1972). In similar fashion, the Cuban treefrog, having colonized the now defunct Ramey Air Force Base in Puerto Rico (Schwartz and Henderson 1991), may have been transported on equipment. Dispersal of animals free on motorized vehicles is probably responsible for a disjunct population of *H. mabouia* in south-central Florida (Meshaka et al. 1994), and the source of repeated introductions of *Anolis sagrei* at Archbold Biological Station following conferences (pers. obs.). Similarly, dispersal on a trailer was the source of a nearly successful colonization attempt by at least seven Cuban treefrogs at one time to a ranch in south-central Florida (Highlands Co.) from Okeechobee Co. (Stan Pollack, pers. comm.). Five individuals residing in the awning of another trailer were dispersed from Highlands Co. to Sarasota Co. during an afternoon drive (Mary Hout, pers. comm.).

The plant trade has played a critical role in the colonization of *Anolis sagrei* throughout Florida (Godley et al. 1981), and the loose soil of nursery shipments carries *Ramphotyphlops braminus* (Meshaka 1994b) and *Eleutherodactylus planirostris* (Goin 1947) throughout Florida. The same could be true for *Gastrophryne carolinensis*, *Ophisaurus ventralis*, and *Diadophis punctatus* which are established in parts of the West Indies (Schwartz and

TABLE 1. Historical records of the Cuban treefrog (*Osteopilus septentrionalis*) in Florida.

County	Site	Source
Broward	Dania	King, 1960
	Broward-Palm Beach Co. line	Lee, 1969
	County	Ashton, 1976
Charlotte	County	Layne et al., 1977
	County	Stevenson, 1976
Collier	Naples, Cape Sable	Duellman and Crombie, 1970
	Chokoloskee Island	Austin, 1973
	County	Ashton, 1976
Dade	Miami	Schwartz, 1952
	Everglades, Royal Palm	Allen and Neill, 1953
	Everglades	Duellman and Bell, 1955
	Everglades	Duellman and Schwartz, 1958
DeSoto	County	Ashton, 1976
	County	Stevenson, 1976
Glades	County	Conant and Collins, 1991
Highlands	County	Stevenson, 1976
Indian River	Vero Beach	Myers, 1977
Lee	Ft. Meyers	Wilson and Porras, 1983
	Ft. Meyers Beach	Wilson and Porras, 1983
	Sanibel	Wilson and Porras, 1983
Leon	County	Ashton, 1976
Monroe	Key West	Barbour, 1931
	Key West	Carr, 1940
	Key West	Wright and Wright, 1949
	Key West	Mittleman, 1950
	Key West	Duellman and Schwartz, 1958
	Stock Island	Duellman and Schwartz, 1958
	Cudjoe Key	Lazell, 1989
	Little Torch Key	Lazell, 1989
	Middle Torch Key	Lazell, 1989
	Big Pine Key	Duellman and Schwartz, 1958
	Key Vaca	Peterson et al., 1952
	Key Vaca	Duellman and Schwartz, 1958
	Matecumbe Key	Duellman and Schwartz, 1958
	Matecumbe Key	Wright and Wright, 1949
	Upper Matecumbe	Trapido, 1947
	Upper Matecumbe	Duellman and Schwartz, 1958
	Key Largo	Allen and Neill, 1953
	Key Largo	Duellman and Schwartz, 1958
	County	Ashton, 1976
Orange	Apopka	Conant and Collins, 1991 (record in 1976)
	County	Ashton, 1976
	County	Stevenson, 1976
	County	Conant and Collins, 1991
Palm Beach	Boca Raton	Austin, 1975
St. Lucie	Port St. Lucie	Myers, 1977
Sarasota	County	Ashton, 1976
Washington	County	Ashton, 1976



FIG. 1. Distribution of the Cuban treefrog (*Osteopilus septentrionalis*) in Florida. Solid circles denote locality records of voucher specimens collected 1991–1994 and deposited in the United States National Museum. Stars denote published records not included by locality records of this study.

Henderson 1991). The Cuban treefrog is easily dispersed in plant shipments. For example, on several occasions live individuals were uncovered in foliage shipments sent to the zoo in Toronto, Canada (K. Jackson, pers. comm.), and a gravid female (USNM 218509) was collected in Baltimore, Maryland on June 1927 in a shipment of bananas that originated in Cuba. However, the Cuban treefrog is most easily dispersed in cultivated palm trees, especially royal palms (Table 2), for two reasons. First, the moist confines of palm axils provide a suitable food base and refuge for habitation and dispersal. Second, palm trees are sent in large numbers to disturbed areas which meet, often in full, the simple life history requirements of this species (Meshaka 1994a).

Mechanized transport of palm trees may be a greatly accelerated version of dispersal in palm trees and other vegetation during hurricanes (Darlington 1938; King 1962), a natural phenomenon with which this species has evolved. Dispersal in the decapitated heads of palm trees, such as royal palm trees which are native to the West Indies, would be not at all surprising given the protective qualities of the palm bole. Further, successful colonization is probable after a natural dispersal event in light of a breeding response by the Cuban treefrog immediately following a hurricane in urban (Meshaka 1993) and natural (Meshaka 1994a) areas of extreme southern Florida. Thus, its success in passive dispersal stems from use of refuges in objects which are themselves dispersed naturally or analogously through the activities of humans.

Because of humans, transport of palm trees repeatedly introduces the Cuban treefrog to sites. Each dispersal event increases the chance for successful colonization which takes place at a faster rate than is naturally possible by either actively dispersing along the edge of a range or passively dispersing in a hop-scotch manner in hurricanes. The known sale of palm trees from Homestead, Florida to the West Indies and throughout Florida (e.g., Manuel Diaz Farm) could be responsible for similar colonization patterns of other species which, like the Cuban treefrog, inhabit palm trees (Table 2). In this regard, the trade of palm trees may now be added to the list of dispersal agents which accelerate the colonization process of *Hemidactylus garnotii* through Florida (Wilson and Porras 1983) and now the Bahamas; Abaco, Man 'O War Cay (Buckner and Franz 1994) and Nassau, New Providence Island (Meshaka 1995). The same may be said for the colonization of

TABLE 2. Numbers of amphibians and reptiles (excluding anoles) captured within the axils of cultivated palm trees from 1991 to 1994 in Florida and Nassau, New Providence Island.

Species	Queen Palm *Arecastrum romanzoffianum* N = 116	Royal Palm *Roystonea edata* N = 44	Total 160
Cuban treefrog (*Osteopilus septentrionalis*)	10	40	50
Green treefrog (*Hyla cinerea*)	0	1	1
Squirrel treefrog (*Hyla squirella*)	0	4	4
Indo-Pacific gecko (*Hemidactylus garnotii*)	11	2	13
Corn snake (*Elaphe guttata*)	3	0	3
Total number of animals	24	47	71
Number of animals/palm	0.20	1.10	0.44
Number of Cuban treefrogs/palm	0.09	0.91	0.31

Hyla cinerea and *H. squirrella* in disparate regions of the West Indies (Schwartz and Henderson 1991) as well as the dispersal of *Elaphe guttata* on Grand Cayman Island which was suspected of having been associated with foliage trade from Florida (Franz et al. 1987). Like the dispersal of the Cuban treefrog through Florida, these north temperate invaders of the West Indies could be expected to have a higher probability of colonization success with increasing frequencies of dispersal events in large numbers of palm trees.

For the Cuban treefrog, foliage-mediated dispersal between Florida and the West Indies creates a reversal of source and target areas, a dimension to the colonization process infrequently realized by geographically-expanding species. One outcome of this phenomenon is the colonization and/or recolonization of West Indian sites from Florida. For instance, the second record of the Cuban treefrog on the British Virgin Islands, collected by J. D. Lazell, Jr. in October 1993, came from Necker Island whose introduction was associated with importation of nonfumigated ornamental plants from Miami to a private development on the Island (J. D. Lazell, Jr. pers. comm.). Arguably, cargo ships suspected by Barbour (1931) of dispersing the Cuban treefrog from Cuba to Key West may well have been sending some back to Cuba. A second outcome of source-target-site reversal is genemixing through the introduction of Florida specimens to established populations in the West Indies. For example, 75 queen palm trees searched on Nassau in November 1992 (Table 2) were known to have originated from Manuel Diaz Farm as part of a beautification project. In May 1992, 57 Cuban treefrogs were collected from 619 palm trees in a grove at Manual Diaz Farms. Most of the trees were queen palms but some solitaire palms (*Seforthia elegans*) were also present.

Thus, the Cuban treefrog is a vagile species and its opportunity to disperse is enhanced by activities of humans (trade of palm trees) which are analogous to natural processes. The rapid and haphazard pattern of its dispersal is in keeping with that of its primary agent of dispersal, and these patterns are also evident in other colonizing species whose recent range expansions can be associated with similar dispersal agents. The population increase at introduced sites enforces the overall success of the Cuban treefrog by providing a new source from which to populate or repopulate native and introduced areas.

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Range Extensions for *Hemidactylus frenatus* in México

WALTER SCHMIDT BALLARDO
FERNANDO MENDOZA QUIJANO
and
MA. ELA MARTÍNEZ SOLÍS
Museo de Zoología, Facultad de Ciencias
Universidad Nacional de México Autonoma
Apartado Postal 70–399, C. P. 04510, México Distrito Federal, México

The common house gecko (*Hemidactylus frenatus*) is not indigenous to México, but apparently arrived from the Pacific islands (Java) (Smith and Taylor 1950, Bull. U.S. Nat. Mus. 199:1–253). This lizard was previously reported from Guerrero (Smith and Taylor, *op. cit.*), Yucatán (Marcellini 1971, Southwest. Nat. 15:397; Lee 1980, Univ. Kansas Nat. Hist. Mus. Misc. Publ. 67:1–75), Sinaloa, San Luis Potosí, Colima, Oaxaca, and Chiapas (Smith and Smith 1976, Synopsis of the Herpetofauna of Mexico. Vol. III. John Johnson, North Bennington, Vermont. 977 pp.), Baja California Sur (Reynoso 1990, Herpetol. Rev. 21:22) and Morelos (Castro 1987, Bull. Chicago Herpetol. Soc. 22:69–70).

Hemidactylus frenatus was probably introduced in México through Acapulco (Weeb 1972, British J. Herpetol. 4:267–268) via shipping port activity, and has expanded its range into tropical and subtropical zones in both versants of the country, successfully colonizing other areas, mainly urban centers.

Herein, we document the establishment of *Hemidactylus frenatus* in eight Mexican states. All specimens collected by the authors are deposited in the Museo de Zoología, Facultad de Ciencias, Universidad Nacional de México Autonoma (MZFC). Other specimens are deposited in the collections of the Instituto de Biología, Universidad Nacional de México Autonoma (IBH), and Texas Cooperative Wildlife Collection (TCWC). Adrián Nieto and Michael J. McCoid kindly verified the identifications. The records are:

CAMPECHE: Municipality of Carmen, Escárcega. 122 m elev. 11 October 1993. MZFC 6620; Ciudad del Carmen. 11 March 1982. IBH 3488; Municipality of Campeche, Campeche (19°53'29"N, 90°27'54"W). 195 m elev. 11 October 1993. MZFC 6619.

HIDALGO: Municipality of Huejutla de Reyes, 10 Km N of Huejutla (21°05'01"N, 98°27'54"W). 290 m elev. 14 November 1993. MZFC 6288.

JALISCO: Municipality of Tomatlán. 15 August 1993. MZFC 6111–6112; Municipality La Huerta, Chamela (19°30'N and 105°03'W). 21 July 1983. TCWC 61705–61707.

NAYARIT: Municipality of Tuxpan. 14 July 1994. MZFC 6764.

QUERÉTARO: Municipality of Jalpan, Jalpan. 860 m elev. 10 October 1993. MZFC 6625.

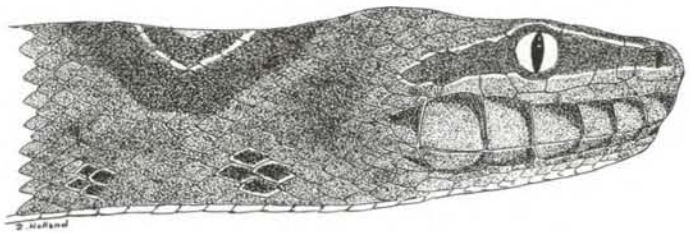
QUINTANA ROO: Municipality of Isla Mujeres, Isla Mujeres. 20 December 1991. MZFC 6109.

TABASCO: Municipality of Centro, Villahermosa. August 1987. IBH 6852; Municipality of Cárdenas, Cárdenas, Hotel Rivera (15°39'38"N, 93°22'32"W) 23 m elev. 9 October 1993. MZFC 6615–6616.

VERACRUZ: Municipality of Veracruz, Veracruz. 31 May 1987. IBH 6851; Municipality of Catemaco, Catemaco. 14 June 1991. MZFC 5830; Municipality of Coatzacoalcos, Coatzacoalcos. 14 July 1993. MZFC 5921.

The invasion of new territory by this gecko is often the result of human activities (Meshaka et al. 1994. Herpetol. Rev. 25:127–128). Apparently, it is also aided by natural phenomena, like hurricanes (pers. comm. from inhabitants of some of the localities here recorded). The presence of this lizard may have a negative effect on indigenous gecko populations of other genera (e.g., *Sphaerodactylus*) because its feeding habits include cannibalism and presumably it is a potential predator.

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BOOK REVIEWS

Turtles of the United States and Canada, by Carl H. Ernst, Jeffrey E. Lovich, and Roger W. Barbour. 1994. Smithsonian Institution Press. (Dept. 900, Blue Ridge Summit, Pennsylvania 17294, USA), xxxviii+571 pp. US $60 (cloth bound), ISBN 1-56098-346-9.

PETER MEYLAN
Natural Sciences, Eckerd College
St. Petersburg, Florida 33711, USA
e-mail: meylanpa@eckerd.edu

This book is a considerable enlargement and revision of Ernst and Barbour's (1972) *Turtles of the United States*. Jeff Lovich has joined Ernst and Barbour in the revision. The text is a very complete compilation of the published literature on the 56 species of turtles (54 native and two introduced) that occur in the United States and Canada and their adjacent waters. The authors have made a monumental effort to assemble, sort, and report in a concise and organized fashion, the huge amount of data on North American turtles that is available in the primary literature. Their survey is remarkably complete through 1992 and, with rare exception, they have accurately presented the findings from the primary literature. The book includes an extensive bibliography (almost 90 pages) of work that was published between 1970 and 1992. The reader is referred to Carr (1952) and Ernst and Barbour (1972) for most earlier citations.

The book includes only 16 pages about turtles in general, a four-page key to North American forms, a three-page glossary of scientific names, and the bibliography. The body of the text (470 pages) consists of 56 species accounts. Most accounts include sections on recognition (identification), karyotype, fossil record, distribution, geographic variation, confusing species, habitat, behavior, reproduction, growth and longevity, food habits, predators and defense, populations, and remarks. Each is accompanied by black-and-white photographs that typically include dorsal and ventral views of the shell and a close-up of the head. For many species, geographic and ontogenetic variation is illustrated in appropriate photos. A set of color plates includes one view of every species. The quality of the photos is highly variable; too many of the black-and-whites are too dark or too shadowy. The authors should have exploited the generosity and photographic skills of the turtle research community rather than attempt to use their own materials in nearly every case.

An important aspect of this large text is that the authors are consistent in their organization. Information is organized in like fashion from account to account. Where data are lacking, that is also carefully pointed out. These features greatly enhance the value of this book and make it a very handy reference.

It is unfortunate, however, that the authors did not use this occasion to summarize observations at levels other than that of the species. I found it surprising that they did not feel compelled to summarize features common to higher taxonomic groups (e.g., families and genera). Such summaries for the family Emydidae or speciose genera like *Graptemys* or *Gopherus* would have been particularly useful.

The authors have obviously read a small mountain of literature and have done an excellent job of summarizing, organizing, and presenting the efforts of hundreds of authors working in a remarkable diversity of disciplines. Given the size of the task, it seems inevitable that some errors would creep in. The only obvious error that I found from the ecological literature is the citation of Marchand (1942) for the abundance of *Sternotherus minor* in Rainbow Run, Marion Co., Florida, when he did not find it there at all (Meylan et al. 1992; Marchand, pers. comm., 1990). Otherwise, my impression of the ecological, behavioral, and physiological treatments is that they are accurate, remarkably complete, and extremely useful.

The only serious problems that I encountered are in the areas of systematics and morphology. The view of turtle systematics presented in the introductory material is outdated. We are told in the karyology section that greater similarity means closer relationship. In the section on turtle evolution we are told that turtles evolved a shell. Turtles are defined by the presence of a shell. Exactly what it was that produced a shelled form is still debated (Laurin and Reisz 1995; Lee 1993), but before it had a shell, it was not a turtle.

If the Pleurodira and Cryptodira are sister groups, one can't originate in the Jurassic and the other in the Cretaceous (p. xx). In fact, if *Proterochersis* is a pleurodire (Fraas 1913; Gaffney and Meylan 1988; Gaffney et al. 1991; but see Roogier et al. 1995), then both pleurodires and cryptodires are Triassic in age. The authors also seem to reject the notion that living sea turtles, including the Dermochelyidae, are each others' closest relatives. Instead they recognize a Dermochelyoidea equivalent in rank to the Chelonioidea (which they restrict to the Cheloniidae without comment) and the other three living cryptodire superfamilies. This is a significant throwback because it implies that *Dermochelys* could be the sister group of other cryptodires when it is now well established that it is a highly derived chelonioid. It seems likely that these issues in higher turtle systematics will not be very relevant to the average user of this text.

Another systematics issue, the inconsistent use of the name Emydidae, certainly is. The authors switch between a broad and a narrow definition for the family name Emydidae, even in consecutive lines, without advising the reader! They use the name in the broad sense (Emydidae plus Bataguridae of Gaffney and Meylan 1988) in some places (xviii; p. 203, line 2) but in the narrow sense (New World "pond turtles" minus *Rhinoclemys*, plus *Emys*) in others (p. xxi; p. 203, line 1, p. 204). Readers will be mislead if they interpret the statement on p. 203 that "formerly the family was divided into two subfamilies...Batagurinae...and... Emydinae," as a suggestion that these authors are always using the term Emydidae in its restricted sense.

Certainly the most troubling systematic statement for this reviewer is the use of the generic name *Trionyx* for three North American and two introduced Asian softshells. I would expect that these authors should be sympathetic to my desire to reveal the relative relatedness among what was formerly included in the genus *Trionyx* (Meylan 1987). After all, every one of their species accounts includes a section on geographic variation in which the reader is informed as to whether or not subspecies have been recognized. In some cases, a number of pages and a series of figures are devoted to making sure that the reader realizes that a given species is variable; that it is not the same entity throughout its range. My systematic revision of the Trionychidae (Meylan 1987) was an effort to make the same point at a much higher level. *Apalone* (the three North American species) is clearly a monophyletic group. Although it is in the same tribe as the type species of *Trionyx* (*Trionyx triunguis*), it is not the sister group of this species. Its sister group is a pair of large, Old World, riverine forms, *Rafetus euphraticus* from the near East, and *Rafetus swinhoei* from China. *Trionyx* (sensu stricto) is the sister group of *Apalone* plus *Rafetus*. *Apalone* appears to have been present as

early as the late Cretaceous (Gardner et al. 1995) which suggests that it may have been an independent entity for almost half the history of turtles. Morphologically and biologically, *Apalone* is far more distinct from *Rafetus* and *Trionyx* (sensu stricto) than *Emydoidea* is from *Emys* or *Chrysemys* is from *Pseudemys*. If we continue to use the generic name *Dogania* for the most flexible of softshells, then use of the name *Trionyx* for *Pelodiscus sinensis* and *Palea steindachneri* would make *Trionyx* paraphyletic. If these authors advocate using *Trionyx* for *Dogania*, I wonder if they would also advocate using *Testudo* for *Gopherus* and *Coluber* for *Lampropeltis*. My guess is that the opinions of the authors are colored by an emydocentric view of turtle diversity in which the great morphological distance of trionychids from emydids overshadows the variation within this highly divergent family.

A number of errors in descriptions of turtle morphology should be pointed out. They have used the term internal posterior cortical canal (p. xx) for the internal carotid canal. They describe the palatine of turtles as single and paired in the same paragraph (p. xxiv); they are always paired. The structures in the figure on page xxv labeled "nares" are in fact the posterior palatine foramina and the bone labeled as the premaxilla in the dorsal view is actually a portion of the maxilla. The structure labeled "zygomatic arch" in the same figure should be labeled jugal bar. Use of the former term implies homology to a structure in synapsids and should be avoided. The statement that the premaxillae separate the internal nares and the palatines in cheloniids suggests that they are being confused with the vomer. And anyone who suggests that cheloniids have lost the ability to retract the neck has never known the pleasure of trying to collect blood from the cervical sinus of a recalcitrant loggerhead.

In the trionychid section (p. 103), the treatment of the bones of the anterior lobe of the plastron is likely to increase confusion about the homologies of these elements. The authors attempt to follow Williams and McDowell (1952), who thought that the entoplastron was absent from trionychids, that the single midline element anterior to the hyoplastra was a fused epiplastra, and that the two anterior-most elements were neomorphs (that they called preplastra). However, the figure on page 104 fails to follow this terminology. What are now considered to be the epiplastra (Meylan 1987:11; Bramble and Carr, ms.) are labeled both as the epiplastra and preplastra, and the entoplastron (fused epiplastra of Williams and McDowell 1952) is unlabeled.

The authors do not appear to be well versed in the terminology of molecular genetics. They say that Hawaiian *Chelonia mydas* are similar to some Atlantic populations, but "differ by having five restriction enzymes." They also miss the critical point that it is natal homing and not nest-site fidelity that leads to genetic differentiation among populations in this species.

To be fair, it seems unlikely that these authors envision their work as a systematic or morphological treatise. Rather, they have set out to summarize the ecological, behavioral, and physiological literature on North American turtles. By doing this at the species level they have taken the most conservative approach, and they succeed admirably.

Publication of this book provides an opportunity to examine the extent of knowledge of the North American turtle fauna. With about 470 pages of species accounts, the average account is nearly eight-and-a-half pages. Considering the layout of the book, the size of the font, and the concise nature of the presentation, one could come to the conclusion that we know a great deal about North American turtles. As one might expect, however, the treatments are not nearly equal in length. The longest are those on *Chelonia mydas* and *Chrysemys picta* (21 pages each). The shortest is *Trionyx* [*sic*] *steindachneri* (2 pages). Chelydrids receive the most attention, with an average of 14 pages per species. Among native forms, kinosternids get the shortest treatments with 7 pages per species. Half the book is devoted to the Emydidae, but this is as it should be because this family represents more than half (57.4% by species) of the native fauna. It is interesting that among native turtles, it seems to be a series of Gulf Coast emydids that are most poorly known. Most of these are sibling species that have only recently been recognized and insufficient time has passed for the accumulation of much literature.

Having recently had occasion to summarize the available data for a series of Old World trionychids, it is easy to say that, by comparison, most North American forms are very well known. In fact, the depth of scientific knowledge for certain species is truly remarkable. It is not surprising that widespread forms like *Chelonia mydas, Chrysemys picta, Trachemys scripta, Terrapene carolina,* and *Chelydra serpentina* appear to be the best known. It is these forms that have received the most attention from physiologists and it is their contributions which add significantly to the length of the longest accounts in this book.

Although there may be a few problems with this book, overall it is a monumental work. It will undoubtedly serve as the standard reference to North American turtles for the next generation of biologists. Every serious vertebrate biologist on the continent will want a copy.

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Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians, edited by W. Ronald Heyer, Maureen A. Donnelly, Roy W. McDiarmid, Lee-Ann C. Hayek, Mercedes S. Foster. 1994. 364 pp. Smithsonian Institution Press, Washington D.C. Cloth: US $49.00, Paper: $17.95. ISBN cloth: 1-56098-270-5, ISBN paper:1-56098-284-5.

DARYL R. KARNS
Biology Department, Hanover College
Hanover, Indiana 47243-0108, USA
e-mail: karns@alpha.hanover.edu

The analysis of the distribution and abundance of organisms is at the core of the science of ecology. It is therefore a significant event when a distinguished group of international authorities on amphibian biology produce a volume such as *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. In this handbook, standard methods for assessing the distribution and abundance of amphibians are described, and the research community is asked to follow those procedures to insure comparability of studies across space and through time. Because of its authoritative credentials and the quality of the book, this volume will be studied, used, and cited by a wide variety of investigators and students in all parts of the world. This is the first production in the Biological Diversity Handbook Series from the Smithsonian Institution Press. Based on the high standard of quality set by this first handbook, forthcoming volumes will be eagerly awaited.

The book contains ten chapters, an impressive set of appendices, a glossary, and 22 pages of literature citations. This volume will be regularly taken off the shelf as a reference book for teaching and research. The foreword by David B. Wake and the preface by the editors explain the historical development of the book and its relationship to concern over declining amphibian populations. Chapter 1 briefly discusses the biodiversity crisis, the rationale for the book, its historical predecessors, and the intended audience. Chapter 2 is a concise and informative overview of amphibian biology. The next two chapters discuss basic aspects of research design and statistical concepts in the construction of amphibian studies. Lee-Ann C. Hayek and the editors have done a heroic job of trying to clearly distill the basics of research design and pertinent statistical concepts and procedures into a manageable space in these chapters, but this will be a difficult section of the book for some readers. I found the discussion of statistical significance (always a problem for students) to be particularly clear.

Chapter 5 provides advice on research planning and methods for collecting data on a wide variety of important factors collateral to the study of amphibians. Topics range from measuring weather variables, to microhabitat description, to automated frog call recorders. The discussion of data loggers deserves special attention. Chapter 6 is the biological core of the book and presents ten standard techniques for inventory and monitoring. Based on my particular field experiences and biases, I think the authors' choice of methods covers all the reasonable bases. This will be the chapter turned to most often. The presentation of each technique follows a standardized format and gives the reader basically everything that is needed (material and intellectual) to initiate a study using that method. Chapter 7 is an interesting assemblage of supplemental techniques not conveniently covered among the ten techniques described in Chapter 6, including use of thread bobbins for tracking, night driving surveys, and use of field trips for data acquisition. One of the pleasures of this volume is that the methods in these chapters are described in sufficient detail to allow someone to actually go out and do them. Reading these accounts is like having a conversation with someone who has "been there, done that," and you trust the advice.

Chapters 8 and 9 return to data analysis. In Chapter 8 the authors clearly "walk" the reader through several widely used techniques for estimating population size. I think readers will find the summary of the analysis of biodiversty data in Chapter 9 to be quite useful. There is a bewildering jungle of coefficients and statistical tools out there for making comparisons; the important ones are presented here in a clear and practical fashion. The population estimate and biodiversity analysis chapters are both made eminently more "user-friendly" by the use of examples with sample data sets. The last chapter closes with conclusions, recommendations, and a statement of the philosophy of the editors regarding the adoption of the proposed standard methods. The next 49 pages are devoted to a series of useful appendices on handling and marking amphibians, recording frog calls, and whole specimen and tissue preservation techniques. There is a list of vendors and even a step-by-step random number table.

A book like this should really be assessed by several reviewers; the volume covers so much territory that multiple appraisals would be useful. In general, I think the handbook is remarkably ambitious and very successful in achieving its objectives. The production quality is high and the book is essentially free of typographical errors. It is reasonably priced (the paperback edition is a real bargain). The editors have done a good job of melding together the styles and content of sections by many authors. Perhaps inevitably, there is some redundancy in topics. The handbook has excellent data-based examples in a number of sections; however, in future editions I would like to see even more examples and problem sets. I think these teaching aids greatly increase the utility of the volume for a wider audience.

Throughout the handbook, authors acknowledge predecessors to this volume (e.g., Campbell and Christman 1982; Corn and Bury 1990; Davis 1982; Vogt and Hine 1982). However, more successfully than anything else available, this handbook pulls together a large and diffuse literature on field techniques and statistical methods into one convenient package. The authority of the handbook is greatly increased by the committee approach taken by the editors. The methods presented here represent a consensual agreement among a pool of knowledgeable participants, thus avoiding individual methodological biases. The special attributes of amphibians demand both terrestrial and aquatic sampling procedures. Because of this, workers dealing with a variety of other taxa will find this to be a rich source of information and a stimulus for the cross-fertilization of methodological ideas.

The first chapter states that the book provides recommendations and guidelines for the inventory and monitoring of amphibian populations, and the authors discuss the need for the standardization of methods. In the final chapter (p. 272) this point is more strongly stated: "We urge, therefore, that all users follow to the letter the procedures indicated." I agree with the authors that there is a need for the standardization of methods, and the value of standardization is illustrated by important studies such as Pechmann et al. (1990) and Inger and Voris (1993). The handbook asks the research community to voluntarily adopt a set of standards, and as a result of the publication of this volume, we are now engaged in an interesting experiment. To what degree will this book's recommendations be put into effect by the assortment of investigators (government, academic, private) that deal with questions of biodiversity measurement and monitoring? The natural world is inherently messy, and researchers will not always be able to follow certain idealized methods of collecting

data "to the letter." Experienced researchers will design programs best suited to their particular needs. The authors of the handbook recognize this reality, and in the last chapter they propose a feedback mechanism by which demonstrated methodological improvements can be incorporated into future editions. At the other extreme, less experienced researchers, perhaps uncertain of their planning and judgment, may try to use this volume as a "cookbook" and attempt to ram a survey or monitoring problem into one of the available options, even if the fit is not particularly good. In any event, accurate documentation of all procedural aspects of a research project is mandatory. For standardization of methods to become a reality there must be a general awareness of the handbook and it must be used. I asked several individuals involved in biological survey work for reputable environmental firms if they were aware of this volume—they had not heard of it (but have now ordered copies).

In Chapter 1 (p. 3) the editors state that the handbook is intended to be "comprehensive so that individuals with an undergraduate degree in science, or equivalent training, can measure the biological diversity of amphibians using only this volume." I have used this book with students and discussed its use with a number of biologists who have undergraduate or Master's degree level backgrounds coupled with job training. In general, they report the handbook to be an extremely valuable resource, but they do have problems with its use. They appreciated the clear descriptions of specific field methods and guides to resources, but some encountered difficulties with aspects of research planning and design, statistical methods, and using statistical thinking in making methodological decisions. This is not a criticism of the book's content; as I noted earlier, I think the authors did an excellent job with these basic research topics, but this book cannot be, nor is it intended to be, a substitute for training in population and community ecology and biostatistical thinking. The numerous references in the handbook will allow the reader to pursue topics in greater detail as needed. Investigators in need of assistance should seek expert advice.

In talking and listening to some of the authors of this volume, it was obvious that they were excited about being involved in a project that has the potential for making an important and lasting contribution to the study and conservation of amphibians. I especially like the populist philosophy that runs through this book—the intent is to be inclusive, to get interested people working together and doing good science. This effort demands that we tap into the large reservoir of interested persons, who are not specifically trained in biology, but just interested in the natural world (as is already being done in a number of research programs). These "citizen-scientists" are more than willing to go out on cold spring nights or hot, humid tropical nights on lonely roads with notebook and tape recorder in hand to document what is there. In the long run, the collaboration that is forged between these individuals and the scientific community may be one of the most important outcomes of this and similar projects. I applaud the editors and authors of this important book on a job well done.

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Handbook: Indian Lizards, by B. K. Tikader and R. C. Sharma. 1992. Zoological Survey of India, Publications Division, Nizam Palace East, Calcutta 700 016, India. Indian Rupees 400.00/US$ 32.00/£ 22.00. 250 pp.

INDRANEIL DAS

Centre for Herpetology, Madras Crocodile Bank Trust
Post Bag 4, Mamallapuram, Tamil Nadu 603 103, India

The scientific study of biological diversity in tropical Asia is in its infancy. In the midst of efforts to protect biodiversity, concerns have been expressed of the loss of expertise in systematic research and the retarded growth of systematic knowledge, surely the cornerstone of biological conservation. We don't even know which vertebrates occur in the region, far less the higher relationships between taxa. This, in turn, may potentially result in species loss: the failure to recognize distinct species is known to have caused species extinction (Daugherty et al. 1990).

Systematic research, which is poorly funded in India, is carried out almost exclusively by the staff of the Zoological Survey of India (ZSI), drawing upon the extensive collection started by the Asiatic Society of Bengal, although much has since been added by the Survey's own expeditions throughout the country, and even occasionally beyond our frontiers. This research has led to a virtual explosion of publications by its staff, primarily in the periodicals issued by the Survey (notably the Records, the Memoirs, and the Occasional Papers) as well as illustrated books (such as the Handbook series, which has covered arachnids, freshwater molluscs and turtles), brought out by the ZSI as a service to furthering our understanding and appreciation of India's rich and diverse fauna.

As might be expected, given an organization with a staff of over 1,000 and the lack of rigorous peer review, the quality of the work is highly heterogenous. Studies by the Survey have resulted in fundamental understanding of the biology and biogeography of our land (e.g., the Satpura Hypothesis of Hora, 1949). On the other side of the coin however, several major errors in the description of species purported to be new, many of which are not based on adequate series, are also attributable to the work of the Survey.

The goal of the Handbook series is to enable the man on the street to identify the Indian species. If the present work, written by an arachnologist (Tikader, a former Director of the ZSI, now deceased) and a herpetologist (Sharma, previously Deputy Director of the ZSI, now retired) is meant to help the layperson identify the local lizards and learn some basic facts about their biology, their objectives have not been realized. The mistakes begin on the cover of the dust jacket (similar to the book on turtles by Tikader and Sharma, 1985) of a male *Calotes versicolor* perched on *Cissus quadrangularis*, a xeric region plant, identified as "*Salea horsfiedi*" (sic), a species from the wet evergreen forests of the Western Ghats.

The introduction includes a general review of the biology of lizards—their ancestry, morphology, diet, reproduction, and a rather lengthy discussion on their distribution. Also included is a key to the families of Indian lizards. The core of the book deals with the lizards themselves. Each family section starts with a dichotomous key to the genera and is followed by species accounts. For each species, the authors provide an English name, the scientific name, authority, and date. The heart of the species section are the descriptions of the lizards, which are little different from what we already know from M. A. Smith (1935). The distributional notes contain details of ranges within India and outside (where applicable). "Habits and Habitat" include fragmentary natural history data, and status for most species is 'rare,' 'indeterminate,' or 'in abundance,' although for some species status has been categorized as 'rare, indeterminate.' The authors add two species to the Indian fauna: *Phrynocephalus reticulatus* (from Ladak [sic], Kashmir) and *P. euptilophus* (from Western Rajasthan).

The plates are organized into a set of barely passable black-and-white photos, followed by color photos, the best of which are appalling. Some of the photos apparently have been photographed directly from the concise book on the Indian reptiles by Daniel (1983). A great number of the species are illustrated by museum specimens that are mere black blobs against a white background. One (*Eremias gutulata watsoniana*) is printed upside down. Typos are unacceptably high throughout, even in the plate captions. The line drawings, being mostly borrowed from older works such as Smith (1935), are useful and have printed well. Some of those that are new have problems. For instance, the text-figure of *Riopa ashwamedhi* (Fig. 25: 150), a species described by Sharma himself, shows a Martian-like figure, making one wonder whether the authors take herpetology seriously. The maps showing the distribution of our lizards deserve particularly harsh comment. Ranges are marked arbitrarily with polka dots, checks, stripes, and the authors' other favorite designs; these are amateurish and distracting. More seriously, they are inaccurate. One example is the map (No. 17: 210) showing the distribution of the gekkonid *Hemidactylus brookii*. We know from Smith that it is widespread in India, but Tikader and Sharma cover the whole of mainland India with their choice of hatching, without critically trying to ascertain the true distribution points and natural discontinuities, while omitting the species from adjoining Nepal and Bangladesh. The range of *Uromastyx hardwickii* is shown right down into the Indian peninsula, in a map (No. 21: 214) it shares with a variety of unrelated lizards including the geckos *Lophopholis* (now *Hemidactylus*) *scabriceps*, *Gehyra mutilata* and another agamid, *Calotes grandisquamis*.

Valid species of lizards whose occurrence in India are indisputable that have been omitted in the work are so numerous that these have been listed by family below:

Gekkonidae

Alsophylax boehmei Szczerbak 1991
Cnemaspis boiei (Gray 1842)
Cnemaspis nairi Inger et al. 1984
Cnemaspis tropidogaster (Boulenger 1885)
Gekko verreauxi (Tytler 1864)
Cyrtodactylus himalayanus Duda and Sahi 1978
Cyrtodactylus malcolmsmithi Constable 1949
Cyrtodactylus mansarulus Duda and Sahi 1978
Cyrtodactylus pulchellus Gray 1828
Cyrtodactylus walli Ingoldby 1922
Hemidactylus mahendrai Shukla 1983
Lepidodactylus lugubris (Duméril and Bibron 1836)

Agamidae

Laudakia melanura (Blyth 1854)
Laudakia pakistanica (Baig 1989)
Salea kakhiensis (Anderson 1878)

Scincidae

Ablepharus pannonicus Fitzinger in: Lichtenstein in: Eversmann 1823
Dasia halianus (Halys and Nevill 1887)
Dasia subcaeruleum (Boulenger 1891)
Eumeces blythianus (Anderson 1871)
Eumeces schneideri (Daudin 1802)
Mabuya clivicola Inger et al. 1984
Mabuya gansi Das 1991
Mabuya rudis Boulenger 1887
Ophiomorus raithmai Anderson and Leviton 1966
Scincella macrotis (Steindachner 1869)
Sphenomorphus reevesi (Gray 1838)

Lacertidae

Acanthodactylus blanfordii Boulenger 1918

In summary, 27 species are missing from a work purported to be a comprehensive guide to the Indian saurians. However, included in the work is the so-called "luminous gecko," *Cyrtodactylus madarensis* Sharma, 1980, which was shown to be synonymous with *Eublepharis macularius* by Das (1991).

The text itself is not free of errors. A detailed listing is impossible, and would probably result in another tome. A sampling would be more interesting and is within the scope of the review. The distribution of the skink *Tropidophorus assamensis* is given as "India: Assam" (probably a result of direct transcription from Smith, 1935), whereas after the partition of India, part of Assam from where the types of the species came, became Bangladesh's Sylhet district, and the species has not been collected from within the boundaries of the Republic of India. The map for the species (No. 26: 219) shows its occurrence in the Khasi Hills of Meghalaya), the basis of which is not mentioned. *Varanus salvator*, the water monitor, is listed as being in Schedule I of the Indian Wildlife (Protection) Act (it is in Schedule II). *Gekko smithii* is indicated as occurring in the Andamans. The species that does occur in these islands is *G. verreauxi*, as shown by Ota et al. (1991), although *G. smithii* has been reported (Ota et al. 1991) to occur within Indian limits—in the adjacent Nicobar Islands. Its extralimital range is also wider than "Malaysia up to Patani in the north" indicated in the text, being recorded from the Sundas.

The bibliography lists most important pre-1935 literature, with those published subsequently being mostly the papers of the staff of the ZSI or the occasional papers from the Journal of the BNHS. The large volume of literature published on, or having relevance to, Indian lizards in foreign journals is missing.

In summary, this work has the hallmarks of the country's premier scientific institute's recent series of publications on reptiles: unedited, poorly illustrated, and obviously unresearched information. Being printed on good quality paper and well bound, it is likely to fool into complacency the bureaucrats who hold the strings of the research purse.

Considering cutbacks in funding for basic research in India, and the perpetual complaints by the staff of governmental agencies of the lack of funds for conducting biological investigations, one wonders how such books continue to see the light of the day. It apparently went unrefereed, was written in great haste, and without consultation with colleagues outside the ZSI or the recent literature. Several of the types of Sharma's new lizard species are at present "not available" at the ZSI, frustrating researchers in sys-

tematics. And lastly, it is alarming to read from the dust jacket that the second author is "now actively engaged in writing Fauna of India on Reptiles" (sic).

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DOUGLAS E. RUBY

Department of Natural Sciences, University of Maryland Eastern Shore
Princess Anne, Maryland 21853, USA
e-mail: druby@umes-bird.umd.edu

The goal of this book was to compile the literature on North American tortoises, broaden knowledge about tortoises, and improve the scientific rigor of studies on these species. The last such compilation was also by one of the editors of this book (Bury 1982). The book presents a wide-ranging set of reviews of the ecology and management issues related to the four tortoise species. (The full bibliography is listed in Herpetol. Rev. 26:7–8). As such, it represents an excellent source of current information about the four tortoise species, comparing some ecological requirements between species, and indicating fruitful directions for future research. The book contains two papers on classification issues, four on the distribution and habitat use of tortoises, one status report on the endangered species *Gopherus agassizii*, and two papers each on the topics of reproduction, burrow use, and life history. A closing critique of the status of knowledge about North American tortoises completes the volume by summarizing current knowledge and outlining the problems with present literature.

The first two papers, by Crumly, and Crumly and Grismer, examined the phylogenetic status of the genus *Gopherus*. In a cladistic analysis using PAUP and MacClade, they concluded that the genus was monophyletic. The second paper concluded that *Xerobates lepidocephalus* from Baja California was actually a specimen of *G. agassizii*. Mushinsky and McCoy tested for the effect of isolation of small populations of gopher tortoise on population size and distribution. They concluded that gopher tortoises need open types of habitats altered by fire. The rapid increase of the human population in Florida is producing fragmentation of the habitat which can result in local extirpation of populations.

The next series of papers compared habitat patterns of different species and within species but at different locations. Fritts and Jennings examined *G. agassizii* in México. Interestingly, they found populations were most common where rainfall exceeded 100 mm, a sharp contrast to the conditions in the northern range of this species (Sonoran and Mojave deserts). An informal census indicated that local peoples used the tortoises for food. They concluded that collecting was not yet a major factor on populations although it occurred near some towns in México. Bury, Esque, DeFalco, and Medica evaluated the status of *G. agassizii* in the eastern Mojave Desert, focusing on habitat use and pointing out the relationship between tortoise activity and soils which can support burrow construction. Densities on middle and upper slopes are poorly known, leading to possibly misleading perceptions about the tortoises' use of only lowland and flat areas. Germano, Bury, Esque, Fritts, and Medica considered the range and habitat of *G. agassizii* and what factors determine density. The wide range of environments used by this species challenges our understanding of tortoise needs and raises the question of how much flexibility in ecological requirements exists in this species. Corn reported on population trends on *G. agassizii* in the Mojave Desert. Population estimations were based on 60-day censuses on small plots. Unfortunately, as Corn pointed out, these procedures violate the assumptions of the Lincoln-Peterson Index and the actual numbers are not reliable. As indicated by the data presented, few sites have been studied more than five years—a short period in the life of an organism with a life expectancy of 50 years—and most have been visited only sporadically. The seven permanent sites listed in this paper need thorough, annual censuses before trends are clear. There is a poor understanding of how tortoise populations respond to environmental conditions, including fluctuations in precipitation such as the five-year drought in California which ended in 1993. None of the articles considered the possibility that the recent population declines in the western Mojave were a direct effect upon *G. agassizii* of such an extended period of low precipitation and therefore greatly reduced forage. It is quite possible that the physiology of *G. agassizii* has been selected for surviving annual droughts but the frequency of multiple-year droughts may be rare enough that this survival strategy produces a catastrophic decline in populations during long-term droughts (Ruby et al. 1994).

In a different direction, Oldemeyer compiled information on the effect of cattle and sheep grazing on desert tortoises. Despite substantial reductions in cattle numbers since 1934, the quality of most rangeland in the Mojave Desert continues to be rated poor by the U.S. Bureau of Land Management. As Oldemeyer indicated from his literature search, there have been few adequate studies on the effects of grazing in the Mojave Desert and most of the research reports he cited were unavailable or unreviewed. Because the diet, which is driven by precipitation patterns, varies from site to site and year to year, it is very difficult to generalize about dietary overlap between cattle and tortoises. One study (Turner et al. 1981) tested the effect of enclosures for two years, too short a time period for answering questions about the ability of the range to recover from grazing. Although this issue needs a detailed long-term test, political pressures have prevented the BLM from funding such a large scale project to obtain a more meaningful answer.

The next series of papers looked at physiological and developmental aspects of tortoises. Esque and Peters provided a well-documented report of their direct observations of stone and bone

ingestion. The importance of calcium in the diet of tortoises seems obvious; however, specific requirements for proper health are currently unknown. They recommended that managers leave bones and skeletons to weather in the field as a calcium source. The weathering process improved the desirability of the bones to the tortoises. Linley and Mushinsky provided experimental data on the eggs and hatchlings of the gopher tortoise (*G. polyphemus*) and found that the larger eggs produced larger hatchlings. Their data provide key parameters for estimating energy budgets in tortoise populations. Diemer and Moore reported on a six-year study on the reproduction of *G. polyphemus* in Florida. They outlined the phenology of this population and the relationships between egg diameter and clutch size with median carapace length in females. They concluded that estimates of minimum production of hatchlings cannot be evaluated against actual population counts because juveniles were hard to find, not as active, and small in size. These factors mitigated against successful sightings and captures of hatchling and juvenile tortoises.

Tom reported on microhabitat use and burrow activity in the Bolson tortoise (*G. flavomarginatus*). As the largest species of *Gopherus* and with a limited range in the Chihuahuan Desert, it is susceptible to disturbance. She found less burrow changing in the drier season than the wet. Juveniles produced their own burrows preferentially. Built under vegetation such as *Opuntia*, the burrow served as a microclimate shelter, provided shade and temperature control, and protected against predators.

Wilson, Mushinsky, and McCoy used radiotelemetry to study juvenile gopher tortoises. They hypothesized that the small home range of juveniles is a result of predator avoidance. There is a need to know the heating and cooling rates of juveniles in order to estimate the thermoregulatory effects of juvenile activity. Morafka looked at tortoise neonates in general. He contrasted tortoises with emydid turtles and presented data that tortoises lay fewer but larger eggs compared to emydids. While both groups allocate about the same reproductive effort on an annual basis, the allocation pattern is quite different. He pointed out that the kinesis of the posterior marginal shell and the neutral pH of the stomach were important adaptations for hatchlings. Recruitment of neonates may be very infrequent in natural populations and this emphasizes the need for long-term studies of 20–30 years (a rare event among ecological studies in general and difficult with academic lifestyles). The nutritional needs of neonates may be substantially greater than predicted for their body mass. Morafka proposed a chaotic model of recruitment and contrasted the two tortoises from mesic conditions (*G. berlandieri* and *polyphemus*) with the two species from desert conditions (*G. agassizii* and *flavomarginatus*). He pointed out that the larger egg sizes and their heavy lipid stores per year, not their total reproductive effort, make tortoises appear to have a bet-hedging strategy for desert unpredictability.

Germano presented an analysis of comparative life histories among the four species of *Gopherus*. He noted that many details were lacking to provide a fuller understanding of the demography and population dynamics. The four North American tortoise species range widely in size as adults, occur in subtropical or desert environments, and exhibit a sexual dimorphism that is inversely correlated with size. Despite this, the largest and smallest species mature at about the same age. Germano pointed out the need for parallel studies on the Sonoran and Sinaloan populations of *G. agassizii* and on *G. berlandieri* in México to complement previous and on-going studies. Techniques for locating animals by radiotelemetry, determining clutch frequency from radiography and ultrasound, and aging animals from scute sections are some of the procedures that need to be more widely used. The greatest challenge lies in determining longevity of populations. These data are unlikely to become available quickly as the longevity of individual tortoises exceeds the academic lifespan of most researchers! Tinkle's (1979) call for long term ecological studies remains highly relevant to understanding the ecology and behavior of tortoises.

Germano and Bury conclude with a research critique of the field and a strong call for high quality efforts. This article is an accurate description of herpetologists' and ecologists' knowledge about tortoises and serves as an excellent outline for research possibilities. Several areas of fruitful pursuit will involve the use of sample areas large enough to be consistent with the home range of tortoises for estimating occurrence and density, the validation of line transects through different habitats in estimating tortoise abundance, and accumulating information on what determines habitats with high and low density of tortoises.

Their critique also strongly pleads for greater scientific rigor in the design, analysis, and publication of work on the tortoises. Although there is a substantial "gray literature" on all four species, the problem is particularly acute for the desert tortoise. Since this reviewer has experienced this problem first hand during work at the Desert Tortoise Conservation Center (DTCC) in Las Vegas, it is clear that the gray literature is problematic and may slow progress in understanding tortoise biology and presenting clear conclusions about the status of threatened species to the political and social realms for necessary action. Progress is also impeded when the accuracy and validity of such unreviewed work is assumed by workers, particularly those without ecological backgrounds, even though careful reading indicates basic research and statistical standards have not been met. Bury and Germano commend the Gopher Tortoise Council for acting to reduce their proceedings to a quarterly newsletter. Some authors in this book also indicated which citations were unpublished works. Journal editors need to have clear policies about citing such unreviewed literature and whether manuscript reviewers can reject submitted manuscripts based on unreviewed and unpublished works.

The book in whole presents a needed compilation of ecological studies and reviews on the tortoises. The state of knowledge was contrasted with other groups of reptiles, particularly studies of freshwater turtles which remain the best known turtles. The range of topics makes this publication useful to many herpetologists and will stimulate life history, habitat usage, and physiological adaptation studies of turtles and, more broadly, of reptiles.

Results from a simultaneous project on the desert tortoise at the DTCC in Las Vegas (Spotila et al. 1994) were not incorporated in this volume. However, based on Bury and Germano's proposals for future research and their strong recommendation for careful scientific design, the DTCC project unquestionably serves as a model system. The criteria of careful planning, hypothesis-based research, and close collaboration across several biological disciplines produced a significant advance in our knowledge of the biology of *G. agassizii*, which subsequently appeared in *Herpetological Monographs*. A combination of studies on physiological and behavioral correlates of stress, reproductive cycling and social interactions, microhabitat use of burrows and temperature regulation plus new techniques for sexing juveniles and applied experiments involving barriers show the positive effect of broad collaboration and the significant potential for advances in knowledge when integrating scientific perspectives with management goals.

The absence of reference to this significant work in Bury and Germano's book, however, simply indicates that progress is be-

ing made on a wide ranging basis for four species which are currently or potentially threatened by human activity. As *Biology of North American Tortoises* is free from the U.S. Fish and Wildlife Service, it should be widely available to the herpetological community. It provides a good review of issues and the published literature for those not deeply involved in tortoise work, suggests many project possibilities for graduate students, and challenges herpetologists in the area to focus on high quality work. The success of this book will be measured by how quickly R. B. Bury plans a third compilation.

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DORCAS O. SCHAEFFER
Department of Comparative Medicine
College of Veterinary Medicine, University of Tennessee
Knoxville, Tennessee 37901-1071, USA

Animal welfare concerns have, in the last few years, become priority items for zoological parks and research institutions. Until very recently, however, the focus of welfare issues was on mammals and birds; reptiles were largely ignored.

The present volume is one of a few current publications that deals exclusively with the well-being of reptiles. The book is divided into eleven chapters, with the first half addressing biological issues, and the second half dealing with ethological topics. An array of zoologists, ethologists, and veterinarians contributed to the text, resulting in a comprehensive, thought-provoking document.

The first two chapters, Physiology and Functional Anatomy (Harvey B. Lillywhite and Robert E. Gatten, Jr.) and Biology of Stress...(Louis J. Guillette, Jr., Alison Cree, and Andrew A. Rooney) contain pertinent, if somewhat technical, structural and physiological information. Chapter 2, especially, presents very interesting information concerning the effects of stress on the immune system, growth, and reproduction. Chapter 3, Nutritional Considerations (Fredric L. Frye), while presenting valid information, tends to be wordy and over-emphasizes some topics (i.e., accidental herbivores and omnivores). Chapter 4, Veterinary Perspectives (John E. Cooper and David L. Williams), contains excellent sections on anesthesia and evaluation of relative stressors; it explains major concepts in sufficient detail to be useful to all readers. The argument on "pseudonatural" versus "clinical housing" is also presented in a very objective fashion. The final chapter in the biology section, Naturalistic Versus Clinical Environments (Clifford Warwick and Catrina Steedman), is somewhat disappointing. The opinion is presented that environments which are "too clean" cause immune suppression, without addressing other concomitant husbandry stressors. Additionally, "sanitation" and "sterilization" are used almost interchangeably, when these in fact are two distinct concepts. This weakens the chapter and leads the reader to erroneously conclude that thorough environmental cleaning is always detrimental to the reptile's health and well-being.

The second half of the book deals with ethological aspects of captive reptile well-being. Chapters 6, Normal Behavior (James C. Gillingham) and 7, Effects of Ontogenetic Processes and Rearing Conditions (Gordon M. Burghardt and Donna Layne), are extremely well written. They are succinct and provide appropriate specific information for each major topic covered. The discussion of neonatal "social arrangements" and feeding were particularly interesting. Both sections are also well-referenced.

Chapter 8, Behavioral Consequences of Husbandry Manipulations... (David Chiszar, W. Thomas Tomlinson, Hobart M. Smith, James B. Murphy, and Charles W. Radcliffe), presents objective views and data on effects of handling and cleaning; it also offers a reasonable compromise between sanitation and the reptile's well-being (i.e., leaving olfactory cues in a cleaned cage).

Chapter 9, Psychological and Behavioral Principles and Problems (Clifford Warwick), contains some very useful lists of signs of psychological comfort and psychological arousal. However, the tone of this section is often caustic and condescending, making it difficult for the reader to appreciate the strengths of this chapter.

Chapter 10, Ethologically Informed Design in Husbandry and Research (Neil Greenberg), presents a philosophical, realistic viewpoint on developing appropriate research designs. Finally, Miscellaneous Factors Affecting Health and Welfare, Chapter 11 (Phillip C. Arena and Clifford Warwick), deals with stress and pain, euthanasia, and reintroduction.

As a whole, the book is very informative and fascinating to read. The most detracting aspect of this volume is the negative tone displayed in Chapters 1, 5, 9, and 11. Many of the attitudes and practices described as commonplace today are actually holdovers from years past. Most researchers, curators, and animal care and use committees are very interested in captive reptile welfare and want to learn appropriate husbandry, handling, and project design. Condescension as expressed here is likely to discourage, if not offend, these individuals. Chapters 4, 6, 7, 8, and 10 present a much more positive and encouraging attitude, especially regarding collaboration among professionals to achieve appropriate standards of care. Overall, the book is a very useful text and one that should be included in the library of all herpetologists, zookeepers, researchers, research veterinarians, and animal care and use committees.

ERRATUM

Stephen Hager's Natural History Note (1995. Herpetol. Rev. 26:145–146) concerning growth in *Phrynosoma coronatum* contained several printing errors. Sample sizes for both adults and hatchlings were 4 (not 8 and 5 as printed). The standard deviation for hatchlings should read SD = 0.133; and for adults, SD = 0.169.

SSAR Committee Chairs and Coordinators

CHAIRPERSONS

Conservation
C. KENNETH DODD, JR.
National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
JULIAN C. LEE
Department of Biology
P.O. Box 249118
University of Miami
Coral Gables, Florida 33124, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

International Cooperation
MARTHA L. CRUMP
Department of Biological Sciences, Box 5640
Northern Arizona University
Flagstaff, Arizona 86011, USA

Long Range Planning
LYNNE D. HOUCK
Department of Ecology & Evolution
University of Chicago
940 East 57th Street
Chicago, Illinois 66037-1455, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602-2597, USA

1996 Local Meeting
LINDA TRUEB
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Nominating
STEVE M. REILLY
Department of Zoology
107 Irvine
Ohio University
Athens, Ohio 45701, USA

Regional Society Liaison
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Resolutions
GEORGE R. PISANI
Department of Biological Sciences
University of Kansas
Lawrence, Kansas 66045-2106, USA

Zoo Liaison
JEFF ETTLING
Department of Herpetology
Sedgwick County Zoo
5555 Zoo Boulevard
Wichita, Kansas 67212, USA

COORDINATORS

Common and Scientific Names
JOSEPH T. COLLINS, Coordinator
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA

Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
3905 Old Sabino Canyon Road
Tucson, Arizona 85750, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

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Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings. **Corresponding authors should include an e-mail address (if available); this will greatly facilitate communication with the editors.**

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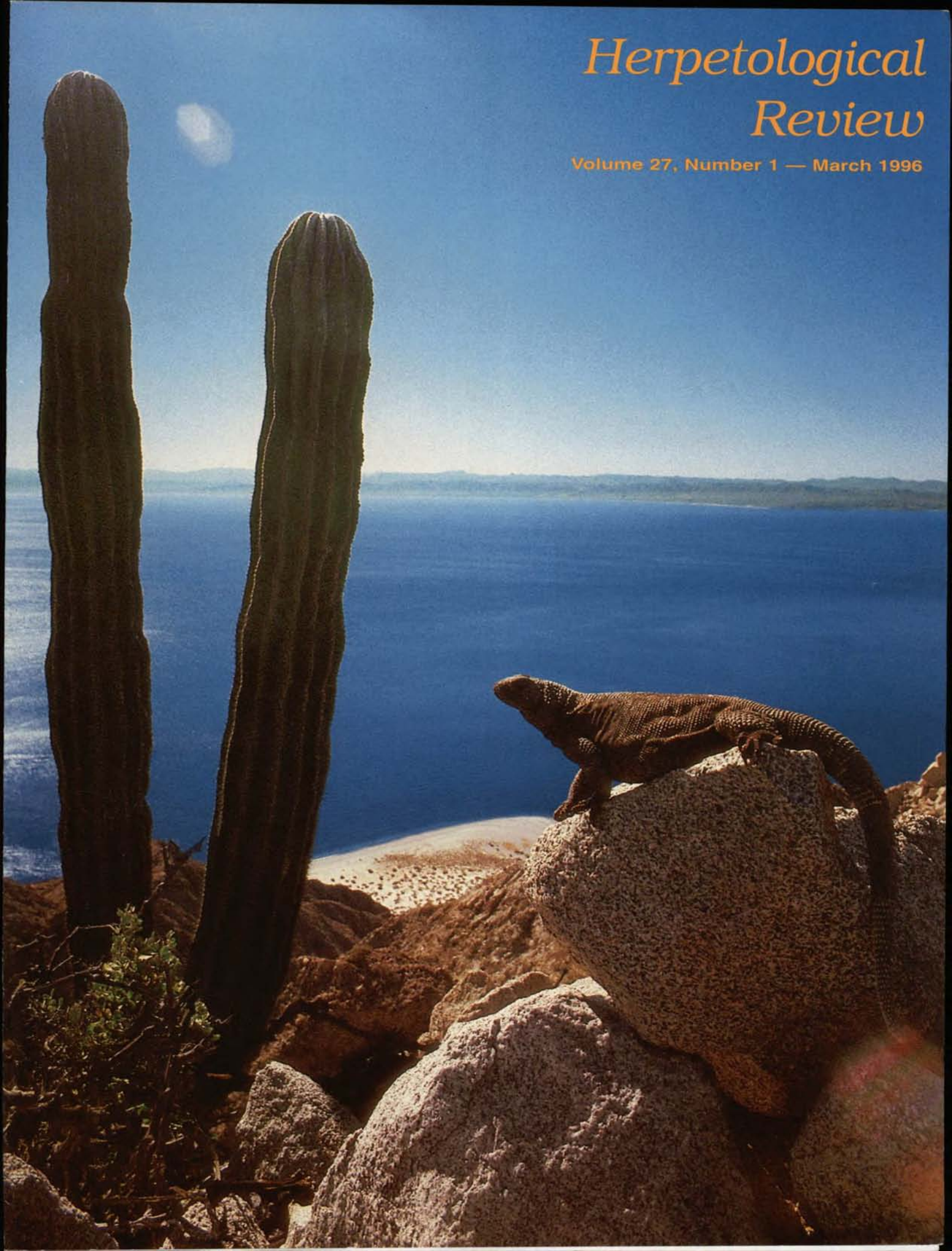
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SSAR BUSINESS

SSAR Election Results

Results of the recent SSAR election are as follows:

President-elect (to serve as President for 1997): ..... *Henry R. Mushinsky.*

Secretary: ..... *Ellen J. Censky* (unopposed).

Treasurer: ..... *Karen L. Toepfer* (unopposed).

Directors: ..... *John B. Iverson, James P. Bogart.*

SSAR Student Travel Awards Fundraiser Call For Donations

At the 1995 SSAR meeting in Boone, North Carolina, the SSAR Student Travel Awards Committee introduced its second annual Frameable Art Silent Auction to raise funds for students attending and presenting papers at the 1996 meeting in Lawrence. The outcome of this year's silent auction was especially positive, with over $1700 raised. On behalf of SSAR and the Student Travel Awards Chair, Dawn Wilson, thanks to all who participated. Hoping to continue this successful tradition, the Student Travel Awards Committee is pleased to announce the third annual frameable art silent auction to be held at the 1996 SSAR meeting in Lawrence. Acceptable donations include: photos of your study animal (or herpetologists!), line drawings, prints, paintings, or anything that can be put into a frame, if not framed already. If you are interested in donating an item please contact: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; Tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

SSAR Student Travel Awards Call for Applications

Ten SSAR Student Travel Awards of $200 each are available to undergraduate and graduate student members of SSAR to help defray the cost of travel to the upcoming meeting in Lawrence.

An applicant must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author of a paper or poster to be presented. An applicant must include in the application package:

1) a letter signed by his/her major advisor or departmental chair that states: he/she is currently an undergraduate or graduate student and that he/she is not completely funded for travel from another source;

2) an official copy of the poster or paper abstract to be presented;

3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Travel Awards Committee are excluded from applying for a travel award.

APPLICATIONS MUST BE POSTMARKED BY 15 MAY 1996. Award recipients will be notified by early June 1996 and award checks will be dispersed at the meeting. Send applications to: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; Tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

About Our Cover

Sauromalus hispidus is one of four endemic species of chuckwalla lizards found on islands in the Gulf of California, México; the others are *S. klauberi, S. slevini*, and *S. varius* (Hollingsworth 1995. M.A. thesis, San Diego State University). Each of the latter three species is restricted to a single island, but *S. hispidus* occurs on 11 islands throughout the Isla de la Guarda archipelago, the Isla San Lorenza group, and numerous small islands within the Bahía de Los Ángeles (Grismer, Beaman, and Lawler 1995. Cat. Amer. Amphib. Rept. 615:1–4). Its occurrence on relatively widely distributed islands of varying ages and geological origins (Grismer 1994. Herpetol. Nat. Hist. 2:17–40) has led to speculation that much of its distribution is the result of aboriginal introductions as a food source (Aschmann 1959. The Central Desert of Baja California, Demography and Ecology. Manessier Publ. Co., Riverside, California; Case 1982. *In* G. M. Burghardt and A. S. Rand (eds.), Iguanas of the World: Their Behavior, Ecology, and Conservation, pp. 184–212. Noyes Publ., Park Ridge, New Jersey).

Much of our knowledge of the life history and ecology of *Sauromalus hispidus* comes from the work of Case (1982, *op. cit.*; 1983. *In* T. J. Case and M. L. Cody (eds.), Island Biogeography in the Sea of Cortez, pp. 159–209. Univ. California Press, Berkeley). This species is rather widespread on the islands in the Gulf, although it prefers rocky areas where adults take refuge in self-constructed burrows at the base of rocks. Individuals are commonly observed feeding on vegetation growing in nearby arroyo bottoms and groups of 8–10 can be seen feeding at a single site. Juveniles have been observed up to 3 m above ground feeding on the fresh blossoms of palo verde trees.

One of the most striking features of *Sauromalus hispidus* and *S. varius* is their very large adult size, with snout-vent lengths reaching 317 mm in the former (Case 1982, *op. cit.*; Hollingsworth, *op. cit.*). Case considered these species to be examples of insular gigantism, resulting from a seasonally abundant food supply and the absence of predators. Conversely, Grismer et al. (*op. cit.*) postulated that large body size was primitive for *Sauromalus* and that small body size was the evolutionarily derived condition (i.e., chuckwallas went from big to small). This is supported by additional phylogenetic, morphological, and behavioral correlates presented by Hollingsworth (*op. cit.*).

Unfortunately, like other endemic Gulf-island reptiles, *Sauromalus hispidus* is beginning to appear in the illegal pet trade (Mellink 1994. Herpetol. Nat. Hist. 3:95–99). The impressive size and generally docile nature of these lizards makes them attractive pets, and their ease of collection makes them simple targets for reptile smugglers in Baja California.

The cover photo was taken by **L. Lee Grismer**, associate professor of biology at La Sierra University in Riverside, California. Lee's research on the systematics and biogeography of the amphibians and reptiles of Baja California has spanned nearly 20 years and resulted in over 40 publications. His just-completed book (*Amphibians and Reptiles of Baja California and the Sea of Cortes: A Guide to their Identification, Distribution, and Natural History*) will be published by the University of Arizona Press. Grismer's photo (using a Nikon N90S camera and 17mm wide angle lens with Kodachrome 64 film) was taken from the crest of the southern end of Isla San Lorenzo Sur overlooking the Gulf of California and the adjacent peninsula of Baja California.

Separation and imaging of Grismer's photo is the work of **Jim Bridges** of Herpeto Inc., Hollywood, Florida, USA.

Items Needed for SSAR Auction

Joe Collins will be conducting the SSAR auction during the annual meeting at the University of Kansas in July 1996. All proceeds from the auction go to the SSAR treasury, and help to continue the production of diverse publications and services which has made the SSAR the largest professional herpetological society in the world. Items of value as well as those that lend themselves to humor are always welcome. Joe is skilled at removing large quantities of cash from auction participants through the judicious use of beer and plastic. Anyone wishing to donate auction items in advance should send them directly to: *Joseph T. Collins, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454 USA.*

New SSAR Conservation Committee Page on WWW

The Conservation Committee has prepared a page of links to major conservation interest-groups, both herpetological and general. Rather than duplicating (or plagiarizing!) the work of others, we have attempted to link readers to pages that, in turn, provide often extensive directories of conservation sites and of available LISTSERVs.

The page was initiated at the urging of SSAR Conservation Committee Chair C. Kenneth Dodd, Jr. (e-mail: kdodd@nervm.nerdc.ufl.edu) as a general resource for the herpetological community. It was compiled by George Pisani (e-mail: gpisani@falcon.cc.ukans.edu) and Breck Bartholomew (e-mail: Herpbooks@sisna.com) using WAIS searches on a variety of topics. We do not represent this list as being all-inclusive, and welcome suggestions from readers for additions or deletions.

To access the page, use the CONSERVATION button on the SSAR home page (http://falcon.cc.ukans.edu/~gpisani/SSAR.html).

NEWSNOTES

Roger Conant Honored

On 15 July 1995, Roger Conant received the Nature Educator of the Year Award of the Roger Tory Peterson Institute of Natural History in Jamestown, New York. The presentation was made by the dean of birders himself, Roger Tory Peterson, at the institution founded in his hometown. The award is given annually to a person of national importance whose lifework has influenced young people in a manner consistent with the mission of the Institute: to inform society about the natural world through the study and teaching of natural history.

On 1 June 1996, Conant will receive the David S. Ingalls, Jr. Award for Excellence from the Cleveland Museum of Natural History. This award honors a person who has excelled in research, conservation, or education in a discipline of natural science represented in the Museum's collections. The individual chosen must have made a major contribution that is recognized by the national and international scientific communities. The previous winners of the Ingalls award are Stephen Jay Gould (1993), Roger Tory Peterson (1994), and Edward O. Wilson (1995). The award ceremony will be open to the public. For details please contact the Museum (Tel. 216-231-4600) or the Northern Ohio Association of Herpetologists (Tel. 216-254-3006).

WANTED
COLOR SLIDES OF HERPS FOR WEST INDIES BOOK

A COLOR FIELD GUIDE TO THE 632 SPECIES OF AMPHIBIANS and reptiles in the West Indies is "in progress" and will be published by SSAR (probably in 1997 or 1998). All profits from the sale of the book will go to the society. Color slides of about 500 species have been taken, and some additional species will be photographed during the next year. However, it is hoped that slides of some of the "missing species" can be obtained by generous loans from colleagues. Below is a list of the species for which slides are needed.

If you have slides of one or more of the species listed below, please contact the author, Blair Hedges, at sbh1@psuvm.psu.edu (tel. 814–865–9991; fax 814–865–9131; Department of Biology, 208 Mueller Lab, Penn State University, University Park, PA 16802). An indication of the quality of the image would be helpful. For the non-endemic West Indian species, mainland specimens are fine. White backgrounds are preferred, and for anoline lizards, closeups of head with extended dewlap are needed in addition to full body shots; but any publishable photograph is welcome. After information on slide availability is assembled, slides will be requested in early 1997. Unfortunately, no funds are available for the purchase of slides, but loan of needed slides (for one-time use) will be much appreciated and will be properly acknowledged in the book.

Color slides are needed for the following species:

AMPHIBIANS—*Bufo cataulaciceps, B. fluviaticus, B. fractus, B. lemur, Eleutherodactylus jasperi, E. karlschmidti, E. lentus, E. lucioi, E. semipalmatus, E. thomasi, E. warreni, Leptodactylus insularum, L. validus.*

REPTILES—*Trachemys decorata, T. decussata, T. stejnegeri, T. terrapen, Amphisbaena fenestrata, Cadea palirostrata, Celestus anelpistus, C. curtissi, C. duquesneyi, C. fowleri, C. hewardi, C. macrotus, C. microblepharis, C. occiduus, Diploglossus montisserrati, Aristelliger cochranae* (Navasa Island endemic), *A. georgeensis, A. hechti, Hemidactylus garnotii, H. palaichthus, Phyllodactylus pulcher, Sphaerodactylus argivus, S. beattyi, S. becki, S. caicosensis, S. cochranae, S. elasmorhynchus, S. kirbyi, S. lazelli, S. levinsi, S. mariguanae, S. microlepis, S. micropithecus, S. nycteropus, S. ocoae, S. parthenopion, S. scaber, S. shrevei, S. underwoodi, S. vincenti, S. williamsi, Thecadactylus rapicauda, Bachia heteropus, Gymnophthalmus pleii, Cyclura carinata, C. cychlura, C. pinguis, Anolis acutus, A. aeneus, A. altavelensis, A. alumina, A. birama, A. concolor, A. cyanopleurus, A. delafuentei, A. desechensis, A. ernestwilliamsi, A. extremus, A. fairchildi, A. ferreus, A. fugitivus, A. griseus, A. juangundlachi, A. koopmani, A. longiceps, A. longitibialis, A. luciae, A. marcanoi, A. marmoratus, A. mimus, A. monensis, A. nubilis, A. oculatus, A. paternus, A. pigmaequestris, A. pinchoti, A. richardi, A. rimarum, A. roosevelti, A. roquet, A. rubribarbus, A. rupinae, A. spectrum, A. vanidicus, A. vescus, A. websteri, Ameiva ameiva, A. cineracea, A. dorsalis, A. corvina, A. dorsalis, A. fuscata, A. major, A. polops, Cnemidophorus vanzoi, Kentropyx borckiana, Tretioscincus bifasciatus, Leiocephalus endomychus, L. eremitus, L. herminieri, L. onaneyi, L. pratensis, L. psammodromus, L. rhutidira, L. vinculum, Epicrates chrysogaster, E. exsul, E. gracilis, E. subflavus, Alsophis anomalus, A. rufiventris, A. sanctaecrucis, Arrhyton ainictum, A. polylepis, Chironius vincenti, Clelia erabunda, Coniophanes andresensis, Ialtris agyrtes, I. parishi, Liophis cursor, L. melanotus, L. ornatus, L. perfuscus, Mastigodryas bruesi, Pseudoboa neuwiedi, Leptotyphlops bilineata, L. calypso, L. goudoti, L. tenella, Tropidophis caymanensis, T. greenwayi, T. nigroventris, T. semicinctus, Typhlops catapontus, T. caymanensis, T. epactia, T. gonavensis, T. monensis, T. tasymicrus, T. tetrathyreus, Bothrops caribbaea, B. lanceolata.*

ASIH Symposium Announcement

"Comparisons and Current Uses of Phylogenetic Approaches to Ichthyology and Herpetology" is the tentative title of a symposium to be held at the 77th Annual Meeting of the American Society of Ichthyologists and Herpetologists 25 June–2 July 1997 in Seattle. The co-chairs are Mark Pyron and Robert Espinoza.

It is becoming increasingly evident that incorporating phylogenetically-based methods can be important to studies addressing questions germane to comparative biologists. These methods have also served to reunite diverging fields by providing an important link between evolution and morphology, physiology, behavior, and ecology. Numerous phylogenetic approaches are now available to comparative biologists. However, it is not always apparent which approach is the most appropriate for a given study. Furthermore, debate continues to erupt on the theoretical, statistical, and practical soundness of many of the currently used techniques.

This symposium will address these issues by drawing on both theoretical and empirical studies from the fields of ichthyology and herpetology. We anticipate that the diversity of speakers and topics presented will promote a critical evaluation of the merits and limitations of comparative methods in current use.

If you have any questions regarding the symposium, contact MP for fishes (pyron@uiuc.edu) or RE for herps. *Robert E. Espinoza, Department of Biology, University of Nevada, Reno, Nevada 89557-0015, USA. Tel. (702) 784-4565; Fax (702) 784-1369; e-mail: espin_r@unr.edu.*

MEETINGS

Third World Congress of Herpetology

The Third World Congress of Herpetology will be held on 2–10 August 1997 in Prague, Czech Republic, hosted by the Academy of Sciences of the Czech Republic and the Czech Herpetological Society. The country, known by its amphibians of the Carboniferous and Permian ages, some of them related to the oldest reptiles, others close to the ancestors of frogs, and by the Tertiary anurans with their astonishingly well-preserved tadpoles, is in the center of Europe. Thus, the place is easily accessible from all parts of the World. This, together with low costs for high quality convention facilities (the Czech Republic is among the fast developing post-communist countries successfully transforming its economy) is why we expect that the individual costs will be kept at a very low level. Moreover, organizers want to encourage student participation by a reduced student rate. Attendance is expected to be large (at least 1300 delegates).

The program of the Congress will cover all fields of herpetology, both contemporary taxa and fossils, and emphasize an interdisciplinary approach. All scientific activities presented to the Congress will be defined as scientific problems, not as methods. The Congress should provide a platform for meetings and discussions of neo- and paleoherpetologists and, as a consequence, help to remove the border which still exists here and there between the people interested in contemporary and extinct amphibians and reptiles.

The organizers' intention is to prepare the Congress in agreement with the original aim of such scientific meetings which was to enable people to present their own results and to expose these results to immediate verbal discussion. Consequently, the main part of the Congress will be filled with contributed talks arranged in monotopic symposia. Additionally, there will be some specialized symposia and round tables organized in advance by those people who want to promote discussions on certain topics. There also will be two poster exhibitions with 400 posters each. Also the posters will be grouped by topic. To accommodate the expected number of contributions, it is expected that the program will run in ten concurrent sections, in halls with capacities from 50 to 300 seats. This will provide for 720 talks, each 20 minutes long. The Congress will begin and conclude with six (3 + 3) plenary lectures. Innovative, provocative, non-conforming, and hence stimulating research are the criteria for the selection of these speakers. Proposals should be submitted to the Congress Director (see below) who will transmit them to the Scientific Programme Committee.

The Congress will feature both scientific and social events. There will be evening programs including a concert of old Czech music, a beer party in a brewery dating back to 1499, and a steamer cruise on the Vltava River. The Congress program will be divided by one-day professional field excursions. Several itineraries will be prepared, to meet interests of both neo- and



Some of Prague's street signs are associated with herpetology. During the 14th century there was a lot of building in Prague, and the labeling of houses became absolutely indispensable. These plaques were so important that the house owners got their nicknames after them—"Janek from the Golden Snake" or "Simon from the Green Frog." They were used until 1770, when, in spite of protests by Prague councillors, the houses were given numbers.



paleoherpetologists. Notable are the large areas that have served from the 18th century until 1991 (when the Soviet army left the country) for military exercises (the largest tank shooting range in Europe). As these areas were not affected by agriculture during the past 200 years, the ecosystem evolved there only by natural succession. This has resulted in surprisingly high population densities of amphibians and reptiles.

Prague is one of those rare cities whose more than thousand-year history is preserved in its architecture and beautiful scenery, which is why it was included in the World Heritage List. The appointed CBT Travel Agency prepared a wide variety of half-day and full-day tours for accompanying persons, to present the rich historic background, folklore, and cultural treasures, not only in Prague but in the whole country. The post-Congress tours will include a nine-day excursion to Central Asia, which will provide opportunities to see historical sites and to watch splendid animals. Another tour ("Paleo-herps of Central Europe") will cover shorter distances but allow in-depth examination of the history of amphibians and reptiles. Participants will see, among others, ichthyosaur embryos, plesiosaurs, crocodiles, pterosaurs, and many other Mesozoic reptiles (also several *Archaeopteryx* specimens) in the most famous museum exhibitions in Bavaria.

There will be also some other activities associated with the Congress, for instance the exhibition "Evolution of Central European Herpetofauna" in the National Museum, 6th International Symposium on Pathology of Reptiles and Amphibians organized by the University of Veterinary and Pharmaceutical Sciences in Brno, exhibition and sale of scientific books by publishing houses and antiquarian bookdealers from all around the world.

During September 1995, the First Announcement and Preliminary Registration Form were distributed. For those wishing to receive this material, please send your request to either of the persons listed below. To determine if you are already on the WCH mailing list, check the Congress World Wide Web page (www.gli.cas.cz) or their mail server (wch-source@gli.cas.cz). On these Internet addresses, one may also find names of persons already registered. During June and July 1996, the Call for Papers and Registration Form will be distributed, but only to respondees to the First Announcement. *The deadline for receipt of abstracts will be 1 January 1997.* Presenters and their titles will be listed on the Internet after January 1997. For those who want to see Congress Abstracts in advance, these will be available on 3.5-inch diskettes by the end of March 1997.

Arrangements for the Third Congress of Herpetology are well advanced. However, the Congress cannot be successful without participants. Only they will fill it with an interesting and attractive program. So keep in mind that there are some enthusiasts in Prague prepared to do all they can to make your visit to Prague a wonderful experience.

Contacts.—For scientific aspects (program, abstracts, professional field excursions, collecting permits): Zbynek Rocek, Congress Director, Department of Paleontology, Geological Institute, Academy of Sciences, Rozvojová 135, 165 00 Praha 6 - Suchdol, Czech Republic. Tel. (++42-2) 24311421; Fax (++42-2) 24311578; e-mail: rocek@gli.cas.cz.

For technical aspects (registration fees, transportation, accommodation, accompanying persons program, post-Congress tours, conditions for trading activities, general inquiries, tours and excursions): Third World Congress of Herpetology, c/o Czech Medical Association J.E. Purkyne, Congress Department, P.O. Box 88, Sokolská 31, 120 26 Praha 2, Czech Republic. Tel. (++42-2) 296889 or (++42-2) 249151195; Fax (++42-2) 294610 or (++42-2) 24216836.

Prepared by Zbynek Rocek

Meetings Calendar

20–23 March 1996—Society for Northwestern Vertebrate Biology Annual Meeting, LaSells Stewart Conference Center, Corvallis, Oregon, USA. The meeting will include a one-day training workshop on amphibians and reptiles of the Pacific Northwest, a monitoring symposium, sessions on herpetology, mammalogy, and ornithology, and a live animal display of herps of the PNW. For additional information contact Janet Jones, Treasurer, SNVB, 4820 Yelm Hwy SE, Suite B-175, Olympia, Washington 98503, USA. Tel. (360) 753-7663.

12–14 April 1996—Minton Symposium, Indiana Academy of Sciences, Indiana University/Purdue University Conference Center, Indianapolis, Indiana, USA. *Refer to meeting announcement on page 6 for details.*

13 April 1996—All Florida Herpetology Conference, University of Florida, Gainesville, USA. *Refer to meeting announcement on page 6 for details.*

8 June 1996—Northeast Turtles Conference, Lyndhurst, New Jersey, USA. Sponsored by the New York Turtle and Tortoise Society. Tentative date. To obtain confirmation or further details, contact NYTTS at (212) 459-4803 or monitor sci.bio.herp on the Internet for details.

13–19 June 1996—76th Annual Meeting, American Society of Ichthyologists and Herpetologists, together with the 44th Annual Meeting of The Herpetologists' League, New Orleans, Louisiana, USA. Hosted by the University of New Orleans. Deadline for receipt of abstracts 1 April 1996. Contact: Bob Cashner, ASIH

Local Committee Chair, Dept. Biological Sciences, University of New Orleans, New Orleans, Louisiana 70148, USA. Tel. (504) 286-6741; Fax (504) 286-6121; e-mail RCCBS@UNO.EDU.

19–23 June 1996—Annual Meeting, The Society for the Study of Evolution and Society of Systematic Biologists.Washington University, St. Louis, Missouri, USA. SSB Symposium: "Morphological Data in Phylogenetic Analysis: Recent Progress and Unresolved Problems" (John Wiens, Organizer). Contact: Michael Ryan, Department of Zoology, University of Texas, Austin, Texas 78712, USA. Tel. (512) 471-5078. Meeting Web page at http://bio650.wustl.edu.

27–29 June 1996—20th Anniversary Meeting, International Herpetological Symposium. Sheraton Fiesta Hotel, San Antonio, Texas, USA. Focus on the herpetofauna of Madagascar and vicinity. Keynote speaker: W. Ronald Heyer. Banquet speaker: William W. Lamar. Contact: Davis Hulmes, 361 Van Winkle Avenue, Hawthorne, New Jersey 07506, USA. Tel. (201) 427-0768.

24–29 July 1996—39th Annual Meeting, Society for the Study of Amphibians and Reptiles. Hosted by The University of Kansas, Lawrence, Kansas, USA. *Refer to meeting announcement in this issue for details.*

1–5 August 1996—2nd International Conference on the Biology and Conservation of the South Asian Amphibians and Reptiles, University of Peradeniya, Sri Lanka. Contact: Anslem de Silva, Conference Director, Faculty of Medicine, University of Peradeniya, Sri Lanka. Tel. 94-08-88130; Fax 94-08-32572; e-mail: Anslem@Med.Pdn.ac.lk.

20–24 August 1996—2nd International Symposium and World Congress on the Preservation and Conservation of Natural Science Collections: "Natural Science Collections—A Resource for the Future." St. John's College, Cambridge, U.K. Contact: Chris Collins, Natural Sciences Congress '96, Geological Conservation Unit, Department of Earth Sciences, Downing Street, Cambridge, CB 2 3EQ, U.K. Tel. (0223) 62522; fax (0223) 60779.

24–27 August 1996—3rd Annual Conference of the Association of Reptilian and Amphibian Veterinarians, Saddlebrook Resort, Tampa, Florida, USA. Deadline for receipt of abstracts 15 April 1996. Contact: Wilbur Amand, VMD, P.O. Box 605, 1 Smithbridge Road, Chester Heights, Pennsylvania 19017, USA. Fax (215) 387-2165.

19th Annual AFHC

The All Florida Herpetology Conference will be held Saturday, 13 April 1996 at the University of Florida in Gainesville. The Florida Museum of Natural History and Gainesville Herpetological Society co-sponsor the event. Speakers include Al Baldago, Winston Card, Ellen Censky, Indraneil Das, James Dixon, Walter Meshaka, Tom Tyning, and Wayne Van Devender. Other events include a "Seminar in Current Gopher Tortoise Conservation Issues," with speakers Mike Allen, Ray Ashton, Joan Berish, Dick Franz, Grace McLaughlin, and Henry Mushinsky; a reptile egg incubation workshop led by Bill Brant and Eugene Bessette; and a disease diagnostics laboratory conducted by Richard Funk. A live exhibit of Florida herpetofauna is planned, along with a close-up photography workshop. Field trips to the Katherine Ordway Preserve and the Perry Oldenburg Mitigation Park will be held Sunday, 14 April. Herpetological art, supplies, and books will be exhibited for sale, and the traditional evening barbecue and auction round out the evening at the museum. To preregister, call or write: *David L. Auth, Division of Herpetology, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA. Tel. (904) 392-1721.*

SYMPOSIUM IN HONOR OF DR. SHERMAN A. MINTON, JR.
12–14 April 1996, Indianapolis, Indiana

The Indiana Academy of Sciences is sponsoring a Symposium in April of 1996 in honor of **Sherman A. Minton, Jr**. on the occasion of the publication of his revision of the *Amphibians and Reptiles of Indiana*. The symposium will be held 12–14 April 1996 in Indianapolis at the Indiana University/Purdue University Conference Center. Dr. Minton is well known for his work on venomous reptiles, the reptiles of Pakistan, the regional herpetology of the Midwest, and popular books on herpetology.

The Symposium will include a Friday evening (12 April) dinner featuring **Whit Gibbons** as the after dinner speaker. The morning program of the Saturday Conference (13 April) will focus on Minton's career with talks by **Carl Gans** (reptiles of Pakistan), **David Hardy** (pitviper bites), **Bernard Bechtel** (abnormalities in reptiles), and **Harold Voris** (venomous sea snakes). The afternoon session will focus on "Hoosier Herpetology" and the publication of Minton's revision of his classic monograph on the herpetofauna of Indiana; biologists working on the amphibians and reptiles of Indiana will present brief overviews of their research and provide a perspective on herpetological research in Indiana today. There will be optional field trips on Sunday (14 April).

For registration information, contact: Harriet A. Rodenberg (Minton Conference), University Place, Conference Center and Hotel, 850 West Michigan Street, Indianapolis, Indiana 46202-5198, USA. Tel. (317) 274-5053; Fax (317) 274-3878; e-mail: hrodenbe@indycms.iupui.edu.

Field Assistant in Arizona

Field Assistant is needed in southeast Arizona 1 July–15 November 1996 for rattlesnake capture-recapture and tissue-sampling study ($1200/mo and worker's compensation coverage). Applicants should be familiar with capture and (museum) preservation techniques for both reptiles and rodents. The successful candidate must be able to readily identify all reptiles and rodents found in SE Arizona upon arrival. A vehicle is required—preferably a small truck or larger. A small camper with bed, stove, and refrigerator is provided.

Long hours and no time off—every day is a work day. NO collecting for personal reasons allowed, on or off site. I need hard workers who will dedicate themselves to the project and to careful and precise collection and recording of data. Send cover letter, two letters of recommendation from biologists, and curriculum vitae or resume to: *Andy Holycross, ASU Zoology Dept., Tempe, Arizona 85287-1501, USA*. 30 April 1996 application deadline. Please direct questions/inquiries by e-mail (holycow@asu.edu) or telephone (602-965-3571).

LETTERS TO THE EDITOR

To Stipple, Not to Stab

YEHUDAH L. WERNER
Department of Evolution, Systematics and Ecology
The Hebrew University of Jerusalem, 91904 Jerusalem, Israel
e-mail: yehudahw@vms.huji.ac.il

Tucker (1995) argues that species-range maps that contain actual locality-record points should not additionally show the hypothetical overall range ("stippling"). His concern is that hasty readers might overlook the author's explanations, and conclude from the map that the species occurs at points where really it is absent; this could lead to erroneously ascribing continuity to some populations which in fact are disjunct and merit conservation.

Tucker's concern is justified and his conclusion on methodology is legitimate, though below I shall beg to differ. Nevertheless, I feel that the way he presented his case calls for certain comments.

(a) Tucker (of the Illinois Natural History Survey) speaks of the field-guide level of literature (tertiary literature) but selects for his example of potentially misleading stippling the 1961 monograph of Smith (of the Illinois Natural History Survey). After 34 years this work may be unknown to many readers. It was decidedly not a field guide; it was a research report and defined as such (primary literature). This changes the target readership and the forecast of abuse of the maps.

(b) Smith (1961) only hatched the overall range, within Illinois, for those species which do not occur throughout the state. He did not hatch the maps of species which he believed to occur state-wide. Thus his map for *Rana catesbeiana* (Fig. 83, p. 97) looks just as Tucker wishes. There are some records in most counties but a two-county-wide latitudinal belt from Rock Island and Mercer to Will and Kankakee counties lacks records. So here Tucker's hasty reader, unless he peruses the text, will walk away not knowing that in the author's opinion this discontinuity was insignificant.

(c) Although Tucker is worried about hasty readers, he himself sets them a trap: his Fig. 1A shows the overall range of *Clonophis kirtlandi* "after Smith, 1961" without locality dots, whereas in fact in the original (Fig. 236, p. 253) these were present. Anybody reading Tucker hastily would gain from his illustration a quite mistaken impression of the work of Smith. It was this figure that triggered my involvement, along with curiousity as to what kind of organism *Clonophis kirtlandi* was.

(d) Speaking of haste, full interpretation of Tucker's note is encumbered by missing references to works mentioned in the text (Johnson 1987; Minton 1972) and a cryptic reference to a "Catalogue of American Amphibians and Reptiles." The introduction of references in the text with "e.g." to say that the author knows of more literature is usually avoided as a matter of course.

(e) Lastly, I contest Tucker's taxonomy of conclusions. He holds that a conclusion on overall range is subjective while subspecific identification of specimens is objective. But surely with a little more work a hypothesis on overall range can be concluded quite objectively, and certainly it is easy (and common) to identify subspecies subjectively.

These comments notwithstanding, Tucker (1995) is right in saying that the style of maps must depend on circumstances and purpose, and hence is wrong in criticizing Smith (1961) and dictating a standard. My colleagues and I have long regarded the Smith (1961) maps as exemplary, as also did Burr and Page (1987). Smith's maps, innovative at the time, distinctly show at a glance both the facts and the author's interpretation. Of course, when hatching is light as in Smith (1961) the situation is clearer than it would be with heavy stippling as in Tucker (1995).

LITERATURE CITED

BURR, B. M., AND L. M. PAGE. 1987. Philip Wayne Smith 1921–1986. Copeia 1987:839–840.

SMITH, P. W. 1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28(1):vi+298 pp.

TUCKER, J. K. 1995. To stipple or not to stipple. Herpetol. Rev. 26:88–90.

CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: herpbooks@sisna.com. Comments and suggestions are also welcome.

Population Dynamics

The *Australian Journal of Ecology* recently published a series of papers presented at the Second World Congress of Herpetology, Symposium on Population Dynamics.

SINSCH, U., AND D. SEIDEL. 1995. Dynamics of local and temporal breeding assemblages in a *Bufo calamita* metapopulation. Aust. J. Ecol. 20(3):351–361.

JEHLE, R., W. HODL, AND A. THONKE. 1995. Structure and dynamics of central European amphibian populations: A comparison between *Triturus dobrogicus* (Amphibia, Urodela) and *Pelobates fuscus* (Amphibia, Anura). Aust. J. Ecol. 20(3):362–366.

BELL, B. D., AND A. P. BELL. 1995. Distribution of the introduced Alpine newt *Triturus alpestris* and of native *Triturus* species in north Shropshire, England. Aust. J. Ecol. 20(3):367–375.

TINSLEY, R. C., AND K. TOCQUE. 1995. The population dynamics of a desert anuran, *Scaphiopus couchii*. Aust. J. Ecol. 20(3):376–384.

BERVEN, K. A. 1995. Population regulation in the wood frog, *Rana sylvatica*, from three diverse geographic localities. Aust. J. Ecol. 20(3):385–392.

BULL, C. M. 1995. Population ecology of the sleepy lizard, *Tiliqua rugosa*, at Mt. Mary, South Australia. Aust. J. Ecol. 20(3):393–402.

BRUCE, R. C. 1995. The use of temporary removal sampling in a study of population dynamics of the salamander *Desmognathus monticola*. Aust. J. Ecol. 20(3):403–412.

Tuatara Conservation

Cree et al. compare evidence for successful reproduction of tuatara in the presence or absence of introduced Pacific rats. On two rat-free islands, 22–31% of all tuatara captured were juveniles or small adults, whereas juveniles were not seen on five of the six rat-inhabited islands and small adults were absent from three. Plasma concentrations of sex hormones suggest that at least

some adults of both sexes remain reproductively active on most islands.

CREE, A., C. H. DAUGHERTY, AND J. M. HAY. 1995. Reproduction of a rare New Zealand reptile, the tuatara *Sphenodon punctatus*, on rat-free and rat-inhabited islands. Conserv. Biol. 9(2):373–383.

Pit Vipers in Ecuador

Kuch and Freire recently published a series of papers on the distribution and morphology of some equatorial pit vipers. Two of the papers contain dot-distribution maps for the species in Ecuador.

FREIRE, A. AND U. KUCH. 1994. A note on the geographical distribution of *Bothrops asper* (Garman, 1883) in Ecuador. Snake 26(2):135–139.

KUCH, U. AND A. FREIRE. 1995. Bemerkungen zur geographischen verbreitung und variabilität von Schlegels palmen-lanzenotter, *Bothriechis schlegelii* (Berthold, 1846), in Ecuador (Squamata: Serpentes: Viperidae) [Notes on the geographical distribution and variation of the eyelash palm-viper, *Bothriechis schlegelii* (Berthold, 1846) in Ecuador (Squamata: Serpentes: Viperidae)]. Herpetozoa 8(1/2):49–58.

KUCH, U. AND A. FREIRE. 1995. Notes on morphology, reproduction and medical importance of the poorly known small-eyed lancehead, *Bothrops microphthalmus* Cope, 1876, in Ecuador (Squamata: Serpentes: Viperidae). Herpetozoa 8(1/2):81–83.

North American Trionychid Systematics

Gardner et al. examined trionychid fossils from the Judith River Group as well as extant species of North American trionychids using cladistic methods. Their analysis supports the referral of three fossil species to the new genus *Aspideretoides* and one to *Apalone*.

GARDNER, J. D., A. P. RUSSELL AND D. B. BRINKMAN. 1995. Systematics and taxonomy of soft-shelled turtles (Family Trionychidae) from the Judith River Group (mid-Campanian) of North America. Can. J. Earth Sci. 32:631–643.

Liverwort on a Lizard

Gradstein and Equihua discuss the presence of three species of algae and a liverwort growing on the head of a lizard. According to the authors, the epizoic liverwort reported constitutes the first record of a cormophytic plant growing on a living vertebrate.

GRADSTEIN, S. R., AND C. EQUIHUA. 1995. An epizoic bryophyte and algae growing on the lizard *Corythophanes cristatus* in Mexican rain forest. Biotropica 27(2):265–268.

Parareptile Phylogeny

The bizarre specializations of turtles have long hindered attempts to establish their relationships with other tetrapods. Recent advances using cladistic methodology, however, have narrowed the possible hypotheses. Lee presents a phylogenetic analysis of the problem in a recent paper. Turtles are first shown to be highly modified survivors of an early radiation of poorly-known amniotes commonly termed "parareptiles." This clade is then subjected to a detailed phylogenetic analysis. The choice of traits used in previous cladistic analyses is also discussed.

LEE, M. S. Y. 1995. Historical burden in systematics and the interrelationships of 'parareptiles.' Biol. Rev. 70(3):459–547.

Evolution of Body Size

Among species of *Varanus*, body mass varies by a full five orders of magnitude making this genus ideal for studying the evolution of body size. Pianka plotted the body sizes of extant varanid species on a phylogeny, and probable sizes at ancestral nodes inferred from those of their descendants. Felsenstein's method of phylogenetically independent contrasts, coupled with information on branch lengths, was exploited to identify several likely instances of relatively rapid evolution of body size both, within and between clades.

PIANKA, E. R. 1995. Evolution of body size: Varanid lizards as a model system. Am. Nat. 146(3):398–414.

Prehensile Anuran Tongue

High-speed videography and muscle denervation experiments were used to quantify the feeding kinematics of the African pig-nosed frog. The tongue of this frog "telescopes" straight out, as opposed to "flipping" as in most other frogs. In addition, two lateral lobes of tissue at the tongue tip envelop prey upon contact. These lateral lobes are capable of applying significant pulling forces and the tongue is described as prehensile. The trajectory of the tongue can be adjusted throughout protraction so that the frog can "aim" its tongue in all three directions. The authors propose that the frog uses a hydraulic mechanism to protract its tongue.

RITTER, D., AND K. NISHIKAWA. 1995. The kinematics and mechanism of prey capture in the African pig-nosed frog (*Hemisus marmoratum*): description of a radically divergent anuran tongue. J. Exp. Biol. 198:2025–2040.

Evolution of Viviparity

Shine tests the idea that prolonged uterine retention directly enhances hatchling viability, because eggs incubated at maternal body temperatures produce "better" hatchlings than do eggs incubated at normal nest temperatures. Eggs of two species of montane scincid lizards were incubated under thermal regimes designed to simulate temperatures in nests and maternal oviducts. Hatchling phenotypes (morphology, running speed, and behavior) were substantially affected by incubation temperatures.

SHINE, R. 1995. A new hypothesis for the evolution of viviparity in reptiles. Am. Nat. 145(5):809–823.

Japanese Journal of Herpetology

The Herpetological Society of Japan publishes the *Japanese Journal of Herpetology* quarterly. Papers are published in both English and Japanese with abstracts in both languages. Society dues are ¥ 5,000 per year, plus a registration fee of ¥1,000 for new members. Credit cards (Visa/Mastercard) are accepted. For

more information about the society, write to: Tsutomu Hikida, Secretary, Department of Zoology, Faculty of Science, Kyoto University Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto, 606-01 Japan. Contents for two recent issues of the journal are:

SATO, S., M. KURAMOTO AND Y. ONO. 1994. Morphological variation in *Hynobius naevius* (Caudata: Hynobiidae) in Kyushu, Japan. Japanese J. Herpetol. 15(4):119–125.

KADOWAKI, S. 1994. A preliminary study of the ecology of a Japanese snake community — Species composition over five years. Japanese J. Herpetol. 15(4):126–130.

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ANONYMOUS. 1994. The Second World Congress of Herpetology held at Adelaide, Australia. Japanese J. Herpetol. 15(4):155–163.

GORIS, R.C. 1994. Book Review: Frog-tune in the countryside. Japanese J. Herpetol. 15(4):164.

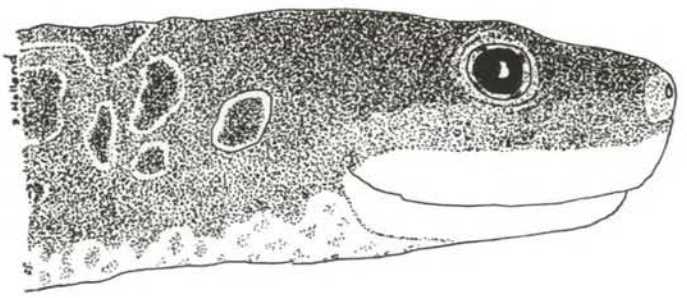
NAKACHI, A. 1995. Seasonal activity patterns of the colubrid snake, *Cyclophiops semicarinatus*, on Okinawajima Island, Ryukyu Archipelago, Japan. Japanese J. Herpetol. 16(1):1–6.

TANAKA, T. 1995. Long-term observations on the molting of a Japanese toad, *Bufo japonicus formosus*. Japanese J. Herpetol. 16(1):7–11.

MATSUI, M., H. OTA, M.W. LAU AND A. BOGADEK. 1995. Cytotaxonomic studies of three ranid species (Amphibia: Anura) from Hong Kong. Japanese J. Herpetol. 16(1):12–18.

USUDA, H. 1995. Waving behavior and its effect on the reproductive behavior of *Hynobius nigrescens*. Japanese J. Herpetol. 16(1):19–24.

Plus several absracts from the 33rd Annual Meeting of the Herpetological Society of Japan.



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ARTICLES

Notes and Corrections on Two Scolecophidians: *Ramphotyphlops albiceps* and *Leptotyphlops brasiliensis*

V. WALLACH
Center for Vertebrate Studies, Department of Biology
Northeastern University, Boston, Massachusetts 02115, USA

In a discussion of characters that distinguish the snake genera *Ramphotyphlops* and *Typhlops*, I suggested that *Ramphotyphlops albiceps* might be more correctly considered a *Typhlops* due to the apparent lack of the characteristic *Ramphotyphlops*-like hemipenis (Wallach 1993). Of the six specimens available to me at that time, only a single juvenile appeared to be a male upon dissection. I mistakenly took the undeveloped gonads to be testes (no follicles were visible) and the hollow, striated cloacal glands to be straight *Typhlops*-like hemipenes. Examination of a genuine male (ZMUC R52204 from Similan Island, Thailand) demonstrates my error and confirms that *Ramphotyphlops albiceps* was correctly transferred from *Typhlops* to *Ramphotyphlops* by Hahn (1980). The 136 mm male has 20 midbody scale rows, 307 middorsals, 17 subcaudals, and a 6 mm tail. Relative tail length is 4.4% total length as compared with a mean of 1.6% in seven females (range = 1.3–2.0%). Both coiled hemipenes and retrocloacal sacs are present. The hemipenis exhibits 3.5 coils in the retracted state and the retrocloacal sacs are tapered, 0.25 mm in diameter, and 2.5 mm in length (= 2% SVL).

Rodrigues and Puorto (1994) recently described what they believed was the second known specimen of *Leptotyphlops brasiliensis* (IB 50.436) from Barreiras, Bahia, Brazil. They mentioned in passing a specimen cited by Peters and Orejas-Miranda (1970) from Barrieras (= Barreiras), Bahia, Brazil, but discounted its validity by stating that it had been "ignored in the subsequent literature." Orejas-Miranda (1967) purported the species to be known solely from the holotype and Vanzolini et al. (1980) doubted the report of *L. brasiliensis* by Cordeiro and Hoge (1974), which Rodrigues and Puorto (1994) showed to be a misidentified *L. albifrons*. However, the Peters and Orejas-Miranda (1970) record was based on an actual specimen, one that was further documented by Lang (1990), and constitutes the second valid record of *L. brasiliensis*. The specimen described by Rodrigues and Puorto therefore represents the third known specimen of the species.

The second known specimen was collected by J. R. Bailey and A. L. de Carvalho on 21 March 1942 at Barreiras, Bahia, Brazil. It is deposited in the Museum of Zoology at the University of Michigan (UMMZ 108817). I examined the specimen in 1988 and can provide the following data from my brief notes: it is a female with tan dorsum and cream venter; total length 272 mm; midbody diameter 5.5 mm; body diameter contained in total length 46.2 times; snout-vent length 254 mm; tail length 18 mm; tail/total length = 6.6%; 14 longitudinal scale rows; 10 midtail scale rows; 211 total middorsals; 15 subcaudals; three supralabials (two preocular and one postocular); prefrontal, frontal and interparietal small and not broader than long; supraoculars absent; both parietals and occipitals transversely enlarged.

The visceral topography can be described as follows (% = % SVL, MP = midpoint): trachea (19.7%, MP = 10.6%) containing about 150 rings (or 76/10% SVL) with moderate tracheal membrane expansion (TM/CR = 0.25 at midneck, 0.50 posteriorly); left lung complex absent; tracheal entry terminal; right lung unicameral and long (37.4%, MP = 39.2%), vascularized to caudal tip at 57.9%, with dense faviform parenchyma (3 tiers deep) along cranial 11.4% and sparse edicular parenchyma along caudal 26.0%; right bronchus long (17.3%), extending 0.46 of the length of the right lung with type G foramina located between the tips of adjacent rings; heart elongate and large (5.5%, MP = 17.7%); junction of right and left systemic arches craniodorsad of ventricular apex by 4.7%; heart-liver gap long (8.7%); liver moderate (35.4%, MP = 46.9%), asymmetrical only cranially with right liver extension 0.21 of liver length; liver-gall bladder interval moderate (36.2%); posterior tips of liver overlap gall bladder (liver gall bladder gap –0.4%); gall bladder (MP = 64.8%) adjacent to and between cranial spleen and caudal pancreas; right kidney (3.5%, MP = 78.9%) shorter than left (3.9%, MP = 82.3%); both kidney-vent interval (22.8%) and kidney-vent gap (15.7%) long; enormous rectal caecum twice the diameter of adjacent small intestine and twice the length of that of any other known snake (9.8%).

Mean statistics (plus range parenthetically) for the three known specimens of *L. brasiliensis* are 257.7 mm total length (248–272 mm), 209.3 total middorsals (207–211), 15.3 subcaudals (15–16), length/width ratio 45.0 (38.2–50.6), and relative tail length 6.6% (6.3–6.9%). As the two Barreiras specimens possess three supralabials in contrast to two in the type specimen, it is possible that the type is aberrant for that character and that the diagnosis of *L. brasiliensis* should include "three (rarely two) supralabials." The holotype of *L. brasiliensis* (IRSNB 2049) originated from an unknown locality in Brazil. Since the two specimens with specific locality data (collected 45 years apart) are both from Barreiras, I restrict the type locality of *Leptotyphlops brasiliensis* to Barreiras, western Bahia, eastern Brazil, ca. 12°S, 45°W.

Acknowledgments.—I thank J. B. Rasmussen for the loan of the *Ramphotyphlops albiceps* that settles the question of proper generic assignment of the species *albiceps*, and Arnold G. Kluge (UMMZ) for hospitality offered in 1988 during my visit to the museum and for permission to dissect the *Leptotyphlops* reported on here.

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Cnemidophorus univalens Kraemer, 1989: An Erroneous Subsequent Spelling without Nomenclatural Status

JAMES M. WALKER
Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA

HOBART M. SMITH
Department of EPO Biology, University of Colorado, Boulder, Colorado 80309, USA

and

JAMES E. CORDES
Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA

Within the published symposium, *Is the Organism Necessary?*, presented at the 1987 meeting of the American Society of Zoologists, is an interesting and amusing reference to several real and imagined parthenogenetic species of *Cnemidophorus* by Kraemer (1989), not a herpetologist. To find several paragraphs on *Cnemidophorus* in this symposium by this author was unanticipated to say the least. Kraemer and Walker were colleagues in the same department at the University of Arkansas for nearly 30 years and she was one to whom either the highs and lows of working on lizards in the genus *Cnemidophorus* were mentioned many times. Evidently this individual was particularly intrigued by discussions of the controversial subject of pseudocopulation between individuals of the parthenogenetic *C. uniparens* (e.g., Crews and Fitzgerald 1980), for she ventured to publish on this subject (Kraemer 1989) without our knowledge at the time. In fact, the paper only became known to us when a graduate student asked JMW, "Who described *Cnemidophorus univalens*?" Indeed!

Under the sectional heading "*The "case" of* Cnemidophorus uniparens *(Reptilia: Lacertilia)*," Kraemer (1989:1142) announced an intent to discuss neurendocrine system-reproductive system interrelationships and pseudocopulation in *C. uniparens* and *C. laredoensis*. In the second paragraph of this section there appeared the name *C. univalens*, an apparent lapsus for *C. uniparens*. In the third paragraph the name *C. uniparens* reappeared and with it an unflawed discourse to its end. In the fourth paragraph, however, the gremlins wreaked havoc! Kraemer (1989) noted (with literature citations within the quoted material omitted), "Some scientists working on *Cnemidophorus univalens* are concerned that no one has seen male-like or female-like pseudosexual behavior in nature, even though the behavior has been seen by a number of workers, occurring in caged animals.... Others... have noted that many of the captive behaviors seen in the parthenogenetic species (diploid *C. uniparens* and triploid *C. univalens*) have also been seen in gonochoristic species, between females. It can be argued that the very fact that pseudosexual behavior *occurs*, however, may constitute reason for the controversy, and justifies questioning the present status of the neurendocrine basis of such sexual behavior in *C. univalens*."

To set the record straight for herpetologists who should happen upon Kraemer (1989), there is no parthenogenetic species of whiptail lizard named *C. univalens*. It constitutes an "erroneous subsequent spelling" (in the terminology of the International Code of Zoological Nomenclature) of *C. uniparens*, and as such has no nomenclatural status, and is not even a nomen nudum. Moreover, *C. laredoensis* remains diploid and *C. uniparens* triploid, as before.

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TECHNIQUES

Use of Pineal Spot ("Pink Spot") Photographs to Identify Leatherback Turtles

DONNA MCDONALD
Department of Planning and Natural Resources, Division of Fish and Wildlife Lagoon Street Complex, Frederiksted, St. Croix, USVI 00841, USA

PETER DUTTON
Department of Biology, Texas A&M University College Station, Texas 77843, USA

ROBERT BRANDNER
and
SUSAN BASFORD
4241 N. Houghton Road, Tucson, Arizona 85749, USA

Identification of individual sea turtles is crucial to developing biological profiles on these endangered species. Flipper-tagging with metal tags is the method most widely used by sea turtle biologists; tag loss on many nesting beaches is high, however. In St. Croix, U.S. Virgin Islands, the majority of flipper tags on leatherback turtles (*Dermochelys coriacea*) persists for only three to four years (McDonald and Dutton 1994), and only 50–60% are retained through the first remigration (i.e., the first nesting season following tagging) (McDonald and Dutton, *in press*).

One external characteristic unique to each adult leatherback turtle is a pink spot on the top of the head. Its appearance, including size, shape, color, and pattern appears to be unique to each individual. In 1986, as part of the Leatherback Turtle Research and Conservation Project, researchers began photographing the pink spot of leatherbacks nesting at the Sandy Point National Wildlife Refuge in St. Croix. Photographs were intended to serve as a backup method of identification in case flipper tags were lost. Our study verifies that the appearance of the pink spot is recognizable at the individual level over several years.

Most leatherbacks nesting at Sandy Point were photographed each season from 1987–1994. Because females return to nest every two to five years (Dutton et al. 1994), some individuals have been photographed several times. Six observers examined two sets of photographs: one set of "original," taken in 1987 or 1988, and one set of "subsequent year," taken several years later, for ten individual leatherbacks positively identified by flipper tags. Two of the observers were experienced in studying pink spot photographs ("experienced"); three had worked with leatherback turtles but had never examined pink spot photographs ("semi-experienced"), and one had never worked with leatherbacks ("novice"). Photos were taken seven years apart for one turtle, six years apart for seven turtles, and five years apart for the remaining two. All identification numbers were concealed. Observers were asked to match each photograph in the "original" set with the same turtle

in the "subsequent year" set. Two photographs that had no matches were included in the "subsequent year" set. Observers who were not 100% correct in the first trial were asked to repeat the experiment once (errors in identification were not pointed out to them). Three observers, including the two "experienced" and the one "novice," correctly identified all pairs in the first trial, and the other three were 80–100% correct by the second trial.

These results verify that the size and shape of most pink spots persist for at least five to seven years, and most individual pink spots are recognizable, even by inexperienced observers. Since the remigration interval for leatherbacks on Sandy Point is 2–5 years, this technique may be used to identify remigrants that have lost all flipper tags.

Pink spots can change in appearance, however. All six observers had difficulty matching one of the pink spots due to subtle changes in outline and internal mottling. Camera angle and distance, sand on the turtle's head, glare from the camera flash, and new scars can also affect the appearance of the pink spot. When a turtle is photographed, its head should be free of sand, and the camera angle and distance should be standardized. This method will be most useful for populations in which most (ideally all) individual turtles can be photographed at least once during each nesting season over three to four seasons. Because photo identification is not 100% reliable, and some turtles do not always return to the same beach to nest, this technique should serve as a supplement, not a replacement, for the use of flipper tags.

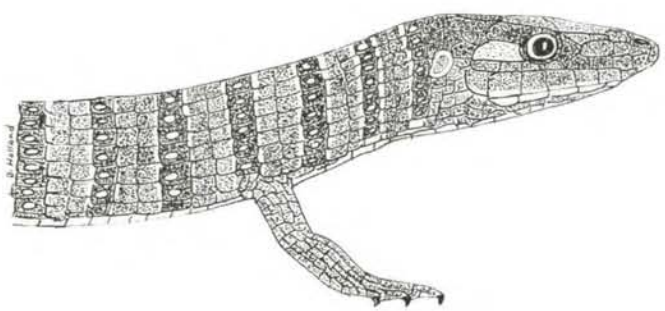
Acknowledgments.—The Leatherback Turtle Research and Conservation Project, Virgin Islands Department of Planning and Natural Resources, Division of Fish and Wildlife, is funded by the United States Fish and Wildlife Service, and by Earthwatch and its Research Corps. We thank Mike Evans, Zandy Hillis, Amy Mackay, and James Rabholz for participating in the study.

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A Capture Technique for Small, Smooth-scaled Lizards

RICHARD D. DURTSCHE
Department of Zoology, University of Oklahoma
Norman, Oklahoma 73019, USA
e-mail: rdurtsche@aardvark.ucs.uoknor.edu

A variety of methods exist for sampling lizards, including pitfall traps, rubber bands, and noosing (Campbell and Christman 1982; Karns 1986; and Simmons 1987); more recently, glue boards (Bauer and Sadlier 1992), refuge tubes, baited lizard sticks (Strong et al. 1993) and extraction hooks (Bedford et al. 1995) have been used. While these techniques are efficient, many are biased toward medium to larger-bodied lizards. Small lizards, including hatchlings and juveniles, and smooth-scaled lizards are often missed or destroyed using these collection methods. Pitfall traps, glue boards, and refuge tubes all rely upon lizards (regardless of size) encountering them. Noosing small lizards may be ineffective, and smooth-scaled lizards will often slip through the nooses—even those tightened around their bodies.

Faced with the difficulty of capturing juvenile *Mabuya unimarginata* (Scincidae) in lowland tropical wet forest leaf litter at the edge of the Rio San Juan in Nicaragua, I combined two partially successful methods into a technique effective for capturing small lizards. By tying a small (8 mm x 30 mm) rectangular piece of "Victor Holdfast® Mouse and Insect Glue Board" (Woodstream, Inc., P.O. Box 327, Lititz, Pennsylvania 17543, USA) to the end of a pole (fishing pole, collapsible car antenna) with two pieces of string (Fig. 1), I created a lizard collecting pole. I use a telescoping car antenna with the sticky pad fastened to the end, and, to increase extension capabilities and usefulness, I use duct tape to secure the antenna to the end of a potato rake (Fig. 1). This allows me to move objects such as rocks and logs to uncover lizards which can then be captured with the sticky pad. Simply touching the sticky pad to the back of the lizard allows for easy capture of these small, delicate, reptiles. Corn oil, applied to the skin, frees lizards from the sticky pad (Bauer and Sadlier 1992); specimens can then be marked, measured, and released with no apparent ill effects. The non-stick, peel-away, cover sheet on the glue boards is replaceable, keeping dirt and litter off

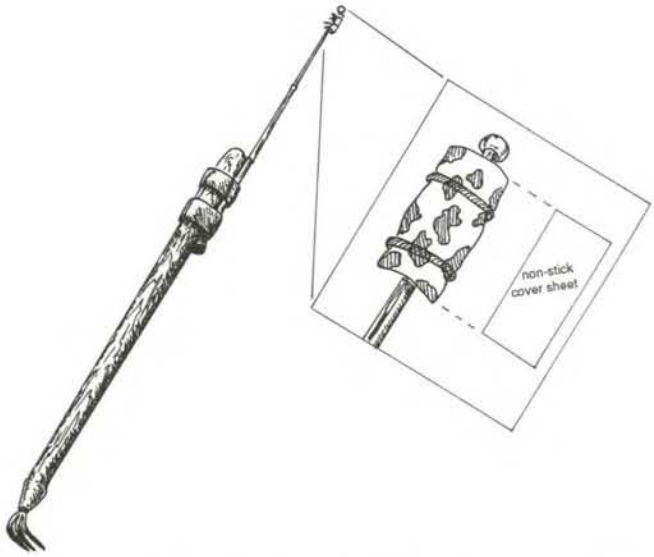


FIG. 1. Lizard pole and sticky pad with disruptive pattern. The non-stick cover sheet is kept on the glue surface when the pad is not in use.

the sticky pads when not in use. I typically cut several rectangular strips from a glue board and carry them with me in a plastic vial, along with extra string, as replacements.

Because lizards respond to the white background of the sticky pad, I create a disruptive pattern on the sticky pad with black, brown, or green Sharpie® marking pens (Fig. 1). From my experience, this does not affect the holding power of the glue. Lizards occasionally respond to these pads, white or with disruptive coloration, as though they represent a prey item; when contacting the pad, they were stuck, and the more active they became, the more they adhered to the glue strip. I have had several *Norops oxylophus* (Polychridae) try to bite the sticky strip.

While intended for use on small, smooth-scaled lizards,this technique is quite effective for extracting a wide range of small to medium-sized lizards from a variety of different microhabitats. Some species I have collected with this technique include: the polychrids *Norops capito*, *N. carpenteri*, *N. humilis*, *N. limifrons*, *N. oxylophus*, and *N. sericeus*, the scincids *Mabuya unimarginata* and *Scincella lateralis*, the crotaphytid *Crotaphytus collaris*, the phrynosomatids *Sceloporus undulatus*, *S. spinosus*, *Cophosaurus texanus*, and *Urosaurus ornatus*, the iguanid *Ctenosaura pectinata*, and the teiids *Cnemidophorus sexlineatus*, *C. sacki*, and *C. costatus*. Using this method, only lizards with a body mass ≤ 10 g (e.g., *Norops capito*) could be captured; larger lizards are not held by the glue.

This non-destructive technique should enable researchers to successfully obtain live specimens of small species and hatchlings and juveniles of lizards that are otherwise difficult to sample.

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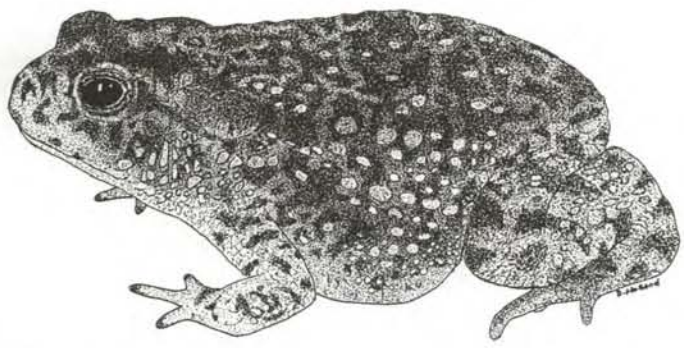
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Bufo microscaphus californicus (Arroyo Toad). USA: California: San Diego Co., San Mateo Creek, Camp Pendleton Marine Corps Base. Illustration by Dan C. Holland.

Tracking Techniques Useful for Field Studies of Anuran Orientation and Movement

BRYAN WINDMILLER
Department of Biology, Tufts University
Medford, Massachusetts 02155, USA

A variety of methodologies is available to field researchers studying the orientation and movement patterns of amphibians. Recapture of marked individuals (Clarke 1974; Oldham 1967; Twitty et al. 1964) and the use of radiotelemetry (Richards et al. 1994; Sinsch 1989; Van Gelder et al. 1986), radioactive tags (Ashton 1994; Kleeberger and Werner 1982; Madison and Shoop 1970; Semlitsch 1981; Williams 1973), and thread bobbins (Dole 1965; Heyer 1994) have been described. The two tracking techniques I describe here, using fluorescent yarn tags and luminescent capsules, offer the advantages of simplicity and low cost, and can be used with anurans too small to track with radio transmitters or thread bobbins. Furthermore, both techniques allow for fine resolution of path orientation, thus permitting the use of circular statistics on ungrouped data (Batschelet 1981).

Fluorescent Yarn Tags.—Fluorescent pigment applied directly to the integument has been used to study the movement of small mammals (Lemen and Freeman 1985), lizards (Fellers and Drost 1989) and turtles (Blankenship et al. 1990; Butler and Graham 1993; Keller 1993). Pigment trails are revealed through the nighttime use of ultraviolet light. Direct application of fluorescent pigment to amphibian skin is problematic, however, as pigment particles adhere strongly to moist amphibian skin and might interfere with trans-cutaneous gas exchange. To circumvent this problem, I applied the pigment to lengths of acrylic yarn and then affixed the yarn to the dorsal skin of juvenile *Rana clamitans* and *R. catesbeiana* as follows: (1) between two and four 100–140 mm lengths of acrylic yarn were cut and arranged in parallel, (2) two 15 mm squares were cut from a roll of self-adhering veterinary bandage material (e.g., Co-Flex™ [available from: Vet Care, Astoria, New York, USA: tel. (800) 767-0508]), (3) one end of each strand of yarn was glued to one of the bandage squares using a few drops of heat-melted glue, (4) the second bandage square was glued onto the first, thus enclosing the yarn ends, (5) the mid-dorsum of the frog was patted dry, and a drop of cyanoacrylate glue was placed on one side of the bandage material which was then pressed onto the frog's skin for one minute, (6) holding the frog securely, the free ends of the yarn were dangled into a plastic bag filled with fluorescent pigment (Radiant Color, Richmond, California, USA: tel. [800] 777-2968) and the pigment was pressed into the yarn. The completed yarn tag weighs between 0.5 and 1 g, depending on amount of yarn, and may be used successfully on juvenile *Rana* as small as 3 g wet weight.

Yarn-tagged frogs were released at predetermined locations, and the release points were marked with fluorescent stake flags inscribed with date, time, toe-clip number of the frog, and color of the fluorescent pigment used. The night following release, fluorescent pigment granules along the frogs' paths were visualized with a long-wave (366 nm) ultra-violet lamp (Blak-Ray™ model ML-49, UVP, Inc., San Gabriel, California, USA) and safety/UV-enhancing glasses. Pigment trails were marked with serially-numbered stake flags placed at 5–10 m intervals and at major turning points. Relocated frogs were affixed with a fresh yarn tag; my observations indicate that re-tagged frogs typically resume their previous heading within 10 m of the release point. The path of the frog was recorded during daylight hours by mapping the stake flags using a tape measure and surveying compass and plotting

the points using CAD software with coordinate geometry capability.

Fluorescent pigment tracking allows determination of the actual paths taken by juvenile ranids for distances up to 150 m, although many trails will become undetectable in less than 50 m. Pigment trail detectability is influenced by ambient light, substrate texture, amount of pigment applied to the yarn tag, and pigment color (blue pigment generally produces the faintest trails, chartreuse produces the brightest). Yarn tags are easily removed by gentle pressure; approximately 30% of marked frogs shed their yarn tags before the resulting trail became undetectable and all tags fell off in the field within 1–2 days. The skin at the point of tag attachment showed some temporary discoloration after tag removal but no lesions were observed; frogs maintained in captivity following fluorescent pigment-tagging showed no apparent ill effects. No tagging-related mortalities were recorded among the 55 frogs released with pigment-coated yarn tags.

Luminescent Capsules.—The second tracking methodology is visual observation of frogs affixed with luminescent capsules. Clark and Gillingham (1984) glued small tubes filled with Cyalume™ fluid (American Cyanamid Co., Wayne, New Jersey, USA) to the backs of anoles to observe nocturnal behavior. This technique may be adapted for use with frogs by extracting luminescent long-duration Cyalume™ fluid from the manufacturer's tube, half-filling an Eppendorf micro-centrifuge tube with the fluid, and then sealing the package securely with the tube's cap. Luminescent capsules may be individually marked using a laboratory marker, glued onto squares of self-adhesive bandage material, and glued to the frogs' dorsal skin as described above. Depending upon the size of the subject, 0.5 ml or 1.5 ml Eppendorf tubes (with final package weights between 0.8 g and 1.9 g) may be used. Luminescent capsules as small as 0.5 g may be made as follows: (1) cut off and keep the cap from a 0.5 ml Eppendorf tube, (2) cut the tube in half transversely, keeping the half with the pointed tip, (3) partially fill the half-tube with Cyalume™ fluid, (4) dip the cap in melted paraffin to ensure a tight seal, and (5) securely seal the half-tube with the cap. It is critical that researchers using this technique ensure that the Eppendorf tubes are well sealed; skin contact with Cyalume™ fluid is fatal to *Rana catesbeiana*, and possibly to other species. Toxic effects can sometimes be reversed if the affected animals are promptly rinsed with copious amounts of cool water.

Luminescent capsules allow simultaneous release, observation, and recapture of groups of 10–60 frogs at two or more release sites; sub-groups of frogs may be distinguished through use of different colors of Cyalume™ fluid. I released the frogs after nightfall in open areas, observed movements over a 2–4 h period, and then recaptured the frogs, marking the final location of each individual with a fluorescent stake flag and taking bearings from release point to recapture point with a surveying compass. Depending upon vegetation density and ambient light, frogs may be visible at distances up to 80 m. Luminescent capsules may be removed with gentle pressure, and the frogs could then be used as paired controls if released later at a different location. About 10% of the capsules fell off the frogs soon after release. Best results are obtained when the capsules are affixed to the frogs in the laboratory prior to transporting them to the release site. Long-lasting Cyalume™ fluid remains bright for at least 12 h.

By determining the actual path taken by anurans, the fluorescent yarn tag method allows the researcher to visualize and test the relationship between path orientation and the spatial distribution of small-scale environmental variables, such as topography, and substrate type. Single paths recorded in the manner described can be analyzed for linearity and for elementary orientation mechanisms by the analysis of turning angles (Benhamou and Bovet 1992). Tracking with luminescent capsules allows the researcher to simultaneously observe the movement of many anurans from a distance and to record such phenomena as the influence of conspecifics on path choice.

Note.—Researchers should exercise care in applying cyanoacrylate glues to the skin of species other than *Rana catesbeiana* and *R. clamitans*. I have observed that cyanoacrylate glues cause severe, and occasionally fatal, skin lesions when applied to spotted salamanders, *Ambystoma maculatum*.

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HERPETOLOGICAL HUSBANDRY

Incidence of Bites from Venomous Reptiles in North American Zoos

WINSTON CARD
and
DAVID T. ROBERTS
Department of Herpetology, Dallas Zoo
621 East Clarendon Drive, Dallas, Texas 75203, USA

Some effort has been made to develop and encourage improved techniques for handling venomous reptiles in zoos (Boyer and Murphy 1994; Gillingham et al. 1983; Hardy 1992; Minton 1994; Mitchell 1984; Murphy 1971; Quinn and Jones 1974; Radcliffe 1975; Reinert and Bushar 1991; Walczak 1991). However, bites from these animals continue to present a potential hazard in zoological parks that maintain venomous reptile collections.

Dallas Zoo staff members circulated surveys to 54 North American zoos in an attempt to determine the incidence of venomous reptile bites in North American zoos over the previous 25 years. Respondents were asked to provide the age and years of experience of victims, the circumstances under which the bites occurred, the species responsible for bites, and the years in which incidents occurred. We did not attempt to quantify any medical aspects of the reported bites, as this report deals primarily with why the bites occurred.

Forty-seven institutions responded, of which 30 had venomous reptile collections in the past 25 years. Of those 30 institutions, 21 reported staff members bitten by venomous reptiles between 1970 and 1995, with several institutions reporting multiple bites within that time period for a total of 31 incidents. Twelve of the 32 victims were between the ages of 20 and 25 years. This represents the largest number of bites for any age group. All twelve of these victims were reported to have had less than five years of professional experience working with venomous reptiles.

Fifteen incidents occurred during routine handling procedures. A significant number of these bites (12) were the result of individuals opening cage doors with their hands or using hooks of an inappropriate length. In one case, the victim was using a 24-inch (61 cm) hook to manipulate a 37-inch (94 cm) snake!

Six bites occurred during feeding episodes. In the most common scenario, a keeper was bitten while tossing a food item into an enclosure without the aid of a tool. Several individuals were also bitten when food items were offered with tools that were of an improper length.

Of the 14 remaining bites, five occurred during handling procedures that involved direct physical restraint without the use of any acceptable restraint devices. Two occurred while animals were being photographed, one during a veterinary procedure, and the remaining six were not described.

Twenty-two bites were inflicted by crotalids and four by elapids. Surprisingly, four bites were inflicted by helodermatids (Table 1). Although this represents a small number of the total, these species are considered relatively benign captives. This assumption probably misleads individuals to handle these lizards carelessly.

TABLE 1. Chronological distribution of venomous reptile bites in North American zoos from 1970–1995.

Year of bite	Species
1970	*Bitis caudalis*
1971	*Sisturus miliarius barbouri*
1972	*Crotalus atrox*
1977	*Naja haje*
1978	elapid (did not specifiy species)
1979	*Agkistrodon piscivorus leucostoma*
1979	*Trimeresurus purpuromaculatus*
1980	*Sistrurus catenatus catenatus*
1980	*Crotalus durissus*
1981	*Agkistrodon bilineatus taylori*
1981	*Crotalus durissus unicolor*
1982	*Agkistrodon contortrix contortrix*
1982	*Crotalus atrox*
1982	*Agkistrodon contortrix*
1983	*Bothrops atrox*
1983	*Agkistrodon bilineatus bilineatus*
1984	*Deinagkistrodon acutus*
1984	*Crotalus horridus*
1985	*Bothrops alternatus*
1986	*Heloderma horridum horridum*
1986	*Agkistrodon bilineatus*
1986	*Crotalus atrox*
1987	*Crotalus cerastes*
1988	*Dendroaspis angusticeps*
1988	*Heloderma suspectum*
1989	*Crotalus lepidus klauberi*
1991	*Heloderma suspectum*
1992	*Crotalus adamanteus*
1992	*Dendroaspis polylepis*
1994	*Crotalus viridis*
1995	*Heloderma horridum horridum*

Although there were no fatalities in this series, all of the reported bites were of a serious nature, with 26 victims requiring extensive medical attention. While safe handling protocols for venomous reptiles are generally a part of standard procedures for most zoos, accidents still occur regularly (about once per year). The majority of bites reported might have been avoided if appropriate protocols were employed. Some of these include using transparent acrylic tubes for physical restraint, using feeding forceps and hooks of appropriate lengths, and never exposing hands or limbs as a potential target. Although these protocols seem to be a matter of common sense, the responses to our survey suggest that they are often overlooked, resulting in most of the bites reported. Perhaps staff members responsible for training new keepers might do more to teach the importance of following protocol at all times.

We hope that by describing the nature and frequency of these incidents, we will stimulate individuals involved in the manipulation of venomous reptiles to be more vigilant.

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County Zoo, Central Florida Zoological Park, Central Park Wildlife Center, Cheyenne Mountain Zoological Park, Cleveland Metroparks Zoo, Denver Zoological Gardens, Detroit Zoological Park, Dreher Park Zoo, Gladys Porter Zoo, Greenville Zoo, Houston Zoological Gardens, Indianapolis Zoo, Jacksonville Zoological Park, John Ball Zoo, John G. Shedd Aquarium, Lincoln Park Zoological Gardens, Los Angeles Zoo, Louisville Zoological Garden, Lowery Park Zoo, Kansas City Zoo, Metropolitan Toronto Zoo, Miami Metrozoo, Milwaukee County Zoological Gardens, Montgomery Zoo, National Aquarium in Baltimore, National Zoological Park, North Carolina Zoological Park, Rio Grande Zoological Park, Riverbanks Zoological Park, Sacramento Zoo, San Antonio Zoological Gardens, Santa Fe Teaching Zoo, Sedgwick County Zoo, Seneca Park Zoo, St. Louis Zoological Park, Tulsa Zoo, Utah's Hogle Park Zoo, Wildlife Safari, Woodland Park Zoological Gardens, and Zoo Atlanta.

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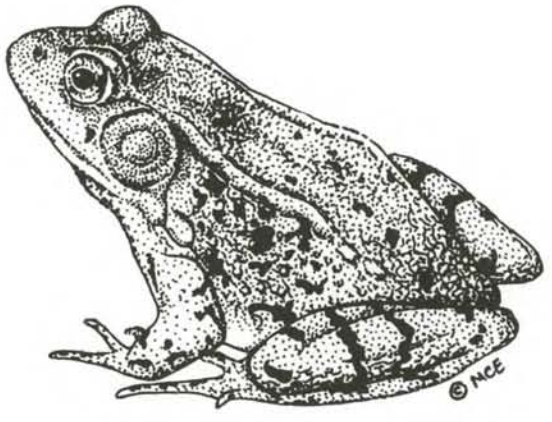
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Rana clamitans melanota (Green Frog). USA: Massachusetts: Lynnfield. Illustration by Mark C. Erelli.

RECENT POPULATION CHANGES

Recent Population Changes provides an outlet for anecdotal or minimally documented information on local extinctions or regional population changes. These reports could be valuable historic indications that might enhance our understanding of very long term (>20 yrs) population trends and changes in distribution patterns.

Manuscripts should be submitted directly to the editor of this section: Ralph W. Axtell, Department of Biological Sciences, Southern Illinois University, Edwardsville, Illinois 62026, USA.

Extirpation of the Parthenogenetic Lizard *Cnemidophorus tesselatus* from Historically Significant Sites in Pueblo County, Colorado

JAMES M. WALKER
Department of Biological Sciences, University of Arkansas
Fayetteville, Arkansas 72701, USA
e-mail: jmwalker@comp.uark.edu

JAMES E. CORDES
Division of Sciences, Louisiana State University at Eunice
Eunice, Louisiana 70535, USA
e-mail: jcordes@eunice.lsue.edu

and

HARRY L. TAYLOR
Department of Biology, Regis University
Denver, Colorado 80221, USA
e-mail: hltaylor@regis.edu

Several important studies of the *Cnemidophorus tesselatus* complex of parthenogenetic whiptail lizards have been based in part on specimens obtained from a site east of Interstate Highway 25 (I-25) at 0.8 to 3.2 km north of Colorado State Highway 47, between Jerry Murphy-Overton Road and Fountain Creek (i.e., Overton Road site), in Pueblo, Pueblo Co., Colorado, USA. This site is near, if not the same as, the type locality restrictions for the species by Milstead (1953) and Maslin (1959). Zweifel (1965) based his informal description of *C. tesselatus* Pattern Class A [which Wright and Lowe (1967) and Parker and Selander (1976) later found was triploid], on a study of specimens from the Overton Road site deposited in the University of Colorado Museum (UCM). The Overton Road population was also used by T. P. Maslin and students in the 1960s as the nearest source of *C. tesselatus* for various studies undertaken at the University of Colorado (Pennock 1965; Maslin 1967; Taylor et al. 1967, 1989). Today, the numerous catalogued specimens in the UCM and one in the Carnegie Museum (CM) represent the only vouchers known to us of the past existence of this historically significant and apparently extirpated population of triploid parthenogenetic whiptail lizards.

When JMW and HLT visited the Overton Road site in the 1960s it was possible to find numerous individuals of *C. tesselatus* (e.g., about 10 lizards were collected on 19 May 1963) and *C. sexlineatus* in what was then a City of Pueblo garbage dump. Although there was some mixing of these lizards at that time, the likelihood of finding the desired species could be increased by searching different microhabitats. *C. tesselatus* was most abundant in shrubby growth at the dump site; *C. sexlineatus* was most abundant in grass-weed associations at the dump site.

We now believe that *C. tesselatus* has been extirpated from the Overton Road site since 1973. To our knowledge, the last collec-

tion of *C. tesselatus* made at the site was by E. D. Parker, Jr. in 1971 or 1972 (see Parker and Selander 1976) east of Overton Road, where he found no lizards the next year owing to development of a subdivision (Parker, per. comm.). On 11 July and 10 August 1988 and 4 July 1993, we searched the 2.4 x 0.5 km area west of Overton Road (where Maslin and students collected *C. tesselatus* in the 1960s). We found no individuals of *C. tesselatus* on these occasions, although *C. sexlineatus* was observed and/or collected in all parts of the site and in habitat adjacent to a residential subdivision (which destroyed the habitat where Parker had collected) east of Jerry Murphy-Overton Road. Most of the surface debris in the abandoned dump west of the road had been buried years ago by reclamation work. Today, the Overton Road site is thickly covered with shrubby vegetation, grasses, and weeds (with small openings, roads, and trails) except in an area about 2.8 to 3.2 km north of Colorado Highway 47 where the habitat is more open-structured. We were unable to find *C. tesselatus* in patches of habitat between Jerry Murphy-Overton Road and Fountain Creek south of Colorado 47 (toward the mouth of the creek) and near the confluence of the Arkansas River and Salt Creek where UCM specimens were collected 21 June 1963 by R. L. and J. Holland.

In summary, we have have found no individuals of *C. tesselatus* at any site in Pueblo east of I-25 since we initiated our recent field work in Colorado in 1988. The apparent extirpation of the species from this part of the city most likely resulted from habitat destruction and/or alteration brought on by urban development, changes that have not caused extirpation of *C. sexlineatus* from the area. We have observed individuals of *C. tesselatus* Pattern Class A west of I-25 in Pueblo on the north side of the Arkansas River and on both sides of Pueblo Lake between 1988 and 1995. At some of these sites (e.g., Pueblo Nature Center), *C. tesselatus* was present in large numbers. We hope that any newly obtained records of *C. tesselatus* in Pueblo east of I-25 either be published or made known to us directly.

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PRIVATE COLLECTOR SEEKS THE FOLLOWING BOOKS:

BARTRAM: Travels through North and South Carolina, Georgia, East and West Florida...1791.
DAUDIN: Histoire Naturelle, Generale et Particuliere Des Reptiles, 8 volumes, 100 plates, 1801-1803.
DUMERIL: Erpetologie Generale ... des Reptiles, 10 volumes, 120 plates, 1834-1854.
GIRARD: U.S. Exploring Expedition...Under...C. Wilkes. Vol XX. Herpetology. Text & Plates (1858).
JAN & SORDELLI: Iconographie Generale des Ophidiens (1860-81), the original edition (paying $10,000 US) and/or individual parts (to complete my incomplete copy) especially the text and the following plates:

2nd livraison	plates	1 - 6	7th livraison	plate	1
5th livraison	plate	1	8th livraison	plate	1 - 3
6th livraison	plates	1 - 6	9th livraison	plates	1 - 3

HARLAN: American Herpetology, or genera of...reptiles (Philadelphia, 1827).
HOLBROOK: North American Herpetology (2nd ed., 1842) the entire original edition and/or individual vols.
LINNAEUS: Museum Adolphi Friderici Regis (Holmiae, 1754, folio with 33 plates).
SAGRA: Historie Physique, Politique, et Naturelle de L'Tle de Cuba. (Paris, 1839-71) Seeking the Reptilia section only.
SHAW: General Zoology of Systematic Natural History. (1802) Seeking Vol III, Parts 1+2 (Amphibia and Serpentes).
TOPSELL: Historie of Serpents; or the Second Book of Living Creatures. Original (1608) or reprint (1973).
TSCHUDI: Untersuchungen uber die Fauna Peruana. 1844-1846.
WALBAUM: Chelonographia oder Beschreibung einiger Schildkroten...(Lubeck & Leipzig, 1782).

Adrian L. Crane, esq., 8111 LBJ Frwy, Suite 1265, Dallas, Texas, USA 75251
Tel. (800) 444-8810, (214) 235-4444, FAX (214) 235-4454

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NATURAL HISTORY NOTES

The Natural History Notes section (formerly Life History Notes) is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword which best describes the nature of their note (e.g., Reproduction, Longevity, Morphology, etc.). Use of figures to illustrate any data is encouraged, but should replace words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send two copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover). Manuscripts concerning reptiles should be sent to Lee A. Fitzgerald; those concerning amphibians should be sent to Charles W. Painter.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1990. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd ed., Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhyacosiredon leorae*. Size. Herpetol. Rev. 25:22.

ANURA

ELEUTHERODACTYLUS COOKI ("Guajon" or "Demonio de Puerto Rico"). **ECTOPARASITES.** Maldonado Capriles and Medina Gaud (1977. J. Agr. Univ. P. R. 61:402–404) reported larval ticks belonging to the *Ornithodoros talaje* group parasitizing *E. cooki* near Yabucoa, Puerto Rico. We examined 17 *E. cooki* collected 3 km SW of Yabucoa, Puerto Rico, from the herpetology collection of the Natural History Museum, University of Kansas, Lawrence (KU 206049–206050; 276648–276662). Ours is the first report of prevalence, mean intensity of infestation and histopathology for a tick infestation in an eleutherodactyline frog. Infested skin was embedded in paraffin, sectioned at 5 µm and stained with hematoxylin and eosin. Voucher tick specimens were deposited in the U.S. National Tick Collection, Institute of Arthropodology and Parasitology, Georgia Southern University, as RML 121615. Ticks were tentatively identified as *Ornithodoros talaje*. As the hypostome was missing, there is a possibility they might be *Ornithodoros puertoricensis*. However, other morphological characters like length of the palps and configuration of the basis capituli suggest they are *O. talaje* (J. E. Keirans, pers. comm.). The ticks appeared to be randomly distributed over the dorsal body surfaces of all infested frogs. Prevalence (number of infected individuals/number of individuals examined) was 35% (6/17). Mean intensity (mean number of ticks per infected host was 1.5 + 0.5 SD while the range (difference between lowest and highest number of ticks) was 1–2.

The ticks produced a diffuse inflammatory reaction consisting of degranulated heterophils, some lymphoid cells, plasma cells, and occasional histiocytes. There was focal ulceration at the point where the tick hypostome penetrated the integument. We also noted mild epithelial hyperplasia with leucocytic exocytosis. Dermal collagen was infiltrated by inflammatory cells and a thick layer of these mixed leucocytes including many degranulated heterophils was present along the deep dermis.

The only other West Indian *Eleutherodactylus* to be infested with ticks is *E. zeus*, from Cuba (R. L. Joglar, pers. obs.). *Eleutherodactylus zeus*, like *E. cooki*, may be primarily a cave-dweller (R. L. Joglar, pers. obs.).

We thank William E. Duellman for allowing us to examine *Eleutherodactylus cooki* from KU collection, and James E. Keirans, Institute of Arthropodology and Parasitology, Georgia Southern University for identification of ticks.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, **H. J. HOLSHUH**, Comparative Medical and Veterinary Services, County of Los Angeles, Downey, California 90402, USA, and **RAFAEL L. JOGLAR**, Departamento de Biologia, Universidad de Puerto Rico, Rio Piedras, Puerto Rico 00931, USA.

HYLA GRATIOSA (Barking Treefrog). **REPRODUCTION.** On 19 August 1992, we collected two pairs of amplexing *Hyla gratiosa* from open water of a temporary pond northeast of the University of South Florida campus (28°06' N lat., 82°23' W long., Hillsborough County, Florida, USA). Two other pairs were collected in open water on 6 July 1994. In each case, amplexed pairs were transported to the laboratory in separate containers with pond water. Once in the laboratory, pairs were housed overnight in individual aquaria, with fresh tap water. The following morning, within 9 h of capture, eggs had been laid. Eggs were counted and a subsample was measured for ovum diameter and egg capsule diameter with a Wild dissecting microscope at 40X magnification. Most eggs from all the clutches were fertile.

TABLE 1. Length, weight, and fecundity data for four pairs of *Hyla gratiosa*. Date = date of capture; SVL = snout-vent length; WT = weight after oviposition; Egg Number = estimated clutch size; EC = average diameter of egg capsule ± one standard deviation; Ovum = average diameter of ovum ± one standard deviation; N = number of eggs measured.

	Date	SVL	WT (g)	Egg Number	EC (mm)	Ovum (mm)	N
Male 1	19 Aug 92	45	12.3				
Female 1	19 Aug 92	48	13.5	789	1.74 ± .08	1.32 ± .09	16
Male 2	19 Aug 92	51	16.3				
Female 2	19 Aug 92	51	15.2	931	1.74 ± .09	1.33 ± .06	16
Male 3	6 July 94	55	11.1				
Female 3	6 July 94	55	12.0	1535	1.76 ± .08	1.32 ± .09	20
Male 4	6 July 94	62	17.3				
Female 4	6 July 94	61	16.3	1784	1.83 ± .11	1.28 ± .05	20

Clutch size ranged from 789–1784, ovum diameter from 1.12–1.60 mm and egg capsule diameter from 1.55–2.03 mm. Mean ovum diameter and mean egg capsule diameter were not significantly different among clutches (ANOVA, $p > 0.05$) (Table 1). This is similar to values for ovum and capsule diameter found by Wright and Wright (1949. Handbook of Frogs and Toads of the United States, Comstock Publ. Assoc., Ithaca, New York. 640 pp.). This pond has been under observation for five years. At this location, *H. gratiosa* begin chorusing in late February and are rarely heard by late September. Amplexing pairs have been observed

from late May until mid-September. Although *H. gratiosa* ovum and egg capsule diameter were reported by Wright and Wright (1949) we are not aware of any reports of *H. gratiosa* clutch size.

Submitted by **PABLO R. DELIS**, Department of Biology, University of South Florida, Tampa, Florida, 33620, USA, and **ADAM P. SUMMERS**, Organismic and Evolutionary Biology, University of Massachusetts at Amherst, Amherst, Massachusetts, 01003-5810, USA.

RANA CATESBEIANA (Bullfrog). **PREDATION.** The diet of *Dolomedes triton*, the six-spotted fishing spider, includes many insects and small fish (Carico 1973. Bull. Comp. Zool. 144(7):435–488), but predation of *Rana* tadpoles has not been widely documented. Of 625 prey items identified by Zimmermann and Spence (1989. Oecologia 80:187–194) only one of these was an amphibian (female spider, *Rana sylvatica* tadpole). In lab studies (Blechnann and Lotz 1987. Anim. Behav. 35:641–651), *D. triton* was observed capturing *Bufo bufo* tadpoles and juvenile *Xenopus laevis* (2–3 cm).

On 24 March 1994, between 2100 and 2230 h, a gravid female *Dolomedes triton* (identified by James Canco) was captured in the process of feeding on a *Rana catesbeiana* tadpole (verified by George Cline) at a small farm pond 3 miles south of Jacksonville, and 1 mile east of AL Hwy 21 on Longshore Drive, Calhoun Co., Alabama, USA. The spider was hanging from a partially submerged metal structure by the hindmost pair of legs, while grasping the tadpole at the water's surface with the two anterior pairs of legs. The tadpole was ca. 60 mm TL. The tadpole had well-developed hind legs but no visible forelimbs. The cephalic region of the tadpole was necrotic, presumably indicating the point of attack.

Because *Dolomedes triton* feeds on small fish and insects it seems logical that it would also include tadpoles as part of its diet.

Submitted by **C. PAUL ROGERS**, Department of Biology, Jacksonville State University, Jacksonville, Alabama 36265-9982, USA.

LACERTILIA

ANOLIS CAROLINENSIS (Green Anole). **DIET.** *Anolis carolinensis* is known to prey on a variety of insects and other arthropods (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co. Boston, Massachusetts. 450 pp.). Herein, we report predation upon a scorpion by *A. carolinensis*. To our knowledge, this is the first report of predation on scorpions by *A. carolinensis*.

On 18 November 1994 (ca. 1430 h) we observed a male *A. carolinensis* (50.4 mm SVL, 3.4 g) on the side of an abandoned building in eastern Lee County, Alabama, USA. The lizard was gaping and failed to exhibit any escape behavior when approached. It continued to gape after capture and, upon examination, the sting of a scorpion was noticed in its throat. The anole apparently was having difficulty ingesting the scorpion, and 10 min. passed before the scorpion was completely ingested. The following day the lizard was killed and preserved. The scorpion (33 mm TL) was removed from the digestive tract of the anole and determined to be *Vaejovis carolinianus* a small species common in east central Alabama. The anole was deposited in the Auburn University Museum (AUM #33730)

Scorpions are significant components in the diets of several desert lizard species (Pianka 1986. Ecology and Natural History of Desert Lizards. Princeton University Press, New Jersey). These desert lizards either consume scorpions at night, when the arthropods are most active, or encounter them during diurnal foraging when the scorpions are sedentary. Nothing is known, however, concerning the importance of scorpions in the diet of *A. carolinensis*.

We thank Robert Mount for allowing us access to his property and George Folkerts for identifying the scorpion. Brian Butterfield, Craig Guyer, and Karen Schnuelle provided insightful comments.

Submitted by **PAUL A. BUTTENHOFF** and **WILLIAM A. HOPKINS III**, Department of Zoology and Wildlife Science, 331 Funchess Hall, Auburn University, Alabama 36849, USA.

ANOLIS MAYNARDI (NCN). **ENDOPARASITES.** *Anolis maynardi* is known only from the Cayman Islands where it is restricted to Little Cayman Island and Cayman Brac (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies. Descriptions, Distributions, and Natural History. University of Florida Press, Gainesville, 720 pp.). The purpose of this note is to report on an examination of gastrointestinal tracts from 12 *A. maynardi*. We know of no published reports on the endoparasites of *A. maynardi*. Specimens were borrowed from the Florida Museum of Natural History, University of Florida, Gainesville (UF) or the Division of Amphibians and Reptiles, National Museum of Natural History, Smithsonian Institution (USNM): N = 12, mean snout-vent length, SVL = 61 + 9 SD, range = 49–67 mm, Little Cayman Island, 1965 (UF 21719, 21752-53, 21785–87),1982 (USNM 236622),1986 (UF 63458-61); Cayman Brac, 1986 (UF 63457).

The body cavity was opened by a longitudinal incision from throat to vent. The esophagus, stomach, small intestine and large intestine were examined separately, in situ, using a dissecting microscope. Each parasite was removed and identified using a glycerol wet mount.

The endoparasite fauna of *A. maynardi* consisted of nematodes: *Physocephalus* sp. (prevalence: number infected individuals/number individuals examined = 8%, mean intensity: mean number helminths per infected host = 1); *Gongylonema* sp. (prevalence = 8%, mean intensity = 1); *Parapharyngodon cubensis* (prevalence = 17%, mean intensity = 2); larval spirurid (prevalence = 8%, mean intensity = 1); *Atractis scelopori* (prevalence = 17%, mean intensity = 44). All of our findings represent new host records. Nematodes were deposited in the U.S. National Parasite Collection, (USNPC), Beltsville, Maryland 20705: *Physoceehalus* sp. 84785; *Gongylonema* sp. 84786; *Parapharyngodon cubensis* 84889, 84890; larval spirurid 84891; *Atractis scelopori* 84892, 84893.

We thank Kevin De Queiroz (USNM) and David L. Auth (UF) for permission to examine *A. maynardi*.

Submitted by **STEPHEN R. GOLDBERG**, Department of Biology, Whittier College, Whittier, California 90608, USA, and **CHARLES R. BURSEY**, Department of Biology, Pennsylvania State University, Shenango Valley Campus, 147 Shenango Avenue, Sharon, Pennsylvania 16146, USA.

CNEMIDOPHORUS SACKII GIGAS (Giant Spotted Whiptail). **DIET**. Four specimens of *Cnemidophorus sackii gigas* were collected by T. P. Maslin and party on 14-15 June 1972 from a site 8 km N Iguala, Guerrero, México (elevation 870 m). These specimens were deposited in the University of Colorado Museum (UCM 48822, male, SVL = 134 mm; UCM 49830, female, SVL = 132 mm; UCM 49831, female, SVL = 94 mm; UCM 49832, male, SVL = 127 mm). The stomach contents of these specimens were removed and identified. Half of the 64 prey items identified were ants (Hymenoptera, Table 1). However, one lizard (UCM 49830) consumed 23 ants whereas the other lizards consumed less than six ants each; so ants were probably not the most important constituent of these lizards' diets. Beetles and beetle larvae (Coleoptera) were the second most abundant prey type and comprised the majority of the volume of prey consumed and so were more important in the diet of these lizards. All four lizards had many sand grains in their stomachs and three of the four contained nematodes (presumably parasites). No lizard consumed any plant material. We conclude that *C. sackii gigas*, like most whiptail lizards, is insectivorous.

TABLE 1. Diet of *Cnemidophorus sackii gigas* in Guerrero, México. The first column gives the numerical percentage of each prey taxon in the sample (64 prey items). The second column gives the number of lizards in which each prey taxon was found (N = 4 lizards examined).

	Percentage In Sample	Number of Lizards Consuming
C. Chilopoda (centipedes)	1.6	1
C. Insecta		
o. Isoptera (termites)	3.1	2
o. Hemiptera (bugs)	3.1	2
o. Coleoptera (beetles)		
Chrysomelidae	3.1	2
Scarabaeidae	14.7	3
Unidentified beetles	12.5	3
scarabaeiform larvae	3.1	2
other beetle larvae	3.1	2
o. Lepidoptera (caterpillars)	6.3	3
o. Hymenoptera (ants)	50.0	4

Submitted by **MARK A. PAULISSEN**, Department of Biological and Environmental Sciences, McNeese State University, Lake Charles, Louisiana 70609, USA, and **JAMES M. WALKER**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

CNEMIDOPHORUS SACKII SACKII (Sack's Spotted Whiptail). **DIET.** In June 1969, T. P. Maslin and party collected a series of *Cnemidophorus sackii sackii* from the remote Tomellin Canyon region in southeastern Puebla, México (Walker 1981. J. Herpetol. 15:321–328); these specimens were deposited in the University of Colorado Museum (UCM). We removed and identified the stomach contents of four of these specimens (UCM 38864, female, SVL = 120 mm, collected 2.0 km NE Chilac, elev. 1280 m; UCM 38898, male, SVL = 127 mm and UCM 38905, male SVL = 132 mm, both collected 0.6 km WNW Calipan, elev. 1067 m; UCM 38857, male SVL = 87 mm, collected 2.0 km SW Chilac, elev. 1219 m); all lizards were collected on 20 June 1969. Over three-fourths of the 216 prey items identified were termites (Isoptera, Table 1); however, this is deceiving since one lizard (UCM 38864) consumed 117 termites. Beetles and beetle larvae (Coleoptera) were the second most abundant prey type in lizard diets and the most important volumetrically since most of the beetles and larvae were 20–30 mm in length. All four lizards had at least a few sand grains in their stomachs and three of the four contained nematodes (presumably parasites). No lizard consumed flying insects, jumping insects, or plant material. Maslin and Walker (1973. Herpetologica 29:128–143) observed a *C. sackii sackii* consume part of a discarded pressed ham and suggested this species consumed carrion when available; we found no evidence of this in our sample.

TABLE 1. Diet of *Cnemidophorus sackii sackii* in Puebla, México. The first column gives the numerical percentage of each prey taxon in the sample (216 prey items). The second column gives the number of lizards in which each prey taxon was found (N = 4 lizards examined).

	Percentage In Sample	Number of Lizards Consuming
C. Arachnida (spiders)	0.5	1
C. Insecta		
o. Isoptera (termites)	78.7	3
o. Coleoptera (beetles)		
Chrysomelidae	0.5	1
Curculionidae	0.5	1
Scarabaeidae	3.7	3
Unidentified beetles	2.8	3
scarabaeiform larvae	7.9	3
other beetle larvae	0.5	1
o. Lepidoptera (caterpillars)	0.5	1
o. Hymenoptera (ants)	3.2	2
Unidentified Insect	1.8	2

Submitted by **MARK A. PAULISSEN**, Department of Biological and Environmental Sciences, McNeese State University, Lake Charles, Louisiana 70609, USA, and **JAMES M. WALKER**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

CNEMIDOPHORUS SEXLINEATUS (Six-lined Racerunner). **AQUATIC BEHAVIOR.** Unusual escape behaviors, including arboreality (Paulissen and Harvey 1985. Herpetol. Rev. 16:27) and aquatic escape (Dillon and Baldauf 1945. Copeia 1945:174; Stille 1947. Copeia 1947:143), have been documented for *Cnemidophorus sexlineatus*. Herein, we report on a third incident involving escape into an aquatic habitat by this species.

During an investigation of herpetofaunal communities within the North Alum Creek watershed of the Ouachita National Forest (Saline County, Arkansas, USA), we had the opportunity to witness aquatic behavior in the prairie racerunner, *C. s. viridis*. On 18 May 1995 at 1303 h CDST three of us (SET, JDW, and LCH) had just left a pine plantation and were walking along a mostly-grassy, timber road when we observed a juvenile lizard (SVL = 38 mm) leap from within vegetational cover of the central path of the lane and dive into a shallow pool of clear water (created by the filling of tire ruts). The lizard swam directly to the bottom of the pool (ca. 120 mm in depth) and buried the anterior two-thirds of its body within in a cup-shaped, mud depression. We waited for the lizard to emerge from its hiding place; the lizard rose to the surface after 1 min 26 sec had elapsed and swam to the edge

of the puddle. We coaxed it out into the pool again, and it dove for a second time to a point beneath a small submerged tree branch. This time the lizard remained motionless with its entire body shielded by the branch for 1 min 56 sec before resurfacing and swimming to the water's edge. We collected the specimen which was catalogued into the Arkansas State University herpetological collection (ASUMZ 20394).

We thank the Weyerhauser Co. for allowing us to perform survey work on its land. This research was conducted and financed in cooperation with Oklahoma State University through grant monies provided by the U.S. Forest Service, the Weyerhauser Co., and the National Council of the Paper Industry for Air and Stream Improvement, Inc.

Submitted by **STANLEY E. TRAUTH, J. D. WILHIDE, LEWIS C. HUNT, ANTHONY HOLT, TRACY L. KLOTZ,** and **SCOTT A. WOOLBRIGHT**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467, USA.

NESTICURUS BICARINATUS (NCN). **REPRODUCTION.** Instituto Nacional de Pesquisas da Amazonia, number 766 and Museu Paraense Emflio Goeldi, number 16887. Verified by Tereza Cristina Avila-Pires. I found an adult *N. bicarinatus* beside a nest containing two eggs at 1000 h on 31 May 1994. The nest was on a sand bank in undisturbed rainforest, 124 cm from the bank of a small (width = 4.4 m; maximum depth = 0.7 m) stream (Igarape Acara), in Reserva Florestal Adolfo Ducke (Lat. 03°08'S, Long. 60°04'W). The nest was 92 cm above water level and completely open, presumably because I disturbed the female before she could fill the nest. The adult beside the nest was emaciated and it is unlikely that it was carrying more eggs. When I returned at 1030 h the adult had abandoned the nest and I collected the eggs. However, when I returned two days later the hole had been filled. As there was no rain or flooding during that period I assume that the female had returned to close the nest.

The nest was 5.8 cm long, 2.9 cm wide, and 3.6 cm deep. One wall along the long axis was steep and the floor sloped up to the other edge along the long axis. The walls along the short axes were steep. The length, width, and mass of the eggs were 1.76 cm, 1.00 cm, l.l g, and 1.79 cm, 1.01 cm, and l.l g, respectively. They were incubated in vermiculite at room temperature (ca. 30°C) and they hatched 24 August 1994. The incubation period (86 days) may have been shorter than in the field because ground temperatures in the soil near the stream are generally lower (23–27°C). However, I did not measure temperatures at the nest site. At hatching, the total length, snout-vent length, and mass of the hatchlings were 9.9 cm, 3.6 cm, 1.2l g, and 9.6 cm, 3.5 cm and l.ll g, respectively. As the hatchlings weighed as much as the eggs, water must have been taken up during incubation. One egg and one hatchling were deposited in each museum.

Submitted by **WILLIAM E. MAGNUSSON**, Departamento de Ecologia, Instituto Nacional de Pesquisas da Amazonia, CP 478, 69011-970 Manaus AM, Brazil.

SCELOPORUS OLIVACEUS (Texas Spiny Lizard). **SIZE.** Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern North America, 3rd ed., Houghton Mifflin Co., Boston, Massachusetts. 450 pp.) gave the maximum size of *Sceloporus olivaceus* as 279 mm TL and 121 mm SVL. On 26 June 1994, an adult female *S. olivaceus* (299 mm TL, 113 mm SVL) was discovered at 0230 h inside a house 3.2 km E Edinburg, Hidalgo Co., Texas, USA. The specimen (Michael J. McCoid Private Collection 3151) was gravid with eight palpable eggs. The specimen has been deposited with the TCWC (verified by R. K. Vaughan).

Despite the TL of the above specimen exceeding that reported by Conant and Collins (*op. cit.*), the SVL was less. Since longer SVL specimens have been recorded and female phrynosomatids (usage fide Conant and Collins, *op. cit.*) generally have shorter tails than males, even larger TL *S. olivaceus* are to be expected. The specimen reported here had a pristine tail, suggesting that the 121 mm SVL specimen listed above had an incomplete tail.

Submitted by **MICHAEL JAMES MCCOID**, Caesar Kleberg Wildlife Research Institute, Texas A&M University, Kingsville, Texas 78363, USA, and **DAVID S. HENSLEY**, Route 1, Box 143, Edinburg, Texas 78539, USA.

TUPINAMBIS TEGUIXIN (Common Tegu). **FORAGING.** Tegu lizards are known to be food habit generalists, including small vertebrates in their diets (Dessem 1985. Copeia 1985:245–247; Gudynas 1982. Bull. Chicago Herp. Soc. 16:29–39). On 13 January 1991, at Ilha do Cardoso State Park (25°03'S, 47°53'W) around noon on a very hot day, we observed an adult male tegu (50 cm SVL) following an ash-throated crake (*Porzana albicolis*) and three small chicks. The birds were walking in short grass along the border of a swamp, and the lizard was following them, walking at a normal pace. After three attempts, the tegu managed to catch one of the birds by lunging at it and biting its back. The lizard crushed the bird with its jaws and swallowed it whole, pressing it against the ground to help position it. Later, on 14 December 1992, also at Ilha do Cardoso, another tegu (40 cm SVL) was observed preying on the two eggs of a collared plover, laid in a nest among dune vegetation immediately above high tide mark on a sandy beach. Tegus have commonly been observed foraging in a deliberate zigzagging way among the debris left at high tide and in the adjacent dune vegetation. It is in this area where the plovers nest.

Submitted by **PAULO MARTUSCELLI** and **FABIO OLMOS**, Instituto Florestal de Sao Paulo, Caixa Postal 194, Peruibe, SP, 11750-970, Brazil.

UROSAURUS ORNATUS (Tree Lizard). **AUTOHEMORRHAGING.** I have observed two small, but adult-sized, (SVL = 45 mm, TL = 70 mm, mass = 3.2 g; SVL = 47 mm, TL = 45, mass = 3.9 g) male tree lizards ooze blood from their eyes in response to handling. Both were captured by noosing at Aquirre Spring Recreation Area located 25 air km east of Las Cruces, Dona Ana County, New Mexico, USA. The first incident occurred on 12 May 1992 and the second on 6 July 1994. Both males only ejected blood from one eye, the blood filling the orbit of the eye and trickling down the face. This "oozing" occurred at the moment of capture, specifically, before I had my hands on the lizards. The lizards seemed to be reacting to the stress of sudden capture involving neck constriction and perhaps swinging through the air as I retrieved the noosed animal. Recaptures by noosing of these two lizards at later dates yielded no blood oozing. Blood squirting from the orbital region has been reviewed for horned lizards, *Phrynosoma* (Middendorf and Sherbrooke 1992. Copeia 1992:519–527). Orbital bleeding (autohemorrhaging) has also been reported in several species of dwarf boas in the genus

Tropidophis (Smith et al. 1993. Herpetol. Rev. 24:130–131). To my knowledge, orbital bleeding has not been reported in *Urosaurus*. Middendorf and Sherbrooke (Sherbrooke 1990. Wilson Bull. 102:171–174; Sherbrooke 1991. Amer. Mid. Nat. 126:187–195) found dogs, but not other natural predators, consistently elicited blood squirting in *Phrynosoma cornutum* and interpreted the response as an antipredator defense mechanism against canids. Smith et al. (1993) also reported some species of snakes will autohemorrhage when captured and handled. In these snakes, the blood simply flowed across the eye, under the ocular, and was not forcefully ejected out the orbit region as in *Phrynosoma*. It seems that tactile cues play a significant role in both blood squirting and autohemorrhaging. Therefore, noosing and swinging through the air probably were the stressful tactile cues that brought forth orbit blood oozing (autohemorrhaging) in the *U. ornatus*.

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Submitted by **LAURA A. MAHRT**, Department of Biology, New Mexico State University, Las Cruces, New Mexico 88003-0001, USA.

SERPENTES

AGKISTRODON PISCIVORUS CONANTI (Florida Cottonmouth). **DIET.** On 25 October 1993 at 2045 h, we observed a subadult *Agkistrodon piscivorus conanti* scavenging on the carcass of a wild hog (*Sus scrofa*) that had been butchered and dumped from a bridge crossing Cypress Creek on State Road 71, 15.3 km south of County Road 386, Gulf County, Florida, USA. We observed the snake for 25 min from the bridge (ca. 3.5 m overhead) as it manipulated long strips of fat and with difficulty, eventually swallowed portions.

Agkistrodon piscivorus is an opportunistic feeder and frequently scavenges. Gloyd and Conant (1990. Snakes of the *Agkistrodon* Complex. SSAR, Oxford, Ohio) provide an extensive literature review of the diet. However, we believe this is the first report of a cottonmouth scavenging on the carcass of a wild hog.

We thank Steve DeCresie and Brian Bearwood for accompanying us in the field.

Submitted by **GEORGE HEINRICH**, P.O. Box 61301, St. Petersburg, Florida 33784-1301, USA, and **KARL R. STUDENROTH, JR.**, 4434 Dorothy Dr., Apt. 3, Marianna, Florida 32446, USA.

AGKISTRODON PISCIVORUS PISCIVORUS (Eastern Cottonmouth). **COLORATION.** On 3 August 1994, a 72 cm SVL gravid *Agkistrodon piscivorus piscivorus* was captured in the Savannah River Swamp on the Savannah River Site near Aiken, South Carolina, USA. The normally-pigmented female was returned to the lab and gave birth to five young on 3 September 1994. The litter consisted of two live-born hypomelanistic males, one live-born normal male, and two stillborn normal males. The young of this litter were larger (SVL average = 22.92 cm, SD = 0.59 cm; mass average = 20.32 g, SD = 0.55 g) than those of 10 other litters (mean SVL = 20.05–22.76 cm, mean mass = 12.27–19.83 g) born around the same time from females in the same population. The patterns of the hypomelanistic neonates were normal, having reddish-brown dorsal bands lined with white on a yellowish-tan ground color (Fig. 1). The venters were light tan with reddish-brown blotches. The eyes were the same colors as the dorsal bands and ground colors. One of the hypomelanistic neonates died upon eating a cage mate and is specimen #3483 in the Savannah River Ecology Laboratory natural history collection. The other is being maintained in captivity for educational use through the SREL Outreach Program.

The author thanks R. A. Seigel, M. S. Mius, and J. W. Gibbons for comments on the manuscript. Research related to this observation was supported by Contract DE-AC09765R00-819 between the University of Georgia and the U.S. Department of Energy.



FIG. 1. Neonate hypomelanistic *Agkistrodon piscivorus piscivorus* and normally pigmented litter mate from Barnwell Co., South Carolina, USA. Photo by David E. Scott.

Submitted by **JOHN R. LEE**, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

BOIGA IRREGULARIS (Brown Tree Snake). **DIET**. The diet of *Boiga irregularis* is fairly well known in its native range (Shine 1991. Copeia 1991:120–131) and in areas where it has been introduced (Savidge 1988. J. Herpetol. 22:275–282). A major component of the diet is birds (adults, nestlings, and eggs). On 4 October 1994 at approximately 2100 h we found a brown tree snake on the road just south of Paluma township in north Queensland, Australia in the process of consuming a pale-yellow robin (*Tregallasia capito*). On closer examination it became clear that the bird was a road-kill. Records of snakes consuming dead prey (including road-kills) are not uncommon (e.g., Bedford 1991. Herpetofauna 21:35) but to our knowledge this type of behavior has not previously been recorded for *B. irregularis*. As mentioned above, however, they are known to consume stationary prey such as bird eggs. In addition, *B. irregularis* are opportunistic predators (Savidge, *op. cit.*) that use chemical cues for foraging (Chiszar et al. 1988. Amphibia-Reptilia 9:77–88) so this record of a snake eating a dead prey item is not unexpected.

Submitted by **GEORDIE A. TORR** and **STEPHEN J. RICHARDS**, Dept of Zoology, James Cook University, Townsville, 4811, Australia.

BOTHROPS ATROX (Common Lancehead). **FORAGING BEHAVIOR and OPHIOPHAGY.** Recently, Martins and Gordo (1993. Herpetol. Rev. 24:151–152) reported finding colubrid snakes in the stomachs of *B. atrox* collected in disturbed areas in

Pará, eastern Amazonian Brazil. Snakes were found only in juvenile *B. atrox* and comprised 7% of 44 prey items. Observations on snakes feeding under natural conditions are scarce in the literature. Here we describe an observation of a subadult female *B. atrox* eating a colubrid snake in primary forest in Central Amazonia, Brazil.

The observations were made during a radio-tracking study of *B. atrox* begun in December 1993 at Reserva Florestal Adolpho Ducke, a 10,000 ha tract of primary forest under protection situated 26 km north of Manaus, State of Amazonas, Central Amazonia, Brazil. On 2 December 1993, a subadult female (900 mm SVL, 137 mm TL, 230 g) was surgically implanted with a 14 g radio transmitter (SI-2, Holohill Systems Ltd.) and released 21 h following capture. Within several days the snake seemed normal in its behavior and was tracked 2–3 times weekly thereafter. All observations reported here were made at distances of 2–5 m and did not appear to affect behavior even during close approaches by the observer (2 m). Voucher photographs of the predation are in the authors' diapositive files.

On most occasions the tagged snake was found, both during the day and at night, to be tightly coiled on the leaf litter, either exposed or in retreats. However, at 1230 h on 17 April 1994, it was found moving through leaf litter on the forest floor. The snake was not followed at this time, but when relocated 2 h later, it was crawling slowly on the margin of a small stream (ca. 80 cm wide), and stopped upon our approach. One of us (MM) followed it from 1435–1525 h while it moved about 10 m on the stream margin, consistently probing the substrate (fallen leaves, branches, low plants, the bases of tree trunks) with frequent tongue flicks. At 1525 h it began to climb a hill and stopped on a fallen tree trunk (ca. 10 x 60 cm), 1.5 m from the stream. Three minutes later it was observed grasping and pulling an already immobile snake (*Atractus torquatus*, TBL ca. 600 mm) from behind the log (the strike was not witnessed because the snake's head and prey were behind the log). The head and neck of prey were in the ground with three fourths of the body exposed. The *B. atrox* failed to pull the prey from underground and lost its grasp. The prey was grasped again near the cloaca, immediately released, and the pitviper's mouth rubbed on the substrate (an apparent aversion by the predator to cloacal secretions of the prey). The prey was nosed several times in an apparent attempt to locate the head, and at 1535 h the anterior fifth of the body was grasped, pulled from the soil while moving 1.5 m backwards, and released. The body was probed in both directions until the head was seized and swallowing begun at 1539 h. At 1610 h the tip of the prey's tail was hanging from the pitviper's mouth and it had resumed tongue flicking. By 1613 h swallowing was complete and the pitviper remained still for 24 min before moving away.

Based on our records for *A. torquatus*, the prey's mass was 40–60 g and using the initial weight of the *B. atrox*, the prey/predator mass ratio of this event would be 0.17–0.26. The observation described above corroborates our impression (unpubl. data) that although a primarily nocturnal, thermally oriented, sit-and-wait predator, *B. atrox* also forages actively during daytime for ectothermic prey using chemoreception.

The mentors of our study, H. Greene and D. Hardy, Sr., kindly shared their friendship and experience, and provided the equipment. D. Hardy and I. Sazima critically read the manuscript. K. Zamudio assisted with field work. Our work at Reserva Ducke was kindly allowed by the Instituto Nacional de Pesquisas da Amazonia and CNPq provided a grant to MM.

Submitted by **SILVIA G. EGLER**, Coordenação de Pesquisas em Ecologia, Instituto Nacional de Pesquisas da Amazônia, 69011-970 Manaus, Amazonas, Brasil, **M. ERMELINDA OLIVEIRA** and **MARCIO MARTINS**, Departamento de Parasitologia and Departamento de Ciências Fisiológicas, Instituto de Ciências Biológicas, Universidade do Amazonas, 69077-000 Manaus, Amazonas, Brasil.

CROTALUS HORRIDUS (Timber Rattlesnake). **MATING.** Male accompaniment of female rattlesnakes, prior to courtship and mating, has been described by Duvall et al. (1992. *In* Biology of the Pitvipers, Selva Press, Tyler, Texas: pp. 321–326) in *Crotalus v. viridis* and by Macartney and Gregory (1988. Copeia 1988:47–57) in *Crotalus v. oreganus*. In both studies, sexual attractiveness and receptivity were correlated with female ecdysis. There are few records of these behaviors in *Crotalus horridus*. In a long-term study in Virginia, Martin (1993. J. Herpetol. 27:133–143) observed mating activity five times from 21 August to 18 September in different years. One of these observations was of a male courting a pre-molt female (W. H. Martin, pers. comm.). Brown (J. Herpetol., *in press*) observed male accompaniment of vitellogenic females from 15 July to 25 September over a 12-yr period in New York, noting that such behavior preceded courtship and mating. He noted a correlation between sexual attractiveness and female skin shedding.

There are no records of free-living *C. horridus* mating in North Carolina (W. M. Palmer, pers. comm.). During the period 12–15 August 1994, using radiotelemetry, I observed a sequence of reproductive behaviors in a pair of *C. horridus* which culminated in copulation. These observations occurred in Hanging Rock State Park, Stokes County, North Carolina, USA and are summarized below.

On 12 August at 1745 h, a pre-molt adult female (90 cm total length; containing a transmitter) was found accompanied by an adult male (100 cm TL). The snakes were coiled loosely together, the male in a superior position. On 14 August at 1245 h, the female and the same male (identified by rattle count and body pattern) were located 4 m from their previous location. They were coiled together with the male in an overlying superior position. Both snakes were partially concealed in low vegetation. The female had not shed.

On 15 August at 1345 h, the pair was found copulating. The snakes were aware of, but did not seem concerned about, a human observer nearby. The female was freshly shed, as indicated by her bright appearance and by the addition of a new rattle segment. The snakes were fully extended and facing in opposite directions while coupled. The female's tail was pointed upward and the region immediately anterior to her cloaca was distended. The male was copulating with his left hemipenis, while the right hemipenis was not visible. The male's tail lay to one side, curved back along his body (Fig. 1).

Twenty minutes after my initial observation, the female began a series of forward movements. In response to these movements, the male began a reverse rectilinear locomotion (backing up) to remain coupled with the female. The male was adept at these reverse movements, negotiating obstacles of vegetation, fallen limbs, and other forest debris. At no time did I observe the male being dragged by the female. Forward movements initiated by the female were made at approximately 10-min intervals and averaged about 0.5 m in distance.

Immediately prior to, and continuing throughout each of these movements, the female exhibited a behavior I describe as slow tail lashing. Her tail was curled sharply, left or right of the mid-dorsal line, until her rattle was pointed down (Fig. 1). Once reaching this position, the tail was slowly uncurled until the tail was

fully extended to a vertical position and then was curled down on the opposite side. These slow tail lashes were repeated during each forward movement. Tail movement ceased when forward motion ceased. After 3 h the snakes had moved a distance of 10 m, and the female entered an area of dense cover and coiled loosely. The pair was still coupled and the male was fully extended. At 1830 h I left the snakes while they were once again extended in opposite directions. The next day (16 Aug), I found the female coiled in dense vegetation 55 m away. The male was not found.

I thank the personnel at Hanging Rock State Park for their steadfast support and contribution to this study. Radiotelemetry of *C. horridus* in Hanging Rock State Park is partially funded by the North Carolina Wildlife Resources Commission Nongame and Endangered Wildlife Small Grants Program. I am grateful to W. S. Brown, W. H. Martin, W. M. Palmer, and A. B. Somers for sharing information and advice, and for reviewing the manuscript.



FIG. 1. *Crotalus horridus* copulating fully extended and in opposite directions. The male is on the right, with his tail curved back along his body.

Submitted by **JOHN B. SEALY**, P.O.Box 254, Danbury, North Carolina 27016, USA.

CROTALUS VIRIDIS VIRIDIS (Prairie Rattlesnake). **BEHAVIOR.** On 18 August 1994 at two locations in Badlands National Park, South Dakota, USA, separate adult prairie rattlesnakes were observed each with a group of young. One snake with young was found in a burrow within a black-tailed prairie dog *(Cynomys ludovicianus)* colony, while the other adult with young was found on the edge of the prairie dog colony nestled within a bed of cactus *(Opuntia* spp.). The adult rattlesnake in the cactus bed was seen with 4–6 young snakes ca. 20 cm in total length. The adult rattlesnake within the prairie dog colony had six young rattlesnakes ca. 20 cm in total length. On 25 August 1994, the young were still present with the adult at the cactus site. The other site was not examined. On 8 September 1994, the cactus site was visited again, and no snakes were seen. Also on this date, recent shed skins of the adult and three of the young were found around the aggregation site. Prior to observing the adult rattlesnake with young at the cactus site, this rattlesnake was observed for approximately one month at this same location. Two weeks before observing this adult with young, no young snakes were present.

The sex of the adult rattlesnakes is unknown, but most likely they were female. Nor do we know the exact date of the birth of the young. However, the young stayed with the adult for at least one week after initial observation, perhaps suggesting parental care and nesting behavior.

We also noted intense rattling by the adult rattlesnake in the cactus bed prior to the presence of young; this animal's rattling was heard well in advance of our arrival. Yet when the snakes were observed on the afternoon of 18 August, the adult rattled only after being disturbed.

Submitted by **GEORGE R. CUNNINGHAM, SUSANNE M. HICKEY**, 909 Evergreen Ave., Bellevue, Nebraska 68005, USA, and **CHRISTOPHER M. GOWEN**, 3108 Sedgewick Drive, Lynchburg, Virgina 24503, USA.

HETERODON PLATIRHINOS (Eastern Hognose Snake). **DEFENSIVE BEHAVIOR**. Platt (1969. Univ. Kansas Publ. Mus. Nat. Hist. 18:253–420) described death feigning by hognose snakes as the terminating stage in a sequence of defensive behaviors and usually is displayed only after experiencing extreme levels of provocation from man. At 1800 h on 20 May 1993, I encountered a pair of copulating hognose snakes both of which had been radiotracked for several weeks. The male (47. 5 cm SVL, 111 g) had trailed the female (65.5 cm SVL, 219 g) for three days, traveling at least 600 m. When I physically disturbed the copulating snakes, both immediately turned ventral side up and became limp, feigning death typical of the species. The behavior was not preceeded by either the escape or threatening stages or by the extreme writhing and cloacal discharge often seen in death feigning. The remarkable observation is that the pair remained in copulation while feigning death (Fig. 1). Left undisturbed for about 15 min, the female ceased feigning, began moving, and dragged the still feigning smaller male for about 65 m until they separated.



FIG. 1. *Heterodon platirhinos* feigning death while in copulation. The smaller male is underneath the female.

Submitted by **MICHAEL V. PLUMMER**, Department of Biology, Box 2251, Harding University, Searcy, Arkansas 72143, USA.

HETERODON SIMUS (Southern Hognose Snake). **HATCHLING SIZE.** Although clutch sizes have been reported for *Heterodon simus* (Edgren 1955. Herpetologica 11:105–117; Price and Carr 1943. Copeia 1943:93), no information exists on the size of hatchlings.

I collected five freshly road-killed *H. simus* between 26 and 28 October 1994 along a 0.6 km stretch of Range Road 234 on Eglin Air Force Base, Okaloosa County, Florida, USA (T1S, R25W, Sec. 12). The surrounding habitat consists of longleaf pine-turkey oak sandhill invaded by off-site sand pine. All five individuals were closely examined and found to have obvious umbilical scars and empty digestive tracts. These observations led me to conclude that these individuals were recent hatchlings and possibly dispersing siblings of this secretive, semi-fossorial species.

Snout-vent length ranged from 139–147 mm (mean 143.4) and total length ranged from 160–173 mm (mean 166.8). All individuals were deposited in the Auburn University Museum (AUM 33734-38).

I thank Craig Guyer and John Palis for reviewing the manuscript.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

LAMPROPELTIS GETULA SPLENDIDA (Desert Kingsnake). **DIET.** On 15 May 1995 at 2211 h, a yearling female *L. g. splendida* (335 + 50 mm, 22.2 g; TJL 102) was captured crossing TX FM 192 near its jct with TX FM 34 and placed into a snake bag. The following morning a half-digested female *Tantilla* sp. was found at the bottom of the bag (210 [incomplete] + 60 mm, 7.7 g [preserved]; UTEP 16001). The *Tantilla* was missing the anterior third of its body and a partially digested centipede, *Scolependra heros* (85+ mm), was protruding from its body wall. The inference is that soon after the *Tantilla* ingested the centipede, it was in turn eaten by the *Lampropeltis*. Using preserved specimens from the UTEP collection and data from Cole and Hardy (1981. Bull. Amer. Mus. Nat. Hist. Vol. 3: Art. 3:201–284) to estimate a tail length/total length ratio, we hypothesize that the consumed *Tantilla* was a *T. nigriceps* having a total length of 317 mm, which was 82% of the total length of the *Lampropeltis*. Published accounts listing generic ophidian prey of *Lampropeltis getula* include *Carphophis, Heterodon, Elaphe, Hypsiglena, Lampropeltis, Masticophis, Pituophis, Thamnophis, Agkistrodon,* and *Crotalus* (Blanchard 1921. U.S.N.M. Bulletin 114, vi + 260 pp; Wright and Wright 1957. A Handbook of Snakes of the United States and Canada. Cornell Univ. Press, Ithaca, xvi + 1105 pp.; Stark 1985. Herpetol. Rev. 16(3):79, 81.). *Tantilla* is now added to this list.

Thanks to C. S. Lieb, W. P. MacKay, and R. G. Webb for helpful comments and suggestions to the manuscript.

Submitted by **TRAVIS J. LaDUC** and **DOMINIC I. LANNUTTI**, Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968-0519, USA, **MIKE K. ROSS**, 957 E 54th Pl. #2, Chicago, Illinois 60615, USA, and **DAVID BEAMER**, 12019 Wicker Ave., Cedar Lake, Indiana 46303, USA.

MICRURUS FULVIUS FULVIUS (Eastern Coral Snake). **DIET.** Snakes compose a major part of the diet of *Micrurus fulvius*. Prey lists reported by Jackson and Franz (1981. Herpetologica 37:213–228) and Greene (1984. *In* R. A. Seigel et al. (eds.), Vertebrate Ecology and Systematics. Univ. Kansas Mus. Nat. Hist. Spec. Publ. No. 10, pp. 147–162) include 21 snake genera. This note documents an additional genus.

On 13 January 1993, a large female *M. f. fulvius* (SVL= 89.6 cm, TL= 97.9 cm) was trapped in a double-opening funnel trap used with a drift fence array in scrubby flatwoods (Myers and Ewel 1990. Ecosystems of Florida. Univ. Central Florida Press, Orlando, 765 pp.) at Boyd Hill Nature Park, St. Petersburg, Pinellas County, Florida, USA. After removal from the trap, the *Micrurus* regurgitated a partially digested Florida scarlet snake (*Cemophora coccinea coccinea*). The *Cemophora* was a female with a remaining total length (undigested portion) of 50.5 cm and tail length of 7.9 cm; a total length of 57.2 cm was estimated from a known mean tail length/total length ratio for females (Williams and Wilson 1967. Tulane Stud. Zool. 13:103–124).

I thank Dale R. Jackson for reviewing a draft of this note.

Submitted by **GEORGE HEINRICH**, P.O. Box 61301, St. Petersburg, Florida 33784-1301, USA.

MICRURUS MIPARTITUS (NCN). **POLYMORPHISM.** Different color morphs of Costa Rican *M. mipartitus* have been described (Villa 1972, Brenesia 1:10–13; Savage and Vial 1974, Rev. Biol. Trop. 21(2):295–349). Here we report for the first time the co-occurrence of different phenotypes of this species. In the period of 23 July 1993 to 8 September 1993, four specimens of *M. mipartitus* were collected in Rara Avis, 19 km SE of Estación Biológica La Selva, Heredia Province, Costa Rica.

The four specimens represented three different phenotypes: bicolor black and orange (two specimens: A and C), bicolor black and white (specimen D), and tricolor black, white, and orange (specimen B) (specimens ordered chronologically). Specimen A had a total length of 23 cm and 59 orange body rings; specimen B, 21 cm, 50 white/orange/white body rings; specimen C, 51 cm, 48 orange body rings; specimen D, 44 cm, 55 white body rings.

It is unlikely that the color variation is size-related, since juvenile A and adult C shared the same orange phenotype while individual D, having a white phenotype, was of intermediate size. Individuals C and D, two entirely different color morphs, were caught within the same week at locations less then 100 m apart.

Even our limited data show that this is not a size-related, geographical, or seasonal phenomenon, but a true case of polymorphism. The exact function of polymorphism in *M. mipartitus* is not clear and requires further investigation. The highly venomous coral snakes are often hypothesized to be involved in mimicry systems, serving as models for non- or mildly venomous colubrid mimics. In dynamic Batesian mimicry systems, the survival of the model should decrease as the resemblance of a mimic increases. Hence, Batesian models should be expected to evolve different aposematic color patterns as a coevolutionary response to selection resulting from successful mimics (Huheey 1988, Am. Nat. 131:S22–S41). Therefore, the polymorphism in *M. mipartitus* may represent an evolutionary escape from mimics with color patterns similar to those of one or more forms of *M. mipartitus*. Possible colubrid mimics collected in sympatry in Rara Avis are *Geophis brachycephalus, Liophis epinephalus,* and *Oxyrhopus petola*. Specimens C and D were deposited in the Instituto Clodomiro Picado, Universidad de Costa Rica, Costa Rica.

TWAN LEENDERS, GABRIËL BECKERS, and **HENK STRIJBOSCH,** Department of Ecology, Section of Animal Ecology, University of Nijmegen, Toernooiveld 1, 6525 ED Nijmegen, The Netherlands.

PITUOPHIS MELANOLEUCUS CATENIFER (Pacific Gopher Snake). **PREY.** During a study of habitat use by San Joaquin antelope squirrels *(Ammospermophilus nelsoni)* on the Carrizo Plain Natural Area, near California Valley, San Luis Obispo County, California USA,we captured, PIT-tagged, radio-collared, and released an adult female (155 g) squirrel on 14 July 1994. Over the next week, we radio-located this squirrel at least once a day. On 21 July, we first noticed the squirrel had not moved from a burrow and we speculated that it had been eaten by a snake. The weak radio signal from the transmitter remained in the same position until 27 July when it moved 39.4 m (straight-line distance) to the west. We originally tried to retrieve the transmitter on 22 July, but after excavating a rodent burrow to a depth of 1.4 m below the surface and still not reaching the transmitter, we gave up and reconstructed the site. A second attempt to retrieve the transmitter was made on 4 August when we suspected the transmitter was closer to the surface of the ground based on a stronger radio signal. After digging about 20 cm into a rodent burrow system, we found the transmitter inside an adult (120 cm SVL, 723 g), female, Pacific gopher snake *(Pituophis melanoleucus catenifer).* The captured snake had cloudy eyes and was apparently ready to shed. It was then housed in captivity for 5 days and x-rayed to verify the location of the radio-collar and PIT tag originally placed on, and in, the antelope squirrel. On 9 August, the snake passed the intact collar and functioning transmitter (40 mm diam, 2.6 g mass), as well as the PIT tag, and was released the next day at the site of capture.

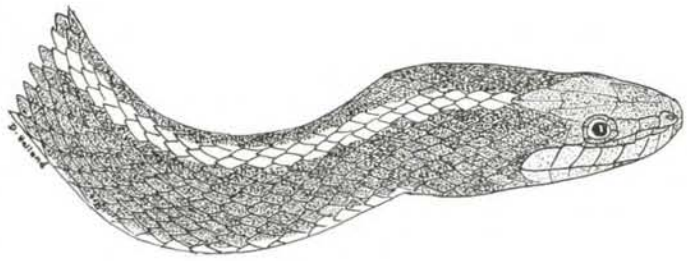
Although gopher snakes are known to prey upon a wide variety of rodents (Stebbins 1954. Amphibians and Reptiles of Western North America. McGraw Hill Book Co., New York. 536 pp.), these observations provide the first record of predation on *A. nelsoni* by *P. m. catenifer.* More importantly, these observations suggest that at least some medium-sized snakes (>100 cm SVL) can eat and pass, without ill effect, radio-collars fitted on live rodents.

Our thanks to Kathleen M. Sharum, Margaret B. Harker, and Thomas G. Murphey for assistance in radio tracking and John B. Truax for providing the x-ray of the snake. The Bureau of Land Management and The Nature Conservancy graciously allowed us to pursue our study on properties under their administration. Permits to conduct this research were provided by the California Department of Fish and Game.

Submitted by **MARK R. JENNINGS*, GALEN B. RATHBUN,** and **CATHERINE A. LANGTIMM,** National Biological Survey, California Pacific Science Center, Piedras Blancas Research Station, P.O. Box 70, San Simeon, California 93452-0070, USA. *MRJ: Research Associate, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-9961, USA.

PSEUDECHIS COLLETTI (Collett's Blacksnake). **TWINNING.** Though not terribly uncommon in snakes, twinning has usually been reported for colubrids (Burkett and Huggins 1985. Herptol. Rev. 16:56; Singh 1973. Herpetologica 29:19–20). On 11 August 1994, twin Collett's blacksnakes were hatched at the San Diego Zoo. The clutch of 16 eggs was laid on 10 June 1994 by our long-term captive female. The eggs were incubated at 29.4°C in an airtight, covered Tupperware™ container filled with a 1:1 mixture of vermiculite and water. Average incubation time for this species is around 60 days. At oviposition, the eggs averaged 52 mm x 33 mm and had an average weight of 34.7 g. Six of the eggs went bad within the first month and were opened. Of the six eggs, five were fertile with embryos just starting to develop, the other showed no signs of fertility. On the sixty-first day, four eggs had slit and were removed for hatching. Upon inspection the next morning, five hatchlings were found inside the box. Two of the hatchlings were noticeably smaller and had distinctive kinks at the end of their tails. No other snakes in the clutch had kinked tails. The twins weighed 7 g and measured 24 cm total length (TL) and 10 g and 26 cm TL, respectively. The rest of their clutch mates averaged 17.6 g and 31.2 cm TL. The yolk was not recovered from the egg with the twins so it is not known if they are fraternal or identical twins. Two remaining eggs slit, and were left for hatching. When the snakes had not hatched after three days, they were opened for observation. One egg had a fully formed but dead individual, and the other contained another set of twin snakes. In this instance, two yolk sacks could clearly be seen. Unfortunately, the snakes were not preserved. This represents the first incidence of twinning found for *P. colletti*. The living twins remain in the collection of the San Diego Zoo.

Submitted by **JOHN F. KINKAID**, Department of Herpetology, San Diego Zoo, P.O. Box 551, San Diego, California 92112, USA.



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Delayed Fertilization in the Monitor Lizard *Varanus gouldii*

Delayed fertilization has been reported in a large number of squamates (Blackwell 1954; Darevsky 1971; Fitch 1970; Greer 1989; Groves 1973; Haines 1940; Joss and Minard 1985; King 1977; Philipp 1979; Wall 1905; Woodward 1933), but there has only been one suspected instance reported in varanids (Auffenburg 1981). This report describes a case of delayed fertilization in *Varanus gouldii* at the Dallas Zoo.

A pair of *V. gouldii* were observed copulating on several occasions between 2 July and 17 September 1994. On the latter date, the male was removed due to a dermal infection. Twenty-one days later, the female deposited a clutch of ten eggs. After a few weeks these eggs began to desiccate and fertility could not be determined. The same female deposited a second clutch of eight eggs 65 days after oviposition of the first clutch. After three months of incubation, a fiberoptic egg candler revealed the presence of embryos and blood vessels, confirming fertility in four of the eggs. The male had not been housed with the female after 17 September 1994. Since gestation is unknown for this species, the exact length of sperm storage cannot be determined.

Acknowledgments.—We thank J. B. Murphy, L. A. Mitchell, C. M. Garrett, D. M. Boyer, D. T. Roberts, K. A. Bradley, and A. C. Walters for helpful advice in the preparation of this manuscript.

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MARK DOLES

and

WINSTON CARD

Department of Herpetology
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA.

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in volume 26, number 1.

CAUDATA

AMBYSTOMA TAYLORI (Taylor's Salamander). **RECORD SIZE.** *Ambystoma taylori* is a poorly studied Mexican salamander endemic to Laguna Alchichica, one of several crater lakes (axalapazcos) in the llanos of eastern Puebla, México, located at 2345 m (97°24'00"WL, 19°24'13"NL). The maximum snout-vent length (SVL) reported for *A. taylori* is 113 mm (Brandon et al. 1981. S. California Acad. Sci. 80(3):112–125.). Herein I report a female 126 mm SVL (to the median point of the cloaca), 230 mm TL, and 76.04 g live wet weight collected 27 February 1994 at 2030 h. The specimen was found struggling in a vertical position at the surface of the lake approximately 1 m from the edge. At this point the lake is approximately 1 m in depth. The specimen (ENEPI 6035) is deposited in the herpetological collections at the Universidad Nacional Autonoma de México, Campus Iztacala. I am grateful to Julio Lemos-Espinal who read an initial draft of this note.

Submitted by **MIGUEL ANGEL SANTINELLI-RAMOS,** Fuente de Tauro #15, Lomas de Tecamachalco, Edo. de México 53950, México.

ANEIDES FERREUS (Clouded Salamander). **REPRODUCTION.** Arboreality is common among tropical plethodontid salamanders (Lynch and Wake 1976. Nat. Hist. Mus. Los Angeles Co. Sci. Bull. 25:1–65), and it is probable that many of these species nest in trees (e.g., Good and Wake 1993. Herpetol. Monogr. 6:131–159; McCranie and Wilson 1993. Herpetol. Rev. 23:115–116). However, temperate plethodontids are generally terrestrial or fossorial (but see Jaeger 1978. Copeia 4:686–691; Madigon and Shoop 1970. Science 168:1484–1487), except for some members of the genus *Aneides*. Stebbins (1951. Amphibians of Western North America. Univ. California Press, Berkeley) reported *A. lugubris* in tree cavities as high as 20 m, and also reported nesting sites in hollow trees. Van Denburgh (1916. Proc. California Acad. Sci. 4th ser. 6(7):215–221) reported *A. ferreus* 6.6 m high in a snag, and Leonard et al. (1993. Amphibians of Washington and Oregon, Seattle Audubon Society, Seattle, Washington) reported *A. ferreus* 40 m high in a snag. Dunn (1942. Copeia 1942:52), and Storm (1947. Herpetologica 4:60–62) described nests of *A. ferreus* in decaying logs; however no tree nests have been reported. During August 1988, one of us (RAW) was examining the canopy foliage of recently felled trees from a logging operation in an old-growth stand at the Yurok Experimental Forest in Del Norte Co., California, USA, for evidence of marbled murrelet (*Brachyramphus marmoratus*) nests. The forest was predominately redwood (*Sequoia sempervirens*), with western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*). The trees being harvested were 70–100 m in height, with breast height diameters of 2–3 m and first limbs >20 m above ground. On a large redwood tree RAW discovered a cluster of six salamander eggs. The egg cluster had been dislodged from a fern clump (*Polypodium* spp.) that had broken open from the impact of felling. No adult salamander was observed in attendance when the cluster was discovered. The fern was at the base of a limb

located 30–40 m above ground; tree height was ca. 80 m and diameter ca. 3 m. The egg cluster measured ca. 3 cm diam. The eggs were collected and brought into the lab where three of the six eggs hatched about one week later. The hatchlings were identifed as *A. ferreus* by HHW.

Submitted by **HARTWELL H. WELSH, JR.**, Redwood Sciences Laboratory, 1700 Bayview Dr., Arcata, California 95521, USA, and **RANDOLPH A. WILSON**, Forestry Sciences Laboratory, 2500 South Pine Knoll, Flagstaff, Arizona 86001, USA.

BOLITOGLOSSA RUFESCENS (Northern Banana Salamander) **PREDATION**. While predation on small ectotherms by mantids has previously been documented (Wright 1982. N. Terr. Nat. 1(5):10–11), accounts of predation on salamanders are conspicuously scarce from the literature. The following is an account of an attack by an adult mantid, *Choeradodis strumaria*, on an adult salamander, *Bolitoglossa rufescens*. The observation was made on 10 July 1993 at ca. 2230 h at the University of México's Estacion de Biologia "Los Tuxtlas" in southern Veracruz, México.

As I observed a pair of *B. rufescens* ascend a concrete wall during a rain shower, an adult *C. strumaria* landed on the wall ca. 1 m above the salamanders. After a few seconds the mantid began walking rapidly down towards the still ascending pair and stopped ca. 0.5 m above them directly in their path. When one of the salamanders was within range, the mantid tried unsuccessfully to grasp it. Following the initial attack, both salamanders stopped and remained motionless. Within 5 s the mantid attacked a second time and was once again unsuccessful. The salamander that had been attacked turned around and began crawling down the wall away from the mantid. The mantid pursued the salamander and on the third attack was successful in grasping it. The salamander immediately began writhing violently and the pair fell onto the concrete sidewalk beneath the wall. The pair struggled for ca. 1 min before the salamander became motionless. The mantid began to feed on the salamander at a point just posterior of the left eye. After ca. 1 min the salamander started struggling once more. The apparently weakened salamander was unable to free itself from the mantid. Following ca. 1–2 min of struggling, the mantid released the salamander and quickly flew off into the forest. After it was released, the salamander remained motionless on the sidewalk for ca. 10 min before any movement was noticed. Upon capture and examination, one small wound was visible immediately behind the left eye but otherwise the salamander appeared unharmed. After release at the site of the incident, the salamander rapidly ascended to the roof.

While no other attacks of this nature were observed over a period of 10 weeks, mantids and salamanders were frequently observed in close proximity on the concrete wall of the Estacion's buildings, particularly during rain showers. Based on this observation, it is possible that mantids may be successful in catching, subduing, and consuming salamanders. It appears, however, that prey handling costs may be relatively high and this was an isolated occurrence.

I would like to extend my gratitude to Wyatt Hoback for his assistance in identifying the mantid and thank Richard C. Vogt for logistical support during my stay in Veracruz. Funding for my work at the Estacion de Biologia was provided out of pocket.

Submitted by **PAUL BUTTENHOFF**, Department of Zoology and Wildlife Science, Auburn University, Alabama 36849, USA.



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NECTURUS MACULOSUS (Mudpuppy). **REPRODUCTION**. During a snorkel survey at the Larsen Road bridge crossing of the Namekagon River, Sawyer Co., Wisconsin, USA (T42N, R8W, Sec. 21) on 13 August 1991, I found an adult mudpuppy with at least 15 striped juveniles beneath a rock slab 1 m from shore in a side channel upstream from the bridge. This observation, in conjunction with a similar sighting at the same locality on 16 September 1982 (Cochran and Lyons 1985. Herpetol. Rev. 16:53, with the location mistakenly listed as Sec. 16), provides an indication of the range in phenological timing of mudpuppy reproductive events that might be encountered at a given site. Whether variability in timing within years is as extensive as that observed in this case between years is debatable. Some workers (Fitch 1959. Copeia 1959:339–340, and references therein) have suggested that the period of spawning is brief because embryos from different nests in the same location are usually at similar stages of development.

I thank Joe Cochran for assistance with the snorkel survey.

Submitted by **PHILIP A. COCHRAN**, Division of Natural Sciences, St. Norbert College, DePere, Wisconsin, 54115, USA.

PLETHODON ALBAGULA (Western Slimy Salamander.) **FOOT ANOMALIES**. Six of 10 (60%) slimy salamanders, MCZ 119267–76, collected 13 March 1994 ca. 1.5 km NE of Driftwood, Hayes Co., Texas, USA, have apparent developmental anomalies of feet or toes. Some have more than one affected foot (20% of all 40 feet). Anomalies vary from palmation and syndactyly to a double manus (Fig. 1). Of the four normal individuals, two are apparently young of the year, 23 and 28 mm SVL. The habitat appears natural, with no sources of pollution. Bear Creek flows within 20 m of the site, is clear, and heavily used for recreation. Slimy salamanders are abundant at this site.

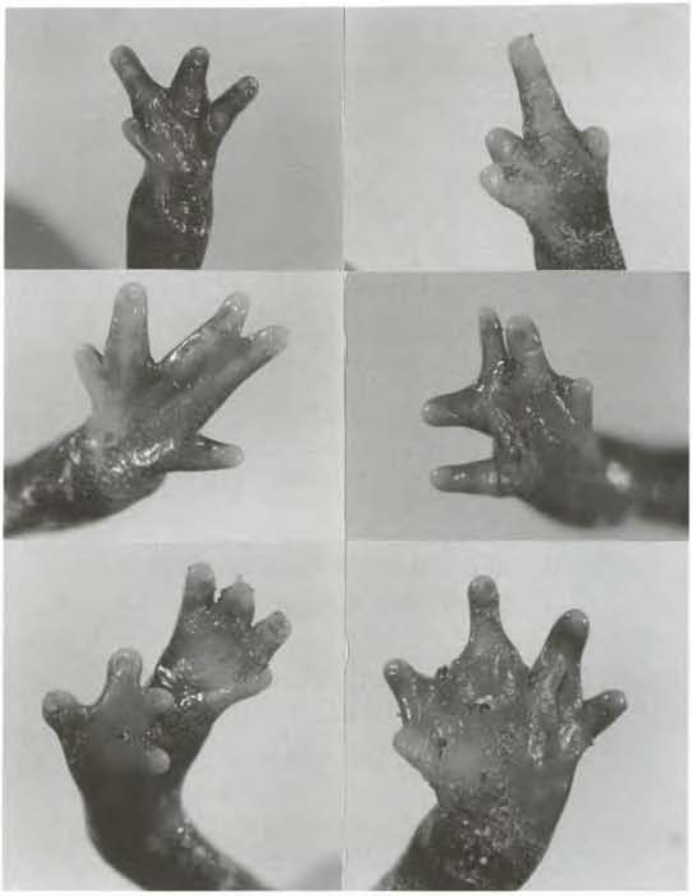


FIG. 1. Foot anomalies in *Plethodon albagula* from Hayes Co., Texas.

Of 84 other MCZ specimens of *P. albagula* from other sites in Hayes, Comal, and Travis counties, none shows comparable anomalies. Some are missing toes: eight individuals (9.5%); one has two affected feet. These anomalies appear to be the result of trauma rather than developmental. One (MCZ 117600) from Austin, Travis Co. has a rectangular heel protuberance on the right pes. The number of unusual salamanders among these 84 is 10 (11.9%) with 11 abnormal feet (3.3%). The difference, compared to MCZ 11267-76, is significant (Chi square). I am indebted to Thomas Sinclair for collecting the specimens.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA.

PLETHODON CINEREUS (Eastern Red-backed Salamander) **NEST BEHAVIOR**. Female *P. cinereus* suspend their eggs in moist cavities within and under rotting logs and stumps on the forest floor (Gilhen 1984. Amphibians and Reptiles of Nova Scotia. Nova Scotia Museum, Halifax, 64 pp.). Each female then remains with her eggs during their direct development (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill Book Co., New York, 670 pp.).

Amphibian surveys were conducted in hardwood forest stands just outside the northern park boundary of Fundy National Park, Sussex, New Brunswick, Canada on 6 August 1994 (45°40'N; 65°09'W) and 19 August 1994 (45°41'N; 65°05'W). The goal of the research was to identify and count the number of species and individuals of each species in a 100 m^2 plot and to release the amphibians unharmed. During these two surveys a total of nine *P. cinereus* nests were discovered. Seven of the nests were found in logs, while the other two were located in stumps. One log contained three nests, but they were not located near one another. During the second survey (19 August) young *P. cinereus* were observed prematurely hatching from their eggs due to the disturbance caused during the search. These newly hatched young still retained yolk sacs in their stomachs. Several previously hatched young were also present, and did not contain yolk sacs. It is common for the young to stay near the nest after they hatch for up to three weeks (Sayler 1966. Copeia 1966:183–193). The number of eggs and/or young per nest ranged from 1–14 (a few young may have escaped detection). Gilhen (*op. cit.*) reported that *P. cinereus* females in Nova Scotia produce 4–17 eggs. Sixty-six percent (N = 6) of the nests observed had 8 or more eggs and/or young. When disturbed, the young immediately tried to escape. The newly hatched young were ca. 1 cm SVL and 0.5–1.0 cm tail length.

In general, *P. cinereus* are territorial and aggressive towards members of their own species (Duellman and Trueb, *op. cit.*). Therefore, it was surprising to note at 8 of the 9 nests two adult salamanders were in attendance, while at the remaining nest only one adult was observed. In all 8 cases where two adults were present, both adults were either in contact with, or in close proximity to, the eggs and/or young This observation conflicts with previous reports of only one adult, the female, brooding or guarding the eggs (Duellman and Trueb, *op. cit.*; Highton and Savage 1961. Copeia 1961:95–98; Sayler, *op. cit.*). If indeed one of the individuals was the brooding female, it is possible the other adult

was a male rather than a second female. This may be supported by the behavioral observations of Highton and Savage (*op. cit.*) who found that brooding *P. cinereus* females chase neighboring females away from their nest. They also reported that neighboring females will eat the brooding female's eggs. Aggressive interactions between both individuals present or predation of eggs by either one of the individuals was not observed. *Plethodon cinereus* is sexually dimorphic with males tending to have smaller total body lengths than females (Gilhen, *op. cit.*). At five of the nests one adult was larger in total body length than the other individual, while at three nests both adults were approximately the same size. More detailed examination of specimens would have been necessary to confirm sexes.

On one other occasion (19 June 1991), in Halifax Co., Nova Scotia (44°31'30"N; 63°45'30"W) two adult *P. cinereus* were found at a nest under a rotting stump.

I thank R. Waldick and B. Freedman for the use of some of these behavioral data which were collected while the author was working for them as part of the Greater Fundy Ecosystem Project. I would also like to thank R. Wassersug and E. Coscia for helpful suggestions on this manuscript.

Submitted by **STEPHEN C. FRIET**, Department of Biology, Dalhousie University, Life Sciences Centre, Halifax, Nova Scotia B3H 4JI, Canada.

PLETHODON CINEREUS CINEREUS (Redback Salamander). **COLORATION.** A single erythristic phase *Plethodon c. cinereus* was captured in a drift-fence array located in Great Pond Township of Hancock Co., Maine, USA, on 10 September 1993; four others were captured in a similar array in LaGrange Township, Penobscot Co. from 15 June to 31 July 1994. The salamander captured in Hancock Co. was located in a stand of mature hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*); the animals from Penobscot Co. occurred in a northern hardwood stand (*Fagus grandifolia* and *Acer saccharum*). A softwood dominated forest stream passed within 150 m of the drift-fences at both sites.

The specimens were brick red dorsolaterally with black flecks spread evenly across the body, including on the head and legs. The density of flecks on the tail increased to produce a mottled appearance of equal parts of black and red. Ventrally, the throat was mostly creamy white and the belly was mottled with cream and slate grey. The single specimen from Hancock Co. was 42 mm SVL, sex unknown. Two females from Penobscot Co. were 46 and 44 mm SVL; two others were 44 mm SVL, sex unknown. A total of 9 redback salamanders were captured during the summer of 1993 at the softwood-dominated Hancock Co. site. The frequency of redback to scarlet phase individuals was 8:1. The Penobscot Co. array yielded 157 redback salamanders with a redback to scarlet phase ratio of 38.3:1.

Plethodon c. cinereus is the only salamander species in New England to exhibit color pattern polymorphism with three distinct color phases: the red-striped, the grey, and the scarlet or erythristic phase. The rarest of the three color morphs is the erythristic phase which is previously unreported from Maine. The evolutionary basis for color pattern polymorphism in this species is poorly understood but see Lotter and Scott (1977. Copeia 1977:681–690) and Tilley et al. (1982. Herpetologica 38:409–417) for a discussion and experimental test of the hypothesis that erythristic individuals might be Batesian mimics of red efts (juvenile *Notophthalmus viridescens*).

Submitted by **PHILLIP G. DEMAYNADIER**, Department of Wildlife Ecology, Nutting Hall, University of Maine, Orono, Maine 04469, USA.

PLETHODON IDAHOENSIS (Coeur d'Alene Salamander). **PREDATION.** Little is known about predation on terrestrial salamanders. On 16 June 1993, a partial carcass (Fig. 1) of *Plethodon idahoensis* (ca. 51 mm SVL, ca. 44 mm TL) was discovered under a rock (< 20 cm diam) alongside an unnamed creek which flows into the south end of Beauty Bay, Coeur d'Alene Lake, Kootenai Co., Idaho, USA (T49N, R3W, NE1/4 of section 11). The head, vertebral column, tail, and the left fore and hind limbs composed the carcass (Fig. 1). The tail was undulating at the time of collection (1230 h) and was still moving 3 h later when preserved in 10% NB formalin. The lack of an obvious mental gland suggests it was a female.

The only observed predator of *P. idahoensis* is the western robin, *Turdus migratorius;* a robin carried an individual *P. idahoensis* to another site before attempting to consume it (Wilson and Simon 1985. Herpetol. Rev. 16:111). Discovery of the carcass under a rock, however, suggests an attack by a ground-dwelling predator such as a shrew or an invertebrate, rather than a bird. In the field, carabid beetles have been observed consuming the soft parts of frogs (Robertson 1989. Herpetol. Rev. 20:7–8) and salamanders, e.g., *Ambystoma jeffersonianum* (Smith 1946. Herpetol. 3:67) and *Plethodon vehiculum* (Ovaska and Smith 1988. Can. J. Zool. 66:599–604). In the lab, carabid beetles (*Scaphinotus* and *Pterostichus*) consumed *Plethodon vehiculum,* but chose individuals much smaller (< 26mm SVL) than the *P. idahoensis* reported here (Ovaska and Smith 1988, *op. cit.*). *Scaphinotus* occurs in the same habitat as *P. idahoensis* (Wilson, pers. comm.). It is unknown whether the predator subdued this salamander or whether the salamander was moribund prior to the attack. The undulating tail suggests the animal was alive when first attacked.

The carcass will be deposited in the Charles R. Conner Museum at Washington State University, Pullman. I thank John H. Larsen, Jr. for commenting on the manuscript. Field work was supported by the Murdock College Science Research Program.



FIG. 1. Carcass of an adult *Plethodon idahoensis* found under a rock.

Submitted by **NANCY L. STAUB**, Biology Department, Gonzaga University, Spokane, Washington 99258, USA.

PSEUDOEURYCEA CEPHALICA MANNI (NCN). **REPRODUCTION.** Among the 26 species of salamanders of the genus *Pseudoeurycea* ocurring in México (Flores Villela 1993. Carnegie Mus. Nat. Hist. Spec. Publ. (17):1–73), data on reproduction exist for only seven species: *P. expectata* (Stuart 1954. Proc. Biol. Soc. Washington 67:159–178; Salthe 1963. J. Morphol. 113(2):161–171); *P. belli* (Duellman 1961. Univ. Kansas Publ. Mus. Nat. Hist. 15:1–148); *P. nigromaculata* and *P. juarezi* (McDiarmid and Worthington 1970. Herpetologica 26:57–70); *P. brunnata, P. goebeli*, and *P. rex* (Houck 1977. *In* Taylor and

Guttman [eds.]., The Reproductive Biology of Amphibians, pp. 43–72. Plenum Press, New York). According to Duellman and Trueb (1986. Biology of Amphibians. McGraw-Hill. 670 pp.), *Pseudoeurycea* has internal fertilization, terrestrial eggs, and direct development.

On 30 March 1990, we collected an adult female *P. cephalica manni* (MZFC 5988, 47.7 mm SVL, 82.4 mm TL, 3.0 g) 2 km NW Palo Gacho, Municipality of Tenango de Doria, Hidalgo, México, 2300 m elevation, in a pine-oak forest. The specimen was found under a rock (Fig. 1) with 28 eggs in a gelatinous mass that measured 18.2 mm (largest diameter) and weighed 1.3 g. The eggs were elliptical in shape, with an average length of 4.5 mm (SD = 0.335; range = 3.9–5.0 mm) x 4.0 mm (SD = 0.233; range = 3.5–4.7). Some eggs were in late gastrulation stages 9 and 10 (Duellman and Trueb, *op. cit.*).

The specimen was found under a rock, coiled about the clutch in a depression, as recorded for *P. juarezi* (McDiarmid and Worthington, *op. cit.*) and *Nototriton barbouri* (McCranie and Wilson 1992. Herpetol. Rev. 23:115–116).



FIG. 1. Adult female *Pseudoeurycea cephalica manni* (MZFC 5988) with clutch of eggs.

When we tried to collect the female, she secreted a substance on the skin and undulated her tail and body. This behavior has already been reported in the genus *Pseudoeurycea* and is common in almost all species of salamanders (Duellman and Trueb, *op. cit.*).

We thank Hobart M. Smith, Oscar Flores, and Aurelio Ramírez for reviewing the manuscript, and Mario Mancilla Moreno for the photograph. Sol de Mayo Mejenes López prepared the photographic print for publication. This work was supported by the Direccion General de Asuntos al Personal académico (DGAPA) project IN-201789 and project PADEP 003001.

Submitted by **FERNANDO MENDOZA QUIJANO** and **EFRAIN HERNANDEZ GARCIA**, Museo de Zoología, Facultad de Ciencias, UNAM, Apdo. Post. 70-399, México, D.F., México.

ANURA

AGALYCHNIS CALCARIFER (NCN). **REPRODUCTION**. *Agalychnis calcarifer* (Hylidae) is a large neotropical frog that breeds in puddles formed on fallen logs in lowland rain forests of Central and South America (Donnelly et al. 1987. Copeia 1987:247–250; Duellman 1970. Monogr. Mus. Nat. Hist. Univ. Kansas 1:1–753). As part of a larger study of arboreal egg-laying frogs, I and several volunteers observed the breeding biology of *A. calcarifer* during 18 months between 1989 and 1992. We made these observations at La Selva Biological Station, Heredia Province, Costa Rica in lowland (35–185 m) wet tropical forest. Rainfall averages approximately 400 cm per year, and the rainy season occurs between May and December. Four breeding sites, all in pan holes between the buttresses of fallen trees, were used repeatedly by ovipositing *A. calcarifer*. Adults were observed amplecting and egg-laying on 9 August and 5 September 1991 at one site, and on 10 August 1991 at another site. The following sequence was recorded for egg-laying on the morning of 9 August 1991.

0930 h: Pair in amplexus on log.
0945 h: Frogs entered water in log puddle and swam 2.3 m.
0948 h: Female moved out of water and positioned vent ca. 7 cm vertically above the surface of the water on log.
0951 h: Female's abdomen contracted and male positioned his vent parallel to female's.
0952 h: Male bobbed his head once quickly. His lower jaw came in contact with the top of the female's head.
0953 h: Female began ovipositing.
0955 h: Female moved ca. 3 cm away from egg mass.
0956 h: Male climbed to top of female's head. Male moved off female and onto log. Female dropped back into water on log. By 1020 h the male had jumped off the log out of view and the female was still sitting in the water. Observations ended.

During the three times that egg-laying was observed, females took 3, 9, and 10 minutes each to complete ovipositing. Amplecting animals were already paired when first sighted, thus total duration of amplexus is not known.

Agalychnis calcarifer bred in pan holes that were also used by other anurans. Adults of *Leptodactylus melanonotus* and *Eleutherodactylus crassidigitus* (both Leptodactylidae) were found in or near the water pools at several sites. An adult female *Smilisca phaeota* (Hylidae) was found at one site the morning after many small floating hylid eggs were found at this site.

I thank David Roberts and James Murphy of the Dallas Zoo for their careful observations.

Submitted by **WENDY E. ROBERTS**, Museum of Vertebrate Zoology and Department of Integrative Biology, University of California, Berkeley, California 94720, USA.

ATELOPUS ZETEKI (Panamanian Golden Frog). **PURE TONAL VOCALIZATION**. Males of the genus *Atelopus* produce three general call pattems: the pulsed call, the pure tonal whistle, and the short call (Cocroft et al.1990. Copeia 1990:631–643; Crump 1988. Anim. Behav. 36:1064–1077; Jaslow 1979. J. Herpetol. 13:141–145; and Lescure 1981. Bull. Mus. natn. Hist. nat., Paris 3:893–910). The pulsed vocalization appears to function primarily as male advertisement to conspecifics, and secondarily as a dominance signal during bouts of aggression (Cocroft et al., *op. cit.*; Crump, *op. cit.*; and Jaslow, *op. cit.*). There is no evidence that vocalizations play a role in female attraction. Pulsed calls may be used in mate attraction by males of two South Ameri-

can atelopids, *A. pulcher* (= *A. spumarius*) and *A. flavescens* (Jaslow, *op. cit.*; and pers. obs). The short call is produced by most species when seized by a potential predator or in crowded captivity (Jaslow, *op. cit.*; Cocroft et al., *op. cit.*). Also, I have witnessed two species from Panama, *Atelopus* sp. from Nusagandi, San Blas, [likely the same *Atelopus* sp. referred to by Savage (1972. Herpetologica 28:77–94) and Cocroft et al. (*op. cit.*) and *A. chiriquiensis*, from Cerro Punta, Chiriqui, using the short call during conspecific wrestling bouts. These calls are given by the individual being attacked. Crump (*op. cit.*) reported similar behavior in *A. varius*. The pure tonal whistle has been documented in *A. cruciger, A. minutulus*, and *A. chiriquiensis*. This whistle is used by the inferior male *A. chiriquiensis* after losing an aggressive confrontation (Jaslow, *op. cit.*).

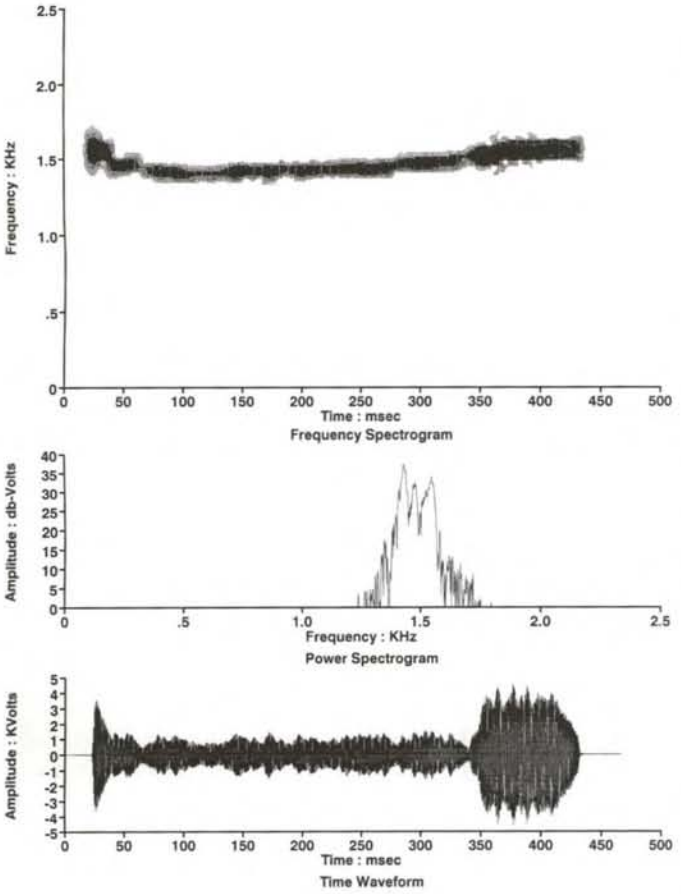


FIG. 1. Frequency Spectrogram (top), Power Spectrogram (middle), and Time Waveform (bottom) for 1 of 3 recorded pure tonal whistles in *Atelopus zeteki*. The frequency spectrogram was calculated at 256/2000 (FFT points/FFT steps), with a bandwidth of 39.1 Hz. The power spectrogram was calculated at 8192 FFT points, with a bandwidth of 1.2 Hz. All calculations and graphs in Figure 1 were produced using Signal© (Beeman 1993. Signal User Guide, vers. 2.2, Engineering Design. Belmont, Massachusetts).

During March 1994 in Panama, I recorded *A. zeteki* males vocalizing in an outdoor terrarium at El Valle de Anton, Provincia de Cocle, using a Sony TCD-D10 PRO Digital Audio Tape-corder via an Audio-Technica 815a directional microphone. During this recording, one male changed from a pulsed call to a tonal whistle, a vocalization not previously documented for this species. The male was neither being agitated by me nor another frog. During an experimental trial in July 1994 another male was observed using pure tonal whistles in response to playbacks of male pulsed vocalizations. No sound recordings were made during the observation period. I suspect that whistles performed during this playback experiment may have been pre-confrontational surrender to a perceived potential aggressor.

The tonal call of *A. zeteki* is lower in frequency than the pulsed and short types and is frequency modulated. There is an initial downward frequency sweep followed by a more gradual upward sweep. The pure tone has a mean maximum frequency of 1660 Hz ± 17.3 and a mean minimum frequency of 1390 Hz ± 0 for the three calls recorded. The mean peak frequency was 1556.7 Hz ± 90.2 and duration varied between 386 and 468 msec. Recordings have been deposited and catalogued (BLB-20404/EL9401D) in the archives of the Borror Laboratory of Bioacoustics at The Ohio State University.

I especially am thankful for the help of David W. Swihart, Thomas E. Hetherington, A. Stanley Rand, Roberto Ibanez, Sandra L. L. Gaunt, Hitesh Khanna, and Molly A. Lindquist. Financial support was provided through a Smithsonian Tropical Research Institute short-term fellowship. Call analysis was done at the Borror Laboratory of Bioacoustics.

Submitted by **ERIK D. LINDQUIST**, Department of Zoology, The Ohio State University, 1735 Neil Ave., Columbus, Ohio 43210, USA.

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog). **PREDATION**. *Osteopilus septentrionalis* is an introduced species presently expanding its range in the peninsula of Florida. It is an aggressive feeder upon insects and smaller native treefrogs (Ashton and Ashton 1988. Handbook of Reptiles and Amphibians of Florida, Part Three, The Amphibians. Windward Publishing, Inc., Miami, Florida. 191 pp.), while noxious skin toxins presumably afford it protection against some local predators. An instance of *O. septentrionalis* being ingested as the prey of a native Florida snake, without apparent discomfort to the predator, is documented here.



FIG. 1. *Thamnophis sauritus sackenii* swallowing the head of an *Osteopilus septentrionalis* that was eaten rear feet first.

On 18 February 1994, I investigated an anuran distress call in the vicinity of the front door of my home (4 km E of Alva, Lee Co., Florida, USA) at 1055 h on a humid overcast morning. Entwined among the exotic foliage climbing the house, about 1 m above ground level, was a ca. 60 cm TL peninsula ribbon snake (*Thamnophis sauritus sackenii*) grasping the ends of both rear legs of a ca. 4 cm SVL *O. septentrionalis* (Fig. 1). The snake seemed not to be bothered by any aspect of the frog as it took 15 minutes to completely swallow it. Several slides taken within close proximity failed to disturb the situation. The air temperature was 23.1°C.

At 1205 h, the snake was still resting in the same basic position with the slight bulge located in the middle of its length, confirming that the frog was not regurgitated within the first hour. This suggests that the spread of *O. septentrionalis* in Florida will meet some resistance as at least one native snake species is capable and willing to utilize them as food.

Submitted by **WILLIAM B. LOVE**, P.O. Box 643, Alva, Florida 33920, USA.

PELTOPHRYNE GUENTHERI (NCN). **DIET**. Although aspects of ecology were summarized by Schwartz and Henderson (1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville), the diet of *Peltophryne guentheri* has not been described. This endemic toad occupies largely xeric lowland habitats throughout Hispaniola. Stomachs taken from 204 individuals (90 juveniles, 65 adult females, and 49 adult males), collected during various months from a variety of locations on Hispaniola, were examined. Adult status was determined by the presence of eggs in females and enlarged testes in males.

TABLE 1. Stomach contents of *Peltophryne guentheri* from Hispaniola.

Contents	Number	Volume	Frequency	Importance
Arachnida Araneae	15	0.653	7	0.157
Coleoptera	136	1.953	53	0.739
Coleoptera (immature)	128	0.538	13	0.276
Dictyoptera	2	0.035	2	0.019
Diptera	4	0.010	3	0.023
Hemiptera	8	0.063	7	0.058
Homoptera	4	0.023	4	0.030
Homoptera (immature)	22	0.230	1	0.062
Hymenoptera (Formicidae)	636	1.645	59	1.176
Hymenoptera (Formicidae immature)	3	0.050	1	0.016
Hymenoptera other	10	0.568	8	0.133
Isoptera	127	0.190	2	0.156
Lepidoptera (immature)	5	0.135	3	0.043
Orthoptera	9	0.368	9	0.118
Plecoptera	1	0.005	1	0.008
Arthropod parts (unidentified)	—	0.055	16	
Nematoda	6	0.008	3	
Plant material	—	1.773	49	
Grit	—	0.153	8	

Prey was present in the stomachs of 105 individuals (empty stomachs were likely attributable to specimens collected early in the evening before feeding had commenced). Stomach contents were analyzed and arthropods were identified to order and counted. Volumes of all food items were determined using fluid displacement methods of Milstead (1957. Texas J. Sci. 9:410–447). Ants were present in the greatest number (636 of 1109 food items) and were found in the most stomachs (59). Adult beetles constituted the greatest volume (1.95 of 6.34 cm^3 total prey volume) and were found in 53 stomachs. Eight stomachs contained grit and 49 contained plant matter (ingestion of which was presumably adventitious). Results are summarized in Table 1.

No significant differences (Wilcoxen signed-rank test) existed between the diets of males and females ($Z = -1.14$, $P = 0.26$) or between those of adults and juveniles ($Z = -1.08$, $P = 0.28$). Snout-vent length was positively correlated with mean prey size (Spearman rank correlation, $Z = 3.95$, $P < 0.01$).

Importance values (Powell et al. 1990. Carib. J. Sci. 26:67–70) were used to calculate Levin's measure of niche breadth (Krebs 1989. Ecological Methodology. Harper & Row). A calculated breadth of 0.61 suggests that *Peltophryne guentheri* is a dietary generalist despite the prevalence of ants and beetles in the stomachs examined.

I thank Robert Powell for access to specimens in the Bobby Witcher Memorial Collection, Avila College, and William E. Duellman and John E. Simmons for permission to examine specimens in the Albert Schwartz Field Series, University of Kansas Museum of Natural History.

Submitted by **KEELY J. PARSONS**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145, USA.

RANA CAPITO (Gopher Frog). **COMBAT**. The occurrence of male-male combat in ranid frogs was summarized by Wells (1977. Anim. Behav. 25:666–693) and Shine (1979. Copeia 1979:279–306), where *Rana catesbeiana* and *R. clamitans* were listed as North American ranids known to participate in male-male combat. Howard (1980. Anim. Behav. 28:705–716) subsequently reported male-male combat in *R. sylvatica*. The following observation describes a bout between two gopher frogs (*Rana capito*), a species not previously reported to engage in male-male combat.

The episode took place at an ephemeral pond in Harrison Co. in southeastern Mississippi, USA, during the night of 4 March 1988. The two frogs were engaged in the behavior upon their discovery. The frogs were facing each other on the pond bottom, at a depth of ca. 35 cm. Both frogs exhibited three types of antagonistic actions toward one another: 1) head-butting, 2) pushing with the forelimbs, and 3) kicking with the hindlimbs. During the struggle the frogs often appeared to close their eyes, and their nictitating membranes covered the eye throughout. Several times the frogs became separated and turned away from one another, but always returned to face each other. The episode lasted three minutes from the time they were discovered, and each frog surfaced at least one time during the bout, presumably for air. Upon reaching the surface, the frog would immediately turn and swim back toward the other frog on the pond bottom. The frogs seemed undisturbed by flashlight, until one surfaced directly facing the beam and then disappeared under grass on the pond bottom. Only one of the frogs was captured and positively identified as a male, but the other was similar in size and its behavior was aggressive. Heavy rains occurred in the 24 hour period prior to the episode, and coincided with the time period in which deposition of gopher frog egg masses was observed.

Wells (*op. cit.*) described behavior typically associated with male-male combat in frogs. Because our (GNJ) observations

closely follow those he summarized, we believe this account documents that male-male combat exists within the mating system of *R. capito*.

Submitted by **J. SEAN DOODY, JEANNE E. YOUNG**, Department of Biological Sciences, Southeastern Louisiana University, Box 814, Hammond, Louisiana 70402, USA, and **GLEN N. JOHNSON,** Southern Forest Experiment Station, 1925 Thirty-fourth Street, Gulfport, Mississippi 39501, USA.

RANA PRETIOSA (Spotted Frog). **BASKING BEHAVIOR.** On 16 April 1993, a male *Rana pretiosa* (60 mm SVL) was perched horizontally on a dead cattail (*Typha* sp.) leaf about 30 cm above the water in a 0.2 ha marsh 1 km north of Charleston, Wasatch Co., Utah, USA. Air and water temperatures were 18.5°C and 13.5°C, respectively. The frog was in full sunlight from 1350 until 1415 h when we captured it to obtain measurements. This observation is noteworthy given the aquatic habits of *R. pretiosa* (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press. Moscow, 332 pp.). Several *R. pretiosa* at this site had leeches (*Helobdella stagnalis*; P. Hovingh, pers. comm.), although the individual we observed did not. Basking also may increase growth rates, but there may be other unknown advantages conferred to the animal (Freed 1980, Physiol. Zool. 53:433–444). We thank P. S. Corn and P. Hovingh for suggestions regarding this note.

Submitted by **DAVID A. ROSS** and **BRADLEY J. RICHARDSON**, Native Wildlife Section, Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, Utah, 84116-3195, USA.

Present address for DAR: Utah Division of Wildlife Resources, 515 East 5300 South, Ogden, Utah, 84405-4599, USA.

CROCODYLIA

CAIMAN LATIROSTRIS (Broad-snouted Caiman). **NESTING.** Although *Caiman latirostris* is widely distributed in southeastern South America (Medem 1983. Los Crocodylia de Sur America. Vol. 2. Ed. Carrera, Bogota. 270 pp.), the reproductive biology of the species remains poorly known (Thorbjarnarson 1992. Crocodiles: An Action Plan for their Conservation. Gland, Switzerland: IUCN). *Caiman latirostris* is considered an endangered species due to habitat destruction and over exploitation (Groombridge 1987. *In* Webb et al. (eds.), Wildlife Management: Crocodiles and Alligators, pp 9–21. Surrey Beatty and Sons Pty. Ltd., Sydney), hence information about all aspects of its reproductive biology is needed to formulate plans for the species' conservation. In this note we present data on nest characteristics, clutch size, and egg size from eight nests found on floating grass mats.

This study is part of an environmental impact study carried out by Companhia Energética de São Paulo (CESP) in the area to be inundated by Porto Primavera Dam, Paraná River, on the border between São Paulo and Mato Grosso do Sul states. The surveys were conducted between parallels 20°48' and 22°30'S. Nests were located by flying over the floodplains of the Paraná River and tributaries in a Bell 206 helicopter on 1 February 1993 and 25 February 1994. Studies on reproductive ecology of *C. latirostris* have been hindered mainly because it is difficult to locate their nests. However, searching from the air facilitated finding nests on floating grass mats. We spent about 30 minutes/flight to locate each nest. Aerial surveys of nests are frequently used in studies of crocodiles and alligators (e.g., Webb 1987. *In* Webb et al. (eds.), *op. cit.*, pp. 107–124; Joanen and McNease 1989. Amer. Zool. 29:987–998). However, the technique has not been frequently used in South America (Campos 1993. J. Herpetol. 27:127–132). Based on our experience, we recommend the use of helicopters to locate nests of *Caiman latirostris*.

TABLE 1. Sizes of broad-snouted caiman nests, eggs, and embryos from the area to be inundated by the Porto Primavera Dam. Nests 1–5 were found in January 1993, and nests 6–8 during February 1994. LE = mean egg length, WE = mean egg width, and SD = standard deviation.

#	nest			eggs			embryos	
	length (cm)	width (cm)	height (cm)	number	LE ± SD (mm)	WE ± SD (mm)	length (mm)	age (days)
1	150	150	—	—	—	—	65	19
2	108	105	52	24	74 ± 3	41 ± 2	160	35
3	120	110	40	17	63 ± 2	41 ± 1	73	21
4	102	100	40	24	67 ± 3	44 ± 1	123	32
5	98	95	45	33	68 ± 2	44 ± 1	140	33
6	102	100	45	23	64 ± 4	40 ± 1	220	60
7	135	111	50	22	69 ± 4	40 ± 1	198	45
8	113	100	40	8	72 ± 2	42 ± 1	210	58
mean	116.0	108.9	44.5	21.6	68.4	42.4	148.6	37.9
SD	18.2	17.5	4.9	7.6	4.5	1.9	59.6	15.4

We inspected five nests of *C. latirostris* in 1993 and three nests in 1994. The nests were located on floating grass mats dominated by *Cyperus prolixus* and *Scirpus cubensis*. Other common macrophyte species were *Cyperus surinamensis, Setaria geniculata*, and *Habernaria* sp. We measured the height, length, and width of each nest, and counted and measured the eggs. We also removed one egg from each nest and measured the total length of the embryo. We used Crawshaw's table (1989. Nesting Ecology of the Paraguayan Caiman (*Caiman yacare*) in the Pantanal of Mato Grosso, Brazil. Unpubl. M.S. Thesis, Univ. Florida, Gainesville), developed for *C. crocodilus yacare*, to estimate the age of the egg from the size of the embryo.

Females were present at two nests. Nests contained 8–33 eggs, but the nest with 8 eggs was partially inundated. The mean clutch size overall was 21.6, and excluding the partially inundated nest it was 23.8 eggs (N = 6, SD = 5.2) (Table 1). The estimated age of embryos indicates that laying occurred in late December, while hatching occurred during early March in both years. The clutch sizes found in this study were smaller than those reported in earlier studies (Larriera 1993. *In* Verdade et al. (eds.) Proceedings of the 3rd Workshop on Conservation and Management of the Broad-nosed Caiman, pp 61–69. ESALQ/USP, Piracicaba, Brasil). This is the first report of *C. latirostris* nesting on floating grass mats.

We thank V. Pott for identifying the plants, and M. Cotovicz and E. Dantas for helping in the field.

Submitted by **ZILCA CAMPOS** and **GUILHERME MOURÃO**, Laboratorio de Vida Selvagem, EMBRAPA/CPAP, Cxp. 109, Corumba, MS 79320-900, Brazil.

TESTUDINES

GOPHERUS POLYPHEMUS (Gopher Tortoise). **BURROW ASSOCIATE.** The burrow system created by *Gopherus polyphemus* plays an important part in the ecology of the upland ecosystem, providing shelter from extreme temperatures, light, fire, aridity, and predation. Jackson and Milstrey (1989. *In* J. E. Diemer et al. (eds.), Gopher Tortoise Relocation Symposium Proceedings. Florida Game and Fresh Water Fish Commission Nongame Wildl. Prog. Tech. Rpt. No. 5:86–98) list 362 species recorded from *G. polyphemus* burrows (60 vertebrates and 302 invertebrates). In this note we report a previously unrecorded species utilizing burrows.

A *Lampropeltis getula* (common kingsnake) entered an active adult *G. polyphemus* burrow on 22 May 1990 at Tenoroc State Reserve located approximately 4 km NE Lakeland, Polk Co., Florida, USA. The female snake (SVL = 97 cm, TL = 109.4 cm) was trapped using a double-opening funnel trap (Fitch 1951. Herpetologica 7:77–80), sexed, measured, marked, photographed, and released.

On 16 May 1991, during a *G. polyphemus* burrow associate survey at the same location, a male *L. getula* (SVL = 129 cm, TL = 137 cm) was trapped in a double-opening funnel trap at an abandoned subadult burrow and processed in the same manner.

Both specimens were caught at burrows associated with open, arid, reclaimed phosphate mined land. Burrows were located within 76 m of foraging habitat, extensive vegetative cover, and fresh water. The interburrow distance was 31.7 m.

We thank Joseph R. Casada and Steve DeCresie for assistance with fieldwork and the staff of Tenoroc State Reserve for logistical support. We also thank Richard Franz for reviewing the manuscript. This research was supported in part by a grant to LAM from the Florida Institute of Phosphate Research (#88-03-082) and was conducted under FGFWFC permit #W88052.

Submitted by **GEORGE HEINRICH**, P.O. Box 61301, St. Petersburg, Florida 33784-1301, USA, **LAURIE ANN MacDONALD**, 103 Wildwood Lane, St. Petersburg, Florida 33705, USA, and **JENNIFER D. McMURTRAY**, St. Johns River Water Management District, 305 East Drive, Melbourne, Florida 32904, USA.

LACERTILIA

ANOLIS UNIFORMIS (NCN). **FEEDING BEHAVIOR.** Insectivorous lizards are often characterized as consuming prey that 1) require low pursuit and handling costs (Greene 1982, *In* D. Mossakowski and G. Roth (eds.), Environmental Adaptation and Evolution, pp. 107–128. Gustav Fischer, Stuttgart) and 2) are limited in size by lizard body size (Schoener 1968. Ecology 49:704–726). The maximum prey size for some insectivorous lizards may be best predicted by the circumference of the lizard's mouth (DeMarco et al. 1985. Copeia 1985:1077–1080). Some of my observations on *Anolis uniformis* feeding behavior are inconsistent with these characterizations, instead suggesting this species may regularly feed on prey requiring high handling costs and which are only partially consumed.

During May through July 1987, I conducted a field study on the ethology of *A. uniformis* at Los Tuxtlas Tropical Biological Preserve, Veracruz, México. During 59.5 h of focal animal observation, 18 feeding bouts were observed. The majority of these (15; 83%) involved small prey that were consumed whole. On three occasions, however, three different individuals attacked and consumed parts of much larger than average prey (all Diptera). These observations are interesting for two reasons. First, these lizards were not consuming prey whole and all of these insects appeared larger than the lizard's mouth circumference. In one instance, the head, prothorax, and one wing of a large Diptera were consumed. The length of the remaining part suggests this insect, whole, may have been inconsumable by the *A. uniformis*. In a second instance, half of the head capsule of another Diptera was consumed. Using the procedure of DeMarco et al. (*op. cit.*), this prey's circumference was roughly 2.9 times greater than the circumference of the predator's mouth. These lizards seemed to be performing behaviors promoting disarticulation of their prey. Constant mouth opening and closing occurred with the jaw at the juncture of the head and thorax of the flies. The lizards also wiped the insects against the substrate, resulting in wing removal and probably contributing to decapitation.

The second noteworthy aspect of these observations is that although only three of 18 (17%) *A. uniformis* feeding bouts involved large prey, they accounted for more than 94% of the observed handling time. The handling time in these three encounters lasted an average of 39.3 min (21, 37, 60 min), while none of the other 15 bouts lasted more than 10 sec.

For at least some insectivorous lizards, maximum prey size may be more properly related to the size of prey body regions and the ability to disarticulate prey; in such instances, the time devoted to prey handling may be substantial.

Submitted by **DOUGLAS A. EIFLER**, Department of Organismic and Evolutionary Biology, Harvard University, Cambridge, Massachusetts 02138, USA.

GEKKO CHINENSIS (Chinese Gecko). **SPIDER PREDATION**. On 8 August 1992 at the abandoned village of Kwo Lo Wan, island of Chek Lap Kok, South China Sea ca. 24 km west of Hong Kong, we discovered a young *Gekko chinensis* (SVL 56 rmm; 3.54 g damp weight, preserved) fresh-dead and silk-wrapped in the orb web of a large spider. Foolishly, we first collected the gecko (MCZ 177074), allowing the spider to escape into the tree canopy. Subsequently, we collected a second spider (MCZ A-13831) nearby. This spider, *Araneus ventricosus* (Araneidae), was equal in size to the one tending the web with the gecko (29 mm cephalothorax to abdomen tip; 2.45 g damp weight, preserved). This species was not as common as the larger *Nephila maculata* (Araneidae), a well-known predator of vertebrates as large as pipistrelle bats (Hill and Phillipps 1981. A Colour Guide to Hong Kong Animals, Government Printer, Hong Kong. 281 pp.). Sadly, the island of Chek Lap Kok has now been destroyed, flattened, and leveled to 2 m above sea level. I am indebted to Kerry Sherred and Robin Marirea for assistance in the field, and to Laura Leibensperger for identification of the spider.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA.

HEMIDACTYLUS FRENATUS (House Gecko). **FORAGING**. Though most reports of gecko diets, particularly those based on stomach contents analysis, mention only arthropods, geckos have been reported feeding on sap on the stems of plants (e.g., *Gehyra variegata* in Australia: Dell 1985. West. Austr. Nat. 16:69–70) and nectar from flowers (e.g., *Hoplodactylus pacificus* in New Zealand: Whitaker 1968. Science 11:623–651; *Phelsuma guimbeaui* on Maritius: McKeown 1989. Int. Zoo. Yearbk. 28:116–122). There are also reports of geckos lapping up man-made sweetened fluids (e.g., *Phyllodactylus*, Houston: Dell 1985, *op. cit.*) such as jam (e.g., *Leptodactylus lugubris*: McCoy 1980. Reptiles of the Solomon Islands. Wau Ecol. Inst. Handbk. No. 7.), and honey (e.g., *Heteronotia binoei*: Peters 1968. Aquarien Terrarien Zeitschrift 21:252–254). McCoy (*op. cit.*) reported seeing *Leptodactylus lugubris* "drinking the dregs in cups of sweetened tea and coffee." We report another gecko drinking from a rather different human provided source of sweetened liquid.

We observed several different *Hemidactylus frenatus* feeding from a hummingbird feeder in Panama. The feeder was filled with a clear solution of refined sugar (1 part sugar to 7 parts water) and regularly visited by several species of hummingbirds during the day. The feeder was suspended from a bracket outside an apartment window, 22 cm from the wall and 4 m above the ground. The introduced geckos are abundant in Panama, almost entirely around human habitations. On the Smithsonian Tropical Research Institute building where these observations were made, it is common to see one or two adult-sized geckos on a single 75 by 90 cm window.

Geckos were observed for the first time at the feeder less than 3 weeks after its installation. We observed geckos on the feeder most nights during the period from October to December. At least 4 individuals, 1 large, 2 medium, and 1 juvenile were seen on the feeder, and probably more visited it (Fig. 1). Aggressive behaviors (chases and growl calls) like those observed when two geckos came close to one another on a window screen usually occurred when two geckos were together on the feeder.

In early January the feeder was moved to another window 6 m away horizontally and a floor (3 m) higher. Over the following months, no geckos were seen on the feeder, though they were observed feeding on insects on the window screens near it. Perhaps feeding at the hummingbird feeder was a case of social facilitation. A single gecko may have discovered the feeder in its original position and others, seeing the first feed there, approached and imitated it. Six months after the feeder was moved, a few individuals apparently learned to feed from it, and were regularly seen on the feeder.

Geckos, like anoles, commonly lap droplets of water from leaves and twigs (Cogger 1958. Aust. Mus. Mag. 1211:343–347). We do not know if the geckos we observed were seeking water or carbohydrates from the feeder but they were certainly consuming both. That the geckos visited the feeder during the height of the rainy season when water was easily available elsewhere, suggests they were seeking food rather than water.

The close association of *Hemidactylus frenatus* with humans in Panama is striking. They use human structures for foraging surfaces, hiding places, and oviposition sites, and are rarely seen or heard away from them. They also feed on insects attracted to electric lights. Their use of a hummingbird feeder is another instance of these geckos exploiting a human provided resource, and one possibly involving social facilitation.

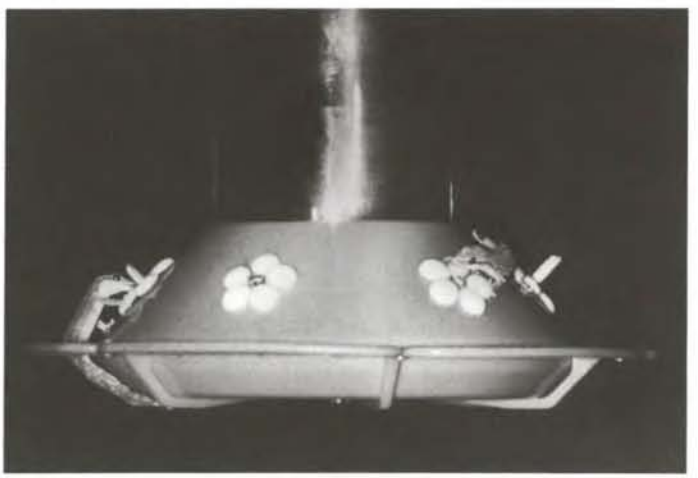


FIG. 1. Two geckos (*Hemidactylus frenatus*) feeding at the hummingbird feeder.

Submitted by **BRIGITTE POULIN**, **GAETAN LEFEBVRE**, and **A. STANLEY RAND**, Smithsonian Tropical Research Institute, P.O. Box 2072, Balboa, Republic of Panama.

SERPENTES

BOTHROPS NEUWIEDI (Yoperojobobo, Neuwied's Lancehead). **BROOD SIZE**. In Bolivia, in September 1990, two individuals of *Bothrops neuwiedi* were captured live: a female (total length [TL] = 1008 mm, weight = 1000 g) from Dpto. Beni, Estación Biológica Beni (14°38'S, 66°18'W; 190 m elev.) and a male (TL = 830 mm, weight = 823.4 g) from Dpto. Santa Cruz, Cañada Larga (17°32'S, 62°27'W; ca. 400 m elev.). The snakes have been maintained together in captivity, under favorable conditions of temperature (20–26°C) and humidity (ca. 60%) in the city of La Paz (3600 m elev.). They have been fed weekly with white mice (*Mus musculus*) that weighed ca. 20 g each.

Mating behavior was observed during the first week of April 1991 and 1992, and did not differ significantly from behavior previously reported for other terrestrial viperids. In both years gestation was approximately nine months.

In January 1992 a brood of three young was produced. The brood produced in January 1993 numbered 32 young, considerably larger than the previous record of 21 young (Murphy and Mitchell 1984. Acta Zool. Path. Antverp. 78:199–214). The young of the two broods differed in average weight and total length at birth. Data for the 1992 litter are: mean weight = 8.5 g (range 8.2–9.0 g); mean TL = 220 mm (range 210–230 mm); for the 1993 litter: mean weight = 9.4 g (range 8.0–11.0 g); mean TL = 241 mm (range 223–255 mm). These data are not significantly different from those reported by Murphy and Mitchell (*op. cit.*).

Submitted by **EFRAIN PEÑARANDA B.**, Museo de Historia Natural Noel Kempff, Casilla 1073, Santa Cruz, Bolivia.

HETERODON NASICUS (Western Hognose Snake). **REPRODUCTION**. Six gravid western hognose snakes encountered while drift fence trapping for turtles (Iverson 1991. Herpetologica 47:371–393) at Gimlet Lake on the Crescent Lake National Wildlife Refuge, Garden Co., Nebraska, USA, were captured in late May or June, fed adult *Ambystoma* to satiation, and held in captivity at 24–30°C until they oviposited. The eggs were then incubated to hatching at 25–30°C. The reproductive data from those snakes (Table 1) are concordant with previous data (Pendlebury 1976. Canadian Field-Nat. 90:416–422; Platt 1969. Univ. Kansas Publ. Mus. Nat. Hist. 18(4):253–420), except that 1) the clutch of three represents a new minimum clutch size for the species, 2) four of the five incubation times (46–50 days) are shorter than previously recorded (52–89 days), and 3) the clutch masses of the two smallest clutches (3 and 4 eggs) represent smaller percentages of post-gravid body mass (21 and 22%) than for the other four clutches (52–74%) or for those previously recorded (42–83%). The difference in timing of oviposition between years is attributable to the record cold spring and summer of 1993, presumably delaying onset of egg-laying, and the record warm spring of 1994. which may have led to earlier reproduction (Iverson, unpublished weather records). The field assistance of Tom Akre, Christopher Griffiths. Heather Higgins, Abby Sirulnik, Cameron Young, and my family is gratefully acknowledged.

Submitted by **JOHN B. IVERSON**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA.

SISTRURUS CATENATUS CATENATUS (Eastern Massasauga), **FOOD HABITS**. A *Sistrurus c. catenatus* was found inside a northern bobwhite (*Colinus virginianus*) nest on 11 May 1971 in Rober Allerton Park, Piatt Co., Illinois, USA. The habitat in the vicinity of the bobwhite nest was composed of mixed grasses and forbs, staghorn sumac (*Rhus typhina*), and multiflora rose (*Rosa multiflora*).

The bobwhite nest was discovered while removing a pile of wooden box traps. The snake's rattling drew attention to its location in the nest containing nine eggs. When the snake and nest were located, the disturbed snake disgorged two fully intact bobwhite eggs.

Sistrurus catenatus is generally known to prey primarily on small mammals such as *Microtus* and *Peromyscus* (Keenlyne and Beer 1973. J. Herpetol. 7:382–384; Seigel 1986. Biol . Conserv. 35:333–346). This is to my knowledge the first published case of massasauga consumption of eggs. It is surprising that in the intervening 23 years since this observation, there have been no other records of egg predation by massasaugas. Bird eggs, including those of bobwhite, were found in stomachs of *Elaphe obsoleta* (black rat snake) and *Coluber constrictor* (northern black racer) in Virginia (Uhler et al. 1939. Trans. N. Amer. Wildl. Conf. 4:605–622).

The late W. D. Klimstra, Cooperative Wildlife Research Laboratory, Southern Illinois University, reviewed a 1972 draft of this paper. He along with E. Beltz encouraged its publication.

Submitted by **ROGER D. APPLEGATE**, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820, USA. Present address: Wildlife Division, Department of Inland Fisheries and Wildlife, 650 State Street, Bangor, Maine 04401-5654, USA.

TABLE 1. Snout-vent length (SVL in cm), gravid body mass (BM in g), clutch size (CS), mean egg length (EL in mm), width (EW in mm), and mass (EM in g), clutch mass as a proportion of spent body bass (SRCM), and mean hatchling SVL (in cm) and BM (in g) from six reproductive female Gimlet Lake hognose snakes. Means presented ± 1 S.D. when available.

Date	Gravid							Date	Hatchling	
Deposited	SVL (cm)	BM (g)	CS	EL (mm)	EW (mm)	EM (g)	SRCM	Hatched	SVL (cm)	BM (g)
16 July 93	48	135	12	27.5 ± 1.4	17.3 ± 0.9	4.78	0.735	4 Sept	—	—
20 July 93	53	152	12	28.7 ± 2.0	17.0 ± 0.7	4.98 ± 0.19	0.650	4 Sept	—	—
22 June 94	49	137	9	29.9 ± 1.7	16.9 ± 0.6	5.24 ± 0.37	0.589	11 Aug	14.9 ± 0.6	4.00 ± 0.28
24 June 94	50	90	4	37.2 ± 2.2	13.7 ± 2.3	4.35 ± 1.74	0.230	—	—	—
24 June 94	48	93	3	34.3 ± 1.2	16.2 ± 0.7	5.63 ± 0.15	0.224	16 Aug	14.5 ± 0.3	4.58 ± 0.38
29 June 94	54	162	15	26.9 ± 1.4	15.9 ± 0.6	4.26 ± 0.22	0.651	18 Aug	14.3 ± 0.7	3.92 ± 0.24

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in Volume 26, Number 1.

CAUDATA

AMBYSTOMA TIGRINUM MAVORTIUM (Barred Tiger Salamander). USA: NEBRASKA: MORRILL CO: SE 1/4 Sec. 25, T22N, R52W. June 1993. Roger Heigel. Verified by Jeffrey Mitton. UCM 57354, dried adult now in alcohol. First county record (Lynch 1985, Trans. Nebraska Acad. Sci. 13:33–57).

Submitted by **RICHARD L. HOLLAND**, Science Department, Boulder High School, 1604 Arapahoe Avenue, Boulder, Colorado 80302, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

DESMOGNATHUS AENEUS (Seepage Salamander). USA: SOUTH CAROLINA: OCONEE CO: Reedy Branch (Rainy Mountain Quadrangle), 34°48'22"N, 83°17'53"W, elev. 365–425 m. 5 June 1995. D. Jackson, P. G. Livingston, C. C. Spencer, B. L. Stuart. Verified by Richard C. Bruce. Charleston Museum (ChM CA4392–CA4394). Three adult specimens collected under leaf litter on bank of Reedy Branch tributary. First record for South Carolina (Harrison, pers. comm., Harrison 1992, Cat. Am. Amph. Rept. 534.1–534.4); Camp Branch (Rainy Mountain Quadrangle), 34°45'[48"N, 83°18'43"W, elev. 365–425 m. 21 July 1995. E. Danell, P. G. Livingston, C. C. Spencer, B. L. Stuart. Verified by Richard C. Bruce. Charleston Museum (ChM CA4395–CA4396). Two adult specimens collected under moss and leaf litter on bank of seep flowing into Camp Branch. Second record for South Carolina.

Submitted by **P. GAYLE LIVINGSTON**, **CHRISTINE C. SPENCER**, and **BRYAN L. STUART**, Highlands Biological Station, P. O. Box 580, Highlands, North Carolina 28741, USA.

SIREN INTERMEDIA (Lesser Siren). USA: TEXAS: KAUFMAN CO: 6.4 km NW Mabank. Two specimens collected from a small pond along Old Rt. 40, 0.8 km W U. S. Rt. 175. 23 July 1993. R. L. Gutberlet, Jr. and D. S. Figueroa. Verified by J. A. Campbell. University of Texas at Arlington Collection of Vertebrates (UTA-A 40755–56). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **RONALD L. GUTBERLET, JR.** and **DANIEL S. FIGUEROA**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA.

ANURA

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: LOUISIANA: EAST BATON ROUGE PARISH: Baton Rouge, Greenhouse at 17810 Sotile Drive, ca. 2.0 km NE jct. Interstate 10 and Highland Road. 27 July 1995. Mike Leggio and Steven Platt. Verified by Richard R. Montanucci. One adult and three neonates collected. Vertebrate Collection, Department of Biological Sciences, Clemson University (CUSC 1263). Parish record; nearest reported populations are in Jefferson Parish (Dundee and Rossman 1989, Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.). Extends range ca. 100 km northeast. Appears established at this site; 50+ neonates were observed throughout the greenhouse. Original introduction probably in houseplants from Florida.

Submitted by **STEVEN G. PLATT** and **LANCE W. FONTENOT**, Department of Biological Sciences, Clemson University, Clemson, South Carolina 29634-1903, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad). USA: TEXAS: FLOYD CO: 2.4 km E Barwise. 6 June 1995. Ann M. Anderson, James T. Anderson, and David A. Haukos. Verified by Stephen L. Williams. Museum of Texas Tech University (MTTU 11489). County record; several adult males were heard and seen calling at 2100 h in a flooded playa wetland. The dominant vegetation type was *Coreopsis tinctoria*. This record extends the range northward (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp.). This species was also discovered in Crosby County, directly south of Floyd, on 6 June 1995 and one specimen was caught (MTTU 11490). Previously documented in Crosby County below Whiter River Reservoir Dam. The Crosby County individuals were found in a flooded playa wetland, 7.3 km S Crosbyton, also in association with *Coreopsis tinctoria;* both playas had an irrigation pit filled with water most of the year. This record fills the hiatus in current known county distribution of this species—Briscoe County to the north and Crosby and Lubbock counties to the south.

Submitted by **ANN M. ANDERSON**, **JAMES T. ANDERSON**, and **DAVID A. HAUKOS**, Range and Wildlife Department, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409, USA.

GASTROPHRYNE OLIVACEA (Great Plains Narrowmouth Toad). USA: TEXAS: HUDSPETH CO: 14.81 road km S jct. FR 34 and FM 192 on FM 192. 18 July 1995. C. M. Eckerman and T. J. LaDuc. Verified by C. S. Lieb. UTEP 16138–16140, 16146–16148. New county record; extends range approximately 120 km NW of nearest known locality in Jeff Davis County (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, Texas. 434 pp.). Found in ephemeral ponds on the E and W sides of the road. All specimens collected were calling males.

Submitted by **CURTIS M. ECKERMAN**, Department of Biological Sciences, The University of Texas at El Paso, El Paso, Texas 79968-0519, USA.

HYLA ANCEPS (NCN): BRASIL: ESPÍRITO SANTO: ARACRUZ: Barra do Sahy (19°50'S, 40°04'W, sea level). 26–27 January 1995. C. F. B. Haddad, J. P. Pombal, Jr. and J. L. Gasparini. Verified by Ulisses Caramaschi. Museu Nacional do Rio de Janeiro (JNRJ 17318). Published distribution of the species is lowlands of the state of Rio de Janeiro in southeastern Brazil (Frost 1985, Amphibian Species of the World. Allen Press, Lawrence, Kansas. 732 pp.). First documented record for the state of Espírito Santo, extending the distribution northward.

Submitted by **CÉLIO F. B. HADDAD**, **JOÃO L. GASPARINI**, Departamento de Zoologia, Universidade Estadual Paulista, C. P. 199, 13506-900 Rio Claro, São Paulo, Brasil, and **JOSÉ P. POMBAL, JR.**, Departamento de Zoologia, Universidade Estadual de Campinas, C. P. 6109, 13083-970 Campinas, São Paulo, Brasil.

PSEUDACRIS CLARKII (Spotted Chorus Frog). USA: TEXAS: FLOYD CO: 2.4 km E Barwise. 5 May &16 May 1995. Ann M. Anderson, James T. Anderson, and David A. Haukos. Verified by Stephen L. Williams. Museum of Texas Tech University (MTTU 11486–11488). County record; several adult males were heard and seen calling after dark in a flooded playa wetland. Previous records include most counties surrounding Floyd, except those to

the east (Dixon 1987, Amphibians and Reptiles of Texas, Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **ANN M. ANDERSON**, **JAMES T. ANDERSON**, and **DAVID A. HAUKOS**, Range and Wildlife Department, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409, USA.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: TEXAS: Cass Co: near Timber Branch, where it flows beneath Texas Rt. 43. 24 July 1993. D. S. Figueroa and R. L. Gutberlet, Jr. Verified by J. A. Campbell. University of Texas at Arlington Collection of Vertebrates (UTA-A 40890). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **RONALD L. GUTBERLET, JR.** and **DANIEL S. FIGUEROA**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: COLORADO: Clear Creek Co: Lawson (NE 1/4 Sec. 25, T3S, R74W). 8 July 1995. L. J. Livo. Verified by Richard L. Holland. (UCM 57368, tadpole). First county record. Huerfano Co: 1.1 km E and 0.1 km S jct. Cucharas River with Walsen Arroyo (SE 1/4 Sec. 30, T27S, R65W). 19 May 1995. L. J. Livo, D. Chiszar, H. M. Smith. Verified by Richard L. Holland. (UCM 57333–57334). First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildlife. 131 pp.). Las Animas Co: jct. Apishapa River and Trujillo Creek (Sec. 18, T31S, R65W). 24 May 1995. L. J. Livo. Verified by Richard L. Holland. (UCM 57332, four tadpoles). First specimens for county (*op. cit.*). The Huerfano and Las Animas records help fill in the little known distribution of this species in the southeast quarter of the state. The Clear Creek record establishes the presence of a fourth amphibian, *Pseudacris triseriata*, in a county once believed to be devoid of amphibians because of mining activities (Porter and Hakanson 1976, Copeia 1976:327–331). The Clear Creek record was obtained during ongoing amphibian surveys conducted by the Central Region of the Colorado Division of Wildlife.

Submitted by **LAUREN J. LIVO**, 1215 S. Osceola Street, Denver, Colorado 80219, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: COLORADO: Eagle Co: W side Edwards on flood plain east of trailer village. 10 August 1995. H. M. Smith. Verified by Richard L. Holland. UCM 57376–7. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc. 20 pp.).

Submitted by **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA; **MICHAEL LAVERTY**, 34185 Colorado Road, McCoy, Colorado 80463, USA; and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA.

PSEUDACRIS TRISERIATA (Western Chorus Frog). USA: COLORADO: Pitkin Co: unnamed pond east of Hardscrabble Lake, White River National Forest (NW 1/4 Sec. 34, T9S, R87W). 15 July 1995. G. P. Horstman and M. Gilbert. Verified by L. J. Livo. UCM Color Slide 105. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildlife. 131 pp.). This record was obtained during ongoing amphibian surveys conducted by the Northwest Region of the Colorado Division of Wildlife.

Submitted by **GREGORY P. HORSTMAN**, Colorado Division of Wildlife, 711 Independent Avenue, Grand Junction, Colorado 81505, USA.

RANA CATESBEIANA (Bullfrog). USA: COLORADO: Garfield Co: pond at S edge Parachute. 17 September 1995. John A. Rybak. Verified by Richard L. Holland. UCM 57403 (juv). First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc. 20 pp.). Species is common in ponds adjacent to the Colorado River throughout much of the county, although it is introduced.

Submitted by **JOHN A. RYBAK**, 177 Sagemont Circle, Parachute, Colorado 81635, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

RANA CATESBEIANA (Bullfrog). USA: COLORADO: Phillips Co: Holyoke Lions Fishing Lake, 0.4 km S Rt. 6, 2 km E jct Rts. 6 and 385 in Holyoke. 14 July 1995. David Chiszar. Verified by Richard L. Holland. UCM 57369. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildlife. 131 pp.).

Submitted by **DAVID CHISZAR** and **DEMETRI THEODORATUS**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA, and **HOBART M. SMITH,** Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: COLORADO: Crowley Co: Trainor Ranch, jct 22.5 Road and U Road. 1 July 1995. D. Chiszar and H. M. Smith. UCM 57339, 57341 (adult, transforming young, and tadpoles, cannibal and noncannibal); Kiowa Co: jct Rt. 385 and B Road. 2 July 1995. D. Chiszar and H. M. Smith. UCM 57340 (mangled DOR). Verified by Richard L. Holland. First county records (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildlife. 131 pp.) and an extension of the known range northeastward about 120 km.

Submitted by **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

TESTUDINES

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: COLORADO: Crowley Co: Rt. 71, 3.2 km N Road W. 30 June 1995. D. Chiszar and H. M. Smith. UCM 57338 (plastron only). Verified by Richard L. Holland. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildlife. 131 pp.).

Submitted by **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: COLORADO: Prowers Co: Willow Creek, 3.92 km E Lamar. 13 July 1995. B. D. Will. Verified by Richard L. Holland. UCM Photograph 100. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Colorado Herpetol. Soc. 20 pp.).

Submitted by **BRYANT D. WILL**, District Wildlife Manager, P. O. Box 785, Lamar, Colorado 81052, USA; **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: NEBRASKA: Scotts Bluff Co: SW 1/4, SW 1/4 Sec. 25, T23N, R53W. 10 July 1995. H. M. Smith. Verified by Rosanne Humphrey. UCM Color Slides 103–104. First county record (Lynch 1985, Trans. Nebraska Acad. Sci. 13:33–57).

Submitted by **RICHARD L. HOLLAND**, Science Department, Boulder High School, 1604 Arapahoe Avenue, Boulder, Colorado 80302, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

CHRYSEMYS PICTA BELLII (Western Painted Turtle). USA: NEBRASKA: Box Butte Co: N branch Snake Creek at Co. Rd. crossing, NE 1/4 Sec. 15, T25N, R52W. 10 July 1995. R. L. Holland and H. M. Smith. Verified by Lauren Livo. UCM 57363. First county record (Lynch 1985, Trans. Nebraska Acad. Sci. 13:33–57).

Submitted by **RICHARD L. HOLLAND**, Science Department, Boulder High School, 1604 Arapahoe Avenue, Boulder, Colorado 80302, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

DEIROCHELYS RETICULARIA MIARIA (Western Chicken Turtle). USA: MISSOURI: Butler Co: 2.4 km SE jct. State Road EE and Co. Road 269, Big Cane Conservation Area, 90 m elev. 1–2 June 1995. K. A. Buhlmann and T. R. Johnson. CM Photographic Acc. 36014.1-36014.4. Verified by Joseph T. Collins. Two presumed juvenile females, both 3–4 years old (PL 101 and 117 mm), and one 5-year-old mature male (PL 117 mm) captured in a semi-closed canopy, bald cypress (*Taxodium distichum*) dominated, blackwater wetland. Specimens were released. This species had not been observed in Missouri since 1962 (M. A. Nickerson, pers. obs.) or collected since 1957 (Anderson 1965, The Reptiles of Missouri. Univ. Missouri Press, Columbia. 330 pp.). The western chicken turtle is listed as endangered by the state of Missouri. Historically, chicken turtles were likely common in the bald cypress/bottomland hardwood floodplain swamp forests that have been cleared, ditched, and converted to agriculture, primarily rice farming. Further survey work is needed in the Missouri bootheel region to identify other suitable surviving patches of natural habitat that may contain isolated populations of these turtles.

Submitted by **KURT A. BUHLMANN**, University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA, and **TOM R. JOHNSON**, Missouri Department of Conservation, Natural History Section, P. O. Box 180, Jefferson City, Missouri 65102-0180, USA.

KINOSTERNON ODORATUM (Common Musk Turtle). USA: TEXAS: Kaufman Co: 6.4 km NW Mabank. Specimen was collected from a small pond along Old Rt. 40, 0.8 km W U. S. Rt. 175. 23 July 1993. D. S. Figueroa and R. L. Gutberlet, Jr. Verified by J. A. Campbell. University of Texas at Arlington Collection of Vertebrates (UTA-R 35118). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **RONALD L. GUTBERLET, JR.** and **DANIEL S. FIGUEROA**, Department of Biology, University of Texas at Arlington, Arlington, Texas 76019, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). USA: COLORADO: Rio Blanco Co: NE outskirts of Rangely, sandy area 35 m from White River, beyond a wooded area delimiting a housing area. July 1995. Bradley Rouse. Verified by Richard L. Holland. UCM 57381 (carapace and a few other bones of a specimen found recently dead). First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc. 20 pp.), supported as a naturally-occurring population by reports from local residents of others seen widely distributed in the county.

Submitted by **BRADLEY ROUSE**, 317 East Raven, No. 39, Rangely, Colorado 81648, USA; and **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). USA: NEBRASKA: Scotts Bluff Co: Sec. 36, T23N, R53W. 10 July 1995. J. L. Hall. Verified by Lauren Livo. UCM Color Slides 101-102. First county record (Lynch 1985, Trans. Nebraska Acad. Sci. 13:33–57).

Submitted by **J. LLEWELLYN HALL**, 320714 County Road G, Minatare, Nebraska 69356, USA; **RICHARD L. HOLLAND**, Science Department, Boulder High School, 1604 Arapahoe Avenue, Boulder, Colorado 80302, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

SAURIA

ANOLIS EQUESTRIS (Knight Anole). USA: FLORIDA: Collier Co: Naples, 3480 10th Street North. Sec. 22, T49S, R25E. 25 April 1995. Dick Noonan. Verified by David L. Auth. UF 100, 104. Head only, body eaten by a cat. New county record and first record of this species on west coast of Florida (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles & Crocodilians. Windward Publ., Miami, Florida. 191 pp.).

Submitted by **BRICE NOONAN**, Department of Zoology, University of Florida, Gainesville, Florida 32611, USA.

SERPENTES

BOTHROPS ATROX (Common Lancehead): BRAZIL: SERGIPE: Santa Luzia do Itanhy: Lagoa Mangueira Grande, Mata do Crasto (11°20'S, 37°25'W), 0–100 m elev. 7 July 1994. Cristina Arzabe. Verified by I. Sazima. Museu de História Natural, Universidade Estadual de Campinas (ZUEC 01782, adult female; 01783, young male). The name *B. atrox* is currently applied to populations from the "Equatorial forest of Colombia, Venezuela, Guianas, Brazil, Peru, Ecuador and Bolivia" (Hoge and Romano 1972, Sinopse das Serpentes Peçonhentas do Brasil. Serpentes, Elapidae e Viperidae. Mem. Inst. Butantan 36:109–207). The two specimens from the Atlantic forest in Sergipe match in color and scale counts those from the eastern Hylaea (Campbell and Lamar 1989, The Venomous Reptiles of the Latin America. Cornell Univ. Press, Ithaca, New York. 425 pp.). Previous reports from NE Brazil include two specimens from the Atlantic forest in Paraíba and Sergipe [Vanzolini 1981, Papéis Avulsos Zool. S. Paulo 34(19):189–204] and two specimens from the "Cariri" area [Williams and Vanzolini 1980, Papéis Avulsos Zool. S. Paulo 34(6):99–108].

Submitted by **PAULO ROBERTO MANZANI**, Departamento de Zoologia, CP 6109, Instituto de Biologia, Universidade Estadual de Campinas, 13083-970 Campinas, São Paulo, Brazil, and **CRISTINA ARZABE**, Departamento de Biologia, CP 353, Universidade Federal de Sergipe, 49100-000 S. Cristovão, SE, Brazil.

CROTALUS VIRIDIS VIRIDIS (Prairie Rattlesnake). USA: NEBRASKA: Box Butte Co: SW 1/4, SW 1/4 Sec. 29, T25N, R51W. 9 July 1995. R. L. Holland and H. M. Smith. Verified by Lauren Livo. UCM 57366 (DOR, head and tail only). First county record (Lynch 1985, Trans. Nebraska Acad. Sci. 13:33–57).

Submitted by **RICHARD L. HOLLAND**, Science Department, Boulder High School, 1604 Arapahoe Avenue, Boulder, Colorado 80302, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). USA: NEW MEXICO: Socorro Co: Cibola National Forest, San Mateo Mountains, vicinity of Vicks Peak, ca. 62 km S and 16 km W of Magdalena. In south-facing talus slope, ca. 2438 m elev. 28 April 1993. R. E. Anderson. Verified by C. W. Painter. KU Color Slide 11217. Extends range ca. 134 km NNW nearest locality (4.5 km N Hill, Dona Aña County, W. G. Degenhardt, pers. comm.).

Submitted by **RICHARD E. ANDERSON**, Department of Biological Sciences, Southeastern Louisiana University, Box 814, Hammond, Louisiana 70402, USA.

LAMPROPELTIS GETULA CALIFORNIAE (California Kingsnake). MÉXICO: BAJA CALIFORNIA SUR: Vizcaíno Peninsula, ca. km marker 120, ca. midway between San Hipolito and La Bocana. 19 May 1995. Richard A. Erickson and Robert A. Hamilton. Verified by Robert L. Bezy. LACM Photo Collection 1317. Grismer et al. (1994, Bull. So. California Acad. Sci. 93:45–80) recently reviewed the herpetofauna of the Vizcaíno Peninsula. Citing records elsewhere in the Vizcaíno Desert and unconfirmed reports of ranchers in the Sierra Santa Clara, they predicted this snake is widespread on the peninsula. However, this is the first documented record for this little-studied area.

Submitted by **RICHARD A. ERICKSON**, LSA Associates, One Park Plaza, Suite 500, Irvine, California 92714, USA, and **ROBERT A. HAMILTON**, P. O. Box 961, Trabuco Canyon, California 92678, USA.

LAMPROPELTIS TRIANGULUM MULTISTRIATA x TAYLORI (Pale x Utah Milk Snake intergrade). USA: COLORADO: Rio Blanco Co: eastern Rangely. Late May 1995. Tom and Marion Bell. UCM 57378. First county record (Livo 1995, Colorado Amphibian and Reptile Records by County. Publ. Colorado Herpetol. Soc. 20 pp.); Moffat Co: Irish Canyon. October 1946. Mr. Mainland. UCM 7646. Both verified by Richard L. Holland. Supports intergrade status of northwestern Colorado populations (Roth and Smith 1990, Bull. Chicago Herp. Soc. 25:6–7), originally based on one specimen.

Submitted by **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA; **CAROLYN RISTAU**, Department of Psychology, Barnard College, Columbia University, 3009 Broadway, New York, New York 10027-6598, USA; **TOM** and **MARION BELL**, P. O. Box 14, Rangely, Colorado 81648, USA; and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA.

MASTICOPHIS BILINEATUS BILINEATUS (Sonoran Whipsnake). USA: ARIZONA: Pima Co: in a rocky, vegetated wash in the foothills of the Coyote Mountains, 24 km NE Kitt Peak, S Arizona Rt. 86 (SW 1/4 Sec. 22, T16S, R8E). 25 April 1992. R. E. Anderson and C. K. Anderson. Verified by J. N. Stuart. Louisiana State University Museum of Zoology (LSUMZ 56929). Extends range ca. 80 km W of known range, and narrows hiatus between it and the disjunct Ajo Mountain whipsnake, *Masticophis bilineatus lineolatus* (Stebbins 1985, Peterson Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.).

Submitted by **RICHARD E. ANDERSON**, Department of Biological Sciences, Box 814, Southeastern Louisiana University, Hammond, Louisiana 70402, USA, and **CHRISTOPHER K. ANDERSON**, 5 Raven Road, Canton Massachusetts 02021, USA.

NERODIA ERYTHROGASTER FLAVIGASTER (Yellowbelly Water Snake). USA: ILLINOIS: St. Clair Co: Scott Air Force Base. 1 June 1995. John G. Palis. Verified by Ronald A. Brandon. Southern Illinois University at Carbondale (SIUC R–2865 juv) found beneath roofing-shingle pile adjacent to shallow roadside ditch (NE 1/4 NW 1/4 Sec. 13, T1N, R7W); another juvenile (SIUC R–2866) captured while foraging on *Bufo americanus* and *Hyla chrysoscelis* tadpoles in a small, shallow pool in a mowed field (NE 1/4 NE 1/4 Sec. 14, T1N, R7W). New county record (Smith 1961, Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298).

Submitted by **JOHN G. PALIS**, Rural Route 1, Box 258, Tell City, Indiana 47586, USA, and **KENNETH S. MIERZWA**, TAMS Consultants, Inc., 180 North Stetson, Suite 3200, Chicago, Illinois 60601, USA.

RAMPHOTYPHLOPS BRAMINUS (Braminy Blind Snake). USA: FLORIDA: Monroe Co: Key Vaca, Marathon, under debris in small woodland near Mile Marker 50 on U.S. Rt. 1. 23 July 1994. Gregory J. Watkins-Colwell. Verified by J. T. Collins. KU 222389. Not a county record, but is first record for Key Vaca; known to occur throughout southern Florida and has been found on Big Pine Key (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida, Part One: The Snakes. Windward Publ., Miami, Florida. 191 ppp.; Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.).

Submitted by **GREGORY J. WATKINS-COLWELL**, College of Chiropractic, University of Bridgeport, Bridgeport, Connecticut 06601, USA, and **KELLIE A. WATKINS-COLWELL**, William Pitt Family Medicine Center, 128 Strawberry Hill Avenue, P.O. Box 1222, Stamford, Connecticut 06904, USA.

RAMPHOTYPHLOPS BRAMINUS (Braminy Blind Snake). MASSACHUSETTS: Suffolk Co: Boston, a building on Fulton Street, North End. 10 November 1993. Verified by V. Wallach. MCZ R-178146. Total dorsal scale count is 320-322. This species was first discovered in Massachusetts in the same building on 25 November 1990, as reported by Wallach et al. (1991, Herpetol. Rev. 22:68). Both were found in glue (i.e., sticky) traps in the basement. While investigating the latest occurrence, it was learned that there were an additional three snakes in 1990, but that they had been thrown away by the building's owner. One of those was found crawling across the floor.

After the 1993 occurrence, the basement and alley behind the building were searched in an effort to locate more snakes and determine how they could enter or survive in the house. There are drain pipes and cracks in the cement floor and piles of debris in the boiler/washer room. From the back alley, the wooden beams in the ceiling of the basement were visible through a cracked wall. There were ant hills in cracks along the building's foundation. The owner, who has lived in the building for about 25 years, had only seen blind snakes on these two occasions and related that no exotic plants or other items were taken into the apartment prior to

the second occurrence. In 1990, the same person said that potted plants had been taken into one of the building's upstairs apartments. Rat poison and glue traps had been placed throughout the basement and first floor and the lower floors fumigated once a year.

Braminy blind snakes were collected in the same building three years apart, which confirms that this parthenogenic, tropical reptile is established in Boston. The potential hazards (e.g., poison) in the building, variety of potential entry points, and time of year when the snakes appeared, suggest they are living in the soil near the building and may be seeking warmth and cover in the building as the outside temperature declines.

Other than Boston, the two northernmost records for this snake in the contiguous United States are Lake Placid, Highlands County, Florida (Meshaka 1994, Herpetol. Rev. 25:34), about 1400 mi SSW Boston, and New Orleans, Orleans Parish, Louisiana (Thomas 1994, Herpetol. Rev. 25:34), about 1600 mi SW Boston.

Submitted by **GWILYM S. JONES**, **LESLIE A. THOMAS**, and **KEVIN WONG**, Center for Vertebrate Studies, Department of Biology, Northeastern University, Boston, Massachusetts 02115, USA.

VIRGINIA VALERIAE (Smooth Earth Snake). USA: FLORIDA: Okaloosa Co: Eglin Air Force Base, Range Road 211 at Milligan Creek Bridge (Sec. 32, T2N, R25W). 26 June 1995. J. B. Jensen. Verified by Paul Moler. UF 99675. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part One, The Snakes. Windward Publ., Miami, Florida), bridging a hiatus in the western portion of the Florida panhandle (Conant and Collins 1991, Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.). Individual was captured along the ecotone between longleaf pine-turkey oak sandhill and a clear titi-bordered seepage stream.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA, and **MARK A. BAILEY**, Alabama Natural Heritage Program, 64 North Union Street, Montgomery, Alabama 36130, USA.

New Texas Herpetofaunal County Records Represented In The Tulane University Museum Of Natural History

With the combining of the long-standing Tulane University Amphibian and Reptile Collection (TU) with a separate collection accumulated by Royal D. Suttkus at the Tulane Museum of Natural History, which now retains the TU acronym, and the cataloging of a large backlog of uncataloged specimens, I decided to review our distributional records in relation to those published. These records are supplementary to those in Dixon (1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. xii + 434 pp.) and subsequent records found in *Herpetological Review*, the *Texas Journal of Science*, and miscellaneous sources listed in the *Zoological Record*.

Except for *Rana grylio*, verifications of amphibian records were supplied by David A. Good and those of reptiles were made by Douglas A. Rossman, both of the Louisiana State University Museum of Natural Sciences.

Ambystoma maculatum larvae (Spotted Salamander). Tyler Co: tributary to Little Beech Creek, 2.3 km S of north gate on north Big Thicket park boundary. 20 March 1978. R. D. Suttkus and G. H. Clemmer. TU 22963–23024. This record fills in a gap within the range suggested by Dixon (*op. cit.*).

Necturus beyeri (Gulf Coast Waterdog). Hardin Co: Turkey Creek, 5.6 km E of U.S. Rt. 69 & U.S. Rt. 287. 7 October 1978. R. D. Suttkus and H. L. Bart, Jr. TU 21264; Hickory Creek, 2.4 km E U.S. Rt. 69 and U.S. Rt. 287. 7 October 1978. R. D. Suttkus, H. L. Bart, Jr. TU 21265–21268; Hardin-Tyler Co. line road, Beech Creek, 8.1 km W Farm to Market Road. 92. 4 August 1982. R. D. Suttkus and M. Blackwell. TU 21269; Village Creek at Farm to Market Road. 418, 5.3 km E Kountze. 12 May 1982. R. D. Suttkus and Trace. TU 21200; Village Creek below Silsbee bridge on U.S. Rt. 96. 6 June 1959. R. D. Suttkus and R. C. Cashner. TU 21375–21376.; Mill Creek, tributary to Village Creek, 3.9 km W Silsbee, Texas Rt. 327. 20 February 1978. R. D. Suttkus, G. H. Clemmer. TU 28993.

Pseudacris clarkii (Spotted Chorus Frog). Randall Co: Palo Duro Canyon State Park. 26 July 1967. F. Jannett. TU 30597–30598. This record fills in a small gap in the northwestern perimeter of the range.

Rana grylio (Pig Frog). Jasper Co: Neches River along left bank, 1.6 km W Evadale by U.S. Rt. 96. 12 May 1982. R. D. Suttkus and V. Trau. TU 23345 (119 larvae). This is a tentative determination made from tadpoles less than 25 mm in length. Ronald Altig examined some of this lot of specimens and thinks they are *grylio*. He did ask if they had a bright metallic band across the back when alive (a feature not mentioned in his key; 1970, Herpetologica 26:180–207) The long period in preservation may have caused fading of the metallic band, and, as Altig stated, determination of young stages always is difficult. Altig indicated that the tadpoles are not of the *Rana pipiens* complex and that *Rana catesbeiana* would be the only conflict in identification for that area. I did have many *catesbeiana* tadpoles of various sizes from southeastern Texas for comparison.

Rana sphenocephala (= *Rana utricularia*). (Southern Leopard Frog). Clay Co: Red River along right bank at Texas Rt. 79, 10.6 km NE Byers. 13 May 1987. R. D. Suttkus and W. Palmer, Heitzman, and McInnis. TU 22039. This extends range ca. 21 km NW of Dixon's suggested range limit.

Apalone mutica mutica (Midland Smooth Softshell). Jasper Co: Neches River along left bank, 15.2 km below old U.S. Rt. 96 bridge. 20 March 1982. R. D. Suttkus, E. B. Peebles, D. L. Rome. TU 21659, 21627–21629; Neches River along left bank, 9.5 km below old U.S. Rt. 96 bridge. 20 March 1982. R. D. Suttkus, E. B. Peebles, D. L. Rome. TU 21660–21662. Orange Co: Neches River along left bank, 0.8 km upstream from mouth of Pine Island Bayou. 12 July 1979. R. D. Suttkus, A. Black, S. Osborn, and S. Utter. TU 28148. Tyler Co: Neches River along right bank, 8.1 km S Spurger off Farm to Market Road. 1013. 7 October 1978. R. D. Suttkus and H. L. Bart, Jr. TU 30690; Neches River along right bank, 0.5 km N of Farm to Market Road. 1013. 4 June 1977. E. C. Beckham and R. D. Suttkus. TU 31123; Neches River along right bank, 8.7 km E Spurger, Farm to Market Road. 1013. 18 September. 1982. R. D. Suttkus, D. Behler, P. Burris. TU 21664.

Apalone spinifera pallida (Pallid Spiny Softshell). Cottle Co: Buck Creek at Texas Rt. 1168. 18 May 1989. R. D. Suttkus and C. Jones. TU 21668.

Apalone spinifera emoryi (Texas Spiny Softshell). Crockett Co: 45.2 km S Sheffield in Pecos River. 14 July 1963. Tulane Environmental Biology Class. TU 30071.

Graptemys kohnii (Mississippi Map Turtle). Jefferson Co: Pine Island Bayou along right bank, 1.2 km below first pipeline below Farm to Market Road. 105. 17 September 1982. R. D. Suttkus and D. Taylor. TU 21652; Newton Co: Sabine River along right bank at Taylor Bend, 6.6. km SSW Bancroft, Louisiana. 26 July 1982. R. D. Suttkus, W. M. Brenneman. TU 21653; Jefferson-Hardin county line: Pine Island Bayou 4.4 km S Sour Lake, Texas Rt. 326. 5 September 1982. R. D. Suttkus and M. Blackwell. TU 21477, 21654. Newton Co: Sabine River along right bank 1.6 km below Armstrong Lake. 18 October 1979. R. D. Suttkus; Sabine Co: 12.9 km SW Toro, Louisiana in Sabine River. 1 July 1963 . R. D. Suttkus, M. G. Ferraro TU 29889; Sabine River along right bank, 1.2 km below first pipeline below Farm to Market Road 105. 26 July 1982. R. D. Suttkus and W. M. Brenneman. TU 21653. Tyler Co: Neches River, 8.1 km E Spurger, 1.1 km off Farm to Market Road. 1013. 27 September 1977. R. D. Suttkus, E. C. Beckham, S, Rohmann. TU 30553.

Macroclemys temminckii (Alligator Snapping Turtle). Tyler Co: 24.2 km E Woodville in Beech Creek, 4.4. km S of north Big Thicket park boundary. 20 March 1978. R. D. Suttkus. TU 21300.

Sternotherus carinatus (Razorback Musk Turtle). Jefferson Co: Willow Creek, tributary of Pine Island Bayou, 4.5 km S of Sour Lake via Texas Rt. 326. 5 September 1982. R. D. Suttkus and M. Blackwell. TU 21428; dead end oxbow along right bank of Pine Island Bayou. 25 March 1979. R. D. Suttkus, C. Miller, J. Faletto. TU 27098; Polk Co: Big Sandy Creek at Farm to Market Road. 1276, 7.1 km SE Jct. U.S. Rt. 190. 20 March 1978. R. D. Suttkus and G. H. Clemmer. TU 21419; E Fork Double Branch, 11.1 km NW Dillardsville. 2 June 1982. R. D. Suttkus. TU 21423; Menard Creek, 1.1 km W Segno on Farm to Market Road. 943. 15 July 1978. R. D. Suttkus and G. H. Clemmer. TU 31112. Tyler Co: Theuvenins Creek, 13.1 km W Spurger via Farm to Market Road. 1013. 14 July 1978. R. D. Suttkus, E. C. Beckham, S. Rohmann. TU 31103; Neches River, 9.0 km E Spurger, just north of Farm to Market Road. 1013. 28 July 1977. R. D. Suttkus, G. H. Clemmer. TU 31141, 31273; Neches River along right bank opposite Big Creek. 28 December 1978. R. D. Suttkus. TU 28149; B. A. Steinhagen Reservoir, Neches River along right bank just above Town Bluff Dam. 3 February 1979. R. D. Suttkus, J. Falleto, , C. Miller; Neches River along right bank just above Town Bluff Dam at Town Bluff. 17 February 1979. R. D. Suttkus, C. Miller. Sabine Co: Palo Gaucho Bayou, 15.2 km NE Hemphill. 13 July 1964. R. D. Suttkus and Environmental Biology Class. TU 30727.

Trachemys scripta elegans (Red-eared Slider). Tyler Co: Drakes Branch at a dirt road, 12.4 km WNW Fred. 28 September 1977. R. D. Suttkus, E. C. Beckham. TU 21580.

Eumeces fasciatus (Five-lined Skink). Kerr Co: Kerrville. August 1948. A. H. Chaney. TU 5822–5823. I view this as a probable erroneous locality. It is perhaps 190 km NW of the closest record and in a well-collected area. Chaney, who collected many amphibians and reptiles in the Kerrville area and lists specific dates in August 1948, says (in litt.) that he cannot identify these specimens in his notes and that he traveled around quite a bit during that time. The Kerrville area has some extensive forested areas that might seem to be suitable habitat for the species, but such a habitat seems to be principally occupied by *Eumeces tetragrammus brevilineatus*. *Eumeces tetragrammus* and *E. fasciatus* do overlap some in part of east central Texas but a hiatus exists between the species farther to the south. Collectors should check carefully for *E. fasciatus* in east central Texas.

Tantilla nigriceps (Plains Blackhead Snake). Dallam Co: 21.5 km NE Dalhart. 21 July 1967. H. A. Dundee. TU 18591–18593. This is not a new county record, Chiszar and Smith (1992, Herpetol. Rev. 23:124) having reported it from 13.75 km NW Dalhart, but it does extend the NW limits of the known range in Texas.

HAROLD A. DUNDEE
Tulane University Museum of Natural History
Belle Chasse, Louisiana 70037-3098, USA.

Additional Geographical Records for Reptiles in Virginia

The herpetological collection of the Department of Biology, George Mason University, Fairfax, Virginia (GMU) includes a number of specimens representing locality records for Virginia reptiles not included in the recent publication by Mitchell (1994) nor its predecessor by Tobey (1985). These records are presented here. In addition, Mitchell (1994) referred to several locality records taken from Ernst (1992), Ernst (pers. comm.; now Ernst et al., in press) or Ernst and Barbour (1989) as "Unvouchered Records" and plotted them on his distribution maps as hollow circles. Data confirming these specimens are also presented below.

Chrysemys picta (Painted Turtle). PREVIOUSLY UNVOUCHERED RECORDS: Independent City of Alexandria, marsh on south side of George Washington Memorial Parkway, 1 mi S National Airport. June 1982. J. E. Lovich. GMU 1237. Fairfax Co: Mason Neck National Wildlife Refuge, Kane's Creek bald eagle nest site. 22 March 1984. S. Haines. GMU 2646–2647. Burke Lake Park, nr dam. 27 March 1985. S. W. Gotte, S. Elfers. GMU 2654; August 1980. C. W. Brown. GMU 1214. Fort Belvoir, Accotink Creek. 21 March 1987. S. W. Gotte, A. F. Laemmerzahl. GMU 3167; 15 March 1987. S. W. Gotte, J. F. McBreen. GMU 3178–3180; 500 yds from parking lot nr Accotink Creek. 10 April 1987. S. W. Gotte, J. F. McBreen. GMU 3193–3195; bald eagle's nest site. May 1990. S. W. Sekscienski. GMU 3876; Accotink Bay Wildlife Refuge. 20 April 1994. C. H. Ernst. GMU 4002. Reston, Nike Park. 3 June 1992. P. J. King. GMU 3930–3931.

Clemmys guttata (Spotted Turtle). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Great Falls, 100 m from Potomac River nr Interpromontory Road. 27 July 1984. S. W. Gotte. GMU 2409. Fort Belvoir, Pohick Bay. 1990. S. W. Gotte. GMU 3919; 4 April 1986. S. W. Gotte. GMU 2905–2906; 28 May 1987. S. W. Gotte, A. F. Laemmerzahl, J. F. McBreen. GMU 3395. Stafford Co: no precise locality or collection data. GMU 3753.

Clemmys insculpta (Wood Turtle). PREVIOUSLY UNVOUCHERED RECORDS: Warren Co: 1.6 mi W of Shenandoah River Bridge, U. S. I-66. 26 October 1990. L. Wanrow. GMU 3916.

Pseudemys rubriventris (Redbelly Turtle). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Burke Lake Park. 7 October 1988. R. Richardson. GMU 3676. Mason Neck National Wildlife Refuge. 16 March 1987. A. F. Laemmerzahl. GMU 3428.

Terrapene carolina (Eastern Box Turtle). NEW COUNTY RECORD: Culpeper Co: Phelps Wildlife Management Area: 13 August 1987. S. W. Gotte, A. F. Laemmerzahl. GMU 3433–3435. Fills gap between Prince William, Stafford and Fauquier counties. PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Reston, South Fork Little

Difficult Run at Foxmill Road. 17 February 1982. S. W. Gotte, J. E. Lovich, P. Fuller. GMU 974; jct. Reston Ave. and Foxmill Road. 9 November 1984. R. Furey. GMU 2839. Lorton, Gunston Road, 4.7 mi from U. S. Rt 1. 26 May 1988. S. W. Gotte. GMU 1570; Gunston Cove. 4 April 1986. S. W. Gotte. GMU 2909, 2950–2952; April 1987. S. W. Gotte. GMU 3438. Centreville, jct. Union Mill and Braddock Roads. 22 May 1984. C. H. Ernst. GMU 2038; jct. Braddock and Clifton Roads. 16 August 1987. A. F. Laemmerzahl. GMU 3430. Great Falls, Interpromontory Road. 2 August 1984. S. W. Gotte. GMU 2408; City of Great Falls. August 1988. GMU 3640. Fairfax: Fairfax Circle. December 1983. M. G. Emsley. GMU 1717; George Mason University Campus. 12 April 1976. C. H. Ernst. GMU 4. June 1972. C. H. Ernst. GMU 318–322. May 1986. C. H. Ernst. GMU 2955. Mason Neck National Wildlife Refuge: May 1984. D. P. Kelso. GMU 1799–1801; 27 October 1984. C. H. Ernst. GMU 2584–85; 29 June 1985. C. H. Ernst. GMU 2702–2703; 16 June 1985. S. W. Gotte. GMU 2710–2711; 25 July 1985. C. H. Ernst. GMU 2713; 2 March 1986. C. H. Ernst, E. M. Ernst. GMU 2894–2895; 14 April 1986. C. H. Ernst. GMU 2940–2949; 7 June 1986. E. M. Ernst. GMU 2954; 30 July 1986. A. F. Laemmerzahl. GMU 1739, 3297; 7 May 1987. C. H. Ernst. GMU 3369; May 1986. S. W. Gotte. GMU 3482; 16 March 1987. C. H. Ernst. GMU 3429; 13 May 1987. C. H. Ernst. GMU 3759; 17 April 1991. C. H. Ernst. GMU 3851–3852; 4 July 1991. E. M. Ernst. GMU 3854–3856; 17 June 1988. C. H. Ernst. GMU 3677, 3766; May 1993. T. P. Boucher. GMU 3982. Burke Lake Park: May 1975. C. H. Ernst. GMU 817–818; 14 April 1976. C. H. Ernst. GMU 860; April 1982. L. A. Ernst. GMU 1429; April 1983. J. E. Lovich. GMU 1529; March 1984. J. Snyder. GMU 1796; March 1986. S. W. Gotte. GMU 2888–2889; 28 April 1986. C. H. Ernst. GMU 2939; 27 March 1991. C. H. Ernst. GMU 3850. Fort Belvoir: 24 April 1989. S. C. Belfit. GMU 3697–3698; 27 March 1991. C. H. Ernst. GMU 3853; 21 February 1990. S. Belfit. GMU 3857. Arlington Co: Gulf Branch Nature Center. Winter 1987. J. F. McBreen. GMU 3505. Lee Co: Station Creek at U. S. Rt. 58. 30 April 1978. T. C. Barr, Jr. GMU 2298. Prince William Co: Lake Brittle. 28 March 1985. S. W. Gotte, K. Ballard. GMU 2687; Conway-Robinson State Forest, U. S. Rts. 29 and 211. March 1986. D. Nusbaumer. GMU 2887; Manassas. 15 May 1986. C. H. Ernst. GMU 3000. Frederick Co: Mountain Falls, 1 mi past Rt. 606–608. 1986. D. Nusbaumer. GMU 2883–2886.

Trachemys scripta (Slider). PREVIOUSLY UNVOUCHERED RECORDS: Independent City of Alexandria, Belle Haven Park. 23 March 1992. C. H. Ernst. GMU 3922 (*Trachemys s. scripta*). Fairfax Co: Mason Neck National Wildlife Refuge. 30 August 1984. S. W. Gotte. GMU 2625–2630 (five juvenile *Trachemys s. elegans* hatched from eggs laid 19 June 1984); August 1984. S. W. Gotte. GMU 2880–2881, 2913 (three juvenile *Trachemys s. elegans* hatched from eggs laid June 1984). The slider has been introduced into northern Virginia via the pet trade and exists as a reproducing population residing mostly in the tidal marshes of the Potomac River. The subspecies *T. s. scripta* and *T. s. elegans* are both present, with *elegans* dominant; some intergradation has occurred.

Kinosternon subrubrum (Eastern Mud Turtle). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Pohick Bay. 12 June 1987. J. F. McBreen, S. W. Gotte and A. F. Laemmerzahl. GMU 3411; Gunston Cove at Pohick Creek. May 1987. J. F. McBreen. GMU 3436; Fort Belvoir, bald eagle nest site. May 1990. S. W. Sekscienski. GMU 3875. Mason Neck National Wildlife Refuge. May 1994. S. Zylstra. GMU 4008.

Sternotherus odoratus (Common Musk Turtle). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Fort Belvoir, bald eagle nest site. May 1990. S. W. Sekscienski. GMU 3866–3874. Burke Lake Park, South Run, dead on bank. 15 April 1994. C. H. Ernst. GMU 4031. Independent City of Suffolk, Dismal Swamp. 30 June 1989. C. H. Ernst. GMU 2637.

Sceloporus undulatus (Fence Lizard). NEW COUNTY RECORD: New Kent Co: Rt. 1013 at Dischund Creek. 5 October 1984. C. H. Ernst, S. W. Gotte, J. Snyder. GMU 2531–2533.

Eumeces fasciatus (Five-lined Skink). NEW COUNTY RECORD: Culpeper Co: Phelps Wildlife Management Area. 13 August 1987. S. W. Gotte, A. F. Laemmerzahl. GMU 3452. First record for region between northern Virginia counties and Madison County to the southwest. PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Burke Lake Park. 25 March 1976. C. H. Ernst. GMU 14. Fairfax, George Mason University Campus. 26 March 1974. C. H. Ernst. GMU 95; 9 June 1981. C. H. Ernst. GMU 479. Pohick Bay Regional Park. 28 May 1987. J. F. McBreen, S. W. Gotte. GMU 3378–3379; Fort Belvoir. Spring 1985. J. F. McBreen. GMU 3675; 13 September 1988. S. W. Sekscienski. GMU 3746; May 1991. A. F. Laemmerzahl. GMU 3863. Westmoreland Co: jct. Rts. 204 and 3. 18 April 1987. J. F. McBreen. GMU 3358–3360. James City Co: 0.5 mi S. on Rt. 610 at Rt. 715. 12 October 1984. C. H. Ernst. GMU 2608–2609.

Scincella laterale (Ground Skink). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Burke Lake Park. 9 May 1983. S. W. Gotte. GMU 1541. Mason Neck National Wildlife Refuge. 12 June 1984. S. W. Gotte. GMU 2113–2114. Fort Belvoir. 11 May 1989. S. W. Sekscienski. GMU 3865. New Kent Co: Rt. 1011 at Dischund Creek. 5 October 1984. C. H. Ernst. GMU 2597. Westmoreland Co: jct. Rts. 204 and 3. 18 April 1987. J. F. McBreen. GMU 3357.

Carphophis amoenus (Worm Snake). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Fairfax, George Mason University Campus. 8 June 1976. C. H. Ernst. GMU 8. Fairfax Station. November 1978. P. Haze. GMU 18. Swift Run. 7 April 1991. A. Thorpe. GMU 3862. Oakton, Miller Road. July 1979. C. W. Brown. GMU 1219. E. C. Lawrence Park: Jefferson Run Road. 10 June 1981. S. W. Gotte. GMU 481. 2 June 1983. GMU 1549; 17 July 1983. S. W. Gotte. GMU 1714; 12 April 1987. S. W. Gotte. GMU 3371. Fort Belvoir: Pohick Creek. 28 May 1987. S. W. Gotte, J. F. McBreen. GMU 3376; 26 June 1987. S. W. Gotte, J. F. McBreen. GMU 3478; Accotink Creek. 5 September 1988. S. W. Gotte. GMU 3660; 19 July 1989. S. W. Sekscienski. GMU 3750. New Kent Co: Rt. 1011 at Dischund Creek. 5 October 1984. C. H. Ernst. GMU 2595; Chickahominy Shores. 5 October 1984. C. H. Ernst. GMU 2610. Prince William Co: Hopewell Gap. 1979. B. Hedges. GMU 85; Manassas Battlefield National Park. 18 March 1992. J. M. Hagin, B. A. Kirsher. GMU 3923.

Coluber constrictor (Racer). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Herndon. 9 September 1990. C. L. Beck. GMU 3797. Bull Run Regional Park. December 1983. S. W. Gotte, K. Ballard. GMU 1765. Oakton. 17 March 1987. C. H. Ernst. GMU 3189. Fort Belvoir, Pohick Creek. May 1987. J. F. McBreen, S. W. Gotte. GMU 3383. Mason Neck National Wildlife Refuge: 16 June 1987. C. H. Ernst. GMU 3474; 1 November 1987. C. H. Ernst. GMU 3476; 0.25 mi East of entrance to Woodmarsh Trail. 6 June 1992. T. P. Boucher. GMU 3928.

Diadophis punctatus (Ringneck Snake). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Fairfax, George Mason University Campus: October 1983. C. H. Ernst. GMU 2201–2202; 14 June 1989. C. H. Ernst. GMU 3713; June 1988. A. F. Laemmerzahl. GMU 3629. Montgomery Co: Blacksburg. May 1985. C. W. Brown. GMU 2851–2852.

Elaphe obsoleta (Rat Snake). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Burke Lake Park Golf Course, Rt. 123. 16 September 1987. C. H. Ernst. GMU 3475. Clifton. 20 May 1984. C. H. Ernst. GMU 3714–3715. Mason Neck National Wildlife Refuge. 28 May 1975. S. Haines. GMU 11–12. Vienna: May 1983. C. W. Brown. GMU 1611–1615; October 1985. C. W. Brown. GMU 2832; July 1986. A. F. Laemmerzahl. GMU 3252. Annandale, jct. Wakefield Chapel and Braddock Roads. June 1983. C. H. Ernst. GMU 1619. Great Falls: Jefferson Run Road. 28 July 1982. S. W. Gotte. GMU 1357; U. S. Rt. 7, 5 miles E of Laurel Hill Road. 16 June 1987. A. F. Laemmerzahl. GMU 3393. Burke Lake Park. 1 November 1990. C. H. Ernst. GMU 3814.

Lampropeltis calligaster (Prairie Kingsnake). NEW COUNTY RECORD: Albemarle Co: U. S. Rt. 29. 0.2 miles N of Rivanna River. 29 April 1985. S. W. Gotte. GMU 2691. Fills gap between Madison and Culpeper counties and Louisa County.

Lampropeltis getula (Common Kingsnake). NEW LOCALITY RECORD: Prince William Co: Manassas. 14 May 1983. C. H. Ernst. GMU 1647. Female, one of copulatory pair; male still alive at GMU. Extends range in northern Virginia one county southwest from Fairfax County.

Lampropeltis triangulum (Milk Snake). NEW LOCALITY RECORD: Clarke Co: Blandy Experimental Farm & State Arboretum. May 1983. S. W. Gotte. GMU 4003. Long term captive. Died July 1994. Completes county sequence in northwestern Virginia.

Opheodrys aestivus (Rough Green Snake). NEW COUNTY RECORDS: Clarke Co: Rt. 601. 2 miles N of Rt. 7. 22 September 1984. S. W. Gotte, K. Ballard, B. Milsap. GMU 2525. Extends range one county west in northwestern Virginia. New Kent Co: Rt. 618, 2 mi NW U.S. Rt. 60. 12 October 1984. C. H. Ernst, S. W. Gotte, J. Snyder. GMU 2526. PREVIOUSLY UNVOUCHERED RECORD: Westmoreland Co: 0.5 mi on Rt. 204 beyond Rt. 3. 18 April 1987. J. F. McBreen. GMU 3356.

Agkistrodon contortrix (Copperhead). PREVIOUSLY UNVOUCHERED RECORDS: Fairfax Co: Great Falls, Jefferson Run Road. 2 June 1983. S. W. Gotte. GMU 1547. Clifton, Kinchloe Fields. May 1986. J. Chick, J. Slapcinsky. GMU 2996. Hemlock Overlook Regional Park. 30 April 1991. J. C. Wilgenbusch. GMU 3848.

Crotalus horridus (Timber Rattlesnake). PREVIOUSLY UNVOUCHERED RECORDS: Rappahannock Co: Rt. 610, 0.5 mi W of Chester Gap, 2200 ft. elev: 20 May 1985. S. W. Gotte. GMU 2692; 3 June 1985. S. W. Gotte. GMU 2698; 2300 ft. elev. 24 June 1985. S. W. Gotte. GMU 2700. Augusta Co: 1.3 mi W of Camp Todd, 3700 ft. elev. 5 June 1985. D. W. Johnson. GMU 3304.

Caiman crocodilus (Spectacled Caiman). NEW COUNTY RECORD: Fairfax Co: Lake Fairfax Park, in shallows of lake. October 1972. C. H. Ernst. GMU 709. Mitchell (1994) only presents data on three individuals caught in Virginia (Independent City of Norfolk, Henrico County, and Arlington County). The Fairfax County specimen (91 cm SVL) was caught alive. It had apparently been a resident of the lake most of the summer, having been observed by park personnel several times during that period. Fresh fecal contents showed it had been eating fish.

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SANDRA E. D'ALESSANDRO
and
CARL H. ERNST
Department of Biology
George Mason University
Fairfax, Virginia 22033-4444, USA.

BOOK REVIEWS

A Naturalist in Florida: A Celebration of Eden, by Archie Carr. (Edited by Marjorie Harris Carr. Foreword by Edward O. Wilson.) Yale University Press: i-xviii + 264 pp. Hardcover. US $28.50. ISBN 0-300-05589-7.

Here is the book that Archie Fairly Carr, Jr., always wanted to write about his beloved Florida, but never got around to doing. Yet every word is his, with phrases and clauses strung together in his own inimitable style.

The seeming paradox was cleverly bridged by his devoted wife, Majorie Harris Carr, now his widow. She assembled, skillfully blended, and synthesized what I, an old-timer, have enjoyed to the full—a new book by Archie Carr. The text was abstracted or adapted from a variety of sources. A few of the chapters are from his books and papers, a sprinkling are from hitherto unpublished manuscripts, but most are from magazine articles that appeared years ago and which, until now, were unknown to non-subscribers. The result is a highly readable collection of Archie's observations on various aspects of the natural history of Florida, and the vast changes it has endured as much of its wildlife and habitats have been destroyed by the hordes of people who have invaded what was truly a naturalist's Eden in pioneer days.

There is a wealth of information for the herpetologist in this book. The titles of many chapters are indicative, such as "Tails of Lizards," "Living with an Alligator," "In Praise of Snakes," and a virtual treasury of observations and comments on Florida's largest and most widespread reptile in a lengthy essay on "Alligator Country." Other chapters are devoted to herps even though their titles fail to suggest it. Further, in most of those on other subjects, amphibians and reptiles occupy prominent and unexpected roles in Archie Carr's narratives. In a chapter on "The [Spanish] Moss Forest," for example, there is a cogent discussion about the eastern spadefoot, *Scaphiopus holbrookii*, and how its behavior resembles that of its relatives in the arid Southwest. Also, under "Water Hyacinths" he explains how bonanzas of amphibians and reptiles can be found by rolling masses of the pestiferous floating plants ashore and sorting through them.

Archie Carr was first and foremost a herpetologist, but he was also deeply interested in all aspects of the Floridian fauna and flora. He loved Florida, where he spent most of his life, despite his many excursions and sometimes longer stays in the Tropics. He was a skilled writer who had the gift of making some of his prose read almost like poetry. Several of his books won him prizes

and medals, and he was hailed as one of the best nature writers of the century. His brilliant mind and keen powers of observation could make even the most prosaic natural history event come alive and seem important. Florida was Archie's favorite topic, with the possible exception of turtles. He was one of the world's foremost authorities on those reptiles, especially the sea turtles. He was a highly respected scientist, and unquestionably was one of the all-time greats among the faculty members of the University of Florida at Gainesville. Unhappily, we lost him in 1987.

Archie Carr was no armchair naturalist. He relished being in the field, pursuing his studies and observations, and also meeting the common man and gathering information from hunters, fishermen, farmers, and others who spent much of their time out-of-doors. His text is flavored with the "ain'ts," "don't need nones," and "let's ketch its" of his poorly educated acquaintances. An amusing and instructive part of this book is his contribution to the patois of the Florida Crackers who had their own names for a great variety of things. A torrential downpour was a "frog-choker rain." A water lily was a "bonnet." Certain kinds of fishes were "stumpknockers," "pusselguts," and "hogchokers." A "cut-bait fisherman" was one who used dynamite instead of hook and line. Kinosternid turtles were invariably called "stinkjims" and the Suwanee cooter, *Pseudemys concinna suwanniensis*, that Archie himself described as a new taxon, was the highly esteemed protein component of "Suwannee chicken stew."

Standardization of names, for the sake of accurate communication, is important, as well I know. I chaired the pioneer committee on herpetological common names of the American Society of Ichthyologists and Herpetologists during the 1950's. But colloquial names also have their place, both in history and as picturesque punctuations of our language. Regrettably, most of them are dying out as we are homogenized from coast to coast, chiefly by television. In a sense, we are becoming almost like clones of one another, with choice bits of regional Americana rapidly slipping away.

In her "Preface" Marjorie Carr mentions that when, in the late 1960's, Archie started to write a book about Florida he "immediately sensed a danger looming." Without care his writings might become a "lament" on what has happened to Eden. So he approached it from the positive side, recounting a great many of his interesting and pleasurable experiences, and he pointed out how some of the animals have made comebacks. Nonetheless, he sneaked in "some factual tooth-gnashing every now and then" about how thoughtless and avaricious humans have contributed to the loss of the beauty, tranquility, and living treasures of our most tropical state. Margie bore this in mind while assembling the various parts of this lively compendium of her late husband's literary contributions.

Maps are included showing place names mentioned in the text, valuable tools for orientation. Archie's writings span a period of fifty years, and the nomenclature used for some of the organisms is out of date. Isn't it always so? Scientific names change as studies progress. Special thanks are due to Marjorie Carr for making this book possible. It is a tribute to her as well as to Archie.

ROGER CONANT
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131, USA.

Snake Identification. Identity Software, 1994, Intec Ltda., Neotropics Genera Version 1; Rio de Janeiro, Brazil, or La Mesa, California, USA.; 1.5 megs, Windows 3.1 or later; US $69.00.

I commend the author (unknown) for the effort of obtaining the necessary copyright releases to utilize the taxonomic data presented in the keys to the neotropical snake genera by Peters and Orejas-Miranda (1970) and Peters, Orejas-Miranda, and Vanzolini (1986), in their *Catalogue of the Neotropical Squamata, Part 1: Snakes* (wrongly cited by Intec Ltda., as Peters and Robert Donoso-Barros).

The program is easily installed and I am sure the company recommends that you have at least 4 megs of RAM to run Windows 3.1.

There are two ways to obtain the unknown snake genus for which you may be searching. The first is a Sequenced-Key Menu that allows you to select one choice of a dichotomous couplet. Once you have selected the character, a second couplet appears and again you make a choice, etc. Once you have selected all of the characters that fit your unknown genus, the correct? genus should pop up on your screen.

There is also a Random-Key Menu that allows you to select from a list of 244 characters (duplication removed from the Sequenced-Key list of 366 characters). As you utilize the character set, you are allowed to save each character, use an **update** icon to search the data base, and eliminate genera lacking those characters. You may continue adding characters and searching with the **update** button until you have exhausted your choices or found the answer. Identity Software has indicated that there is a problem if you enter characters from both the Sequenced-Key and the Random-Key. There are "several of the genera that cannot be completely separated. This situation occurs because the initial list of characteristics was developed for use with the sequenced key." The company claims that a future update will eliminate the discrepancy.

You cannot add or delete characters to or from either key. You must use those that are provided. Future updates will include information that may better define the genera.

Printing the information found in Version 1 is not as easy as suggested by the company. When I follow the directions for printing the screen by selecting the **Print** button, I receive blank pages, rather than the print screen data selected (although this may simply be a non-configured print mode in my printer [HP 500+]).

However, in good conscience, I cannot recommend the purchase of *Snake Identification* software at this time. There are several reasons for not using the current version.

1. The data are old and though the keys may work for many of the genera, there are a number of revised and new genera not included, whereas others that have been synonymized, resurrected, or newly described are present. This creates considerable taxonomic confusion. Some of the new genera included are *Bothriechis*, *Bothriopsis*, *Ophryacus*, and *Porthidium*. Those genera not included are *Cerrophidion*, *Crisantophis*, *Emmochliophis*, *Enuliophis*, *Exiliboa*, and *Rhadinophanes*. Resurrected genera not included are *Cercophis*, *Tropidodryas*, and *Echinanthera*. Synonymized genera included are *Dromicus*, *Leimadophis*, *Lygophis*, *Leptomicrurus*, *Paraptychophis*, and *Paroxyrhophus*. The writer of the program states that the initial version (version 1) "does not include all of the most recent data; however the random key will be updated in order to provide up-to-date information about the recognized genera." The writer of the software states in the registration form, "that *snake identification* will be updated to include the most recent information. If you would like to receive at least one upgraded version of this program as soon as available, please

check one of the following..." The "following" represents two boxes, one for a money order, the other for a check, each for $69.00, and payable to Identity Software. There is no indication of how soon the software will include new information, nor who is keeping track of the rapidly changing status of generic names, character adjustments, and geographic distributions. Most of the data included represents our knowledge of 25 years ago. Today, DNA sequencing, other types of protein analyses, osteological and soft anatomy discoveries are making rapid changes in generic concepts. In an attempt to use the present program to identify South and Middle American snake genera through representative species, I was frequently presented with the wrong genus. Some species that appear difficult to identify to genus are within *Mastigodryas*, *Rhadinaea*, *Liophis*, *Tachymenis*, and *Leptodeira*. In some cases, the data set presented in the couplet is in error; e.g., species of *Leptodeira* have a maxillary diastema and grooved, enlarged rear teeth. The data set used to identify *Leptodeira* through the Sequenced-Key does not contain a diastema nor grooved teeth. Instead, character #190 is present, "Teeth-Shape-Maxillary-Diastema absent, bk teeth not enlarged." However, the Random-Key data set contains character # 215, "Teeth-Maxillary-Size-bone not reduced, teeth present before enlarged grooved fangs." Therefore it is possible to identify *Leptodeira* in the Random-Key, but not in the Sequenced-Key.

2. When most of us are using keys to identify a snake, we usually have an alcoholic specimen in the tray, we thumb through the key with one hand and examine characters with the other, and normally sit in front of a microscope rather than a computer. In general, we would not allow a piece of expensive electronic equipment to be covered with snake scales and alcohol. The computer program for snake identification requires us to record all of the necessary data from the specimen **prior** to keyboard use. Without prior knowledge of all of the character states in the program, we are required to take data that we would not normally record for every specimen.

3. Perhaps the greatest problem with Version 1 is the out-of-date nature of the some of the generic characters for various genera. Because the genus is an artificial category, many of the attributes are subject to change as more species are added or deleted from a genus; e.g., a genus with all species having a 17-17-15 scale row reduction with apical scale pits, will change drastically by adding a new species without a reduction and without apical scale pits. An excellent example of an abrupt change is the recent description of the new genus *Xenoxybelis* (Machado 1993) for *Oxybelis argenteus*, based upon hemipenial morphology.

I do not envy the person(s) of Intec Ltda. who have the task of keeping up with the rapid changes taking place in snake systematics today. I believe that the future updates that include species identification keys will be a much better purchase than the one at hand.

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JAMES R. DIXON
Department of Wildlife and Fisheries Sciences
Texas A&M University
College Station, Texas 77843, USA.

Decline of the Sea Turtles: Causes and Prevention. Committee on Sea Turtle Conservation, Board of Environmental Studies and Toxicology, Board on Biology, Commission on Life Sciences, National Research Council. 1990. National Academy Press, Washington, D.C. xv + 259 pp. US $14.95.

A valuable compendium on sea turtles, this book was unabashedly written as a political response to a menacing situation in the USA: millions of dollars of federal funds spent to save turtles, but a conservation—and political—situation which continued to deteriorate. Much of this money was spent on the development of technology to reduce the incidental capture, and killing, of sea turtles in trawl nets of U.S. shrimpers.

Despite the eventual deployment of nearly a dozen types of turtle excluder devices (TEDs), some of the best models formulated *without* using any federal funds, there have been years of political and legal foot-dragging, stone-walling, infighting, and other political maneuvering to stop legislation for mandatory use of TEDs on shrimp trawls. Consequently, incidental captures continued, as did *preventable* deaths of large numbers of turtles, many of which were breeders and/or the highly endangered Kemp's ridley turtle. (It is also noteworthy that this fishery is government subsidized, targeted on a luxury product, over-fished, and destructive to other valuable fisheries resources). Remarkably, the estimated number of turtles killed annually by U.S. trawlers exceeds—by a generous margin—the estimated number of turtles taken yearly throughout the entire Western Atlantic system by subsistence fishermen in the Caribbean and east coast of Latin America. The effect of the TED fiasco south of the Rio Grande has *not* been increased credibility of conservation initiatives exported from the USA.

As has been known for years to turtle biologists, incidental capture of these reptiles in shrimp trawls is a major source of mortality: unsustainable to the respective breeding populations. The use of turtle excluder devices is an effective way to reduce this mortality, without undue impact on the trawl fishery. The magnitude of the problem of incidental capture cannot be overemphasized, and this book provides critical information prompting a long-delayed, responsible political solution. On 1 March 1990, legislation for mandatory use of TEDs in the Gulf of Mexico finally went into effect for U.S. shrimpers.

Although the title is "Decline of the Sea Turtles: Causes and Prevention," the very specific focus on TEDs, as described above, is clear from the structure and contents of the book: Executive Summary; Introduction; Biology; Population Trends; Distribution of Sea Turtles in U.S. Waters; Natural Mortality and Critical Life Stages; Sea Turtle Mortality Associated with Human Activities; Conservation Measures; Conclusions and Recommendations; References; and Appendixes A–J. The appendixes are: A) Endangered Species Act Amendments of 1988; B) Interim Report, Committee on Sea Turtle Conservation; C) Illustrations of Turtle Excluder Devices; D) Aerial Survey Data of Sea Turtles in Fishing Zones; E) Sea Turtle Stranding Data; F) Shrimp Fishing Effort; G) Annotated and Chronological List of Educational Efforts on TEDs for Fishermen by National Marine Fisheries Service; H) Annotated and Chronological List of Educational Efforts on TEDs for Fishermen by Sea Grant; I) Newsletters and Notices Pertaining to TEDs; and J) Biographies of Committee Members.

The Committee on Sea Turtle Conservation, directly responsible for the book, included specialists in several fields pertinent to the issues, and four of the best informed and most capable sea turtle biologists in the world: hence, the reader can hardly have low expectations. For that reason this reviewer feels impelled to

bias this review toward the major disappointments, and save limited space by simply stating that there is a great deal of good information and synthesis in the book. Anyone interested in marine turtles would benefit from reading it, as would people involved in marine fisheries with politically volatile activities.

For a book as large and complex as this, it is not surprising to find problems of form. Still, it would have provided a more serious and useful depiction of U.S. turtles to have used some of the many excellent illustrations which are now commonly seen at turtle conferences, instead of the stylized cartoons in Fig. 2-1 (p. 22). For a review, it is astonishing how much information is presented without any citation of source.

A lucid warning comes from the title page: no author's name appears, but instead there is a giddy series of organizations, including one committee, two boards, a commission, and a council. Clear evidence that the book was manufactured by committees, etc. can be seen in a varying style and inconsistent treatment of topics between chapters and comparable sections. The subject of sea turtle species is a woeful example: in the preface, we are informed that the task of the committee was to provide information on the five species which occur within U.S. waters; yet, six species are listed in the table of contents. On pages 21 and 23 we are told that there are a total of eight species of sea turtles—which can only be true if one accepts that there are two species in the genus *Chelonia*: the green turtle, *C. mydas* and the east Pacific black turtle, *C. agassizii*. However, on page 16 *Chelonia mydas* is described as including the east Pacific populations in México (thus, negating the validity of *C. agassizii*). A meticulous, critical review and final revision of the entire manuscript would have done wonders to giving the work the final polish which it merits.

The reader will be startled by the levels of Yankee egocentrism. This book is *not* about "Decline of the Sea Turtles," nor even about turtles in the USA. It is clearly focused on the eastern USA and neighboring waters of the Caribbean and Gulf of Mexico. The reader not acquainted with the subject would hardly guess from reading the book that there is a major area of Pacific waters under U.S. jurisdiction, where the management and conservation of sea turtles is problematic. Furthermore, outside of official U.S. jurisdiction is a vast kaleidoscope of sea turtle problems involving international relations, political and economic conundrums, as well as disparate national laws, cultures, habits, technologies, and traditions, to say nothing of varying government and civil responses to these problems. There is an urgent need to respond to the decline of sea turtles in these regions, but the book simply does not consider them. The ambitious title is not germane to the text.

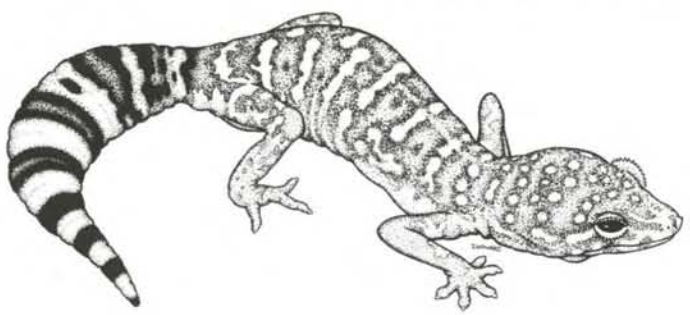
However, more disturbing is a statement about the olive ridley turtle, a species rare in U.S. waters. We are informed (p. 41) that "its status and future are not in the main, a direct United States responsibility." Are we to believe that U.S. foreign policy, arms sales, biocide sales, global environmental pollution, and economic and cultural domination have no effect on natural resources 200 miles offshore of the east coast of the USA?

It is made perfectly clear in the Executive Summary (p. 2) that the book does "not analyze social and economic issues related to sea turtle conservation." That the various academic committees, boards, and commissions thought that they could realistically analyze the causes, and prescribe preventions, of declines of sea turtles from within this limited horizon is frightening. Anyone struggling outside of the rarefied atmosphere of higher academia to make biological conservation and sustained utilization a reality, will still have to invest considerable time and effort in educating the educated. The best biological information in the world will alone not save a single population, species, or ecosystem; biological conservation is a sociopolitical activity, not science.

In summary, a different title would have avoided, or greatly reduced, many of the above problems. A more restrictive, specific, even more humble, title might have been: "A contemporary review and synthesis of biological information on sea turtles along the Atlantic and Gulf of Mexico coasts of the USA, with special reference to the problem of incidental capture in shrimp trawls."

J. FRAZIER
CINVESTAV
A.P. 73 "Cordemex"
Merida, C.P. 97310
Yucatan, México
E-mail: frazier@kin.cieamer.conacyt.mx

Note added in press: The above review was written in 1993, for *Oryx*, which later suspended publishing book reviews. At that time I naively assumed that with the long overdue legislation of 1 March 1990, TEDs would finally be implemented, and that the incidental catch—at least in U.S. waters—would at last be brought under control. Indeed, it was a U.S. congressional mandate, at the behest of congressional opponents of TEDs, which resulted in the National Research Council being commissioned to write *Decline of the Sea Turtles*. Never underestimate the nearsightedness and narrow-mindedness of recalcitrant politicians! Nor the greed and irresponsibility of the commercial fishing industry! As of the summer of 1995, the incidental capture issue in U.S. Gulf states is far from being solved; the political solution, with the use of TEDs, seems more mired in avaricious politics than ever. Meanwhile, the biological information, pointing to the urgent need for a rapid and lasting resolution, only accumulates faster (Gallaway et al. 1995. Sea Turtle and Shrimp Fishery Interactions—Is a New Management Strategy Needed? Texas Shrimp Assoc., LGL Ecological Research Associates, Inc., Bryan Texas, 142 pp.; Shaver 1995. Marine Turtle Newsletter 70:2–4). This underlines the conclusion that biological conservation is politics, not science. And south of the Rio Grande, the credibility of the U.S. in environmental matters continues to slide backward. An interesting review of the issue is Weber et al. (1995. Delay and Denial: A Political History of Sea Turtles and Shrimp Fishing. Center for Marine Conservation, Washington, D.C., 46 pp.).—*JF, 24 August 1995.*



Male *Coleonyx switaki* (Barefoot Gecko). USA: California: San Diego Co. Illustration by Thad A. Howard.

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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES (SSAR)

Editor *(Name and Complete Mailing Address)*

ROBERT W. HANSEN
16333 Deer Path Lane, Clovis, CA 93611

Managing Editor *(Name and Complete Mailing Address)*

THOMAS F. TYNING
Massachusetts Audubon Society, 350 Williams St., Pittsfield, MA 01201

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Amphibians of Washington and Oregon, by William P. Leonard, Herbert A. Brown, Lawrence L. C. Jones, Kelly R. McAllister, and Robert M. Storm. 1993. Seattle Audubon Society. 168 pages. Softcover. ISBN 0-914516-10-8 US $9.95. Available from Seattle Audubon Society, 8028 35th Avenue NE, Seattle, Washington 98115, USA ($2.50 shipping and handling).

Another regional field guide. Do we need it? Does it fill a vacant niche? Does it work? In this case, the answer to each of these questions proves to be an unqualified "yes." This is not to take anything away from the two other field guides which cover the states of Washington and Oregon (Nussbaum et al. 1983; Stebbins 1985). They too are excellent resources, and along with this new book, represent a fine herpetological natural history library for these two states.

This field guide represents the most recent addition to the Trailside Series published by the Seattle Audubon Society, a series "designed to enhance the knowledge and appreciation of natural history in the Northwest and assist in the conservation of species and habitats." In keeping with this theme, the authors state that their book is designed simply to be used to assist in identifying the amphibians of Washington and Oregon. Their target audience includes "teachers, students, naturalists, professional field biologists, and lay-persons alike," a broad group indeed!

The diversity of the intended audience is reflected in the diversity of the authors themselves and the organizations sponsoring this publication. The five authors represent five different institutions and agencies (two universities, two state agencies, and one federal agency). An equally diverse group of seven societies, state agencies, and federal agencies sponsored this publication. I believe this level of cooperation reflects two things: first, a superb effort by Bill Leonard in organizing this many individuals and groups, and second, a growing appreciation by more than just small groups of academics and enthusiasts that amphibians are important components of ecosystems as well as fascinating creatures in their own right.

The bulk of the text (132 pages) is devoted to species accounts. Of the remaining sections making up the book, three (Overview of Amphibians, Notes on Salamanders, and Notes on Frogs and Toads) give the reader some basic biological knowledge of these animals. Another section effectively discusses the current state of affairs in amphibian systematics and taxonomy. In the section entitled Conservation and Regulations, the loss of amphibian habitats and species is emphasized, and the current legal status and resulting collecting regulations are given for those species most affected. For those less familiar with the biology of these animals, figures showing general features of salamanders and frogs are provided along with a very helpful glossary. A checklist of species is also provided, and four pages of references are given.

The 33 species accounts are consistent in writing, organization, and level of information, not an easy editorial task when dealing with five authors. Each account begins with a description of the characteristics useful in correctly identifying the species of salamander or frog. Key characteristics are highlighted in bold type, a very helpful feature, especially when juggling a specimen in the field. A section follows with the descriptions of species with similar appearance, helpful especially for those groups (e.g. genus *Plethodon*) with several species exhibiting only minor morphological differences. Distribution information is accompanied by a map showing the areas where the species is known to occur. County boundaries are marked. Life history information, habitat association, diet, behavior, and breeding biology are summarized in a single section. A final component of each account is a section containing additional information (e.g., taxonomy, subspecies, population status, anecdotal information) of potential interest to the reader.

This book succeeds on several fronts, but the most obvious is the high quality of the photographs. Unlike those used in some field guides, these are clear, crisp, close-up shots in which the details of structure and color can be seen. In addition to quality, we are also treated to quantity. Each account is accompanied by three to six photos showing not only a dorsal view of the animal, but usually a ventral view, as well as larvae, variants, egg masses, and habitat. A number of individuals are responsible for these wonderful photos, but the vast majority are the work of Bill Leonard.

While most of the text beyond the species accounts is standard field guide fare, two sections deserve mention. First, the section concerning taxonomy is well done and up to date. Taxonomy is described as a field undergoing its own changes and producing much new understanding of relationships and classification as the field evolves. It is a gentle introduction to those with little or no understanding of this area of biology and attempts to quiet concerns about the "splitting" of species and the seemingly continual addition of new names attached to subcomponents of well known taxa.

The second section of note concerns conservation of amphibians and regulation of their capture. Here the authors discuss the apparent decline in amphibian populations around the world and in the Pacific Northwest. Readers are informed of federal and state regulations concerning collection of amphibians, and those species whose populations are of primary concern are noted. This information supports the strong conservation ideal evident in the introduction, where readers are encouraged to handle any captured animals with care, to return them to where they were found, and to be sensitive to their habitats. The message: amphibians are best appreciated in their natural setting.

There is little here to criticize. Some might like to have a key to the amphibians with which to aid species identification, but I believe that it would actually be little used by those who will use this book the most. I personally would like to have seen a more extensive bibliography with references specific to each taxa cited in association with each account, but again, many of the targeted audience might not feel such a need.

All in all, this is an excellent book. The authors have not only successfully met their goal of assisting a diverse audience in identifying the amphibians of Washington and Oregon, but have gone well beyond that by presenting the most up to date information concerning the natural history, taxonomy, and conservation of these animals. In addition, they have produced a field guide which does not compete with, but rather complements the other volumes available for this region. While it may not be as exhaustive as Nussbaum et al. (1983) or have the breadth of Stebbins (1985), it already is being used by amateurs and professionals alike and will be for years to come.

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DAVID M. DARDA
Department of Biological Sciences
Central Washington University
Ellensburg, Washington 98926, USA
e-mail: dardad@cwu.edu

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Department of Biological Sciences
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Norfolk, Virginia 23529–0266, USA

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Kansas City, Missouri 64145, USA

Herpetological Conservation
PAUL STEPHEN CORN, Editor
National Biological Survey
4512 McMurray Avenue
Fort Collins, Colorado 80525–3400, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rohanse@cello.gina.calstate.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: 71061.150@compuserve.com

Section Editors

Techniques
STEPHEN D. BUSACK
National Fish & Wildlife Forensics Lab
1490 East Main Street
Ashland, Oregon 97520, USA
E-mail: steve_busack@mail.fws.gov

Book Reviews
AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: breckbarth@aol.com

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA

Natural History Notes (Amphibia)
CHARLES W. PAINTER
Endangered Species Program
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA

Natural History Notes (Reptilia)
LEE A. FITZGERALD
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131, USA
E-mail: leefitz@mail.unm.edu

Recent Population Changes
RALPH W. AXTELL
Dept. of Biological Sciences
Southern Illinois University
Edwardsville, Illinois 62026, USA

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Regional Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Production Staff
ELLIN BELTZ
ELOISE BELTZ-DECKER

Advertising Manager
ELIZABETH A. JOHNSON
New Jersey Field Office
The Nature Conservancy
200 Pottersville Road
Chester, New Jersey 07930, USA
(908) 879-7262
(908) 879-2172 fax

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees.

ANNUAL DUES AND SUBSCRIPTIONS: Annual membership dues for the year 1996 in the Society for the Study of Amphibians and Reptiles are as follows: Individual membership US$40; Student membership $30; Family membership $55. $16 of the amount of a membership pays for a subscription to *Herpetological Review* for one year. $21 of the amount of a membership pays for a subscription to *Journal of Herpetology* for one year. Remaining funds help support Society activities. Additional fee for air mail postage outside USA $35 for one year. All members receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*. Institutional subscriptions for *Herpetological Review* are $70 and individual subscriptions may be purchased for $24. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $20; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Karen L. Toepfer, SSAR Treasurer, P.O. Box 626, Hays, Kansas 67601–0626, USA. Telephone: (913) 623-4258; Fax: (913) 625-8890; e-mail: fmkt@fhsuvm.fhsu.edu.

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Future Annual Meetings

1996 — University of Kansas, Lawrence, Kansas, USA, 24–29 July (Linda Trueb, Chair).
1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July (Theodore Pietsch, Chair).
1998 — University of Guelph, Guelph, Ontario, Canada, 16—22 July (James P. Bogart, Chair).

1996 Annual Meeting
Society for the Study of Amphibians and Reptiles
39th Annual Meeting

24 – 29 July 1996
The University of Kansas, Lawrence, Kansas, USA

Keynote Lecture: To be announced.

Symposium: "A Tropical Natural History: Essays in Honor of William E. Duellman." *Organizers:* Darrel Frost (American Museum of Natural History) and John D. Lynch (The University of Nebraska).

Symposium: "Diversity of Approaches to Amphibian and Reptilian Systematics." Participants restricted to graduate and post-doctoral students. *Organizers:* Daniel J. Meinhardt and Joseph R. Mendelson III. *Contact:* Joseph R. Mendelson III, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA; Telephone: (913) 864-3439; Fax: (913) 864-5335; E-mail: sapo@falcon.cc.ukans.edu

Symposium: "Population Status and Conservation of Amphibians." Sponsored by the US DAPTF. *Contact:* Michael J. Lanoo, Muncie Center for Medical Education, Indiana University School of Medicine, MB209, Ball State University, Muncie, Indiana 47306, USA; Telephone: (317) 285-1050; Fax: (317) 285-1059; E-mail: 00mjlanoo@bsuvc.bus.edu

Workshop: "Herpetological Collections: Funding, Growth, and Management." Guest speakers will include Dr. Meredith Lane, Program Officer for the National Science Foundation. Other speakers will provide information on conservation project grants from other organizations such as the Institute for Museum Services and the National Institute of Conservation. Workshop will include description of planning process for, and in-depth tour of, the new state-of-the-art Fluid Collections Facility. *Contact:* John E. Simmons, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA; Telephone: (913) 864-3342; Fax: (913) 864-5335; E-mail: jsimmons@kuhub.cc.ukans.edu

Oral and Poster Sessions: Several concurrent sessions each day.

Student Paper Awards: Seibert Prizes to be awarded to the two best student-presented papers at the meeting ($250 first prize, $150 second prize).



Dyche Hall, home of the Natural History Museum.

Herpetological Travelogue Slide Shows: Profusely illustrated lectures of exotic amphibians and reptiles and their habitats.

Multimedia Presentations: "HERPS OF THE WEST" and "AMPHIBIANS OF THE APPALACHIANS" by David Dennis and Eric Juterbock; "HERPETOLOGICAL NAMESAKES" by Kraig Adler and David Dennis.

Declining Amphibians: Annual board meeting of the IUCN/SSC Declining Amphibian Populations Task Force.

Social Activities: Welcoming Social, Auction, Barbeque Picnic, Graduate Student Social (including herpetological trivia quiz with prizes).

Art and Photographic Exhibit: Featuring herpetological art and photographs.

Rare Book Exhibit: A special exhibit, "THE SLIMY TOETH," by Sally Haines in the Spencer Research Library, featuring 16th and 17th century books dealing with herpetology.



The SSAR meetings will be held in the Kansas Union.

Live Exhibit: Featuring amphibians and reptiles from Kansas. Presented by the Kansas Herpetological Society.

Vendors: Books, carvings, jewelry, T-shirts, and equipment of interest to herpetologists.

KU Publications: Greatly discounted prices on herpetological publications (Occasional Papers, Miscellaneous Publications, Monographs, and Special Publications) of the KU Natural History Museum.

Venue: All sessions, exhibits, meetings, and most social events will be held in the Kansas Union located adjacent to the Natural History Museum; the picnic will be held at nearby Clinton Lake (bus transportation provided).

Costs: Preregistration $125 regular, $90 student; late registration fee after 1 June $170 regular, $125 student; companion (social only) preregistration $30, after 1 June $50. Lodging in dormitory: $100 person/5-day package (double occupancy; includes breakfast each day and 3 dinners) and $140 person/5-day package (single occupancy; includes breakfast each day and 3 dinners). Buffet lunch provided at meeting site—$30 for 5 days. Owing to lack of nearby local restuarants and difficulty securing convenient campus parking, all participants are encouraged to purchase lunch-ticket package so that they can eat at the meeting site.

Further Details: Meeting Announcement/Call for Papers will be mailed to all North American members of the SSAR in March 1996, or upon request from Cathy M. Dwigans, Academic and Professional Programs, Continuing Education, The University of Kansas, Lawrence, Kansas 66045, USA; telephone (913) 864-3284; Fax (913) 864-5074. Chairperson of Local Committee: Linda Trueb, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA; Telephone: (913) 864-3342; Fax:(913)864-5335. E-mail: Trueb@kuhub.cc.ukans.edu

SSAR BUSINESS

A Letter from the SSAR President

Dear Fellow Members:

The Society's Board of Directors considered a number of important matters at its recent meeting in Boone, North Carolina. (See Secretary Eric Juterbock's report on the meeting for further details). Several of those matters merit additional explanation, and none more so than the increase in dues for student members.

Last year the Board voted to raise dues, for the first time in many years, for all categories except students. That decision was an attempt to hold down costs for our valued student members while at the same time meeting the gradually increasing costs of operation of the Society and the costs of implementing new and expanded programs. Although the Board was able to hold off an increase in student dues for one year, a review of our budget this summer made it clear that to do so any longer would not be prudent. Faced with an unanticipated rise in postal costs and other unexpected increases in operating expenses, the Board voted to increase student dues by $5.00, thereby bringing student membership back in line with other categories of members and avoiding a continuing structural deficit in the Society's budget. No other membership categories were affected this year.

Sensitive to the effect of such a dues increase, the Board also voted to extend to our student members a one-time discount on all books and other monographic publications of the Society. Between now and 1 May 1996 student members may purchase any society publications (other than back issues of journals and books presently offered at prepublication prices) at a 20% discount. We hope that many students will take advantage of this valuable offer and that it will offset any inconvenience associated with the rise in student dues. Of course, even at the new rate, the Society continues to provide extraordinary value to student members. In addition to receiving the *Journal of Herpetology* and *Herpetological Review*, students are always eligible for members' prepublication discounts. The Society also assists many students through its Grants-in-Herpetology program, and it recently launched its highly successful program of travel awards to students attending the Society's annual meeting. Most recently, the Board approved a project proposed by a student member to produce a directory of funding sources for herpetological research. With these many benefits, the Board of Directors hopes that our valued student members will not only renew their own memberships but will encourage their herpetological colleagues to join them.

Among its other actions, the Board continued to promote the conservation efforts of the Society in a number of ways. This year the Society contributed $5,000 of the proceeds from the annual auction to assist the Declining Amphibian Populations Task Force, an international organization that has evolved within less than five years to take a leadership role in the study of amphibian populations. The Society also looks forward in 1996 to the first issue of our new series *Herpetological Conservation*.

The Society for the Study of Amphibians and Reptiles has always encouraged the active participation of its members. That participation has recently been made even easier with the establishment of a home page on the World Wide Web. On our Web site, members can find announcements, addresses of officers, the contents of upcoming issues of our journals, and other useful information. Of course, members are also encouraged to communicate directly with the officers if they have ideas for strengthening the programs of the Society.

Best regards,

ALAN H. SAVITZKY
President

About our Cover

Hypsilurus boydii, Boyd's forest dragon, is an arboreal agamid found only in the rainforest of far northern Queensland, Australia. Until recently, very little was known about this species and the few published accounts are anecdotal. The majority of the following information is based on unpublished research currently being conducted by **Geordie Torr** at James Cook University, Townsville, Australia.

Forest dragons are sexually dimorphic; males attain a snout-vent length of ca. 165 mm compared to 150 mm in females. Reproduction is seasonal, with females laying 1–5 eggs in a shallow nest in a sunny area between September and December. Lizards living in high elevation areas lay fewer, larger clutches of larger eggs than their low elevation conspecifics.

These diurnal lizards feed almost exclusively on invertebrates, with ants, beetles, and earthworms amongst their most common prey items. Although most often seen perching at around eye-height on small trees, the use of spool-tracking has revealed daily terrestrial movement on the order of 50–100 m per day. At night, forest dragons can often be spotlighted sleeping on trees. Larger lizards generally sleep vertically on the trunk but hatchlings, juveniles, and small females often sleep in a horizontal position on branches, their head pointing towards the trunk. This behavior is very similar to that exhibited by some species of *Anolis* (Clark and Gillingham 1990. Anim. Behav. 39:1138–1148).

Forest dragons appear to be thermoconformers and daily activity is probably regulated by light intensity rather than temperature. Lizards became active at dawn and cease activity at dusk. During winter, forest dragons "disappear," moving up into the lower canopy and becoming inactive, descending infrequently to feed.

The lizard on the cover is an adult male, photographed in situ at one of Geordie Torr's study sites. It was photographed with a Bronica medium format camera, using a standard 75 mm lens and two flash units. The photograher is **John Weigel**, who, along with wife Robyn operate the Australian Reptile Park, just north of Sydney. The Park was established in 1958 by the late Eric Worrell. It currently maintains the largest collection of native reptiles in Australia and is the sole supplier of snake venoms used in the production of Australian antisera. John is an expatriot American, and while a student at the University of Colorado he took Comparative Anatomy 101 from Hobart Smith—but admits to receiving a "C." He is an Australian citizen now, and an active supporter of amateur herpetology in his adopted country, having lobbied strongly for loosening of regulations constraining amateur herpetological activities. He has published a field guide to snakes of southeastern Australia, a book on the captive husbandry of Australian reptiles, and his photographs are popular inclusions in most books that picture Australian reptiles and amphibians. He is currently working on a photo-introductory book on Australian herps.

Separation and imaging of Weigel's photo is the work of **Jim Bridges** of Herpeto Inc., Hollywood, Florida, USA.

1995 Annual Meeting: Boone, North Carolina

Boone, North Carolina, from 8 to 13 August 1995, served as the site of the 38th annual meeting of the SSAR. Appalachian State University, with Wayne Van Devender chairing the Local Committee, served as host to the more than 500 attendees. The large size of the meeting was no doubt aided by the grand venue, a conference center located on a small cloud-shrouded mountain in the heartland of plethodontid salamanders. and the Local Committee cooperated by ordering sufficient late-afternoon rain showers that it never got too hot and was conducive to observing salamanders.

Appetizer

For those of our group who could not possibly start an Annual Meeting without a brief Board Meeting, our start to the Boone fete was the annual meeting of the SSAR Board. We met for seven and one half hours on the 8th, and (Board addicts that we were, we could not bear to let go for another day) we reconvened for one and half hours (and pizza) to work out the 1996 budget on the 9th. Not considering the overnight recess, this was still one of the longer Board Meetings of recent years. All of the Board members and all but one of the officers were in attendance by lunch time, as were half of the editors and committee chairs. An unusually large number of members were also in attendance, so the meeting was one of the better attended recent Board Meetings; most made it back as we reconvened for the budget discussion the next day. Business of the meeting was summarized at the Business Meeting (below).

Meat and Potatoes

The 38th Meeting officially opened at 0900 h on 9 August, in Broyhill Hall at the Broyhill Inn (site of most meeting events), with welcoming remarks from Wayne Van Devender. Wayne also announced that Matjaz Rojc, of Ljubljana, Slovenia, donated to the meeting a supply of the new Slovenian coin imprinted with *Proteus* (the only salamander on a coin!); Wayne later distributed these coins to attendees. R. Clinton Parker, Senior Associate Vice Chancellor for Academic Affairs at ASU, then welcomed us to the University. After SSAR President Savitzky issued one more welcome and mentioned plans for the Third World Congress of Herpetology, in Prague in 1997, Linda Trueb, Co-Chair of the 1996 Annual Meeting Committee, invited us all to next year's meeting at the University of Kansas, in Lawrence (see announcement on pages 165–166). There followed the Plenary Address, after which the assembled multitudes were collectively photographed.

Judy Stamps (University of California at Davis) presented "Territorial Behavior: Testing the Assumptions." Dr. Stamps presented evidence about how juvenile settlers are attracted to conspecifics and how inter-male competition and sexual size dimorphism are related to the spatial distribution patterns of adult females. These results were drawn from her field experiments with West Indian *Anolis*.

Between 1330 h on 9 August and 1600 h on 12 August, 210 authors presented 130 contributed papers in 12 sessions. In three symposia, Regional Herpetological Societies, Evolutionary Patterns of Amphibian Development, and Eastern Rattlesnakes, 48 authors presented 40 papers. Three poster sessions included 75 posters by 128 authors. A session called "Conservation Issues in Herpetology" was attended by many on the evening of the 8th. Ken Dodd (National Biological Service) moderated the discussion, which included Alison Haskell (U.S. Fish and Wildlife Service), Ron Heyer (National Museum of Natural History), and Mike Lannoo (Declining Amphibian Populations Task Force). Several dozen herpers participated in a "Herp Photo Workshop" conducted by Dave Dennis and Eric Juterbock on the afternoon of the 9th.

The Business Meeting was conducted on Saturday, 12 August, between 1630 and 1715 h in the Bernhardt Lounge at Broyhill, and attracted a crowd of over 60 officers and members even though there was a concurrent discussion group concerning the Declining Amphibian Population Task Force (DAPTF). In calling the meeting to order, President Savitzky noted that he had worried about forgetting the famous "SSAR Presidential Gavel" ever since it was entrusted to him by then-President Lynne Houck last August.

President Savitzky reported on a number of items of business announced or conducted at the Board Meeting. Our most significant business this year was to modify the dues structure. Last year all classes of members except students received a small increase; this was postponed but not prevented forever for students. With the increases in SSAR activities and in postal rates, we found it necessary to increase student dues by $5 effective in 1996. The Board did approve offering students a 20% discount on all individual SSAR publications until 1 May 1996. The Board also granted the DAPTF $5000 to aid their work. SSAR is also investigating collaborative projects involving audio products, which could conceivably yield proceeds for DAPTF as a long-range source of funds. There is a need for mass marketing advice. President Savitzky has formed an ad hoc Committee on International Cooperation, chaired by Marty Crump, and including Oscar Flores, Tyrone Hayes, Roy McDiarmid, and Ted Papenfuss. Their charge is to investigate how SSAR could aid herpetologists in other countries to gain access to such items as research supplies, equipment, and bibliographic materials. George Pisani has put together a World Wide Web page (Internet) for SSAR and will be adding information. The Student Travel Awards Committee, coordinating their second annual fund-raising auction at Boone, will undergo a change of leaders, as founding student co-chair Dawn Wilson is retiring; she recommended John Lee as her successor. The Committee made 10 travel awards of $200 each to students attending the Boone meeting.

Treasurer Karen Toepfer reported that 1994 expenses paid to date, $165,478, were balanced by 1994 income of $186,061. There should be some increase in expenses for 1995, due to the increase in postal rates and the enlargement of *Herpetological Review*. At the time of the meeting, there were 2339 members, approximately 150 more than this time last year; 34 new members joined at Boone.

Past-President Houck reported that she had encouraged students to organize and conduct a students-only paper session, and one on amphibian developmental biology was accomplished this year. The *Journal of Herpetology* is in good shape and 1995 will be one of the largest ever volumes (for number of pages). Submissions remain high and the Table of Contents will be added to SSAR World Wide Web page. Editor Bob Hansen noted that *Herpetological Review* exists to serve the society for information exchange. He also pointed out all of the changes implemented this year. The *Catalogue of American Amphibians and Reptiles* remains in good shape but still needs authors for accounts of North American species. The subscription rate increased $5 for 1996. Kraig Adler, Editor of *Facsimile Reprints in Herpetology* and *Contributions to Herpetology*, announced that the "Captive Management and Conservation of Amphibians and Reptiles," published in December 1994, has already sold 1500 copies. "Lizards of Australia and New Zealand," by J. E. Gray and A. Günther, was issued in June 1995 and "The Herpetological Papers of Wilhelm Peters" in September 1995. Through 1996, he expects to publish the classic "Herpetology of Japan," by Leonhard Stejneger, and three new books: "Field Guide to Amphibians and Reptiles of the West Indies," by Blair Hedges; "Contributions to West Indian Herpetology," the 1994 symposium edited by Bob Powell and Robert Henderson; and "Lizards of Iran," by Steven Anderson. In 1996, *Herpetological Circulars* will issue the 4th edition of "Standard Common and Current Scientific Names for North American Amphibians and Reptiles," compiled by J. T. Collins, on behalf of SSAR. *Herpetological Conservation* Editor Steve Corn expects to issue the first volume in the series, the "Canadian Amphibian Decline Symposium," edited by David Green, in 1996.

Awardees for GIH grants and the Kennedy Student and Seibert Awards were noted (see p. 170). Future meetings in Lawrence, Kansas (24–29 July 1996), Seattle (26 June–2 July 1997), and Guelph, Ontario (16–22 July 1998) were announced. Regional Societies Liaison Marty Rosenberg reported that the Regional Societies Symposium, covering such topics as marketing, education, and research, had nine papers. Next year they have tentative plans to sponsor a symposium focused on local conservation efforts.

Nominations for election to SSAR office for 1996 were announced. President-elect: Henry Mushinsky and Steve Tilley; Secretary: Ellen J. Censky; Treasurer: Karen Toepfer; Director (Class of 1998): John Iverson and John Simmons; and, Director (non-U.S., Class of 1998): James Bogart and Diane Secoy. After Bob Aldridge nominated Randy Krohmer for Director, Kraig Adler moved (Bob Hansen second) to close the nominations; motion passed and the slate was accepted. Lynne Houck then read the resolutions (see below). With no new business added from the floor, Henri Seibert moved (Lynne Houck second) to adjourn, and President Savitzky adjourned us until 1996 in Lawrence.

Desserts

No annual meeting would be complete without the myriad social and other activities after the papers are done for the day. Chairman Van Devender and his crack committee did a great job of planning such relief for us! In addition to the excellent feed that was the luncheon buffet at the Broyhill, and such fine local food as barbecue, catfish, and southwestern cuisine, there was limitless food at the "welcome social" on the evening of the 9th and the SSAR auction on the evening of the 12th. There was also the off-campus barbecue and social the evening of the 10th, complete with music and dancing.

A large room housed the numerous exhibitors, who, among such other items as tee shirts, art work and research equipment, had more herp books than anyone could expect to read in a lifetime. It took two rooms in the science building to house the live herp exhibit, where attendees gathered daily to photograph the local herpetofauna (as well as a few exotics). A herp art exhibit was located in Broyhill. There was also a student-only program and social on the 11th.

The now traditional entertaining/educational events expected at SSAR meetings did not disappoint, either. I stopped counting at 300 members of the audience for the multi-media event on the evening of the 11th. "Amphibians of the Appalachians" and "Herpetology of the West" by Dave Dennis and Eric Juterbock and "Herpetological Namesakes" by Kraig Adler, Dave Dennis, and Eric Juterbock were well received. The grand finale, on the evening of the 12th, began with the President's Travelogue, which attracted a standing-room-only crowd that I could not begin to count. Julian Lee presented "Amphibians and Reptiles of the Lowland Maya Area," Aaron Bauer, "The Herpetofauna of the Southern African Arid Zone," and Wayne Van Devender, "Amphibians and Reptiles of Australia After the World Congress." Guaranteed to stimulate more trips to view and photograph herps in the coming years. Of course, the SSAR Auction rounded out the events of the week. With food and our favorite beverages, a huge crowd gathered to acquire those "must-have" items auctioned off by Joe Collins, who also announced the winners of the Student Travel Silent Auction. Over $5,000 was raised. Some of us were even able to partake of one of the several field trips to herp hot spots like Grandfather Mountain, Linville Gorge, and Yonahlossee Road before leaving town on the 13th.

Respectfully submitted by J. Eric Juterbock, SSAR Secretary.

1995 SSAR Resolutions

Honoring Outgoing SSAR Officers and Editors

WHEREAS the following individuals have given freely of their time, skills, insight, and knowledge to the Society for the Study of Amphibians and Reptiles in this past year; and,

WHEREAS they have been therefore instrumental in advancing the Society's goals and furthering its growth as an international scientific society; and,

WHEREAS SSAR is dependent upon the generosity of these persons and those who have gone before them, and is greatly indebted to them for their fine efforts in its behalf;

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and Reptiles urges these persons not to ride off into the sunset, but rather to continue to be available, with or without official titles, as resources to guide those who follow; and,

RESOLVED FURTHER that the Society offers its most sincere thanks to the following persons who have served in these capacities:

ROBIN M. ANDREWS—Director
A. DALE BELCHER—Chair, Grants-in-Herpetology Committee
MARTHA CRUMP—Chair, 1994 Nominating Committee
MAUREEN A. DONNELLY—Grants-in-Herpetology Committee
THOMAS H. FRITTS—Immediate Past-President
J. WHITFIELD GIBBONS—Co-Chair, 1994 Local Committee
DAVID L. HARDY, Sr.—Elector
LYNNE D. HOUCK—President
RANDY JENNINGS—*Herpetological Review* Section Editor
JOSHUA LAERM—Co-Chair, 1994 Local Committee
SAM MCDOWELL—*Journal of Herpetology* Editorial Board
MARY MENDONÇA—Member, 1994 Nominating Committee
CHARLES W. PAINTER—Grants-in-Herpetology Committee
STEVE PERRILL—Member, 1994 Nominating Committee
STEVE REILLY—Chair, 1995 Nominating Committee
ERIC M. RUNDQUIST—*Herpetological Review* Section Editor
BERN W. TRYON—Director
DAWN S. WILSON—Grants-in-Herpetology Committee

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 11 August 1995, at its Annual Business Meeting.

Thanking The Local Committee

WHEREAS the southern Appalachian Mountains harbor a most diverse and interesting salamander fauna, and provide an excellent setting for herpetological meeting; and,

WHEREAS the Society for the Study of Amphibians and Reptiles is pleased to be able to hold its 1995 Annual Meeting in such a setting; and,

WHEREAS Robert Wayne Van Devender and the rest of the Local Committee have done a fine job in managing this meeting's many responsibilities; and,

WHEREAS the officials of Appalachian State University have cordially made their campus available to us.

THEREFORE, be it
RESOLVED that the Society for the Study of Amphibians and

Reptiles extends its most sincere thanks to the members of the Local Committee, and to all involved in making this meeting a success.

Adopted unanimously by the Society for the Study of Amphibians and Reptiles, 11 August 1995 at its Annual Business Meeting.

1994 SSAR Budget Report

Budget Category	Amount Allocated	Amount Spent
Annual Meeting (Keynote Speaker)	$500	500.00
Catalogue AA&R	8,000	8,231.13
Contingency Fund	3,000	0
Contributions to Herpetology	15,000	8,348.33
Emergency & Special Projects Fund	5,000	1,695.25
Facsimile Reprints in Herpetology	2,000	0
Grants-in-Herpetology	1,000	2,512.00
Herp Circulars	2,800	2,897.02
Herpetological Conservation	0	1,153.75
Herpetological Review (including editor's expenses)	18,000	20,870.97
Journal of Herpetology (including editor's expenses)	64,342	61,244.15
Publications Secretary	15,000	14,241.50
Secretary	1,800	509.37
Treasurer	7,700	9,490.83
Total 1994 Budget	**$144,142.00**	**$131,694.30**

Kennedy Student Award Committee Annual Report — 1995

The Kennedy Award Committee has completed its work for Volume 28 of the *Journal of Herpetology*. The Committee has selected "Growth Rate and Survival in Relation to Relative Head Size in *Vipera berus*" by Anders Forsman. Mr. Forsman carried out this work as a doctoral candidate in the Department of Zoology, Uppsala University, Uppsala, Sweden. The dissertation supervision was directed by Staffan Ulfstrand. After a year of postdoctoral studies with Richard Shine in Australia, Anders Forsman is back in the Department of Zoology at Uppsala University as an Assistant Professor. He is currently investigating color polymorphism in adders, lizards, and grasshoppers.

Twenty manuscripts were in competition this year. The Committee noted the high quality of the submitted papers.

KEN R. MARION, Chair
Kennedy Student Award Committee.

Seibert Award Winners for 1995 Announced

The fourth annual Seibert Awards were presented at the 38th Annual Meeting of the SSAR in Boone, 8–12 August 1995. These awards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR (having served as an officer for over 20 years). The awards recognized outstanding student presentations at the annual meeting. There were 36 presentations eligible.

The winners.—Steven Poe (First Award), Department of Zoology and Texas Memorial Museum, University of Texas at Austin ("Phylogenetic systematics of the Crocodylia: An integrative approach"); Richard E. Anderson (Second Award), Department of Biological Sciences, Southeastern Louisiana University ("Systematics of the polytypic species *Coluber constrictor*").

Honorable Mention (in no particular order).—J. R. Bodie (Savannah River Ecology Lab, University of Georgia), K. R. Smith (Department of Biological Sciences, Southeastern Louisiana University), and V. J. Burke (Savannah River Ecology Lab, University of Georgia): "A comparison of diel nest temperature and nest site selection for two sympatric species of freshwater turtles." Dana A. Soehn and Edwin D. Michael (Division of Forestry, West Virginia University): "Salamander abundance in small clearcuts."

The judges were Ellen Censky (Carnegie Museum), Rafael de Sa (University of Richmond), Lynnette Sievert (Maryville College), and Norm Scott, Chair (National Biological Service).

Items Needed for SSAR Auction

Joe Collins will be conducting the SSAR auction during the annual meeting at the University of Kansas in July 1996. All proceeds from the auction go to the SSAR treasury, and help to continue the production of diverse publications and services which has made the SSAR the largest professional herpetological society in the world. Items of value as well as those that lend themselves to humor are always welcome. Joe is skilled at removing large quantities of cash from auction participants through the judicious use of beer and plastic. Anyone wishing to donate auction items in advance should send them directly to: *Joseph T. Collins, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.*

SSAR Student Travel Awards

The first annual SSAR Student Travel Awards were presented at the SSAR meeting in Boone, North Carolina. The winners were: Christopher Binckley, Paul Buttenhoff, Brian Butterfield, Michael Gallagher, Andrew Gluesenkamp, Karen Graham, Steve Johnson, Kimberly Naklicki, Karan Schnuelle, and Sue Simon. Congratulations to all.

The SSAR Student Travel Awards Committee wishes to thank the following people for their donations to the Frameable Art Silent Auction: Kraig Adler, Robert Aldridge (SSAR), Ronald Altig, Patty Barber, Bern Bechtel, Betty Bechtel, Martin Capron, Caribbean Conservation Corp., Pablo Delis, David Dennis, Kenneth Dodd, David Hardy, Dan Holland, Jim Horton, Barbara Kermeen (AVM), Dan Keyler, Julian Lee, Ernie Liner, J. Kelly McCoy, Roy McDiarmid (USNM), Samuel McDowell, Margo McKnight, Anne Meylan, Peter Meylan, Jerry Reynolds, Alan Savitzky, Norman Scott, Larry Settle, Jeffery Tamplin, and Bradford Winn.

SSAR Student Travel Awards Fundraiser Call For Donations

At the 1995 SSAR meetings in Boone, North Carolina, the SSAR Student Travel Awards Committee introduced its second annual Frameable Art Silent Auction to raise funds for students

attending and presenting papers at the 1996 meeting in Lawrence. The outcome of this year's silent auction was especially positive, with over $1700 raised. On behalf of SSAR and the Student Travel Awards Chair, Dawn Wilson, thanks to all who participated. Hoping to continue this successful tradition, the Student Travel Awards Committee is pleased to announce the third annual frameable art silent auction to be held at the 1996 SSAR meeting in Lawrence. Acceptable donations include: photos of your study animal (or herpetologists!), line drawings, prints, paintings, or anything that can be put into a frame, if not framed already. If you are interested in donating an item please contact: *John Lee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA; tel. 803-725-5873; e-mail: LEE@SREL.EDU.*

HR Miscellany

Effective immediately, *Herpetological Review* will publish e-mail addresses for authors of articles and notes. Authors are requested to include an e-mail address, if available, along with their postal address on all material submitted for publication in *HR*.

We have a continuing need for herpetological art work for publication in *HR*. Original drawings should be of a scale that would permit reduction to approximately 30 x 90 mm or smaller. Of particular interest are drawings of material for which locality data or museum catalogue numbers are available; this information should be included with the drawings. Original art (or good quality copies) should be packaged to ensure safe delivery and sent to the Editor (address on inside front cover).

NEWSNOTES

Southwestern Research Station Positions And Grants For 1996

VOLUNTEERS—Approximately 20 volunteer positions are open in 1996 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. and fax 520-558-2396.*

SOUTHWESTERN RESEARCH STATION STUDENT SUPPORT FUND—The American Museum of Natural History awards several grants each year of approximately $400–$800 to graduate students or postdoctoral students pursuing research at its Southwestern Research Station in the Chiricahua Mountains, Portal, Arizona.

Information and application forms for this program and other Museum grant programs can be obtained by writing: Office of Grants and Fellowships, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA. Application due date: February 15, 1996. Address questions concerning the Station to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, Portal, Arizona 85632 USA; tel. and fax 520-558-2396.*

SEASONAL OFFICE ASSISTANT—Assist in operations of biological research station office and nature shop: taking reservations, answering phones, greeting guests, supervising volunteers, etc. Begin March 15, 1996, through September 1996. Five-day week; salary $190/wk, plus room (shared) and board. Applicant must be punctual, organized, enjoy people, and be interested in living in a remote setting (Chiricahua Mountains) and working with biological researchers. Biological training an asset. Call and send résumé to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632, USA. Tel. and fax: 520-558-2396.*

Graduate and Post-Graduate Research Grants

The Biological Research Station of the Edmund Niles Huyck Preserve offers grants (max. = $2500) to support biological research which utilizes the resources of the Preserve. Among the research area supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2000 acre Preserve is located on the Helderberg Plateau, 30 miles southwest of Albany, New York. Habitats include northeast hardwood-hemlock forests, conifer plantations, old fields, permanent and intermittent streams, 10 and 100 acre lakes, and several waterfalls. Facilities include a wet and dry lab, library, and houses/cabins for researchers. Deadline = 1 February 1996. Application material: *Dr. Richard L. Wyman, Executive Director, E.N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, New York 12147, USA.*

Reptilia

A new bimonthly magazine devoted to reptiles and amphibians is being published. *Reptilia* is the only herp magazine published in Spanish for herpetoculturists.

The main objectives of *Reptilia* are to spread information about the diverse aspects involved in keeping terrarium animals; to report on their natural history and thus facilitate the understanding of their needs; to encourage breeding; to give credible and easily understood veterinary information to amateurs and professionals alike; to offer information about legislation and regulation; to demythologize the world of these animals through knowledge of their relationship to different cultures; and to serve as a medium through which all interested parties can communicate. For more information contact: *Reptilia*, c/ Muntaner 88, 5° 1ª, 08011 Barcelona, Spain. Fax (93) 280 64 94.

International Hylid Society

The International Hylid Society is a new organization dedicated to treefrog enthusiasts worldwide. Membership is open to anyone with an interest in treefrogs. This includes anyone from the pet-keeper to the professional herpetologist. The focus of the organization is on treefrogs—not just those of the family Hylidae—but any of the many "treefrog" species throughout the world. This is a non-profit organization that serves as a resource and information exchange center to benefit the members and the well being of the treefrog species they keep or study.

Members will receive *The Bulletin of the International Hylid Society* on a quarterly basis. This will contain articles on a variety of topics such as species profiles, husbandry techniques, breeding information, vivarium construction, insect culturing methods, up-to-date information from several zoos, hard-to-find international articles, various tips and ideas on a variety of subjects. The *Bulletin* will also include classified ads (free to members), a breeder directory, and full color photos.

Volume 1 Number 1 will be published Jan/Feb 1996. We are currently accepting article and photograph submissions. Classified ads are also being accepted. Membership is US $15.00 per year. If you would like your name to appear in the breeder directory along with the species you work with, please include the scientific name(s) of those species. This directory will be made available to members only. Please make check or money order payable in U.S. funds to: The International Hylid Society, and send it with your postal information to: *William Brown, c/o Amphibian Conservation and Research Center, 1423 Alabama St., Lafayette, Indiana 47905, USA. Tel. (317) 742-5331; e-mail 102436.2415@compuserve.com*

LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles. This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered herps. We are in need of more information especially on the State and Province level. Please send pertinent information to the Section Editor.

USA: The U.S. Fish and Wildlife Service is seeking public comments on a proposal to list the frog guajõn (*Eleutherodactylus cooki*) as threatened on the the Federal list of threatened and endangered species. This frog is found only on the island of Puerto Rico, where it is known only from the Pandura Mountain range in the extreme southeastern part of the island. No critical habitat will be proposed for the species. Comments should be submitted to the Supervisor, U.S. Fish and Wildlife Service, Caribbean Field Office, P.O. Box 491, Boqueron, Puerto Rico 00622, USA. *(Information summarized from a USFWS News Release, dated 2 October 1995).*

USA: U.S. Fish and Wildlife Service: The Director of the USFWS signed a new "Policy on Candidate Assessment and Petition Management Under the Endangered Species Act" (19 July 1995). This policy changes the Service's designation of candidates for listing pursuant to the Act. As of 19 July, the term "candidate" means only those species for which the Service has sufficient information indicating that listing may be appropriate (i.e., species that were previously known as category 1 candidates). Species formerly known as category 2 candidates will now be referred to as "species at risk." *(Information summarized by Cindy Schultz, USFWS).*

USA: The U.S. Fish and Wildlife Service was petitioned on 23 May 1995 by the Environmental Protection and Information Center of Garberville, California, and ten co-petitioners including the Sierra Club and the California Sportfishing Alliance, to list the southern torrent (formerly Olympic) salamander (*Rhyacotriton variegatus*), as threatened. On 29 June 1995, USFWS published a "90 day finding" in the Federal Register stating that the petition has merit, thus initiating a one year status review period in which to gather additional information. The southern torrent salamander resides in headwater habitats of conifer-dominated, usually mature and old-growth forests from north central Oregon to northwestern California. This salamander is patchily distributed and is found along cold, clear, highly oxygenated waters. Adults have low fecundity and low vagility; larval metamorphosis requires 4–5 years. These natural history attributes make this species highly susceptible to perturbations which increase sedimentation and raise water temperatures. Comments and concerns should be addressed to: Ann Chrisney, USFWS, 2800 Cottage Way, Room E-1803, Sacramento, California 95225-1846, USA. *(Information provided by Hart Welsh, Redwood Sciences Laboratory, 1700 Bayview Drive, Arcata, California 95521, USA).*

CITES: The U.S. Fish and Wildlife Service approved the export from the U.S. of American alligators (*Alligator mississippiensis*) harvested during 1995–1997 harvest seasons from certain states previously approved for such export for the 1992–1994 seasons (AL, FL, GA, LA, MS, SC, TX) and Arkansas, which was previously approved for the 1994 harvest season. The approval stipulates that monitoring procedures previously established be continued and states the manner in which tags are to be attached to the hides at the time of export and the conditions for export of parts and products. *(Federal Register, 21 August 1995).*

USA: U.S. Fish and Wildlife Service: The USFWS has received a petition for a rule to list southern California populations of the mountain yellow-legged frog (*Rana muscosa*) under the Endangered Species Act. The petitioners state that the best current scientific evidence indicates that the southern populations of this frog constitute a distinct taxonomic unit separate from frog populations inhabiting the Sierra Nevada mountain range. The petition was submitted on 10 July 1995 and places response requirements on the USFWS. For more information contact: *Biodiversity Legal Foundation, P.O. Box 18327, Boulder, Colorado 80308-1327, USA.*

USA: Alabama: Alabama has initiated a Herpetological Atlas project and is looking for participants. The goal is to have as many volunteers in as many areas of the state as possible. For further details on how to get involved contact: *Alabama Natural Heritage Program, P.O. Box 301455, Montgomery, Alabama 36130-1455, USA. Tel. (334) 242-3033.*

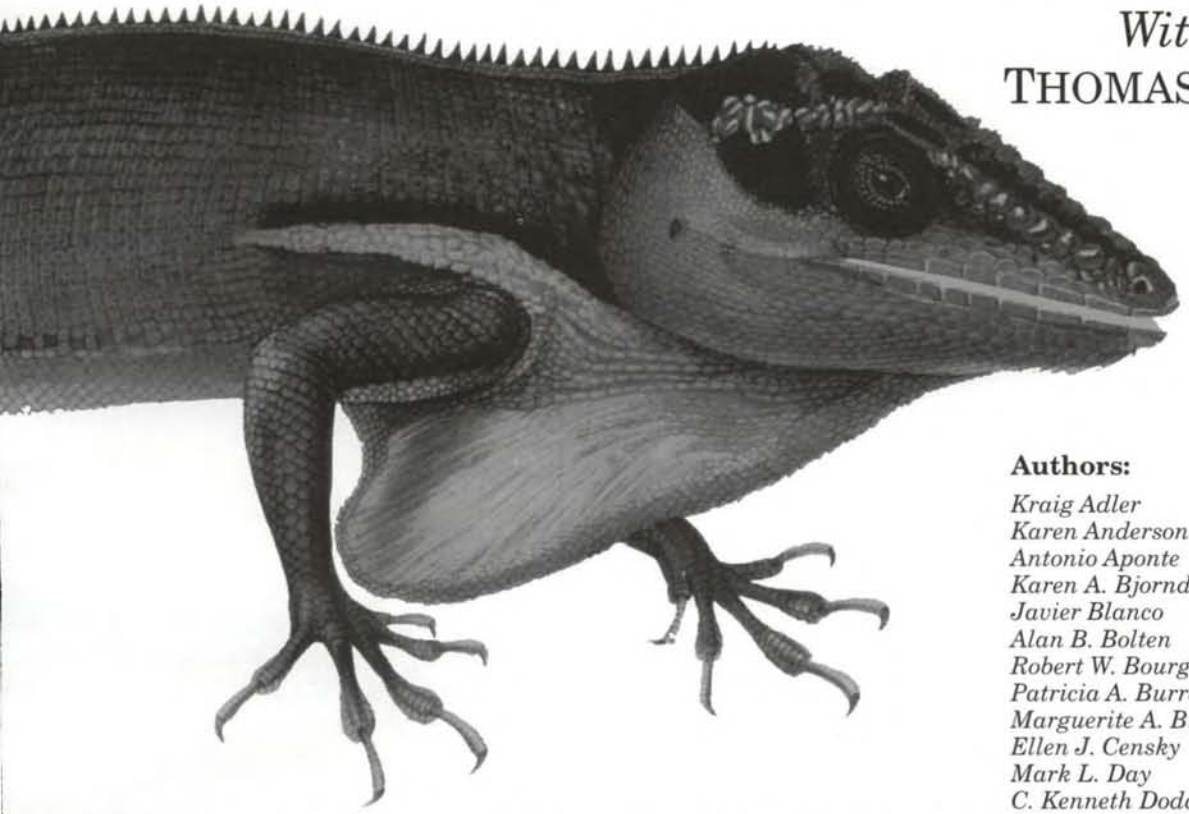
KURT BUHLMANN
SSAR Conservation Committee.

A New Book from the Society for the Study of Amphibians and Reptiles

Contributions to *West Indian Herpetology*

A volume edited by ROBERT POWELL *and* ROBERT W. HENDERSON

With a foreword by
THOMAS W. SCHOENER



THIS NEW BOOK (with contributions by 59 authors from the United States, Europe, and the West Indies) provides an introduction to Antillean herpetology, including a history of West Indian herpetology, an updated checklist of the herpetofauna (including full literature citations for the original descriptions of all 622 species), and a section of **COLOR PLATES** illustrating representatives of all genera of native West Indian amphibians and reptiles. Also included are papers providing a broad view of current herpetological research in the West Indies (with a strong emphasis on field-oriented projects). All research chapters are abstracted in English, Spanish, and French.

Authors:

Kraig Adler
Karen Anderson
Antonio Aponte
Karen A. Bjorndal
Javier Blanco
Alan B. Bolten
Robert W. Bourgeois
Patricia A. Burrowes
Marguerite A. Butler
Ellen J. Censky
Mark L. Day
C. Kenneth Dodd, Jr.
William E. Duellman
Harold A. Dundee
Richard Franz
Joel Friesch
Harry W. Greene
Carla Ann Hass
S. Blair Hedges
Robert W. Henderson
Duncan J. Irschick
Thomas A. Jenssen
Rafael L. Joglar
Hinrich Kaiser
Rhema Kerr
James Lazell
Julian C. Lee
Lori A. Lenart
Allen R. Lewis
Pamela T. Lopez
Jonathan B. Losos
John D. Lynch
Walter E. Meshaka, Jr.
John C. Murphy
Richard Nelson
José A. Ottenwalder
John S. Parmerlee, Jr.
Robert Powell
Douglas P. Reagan
Neftalí Rios
Javier A. Rodríguez-Robles
Jonathan Roughgarden
Richard A. Sajdak
Gloria Santana
Andreas Schubert
Michael E. Seidel
José Sepulveda
Sharoni Shafir
Donald D. Smith
Scott P. Sowell
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MEETINGS

Meetings Calendar

12–14 April 1996—Minton Symposium, Indiana Academy of Sciences, Indiana University/Purdue University Conference Center, Indianapolis, Indiana, USA. *Refer to meeting announcement in this issue for details.*

Mid-April 1996—2nd International Conference on the Biology and Conservation of the South Asian Amphibians and Reptiles, University of Peradeniya. Contact: Anslem de Silva, Conference Director, Faculty of Medicine, University of Peradeniya, Sri Lanka. Tel. 94-08-88130. Fax 94-08-32572.

13–19 June 1996—76th Annual Meeting, American Society of Ichthyologists and Herpetologists, together with the 44th Annual Meeting of The Herpetologists' League, New Orleans, Louisiana, USA. Hosted by the University of New Orleans. Deadline for receipt of abstracts 1 April 1996. Contact: Dr. Bob Cashner, ASIH Local Committee Chair, Dept. Biological Sciences, University of New Orleans, New Orleans, Louisiana 70148, USA. Tel. (504) 286-6741; fax (504) 286-6121; E-mail RCCBS@UNO.EDU

24–29 July 1996—39th Annual Meeting, Society for the Study of Amphibians and Reptiles. Hosted by The University of Kansas, Lawrence, Kansas, USA. *Refer to meeting announcement in this issue for details.*

20–24 August 1996—2nd International Symposium and World Congress on the Preservation and Conservation of Natural Science Collections: "Natural Science Collections—A Resource for the Future." To be held at St. John's College, Cambridge, U.K. Contact: Chris Collins, Natural Sciences Congress '96, Geological Conservation Unit, Department of Earth Sciences, Downing Street, Cambridge, CB 2 3EQ, United Kingdrom. Tel. (0223) 62522; fax (0223) 60779.

British Herpetological Society Meetings for 1996

The British Herpetological Society has released a preliminary timetable for meetings during 1996. Further details concerning time and venue for most of these meetings will be published in the BHS *Bulletin* as soon as they become available. Additional information concerning meetings or membership may be obtained by correponding with: *The Secretary, British Herpetological Society, c/o Zoological Society of London, Regent's Park, London NW1 4RY, U.K.*

1. Herpetofauna Recorders Meeting (HRM) (early February; Edinburgh probable site).
2. Annual General Meeting, Birkbeck College, London (23 March). Speakers include Dr. Susan Evans: "Origin, evolution and diversification of lizards;" Colin Fitzsimmons: "The role of the BHS Education Officer."
3. London Zoo Day (30 March).
4. Conservation & Education Event, Jersey Zoo (4–5 May).
5. Visit to Beam Brook (mid-May).
6. Captive Breeding Meeting (i) (25 May).
7. Captive Breeding Meeting (ii) (20 July).
8. Captive Breeding Meeting (iii) (12 October).
9. Autumn General Meeting, Birkbeck College, London (26 October). Speakers include Prof. J. Davenport: "Intertidal Madeiran lizards—miniature marine iguanas;" Dr. M.R.K. Lambert: "Herpetofauna as bioindicators to assess environmental impact of a pesticide spill in Somaliland."
10. Captive Breeding Open Day, New Denham (9 November).
11. Research Meeting, Birkbeck College, London (7 December).

New York Turtle & Tortoise Society Meetings

The New York Turtle & Tortoise Society has established the following meeting schedule for early 1996: 21 January, 18 February, 17 March, and 21 April. Meetings are held at the American Museum of Natural History (Room 319) in New York. For further information contact: NYTTS, P.O. Box 878, Orange, New York 07051, USA. Tel. (212) 459-4803; E-mail asalzberg@aol.com

SYMPOSIUM IN HONOR OF DR. SHERMAN A. MINTON, JR.
12–14 April 1996, Indianapolis, Indiana

The Indiana Academy of Sciences is sponsoring a Symposium in April of 1996 in honor of **Sherman A. Minton, Jr**. on the occasion of the publication of his revision of the *Amphibians and Reptiles of Indiana*. The symposium will be held 12–14 April 1996 in Indianapolis at the Indiana University/Purdue University Conference Center. Dr. Minton is well known for his work on venomous reptiles, the reptiles of Pakistan, the regional herpetology of the midwest, and popular books on herpetology.

The Symposium will include a Friday evening (12 April) dinner featuring **Whit Gibbons** as the after dinner speaker. The morning program of the Saturday Conference (13 April) will focus on the career of Dr. Minton with talks by **Carl Gans** (Minton's work on the reptiles of Pakistan), **David Hardy** (pitviper bites), **Bernard Bechtel** (abnormalities in reptiles), and **Harold Voris** (venomous sea snakes). The afternoon session will focus on "Hoosier Herpetology" and the publication of Minton's revision of his classic monograph on the herpetofauna of Indiana; biologists working on the amphibians and reptiles of Indiana will present brief overviews of their research and provide a perspective on herpetological research in Indiana today. On Sunday (14 April) there will be optional field trips.

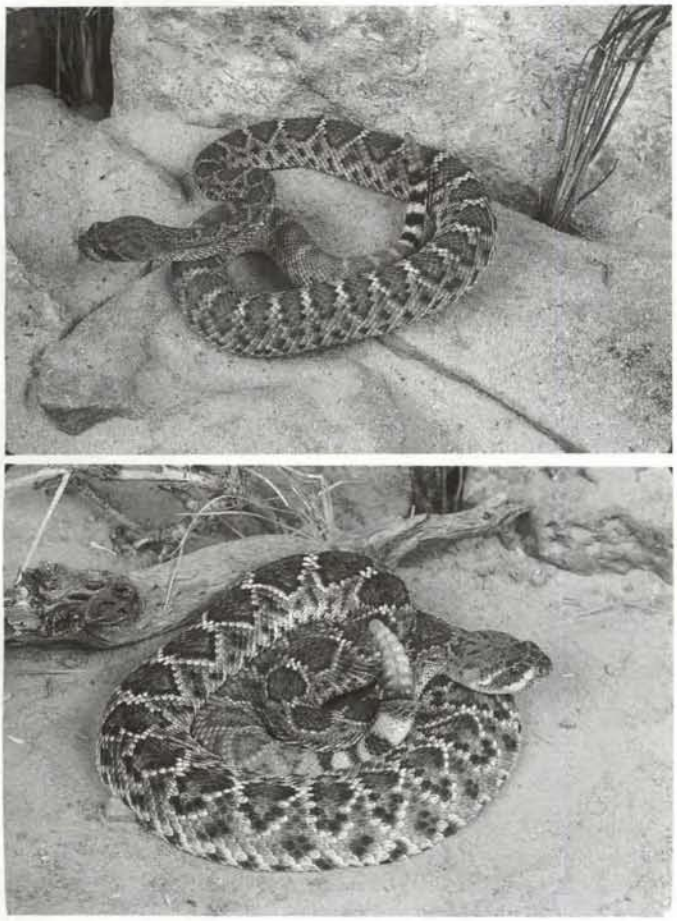
For registration information, contact: Harriet A. Rodenberg (Minton Conference), University Place, Conference Center and Hotel, 850 West Michigan Street, Indianapolis, Indiana 46202-5198, USA. Tel. 317-274-5053; Fax: 317-274-3878; e-mail: hrodenbe@indycms.iupui.edu

CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: breckbarth@aol.com. Comments and suggestions are also welcome.

Snake Systematics and Evolution

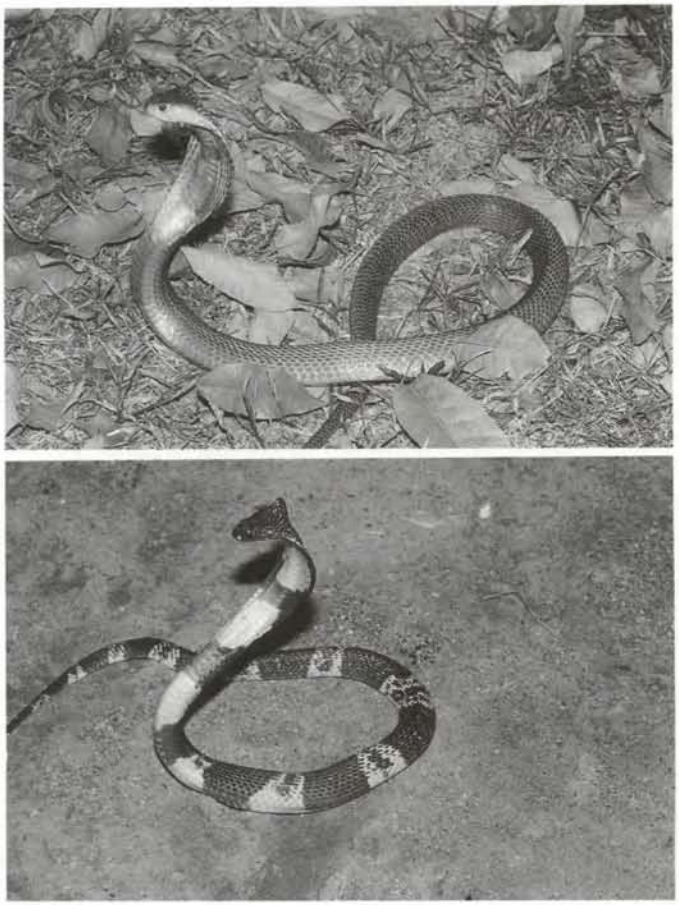
Using three different types of taxonomic characters, Murphy et al. examined the rattlesnakes *Crotalus ruber* and *C. exsul*. The two species differed by a single nucleotide in the 297 base cytochrome *b* gene sequenced and in the allelic frequency of one (of 29) allozymes. The authors recommend the two species be considered a single species, *C. exsul*, consisting of three subspecies, *C. e. exsul, C. e. ruber,* and *C. e. lorenzoensis*, the latter being restricted to the Isla San Lorenzo Sur population.



One species or two? Top: *Crotalus exsul* (México: Baja California: Isla Cedros). Bottom: *Crotalus ruber* (México: Baja California: Bahía de los Angeles). Photos by Louis Porras.

MURPHY, R. W., V. KOVAC, O. HADDRATH, G. S. ALLEN, A. FISHBEIN, AND N. E. MANDRAK. 1995. mtDNA gene sequence, allozyme, and morphological uniformity among red diamond rattlesnakes, *Crotalus ruber* and *Crotalus exsul*. Can. J. Zool. 73:270–281.

By sequencing the cytochrome oxidase I (COI) region of the mtDNA, Wüster and Thorpe found a cryptic species of Asiatic spitting cobra, *Naja siamensis*. This cryptic species is an important cause of snakebite in Thailand and the authors urge comparisons of venom composition and antivenin between this species and *Naja kaouthia* to ensure optimal snakebite treatment.



Naja siamensis, a newly described species of Asiatic spitting cobra, occurs in two color phases. Top: Uniformly brown morph from Khok Samrong District, Lop Buri Province, Thailand. Bottom: Black-and-white morph from Ta Khli District, Nakhon Sawan Province, Thailand. Despite these stunning color differences, the authors found no differences in cyctochrome oxidase subunit I sequence. Photos by Wolfgang Wüster.

In another paper, Wüster et al. compare morphology and mtDNA sequences to determine the population systematics of Asiatic cobras. The distribution of four *Naja* species are mapped and many problematic populations are resolved. The usefulness of the COI region of mtDNA is discussed.

WÜSTER, W., AND R. S. THORPE. 1994. *Naja siamensis*, a cryptic species of venomous snake revealed by mtDNA sequencing. Experientia 50:75–79.

WÜSTER, W., R. S. THORPE, M. J. COX, P. JINTAKUNE, AND J. NABHITABHATA. 1995. Population systematics of the snake genus *Naja* (Reptilia: Serpentes: Elapidae) in Indochina: Multivariate morphometrics and comparative mitochondrial DNA sequencing (cytochrome oxidase I). J. Evol. Biol. 8:493–510.

A new snake genus, *Xenophidion*, as well as two new species were recently described by Günther and Manthey. *Xenophidion* is regarded as a distinct evolutionary lineage, presumably of the Colubridae. It is distinguished from all other snakes by "the position and shape of the palatine process and with it the anterior connection between the maxilla and palatine, the broad and long

ectopterygoid process of the maxilla, the form of the anterior dentary with an enlarged caniniform tooth, as well as the pholidosis on the head." The authors plan to compare *Xenophidion* to snakes representing all existing families and subfamilies to determine its systematic position.

GÜNTHER, R., AND U. MANTHEY. 1995. *Xenophidion*, a new genus with two new species of snakes from Malaysia (Serpentes, Colubridae). Amphibia-Reptilia 16(3):229–240.

Jackson and Fritts examined tooth surface morphology of several colubrid and elapid snakes to determine the origin of the proteroglyph fang. The authors propose that ridges on the posterior maxillary teeth have rotated to form a hollow fang in opisthoglyphous snakes. The morphology of opisthoglyph and proteroglyph fangs appears to be homologous, suggesting a posterior maxillary origin for the proteroglyph fang.

JACKSON, K., AND T. H. FRITTS. 1995. Evidence from tooth surface morphology for a posterior maxillary origin of the proteroglyph fang. Amphibia-Reptilia 16(3):273–288.

North American Tortoises

The effect of precipitation, average maximum temperature, and average minimum temperatures on the growth rate of the four species of North American tortoises was examined in a recent paper by Germano. His preliminary analysis suggests that these environmental factors are not the main determinants of growth in tortoises. In addition, growth rates were used to determine the mean age at maturity for each of the four species.

GERMANO, D. J. 1994. Growth and age at maturity of North American tortoises in relation to regional climates. Can. J. Zool. 72:918–931.

Unpublished reports state the desert tortoise, *Gopherus* (=*Xerobates*) *agassizii*, has experienced dramatic declines during the last 100 years. These reports were important to the U.S. Fish and Wildlife Service decision to list *G. agassizii* as threatened. In reviewing the data in these reports, and additional information, Bury and Corn failed to find any evidence of the presumed dense, wide-spread historical populations. Using this example the authors stress the use of peer-reviewed data in formulating management decisions.

BURY, R. B., AND P. S. CORN. 1995. Have desert tortoises undergone a long-term decline in abundance? Wildl. Soc. Bull. 23(1):41–47.

Amphibian Systematics and Evolution

Riehl and colleagues used micro-complement fixation (MC'F) to clarify the relationships among some Palearctic hylid frogs of the genus *Hyla*. The groups distinguished by MC'F are consistent with patterns of speciation that can be supported by biogeographical history.

RIEHL, C. J., J. T. LELL, AND L. R. MAXSON. 1995. Relationships among Palearctic *Hyla*: Insights from immunology. Biochem. Syst. Ecol. 23(3):245–249.

DNA sequences of the conservative 12S and 16S ribosomal RNA genes were used to develop a phylogeny for amphibian higher classification. The monophyly of the three amphibian orders and two anuran suborders (Neobatrachia and Archaeobatrachia) are supported by the data. Relationships between familes are also discussed, although within Caudata, family relationships are not resolved at significant confidence levels.

HAY, J. M., I. RUVINSKY, S. B. HEDGES, AND L. R. MAXSON. 1995. Phylogenetic relationships of amphibian families from DNA sequences of mitochondrial 12S and 16S ribosomal RNA genes. Mol. Biol. Evol. 12(5):928–937.

Phylogenetic relationships within the salamander family Salamandridae were examined using both DNA sequences and morphology. The two data sets were highly congruent. Monophyly of the family is supported, however some of the genera within the family are found to be paraphyletic.

TITUS, T. A., AND A. LARSON. 1995. A molecular phylogenetic perspective on the evolutionary radiation of the salamander family Salamandridae. Syst. Biol. 44(2):125–151.

Amphibian Parasites

Vojtkova and Roca review the trematode parasites found in European anurans. They found that 49 species of adult Digenea and 39 species of larvae have been recorded from 16 species of anurans. These data are presented in several tables, and are divided by the parasites recorded for each species of anuran, geographic distribution, as well are the organ parasitized. An important list of references is also provided.

VOJTKOVA, L., AND V. ROCA. 1994. Parasites of the frogs and toads in Europe. Part II: Trematoda. Rev. Esp. Herp. 8:7–18.

Drought Ecology

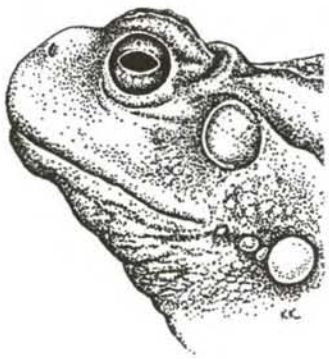
Germano et al. discuss the effect of a one-year drought on the behavior and reproduction of a population of *Gambelia sila*. During the drought adults were not found above ground and did not breed. Yearling lizards, however, were found above ground. The authors consider three hypotheses to account for the response of these iteroparous lizards to drought.

GERMANO, D. J., D. F. WILLIAMS, AND W. TORDOFF III. 1994. Effect of drought on blunt-nosed leopard lizards (*Gambelia sila*). Northwest. Nat. 75:11–19.

Quantitative Genetics

The heritability of locomotor speed and endurance were determined for a population of the lizard *Lacerta vivipara*. Heritability was low for speed but high for endurance and the authors found no evidence for a trade-off between the two characters. The authors discuss their data with respect to the hypothesis of a genetic trade-off between speed and endurance.

SORCI, G., J. G. SWALLOW, T. GARLAND, AND J. CLOBERT. 1995. Quantitative genetics of locomotor speed and endurance in the lizard *Lacerta vivipara*. Physiol. Zool. 68(4):698–720.





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LETTER TO THE EDITOR

The Last Word

The response to my cladistics article, both in volume of published pages and in prestige and scholarly standing of respondents, was heartening. I am particularly pleased that Peter Meylan instigated discussions of my paper with Henry Mushinsky's herpetology discussion group at USF, and delighted to hear also from Wayne King that the paper had been circulated to participants in the UF herpetology course for review and discussion. My purpose was to stimulate thought by providing an unequivocal counterpoint to cladistic dogma, and I could not have asked for a more gratifying response, even though the four responses included few words of praise. I take heart from the fact that, of the many dozens of specific points and criticisms I raised, only isolated ones were selected for response. But whether the many unchallenged points are indeed unanswerable is for others to judge.

Reading the responses and pondering their messages, I actually find less fundamental disagreement than might be anticipated. Dr. Kluge selected a defense of the principle of parsimony as his theme, although I wish he had been less theoretical and instead had given some concrete examples. I remain convinced that an unbiased cladist might indeed place Galapagos and Aldabra tortoises in a single clade. But the truth is that I obviously do not reject commonsense use of parsimony or identification of shared derived features, nor does Dr. Kluge portray these as paths to absolute truth. We just lie at different points on a continuum. Where our philosophies diverge is as follows: I concede that any and all approaches to systematics use a form of commonsense cladism, by identification of obvious synapomorphies. The African and Indian elephants, although generically distinct, obviously form a clade separate from other extant taxa (although including numerous extinct forms), and it doesn't take a computer analysis to conclude that large ears, tusks, trunk, giant size, etc. are, in this case, indicative of genuine relationship. I also acknowledge that "commonsense" conclusions based upon morphology can be disturbed or even reversed by genetic or molecular data. Kluge's thesis is that far more refined taxonomic conclusions (or hypotheses) can be made by consideration of more and finer-grained characters and by subjecting the data gathered to computer analysis. My conclusion, by contrast, is that there is a point where common sense and "gestalt cladism" ends, and that this is where one should stop. Too many events—ranging from uncertain character polarity, to dubious sister-group selection, to excessive reliance upon the principle of parsimony to choose between ambiguous scenarios, to arbitrary or subjective character selection, to the phenomenon of parallel adaptive modifications in unrelated organisms generating, not one, but a suite of false shared derived characters—can intervene to make the more rarified extremes of cladism unlikely to show convergence with actual past events. Adherents claim that their hypotheses are testable, but this is not strictly true—an absolute test would require that the existence of "node" forms in the fossil record, and the characters that distinguish them, would be predicted and then confirmed by actual discovery. If, on the other hand, "nodes" have no real existence, past or present, and cladists do not even seek them, as Meylan has argued, then I suggest that they have no place in science.

I found Darrel Frost's comments, that might be paraphrased "The man is DANGEROUS! He has a FOLLOWING! He must be STOPPED!" somewhat ad hominem in nature. Obviously I am happy that people read my stuff. Moreover, to disparage turtle hobbyists is unwise and unjust. The most dedicated ones provide an important counterpoint to theoretical systematists, in that they actually handle large numbers of specimens—living ones at that—of species that may be very poorly represented in museums, and they develop an "eye" for shades of regional variation—or even new species—that often elude those dependent upon available museum series. Indeed, the majority of new turtle taxa described in the last decade were discovered by hobbyists. Moreover, hobbyists' taxes help pay for publicly-funded turtle research, and this, I believe, gives researchers with government grants an obligation to make their findings comprehensible to an educated lay audience.

But all good debates must come to an end, and the time comes when one must call for a vote. I start from behind—four resounding "nay" votes were received by *Herp. Review*. But these must be weighed against fourteen written responses (I exclude numerous verbal messages of support) that reached me directly—and not from hobbyists, but in all cases from professional herpetologists and evolutionary biologists, all with instant name-recognition and standing within the professional community. Excerpts from some of these letters, all of which were supportive, are as follows:

"This is the most heartening discourse I've ever read on the subject of cladistics, although you go where angels fear to tread. It is an expository gem, intelligible throughout (what a rarity in this subject's literature), thorough in treatment, disarmingly documented—a scholarly masterpiece."

"Just a note to thank you for the wonderful article you obviously took great pains to prepare.... I had felt like a 19th century naturalist, isolated from scientific respectability with a tiny number of others, until I read your piece."

"I've just read your article on cladism..., and found myself actually laughing aloud—sympathetically—while reading a professional contribution. I heartily agree with your feelings, which you are certainly at pains not to disguise, and with your points, which are well made indeed."

"Very much enjoyed your unClad attack.... Said things I always wanted to say, but didn't have the background. Good show!"

"I don't know how long it has been since I enjoyed a scientific paper as much as I did your Cladism: The Great Delusion."

"Thanks for the thoroughly enjoyable paper. This was salve for my soul, after so many confrontations with the cladistic police. Count me among the reactionary forces of numerical taxonomy downtrodden but sure to rise again.... Thanks for the breath of fresh air.... It is true that there has been a revolution in systematics, resulting in many new journals, many exciting conclusions, and a lot of stimulating debate. But this revolution isn't cladistics. Molecular systematics is a genuine 'new way of seeing,' and cladistic methodologies have not fared well in this arena."

"Your recent article on cladism is passionate, reasoned and illuminating. I believe the voices of dissent are getting louder.... I suspect that cladism will never really disappear because it promises something that the new generation so badly desires—the promise of instant gratification and with it the bonus of innumerable opportunities to christen new names for old taxa."

"The title of your article—the great delusion—could be taken one step further. Cladists now assign polarities to characters. These characters are then used to override their own computer pronouncements. The cladists are, therefore, no more than traditional morphologists in computer clothing. The problems your article raised about confusing opinion with fact need no more expansion to you."

"We will overcome someday."

Gentlemen (for no ladies voted)—it seems the ayes have it.

PETER C. H. PRITCHARD
Florida Audubon Society
460 Hwy 436 #200
Casselberry, Florida 32707, USA.

ARTICLES

Age at Maturation, Body Size, and Life-History Evolution in the Salamander Family Plethodontidae

Tilley and Bernardo (1993) have done herpetologists a great service in their review of life history evolution in the salamander family Plethodontidae. They are quite correct in their interpretation that our current understanding of plethodontid life history evolution is based more on traditional viewpoints (e.g., Dunn 1926) than on real data. My intent in this paper is to supplement their suggestions on research directions in this family of salamanders.

What are the Important Aspects of Plethodontid Life Histories?

Because body size affects nearly every aspect of plethodontid evolutionary ecology (e.g., Hairston 1987; Tilley and Bernardo 1993), I will focus on this key trait. I will argue that the primary influences on interspecific and intraspecific variation in body size are duration of the larval period and juvenile period.

My arguments require several assumptions. First, while there are good reasons not to ignore the effects of egg size (e.g., Bernardo 1991a, 1994), I do so only to simplify my arguments. Second, I assume that growth after maturation contributes negligibly to interspecific variation in adult body size. At least for females, a significant component of energy formerly dedicated to growth is allocated to reproduction after maturity is attained (Hom 1988; Tilley 1980). This assumption may have less validity for males (Bruce 1993; Tilley 1980).

Egg size effects aside, there are only four ways to change body size in an amphibian: change (1) larval growth rate; (2) juvenile growth rate; (3) duration of the larval period; and (4) duration of the juvenile period. I will argue that variation in plethodontid life histories is due primarily to the latter two, and variation in growth rate contributes negligibly to variation in life histories.

For example, *Desmognathus monticola* attain a larger body size as adults than do *D. ochrophaeus* (Organ 1961). They do so primarily by extending the length of the juvenile period; growth rate and egg size play less important roles (Bruce 1990). The result is an additional year of growth prior to maturity, with all the correlated effects, e.g., increased clutch size and egg size (Bernardo 1994; Tilley 1968). Extending the comparison to the largest species in the genus, *D. quadramaculatus*, the larger size of this species seems to be due to an increase in larval period, relative to *D. monticola* and *D. ochrophaeus* (Bruce 1988a).

Changing the duration of the larval or juvenile period can also explain intraspecific variation in adult body size. Tilley (1973) specifically ascribed large body size of high elevation *D. ochrophaeus* (relative to low elevation conspecifics) to delayed maturity. The growth curves of Tilley (1980) document that the larger size of high elevation individuals is due to an additional year of growth as juveniles, with variation in growth rate contributing little to the difference in adult body size. In an elegant study, Bernardo (1994) convincingly demonstrated that this life history variation is due to genetic difference in maturation age and that growth potential does not differ between these populations.

In order to determine whether this trend is a general one for the desmognathines, I used the data that Tilley and Bernardo provided (their Table 1) to calculate approximate growth rates and evaluate the degree of interspecific variation in this trait (these rates should not be regarded as estimates of growth rate in natural populations). These rates are presented in Table 1.

As a test of the utility of these estimates, I constructed a table that listed the contributions of hatching size, growth rates, and age at maturation to the difference in adult body size between *D. monticola* and southern *D. ochrophaeus*. This table was compared with that listed in Bruce (1990)—who used real animals—and the differences between my estimates and Bruce's appeared to be small enough (Table 2) to allow interpretation of growth rate data of Table 1. (Because Tilley and Bernardo's table used Bruce [1990], I removed any data attributable to this reference so that the estimates presented in Table 2 were as independent as possible. Thus, in constructing Tables 1 and 2, I used Juterbock [1984] as my primary reference for *D. monticola*. However, the only estimate of minimum age at maturity for this species is found in Bruce [1990]. Thus the two data sets present in Table 2 are not completely independent.)

TABLE 1. Rates of growth estimated from Tilley and Bernardo (1993). Larval growth rate is calculated as

$$\frac{\text{(size at metamorphosis} - \text{hatching size)}}{\text{(age at metamorphosis)}}.$$

Juvenile growth rate is calculated as

$$\frac{\text{(size at maturity} - \text{size at metamorphosis)}}{\text{(age at maturity} - \text{age at metamorphosis)}}.$$

Data are medians taken from Tilley and Bernardo. *Desmogathus aeneus* and *D. wrighti* are direct-developers (Collazo and Marks 1989; Harrison 1967; Organ 1961; Wake 1966).

Species	larval growth rate (mm SVL/mo)	juvenile growth rate (mm SVL/mo)
Desmognathus quadramaculatus	0.62	0.67
Leurognathus marmoratus	0.59	1.08
Desmognathus monticola	0.30	0.80
Desmognathus fuscus (northern)	0.63	1.17
Desmognathus ochrophaeus (southern)	0.40	0.54
Desmognathus aeneus	—	0.48
Desmognathus wrighti	—	0.40

The growth rates do not differ dramatically across taxa in the way one would expect if variation in growth rate is a significant component of interspecific variation in body size (Table 1). In addition, I used the growth rates present in Table 1, and the data on minimum SVL at maturity and minimum age at maturity from Tilley and Bernardo, to generate Pearson correlation coefficients among these traits. Larval growth rate was not correlated with SVL at maturity ($r = 0.36$, df = 3, $P > 0.05$); nor was juvenile growth rate ($r = 0.59$, df = 5, $P > 0.05$). However, age at maturity was positively correlated with SVL at maturity ($r = 0.77$. df = 5, $P < 0.05$). Thus, it appears that variation in body size in desmognathine salamanders is most related to variation in maturation age. Maturation age is simply a function of the duration of the larval and juvenile periods.

Does this pattern hold for the other groups of the plethodontids, i.e., the tribes Plethodontini, Bolitoglossini, and Hemidactyliini of the subfamily Plethodontinae? As noted by Tilley and Bernardo, there is little information concerning life histories in the

Plethodontini and Bolitoglossini, but dramatic variation in several species of the Hemidactyliini has been well documented and suggests that the trend for the desmognathines also holds for the hemidactyliines.

For example, the hemidactyline *Gyrinophilus porphyriticus* in the southern Appalachians exhibits variation in age at maturation. In the Cowee, Nantahala, Balsam, and southern Blue Ridge Mountains, the larval period is 3–5 yr (Bruce 1980). In the Nantahala and Balsam Mountains and Cowee Mountains northwest of Watauga Gap, *G. porphyriticus* individuals follow metamorphosis with a one year juvenile period, whereas those from the southeast Cowee Mountains and southern Blue Ridge Mountains are mature at metamorphosis (Bruce 1972, 1978). The result of this accelerated maturation is smaller animals. Further, *G. porphyriticus* from the Great Smoky Mountains metamorphose at a small size (suggestive of a short larval period) but mature at a size comparable to the Northwest Cowee, Nantahala, and Balsam Mountain populations, suggesting an extended juvenile period (Bruce, unpubl. data). This indicates that geographic differences in adult body size in *G. porphyriticus* are due to variation in larval period and juvenile period.

Thus, a key question for researchers involves the relationship between larval period and juvenile period. A relationship usually exists between age at metamorphosis and age at maturation. However, the correlation is usually a spurious one: paedomorphs notwithstanding, a long larval period is accompanied by a delay in maturation. There may be no correlation between length of the juvenile period and length of the larval period (for the species of Table 1: $r = -0.23$, $df = 5$, $P > 0.05$). While this analysis is based on only a few data, it suggests the hypothesis that age at maturation and age at metamorphosis are free to evolve independently. Previously, Bruce (1989) suggested that the two factors are not tightly linked in desmognathine salamanders. The presence of paedomorphic hemidactyliines further supports this hypothesis.

I suggest that the evolution of body size in plethodontids is largely a result of changes in age at metamorphosis and maturation. I believe that a focus on questions that address variation in larval period and/or juvenile period is most likely to result in informative work. A critical way to address these questions is to generate mortality schedules.

Mortality Schedules and Life History Evolution in Plethodontids

What are the causes of variation in age at maturation in the plethodontid salamanders? All other factors being held equal, life histories evolve when mortality schedules are varied (Charlesworth 1980; Schaffer 1974). For example, Charlesworth (1980) showed that when a delay in reproduction is associated with an increase in fecundity, e.g., via an increase in body size (the case for salamanders [Kaplan and Salthe 1979]), there is selection for delayed maturation when early age mortality is increased. Organ (1961) suggested the hypothesis that the mortality of more aquatic, stream-dwelling plethodontids (i.e., larger species) is higher early in life than in more terrestrial species (i.e., smaller species). If this hypothesis is correct, then high early life mortality can explain delayed maturation and large body size in aquatic plethodontids.

Viewed in this context, the need for clear mortality schedules is outstanding. Currently, there are schedules of survival for only four species of plethodontids: *D. ochrophaeus* (Tilley 1980), *D. fuscus* (Danstedt 1975; Spight 1967), *Plethodon jordani* (Hairston 1983), and *Eurycea wilderae* (Bruce 1988b). Some comparisons can be made among the life tables for these four species. For example, Bruce (1988b) noted that the most aquatic species (*E. wilderae*) has the highest early life mortality and shortest mean generation time, and the most terrestrial species (the direct-developing *P. jordani*) has the lowest early life mortality and longest mean generation time.

TABLE 2. Comparison of two estimates of contributions to difference in adult body size between *Desmognathus monticola* and *D. ochrophaeus*. The estimate from this study is derived from median data taken from Tilley and Bernardo (1993). To facilitate this comparison the juvenile growth rate of *D. monticola* was assumed to be constant.

	Bruce (1990)		This study	
Source of difference	SVL (mm)	%	SVL (mm)	%
Hatchling size	2.4	13.8	3.20	15.6
Age at maturation	11.5	66.1	13.45	65.6
Growth	3.5	20.1	3.85	18.8
Total	17.4	100.0	20.50	100.0

However, more meaningful interpretations will result from life tables of groups of species that are closely related. For example, Organ (1961) provided life tables for five species of desmognathines that suggested that the more aquatic species suffer higher mortality early in life than species that are more terrestrial. However, Organ suggested that all the species he studied matured at the same time, and there is basis for reconsideration of his estimates (e.g., Bruce 1989).

In generating their life tables, these workers assumed that mortality in mature plethodontids is constant. A useful study would be one that tests this assumption, and new techniques for estimating the age of individuals (e.g., osteochrononlogy [Houck and Francillon 1988]) would help in this evaluation.

Age at Maturation and Adaptive Radiation?

While age at maturation is the primary determinant of adult body size in plethodontids, how is it related to other aspects of plethodontid evolution? I suggest that variation in age at maturation is related to, at least, two phenomena that are important aspects of adaptive radiation: speciation and specialization.

Bernardo (1991b) has suggested that because body size influences the distance moved after deposition of a spermatophore (Arnold et al. 1993), divergence in body size between populations can result in sexual isolation. There appears to be significant sexual isolation between the northwest and southeast Cowee Mountain populations of *Gyrinophilus porphyriticus* and this isolation appears to be due to population divergence in body size via differences in age at maturation (Beachy, *in press*). It seems tenable that much of the species diversity of the family is due to evolution of body size and the unique tail-straddle walk of the plethodontids.

Phyletic shifts in body size have been associated with, and may be a cause of, major ontogenetic changes that produce profound new morphologies in amphibians (Hanken 1989). A spectacular example of how change in body size affects morphology, behavior, and ecology is the tropical plethodontid genus *Thorius* (Hanken 1982, 1985).

Researchers often avoid the "tedious" tasks of elucidating life histories and mortality schedules. The work is usually time-consuming and descriptive (problematic for the graduate student looking to make a breakthrough during a time when the power of the

ecological experiment has been fully appreciated [e.g., Hairston 1986; Wilbur 1987]). However, commitment to this descriptive program will provide important insights to plethodontid evolutionary ecology. For at least the Desmognathinae and Hemidactyliinae (the less derived of the four major groups of plethodontids), shifts in maturation age (and sometimes metamorphic age) seem to be the dominant correlate with changes in body size. If changes in body size in plethodontids are due primarily to changes in age at maturity, then the study of life histories is intricately bound with morphology, ecology, and adaptive radiation in, this, the most successful group of caudate amphibians.

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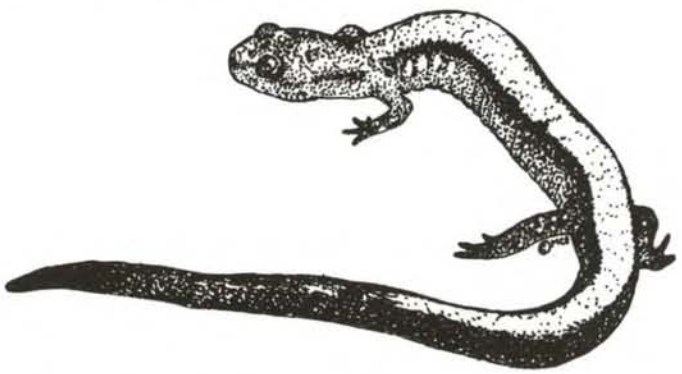
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CHRISTOPHER KING BEACHY
Department of Biology
Box 1522
Clarke College
Dubuque, Iowa 52001-3198, USA.



Plethodon cinereus (Red-backed Salamander). USA: Massachusetts: Reading. Illustration by Mark C. Erelli.

A Second External Character for Distinguishing Garter Snakes (*Thamnophis*) from Water Snakes (*Nerodia*)

In the course of accumulating data on meristic and mensural characters for a book on garter snakes (Rossman et al., *in press*), I was struck by the fact that *Thamnophis validus* appeared to have the scales in the first dorsal scale row (DSR 1) less enlarged (as reflected by the ratio: maximum vertical height of DSR 1/maximum width of vertebral row) than those of its congeners that I had examined up to that point. Since the placement of *validus* in the genus *Thamnophis* is a recent development (de Queiroz and Lawson 1994; Lawson 1987) and runs contrary to the evidence provided by the divided condition of its anal plate—which traditionally had resulted in that species being included in *Nerodia* (Conant 1961)—I surveyed a series of each of the 39 species currently included in the two genera, a total of 641 specimens.

The results of my survey are summarized in Table 1. Not only does *validus* have a less enlarged DSR 1 than all other *Thamnophis* (save for the ribbon snakes, about which more below), but so did all *Nerodia* except female *N. floridana* (one of 13 species exhibiting significant sexual dimorphism in this character—in each case the females have the more greatly enlarged DSR 1).

The data were subjected to one-way ANOVA, and pairwise statistical significance at the 95% confidence limit was determined both by the Fisher PLSD and the Scheffe F-test. Generally, these tests revealed that values at the lower end of the *Thamnophis* range are usually not significantly different from those at the higher end of the *Nerodia* range, although the lack of overlap in the means of these genera (excepting *T. validus*, the ribbon snakes, and female *N. floridana*) certainly seems to be indicative of a trend.

The greatest enlargement of DSR 1 in *Thamnophis* occurs in the highly aquatic *T. gigas* as well as in the terrestrial *T. fulvus*, *T. scalaris*, and *T. scaliger*; the least enlargement in garter snakes (excluding *T. proximus* and *T. sauritus*) is found in the primarily terrestrial *T. marcianus* and *T. radix*. Thus the enlargement of DSR 1 is not obviously correlated with either ecology or behavior, and it may well reflect phylogeny. If this is the case, what are we to make of the failure to conform to their apparent generic mode in the cases of *T. validus*, the ribbon snakes (one of which, *T. sauritus*, has significantly lower values than even the water snakes, a feature noted by Cope 1900), and female *N. floridana*? I confess that the latter baffles me, but the other three species previously had proven to be taxonomically enigmatic, so the evidence from this new character may help to clarify their relationships... or it may serve to further "muddy the water," depending upon one's perspective. In the case of *T. validus*, the possession of a weakly enlarged DSR 1 and a divided anal plate cannot by themselves justify setting aside the taxonomic conclusions based on molecular data; nevertheless, they strongly suggest that the question of whether *validus* is a garter snake or a water snake has not been resolved beyond doubt and deserves further study.

As for the ribbon snakes, *T. proximus* and *T. sauritus* have long been recognized as being somewhat aberrant within the genus *Thamnophis* on the basis of mensural, meristic, visceral, and molecular data (Dowling et al. 1983; Rossman 1963; Rossman et al., *in press*; N. Rossman et al. 1982) and this new character simply adds to the array. One hopes that a phylogenetic analysis of morphological characters (Rossman, Boundy, and Good, in progress) will help resolve the status of the ribbon snakes—and *T. validus*, as well.

TABLE 1. Relative height of the first dorsal scale row (maximum vertical height of DSR 1/maximum width of vertebral row) in 39 species of *Thamnophis* and *Nerodia*. Where no statistically significant sexual dimorphism was revealed (NS), values for males and females were combined. Each set of values includes mean ± standard deviation, range of variation (in parentheses), and number of specimens.

Species	Males (or combined) Females (if sig. diff.)	*P*
T. atratus	2.3 ± 0.15 (2.1–2.6) 13	>.001
	2.6 ± 0.21 (2.2–2.9) 9	
T. brachystoma	2.5 ± 0.22 (2.1–2.8) 27	NS
T. butleri	2.3 ± 0.18 (2.0–2.5) 11	NS
T. chrysocephalus	2.3 ± 0.14 (2.1–2.5) 6	>.005
	2.6 ± 0.15 (2.3–2.7) 6	
T. couchii	2.6 ± 0.14 (2.3–2.8) 13	NS
T. cyrtopsis	2.5 ± 0.20 (2.1–2.9) 19	NS
T. elegans	2.3 ± 0.23 (2.1–2.8) 8	>.005
	2.5 ± 0.18 (2.3–2.8) 9	
T. eques	2.8 ± 0.24 (2.3–3.2) 24	NS
T. errans	2.6 ± 0.20 (2.3–2.9) 11	NS
T. exsul	2.5 ± 0.19 (2.2–2.6) 4	[sample too small]
T. fulvus	2.6 ± 0.21 (2.2–2.8) 11	>.001
	3.0 ± 0.31 (2.5–3.5) 12	
T. gigas	2.5 ± 0.21 (2.3–2.8) 6	>.005
	2.9 ± 0.27 (2.7–3.4) 9	
T. godmani	2.6 ± 0.34 (2.3–3.2) 11	NS
T. hammondii	2.5 ± 0.27 (2.1–3.0) 11	NS
T. marcianus	2.2 ± 0.22 (1.9–2.6) 10	>.025
	2.4 ± 0.25 (2.1–2.9) 15	
T. melanogaster	2.4 ± 0.17 (2.1–2.7) 13	NS
T. mendax	2.4 ± 0.10 (2.3–2.5) 7	NS
T. nigronuchalis	2.5 ± 0.24 (2.2–2.9) 10	NS
T. ordinoides	2.4 ± 0.10 (2.2–2.5) 7	>.0025
	2.6 ± 0.18 (2.3–2.9) 13	
T. postremus	2.4 ± 0.16 (2.1–2.6) 21	NS
T. proximus	1.6 ± 0.11 (1.3–1.7) 14	>.05
	1.7 ± 0.12 (1.5–1.8) 6	
T. pulchrilatus	2.7 ± 0.44 (2.2–3.7) 11	NS
T. radix	2.2 ± 0.17 (1.8–2.5) 19	>.005
	2.5 ± 0.23 (2.2–2.8) 6	
T. rufipunctatus	2.4 ± 0.18 (2.1–2.7) 18	NS
T. sauritus	1.2 ± 0.10 (1.1–1.4) 9	>.0005
	1.5 ± 0.14 (1.3–1.8) 14	
T. scalaris	3.0 ± 0.32 (2.3–3.6) 19	NS
T. scaliger	2.6 ± 0.19 (2.4–2.9) 9	>.005
	3.0 ± 0.22 (2.7–3.3) 9	
T. sirtalis	2.4 ± 0.23 (2.2–2.9) 7	>.05
	2.6 ± 0.17 (2.3–2.9) 14	
T. sumichrasti	2.6 ± 0.13 (2.4–2.8) 9	NS
T. validus	1.7 ± 0.12 (1.6–1.9) 13	NS
N. clarkii	1.7 ± 0.15 (1.3–1.9) 15	NS
N. cyclopion	1.9 ± 0.12 (1.7–2.1) 13	NS
N. erythrogaster	1.9 ± 0.17 (1.6–2.2) 19	NS
N. fasciata	1.7 ± 0.15 (1.5–2.0) 18	NS
N. floridana	1.8 ± 0.12 (1.7–1.9) 3	>.05
	2.3 ± 0.21 (2.1–2.9) 13	
N. harteri	2.0 ± 0.11 (1.9–2.3) 19	NS
N. rhombifer	1.8 ± 0.16 (1.4–2.0) 17	NS
N. sipedon	2.0 ± 0.15 (1.7–2.2) 13	NS
N. taxispilota	1.7 ± 0.19 (1.4–2.1) 18	NS

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DOUGLAS A. ROSSMAN
Museum of Natural Science
Louisiana State University
Baton Rouge, Louisiana 70803, USA.

Some Aspects of the Ecology of *Pseudis paradoxa* from Northeastern Argentina

During the past seven years, we have made an attempt to gather species diversity data in an ecological preserve in northeastern Argentina (Yanosky et al. 1993). Ecological data have been taken on 32 species of anurans. One of these is the paradoxal frog, *Pseudis paradoxa*. In the Argentine Chaco, this frog breeds in temporary ponds and the tadpoles reach rapid maturity and transformation. Yet in permanently wet areas, the tadpoles reach enormous proportions (up to 220 mm), and at transformation they are of adult size (Cei 1980; Emerson 1988).

Cei (1980) states that *P. paradoxa platensis* is typically found in permanent marshes alongside major rivers and lagoons. It feeds upon small frogs and aquatic insects. Mating seems to be highly correlated with sudden rainfall or other seasonal events.

Egg laying occurs in this environment and frothy masses of greenish eggs are laid at random among the aquatic plants of the shores. The hatched larvae retain a greenish color on their venters for several days following hatching.

We present data on breeding activity of adults and ontogenetic pattern change among the tadpoles of a northeastern Argentine population of *Pseudis paradoxa*.

Results.—Pseudis paradoxa was heard calling for the first time at 1800 h, on 26 November 1993, in a vegetated pond at the entrance to the El Bagual Ecological Reserve Station. This animal was later captured on the same night with a dip net as it called from a floating position with only the eyes, nostrils, and vocal sac visible. This individual called over a water depth of 55 cm. It measured 53 mm SVL and weighed 15.8 g. During 30 November a large chorus of *Pseudis* was heard calling for the first time from two artificial ponds near a road. On the night of 1 December, amplexing pairs were seen on the surface of the water with and without floating vegetation. Ten floating amplexing pairs were observed at various depths of water as follows: two pairs were observed at 70 cm deep, two at 50 cm deep, three at 40 cm deep and three at 20 cm deep, with air temperature of 17°C at 2300 h. These 20 individuals were captured. The female and male weights and SVL measurements are 13.5–18.0 g (mean = 14.9), 9.0–15.5 g (mean = 12.9); 47–59 mm (mean = 51.8), 45–53 mm (mean = 49.9), respectively. They begin calling at dusk (near darkness) and continued through the first hours of the night. On several non-rainy days following rains, *Pseudis* called during daylight hours (morning and afternoon). The initial call was heard 26 November after the rainy season began on 12 November 1993. Individuals called through the remainder of November, all of December, and the two first weeks of January. In general, choruses were heard from most water bodies by 3 December. Maximum time period between first rain of the season, first possible appearance of eggs and metamorphosis is 12 November to the first week of January (about 50–56 days). However, since *Pseudis* vocalizations were not heard prior to 26 November, using the latter date as the first attempt to call and mate, development takes about 40 days.

Tadpoles were found in artificial and natural pools between 10–15 cm to 70–80 cm deep. The tadpoles were found throughout the water column, observed singly, and cohabit ponds with a large number of other anuran tadpoles. During periods of no rainfall, early stages of small tadpoles were continuously found, agreeing with observations for continuous calling and mating.

Tadpole growth in captivty is very slow. The larvae are motionless most of the time at the bottom of the water column and feed on vegetables and goldfish food.

Pseudis paradoxa tadpoles show an ontogenetic shift in color pattern from stage 25 through stage 38. The smallest tadpole (5 mm, stage 25) is almost colorless, but by a total length of 7 mm (stage 25) the tadpole appears to have three black spots: one spot just behind the body on the dorsal muscle and part of the dorsal fin, the second as a black spot in the tail muscle about midway from body to tip of tail, and the third spot at the tip of the tail. Tadpoles 10–15 mm in total length (stage 25) tend to have the anterior black spot extending downward and anteriorly across the body, the middle spot has formed a narrow bar that progressively extends above and below the tail muscle, and the tip of the tail black spot is expanding forward. As the tadpole grows in length and weight, the most posterior black spot (tail tip) spreads anteriorly, eventually creating a blackish tadpole. An illustration of the ontogenetic pattern differences of the *Pseudis* tadpole from stage 25 (21 mm TL tadpole) to stage 26 (76 mm TL tadpole) (Gosner 1960), is presented in Figure 1a–1e, and described below for additional stages.

Stages 21–25: A tadpole with a transparent tail changes to a tadpole with a transparent tail with small dark spots and three vertical black bars, one in contact with the body, a median one and the third near the tip of the tail. All specimens contain a black stripe from the mouth to the eye, and a dark dorsal wedge between the eyes to the tip of the snout, bordered by two conspicuous white lines. Measurements for one specimen are: TL = 45.7 mm; BL = 15.1 mm; MBH = 13.9 mm and W = 0.8 g.

Stages 26 and 27: The posterior half of the tail turns black beginnning with individual tadpoles 46 mm long. Cephalic white lines are not as pronounced as observed in previous stages. The cephalic lines are absent in stage 27. Depressions occur along each side of the dorsal fin, from its insertion on the head to the posterior part of the body. There is great variation in size individually and the transparent parts of the fin are not clearly visible, because of dense dark spots. Measurements of one speci-

men are: TL = 59.1 mm; BL = 16.5 mm; MBH = 18.2 mm and W = 1.35 g.

Stage 28: The black vertical bars in the tail have disappeared and the tail is almost completely black. In animals 68 mm long there is a very dark border on the ventral side of the fin. The posterior end of the tail is no longer black but intensely black spotted. Head depressions are very evident. Measurements for three individuals are: TL = 70.3, 73.2 and 68 mm; BL = 21.5 mm, 22.5 and 19.3 mm; MBH = 24.4 mm, 27.7 and 22.2 mm; W = 3.15, 4.4 and 2.6 g.

Stage 35: Head depressions are present and the dorsum is greenish. Measurements for two specimens are: TL = 67.1 and 62.3 mm; BL = 23.3 and 23.2 mm; MBH = 24.7 and 24.8 mm; W = 7.8 and 4.05 g.

Stage 37: Head depressions are present, dorsum greenish and the anterior part of the belly is olive, passing posteriorly into light brown, pearl silver, and eventually pinkish. The black border on the ventral side of the fin is very evident. The fin is now "tiger spotted." Measurements for two specimens are: TL = 96 mm and 76.2 mm; BL = 25 and 24.4 mm; MBH = 28 and 25.5 mm; W = 6.5 and 5.3 g.

Stage 38: The cephalic depressions are deeper; the dorsum becomes more green; the body and tail become less blackish and with many small dark and rounded spots. Measurements of one individual are: TL = 92 mm; BL = 34.2 mm; MBH = 37.6 mm; W = 13.5 g.

In summary, between stages 34 and 38, (TL between 76 and 135 mm), there is a progressive loss of black pigment. The black spots or tiger-like markings become progressively smaller, until there is an almost greenish-like tadpole with obscure brownish or dark gray body markings. The pronounced "valleys" on either side of the insertion of the tail fin onto the head and body are strongly evident.

Discussion.—Kehr and Basso (1990) present a description of the *Lysapsus limellus* tadpole. They note that the tip of the tail is colorless at stage 28, but progressively becomes black between stages 30 and 39. However, in this species of *Lysapsus* the black tail spot never exceeds 25% of the tail length. Caldwell (1982, 1986) stated that the black tail spot may function as disruptive selection to avoid differential predation pressures. This hypothesis was tested by Caldwell (1982), and under the constraints of the laboratory tests, was supported. In her experiments, Caldwell used populations of *Acris* with and without black tail tips. If we assume that all water bodies at the site contain equal numbers of aquatic insect predators (all tadpoles were patterned with black), then the ontogenetic pattern changes of *Pseudis* tadpoles may carry them beyond certain differential predation limits. However, populations of *Pseudis* tadpoles may be polymorphic. Cei (1980) illustrates a 94 mm total length *Pseudis paradoxa* tadpole without black tail spots. However, without prior knowledge of the locality of Cei's tadpole or of other possible color patterns, this pattern type may support Caldwell's (1982) hypothesis of differential predation pressure, which depends upon water depth, type of predator, and permanency of water.

Emerson (1988) discusses various aspects of tadpole size and patterns of development of *Pseudis paradoxa*. Emerson describes giantism as a possible function of two hormones, thyroxine and prolactin. A hypothesis is presented concerning these hormones, but the hypothesis is not testable at this time. Tadpole size is often independent of tadpole stage in the Argentine sample of *Pseudis paradoxa*. For example, total lengths of tadpoles in stage 25 vary from 5–46 mm, stage 35 vary only from 62–67 mm, while at the same time total lengths of tadpoles in stage 26 may reach 76 mm. It seems that length (and weight) of *P. paradoxa* tadpoles

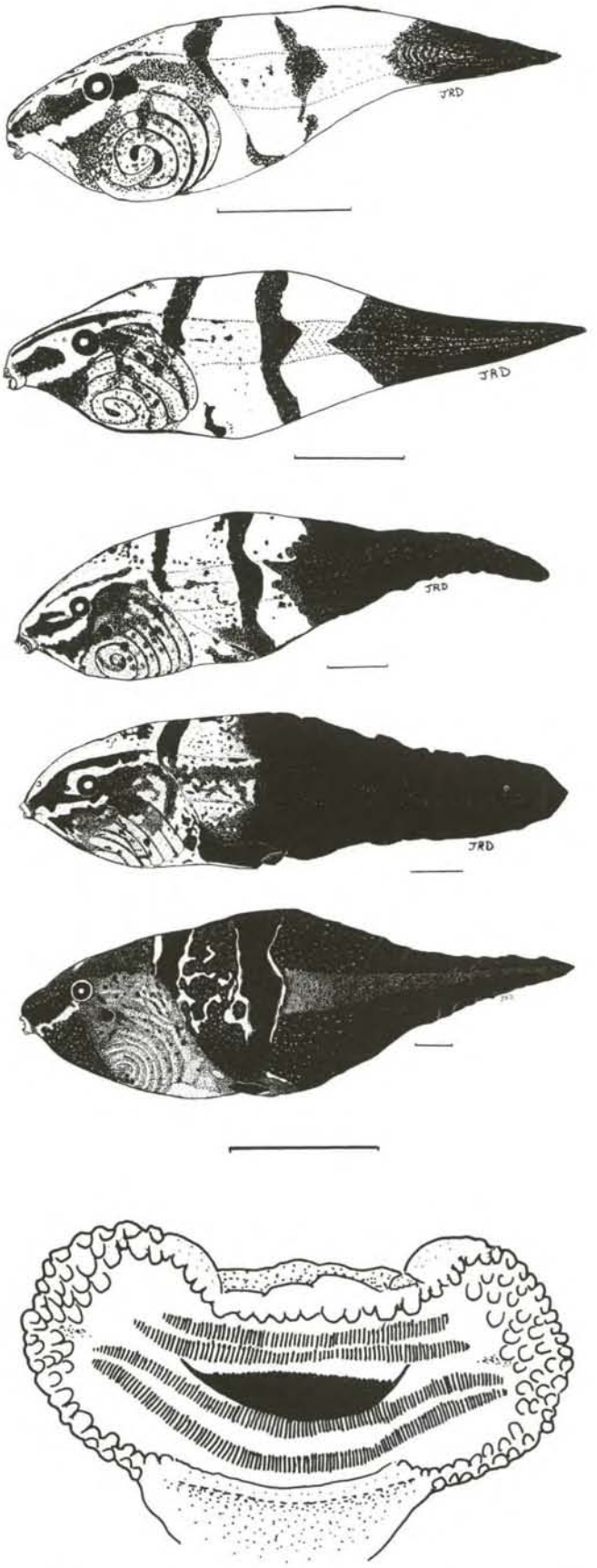


FIG. 1. Ontogenetic pattern of *Pseudis paradoxa* tadpoles at (a) 21, (b) 27, (c) 44, (d) 52, and (e) 76 mm total length, from a temporary pond on El Bagual Ranch, Formosa, Argentina. Tadpoles represent Gosner (1960) stages 25–26, and the black bar = 5 mm. Figure 1f represents a view of the tadpole mouth parts.

may be a function of available food and environmental temperatures, independent of developmental stages.

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JAMES R. DIXON
Department of Wildlife and Fisheries Sciences
Texas A&M University
College Station, Texas 77843 USA

CLAUDIA MERCOLLI
and
A. ALBERTO YANOSKY
El Bagual Reserve
3601 - Presidente Irigoyen
Provincia de Formosa, Argentina.

Fire Ecology of the Florida Box Turtle, *Terrapene carolina bauri*

The effects of habitat fires, both natural and those caused by humans, on amphibian and reptile populations have been of some recent interest (Mushinsky 1985, 1986, 1992; Mushinsky and Gibson 1991; Mushinsky and Wirtz 1993; Patterson 1984). In Florida the influence of periodic burning is especially important in the pine flatwoods and dry prairie ecosystems (Abrahamson and Hartnett 1990). Natural fires maintain the habitat as a stable and essentially nonsuccessional association; however, human alteration of the natural fire frequency commonly brings about rapid successional changes in these ecosystems (Monk 1968; Peroni and Abrahamson 1986; Richardson 1977). The major natural cause of these wild fires is a lightning strike (Abrahamson et al. 1984), and fires were common in pre-1900 Florida before human structures such as roads, cultivated fields, or urban developments limited the amount of area burned (Abrahamson 1984). Originally, most natural fires probably occurred during the summer dry period from June to September allowing for recovery during the rest of the year, but currently managed burning also occurs during the dry winter season (Abrahamson and Hartnett 1990). These changes in the frequency of burning, in addition to human agricultural and urban development, have brought about a decrease in the total area of the pine flatwoods and dry prairie ecosystem in Florida. The end result of this activity has been a reduction in the available critical habitat of some amphibian and reptile species.

The Florida box turtle, *Terrapene carolina bauri*, ranges over most of central and eastern peninsular Florida and the Keys (Ashton and Ashton 1985; Ernst et al. 1994; Iverson and Etchberger 1989). Carr (1952) also reported it to be most abundant in the limestone flatwoods of southern Dade County. Over the range of *T. c. bauri*, the flatwoods habitat with which it is best associated (Abrahamson and Hartnett 1990) is subject to periodic burning. To what extent is the Florida box turtle adversely affected by such events?

While examining a series of *T. c. bauri* in the collections of the United States National Museum of Natural History, Smithsonian Institution (USNM), and George Mason University (GMU), a relatively large proportion (30%) of the specimens exhibited burn damage to their carapace. This damage was manifested as extremely scarred or warped areas on the carapacial scutes and often included the underlying bones. The USNM and GMU collections contain over 1000 specimens of *T. carolina*, representing all six known subspecies (Ernst and McBreen 1991b), but no other subspecies had as many fire damaged individuals (< 5% each in those from the United States), possibly indicating that fire plays a more important role in the ecology of *T. c. bauri*.

All *T. c. bauri* examined were adults. Carapace length and height were analyzed using a large sample approximation of the Mann-Whitney U-test. Both carapace length and height were found to be sexually dimorphic in an overall comparison of males and females ($Z = -4.07$, $p = 0.05$; $Z = -2.26$, $p = 0.05$, respectively) and in a subsample of unburned males and unburned females ($Z = -2.58$, $p = 0.05$; $Z = -2.02$, $p = 0.05$, respectively). However, in comparing burned males with burned females, carapace length, but not carapace height, was sexually dimorphic ($Z = -2.54$, $p = 0.05$; $Z = -1.19$, $p = 0.05$, respectively). Observed differences in carapace length, height, and age of burned and unburned males and females are provided in Table 1.

Sexual dimorphism in carapace length and height is well documented in the genus *Terrapene* (Ernst et al. 1994; Ernst and McBreen 1991a, 1991b; Milstead 1969); however, it does not address whether age, size, or sex influence the probability of being damaged by fire. A chi-square test of independence was used to determine if sex and burn damage were independent of age class or size (carapace length and height). Age classes identified were < 15, 16–20, > 21 years, and the size classes (in mm) used were 105–120, 121–135, and > 135 for carapace length and 50–60, 61–67, and > 68 for carapace height. Comparisons between various group combinations are presented in Table 2. The results indicate that age group and carapace height are independent of fire damage, but that carapace length is not. Since carapace length is not independent of fire damage when comparisons are made between both burned and unburned animals and burned females and burned males, it is possible that wild fires do not randomly affect adult populations of *Terrapene c. bauri*. Fossorial Floridian lizards and snakes occupying burrows have high survival rates during fire events (Mushinsky 1985; Mushinsky and Wirtz 1993). *Terrapene c. bauri* does not dig a subterranean burrow. However, it does construct a shallow form in litter for sleeping and aestivating (Ernst, pers. obs.), and it is likely most turtles that survived burning occupied such forms. This is supported by the location of burn damage on carapace, which was generally limited to the neural and anterior costal bones. The Florida box turtle will enter other animals' burrows, and those lucky enough to be underground at the time of a fire are probably unharmed. Those individuals caught in the open are likely killed. Hatchling and juvenile *T. c. bauri* usually hide under litter (Ernst, pers. obs.), and such behavior would not favor survival in the event of fire.

TABLE 1. Sizes and ages of *Terrapene carolina bauri* examined.

		Burned Males	Burned Females	Unburned Males	Unburned Females
CARAPACE LENGTH					
	N	13	19	36	35
	Mean (SD)	139.1 (10.1)	128.8 (9.4)	140.8 (17.1)	130.3 (11.0)
	Range (mm)	117.4–155	112.8–145.5	105.1–198.2	109.1–166.4
CARAPACE HEIGHT					
	N	12	19	35	34
	Mean (SD)	64.3 (4.8)	67.4 (5.1)	66.6 (6.9)	68.3 (5.2)
	Range (mm)	57.4–75.6	54.5–77.0	52.5–89.6	57.1–79.1
AGE					
	N	13	19	36	35
	Mean (SD)	19.6 (5.7)	21.4 (6.1)	18.4 (5.9)	20.4 (6.2)
	Range (mm)	13–27	12–27	10–27	9–27

The above observations indicate that fire may play a critical role in the ecology of Florida box turtle populations. Unfortunately, so little has been published on the life history of this animal that it is difficult to assess its ecological and behavioral requirements with any degree of certainty. A thorough study of this turtle in view of its fire-related ecological consequences would be worthwhile.

TABLE 2. Comparison of age and size of burned and undamaged *Terrapene carolina bauri* (* = significant difference at $p = 0.95$).

Category	X^2	df
AGE CLASS		
Burned v. Unburned	0.2110	2
Burned Male v. Burned Female	4.416	2
Unburned Male v. Unburned Female	2.7778	2
Unburned Male v. Burned Male	2.3442	2
Unburned Female v. Burned Female	3.5484	2
All Groups	8.9487	6
CARAPACE LENGTH CLASS		
Burned v. Unburned	10.8*	2
Burned Male v. Burned Female	4.22	2
Unburned Male v. Unburned Female	7.0404*	2
Unburned Male v. Burned Male	0.6087	2
Unburned Female v. Burned Female	0.9429	2
All Groups	13.73*	6
CARAPACE HEIGHT CLASS		
Burned v. Unburned	1.9847	2
Burned Male v. Burned Female	1.7789	2
Unburned Male v. Unburned Female	2.5447	2
Unburned Male v. Burned Male	1.7876	2
Unburned Female v. Burned Female	1.0342	2
All Groups	6.7035	6

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CARL H. ERNST
TIMOTHY P. BOUCHER
STEVEN W. SEKSCIENSKI
and
JAMES C. WILGENBUSCH
Department of Biology
George Mason University
Fairfax, Virginia 22030, USA.

RECENT POPULATION CHANGES

Historical Distribution, Current Status, and a Range Extension of *Bufo boreas* in Utah

The boreal toad (*Bufo boreas*) is proposed for Federal protection as a Category 2 species, under the Endangered Species Act. This listing indicates the species may be threatened or endangered with extinction due to declining populations in Colorado, New Mexico, and Wyoming (Federal Register 1991). In Utah, the distribution and status of this toad are unknown, especially in southern Utah (Stebbins 1985). Amphibian populations in portions of the western United States are experiencing rapid declines (Bradford 1991; Corn and Fogelman 1984; Fellers and Drost 1993). Carey (1993) discussed the disappearance of *B. boreas* due to disease and interrelated factors in Colorado.

Early accounts and collections portray *B. boreas* as a common toad in some areas of Utah. Tanner (1931) described *B. boreas* as being "far more common in the northern part of the state than in the southern. It is the common species in the canyons and mountains of central and northe[r]n Utah." Woodbury (1952) wrote that this species is "known from the northern portion" of the Great Salt Lake Valley and is a "common 'garden' toad." Tanner (1931) found *B. boreas* "common around the shores of Great Salt Lake." Van Denburgh and Slevin (1915) collected 87 specimens from five locations in Salt Lake and Utah counties. Slevin (1928) reported *B. boreas* from Juab and Summit counties. Records in the University of Utah Museum of Natural History indicate 10 specimens were taken from one site in Wasatch County on 12 July 1959. While Hardy (1938) described this species as "common in the Colorado River drainage in Sevier and Wayne counties" in southern Utah, there are only 4 museum records from those counties. Hardy (1938) also wrote that *B. boreas* was "not common in Carbon County" in southern Utah.

We queried 57 institutions in the United States for their holdings of *B. boreas*. Twelve institutions reported a total of 100 specimens from 52 localities in Utah (Fig. 1). All museum material was collected prior to 1971. Museum records for which elevation data were available (N = 29) ranged from 1374 m to 3136 m in elevation. Museum acronyms follow Leviton et al. (1985).

We found 22 localities in unpublished reports and personal communications. We queried two professional biologists who collected or observed amphibians in boreal toad habitat. There is one report of *B. boreas* in southern Utah (F. Turner, pers. comm.). While records are lacking in adjacent Nevada (Linsdale 1940), the nearest record is about 150 km northwest of this observation. Turner (pers. comm.) also observed *B. boreas* at four locations in northern Utah (Fig. 1).

The majority of historical locations were from northern Utah (Table 1) and may reflect collection effort. We (P.H. or D.A.R.) last observed evidence of reproduction (tadpoles or juvenile *B. boreas*) in three sites between 1982 and 1988 in northern Utah (Fig. 1). At least one subsequent survey was conducted at each of these sites. Tadpoles (N = 200) were also observed at one site in northern Utah (Pederson 1977a). Other recent observations of *B. boreas* in Utah are scattered and usually are of one to several adults (Fig. 1). In 1976, four adults were observed in northern Utah (Pederson 1977b). Two observations at a separate locality in northern Utah during 1978 through 1980 were reported by Shields and Moretti (1982).

TABLE 1. Number of historical locations, number of locations resurveyed, and number of sites occupied by *Bufo boreas* in northern and southern Utah. New sites are indicated in parentheses and number of occupied sites with evidence of reproduction (i.e., egg masses, tadpoles) is given in parentheses.

	Number of Historical Locations*	Number of Resurveyed Sites	Number of Occupied Sites
		Northern Utah	
	64	5	0
	(3)	—	3 (2)
		Southern Utah	
	7	3	0
	(3)	—	3 (2)
Totals	71	8	6

*Specific locality information may be acquired by contacting the Aquatic Section, Utah Division of Wildlife Resources, Salt Lake City.

Early literature (Tanner 1931) alludes to the presence of *B. boreas* along the Great Salt Lake (Salt Lake County) and Utah Lake (Utah County). Our search revealed no museum records within 17 km of either of these localities. We believe that *B. boreas* occupies montane habitats and sometimes valley wetlands adjoining montane habitat but does not use valley habitats distant from mountains. One report from southern Utah (Tanner 1927) is not represented by a museum specimen.

Three new locations represent southern extensions of the range of *B. boreas* (Fig. 1). The first locality is from 2500 m in elevation. We (RAF, TCE, DAR) observed adult toads (N = 70) at several beaver ponds and egg strings (N = 35) in 5 ponds in 1994. Metamorphs (about 17 mm SVL) were observed at two of these ponds during July. We (RAF) observed adult *B. boreas* (N = 15) and numerous metamorphs at a second new locality at 3030 m in elevation during 1994. We observed adult *B. boreas* (N = 3) at a third new locality at 2803 m in elevation during 1994.

Based on these limited observations, the current distribution of *B. boreas* in Utah is not well documented. Montane habitats in southern Utah are disjunct (Wahlquist 1981) and, as such, may predispose *B. boreas* populations to extirpation as a result of anthropogenic factors. Surveys should be expanded and continued to determine the distribution and population status of this anuran, and factors affecting its populations.

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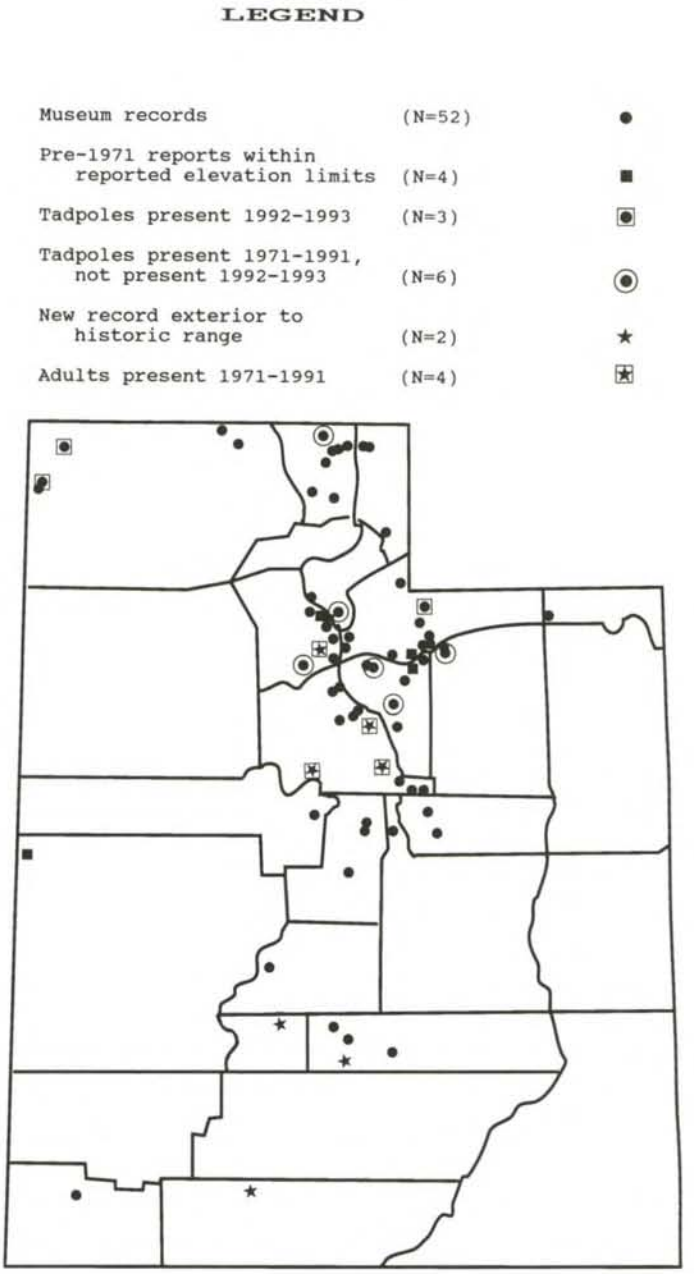


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DAVID A. ROSS*
Native Wildlife Section
Utah Division of Wildlife Resources
1596 West North Temple
Salt Lake City, Utah 84116-3195, USA

TODD C. ESQUE
National Biological Service
345 E. Riverside Drive
St. George, Utah 84770, USA

RICHARD A. FRIDELL
Utah Division of Wildlife Resources
3505 West 290 North
Hurricane, Utah 84737, USA

and
PETER HOVINGH
721 Second Avenue
Salt Lake City, Utah 84103, USA.

Present address: Utah Division of Wildlife Resources, 515 East 5300 South, Ogden, Utah 84405-4599, USA.

TECHNIQUES

Experimental Use of Remotely-triggered Cameras to Monitor Occurrence of Timber Rattlesnakes (*Crotalus horridus*)

Populations of *Crotalus horridus* are in decline across the northeastern U.S. (Brown 1993), and assessment of the density of specific rattlesnake populations is important. Clipping ventral scales and painting rattles will identify individuals, but recapture is often difficult; snakes are averse to handling and may avoid areas of capture (Brown 1992). Radiotelemetry has been successfully employed to study habitat use (Reinert 1993), but is expensive and time-intensive. Deployment of remotely-triggered cameras at potential den and basking sites is a less intrusive and time-intensive method of studying rattlesnake populations.

To determine whether an infrared beam transmitter would alter rattlesnake behavior, we placed an active infrared-beam transmitter (TrailMaster® TM1500, Lenexa, Kansas 66215, USA, [not an endorsement of product] game monitoring system [Kucera and Barrett 1993]) and a neutral object of the same size near a captive rattlesnake in an enclosure. The snake investigated, but did not display aversion to, or exhibit prolonged interest in, either unit. When the infrared receiver and transmitter were positioned so that the snake would have to cross the beam to reach a dead rodent provided for food, the snake crossed the beam, tripped the camera, and fed at a normal rate. A second feeding followed the first and, again, the snake's behavior appeared normal.

Three sites where timber rattlesnakes had either been observed or where shed skins had been found recently were each monitored with two TrailMaster® systems for twelve days. Another site known for rattlesnake use was monitored for one week with one unit. The four sites included a talus slope with 50% canopy, a large level rock slab with potential as a basking site, and two crevices at ground level below massive rock outcrops.

Monitoring units can be programmed to optimize the likelihood of recording the desired species. A medium sensitivity setting of 10 was optimal for recording rattlesnakes and prevented blowing leaf litter, moving shrub stems, heavy fog or rain from activating the monitor-connected cameras. A 35mm, motor-driven, auto-focus/flash/advance Olympus camera with a 50mm lens was supplied with the system. A delay of 15 minutes between exposures prevented using the entire roll of film during any one activity period.

Problems unique to deployment of units at ground level in rattlesnake habitat included disruption by curious animals, pooling of rain water, and excessive exposure to sunlight. Cameras placed on a rock slab were tipped and their wires disconnected by shedding snakes (skins were found nearby) or other animals. Building a small rock cairn around the camera and tripod, and taping or caulking the wire connections, prevented recurrences. In areas with talus we positioned the camera above the site by strapping the camera to dead limbs with velcro straps and placing the limbs across rocks.

The transmitter/receiver units are designed to be strapped vertically to trees so that rain will not enter a small opening on the bottom of the units which maintains normal internal pressure over

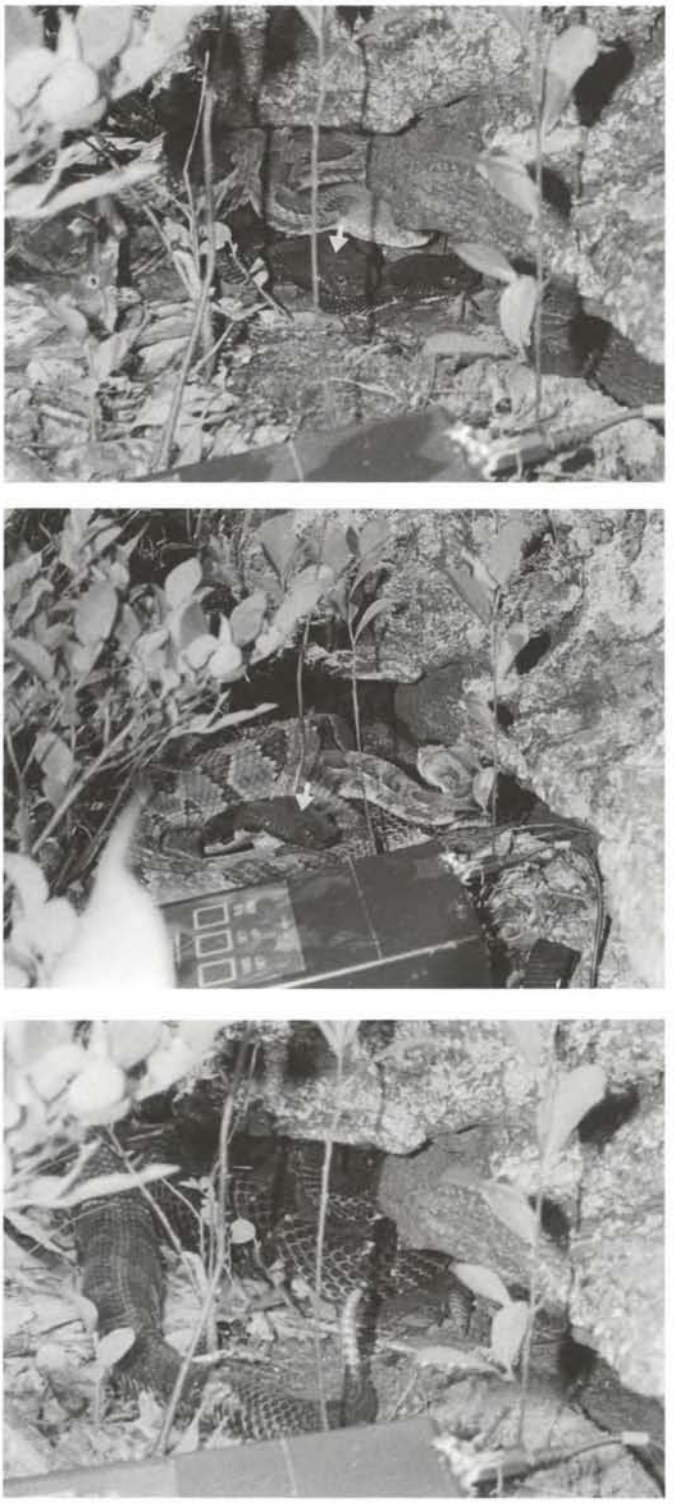


FIG. 1 (a–c). Photographs taken by remotely-triggered camera stations. 1a (top): heads of *Crotalus horridus*. 1b (middle): two *C. horridus*, one with same scar appearing in 1a. 1c (bottom): rattle segments can be counted to approximate ages of individuals.

a range of temperatures. Since we needed to place the units horizontally on the ground with the beam closely parallel to the surface, we silicone-caulked wire connections and pointed the bottom of the units downward on any incline, avoiding areas where puddling could occur. None of our units was damaged by rain but the manufacturer recommends enclosing the transmitter and receiver in clear plastic bags and taping the open end around the wires.

Bright sunlight can interfere with the infrared beam and overheat the units. Our best results were achieved at a site where the receiver and transmitter were placed in partial shade. The beam monitored only one meter along the interface between rock outcropping and the ground where snake activity had been observed. At the end of one week, 35 of 36 frames of black and white film (400 ASA) contained images of rattlesnakes. In one frame three *Crotalus* heads, one yellow and two black (Fig.1a), were together. One black and one yellow morph had been observed previously at the site, and the remotely-triggered cameras verified the presence of an additional individual after only 2 h of effort had been expended on placement and film collection. This compared with 8.7 person-hours of active search effort for each of the other individual snakes recorded. Camera and receiver recorded date and time of events; a scar on the head of one snake identifies the same individual in separate photographs (Fig.1b). In other frames, rattle segments can be counted (Fig.1c) providing some indication of age of snakes. Use of color film, although more expensive than black and white, would allow for identification of specific individuals because of unique coloration and patterning.

Camera units also recorded nighttime use of the rock slab by a bobcat (*Lynx rufus*), raccoons (*Procyon lotor*), and an unidentified bird. In the talus, mice (*Peromyscus* sp.) and squirrels (*Sciurus carolinensis*) were often recorded.

The presence of units at a site may attract attention leading to the harassment or capture of the snakes and is not advisable in areas with high human visitation. Because rattlesnake dens are frequented by poachers and collectors, theft of camera units is also a distinct possibility. Use of this system to monitor remote sites on a daily basis over an extended period of time, however, is worthwhile. Given the low population densities of some endangered species, documentation of even one more living individual at a site is important.

Acknowledgments.—Equipment was provided by the Northeastern Forest Experiment Station and funding was provided by The Nature Conservancy and the Massachusetts Natural Heritage and Endangered Species Program. We thank Alan Richmond for suggestions for the captive snake experiment, and the staff at the Massachusetts Audubon Society Laughing Brook Education Center in Hampden, Massachusetts for assistance. We are also grateful to Frank Lowenstein, manager of the Berkshire chapter of the Nature Conservancy, to Christopher Weaver and Heather Lanza for their support in the field, and to R. R. Stechert for invaluable advice regarding *Crotalus*.

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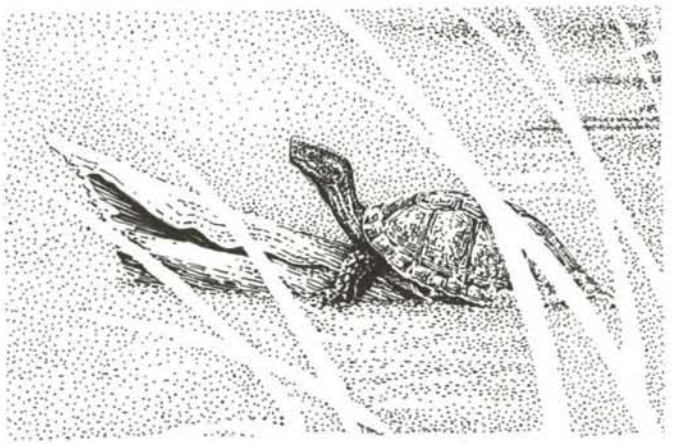
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KAY SADIGHI
The Nature Conservancy
P.O.Box 268
Sheffield, Massachusetts 01257, USA

RICHARD M. DEGRAAF
U.S. Forest Service
Northeastern Forest Experiment Station
Amherst, Massachusetts 01003, USA

and
WILLIAM R. DANIELSON
Department of Forestry & Wildlife
University of Massachusetts
Amherst, Massachusetts 01003, USA.



Clemmys marmorata (Western Pond Turtle). USA: California: Sacramento Co., Reichmuth Park, Sacramento. Illustration by Tim Manolis.

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Radio Transmitter Attachment for Turtle Telemetry

Variations in chelonian size, differences in behavior and habitat preference, and diverse research goals pose problems for fastening radio transmitters to turtles. Transmitters glued to turtles with aquarium sealant are quickly dislodged in the field; the bond from 5-minute clear epoxy deteriorates within one season (D. C. Holland, pers. comm.). Some fast-setting epoxies create a strong bond between transmitter and scute, but can emit enough heat to pose a burn hazard to underlying tissue (Renaud et al. 1993).

PC-7 (Protective Coating Co., Allentown, Pennsylvania, USA) is a slow-setting epoxy that emits no significant heat and secures material to scutes with a bond that endures for years. PC-7's viscosity will also hold a transmitter in place as it dries, and this simplifies application. Attachment with PC-7 (best started at night, so the epoxy can cure when the turtle is less active) proceeds as follows:

1) Thoroughly clean the attachment site with ethanol and a tooth brush (phenolic impurities are highly toxic to turtles [Hillyer 1993]).

2) Use thin strips of masking tape to cover all scute junctions near any area to be epoxied. Growth occurs at these boundaries and rigid adhesives (like PC-7) must not span them.

3) Lay a ring of caulking down along the perimeter of the scute to receive the transmitter. Reusable winter window caulking "rope" (FROSTKING FINGERTIP CAULK by Thermwell Products Inc.) is ideal for constructing this rim. The rim helps prevent epoxy from extruding onto neighboring scutes when the transmitter is pressed into place.

Aquatic Turtles.—For aquatic species, on which attached instruments can serve to snag and drown the turtle, the procedure continues as follows:

4) Apply epoxy within the caulk rim on the target scute and gently press the transmitter (AVM Instruments, Livermore, California, USA) into the well of epoxy. Do not apply pressure to the transmitter coils (red coiled wires) as this can detune the unit.

5) Epoxy the antenna in as wide an arc as possible just inside the marginal scutes. Trim the antenna to ensure that its arc will not constitute more than 75% closure of a circle when in its final position. A transmitter's signal is muted if the antenna's tip nears its base. To preclude snagging on underwater twigs, the unepoxied antenna segments at all scute junctions must be covered; a pliable adhesive like 5-minute epoxy should be used on these narrow interstices.

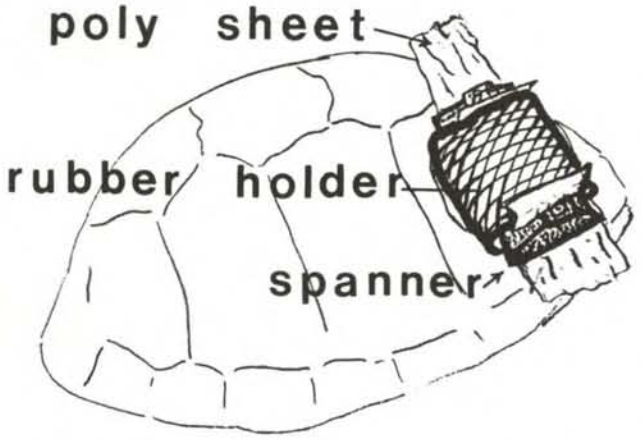


FIG. 1. Rubber holder with openings oriented laterally; plastic spanner in position.

While PC-7 provides a reliable bond that endures aquatic stress, it does make replacing transmitters difficult. Prying an old transmitter off can tear scutes bonded to the epoxy. Begin the removal process with a Dremel drill (with an emery cutting wheel), and follow the drill with a jeweler's saw to safely separate transmitter from scute. This is faster (one hour per transmitter) than using only a jeweler's saw to slice through the epoxy. An exacto knife will gently tease any epoxy residue off the scute.

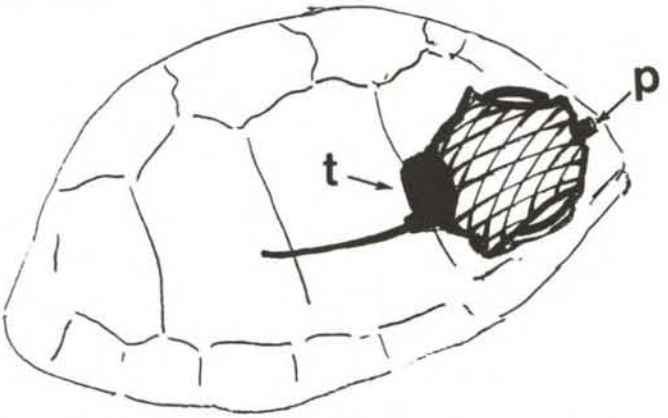


FIG. 2. Battery positioned within rubber holder; transmitter (t) projecting from posterior hole (at left) and anchoring pin (p) protruding through anterior puncture (at right).

Terrestrial Turtles.—For terrestrial turtles, our method can be adapted, after step 3, as follows:

4) Apply a thin patch of PC-7 epoxy within the putty rim on the target scute (on male box turtles, vertebral scute #2 is used; on females, pleural scute #1 is used instead, so the attached transmitter will not impede mounting by courting males). Work the epoxy into the scute's surface irregularities.

5) Cut a 3 cm length from a 1.25 inch bicycle inner tube. Make 3 to 5 holes of approximately 4 mm each in what will serve as the bottom half of this 3 cm rubber ring. The holes will allow epoxy, extruded from inside the ring in step #8, to bond the rubber holder to the expoxy on the scute.

6) Line the interior of the rubber ring's top half with tape and polyethylene to preclude its getting glued to the bottom.

7) Set a wad of epoxy on the center of a 3.5 cm x 8 cm polyethylene sheet. With its epoxy side down, slip one of the long ends of poly sheet into, and through, the rubber ring and draw the sheet into the ring until the epoxy is directly over the holes.

8) Coat a hard 3 cm x 4 cm plastic rectangle with vegetable oil so it can not adhere to epoxy. Slip this oiled plastic spanner into the narrow space above the polyethylene sheet's upper, clean surface. The space that the spanner creates between the sheet and the ring's roof further reduces the risk of gluing the ring's rubber walls together (Fig. 1). Insertion of the spanner extrudes epoxy through the holes in the bottom of the rubber ring, and out of its two ends.

9) Press the ring down, with its holes facing toward the carapace, onto the prepared scute. To ensure a strong bond, gently rotate the assembly to blend ring and scute epoxies. Orient the ring's blind ends sagittally, and its open sides laterally (Fig.1), so the antenna will emerge posteriorly in Step #11 (Fig.2).

10) After 12 h of epoxy curing, remove the plastic spanner and as much of the polyethylene and tape shielding as possible from inside the rubber ring. Cut a 1 cm hole in the posterior end of the rubber holder, and make a small puncture in its anterior end.

11) Thread the antenna, and then push the transmitter through the posterior 1 cm hole. The posterior hole's perimeter grips the

transmitter tightly. The short metal pin (built into the unit, upon request, by AVM Instruments) projecting from the end of the battery opposite the transmitter will anchor the anterior end when slipped into the puncture at the front of the rubber ring (Fig.2).

12) This secured rubber holder enables simple, fast (2 min) field replacement of transmitters. Covering the assembly with duct tape will protect the rubber from twig snags and abrasion.

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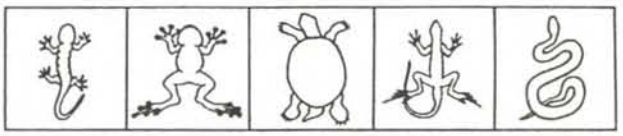
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WILLIAM R. BELZER
Biology Department
Clarion University of Pennsylvania - Venango Campus
Oil City, Pennsylvania 16301, USA

and
DEVIN A. REESE
Museum of Vertebrate Zoology
University of California
Berkeley, California 94720, USA.

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HERPETOLOGICAL HUSBANDRY

Five Year Study of Nesting of Captive *Terrapene carolina triunguis*

Very little information has been published on nesting by the three-toed box turtle, *Terrapene carolina triunguis* (Dundee and Rossman 1989). Most published information is on the nesting of other subspecies of *Terrapene carolina* (Allard 1935; Carr 1952; Congello 1978; Cross 1980; Ernst and Barbour 1972; Ewing 1933; Stuart and Mullen 1987; Tucker and Funk 1977), and much of this is anecdotal. In order to obtain more information, we conducted a study from 1990 through 1994 on the egg-laying habits of this subspecies.

Materials and Methods.—The study site was located in Morehouse Parish about 40 km N of Monroe, Louisiana, USA, (32°47'N, 91°52'W), at an elevation of 45 m. Observations were conducted within a 31 x 34 m relatively flat area surrounded by a 1.23 m high chain link fence. Seven water pools (diameter = 31 cm, depth = 7.5 cm) were placed in the ground, and numerous places to hide and brumate were available. Supplemental food was provided at least once a day. Native grasses and weeds covered most of the ground. The area also contained trees, ornamental bushes, strawberry plants and, at times, mushrooms.

The turtles came from within 10 km of the study enclosure with the exception of four that came from approximately 137 km south of the area. We obtained turtles by collecting those found on roads. When one was found, we weighed it, noted any unusual characteristics, and released it within the study area. The turtles varied considerably in their coloration and markings, and we used those differences to identify individuals. A camcorder was used to record nesting behavior.

We weighed 61 mature, healthy adult turtles. The mean (± SE here and elsewhere) body mass of the females was 456 ± 6 g (range 323–658, N = 37), and the mass of the males was 350 ± 7 g (range 276–414, N = 24).

During the study 35 females were observed; 7 for the entire five-year study, 6 for four years, 3 for three years, 3 for two years, and 8 for one year. The remaining 8 were observed for only a portion of one egg-laying season.

We attempted to record every clutch laid by watching the females each evening from early May through mid-August. Because we were unable to observe them during parts of the morning and afternoon, and because some females nested in places difficult to discover, some nests could have been missed. We patrolled the study area at about 15-minute intervals from 1600 h until dark. The area was searched again at 2200 h. When we discovered a female digging we marked the location of her nest while she was at the site. The next morning we covered the nest with a square of hardware cloth and labeled it with the turtle's identity and the date of oviposition. After about 60 days, we replaced the hardware cloth with a domed aluminum colander (diameter = 20.5 cm) so the neonates would not be trapped inside the nest. If neonates did not emerge after 80–102 days (depending on the temperature and location), we opened the nests.

Results: *Nest Site Selection.*—A female typically began searching for a nesting site after 1600 h. She searched slowly, examining the earth. Many times she paused, scratched the surface with her front feet and "smelled" where she had scratched. If the spot was acceptable, she moved forward so that her back legs were over the spot she scratched. She then began to dig a nest with her hind feet, alternating between feet. Sites were sometimes abandoned if roots or other hard objects were encountered, or if the nest cavity broke into a tunnel made by a crayfish or other animal. A hard rain storm generally caused a female to abandon a nesting site, but light rain showers did not seem to interfere. Sometimes nests were abandoned for no apparent reason.

Aggressiveness by female *T. carolina* during the nesting season was reported by Zeiller (1994). Similarly, we found that several females became aggressive and restless just prior to laying their eggs; we observed this behavior at no other time. Two females were especially aggressive toward other females that were searching for nesting sites. On several occasions they appeared to attempt to push other females from their nesting sites.

We observed, as did Pope (1939), that if a female had lost a part of a back leg, she would still try to dig with the nub. In that event the nest would not be as large as a nest dug with two back feet. Frequently the nest was not large enough for all of her eggs. In such cases, one or two eggs would be left lying on the ground near the nest.

TABLE 1. A comparison of the lengths of internesting intervals and number of clutches laid per season for three-toed box turtles in Louisiana. Mean = mean internesting interval (days) ± SE. N = total number of intervals.

Clutches per season	Mean (days)	Range	N
2	22.0 ± 6.3	16–33	5
3	20.8 ± 4.7	14–38	46
4	18.4 ± 3.1	14–25	36
5	18.9 ± 3.9	14–24	8
6	16.1 ± 3.7	12–24	10

Most females did not lay the first evening they began to search. Frequently a female began two or three nests in one evening, but left them unfinished. The following evening she would again attempt to nest. Of the 243 clutches observed, only 30% of the clutches were laid the day that the female began to search, 22% the second; 16% the third; 11% the fourth; 7% the fifth; 4% the sixth and the remaining 10% later.

There was a considerable variety in the locations and substrates that females attempted to use for nesting. Most clutches were laid in open areas that received direct sunlight during a portion of the day, but a few were laid in areas that never received sunlight and under bushes in the loose soil of flower beds. Two females attempted to dig nests on a concrete patio.

There was some variability in the way individual females dug their nests. Most carefully lifted dirt from the hole with the hind feet and laid it behind the hole; however, one female threw dirt 30 cm or more behind her. She did not continually hold her position with her front feet, but rotated some 270° around the hole as she dug. With few exceptions, excavated nest cavities were flask-shaped. The size of the nest cavities appeared to be determined by how far the female could reach with her hind legs, as she seemed to dig as long as she could reach soil and remove it from the hole.

Oviposition.—The nesting process normally took several hours to complete (Allard 1935; Carr 1952; Ernst and Barbour 1972). When the typical female had completed nest excavation, there

was a crescent-shaped pile of loose dirt behind the hole. After the nest was excavated, the female continued to put one back foot and then the other into the hole. After a short time, she fully extended her head, then retracted her neck, pulled her head into her shell, and strained to push an egg from her body. Sometimes a female appeared to have difficulty laying an egg and she strained for extended periods of time. On 24 occasions we recorded oviposition of 11 different females using a camcorder. The mean amount of time between the laying of two eggs was 203 ± 17 s (range 60–574, N = 55, median = 166 s).

Covering the Nest.—The typical female started covering her eggs about a minute after laying her last egg. She did not begin by using the dirt evacuated from the nest, but instead reached forward with her rear feet to the area near the bridge of her shell and raked grass and/or litter from the surface of the ground into the nest. After packing a mixture of soil and organic material into the egg chamber, she finished covering the nest by utilizing the soil excavated from the hole. This method explains the previously observed difference in density between the soft material surrounding the eggs and the hard-packed dirt in the "neck" of the flask-shaped nest (Zeiller 1994). The soft material around the eggs may aid in the emergence of the neonates from the nest (see below).

At times, after pulling a bit of material into the hole, the female tamped the material with the upper side of her toes. She put both feet on the material and tamped, alternating feet every 0.5 to 0.7 sec. She tamped for a variable length of time, and then returned to raking material into the hole. She alternated raking and tamping until she finished filling the nest.

Often after completion of nesting, females got into one of the water pools and sat for long periods of time, occasionally exercising her hind legs in the water. Dickson (1953) reported similar behavior.

Neonate Emergence.—The relatively soft material surrounding the eggs in the nest allowed some movement of the neonates after pipping. Movements of the neonates apparently contributed to the collapse of the cap of soil above the egg chamber, as we never found an egg chamber caved in without a live neonate inside. The collapse of the egg chamber cover frequently took place during or soon after a heavy rain.

Twins have been reported for *T. c. triunguis* (Crooks and Smith 1958) and *T. c. major* (Tucker and Funk 1976). Of 464 eggs that hatched, one egg contained twins. When the nest was opened we found one egg partly pipped. It contained both a live turtle and a dead one. The twin lived from 13 October until 22 March the following year.

Reproductive Output.—There have been conflicting reports concerning the reproductive strategy of the box turtle, many of which have been anecdotal. Iverson (1977) reported that *T. carolina* laid one clutch per year. Laying of more than one clutch per nesting season has been reported for *T. carolina* (Dickson 1953), *T. c. carolina* (Ewing 1935; Finneran 1948; Riemer 1981; Zeiller 1994), *T. c. major* (Tucker et al. 1978; Jackson 1991), and *T. c. bauri* (Dodd and Franz 1994). Ernst et al. (1994) state that two clutches per season are normal for *T. carolina* subspecies other than. *T. c. major*.

In our study the mean number of clutches per female per season was 3.31 ± 0.13 (N = 230 clutches). The mean internesting interval was 19.1 ± 0.3 days (N = 156 intervals), and the mean number of eggs per clutch was 3.40 ± 0.7 (range 1–7, N = 247 clutches; Fig. 1).

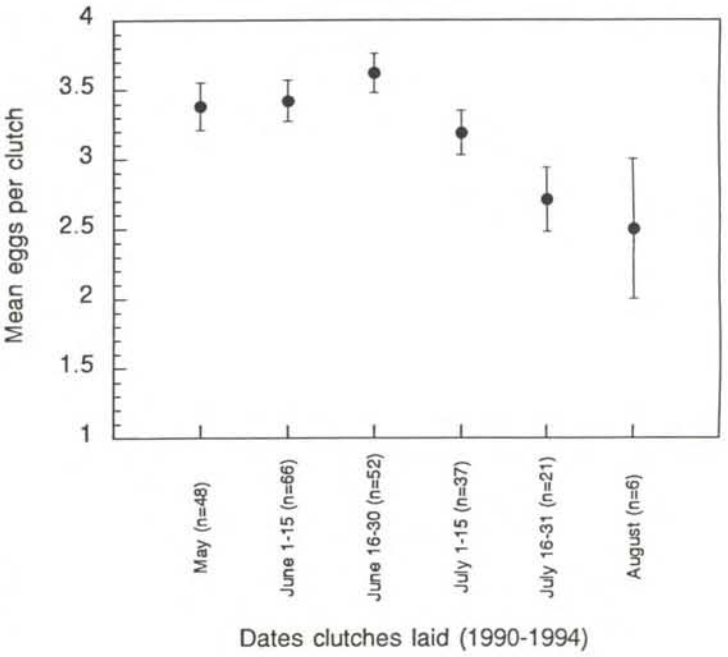


FIG. 1. The mean number of eggs per clutch varies during the nesting season. Clutch means ± 1 SE are plotted. (N) = number of clutches.

The mean weight of eggs was 9.64 ± 0.45 grams (range 8–11, N = 7). The mean egg length was 34.14 ± 0.82 mm (range 24.7–40.2, N = 21). The mean width was 20.56 ± 0.41 mm (range 17.1–24.3, N = 21). Most of the eggs measured were infertile.

The hatching success for 845 eggs was 55%. The mean weight of neonates was 7.2 ± 0.1 grams (range 4.2–9.8, N = 133). The

TABLE 2. Incubation periods and hatching success for three-toed box turtles in Louisiana varied among eggs laid during different periods in a nesting season. Mean = mean incubation period (days) ± SE. % Hatch = percent of eggs that hatched. N = number of eggs.

	Periods of Oviposition					
	May	1–15 June	16–30 June	1–15 July	16–31 July	August
Mean	91.3 ± 0.7	84.1 ± 0.6	81.4 ± 0.8	82.7 ± 0.8	78.0 ± 1.7	90.6 ± 0.2
Range	80–102	64–98	62–109	71–106	66–114	90–91
% Hatch (N)	30.6 (160)	63.4 (224)	63.8 (188)	62.8 (161)	45.7 (83)	38.5 (13)

mean neonate weight per clutch was 24.7 ± 1.4 grams (range 14.1–37.8, N = 24 clutches). These 24 clutches were laid by 16 different females.

Some females laid more clutches per season than others. Severely injured or sick turtles did not nest. The length of the nesting season, which differed from year to year, and the length of the interclutch intervals were two other factors that helped determine the number of clutches a female could lay in one season. One female twice laid 6 clutches in one season, and she and two other females laid 5 clutches in a season. The other females laid from one to four clutches in a season (Table 1).

In calculating incubation periods we considered a neonate hatched when it no longer had a visible yolk sac. We defined a nesting season as the time from the laying of the first clutch of a year through the laying of the last. All clutches were laid between 13 May and 13 August, and 71% of the clutches were laid between 1 June and 20 July.

The small size of the study area limited the variety of nesting sites and this probably influenced the length of time females searched before nesting. We attempted to protect the nests from vertebrate predators and from dehydration, and this influenced the hatching success and incubation periods.

Occasionally there were long wet periods during May. The study area was relatively flat and the soil had a high clay content. This did not promote rapid drainage and was probably an important factor in the lack of hatching success for clutches laid in May. The greater hatching success of eggs laid in June and July appeared to be due not only to the warmer weather, but also to the drier environment (Table 2).

We feel certain that confinement to the study area had no significant influence on the number of clutches laid per season, and that healthy three-toed box turtles in northeast Louisiana normally lay 3–4 clutches per nesting season.

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MARTHA ANN MESSINGER

and

GEORGE M. PATTON

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Delayed Fertilization in the Monitor Lizard *Varanus gouldii*

Delayed fertilization has been reported in a large number of squamates (Blackwell 1954; Darevsky 1971; Fitch 1970; Greer 1989; Groves 1973; Haines 1940; Joss and Minard 1985; King 1977; Philipp 1979; Wall 1905; Woodward 1933), but there has only been one suspected instance reported in varanids (Auffenburg 1981). This report describes a case of delayed fertilization in *Varanus gouldii* at the Dallas Zoo.

A pair of *V. gouldii* were observed copulating on several occasions between 2 July and 17 September 1994. On the latter date, the male was removed due to a dermal infection. Twenty-one days later, the female deposited a clutch of ten eggs. After a few weeks these eggs began to desiccate and fertility could not be determined. The same female deposited a second clutch of eight eggs 65 days after oviposition of the first clutch. After three months of incubation, a fiberoptic egg candler revealed the presence of embryos and blood vessels, confirming fertility in four of the eggs. The male had not been housed with the female after 17 September 1994. Since gestation is unknown for this species, the exact length of sperm storage cannot be determined.

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MARK DOLES

and

WINSTON CARD

Department of Herpetology
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA.

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in volume 26, number 1.

CAUDATA

AMBYSTOMA TAYLORI (Taylor's Salamander). **RECORD SIZE.** *Ambystoma taylori* is a poorly studied Mexican salamander endemic to Laguna Alchichica, one of several crater lakes (axalapazcos) in the llanos of eastern Puebla, México, located at 2345 m (97°24'00"WL, 19°24'13"NL). The maximum snout-vent length (SVL) reported for *A. taylori* is 113 mm (Brandon et al. 1981. S. California Acad. Sci. 80(3):112–125.). Herein I report a female 126 mm SVL (to the median point of the cloaca), 230 mm TL, and 76.04 g live wet weight collected 27 February 1994 at 2030 h. The specimen was found struggling in a vertical position at the surface of the lake approximately 1 m from the edge. At this point the lake is approximately 1 m in depth. The specimen (ENEPI 6035) is deposited in the herpetological collections at the Universidad Nacional Autonoma de México, Campus Iztacala. I am grateful to Julio Lemos-Espinal who read an initial draft of this note.

Submitted by **MIGUEL ANGEL SANTINELLI-RAMOS,** Fuente de Tauro #15, Lomas de Tecamachalco, Edo. de México 53950, México.

ANEIDES FERREUS (Clouded Salamander). **REPRODUCTION.** Arboreality is common among tropical plethodontid salamanders (Lynch and Wake 1976. Nat. Hist. Mus. Los Angeles Co. Sci. Bull. 25:1–65), and it is probable that many of these species nest in trees (e.g., Good and Wake 1993. Herpetol. Monogr. 6:131–159; McCranie and Wilson 1993. Herpetol. Rev. 23:115–116). However, temperate plethodontids are generally terrestrial or fossorial (but see Jaeger 1978. Copeia 4:686–691; Madigon and Shoop 1970. Science 168:1484–1487), except for some members of the genus *Aneides*. Stebbins (1951. Amphibians of Western North America. Univ. California Press, Berkeley) reported *A. lugubris* in tree cavities as high as 20 m, and also reported nesting sites in hollow trees. Van Denburgh (1916. Proc. California Acad. Sci. 4th ser. 6(7):215–221) reported *A. ferreus* 6.6 m high in a snag, and Leonard et al. (1993. Amphibians of Washington and Oregon, Seattle Audubon Society, Seattle, Washington) reported *A. ferreus* 40 m high in a snag. Dunn (1942. Copeia 1942:52), and Storm (1947. Herpetologica 4:60–62) described nests of *A. ferreus* in decaying logs; however no tree nests have been reported. During August 1988, one of us (RAW) was examining the canopy foliage of recently felled trees from a logging operation in an old-growth stand at the Yurok Experimental Forest in Del Norte Co., California, USA, for evidence of marbled murrelet (*Brachyramphus marmoratus*) nests. The forest was predominately redwood (*Sequoia sempervirens*), with western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*). The trees being harvested were 70–100 m in height, with breast height diameters of 2–3 m and first limbs >20 m above ground. On a large redwood tree RAW discovered a cluster of six salamander eggs. The egg cluster had been dislodged from a fern clump (*Polypodium* spp.) that had broken open from the impact of felling. No adult salamander was observed in attendance when the cluster was discovered. The fern was at the base of a limb

"T" (Fig. 1B). After cutting, melt both ends of the woven strip and the perimeter of the mesh material with a soldering iron to prevent unraveling and to conform the mesh material to the shape of the transmitter. Harness straps are then made from strips of clear polyurethane elastic (Stretchrite™) measuring 10 cm by 0.5 cm; polyurethane elastic is thin and lightweight, and maintains elasticity at low humidity and high temperature. Fasten the straps, positioned at about 45°, to the vertical leg of the "T" with cyanoacrylic glue (Superglue™) and a stitch of thread (Fig. 1B). The backpack harness may now be affixed to the transmitter package with dental acrylic.

Position the backpack on the lizard's neck with the antenna pointing posteriorly (Figs. 1C and 1D). Pull a strap over the shoulder of one leg and through the axilla of the other leg, and fasten it to the top of the transmitter package with a drop of superglue. Fasten the second strap in the same manner, and glue the two straps together where they cross on the venter; this will keep the package from shifting (Fig. 1D). The straps must be pulled sufficiently tight so as to remain snug when the lizard deflates its body and adpresses its ribs following release. This attachment method allows the package to sit firmly on the back of the lizard and restricts movement of neither the head nor the legs.

Total mass of the telemetry backpack (< 4 g) is about 25% of the mass of the adult *P. mcallii* (mean = 15.8 g, range 11.0–25.0 g) that we fitted with transmitters; the backpack was comparable in mass to an egg clutch for this species, about 27% of total body mass (Pianka and Parker 1975). Newly captured adults were fitted with transmitters and held in captivity for 5 to 10 d to allow them to become accustomed to the backpack in the absence of predators. In captivity the lizards resumed feeding immediately after attachment of the transmitters; in the field, released lizards also resumed normal activities (eating, mating, constructing burrows, etc.). Individuals were recaptured every 2–4 months to exchange batteries and to take body measurements without the transmitter.

Forty-five individual *P. mcallii* were outfitted in this manner from April 1990 through July 1992, for a total of 7944 lizard-days and 1172 resightings. Most individuals carried their backpacks until killed by predators or until we removed the backpack at the end of the study. All lizards in the study were permanently marked with colored beads (Fisher and Muth 1989), enabling us to differentiate "escaped" from newly-captured individuals. Few individuals slipped out of their harnesses, but the backpack was shed when the straps failed in three cases. In two of these cases, the glue joint failed; a strap broke on one backpack harness. Evidence from two other losses indicates predator assistance (puncture holes and tears in straps and acrylic).

This method of attachment can be used on other species of horned lizards as well as on species with less specialized body forms.

Acknowledgments.—We thank Victor Horchar and Tracey Weiss for assistance in the field. Barbara Kermeen (AVM) took things in stride and provided technical advice when we arrived at her office with lizards in hand. The California Department of Fish and Game provided funding (FG9268) and the University of California's Boyd Deep Canyon Desert Research Center provided logistic support.

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MARK FISHER

and

ALLAN MUTH

University of California, Riverside
Deep Canyon Desert Research Center
P.O. Box 1738
Palm Desert, California 92261-1738, USA.

HERPETOLOGICAL HUSBANDRY

A Simple Method of Mite Control

Lizards play host to a broad range of ectoparasites. In a group of San Esteban chuckwallas *(Sauromalus varius)* located at the Arizona Sonora Desert Museum, mites of the species *Hirstiella pyriformis* and *H. trombidiformes* were found to be prevalent ectoparasites. The chuckwallas were housed indoors in 76 x 76 x 40 cm wooden cages with screen fronts and windows on the sides. An incandescent heat light and 20-watt fluorescent fixtures equipped with both blacklight and Chroma 50 (GE) tubes were attached to the ceilings of the cages. Mites and their egg sacs were commonly found in the corners of the cages, adjacent to and under light fixtures, along the crevices created by the closed cage doors, and external to the cages along the stand/cage juncture as well as on the lizards. These mites migrate to lay their eggs and then to search for a host.

Historically mites have been battled on two fronts: eradication of mites on the lizard and in the cage. Topical application of such chemicals as Dri-Die (Farkas 1993; Loomis 1985), Wermectin (Farkas 1993), and alcohol require handling and restraint of the animal as well as careful application to avoid such delicate tissues as eyes and mucous membranes. Ivermectin, which may be topically applied or injected (Abrahams 1992; Nathan 1994), raises the additional risks of needle damage and improper dosages. All of these chemicals may be injurious or cause death to the animal if used improperly (Farkas 1993; Loomis 1985; Nathan 1994).

Mite control in cages is often attempted by the application of dilute bleach solutions (Nathan 1994), trichlorfon (Boyer and Boyer 1991), or Wermectin (Farkas 1993) sprays. These methods require removal of the animal and careful husbandry lest the animal, its food, or water come into contact with any of the residual chemicals. Vapona (Loomis 1985) and No-pest (Farkas 1993; Nathan 1994) strips have been placed in cages with the animals; the strips must be encapsuled to prevent animal contact and the water bowl must be removed (Farkas 1993; Loomis 1985; Nathan 1994).

With such stipulations regarding the current methods of mite control, new methods which neither require veterinary prescriptions, husbandry changes or large budgets, nor present acute toxic reactions or latent poisoning situations, need to be considered. I have developed a technique for physical removal of mites and their eggs which avoids these problems.

One-inch wide strips of masking tape were applied to the internal and external walls of the cages, usually at a horizontal orientation. Tape locations included adjacent to cage windows, doors, and along the upper cage walls and ceiling junctions out of reach of the lizards. Only the center of the tape was fixed to the cage.

This was accomplished by running a sharp object down the center of the strip, thereby leaving the edges unattached. Mites crawl up under the tape and are trapped by adhesion. Many egg sacs have also been found under the tape. The tape is changed weekly due to saturation by the mites.

Though mite prevention through proper cleaning, sterilization, and quarantine is preferable to any control method, once infestation has occured additional measures must be taken. The masking tape trap method for mite control, when used in conjunction with other proven methods, may be a beneficial tool for maintaing a healthy collection.

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PATRICIA A. MAHANEY
Department of Herpetology & Ichthyology
Arizona Sonora Desert Museum
2021 N. Kinney Road
Tucson, Arizona 85743-8918, USA.

Early Breeding in a Captive Corn Snake (*Elaphe guttata guttata*)

The pairing of a normal female and an anerythristic male corn snake, *Elaphe guttata guttata*, (both captive hatched on 13 September 1989), resulted in a clutch of ten eggs laid on 18 May 1991. Seven of the eggs in this clutch hatched between the period 29 July and 4 August 1991. A female (hatched 4 August 1991) and a male from the same clutch were subsequently housed together in a terrarium providing a temperature gradient of approximately 15–32°C. No copulation was observed, but between 15 and 26 May 1992 the female laid five eggs. Due to an acute decline in health, the female was euthanized on 29 June 1992, and a necropsy revealed an additional retained egg in the oviduct. At the time of sacrifice the female (AMB 3379, Villanova University) measured 60 cm SVL + 8 cm tail length. Two of the eggs laid in May were viable and after incubation at room temperatures (maximum 26°C) hatched on 12 and 13 August 1992.

The age at first reproduction in *E. g. guttata* is typically reported to be approximately two years (McEachern 1991; Rossi 1992). However, early breeding can occur in captives of many snake species, and reproduction in corn snakes can occur at less than one year (McEachern 1991). Documented cases of breeding before about the age of 18 months, however, are very rare. Bechtel and Bechtel (1958) reported that maturity was reached in their captive female corn snakes at about 18 months and a total length of 21–29 inches (53–74 cm). Golder (1981) reported more rapid maturation under constant controlled conditions, with oviposition by second captive generation females at an age of one year and five days and a total length of 71 cm. Pre-oviposition gestation in captive *E. guttata* has been variously reported to last from 35–37 days (Holman 1960; MacMahon 1957) to 54–68 days (Bechtel and Bechtel 1958). Assuming even the shortest period of gestation, the female that laid eggs on 12 May 1992 at an age of nine months, eleven days, would have had to mate at an age of approximately eight months. This is three months earlier than the snake reported by Golder (1981), assuming similar gestation periods, and appears to be the earliest documented successful mating by a corn snake.

Although eight months is certainly precocious, the size of the animal at the time of mating was probably only slightly less than at death (68 cm total length), reasonably close to the 75 cm minimum size for reproduction suggested by McEachern (1991), and greater than the 53 cm minimum reported by Bechtel and Bechtel (1958). This confirms the primacy of body size over chronological age in predicting sexual maturation in captive snakes.

In this instance, the very early mating of sibling corn snakes was inadvertent; the animals were maintained together on the assumption that they were too young to mate. Nonetheless, this successful reproductive event highlights potential dangers of early matings in captive snakes. Young females of relatively small size may suffer greatly from the dehydration and weight loss that accompany oviposition (McEachern 1991), may have a greater tendency to become egg-bound, or may suffer unforeseen future reproductive problems (Rossi 1992).

Acknowledgments.—We thank Charlie Klauder for the (accidental) breeding loan of AMB 3379.

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MARK T. WITWER
70 Sunhigh Drive
West Chester, Pennsylvania 19380, USA

and

AARON M. BAUER
Biology Department
Villanova University
800 Lancaster Avenue
Villanova, Pennsylvania 19085, USA.

NATURAL HISTORY NOTES

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CAUDATA

AMBYSTOMA TIGRINUM TIGRINUM. (Eastern Tiger Salamander). **REPRODUCTION** and **TWINNING.** Very few data have been recorded on the occurrence of twins in *Ambystoma tigrinum tigrinum*. Here I describe an occurrence of eggs with twin embryos and their hatching in a sample of *A. t . tigrinum* eggs collected on Long Island, New York, USA, from 1987–1993.

During repatriation of this New York State endangered species to one of its historic localities on Long Island, egg masses were transferred from six Long Island donor ponds to three ponds on the former Hudson Estate (Bishop 1941, Salamanders of New York State, New York State Mus. Bull. 324:155–173). Data were recorded on the number of eggs per clutch, and notes were taken on embryo development in the field and in aquaria.

In 1987 and 1988, three eggs with twin embryos were found (two in 1987 and one in 1988); all were from one of the donor ponds in Ridge, Suffolk County, New York (NYS Department of Environmental Conservation Endangered Species Unit site S-15). No further occurrences of twin salamanders have been observed in the total sample of 7846 eggs since 1988.

The question arises whether the eggs with twin embryos were deposited by the same female. Unfortunately this could not be determined. All three of the eggs with twins had developed into twin embryos prior to being collected from the donor pond. In each instance, the egg with twins was placed in a separate aquarium to monitor its development. The aquaria contained other loose *A. t. tigrinum* eggs in pond water from the donor pond, which was gradually replaced with pond water from the eventual release site.

While the eggs with twins were in the aquarium, data were recorded on egg and embryo dimensions and development. All measurements were taken through the aquarium glass after gently moving the egg against the glass. The diameter of the normal eggs and eggs with twins all varied from 8–10 mm.

In all cases, the twin embryos were noticeably smaller than those of single-embryo eggs. At the time of hatching, the twin embryos were 11 mm total length, whereas single embryos were 14 mm total length.

The hatching process was observed for two of the three cases of twins. After the first embryo emerged, the capsule apparently resealed, or allowed so little leakage, that the second embryo could delay its emergence. In the two observed hatchings, the delay of emergence between the first and second embryos was 12 h in the first case and 16 h in the second.

Despite the smaller size of the twin larvae, all six twin hatchlings were equally as vigorous as other newly-hatched *A. t. tigrinum* larvae. All six twins survived and were released.

I wish to thank the New York State Department of Environmental Conservation, Division of Fish and Wildlife, Endangered Species Unit and N.Y.S. D.E.C. Region 1 for their cooperation and support during this project. In particular, I would like to thank Alvin Breisch and Michael Kallaji of the Endangered Species Unit, Michael Scheibel of Region 1 D.E.C., and Norman Soule of the Cold Spring Harbor Fish Hatchery and Aquarium, for their advice and help throughout the project. I am also grateful to Alvin Breisch of the N.Y.S. D.E.C. Endangered Species Unit and Herbert C. Mills of the Nassau County Museum, for reviewing the first draft of this note.

Submitted by **ALLAN J. LINDBERG**, Nassau County Museum, 45 Sandy Hill Road, Oyster Bay Cove, New York 11771, USA.

PSEUDOEURYCEA BELLI BELLI (NCN). **PREDATION.** In July 1994, while collecting reptiles in a pine-oak forest, a *Pseudoeurycea b. belli* (MZFC-6841, 69 mm SVL, sex unknown) was regurgitated by a *Rhadinaea t. taeniata* (MZFC-6803, 485 mm SVL) at El Tapeixtle, near El Terrero, Municipality of Minatitlán, Colima, México, elevation 2310 m. The salamander's tail was broken, but the body was intact. According to Myers (1974. Bull. Amer. Mus. Nat. Hist. 153(1):220), *Pseudoeurycea b. belli* has not been recorded previously as prey for *Rhadinaea t. taeniata.* The only other prey item recorded for *R. t. taeniata* is *Anolis* sp. This record increases the number of species of *Rhadinaea* that feed on plethodontid salamanders to 11 (see Myers 1974, *op. cit.*; Mendoza-Quijano and Rendon-Rojas 1995, Herpetol. Rev. 26:40).

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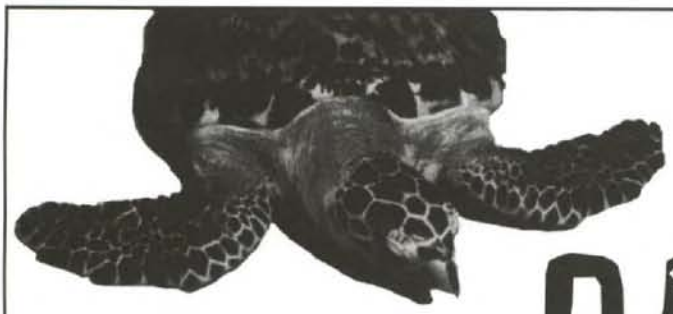
Submitted by **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, UNAM, Apdo. Post. 70-399, D.F. 04510 México, **ALICIA LOEZA-CORICHI**, Instituto Manantlán de Ecología y Biodiversidad, Universidad de Guadalajara, Nicolás Bravo #66, El Grullo, Jalisco, C.P. 48740, México, and **OSCAR FLORES-VILLELA**, Museo de Zoología, Facultad de Ciencias, UNAM, Apdo. Post. 70399, D.F. 04510 México.

ANURA

BUFO WOODHOUSII (Woodhouse's Toad). **FECUNDITY.** Anurans are noted for their ability to produce extremely large clutches. Probably the largest reported clutch is one laid by a female *Rana catesbeiana* that contained 47,840 eggs (McAuliffe 1978. Nebraska Game and Parks Report, Lincoln). North American bufonids are also noted for laying extremely large clutches. For example, 45,054 eggs for *Bufo cognatus* (Krupa 1994. J. Herpetol. 28:217–224), ca. 26,000 eggs for *B. exsul*, and ca. 18,000 eggs for *B. canorus* (Kagarise Sherman 1980. Ph.D. dissertation, Univ. Michigan, Ann Arbor), and 13,452 eggs for *B. americanus* (Kruse 1981. Herpetologica 37:228–233). To the best of my knowledge, Smith (1934. Amer. Midl. Nat., 15:377–528) reported the largest clutch for *B. woodhousii* at 25,644 eggs. Below, I report on a larger clutch for this species.

At sunset, shortly after a heavy rain on 28 May 1987, a 101 mm SVL female *B. woodhousii* was found paired to a 74 mm SVL male in a temporary pool in Norman, Cleveland Co., Oklahoma. The female had not yet begun to oviposit. The pair was gently transferred to a water-filled wading pool at the University of Oklahoma's Animal Behavior Facility. The pair remained together during the night and the female began ovipositing after midnight and was finished by 0600 h the next morning. At this time the pair was released and the eggs were preserved in a 5% formalin solution. Later, the eggs were spread out in a grid-marked pan and counted using a tally counter. The preserved clutch is currently housed at the University of Kentucky's School of Biological Sciences.

The clutch contained 28,493 eggs, which is probably the largest clutch reported for this species. However, it is likely that larger clutches are produced by this species. I have observed egg masses



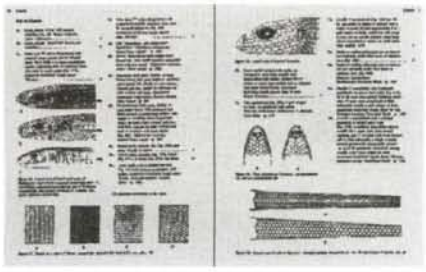
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OF NORTH CAROLINA

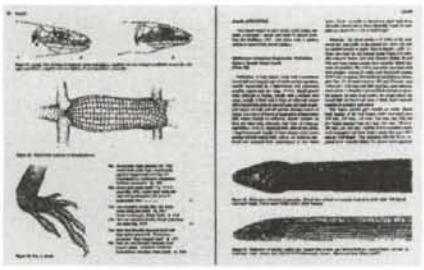
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laid by a single female *B. woodhousii* that covered a greater area than did 40,000 to 45,000-egg clutches laid by *B. cognatus* (Krupa 1994. J. Herpetol. 28:217–224). Thus, counting additional clutches will most likely reveal that *B. woodhousii* is capable of producing much larger clutches than reported here.

Submitted by **JAMES J. KRUPA**, School of Biological Sciences, University of Kentucky, Lexington, Kentucky 40506-0225, USA.

ISCHNOCNEMA QUIXENSIS (NCN). **VOCALIZATION.** The telmatobiine leptodactylid frog *Ischnocnema quixensis* is a terrestrial inhabitant of the upper Amazon Basin in southern Colombia, Ecuador, Peru, and western Brazil. Although this species is relatively abundant within its range, nearly nothing is known about its ecology (Duellman 1978. Misc. Publ. Mus. Nat. Hist. Univ. Kansas 65:1–352). Its reproductive biology is completely unknown.

During October to December 1988 at Panguana, Río Lluapichis, Amazonian Perú (9°35'S, 74°56'W, elev. ca. 250 m; see map in Toft and Duellman 1979. Herpetologica 35:71–77) we recorded two different calls of a male *I. quixensis*. Recordings were made on TDK cassette tape using a SONY-D6C tape recorder (4.8 cm/sec) and a Sennheiser microphone ME 88. Analysis were made with a Kay DSP Sonagraph 5500. Sound pressure levels were measured using an impulse sound level meter (CEL-214; flat-weighted, fast RMS mode) at a distance of 1 m from the calling male.

Male *I. quixensis* mainly call at night with a peak at sunset (1800–2000 h). The recorded male was interacting with another male 3.5 m distant. There were two types of sound signals, which occured either alone or in combination.

Call Type I (Fig. 1): Although there were no observations on female phonotaxis, we interpret this sound as an advertisement call (sensu Wells 1977. Anim. Behav. 25:666–693). It is a loud single "fueet," consisting of clear harmonics with a fundamental frequency between 1300 and 3400 Hz. The frequency range attends from 1250 to 5600 Hz. Dominant frequency is at 2560 Hz with secondary maxima at 1.6 kHz, 1.9 kHz, and 5.1 kHz. Call duration is about 310 ms.

Call Type II (Fig. 2) is a very low, snarling sound, which can sometimes be heard directly before an advertisement call. Its frequency range attends from 500 Hz to 3600 Hz. Dominant frequency is at 1500 Hz and call duration is about 200 ms.

Sound pressure level of call type I (N = 8) was 85 ± 1 dB. Call type II is audible only for a very short distance. Peak levels of this call type were not measured.

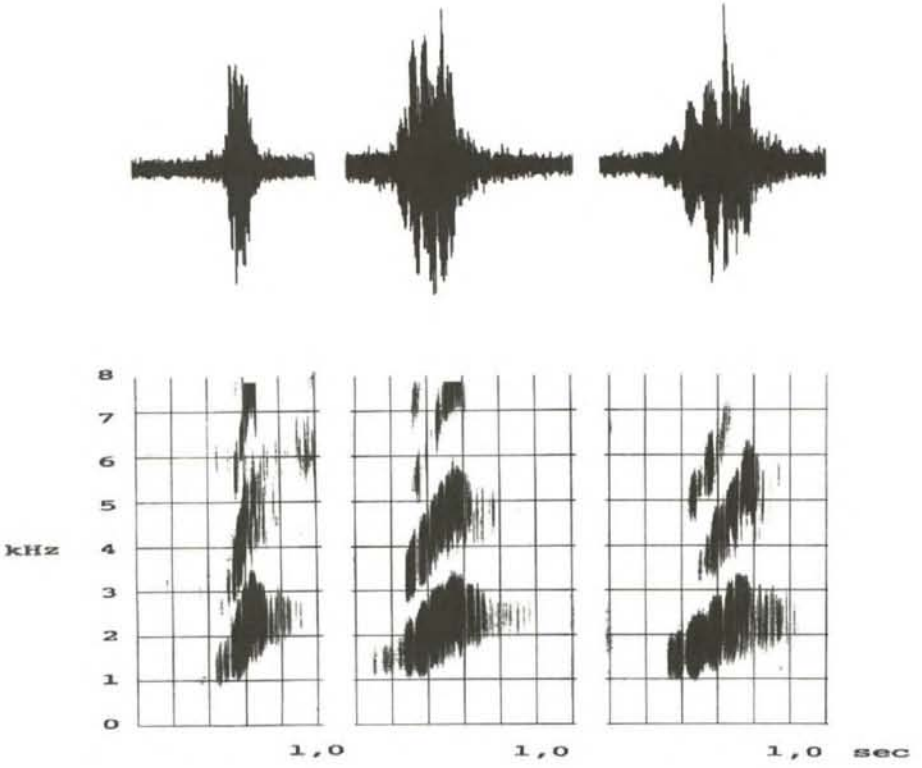


FIG. 1. Oscillograms (upper) and sonograms (lower) of advertisement calls (call type I) of *Ischnocnema quixensis*. Air temperature 27°C.

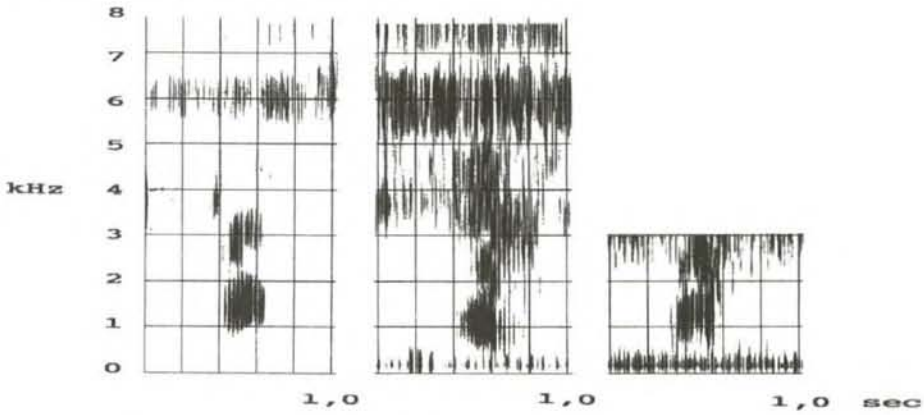


FIG. 2. Sonograms of call type II of *Ischnocnema quixensis*. Air temperature 27°C.

We thank Hans-Wilhelm Koepcke for providing the possibility to continue investigations of anuran ecology at Panguana. We are grateful to Walter Hödl for directing us in measurements of sound levels, and to Richard A. Seigel for helpful comments on our manuscript. Ing. José Purisaca, Ministerio de Agricultura, Lima, and Nelly Carrillo de Espinoza, Museo de Historia Natural, Lima, generously cooperated. Fieldwork was supported by the Deutsche Forschungsgemeinschaft, Bonn.

Submitted by **ANDREAS SCHLÜTER**, Staatliches Museum für Naturkunde, Schloss Rosenstein, Rosenstein 1, D-70191 Stuttgart, Germany, and **JAVIER ICOCHEA**, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Av. Arenales 1256, Apartado 14-0434, Lima 14, Peru.

Note added in proof: The report by Heyer and Cascon (1995. J. Herpetol. 29:304–307), concerning call characteristics of Brazilian *Ischnocnema quixensis*, appeared too recently to be considered in this report.

LACERTILIA

GERRHONOTUS OPHIURUS (NCN). **CLUTCH SIZE** and **MATERNAL CARE.** Here we present observations on clutch size and maternal care in *Gerrhonotus ophiurus*, a species distributed in southern San Luis Potosí, northern Hidalgo and Puebla, and northern and central Veracruz, México (Tihen 1948. Trans. Kansas Acad. Sci. 51(3):302–305; Smith and Taylor 1950. Bull. U.S. Nat. Mus. 199:1–253; Taylor 1953. Kansas Univ. Sci. Bull. 35(13):1587–1614; Good 1994. Herp. Monogr. 8:180–202). On 26 May 1992 we collected an adult female *G. ophiurus* (WSB-012, SVL = 128 mm, TL = 495 mm) at Xilitilla, km 259 on Mx. Hwy. 120, Municipality of Xilitla, San Luis Potosí. The elevation of the site is 740 m and the vegetation is tropical deciduous forest. The specimen was collected with a clutch of 10 eggs. The eggs varied in length and width from 20 x 12 to 20 x 15 mm (N = 9; mean = 20 x 13.5 mm; SD = 0.00 and 3.27 for length and width), and in mass from 2.5 to 3.39 (N = 9; mean = 3.09; SD = 0.81). The mass of the clutch, excluding one egg which was desiccated and not measured, was 27 g. These egg sizes are larger than those reported by Flury (1949. Herpetologica 5:65–67) for a clutch of 10 eggs of *G. liocephalis infemalis* (= *G. infernalis*).

At the time of collecting, the female did not attempt to escape and only moved her head as though searching for refuge or protection, much as noted by Greer (1967. Herpetologica 23:94–99) for a male *Diploglossus delasagra* presumably guarding eggs. The female was coiled around the clutch as described for other species of anguids (Somma 1990. Smithsonian Herpetol. Infor. Serv. 81:1–53.). Gibbons (1977. Misc. Publ. Mus. Zool. Univ. Michigan 154:1–55.) mentioned that *G. liocephalus* probably removed spoiled eggs from the nest (see also Greene and Dial 1966. Herpetologica 22:303; Fitch 1970. Univ. Kansas Misc. Pub. Nat. Hist. 52:111). We found a dry egg in the clutch which had not been removed, nor did we see signs of oophagy.

Greene and Dial (*op. cit.*) concluded that *Gerrhonotus* spp. care for their eggs, and our observations support their conclusion, because only 27 days elapsed until the eggs hatched. Presumably the female had guarded her nest for at least half of the developmental period of 42–46 days (Flury, *op. cit.*).

On 21 June 1992, all nine eggs hatched in the laboratory. The hatchlings ranged in SVL from 33–40 mm (mean = 38.3 mm), tail length from 64–75 mm (mean = 70.8 mm), and total length from 97–115 mm (mean = 109.2 mm). Hatchling color varied; three individuals showed reddish coloration and the other six were yellowish. Flury (*op. cit.*) described similar color variation for *G. liocephalis infernalis* (= *G. infernalis)* from Texas.

We thank J. W. Sites, O. Flores-Villela, H. M. Smith, and L. A. Fitzgerald for comments on drafts of this manuscript. FMQ is grateful for financial support from the Direccion General de Apoyo Personal Academico (DGAPA) project IN201789.

Submitted by **FERNANDO MENDOZA QUIJANO** and **WALTER SCHMIDT BALLARDO**, Museo de Zoologia, Fac. de Ciencias, UNAM, Apdo. Postal 70-399, México, D.F. 04510, México.

PHRYNOSOMA CORONATUM BLAINVILLII (San Diego Horned Lizard). **GROWTH**. *Phrynosoma coronatum blainvillii* were marked and released from April 1990 to October 1991 on two study sites in southern California. The first study site was located at TlS, R3W, S10 (SW 1/4) in the City of Redlands, San Bernardino Co., and the second at T4S, R4W, S24 (SW 1/4) on the University of California's Motte Rimrock Reserve, City of Perris, Riverside County. A total of eight individuals (four adults and four hatchlings) were recaptured for growth rate analysis; juveniles were not included because of a recapture rate of zero. Mean daily growth between recaptures was calculated for each individual then averaged for hatchlings and adults. All lizards were measured to the nearest 1 mm. Lizards >75 mm SVL were considered adults, those between 75 mm and 50 mm were considered juveniles, and lizards <50 mm, hatchlings.

Hatching of horned lizards occurred during a short period from late July to early August. Hatchlings ranged from 27–31 mm SVL and may have been several days old at the time of measurement. One male hatchling was recaptured twice with an increase of 0.345 and 0.200 mm/day at 13 and 15 days between measurements, respectively. Another male was recaptured once (16 days between measurements) and grew 0.375 mm/day. Two females were recaptured once, each at 13 day intervals between measurements, with one growing 0.077 mm/day and the other 0.154 mm/day. Overall mean growth of hatchlings was 0.230 mm/day (SD = 0.127; N = 5). One hatchling measured 47 mm SVL on 1 October 1990 before its first hibernation.

Juvenile growth was not calculated because no individuals were recaptured. Two juveniles, however, were captured following what was thought to be their first hibernation: a male measuring 50 mm SVL was captured in February 1991 and a female measured 66 mm SVL in May 1990.

Mean growth for adult horned lizards was 0.105 mm/day (SD = 0.165; N = 8). One male was recaptured once at 32 days between recaptures and grew 0.125 mm/day. Two other males were recaptured twice; one of these males grew 0.493 and 0.054 mm/day at 345 and 74 days, respectively, between measurements, and the other was recaptured at 230 and 55 days between measurements with no growth and growth of 0.127 mm/day, respectively. One female was recaptured three times during the study at 68, 324, and 49 days between measurements with growth (0.040 mm/day) detected only at the first recapture.

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I thank B. H. Brattstrom for his many discussions of the natural history of the San Diego horned lizard as well as his review of this manuscript. The California Department of Fish and Game kindly provided a Memorandum of Understanding (issued to BHB) to conduct research on *P. c. blainvillii*.

Submitted by **STEPHEN B. HAGER**, Department of Biological Science, California State University, Fullerton, Fullerton, California 92634, USA. Present Address: Department of Biology, New Mexico State University, Las Cruces, New Mexico 88003-0001, USA.

SCELOPORUS CHANEYI (NCN). **REPRODUCTION** and **FEEDING**. On 20 July 1992 we collected 13 adult specimens of *Sceloporus chaneyi* in a rocky *Agave* grassland and open pine forest area approximately 18 km NE San Antonio Peña Nevada, Nuevo Leon, México (23°49'N, 99°52'W). As this species belongs to the *S. scalaris* species group, which contain both oviparous and viviparous species (Sites et al. 1992. Bull. Am. Mus. Nat. Hist. 213:1–110), and the parity mode of this species was not known at the time of its description (Liner and Dixon 1992. Texas J. Sci. 44:421–427), we here report that this species is oviparous. This conclusion is based on the presence of five well-developed, shelled eggs (mean length 10.2 x 6.5 mm; SD = 0.37 x 0.30 mm; range 9.6 x 60 to 10.5 x 6.9 mm) in a gravid female (MZFC 54732, 44.6 mm SVL, 100.2 mm TL, 4.2 g). The rest of the females showed previtellogenic and vitellogenic follicles.

One of us (MEMS) examined the stomach contents of eleven of these specimens (MZFC 5473(6); BYU 45364–45365, 45393, 45399–45400). Except for a small quantity of vegetative material (1.3 % of total mass), stomach contents were composed entirely of insect remains, representing the orders Coleoptera, Diptera, Hemiptera, Homoptera, Hymenoptera, Lepidoptera, and Orthoptera. Hymenopteran remains appeared most frequently (90 out of 125 identifiable remains, with 84 of the 90 belonging to the family Formicidae), though the greatest percent of the mass was from Coleopteran remains (41.6 %), followed by Lepidoptera (31.5 %).

We thank Wesley M. Brown for reviewing this note. This work was funded by a grant (NSF-INT DEB911909) to Jack Sites, Jr. and to Direccion General de Apoyo al Personal Academico (DGAPA; project IN201789).

Submitted by **DANIEL G. MINK**, Department of Biology, University of Michigan, Ann Arbor, Michigan 48109, USA; **MARIA ELA MARTINEZ SOLIS** and **FERNANDO MENDOZA QUIJANO**, Museo de Zoologia, Facultad de Ciencias, UNAM, Apdo. Post. 70-399, D.F. 04510, México.

VARANUS PANOPTES (NCN) and ***VARANUS GOULDII*** (Sand Goanna). **DIET** and **PREDATION.** As part of a study of field metabolic rates, a number of *Varanus panoptes* and *V. gouldii* were captured, injected with isotopes, fitted with a radio transmitter and released on 9 September 1990 in Kakadu National Park, Northern Territory, Australia (12°38'S, 132°22'E). The location of the lizards was periodically checked for the next three weeks when they were to be recaptured for a blood sample. One small *V. gouldii* (mass = 370 g; the maximum mass measured for this species in this area was slightly over 2 kg) moved only a short distance during this period. This species is inactive during the dry season, and they are known to spend most of their time underground between June and October (unpubl. data). The *V. gouldii* entered a new burrow on 25 September, and it blocked the entrance of the burrow from the inside with soil; this behavior was also practiced by other individuals of this species in the dry season. The signal from the radio transmitter indicated that the lizard was approximately 1.5 m from the plugged entrance of the burrow. I routinely placed small twigs over the entrances of burrows to determine if a lizard exited between inspections of the site. This lizard remained in the burrow for 5 days. On the fifth day I visited the site and found a large *V. panoptes* standing approximately 10 m from the burrow, and the transmitter signal was being emitted from that point. The *V. panoptes* was noosed, and when the lizard opened its mouth in a threat display I saw the tip of the smaller goanna's tail. Because I wanted to recover the radio transmitter and a blood sample from the *V. gouldii*, I gently pulled the tail until I had recovered the *V. gouldii* from the *V. panoptes*.

The *V. panoptes* was weighed (3.35 kg) and released unharmed. This species can attain a mass of 7 kg in this area (unpubl. data). The *V. gouldii* represented a meal of 11% the mass of the *V. panoptes*. The dead goanna had a small external wound on the neck, but the neck also appeared to be broken. One foot was missing, and most of the muscle on that leg was stripped away. Otherwise the animal was intact.

Interestingly, inspection of the burrow revealed that, rather than opening the plugged entrance, the *V. panoptes* had dug a hole straight down at the point 1.5 m from the entrance where I had located the transmitter signal on the previous day. This fact, along with the observation that the *V. gouldii* had not left the burrow for 5 days, suggests that *V. panoptes* have keen senses—presumably chemoreception (Losos and Greene 1988. Biol. J. Linn. Soc. 35:379–407), but possibly also hearing—for the capture of prey.

Stomach analyses of varanid lizards have shown that a variety of lizards, including other varanids, are included in the diet (James et al. 1992. J. Herpetol. 26:128–136; King and Green 1979. Copeia 1979:64–70; Losos and Greene, *op. cit.*; Pianka 1970. West. Aust. Nat. 11:141–144; Pianka 1982. West. Aust. Nat. 15:1–8; Shine 1986. Herpetologica 42:346–360). In this case, previous knowledge of the individual prey animal and its burrow suggest that varanids have a formidable ability to detect and subdue their prey.

Submitted by **KEITH A. CHRISTIAN**, School of Biological Sciences, Northern Territory University, P.O. Box 40146, Casuarina, Northern Territory 0811, Australia.

SERPENTES

BOTHROPS ASPER (Nauyaca). **CANNIBALISM.** Intraspecific ophiophagy has been documented in a number of viperids (see Mitchell 1986. Cannibalism in Reptiles: A Worldwide Review. SSAR Herpetol. Circ. 15, 37 pp. for a review). In addition to several species of the genus *Bothrops* listed by Mitchell (*op. cit.*), cannibalism has been observed in *Bothrops asper.* Tryon (1985. Herpetol. Rev. 16:28) described this behavior in a neonate *B. asper* at the Knoxville Zoological Park. The following account is meant to supplement Tryon's (1985) observations by providing corroborative evidence from the field for *B. asper.*

During the course of a radiotelemetry study of *B. asper* in the Los Tuxtlas region of Veracruz, México (Buttenhoff and Vogt, unpubl. data), several juveniles of the species (N = 7, 500–700 mm TL) were examined for stomach contents and internal parasites. One specimen (female, 560 mm SVL) examined on 26 June 1993 contained two prey items. The first item ingested was a male rat, *Rattus rattus* (135 mm SVL), and the second prey item was a female *B. asper* (346 mm SVL). Both were ingested head first

and were in the early stages of digestion indicating that they had been consumed within a relatively short interval of each other. The cannibal had been killed upon collection in the field and there was no possibility that the ophiophagy occurred during postcapture handling. To our knowledge, this is the first field report of intraspecific ophiophagy for this species.

Young *B. asper* are known to consume a variety of prey including frogs (Solorzano and Cedras 1989. Herpetologica 45:444–450), lizards (Buttenhoff and Vogt, unpubl. data), small mammals, and invertebrates (Greene 1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 107–117. Selva Press, Tyler, Texas). As *B. asper* mature, an ontogenetic shift to larger mammalian prey occurs (H. Greene and D. Hardy, pers. comm.; PB and RCV, pers. obs.) and it is unlikely that cannibalistic behavior continues. Conversely, *Bothriechis schlegelii*, a species in which adults prey on frogs, lizards, and birds, in addition to small mammals, intraspecific ophiophagy has been observed in adults (Bridegam et al. 1990. Herpetol. Rev. 21:54–55).

Little is known concerning the significance of ophiophagy (inter- and intraspecific) in the Viperidae. Martins and Gordo (1993. Herpetol. Rev. 24:151–152) observed ophiophagy in young *Bothrops atrox* in Brazil and reported that snakes (not conspecifics) composed 7% of the total prey items in the specimens examined. It is possible that similar behavior exists in other taxa.

If cannibalism is common in some species, there may be selective pressures on conspecific avoidance. Avoidance of conspecific chemical cues, for example, has been documented in prairie rattlesnakes, *Crotalus virdis*, by King et al. (1983. J. Herpetol. 17:196–198). It is possible that species with ophiophagus tendencies may use pheromonal cues as a means of avoiding conspecifics and perhaps litter or clutchmates. Avoiding areas where conspecifics are present would reduce the threat of cannibalism; thus, cannibalism could influence conspecific distribution within a given microhabitat. Natural history data for many species of viperids, however, are scarce, and only when more detailed natural history information becomes available will a clearer picture of cannibalism, and its proximate and ultimate components, emerge.

We thank George Folkerts, Craig Guyer, and Mary Mendonça for making comments that improved the manuscript.

Submitted by **PAUL A. BUTTENHOFF**, Department of Zoology and Wildlife Science, Auburn University, Auburn, Alabama 36849, USA, and **RICHARD C. VOGT**, Est. de Biologia "Los Tuxtlas," UNAM, Apartado Postal 94, San Andres Tuxtla, Veracruz, México.

COLUBER CONSTRICTOR FLAVIVENTRIS (Eastern Yellow-bellied Racer). **NESTING**. While drift-fence trapping for turtles on 11 June 1994 in the Nebraska Sandhills along the northwest shore of Gimlet Lake on the Crescent Lake National Wildlife Refuge, Garden County, Nebraska (Iverson 1991. Herpetologica 47:371–393), a heavily gravid female eastern yellow-bellied racer (93.0 cm SVL; 28.5 cm tail length; 425 g) was captured along the lake side of the fence. Because she was egg-laden and leaving the meadow, we force-fed her a 12 g radiotransmitter package (LF1-STL-803, L. L. Electronics, Mahomet, Illinois 61853, USA) and released her at 1400 h RMDT across the fence to follow her to her nest site. By 2000 h she had moved 261 m northwest (325°) into the sandhills and was underground in an abandoned rodent burrow. At 1230 h the next day she was active near that burrow but was disturbed by us; by 2000 h she was in the same burrow system. The next day (13 June) at 2000 h she was in another abandoned rodent burrow in open grasslands 357 m farther north (356°) into the hills (ca. 30 m elevation above the original meadow). Some time during the next 16 h she deposited 31 eggs (mean size 29.62 x 18.78 mm, 6.17 g; clutch mass 45% of gravid body mass and ca. 77% of post-gravid body mass). The eggs were in loose, fine sand in that burrow, which was on a southwest facing hill (214°) with a ca 15° slope. Depth to the top of the eggs was 14.1 cm and to the bottom of the eggs, 18.4 cm.

At 1200 h 14 June she was active at a location 26 m southwest (233°) of the burrow where she nested. When next located (0600 h the next morning), she had moved approximately 350 m and was inactive in the same burrow system she had occupied on 12 June. By 1430 h that day (15 June) she had returned to Gimlet Lake (including crossing our drift fence) and was about 80 m out into the flooded cattail marsh at the lake's edge. At 1800 h she was located 62 m north (342°) of the lake, buried in the very warm, loose sand piled in front of a kangaroo rat burrow complex. She was then dug up for measuring and for regurgitation of the transmitter, and found to contain a fresh 50 g (55 cm total length) plains garter snake (*Thamnophis radix*) in her stomach. Including her meal and the transmitter, she weighed 322 g.

In summary, this female left what was apparently her normal home range in a meadow near the lake, migrated over 600 m up into the sandhills in 2.5 days, deposited her eggs, returned in 24 h to the lake to hunt successfully for a meal, and then retreated to one of the warmest microclimates available, apparently to facilitate digestion of that meal. Her clutch size matches the record known for the species, but clutch sizes in this population are typically higher than in other populations of this subspecies (compare Fitch 1985. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 76:33). For comparison, snout-vent length, gravid body mass, clutch size, mean egg length, width, and mass, clutch mass as a percent of gravid body mass, and clutch mass as a percent of post-gravid body mass for three other Gimlet Lake racers captured in June 1993 and held until oviposition were 78 cm, 202 g, 18, 28.67 mm, 17.32 mm, 5.15 g, 46%, 85%; 86, 236, 16, 31.90, 18.66, 6.71, 43%, 74.5%; and 101, 245, 21, 25.51, 16.80, 4.70, 40%, 67%, respectively.

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The only other study of nesting movements of racers (Brown and Parker 1976, Copeia 1976:234) was done in Utah on *Coluber constrictor mormon* and revealed that two of four gravid females made similar long movements associated with nesting.

Submitted by **JOHN B. IVERSON, HEATHER HIGGINS, ABBY G. SIRULNIK**, and **CAMERON A. YOUNG**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA.

COLUBER CONSTRICTOR (Blue Racer), ***ELAPHE VULPINA*** (Eastern Fox Snake) and ***CHELYDRA SERPENTINA*** (Snapping Turtle). **REPRODUCTION.** Intraspecific communal nesting behavior has been reported in snakes such as *Demansia psammophis, Diadophis punctatus, Opheodrys vernalis, Elaphe obsoleta, Elaphe vulpina, Coluber constrictor, Masticophis taeniatus*, and *Opheodrys aestivus* (Cook 1965. Herpetologica 20:206; Cavacevich and Limpus 1972. Herpetologica 28:208–210; Foley 1971. Herpetol. Rev. 3:41; Lawson 1983. Herpetol. Rev. 14:20; Parker and Brown 1972. Copeia 1972:892–895; Swain and Smith 1978. Herpetologica 34:175–177; Palmer and Braswell 1976. J Herpetol. 10:257–259). Occasionally, communal egg laying sites in which more than one species has laid eggs have also been reported (Brodie et al. 1969. Herpetologica 25:223–227), but these are not as common. There are no records of shared nest sites of snakes and turtles.

An investigation of nest sites of racers (*Coluber constrictor foxii*) on Pelee Island, Lake Erie, Ontario, Canada, revealed a communal nest site shared by an eastern fox snake (*Elaphe vulpina gloydi*) and a blue racer (*Coluber constrictor foxii*). A snapping turtle (*Chelydra serpentina*) nest was also found only 1.3 m from the snakes' nest. All three nests were found in a large (DBH 110 cm) decaying log lying on a beach. The log was roughly 3 m from the edge of an eastern cottonwood (*Populus deltoides*) grove and approximately 10 m from the Lake Erie beach. There was an opening (80 cm long by 10 cm high) on the east side of the log which led into a cavity lined with rotting wood and sand that had filtered into the cavity.

On 6 July 1994, a large (SVL = 1400 mm) female blue racer was located via radiotelemetry inside the decaying log, approximately 1.5 m southwest of the eastern entrance. She remained there for one day and it was assumed that she was ovipositing. After the racer left the site, we did not search for eggs because of the importance and scarcity of nesting sites.

On 7 August 1994, on a subsequent check of the log, we found four intact fox snake eggs and small pieces of others, just inside a hole that appeared to have been excavated by a predator. This hole was on the west side of the log exactly where the female blue racer was located one month earlier. The four eggs were adherent and only the middle one was free of parasitic insect larvae. Two additional viable eggs were recovered from the inner tree cavity, which was very narrow. The three viable *E. vulpina* eggs were incubated at 27°C and hatched 18–21 August 1994 (neonate SVLs = 254 mm, 213 mm and 236 mm).

On 2 and 3 September 1994, we found two neonate blue racers hiding under loose pieces of the decaying log very close to the fox snake nest. The next day, 4 September, a snapping turtle nest was located in the same rotting log, 1.3 m north of the snake nest sites. Judging by the large excavated hole leading into the nest cavity, we suspect the predator was a raccoon (*Procyon lotor*) or a grey fox (*Urocyon cinereoargenteus*). In total, remnants of 20 destroyed eggs and two partially consumed late-stage embryos were collected. The turtle clutch was slightly separated from the other clutches in the log, and it was obvious that the turtle excavated her nest, whereas the snakes laid their eggs inside the log cavity. The fact that all three clutches were laid in the same log suggests that optimal egg laying sites may not be abundant.

Much of Pelee Island is farmland (>70%) and there are many summer homes on the shoreline habitat. Normally, shoreline habitats undergo gradual erosion, which continually downs trees and provides microhabitats for ovipositional sites. However, as the natural shoreline becomes altered for human use, the number of available nesting sites for reptiles decreases. For this reason, we conclude that communal egg laying among snakes may become more common and that turtles may be forced to nest in close proximity to snake nests.

Communal nesting may reduce overall reproductive success in our population even though the sites may have optimal physical characteristics. There are two possible reasons for reduced success. First, racers, especially neonates, are cannibalistic (Liner 1949. Copeia 3:230; Fitch 1963. Univ. Kansas Publ. Mus. Nat. Hist. 15:351–468; Jackson 1971. J Herpetol. 5(3–4):196); pers. obs.). A larger number of eggs laid at a given site increases the opportunity for neonate-neonate predation. If neonate-neonate predation is a factor in the survival of aggregations of newly hatched young, then communal nesting among racers and other snakes may not optimize survival of young. Second, large aggregations of eggs may also increase the attraction of the nest to predators because of the increased odors and other cues left by the nesting adults and by the eggs. For these reasons, we suggest that separate nest sites would maximize survival of neonates. This, of course, can only be possible if alternative nest sites, each with optimum conditions (temperature, humidity and protection), are available.

Oviparity is one of the life-history traits that renders a snake species most susceptible to extirpation, and island species are more prone to extinction (Dodd 1993, *In* R. A. Seigel and J. T. Collins, eds., Snakes Ecology and Behavior, pp. 363–393. McGraw-Hill, New York). Understanding the nesting behavior and ecology of oviparous reptiles is crucial for their conservation because they are so dependent on the external environment for the successful rearing of young. Experiments designed to compare recruitment rates of neonates when nest sites are scarce vs. abundant, particularly in relation to the effects of communal nesting, would provide important information for the conservation of these island populations of oviparous reptiles.

We thank Ian Fisher and Colleen Soulliere for field assistance. Our work was funded by the Ontario Ministry of Natural Resources, Carolinian Canada, and the Endangered Species Recovery Fund of WWF, Canada.

Submitted by **BENJAMIN D. PORCHUK** and **RONALD J. BROOKS**, Department of Zoology, University of Guelph, Guelph, Ontario, Canada NlG 2Wl.

LAMPROPELTIS TRIANGULUM SMITHI. (Smith's Milk Snake). **PREY**. An adult male *Lampropeltis tnangulum smithi,* SVL = 815 mm, TL = 969 mm (MZFC 0484), was found dead on Mexican Highway 105 México-Tampico, Zacualtipán, Hidalgo, México, elevation 2100 m (no date), in pine-oak forest. This snake contained two female *Sorex saussurei* (Hall 1981. The Mammals of North America. Vol. 1, 2nd ed. John Wiley & Sons, Inc.). Measurements of the shrews were: MZFC 5420, 91 mm total length, 36 mm tail length, 5.4 mm skull length; and MZFC 5421, 89 mm total length, and 35 mm tail length. The skull of MZFC 5421 was crushed, while MZFC 5420 was intact.

The stomach contents of other *L. t. smithi* were empty (MZFC 030, 05024, 05026). The ingestion of shrews as food in *L. tnangulum* apparently is rare as Williams (1988. Systematics and Natural History of the American Milk Snake *Lampropeltis tnangulum.* Second ed. Milwaukee Public Mus. 176 pp.) registered this type of prey only for *L. t. tnangulum* (*Blarina brevicauda*) and for *L. t. abnorma* (*Cryptotis noitai*). These records are the first reports of food habits of this subspecies.

We thank H. M. Smith and L. A. Fitzgerald for comments on this manuscript and D. G. Mink for the translation into English. Logistic support was provided by the Direccion General de Apoyo al Personal Academico (DGAPA) project IN201789.

Submitted by **FERNANDO MENDOZA QUIJANO** and **HUGO A. RUIZ PINA**, Museo de Zoologia, Facultad de Ciencias, UNAM. Apdo. Post. 70-399, D.F. 04510, México.

NERODIA TAXISPILOTA (Brown Water Snake). **DIET.** *Nerodia taxispilota* feed almost exclusively on fish, primarily catfish (Ictaluridae) (Camp et al. 1980. J. Herpetol. 14:301–304; Ernst and Barbour 1989. Snakes of Eastern North America. George Mason Univ. Press, Fairfax, Virginia, 282 pp.). Food items were collected as part of a long-term study on the natural history of *N. taxispilota* in the Savannah River adjacent to the Savannah River Site (SRS), Aiken and Barnwell counties, South Carolina, and Burke Co., Georgia (for exact location, see Gibbons and Semlitsch 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. Univ. of Georgia Press, Athens, 131 pp.). Here we report two genera of fishes (*Lepisosteus* and *Morone*) not previously reported in the diet of *N. taxispilota*. On 18 June 1993 we captured a male snake (53 cm SVL) that was forced to regurgitate a partially digested gar (*Lepisosteus*; 14.2 cm standard length; 27% of the SVL of the snake). We also identified five fish of the family Moronidae (formerly Percichthyidae: temperate bass) from five snakes (date collected, sex, SVL in cm): 26 August 1991, F, 39.7; 30 August 1991, F, 40.8;13 August 1992, F, 36.0;18 August 1992, M, 34.5; 26 August 1992, M, 34.9. Two species of gar (*Lepisosteus osseus* and *L. platyrhincus*) and two species of temperate bass (*Morone saxatilis* and *M. chrysops*) inhabit the Savannah River near the SRS, but *L. platyrhincus* and *M. chrysops* are rare in this area (Bennett and McFarlane 1983. The Fishes of the Savannah River Plant: National Environmental Research Park. Savannah River Ecol. Lab., Nat. Environ. Res. Park Program, U.S. Dept. Energy, SRO-NERP-12, 152 pp.). These records are of interest because *N. taxispilota* typically feed on bottom-dwelling fishes while striped bass and gar are mid-to top-water flshes.

We thank J. W. Gibbons and J. A. Weis for reviewing the manuscript. This research was supported by contract DE-AC0976SR00-819 between the U.S. Department of Energy and the University of Georgia's Savannah River Ecology Laboratory.

Submitted by **MARK S. MILLS** and **CHRIS J. HUDSON**, Department of Zoology, University of Georgia, Athens, Georgia 30602, USA, and Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

OPHRYACUS UNDULATUS (Mexican Pit Viper). **LITTER SIZE.** Little is known about the reproductive habits of *Ophryacus undulatus* (Fitch 1970. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 52:1–247; Murphy and Mitchell 1984. Acta Zool. Path. Antverp. 78:199–214). Murphy and Mitchell reported litter sizes of 6, 8, 3, and 7 from four wild-caught females collected near Omiltemi, Guerrero, México. Additionally, Flores-Villela (*pers. comm.*) observed the birth in captivity of 8 young from a female obtained near Omiltemi on 25 February 1986.

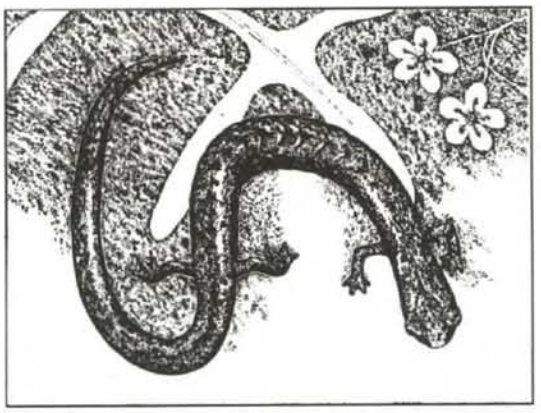
On 17 September 1990 a female *O. undulatus* from 5 km NW of Tenango de Doria, Hidalgo, México gave birth to 13 young. One was born dead and no infertile ova were found. The female (MZFC 4828) measured 600 mm SVL and 667.5 mm TL. The neonates are dark brown dorsally, except for one which is grayish, with darker brown transverse spots. Ventrally they are grayish with yellow fringes, the subcaudal surface is gray. This coloration differs from that of the juveniles of Omiltemi population (Murphy and Mitchell, *op. cit.*; Munoz-Alonso 1988. Tesis Biol. Fac. Ciencias, UNAM, 102 pp.) which exhibit scattered black dots over the entire venter; the dorsal color is smoky-gray to brownish green, with darker zig-zag stripes.

The mean size at birth of the 12 live neonates was 168 mm SVL (range = 162–177 mm, SD = 4.2 mm) and 193 mm TL (range = 187–202 mm, SD = 3.4 mm); their mean mass was 4.34 g, (range = 3.98–4.73 g, SD = 0.23 g).

This litter exceeds by 5 the maximum reported for this species, although the mean TL of the Tenango de Doria litter was considerably less than the mean TLs of the Omiltemi litters (mean TLs: 226, 234, 246, and 233; Murphy and Mitchell *op. cit.* and mean TL = 209 mm for the litter observed by Flores-Villela).

We thank Amaya Gonzalez for help in the laboratory, Oscar Flores-Villela for counsel, and H. M. Smith and Lee A. Fitzgerald for comments on the ms. FMQ acknowledges financial aid for this project through DGAPA project IN201789.

Submitted by **ENRIQUE GODINEZ CANO**, Laboratorio de Herpetología (Vivario), ENEP-Iztacala, UNAM, Los Reyes Iztacala, Edo. de México; **FERNANDO MENDOZA QUIJANO, MARIO MANCILLA MORENO** and **EFRAIN HERNANDEZ GARCIA**, Museo de Zoología, Fac. de Ciencias, UNAM, Apdo. Postal 70-399 México D. F. 04510, México.



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CAUDATA

AMBYSTOMA LATERALE x A. JEFFERSONIUM (Blue-spotted Salamander x Jefferson Salamander hybrid). USA: MINNESOTA: Cass Co: Chippewa National Forest, 47°19'N, 94°28'W. 24 August 1994. C. J. Dorff and S. P. Stucker. Bell Museum of Natural History, University of Minnesota (MMNH 13473, 13475, adult and juvenile females). Verified by James P. Bogart. State record for hybrid.

Submitted by **CAROL J. DORFF**, Minnesota County Biological Survey, Department of Natural Resources, 500 Lafayette Road, St. Paul, Minnesota 55155, USA.

AMBYSTOMA TIGRINUM MAVORTIUM (Barred Tiger Salamander). USA: TEXAS: Deaf Smith Co: Wilderado. 15 June 1966. Euvonne Honeycutt. West Texas A & M University Collection (WTAMU 1942); 2.4 km N Dawn, Wilderado Road. 28 February 1979. D. Brooks. WTAMU 5368; 6.5 km W Umbarger, Rt. 60. 8 April 1979. S. Atchley. WTAMU 5903. Hall Co: Rt. 287 at Prairie Dog Fork, Red River. 18 October 1981. Joel McKinney. WTAMU 6844, 7062, 7074–7077. Lipscomb Co: Rt. 303, 14.5 km S Rt. 15. 5 October 1981. Tam McGee. WTAMU 6902, 7165, 7924, 7955. Swisher Co: Happy. 7 June 1982. D. Brooks. WTAMU 9445, 9469; Tulia. 10 October 1982. Cindy Rogers. WTAMU 9532; 29 August–29 September 1985. Don Sewell. WTAMU 11256, 11274–8, 11507–11, 12793; 22 September 1985. Donita Sewell. WTAMU 11257–8; 29 August 1985. Lance Heitz. WTAMU 11393–4; Rt. 400, 3.25 km N Rt. 82. 16 October 1987. Dale Brodbeck. WTAMU 11098. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

AMBYSTOMA TIGRINUM TIGRINUM (Eastern Tiger Salamander). USA: NORTH CAROLINA: Cumberland Co: 12.7 km WNW Cumberland, Fort Bragg Military Reservation. 9 April 1995. J. C. Beane, C. K. Cheshire, and E. L. Hoffman. Verified by Alvin L. Braswell. NCSM 37616. Larva taken in borrow pit. First specimen voucher for county and first known breeding site for county (NCSM files). An old literature record (Brimley 1944, Amphibians and Reptiles of North Carolina. Carolina Tips Reprint 1939–1943. 63 pp.) from Wade in Cumberland County was not supported by a specimen. Confirmed breeding sites are currently known from six North Carolina counties (NCSM files).

Submitted by **JEFFREY C. BEANE**, North Carolina State Museum of Natural Sciences, Box 29555, Raleigh, North Carolina 27626-0555, USA, **ERICH L. HOFFMAN**, Fort Bragg DPWE, AFZA-PW-DS Endangered Species Branch, 18th Airborne Corps., Fort Bragg, North Carolina 28307-5000, USA, and **CHERYL K. CHESHIRE**, 10601 Old Creedmoor Road, Raleigh, North Carolina 27613, USA.

AMPHIUMA MEANS (Two-toed Amphiuma). USA: LOUISIANA: Tangipahoa Parish: Two adult males (> 33 cm total length) were captured in a roadside ditch along Highway 1064, near Milton Rd., 5 km west of Natalbany. 13 May 1995. Verified by Brian Crother. Second and third parish records; extend range 23 km S and 40 km W of known distribution (Dundee and Rossman 1989, Amphibians and reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.; Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin, Boston, Massachussetts. 450 pp.). Of 38 *Amphiuma* captured in four nights following heavy rain, 36 were *A. tridactylum* and two were *A. means*.

Submitted by **J. SEAN DOODY**, **DON R. CHURCH**, **RICHARD E. ANDERSON**, **ARMIN R. MEIER**, and **PAT J. CONNOLLY**, Department of Biological Sciences, Southeastern Louisiana University, Box 814, Hammond, Louisiana, 70402, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: MINNESOTA: Itasca Co: Chippewa National Forest, Suomi Hills Semi-Primitive Area, 47°26'N, 93°39'W. 22 August 1994. Bell Museum of Natural History, University of Minnesota (MMNH 13472). Captured in drift fence/pitfall array operated by the Minnesota County Biological Survey (Minnesota Department of Natural Resources) and the Chippewa National Forest. Verified by John J. Moriarty. New state record; extends range ca. 115 km northwest of nearest known locality in Bayfield County, Wisconsin (Vogt 1981, Natural History of Amphibians and Reptiles of Wisconsin. Publ. Milwaukee Pub. Mus. 205 pp.)

Submitted by **CAROL J. DORFF**, Minnesota County Biological Survey, Department of Natural Resources, 500 Lafayette Road, St. Paul, Minnesota 55155, USA.

PLETHODON LARSELLI (Larch Mountain Salamander). USA: WASHINGTON: Kittitas Co: NW 1/4 of NE 1/4 Sec. 14, T22N, R12E, Box Canyon, Wenatchee National Forest, 1200 m elev. 16 June 1994. Patricia A. Garvey-Darda. Verified by Kelly McAllister and William P. Leonard. Central Washington University Herpetology Collection (CWU 281, juvenile). A mature adult (CWU 282) was collected from the same locality 2 July 1994. New county record; extends the northern range for this species by a distance of approximately 95 km (Washington Department of Wildlife 1993, Status of the Larch Mountain salamander in Washington. Unpubl. Rep. Washington. Dept. Wildl., Olympia) and is the first recorded occurrence of this species or any member of the family Plethodontidae east of the Cascade crest in the state of Washington (Nussbaum et al. 1983, Amphibians and Reptiles of the Pacific Northwest. University of Idaho Press, Moscow, 332 pp.).

Submitted by **DAVID M. DARDA**, Department of Biological Sciences, Central Washington University, Ellensburg, Washington, 98926, USA, and **PATRICIA A. GARVEY-DARDA**, Cle Elum Ranger District, Wenatchee National Forest, Cle Elum, Washington, 98922, USA.

SIREN INTERMEDIA INTERMEDIA (Eastern Lesser Siren). USA: VIRGINIA: Caroline Co: Fort A. P. Hill Military Reservation, Turkey Track Creek at Thornton Road, ca. 6 km NW Bowling Green. 29 March–1 April 1994. Robert S. Hogan and Steven M. Roble. Virginia Museum of Natural History (VMNH 6761–6763). Verified by Dirk J. Stevenson. Specimens were captured in unbaited minnow traps. New county record and northern range limit (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed.

Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Only previously published records for Virginia are from Southampton County and the City of Suffolk (Padgett and Lane 1986, Herpetol. Rev. 17:49; Pague and Mitchell 1987, Virginia J. Sci. 38:304–318). Extends range limit of the species ca. 175 km NNW from the Southampton County site.

Submitted by **STEVEN M. ROBLE**, Division of Natural Heritage, Virginia Department of Conservation and Recreation, 1500 East Main Street, Suite 312, Richmond, Virginia 23219, USA.

ANURA

ACRIS CREPITANS (Northern Cricket Frog). USA: TEXAS: Childress Co: Childress. 1 September 1973. R. Butler. WTAMU 2222–3. Baylor Lake. 13 February 1987. D. Brooks, R. McKown. WTAMU 10835–6, 12691–3. Potter Co: Canadian River. 26 June 1966. J. Atkins, J. Williams. WTAMU 361, 366. Thompson Park, Amarillo. 3 October 1968. C. R. Maxwell. WTAMU 2262–71. 26 September, 1969. K. Brown, Ted Rush, Billy Roy Smith. WTAMU 123–132, 179–190, 2272–9. 10 October 1973. J. Atkins. WTAMU 2280–4. Rains Co: Lake Fork, 8 km N Emory, Rt. 814. 3 June 1985. Dan Porter. WTAMU 12796. Randall Co: Canyon. 15 August 1968. M. Hinds. WTAMU 2313. 1.92 km N Canyon, Rt. 87. 5 April 1977. Janyce Geffken. WTAMU 3014. Umbarger. 2 July 1966. Gene Newton. WTAMU 2218. Curry Canyon. 30 April 1970. D. Brooks, R. McKown. WTAMU 513–7. Palo Duro Canyon. 4 July 1966. George Baker. WTAMU 2221. 26 May 1975. M. L. Meriage. WTAMU 8086. 28 September 1977. Peggy Jones. WTAMU 3674. Cita Canyon. 22 January 1971. H. Feese, R. Wallace. WTAMU 2252–5, 2301–3. 30 January 1971. H. Feese, R. Wallace. WTAMU 2247–51, 2295–2300. 28 July 1972. B. Benson, Becky Shipman. WTAMU 2226, 2290–4. 16 September 1973. R. McKown. WTAMU 2285–9. Roberts Co: Killebrew ranch, 16.2 km E Rt. 70, N border Canadian River. 7–8 October 1977. Letti Alvarez, Suzanne Jones, Lehman, R. Scrimshire, Keith Meador. WTAMU 3647, 3672–3, 3944, 4004. All verified by Anthony I. Mazeroll. All first county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015–0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309–0218, USA.

BUFO COGNATUS (Great Plains Toad). USA: TEXAS: Cottle Co: Paducah. 3 May 1981. R. McDowell. West Texas A&M University Collection (WTAMU 7160–2, 7217). Crosby Co: White River Lake. 14 November 1987. Jill Wilson. WTAMU 11572–3. Grayson Co: Lake Texoma. 27 September 1986. R. Eccles. WTAMU 10560. Hall Co: Turkey. 22 September 1985. Jendy Townsley. WTAMU 11493. Rt. 3323, 3.2 km W Turkey. 6 October 1985. Jendy Townsley. WTAMU 11608. Martin Co: E side Rt. 31, 3.2 km S Rt. 50. 25 August 1988. T. Smith. WTAMU 14151. Roberts Co: Scrimshire farm, Rt. 282, 12.9 km W Miami. 2 September 1977. Rick Scrimshire. WTAMU 3927–8. Miami. 20 June 1966. G. Baker. WTAMU 14383. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.); extend known range eastward about 190 km in northern Texas and about 40 km southward in western Texas, excluding the Great Bend area.

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

BUFO DEBILIS (Green Toad). USA: TEXAS: Foard Co: Canal Creek. 22 August 1972. K. Conway and D. Brooks. West Texas A&M University Collection (WTAMU 2073). S Crowell. 22 August 1972. K. Conway and R. McKown. WTAMU 2072. Middle Fork, Wichita River. 23 August 1972. K. Conway and D. Brooks. WTAMU 2074–5. Hall Co: Turkey. 21 September 1985. Jendy Townsley. WTAMU 11612. Moore Co: Jones Farm, 11.2 km E Dumas. 23 September 1985. B. Loving. WTAMU 14098. Potter Co: Rt. 1061, 13.4 km mi W Rt. 60. 1 July 1970. H. Blair. WTAMU 1006. Tascosa Road. 14 July 1972. R. McKown and K. Conway. WTAMU 2077–9. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

BUFO PUNCTATUS (Red-spotted Toad). USA: CALIFORNIA: Riverside Co: Roy E. Shipley Reserve, Rawson Canyon, N 1/2 Sec. 31, T6S, R1W. 12 May 1993. Michael M. Fuller. Verified by John W. Wright. LACM 140343–345. Three males found calling at edges of rocky stream, 2200–2300 hours. Collected under authority of Reserve biologist, Bill Wagner. First coastal record for species (per review of collections LACM, MVZ, SDNHM). Mor-

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phological and biochemical data show all three vouchers are hybrids of *B. punctatus* x *B. boreas*. Specimens of putative nonhybrids of both *B. punctatus* and *B. boreas* were later located at this locality on 24 May 1993; vouchers of *B. boreas* were collected (temporarily deposited at the Biological Sciences Department, California State Polytechnic University, Pomona) but permission to collect additional *B. punctatus* was denied by the Reserve Board of Directors; however, photographs were taken to confirm presence.

Submitted by **MICHAEL M. FULLER**, Department of Zoology, University of Oklahoma, Norman, Oklahoma, 73019-0235, USA.

BUFO PUNCTATUS (Red-spotted Toad). USA: TEXAS: Potter Co: 11.3 km W Amarillo, Tascosa Road. 1972. W. Bens. WTAMU 1994. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

BUFO SPECIOSUS (Texas Toad). USA: TEXAS: Cochran Co: Morton. 25 September 1981. M. Gross. WTAMU 6804. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015–0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309–0218, USA.

BUFO VALLICEPS (Gulf Coast Toad). USA: TEXAS: Grayson Co: Lake Texoma. 5 October 1980. Herp Class. WTAMU 6394. Juniper Point, Lake Texoma. 25 September 1981. T. Childs. WTAMU 7449. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.), and a northward range extension of about 75 km.

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

BUFO WOODHOUSII (Woodhouse's Toad). USA: TEXAS: Hall Co: Turkey. 21 September 1985. Jendy Townsley. WTAMU 11606–7. 15 September 1985. Doug Setliff. WTAMU 11474–5. Rt. 3323, 3.2 km W Turkey. 22 September 1985. Jendy Townsley. WTAMU 11602. Memphis. 31 October 1979. Mary Lou Simmons. WTAMU 5970. Hidalgo Co: Rt. 681, 12 km N Rt. 490. 19 June 1970. A. White. WTAMU 900. Martin Co: Rt. 231, 3.2 km S Rt. 50. 25 August 1988. T. Smith. WTAMU 14150. Parmer Co: Rt. 2290, 8 km W Bovina. 12 September 1983. K. Rundell. WTAMU 9466. Randall Co: Canyon. 1 May 1977. Jeff Bertl. WTAMU 3458. 26 September 1985. L. D. Heitz. Amarillo. 10 July 1985. Jerry Splawn. WTAMU 14696. 7 September 1987. Jeff Whatley. WTAMU 12386–8. 18 July 1985. T. Foote. WTAMU 13577–9, 14686, 14741. 6 July 1981. R. Walsh, T. James. WTAMU 7131. 26 April 1987. Matt Craig. WTAMU 12694–8. 12 September, 8 October 1985. R. Brinkley. WTAMU 13286, 13296. Rt. 1707, 1.2 km S Rt. 1714. 26 June 1988. T. Smith. WTAMU 11700. 0.5 km E Ross. 6 September 1987. Jeff Whatley. WTAMU 12392. Sherman Co: Stratford. 16 June, 18 June, 21 July, 12 August 1985. P. Artho. WTAMU 11441, 11443–5. Pronger Ranch, 15.3 km SW Stratford. 23 September 1987. Fred Pronger. WTAMU 11170. Swisher Co: Vigo Park, Swisher. 27 November 1981. B. Dykstra. WTAMU 7282, 7284, 7286, 7288. Wheeler Co: Mobeetie. 10 September 1987. Dennis Stuart. WTAMU 10982–3. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.) and a western range extension of about 40 km at the extreme southern tip of Texas.

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

HYLA CADAVERINA (California Chorus Frog). USA: CALIFORNIA: Riverside Co: Temecula Gorge along the Santa Margarita Ecological Reserve. Lacy L. Grismer, Michael T. Hainline, Jr., and Jesse L. Grismer. Verified by L. Lee Grismer. La Sierra University Herpetological Collection (LSUHC 3000–02). On 30 April 1995, one male was heard calling at 1100 h but was not located. Several individuals were observed later that night between 1900 and 2030 h. Additional males were observed calling within the boundaries of the Santa Margarita Ecological Reserve approzimately 0.5 km to the west. All males were calling from rocks at the water's edge. Lee et al. (1973, Center Reg. Environ. Stud.) conducted a seven month herpetological survey along the Temecula Gorge within the Santa Margarita Ecological Reserve and reported that the occurence of this species was probable but not verified. Verification of this species within the Temecula Gorge and the Santa Margarita Ecological Reserve is important in that this taxon can now be incorporated into the reserve's future management plans.

Submitted by **JESSIE L. GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA, **MICHAEL T. HAINLINE, JR.**, 1298 Burris, EL Cajon, California 92021, USA, and **LACY L. GRISMER**, 28920 Vallejo Avenue, Temecula, California 92592, USA.

HYLA CINEREA (Green Treefrog). USA: TEXAS: Aransas Co: Fulton. 16 April 1992. J. Culwell. WTAMU 14473. 1.2 km N Aransas National Wildlife Refuge. 4 March 1978. Keith Meador. WTAMU 5293. 0.9 km N Aransas National Wildlife Refuge. 20 April 1990. D. Stanford. WTAMU 14029. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West TexasA&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

MELANOPHRYNISCUS RUBRIVENTRIS (NCN). BOLIVIA: COCHABAMBA: López Mendoza, 2780 m. 15 February 1990. Jaime Bosch and Ignacio De la Riva. Verified by William E. Duellman. MNK AM 923. First record for the country. Occurrence of this species in Bolivia is not surprising because there are records in northern Argentina very close to the Bolivian border (see Etzel 1988, D. Aquar. Z. Stuttgart 41:348–350). However, it was unexpected to find it at such high elevation. Other species

such as *Bufo arenarum* and *Odontophrynus americanus* show a similar distributional pattern; they occur in dry forests of northwestern Argentina and enter the Bolivian Eastern Cordillera through dry valleys to the Cochabamba region. This record extends the known distribution of *M. rubriventris* more than 500 km north.

Submitted by **IGNACIO DE LA RIVA**, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.

PSEUDACRIS CLARKII (Spotted Chorus Frog). USA: TEXAS: Potter Co: Amarillo. 9 September 1968. Natural History Class. WTAMU 2373. Randall Co: Canyon. 3 July 1966. Donita Alfred. WTAMU 369. 21 August 1987. Matt Craig. WTAMU 12703–4. 2 October 1987. Mary Gail. WTAMU 10936. 5.6 km E Claude Rt., 1.2 km S. 10 September 1987. Cindy Carnes. WTAMU 12649. Timbercreek. 20 August 1988. Matt Craig. WTAMU 12283–4. Rt. 1714, 1.2 km W Rt. 1705. 2 June 1988. T. Smith. WTAMU 14128–31. Rt. 1714, 7.9 km E Rt. 168. 13 June, 1974. M. L. Meriage. WTAMU 7559. Rt. 1714, 8.4 km E Rt. 168. 13 June 1974. M. L. Meriage. WTAMU 7527. Rt. 1541, 14 km S Rt. 217. 17 June 1974. M. L. Meriage. WTAMU 7558. Hungate Road 4.9 km E Rt. 1541. 30 July 1985. Lance D. Heitz. WTAMU 13463–4, 14624. 0.3 km E Ross, Claude Rt. 1 September 1987. Jeff Whatley. WTAMU 12398. SE Park, Amarillo. 20 September 1987. Jeff Whatley. WTAMU 11145. Rt. 87, 2.4 km S, 0.3 km E Canyon. 13 September 1987. Scott Whitaker. WTAMU 12473. 22 September 1987. Scott Whitaker. WTAMU 12474. San Saba Co: Rt. 190, 12.4 km W Rt. 16. 23 April 1977. Flavius C. Killebrew. WTAMU 3127. Swisher Co: Tulia. 17 September 1979. Beverly Parsons. WTAMU 5996. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

PSEUDACRIS STRECKERI (Strecker's Chorus Frog). USA: TEXAS: Grayson Co: Juniper Point, Lake Texoma. 17 March 1984. Jim Vines, Jay Vines. WTAMU 14304. Verified by Anthony I. Mazeroll. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

RANA BLAIRI (Plains Leopard Frog). USA: TEXAS: Deaf Smith Co: Hereford. 13 June 1966. Gene Newton. WTAMU 2654. Wilderado. 11 June 1966. Donita Alfred. WTAMU 362. Hall Co: 16.1 km N. Turkey, off Rt. 70. 20 October 1985. Jendy Townsley. WTAMU 11601,11631–2. Hansford Co: Gruver. 10 April 1971. L. McCClellan. WTAMU 1571–2. 4.9 km N Gruver. 11 April 1971. L. McClellan. WTAMU 1556, 1573. Lampasas Co: Rt. 580 4.9 km W Rt. 581. 22 km N Amarillo, on FM 354. 22 October 1977. Letti Alvarez. WTAMU 3655. All verifed by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, 434 pp.).

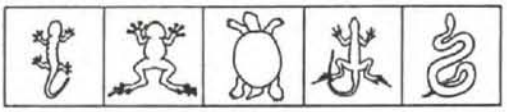
Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A & M University , Canyon, Texas 79015-0808, USA; **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

RANA CAPITO CAPITO (Carolina Gopher Frog). USA: NORTH CAROLINA: Hoke Co: 11.2 km NNW Rockfish, Fort Bragg Military Reservation. 13 March 1995. J. C. Beane, J. T. Finnegan, E. L. Hoffman, A. Schultz, and S. D. Smith. Verified by Alvin L. Braswell. NCSM 37476. One of several adults observed in borrow pit, where specimens were first discovered on 1 March 1995 by E. L. Hoffman. A second breeding pond was found ca. 0.3 km NW of this site. New county record; extends range inland ca. 23 km N and 32 km NE of nearest records in Robeson and Scotland counties, respectively (NCSM files).

Submitted by **JEFFREY C. BEANE**, North Carolina State of Natural Sciences, Box 29555, Raleigh, North Carolina 27626-0555, USA, and **ERICH L. HOFFMAN**, Fort Bragg DPWE, AFZA-PW-DS Endangered Species Branch, 18th Airborne Corps., Fort Bragg, North Carolina 28307-5000, USA.

RANA CATESBEIANA (Bullfrog). USA: TEXAS: Carson Co: 6.5 km W White Deer. 7 August 1987. John Ingle. WTAMU 12604. 12.9 km E Panhandle. 17 August 1987. John Ingle. WTAMU 12605. 22.8 km N Panhandle, 6666 ranch. 24 April 1987. Mark and Renae Haiduk. WTAMU 10545. Childress Co: Lake Childress. 19 April 1987. D. Porter, Matt Craig. WTAMU 10435. 20 April 1987. Matt Craig. WTAMU 10832. 11.3 km S Childress. 4 April 1992. Lachella Inman. WTAMU 14784 (lot of five tadpoles). Deaf Smith Co: Hereford. 4 August 1968. H. Bishop. WTAMU 2382. Donley Co: W creek, Greenbelt Reservoir. 2 November 1981. Jay Long. WTAMU 6970. 13 November 1981. Jay Long. WTAMU 6971. Gray Co: Geening Ranch, 1.2 km N Pampa. 2 May 1987. Joe Carlin. WTAMU 10149–50. Lake McClellan. 10 April 1990. T. Miller, D. Stanford. WTAMU 13800

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Address to be contacted for authors and future members:
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(tadpole). Guadalupe Co: Lake McQueeny. 20 March 1990. D. Porter, F. C. Killebrew. WTAMU 13656. Hale Co: Plainview. 17–19 May 1978. David Hughes. WTAMU 5154–8. 10 September 1977. Michael Reep. WTAMU 3863. 3 September 1977. Michael Reep. WTAMU 3862. Hansford Co: 27.6 km N Spearman. 11 August 1979. F. C. Killebrew. WTAMU 5847. 40 km N Spearman. 12 August 1978. F. C. Killebrew. WTAMU 5850. Madison Co: Rt. 21, 38 km N Bryan. 14 June 1982. Jay Long. WTAMU 8810. Potter Co: Rt. 1061, 16 km W Rt. 66. 2 June 1970. D. Stout. WTAMU 992. Thompson Park, Amarillo. 10 August 1972. Jeffrey Warren. WTAMU 2613. Tascosa road. 11 August 1972. R. Stone. WTAMU 2628. Rt. 1061, 21.2 km NW Rt. 60. 6 July 1977. F. C. Killebrew. WTAMU 3686. 3.2 km N, 1.6 km E Western St., Amarillo. 17 April 1979. WTAMU 5496–7. Mark Goodin. WTAMU 5525. Rt. 238, 8 km N Rt. 90. 11 October 1981. R. Walsh and T. James. WTAMU 7008. Swisher Co: Tulia. 11 November 1983. Cindy Rogers. WTAMU 9432. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

RANA SPHENOCEPHALA (Southern Leopard Frog). USA: TEXAS: Caldwell Co: Rt. 621, 0.8 km E Staples. 15 March 1987. Matt Craig, R. Goodwin, W. Willis. WTAMU 10702, 10797. 16 km SE Luling, nr Palmetto. 22 April 1987. S. Hanby. WTAMU 10049. Nueces Co: 6.4 km S Port Aransas, Mustang Island. 21 March 1979. L. Alvarez and David Hill. WTAMU 5456. Verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, 434 pp.), and a slight southern range extension.

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

SCAPHIOPUS COUCHII (Couch's Spadefoot). USA: TEXAS: Hutchinson Co: 26 km NE Phillips (suburb of Borger), Rt. 119 to Plemons. 20 August 1971. B. Nesbitt. West Texas A & M University Collection (WTAMU 2111–4); 3.2 km NE Fritch, Rt. 136. 15 September 1987. Francis Rogers. WTAMU 11152. Mitchell Co: Rt. 208, 9.75 km N Rt. 80. 20 April 1977. Herpetology Class. WTAMU 3329; Rt. 208, 16 km S Colorado City. 20 April 1977. Herpetology Class. WTAMU 3518. Randall Co: Rt. 87, 3.2 km N Canyon. 29 July 1970. F. C. Killebrew and Sikes. WTAMU 980–1; Rt. 1061, 32.3 km S Amarillo. 12 July 1973. C. R. Butler. WTAMU 2116; near Buffalo Lake, near Umbarger. June 1979. Jeff Berti. WTAMU 6489. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **FLAVIUS C. KILLEBREW** and **KATHLEEN B. BLAIR**, Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

SPEA BOMBIFRONS (Plains Spadefoot). USA: TEXAS: Angelina Co: Lake Sam Rayburn. 24 March 1979. R. Thornton, M. Goodin. West Texas A&M University Collection (WTAMU 6072). Childress Co: Rt. 288, 28.4 km E Childress. 22 September 1973. R. Butler. WTAMU 2181–2. Collingsworth Co: Rt. 203, 4.9 km WNW Quail. 21 April 1990. Jerry Davis, Lindsey Hooper. WTAMU 13215, 13593. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.) and a major range extension (ca. 450 km) eastward.

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A & M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: TEXAS: Crosby Co: White River Lake. 14 November 1987. Jill Wilson. West Texas A&M University Collection (WTAMU 11574–7). Dawson Co: 6th Street, Lamesa. 21 April 1990. Michelle Hogg. WTAMU 13832. Hutchinson Co: Borger. 3 April 1990. L. Keidel. WTAMU 14096. Moore Co: Rt. 354, 25 km E Rt. 385. 22 October 1977. Suzanne Jones. WTAMU 3680. Sherman Co: Rt. 807, 3.2 km S Conlon. 21 June 1985. P. Artho. WTAMU 11440. All verified by Anthony I. Mazeroll. First county records (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp.).

Submitted by **KATHLEEN B. BLAIR** and **FLAVIUS C. KILLEBREW**, Department of Biology and Geosciences, West Texas A&M University, Canyon, Texas 79015-0808, USA, and **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

TESTUDINES

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: COLORADO: Lincoln Co: Marlin Mason Ranch, 1 km N Lincoln-Crowley county line, 1.3 km E Rt. 71. 31 May 1995. Marlin Mason. Verified by Richard L. Holland. UCM photographs 98–99. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, 131 pp.).

Submitted by **BETH DE SANTIS, BRANDON SHEAFOR** and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA, and **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA.

CHRYSEMYS PICTA BELLII (Western Painted Turtle). USA: COLORADO: Crowley Co: pond at jct. Road BB and Rt. 71. 29 May 1995. H. M. Smith. Verified by Richard L. Holland. UCM 57335. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, 131 pp.).

Submitted by **HOBART M. SMITH** and **DAVID CHISZAR**, University of Colorado Museum, Boulder Colorado 80309-0218, USA.

SAURIA

CNEMIDOPHORUS INORNATUS INORNATUS (Little Striped Whiptail). MÉXICO: NUEVO LEON: 3.5 mi (5.6 km) W Aramberri, 4700 ft. (1433 m). 20 July 1975. Ernest A. Liner, Richard M. Johnson, and Allan H. Chaney. TCWC 51816–24 (formerly EAL 4058). Verified by James R. Dixon. Wright and Lowe [1993. J. Arizona-Nevada Acad. Sci. 27(1):129–157] mapped the

various subspecies, and showed no records for this area, which is located ca. 80 mi (129) km to the SE of their mapped distribution.

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA, and **ALLAN H. CHANEY**, Department of Biology, Texas A&M University at Kingsville, Texas 78363, USA.

CNEMIDOPHORUS INORNATUS PAULULUS (Mexican Little Striped Whiptail). MÉXICO: NUEVO LEON: 4.5 mi (7.2 km) N Mier y Noriega at Rancho San Roberto, 6800 ft. (2073 m). 20 July 1974. Ernest A. Liner, Richard M. Johnson, and Allan H. Chaney. EAL 3828. Verified by James R. Dixon. Wright and Lowe [1993. J. Arizona-Nevada Acad. Sci. 27(1):129–157] mapped the various subspecies, and showed no records for Nuevo Leon; this record is ca. 70 mi (112.6 km) to the NE in the extreme southern part of the state, and ca. 46.6 mi (75 km) to the SW of the southern record of *Cnemidophorus i. inornatus*.

Submitted by **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA, and **ALLAN H. CHANEY**, Department of Biology, Texas A&M University at Kingsville, Kingsville, Texas 78363, USA.

CNEMIDOPHORUS INORNATUS PAULULUS (Mexican Little Striped Whiptail). MÉXICO: SAN LUIS POTOSÍ: 9.2 mi (14.8 km) E Santo Domingo at La Presca de Guadalupe on México 80, 3900 ft. (1189 m). 18 July 1976. Ernest A. Liner, Richard M. Johnson, and Allan H. Chaney. EAL 4205 (3 specimens). Verified by James R. Dixon. Wright and Lowe's [1993. J. Arizona-Nevada Acad. Sci. 27(1):129–157] map of the subspecies is ca. 70 mi (112.6 km) to the W of this record.

Submitted by **ALLAN H. CHANEY**, Department of Biology, Texas A&M University at Kingsville, Kingsville Texas 78363, USA, and **ERNEST A. LINER**, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA.

ELGARIA KINGII (Madrean Alligator Lizard). USA: NEW MEXICO: Doña Ana Co: 17 km S Hatch in Choases Canyon, Sierra de Las Uva. May 1994. Donovan Wagner. Verified by Paul W. Hyder. NMSU 6952. First record for the Sierra de Las Uvas (Stebbins 1985, A Field Guide To Western Reptiles and Amphibians, Houghton Mifflin Co., Boston, Massachusetts. 336 pp.) and the third for Doña Ana County (Knight and Duerre 1987, Southwest. Nat. 32:283–285).

Submitted by **DONOVAN WAGNER** and **JAVIER F. GURROLA**, Department of Biology, New Mexico State University, Las Cruces, New Mexico 88003-30001, USA.

EUMECES LATICEPS (Broadhead Skink). USA: LOUISIANA: Evangeline Parish: 2.4 km W jct. Rt. 29 & Rt. 104 on Bayou des Cannes, 30°37'58"N, 92°18'48"W. 16 April 1995. A. E. Landreneau. Verified by James E. Cordes. University of Arkansas Department of Zoology Museum (UADZ 5451–52). New parish record and range extension. An indeterminate record already exists for the boundary between Evangeline and Rapides Parishes in the vicinity of Cocodrie Lake (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rogue. 300 pp.). Our record verifies the parish occurrence of this species, filling the hiatus between Rapides, St. Laundry, and Acadia Parishes, and extends the range to southern Evangeline Parish.

Submitted by **HARLAND D. GUILLORY** and **AMY E. LANDRENEAU**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: LOUISIANA: St. Landry Parish: 3.5 km E jct. US Rt. 190 & Rt.13, 30°29'37"N, 92°22'42"W. 5 May 1995. R. P. Hatler. Verified by James E. Cordes. University of Arkansas Department of Zoology Museum (UADZ 5453). New parish record (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge. 300 pp.).

Submitted by **MALCOLM F. VIDRINE** and **RYAN P. HATLER**, Division of Sciences, Louisiana State Unversity at Eunice, Eunice, Louisiana 70535, USA.

HOMONOTA BORELLI (Neotropical Gecko). ARGENTINA: SALTA: Ciudad (24°47'S, 65°25'W). 12 June 1994. E. Richard. Fundación Miguel Lillo (FML 3180). Verified by Raymond F. Laurent. Species was first recorded from Salta province by Peracca (1897, Boll. Mus. Zool. Anat. Com., Univ. Torino, 12(274):1–19) but Cei (1993. Mus. Reg. di Sci. Nat. Torino, Monog. XIV:952 pp. inter alli) gave no precise records for this province. Another paper (Cruz et al. 1992. Acta Zool. lilloana, 42(1):101–107) indicated this species as occurring in Anta Department. Our records confirm Salta Ciudad as the type locality for this species.

Submitted by **ENRIQUE RICHARD** and **VIRGINIA ABDALA**, Instituto de Herpetología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 - Tucumán, República Argentina.

PODARCIS ERHARDII (Erhard's Wall Lizard). GREECE: Pori and Lagouvardos islets south of Peloponnese (35°58'E, 23°14'N and 35°58'E, 23°12'N, respectively). 20 January 1992. E. D. Valakos, P. Maragou, and M. Mylonas. Verified by B. Chondropoulos. Museum of Natural History, University of Crete, Greece, MNHUC E1–E15 (Pori) and MNHUC E43–E44 (Lagouvardos). First records of the species for both islands. Although the commonest lizard in the Aegean, this species is absent from the surrounding areas of South Peloponnese and the neighboring bigger islands of Kithira and Antikithira (Gruber 1986, Handbuch der Reptilien und Amphibien Europas, W. Boehme (ed.), AULA-Verlag Wiebaden).

Submitted by **EFSTRATIOS D. VALAKOS** and **PANAGIOTA MARAGOU**, Department of Biology, Section Ecology and Taxonomy, University of Athens, GR-157 71 Panepistimioupolis, Athens, Greece, and **MOYSIS MYLONAS**, Department of Biology, P. O. Box 1470, University of Crete, GR-711 10 Iraklio, Greece.

SCELOPORUS SCALARIS (Bunch Grass Lizard). USA: ARIZONA: Cochise Co: Coronado National Forest, Whetstone Mountains, French Joe Canyon, ca. 5450 ft (1660 m) elev., SW 1/4 Sec. 3, T19S, R19E. 14 April 1995. J. M. Howland and J. M. Whittinghill-Howland. Adult male. Verified by Jack W. Sites, Jr. BYU 45508. Only specimen known from Whetstone Mountains; partially fills gap in known range between nearest records—17 km W Empire Valley, ca. 20 km S Babocomari Valley, and ca. 38 km E Dragoon Mountains.

Submitted by **JEFFERY M. HOWLAND**, Nongame Branch, Arizone Game and Fish Department, 2221 West Greenway Road, Phoenix, Arizona 85023, USA, and **JAN M. WHITTINGHILL-HOWLAND**, 4925 West Grandview Road, Glendale, Arizona 85306, USA.

SCELOPORUS SMITHI (Smith's Rosebelly Lizard). MÉXICO: CHIAPAS: Municipality of Arriaga, 2 km SW of Arriaga (latter town 16°13'51"N, 93°52'53"W), 150 m elev. 1 August 1993. Fernando Mendoza and Alfonzo Delgadillo. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México

(MZFC 5965, two females, 51 and 40 mm SVL respectively). Verified by Adrian Nieto Montes de Oca. Found on large granite boulders in the same habitat that other populations occupy in coastal Oaxaca. First record for the state; an apparent confirmation of the presence of this taxon ESE of Tapanatepec, Oaxaca, where Smith et al. [1993 Bull. Maryland Herp. Soc. 29(3):94] reported a possible hybrid between *S. smithi* and *S. v. variabilis*, although the specimen was referred to the latter taxon. The present specimen agrees in most repects with the characteristic scalation, coloration, and pattern of *S. smithi*.

Submitted by **FERNANDO MENDOZA QUIJANO, MA. ELA MARTINEZ SOLIS**, Museo de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México, and **HOBART M. SMITH**, Department of Environmental, Populational, and Organismic Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

SERPENTES

AFRONATRIX ANOSCOPUS (African Brown Water Snake). SENEGAL: SENEGAL ORIENTAL REGION: Bandafassi (12°32'N, 12°18W). 15 February 1994. Yero Keita. Verified by Ivan Ineich. Museum National d'Histoire Naturelle at Paris (MNHN 1995.4173). First record for Senegal; extends to the NW the previous known range (Guinea to Cameroun) (Villiers 1975, Les Serpents de l'Ouest Africain. Institut Fondamental d'Afrique Noire, Initiations et Etudes Africaines, n°2. 3e edition. Dakar. 195 pp).

Submitted by **JEAN-FRANCOIS TRAPE** and **YOUSSOUPH MANE**, Laboratoire de Paludologie, ORSTOM, P. O. Box 1386, Dakar, Sénégal.

BOTHROPS LEUCURUS (White-tailed Lancehead). BRAZIL: ALAGOAS: Usina Seresta, São Miguel dos Campos (9°47'S, 36°05'W). 10 April 1984. Décio Morais. MNRJ 3978; BAHIA: Fazenda Mata Nova, 8 km south to São Roque do Pataguaçu (12°51'S, 38°51'W). 15 June 1991. Valéria P. Firme. MNRJ 4445; CEARA: Floresta Nacional do Araripe, Crato (7°14'S, 39°23'W). 27 January 1990. MNRJ 3942. February 1990. MNRJ 3943. Both collected by Dante Teixeira; SERGIPE: Fazenda Capivara, Brejo Grande (10°26'S, 36°28'W). 25 May 1991. Carlos Caetano. MNRJ 4443–4444. All verified by Ulisses Carasmachi, Museu Nacional do Rio de Janeiro (MNRJ). *Bothrops leucurus* is known only from Salvador (type-locality) and Feira de Santana, Bahia, in northeastern Brazil. In addition, there is an unsubstantiated record from Sergipe (Campbell and Lamar 1989, The Venomous Reptiles of Latin America. Cornell Univ. Press, New York. 425 pp.). These records confirm the presence of this species in Sergipe and add it to the states of Alagoas and Ceará.

Submitted by **MARCOVAN PORTO**, Departamento do Zoologia, Instituto de Biociências, Universidade de São Paulo, P. O. Box 11294, Brazil, Brazil CEP: 051422-970, and **DANTE MARTINS TEIXEIRA**, Departmento de Vertebrados, Museu Nacional/UFRJ, Rio de Janeiro, Brazil, Brazil CEP: 20940-040.

COLUBER CONSTRICTOR MORMON (Western Yellowbelly Racer). USA: COLORADO: La Plata Co: near Bondad. 5 May 1984. Sonya Webb. Verified by Richard L. Holland. UCM 57327. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, 131 pp.); major range extension of some 150 km southward into the upper San Juan River drainage, not far from New Mexico.

Submitted by **PRESTON H. SOMERS**, Department of Biology, Fort Lewis College, Durango, Colorado 80301, USA, **LAUREN J. LIVO**, 1215 South Osceola, Denver, Colorado 80219, USA, **REBBECA R. J. SMITH**, 2632 Taft Street, Lakewood, Colorado 80215, USA, and **DAVID CHISZAR** and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

CROTALUS VIRIDIS (Western Rattlesnake). USA: COLORADO: Dolores Co: vicinity of Cahone/Dove Creek landfill, M road, 1.6 km E jct. Rt. 666, 6.4 km S Dove Creek. About 1991. Colleen Quinn. Verified by Richard L. Holland. UCM 57326 (rattle only). First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, 131 pp.).

Submitted by **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA; **LAUREN J. LIVO**, 1215 South Osceola, Denver, Colorado 80219, USA; **REBECCA R. J. SMITH**, 2632 Taft Street, Denver, Colorado 80215, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

GRAYIA THOLLONI (Thollon's Water Snake). SENEGAL: SINE-SALOUM: Keur Bakar Mané, banks of Djikoye Stream (13°38'N, 16°16'W). 7 September 1990. Babacar N'Dao. Verified by Ivan Ineich. Museum National d'Histoire Naturelle at Paris (MNHN 1995.4172). First record for Senegal. In West Africa, this species was known only from a single specimen from The Gambia, Kotu stream, S of Bathurst, and from a series of specimens from Nigeria (Hughes 1983, Bonn. Zool. Beitr. 34:311–356; Dunger 1972, Nigerian Field 37:21–38). This second specimen from the westernmost part of Africa confirms its presence and extends its range some 3000 km further W than previously known. Djikoye Stream is situated 46 km NE of Kotu Stream; they are separated by the mouth of The Gambia River, which is saline for more than 150 km inland, and by the mangrove swamps associated with this river and its tributaries.

Submitted by **JEAN-FRANCOIS TRAPE** and **YOUSSOUPH MANE**, Laboratoire de Paludologie, ORSTOM, P. O. Box 1386, Dakar, Sénégal.

LEPTOPHIS MEXICANUS SEPTENTRIONALIS (Tamaulipan Parrot Snake). MÉXICO: SAN LUIS POTOSÍ: Municipality of Cuidad Valles, Gustavo Garmedia (15 km N Ciudad Valles). 25 October 1992. Walter Schmidt B. Verified by F. Mendoza-Quijano. Museo de Zoologia, Facultad de Ciencias, UNAM (MZFC-05396). Juvenile specimen; agrees with subspecific characters given in a key by Henderson [1976, J. Herpetol. 10(4):329–331]. First State record and second for the subspecies; extends range 114 km airline from the closest known locality at Tampico, Tamaulipas, although some museum specimens reported for this state as *L. m. mexicanus* before the description of this subspecies by Mertens (1972 Senckenbergiana Biol. 53(5–6):341–341) might be *L. m. septentrionalis*.

Submitted by **MARIO MANCILLA MORENO** and **WALTER SCHMIDT BALLARDO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

NAJA KAOUTHIA (Monocled Cobra). THAILAND: LOEI PROVINCE: Amphoe Phu Rua, 2 km from the village Ban Na No and 5 km from the Phu Luang Wildlife Research Center, 700 m elev. 4 September 1992. Tany Chan-ard. Verified by Wolfgang

Wuster. Thailand National Research Council, Bangkok (TNRC 52-3886). New record for Loei Province (Taylor 1965, Univ. Kansas Sci. Bull. Vol. 45, No. 9, p. 949).

Submitted by **MEREL J. COX**, 695/17 Pracharaj Road, Soi Pracharaj 19, Bangsue, Bangkok 10800, Thailand.

NINIA SEBAE SEBAE (Common Redback Coffee Snake). MÉXICO: CAMPECHE: Municipality of Ciudad del Carmen, 2 km E Escarcega. 11 October 1993. Mario Mancilla Moreno. Verifiifed by Fernando Mendoza Quijano. Museo de Zoologia, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC-06181). One adult male. First state record; extends known range 178 km NE of nearest record at Palenque, Chiapas [Smith 1943, Proc. U.S. Nat. Mus. 93(3169):393–504] and is about 40 km S of Chuina, Campeche, the southern locality for *Ninia s. morleyi*, the other subspecies recorded from the Yucatán Peninsula. The presence of both races in close proximity in this region shows a need for further study of variation in this species.

Submitted by **MARIO MANCILLA MORENO** and **ALEJANDRA RENDON ROJAS**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70–399, México, Distrito Federal 04510, México.

OPISTHOTROPHIS BOONSONGI (Boonsong's Stream Snake). THAILAND: LOEI PROVINCE: Amphoe Phu Rua. Two specimens captured at night in Nam San Noi Stream, 700 m elev. 26 April and 8 May 1993. Tanya Chan-ard. Both verified by Edmond V. Malnate. Thailand National Research Council, Bangkok (TNRC 52-3884 and TNRC 52-3885). Second and third specimens of this species on record; holotype was discovered approximately 40 km W of the site of capture of these two specimens (Taylor and Elbel 1958, Univ. Kansas Sci. Bull. Vol. 38, Pt. 2, No. 13, p. 1156).

Submitted by **MEREL J. COX**, 695/17 Pracharaj Road, Soi Pracharaj 19, Bangsue, Bangkok 10800, Thailand.

OVOPHIS TONKINENSIS (Tonkin Pitviper). PEOPLE'S REPUBLIC OF CHINA: HAINAN PROVINCE: Lingshui County, Diaoluo Mount (Diaoluo shan), stream in the Mengshui forest exploitation. 29 April 1983. Fu Boliang. Verified by Cen Jianqiang. Shanghai Museum of Natural History (SMNH 4096). First record for China; previously known only from northern Vietnam. Also, first record for Hainan Island of a member of the *Ovophis monticola* group (Zhao 1991, Herpetofauna and zoogeography of Hainan Island. *In* Zhao (ed.), pp. 354–363. From Water Onto Land. China Forestry Publ. House, Beijing; Zhao and Adler 1993, Herpetology of China. SSAR Contrib. Herpetol. 10:1–522). Although this snake is closely allied to the Chinese *Ovophis monticola makazayazaya* (sensu Zhao and Adler 1993), differences in scalation warrant a specific distinction (David, unpubl. data).

Submitted by **PATRICK DAVID**, Muséum National d'Histoire Naturelle, Laboratoire de Zoologie (Reptiles & Amphibians), 25 Rue Cuvier, F-75005 Paris, France.

THAMNOPHIS SAURITUS (Eastern Ribbon Snake). USA: ILLINOIS: Johnson Co: Thorne Pond, 2.1 km NE Belknap, SW Sec. 31, T13S, R3E. 2 June and 16 June 1988. R. A. Brandon, S. R. Ballard, and R. Weck. Photo vouchers, Southern Illinois University at Carbondale (SIUC R–2843, 2 animals, and SIUC R–2844); 5 August 1988. R. A. Brandon, S. R. Ballard, and J. Neth. Photo voucher (SIUC R–2845) and 4 offspring stillborn in captivity (SIUC R–2091–2094); near Heron Pond Nature Preserve. 14 November 1988. M. Hutchison. SIUC R–2158; 12 July 1986. D. Hutchison and R. Hutchison. INHS 10756. SE 1/4 NE 1/4 Sec. 31, T13S, R3E. 21 April 1995. E. O. Moll. Photo voucher (SIUC R–2846). First records for county. Massac Co: Mermet Lake. 20 July 1963. L. C. Richardson. SIUC R–364; 20 July 1963. J. Henderson. SIUC R–356. Round Lake, Mermet Lake Conservation Area. 17 July 1963. F. Robinson. UIMNH 56497–56498. Mermet Lake Conservation Area. 25 April 1991. A. Gerard. Photo Voucher (SIUC R–2849). First records for county; all but last specimen previously identified as *Thamnophis proximus*. Pope Co: 1.6 km W New Liberty. 17 June 1989. S. Karsen. SIUC R–2173. First record for county. Pulaski Co: 2 km S Perks. T. Fink. 25 April 1989. SIUC R–2167. Post Creek Cutoff at Route 169, E of Karnak. 5 August 1988. R. A. Brandon and S. R. Ballard. Photo voucher (SIUC R–2848); near juntion of Limekiln Slough and Cache River, NW Sec. 21, T14S, R1E. 9 May 1992. A. Gerard. 8-mm video voucher SIUC R–2847. First records for county. This state endangered species previously was known in Illinois only from seven specimens collected in or near the Wabash Border Division of Richland and Wabash counties before 1900 (Morris and Smith 1981, pp. 21–33 *In* Endangered and Threatened Species of Illinois. Illinois Dept. Conserv.; Rossman 1962, Copeia 1962:741–748; Rossman 1963, Florida St. Mus. Bull. 7:99–178; Rossman 1970, *Thamnophis sauritus*. Cat. Amer. Amph. Rept. 99.1–99.2), and an undocumented sight record from western Lawrence County (Thurow and Sliwinski, Chicago Herpetol. Soc. Bull. 26:129–132). These new records confirm the continuing presence of this species in Illinois some 150 km farther south in the Cache Biver and Ohio River drainages south of the Shawnee Hills.

Submitted by **RONALD A. BRANDON**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901-6501, USA, and **SCOTT R. BALLARD**, Illinois Department of Natural Resources, Division of Natural Heritage, 4521 Alton Commerce Parkway, Alton, Illinois 62002, USA.

TRIMORPHODON BISCUTATUS (Lyre Snake). MÉXICO: BAJA CALIFORNIA SUR: Isla San José, Gulf of California, NE portion of island in Arroyo Palmita Sola (25°03'15"N, 100°39'50"). 16 October 1994. Clark R. Mahrdt. Verified by Brad D. Hollingsworth. LACM PC 1267 adult male. Species has also been reported from the Gulf of California islands of Cerralvo, Danzante, San Marcos, and Tiburon (Murphy and Ottley 1984, Ann. Carnegie Mus. Nat. Hist. 53:207–230; Ramirez 1989, Herpetol. Rev. 20:76); represents the first record for Isla San José.

Submitted by **CLARK R. MAHRDT**, Southwest Biological Associates, 9847 Willow Lane, Escondido, California 92029, USA, and **L. LEE GRISMER**, Department of Biology, La Sierra University, Riverside, California 92515-8247, USA.

VIRGINIA VALERIAE (Smooth Earth Snake). USA: TENNESSEE: Rutherford Co: cedar glade located along N border of Fall Creek Road (36°00'42"N, 86°26'18"W). 21 April 1995. B. T. Miller. Verified by J. L. Miller. Middle Tennessee State University (MTSU 104-S.) New county record; extends the known distribution into the Inner Central Basin of middle Tennessee and decreases the width of the hiatus separating *V. v. valeriae* and *V. v. elegans* (Powell et al. 1992, Cat. Amer. Amph. Rept. 552.1–552.6).

Submitted by **BRIAN T. MILLER**. Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

Confirmation of a Range Extension for the Pine Woods Snake (*Rhadinaea flavilata*)

The range of *Rhadinaea flavilata*, the pine woods snake, is restricted primarily to disjunct areas along the coasts of North Carolina to eastern Louisiana, including most of Florida (Conant and Collins 1991; Myers 1967). One anomaly in this distribution, from Aiken County, South Carolina, extended the range 150 km from the coastline and 145 km from the closest previous record (Young 1988, as shown in Conant and Collins 1991). This observation was based on a single specimen collected in 1987. Here we confirm that range extension with the addition of nine new individuals of *Rhadinaea flavilata* captured between 1987–1994.

Specimens of *Rhadinaea flavilata* were captured during routine surveys on the Department of Energy's Savannah River Site (SRS) by researchers from the Savannah River Ecology Laboratory (SREL). All snakes were captured by lifting woody debris and cover boards or checking pitfall traps (Gibbons and Semlitsch 1991); individuals were then returned to the laboratory for measurement (SVL, tail length, and in most cases, mass). All individuals were released because of the rarity of this species and the ongoing monitoring of SRS herpetofaunal diversity by SREL researchers.

TABLE 1. Captures of *Rhadinaea flavilata* on the Savannah River Site.

Site	Date	Method[1]	Sex[2]	SVL[3]	Tail[3]	Mass[4]
Dry Bay	9 May 87	L	M	23.4	9.5	5.60
Dry Bay	28 Sept 87	P	M	23.5	3.3	6.14
Bay 11	25 Oct 87	P	M	22.1	7.9	5.58
Bay 11	27 Oct 87	P	M	23.1	10.1	6.62
Dry Bay	27 Oct 87	L	M	23.4	9.5	—
Big Squirrel Bay	1 May 88	L	J	9.9	3.8	0.80
Dry Bay	15 June 88	P	F	22.4	9.3	4.96
Dry Bay	25 May 89	B	J	12.6	5.1	1.28
Dry Bay	26 May 94	B	M?	14.3	5.1	2.02
Dry Bay	11 Aug 94	B	M	16.6	6.1	2.71

[1] Capture method: P = pitfall; L = under log; B = under cover board
[2] M = male, F = female, J = juvenile
[3] centimeters
[4] grams

All nine *Rhadinaea flavilata* captured since Young (1988) were found on the SRS in Aiken County, South Carolina; pertinent data are presented in Table 1. Capture sites form two distinct areas: Bay 11 and Big Squirrel Bay are located within several hundred meters of each other, and both are separated from Dry Bay by 5 km. Two other *R. flavilata* have been captured on the SRS but were not measured. Both were collected at the Dry Bay locality.

These captures suggest that at least two populations of *Rhadinaea flavilata* exist on the SRS and confirm the initial range extension of this species by Young (1988). Based on the available data, we propose that the actual range of *R. flavilata* extends between the SRS and the coastline, at least along the Savannah River and probably in some discontinuous way throughout South Carolina and Georgia. Our logic is based on several aspects of the biology of this species. The primary habitat of *R. flavilata*, wet pine flatwoods (Conant and Collins 1991), is common between the SRS and the coastline in both South Carolina (Bennett and Poland 1989) and Georgia (Wharton 1978). In addition, the secretive nature of this species (Conant and Collins 1991; Martof et al. 1980) makes it unlikely that individuals would be easily found. Even with the intensive sampling on the SRS, that began in 1966 (Duever 1967) and has yielded more than 6000 snake captures (Gibbons et al., unpubl. ms.), no *R. flavilata* was captured during the first 22 years. We predict that drift fences with pitfall traps or cover board arrays, set in typical *R. flavilata* habitat, would reveal other non-coastal populations of this clandestine species in South Carolina and Georgia, as well as additional populations on the SRS.

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HOWARD H. WHITEMAN
TONY M. MILLS
DAVID E. SCOTT
and
J. WHITFIELD GIBBONS
Savannah River Ecology Laboratory
Drawer E
Aiken, South Carolina 29802, USA.

BOOK REVIEWS

Das Tierreich. The Animal Kingdom. Part 109. Family Gekkonidae (Reptilia, Sauria) I. Australia and Oceania. Aaron M. Bauer, Editor, this volume. With contributions from Klaus Henle. 1994. Verlag Walter de Gruyter, Berlin and New York, i–xiii + 306 pages. Hardcover. US $386.00 (DM 560). ISBN 3-11-014114-0.

Das Tierreich Part 109 covers 23 genera, 173 species, and 19 subspecies of geckos from Australia and Oceania. It is clear that this volume is much improved with respect to the 1965 version of Wermuth and includes all of the numerous recent findings and changes in nomenclature and distribution. Klaus Henle contributed to the basic accounts for some species. All islands to the north and west of Papua New Guinea and Irian Jaya, as well as the Pacific islands under Japanese and Philippine control, the Galapagos Islands, and the nearshore islands of the Americas are excluded. Australia's island territories, including those in the Indian Ocean are, however, covered. Whereas all island groups politically part of Papua New Guinea have been included, the only portions of Indonesia incorporated in this volume are mainland Irian Jaya and its immediately adjacent nearshore islands. The remainder of Indonesia will be included in volume five of the series. A general map is provided, locating all major island groups in the Pacific. Island nomenclature follows Motteler (1986), which is the commonly accepted reference. Fifty-three point locality maps, based on museum records and published sources, illustrate the distribution of each species and subspecies. Where identifiable, all type-localities—but only in this area—are indicated on the maps. Most of these maps combine the distributions of several species, such that some of them are very difficult to read (e.g., map 2 with seven species and five type-localities, map 19 with six species and nine type-localities). Overlap of mapped distributions is limited but such a choice was apparently not always possible. Also, map 4A is placed illogically before map 4. A general key is given for all the genera of Pacific geckos and directs readers to the page where the genus first appears. Each generic account includes a synonymy presenting all names applied to the genus in whole or part, and their type-species and variants. This is followed by a statement of distribution and a "Comments" section highlighting systematic and taxonomic information or problems. The complete references may be found in the "Literature Cited" section following the text. A complete list of species referred to each genus and a key to Pacific region species follow the list of generic references. Extralimital species are marked by an asterisk in the species referred list.

For each genus and species, Bauer arranged bibliographic references into 15 broad categories (not 13 as stated on page vi): Behavior, Biology, Conservation, Distribution, Ecology, Karyology, Morphology, Osteology, Paleontology, Parasitology, Phylogeny, Physiology, Reproduction, Taxonomy, and Zoogeography. They are not classified alphabetically but in a more logical way which, however, necessitates a longer time to search for one category. The category dealing with parasites is variously called "Parasitology" (pages 105, 123, 126, 142, 150, 171, 189, 205, 209, 214, 215, 216) or "Parasites" (pages 9, 112, 137, 141, 178, 183); and once with a typographic error ("Parasitzes," p. 222). It is unfortunate that a category such as "Molecular studies" (including electrophoresis, DNA sequencing, etc.) was not included.

Species accounts are arranged alphabetically as for the generic accounts except that chresonymies are provided instead of synonymies. The chresonymies in this book are not meant to be exhaustive, although they do contain all names proposed for each taxa as well as a broad selection of other citations, including all of those listed by Wermuth (1965) and Cogger et al. (1983). Revisionary or review works pertinent to each taxon are also included in the chresonymies as are regional herpetofaunas or faunal lists (including significant field guides or other popular and semi-popular works). Names appear verbatim with the full generic name provided unless it appeared in abbreviated form in the description of a new name. Page numbers in the chresonymy citations refer to the first or, in some cases, the primary use of the name in the work in question (always the first use in the case of new names). Effort has been made to correctly date publications cited, a practice that is valuable and generally uncommon. Replacement names, emendations, and incorrect subsequent spellings are noted as such in association with their earliest chronological use. Type localities appear verbatim and type specimens and their present status are identified whenever possible. As in the case of genera, species "References" sections provide citations to primarily biological works, usually not otherwise cited in the chresonymies. However, the choice of placing a bibliographic reference in the chresonymies list or in the "References" list sometimes seems arbitrary. Sometimes, as for *Gehyra membranacruralis*, Bauer (p. 86) gives useful unpublished information in a "Comments" section, thus orienting future research. A particular problem in the compilation of this work was encountered with respect to the work of Wells and Wellington (1984; 1985a, b). These authors have introduced many new names and resurrected others, frequently with minimal justification. According to the International Commission on Zoological Nomenclature (1991) decision, nomenclatural problems generated by the works in question were considered case by case by Bauer. With the exception of *Cyrtodactylus sadleiri*, he has not accepted any of the new species described by these authors. Among the many new generic names proposed by Wells and Wellington, Bauer accepted only *Christinus* as valid.

The bibliography is exhaustive, nearly complete, and includes 1465 references. Although the book went to the publisher by mid-1993, it is not clear when the bibliography was completed since some 1993 references were included while others were not. Two journals have the same title, *Herpetofauna*, one edited in Germany (Weinstadt) and the other in Australia. It is not clear in Bauer's bibliography whether *herpetofauna* (sic) deals with the German journal and *Herpetofauna* (sic) with the Australian one. However, the German journal uses the lower case format so I suspect Bauer followed this convention. The reference of Henderson et al. is without a date but should be 1976. Several typographic and presentation errors exist on most pages, but with the large number of references these were inevitable. Several author names are mispelled: Bourett (p. 117) for Bourret, Ebel (p. 119) for Elbel, Pasteuer (p. 160, 163) for Pasteur, Sauvge (p. 222) for Sauvage, ... The reference of Gill (1993 [= 1993a]) on page 125 is not followed by a or b and the one of Brygoo (2992) on page 225 corresponds to Brygoo (1991). The most unfortunate typographic error is on the spine of the book, Gekkoniade for Gekkonidae but Bauer himself certainly had no proofs for the cover or spine of the book. An index is provided with all the genera and species names used in the book, including chresonymies.

Regional accounts are placed after the bibliography and this part will be very useful to herpetologists. I will comment on some small mistakes. Clipperton Island was erroneously incorporated into French Polynesia (p. 284). *Nactus pelagicus* is wrongly re-

ported from the Society Archipelago in French Polynesia. This is also true for *Hemidactylus frenatus* which never was reported from the Marquesas but only from Tahiti (Society Archipelago) where it was first recorded in 1988 (Petren et al. 1993). Two recent papers dealing with Easter Island geckos were omitted (Klemmer 1989; Ineich and Ota 1993). In the addendum (p. 285), Bauer mentioned several relevant recent papers; Darevsky and Orlova's (1993) discussion of *Lepidodactylus lugubris* should be added. However, most 1993 papers were not available for inclusion at the time of submission.

I will now offer specific comments on some species, reviewed alphabetically, giving more attention to those which are widely distributed and therefore more difficult to analyze.

Gehyra mutilata: Pernetta (1983) reported the species from New Guinea, Matsui et al. (1985) from Sabah (Borneo, Malaysia), Brown and Alcala (1961) and Ross and Lazell (1991) from the Philippine Islands, four references not in the bibliography. Duméril and Bibron (1836:354–355), Boettger (1895), Schmidt and Necker (1933), Slevin (1934), Webb (1972), Clapp (1975), Jones (1979), Werner (1980), and Wiles et al. (1989), all authors which mention this species and figure in the bibliography are not listed in the species account. Useful information on the reproduction of this gecko in French Polynesia is also given by Ineich (1987). Two important references, one on the reproduction of this species (Rose 1982), the other on anatomy (Chou 1977), are missing. In the "References" section, Chou (1978) in "Ecology" is listed as Chow (1978). Lambert (1987), a reference not found in the bibliography, listed the species from the Seychelles under *Gehyra multilata* (sic). Two important references concerning the parasites of *Gehyra mutilata* were omitted (Ali and Riley 1983; Kennedy et al. 1982).

Gehyra oceanica: Useful information or distribution records for this species are given by several authors listed in the bibliography but not in the species account: Roux (1913), Schmidt and Necker (1933), Higgins (1943), Fisher (1948), Whitaker (1970), Clapp and Sibley (1971), Cochereau (1974), Clapp (1975, 1977), Heatwole (1975), Sabath (1981), Gibbons and Zug (1987), Crombie and Steadman (1989), and Wiles et al. (1989). The reference of Rivière (1979) was omitted from the bibliography. It is not clear why Schmidt (1921) was placed in the chresonymies and Schmidt (1922) in the species references under "Distribution." Additional information on the reproduction and eggs of this species in French Polynesia can be found in Ineich (1987). Ineich (1990a) is correctly placed in the "Distribution" section, but this is not the case with Ineich (1990b) which refers to another species, *Lepidodactylus lugubris*.

Gekko vittatus: Sternfeld (1920) reported the species from Belau, Roux (1913) from Santa Cruz (Solomon), and Pernetta (1983) from New Guinea; all three references are not cited in the species account, and the last one is absent from the bibliography.

Hemidactylus frenatus: Boettger (1895), Liner and Dundee (1969), Amerson and Shelton (1976), Mechler (1968), Jones (1979), Murthy (1987), Wiles et al. (1989), Rodda et al. (1991), and Gill (1993a) [reported by Bauer for *Gehyra oceanica* but not for *H. frenatus*] are not mentioned. Note however that for widespread species Bauer excluded many references regarding extralimital biological factors and only selected references from Asia and other areas were included. In the "Reproduction" section of references, "Guillett et al. (1982)" corresponds to Guillette and Jones (1982). The references of Parker (1925), Dammerman (1948), Brown and Alcala (1961), Ross and Lazell (1971), Blanc (1972), van Eijsden (1982), Cheke and Lawley (1983), Pernetta (1983), Lin and Cheng (1984), Cheng (1987, 1988) and Dring et al. (1990) are not cited in the bibliography but they all report on this species. Four major references about the parasites of this gecko are absent from the bibliography (Ali and Riley 1983; Tenorio 1985; Upton et al. 1991; Watermolen 1992).

Hemidactylus garnotii: Smith (1923), Steiner and McLamb (1982), Smith (1983), Dring et al. (1990), Stevenson and Crowe (1992), and Crowford and Somma (1993) deal with this species but are not mentioned in the bibliography. Some references listed in the bibliography are not reported under this species account: Werner (1900), Schmidt (1927), Fisher (1948), Taylor and Elbel (1958), Dryden and Taylor (1969), Ely and Clapp (1973), Amerson and Shelton (1976), Jones (1979), Biswas and Sanyal (1980), and Allison (1982). Tenorio's (1985) report of parasites in this species was omitted in the bibliography.

Hemiphyllodactylus typus: Roux (1913) reported a male *Lepidodactylus crepuscularis* (= *H. typus* according to Bauer) with 13 preanal pores, an important fact considering that *H. typus sensu stricto* is all female; this was not highlighted by Bauer. Meier (1979) reported *Lepidodactylus crepuscularis* from New Caledonia but it is impossible to know if this refers to *Hemiphyllodactylus typus*, *Lepidodactylus lugubris*, or another species owing to insufficient information. Several authors cited in the bibliography are not reported in this species account: Fisher (1948), Brown and Fehlmann (1958), Taylor and Elbel (1958), Jones (1979), and Biswas and Sanyal (1980). The "Distribution" section for this species is really unclear since Tonga appears two times and geographic order was not respected. Also, the Pitcairn Group, reported later (p. 284), was here omitted.

Heteronotia binoei: The reference of Moritz et al. (1991) about the parasites of this gecko is lacking.

Lepidodactylus lugubris: Several papers reported in the bibliography were omitted in the account of this species: Schnee (1904), Boulenger (1912), Schmidt and Necker (1933), Higgins (1943), Fisher (1948), Brown and Fehlmann (1958), Chrapliwy et al. (1961), Mechler (1968), Fitch (1970), Amerson (1971), Clapp and Sibley (1971), Stoddart (1971), Quay (1974), Clapp (1975, 1977), Heatwole (1975), Marshall (1975), Amerson and Shelton (1976), Henderson et al. (1976), Clapp et al. (1977), Jones (1979), Meier (1979), Biswas and Sanyal (1980), Pernetta and Black (1983), Wiles et al. (1989), Chazeau and Bauer (1991), and Rodda et al. (1991). An important reference on the parasites of this gecko was omitted (Upton et al. 1991). Some references dealing with this species are absent from the bibliography (Tanner 1948; Mertens 1958; Peters and Donoso-Barros 1970; Cuellar 1977; Rivière 1979; Miyata 1982; Pernetta 1983; Mudde and van Dijk 1984; Cheng 1987; Stokes and Cogger 1987; Ineich 1988, 1992; Klemmer 1989; Brown et al. 1991; Cameron and Cogger 1992; Saint Girons and Ineich 1992; Ineich and Ota 1993; Villa 1993; and Volobouev et al. 1993). Hoogmoed (1989), mentioned on page 158, is absent from the bibliography. On the same page, Bauer states that *Lepidodactylus intermedius* could be a valid subspecies of *L. lugubris*, following Auffenberg (1980:74). Such a view is unrealistic because *L. lugubris* is clearly referable to a unisexual clone according to its type material located in the Paris Museum, and thus consideration of any subspecies for this unisexual gecko is inappropriate. I have examined the types of *L. intermedius* and they clearly belong to a different valid bisexual taxon which could however be a junior synonym of *Lepidodactylus lombocensis* Mertens, 1929. Bauer's distribution map of this species covers only the Pacific region and thus several type-localities reported in the chresonymies are not figured on the map. "Guillette & al. 1982" in the "Reproduction" section of the references corresponds to Guillette and Jones (1982).

Pernetta and Watling (1979) are not included for *Lepidodactylus manni*. The same applies for Pernetta and Black (1983) about *Lepidodactylus magnus*, *L. novaeguineae*, and *L. orientalis*. For *Lepidodactylus pulcher*, Werner (1900), Vogt (1912), and Brown and Parker (1977) are not mentioned. For *L. pumilus*, Brown and Parker (1977) and Pernetta and Black (1983), and for *L. shebae*, Brown and Parker (1977) are not reported. Concerning *Lepidodactylus woodfordi*, several authors reporting the species are not cited: Boulenger (1898), Werner (1900), Vogt (1912), Sternfeld (1920), Taylor (1922), Brown and Parker (1977), and Brown and Alcala (1978). Ineich (1987:86–87) considered the French Polynesian bisexual populations as a species distinct from *L. lugubris* and referred them to *L. woodfordi*, subsequently considered a valid species (see also Hanley et al. 1994).

Bauer states that a new species of *Lepidodactylus* will be described from Vanuatu (p. 282), another from Belau (p. 283), together with the resurrection of *Gecko moestus* as a valid species of that genus (p. 158), and a new species of the genus *Gekko* from Belau (p. 112), all unpublished data. However, he does not mention the two new species reported from French Polynesia, one from Takapoto Atoll and the second from the Marquesas by Case et al. (1994), a paper that appeared after this volume went to press.

Nactus pelagicus: The references of Wiles et al. (1989) and Gill (1993a) are lacking.

Marshall's (1975) report of a *Perochirus* sp. from the Carolines is not included under this genus by Bauer. Sameit (1986, 1988) deals respectively with *Rhacodactylus auriculatus* and *R. trachyrhynchus* but these papers are not in the bibliography.

Despite the lack of some bibliographic references (impossible to avoid with such an important amount of information) Bauer's work is considerable and of excellent quality. It will help all herpetologists dealing with Pacific lizards and is a big step forward in our knowledge of this area. It will be a necessary tool and should facilitate rapid progress in Pacific herpetology. Such a book should have a nice place in the libraries of people interested in geckos. I can only hope that forthcoming volumes will be of the same quality but strongly recommend that subsequent authors carefully check the proofs to avoid typographic errors similar to those in this volume. I also regret that the high price of this book will certainly limit its diffusion.

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IVAN INEICH
Muséum national d'Histoire naturelle
Laboratoire de Zoologie (Reptiles et Amphibiens)
25, rue Cuvier
F-75005 Paris, France.

Revised Catalogue of the Herpetological Collection in Turin University I. Amphibia, by Elena Gavetti and Franco Andreone. 1993. Published by Museo Regionale di Scienze Naturali, Via Giolitti 36, 10123 Torino, Italy. Catalogue series vol. 10, 185 pages (including 13 black-and-white plates), clothbound, 70,000 lira (about US $43). ISBN 88-86041-08-X.

The herpetological collection of the Università di Torino is relatively small (15,000 specimens) but is, nevertheless, of considerable historic importance. It was initiated with specimens collected by Vitaliano Donati in Egypt in 1759 and enlarged by two former directors of the museum (Franco Bonelli and Giuseppe Gené) with collections from the Piedmont region of northwestern Italy and from Sardinia, respectively. Later, the museum's own scientific personnel, among them some of the leading herpetologists of Italy (Camerano, De Betta, Lessona, and Peracca), further enriched the holdings from their own field work and with specimens obtained from compatriots travelling in distant parts of the world (Abruzzi in East Africa, Borelli in South America, De Filippi in Japan, Australia, and Persia, Fea in Burma, Festa in South America, North Africa, and the Middle East, and Zavattari in Albania, among many others). In addition, specimens from all parts of the world were added through purchase or by exchange with other museums. In particular, it was Mario Peracca (1861–1923), a wealthy member of the nobility who was also a trained zoologist, who added specimens from throughout the world and described numerous species. The collection of amphibians in Turin is thus broadly representative of the world's species and, moreover, contains types of 42 taxa.

This book is an annotated listing of Turin's entire collection of Amphibia and is an expansion of the simple list published by Elter, "La Collezione Erpetologica del Museo di Zoologia dell'Università di Torino" (1981 [1982]). Gavetti and Andreone's book is divided into several sections: a short history, a detailed catalogue of specimens from the two associated museums (zoology and comparative anatomy), a listing of types including designation of lectotypes, references, and an index, plus 52 photographs of the type specimens. The catalogue of specimens lists the registration number (MZUT and MACUT are the respective acronyms for the two museums), the locality, collector or donor, and the number of individuals catalogued under each number. Lectotypes and paralectotypes are designated for five species: *Molge italica* Peracca, 1898 (now *Triturus italicus*); *Hylodes discoidalis* Peracca, 1895 (now *Eleutherodactylus discoidalis*); *Paludicola Borellii* Peracca 1895 (now *Pleurodema borellii*); *Rana aluta* Peracca, 1893 (now *Mantidactylus alutus*); and *R. opiparis* Peracca, 1893 (now *M. opiparis*). Detailed descriptions are given for each lectotype. The amphibian types held by Turin include taxa described by Boulenger, Camerano, Fatio, Gené, Lataste, Lynch, Méhelÿ, Peracca, W. Peters, Savi, Thomas, and Werner. The photographic illustration of each of these types, sometimes including several views, is a special and valuable feature of this book.

The extensive annotations provide useful information for many species. For example, previously unreported type material of several species is announced, corrections to Elter's earlier list of Turin specimens are made, and questions are raised concerning the type designations of some specimens in other museums. In one instance (*Oreophryne biroi* of New Guinea), Turin possesses a heretofore unrecorded syntype from a type series that was otherwise destroyed in Budapest. In another annotation, for a specimen of *Proteus anguinus,* it is stated that "This individual lived in the Museum without being fed from October 1873 to 22 August 1877." There are relatively few typographical errors.

This is a well-produced, complete catalogue with many features that could well be imitated in future inventories of important herpetological collections. We eagerly await the announced volumes on Turin's reptiles.

KRAIG ADLER
Neurobiology and Behavior
Cornell University
Seeley G. Mudd Hall
Ithaca, New York 14853, USA.

Snakes, Lizards, Turtles, Frogs, Toads & Salamanders of New Mexico, by Michael A. Williamson, Paul W. Hyder, and John S. Applegarth. 1994. Sunstone Press, Santa Fe, New Mexico. iv + 176 pp., 126 color photos. Soft cover. US $19.95. ISBN 0-86534-233-4.

This publication, like many of the smaller regional field guides, is paperback and small enough (215 mm x 140 mm) to fit in a pocket. It contains a brief introduction to the use of the guide in the form of a foreward and very brief notes on specimen preservation, and captive care. A dichotomous key to the 123 species recognized by the authors as occurring in the state is provided. The species accounts, which are each a single page in length, include color photographs and range maps. These illustrations occupy about one half of the page. Brief notes (sometimes one half line) on description, reproduction, distribution, and natural history fill the remaining space. Family introductions are also skimpy. Some have as few as four ["Family Testudinidae (Emydidae)"] or five (families Elapidae and Chelydridae) lines of text. The book concludes with short glossary and a bibliography. There is no index.

As a collector of regional herpetofaunal guides, I usually welcome new additions to my library. This book came as a considerable surprise. New Mexico is a state with few professional herpetologists. We generally communicate frequently, and have some idea of projects underway. Thus, the preparation of a state guide (*Amphibians and Reptiles of New Mexico*, by W. G. Degenhardt, C. W. Painter, and A. H. Price, University of New Mexico Press, Albuquerque, *in press*) has been enthusiastically anticipated and assisted for several years. It is remarkable that no one I know connected with New Mexico herpetology was aware of the Sunstone Press book until it was in press.

I am irritated by the price of this book. As a rough comparison, I calculated the price per page of this work and the recently published *The Reptiles of Virginia* by Joseph C. Mitchell (x + 352 pp. Hardbound) at $.1108/page and $.1104/page, respectively. While these are not exactly comparable books (the excellent Mitchell work is hardback and does not include amphibians), it is interesting, and seems to justify my pique.

The lack of editing in this book is its most apparent flaw. Nearly every page contains an error in spelling, punctuation, grammar or spacing. Bold printing is used in the species accounts, presumably to highlight important information, but is used inconsistently from one account to the next. In the bibliography John Applegarth's name is spelled "Applegrath." Absorb is spelled "abosorb" on page 17; parotoid is spelled "paratoid" or "paratiod" in all of the toad accounts; "tubercle" is sometimes spelled "tubircle" (e.g., p. 156); margin is spelled "margine" throughout; "gray" and "grey" are both used; "sack" is often used for "sac" (e.g., p. 17); chevrons is sometimes spelled "shevrons" (p. 92); species epithets *exsanguis* and *gaigeae* are spelled *exanguis* and *gaigae* throughout. There are also inclusions such as the sentence on page 79 with a "6" stuck at the end after the period. There are also several duplications such as this from page 97: "Tongue weakly notched at the tip. Head covered by large regularly shaped scales or "shields." Belly scales similar to those on the rest of the body and tail. Tail autotomous. Tongue weakly notched at the tip." And this from the account of the Sacramento Mountain salamander: "The young are similar in color but with a more pronounced dorsal stripe. Lacks both lungs and external gills. The young are similar in color but with a more pronounced dorsal stripe. As (sic) with the adults they lack both lungs and external gills." It appears the sentence was rewritten, but the original never edited out. Some repetitions are contradictory, as this from page 163: "LARVAE: To 1.25 in. (3.2 cm)" and on the same page, "Tadpole <1" in length." Some sentences are poorly written and thus confusing: "The ground color may be tan, yellow or some shade that closely approximates the ground color" (pg. 82). In the tiger salamander account on page 167 the authors state: "Distribution: Occurs in every county in New Mexico. Upper Sonoran to Pinon Juniper above 8,000 ft." Does that mean only above 8,000 ft? In the Natural History Notes sections of each of the leopard frog accounts is the note "A member of the leopard frog "complex." " Nowhere do the authors explain what the leopard frog "complex" might be. Nor do they explain that the notes "Protected (I)" and "Protected (II)" are state designations which correspond roughly to endangered and threatened, and that special permits are required for any activities involving these species. Contrary to this book (p. 72) neither species of *Coleonyx* is protected in New Mexico. Some of the errors are almost humorous: "Members of the genus *Kinosternon*, represented in our area, are semi-aquatic turtles with a reduced plastron (lower shell) and which produce a fowl smelling scent..." Moving from olfactory defense to olfactory offense, on page 137 we are told that the bullfrog "has reeked havoc with many native amphibian populations." In an unusually illuminating misspelling, the authors state "The Plateau Spotted Whiptail is the result of a series of hybredizations between..." And from the introduction to the order Anura (p. 136): "Most lack claws (or nails) hair, scales , or feathers." Such errors are extremely numerous, certainly in the hundreds. Stuart (1994) found one to six per page.

Of greater concern are the errors in content. In couplet 41 of the key to reptiles, the choices are: "Legs present," and "legs absent." Selecting legs absent leads to couplet 80; a choice between the collared lizard and the leopard lizard. Couplet 81 actually begins the snakes. On page 162, in the introduction to family *Pelobatidae*, The authors state: "Members of the genus *Bufo*, by contrast, have vertical pupils..." In the species account for the Jemez Mountain salamander (*Plethodon neomexicanus)* (p. 170) the distribution section says "Taos, Sandoval, Rio Arriba and Los Alamos counties." Despite considerable effort, this species has never been collected in Taos County (Marilyn Altenbach, pers. comm.). It would be a serious disservice to this endemic if consumptive interests, such as timbering, cited this reference to minimize the apparent vulnerability of the species to habitat degradation. Interestingly, the range map is correct in showing the distribution of the animal. In the account of the Texas toad (p. 160) distribution is given as: "South-central New Mexico (Dona Ana County) and lower Pecos R. drainage to the Texas Border." The range map, however, has no indicated range in Dona Ana County. On page 163 the authors state that Couch's spadefoot "tadpoles are especially prone to cannibalism." While tadpoles do not hesitate to feed on dead tadpoles, *couchii* does not develop a cannibalistic morph as far as I can tell.

The authors do not recognize subspecies in any of the species accounts. Thus, the account for *Sceloporus graciosus* lumps in the Mescalero Dunes taxon *Sceloporus arenicolus*. This is particularly puzzling in view of the fact that John Applegarth is a co-author of the paper which recognized *arenicolus* as a full species (Smith et al. 1992).

The Sonoran mud turtle account on p. 128 states: "marginal scales are all similar in size. In the accompanying photo, the raised tenth marginal characteristic of this species (Ernst and Barbour 1989) is visible. In the description section of the account on the Big Bend slider, *Trachemys gaigeae*, it is stated that "Males have long nails on the forefeet." Unlike *T. scripta* in the U.S., *T. gaigeae* does not have elongated front claws (Ernst 1992).

Despite the expectations created by the rest of the book, the range maps appear to be relatively free of significant errors. That brings up what I find the most troubling aspect of this book. There is no mention, much less acknowledgment, of any sources except John S. Applegarth, who "provided most of the data on which were based the maps and distributions." I find it incredible that a single herpetologist (even three!) could, based on his or her own field experience, have sufficiently complete knowledge of "123 species" over 122,000 square miles of habitat to construct complex range maps. Certainly there are compelling practical reasons (McCoy 1992) to acknowledge preserved collections and/or other information sources. Beyond that, it is somewhere between rude and unethical to omit such acknowledgment. Some collections might well deny future access in response (John Simmons, pers. comm.). Inevitably, serious doubt exists about the accuracy of these maps, because we lack any means of verifying the data used in their preparation. Stuart (1994) has noted a "puzzling (even disturbing)... striking similarity between many of the book's more detailed maps... and the New Mexico range maps drafted by Degenhardt et al..." That such concerns regarding the provenance of the maps must be raised is very troubling indeed.

New Mexico is an important region herpetologically. It is a unique transition area with elements of the faunas of the Great Plains, the Chihuahuan and Sonoran Deserts, the northern Sierra Madre Oriental, the Great Basin, and the southern Rocky Mountains. A book thoroughly covering the herpetofauna of New Mexico has long been needed. Sadly, this work falls far short of fulfilling that need at any level of herpetological interest.

Acknowledgments.—I thank Marilyn Altenbach for consulting her database on *Plethodon neomexicanus*. Conversations with Roger Conant, Hobart Smith, and John Simmons provided various views on several ethical points, which helped clarify my understanding. Jennifer Yocom, of the Rio Grande Zoo herpetology staff, helped highlight many of the errors. David Chiszar read and made comments on a draft of the manuscript. I am most grateful to them.

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SMITH, H. M., E. L. BELL, J. S. APPLEGARTH, AND D. CHISZAR. 1992. Adaptive convergence in the lizard superspecies *Sceloporus undulatus*. Bull. Maryland Herpetol. Soc. 28:123-149.

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A. DALE BELCHER
Rio Grande Zoo
903 Tenth Street SW
Albuquerque, New Mexico 87102-4098, USA.

PUBLICATIONS RECEIVED

Verbreitung, kologie und Schutz der Schlangen Deutschlands und angrenzender Gebiete edited by Gruschwitz, M., Kornacker, P.M., Podloucky, R., Vlkl, W., and Waitzmann, M. 1993. Mertensiella 3. Softcover. 432 pp., US $25.00, ISBN 39801929-2-X.

A collection of 28 papers dealing with the distribution, ecology and conservation of the snakes of Germany and adjacent areas. All six of the extant German snakes *Coronella austriaca, Elaphe longissima, Natrix natrix, Natrix tessellata, Vipera aspis*, and *Vipera berus*) are treated as are the fossil snakes of Germany. All papers are in German, although English summaries and figure captions are provided for all papers. The volume contains over one hundred figures, photos and maps, including color plates of the snakes and their habitats. Most of the papers are in-depth studies dealing with the biology and conservation of the snakes in particular areas of Germany and the maps provided are especially detailed. This is the third volume of the series Mertensiella, published by the Deutsche Gesellschaft fr Herpetologie und Terrarienkunde. Earlier volumes treated the biology and conservation of *Lacerta agilis* (Volume 1, in German and English) and the evolution and biology of varanid lizards (Volume 2, English).

Bevarelsen af Danmarks Padder og Krybdyr edited by H. Bringsøe and H. Graff. 1995. Nordisk Herpetologisk Forening, Køge, Denmark. Softcover. 133 pp., DKr. 150,000 (approximately US $28.00) ISBN 87-985324-0-5.

This volume was issued in commemoration of the 50th anniversary of the Scandanavian Herpetological Society (Nordisk Herpetologisk Forening) and presents an up-to-date review of the conservation of Danish amphibians (14 species) and reptiles (six species). Each amphibian is treated in its own chapter, whereas the reptiles are considered together in a single contribution. Data on reproduction, general ecology, and conservation status are presented for each species, although different chapters have somewhat different emphases. The text is in Danish, with English summaries. The book is illustrated throughout, primarily in color. All species are figured, as are larvae of many of the amphibians and representative views of all major habitat types in Denmark. A short history of the Scandanavian Herpetological Society is also included.

A Standardized Protocol for Surveying Aquatic Amphibians, by Gary M. Fellers and Kathleen L. Freel. 1995. Technical Report No. NPS/WRUC/NRTR 95-01. U.S. Department of the Interior National Biological Service Cooperative Park Studies Unit. 117 pp. Available free from NBS Cooperative Park Studies Unit, University of California, Division of Environmental Studies, Davis, California 95616-8576, USA.

This is a detailed how-to manual for conducting aquatic amphibian surveys, and has been field tested at >2300 sites in California. Although the emphasis is on western U.S. amphibians, researchers in other areas will likely find this present work a useful companion to the more comprehensive volume by Heyer et al. (1994. Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Inst. Press. 364 pp.).

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National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

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Rio Grande Zoological Park
903 Tenth Street, SW
Albuquerque, New Mexico 87102, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

Long Range Planning
THOMAS H. FRITTS
USFWS, MRC111
National Museum of Natural History
10th and Constitution Ave., NW
Washington, D.C. 20560, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602–2597, USA

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Nominating
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Resolutions
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COORDINATORS

Common and Scientific Names
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Natural History Museum
The University of Kansas
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Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
3905 Old Sabino Canyon Road
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Meeting Events
DON C. FORESTER
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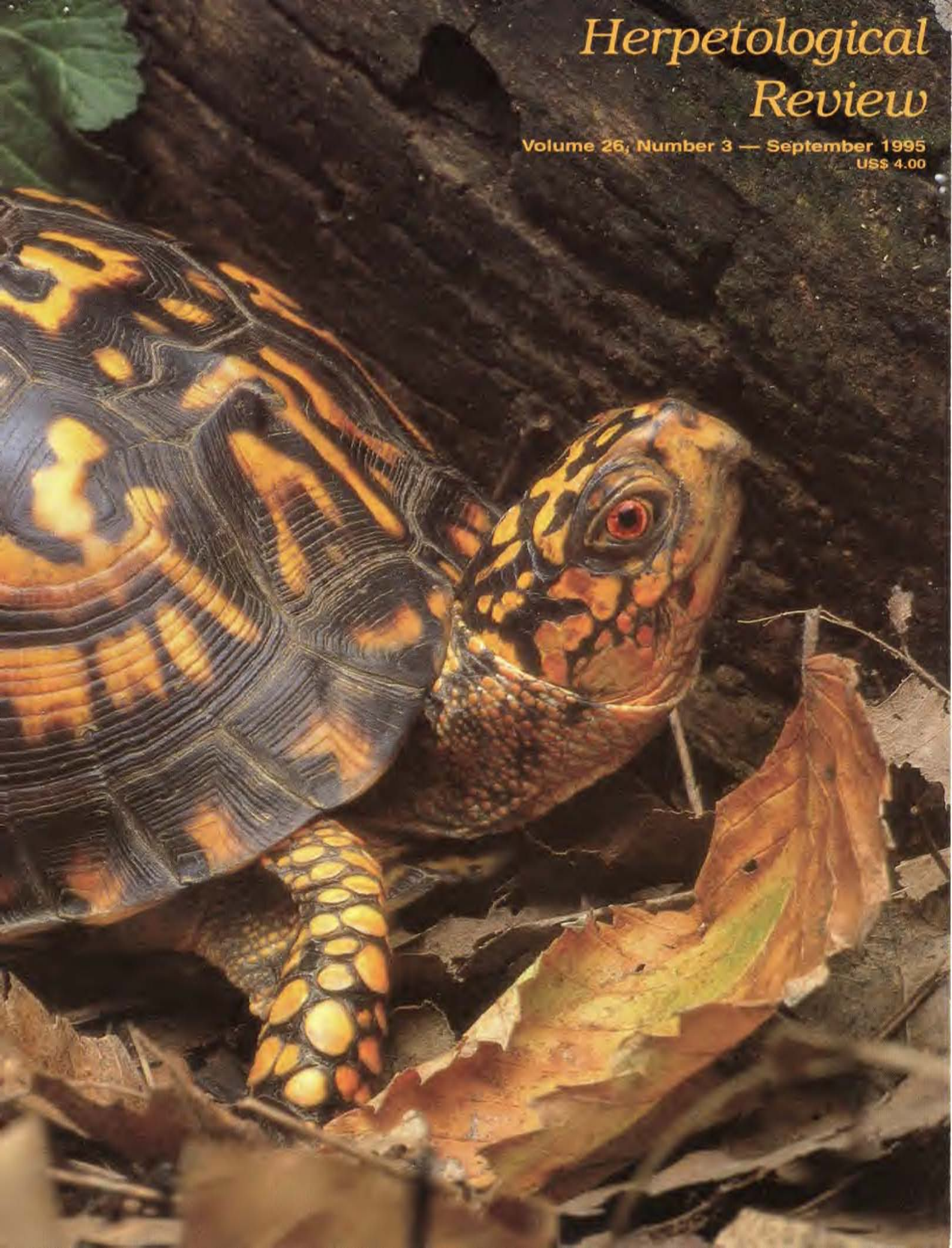
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Herpetological Conservation
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National Biological Survey
4512 McMurray Avenue
Fort Collins, Colorado 80525–3400, USA

HERPETOLOGICAL REVIEW

The Quarterly News-Journal of the Society for the Study of Amphibians and Reptiles

Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rohanse@cello.gina.calstate.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: 71061.150@compuserve.com

Section Editors

Techniques
STEPHEN D. BUSACK
National Fish & Wildlife Forensics Lab
1490 East Main Street
Ashland, Oregon 97520, USA
E-mail: steve_busack@mail.fws.gov

Book Reviews
AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: breckbarth@aol.com

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA

Natural History Notes (Amphibia)
CHARLES W. PAINTER
Endangered Species Program
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA

Natural History Notes (Reptilia)
LEE A. FITZGERALD
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131, USA
E-mail: leefitz@bootes.unm.edu

Recent Population Changes
RALPH W. AXTELL
Dept. of Biological Sciences
Southern Illinois University
Edwardsville, Illinois 62026, USA

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Regional Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Advertising Manager
ELIZABETH A. JOHNSON
New Jersey Field Office
The Nature Conservancy
200 Pottersville Road
Chester, New Jersey 07930, USA
(908) 879-7262

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SSAR Grants-in-Herpetology

Proposals are now being accepted for the 1996 SSAR Grants-in-Herpetology Program. This program is intended to provide financial support for deserving individuals or organizations involved in herpetological research, education, or conservation. Grant proposals will be considered in the following categories:

1. CONSERVATION OF AMPHIBIANS AND/OR REPTILES. Proposals should address research (particularly conservation biology) on species endangered or threatened at the state, national, or international level, or address research on potentially threatened habitats or species, or on introduced injurious species. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson

2. FIELD RESEARCH. Proposals may address needs for field station fees or equipment and materials in field oriented projects, or the field work portions of broader studies. This might include in situ behavioral studies, ecological, life history, or sexual selection studies. Survey work by individuals or regional societies may be submitted here or in TRAVEL below depending on how the funds are to be used. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR, the president of the sponsoring regional society (if applicable), or a student's major advisor or committee chairperson.

3. LABORATORY RESEARCH. Proposals may address needs for equipment or materials in laboratory projects or laboratory portions of broader projects. This might include studies in behavior, biochemistry, molecular biology, biomechanics, or physiology. Proposals must be from individuals only and be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson.

4. HERPETOLOGICAL EDUCATION. Proposals may address an educational project or start up support for an educational program in a zoo, museum, park, nature center, regional herpetological society, etc. The project must focus on an herpetological topic. Proposals must be from individuals only and be accompanied by a letter of support from the herpetological curator, the director of the facility, or the regional society president.

5. TRAVEL. Proposals may address support for travel to field study sites near or far, or to utilize distant collections or facilities. If funding is sought to get from one place to another, proposals should be submitted in the TRAVEL category. Proposals normally submitted in the CONSERVATION or FIELD RESEARCH categories should be submitted here if travel funding is being sought. Proposals must be accompanied by a letter of support from another member of the SSAR or a student's major advisor or committee chairperson, or the regional society president.

In keeping with the Society's goal of encouraging participation by the broadest possible community, preference may be given to individuals who might not have access to other funding sources. All applicants must be members of the SSAR with the exception of those applying for support of regional herpetological society projects. Membership dues must be paid (to SSAR Treasurer) no later than 31 December 1995 for proposals to be considered. Applicants are limited to submission of one proposal in one category per year. If proposals in any of the categories are not forthcoming, or judged not to be of sufficient quality, the funds in those categories may be transferred to other categories. Each proposal must include the following: (A) BACKGROUND AND OBJECTIVES of the proposed project. (B) METHODS of carrying out the project. (C) COMPLETE PROJECT BUDGET (regardless of whether the SSAR grant will entirely cover expenses). (D) BRIEF RESUMÉ of the applicant or project coordinator. (E) LETTER OF SUPPORT. The proposal must be typed, double spaced, and must not exceed five pages excluding resumé and budget.

Applicants must designate to which of the five categories their proposal is submitted (although the committee reserves the right to reassign categories). All proposals must be submitted (postmarked) no later than 31 DECEMBER 1995 to be considered. Please include office and home phone numbers, as well as fax number and e-mail address if available. It is often necessary to

About our Cover

Box turtles (genus *Terrapene*) have figured prominently in recent discussions concerning international trade in pet turtles. [See Legislation & Conservation, p. 117 of this issue, for additional information.] According to a recent report prepared by Allen Salzberg for The Humane Society of the United States (Live freshwater turtle and tortoise trade in the United States, Nov. 1994, 39 pp.), "[D]uring the summer of 1994, every week, thousands of North American box turtles...were shipped out ... to supply the European pet trade." In what appears to be a classic conflict between conservationists and economic interests (chiefly Louisiana animal dealers), the U.S. Fish and Wildlife Service, despite opposition from SSAR, agreed to allow the export of 9750 *Terrapene carolina* during 1995. Scientists argued that populations of long-lived species such as box turtles cannot sustain this level of harvesting. The export allowance will be reexamined next year, and the quotas can go up or down.

The genus *Terrapene* consists of four species (*T. carolina, coahuila, nelsoni, ornata*) and is confined to the U.S. and México. Recent reviews include those by Iverson (1992. A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.), and Ernst and McBreen (1991. Cat. Amer. Amphib. Rept. 511:1–6; 1991. ibid. 512:1–13).

The cover depicts an Eastern Box Turtle (*Terrapene c. carolina*) from Adams Co., Ohio, USA. The photograph was taken by **David M. Dennis**, a noted illustrator and photographer. This turtle served as the model for the commemorative poster prepared by Dennis for the First World Congress of Herpetology in Canterbury. David holds the position of Scientific Illustrator for the College of Biological Sciences at The Ohio State University in Columbus. He has become an internationally renowned illustrator of biological subjects, in particular of amphibians and reptiles, of which he is regarded as preeminent among the world's artists. He is perhaps best known to vertebrate biologists for the exquisite watercolors published in Duellman's *Hylid Frogs of Middle America* (University of Kansas Press, 1970) and in Smith and Brodie's *Field Identification: Reptiles of North America* (Golden Press, 1982). In addition to his talents as an illustrator and photographer, David is one of the two co-founders of SSAR, begun in Ohio in 1958 as The Ohio Herpetological Society. David's art work has appeared in numerous SSAR publications, and his now-famous multimedia presentations (in collaboration with Eric Juterbock and Kraig Adler) are staples at the SSAR annual meetings.

He took this photo using a Nikon FE-2 camera with a 105mm macro lens with Kodachrome 64 film with flash in a soft box. Separation and imaging by **Jim Bridges**, Herpeto Inc., Hollywood, Florida, USA.

contact applicants quickly. Failure to meet the guidelines may result in elimination of a proposal from consideration. The awards will be announced by 1 April 1996. Successful applicants will be expected to submit a written report of the results of this support within a reasonable amount of time after the project year is completed. They are also encouraged to submit the results of research projects for publication in the *Journal of Herpetology* or *Herpetological Review* or to present their findings at the annual meeting of the SSAR. Submit proposals or questions regarding application procedures to: *Julian C. Lee, Chair, SSAR Grants-in-Herpetology, Department of Biology, P.O. Box 249118, University of Miami, Coral Gables, Florida 33124, USA. Tel. (305) 284-6420, FAX (305) 284-3039.*

Financial contributions by SSAR members, institutions, and other benefactors support this program significantly and can increase the number and/or size of awards. Your tax-deductible contribution to this program will directly benefit meritorious research and education in herpetology. Contact the Treasurer of SSAR for additional information on contributing to the Grants-in-Herpetology Program. If you are employed by an organization that will match donations made to nonprofit organizations, please notify your employer that you have made a donation to the Grants-in-Herpetology Program.

Annual Report (1995) Grants-in-Herpetology Committee

Five awards of $500 each in four categories were made this year, as follows:

Conservation.—**Christine Bridges**, University of Missouri-Columbia. Project title: "Effects of an agricultural chemical on tadpole swimming and feeding in the presence and absence of predators."

Laboratory Research.—**Allison Abell**, University of Chicago. Project title: "The relationship among male secondary sexual character expression, territorial aggression, courtship behavior, and mating success in *Sceloporus virgatus*."

Laboratory Research.—**Leslie Rye**, University of Guelph. Project title: "Analysis of two areas of intergradation between subspecies of common garter snake, *Thamnophis sirtalis*."

Field Research.—**Marguerite A. Butler**, Washington University. Project title: "The relative roles of intersexual and interspecific differentiation in the radiation of Greater Antillean *Anolis* lizards."

Travel.—**Michael S. Finkler**, Miami University. Project title: "Impact of egg content on post-hatchling size, body composition, and performance in the common snapping turtle (*Chelydra serpentina*)."

1995 Grants-in-Herpetology Committee.—Kelly Zamudio, University of Washington; Barbara Savitzky, Christopher Newport University; Anders G. J. Rhodin, Chelonian Research Foundation; Julian C. Lee, University of Miami; Randy Jennings, Western New Mexico University, Carole L. Hom, University of California, Davis; Lewellyn Densmore, Texas Tech University; A. Dale Belcher, Rio Grande Zoological Park (chair).

NEWSNOTES

Association of Reptilian and Amphibian Veterinarians

The Association of Reptilian and Amphibians Veterinarians (ARAV) is a non-profit international network of veterinarians and herpetologists whose goal is to improve reptilian and amphibian husbandry and medicine through education and idea exchange. The *Bulletin of the Association of Reptilian and Amphibian Veterinarians*, edited by Thomas Boyer, is published quarterly, and features peer-reviewed original articles on topics such as clinical cases, current therapy, species propagation, and literature reviews, as well as brief reports detailing clinical experiences and the exchange of ideas for direct practical application. Other articles concern captive husbandry strategies for the herpetoculturist.

In addition to their quarterly journal, ARAV also publishes papers delivered at their annual conference. The *Proceedings of the 1994 ARAV Conference* (available for US$30) contain the following titles (and authors): Physical examination of reptiles and amphibians (Paul Raiti); Common infectious diseases of reptiles and amphibians: an etiologic review, diagnostics and treatment recommendations (Mark Lloyd); Common parasitic diseases of reptiles and amphibians (Michael S. Bodri); Basic principles of therapeutics used in reptile medicine (Roger J. Klingenberg); Diagnostic techniques in reptile medicine; Common non-infectious diseases of reptiles (Wm. Kirk Suedmeyer); Current techniques in reptile anesthesia and surgery (R. Avery Bennett); Use of computed tomography as a diagnostic aid in the diagnosis of an abdominal mass in a box turtle (Karen Rosenthal and Amy Kapatkin); Chemotherapeutic treatment of a sarcoma in a corn snake (Karen Rosenthal); Two cases of anemia in reptiles treated with blood transfusions: (1) hemolytic anemia in a diamond python caused by an erythrocytic virus; (2) nutritional anemia in a bearded dragon (Helen McCracken et al.); Successful treatment of a urolith associated with a fungal cystitis in *Iguana iguana* (Nancy L. Anderson); Liver enzymes and pathology in runt crocodiles (*C. porosus*) (J. McInerney); MR of bowel using mineral oil as a contrast agent: a viable option in reptiles with long transit times (Paul Raiti and Nogah Haramati); Endoscopic examination of the urogenital tract in reptiles (Bernd Schildger); A review of allometric scaling with considerations for its application to reptile therapeutics (Janet C. Martin and Charles J. Sedgwick); Clinical approach to the chameleon patient (Scott Stahl); The Wyoming toad (*Bufo hemiophrys baxteri*): a review of causes of mortality in the captive population (Sharon K. Taylor et al.); Normal and pathological ultrasonographic anatomy of amphibians (Mark D. Stetter and Robert A. Cook); Pharmacokinetics of intramuscular administration of three antibiotics in bullfrogs (*Rana catesbeiana*) (James Letcher and Mark Papich); Problems with metabolic scaling of antimicrobial dosages in reptiles (Juergen Schumacher and Elliot Jacobson); The reptilian renal portal system and its effect on drug kinetics (Peter Holz et al.); Pharmacokinetics of enrofloxacin in juvenile Burmese pythons (*Python molurus bivittatus*) (Lee A. Young et al.); Use of long-acting ivermectin suspension in snakes (Meg Sutherland-Smith et al.); Trichomonas associated with ocular and subcutaneous lesions in geckos (Harry A. Miller et al.); Periodontal disease in lizards—a review of numerous cases (Helen McCracken and Christine A. Birch); Detection of antibodies against paramyxovirus (OPMV) on Mexican captive snakes

(Dulce Brousset et al.); Gallamine reversal in Cuban crocodiles (*Crocodylus rhombifer*) using neostigmine alone versus neostigmine with hyaluronidase (Mark L. Lloyd et al.); Snake hematology—practical considerations (Edward C. Ramsay and Thomas K. Dotson).

The ARAV invites all herpetologists and herpetoculturists to become members. Dues are US$30/year for members residing in the continental U.S., $35 for members in Alaska, Hawaii, Canada, México, Puerto Rico, and the Virgin Islands, and $40 for other countries. To join, or to obtain back issues of the *Bulletin*, please write to: *Wilbur B. Amand, Executive Director, ARAV, Box 605, 1 Smith Bridge Road, Chester Heights, Pennsylvania 19017, USA. Tel. (610) 358-9530, Fax (610) 892-4813.*

Litteratura Serpentium

Litteratura Serpentium is the bimonthly publication of the European Snake Society (E.S.S.). Since 1983, a Dutch and an English version have been published simultaneously. Articles are published on both snakes in nature and in the terrarium. The Editors are Rene van der Vlugt (email: R.A.A.van.der.Vlugt@ipo.agro.nl) and Cecile van der Vlugt-Bergmans (email: Bergmans@rel.wau.nl). The Treasurer is Guido Gomes, Pauwenveld 18, 2727 DE Zoetermeer, The Netherlands [Tel. +31 (79) 416592]. Membership fee for 1995 (volume 15): $40.00 (credit card payment). Back issues as well as cumulative indexes are available from the treasurer.

Information for U.K. residents: Chris Mattison, 138 Dalewood Road, Beauchief, Sheffield, S8 OEF, United Kingdom. Meetings: Next Snake Day will be held 28 October 1995 at the Conference Centre URETCO, Meidoornkade 24, Houten (Utrecht), The Netherlands. At the 1994 meeting more than 2000 attendees from Europe and the U.S. were counted.

Proposal for an African Herpetofaunal Biodiversity Program

This initiative is put forward to all relevant institutions and individuals in the hope that as many as possible will join together in working towards the aims of the program as outlined below. This communication invites you (and your organization) to consider being a part of this program, or, at least, to comment and put forward suggestions or amendments which you feel are desirable.

Introduction.—On a global scale, Africa and its islands fall within two biogeographical realms. These are the Palaearctic Realm and the Africotropical Realm. In the former, only three biogeographic provinces are represented. These are the Mediterranean Sclerophyll, the Sahara, and the Atlas Steppe. All of these occupy North Africa. South of these provinces is the Africotropical Realm with 29 biogeographical provinces being recognized. Two of the world's four "megadiversity" countries fall within this latter realm. They are Zaire and Madagascar (the other two are Indonesia and Brazil). While the mammal, bird, and even fish faunas are receiving much attention from conservationists, the herpetofauna remains much neglected with only the crocodiles and, to a degree, the chelonians receiving any major attention.

Aims.—The maintenance of present levels of biodiversity within this region depends on how well a number of essential requirements can be met. These requirements involve the following:

1) A consolidated inventory of the taxa present in the region, their distribution, and survival requirements.
2) An assessment and inventory of current conservation areas.
3) An assessment and inventory of critical conservation sites (whether or not presently conserved) based on existing distribution as well as the location of potentially important refuge areas in times of climatic extremes.
4) The monitoring of local and regional environmental change with particular attention to the areas identified under 2 & 3 above.
5) The implementation of a prioritized action plan to ensure that threatened species and systems are afforded appropriate attention.
6) The inclusion and involvement of local communities in the management and maintenance of conservation areas.
7) The assessment of the potential for the sustainable utilization and captive breeding of economically valuable species which could contribute to the economic development of local people while at the same time promoting the conservation of wild populations and their habitats.

In order for the program to be successful, a coordination center will need to be established. This would act as a clearing house for information and as a facilitator for international collaboration between official and non-governmental conservation bodies, research organizations, individuals, and other affected parties. This center would also assist in establishing overall priorities and in obtaining the international financial support required to implement these priorities. The coordinating center will also need to support an education program aimed at all levels of society from local people whose subsistence may depend on the areas needing conserving, through business and other agencies wishing to utilize these areas for development, and government and other political leaders who may be pressured by other interests. It will also need to develop, or otherwise acquire, an integrated, multi-level, and multi-purpose information system which can be used at local, national, and international levels to support planning and management decisions as well as assisting with primary research. In addition to the overall coordination center, the possibility of regional centers is also envisaged. These would coordinate local projects while maintaining close links with the overall center.

The program envisaged would preferably collaborate with, or involve, international bodies such as the IUCN, WWF, United Nations FAO, EarthWatch, the Biodiversity Foundation for Africa, and a wide range of universities, museums, government and non-government conservation bodies, as well as herpetological societies, reptile parks, and other interested persons and organizations.

The information provided above is of necessity somewhat limited but should give some idea of the proposed program. Comments from interested individuals and organizations will be appreciated. Details of completed, in progress, planned, and desired projects involving work on the African herpetofauna would be of great value. Once replies have been collated, a further document detailing the responses received will be sent out.

Comments and confirmation of interest in the proposed program should be sent to: *Lynn Raw, P.O. Box 200, Merrivale, 3291 South Africa. Tel: +27-331-431422 (home); +27-331-460796 (work); Fax: +27-331-460895; e-mail: Raw@zoology.unp.ac.za.*

SSAR World Wide Web Page

SSAR has begun a World Wide Web Page. Set your browser to

http://falcon.cc.ukans.edu/~gpisani/SSAR.html

and check us out. The site still is under construction, but more useful things are being added weekly. In addition to SSAR information, the web page also offers links to other herpetological on-line resources. FORMER OFFICERS, EDITORS, COMMITTEE MEMBERS: please review the file "SSAR Officers and Editors" to check that your data are up-to-date. This file will be used eventually in a history of the Society. The SSAR Web Page is administered by George Pisani (gpisani@falcon.cc.ukans.edu).

OBITUARY

Jeffrey Howard Black (1943–1995)

Jeffrey Howard Black, Ph.D., died suddenly of a heart attack on January 7, 1995 at his home in Roff in east central Oklahoma. Occurring at the apex of his life, this tragic, untimely death, saddens those who knew him.

Jeff grew up in Oregon where he was born on February 11, 1943 in Prairie City. After receiving a B.S. degree in 1965 from Oregon State University, he went on to earn an M.S. degree from the University of Montana in 1970. His M.S. thesis on *Bufo* in Montana predicted a life-long interest in amphibians.

I first met Jeff Black in the fall of 1967 when he entered the graduate program in zoology at the University of Oklahoma. For several years prior to this, Jeff had an active correspondence about his keen interest in toads (*Bufo*) with Dr. Arthur N. Bragg of our department. As a result of this interchange, he came to the University of Oklahoma to work on his doctorate with Dr. Bragg on *Scaphiopus*. Jeff was well into both his academic and research programs when Dr. Bragg retired and died soon after in 1968. Jeff was in limbo for a while. Then I took over as his major professor; it was my good fortune to work with and establish a friendship with this fine young student.



Jeff was awarded a Ph.D. in Zoology in 1973. His doctoral research, a study on the "Ethoecology of *Scaphiopus* (Pelobatidae) larvae in temporary pools in central and southwestern Oklahoma," kept him on the move after heavy rains to observe and record these fascinating amphibians that had for so many years consumed the energies of Dr. Bragg. While in graduate school, he received the Arthur N. Bragg Award in Natural History and the Ortenburger Award of the Phi Sigma Society.

Jeff started his academic professional career at Oklahoma Baptist University in Shawnee in 1973. Although he had a heavy teaching load, he found time to serve on the Shawnee School Board, and as Research Curator (1979–1982) at the Oklahoma City Zoo. Additionally, he worked with the Tulsa Zoo to develop a course in Zoo Biology, was a Research Associate in Herpetology with the Oklahoma Museum of Natural History, and held an Adjunct Professorship at Oklahoma State University. He was the main impetus in the formation of the Oklahoma Herpetological Society, for which he served as President in 1986, and and as editor of its bulletin, *Mountain Boomer*, for eight years. He served as Regional Societies Coordinator for the SSAR.

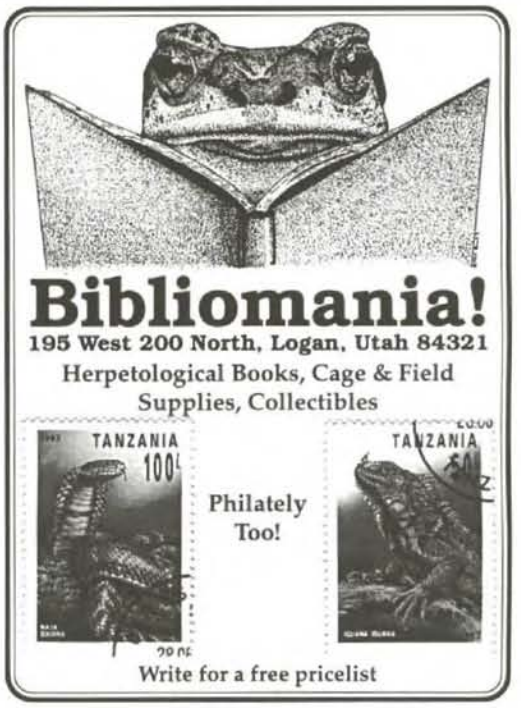
Jeff had broad interests in wildlife and conservation. I recall being notified of a find in one of Oklahoma's many caves to which I sent Jeff, as I could not respond at the time. He went, located and identified the salamander. This whetted his appetite for caves, and he became an avid spelunker, joining the State Grotto and publishing on the cave fauna of Oklahoma. In 1985 he received the President's Stewardship Award from the Nature Conservancy and in 1989 was selected the Oklahoma Educator-Conservationist of the Year by the Oklahoma Department of Wildlife Conservation. He served on the Herptile Committee of the Non-Game Program of the Oklahoma Department of Wildlife Conservation.

In 1988 Jeff moved to East Central Oklahoma University in Ada and was Professor of Biology at his death. That university honored him with their award for Teaching Excellence in 1992. He continued his public service while in Ada and at the time of his death was chair of the Collegiate Academy, and Director of the Oklahoma Junior Academy of Science, of the Oklahoma Academy of Science, for which he had also served as president in 1985.

Although Jeff Black planned to publish a book on the "The Amphibia of Oklahoma" which had been started by Dr. Bragg, teaching and other commitments compromised this effort. However, along with co-author Greg Sievert, he did complete a very popular, small field guide, "A Field Guide to Amphibians of Oklahoma," published by the Oklahoma Department of Wildlife Conservation in 1989. In addition to publishing widely on the herpetofauna of Oklahoma, he wrote a column, The Natural Way, for two small Oklahoma newspapers.

When he moved to Ada, Jeff purchased some acreage in nearby Roff, where he and his wife, Judy, raised exotic sheep. Judy is well known for her weaving, and they both traveled to England and Scotland to observe sheep and weaving. In addition to Judy, he leaves behind two sons and three grandchildren. I was very proud to have Jeff as my student, pleased to work with him and follow his success. He made significant contributions in many ways. He will be missed by his many friends, students, and colleagues. His death is also a loss to the state of Oklahoma.

CHARLES C. CARPENTER
Department of Zoology
University of Oklahoma
Norman, Oklahoma 73019, USA.



LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles. This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered herps. We are in need of more information especially on the state and province level. Please send pertinent information to the Section Editor.

USA: Office of Scientific Authority: The OSA issued a Memorandum dated 24 March 1995 to the Office of Management Authority (OMA) concerning the export of box turtles harvested in Louisiana in 1995. The conclusion made by the OSA, after consultation with the Louisiana Reptile and Amphibian Task Force, is that there is no evidence to indicate that native box turtles are endangered or threatened in Louisiana. The export limit of Gulf Coast box turtles (*Terrapene carolina major*) and three-toed box turtles (*T. c. triunguis*) from Louisiana in 1995 has been set at 9750 individuals. According to existing export information, this represents 50% of the number of Louisiana-harvested *Terrapene carolina* believed to have been exported from the United States in 1993. Other justifications for allowing this harvest include statements that 1) box turtles mature earlier (4–10 years of age) and may be more resilient than Blanding's turtle (*Emydoidea blandingi*), a species for which additional mortality on adults has been shown to cause population declines (see Congdon et al. 1993. Conserv. Biol. 7:826–833) and 2) the Louisiana Department of Wildlife and Fisheries is committed to assuring that commercial harvest of box turtles is managed at a sustainable level.

All box turtles in the genus *Terrapene*, except *T. coahuila* (already an Appendix I species), were added to Appendix II of CITES in November 1994 (Buhlmann 1995. Herpetol. Rev. 26:67). Persons concerned about this export decision should communicate with the Office of Scientific Authority, U.S. Fish and Wildlife Service, Washington, D.C., and the Louisiana Department of Wildlife and Fisheries.

KURT BUHLMANN
SSAR Conservation Committee.

Critical New Zealand Habitat Preserved

Settlement has finally been reached in the long-running negotiations over the ownership and management of Takapourewa (Stephens Island) in the outer Marlborough Sounds, New Zealand. The future management of this sanctuary, one of international herpetological significance, has been of great concern to herpetologists, including the Society for Research on Amphibians and Reptiles in New Zealand (SRARNZ), which petitioned the New Zealand government for the conservation of this site.

Under an agreement reached in late 1994 between the New Zealand government and representatives of indigenous peoples, Stephens Island will become a closed Nature Reserve. This status will provide the maximum protection for the natural values which include the largest species of tuatara (*Sphenodon punctatus*), the only location for Hamilton's frog (*Leiopelma hamiltoni*), and habitat for seven species of lizards. *[Information taken from* SRARNZ Notes, *Number 13, 11 January 1995.]*

MEETINGS

Meetings Calendar

22–28 October 1995—3rd Latin American Congress of Ecology, Universidad de Los Andes, Mérida, Venezuela Fees are US $100 (regular) and US $70 (students). Contact Dr. Jaime E. Péfaur, Executive Secretary, III CLAE, Fax (58) 74 401286; e-mail CLAE@ula.ve.

26–29 October 1995—2nd Annual Conference of the Association of Reptilian and Amphibian Veterinarians (ARAV), Sacramento, California, USA. Contact Wilbur Amand, VMD, P.O. Box 605, 1 Smithbridge Road, Chester Heights, Pennsylvania 19017, USA. Fax (215) 387-2165.

28 October 1995—European Snake Society's Snake Day, Conference Centre URETCO, Meidoornkade 24, Houten (Utrecht), The Netherlands. Contact Chris Mattison, 138 Dalewood Road, Beauchief, Sheffield, S8 OEF, United Kingdom; or Anton van Woerkom, Utrecht University, e-mail: Anton.vanwoerkom@let.ruu.nl.

Herpetological Review Now On-line



A pre-publication listing of the contents of each issue of *HR* is now available from several on-line sources. Postings should occur approximately one month before the publication of the next issue. This service should be helpful to herpetologists in countries where mail delivery is unpredictable, as well as providing pre-publication information to other interested persons. *HR*'s on-line contents listing is available from the following:

Herp-Net — direct dial to 215-464-3562 (300–2400bps 8-N-1) or 215-698-1905 (9600, 14.4kbs) 24 hours per day. Select "Herp. Review" menu item.

Via **Usenet** newsgroup, "sci.bio.herp" (use any newsreader available on your network account), look for the posting "Herpetological Review Contents."

The **Herpetology World Wide Web at Harvard**, maintained by Michael Eisen, can be accessed at:
http://xta1200.harvard.edu:8000/herp
Then select the menu item "Current Contents of Herp Journals."

The **SSAR World Wide Web Page**, maintained by George Pisani, can be accessed at:
http://falcon.cc.ukans.edu/~gpisani/SSAR.html

Both the Harvard and SSAR web pages offer links to other web sites.

Via the **HERP-L** distribution list available to any Internet address. To subscribe send email to listproc@xtal200.harvard.edu with the phrase "subscribe HERP-L <your name>" in the body of the message.

On the commercial **CompuServe** Information Service in their Animal Forum [Go Petstwo] reptile/amphibian library section 6. Search by keyword "SSAR." On **America Online**, under "pet" section, search reptile files.

12–14 April 1996—Minton Symposium, Indiana Academy of Sciences, Indiana University/Purdue University Conference Center, Indianapolis, Indiana, USA. *Refer to meeting announcement in this issue for details.*

Mid-April 1996—2nd International Conference on the Biology and Conservation of the South Asian Amphibians and Reptiles, University of Peradeniya, Contact Anslem de Silva, Conference Director, Faculty of Medicine, University of Peradeniya, Sri Lanka. Tel. 94-08-88130. Fax 94-08-32572. *See meeting announcement below for further details.*

Second International Conference on the Biology and Conservation of the South Asian Amphibians and Reptiles

The Second International Conference, to be held in mid-April 1996, is being jointly organized by the University of Peradeniya/ Amphibian and Reptile Research Organization of Sri Lanka and the IUCN/SSC South Asian Reptile and Amphibian Specialist Group. The venue will be the University of Peradeniya, Sri Lanka.

The conference will provide a forum for presenting results of research on the herpetofauna of southern Asia. Other aims of the meeting are to form a panel for the coordination of research and conservation activities concerned with this fauna in the region, identify research priorities and a programme for the implementation of the IUCN/SC South Asian Reptile and Amphibian Specialist Group's Action Plan.

Two-day field trips (to Sinharaja World Heritage Site, Knuckles Biosphere Reserve, Peradeniya Botanical Gardens) will be arranged for participants.

For further details contact: *Anslem de Silva, Conference Director, Faculty of Medicine, University of Peradeniya, Sri Lanka. Tel. 94-08-88130; fax 94-08-32572* or (in India) *Indraneil Das, Chairman, IUCN/SSC South Asian Reptile and Amphibian Specialist Group, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram 603 104, India. Tel. +044 4124 46332.*

SYMPOSIUM IN HONOR OF DR. SHERMAN A. MINTON, JR.
12–14 April 1996, Indianapolis, Indiana

The Indiana Academy of Sciences is sponsoring a Symposium in April of 1996 in honor of **Sherman A. Minton, Jr**. on the occasion of the publication of his revision of the *Amphibians and Reptiles of Indiana*. The symposium will be held 12–14 April 1996 in Indianapolis at the Indiana University/Purdue University Conference Center. Dr. Minton is well known for his work on venomous reptiles, the reptiles of Pakistan, the regional herpetology of the midwest, and popular books on herpetology.

The Symposium will include a Friday evening (12 April) dinner featuring **Whit Gibbons** as the after dinner speaker. The morning program of the Saturday Conference (13 April) will focus on the career of Dr. Minton with talks by **Carl Gans** (Minton's work on the reptiles of Pakistan), **David Hardy** (pitviper bites), **Bernard Bechtel** (abnormalities in reptiles), and **Harold Voris** (venomous sea snakes). The afternoon session will focus on "Hoosier Herpetology" and the publication of Minton's revision of his classic monograph on the herpetofauna of Indiana; biologists working on the amphibians and reptiles of Indiana will present brief overviews of their research and provide a perspective on herpetological research in Indiana today. On Sunday (14 April) there will be optional field trips.

For registration information, contact: Harriet A. Rodenberg (Minton Conference), University Place, Conference Center and Hotel, 850 West Michigan Street, Indianapolis, Indiana 46202-5198, USA. Tel. 317-274-5053; Fax: 317-274-3878; e-mail: hrodenbe@indycms.iupui.edu.

CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA; e-mail: breckbarth@aol.com. Comments and suggestions are also welcome.

Freeze Tolerance

The physiology of freezing is discussed in two papers by Layne and Lee and colleagues. Five frog species were studied and found to tolerate temperatures as low as -8°C for at least two weeks. At the onset of freezing the liver produces high (to 100x normal) concentrations of glucose or glycerol. The water content of major organs is reduced by 50% and breathing, heart beat, and most other vital functions cease only to begin again with hours of thawing.

Layne, J. R., Jr and R. E. Lee, Jr. 1995. Adaptations of frogs to survive freezing. Climate Res. 5:53–59.

Costanzo, J. P., R. E. Lee Jr, A. L. DeVries, T. Wang, and J. R. Layne, Jr. 1995. Survival mechanisms of vertebrate ectotherms at subfreezing temperatures: applications in cryomedicine. FASEB J. 9:351–352.

Amphibian Conservation

During a 17-year study in England, Beebee found that spawning dates for three species of amphibians have become earlier. The date of first sighting for each species has also become earlier. Temperature at the breeding site has increased over the same time period and correlates with the breeding times.

Measures needed for the conservation of 13 Lesser Antillean anurans are discussed by Kaiser and Henderson. All of the islands have legislation which should protect these species if properly implemented.

In 1915, zoologists Joseph Grinnell and Tracy Storer conducted an intensive survey of amphibians (and other vertebrates) across a section of the central Sierra Nevada of California, including portions of Yosemite. Using historical collection data, some published in Grinnell and Storer's *Animal Life in the Yosemite* (1924. University of California Press) with other information taken from the surveyors' field notes, Drost and Fellers repeated the earlier survey in 1992. They found that all seven native frogs showed evidence of decline, with two species (*Rana aurora* and *R. boylii*)

virtually extirpated from this portion of their historical range. Even the widespread Pacific treefrog (*Pseudacris regilla*), a species not generally included in discussions of "declining amphibians," showed significantly reduced numbers at higher elevations.

BEEBEE, T. J. C. 1995. Amphibian breeding and climate. Nature 374:219–220.

KAISER, H. 1994. The conservation status of Lesser Antillean frogs. Herpetol. Nat. Hist. 2(2):41–56.

DROST, C. A., AND G. M. FELLERS. 1994. Decline of frog species in the Yosemite section of the Sierra Nevada. Tech. Rep. No. NPS/WRUC/NRTR 94-02. 56 pp. Cooperative National Park Resources Studies Unit, University of California, Davis.

Amphibian Taxonomy

Using 18 morphometric measures, Sinsch et al. reassess Peruvian frogs of the leptodactylid subfamily Telmatobiinae. Based on their analysis they recommend the recognition of two genera and six species rather than the present arrangement of three genera, six species, and nine subspecies.

SINSCH, U., A. W. SALAS, AND V. CANALES. 1995. Reassessment of central Peruvian Telmatobiinae (genera *Batrachophrynus* and *Telmatobius*). I. Morphometry and classification. Alytes 13(1):14–44.

Anuran Biology

A wide variety of topics are covered in a new book by Herrmann and Zimmermann (1994. Beiträge zur Biologie der Anuren [Contributions to the Biology of Anurans]. Tetra Verlag, Melle, Germany. 185 pp.). Although many of the chapters focus on anuran faunas and conservation, others discuss topics such as fossils and herpetoculture. Each chapter is in German with an English summary.

HERRMANN, H.-J. 1994. Exposition von anuren in schauanlagen. pp. 4–12.

KÜHNEL, K.-D. 1994. Freilandbeobachtungen einiger Raniden in Tebet und Südwest-China (Sichuan und Yunnan). pp. 13–23.

BEUTELSCHIESS, J., AND C. BEUTELSCHIESS. 1994. Herpetologische eindrücke aus dem Kinabalu Park, Borneo. pp. 24–29.

ZIMMERMANN, H., S. HETZ, AND P. ZIMMERMANN. 1994. Das Goldfröschen *Mantella aurantiaca* - sein Lebensraum und Konzeptionen zu seiner Arterhaltung. pp. 30–48.

HETZ, S. K., AND H. ZIMMERMANN. 1994. Das madagassische Goldfröschen *Mantella aurantiaca* (Moquard, 1900) in seinem biotop - Verbreitung, habitatansprüche und Gefährdung. pp. 49–55.

GLAW, F. 1994. Artendiversität und evolutive trends bei madagassischen Anuren. pp. 56–61.

MEYER, E. 1994. Boscosa - ein Regenwalschutzprojekt auf der Halbinsel Osa in Costa Rica. pp. 62–68.

SCHLÜTER, A. 1994. Anuren des Guainquinima-Tepuis, Venezuela. pp. 69–102.

WIDMER, A. 1994. Die froschlurche (Anura) des Schutzgebietes "Frederico Wildermuth" Provinz Santa Fé, Argentina. pp. 103–120.

WIDMER, A., AND J. JENNY. 1994. "Reserva Natural Federico Wildermuth" Naturschutz und Forschung in der Pampa. Provinz Sante Fé; Argentinien. pp. 121–127.

SCHMITT, R. 1994. Herpetologische impressionen von Nicaragua. pp. 128–133.

LÖTTERS, S. 1994. Mitteilung über das plötzliche Verschwinden von Anurenpopulationen in den nördlichen Anden Ecuadors. pp. 134–137.

HERRMANN, H.-J., M. ENGELHARDT, AND M. WENDORF. 1994. Über haltung und vermehrung von *Phrynohyas venulosa hebes* (Cope 1862) im amphibien-vivarium. pp. 138–145.

KABISCH, K., H.-J. HERRMANN, P. KLOSSEK, H. LUPPA, AND K. BRAUER. 1994. Die schaumdrüse von *Polypedates leucomystax* und die chemische zusammensetzung des von ihr produzierten schaumes. pp. 146–155.

WERNEBURG, R. 1994. Dissorophoide amphibien als stammgruppe der Lissamphibien. pp. 156–183.

More on Manipulating Sex Ratios for Conservation

In response to Vogt's editorial on manipulating sex ratios as a conservation strategy, Mrosovsky and Godfrey point out additional data on the intersex hatchlings cited by Vogt and caution against changing management strategies without proper evaluation.

MROSOVSKY, N., AND M. H. GODFREY. 1995. Manipulating sex ratios: Turtle speed ahead! Chelonian Cons. Biol. 1(3):238–240.

Green Blood

Skinks of the genus *Prasinohaema*, endemic to New Guinea and adjacent islands, are unique in being the only amniotes with green blood. Austin and Jessing examined the blood of these lizards to determine the source for the green pigmentation and discovered that these lizards have 40 times the biliverdin concentration of humans with green jaundice.

AUSTIN, C. C., AND K. W. JESSING. 1994. Green-blood pigmentation in lizards. Comp. Biochem. Physiol. 190A(3):619–626

Geckos

In a series of papers, Seipp and colleagues describe two new geckos and *Rhacodactylus ciliatus* is redescribed after being rediscovered more than 100 years after it was originally described by Guichenot (1866).

Bauer and Russell test the hypothesis that frequency of tail loss is reduced in lizards with specialized tails. They found, however, that autotomy frequency was not correlated with tail specialization. Structural constraints imposed by paedomorphosis may effect autotomy frequency in gekkonids.

SEIPP, R. 1994. Eine neue Art der Gattung *Phelsuma* Gray 1825 aus Zentral-Madagascar (Reptilia: Sauria: Gekkonidae) [A new species of the genus *Phelsuma* Gray 1825 from central Madagascar]. Senckenbergiana Biologica 74(1/2):193–197.

SEIPP, R., AND K. KLEMMER. 1994. Wiederentdeckung von *Rhacodactylus ciliatus* Guichenot 1866 im Süden Neukaledoniens (Reptilia: Sauria: Gekkonidae) [Redescription of *Rhacodactylus ciliatus* Guichenot 1866 from the southern district of New Caledonia]. Senckenbergiana Biologica 74(1/2):199–204.

SEIPP, R., AND F. J. OBST. 1994. Beschreibung einer neuen Unterart des neukaledonischen *Rhacodactylus leachianus* Cuvier 1829 (Reptilia: Sauria: Gekkonidae) [Description of a new subspecies of *Rhacodactylus leachianus* Cuvier 1829 from New Caledonia (Reptilia: Sauria: Gekkonidae)]. Senckenbergiana Biologica 74(1/2):205–211.

BAUER, A. M., AND A. P. RUSSELL. 1994. Is autotomy frequency reduced in geckos with "actively functional" tails? Herpetol. Nat. Hist. 2(2):1–15.

Migration

Using genetic markers derived from mitochondrial DNA, Bowen and colleagues were able to trace the origin of juvenile loggerhead turtles (*Caretta caretta*) found in Baja California. Loggerheads are not known to nest along the Pacific coast of the Americas and it was determined that most of the juveniles were from nesting sites in Japan. As juveniles these turtles traverse approximately one-third of the planet.

Bowen, B. W., F. A. Abreu-Grobois, G. H. Balazs, N. Kamezaki, C. J. Limpus, and R. J. Ferl. 1995. Trans-Pacific migrations of the loggerhead turtle (*Caretta caretta*) demonstrated with mitochondrial DNA markers. Proc. Nat. Acad. Sci., USA 92:3731–3734.

Paleoherpetology

Wassersug and Wake describe two well-preserved tadpoles from the Middle Miocene of central Turkey. The tadpoles most closely resemble the genus *Pelobates*. Taxonomic and ecological considerations are discussed.

Parmley examined fossils of the snake *Lampropeltis intermedius* and determined that they belong to *Lampropeltis getula* and *Pituophis*. In light of these new data, the significance of *Lampropeltis similis* fossils are discussed.

Wassersug, R. J., and D. B. Wake. 1995. Fossil tadpoles from the Miocene of Turkey. Alytes 12(4):145–157.

Parmley, D. 1994. Reevaluation of the extinct kingsnake *Lampropeltis intermedius* Brattstrom (Colubridae) with comments on the ancestry of *Lampropeltis triangulum*. Herpetol. Nat. Hist. 2(2):83–88.

Biodiversity & Conservation

Biodiversity and conservation are the subjects of a new book on Mexican flora and fauna. Both phylogenetic uniqueness and endemism were considered in the development of the authors' recommendations. The book also offers a good summary of the Mexican herpetofauna.

Flores Villela, O., and P. Gerez. 1994. Biodiversidad y conservación en México: vertebrados, vegetación y uso del suelo. Universidad Nacional Autónoma de México, Ciudad Universitaria, México. 439 pp.

New Zealand Herpetology

Volume 21, number 4 of the *New Zealand Journal of Zoology* is a special issue consisting of 16 papers from the Second World Congress of Herpetology. The papers are divided into three sections: Reviews, Physiology, and Conservation. The contents of this volume are:

Daugherty, C. H., G. B. Patterson, and R. A. Hitchmough. 1994. Taxonomic and conservation review of New Zealand herpetofauna. 317–323.

Towns, D. R., and C. H. Daugherty. 1994. Patterns of range contractions and extinctions in the New Zealand herpetofauna following human colonisation. 325–339.

Bell, B. D. 1994. A review of the status of New Zealand *Leiopelma* species (Anura: Leiopelmatidae), including a summary of demographic studies in Coromandel and on Maud Island. 341–349.

Cree, A. 1994. Low annual reproductive output in female reptiles from New Zealand. 351–372.

Cartland, L. K., and N. M. Grimmond. 1994. The effect of temperature on the metabolism of juvenile tuatara, *Sphenodon punctatus*. 373–378.

Spencer, N. J., and N. M. Grimmond. 1994. Influence of elevation on the thermoregulation of two sympatric lizards. 379–385.

Newman, D. G., P. R. Watson, and I. McFadden. 1994. Egg production by tuatara on Lady Alice and Stephens Island, New Zealand. 387–398.

Cartland, L. K., A. Cree, W. H. F. Sutherland, N. M. Grimmond, and C. M. Skeaff. 1994. Plasma concentrations of total cholesterol and triacylglycerol in wild and captive juvenile tuatara (*Sphenodon punctatus*). 399–406.

Tyrell, C., and A. Cree. 1994. Plasma corticosterone concentrations in wild and captive juvenile tuatara (*Sphenodon punctatus*). 407–416.

Green, D. M. 1994. Genetic and cytogenetic diversity in Hochstetter's frog, *Leiopelma hochstetteri*, and its importance for conservation management. 417–424.

Brown, D. 1994. Transfer of Hamilton's frog, *Leiopelma hamiltoni*, to a newly created habitat on Stephens Island, New Zealand. 425–430.

Thurley, T., and B. D. Bell. 1994. Habitat distribution and predation on a western population of terrestrial Leiopelma (Anura: Leiopelmatidae) in the northern King Country, New Zealand. 431–436.

Bell, E. A., and B. D. Bell. 1994. Local distribution, habitat, and numbers of the endemic terrestrial frog *Leiopelma hamiltoni* on Maud Island, New Zealand. 437–442.

Newman, D. G. 1994. Effects of a mouse, *Mus musculus*, eradication programme and habitat change on lizard populations of Mana Island, New Zealand, with special reference to McGregor's skink, *Cyclodina macgregori*. 443–456.

Towns, D. R. 1994. The role of ecological restoration in the conservation of Whitaker's skink (*Cyclodina whitakeri*), a rare New Zealand lizard (Lacertilia: Scincidae). 457–471.

Goetz, B. G. R., and B. W. Thomas. 1994. Use of annual growth and activity patterns to assess management procedures for captive tuatara (*Sphenodon punctatus*). 473–485.

SHIS Publications

The Smithsonian Herpetological Information Service (SHIS) series publishes papers judged useful to individuals interested in the biology of amphibians and reptiles, but which are unlikely to be published in journals. More information can be obtained by writing George Zug, Division of Amphibians and Reptiles, National Museum of National History, Smithsonian Institution, Washington, D.C. 20560, USA. The six papers published during 1994 are:

Vanzolini, P. E. 1994. On the distribution of certain South American turtles (Testudines: Testudidae & Chelidae). (97):1–10.

Auth, D. L. 1994. Checklist and bibliography of the amphibians and reptiles of Panama. (98):1–59.

Liner, E. A. 1994. Bibliography and scientific name index to amphibians and reptiles published in the Caribbean Journal of Science Volumes 1–25, 1961–1989. (99):1–30.

Kitchell, K., Jr. and H. A. Dundee. 1994. A trilogy on the Herpetology of Linnaeus's Systema Naturae X. (100):1–61.

Crombie, R. I. 1994. Herpetological publications of the National Museum of Natural History (USNM), 1853–1994. (101):40.

Kuzmin, S. L. 1994. Bibliography of the Siberian Newt (*Salamandra keyserlingii* Dybowski, 1870). (102):1–53.

Amphibia-Reptilia

Amphibia-Reptilia is a peer-reviewed journal published quarterly by the Societas Europaea Herpetologica. Subscription information can be obtained by writing U. Joger, General Secretary, Hessisches Landesmuseum, Zoologische Abteilung, Friedenplatz 1, D-64283 Darmstadt, Germany. The contents of volume 16, number 2 (1995) are:

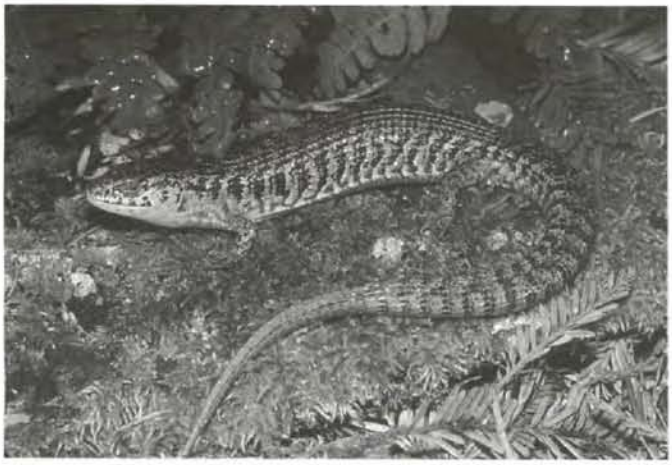
LARDNER, B. 1995. Larval ecology of *Rana arvalis*: an allopatric island population compared with a sympatric mainland population. 101–111.

LYNCH, L. C., AND D. G. BLACKBURN. 1995. Effects of testosterone administration and gonadectomy on nuptial pad morphology in overwintering male leopard frogs, *Rana pipiens*. 113–121.

RASMUSSEN, J. B., K. M. HOWELL, AND M. ANDERSON. 1995. A review of the Usambara forest snake *Geodipsas vauerocegae* and the Uluguru forest snake *G. procterae*. 123–136.

ARNTZEN, J. W., R. S. OLDHAM, AND D. M. LATHAM. 1995. Cost effective drift fences for toads and newts. 137–145.

COOPER, W. E., JR. 1995. Strike-induced chemosensory searching by the anguid lizard *Elgaria coerulea*. 147–156.



The northern alligator lizard (*Elgaria coerulea*) is the subject of papers by Cooper and Good in *Amphibia-Reptilia* (volume 16, number 2). Photo is of an adult from the Santa Cruz Mts., Santa Cruz Co., California, USA. Photo by R. W. Hansen.

GOOD, D. A. 1995. Cranial ossification in the northern alligator lizard, *Elgaria coerulea* (Squamata, Anguidae). 157–166.

MULLIN, S. J., AND H. R. MUSHINSKY. 1995. Foraging ecology of the mangrove salt marsh snake, *Nerodia clarkii compressicauda*: effects of vegetational density. 167–175.

ARONSSON, S., AND J. A. E. STENSON. 1995. Newt-fish interactions in a small forest lake. 177–184.

DELHEUSY, V., C. BRILLET, AND V. L. BELS. 1995. Etude cinématique de la prise de nourriture chez *Eublepharis macularius* (Reptilia, Gekkonidae) et comparaison au sein des geckos [Cinematographic study of prey handling in *Eublepharis macularius* (Reptilia, Gekkonidae) and a comparison to other geckos]. 185–201.

MIJARES-URRUTIA, A., AND A. ARENDS R. 1995. Aportes al conocimiento de *Gonatodes falconensis* Shreve, 1947 (Lacertilia: Gekkonidae) del noroest de Venezuela [Redescription and new records of *Gonatodes falconensis* Shreve, 1947 (Lacertilia: Gekkonidae) from northeast Venezuela]. 203–210.

SÁ-SOUSA, P. 1995. The introduced Madeiran lizard, *Lacerta (Teira) dugesii* in Lisbon. 211–214.

ARTICLES

Fruit and Nectar Feeding by *Podarcis lilfordi* (Lacertidae) on Cabrera Archipelago (Balearic Islands)

Although only about 2% of lizard species are strictly herbivorous, many others consume plant and animal material in variable proportions (e.g., Busack and Jaksic 1982; Heatwole and Taylor 1987; Iverson 1979; Pough 1973). Omnivorous lizards often prefer flowers and fruits over leaves, presumably because reproductive parts are more efficiently assimilated than vegetative parts (Durtsche 1992; Heatwole and Taylor 1987; Pough 1973).

Lizard nectarivory has only been described on islands, in species of the families Gekkonidae (from Seychelles: Cheke 1984; Evans and Evans 1980; Gardner 1986; from New Zealand: Whitaker 1987a, 1987b), Scincidae (from Seychelles: Cheke 1984), Teiidae (from Bonaire, Lesser Antilles: Dearing and Schall 1992) and Lacertidae (from Madeira: Elvers 1977, 1978). Most reports of frugivory also result from studies of insular populations: Racine and Downhower 1974; Christian et al. 1984; Schluter 1984 (Galapagos Islands); Barquin and De La Torre 1975; Valido and Nogales 1994 (Canary Islands); Sadek 1981 (Madeira and Salvages Islands); Iverson 1985 (Bahamas); Whitaker 1987a (New Zealand); Auffenberg 1988 (Philippines); Sylber 1988 (Gulf of California); Castilla and Bauwens 1991 (Columbretes Archipelago, Spain); and Dearing and Schall 1992; Lichtenbelt 1993 (Netherlands Antilles). Nevertheless, continental populations may be frugivorous (e.g., Hernández 1990; Traveset 1990).

Here we report our observations on herbivory in *Podarcis lilfordi* (Günther 1874), a small lacertid lizard (81 mm maximum SVL) endemic to the islands that surround Mallorca and Menorca, Balearic Islands, Spain. The few references on the diet of this lizard describe it as an insectivorous species, although mentioning flower and fruit consumption (Pérez-Mellado 1989; Salvador 1986). Mayol (1985) points out that these lizards also eat nectar, but he does not specify, however, whether such nectar is collected without consuming the flowers. Pérez-Mellado (1989) reports that *P. lilfordi* reaches the nectar of *Crithmum maritimum* (Umbelliferae) by consuming its stamens.

Our data are based upon direct observations of foraging lizards, made during the peak of their daily activity period, mostly from January through September, 1993, in the archipelago of Cabrera and on Moltona islet (south of Mallorca island). The vegetation of these islands is dominated by a Mediterranean scrubland. We followed some individual lizards or watched particular plant species, from a distance of 2–3 m, during 20 min or until the animals disappeared. For each observation period, we recorded the number of plant parts consumed with a hand counter, and timed the feeding behavior with a stopwatch. Some additional data were obtained by examining stomach contents (gathered using stomach flushing) and fecal samples (taken haphazardly from the ground), collected during 1992 and 1993.

In the flowering period (mid March–mid April) of *Euphorbia dendroides* (Euphorbiaceae), a highly branching shrub that can reach 2 m in height, *P. lilfordi* was observed climbing up the trunk or the lowest branches near the ground to reach the yellow insect-pollinated flowers. This plant produces hundreds to thousands of inflorescences, 5 mm in size, that are in turn assembled in umbels of one to five. Each inflorescence consists of several minute flow-

ers surrounded by 4–5 glands, which secrete a copious and highly concentrated nectar. We observed lizards up to 1.1 m above ground surface, moving from branch to branch with no difficulty. After finding an umbel, the lizard stops and, placing its snout in front of the glands, starts lapping up the nectar. The lizard usually feeds from all inflorescences of a whole umbel before moving to the next, usually nearest umbel. The feeding rate averaged 8.8 ± 7.3 (SD) lapped inflorescences/minute (N = 10 individuals; total time spent on plants 109 min). Not all visited inflorescences are lapped, which suggests that lizards are examining and selecting those richer in nectar. The period that an individual lizard remained in a shrub varied from several seconds to 18 min (N = 16 individuals). Up to five individuals were counted simultaneously feeding on a single shrub, which is equivalent to 2.4 lizards/m^2 of cover (N = 9 plants observed). Nectar feeding was observed with greatest frequency on sunny days (with a photoperiod length of 12 hours) between 0800 h (1.5 hours after local sunrise) and 1100 h (GMT), although some individuals were seen on inflorescences until mid-afternoon.

When feeding upon nectar of *E. dendroides*, the lizard rubs its snout against the anthers that jut out from the male flowers. Also, while moving among inflorescences within the shrub, the ventral part of its body brushes against both male and female flowers, with the possibility of laying the collected pollen from males on the stigmas of females, and thus favoring pollination. This is supported by our direct observations (with binoculars) of several individuals with the snout covered by pollen while they were feeding upon nectar.

Podarcis lilfordi was also observed feeding upon nectar of *Rosmarinus officinalis* (Labiatae), a shrub widely distributed in Cabrera that blooms during winter. Its bluish insect-pollinated flowers are about 8 mm long, located in racemes at the distal ends of the branches, and produce abundant nectar. Up to six individual lizards were counted under a shrub about 1 m in diameter. Lizards concentrate under the shrubs not only to eat but also for refuge since the stems are multi-branched and densely foliaged. To reach the nectar, *P. lilfordi* introduces the tip of its snout into the tube of the corolla and, extending its tongue, starts lapping from the bottom. As in the case of *E. dendroides*, lizards do not feed from all flowers visited.

The particular arrangement of the floral pieces of *R. officinalis* allows also that while the lizard is lapping up nectar, the stigma and the anthers come in contact with the upper part of its head. If some of the pollen grains adhere to the head, it is quite possible that the lizard promotes pollination in this plant.

Lizards feed not only upon the nectar of *R. officinalis*, but also consume its flowers. They can ingest entire flowers or just bite a piece of the corolla, often taking stamens and the pistil with it. They have also been observed removing dropped flowers. The examination of stomach contents reveals that during February and March, the flowers of *R. officinalis* constitute, on average, 70 ± 35% (SD) of stomach content volume (N = 15). The flowers of *E. dendroides* were never observed to be consumed by lizards, probably because of the toxic latex that the plant exudes when tissue breaks.

Another species from which flowers are abundantly consumed in Cabrera, though never reaching the importance of *R. officinalis*, is *Globularia alypum* (Globulariaceae), a short shrub with small violet flowers arranged in capitula of about 15 mm diameter. From January to March, lizards were observed climbing with some difficulty, the thin (ca. 1 mm thick) branches which bent under the weight of the animals. While climbing, they appeared to maintain balance with the aid of their tails. Some lizards were observed jumping from the ground to reach the flowers. They usually tore off the stamens, pistils, bracts, and petals, leaving some capitula almost completely bare of functional flowers.

Six individuals were also seen, in January, tearing off and ingesting the petals of the yellow flowers of *Fumana ericoides* (Cistaceae), a plant sparsely distributed in Cabrera. At the beginning of September, on Na Plana, one of the islets of the Cabrera archipelago, the majority of individuals of *P. lilfordi* were observed on the branches of *Arthrocnemum fruticosum* (Chenopodiaceae) ripping the stamens from the flowers. Flowers from other species, such as *Alyssum maritimum* (Brassicaceae) and *Cneorum tricoccon* (Cneoraceae) also have been occasionally found in stomach contents.

Analysis of about 350 lizard scats of *P. lilfordi* from the Cabrera archipelago showed that it consumes the fleshy fruits of a variety of species (Table 1). The prevalence in the diet of a particular species was dependent on the fruit availability in the place and time of the collection of the samples. With the exception of *C. tricoccon*, which appears to be dispersed mainly by lizards on Cabrera, these fleshy fruits are also consumed by birds (Traveset 1993). The fruits of *C. tricoccon* are available from late winter through late spring and are consumed by lizards as soon as they ripen (turning a red color). Lizards were often seen climbing the shrubs—which can reach up to 1 m in height—and removing the cocci (three per fruit), one at a time. Usually, the lizard takes a coccus in the mouth and transports it some distance from the plant, where it is swallowed. We found up to four seeds of this plant in lizard scats, although two or three is usual. The seeds have been shown to be viable after passing through the lizard's gut, using the TTC (2,3,5 triphenyl tetrazolium chloride) bioindicator (Heydecker 1968).

TABLE 1. Plant species consumed by *Podarcis lilfordi*. N = nectar, Fw = flowers, Fr = fruits.

Plant species (Family)	N	Fw	Fr
Juniperus phoenicea (Cupressaceae)			+
Ephedra fragilis (Ephedraceae)			+
Ficus carica (Moraceae)			+
Arthrocnemum fruticosum (Chenopodiaceae)		+	
Fumana ericoides (Cistaceae)		+	
Alyssum maritimum (Brassicaceae)		+	
Euphorbia dendroides (Euphorbiaceae)	+		
Rhamnus ludovici-salvatoris (Rhamnaceae)			+
Pistacia lentiscus (Anacardiaceae)			+
Cneorum tricoccon (Cneoraceae)		+	+
Withania frutescens (Solanaceae)			+
Rosmarinus officinalis (Labiatae)	+	+	
Phillyrea angustifolia (Oleaceae)			+
Phillyrea latifolia (Oleaceae)			+
Globularia alypum (Globulariaceae)		+	
Arum italicum s.l. (Araceae) *			+
Asparagus stipularis (Liliaceae)			+

* This species has only been found on Moltona islet.

Preliminary analyses of stomach contents and observations of foraging behavior in *P. lilfordi* reveal that the degree of herbivory varies with season. During February and March plant material constitutes 70 ± 35% (SD) of the volume of stomach contents,

and appears in 93% of stomachs (N = 15). Percentages decrease to 3 ± 7% and 13%, respectively, in stomach contents examined from specimens (N = 15) captured during August.

Our observations indicate that plant material constitutes an important fraction of the diet of *Podarcis lilfordi* during some months of the year at some localities. *P. lilfordi* consumes flowers and fruits of different plant species, and probably acts as seed dispersers for them. It also obtains nectar of several species by lapping the flowers without ingesting or damaging them. This indicates that, at least for species such as *Euphorbia dendroides* and *R. officinalis*, the lizard may have a role as pollinator. Such a role has been proposed for another lacertid, *Podarcis muralis dugesii* (Elvers 1977, 1978), and for three species of geckos (Whitaker 1987a, 1987b). According to Elvers (1977), the smooth texture of the skin of most lizards would make them inefficient collectors and transporters of pollen. Our observations, however, indicate that body contact with the sticky nectar while visiting the flowers increases pollen adherence to the skin.

We conclude that *P. lilfordi* has the potential of having a relevant effect on the reproduction of several plant species. Besides influencing plant fitness, either positively (pollinating flowers or dispersing seeds) or negatively (consuming flowers, partially or totally), the lizards may well affect the vegetation structure of the island to some degree, especially at those sites where they are most abundant.

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ENCARNA SÁEZ

and

ANNA TRAVESET

Institut d'Estudis Avançats de les Illes Balears
Crtra. de Valldemossa, Km. 7.5
07071-Palma de Mallorca
Spain.

Status of *Leptodactylus labyrinthicus* (Calf Frog, Rana Ternero) in Venezuela

Since the publication of Rivero's "Salientia of Venezuela" (1961), the identification and distribution of the different members of the *Leptodactylus pentadactylus* species group in Venezuela has been puzzling. The group, composed of 11 species (Heyer 1979), ranges from Honduras to the Guianas, reaching Peru and Argentina through the Amazonian region. No member of the species group is present in Chile (Veloso and Navarro 1988).

Prior to Heyer's (1979) study of the systematics and distribution of the *L. pentadactylus* species group, *L. pentadactylus* was the only large species of the group recorded from Venezuela. In 1961, Rivero received some specimens collected by Maquiritare Indians in the vicinity of the Río Cunucunuma, Estado Amazonas, close to the border with Brazil and Colombia in the southernmost part of the country. This information was reported later in a review of the distribution of frogs in the Venezuelan Guayana (Rivero 1964b). Subsequently, Heatwole et al. (1965) reported collecting one specimen in the area south of El Dorado, Estado Bolívar; Rivero and Esteves (1969) found a fairly large population in Güiria, Estado Sucre; and Rivero-Blanco and Dixon (1979) reported its presence in Yuruani, Estado Bolívar.

In August 1991, we were surveying frogs in the state of Sucre in northwestern Venezuela. On 16 August 1991, while a late afternoon rain was falling, we found a population of large frogs similar to *L. pentadactylus* (Fig. 1), at La Fragua (10°12'N; 63°57'W, ca. 350 m), a village in one of the valleys running down from the northern versant of the Sierra del Turimiquire (Fig. 2). Males began calling at about 1730 h and stopped at 2000 h. Occasionally, automobiles pass this site on the road to Cumanacoa. All large trees have been cut, and the most common habitat is secondary growth of mixed riparian and thorny forests. The frogs appeared only slightly disturbed by our presence, even when flushed with lantern light. Approximately five males were calling louder than others in the background. They were under rocks, in crevices, or among dense herbs about 45–60 cm high. Some adult specimens were collected along the bank of a temporary stream, parallel to the small Río La Fragua, one of the tributaries of the larger Río Manzanares. We were informed that people in the village do not include the frogs as part of their diet. *Bufo granulosus*, *B. marinus*, *Leptodactylus wagneri*, *Physalaemus pustulosus*, and *Hyla crepitans* also make up the anuran community.



FIG. 1. Male *Leptodactylus labyrinthicus* from La Fragua, Estado Sucre, Venezuela, showing the chest spines grown during the reproductive season.

Three specimens were collected—two males and one female. One male was immediately preserved for deposition in the Collection of Vertebrates, Universidad de Los Andes (CV-ULA 5541). The other two frogs were transported alive to Mérida, but during the trip, the male ate the female. That male was kept alive until mid-July 1992; after its death, unfortunately, the carcass was discarded. Figure 1 shows one of the collected mature male specimens with chest spines.

On 19 August 1991, we arrived at Macuro (10°40'N; 61°02'W, about 10 m), in the easternmost sector of the Península de Paria National Park, Estado Sucre (Fig. 2). This point is a flat terrace extending for some 300 m to the piedmont of a chain of hills, covered with tropical humid forests (Petróleos de Venezuela, S. A. 1992). The island of Trinidad is within view. That night five different species of frogs were heard calling, including one with apparently the same call as the one at La Fragua. At mid-afternoon on the following day, an extremely heavy rain fell while we were climbing the mountains. Before sunset, at the piedmont (between 50 and 100 m) another population with the same call was located. No specimens were collected but notes were taken. More than 20 males were identified by their calls while coming down the trail along Macuro Creek. Each calling male was separated from its nearest neighbor by a mean distance of about 10 m. The habitat was tropical rain forest with large trees and agricultural clearings. Some of the calling frogs were no more than 20 m from houses and domestic animals. *Bufo granulosus*, *B. marinus*, *Colostethus trinitatis*, *Eleutherodactylus* sp., *Leptodactylus fuscus*, and *Physalaemus* aff. *pustulosus* were also recorded.

On 1–2 November 1993, the senior author revisited the La Fragua locality to check for the population of large frogs. At that time, no major environmental changes were noted. There was a light rain every evening, but frog activity was low. Only *Hyla crepitans* was heard calling. By playing a tape of calls of the large *Leptodactylus* species recorded at the same place two years before, several responses from individuals of the desired species were obtained—isolated calls from different sites. Only a few individuals could be seen. Three specimens were collected and preserved (CV-ULA 5620–22). The docile and submissive behavior shown by these large frogs was noteworthy.

The frogs collected were similar to two specimens (CV-ULA 1179–80) of large *Leptodactylus* from Cueva del Agua, 600 m, Estado Anzoátegui, received by the Vertebrate Collection of the Universidad de Los Andes in July 1979. Cueva del Agua is about 100 km W of La Fragua (Fig. 2).

Three large species of *Leptodactylus* might occur in Venezuela: *L. knudseni*, *L. labyrinthicus*, and *L. pentadactylus* (Péfaur



FIG. 2. Distribution of *Leptodactylus labyrinthicus* in Venezuela, showing populations reported here (stars), by Heyer (1979) (squares); and by Rivero and Esteves (1969) (triangle).

1992). Using Heyer's (1979) key for the members of the *L. pentadactylus* group and Hero and Galatti's (1990) characteristics for a pair of species of this same group, and on distributional grounds, we have identified our specimens as *Leptodactylus labyrinthicus*. This identification was confirmed by Heyer upon his examination of the specimens (Heyer, pers. comm.). Based on distributional inferences (Heyer 1979) it is probable that the specimens reported by Rivero (1961), Heatwole et al. (1965), and Rivero-Blanco and Dixon (1979) are *L. knudseni*, but those collected by Rivero and Esteves (1969) are *L. labyrinthicus*.

The populations of *L. labyrinthicus* reported here confirm the presence of this species in Venezuela north of the Río Orinoco in tropical humid forest or previously forested environments of the eastern part of the country (Fig. 2). However, there still remains the question of why this species is not present in the tropical humid forest environments of north-central and northwestern Venezuela. Members of this species are distinct and ubiquitous where present. During the reproductive season (Rivero and Esteves 1969; and our data), its loud and peculiar call, similar to the bleat of a calf, large size, and predatory behavior make it impossible to overlook. Several thorough herpetological studies of Venezuelan tropical forests and savannahs failed to detect this species, although a wide range of habitats were sampled. Studies conducted in forested environments (Cordero 1987; Rivero 1964a) in the Coastal Range and associated habitats did not report this species. Among the savannah studies, one was conducted in the eastern part of Venezuela, south of the Río Orinoco (Hoogmoed and Gorzula 1979), while others were north of the Río Orinoco, three in the Central Llanos (Fouquette 1968; Lamotte and Solano 1989; Staton and Dixon 1977), and one in the Upper or Western Llanos (Péfaur and Díaz de Pascual 1987). None included this species in their accounts.

Some important biogeographical and ecological facts about *L. labyrinthicus* should be noted: (1) Its general distribution in eastern Venezuela is not continuous; populations are restricted in their distribution and confined to Sucre and the northern part of Anzoátegui and Monagas states. (2) At least in the past, the Río Orinoco and/or the Guyana Shield environments have not been zoogeographical barriers for the species, as it exists north of that river (in Venezuela), and south of the shield (in Roraima State, Brazil) (Heyer 1979: MZUSP 24936). Continuity of the tropical humid forest persists (Huber and Alarcón 1988), potentially permitting a distribution throughout those environments. However, the geographical distance between the northeastern Venezuelan (about 11°N) and northern Brazilian (about 5°N) populations, plus the existence of a complex of geological and floristic factors in the intermediate environment, allow the prediction of taxonomic differentiation between the northern and southern populations at least at the level of subspecies. (3) The distributional hiatus between these two populations of *L. labyrinthicus* is seemingly occupied by populations of *L. knudseni*. (4) Although the species occurs primarily in tropical humid forests, it also can be found in areas of drier secondary forests. (4) The Llanos, or savannahs, are not suitable habitats for *L. labyrinthicus*.

At present, in both Brazil and Venezuela, there are some experimental commercial frog farms using what we are here calling *L. labyrinthicus*. From a conservation point of view, these attempts at exploitation could become a problem in Venezuela: (1) these frogs are economically attractive because of their large size; (2) they are easy to collect due to their behavior (loud call and docility); (3) it is hard to differentiate between *L. knudseni* and *L. pentadactylus*; and (4) they are distributed only in a small sector of the country. These factors could easily lead to the decimation of the populations by over collecting. At this time, our knowledge of *L. labyrinthicus* biology is too meager to be confident that the management of commercial farms will be adequate.

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JAIME E. PÉFAUR

and
NANCY M. SIERRA*
Ecología Animal
Facultad de Ciencias
Universidad de Los Andes
Mérida 5101, Venezuela.

** Present address of NMS: Departamento de Zoologia, I.B., Universidade Estadual de Campinas (UNICAMP), C.P. 6109, CEP 13081-970, Campinas, S. P., Brasil.*

New Records of Dicephalic Snakes in Museum Collections

The first review of two-headed snakes by Cunningham (1937) surveyed 48 taxa, while the latest review of the subject by Smith and Pérez-Higareda (1988) added another 51 taxa for a total of 99 species and subspecies known to have duplication in some part of the body. This note reports the presence of 11 additional specimens, including the first records for one (or possibly two) species, in the California Academy of Sciences (CAS) *(Lampropeltis getulus californiae, Pituophis catenifer catenifer, Thamnophis atratus atratus, Thamnophis* cf. *gigas),* the Museum of Comparative Zoology (MCZ) *(Coluber constrictor, Elaphe obsoleta, Thamnophis sirtalis sirtalis, Bothrops atrox),* and Brigham Young University (BYU) *(Thamnophis elegans vagrans).* Abbreviations used include SVL (snout-vent length), TL (tail length), MBD (midbody diameter), RTL (relative tail length), SL (supralabials), N (nasal: undivided=1, semidivided=1/2, divided=2), L (loreal), PRO (preocular), PTO (postoculars), SO (subocular), T (temporals), IL (infralabials), AG (anterior genials), PG (posterior genials), G (gulars), DSR (dorsal scale rows), V (ventrals: divided=div.), SC (subcaudals: single=sin., paired=pr.), USVI (umbilical scar-vent interval), and VT (vertebrae).

The most publicized dicephalic snake is probably *Lampropeltis getulus californiae,* four of which were kept at the San Diego Zoo over a 20-year period from 1954–1974 (Chapman 1960; Lüdicke 1964; Schmidt and Inger 1957; Shaw 1955, 1956, 1958, 1959, 1968, 1971; Shaw and Campbell 1974; Wexo 1981a-b, 1987, 1992). Dudley Duplex I and Nip and Tuck exhibited the ringed phase pattern while Dudley Duplex II and an unnamed specimen that survived only a short time in captivity represented the striped phase. A fifth specimen (ringed phase) was reported by Belfit and Nienaber (1983). Two ringed-phase specimens, representing the sixth and seventh records for *L. g. californiae,* are preserved in the collection of the CAS. CAS 195591, from North Bay, Santa Rosa, Sonoma Co., California, is a 305-mm craniodichotomous juvenile with the following characteristics: 25.5 + 7 body and tail rings, SVL 259 mm, TL 46 mm, RTL 15.1%, 220 V, A 1, 56 pr. SC (#2-4 sin.), 23-23-19 DSR, 7 SL(#3-4 in orbit), N 2, 1 L, 1 PRO, 2 PTO, 2+3 T, USVI 17.7% V. Both heads are rotated laterally and joined at the angle of the jaw. The only cephalic scale variation involves the IL, which number 9 (first 4 contacting AG) on both sides of the right head while the left head possesses 9(4) on the left side and 10(4) on the right side.

CAS 195590, collected in 1984 on the Stanford University campus, Palo Alto, Santa Clara Co., California, is a 751-mm prodichotomous *L. g. californiae* with 24 + 6 body and tail rings, SVL 648 mm, TL 103 mm, RTL 13.7%, 223 V, A 1, 57 pr. SC, 21-23-19 DSR, 7(3,4) SL, N 2, 1 L, 1 PRO, 2 PTO, 2+3 T, and USVI 13.0% V. The left head has 8(3) IL on both sides but the right head exhibits 10(4) IL on the left side and 8(3) IL on the right. The specimen is eviscerated but the respiratory system was duplicated as two avascular tracheae are present, with vascular parenchyma of the right lung observable posteriorly and a left orifice lacking, confirming that the specimen had two separate tracheae (and therefore two right lungs as well), a terminal tracheal entry into the right lung, and lack of both a tracheal lung and left lung complex. Normal specimens of *L. g. californiae* possess a terminal tracheal entry and lack both a tracheal lung and left lung (pers. obs.).

Records of dicephalic *Pituophis catenifer* include Wright (1878) from San Jose, California, and Arefare (1892) from Auburn, California. Cunningham (1937) suspected that this latter specimen was the same one present in the CAS collection and which appeared in the San Francisco Examiner of 8 October 1891. A remarkable specimen is a craniodichotomous adult *P. c. catenifer,* representing either the third or fourth record for this subspecies, now in the collection of the CAS. CAS 195593 was collected as a hatchling in 1969 in Napa Co., California, resided in a local school for five years, and then was exhibited at the Steinhart Aquarium at the CAS until its death on 31 January 1991. Based upon a hatching period from September to November, it lived for 22 years plus 2-4 months, constituting a longevity record for both dicephalic snakes and this subspecies (Snider and Bowler 1992). This specimen is now represented by cleared-and-stained heads and a short neck section. The bifurcation of the spine has 6 VT on the left and 6 VT on the right, followed by 12 anteroposterioly compressed VT and then 20 normal VT. The first ribs appear on the VT 3. This snake is illustrated Leetz (1983, 1991) as well as several newspaper articles over the years and the current CAS visitor's brochure.

Dicephalic *Thamnophis atratus* have not been previously reported. CAS 195592 is a 234-mm craniodichotomous juvenile *T. a. atratus,* collected by Marianne Schonfisch on a road around "Windy Hill," Palo Alto, Santa Clara Co., California, with the following data: SVL 185.5 mm, TL 48.5 mm, RTL 20.7%, 153 V, A 1, 80 pr. SC, 19-19-15 DSR, N 1/2, 1 L, 1 PRO, 3 PTO, 10(5) IL, and USVI 17.0% V. Head shield variation includes 8(4,5) SL on both sides of right head but left head exhibits 8(4,5) SL on left and 7(3,4) SL on right side, 1+2+2 T on left side and 1+2+2/1 T on right side of right head while the left head possesses 1+2+1 T on left side and 1+2+2 T on right side. The gray vertebral stripes of each neck fuse at the level of V 27.

CAS 156520 is a 200-mm prodichotomous juvenile *Thamnophis* cf. *gigas* collected by Ed Ruman et al. in August, 1983, on Michigan Bar Road, Sloughhouse, Cosumnes River, Sacramento Co., California. This cleared-and-stained specimen was originally catalogued as a *Thamnophis atratus aquaticus* but that species is coastal in distribution and does not occur anywhere near the reported place of collection. Segmental counts and relative tail length fall within the range of variation of male *T. gigas* from the Sacramento area (Rossman and Stewart 1987) although this specimen could possibly be a female *T. e. elegans* or a *T. sirtalis fitchi* with high ventral and low subcaudal counts. Based upon its original identification and data, it is more likely to represent *T. gigas* than *T. sirtalis,* and if so would represent the first record for the species. It possesses the following characteristics: SVL 154 mm, TL 46 mm (tip missing), RTL ca. 23%, left and right neck bifurcations each with 11 VT, 168 total precloacal VT, 75 caudal VT, first ribs on VT 4 of each neck, 4 lympapophyses, 243 total VT (counting only one neck).

The first dicephalic *Thamnophis s. sirtalis* was reported by Ditmars (1903) and many subsequent individuals have been re-

ported (Cunningham 1937). Two neonate specimens of *T. s. sirtalis* in the MCZ were collected by Scott Heimo in August, 1962, near Westminster, Worcester Co., Massachusetts, both presumably from the same mother. MCZ 68959 is a 156-mm craniodichotomous individual in which the head is only partially duplicated, there being two snouts with 4 N, 4 L, 4 internasals, 5 prefrontals, one triradiate frontal, and a pair of normal parietals. Other characteristics include: SVL 121 mm, MBD 3.5 mm, TL 35 mm, RTL 22.4%, 19-19-17 DSR, 3 G, 159 V (#8-9 divided), A 1, 74 pr. SC, SL 7(3,4), N 2, 1 L, 1 PRO, 3 PTO, 1+2 T on left side, 1/2 T on right side, IL 10(5), USVI 14.4% V (V 137 still open). Only two maxillae are present, one on each of the outer lateral sides of the head. The medial sides of each snout exhibit 4 SL.

MCZ 68960 is a 109-mm amphidichotomous *T. s. sirtalis* in which the two heads are not completely separated but the posterior 2/3 of the body is bifurcated (the vertebral column appears to be duplicated along its entire length). It possesses N 2, 1 L, 1 PRO, 3 PTO, 1+2 T, and 2 AG on each side of the head, and 19-19-17 DSR. Variable scale counts include: 146 V (#61-92 div.) and 59 pr. SC (#6-10 and 44-52 sin.)/ca. 140 V (#51-80 div.) and 59 pr. SC, left/right lateral head counts include 8(4,5,6)/7(3,4) SL and 9(4)/8(4) IL, and left/right medial head counts include 6(3,4)/4 SL, 5 (4)/4(4) IL, and 1+1/1 T. There are three PG as both heads share a single curved genial contacting the medial AG of each side. The undivided anterior portion of the body plus the head measures 30 mm with the left body and tail 46 mm + 26 mm and the right body and tail 54 mm + 25 mm. Total length of the left/right sides are 102/109 mm with RTL 25.5%/22.9%.

A dicephalic *Elaphe obsoleta confinis* was reported by Strecker (1926). MCZ 176975 is a 196-mm embryonic craniodichotomous *E. obsoleta*, without locality data, donated by Rick Stafford in 1975. The two heads are nearly complete but joined at the tertiary temporals and last supralabials. Characteristics include: 34.5 + 14 dark rhombs on the body and tail, SVL 161 mm, MBD 5 mm, TL 35 mm, RTL 17.9%, 30-27-19 DSR, 230 V (#3-6, 14-31, 40-41, 43-44, 50-51, 85-86 div.), A 2, 64 pr. SC, N 2, 1 L, 1 PRO, 2 PTO, 10(4) IL, 3 G, USVI 23.2% V. Variable scale counts include: 9(4,5)/7(4,5) SL and 2+3+4 T on the left head (measuring 11 mm) and 9(3,4,5)/8(4,5) SL and 2+3+3 T on the right head (12 mm).

The first record of a dicephalic *Coluber constrictor* was that of Mitchill (1826). A gravid 1.3 m *C. constrictor* collected in Rockport, Essex Co., Massachusetts, by Rick Roth on 14 June 1994 laid a clutch of 18 small eggs (ca. 30 x 22 mm) on 19 June. Sixteen eggs hatched between 6-10 August but the two remaining eggs, which failed to hatch after another 10 days, contained a dicephalic specimen in one and a pair of perfectly formed twins in the other. MCZ 179700 is a craniodichotomous individual that has the two heads joined at the angle of the jaw and the body is folded back upon itself and fused together in three places. It has the following characteristics: SVL ca. 193 mm, TL 70 mm, RTL ca. 27%, 193 V, A 2, 103 pr. SC, 18-16-14 DSR, N 2, 1 L, 2 PRO, 2 PTO, and 3 G. Variable characters include 8(4,5)/7(3,4) SL on left head, 7(3,4)/8(4,5) SL on right head, 9(4) IL on left head, 10(4) IL on right head, 2+2/1+2 T on left head (both sides), and 2+2+2/2+1+2 T on right head. The dorsal scale rows are noteworthy as they are perfectly formed and not unusual in any way except in being even numbered. The twins (MCZ 179701–02), which are apparently females as everted hemipenes are absent, are identical in the following features: 99 pr. SC, 17-17-15 DSR, 7(3,4) SL, 9(4) IL, N 2, 1 L, 2 PRO, 2 PTO, 2+1+1 T on left side, 2+1+2 T on right side. Variable characteristics include (MCZ 179701 first, followed parenthetically by MCZ 179702): SVL 175 (171) mm, TL 58 (55) mm, RTL 24.9% (24.3%), 5 (4) G, V 179 (180), USVI 14% (16%). Total number of VT appears to be the same as G+V+SC count=283.

An uncatalogued photograph in the MCZ depicts a craniodichotomous *Thamnophis sirtalis sirtalis* collected at Saugus, Essex Co., Massachusetts from August-September, 1939, by Arthur Holbrook, Sr. Disposition of the specimen is unknown as it was never entered into the MCZ collection.

Numerous dicephalic *Bothrops atrox* have been reported, the first by Cunningham (1932). MCZ 14103 is a 247-mm asymmetrically prodichotomous *B. atrox*, without locality data, from the New York Zoo, donated by Thomas Barbour in 1920. Both heads measure 18 mm but the right head and neck (48 mm) are 27% longer than the left (35 mm). Other characteristics include: SVL 206 mm, MBD 11 mm, TL 41 mm, RTL 16.6%, 25-27-21 DSR, 179 V on body (#40-42, 46-57, 62-63, 79-80, 86-110 div.), 7 V and 2 G on the left neck (= 186 total V) and 19 V and 2 G on the right neck (= 198 total V), A 1, 62 pr. SC (#1, 3-21, 23-25 sin.), 7 SL (#2 entering pit), N 2, 2 PRO, 1 SO, one row of oculolabials, 6 intersupraoculars, 10(3) IL, and USVI 34.1% V. The only variable feature of scutellation is 3/2 PTO on the left head and 2/2 PTO on the right. The left paravertebral scale row is transversely enlarged four times the width of the costal scales for nearly the length of the body.

The first dicephalic *Thamnophis elegans vagrans* was reported by Cunningham (1937). A second specimen is represented by a 180–200 mm freeze-dried prodichotomous juvenile on exhibit in the Monte L. Bean Museum at BYU. This specimen was collected by Tim Gibson on 9 August 1981 at Orem, Utah, and exhibits an asymmetrical bifurcation of the necks with the left neck divided for 1.5 head lengths and the right neck for 2 head lengths.

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V. WALLACH
4 Potter Park
Cambridge, Massachusetts 02138, USA.

Ecological Observations of the Scincid Lizard *Mabuya agilis* in a Brazilian Restinga Habitat

Scincid lizards of the genus *Mabuya* are common in tropical regions and widespread in South America. About twelve species of this genus (out of 85) are found in Brazil (Peters and Donoso-Barros 1970), occurring in all Brazilian ecosystems. Relatively few ecological studies have been conducted for Brazilian species of *Mabuya* (e.g., Rebouças-Spieker 1974; Vanzolini and Rebouças-Spieker 1973, 1976; Vitt 1991; Vitt and Blackburn 1991; Vrcibradic and Rocha, ms. submitted); hence, their ecology is in general, poorly known.

Mabuya agilis is a small lizard (60–70 mm SVL) that inhabits open coastal habitats common in southeastern Brazil (Araujo 1984; Vrcibradic and Rocha, ms. submitted). In Linhares, southeastern Brazil (see below), *M. agilis* inhabits "restinga" habitats, occurring in grass tufts or near the base of shrubs and bromeliads (pers. obs.). Restingas are coastal Quaternary sand dune habitats covered with sparse herbaceous and shrubby vegetation (Suguio and Tessler 1984). In spite of its relative abundance in the area, this species has relatively reclusive habits, compared to sympatric lizard species (e.g., *Tropidurus torquatus*, *Cnemidophorus ocellifer*, *Ameiva ameiva*) (Bergallo and Rocha 1993, 1994).

Study Area.—In this study, we present data on food habits, thermal biology and activity of *Mabuya agilis* in Linhares. Field work was carried out in a "restinga" habitat (locally called "Nativo") in the Reserva Florestal Vale do Rio Doce (19°18'S, 40°19'W), Linhares municipality, Espirito Santo, southeastern Brazil. The elevation in the reserve varies between 30 and 60 m. The climate is wet and warm, with annual rainfall of 1300 mm and mean annual temperature of 23°C (Jesus 1988). This study was conducted in July 1993, during the dry season.

Methods.—We made observations in the field from 0630 to 1800 h. Lizards were collected in the course of 13 days using five pitfall traps provided with 10 m drift fences. We visited the pitfalls regularly (at half-hour intervals) and checked for the presence of lizards. In addition, we walked along a trail in the restinga looking for lizards. When a lizard was sighted the hour of activity was recorded and an attempt was made to capture it by hand. Whenever we failed such an attempt and the lizard moved to the interior of a thicket of grass, we rapidly established a pitfall trap with fences near the thicket. Then, we kicked at the grass thickets to startle the lizard and drove it to the pitfall trap. We also sometimes used a rifle to improve lizard collecting. Each lizard's cloacal temperature was recorded (to the nearest 0.2°C) using a Schultheis quick-reading cloacal thermometer. For thermal biology purposes we only considered those lizards collected by rifle or those dislodged from grass tufts and driven to the pitfalls, if temperature measurement was made within 30 s from the first observation. The temperatures of the air (1 cm above ground) and substrate where each lizard was first sighted were also recorded. For lizards found inside the pitfalls, temperatures were not considered. The hour at which each lizard was active at the time of its first sighting was also recorded. The mean activity temperature of *M. agilis* was estimated as the mean average of the body temperatures of active lizards (Brattstrom 1965). Variation in body temperature throughout the day was estimated by averaging the body temperatures within each hour interval. Air and substrate temperatures within each hour interval were also averaged for comparisons with the lizards' daily variation in body temperature. The relationship between body temperature and air and substrate temperatures, respectively, were analyzed by regression analyses and multiple regression (Zar 1974).

The stomach contents of 18 *M. agilis* were analyzed and identified to order. For each lizard we counted the number of prey of each type and each item was measured with a Vernier caliper (to the nearest 0.1 mm) and its volume (in mm^3) was estimated by multiplying its three dimensions (length, width, and depth; Schoener 1967). Diet composition was then described in terms of number and volume of each prey type in the sample, and of frequency, defined as the number of lizard stomachs containing each prey type.

Activity.—*Mabuya agilis* was active between 0800 and 1700 h and had a unimodal activity pattern, with a peak between 0900 and 1100 h (Fig. 1). This activity pattern (including peak and extension) is similar to that of other species of this genus in different areas of Brazil (Vitt 1991; Vitt and Blackburn 1991; Vrcibradic and Rocha, ms. submitted). An extensive activity period for lizards of the genus *Mabuya* has also been demonstrated to occur in other continents (e.g., Huey and Pianka 1977).

Thermal Biology.—Body temperatures of *M. agilis* ranged from 25.0°C to 36.4°C with a mean activity temperature of 31.4 ± 3.1 SD (N = 24). Highest body temperatures were recorded between 1400 and 1500 h (mean = 34.5 ± 1.8 SD, N = 2) and the lowest between 1600 and 1700 h (mean = 25.8 ± 1.1 SD, N = 2) (Fig. 2), when the lizards retreat to shelter. The decline of the mean temperatures (air, substrate, and body) observed between 1200 and 1300 is due to cloud cover during that time period on both days on which those particular data were obtained. Body temperature was significantly correlated to both air temperature ($r = 0.90$, $p <$

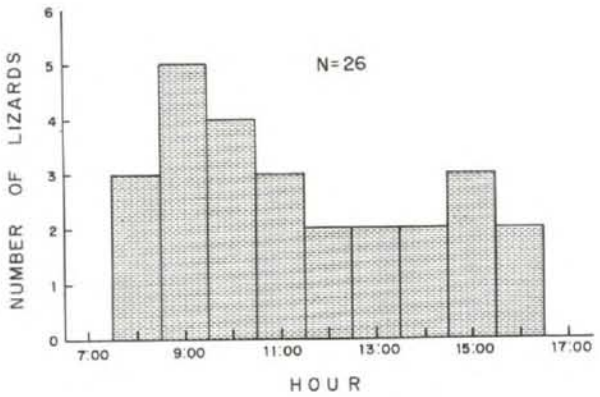


FIG. 1. Activity of *Mabuya agilis* in the Nativo of Linhares, Espirito Santo.

0.001, N = 24) and substrate temperature ($r = 0.68$, $p < 0.001$, N = 22) (Fig. 3), but air temperature explained an additional part of lizard body temperature after factoring out the effect of substrate temperature (Multiple Regression, $R^2 = 0.83$; $p < 0.001$; N = 22). The mean activity temperature and the range of body temperatures attained by *M. agilis* were similar to those of other Brazilian species of this genus (e.g., *M. macrorhyncha*: 31.9 ± 3.2 SD, Rocha 1994; *M. bistriata*: 32.9 ± 1.0 SD, Vitt and Blackburn 1991).

Diet.—We found 19 types of prey in the stomachs of *Mabuya agilis* (Table 1). The diet was composed mainly of arthropods, with 30.2% of total prey volume consisting of termites (Table 1). Termites were also the most important prey items in terms of number (69.8%) and frequency (61.1%), although coleopterans were also important prey (13.4% by volume, 7.5% by number, and 44.4% by frequency) (Table 1).

TABLE 1. Volume (in mm^3), number, and frequency of each prey taxon in the diet of *Mabuya agilis* at Linhares, southeastern Brazil (N = 18 lizards examined).

Item	Volume (%)	Number (%)	Frequency (%)
Isoptera	714.8 (30.2)	139 (69.8)	11 (61.1)
Coleoptera	318.9 (13.4)	15 (7.5)	8 (44.4)
Araneae	69.6 (2.9)	8 (4.0)	7 (38.9)
Psocoptera	2.3 (0.0)	7 (3.5)	2 (11.1)
Homoptera	65.1 (2.7)	6 (3.0)	6 (33.3)
Larvae			
Lepidoptera	311.0 (13.1)	5 (2.5)	4 (22.2)
Coleoptera	70.0 (2.9)	2 (1.0)	2 (11.1)
Orthoptera	111.5 (4.7)	3 (1.5)	3 (16.7)
Diptera	2.2 (0.0)	3 (1.5)	2 (11.1)
Hymenoptera	15.9 (0.7)	2 (1.0)	2 (11.1)
Thysanura	29.1 (1.2)	2 (1.0)	2 (11.1)
Blattodea	15.6 (0.6)	1 (0.5)	1 (5.6)
Hemiptera	5.7 (0.2)	1 (0.5)	1 (5.6)
Embioptera	3.3 (0.1)	1 (0.5)	1 (5.6)
Collembola	0.5 (0.0)	1 (0.5)	1 (5.6)
Pseudoscorpionida	0.3 (0.0)	1 (0.5)	1 (5.6)
Pupae	15.8 (0.7)	1 (0.5)	1 (5.6)
Lacertilia	478.8 (20.1)	1 (0.5)	1 (5.6)
UAR *	143.7 (6.0)		
Total	2377.7	199	

* UAR = unidentified arthropod remains.

The diversity of prey types found in the stomach of *Mabuya agilis* is characteristic of sit-and-wait predators (Huey and Pianka 1981; Schoener 1971). Conversely, the predominance of a prey type with relatively low mobility and a clumped distribution in the environment, such as termites, is typical of the diet of wide-foraging predators (Huey and Pianka 1981; Magnusson et al. 1985). The combination of sit-and-wait and wide-forager strategies seems to be common among skinks of the genus *Mabuya*, of which a number of species have been suggested to adopt both foraging strategies (Vanzolini et al. 1980; Vitt 1991; Vrcibradic and Rocha, ms. submitted). Considering sit-and-wait and wide foragers as two extremes of a continuum of foraging patterns, the data on feeding habits of *Mabuya agilis* indicate that this lizard has a feeding behavior that lies at an intermediate point between the two extremes. Anderson (1993) has recently referred to skinks as "proximal intensive foragers" compared to the wide-intensive foraging mode of the teiid *Cnemidophorus tigris*.

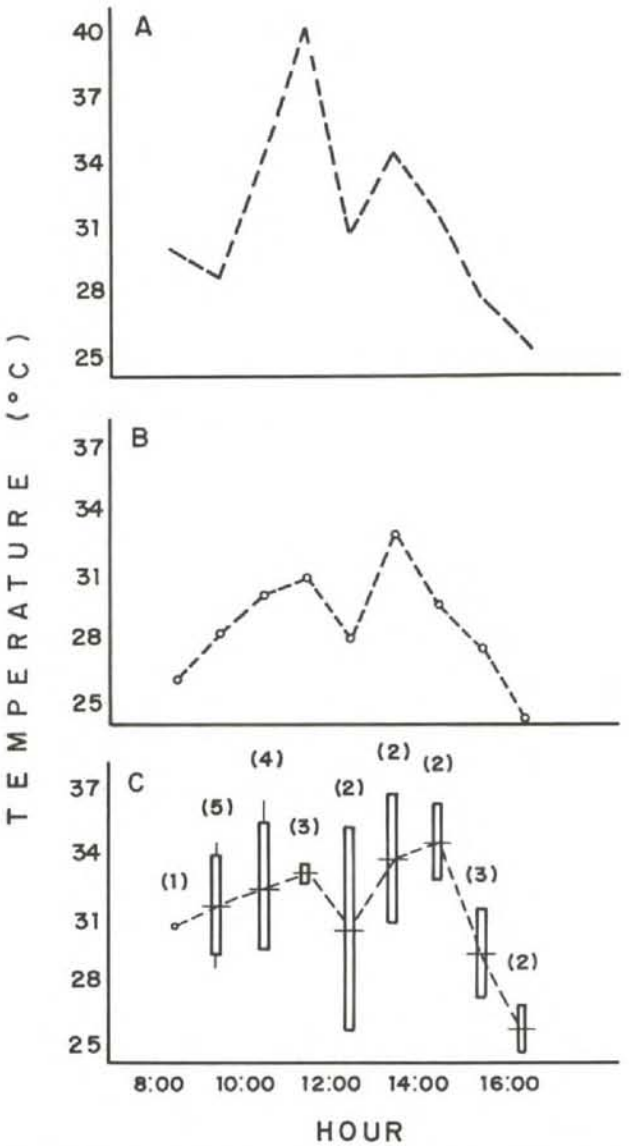


FIG. 2. Mean substrate temperature (top), mean air temperature (middle), and body temperature of *Mabuya agilis* (bottom) in the Nativo of Linhares. In the bottom graph horizontal lines, vertical bars, and vertical lines represent respectively the mean, standard deviation, and range. Temperatures in °C.

One adult individual of *Mabuya agilis* (SVL = 57.8 mm) had a juvenile lizard (*Tropidurus torquatus*) in its stomach. The ingestion of small vertebrates (e.g., lizards and frogs) is apparently not uncommon among *Mabuya*, as observed in other studies (e.g., Vitt and Blackburn 1991; Vrcibradic and Rocha, ms. submitted). *Tropidurus torquatus* is the most abundant lizard in the study area (Bergallo and Rocha 1994) and this observation indicates that *Mabuya agilis* is a potential source of mortality for juvenile *T. torquatus*.

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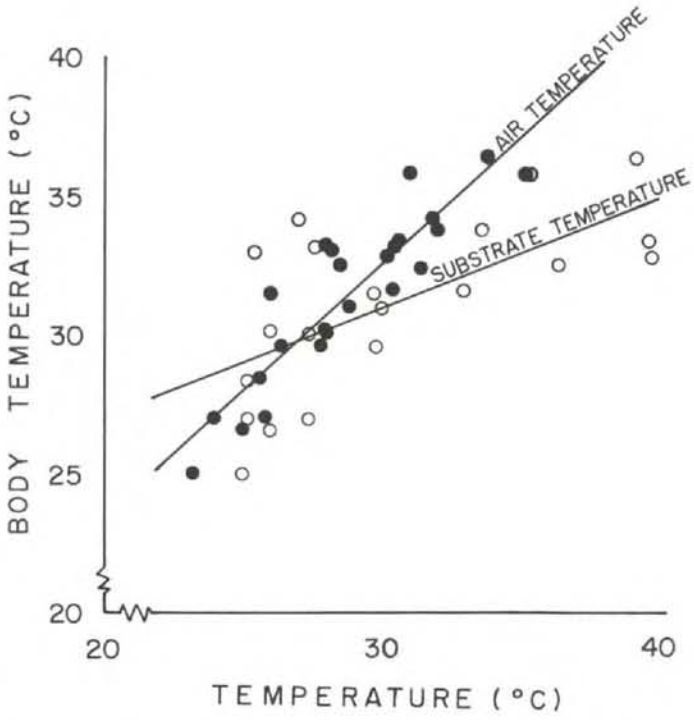


FIG. 3. Relationship between air temperature (black dots), substrate temperature (open dots), and body temperature of *Mabuya agilis*. For statistics see text.

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DAVOR VRCIBRADIC

and

CARLOS FREDERICO DUARTE ROCHA

Setor de Ecologia, Instituto de Biologia
Universidade do Estado do Rio de Janeiro
Rua São Francisco Xavier, 524 - Maracanã
20550-019 Rio de Janeiro, Brazil.

Observations on the Escape Behavior of the Horned Lizard *Phrynosoma mcallii*

The horned lizards of the genus *Phrynosoma* are morphologically specialized, primarily myrmecophagous iguanids whose behavior and ecology tend to set them apart from other genera of lizards (Pianka and Parker 1975; Stebbins 1985). Horned lizards respond to potential predators with one or more defense mechanisms: cryptic coloration, mimicry of natural habitat features, immobility, running a short distance and then burial under loose substrate, cephalic horns, blood squirting, hissing, body inflation, jumping, rocking, and open-mouthed attack (Middendorf and Sherbrooke 1992; Milne and Milne 1950; Norris 1949; Sherbrooke 1981, 1991; Sherbrooke and Montanucci 1986; Smith 1946; Stebbins 1985; Tanner and Krogh 1973).

Norris (1949) and Stebbins (1985) reported that when approached or frightened, *Phrynosoma mcallii* dove into the sand after a short run to escape potential predators. This type of escape behavior is very similar to that exhibited by fringe-toed lizards (*Uma* spp.). Thus, *P. mcallii* was thought to occur only in aeolian habitat within its range, as in the case with the fringe-toed lizard, *Uma notata* (Norris 1949; Stebbins 1985). We observed *P. mcallii*, however, in areas without substantial aeolian sand. These areas are primarily hardpan covered with a layer of gravel and sparse vegetation. Because of their cryptic coloration, motionless *P. mcallii* are hard to detect on this type of substrate (personal observations). So the question arises, is remaining motionless the only mechanism *P. mcallii* uses to protect itself from potential predators in areas devoid of sand? In this paper we report the escape and defense behavior of *P. mcallii*.

The areas for this study were (1) Ocotillo Wells State Vehicular Recreation Area, (2) the southern portion of the Superstition Mountains, and (3) southern East Mesa, all in southeastern California; all were areas considered favorable for *P. mcallii* by Turner and Medica (1982). The lizards were encountered during contract surveys or incidental sightings on foot, or in a vehicle in April, and June through August 1994. Capture methods and handling of *P. mcallii* were approved by the California Department of Fish and Game and the San Jose State University Institutional Animal Care and Use Committee, Protocol No. 633.

Sixty-four (89%) of the 72 *P. mcallii* encountered crouched low and remained motionless. Of the lizards approached on foot (N = 65), 63 lizards (97%) flattened themselves against the substrate and/or were motionless, while of those encountered in a vehicle (N = 7), only one (14%) remained in place. Thirty-one of the lizards that crouched low were observed on sandy substrate, while 33 were on hardpan/gravely substrate. When lizards were about to be grasped, they remained motionless (73%) or ran (27%).

Handled *P. mcallii* would often wiggle their head, causing their sharp occipital horns to dig into the handler's hand, often causing their release. This type of defense behavior was noted in Smith (1946) and might be effective against predators that handle struggling prey in their mouth (Sherbrooke 1990).

Some *P. mcallii* ran for a short distance (< 20 m) when about to be grasped. Of the lizards that fled (N = 17), a total of 9 escaped capture by running into a burrow, 4 ran to the base of a shrub, and 4 crouched down a short distance further in front of, or behind us. Seven of the lizards that ran into a burrow were encountered on hardpan/gravely substrate, while 2 were on sandy substrate. Hardpan/gravely substrate was present in all cases for those lizards that ran to the base of a shrub. For those that crouched down a short distance away, only one was observed on sandy substrate, the rest on hardpan/gravely substrate. Norris (1949) reported that *P. mcallii* would either dive into the sand or crouch down after a short run. Of the *P. mcallii* encountered on sandy substrate none was observed to dive into the sand after a short run, and only one buried itself at the base of a dead shrub.

Most of the *P. mcallii* seen from a vehicle ran for a short distance and stopped. Four ran across off-highway motor vehicle riding trails and stopped at a base of a shrub, while 2 stopped on the riding trail. The impact of off-highway motor vehicles on *P. mcallii* populations is presently unknown.

Most of the lizards we encountered, regardless of substrate type, remained motionless which we assumed maximized the effectiveness of their cryptic coloration to escape potential predators (Norris 1949; Sherbrooke and Montanucci 1986; Stebbins 1985). Of the lizards that fled, some used rodent burrows for escape after the short run. This aspect of their behavioral ecology merits further study as they have a wider habitat preference than previously believed (Stebbins 1985).

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BERNARD WONE

and

BEATE BEAUCHAMP

Department of Biological Sciences
San Jose State University
One Washington Square
San Jose, California 95192-0100, USA.

Trachemys scripta elegans in Southwestern Spain

In recent years, the introduction of foreign species has become a common practice in Spain, including Extremadura (southwestern Spain). The crustacean *Procambarus clarckii* (pers. observ.), the fish *Micropterus salmoides* and *Lepomis gibbosus* (Lope and Cruz 1985), and the bird *Amandava amandava* (Cruz et al. 1981) can now be found in this region, and permanent breeding populations are established. As regards the herpetofauna, *Rana catesbeiana* was reported north of Cáceres, the frogs having escaped from a commercial culture operation (García París 1991). In this note we report the presence, in Badajoz province, of a chelonian of American origin, *Trachemys scripta*, from two areas 80 km apart. Courtship behavior is also reported.

In the summer of 1993, a specimen of *T. scripta* was captured in the Río Zapatón (22 km north of Badajoz city). Two other individuals were subsequently reported by a fisherman in the same place. In March 1994, we observed two specimens on three occasions at the dam of Cornalvo (70 km east of Badajoz city).

The captured specimen was an adult female with a carapace length of 201.6 mm, a plastron length of 199.5 mm, and a weight of 1426 g. This specimen is referrable to the subspecies *T. s. elegans* (using the descriptions by Behler and King 1979).

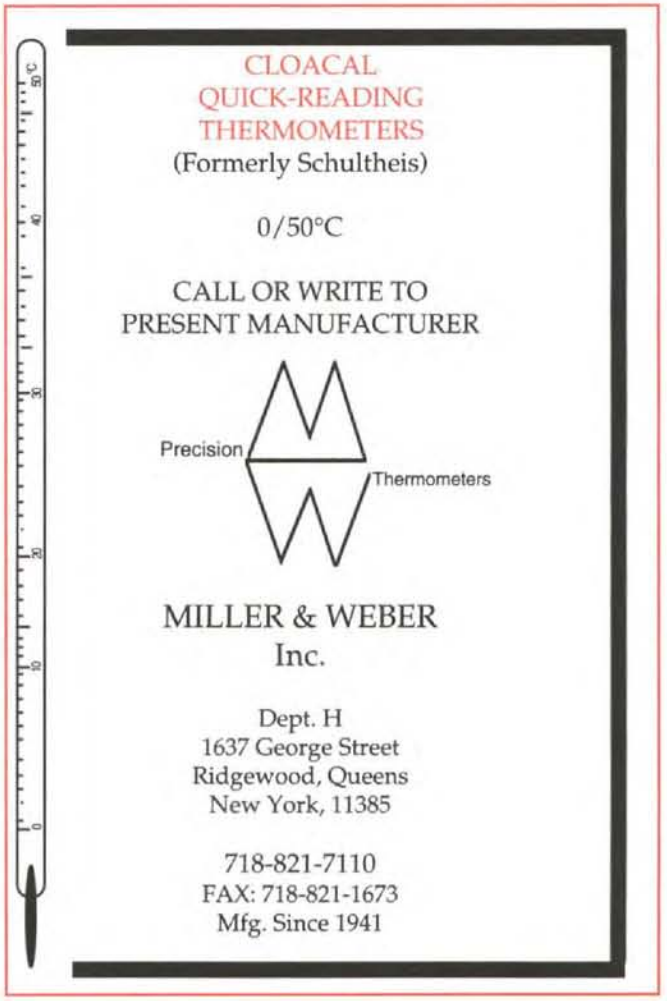
The estimated carapace length of the two individuals observed at the dam of Cornalvo was 170–180 mm. Most of the time they were inactive and basking. At dusk on 9 March, they began a series of movements. Because terrestrial telescopes were used, our observations were restricted to the movements which took place on the water surface. One of the individuals remained motionless, with its head and carapace above the surface, while the other appeared and disappeared at several points around it. The second individual occasionally emerged facing the static one, which would follow it for a short distance as it swam backwards. These behaviors have been reported for females and males respectively (Jackson and Davis 1972). Occasionally, the more active individual threw small water spouts toward the other, a behavior reported in the neotropical races *T. s. grayi* and *T. s. ornata* (Lovich et al. 1990).

The introduction of this species has been confirmed in different countries (Bouskila 1986; Daniels 1994; Ernst 1990; Newbery 1984; Platt and Fontenot 1992), as well as in North American areas outside its natural range. Also, *T. scripta* has been reported in some Spanish locations where the development of stable populations seems unlikely (García-Paris and Martín 1987; García-Paris et al. 1989; Rivera and Arrivas 1993). This is the first report of this species in Extremadura. The ecological features of our two sites are very different. Adjacent riparian vegetation (*Fraxinus* sp., *Salix* sp., *Populus* sp., *Rubus* sp., *Arundo* sp., *Phragmites* sp., *Typha* sp., and *Juncus* sp.), and areas of submerged vegetation provide good protection on the banks of the Río Zapatón, close to the optimum habitat for the species (Morreale and Gibbons 1986). In contrast, the dam of Cornalvo is completely bare, with rocky soil, although the surrounding area has holm oak and low brush, *Cistus* sp. and *Quercus* sp. being the dominant vegetation (Mediterranean forest). *Trachemys scripta* coexists with *Mauremys leprosa* in both places, and perhaps also with *Emys orbicularis* in Cornalvo, since the latter occurs in adjacent brooks.

The turtles from Cornalvo are within the size range for mature individuals (Jackson 1988), and the described behavior suggests that they are breeding, with the consequent risk of settlement. The size of the captured female and the descriptions of the other individuals suggest that the same could be happening in the Río Zapatón.

The potential for competition between *T. scripta* and the native species (*M. leprosa* and *E. orbicularis*) needs to be studied (Bouskila 1986). If the range of *T. scripta* expands, a displacement of the native species can be expected, as is suspected for *Pelomedusa subrufa* in South Africa (Newbery 1984), and *Mauremys caspica* in Israel (Bouskila 1986). This event would have especially deleterious consequences for *E. orbicularis*, as it is far more endangered and scarce in Extremadura than is *M. leprosa* (da Silva 1993). Steps are being taken to eliminate *T. scripta* individuals, and decisions will have to be made on the trade of exotic species and their subsequent establishment, as four to seven million hatchlings are sold annually in the international market (Warwick 1991). Due to its broad ecological tolerances, omnivorous diet, and dispersal ability, it seems likely that breeding populations of *T. scripta* will become established in southwestern Spain, an area of habitats and climate similar to parts of its native range (Morrelae and Gibbons 1986). This supports the need for controls on the international market for this species.

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EDUARDO DA SILVA

and

MANUEL BLASCO

Departamento de Ciencias Morfológicas y Biología Celular y Animal
Area de Biología Animal
Facultad de Ciencias
Universidad de Extremadura
Avenida de Elvas s/n
06071 Badajoz, Spain.

Fox Snake Winter Activity in Central Illinois

The western fox snake (*Elaphe vulpina vulpina*) is distributed in the north-central midwest (Powell 1990). In the northern portion of its range (e.g., Wisconsin), the snake inhabits forested areas and various other habitats (Vogt 1981). An isolated eastern race (*E. vulpina gloydi*) in the region bordering Lake Huron and Lake Erie occurs in extensive marshes (Conant and Collins 1991). In marked contrast, *E. v. vulpina* persists in agricultural areas that were formerly prairie in the Prairie Peninsula of central Illinois and Indiana (L. E. Brown and J. R. Brown 1975; Minton 1972; Smith 1961). Even though *E. vulpina* is commonly encountered, Ernst and Barbour (1989) pointed out that it is the least known of the species of *Elaphe* in North America. Furthermore, little information is available on the thermal ecology of the species (Ernst and Barbour 1989). The most notable contributions were provided by Dill (1972) who recorded body core temperatures from transmitters implanted in a single individual during August–September in Minnesota, and Costanzo (1986) and Zaremba (1978) who collected temperature data within and near hibernacula (cisterns) in Wisconsin in late summer, fall, and spring. We report the observation of substantial winter surface activity by an *E. v. vulpina* in central Illinois. This is highly unusual behavior because snakes, as ectotherms, are known for their lack of surface activity during the cold months of winter in northern regions.

Our observations occurred at an ice skating party on 17 February 1991 on Peterson's Pond (a human-made impoundment), 4.7 km NNE Hudson, Illinois (NW 1/4, NE 1/4, SE 1/4, Section 3, T25N, R2E, Hudson Township, McLean County), USA. The *E. v. vulpina* was first noticed at 1440 h on the south edge of the pond. It proceeded to move slowly over the ice across the center of the pond. The guests at the ice skating party were located some distance away and did not chase or pursue the snake. When the *E. v. vulpina* reached the opposite side of the pond it was collected. It had traveled 39.6 m across the ice. When captured, the *E. v. vulpina* was quite cold and lethargic, but after it was taken inside, it eventually warmed up and behaved normally. No *E. v. vulpina* are kept as pets in this rural area, and thus it is probable that the *E. v. vulpina* we observed was not an escapee from captivity. The specimen was an adult male with a total length of 101 cm and tail length of 17 cm (measured alive).

Air temperature near Peterson's Pond was observed to be 9.4°C shortly after the capture of the *E. v. vulpina*, but the thermometer was not shaded and not of scientific quality. Maximum and minimum temperatures on 17 February 1991 were +6.7 and -3.3°C respectively, recorded at the Illinois State University weather station in Normal, Illinois, some 16 km to the south of Peterson's Pond. For the five days preceding 17 February 1991, the mean minimum temperature was -12.6°C (range was -3.3 to -17.8°C). Mean maximum temperature for the same five days was -1.2°C (range was +3.9 to -11.7°C). Maximum temperature was above 0°C on only two of the five days. On 12 and 14 February 1991, trace amounts of snow were recorded at the Illinois State University weather station. However, on 15 February 1991, 1.8 cm of snow fell with 40.2–48.3 km/hour winds resulting in poor visibility and blizzard-like conditions. By the afternoon of 17 February 1991 most of the snow on the ground near Peterson's Pond had melted but some patches remained from the snowfalls of 15 February 1991 and earlier dates. The ground was still frozen except for about 1 cm which had thawed on the surface. The pond ice had been measured on 11 February 1991 and was 45.7 cm thick.

In Wisconsin, Vogt (1981) indicated that *E. v. vulpina* leave their denning areas in the last two weeks of April, but in western/northwestern Indiana, Minton (1972) did not find the species earlier than 5 May. Smith (1961) stated that *E. v. vulpina* "can be found from early spring until late fall" in Illinois. His reference to "early spring" may reflect his finding of 16 *E. v. vulpina* in an old well in March (no specific date given). Wells are often used as hibernacula by snakes (e.g., W. S. Brown et al. 1974). In the area around Peterson's Pond, *E. v. vulpina* is commonly encountered (see L. E. Brown and J. R. Brown 1975), but in the 23 years prior to 17 February 1991 and in the three subsequent years we never saw any specimens in winter or spring before May. However, other snake species in the area (e.g., *Storeria dekayi*, *Thamnophis sirtalis*) have sometimes been observed in April.

Rising temperatures are usually considered a major stimulus for emergence of reptiles from hibernation but this has received little experimental investigation (Gregory 1982). The somewhat higher air temperature may have been responsible for the winter surface activity of the *E. v. vulpina* we observed. However, the air temperature was not unusually high, and was typical for February in central Illinois. Vibrations produced by participants in the ice skating party may also have been a factor responsible for the snake's emergence, particularly the frequent movement of a garden tractor pulling sleds and skaters around the pond and on the ice. A number of times the tractor moved over the earthen embankment of the pond near the location where the snake was first seen, although the tractor stopped some time before the appearance of the *E. v. vulpina*. We suspect that the *E. v. vulpina* emerged from a hibernaculum in the embankment or on the south-facing slope of an adjacent ravine.

Costanzo (1988) and Costanzo et al. (1988) demonstrated in the laboratory that *Thamnophis sirtalis* can survive entombment in ice and freezing of 36% of their body water. Furthermore, some species of snakes can supercool their bodies to as low as -3.5 to -7.4°C under experimental conditions (Lowe et al. 1971). However, numerous snake species are known to hibernate at body temperatures well above freezing with no indication of supercooling (W. S. Brown et al. 1974; Jacob and Painter 1980). Gregory (1982) indicated that surface activity on warm days in winter is known for some reptiles in warmer parts of their ranges, e.g., *Crotalus viridis* in New Mexico (Jacob and Painter 1980). In contrast, mid-winter surface activity is probably rare or nonexistent for most snake species in northerly climates. For example, W. S. Brown (1982) found no evidence for winter emergence from hibernation by timber rattlesnakes *Crotalus horridus* that were closely monitored in New York. Probably the most notable example of winter surface occurrence in a northern region is that of *Vipera berus* in northern Europe but this has only rarely been observed (Viitanen 1967).

In summary, an *E. v. vulpina* was observed in mid-winter (17 February 1991) to slowly move 39.6 m across the ice of a pond in a former prairie region in central Illinois. The cause of the emergence was probably somewhat higher air temperature and/or disturbance to the hibernaculum due to vibrations produced by humans. Winter surface activity is rare in snakes in northern climates.

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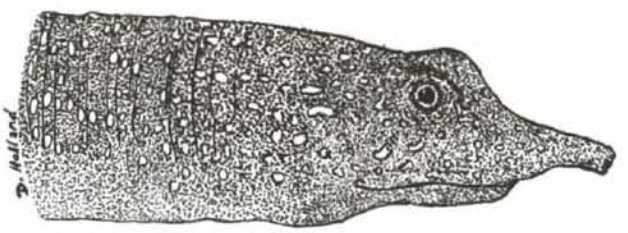
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LAUREN E. BROWN

and

KARA ANNE BROWN

Department of Biological Sciences
Illinois State University
Campus Box 4120
Normal, Illinois 61790-4120, USA.



TECHNIQUES

Techniques for Capturing Arboreal Lizards

One of the more difficult and time consuming tasks in conducting field research is the collecting of animals. Because of increased structural diversity in tropical forests, and the elusiveness of some species, field biologists are continually seeking ways to simplify the collection of specimens. On a recent trip to Amazonian Ecuador we developed and tested a relatively easy trapping method applicable to lizards and to many other types of animals as well.

Tropidurus (= *Uracentron*) *flaviceps* is an arboreal tropidurid lizard of moderate size that lives on large branches in the rainforest canopy. Upon disturbance these lizards immediately retreat into treeholes. Duellman (1978) collected these animals by searching felled trees. This method, however, does not yield large numbers of animals, nor does it lend itself to the study of the ecology and behavior of these animals. Duellman, for example, collected only 2 individuals during four years of field work; Dixon and Soini (1975) collected more, but most were from a single tree. During the course of our field season within the Reserva Faunistica Cuyabeno, we discovered that *T. flaviceps* occurs not only in the canopy of "terra firma" forest, but also in trees of lagoons and seasonally inundated forest. One species of tree in particular, *Macrolobium acaciaefolium* (Leguminosae [Fabaceae]), offers ideal habitat for these lizards. Often at heights in excess of 20 m, the medium and large trees of this species almost always contain one (and usually more) hole into which lizards will retreat. These lizards, however, occur at low frequency. We searched over 600 trees, but only eight (1.3%) contained individual lizards. The high water level in the lagoon during the wet season facilitated access to these trees. After several unsuccessful days of attempting to noose lizards, we attempted three trapping techniques (Table 1).

The first method was to attach mouse glue traps to tree branches (Bauer and Sadlier 1992; Rodda et al. 1993). We chased animals into a hole and nailed Victor® mouse glue traps (cut to a convenient 20 cm x 4 cm) to the tree so that they completely encircled the branch both above and below the hole. We collected four reemerging animals in this manner and subsequently removed lizards from the traps using vegetable oil; the animals did not appear to suffer ill effects from either glue board or oil. Drawbacks to this technique are that the intended trap victim may escape by jumping over the glue board (Zani, pers. obs.) and glue boards lose their ability to hold animals in approximately two days, or after the first hard rain, and must be replaced.

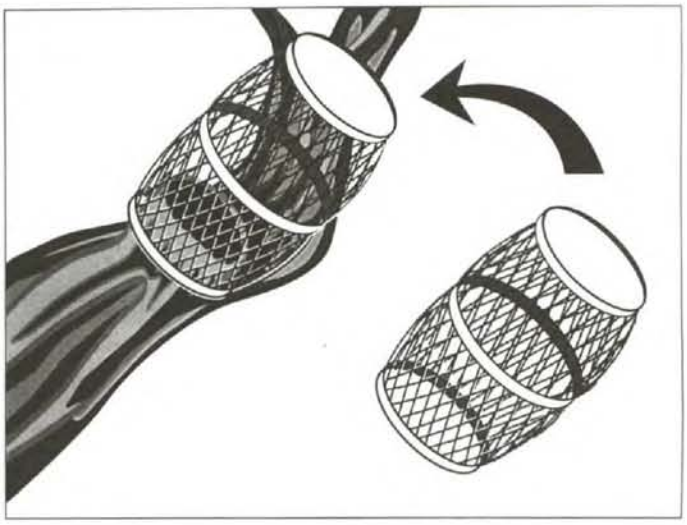


FIG. 1. A method for catching lizards in tree holes by covering the hole with a wire-mesh minnow trap.

Our second technique was "male-baiting." Male *T. flaviceps* are territorial and aggressively defend territories that generally encompass one or more trees (Vitt and Zani, unpubl.). We placed an adult male inside a wire-mesh minnow trap tied to a branch within the territory of another male. Within several hours, the resident male investigated the "intruder" and entered the minnow trap. However, even after two days of baiting we could not trap a second resident male. While this technique was successful once, we deemed it undesirable because it may require a relatively long time commitment (Table 1), and it may work only on territory-holding males.

The third, and most successful, technique was to cover known retreats of lizards with minnow traps. First, we chased lizards into a hole. Then we fitted a wire-mesh minnow-trap, with the entrance modified to accommodate head dimensions of the largest possible male, over the hole (Fig. 1). We used nylon string to tie the trap securely onto the branch, and filled remaining gaps between trap and tree with cloth or covered them with duct tape. We plugged other holes connected to the "trapped" hole with cloth as well. We then left the tree for up to four hours while we investigated or trapped other trees. Within this time period, lizards usually emerged from retreats by the only means available, the trapped hole, and entered the trap. We removed animals by opening one end of the trap as it remained attached to the tree, or by removing the entire trap, placing it into a large cloth sack, and opening the trap (we preferred this method when dealing with multiple, or very active, lizards).

TABLE 1. Number, and time to capture, of *Tropidurus flaviceps* collected using three capture methods.

Method	Total animals trapped	Animals not trapped	Time to capture		Total trap hours
			Minimum	Maximum	
Glue trap	4	3	4 h	1 d	150
Male baiting	1	1	3 h	N/A*	50
Minnow trap	23	1	0.5 h	1 d	250

*After 2 d the male remained untrapped.

It does not seem to matter if another lizard is already in the trap when an animal emerges from its retreat. On several occasions we captured more than one lizard (and as many as 5) during a single trapping event. By using two traps in a single tree we collected 12 lizards in a single day; over the course of a week we collected 23 lizards in the minnow traps. The limit to our collection efforts was the number of traps available and the number of trees we could search in the time allowed. In most cases, we collected all animals that we observed in a tree (and many we did not observe) within a 24 hour period.

Hole trapping appears to be the best method to collect *T. flaviceps*. Not only does it offer the best success ratio (Table 1), but minnow traps are simple and easy to use. Animals living in treeholes are ideal candidates for this collection method; in addition to lizards, we captured a large treefrog (*Osteocephalus taurinus*) and several spiders using the minnow traps. This technique could also be useful for animals dwelling in rock crevices or in terrestrial burrows. The only requirements are that access from the retreat be limited to a single, trapable exit, and that the animal be active enough so that it will re-emerge in a relatively short amount of time.

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PETER A. ZANI

and

LAURIE J. VITT

Department of Zoology and
Oklahoma Museum of Natural History
University of Oklahoma
Norman, Oklahoma 73019, USA.

Two Efficient Techniques for Catching Skinks

Noosing, pitfalling, and using rubber bands as projectiles are popular techniques for catching live lizards (Simmons 1987). Similarly, Myers (1956) and Strong et al. (1993) caught frugivorous teiids and small insectivorous lizards by attracting them to fruit or mealworms, respectively, threaded onto fishing line. During a Lyme disease survey, we discovered that lizards of the genus *Eumeces* can be heavily parasitized by immature *Ixodes scapularis* ticks, and we attempted to catch *Eumeces fasciatus, E. inexpectatus,* and *E. laticeps* using pitfall traps and noosing techniques. Pitfall captures were few, and noosed skinks frequently wriggled free before they could be secured. Partly by serendipity we developed two techniques to greatly improve our skink capture rate.

The first technique involves attracting a skink to a cricket, mealworm, or beetle tied or threaded onto fishing line and dangled from a fishing rod. The skink is attracted (even if it has started to retreat) to the insect which is then seized by the skink. The skink can either be lifted off the substrate still grasping the bait (most *E. laticeps* do not relinquish their jawhold) and lowered into a collecting bucket, or may be lured into a net which is carefully moved into place after the skink has developed an interest in the cricket (this technique works better with *E. fasciatus* and *E. inexpectatus*). Skinks that have retreated into a crevice or thick vegetation can often be coaxed out by dangling a cricket close to the refugium. Capture success rate using this technique was 92% (N = 147 attempted captures).

The second technique involves setting Sherman® small mammal traps baited with crickets. In order to increase trapping efficiency, we set traps in areas of known skink activity. Two crickets are secured to each Sherman trap by tightly tying cotton thread around the abdomen or thorax and then attaching the free end of the thread to the trap. One cricket is restrained near the trap entrance while the other is secured inside, at the back of the trap. This technique was successful in all trapping attempts.

These two simple techniques greatly improved our capture rate. We also caught green anoles (*Anolis carolinensis*) and six-lined racerunners (*Cnemidophorus sexlineatus*) using cricket lures, but these lizards did not always accept the bait and were often more easy to catch by noosing.

Acknowledgments.—Techniques were developed under a Faculty Research Grant from Georgia Southern University, a grant from the Edward John Noble Foundation, NIH grants AI24899 and AI30026, and CDC grant U50/CCU406614.

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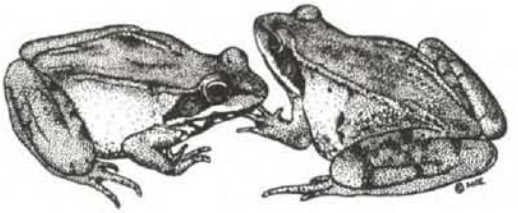
LANCE A. DURDEN
ELLEN M. DOTSON*

and

GREGORY N. VOGEL

Institute of Arthropodology & Parasitology
Georgia Southern University
Landrum Box 8056
Statesboro, Georgia 30460, USA.

**Present address: Division of Parasitic Diseases, Centers for Disease Control & Prevention, 4770 Buford Highway, Mailstop F22, Chamblee, Georgia 30341, USA.*



Rana sylvatica (Wood Frog). USA: Massachusetts: Blue Hills. Illustration by Mark C. Erelli.

Oxytocin Induced Nesting Behavior in Female Red-eared Turtles, *Trachemys scripta elegans*, without Oviductal Eggs

Oviposition in many species of turtles may be artificially induced by administration of hormones (Ewert and Legler 1978). Ewert (1989) noted that administration of oxytocin induced nesting behavior in oviductal egg-bearing females of *Chelydra serpentina, Clemmys insculpta, Sternotherus carinatus, Kinosternon leucostomum*, and *K. scorpioides* when these species were provided with suitable nesting substrates. During investigations on reproduction in *T. scripta*, we found that administration of oxytocin could also induce nesting behavior in female *T. scripta* without oviductal eggs.

Turtles used in this study were caught while crossing roads en route to nesting areas or at actual nesting areas between 26 May and 19 June 1994. Localities represented were Grafton (N = 6) and Stump Lake (N = 62), Jersey County, Illinois; Swan Lake (N = 95) and Pohlman Slough (N = 15), Calhoun County, Illinois; and Ellis Bay (N = 5) and West Alton Bay (N = 1), St. Charles County, Missouri. Illinois localities are either on or border the lower Illinois River, whereas Missouri localities are either on or border the Mississippi River.

Each turtle was palpated to determine whether it contained oviductal eggs; 51 turtles did not. All oviductal egg-bearing females (N = 133) were administered Sanofi brand oxytocin (20 USP units/ml) to stimulate oviposition at the dosage (1.5 ml/kg = 3 USP units/100 g) recommended by Ewert and Legler (1978). Because some females retain some or all oviductal eggs after oxytocin is administered (Congdon and Gibbons 1985), we palpated each turtle after oviposition appeared to be completed.

We marked all turtles on one or more marginal scutes, and returned them to their original collecting areas at 12 (N = 22), 24 (N = 74), 36 (N = 28), and 48 (N = 9) hours post-injection. Collecting date, release date, and number of oviductal eggs we estimated each turtle retained was recorded.

Even though all turtles had previously oviposited in the laboratory, we observed nesting behavior in six released into the field at 12 h, and in one released into the field at 24 h, post-injection. None of the turtles from the 36 or 48 h groups was recollected after release. The number of turtles found renesting from the 12 h group was significantly greater ($g = 18.43$, $p < 0.0004$, df = 3) than the number found renesting from turtles held for 24 or more hours.

All seven turtles that attempted to re-nest were found the morning after release. Two were moving to the nesting areas, four were in various stages of nest construction, and one turtle had completed an empty nest. None of the recollected turtles contained oviductal eggs.

Despite the fact that oviductal eggs were absent, nesting behavior occurred among some turtles. We attribute this behavior to the continued effects of the injected oxytocin. Although there was no formal control, we did release the 51 non-egg bearing turtles that we believe had nested naturally just prior to capture. Except that they received no injection of oxytocin, we handled these turtles the same as the females that contained oviductal eggs. We did not find any of these turtles making false nesting attempts.

These results suggest important implications for the use of oxytocin in turtle reproductive studies. Any time an aquatic turtle undertakes terrestrial movement it is at increased risk of death (Gibbons et al. 1990). Some turtles, even those with empty oviducts, will undertake nesting migration up to 24 h after artificial induction of oviposition. Consequently, we suggest that turtles be held at least 24 h post-induction to reduce nesting efforts that expose turtles to unnecessary risk of mortality. Our results also indicate that injection of non-egg bearing females with oxytocin might be a useful technique in experimental studies of nesting behavior and nest-site selection.

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JOHN K. TUCKER
Long Term Resource Monitoring Program Pool 26
Illinois Natural History Survey
4134 Alby Street
Alton, Illinois 62002, USA

FREDRIC J. JANZEN
Department of Zoology and Genetics
Iowa State University
Ames, Iowa 50011, USA

and
GARY L. PAUKSTIS
2489 Quail Court
Aurora, Illinois 60504, USA.

A Safe Method for Handling Large Snakes in the Field

Restraining large and potentially dangerous reptiles for field studies without using anesthesia can pose risk to researcher as well as subject. Several techniques developed for safely handling crocodilians and venomous snakes are reviewed by Flower (1978), Almandarz (1986), and Gregory et al. (1989). Passive restraint of large boids has not been addressed, possibly because few field investigations into their natural history have been undertaken.

In January 1992, the authors began a long term study of ecology, behavior, and conservation of anacondas, *Eunectes murinus*, in the Venezuelan llanos; more than 200 anacondas ranging between 0.72 m (0.17 Kg) and 5.3 m TL (82.5 Kg) were handled during routine collection of data. In order to reduce stress on the specimen, and to minimize the number of handlers and the time required to take data from each animal, we developed the following method for safely working with anacondas.

While holding the anaconda's jaws closed, a cotton sock of appropriate size is pulled over the snake's head. Once the snake's snout contacted the bottom (toe) of the sock, several wrappings of plastic electrician's tape are firmly, but not tightly, secured over the sock around the snake's neck (directly behind the quadrate bone). The tape will secure the sock on the anaconda's head. Taking care to keep the mouth closed, a second length of tape is secured, over the sock and around the snake's snout (midway between eyes and nostrils) to secure the jaws. At this point the anaconda can be released for measuring, scale counting, scale clipping, parasite collection, blood sampling, etc., without risk to the investigator.

Although anacondas treated in this manner frequently struck with great accuracy, they were unable to inflict injury and usually settled down after a short period. Releasing the snakes into cloth bags or steel barrels for transport may be accomplished by removing the tape and the sock while the animal is restrained. For large snakes, the loose sock was often left in place while the animal was released into the barrel to permit handlers to move away while the snake's vision was still compromised.

This technique proved quite reliable. None of the snakes was able to remove the sock, nor did any bite through it. No health problems were attributed to the use of this technique. This passive restraint method could be used effectively on many species of large, non-venomous snakes in both field and captive situations.

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JESÚS A. RIVAS*

MARÍA D. C. MUÑOZ

Profauna, Dirección de Aprovechamiento de Recursos
Ministerio del Ambiente y de los Recursos Naturales Renovables
Edificio Camejo, 1st Piso
Caracas, Venezuela

JOHN THORBJARNARSON

WILLIAM HOLMSTROM

and

PAUL CALLE

Wildlife Conservation Society
Wildlife Conservation Park
2300 Southern Boulevard
Bronx, New York 10460-1099, USA.

**Current Address: Graduate Program in Ethology. Department of Psychology. University of Tennessee. Knoxville, Tennessee 37996-0900, USA.*

A Backpack Method for Mounting Radio Transmitters to Small Lizards

Capture-recapture methods, used in field studies to determine home range size, activity patterns, growth rates, etc., depend upon relocating individual animals. When this is not easily accomplished, radio telemetry will frequently be used. Telemeters can be mounted externally or implanted surgically in large animals, but smaller animals can pose difficult problems. We developed a backpack and harness for radio transmitters that enabled us to relocate individuals during field studies of the cryptic, and surprisingly mobile, flat-tailed horned lizard (*Phrynosoma mcallii*). Our technique differs from that reported for *P. cornutum*; Munger (1984) used a loop antenna to secure the radio to the lizard.

An SM1 transmitter (AVM Instrument Co.) was constructed to conform to the lizard's curvature immediately posterior to the pectoral girdle and posterior projection of the horns. It was then embedded in dental acrylic with a 4 cm whip antenna extending posteriorly from the middle of the transmitter. The backpack harness securing the transmitter to the lizard was constructed of polypropylene pleating tape and clear polyurethane elastic, materials that are readily available in fabric stores.

Pleating tape is 5 cm wide polypropylene mesh partitioned into three sections by parallel strips of tightly woven polypropylene (Fig. 1A). When an inverted "T" is cut from the pleating tape (Fig. 1A), a 2-cm length of one of the strips of woven polypropylene forms the vertical leg of the "T," and a 2-cm long by 1-cm wide portion of the mesh material forms the horizontal bar of the

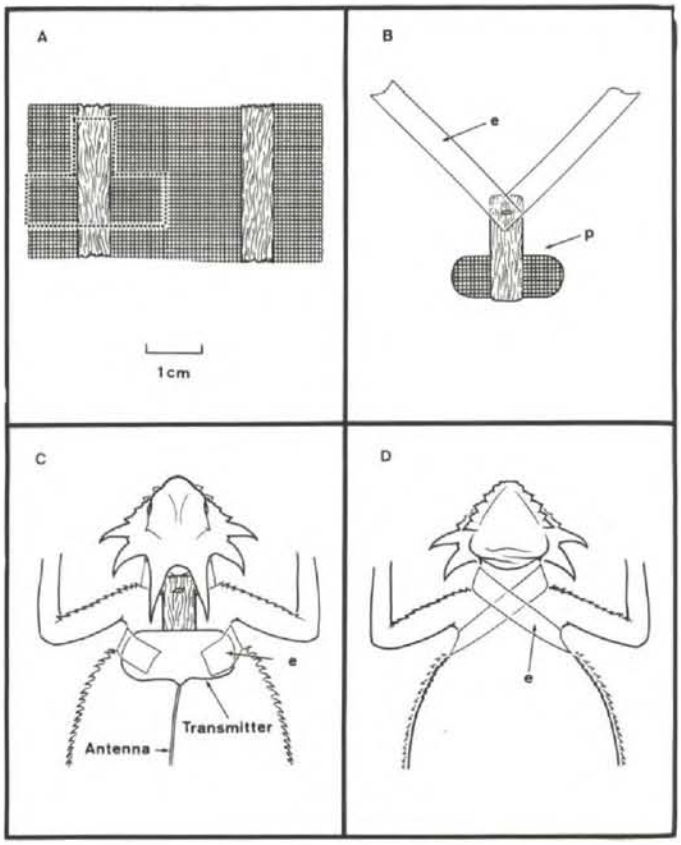


FIG. 1. Preparation and attachment of a backpack harness using pleating tape (p) and polyurethane elastic (e) to secure a transmitter to a horned lizard. See text for details.

"T" (Fig. 1B). After cutting, melt both ends of the woven strip and the perimeter of the mesh material with a soldering iron to prevent unraveling and to conform the mesh material to the shape of the transmitter. Harness straps are then made from strips of clear polyurethane elastic (Stretchrite™) measuring 10 cm by 0.5 cm; polyurethane elastic is thin and lightweight, and maintains elasticity at low humidity and high temperature. Fasten the straps, positioned at about 45°, to the vertical leg of the "T" with cyanoacrylic glue (Superglue™) and a stitch of thread (Fig. 1B). The backpack harness may now be affixed to the transmitter package with dental acrylic.

Position the backpack on the lizard's neck with the antenna pointing posteriorly (Figs. 1C and 1D). Pull a strap over the shoulder of one leg and through the axilla of the other leg, and fasten it to the top of the transmitter package with a drop of superglue. Fasten the second strap in the same manner, and glue the two straps together where they cross on the venter; this will keep the package from shifting (Fig. 1D). The straps must be pulled sufficiently tight so as to remain snug when the lizard deflates its body and adpresses its ribs following release. This attachment method allows the package to sit firmly on the back of the lizard and restricts movement of neither the head nor the legs.

Total mass of the telemetry backpack (< 4 g) is about 25% of the mass of the adult *P. mcallii* (mean = 15.8 g, range 11.0–25.0 g) that we fitted with transmitters; the backpack was comparable in mass to an egg clutch for this species, about 27% of total body mass (Pianka and Parker 1975). Newly captured adults were fitted with transmitters and held in captivity for 5 to 10 d to allow them to become accustomed to the backpack in the absence of predators. In captivity the lizards resumed feeding immediately after attachment of the transmitters; in the field, released lizards also resumed normal activities (eating, mating, constructing burrows, etc.). Individuals were recaptured every 2–4 months to exchange batteries and to take body measurements without the transmitter.

Forty-five individual *P. mcallii* were outfitted in this manner from April 1990 through July 1992, for a total of 7944 lizard-days and 1172 resightings. Most individuals carried their backpacks until killed by predators or until we removed the backpack at the end of the study. All lizards in the study were permanently marked with colored beads (Fisher and Muth 1989), enabling us to differentiate "escaped" from newly-captured individuals. Few individuals slipped out of their harnesses, but the backpack was shed when the straps failed in three cases. In two of these cases, the glue joint failed; a strap broke on one backpack harness. Evidence from two other losses indicates predator assistance (puncture holes and tears in straps and acrylic).

This method of attachment can be used on other species of horned lizards as well as on species with less specialized body forms.

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MARK FISHER

and

ALLAN MUTH

University of California, Riverside
Deep Canyon Desert Research Center
P.O. Box 1738
Palm Desert, California 92261-1738, USA.

HERPETOLOGICAL HUSBANDRY

A Simple Method of Mite Control

Lizards play host to a broad range of ectoparasites. In a group of San Esteban chuckwallas *(Sauromalus varius)* located at the Arizona Sonora Desert Museum, mites of the species *Hirstiella pyriformis* and *H. trombidiformes* were found to be prevalent ectoparasites. The chuckwallas were housed indoors in 76 x 76 x 40 cm wooden cages with screen fronts and windows on the sides. An incandescent heat light and 20-watt fluorescent fixtures equipped with both blacklight and Chroma 50 (GE) tubes were attached to the ceilings of the cages. Mites and their egg sacs were commonly found in the corners of the cages, adjacent to and under light fixtures, along the crevices created by the closed cage doors, and external to the cages along the stand/cage juncture as well as on the lizards. These mites migrate to lay their eggs and then to search for a host.

Historically mites have been battled on two fronts: eradication of mites on the lizard and in the cage. Topical application of such chemicals as Dri-Die (Farkas 1993; Loomis 1985), Wermectin (Farkas 1993), and alcohol require handling and restraint of the animal as well as careful application to avoid such delicate tissues as eyes and mucous membranes. Ivermectin, which may be topically applied or injected (Abrahams 1992; Nathan 1994), raises the additional risks of needle damage and improper dosages. All of these chemicals may be injurious or cause death to the animal if used improperly (Farkas 1993; Loomis 1985; Nathan 1994).

Mite control in cages is often attempted by the application of dilute bleach solutions (Nathan 1994), trichlorfon (Boyer and Boyer 1991), or Wermectin (Farkas 1993) sprays. These methods require removal of the animal and careful husbandry lest the animal, its food, or water come into contact with any of the residual chemicals. Vapona (Loomis 1985) and No-pest (Farkas 1993; Nathan 1994) strips have been placed in cages with the animals; the strips must be encapsuled to prevent animal contact and the water bowl must be removed (Farkas 1993; Loomis 1985; Nathan 1994).

With such stipulations regarding the current methods of mite control, new methods which neither require veterinary prescriptions, husbandry changes or large budgets, nor present acute toxic reactions or latent poisoning situations, need to be considered. I have developed a technique for physical removal of mites and their eggs which avoids these problems.

One-inch wide strips of masking tape were applied to the internal and external walls of the cages, usually at a horizontal orientation. Tape locations included adjacent to cage windows, doors, and along the upper cage walls and ceiling junctions out of reach of the lizards. Only the center of the tape was fixed to the cage.

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JOHN K. TUCKER
Illinois Natural History Survey
Long Term Resource Monitoring Program Pool 26
4134 Alby Street
Alton, Illinois 62002, USA.

TECHNIQUES

A Simple Aquatic Funnel Trap and its Application to Wetland Amphibian Monitoring

Techniques for monitoring adult amphibians at breeding sites are described by Scott and Woodward (1994) and Dodd and Scott (1994). Quantitative sampling techniques for larvae are reviewed by Shaffer et al. (1994). In these reviews, aquatic funnel trapping was bypassed as a method for monitoring adults but recommended as a tool for estimating species richness and relative abundance of larvae.

In unpublished studies, I used large, bulky, and expensive wire mesh funnel traps (e.g., minnow traps) to determine palustrine wetland use by adult *Pseudacris regilla*, *Taricha granulosa* and *Ambystoma gracile*, and stream use by larval *Dicamptodon tenebrosus*. I baited traps with plain or shrimp oil dipped salmon eggs (Pautski's Balls of Fire) in a perforated 35 mm film canister to increase the capture rate of amphibians. Calef (1973) used a trap made by fastening an insect screen funnel into a 3.5 liter (1 gallon) plastic jug to capture tadpoles of *Rana aurora*. Calef, however, provided no other details such as jug diameter or specific mode of application. Whitman (1974, cited in Riley and Bookhout 1990) used a plastic aquatic funnel trap to capture macroinvertebrates. Riley and Bookhout (1990) altered Whitman's trap to monitor invertebrate activity in the water column. The adapted trap is constructed by stapling top and bottom ends from two 2-L plastic beverage bottles together.

The absence of explicit design characteristics for amphibian funnel traps in the herpetological literature (Dodd and Scott 1994; Scott and Woodward 1994; Shaffer et al. 1994), my successful amphibian census experiences with minnow traps, and the publication of Riley and Bookhout's (1990) inexpensive and easily constructed invertebrate funnel trap prompted me to investigate the potential merits of Riley and Bookhout's trap in amphibian censusing. I describe here the details of trap materials and construction, with modifications that have enabled me to use it successfully for wetland amphibian censusing under diverse habitat conditions without adult and larval mortality.

Materials and Construction.—Each funnel trap set-up requires two clean, clear plastic, 2-L soda-pop bottles, three 0.32 cm (1/8 inch) diameter aluminum rivets with a 0.48 - 0.63 cm (3/16-1/4 inch) grip range, three 0.32 cm (1/8) inch) diameter aluminum washer plates, three plastic clothespins, and one 0.79 cm (5/16 inch) or slightly thicker stainless steel rod of length determined by water depths to be sampled.

Using a razor blade I cut an initial slit near the top of one bottle approximately 0.3 cm below the end of the neck taper within the bottle's midsection. I separate the top by continuing the cut with scissors around the bottle. I similarly cut the bottom from the second bottle with a cut 0.3 cm beyond the seam at the base but again within the midsection of the bottle. The top ends of both bottles are saved. Next I use a hot nail to burn four 0.32 cm holes into the larger section and into the clothespins. I burn one air/water exchange hole 0.3 cm below the bottle's taper within the midsection, and three rivet holes in a straight line at 4, 9, and 14 cm from the bottom along the opposite side. I also clip roughly 1/4 of the plastic from one handle of each clothespin and then burn a 0.32 cm hole into the center tip section of each unclipped end. I then rivet a clothespin through the handle to each hole in the bottles' midsection. Finally, I reverse the short tapered funnel end and slide it within the bottom of the main bottle forming a tight, escape-proof fit and overlapping lip for stapling (Fig. 1).

Applications.—I have attached up to three traps along one stainless steel rod to simultaneously measure captures in 2 m of water at several depths within the water column. In deep water I position traps vertically with funnel side down. This maintains the required air pocket within the top so captured amphibians don't suffocate. In shallow water I drive rods with attached traps diagonally in the water, again making certain to provide air pockets. Water-filled traps not fastened to rods sink and will kill captured amphibians. Although heavier than aluminum, I use stainless steel rods because they do not corrode and therefore, minimize water quality impacts. I also bait traps with 5-10 salmon eggs but have never tested trapping success between baited and unbaited traps, nor between shrimp and non shrimp oil dipped eggs.

I found my funnel trap set-up invaluable in determining spring arrival times of breeding *Ambystoma macrodactylum*, *Ambystoma gracile*, *Taricha granulosa*, *Rana aurora* and *Pseudacris regilla*. Leonard and Richter (1994) have successfully combined several months of aquatic funnel trapping with mark-recapture statistics to census adult *Ambystoma macrodactylum* populations in a small breeding pond. At some wetlands these aquatic funnel traps captured adult amphibians that were not previously detected by visual searches, dipnetting, or pitfall trapping.

Funnel traps also enabled me to describe the spatial and temporal microhabitat use by larval *Ambystoma gracile* and *Rana aurora* (Richter, in prep.). I have captured larvae using these traps with minimal habitat disturbance, by simultaneously trapping in yellow water-lily (*Nuphar polysepalum*), cattail (*Typha latifolia*), and soft rush (*Juncus effusus*) dominated emergent plant communities and in open water areas of varied depths, over 8-hour day, 8-hour night, and during 48-hour trapping periods without mortality. Karlstrom (pers. comm.) used these traps successfully in 1994 to

capture *Rana cascadae*, *Rana aurora*, and *Bufo boreas* tadpoles in his amphibian recolonization studies of Mt. St. Helens. He also captured *Rana catesbeiana* tadpoles, *Ambystoma gracile* neotenes, and *Rana aurora* sub-adults in other wetland studies.

To date capture data suggest that these baited funnel traps are excellent in attracting and capturing adult salamanders but may only incidentally capture adult frogs and toads. Moreover, these traps appear to capture larval salamanders, toads and frogs equally well. Although results are promising, additional testing is required to accurately interpret funnel capture data and provide supplementary ecological information about amphibians. Calef (1973), for example, calibrated capture success of traps against known numbers of *Rana aurora* tadpoles in enclosures to estimate populations of an entire lake. Eggers et al. (1982) determined the area of a trap's capture field by developing mathematical equations relating trap spacing to capture rate per trap. They then estimated abundance of fish by extrapolating catch data from the presumptive area fished by each trap to the entire survey area. Statistically rigorous studies should be performed to determine success in capturing amphibians of different taxa, sex, and size, and whether intra and inter-specific agonistic behavior and the presence of predators influence capture data. Likewise, the probability of capture varies between habitats, and must be determined prior to using funnel trap data for population estimation.

In summary, I find aquatic funnel trapping an under utilized but effective method for characterizing wetland breeding amphibian populations. Further, it offers significant potential for examining differential use of wetlands by adult and larval amphibians.

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KLAUS O. RICHTER
Puget Sound Wetlands And
Stormwater Management Research Program
King County Environmental Division
Resource Planning Section
3600 136th Place South East, Bldg. C
Bellevue, Washington 98006-1400, USA.

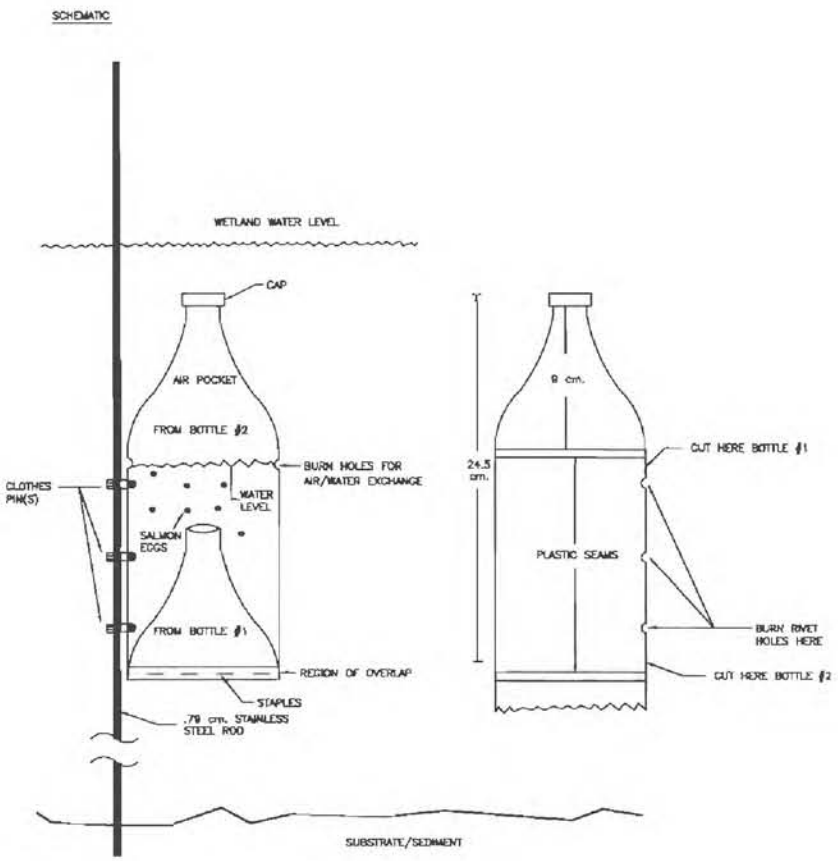


Fig. 1. Diagram showing funnel trap assembly from plastic bottles.

The Use of RAPD Markers for Species Identification in Desmognathine Salamanders

Many salamander species are so morphologically similar that unequivocal assignment of species by physical analysis alone is virtually impossible for some specimens. When such similar species are sympatric, identification can be problematic, making species determination possible only by protein or DNA analysis in some cases (Larson and Chippindale 1993). This problem is frequently encountered with members of the genus *Desmognathus*. Four to five syntopic species of desmognathine salamanders can be found in some habitats, and identification of all individuals is not always possible on the basis of morphology. Identification can be particularly difficult with larvae and juveniles.

The purpose of this study was to determine whether randomly amplified polymorphic DNA (RAPD) markers could be found that were intraspecifically consistent and interspecifically distinct for desmognathine species, and therefore useful for species identification. RAPD markers have been used for the identification of morphologically indistinguishable strains and varieties of a wide range of organisms, including mice (Welsh et al. 1991), fungi (Goodwin and Annis 1991), bacteria (Akopaynz et al. 1992) and apples (Koller et al. 1993). The method is relatively inexpensive, and has proven both reliable and reproducible.

The use of RAPD markers generated by the polymerase chain reaction (PCR) offers certain unique advantages for this type of analysis. Unlike most DNA analysis techniques, RAPD does not require cloning, DNA sequence information, or the use of radioactive isotopes, and results can be obtained within a few hours of tissue collection. Because only minute quantities of DNA are necessary for RAPD analysis, it is possible to sample even small salamanders in a non-destructive fashion. In addition, as demonstrated here, RAPD markers do not exhibit developmental variation, and samples can be taken from embryos, larvae, or from any tissue source, such as tail or toe clippings. The ability to use such minute quantities of virtually any tissue source gives RAPD an advantage over allozyme analysis. Further, while allozyme analysis is limited by the number of available enzymes, the vast number of different primers available makes it possible to generate practically unlimited markers for the comparison of specimens with RAPD.

Materials and Methods.—Twenty-five *Desmognathus ochrophaeus* (five adults from each location and five embryos from a single location) were collected from two locations in Macon, Co. North Carolina (35°10'N, 83°13'W and 35°05'N, 83°35'W) and two locations in Garrett Co., Maryland (39°36'N, 79°07'W and 39°30'N, 79°28'W). Six adult *Desmognathus monticola* were collected from each of two locations, one in Macon Co., North Carolina (35°10'N, 83°13'W), and one in Garrett Co., Maryland (39°36'N, 79°07'W). Five adult *Desmognathus fuscus* were collected from each of two locations 30 km apart in Garrett Co., Maryland (39°36'N, 79°07'W and 39°30'N, 79°28'W). Six *Desmognathus quadramaculatus* were collected from a single site in Macon Co., North Carolina (35°10'N, 83°13'W). Five *Leurognathus marmoratus* were collected from each of two altitudinally distinct populations in Macon (35°00'N, 83°15'W, elevation 700 m) and Haywood 35°18'N, 82°50'W, elevation 1600 m) Counties, North Carolina. All specimens selected for this study could be unequivocally assigned to species by morphological examination. Specimens represented different size classes and (presumably) different age classes.

DNA isolations followed the protocol described by Gustincich et al. (1991). Tissue sources were varied and included liver, embryos, and the tips of tails. DNA amplification was carried out using the method described by Williams et al. (1990) with modifications. The concentration of input DNA was varied to determine the optimal concentration for each primer. The reaction mixes were divided into two components separated by a layer of paraffin wax (Aldrich Chemical Co.) to prevent initiation of the reaction prior to the start of thermal cycling. Taq polymerase was obtained from Promega, Inc. Primers were obtained from Operon Technologies, Inc. Primer sequences were as follows:

OPA-01 CAGGCCCTTC
OPA-02 TGCCGAGCTG
OPA-03 AGTCAGCCAC
OPA-04 AATCGGGCTG
OPA-05 AGGGGTCTTG
OPA-06 GGTCCCTGAC
OPA-07 GAAACGGGTG
OPA-08 GTGACGTAGG
OPA-09 GGGTAACGCC
OPA-10 GTGATCGCAG
OPA-11 CAATCGCCGT
OPA-12 TCGGCGATAG
OPA-13 CAGCACCCAC
OPA-14 TCTGTGCTGG
OPA-15 TTCCGAACCC

Reactions were conducted in an MJ Research, Inc. MiniCycler. Reactions were carried out at least two times for all samples with all primers to determine reproducibility of patterns. Amplification products were electrophoresed through 2% agarose gels.

Results and Discussion.—Of the 15 primers used, six (OPA-01, OPA-02, OPA-04, OPA-06, OPA-10, and OPA-15) provided markers that could be useful in distinguishing some or all of the species investigated here. The other nine primers generated markers that were either so highly conserved that multiple species shared similar or identical markers, or so highly variable that markers were not consistent within individual species. Duplicate reactions indicated that markers were reproducible, with only minor variations, in all cases. The results shown are representative of all specimens examined.

For each of the six informative primers, markers typically were generated for every individual from a given collection site that were consistent with, and specific to, the species designation obtained by morphological examination. However, in some cases, consistent markers were not found for members of the same species obtained from different collection sites, or in the case of *D. ochrophaeus*, obtained from the same collection site. An example of this can be seen with the use of OPA-01 (Fig. 1). *Desmognathus fuscus* and *D. monticola* markers were consistent between collection sites, while *D. ochrophaeus* samples yielded markers that differed between collection sites and even within a single site. (For an example of the use of highly variable RAPD markers in the study of *D. ochrophaeus* populations see Masters and Forester, ms. in prep.).

Another example of intraspecifically consistent and interspecifically distinct markers for *D. fuscus* and *D. monticola* collected from two different sites, and for *D. quadramaculatus* and *L. marmoratus* collected from a single site, can be seen with the use of OPA-10 (Fig. 2). Markers generated from *D. ochrophaeus* samples with this primer differed between populations, and between individuals within populations (data not shown).

An example of markers that can be used for species identification of *D. ochrophaeus* specimens can be seen in Figure 3. Of the 15 primers used in this study, one (OPA-15) generated species-specific markers for all 25 *D. ochrophaeus* individuals examined (twenty adults and five embryos). The markers labelled A and B in Fig. 3 were found in all D. *ochrophaeus*, and the marker labelled A was unique to that species. *D. ochrophaeus* DNA samples isolated from tails, livers, and embryos all gave a consistent and characteristic pattern with OPA-15, indicating that varying tissue sources can be used for identification. Consistent and diagnostic markers also were obtained with this primer for *D. fuscus* and *D. monticola*. However, this primer did not generate markers that could reliably distinguish *D. quadramaculatus* and *L. marmoratus*. The markers obtained for each of 12 *L. marmoratus* specimens (six from each of two sites) were site specific, but not species specific. The markers generated from *L. marmoratus* samples collected at one site could be confused with the markers generated for *D. quadramaculatus* because of similar mobilities.

The use of RAPD is shown here to be a reliable method for species identification of salamanders in the genus *Desmognathus*, if proper care is taken. It was possible to generate RAPD markers that were consistent with the morphological identification of all the specimens examined in this study, and samples could be obtained nondestructively (tips of tails) and from different tissues (tail, larvae, and liver). Several caveats must be observed, however, when using this technique for species identification.

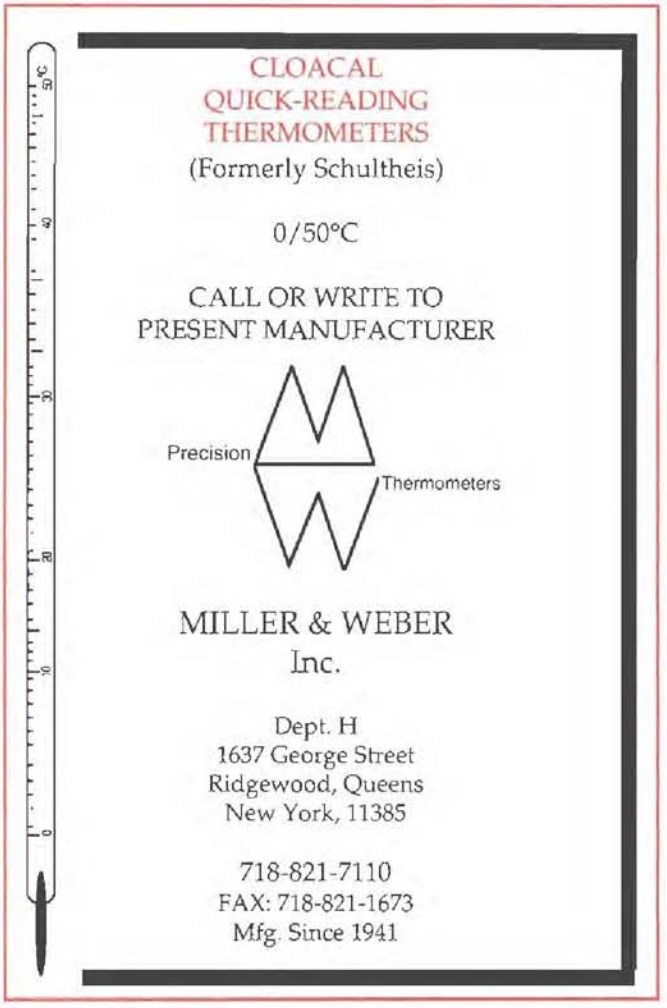
While species-specific markers generated with multiple primers were conserved between the two analyzed Maryland populations of *D. fuscus*, and for the Maryland and North Carolina populations of *D. monticola*, analyses of *D. ochrophaeus* and *L. marmoratus* from different populations indicate that markers are not necessarily conserved between populations of a particular species. There is no way to predict whether markers generated with a particular primer, and for a given species, will be conserved between, or even within, populations. Therefore, it is necessary to test primers with unambiguously identified specimens from those localities where morphologically unidentifiable specimens will be collected in order to identify consistent and distinctive markers for each species of interest.

The complexity of salamander genomes varies considerably from species to species, and the procedures described here were only carried out on desmognathine salamanders. Members of the genus *Desmognathus* have relatively less complex (smaller) genomes than do many species of salamanders (Sessions and Larson 1987), and it is possible that some species will present greater difficulties than those examined in this report. However, judicious choice of primers, adjustment of annealing temperatures, or an increase in the primer length, should make the technique applicable to any organism. Indeed, RAPD has been used successfully for the analysis of plant species with extremely complex genomes (Dweikat et al. 1993; Heun and Helentjaris 1993).

While a comprehensive discussion of the technique is beyond the scope of this note (see reviews by Hadrys et al. 1992, and Black 1993), several general concerns should be noted. The patterns obtained by RAPD are extremely sensitive to reaction conditions and care must be observed to ensure reproducibility. The temperature profile is particularly critical. MacPherson et al. (1993) obtained different RAPD patterns with identical samples and reaction conditions when thermal cyclers of different manufacture were used. In addition, the investigators found patterns to be sensitive to primer concentration, as did Muralidharan and Wakeland (1993). However, when moderately high DNA concentrations (greater than 10 ng) and sufficient primer concentrations (at least 0.2 micromolar) were used, MacPherson et al. concluded that all thermal cyclers examined were capable of reproducibility. Care must also be taken with the enzyme used. Schierwater and Ender (1993) have found that use of polymerase obtained from different sources (with regard to both manufacturer and organism) may lead to variation in RAPD markers. Anyone who wishes to produce useful RAPD profiles must standardize their reaction conditions with regard to all of these factors.

The considerable technical difficulties inherent to RAPD should not be underestimated. However, this method offers unique advantages over other available molecular techniques for species identification. For the identification of extremely small specimens, eggs, or larvae, the technique is likely to be particularly useful. Although the technique is described here only for the analysis of desmognathine salamanders, it seems probable that the technique should be applicable to virtually any species. I hope that this report will serve to encourage greater cooperation between field-oriented and lab-oriented biologists, and allow the use of recent technological advances to answer questions generated by observations in the field and, more specifically, to encourage exploration of the use of RAPDs in other salamander species.

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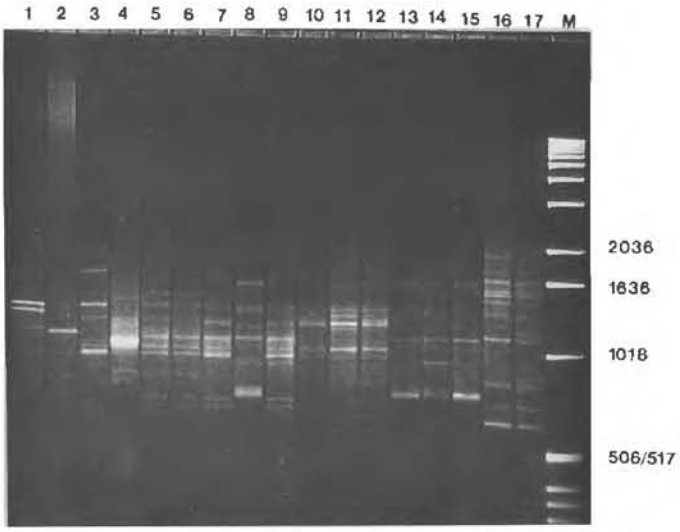


FIG. 1. RAPD products generated using OPA-01. Each lane represents a separate individual. Lanes 1 and 2, *D. ochrophaeus* from a single locality in Macon Co., North Carolina. Lane 3, *D. ochrophaeus* from a second locality in Macon Co., North Carolina. Lane 4, *D. ochrophaeus* from Garrett Co., Maryland. Lanes 5 and 6, *D. monticola* from a single locality in Garrett Co., Maryland. Lanes 7 and 9, *D. monticola* from a single locality in Macon Co., North Carolina. Lane 10, *D. fuscus* from Garrett Co., Maryland. Lanes 11 and 12, *D. fuscus* from a second locality in Garrett Co., Maryland. Lanes 8 and 13-15, *D. quadramaculatus* from a single locality in Macon Co., North Carolina. Lanes 16 and 17, *L. marmoratus* from a single locality in Macon Co., North Carolina. DNA samples were isolated from liver in all cases, except for lanes 1-3, where DNA was isolated from tails. Lane M contains DNA size standards. See text for discussion of RAPD products.

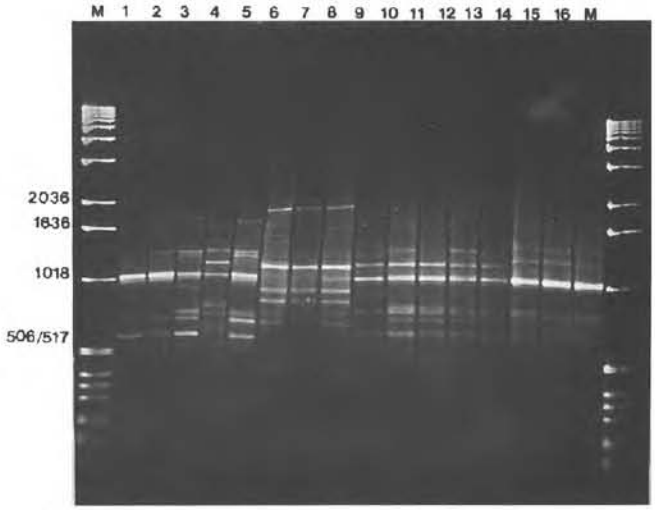


FIG. 2. RAPD products generated using OPA-10. Each lane represents a separate individual. Lanes 1 and 2, *D. monticola* from a single locality in Garrett Co., Maryland. Lanes 3 and 5, *D. monticola* from a single locality in Macon Co., North Carolina. Lane 6, *D. fuscus* from Garrett Co., Maryland. Lanes 7 and 8, *D. fuscus* from a second locality in Garrett Co., North Carolina. Lanes 4 and 9-13, *D. quadramaculatus* from a single locality in Macon Co., North Carolina. Lanes 14-16, *L. marmoratus* from a single locality in Macon Co., North Carolina. All DNA samples were isolated from liver. M lanes contain DNA size standards. See text for discussion of RAPD products.

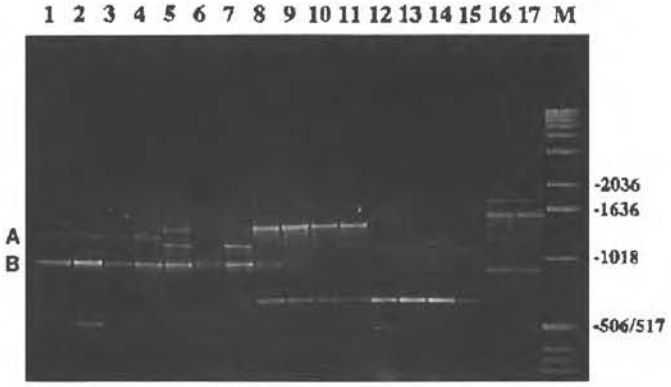


FIG. 3. RAPD markers generated with OPA-15. All lanes represent separate individuals. Lanes 1 and 2, *D. ochrophaeus* from a single locality in Macon Co., North Carolina. Lanes 3 and 4, *D. ochrophaeus* from a single locality in Garrett Co., Maryland. Lane 5, *D. fuscus* from Garrett Co., Maryland. Lanes 6 and 7, *D. fuscus* from a second locality in Garrett Co., Maryland. Lanes 8 and 9, *D. monticola* from a single locality in Garrett Co., Maryland. Lanes 10 and 11, *D. monticola* from a single locality in Macon Co., North Carolina. Lanes 12-14, *D. quadramaculatus* from a single locality in Macon Co., North Carolina. Lane 15, *L. marmoratus* from Macon Co., North Carolina. Lanes 16 and 17, *L. marmoratus* from a single locality in Haywood Co., North Carolina. DNA used in lanes 1 and 2 was isolated from embryos, all other samples were isolated from liver. Markers labelled A and B were found in all 25 *D. ochrophaeus* samples analyzed. See text for discussion of RAPD products.

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BRIAN S. MASTERS
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA.

HERPETOLOGICAL HUSBANDRY

Spawning of *Notophthalmus viridescens* and Rearing of Embryos Under Laboratory Conditions

The adult red spotted newt, *Notophthalmus viridescens*, has long served as the model for the study of appendage regeneration, and other body parts (see reviews by Sicard 1985 and Wallace 1981). A basic paradigm concerning epimorphic regeneration in the adult newt implies that the amputated limb retraces its embryonic development (Faber 1971; Liversage 1991). With the advent of molecular biology, the need for embryonic newt tissue to further test this paradigm is becoming acute. A major obstacle in this endeavor has been the inability of researchers to obtain or to produce and raise newt embryos in sufficient numbers. We outline, for the first time, a systematic means to produce as well as rear large numbers of embryos on a year round basis.

Spawning Chamber.—A glass aquarium (51 cm L x 27 cm W x 31 cm H) containing 25L of dechlorinated tap water (22°C, maintained by constant room temperature), a 5 cm layer of aquarium gravel, several rocks (which protrude out of the water) as well as a mixed variety of aquatic plants (e.g., *Sagittaria* sp. and *Elodea* sp.) housed the adult newts. Each chamber is covered with a fine metal mesh lid (not glass) above which is mounted a 33-watt General Electric "gro and sho bright stik" (model FBS25/GS) fluorescent light plugged into an adjustable timer. Spawning chambers are kept in a windowless room so that both the quantity and quality of light can be regulated closely. Ideally, each chamber should house 4 female and 2 male newts which are sexually mature. These newts can be kept in a spawning chamber indefinitely.

Natural Spawning.—According to Fankhauser (1967), animals caught in the wild during spring will spontaneously deposit eggs if housed in an aquarium containing a mass of aquatic plants. We have found that by cooling males and females 2–3 times a week to 5–10°C overnight, as well as over-feeding them with minced beef heart, *Daphnia* sp., and *Tubifex* sp., and gradually increasing the photocycle 15 min/day for 14 days tends to enhance the yield of embryos. A moderate supply of eggs (20–50 per animal) may be harvested over a period of approximately 3 days to 4 weeks.

Induced Spawning.—Large newts (>12 cm snout to tail tip) of both sexes (2N = 22, ZW = female, ZZ = male, Nace 1974) are selected for breeding. Best results are obtained when noticeably gravid females are chosen. Males with blackened distal hindlimb digital pads as well as blackened inner (medial) surfaces of their hindlimb (nuptial) pads are the most suitable for mating. In addition, prominent distension of the cloacal region resembling a cone, as well as the dorso-ventral broadening of the tail are other indicators of sexual maturity in both genders. Animals chosen for spawning are maintained in clear plastic tubs (35 cm L x 26 cm W x 15 cm H) containing dechlorinated tap water at 22°C. Newts should be well-fed on a varied diet, as described above, for at least two weeks. Water is changed daily. Following overfeeding, animals are placed at 4°C and left in complete darkness for periods varying from overnight to 5 days, whereupon, the animals are returned to room temperature (22°C) and placed in spawning chambers. Initially, animals are exposed to a 10h light:14h dark photocycle. The light portion of the photocycle is increased 15 min per day for 14 days. After the first 7 days of photoacclimation females are injected (primed) in the evening with 100 I.U. of human chorionic gonadotropin (HCG – Sigma, #CG-5; see Redshaw 1972). HCG is injected i.p. into a mildly anaesthetized (by immersion in 0.05% w/v MS 222 neutralized with $NaHCO_3$) female using a 30-gauge needle fitted to a 1.0 cc tuberculin syringe. The following morning, females are given a further 100 I.U. HCG. Should eggs not appear 7 days after the initial HCG treatment, further injections of 100 I.U. HCG may be given on a daily basis. Eggs may be harvested immediately following their deposition on the plant material. These matings typically result in more than 150 viable embryos per female over a period of several weeks to about two months, if the spawners are well fed and left as undisturbed as possible.

Larval and Eft Maintenance.—Egg clusters are recovered daily from the spawning chambers by removing the egg-laden plant sprigs and transferring them directly into aquaria (62 cm L x 31



FIG. 1. Scanning electron micrograph of a newt blastula fractured through the blastocoel revealing internal structure.

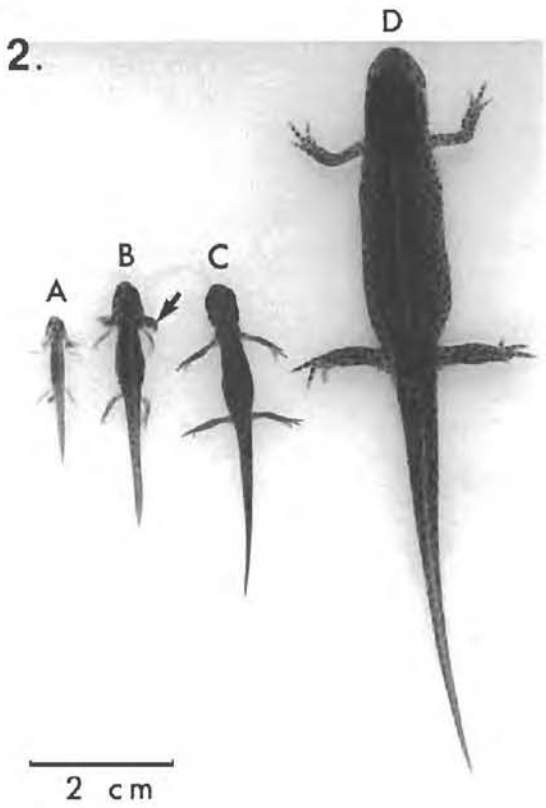


FIG. 2. Light micrograph showing the developmental progression of *Notophthalmus viridescens* from the larval brown eft stage to the mature adult. A. Growing brown eft. B. Mature brown eft with prominent gills (arrow). C. Red eft, lacking external gills as a result of metamorphosis I—transition from water (brown eft) to land (red eft). D. Mature gravid adult (female). Result of metamorphosis II—transition from land (red eft) back to water (adult).

cm W x 42 cm H) containing well established cultures of *Daphnia* sp. Eggs develop in aquaria filled with 22°C dechlorinated tap water and are exposed to a 12h light:12h dark photocycle. The resulting embryos are allowed to develop and are either collected by stage (Fig. 1) as needed, or allowed to mature. Once hatched, the free swimming larvae will begin to consume *Daphnia* sp. Larger brown efts are fed *Tubifex* sp. as well. Efts require live, moving food (Martin et al. 1973). When housed in this manner, handling and maintenance are reduced to a minimum. This limits stress to the animals. Furthermore, animals can eat ad libitum, which assists rapid growth. In addition, fungal contamination of newt larvae appears to be reduced when they are fed on *Daphnia* sp. obtained from cultures which are maintained in water containing algae. *Daphnia* need not be fed yeast. First metamorphosis occurs when brown efts (Fig. 2) prepare, physiologically and morphologically, to move from water to land. Once their external gills have been resorbed, efts become red (Fig. 2) and they are ready for the terrestrial phase. However, we have observed that red efts grow larger and more quickly when left in an aquatic habitat lacking a terrestrial component. Instead of providing land, several large sprigs of *Elodea* sp. should be floating at the surface of the water. Red efts are fed liberally on *Daphnia* sp. and *Tubifex* sp. When raised in this manner, efts thrive well due to a ready access to an abundant food supply; a reserve of which cannot be maintained easily in a terrestrial environment in the laboratory. To date, we have successfully produced in excess of 5000 *Notophthalmus viridescens* embryos in one year using the techniques outlined. We have spawned animals that have been kept in our lab for more than 3 years. Nevertheless, the greatest ease in spawning as well as the highest yields have been obtained from animals that have been brought in "fresh" from the wild between October and May. Our newts are purchased from Michael Tolley, Nashville, Tennessee, USA. In contrast, the most difficult period in obtaining a continuous supply of embryos is from June to September. Although females appear gravid during this period, most of the eggs they deposit are not fertilized. Moreover, we have found that these unfertilized eggs tend to be deposited singly instead of in clusters.

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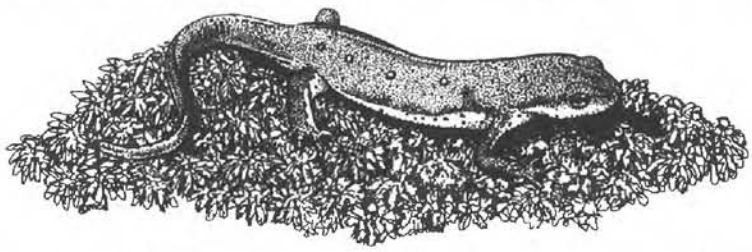
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PAUL A. KHAN
and
RICHARD A. LIVERSAGE
Ramsay Wright Zoological Laboratories
University of Toronto
Toronto, Ontario, M5S 1A1, Canada.



Notophthalmus v. viridescens (Red-Spotted Newt).USA: Massachusetts: Leyden. Illustration by Michael C. Erelli.

NATURAL HISTORY NOTES

Instructions for contributors to Natural History Notes appear in volume 26, number 1.

ANURA

LEPTODACTYLUS BUFONIUS (NCN). **REPRODUCTION.** *Leptodactylus bufonius* breeds in unpredictable habitats in arid Chacoan regions of Paraguay, Argentina, and Bolivia. Males construct nests in the mud at the edges of ponds and other low-lying depressions. They call from inside or close to the nests, and subsequent production of a foam nest occurs within the mud nest. Following oviposition, the top opening of the nest is closed off with mud. The eggs hatch within a few days, but the tadpoles remain within the closed mud nest until rains flood the nest and wash the tadpoles into the pond (Cei 1949. Acta Zool. Lilloana 8:105–110). The tadpoles are able to remain inside the nests for at least 46 days (Philibosian et al. 1974 Herpetologica 30:381–386) if rains do not cause the nests to open. The tadpoles are primarily ureotelic while in the foam, thus urea concentration remains below the lethal limit (Shoemaker and McClanahan 1973. Comp. Biochem. Physiol. 44A:1149–1156). Although nest construction has been described in the papers cited above, no description of nest capping (closing of the nest opening with mud), nor mention of which sex performs the behavior, has been reported. This note offers observations of three females engaged in nest-capping behavior.

Field observations were made on 5–6 December 1989, at a farm pond along Ruta 41, about 56 km NE of Joaquin V. Gonzalez, Salta Province, northern Argentina. Duration of the pond was extremely unpredictable, containing water at irregular intervals from early December through early March. The pond at the time of observation in early December was approximately 15 m X 30 m and had a maximum depth of 30 cm. From 1700–1800 h on 5 December I located and marked 12 mud nests from around the edge of the pond. All nests were cone-shaped and extended up to 5.5 cm above the ground (Fig. 1A). Distance from the edge of the water ranged from 0.51–13.8 m (mean = 3.8 m, SD = 3.68). Nest depth ranged from 8.7–13.5 cm (mean = 11.5 cm, SD = 1.35), and width of the nest opening ranged from 4.5–6.5 cm (mean = 5.4 cm, SD = 0.66).

I checked for anuran activity at the 12 nests beginning at 2330 h, 5 December. Males were found calling from inside three of the nests, and from the ground within 1 m of another two nests. Amplectant pairs were found inside four of the nests, in the process of producing foam nests. The remaining three nests had no frogs associated with them. I observed these 12 nests from 2330–0330 h. None of the five calling males attracted a female during the observation period. The following are observations on the four nests in which eggs were deposited.

Nest #1 (2.55 m from the edge of the pond). I first observed the amplectant pair in the mud nest at 2330 h. From this time until 0150 h both frogs were inside the nest, but by 0205 h both frogs had left the nest When I returned at 0220 h, one frog was capping the nest opening. The frog used its front feet to push mud from the ground, along the side, up to the top of the nest, working all around the sides of the nest. It continued this activity until I caught it at 0302 h, although the frog was still pushing mud up onto the top of the nest, the opening had been completely closed by the time I caught the frog. The individual was a female. No other frog was found within 10 m of the nest.

Nest #2 (13.8 m from the edge of the pond). A pair of frogs was observed in this nest at 2335 h. The pair was still inside the nest at 2435 h. At 2450 h one frog was found sitting 4.5 cm from the nest. The nest opening had not been capped. The frog remained in this position for another 2 h 40 min, at which point I caught it and identified it as a female. The nest remained open at the top. The earth surrounding the nest was so dry and hard that perhaps it was not possible for the female to cap the nest opening.

Nest #3 (51 cm from the edge of the pond). A pair of frogs was observed in this nest at 2340 h. They remained in the nest until at least 0140 h. When I returned at 0212 h one frog was pushing mud up along the sides of the nest, and a second frog was sitting 30 cm from the nest. The individual doing the capping was a female, the one sitting near the nest a male. When I returned at 0236 h and again at 0254 h the nest opening was completely closed, but the female was still pushing mud onto the top and the male was still sitting in the same position 30 cm from the nest. At 0254 h I disturbed the frogs and they both jumped into the water. When I returned at 0311 h the female was once again pushing mud onto the top of the nest, but the male was not found.

Nest #4 (90 cm from the edge of the pond). A pair of frogs was observed inside the mud nest at 2345 h. They were still inside the nest at 2445 h. When I checked the nest at 0145 h a frog was pushing wet mud up along the side of the nest, onto the top. No other individual was observed within 10 m of the nest. I checked



FIG. 1. Mud nest of *Leptodactylus bufonius*. A. Open nest, without foam and eggs inside. B. Capped-off nest. Note that the mud on the top and on the upper sides of the nest is wetter than the mud on the bottom of the nest and on the surrounding substrate.

this nest at 10–15 minute intervals, and each time found the individual still capping the nest, although the opening appeared to be closed by 0225 h. At 0240 h I caught the individual and identified it as a female.

Based on these observations, it seems that the female is the parent who remains and caps the nest, although males may remain nearby after oviposition. In all three instances where I observed the process of nest capping, the mud placed onto the nest top was considerably wetter than the mud on the ground (see Fig. 1B). Thus it seems likely that the female uses water from her bladder to moisten the mud in order to make it more sticky and easier to form into a protective cap.

Because capping behavior represents a considerable time investment (in the three instances observed the times were minimally 42–59 min) and presumably subjects the female to a greater risk of predation, the behavior is an important component of reproductive effort in the species. *Leptodactylus bufonius* would be a fascinating species for which to compare reproductive effort between the sexes: males expend considerable time and energy constructing the mud nest and calling to attract a mate, and females expend energy closing the nest, presumably for protection from desiccation and predators.

I thank Omar Pagaburo for field assistance and Raymond F. Laurant and the Miguel Lillo in Tucuman for logistical support. Carlos Videla and Ignacia Sarmiento kindly granted permission to work on their land. Rodolfo Ruibal read the manuscript and provided helpful comments.

Submitted by **MARTHA L. CRUMP**, Department of Biological Sciences, Northern Arizona University, Flagstaff, Arizona 86011, USA.

RANA CAPITO SEVOSA (Dusky Gopher Frog). **SUBMERGED VOCALIZATION.** Several ranids, including *Rana palustris* (Christiansen and Bailey 1991. The Salamanders and Frogs of Iowa. Iowa Dept. Nat. Res. Nongame Tech. Ser. No. 3. 24 pp.), *R. areolata* (Barbour 1971. Amphibians and Reptiles of Kentucky. Univ. Press of Kentucky, Lexington. 334 pp.), *R. pipiens* and *R. sylvatica* (Pope 1944. Amphibians and Reptiles of the Chicago Area. Chicago Nat. Hist. Mus. Press, Chicago. 275 pp.) have been reported producing both airborne and submerged mating calls. We observed submerged dusky gopher frogs calling at breeding sites in Florida and Alabama.

On 29 January 1994, we heard muffled calls of gopher frogs at Holley Pond on Eglin Air Force Base (AFB), Okaloosa County, Florida (T1N, R25W, Sec. 28). The calls were audible at ca. 10 m. Two males were subsequently observed calling while sitting on the pond bottom on 31 January 1994. On 13 February 1994, several males were observed calling from the bottom of Salt Pond in Conecuh National Forest, Covington County, Alabama (T2N, R15E, Sec. 3). Submerged vocalization was also heard at an unnamed pond on Eglin AFB (T1N, R25W, Sec. 28) on 1 March 1994. We have heard dusky gopher frogs producing airborne calls at the Eglin ponds in previous years, and muted, presumably submerged calls at Salt Pond in 1991 and 1992.

Submerged vocalization is not confined to western Florida and southern Alabama. Gopher frogs have been heard calling under water in North Carolina (A. Braswell, pers. comm.), Georgia (J. Jensen, pers. obs.), and Mississippi (G. Johnson, pers. comm.). Calling from above or below the surface does not appear to be affected by air temperature, as we have heard both at air temperatures between 7.5 and 17°C. Males calling under water may be establishing territories, and/or attempting to attract females already in the pond. Submerged vocalization may also conserve energy and reduce exposure to predators that prey on more conspicuous surface-calling frogs.

Submerged calling has important implications for aural surveys of gopher frogs. Because submerged calls are only audible at 10 m or less, gopher frog presence or absence cannot be accurately determined when frogs are calling under water without listening at various points within or around the wetland basin. This is particularly pertinent when other species of frogs, such as *Pseudacris ornata*, are chorusing. In addition, because submerged calls are more difficult to discern than airborne calls, the numbers of calling males may be underestimated. Submerged calling may at least partially explain why Bailey (1990, *In* C. K. Dodd, Jr., et al., eds. Proc. Eighth Ann. Mtg. Gopher Tortoise Council. Florida Mus. Nat. Hist, Gainesville. 134 pp.) heard fewer males calling than had entered a breeding site encircled with a drift fence.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA, **JOHN G. PALIS**, RR 1, Box 258, Tell City, Indiana 47586, USA, and **MARK A. BAILEY**, Alabama Natural Heritage Program, Dept. of Conservation and Natural Resources, State Lands Division, 64 N. Union Street, Montgomery, Alabama 36130, USA.

RANA CATESBEIANA (Bullfrog). **DIET**. On 1 July 1992, four adult bullfrogs were collected by one of us (JB) from ponds on a reclaimed coal mining site in Randolph County, Missouri (T54N R15E Sec 22). Frogs were captured at night with the aid of a headlamp. The following animals were found in the bullfrogs' stomachs: two frogs had crayfish (*Orconectes virilis*, or *Cambarus diogenes*, ca. 120 mm), one frog had what was believed to be a prairie vole (*Microtus ochrogaster*, 120–130 mm) and the fourth bullfrog had eaten a young female mink (*Mustela vison*, ca. 180 mm). This adds to the published information on the diet of bullfrogs in Missouri (Johnson 1987, The Amphibians and Reptiles of Missouri. Publ. Missouri Dept. Conserv., Jefferson City, 368 pp.).

Submitted by **JEFF BERINGER**, Missouri Department of Conservation, 1110 South College Ave., Columbia, Missouri 65201, USA, and **TOM R. JOHNSON**, Missouri Department of Conservation, P.O. Box 180, Jefferson City, Missouri 65102, USA.

SCAPHIOPUS INTERMONTANUS (Great Basin Spadefoot). **PRODUCTION OF ODOR**. Several groups of frogs, including some pelobatids, are known to produce specific odors that are similar to everyday smells, such as garlic, onions, or vanilla (Noble 1931. The Biology of the Amphibia. McGraw-Hill Co., New York. 577 pp.). The western spadefoot (*Scaphiopus hammondii*) is reported to smell like roasted peanuts when handled (Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 336 pp.), but this apparently has not been noted for *S. intermontanus*.

On the evening of 13 July 1994 we collected four *S. intermontanus*, each about 5.5 cm SVL, along a road between Oliver and Osoyoos, British Columbia (49°03'N, 119°28'W). While measuring and weighing the first, we noticed a peculiar odor which reminded us of peanuts. The next three spadefoots also produced this odor, as did another caught on 31 July 1994. This time the odor seemed to coincide with the extrusion of a cream-colored opaque substance from the parotoid glands. We found three small spadefoots on 16 August 1994, and three more on 7 September 1994 (each about 3 cm SVL); all could be induced to produce the peanut smell. The mucous-like secretion dried to a crust on the hands and produced a burning sensation

when accidentally rubbed in the collector's eye. Upon capture, some of the specimens dipped their heads, tilting their backs towards the collector's hand. Two of the spadefoots also regurgitated when held for an extended amount of time; one produced several larval lepidopterans and a beetle while the other only produced bubbles. We suggest that this group of behaviors enables spadefoots to discourage or distract predators. The specimens were handled for a few minutes before they produced the scent and secretion, so if spadefoots are caught and immediately placed in a container they might not feel sufficiently threatened to react in the manner described.

Submitted by **HEATHER L. WAYE** and **CHRISTOPHER H. SHEWCHUK**, Department of Biology, University of Victoria, P.O. Box 1700, Victoria, British Columbia, Canada, V8W 2Y2.

TESTUDINES

EMYDOIDEA BLANDINGII (Blanding's Turtle). **REPRODUCTION.** A radio-tagged female Blanding's turtle was observed nesting on 21 June 1993 in Crow-Hassan Park, Hassan Township, Hennepin Co. Minnesota (45°15'N). The turtle nested in a re-created prairie with sparse grass cover. The soil is sandy and well drained. Prior to being planted with prairie plant species in the mid 1970s, the site was used for row crops. The nest was monitored throughout the summer. When the nest was checked on 11 October 1993, it was undisturbed. When visited on 25 October, there was an exit hole. Upon excavating the nest, five hatched eggs were found along with three unhatched eggs. Thus five of the eggs took a minimum of 112 d from the time they were laid to the time the hatchlings emerged from the nest. The unhatched eggs were reburied. When the nest was dug up in March 1994, the three eggs had hatched and no hatchlings were present. As there was no exit hole, we presume the hatchlings emerged the previous fall sometime after 25 October 1993. The time from laying of these three eggs to emergence of hatchlings from the nest was therefore at least 126 d. Both emergence times are longer than the 104-day maximum reported in Ernst et al. (1994. Turtles of the United States and Canada. Smithonsian Inst. Press, Washington. 578 pp.). Temperatures were 1.7°C below normal and precipitation was 17.5 cm above normal during the incubation period at this site.

Submitted by **JOHN J. MORIARTY** and **MADELEINE LINCK**, Department of Natural Resources Management, Hennepin Parks, 3800 Co. Rd. 24, Maple Plain, Minnesota 55359, USA.

STERNOTHERUS MINOR (Loggerhead Musk Turtle). **FORAGING DEPTH.** On 20 October 1992 an adult male *S. minor* was encountered feeding on a crayfish (Astacoidea) underwater at a depth of 12.5 m. The observation was made in Catfish Hotel, a spring-fed sink hole at Manatee Springs State Park, Levy County, Florida. The sex of the turtle was determined based on its relative head size. After being observed for several seconds, the turtle abandoned the partially eaten crayfish and retreated under a log at 13 m depth. Dive depths of freshwater turtles have not been well documented. Most freshwater turtles are presumed to forage in shallow habitats where depth does not pose physical or physiological limits. This report suggests that *S. minor* forages at substantial depths when deep habitats are available.

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Submitted by **FRANK R. HENSLEY,** Department of Zoology, University of Florida, Gainesville, Florida 32611, USA, and Savannah River Ecology Laboratory.

LACERTILIA

ANISOLEPS GRILLI (NCN). **REPRODUCTION.** On 29 December 1992 we collected a gravid female *Anisoleps grilli* (SVL = 81.86 mm) at the Parque Municipal da Grota Funda (23°15'S; 46°45' W, 900–1400 m alt., 1600 mm rain/year), Municipality of Atibaia, São Paulo, Brazil. The specimen was brought to the lab and, on 8 January 1993, she laid seven white calcareous shelled eggs in a nest excavated between stones at the bottom of the terrarium. The clutch was incubated at ambient temperature (range 17–26° C) and photoperiod in wet vermiculite. Five eggs were adhered to each other. The two free eggs measured 15.5 x 8.9 and 15.5 x 9.1 mm. At the end of the incubation period they were coriaceous in aspect and had grown 57% in length and 62% in width. The mean incubation time lasted 233.8 days (SD = 6.242; N = 5); two eggs died. The mean SVL and weight of hatchlings was 29.4 mm (SD = 0.89; N = 5), and 0.575g (SD = 0.015; N = 4). One of the hatchlings had a malformation of the right eye and head symmetry. The climate at the collection site is seasonal with a hot/moist summer and a cold/dry winter, with frequent frosts in June/July. The hatching was coincident with the beginning of the hot/moist season. Voucher specimens are housed in the collection at Universidade Estadual de Campinas (ZUEC 1542, 1614–18).

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Submitted by **ARIOVALDO A. GIARETTA** and **KÁTIA G. FACURE**, Departamento de Zoologia, Universidade Estadual de Campinas, 13081-970, Campinas, SP, Brazil.

CARLIA (Scincidae). **TAIL WAVING AND PREY PIRACY.** *Carlia fusca* (Brown Four Fingered Lizard) was observed to wave its tail while moving through leaf litter (O'Shea 1993. Herpetol. Rev. 24:3). Tail waving has been recorded in the pygopodid genera *Aprasia* and *Ophidiocephalus*, and a number of geckos in Australia (Greer 1989. The Biology and Evolution of Australian Lizards. Surrey Beatty and Sons Pty Limited, Chipping Norton, N.S.W., 264 pp.). Most of these animals have only been observed to wave the tail when disturbed. A number of authors reported tail waving to be widespread within *Carlia* (Horner 1991. Skinks of the Northern Territory. NT Museum; Wilson and Knowles 1988. Australia's Reptiles: A Photographic Reference to the Terrestrial Reptiles of Australia. Collins Publ., Sydney, 447 pp.), and *C. munda, C. rufilatus*, and *C. gracilis* have been observed to display in this manner in the Darwin, NT, region. Most species of *Carlia* are sexually dichromatic, as in many Australian agamid species, and therefore may be visually cued (S. Wilson, pers. comm.). However, tail waving has been observed in animals which are alone, in the vicinity of conspecifics, stationary, and foraging. The behavior does not appear to be sex or season specific. Therefore, if tail waving is a visual cue in *Carlia*, it is perhaps used in a manner which differs from that observed in agamids.

In October 1993, at a field site 60 km S of Darwin, NT, Australia, I observed a trail of green ants (*Oecotsylla smaragolia*) on the ground, travelling in a northward direction. They occasionally were transporting insect prey. Waiting 5 cm from the ant trail

were 1 male and 2 female adult *C. munda*, about 1 m apart. As the ants moved their insect prey along the line a lizard would dash over and pluck it from an ant, move about 30 cm from the ant trail and consume the prey. Piracy of prey items from the ants by *C. munda* was observed on all four days I was at this site. On one occasion a fight developed between the two females when one animal attempted to swap positions. Piracy of prey from ants was observed at another field site on a single day (pers. obs.) and at other sites (M. Guinea, pers. comm.). Tail waving was observed on many occasions and did not appear related to prey piracy.

Submitted by **GAVIN S. BEDFORD**, School of Biological Sciences, Northern Territory University, P.O. Box 40146, Casuarina, NT, Australia, 0811.

CNEMIDOPHORUS GULARIS GULARIS (Texas Spotted Whiptail). **MAXIMUM SIZE.** The maximum size for *Cnemidophorus g. gularis* given by Conant and Collins (1991. A Field Guide to the Reptiles and Amphibians of Eastern and Central North America, 3rd ed. Houghton Mifflin Co., Boston, Massachusetts, xviii + 450 pp.) is SVL 3 1/2 in. (90 mm) and TL 11 in. (279 mm). The Tulane University Museum of Natural History contains a male specimen TU 22914 from 3.5 mi (5.6 km) north of Shamrock, Wheeler County, Texas collected by Robert R. Hollander on 14 May1987 which measures 105 mm (3 7/8 in.) SVL and 296 mm (1 13/16 in.) TL. The postantebrachial scales of the specimen appear somewhat larger than the usual postantebrachials of the race and a count of 97 granular scales near mid body where the ventral scute rows are widest is somewhat higher than the 93 previously reported by Conant and Collins (*op. cit.*). Somewhat farther forward the granular scute count is at least 112.

John W. Wright kindly verified the identity of the specimen.

Submitted by **HAROLD A. DUNDEE**, Tulane University Museum of Natural History, Belle Chasse, Louisiana 70037-3098, USA.

GAMBELIA SILA (Blunt-nosed Leopard Lizard). **PREDATION.** Territoriality exhibited by male *Gambelia sila* (Montanucci 1965. Herpetologica 21:270–283; Tollestrup 1983. Z. Tierphyscol. 62:307–320) may expose these lizards to higher rates of predation than if they were secretive. Territoriality may also expose adult *G. sila* to some avian predators that might not be able to catch these lizards if they were hidden in vegetation. On the Elkhorn Plain in San Luis Obispo County, California, adult *G. sila* are conspicuous because they often bask on sparsely vegetated mounds of giant kangaroo rats (*Dipodomys ingens*; Germano and Williams, unpubl. data). Predators known to take *G. sila* include the San Joaquin coachwhip (*Masticophis flagellum ruddocki*), gopher snake (*Pituophis melanoleucus*), loggerhead shrike (*Lanius ludovicianus*), American kestrel (*Falco sparverius*), burrowing owl (*Athene cunicularia*), and roadrunner (*Geococcyx californianus*), and other snakes, birds, and mammals are suspected of being predators (Montanucci 1965. Herpetologica 21:270–283; Tollestrup 1979. Unpubl. Ph.D. diss., Univ. California, Berkeley). Here we report the observation of predation of *G. sila* by a bird previously not known to eat these lizards.

On 17 June 1994, we observed an act of predation on a *Gambelia sila* while we were censusing the perimeter of one of our plots on the Elkhorn Plain, California (Germano and Williams 1994. Northwestern Nat. 75:11–19). As we walked the perimeter to find marked lizards, we spotted a medium-sized male *G. sila* (estimated 100 mm SVL) on a kangaroo rat mound at about 1130 h (PDT). We approached the male with our pole and noose and were about 4 m from the lizard when we saw from the corner of our eyes movement and a large shadow coming from behind us. An instant later, we saw a prairie falcon (*Falco mexicanus*) catch the lizard in its talons, bank quickly to our right, and fly back by us. The falcon flew about 2 m off the ground for approximately 10 m until it was able to gain altitude. It continued flying with the lizard in its talons to the southwest towards the nearby Panorama Hills. This is the first recorded observation of predation of *G. sila* by a prairie falcon.

Submitted by **DAVID J. GERMANO** and **CINDY R. CARTER**, Department of Biology, California State University, Bakersfield, California, 93311, USA.

VARANUS GRISEUS (Desert Monitor Lizard). **REPRODUCTION.** Data on clutch size for monitor lizards from Middle Asia in general, and Kazakhstan in particular, have rarely been reported. On 21 June 1989 a road-killed female *Varanus griseus*, TL = 105 cm (47 cm SVL + 58 cm tail) was found near Sjutkent settlement, South Kazakhstan Region, Republic of Kazakhstan (67°40'E, 41°50'N). Dissection revealed 24 soft-shelled eggs (13 in the left oviduct, 11 in the right), eight of which were damaged. The eggs had an average size of 48.0 x 26.9 mm (46.0–52.0 mm x 26.0–28.0 mm, N = 16) and a mean mass of 20.4 g (N = 16).

The largest clutch size previously known for Middle Asian desert monitors (23 eggs) was recorded in a female of 99 cm TL (44 cm SVL + 55 cm tail) from the Surchan-Darja Region of Uzbekistan on 8 June 1949 (Bogdanov 1960. The Fauna of Uzbekistan, vol. 1 [in Russian]. Academy of Sciences of Uzbekistan, Tashkent. 115 pp.).

Boris Gubin (Institute of Zoology of the National Academy of Sciences, Kazakhstan) helped to measure the lizard.

Submitted by **TATJANA DUJSEBAYEVA (MATVEYEVA)**, Department of Biology, Kazakh State University, Timirjaseva Street, 46, Almaty 480121, Kazakhstan.

SERPENTES

CORONELLA GIRONDICA (Southern Smooth Snake). **PREY SIZE.** *Coronella girondica* is a small colubrid with a total length usually < 70 cm. It is nocturnal and secretive, which probably accounts for it being one of the least known snakes in France (Saint Girons 1989. *In* J. Castanet and R. Guyetant (eds.), Atlas de Repartition des Amphibiens et Reptiles de France. Soc. Herp. Fr. p. 153). The snake's diet consists primarily of small lizards and occasionally small mammals. The following reptiles have been documented in the diet of *C. girondica*: *Hemidactylus turcicus, Tarentola mauritanica, Anguis fragilis, Chalcides bedriagai, C. chalcides, Acanthodactylus erythrurus, Psammodromus algirus, P. hispanicus, Podarcis bocagei, P. hispanica, P. muralis*, and *P. sicula* (Vericard and Escarre 1976. Mediterranea, Alicante 1:5–32).

On 5 August 1994, in the "Causse du Larzac," Millau, Aveyron Prov. France, we found a male *Coronella girondica* (SVL = 465 mm, mass = 40 g) feeding on an adult *Lacerta viridis*. The snake had already swallowed the head and body of the prey up to the point of the cloaca. Thus, the maximum circumference of the prey had passed the articulation of the snake's quadrates with the mandibles. When captured, the snake immediately regurgitated the prey. The lizard was still alive and regained full consciousness after 5 minutes. The total length of the *L. viridis* was 312 mm

(118 mm SVL + 194 mm tail length) and it weighed 30.5 g. The prey: snake mass ratio was therefore 0.76. This is an exceptionally high value for colubrids as Pough and Groves (1983. Amer. Zool. 23:443–445) reported maximum prey: snake mass ratios of 0.18 for a non-viper and 0.36 for a viper. This observation indicates that *C. girondica*, like its congener *C. austriaca*, is apparently able to feed on relatively large prey.

Submitted by **ROBERT JOORIS**, Laboratory of Ecology, State University Ghent, K.L. Ledeganckstraat 35, B-9200 Ghent, Belgium.

CROTALUS MOLOSSUS MOLOSSUS (Blacktail Rattlesnake). **MAXIMUM LENGTH.** On 23 August 1994, a male *Crotalus molossus molossus* was found entering a dead agave plant occupied by a radio telemetered female at our study site 2.5 mi. northwest of Portal, Cochise County, Arizona. Under isoflurane inhalation anesthesia, its measurements were 1330 mm (52.4 in.) total body length (TBL) (1241 mm SVL + 89 mm TL) and 1011 g body mass. Sex was confirmed by probing and the snake was released at the capture site the same day. Slides showing it extended next to a meter rule are on file at MVZ. Maximum TBL measured by Gloyd (1940. The Rattlesnakes, Genera *Sistrurus* and *Crotalus*, Chicago Academy of Sciences, Chicago, Illinois, vii + 266 pp) of 1250 mm for *C. m. molossus* was a male from Brewster County, Texas. Klauber (1972. Rattlesnakes, University of California Press, Berkeley and Los Angeles, California, 1533 pp.) indicated a maximum length of 1257 mm (49.5 in.). Shaw and Campbell (1974. Snakes of the American West, Alfred A. Knopf, New York, 332 pp.) give maximum length as 4.25 ft (51 in., 1295 mm) and Tennant (1984. Snakes of Texas, Texas Monthly Press, Inc., Austin, Texas, 561 pp.) referred to a specimen reported to be 52 in. (1321 mm) TBL from Kerr County, Texas.

Submitted by **DAVID L. HARDY, SR.**, 3905 Old Sabino Canyon Road, Tucson, Arizona 85715, USA, and **HARRY W. GREENE**, Museum of Vertebrate Zoology, University of California, Berkeley, California, 94720, USA.

EPICRATES CENCHRIA CENCHRIA (Brazilian Rainbow Boa). **MALE COMBAT.** The various studies, reviews, and discussions of male combat in snakes do not show that the boine *Epicrates cenchria* exhibits male combat (Carpenter 1986. Smithsonian Herp. Infor. Serv. 69:1–18; Ross and Marzec 1990. The Reproductive Husbandry of Pythons and Boas, Institute for Herpetological Research, Stanford, California, 270 pp.; Shine 1994. Copeia 1994:326–346). In this report, male combat is documented for the first time in *E. c. cenchria*. The following observations were made on three (2M:1F) captive specimens maintained in Toledo, Ohio (USA). These individuals (plus two other adult females) were maintained in a wooden enclosure (2.44 x 1.22 x 1.22 m) equipped with a plexiglass front and incandescent lighting. Air temperature was ca. 28°C. Substrate heat was supplied in the form of a heat pad (30–31°C). Water was provided ad libitum in a Rubbermaid dishpan container. On 9 January 1993, at 0955 h, it was observed that male 2 (SVL = 106 cm) and female 1 (SVL = 130 cm) were copulating; they remained in coitus until 1900 h (duration of coitus was at least 9 h). During this period, male 1 (SVL = 136 cm) did not interfere with the activities of the copulating pair. At 1915 h male 1 was observed next to the pair, which had remained in close physical contact, and began moving on top of male 2 in a jerky and erratic manner. He was then observed to tail-search the female's lower body and tail in what appeared to be attempts to attain a pre-coital posture. At this time male 2 began to move in a slow manner. Both males then moved out ca. 35 cm from this grouping, moving parallel to each other (ca. 12 cm apart). The males met side-to-side and then abruptly began to entwine from midbody to nape.

Within seconds they exhibited a vertical stance (at least one-third of their anterior trunk) that lasted several seconds, then both fell to the floor and quickly separated, going to the same side of the enclosure but did not interact with each another. The female was on the opposite side at this time, and was not approached by either male. Observations were terminated at this point, and a winner could not be determined. Male 1 was 30 cm larger in SVL (28.3% difference) then male 2. Although mass was not determined, male 1 had greater mass than male 2.

The following day, 10 January, at 1630 h, male 1 was observed copulating in the water container with the female, and during this time male 2 remained at the opposite side of the enclosure on the heat pad and did not change position the entire day. Observations were made on the trio and the other two females over the next several days. Although combat was not witnessed again, on several occasions male 1 would raise his head and anterior trunk in the presence of male 2. Further, male 1 was observed to push male 2 across the enclosure floor; he did not exhibit pushing behavior toward the three females. Based on these observations and the fact that male 1 was both longer and heavier, these acts were concluded to be indicators of dominance.

Male combat exhibited by *E. cenchria* was similar to combat behavior described in other boids (Barker et al. 1979. Copeia 1979:466–477; Ross and Marzec, *op. cit.*), particularly its West Indian congeners, such as *Epicrates inornatus* (Huff 1978. Int. Zoo Ybk. 18:96–97) and *E. angulifer* (Tolson 1983. *In* D. L. Marcellini (ed.), Sixth Annual Reptile Symposium, pp. 285-293, Zoological Consortium, Inc., Thurmont, Maryland). Tolson (*op. cit.*) reported body (coil) shoving between male *E. angulifer* that seems similar to *E. cenchria* reported here. Further, like in *E. angulifer*, dominance could not be established conclusively in *E. cenchria*. Because combat was brief, it could not be determined if pelvic spurs were used, especially since they are small in *E. cenchria*. Further, release of musk (Huff, *op. cit.*) was not detected and biting was not observed in *E. cenchria*.

We thank Trooper Walsh for his time in discussing with us male agonistic behavior in captive *E. cenchria* maintained at the National Zoo.

Submitted by **GORDON W. SCHUETT**, Department of Life Sciences, Arizona State University West, P.O. Box 37100, Phoenix, Arizona 85069-7100, USA, and **SCOTT P. SCHUETT**, 1820 Bigelow Street, Toledo, Ohio 43613, USA.

LAMPROPELTIS GETULA HOLBROOKI (Speckled Kingsnake). **OOPHAGY**. Anecdotal observations of *Lampropeltis getula* as a predator of turtle eggs have been previously reported. Wright and Bishop (1915. Snakes, Vol. II, Proc. Acad. Nat. Sci. Philadelphia, pp. 107–192) reported the eggs of the Florida cooter, *Pseudemys floridana* and *Kinosternon* sp. from *L. getula* from the Okefenokee Swamp, Georgia. Brown (1979. Brimleyana. 1:113–124) also reported turtle eggs from two *L. getula*. More recently, Knight and Loraine (1986. Brimleyana. 12:1–4) list the eggs of the family Kinosternidae, as well as *Chelydra* and possibly *Terrapene carolina* as prey items of *L. getula*. Here we report the first observation of predation by *L. getula* on the eggs of the yellow-blotched map turtle, *Graptemys flavimaculata*, a threat-

ened emydid turtle endemic to the Pascagoula River drainage system in Mississippi.

On 6 July 1994, a female *L. getula holbrooki* was observed feeding on the eggs of *G. flavimaculata* between 1245 and 1310 h CMT. The snake measured 119.3 cm SVL (135.1 cm TL) and weighed 750 g after regurgitation of eggs. The snake was observed digging a concentric hole 30 cm in diameter and 6 cm deep on a sandbar along the east bank of the west Pascagoula River near Vancleave, Mississippi. The substrate consisted of loose leaves and sand deposited on the sandbar during periods of high water. The snake moved its body in such a fashion to push the substrate outward toward the margin of the concentric hole. The head and anterior portion of the body were located in the turtle nest cavity during the 25 min duration before the snake was removed from the hole. After removal, one egg remained in the nest cavity. The color and flexibility of the egg shell indicated it was probably deposited earlier that morning. An additional 12 ruptured eggs were later found regurgitated in the snake bag in which the snake was kept. Six of the eggs were regurgitated approximately 20 min after capture, and the remaining six 3 days later. Clutches of *G. flavimaculata* range in size from 3–9 (mean = 4.9) (R. Brauman, unpubl.) and therefore the 12 eggs probably represent predation by this snake on more than one clutch. Only one other *L. getula holbrooki* has been captured on a sandbar in the study area, and therefore the impact of predation by this species on *G. flavimaculata* nests is not known.

We thank Dr. Robert Jones and the Mississippi Department of Wildlife, Fisheries and Parks for their support of a larger study of the reproductive biology and nesting ecology of *G. flavimaculata* during which this observation was made.

Submitted by **ROBERT J. BRAUMAN** and **RICCARDO A. FIORILLO**, Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana 70402, USA.

MASTICOPHIS TAENIATUS TAENIATUS (Desert Striped Whipsnake). **ELEVATION RECORD**. The highest elevation reported for *Masticophis t. taeniatus* is 9360 ft (2851 m), based on MVZ 64131 collected on Rodgers Peak, Panamint Mts., Inyo Co., California (Papenfuss 1986. *In* C. A. Hall, Jr., and D. J. Young, eds., Natural History of the White-Inyo Range, Eastern California and Western Nevada and High Altitude Physiology: University of California, White Mountain Research Symposium, pp. 129–136. White Mtn. Res. Sta., Bishop, California; Stebbins 1985. A Field Guide to Western Reptiles and Amphibians. 2nd ed., Houghton Mifflin Co., Boston, Massachusetts. 336 pp.). On 22 July 1994 a specimen of this species (body length 90 cm) was found on a southwestern slope at an elevation of 10,100 ft (3077 m) at Schulman Grove, White Mountains, Inyo Co., California (Inyo National Forest, T6S, R35E, Sec. 31; ca. 10 map mi. E of Bishop). The snake was active at 1130 h in an area dominated by Great Basin sagebrush (*Artemisia tridentata*) at the foot of a forest of bristlecone pine (*Pinus longaeva*). Specimen identification was confirmed by R. W. Hansen based on photographic vouchers. This record extends the elevational distribution by 700 ft (213 m).

Submitted by **ANTON H.P. STUMPEL**, Department of Animal Ecology, Institute for Forestry and Nature Research (IBN-DLO), Postbus 23, 6700 AA Wageningen, The Netherlands.

REGINA GRAHAMI (Graham's Crayfish Snake). **REPRODUCTION**. On 19 August 1993, Colorado River Municipal Water District (CRMWD) personnel set galvanized minnow traps for Concho water snakes (*Nerodia harteri paucimaculata*) in the drying pools of Elm Creek, Runnels County, Texas. The Elm Creek location (5.1 km N of Ballinger; 20.3 river km from the Colorado River) is a permanent monitoring site for *N. harteri*, and a perennial tributary of the Colorado River. On 20 August, between 0930 and 0945 h, a total of four snakes were captured (2 adult (male and female) *Nerodia erythrogaster transversa*; 1 adult female *N. harteri* with 6 embryos, and 1 adult female *Regina grahami* with 6+ embryos). The *R. grahami* was retained and brought back to the CRMWD Field Laboratory for observation.

At 0730 h on 3 September 1993, there were no neonate *R. grahami* in the vivarium, but by 1630 h the female (SVL 731 mm, tail 153 mm, mass 248 g) gave birth to 10 neonates and one infertile mass. A review of the literature indicates wide variation in the number of young per litter; however, the majority of reports range between 10 and 15 (Anderson 1942. Bull. Chicago Acad. Sci. 6(11):203–222; Beyer 1898. Am. Nat. 32:17–24; Branson 1904. Kansas Sci. Bull. 2(13):353–430; Conant and Bridges 1942. What Snake Is That? D. Appleton-Century. New York. 163 pp.; Clark 1949. J. Tennessee Acad. Sci. 24:244–261; Hudson 1942. Univ. Nebraska Conserv. Bull. 24. 126 pp.; Kofron 1979. Herpetologica 35:44–50; Seigel 1992. J. Herpetol. 26:32–37; Schmidt and Davis 1941. Field Book of Snakes of the United States and Canada. G. P. Putnam's Sons. New York. 365 pp.; Strecker 1926. Baylor Univ. Mus. Contri. 4:3–11). Wright and Wright (1957. Handbook of Snakes of the United States and Canada. Comstock Publ. Assoc., Cornell Univ. Press, Ithaca, N.Y., xviii + 1103 pp.) recorded six as the minimum number and 25 as the maximum number of young per litter. Hall (1969. Am. Midl. Nat. 18.156–163) reported a mean of 15 young per litter. Other reports ranged from 3 to 39 eggs, embryos, and/or neonates (Anderson 1965. The Reptiles of Missouri. Univ. Missouri Press. 330 pp.; Hall, *op. cit.*; Kennedy 1964. Texas J. Sci. 16:210–215; Kofron and Dixon 1980. Southwest. Nat. 25:107–109; Miner 1959. Herpetologica 15:234; Ramsey 1954. Herpetologica 10:188).

Of the 10 neonates born in our lab, 7 were females and 3 were males. Hall (*op. cit.*) reported a sex ratio of 1:1 for both adults and young. His method for determining the sex for neonates was by examining individuals born in captivity and by sexing unborn snakes from preserved specimens. Our methodology followed that of Seigel (*op. cit.*). But Hall (*op. cit.*) also stated the sex ratio of offspring was skewed in favor of females, and there was evidence of sexual dimorphism among neonates, with males larger than females in body length but not body mass. Our data support Hall's (*op. cit.*) findings in that regard. Measurements of the 3 neonate males were: TL range = 285–294 mm, mean = 290.7 mm, SD = 4.0; mass range = 5.3–5.7 g, mean = 5.5 g, SD = 0.2; neonate females: TL range = 273–278 mm, mean = 276.4 mm, SD = 4.0; mass range = 5.3–5.9 g, mean = 5.5 g, SD = 0.2; overall litter measurements were: SVL range = 225–238 mm, mean = 229 mm, SD = 5.0; tail length range = 48–56 mm, mean = 51.7 mm, SD = 2.4; mass range = 5.3–5.9 g, mean = 5.5 g, SD = 0.2. After parturition the adult female weighed 158.5 g. The total litter mass (excluding the infertile mass) was 55.3 g and the relative clutch mass (RCM = ratio of total litter mass to postpartum female mass + total litter mass) was 0.259. This compares to a RCM of 0.300 for *Nerodia rhombifer* (Plummer 1992. Copeia 1992:1096–1098.) and 0.295 for 22 species of viviparous colubrids (Seigel and Fitch,

1984. Oecologia (Berl.) 61:293–301). All the neonates sloughed immediately after birth. Hall (*op. cit.*) found well preserved spermatozoa in males captured as early as 9 April and as late as 1 October, while Kofron (1979, *op. cit.*) reported females ovulated from late April through the third week of June. Assuming a 3-month period of gestation (Betz 1963. Copeia 1963:692–697), ovulation of this *R. grahami* probably occurred in early June.

During the past seven years, we have captured, measured, weighed, sexed, and released five *R. grahami* within the Elm Creek watershed: three snakes at this site; one 27.4 stream km upstream on Mud Creek, an intermittent tributary; and one on the northwestern shore of Lake Winters, in Runnels County. Tinkle and Knopf (1964. Herpetologica 20:42–47) collected a single *R. grahami* (Texas Tech 2908) at Ballinger, Texas and noted this record as evidence for a breeding population of this species well into western Texas. The rareness of this species in west and west-central Texas is probably attributed to this being the western periphery of its range, xeric conditions, and possibly food resource limitations. On 6 September 1993, the adult *R. grahami* and her litter were photographed and released at the original capture site.

We thank the Colorado River Municipal Water District for funding and facilities. Collections were made under the authority of the Texas Parks & Wildlife Department Scientific Permit No. SPR-790-208 to CRMWD. James R. Dixon reviewed an earlier version of this manuscript.

Submitted by **OKLA W. THORNTON, JR.**, and **JERRY R. SMITH**, Colorado River Municipal Water District, HCR 82, Box 4B, Leaday, Texas 76851, USA.

SEMINATRIX PYGAEA (Black Swamp Snake) **SIZE.** The record total length (SVL + tail length) for *Seminatrix pygaea* given in Conant and Collins (1991. Field Guide to Reptiles and Amphibians, Houghton Mifflin Company, Boston, Massachusetts, 450 pp.) is 47.0 cm based on a specimen described by Palmer and Paul (1963. Herpetologica 19:219–221). Their specimen was a female with an incomplete tail, having only 18 subcaudals. The record size given for *S. pygaea* in Ernst and Barbour (1989. Snakes of Eastern North America. George Mason University Press, Fairfax, Virginia) was erroneously printed as 65.4 cm total length, but should have read 46.5 cm (Carl Ernst, pers. comm.).

Here we report a gravid female *S. pygaea* (SREL specimen #3422) with a total length of 55.5 cm (48.5 cm SVL + 9.0 cm tail; mass = 68.4 g), exceeding the previous record by 8.5 cm. The female's length through subcaudal 18 was 51.2 cm.

This female and another gravid female *S. pygaea* (SREL specimen #3423) with a total length of 44.4 cm (37.0 cm SVL + 7.4 cm tail; mass = 43.0 g) were regurgitated simultaneously by a *Lampropeltis getula* (common kingsnake; 91.6 cm SVL, 12.7 cm tail) captured on 2 May 1994 at Ellenton Bay on the Savannah River Site near Aiken, South Carolina. The kingsnake was released at the capture site.

We thank Roger Conant for providing the source of the original record and Mark Mills for preserving the *Seminatrix* specimens. J. Whitfield Gibbons and Vincent J. Burke made helpful comments on the manuscript. Research support and manuscript preparation were provided by contract DE-AC09-765ROO-819 between the University of Georgia and United States Department of Energy.

Submitted by **CHARLES A. KEAN** and **TRACEY D. TUBERVILLE**, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802, USA.

GEOGRAPHIC DISTRIBUTION

Instructions for contributors to Geographic Distribution appear in volume 26, number 1.

CAUDATA

AMBYSTOMA CINGULATUM (Flatwoods Salamander). USA: FLORIDA: Holmes Co: Sec. 9, T5N, R14W, 8.8 air km NNE Bonifay. 24 February 1993. John G. Palis. UF 95951; Okaloosa Co: Sec. 17, T2S, R25W, 9 air km ENE Navarre. 18 January 1993. John G. Palis and Kelly J. Irwin. UF 95950; Walton Co: Sec. 16, T1N, R17W, 3 air km N Bruce. 28 February 1993. John G. Palis. UF 95952. All verified by Paul E. Moler. New county records filling gap in range (Moler 1992, Rare and Endangered Biota of Florida, vol. 3, Amphibians and Reptiles. Univ. Press Florida, Gainesville, 291 pp.).

Submitted by **JOHN G. PALIS**, Rural Route 1, Box 258, Tell City, Indiana 47586, USA.

AMBYSTOMA MACULATUM (Spotted Salamander). MASSACHUSETTS: Dukes Co: Martha's Vineyard, Edgartown. 19 November 1994. Arnold Brown and Vernon Laux. Verified by Jose Rosado. MCZ A-116268. Found runover in a parking lot. Despite a plethora of exciting stories and putative sight records, I had to "...await an actual specimen" from this island for two decades (Lazell 1976, This Broken Archipelago: Cape Cod and the Islands, Amphibians and Reptiles. New York Times Book Co., p. 56). The location, ca. 300 m south of the only probable breeding pond in the vicinity, and the size—49 mm SVL—hint at a record-late, very large, dispersing metamorph. I am indebted to Ilan Keith for salvaging the specimen.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA.

GYRINOPHILUS PALLEUCUS (Tennessee Cave Salamander). USA: TENNESSEE: Warren Co: small spring feeding Collins River, ca. 0.25 km upstream Rt. 127 crossing. 20 February 1992. B. T. Miller. Middle Tennessee State University (MTSU 154C, on permanent loan to National Museum of Natural History). Verified by A. Wynn. Postmetamorphic adult specimen. In contrast to the other reports of naturally metamorphosed *G. palleucus*, this individual was robust and in good health at time of capture. County record decreasing the suspected hiatus in distribution between populations occurring in the inner central basin of Tennessee (Rutherford and Wilson counties) and those in the southern Eastern Highland Rim (Miller and Walther 1994, Herpetol. Rev. 25:73; Redmond 1985, A Biogeographic Study of Amphibians in Tennessee, Doctoral Thesis, Univ. Tennessee, Knoxville. 290 pp.; Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **BRIAN T. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA.

NOTOPHTHALMUS PERSTRIATUS (Striped Newt). USA: GEORGIA: Baker Co: Joseph W. Jones Ecological Research Center: ca. 0.4 km N Mimsville and E of County Road 1630 (31°17'7"N, 78°31'44"W). 7 March 1994. S. Smith, L. V. LaClaire, R. N. Smith, and J. Palis. Verified by Roy McDiarmid. USNM 335058, 335059. Two adult males collected in a small

cypress limesink depression pond contiguous with the longleaf pine/wiregrass uplands. New county record, extends range in Georgia west of the Flint River, ca. 115 km from nearest county record (Mecham 1967, Cat. Am. Amphib. Rept. 38.1–38.2).

Submitted by **LINDA V. LACLAIRE**, U.S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Jackson, Mississippi 39213, USA, **ROBERT N. SMITH** and **SCOTT SMITH**, Joseph W. Jones Ecological Research Center, Route 2, Box 2324, Newton, Georgia 31770, USA, and **JOHN PALIS**, Rural Route 1, Box 258, Tell City, Indiana 47586, USA.

NOTOPHTHALMUS VIRIDESCENS (Eastern Newt). USA: KANSAS: Linn Co: Marais des Cygnes Wildlife Area, NW 1/4 Sec. 27, T20S, R24E. 17 April 1994. Kelly J. Irwin. Verified by Joseph T. Collins. KU 222266 (eft). First voucher from Linn County in 44 years, confirming the record by Gloyd (1932, Pap. Michigan Acad. Sci. Arts Letters 125:389–409) for east-central Kansas. Found in association with one adult each of *Carphophis vermis* and *Diadophis punctatus* under a limestone rock on a southeast facing hillside in mature oak-hickory forest. A subsequent visit to the area on 22–23 April 1994 produced two more efts and four adults [1 male (KU 222262), 3 females] in breeding condition; these represent the second report of a breeding population (Gloyd 1932, *op. cit.*) in the Marais des Cygnes River valley of Kansas as mapped by Conant and Collins (1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin, Boston, Massachusetts, 450 pp.).

Submitted by **KELLY J. IRWIN**, 2218 West 2nd Street, Topeka, Kansas 66606, USA.

ANURA

BUFO ACHALENSIS (Sapito de Pampa de Achala). ARGENTINA: CORDOBA: Department Rio Cuarto, 19 km NW Alpa Corral (32°42'S, 64°42'W) on rocky place in summit ("pampa de altura") of Sierra de Comechingones (Cerro de Oro site). 28 February 1994. Luciano Javier Avila and José Waldemar Priotto. Verified by Ricardo A. Martori. Herpetological collection of Zoologia de Vertebrados, Departamento de Ciencias Naturales, Universidad Nacional de Rió Cuarto, Argentina (ZV-UNRC 2982 to 2987, 3195). Extends range ca. 120 km from Pampa de Achala and Cerro Los Gigantes populations (Cei 1972, Acta. Zool. Lill. 29:233–246) and confirms unvouchered published reports at "Comechingones" (Cei 1980, Monit. Zool. Ital., Mon. 2, Florencia, 609 pp.); cited also at La Carolina, Sierra de San Luis, 150 km W. [Giambelluca 1991, Bol. Asoc. Herp. Arg. 7(1):21–22].

Submitted by **LUCIANO JAVIER AVILA** and **JOSÉ WALDEMAR PRIOTTO**, Departmento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Est. Post. Nro. 9, C. P. 5800, Rio Cuarto (Córdoba), Argentina.

CERATOPHRYS CALCARATA (Horned Frog). VENEZUELA: ESTADO FALCON: Municipio Silva, Parque Nacional Morrocoy, Cerro Chichiriviche, Sector El Silencio, 280 m elev. 5 July 1989. Jorge Naveda and José Ochoa. Verified by Pedro Vernet. Colección de Anfibios y Reptiles, Instituto de Geografía, Universidad de Los Andes (ULABG) 3931. Easternmost record for the species (La Marca 1992, Cuadernos Geográficos 9:1–197).

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela, and **JORGE NAVEDA**, INPARQUES, Dirección Parques Nacionales, Apartado 76471, Caracas 1062-A, Venezuela.

CHIASMOCLEIS VENTRIMACULATA (NCN). BOLIVIA: COCHABAMBA: Provincia Chapare, 6.5 km N Chipiriri, 260 m, 16°45'S, 65°15'W. 15 February 1970. Thomas H. Fritts. Verified by William E. Duellman. KU 136316. First record for the country; nearest record published is Cuzco Amazónico, Madre de Dios, Perú, 12°35'S, 69°05'W (Duellman and Salas 1991, Univ. Kansas Mus. Nat. Hist. Occ. Pap. 143:1–13), ca. 600 km NW (airline). This is the sixth species in the family Microhylidae known from Bolivia (De la Riva 1990, Boll. Mus. reg. Sci. nat. Torino 8:261–319).

Submitted by **IGNACIO DE LA RIVA**, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.

ELEUTHERODACTYLUS ANOLIREX (Robber Frog). VENEZUELA: ESTADO TACHIRA: Municipio Junín, Betania, 2300 m elev. 7 August 1980. Alfredo Paolillo. Museo de Historia Natural La Salle (MHNLS) 8370–8372; 14 August 1980. Alfredo Paolillo. MHNLS 8336–8337, 8340–8341, 8359–8360. All verified by John D. Lynch. First record for Venezuela; species was previously known from a few localities in the Departamento Norte de Santander, Cordillera Oriental, Colombia (Lynch 1983, Advances in Herpetology and Evolutionary Biology. Pp. 52–57). Extends species range ca. 65 km NE from type locality, making this the northernmost record for the taxon.

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela.

ELEUTHERODACTYLUS PLANIROSTRIS (Greenhouse Frog). USA: FLORIDA: Okaloosa Co: Eglin Air Force Base, 0.2 km E Range Road 259 and 1 km N U.S. Rt. 98 (T2S, R25W, NE 1/4 Sec. 17). 29 November 1994. J. B. Jensen. Verified by Paul Moler. Florida Museum of Natural History (UF 95352). Captured within the ecotone between mesic pine flatwoods and a shrub-dominated dome swamp. The locality is ca. 0.5 km from the nearest residential area. New county record for this introduced species (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA, and **JOHN G. PALIS**, Rural Route 1, Box 258, Tell City, Indiana 47586, USA.

HYLA BROMELIACIA (Treefrog). MÉXICO: CHIAPAS: Centro Piscícola "La pesca," Municipio Coapilla (17°07'49"N, 93°10'00"W), elev. 1650 m. 5 March–5 May 1994. T. Acero, J. Cruz, L. de la Cruz, A. Domínguez, R. Hernádez, M. Martínez, E. Pérez, and V. Rodas. Herpetological Collection, Intituto de Biología, Universidad Nacional Autónoma de México (IBH 08642–08649, 8 specimens) and Museo de Zoología de Chiapas (MZICACH 68–79, 12 specimens). Specimens were found on bromeliads in a pine-oak forest. First record for México; extends range ca 250 km NW along Sierra del Norte de Chiapas. Previous northernmost record was Sierra de los Cuchumatanes, Guatemala (Stuart 1943, Occ. Papers Mus. Zool. Univ. Michigan 471:1–28).

Submitted by **MATIAS MARTINEZ-CORONEL**, Museo Zoológico, Escuela do Biología, ICACH, Apartado Postal 57, Tuxtla Gutiérrez, Chiapas, México, **AURELIO RAMIREZ-BAUTISTA**, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-

153, 04510 México Distrito Federal, México, and **ROBERTO VIDAL-LOPEZ**, Museo Zoológico, Escuela de Biología, ICACH, Apartado Postal 57, Tuxtla Gutiérrez, Chiapas, México.

HYLA GRATIOSA (Barking Treefrog). USA: TENNESSEE: Carroll Co: Milan Army Ammunition Plant, 0.40 km S Rt. 104 on MAAP road paralleling Lavinia Atwood Road, 35°54'15"N, 88°40'03"W. 6 June 1994. B. T. Miller. Middle Tennessee State University (MTSU 80A); Rt. 104, ca. 1.4 km W jct. Lavinia Atwood Road on side of MAAP security building (35°54'24"N, 88°39'57"W). 28 June 1994. B. T. Miller. Both verified by A. Floyd Scott. New county record that decreases suspected distributional hiatus in western Tennessee (Redmond 1985, A Biogeographic Study of Amphibians in Tennessee, Doctoral Thesis, Univ. Tennessee, Knoxville. 290 pp.; Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **BRIAN T. MILLER**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA, and **DAVID L. CAMPBELL**, Director of Stewardship, The Nature Conservancy, 2002 Richard Jones Road, Suite 304-C, Nashville, Tennessee 37215, USA.

HYLA RANICEPS (NCN). ARGENTINA: PROVINCE OF BUENOS AIRES: Delta of Paraná River (34°09'S, 58°31'W). 3 March 1984. Néstor G. Basso. Verified by J. D. Williams. Museo de La Plata (MLP.A. 909). First record for province and the southernmost record for the species [Gallardo 1964, Neotropica 10 (31):23–28; Cei 1980, Monitore. zool. ital. (NS) Monogr. 2. 609 pp.].

Submitted by **NÉSTOR G. BASSO**, Instituto de Limnología "Dr. Raúl A. Ringuelet," Casilla de Correo 712, 1900 La Plata, Argentina.

ISCHNOCNEMA QUIXENSIS (NCN). BRAZIL: AMAZONAS: Municipality of Eirunepé, Penedo, right bank of Jurua River (70°45'W, 6°50'S). 29 August 1991. Claude Gascon. Verified by James P. Bogart. Instituto Nacional de Pesquisas da Amazônia (INPA 2394, 2471). First record for Brazil. Closest known recorded locality for this species is Madre de Dios, Peru [Rodriguez et. al. 1993, Pub. Mus. Hist. Nat. UNMSM (A) 45:1–22]. Other localities where this species was collected in Amazonas are: Municipality of Eirunepé, Condor, left bank of Jurua River (70°51'W, 6°45'S). 18 September 1991. INPA 2629, 2673–76, 2689, 2732, 2816–17, 2928, 3000, 3009; Municipality of Itamarati, Barro Vermelho, left bank of Jurua River (68°46'W, 6°28'S). 18 October 1991. INPA 3131, 3138, 3144, 3187, 3243, 3266, 3274, 3293, 3333, 3337, 3421, 3459, 3475, 3515–16; Municipality of Itamarati, Altammira, right bank of Jurua River (68°54'W, 6°35'S). 16 November 1991. INPA 5040, 5230; Municipality of Jurua, Vai-Quem-Quer, right bank of Jurua River (66°01'W, 3°19'S). 2 May 1992. INPA 4822, 4846, 4982, 4987, 4990, 5273, 5299; JMunicipality of Jurua, Vira-Volta, left bank of Jurua River (66°14'W, 3°17'S). 28 May 1992. INPA 5613, 5805; ACRE: Municipality of Cruzeiro do Sul, Nova Vida, right bank of Jurua River (72°49'W, 8°22'S). 13 March 1992. INPA 4599, 4617, 4650; Municipality of Cruzeiro do Sul, Sobral, left bank of Jurua River (72°49'W, 8°22'S). 8 March 1992. INPA 4420, 4440, 4455, 4457, 4532, 4539, 4552, 4559–60, 4566, 4644, 4679, 4690–91; Municipality of Cruzeiro do Sul, Porongaba, right bank of Jurua River (72°47'W, 8°40'S). 18 February 1992. INPA 4254, 4396.

Submitted by **CLAUDE GASCON**, Ecologia/INPA, CP 478, 69011-970 Manaus, Amazonas, Brazil.

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ODONTOPHRYNUS ACHALENSIS (Escuercito de Pampa de Achala). ARGENTINA: CORDOBA: Department Rio Cuarto, 19 km NW Alpa Corral (32°42'S, 64°42'W) on rocky place in summit ("pampa de altura") of Sierra de Comechingones (Cerro de Oro site). 28 February 1994. Luciano Javier Avila and José Waldemar Priotto. Verified by Ricardo A. Martori. Herpetological collection of Zoologia de Vertebrados, Departamento de ciencias Naturales, Universidad Nacional de Rio Cuarto, Argentina (ZV-UNRC 2988 to 2993, 3196). Extends range ca. 120 km from population on Pampa de Achala, Department Calamuchita. [Di Tada et al. 1984, Hist. Nat. 4(17):149–155].

Submitted by **LUCIANO JAVIER AVILA** and **JOSÉ WALDEMAR PRIOTTO**, Departmento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Est. Post. Nro. 9, C. P. 5800, Rio Cuarto (Córdoba), Argentina.

OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog, Rana Platanera). PUERTO RICO: Trujillo Alto: Cooperativa de la Vivienda, Avenida Periferal, Ciudad Universitaria. 9 March 1995. Neftalí Rios López. Verified by William E. Duellman. KU 222212–15. First record for the eastern part of Puerto Rico; extends range ca. 100 km to the west. Previous records were limited to the northwestern part of the Island (Isabela-Quebradilla area) where the introduction occurred in the 1950s (Rivero 1978, Los Anfibios y Reptiles de Puerto Rico. Editorial Universitaria, U. P. R., San Juan. 152 pp.; Schwartz and Henderson 1991, Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville. 720 pp.; Thomas and Joglar, The Herpetology of Puerto Rico, Past, Present and Future. Ann. New York Acad. Sci., *in press*). Four adults were captured— two breeding males at border of non-permanent pond and a non-breeding male and a female perched over tubes of cyclone fence bordering a basketball court. It is possible that this frog is established in Río Piedras and other areas in the San Juan

metropolitan area. Although the origin of the northeastern population is unknown, the most probable source is the population in northwestern Puerto Rico observed on 29 May 1992 at Barrio Guaniquilla, Aguada (R. Joglar, pers. obser.). It is possible that the species has expanded its range and is now more widely distributed in the Island.

Submitted by **RAFAEL L. JOGLAR** and **NEFTALÍ RIOS LÓPEZ**, Universidad de Puerto Rico, Recinto de Río Piedras, Departamento de Biología, Apartado 23360, San Juan, Puerto Rico 00931-3360.

PHYLLOMEDUSA PALLIATA (NCN). BRAZIL: ACRE: Municipality of Cruzeiro do Sul, Nova Vida, right bank of Jurua River, (72°49'W, 8°22'S). 21 March 1992. Claude Gascon. Verified by James P. Bogart. Instituto Nacional de Pesquisas da Amazônia (INPA 4751, 4759). First record for Brazil; closest known recorded locality for this species is Madre de Dios, Peru (Rodriguez et. al. 1993, Pub. Mus. Hist. Nat. UNMSM (A) 45:1–22). Another locality where this species was collected is: ACRE: Municipality of Cruzeiro do Sul, Porongaba, right bank of Jurua River (72°47'W, 8°40'W). 16 February 1992. INPA 4195–6, 4285.

Submitted by **CLAUDE GASCON**, Ecologia/INPA, CP 478, 69011-970 Manaus, Amazonas, Brazil.

PHYZELAPHRYNE MIRIAMAE (NCN). BRAZIL: AMAZONAS: Municipality of Eirunepé, Condor, left bank of Jurua River (70°51'W, 6°45'S). 25 September 1991. Claude Gascon. Verified by W. Ron Heyer. Instituto Nacional de Pesquisas da Amazônia (INPA 2726, 2747). New record for Brazil; extends known distribution of this species more than 500 km west of Madeira River, Brazil (Heyer 1977, Papéis Avulsos de Zoologia 31:141–162). Other localities where this species was collected in Amazonas are: Municipality of Itamarati, Barro Vermelho, left bank of Jurua River (68°46'W, 6°28'S). 30 October 1991. INPA 3432, 3440; Municipality of Itamarati, Altammira, right bank of Jurua River (68°54'W, 6°28'S). 30 October 1991. INPA 3432, 3440; Municipality of Itamarati, Altammira, right bank of Jurua River (68°54'W, 6°35'S). 8 November 1991. INPA 3543; Municipality of Jurua, Vira-Volta, left bank of Jurua River (66°14'W, 3°17'S). 31 May 1992. INPA 5637.

Submitted by **CLAUDE GASCON**, Ecologia/INPA, CP 478, 69011-970 Manaus, Amazonas, Brazil.

PLEURODEMA KRIEGI (NCN). ARGENTINA: CORDOBA: Department Rio Cuarto, 19 km NW Alpa Corral (32°42'S, 64°42'W) on rocky place in summit ("pampa de altura") of Sierra de Comechingones (Cerro de Oro site). 28 February 1994. Luciano Javier Avila and José Waldemar Priotto. Verified by Ricardo A. Martori. Herpetological collection of Zoologia de Vertebrados, Departamento de ciencias Naturales, Universidad Nacional de Rio Cuarto, Argentina (ZV-UNRC 2981). Extends range ca. 100 km from southernmost population cited near Cerro Champaquí (site Tabaquillo), Department Calamuchita. [Barrio 1977, Physis 37(93):311–331].

Submitted by **LUCIANO JAVIER AVILA** and **JOSÉ WALDEMAR PRIOTTO**, Departmento de Ciencias Naturales, Universidad Nacional de Rio Cuarto, Est. Post. Nro. 9, C. P. 5800, Rio Cuarto (Córdoba), Argentina.

RANA CAPITO (Gopher Frog). USA: GEORGIA: Chattahoochee Co: Ft. Benning Military Reservation, ca. 200 m W Box Springs Road, 5.2 km N Shamanski Road. (89°39'08"N, 32°28'05"W). 17 February 1994. J. B. Jensen. Verified by Roy McDiarmid. USNM 335109, 335110. Eleven egg masses were observed attached to emergent vegetation in small, flooded borrow pit and a small portion of one mass was collected. Tadpoles were reared to the point of transformation to aid in positive identification. All survivors, excluding the preserved vouchers, were released to the pond of origin. New county record (Altig and Lohoefener 1983, Cat. Am. Amphib. Rept. 324.1–324.4).

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA, and **LINDA V. LaCLAIRE**, United States Fish and Wildlife Service, 6578 Dogwood View Parkway, Jackson, Mississippi 39213, USA.

SCAPHIOPUS HOLBROOKII HURTERII (Hurter's Spadefoot). USA: ARKANSAS: Baxter Co: 1.6 km W jct. Ark. Rts. 341–201 (on 341 ca. 3.2 km NW Norfork). 12 April 1991. Emily B. Langevin, Jessica Langevin and Nicholas Langevin. Verified (based on bony hump between eyes) by James M. Walker and Stanley E. Trauth. Arkansas State University Museum of Zoology (ASUMZ 17587). One specimen collected 2100 h on road during light rain following a heavy rain. First record for county; located in a mapped hiatus in north-central part of state bordering Missouri (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.); indicates probable continuous distribution of species from eastern to western Arkansas.

Submitted by **JAMES M. WALKER** and **EMILY B. LANGEVIN**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

TESTUDINES

CHELYDRA SERPENTINA (Snapping Turtle). USA: COLORADO: Adams Co: Barr Lake, Barr Lake State Park. Date not recorded. Collected by state park staff. Verified by Richard L. Holland. UCM color slides 95–97. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, 131 pp.).

Submitted by **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

KINOSTERNON SUBRUBRUM (Eastern Mud Turtle). Kentucky: Caldwell Co: W edge Dawson Springs off Rt. 62 on W bank of Tradewater River. 24 July 1994. T. W. Taggart, K. J. Irwin, S. L. Collins and J. T. Collins. Verified by Travis W. Taggart. KU 222235 (found dead; shell only). New county record (John MacGregor 1986, unpubl. maps). Specimen taken under 1994 Kentucky Scientific Collecting Permit issued to author.

Submitted by **JOSEPH T. COLLINS**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045, USA.

STERNOTHERUS CARINATUS (Razorback Musk Turtle). USA: ALABAMA: Mobil Co: Escatawpa River, 0.5 km upstream from U. S. Rt. 98 bridge (30°51' 45"N, 88°22'59"W). 5 October 1994. E. L. Blankenship. Auburn University (AUM photo collection PL103 and P104). 16 October 1994. M. Bailey and K. Schnuelle. AUM 33725. Verified by C. Guyer. New state record (Mount 1984, Vertebrate Wildlife of Alabama. Auburn Univ. Agric. Exp. Sta., Auburn, Alabama. 44 pp.). May represent a recent upstream expansion from the Mississippi portion of the drainage since surveys in the 1970s failed to detect this species in Alabama (R. Mount and G. Folkerts, pers. comm.).

Submitted by **EMMETT L. BLANKENSHIP**, P.O. Box 236, Shorter, Alabama 36075, USA, **MARK A. BAILEY**, Alabama Natural Heritage Program, 64 North Union Street, Montgomery, Alabama 36130, USA, and **KAREN SCHNUELLE** and **BRIAN HAUGE**, Department of Zoology and Wildlife Science, Auburn University, Alabama 36849, USA.

TRACHEMYS SCRIPTA SCRIPTA (Yellowbelly Slider). USA: NEW MEXICO: Socorro Co: Bosque del Apache National Wildlife Refuge, Unit 24E, 4 km SSW of refuge headquarters. 5 October 1994. J. N. Stuart. Verified by Michael E. Seidel. University of New Mexico Museum of Southwestern Biology (MSB 58206; melanistic male). First record of this non-native subspecies for New Mexico, but may not indicate establishment of *T. scripta scripta* in the Rio Grande drainage. *T. scripta elegans*, however, is introduced and apparently established in this New Mexico river. Prelimenary data suggest that *T. s. elegans* and native *T. gaigeae* are hybridizing at Bosque del Apache NWR (Seidel, pers. comm.; Stuart [*in press*], Bull. Maryland Herpetol. Soc.); the presence of *T. s. scripta* therefore may further compromise persistence of pure *T. gaigeae* at the refuge. Collected under U. S. Fish and Wildlife Service Special Use Permit No. 73599.

Submitted by **JAMES N. STUART**, National Biological Service, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131-1091, USA.

LACERTILIA

ANOLIS SAGREI (Brown Anole). USA: FLORIDA: Nassau Co: Anderson's Chevron Station at jct. of I-95 and S.R. A1A/200 in Hero. 4 September 1994. Todd Campbell. Verified by A. C. Echternacht. UFMNH 95568. Two adult females (one collected) and one hatchling observed in a small patch of yaupon holly (*Ilex vomitoria*) shrubs. New county record; extends range ca. 30 km N of previous Jacksonville (Florida) record (Lee 1985, Copeia 1985:182–194). The owner has observed brown anoles for the last three years, but the station regularly sells potted citrus and ornamental plants from South Florida. It is not clear whether these individuals represent a persistent, reproducing population or a regular influx of propagules from nursery vegetation. None was found in adjacent developments. Duval Co: Jacksonville Beach, K-Mart at jct. of U.S. A1A and S.R. 202. 4 September 1994. Todd Campbell. Verified by A. C. Echternacht. UFMNH 95566–95567 (adult male and adult female). Represents second published Duval County locality, ca. 16 km E of Jacksonville record (Lee, *op. cit.*). Ten adults and 15 juveniles observed basking in landscaping shrubs and on the curb. All lizards found within 30 m of K-Mart Garden Center; none found in adjacent developments. This is very likely an established breeding population.

Submitted by **TODD S. CAMPBELL** and **JOSHUA T. HAMMONTREE**, Department of Zoology, University of Tennessee, M313 Walters Life Sciences Building, Knoxville, Tennessee 37996-0810, USA.

ANOLIS SAGREI (Brown Anole). USA: GEORGIA: Lowndes Co: Valdosta, Best Western King of the Road Motel, I-75 at U.S. Rt. 84. First record for Georgia. This site has been searched intensively at least once a year since June of 1983 in connection with another project. Brown anoles were first observed on 18 July 1987 when 2 adult males, 1 adult female, several hatchlings, and hatched eggs were seen on the east side of the motel across the drive from the office. An intensive search revealed no others in the vicinity. By 24 July 1988, adult males, females, and juveniles were found on the ground and walls around the entire motel, and the lizards have been observed at the locality every year through 1994. A single adult male (University of Tennessee Vertebrate Zoology Collection No. 5436) was obtained by Echternacht on 30 May 1992 to validate the locality (Georgia Department of Natural Resources Scientific Collecting Permit 29-No. 000088 issued 11 May 1992). Verified by Julian C. Lee.

Submitted by **A. C. ECHTERNACHT, M. A. WILSON, E. J. MICHAUD**, and **DAN M. MACDONALD**, Department of Zoology, University of Tennessee, Knoxville, Tennessee 37996-0810, USA.

ANOLIS SAGREI (Brown Anole). USA: GEORGIA: Camden Co: Georgia Welcome Center on I-95, ca. 2 km N of the Florida-Georgia border. 4 September 1994. Todd Campbell. Verified by A. C. Echternacht. University of Georgia Museum of Natural History (UGAMNH 24852–24853). Captured two adult males and observed two females in dense yaupon holly and other landscaping shrubs. New county record; extends range ca. 46 km N of Jacksonville (Florida) record (Lee 1985, Copeia 1985:182–194). It is not clear if this is an established breeding population or represents recent propagules from landscaping plants obtained from Florida. Glynn Co: Brunswick, Mountasia Fantasy Golf Course at Brunswick Mall. 5 September 1994. Todd Campbell. Verified by A. C. Echternacht. UGAMNH 25854–25855. Two adult males captured, 12 more males and two females observed within shrubs and tropical plants among an artificial landscape of molded concrete and flowing water. New county record; extends range ca. 100 km N of Jacksonville (Florida) record (Lee, *op. cit.*). This is very likely an established population. The owners indicated these lizards have been present since the establishment of the course three years ago. Glynn Co: St. Simons Island, Ace Garden Center on Demere Road between Sea Island Drive and Retreat Road. 5 September 1994. Todd Campbell. Verified by A. C. Echternacht. UGAMNH 24851. One small female captured and one adult female observed near greenhouse and outdoor nursery; extends range ca. 100 km N of Jacksonville (Florida) record (Lee, *op. cit.*). May represent recent propagules from Florida nursery vegetation. Lowndes Co: Georgia Welcome Center on I-75, ca. 5 km N of Florida-Georgia border. 22 August 1994. Todd Campbell and Joshua Hammontree. Verified by A. C. Echternacht. UGAMNH 5432. One adult female collected and one individual of undetermined sex observed in landscape shrubs on the west side of the main building. Represents the second record for this species in Lowndes County, ca. 30 km S of original Valdosta (Georgia) record (Echternacht et. al. 1995, Herpetol. Rev. 26:107). These are likely recent propagules from Florida nursery vegetation. Cook Co: Adel, Howard Johnson Hotel on Rt. 37 at I-75. 22 August 1994. Todd Campbell and Joshua Hammontree. Verified by A. C. Echternacht. UGAMNH 25857–25858. Two adult males collected and four other individuals (unknown sex) observed. New county record; extends range ca. 34 km N of the Valdosta (Georgia) record (Echternacht et. al., *op. cit.*). May represent a small but established breeding population. Tift Co: Tifton, Ramada Inn on Rt. 82/319 at I-75. 22 August 1994. Todd Campbell and Joshua Hammontree. Verified by A. C. Echternacht. UGAMNH 25859. Young male collected, adult male observed in landscape shrubs around main building of the hotel. New county record; northernmost record for this species, extending its range ca. 70 km N of Valdosta (Georgia) record (Echternacht et. al., *op. cit.*). This was the only individual observed, and likely represents a recent propagule.

Submitted by **TODD S. CAMPBELL** and **JOSHUA T. HAMMONTREE**, Department of Zoology, University of Tennessee, M313 Walters Life Sciences Building, Knoxville, Tennessee 37996-0810, USA.

ANOLIS SAGREI (Brown Anole). USA: TEXAS: Nueces Co: Corpus Christi, South Padre Island Drive and Woodlawn Drive, 27°41'57"N, 97°21'13"W. 11 March 1995. P. J. Krusling. Verified by J. Davis. Cincinnati Museum of Natural History (CMNH 4206). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **PAUL J. KRUSLING** and **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **JODI PATTERSON,** University of Outreach, Texas A&M University at Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, USA.

Below is a corrected version of a note previously published in Herpetol. Rev. 25(4):164.

BASILISCUS BASILISCUS BARBOURI (Basilisk). VENEZUELA: ESTADO MÉRIDA: Distrito Campo Elías: Ejido, La Quebrada, sector Saladito, inmediaciones del Instituto Universitario Tecnológico de Ejido, 1200 m. 13 September 1993. Tulio Enrique Salazar Ruíz. Verified by Pascual J. Soriano M. Colección de Anfibios y Reptiles, Núcleo de Biogeografía de Montaña, Instituto de Geografía y Conservación de Recursos Naturales de la Universidad de Los Andes (ULABG 3426). The subspecies was first reported for the Venezuelan Andes, without indication of museum numbers, from "Estado Mérida: Río Chama," and "Estado Táchira: Palmira, Rio Tarbes" (Torbes?), by Donoso-Barros [1968, Caribbean J. Sci. 8(3–4):113]. ULABG voucher specimen is the first documented record for the Venezuelan Andes, extending the range ca. 400 km SE of the type locality. It is a female bearing pale throat markings that differ from those exhibited by Sierra de Perijá female specimens reported by La Marca as *Basiliscus basiliscus* (1987, Herpetol. Rev. 18:57; and 1987, 37a. Conv. Anual AsoVAC, noviembre 1987:267). Sierra de Perijá specimens have been identified either as *Basiliscus basiliscus basiliscus* by Donoso-Barros (*op. cit.*) or as *Basiliscus basiliscus barbouri* by Viloria and Calchi (1993 Biollania 9:42). Throat markings should be investigated as a potential diagnostic character for the subspecies, since most keys, like those of Peters and Donoso-Barros (1970 Bull. U.S. Natl. Mus. 297) and Gorzula (1978 Serie Boletín Técnico M.A.R.N.R., DG 11 A/BT/01/78) rely solely on male crest differences. One of us (JJGM) observed another specimen (not collected, but documented with color photograph taken on 26 August 1991 and filed in ULABG under number 3427) at Río Albarraegas, sector Belensate, 1400 m, Distrito Libertador, Estado Mérida. Several other observed specimens indicate that the subspecies is distributed along the Albarregas River at 1100 to 1600 m. from sector Belensate to the Urbanización Los Curos in the city of Mérida.

We thank Tulio Enrique Salazar Ruíz for collecting and donating the specimen to ULABG. Search partially funded by grant CDCHT C-564-92A of the Universidad de Los Andes, Mérida.

Submitted by **ENRIQUE LA MARCA**, Instituto de Geografía y Conservación de Recursos Naturales, Universidad de Los Andes, Apartado 116, Mérida 5101-A, Venezuela, and **JUAN JOSÉ GARCIA MILANO**, Laboratorio de Invertebrados de Los Andes, Urbanización Humboldt, Bloque 5, Edificio 02, Apartamento 0102, Mérida 5101, Venezuela.

ELGARIA KINGII (Madrean Alligator Lizard). MÉXICO: JALISCO: Autlán, Reserva de la Biósfera Sierra de Manantlán, on Rincón de Manantlán, in pine forest, elev. 1500 m. 21 June 1988. Luis I. Iñiguez-Dávalos. Verified by Fernando Mendoza Quijano. Museo de Zoología, Fac. de Ciencias, UNAM (MZFC 6003). Extends range of the species 98 km to the south (Webb 1970, Cat. Amer. Amph. Rept. 97.1–97.4); Cuautitlán, Reserva de la Biósfera Sierra de Manantlán, Cuzalapa, 4 km N El Durazno, in pine forest, elev. 880 m. 23 July 1988. Luis I. Iñiguez-Davalos. Colección Zoológica Laboratorio Natural Las Joyas (LNLJ 111). Extends range of the species 108 km to the south (Webb, *op. cit.*). COLIMA: Minatitlán, Reserva de la Biósfera Sierra de Manantlán, Km 2.2 to El Terrero, Minatilán, Colima, in tropical deciduous forest, elev. 1090 m. 20 November 1993. Alicia Loeza-Corichi. Colección Zoológica Laboratorio Natural Las Joyas (MZFC 6813). New state record for Colima; previously recorded from northern Jalisco (Webb, *op. cit.*).

Submitted by **ALICIA LOEZA-CORICHI,** Laboratorio Natural Las Joyas, Universidad de Guadalajara, México, and **OSCAR FLORES-VILLELA**, Museo de Zoología, Fac. de Ciencias, UNAM, Apartado Postal 70-399, México Distrito Federal 04510, México.

EUMECES LATICEPS (Broadhead Skink). USA: KANSAS: Linn Co: Marais des Cygnes National Wildlife Refuge, NW 1/4 Sec. 20, T21S, R25E. 16 April 1994. Kelly J. Irwin, Suzanne L. Collins, and Joseph T. Collins. Verified by John Simmons. KU 222264. Adult male specimen; corroborates the county record originally mapped by Collins (1982, Univ. Kansas Mus. Nat. Hist. Pub. Ed. Ser. 8:1–356), which was based upon a record (Anderson 1950, Herpetologica 6:53) that had since been lost and was deleted from the range map in Collins (1993, Univ. Kansas Mus. Nat. Hist. Pub. Ed. Ser. 13:1–397).

Submitted by **KELLY J. IRWIN**, 2218 West 2nd Street, Topeka, Kansas 66606, USA.

EUMECES LATICEPS (Broadhead Skink). USA: LOUISIANA: Acadia Parish: 2.1 km S US Rt. 190-Rt. 13 jct. in Eunice, 30°27'20"N, 92°24'15"W. 3 April 1995. B. G. Sattler. Verified by Harland D. Guillory. University of Arkansas Department of Zoology Museum (UADZ 5450). New parish record (Dundee and Rossman 1989, The Amphibians and Reptiles of Louisiana. Louisiana St. Univ. Press, Baton Rouge, 300 pp.).

Submitted by **JAMES E. CORDES** and **BRANDON G. SATTLER**, Division of Sciences, Louisiana State University at Eunice, Eunice, Louisiana 70535, USA, and **JAMES M. WALKER**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.

HEMIDACTYLUS GARNOTII (Indo-Pacific Gecko). BAHAMAS: Great Bahamas Bank: New Providence Island, Nassau, on the walls of an old school. 17 November 1992. W. E. Meshaka, Jr. Verified by George Zug. USNMFS 216928. Adult 53.9 mm SVL. Yolking left and right follicles. Second record for the Bahamas (Buckner and Franz 1994, Herpetol. Rev. 25:164) and on an island where it could eventually come into contact with its congener, *H. mabouia* (Franz et al. 1993, Caribbean J. Sci. 29:165–173).

Submitted by **WALTER E. MESHAKA, JR.**, Archbold Biological Station, P. O. Box 2057, Lake Placid, Florida 33862, USA.

HEMIDACTYLUS TURCICUS TURCICUS (Mediterranean Gecko). USA: TEXAS: Aransas Co: 2 km SW jct. St. Rt. 35 and Rt. P13. 10 March 1995. P. J. Krusling. Verified by J. Davis. Cincinnati Museum of Natural History (CMNH 4202—4203). New county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station. 434 pp.).

Submitted by **PAUL J. KRUSLING** and **JOHN W. FERNER**, Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA, and **JODI PATTERSON**, University of Outreach, Texas A&M University at Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, USA.

OPHISAURUS ATTENUATUS (Western Slender Glass Lizard) KANSAS: Kiowa Co: Anchor D Ranch, Sec. 2, T30S, R16W. 30 May 1994. Garrett Jantz. KU Color Slide 11132. Verified by Travis W. Taggart. New county record; most southwesterly record in the state (Collins 1993, Amphibians and Reptiles in Kansas. Third Ed. Univ. Kansas Mus. Nat. Hist. Pub. Ed. Ser. 13:1–397).

Submitted by **JOSEPH T. COLLINS**, Natural History Museum, The University of Kansas, Lawrence, Kansas 66045-2454, USA.

XANTUSIA H. HENSHAWI (Granite Night Lizard). USA: CALIFORNIA: Riverside Co: Perris Valley, 2 km ENE jct. Perris Boulevard and Nandina Avenue, Sec. 33, T3S, R3W (33°52'N, 117°12'W). 30 January and 22 February 1995. Michael D. Wilcox, Stephen J. Myers, and Kent R. Beaman. Verified by Robert L. Bezy. Specimens were photographed and released on site. LACM voucher photograph PC1315. New location for the species in California; extends northern limit of range westward ca. 29 km (Lee 1976, Cat. Amer. Amphib. Rept. 189.1–189.2). In 1992 *X. h. henshawi* was also found at Double Butte, Riverside County (Sec. 19, T5S, R2W; 33°43'N, 117°08'W), ca. 18 km SE of the Perris Valley location. The species has also been observed at the NE end of the Bernasconi Hills, 7 km E of the Perris Valley location (D. Goodward, pers. comm.). These are the only known occurrences in Southern California away from the Peninsular Ranges.

Submitted by **MICHAEL D. WILCOX, STEPHEN J. MYERS**, and **KENT R. BEAMAN**, Tierra Madre Consultants, 1159 Iowa Avenue, Suite E, Riverside, California 92507, and **ROBERT L. McKERNAN**, San Bernardino County Museum, 2024 Orange Tree Lane, Redlands, California 92374, USA.

SERPENTES

CHERSODROMUS LIEBMANNI (Liebmann's Earth Runner). MÉXICO: OAXACA: municipality of Santa María Pápalo, Peña Verde, 1800 m elev. 28 February 1994. Luis Canseco Márquez. Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC 06842), female. Verified by Fernando Mendoza Quijano. First record for the state and a southern range extension of 118 km (airline) from Cuautlapan, Veracruz (Smith and Taylor 1945, Bull. U.S. Natl. Mus. 194:188). All specimens previously reported from Veracruz had a yellowish crossband behind parietal scales [Smith and Braestrup 1963, Herpetologica 18(4):233–240; Pérez-Higareda and Smith 1991, Inst. Biol. UNAM, México, 122 pp.] but the crossband is red on this specimen. This species was known previously only from the state of Veracruz [Smith 1943, Proc. U.S. Natl. Mus. 93(3169):343–504].

Submitted by **LUIS CANSECO-MAQUEZ** and **OSCAR FLORES-VILLELA**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (UNAM), Apartado Postal 70–399, México Distrito Federal 04510, México.

DRYMARCHON CORAIS MELANURUS (Palancacoate). VENEZUELA: ESTADO MÉRIDA: near San Rafael de Tabay, Hacienda El Progreso, ca. 9.5 km airline NE city of Mérida, 1800 m elev. 20 July 1986. María Martín and Pascual Soriano. Verified by María Martín. Colección de Anfibios y Reptiles, Instituto de Geografía, Universidad de Los Andes (ULABG) 3068 (head only); Bolsón semiárido de Lagunillas, Laguna La Verde, S Laguna de Caparú, 26 km SW Mérida, 850 m elev. 27 October 1990. Roberto Casado. Verified by Samanta Zoltan. ULABG 3932. First records documented from the state and first specimens from the Cordillera de Mérida (Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela, Univ. Central Venezuela, Caracas, Edit. Biblioteca 28. 362 pp.; Lancini 1979, Serpientes de Venezuela, Edit. Ernesto Armitano, Caracas. 262 pp.; Lancini and Kornacker 1989, Die Schlangen von Venezuela).

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela, **PASCUAL J. SORIANO** and **ROBERTO CASADO B.**, Universidad de Los Andes, Facultad de Ciencias, Departamento de Biología, Grupo de Ecología Animal A. Mérida 5101, Venezuela.

EPICRATES CENCHRIA CENCHRIA (Rainbow Boa; Tornasol). VENEZUELA: ESTADO MÉRIDA: 1 km from Alcabala de Puente Victoria on road from Mérida to Santa Cruz de Mora. 16 May 1988. Jesús Molinari and Juan Luis Concepción. Colección de Anfibios y Reptiles, Instituto de Geografía, Universidad de Los Andes (ULABG) 2051; Laguna de Caparú, 25 km SW Mérida, 900 m elev. 12 November 1992. Pascual Soriano. ULABG 3926 (shed skin). Both verified by Roberto Casado. These represent first state records and first documented specimens for the Cordillera de Mérida in the Venizuelan Andes (Roze 1966, La Taxonomía y Zoogeografía de los Ofidios de Venezuela, Univ. Central Venezuela, Caracas, Edit. Biblioteca 28. 362 pp.; Lancini 1979, Serpientes de Venezuela, Edit. Ernesto Armitano, Caracas. 262 pp.; Lancini and Kornacker 1989, Die Schlangen von Venezuela).

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela, and **PASCUAL J. SORIANO**, Universidad de Los Andes, Facultad de Ciencias, Departamento de Biología, Grupo de Ecología Animal A. Mérida 5101, Venezuela.

GEOPHIS NIGROCINCTUS (Sierra Coalcoman Earth Snake). MÉXICO: JALISCO: Autlán, Reserva de la Biósfera Sierra de Manantlán, Las Joyas Scientific Station, in pine forest, elev. 1,900m. No date. Alicia Pérez-Núñez. Verified by Fernando Mendoza Quijano. Colección Zoológica, Laboratorio Natural Las Joyas (LNLJ 95); Autlán, Reserva de la Biósfera Sierra de Manantlán, Las Joyas Scientific Station, in cloud forest, elev. 1900m. 21 March 1990. Oscar Flores-Villela. Museo de Zoología, Fac. de Ciencias UNAM (MZFC 4319). New state record for Jalisco; previously recorded only from the type locality in Dos Aguas, Michoacán (Downs 1967, Misc. Publ. Mus. Zool. Univ. Michigan 131:63).

Submitted by **OSCAR FLORES-VILLELA**, Museo de Zoología, Fac. de Ciencias, UNAM, Apartado Postal 70-399, México Distrito Federal 04510, México, **ALICIA LOEZA-CORICHI**, Laboratorio Natural Las Joyas, Universidad de Guadalajara. Museo de Zoología, Fac. de Ciencias, UNAM. Apartado Postal 70-399, México Distrito Federal 04510, México, and **ALICIA PÉREZ-NUÑEZ**, Museo de Zoología, Fac. de Ciencias, UNAM. Apartado Postal 70-399, México Distrito Federal 04510, México.

LAMPROPELTIS CALLIGASTER (Prairie Kingsnake). KENTUCKY: Christian Co: 5.6 mi S Dawson Springs on Ky. Rt. 109. 24 July 1994. S. L. Collins and J. T. Collins. Verified by Kelly J. Irwin. KU 222227 (DOR). Although not a county record, discovery extends range north into Western Coal Fields Province (Meade 1991, J. Tennessee Acad. Sci. 66:175–182). Specimen taken under 1994 Kentucky Scientific Collecting Permit issued to author.

Submitted by **JOSEPH T. COLLINS**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045, USA.

LAMPROPELTIS GETULA HOLBROOKI (Speckled Kingsnake). IOWA: Appanoose Co: Wells Township, NE 1/4 Sec. 12, T67N, R16W. 2 October 1994. E. Tice. Verified by Joseph T. Collins. KU Color Slide 11169. New county record; Iowa endangered species that had not been verified in state for several years.

Submitted by **JEFFREY B. LECLERE**, 878 Galtier Street, St. Paul, Minnesota 55117, USA.

LAMPROPELTIS TRIANGULUM GENTILIS (Central Plains Milk Snake). USA: TEXAS: Sherman Co: 17.7 km S Texhoma. 21 November 1972. Collector unknown. Verified by Richard L. Holland. UCM 57038. First county record (Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Press, College Station. 434 pp.). With nine (of nineteen) red rings on body split dorsally and twelve ventrally, allocation of the northern Texas panhandle population (Blair et al. 1994, Bull. Maryland Herp. Soc. 30:1–3) to this subspecies, instead of to *L. t. celaenops*, is supported.

Submitted by **KURT SCHAEFER**, Department of Biology, Panhandle State University, Goodwell, Oklahoma 73939, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA, and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

LEPTOTYPHLOPS DULCIS DISSECTUS (New Mexico Blind Snake). USA: OKLAHOMA: Texas Co: Goodwell. 15 May 1968. D. Jackson. Verified by Richard L. Holland. UCM 57036. First county record (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, 370 pp.). An anomalous individual. The dorsals are numerous (229), as expected in the subspecies (Smith and Chiszar 1993, Bull. Maryland Herp. Soc. 29:143), and dorsals 5–8 are broader than the following scales, but the anterior supralabial is not split on either side, and no occipital is split. Its characters are intermediate relative to both subspecies, but it is from well within the range of *L. dulcis dissectus*.

Submitted by **KURT SCHAEFER**, Department of Biology, Panhandle State University, Goodwell, Oklahoma 73939, USA, **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA, and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

RAMPHOTYPHLOPS BRAMINUS (Braminy Blind Snake). MÉXICO: PUEBLA: Municipality of Puebla, Puebla City (19°02'N, 98°12'W), 2150 m elev. 10 April 1993. Collected by Paul Davies. Escuela de Biología, Universidad Autónoma de Puebla (EBUAP-930033). Another specimen collected by Ana María Horán (EBUAP-930088). Both specimens verified by Fernando Mendoza Quijano. First records for the state and range extension of 105 km (airline) E from Morelos (Dixon and Hendricks 1979, Zool. Verhandelingen 173:1–39), 190 km (airline) N from Cuicatlán, Oaxaca (Mendoza-Quijano and Rendón-Rojas 1994, Herpetol. Rev. 25:34), and 220 km (airline) west from Playa Mocambo, Veracruz (Mendoza-Quijano et al. 1993, Herpetol. Rev. 24:110). These records suggest a continous distribution of this leptothyphlopid from coast to coast between the parallels 19°10'N and 17°26'N, involving the states of Guerrero, Morelos, Puebla, Oaxaca, and Veracruz. We believe this distribution might have been facilitated through accidental human transportation.

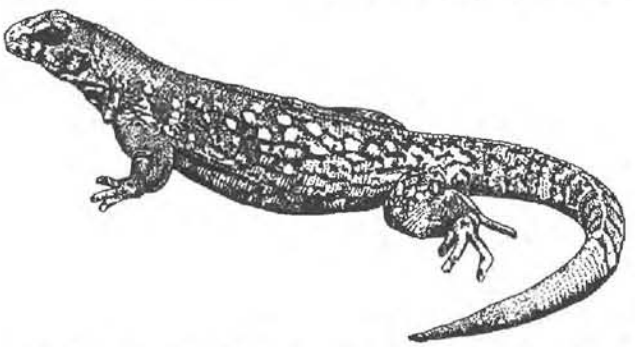
Submitted by **HECTOR ELIOSA LEON, LUIS CANSECO MARQUEZ**, and **GONZALO YANEZ GOMEZ**, Laboratorio do Herpetología, Escuela de Biología, Universidad Autónoma de Puebla, 4 sur 104, CP. 72000, Puebla, Estado de Puebla, México.

THAMNOPHIS ORDINOIDES (Northwestern Garter Snake). USA: WASHINGTON: Kittitas Co: between Cle Elum and South Cle Elum along Yakima River, SE 1/4 Sec. 27, T20N, R15E. 21 April 1994. D. M. Darda and W. P. Leonard. Verified by Murray L. Johnson. Central Washington University Museum, Ellensburg (CWU 279). Extends range ca. 24 km E of the only other county record (Nussbaum et. al. 1983, Amphibians and Reptiles of the Pacific Northwest. Univ. Idaho Press. 332 pp.). Sympatric at this locality with *Thamnophis elegans vagrans* and *T. sirtalis fitchi*. The few records for this taxon from E of Cascade Mountains in Washington and Oregon suggest that emigration from W limited to the immediate vicinity of relatively low mountain passes and along Columbia River Gorge.

Submitted by **WILLIAM P. LEONARD**, Washington Natural Heritage Program, Department of Natural Resources, P.O. Box 47016, Olympia, Washington 98504-7016, USA, and **DAVID M. DARDA**, Department of Biological Sciences, Central Washington University, Ellensburg, Washington 98926, USA.

THAMNOPHIS SAURITUS (Eastern Ribbon Snake). KENTUCKY: Caldwell Co: W edge Dawson Springs off Rt. 62 on W bank of Tradewater River. 24 July 1994. T. W. Taggart, K. J. Irwin, S. L. Collins and J. T. Collins. Verified by Kelly J. Irwin. KU 222229 (juvenile). New county record (Meade 1991, J. Tennessee Acad. Sci. 66:175–182). Specimen taken under 1994 Kentucky Scientific Collecting Permit issued to author.

Submitted by **JOSEPH T. COLLINS**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045, USA.



Dipsosaurus dorsalis (Desert Iguana). USA: Arizona: Pima Co. Illustration by Chuck Smith.

BOOK REVIEWS

Liste des reptiles actuels du monde. I. Chelonii, by Patrick David. 1994. Dumerilia (Publication de l'Association des Amis du Laboratoire des Reptiles et Amphibiens du Muséum national d'Histoire naturelle de Paris) 1:7–127.

Before reviewing the article of interest, an introduction is in order for *Dumerilia* (named in honor of André-Marie-Constant Duméril), a new herpetological journal published by the Laboratory of Reptiles and Amphibians at the Paris Museum of Natural History (AALRAM). *Dumerilia* joins the ranks of other relatively new herpetological journals including *Chelonian Conservation and Biology*, *Herpetological Conservation*, the *Russian Journal of Herpetology*, *Herpetological Natural History* and others. The introduction of so many journals is undoubtedly a reflection of renewed interest in the field of herpetology and the increased need for both specialized journals and more outlets for publication of a burgeoning literature. The scope of *Dumerilia* is broad given the editors' intent to publish "the results of original researches dealing with all aspects of the study of Amphibia and Reptilia, from biology to zoogeography, including systematics, evolution, conservation, or even pure nomenclatural problems." For the time being, only papers submitted by the staff of AALRAM, or colleagues using the collections will be considered for publication.

Dumerilia has an unusual, perhaps unique, review policy. Comments from reviewers are divided into two categories: objective, those dealing with factual errors of omission or commission; and subjective, those based on differences of opinion between the reviewers and the author(s). Objective criticisms must be addressed before acceptance of the manuscript for publication. Subjective criticisms are published in an appendix following the article with the names of consenting reviewer(s). This provides a "point-counterpoint" perspective with the publication of each article. Given the controversy of the traditional anonymous peer review process employed by scientific journals (Pisani 1994; Wilson and McCranie 1993), the policy of *Dumerilia* is an interesting departure from the norm.

The work of Patrick David (1994. Liste de reptiles actuels du monde I. Chelonii) is the first part of an anticipated series in *Dumerilia* listing all presently valid taxa of living reptiles down to the level of subspecies. Scientific names are followed by common names in both French and English as well as pertinent references for each taxon. Six-hundred and ninety-two citations are given making the article a useful reference on the taxonomy and systematics of turtles. Extinct taxa are not listed, even if the extinction was recent. The cut-off date for references was June 15, 1993. David recognizes 273 species in his compilation, the highest number yet reported in comparable modern checklists (Table 1). The inflated number represents not only the recent flux in systematics and taxonomy of turtles but also the various perspectives of the authors and their rules of compilation. For example, differences in the number of families are largely attributable to disagreement over whether the Emydinae and the Batagurinae are subfamilies or families (Gaffney and Meylan 1988). However, King and Burke (1989) recognize batagurines and emydines as subfamilies of the Emydidae, but separate the Staurotypidae from the Kinosternidae following Bickham and Carr (1983).

There are many previous compilations of the world's turtles including books by Pritchard (1979), Obst (1988), and Ernst and Barbour (1989). Beyond the books, with their color photographs and detailed text, are several other modern publications that are best described as annotated checklists of turtle species including Wermuth and Mertens (1977), King and Burke (1989), and Iverson (1992). By now the list of Wermuth and Mertens (1977) is rather dated from the standpoint of turtle systematics and taxonomy, but it is still a useful reference for partial synonymies. That leaves the checklists of King and Burke (1989) and Iverson (1992) as the main competitors with David (1994). So what sets the work of David apart from the previous compilations of the worldUs turtles? In an effort to answer that question, I compared the lists using a variety of attributes (Table 1). Aside from a more recent compilation of the literature, the work of David has common names in both English and French. Other than that it has little more to offer than previous lists. The most useful list, in my opinion, is Iverson (1992) since it has almost everything that all the other lists have. Iverson also provides distribution maps and phylogenies, and I have found the former to be very useful. If you can only afford one checklist of turtles, buy Iverson's. If you need more, David's list would be a useful addition to your library.

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TABLE 1. Comparison of attributes of modern checklists of the world's turtles.

Reference	Families	Genera	Species	Synonymies	Common Names	Maps	Keys	Illustrations	References	Phylogenies
Wermuth & Mertens	12	64	219	yes	no	no	no	no	no	no
King & Burke	13	89	250	no	yes	no	no	selected	yes	no
Iverson	12	87	257	no	yes	yes	yes	no	yes	yes
David	13	90	273	partial	yes*	no	no	no	yes	no

*English and French.

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JEFFREY E. LOVICH
National Biological Service
Palm Springs Field Station
63-500 Garnet Avenue
P.O. Box 2000
North Palm Springs, California 92258-2000, USA.

A Veterinary Guide to the Parasites of Reptiles, Volume 1 Protozoa, by Susan M. Barnard and Steve J. Upton. 1994. Krieger Publishing Company, Malabar, Florida.154 pp. Hardcover. US $26.50. ISBN 0-89464-832-2.

This book, the first in a series on parasites in reptiles, is directed toward individuals with a prior knowledge of these parasites. Fifty-six figures are provided, but of this number, only thirteen are micrographs. For the flagellates, only *Giardia* is represented photographically; for the amoebas, only *Entameba*. The *Apicomplexa* are better served with micrographs of a *Haemogregarina*, *Caryospora*, *Cryptosporidium*, two of *Eimeria*, and one of *Pythonella* and *Sarcocystis*. Ciliophora are represented by *Balantidium* and *Nyctotherus*. Line diagrams are included for some other genera. In general, the micrographs, diagrams, and descriptions would not be adequate for identification of the protistan parasites if one were not familiar with them.

The parasites are grouped phylogenetically rather than by site of infection which might have been a more functional means. Summaries of phylum level features are given but in some instances would not be of diagnostic value to someone with a light microscope (e.g., apical complex structures, evident with an electron microscope). Subphylum and ordinal characters are given as are those of representative species from reptiles. For each species, a description of major features is given and for most, a line diagram is provided. The identity of the hosts, the location in the hosts, and the nature of the life cycle (direct, indirect, etc.), are recorded. The mode of transmission is provided, as are a brief statement of symptoms and the method of diagnosis and treatment. Unfortunately, quite often the treatment is "none required" or, worse, "none reported." Occasionally, advice is given on how to avoid the parasites (as for *Leptomonas*). The approach in some cases is a bit oversimplified and even odd. For example, *Kinetoplastida* from intestines of reptiles are relegated to the genus *Leptomonas* when in fact some are *Herpetomonas* (Dollahon and Janovy 1971). Of course this has little bearing on treatment. Also, why did the authors include *Tritrichomonas muris* from a rodent in their line drawings?

Coverage of Microspora and Myxozoa is very sparse (1–2 paragraphs each) both concluding with no treatment in reptiles being recorded. Coverage is provided for Sarcomastigophora (flagellates and amoebas), and Apicomplexa, as well as a chapter on organisms of uncertain nature. Oddly, there are no micrographs or diagrams of the lizard malarias, only life cycles.

In addition, there is a chapter on laboratory procedures and how to do microscopy. Xylene on lenses is not a good idea, however. Procedures for collecting, preserving, and examining fecal samples are provided. Staining procedures are given for intestinal protozoans and procedures for preparing blood smears (no procedures are given for stains except the name in this case) and tissue impressions.

Appendix I is a list of parasiticides used in treatment of protozoan infection. Given are the organism, the therapeutic approach, the dosage used in mg/kg, a reference mode of administration and comments. Appendix II supplies information on where to acquire chemicals, etc. Appendix III is a summary of hosts/parasites mentioned in the text.

There is a glossary of terms to provide definitions of terms in the text, such as enanation, a state of starvation. A reference section follows.

If you have not had training in recognizing parasitic protists this book will not provide an effective mechanism for so doing. Additional micrographs would be helpful along with an organization based on site of infection rather than taxonomy.

LITERATURE CITED

DOLLAHON, N. R., AND JANOVY, J., JR. 1971. Insect flagellates from feces and gut contents of four genera of lizards. J. Parisotol. 57:1130–1132.

NORMAN R. DOLLAHON
Department of Biology
Villanova University
Villanova, Pennsylvania 19085-1699, USA.

PUBLICATIONS RECEIVED

Manual y Claves Ilustradas de los Anfibios y Reptiles de la Región de Chamela, Jalisco, México, by Aurelio Ramírez-Bautista. 1994. Instituto de Biología, Universidade Nacional Autónoma de México. Cuadernos del Instituto de Biología 23. 127 pp., 78 photographs (74 in color on 16 plates). Softcover. In Spanish. ISBN 968-36-3897-X. US $25.00 plus $4.00 for air-mail shipment and handling. Available from Instituto de Biología, UNAM Cordinacion de Bibliotecas, A.P. 70-233, 04510 México, D.F. Tel. 622-56-89, or from the author: Aurelio Ramírez-Bautista, Instituto de Biología, Departamento de Zoología, A.P. 70-153, 04510 México, D.F.

This handbook describes the herpetofauna of the Chamela Biological Station, a 1600-ha preserve in the southwestern portion of the state of Jalisco, México. This area receives moderate but strongly seasonal rainfall (>700 mm annual average) and is characterized by tropical deciduous forest. The region harbors 19 amphibians and 63 reptiles (including five species of marine turtles and one sea snake). Spanish common names are provided for many species. Individual species accounts provide descriptions (morphology, coloration, etc.) and briefly summarize information concerning habitats, habits, and general distribution.

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Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings.

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4512 McMurray Avenue
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HERPETOLOGICAL REVIEW

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax
E-mail: rohanse@cello.gina.calstate.edu

Managing Editor
THOMAS F. TYNING
Massachusetts Audubon Society
350 Williams Street
Pittsfield, Massachusetts 01201, USA
(413) 442-2165
E-mail: 71061.150@compserve.com

Section Editors

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National Fish & Wildlife Forensics Lab
1490 East Main Street
Ashland, Oregon 97520, USA
E-mail: steve_busack@mail.fws.gov

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AARON M. BAUER
Biology Department
Villanova University
Villanova, Pennsylvania 19085, USA
E-mail: abauer@king-kong.vill.edu

Current Research
BRECK D. BARTHOLOMEW
195 West 200 North
Logan, Utah 84321-3905, USA
E-mail: breckbarth@aol.com

Geographic Distribution
JOSEPH T. COLLINS
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045-2454, USA
E-mail: jcollins@kuhub.cc.ukans.edu

Geographic Distribution
JERRY D. JOHNSON
Department of Biology
El Paso Community College
P.O. Box 20500
El Paso, Texas 79998-0500, USA
E-mail: jerryj@laguna.epcc.edu

Herpetological Husbandry
LYNDON A. MITCHELL
Dept. of Reptiles & Amphibians
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA

Natural History Notes (Amphibia)
CHARLES W. PAINTER
Endangered Species Program
New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504, USA

Natural History Notes (Reptilia)
LEE A. FITZGERALD
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131, USA
E-mail: leefitz@bootes.unm.edu

Recent Population Changes
RALPH W. AXTELL
Dept. of Biological Sciences
Southern Illinois University
Edwardsville, Illinois 62026, USA

Legislation & Conservation
KURT A. BUHLMANN
Institute of Ecology
University of Georgia
Athens, Georgia 30602, USA
E-mail: kbuhlman@uga.cc.uga.edu

Regional Societies
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106-7080, USA

Advertising Manager
ELIZABETH A. JOHNSON
New Jersey Field Office
The Nature Conservancy
200 Pottersville Road
Chester, New Jersey 07930, USA
(908) 879-7262

Production Staff
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1996 — University of Kansas, Lawrence, Kansas, USA, 24–29 July (William E. Duellman, Chair).
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New Submissions 1994

BEHRMANN, H-J. 1981. Care and reproduction of *Varanus t. timorensis* (Reptilia: Sauria: Varanidae). Salamandra. 17(3/4):198–201. translation (2 pages), original (2 pages).

BEUCHELT, H. 1936. Bau, Funktion und Entwicklung der Begattungsorgane der Mannlichen Ringelnatter (*Natrix natrix* L.) und Kreuzotter (*Vipera berus* L.). Morph. Jahrb. 78:445–516. Parts - 6. Erection of the penes, 7. Embryonic development, 8. Phylogenetic considerations on the penes, 9. Summary. translation (19 pages), no original available.

BOUR, R. 1978. The living turtles of Masagascar (Malagasy Republic): A systematic list and description of two new subspecies (Reptilia: Testudines). Bull. Soc. Et. sci. Anjouan, nouvelles serie. 10:141–154. translation (11 pages), original (8 pages).

GASC, J. P. 1970. The different patterns of innervation of the iliocostalis muscle in snakes. Bulletin du Association des Anatomistes, 5th Congress (Sofia). 145:168–175. translation (3 pages), original (4 pages).

GUIBE. J. 1949. Revision of the genus *Langaha* (Ophidia): Sexual dimorphism and its taxonomic consequences. Memoires de l'Institut Scientifique de Madagascar, Serie A. 3(2):147–155. translation (5 pages), original (8 pages).

About our Cover

Dendrobates azureus, the blue poison frog, was described by Marinus D. Hoogmoed in 1969 (Zool. Meded., Leiden 44:134). It is known only from the vicinity of the type locality, on the western slope of Vier Gebroeders Mountain, Surinam.

The family Dendrobatidae contains about 168 species allocated to eight genera (*Aromobates*, 1 sp.; *Colostethus*, 87 spp.; *Dendrobates*, 26 spp.; *Epipedobates*, 26 spp.; *Mannophryne*, 8 spp.; *Minyobates*, 9 spp.; *Nephelobates*, 6 spp.; and *Phyllobates*, 5 spp.), whose collective distribution is from Nicaragua to the Amazon Basin of Bolivia and to the Guianas and southeastern Brazil (Frost, D. R. 1995. Dendrobatidae. *In* Amphibian Species of the World. Version 2/95. Electronic manuscript maintained under the auspices of The Herpetologists' League).

The "arrow-poison" or "dart-poison" frogs have long attracted the interest of both the scientific and herpetocultural communities owing to their often-brilliant coloration, the highly toxic skin secretions of some species, and their diversity. Jerry G. Walls' recent popular book (*Jewels of the Rainforest: Poison Frogs of the Family Dendrobatidae*, TFH Publications, Neptune, New Jersey. 288 pp.) mirrors this interest.The most recent taxonomic treatments are those by Myers (1987. Pap. Avul. Zool., São Paulo 36:301–306), Myers et al. (1991. Am. Mus. Novit. 3002:1–33), and La Marca (1992. Cat. Taxon. Biogeog. Bibliog. Ranas Venezuela, Cuad. Geograf., Univ. Los Andes, No. 9; 1994. Publ. Assoc. Amigos Doñana, No. 4, 75 pp.; and 1994. An. Invest. 1991, Univ. Los Andes: 39–41). However, as is the case with many groups of tropical amphibians, new species continue to be discovered and taxonomic arrangements are dynamic, particularly with respect to assignments of species to genera.

Recent research by John W. Daly and colleagues has provided evidence for dietary uptake of skin toxins. Also confirmed is the relationship between consumption of particular groups of forest-floor arthropods and production of specific classes of toxic alkaloids. [See Current Research, p. 68 this issue, for details.] This work helps explain the observations of zoo personnel and herpetoculturists that dendrobatid frogs maintained in captivity for long periods tend to lose their toxicity.

The cover photo was taken by herpetologist **David G. Barker**, a Texan with broad interests in herpetology and herpetoculture. He is co-author (with Tracy J. Barker) of *Pythons of the World, Volume I, Australia*, which features many of his photographs. He took this photo at the National Aquarium in Baltimore, using a Pentax LX camera, Vivitar 90mm f2.5 lens, and Kodachrome 64 film, at 1/75th sec. at f22. Separation and imaging by **Jim Bridges**, Herpeto Inc., Hollywood, Florida, USA.

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Keynote Address: "TERRITORIAL BEHAVIOR: TESTING THE ASSUMPTIONS," by Judy Stamps (University of California, Davis).

Symposium: "EASTERN RATTLESNAKES: BIOLOGY AND CONSERVATION OF *CROTALUS HORRIDUS* AND *CROTALUS ADAMANTEUS*." *Organizers*: William S. Brown (Skidmore College, Saratoga Springs, New York, USA) and Walt Timmerman (Helena, Montana, USA). *Participants for session on Timber Ratilesnake*: W. S. Brown, B. W. Bowen, A. -M.Clark, L. M. Bushar, H. K. Reinert, D. E. Keyler, B. L. Oldfield, R. Stechert, A. Breisch, S. H. Harwig, S. Smith, W. H. Martin, E. Possardt, T. Tyning, R. T. Zappalorti, D. Wynn, A. H. Savitzky, B. A. Savitzky, G. Rocco, J. B. Sealy, A. Soha, J. T. Taylor, A. C. Smith, Jr., K. Michell, R. R. Rupert, Jr., D. F. Fraser, J. Congdon. *Participants for session on Eastern Diamondback Rattlesnake*: W. Timmerman, W. Auffenberg, W. H. Martin, D. B. Means, G. Dalrymple, P. Kain, S. Telford, J. W. Gibbons, R. Mount, L. Jones.

Symposium: "EVOLUTIONARY PATTERNS OF AMPHIBIAN DEVELOPMENT." *Organizer:* Stephen M. Deban (University of California, Berkeley, USA). *Participants*: S. M. Deban, J. C. O'Reilly, S. B. Marks, C. S. Rose, D. Meinhardt.

Regional Societies Conference: "REGIONAL HERPETOLOGICAL SOCIETIES: PROGRAMS AND PROJECTS." *Organizer*: Martin J. Rosenberg. See page 64 of this issue for details.

Workshop: "HERP PHOTOGRAPHY." *Organizers*: David Dennis and J. Eric Juterbock.

President's Travelogue Slide Shows: Profusely-illustrated lectures of exotic herps and habitats. "Amphibians and Reptiles of the Lowland Maya Area," by Julian C. Lee; "The Herpetofauna of the Southern African Arid Zone," by Aaron M. Bauer; and "Amphibians and Reptiles of Australia: After the World Congress," by R. Wayne Van Devender.

Multimedia Presentations: "Herps of the West" and "Amphibians of the Appalachians" by David Dennis and J. Eric Juterbock; "Herpetological Namesakes" by Kraig Adler, David Dennis, and J. Eric Juterbock.

Oral and Poster Sessions: Several concurrent sessions each day.

Student Paper Awards: Seibert Prizes to be awarded to the two best student-presented papers at the meeting ($250 first prize, $150 second prize).

Student Travel Grants: Ten awards of $200 each will be given. For details see March 1995 issue (page 1).

"The Great Reprint Scavenge" (for students only!). Professionals are asked to clear unwanted duplicate reprints out of their offices (and receive free raffle tickets as a "thank you").

Social Activities: Welcoming Social, the SSAR Annual Auction, Barbecue Dinner, Graduate Student Social, local tours.

Field Trips: Grandfather Mountain, Linville Gorge Wilderness Area, night trips for salamander watching, and others.

Live Exhibit: Featuring herps of the region. Sponsored by the North Carolina Herpetological Society and Appalachian State University. Animals available for viewing and photography.

Costs and Accommodations: Registration $75 student, $110 regular; $50 spouse. After 15 April 1995, registration fees will be $115, $145, and $50, respectively. Lodging at Broyhill Inn (meeting location) will be $40 (single occupancy) or $46 (double occupancy) per day. Dormitory room rates are $15 (single) or $10 (double) per day plus $8 for linen. Approximately 100 additional rooms are reserved at several local motels for $49–$70 per day. Note that Boone, North Carolina is a popular summer resort area; reservations should be made well in advance.

Further Details: See December 1994 issue of *Herpetological Review* (pages 133–135). Meeting Announcement/Call for Papers was mailed to all North American members of SSAR in January 1995; it is also available on request from *Dr. Robert Wayne Van Devender, Department of Biology, Appalachian State University, Boone, North Carolina 28608, USA (telephone 704-262-2665; fax 704-262-2127; e-mail vandevenderr@appstate.edu).* Address questions about meeting sites, rooms, registration, etc., to *Richard Hudson, Office of Conferences and Institutes, University Hall (telephone 704-262-3045; fax 704-262-4992; e-mail hudsonre@appstate.edu).*

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KLEMMER, K. 1974. Two rarities in the Darmstadt Vivarium: the Timor python (*Python timorensis*) and the prehensile-tailed skink (*Corucia zebrata*). Vivarium Darmstadt. (1974) no. 4:12–15. translation (3 pages), original (3 pages).

LAMOTTE, M., AND J. PERRET. 1985. Revision of the genus *Conraua* Nieden. Bull. I.F.A.N. vol. 30, ser. A. no. 4:1603–1644. translation (13 pages), original (43 pages).

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MERTENS, R. 1964. Observations on the earless monitor *(Lanthanotus borneensis)* in the terrarium. Die Aquarien- und Terrarien-Zeitschrift (DATZ) 17(6):179–183. translation (6 pages), original (4 pages).

MUDRACK, W. 1976. A life in days - The skink, its care and breeding. Aquarien Magazin. 3:120–121. translation (4 pages), original (2 pages).

PETERS, UWE. 1982. The Bismarck python, *Bothrochilus boa*. "Das Aquarium." 162:660–661. translation (2 pages), original (2 pages).

RAGE, J. C. 1975. A primative caenophidian snake (Reptilia, Serpentes) from the lower Eocene. Bulletin de la Societe geologique de France 17(2):Supplement. 46–47. translation (3 pages), original (3 pages).

SCHLEICH, HANS-HERMANN. 1979. The Cape Verde giant skink, *Macroscincus coctei*: An extinct lizard? Natur und Museum [Frankfurt]. 109(5):133–138. translation (5 pages), original (6 pages).

SCHULTZE-WESTRUM, THOMAS. 1961. Aquatic and arboreal reptiles of New Guinea. "Kosmos" (Stuttgart). 1962, no. 6:247–252. translation (5 pages), original (4 pages).

SCHULTZE-WESTRUM, THOMAS. 1963. The Papua turtle from New Guinea. Natur und Museum. 93(4):119–127. translation (7 pages), original (5 pages).

TERENTEV, P. V. (ed). 1964. Translations of selected abstracts from *Voprosy Gerpetologii* (Problems of Herpetology). University of Leningrad. translation (8 pages), no original.

TIMMEL, J. F., AND R. PLATEL. 1988. Encephalization in colubrid snakes (Ophidia). Comptes Rendus de l'Academie des Sciences (Paris), Serie III. 306:479–482. translation (4 pages), original (4 pages).

VALLEN, E. 1944. The development of the scent glands of several species of turtles. Acta Zoologica. 25:1–249. translation (32 pages), no original available.

WERMUTH, HEINZ. 1963. The Papua soft-shelled turtle, *Carettochelys insculpta* Ramsay. Die Aquarien-und Terrarien Zeitschrift (DATZ) 16(11):341–343. translation (4 pages), original (3 pages).

WILKE, HARTMUT. 1985. Crocodile-tailed knobby lizards in the Darmstadt Vivarium. Die Aquarien-und Terrarien Zeitschrift. 38(5):234. translation (2 pages), original (1 page).

Also available is the following collection of papers concerning various aspects of monitor lizards, family Varanidae. These papers may be ordered individually or as an entire collection of 152 pages. Sorry, no originals are available.

ANONYMOUS. (undated). *Varanus exanthematicus albigularis* in the Iguana Reptile Zoo, Vlissingen, Netherlands. Zoo Report. (3 pages).

ANDRES, A. 1904. News of a monitor lizard. Bl. Aqu. Terra. Kunde. 15:269. (1 page).

BANNIKOV, A. G. (no date given). The monitor needs protection. Priroda (Nature) 9:97. (2 pages).

BOHME, W. 1988. The Argus monitor (*Varanus panoptes*, Storr 1980) of New Guinea: *V. panoptes horni* ssp. n. Salamandra 24(2/3):87–101. (8 pages).

BÖHME, W., J. P. FRITZ, AND F. SCHUTTE. 1987. The discovery of the giant monitor lizard (Sauria: *Varanus*) from the Arabian Republic of Yemen. Herpetofauna 46 (February):13–20. (5 pages).

CISSE, M. 1972. The diet of varanids in Senegal. Bulletin de l'Institute Fondamental d'Afrique Noire. 34 (2):503–515. (5 pages).

CISSE, M. 1976. The genital cycle of varanids in Senegal. Bulletin de l'Institute Fondamental d'Afrique Noire. Ser. A. 38(1):188–205. (4 pages).

CREBS, U. 1979. *Varanus dumerilii*—a specialized crab eater? Salamandra. 15(3):146–157. (5 pages).

EIDENMULLER, B. 1986. Observations on the care and a recent breeding of *Varanus (Odatria) timorensis timorensis* (Gray 1831). Salamandra. 22(2/3):157–161. (6 pages).

HECK, L., JR. 1955. The cape monitor *Varanus exanthematicus albigularis*. Aqua-Terra-Z. VIII 7:190–191. (1 page).

HORN, H. G. 1977. Notes on the systematics, places of discovery and keeping of *Varanus karlschmidti*. Salamandra. 13(2):78–88. (6 pages).

HORN, H. G. 1980. Previously undiscovered details about *Varanus varius* based on observations in the field and in the terrarium. Salamandra. 16(1):1–18. (8 pages).

HORN, H. G. 1985. Comments on the behaviour of monitors: The ritual fights of *V. komodoensis* and *V. semiremex*, also the threat display phases of the ritual fights of *V. timorensis timorensis* and *V. timorensis similis*. Salamandra. 21(2/3):169–179. (4 pages).

HORN, H. G., AND G. PETTERS. 1982. A summary of: Some notes on *Varanus rudicollis*. Salamandra. 18 (1/2):29–40. (4 pages).

HORN, H. G., AND B. SCHULZ. 1977. *Varanus dumerilii*, as few know it. Das Aquarium. 91 (January):37–38. (2 pages).

HORN, H. G., AND U. SCHURER. Some notes concerning *Varanus glebopalma* (Mitchell, 1955). Salamandra. 14(3):105–116. (7 pages).

HORN, H. G., AND G. J. VISSER. 1988. Observations on *Varanus giganteus* with some morphometric statements. Salamandra. 24 (2/3):102–118. (7 pages).

IGOLKIN, V. A. (no date given). The propagation of reptiles in captivity: the grey monitor *Varanus griseus*. Priroda (Nature). 9:95–96. (4 pages).

KLEE, O. 1969. From other publication; Peters, U. observations on a mangrove monitor *Varanus (Odatria) semiremex* Peters 1869. Aqua-Terra. 6:61–63. (1 page).

KRATZER, H. 1973. Observations on the incubation time of a clutch of eggs of *Varanus salvator*. Salamandra. 9 (1):27–33. (5 pages).

KRATZER, H. 1973. Summary of a review of Aquaterra 9(10), 1972:98–102. Aquaterra. 10(1):12. (1 page).

MAKAROV, A. N. 1985. A case of cannibalism in a desert monitor (*Varanus griseus*). Voprosy Gerpetologii. Abstracts of the papers presented at the VI All - Union Herpetological Conference. Leningrad. "Nauka." 1985:130. (1 page).

MAKAYEV, V. M. 1982. Present condition and problems of conservation of the desert monitor lizard (*Varanus griseus*). Naochnie Osnovi I Patsionalnhogo Ispolzovaniya Zhivotnoho Mira. Moscow. 1982:36–42. (5 pages).

MERTENS, R. 1941. From: Zwei neue Warane des Australischen Faunengebeties. *Varanus indicus spinulosus*, new subspecies. Senckenbergiana. 23 (4/6):266–272. (3 pages).

MERTENS, R. 1954. Uber die Rassen des Wustenwarens, *Varanus griseus*, and the races of *Varanus griseus*. Senck. Biol. 36(5/6):353–357. (5 pages).

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MUNSCH, W. 1987. Monitors encountered in Sri Lanka. Das Aquarium. 214:206–210. (5 pages).

NUTPHAND, W. (No date given). The monitor lizards of Thailand. Mitphadung Publishing Office, Bangkok. 33 pp. (6 pages).

PETERS, U. 1967. Observations on *Varanus varius* (Shaw) in the wild. Aquar. Terrar. 20:120–121. (3 pages).

PETERS, U. 1971. Remarks on Mitchell's water monitor. Aquaterra Z. 8:75–77. (2 page).

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PETERS, U. 1986. The successful rearing of *Varanus spenceri*. Das Aquarium 205, Juni. (2 pages).
POLLECK, R. 1979. The Pacific monitor in the terrarium. Aquar. Terrar. Z. 32:285–286. (2 pages).
RUEGG, R. 1974. The breeding of *Varanus timorensis similis*. Das Aquarium. 62 (August):360–363. (2 pages).
RJUMIN, A. V. 1968. The ecology of the desert monitor (*Varanus griseus*) in southern Turkmenistan. Herpetology of Middle Asia. Academy of Sciences, Uzbek SSR. Tashkent 1968. pp. 28–31. (3 pages).
SAUTEREAU, L., AND P. DEB. 1980. Notes on the rearing and reproduction of *Varanus timorensis*. Bull. Soc. Herpetol. Fr. 15:4–9. (4 pages).
SCHMIDA, G. E. 1971. The Australian spotted tree monitor, *Varanus timorensis similis*. Aquar. Terrar. Z. 24:168–170. (4 pages).
SCHMIDA, G. E. 1974. The short tailed monitor (*Varanus brevicauda*). Aqua. Terra. (Z). 27(11):390–397. (7 pages).
SCHURER, U., AND H. G. HORN. 1976. Observations of wild and captive Australian water monitors: *V. mertensi*. Salamandra. 12(4):176–188. (8 pages).
SCHMUTZ, E., AND H. G. HORN. 1986. The habitat of *Varanus timorensis timorensis*. Salamandra. 22(2/3):147–156. (4 pages).
SHAMMAKOV, S. 1981. From: The reptiles of Turkmenistan, pp. 144–150: *Varanus griseus caspius* (Eichwald 1831). Acad. Nauk. Turkmen SSR., Ashkabad, pp. 312. (4 pages).
STIRNBERG, E., AND H. G. HORN. 1981. An unexpected new generation in a terrarium: *Varanus (Odatria) storri*. Salamandra. 17(1/2):55–62. (3 pages).
VAN DUINEN, J. J. 1983. Breeding *Varanus exanthematicus albigularis*. Lacerta. 42(1):12–14. (3 pages).
VERNET, R. 1982. Study of the ecology of *Varanus griseus* in the northwestern Sahara. Bull. Soc. Herp. Fr. 22:33–34. (1 page).
VISSER, G. J. 1985. Notes on the reproductive biology of *Varanus (Empagusia) flavescens* (Hardwicke and Gray 1827) in the Rotterdam Zoo. Salamandra. 21(2/3):161–168. (4 pages).
YADGAROV, T. Y. 1968. Materials on the ecology of the desert monitor (*Varanus griseus*) in the River Surhandaria Basin. Herpetology of Middle Asia. Tashkent 1968, pp. 24–28. (4 pages).

NEWSNOTES

Announcing *AmphibianDecline*

AmphibianDecline is an Internet forum established to facilitate the exchange of information on the biology and conservation of declining amphibians. Topics of discussion might include information on the status of particular species or populations as well as research findings on how disease, UV radiation, population genetics, acid precipitation, pesticides, non-native species, etc., are affecting amphibian populations. discussions about potential causes of decline and techniques for conducting surveys or measuring relevant factors are also encouraged.

Subscribers to the forum will receive all E-mail sent to *AmphibianDecline* and may also send messages which will automatically be distributed to other *AmphibianDecline* subscribers.

If you have E-mail access to the Internet, you can subscribe to *AmphibianDecline*. To subscribe, send a message to listproc@ucdavis.edu. The subject should be Subscribe and the message needs to be:

Subscribe AmphibianDecline Firstname Lastname

Use your own first and last name. Do not include anything else in the message. You will receive confirmation that your subscription has been received as well as information on how to send messages to *AmphibianDecline* and how to end a subscription. For additional information or comments, contact: *Gary M. Fellers, Research Biologist, National Biological Survey, Point Reyes National Seashore, Point Reyes, California 94956, USA. Tel. 415-663-8522; e-mail: gmfellers@ucdavis.edu.*

ISSCA Announces Reduced Student Rate

The International Society for the Study and Conservation of Amphibians (ISSCA) was founded in 1988 in Paris, France. The aims of ISSCA are to contribute (1) to the study and knowledge of amphibians (batrachology), (2) to the conservation of amphibians and to that of their environment, (3) to the establishment, reinforcement, and facilitation of bonds between batrachologists, and (4) to the promotion of batrachology as an independent scientific discipline.

Four times a year, ISSCA publishes the journal *Alytes*, which features original, peer-reviewed papers in English, French, or Spanish in any discipline dealing with amphibians. A "Guide for Authors" can be obtained from either of the addresses listed below or from a recent issue of the Journal.

The regular rate for a 1995 subscription to *Alytes* and membership in ISSCA (which includes a news bulletin, *Circalytes*) is $54.00 for individuals and $108.00 for institutions. Beginning this year, students may subscribe to *Alytes* and hold membership in ISSCA for half price ($27.00). Payment may be sent in U.S. dollars (make check payable to "ISSCA") to Mark L. Wygoda, ISSCA Deputy Treasurer, P.O. Box 92000, McNeese State University, Lake Charles, Louisiana 70609, USA. Payment in French francs (270 FF regular rate; 135 FF student rate; 540 FF institutional rate) may be sent to ISSCA, Laboratoire des Reptiles et Amphibiens, Museum national d'Histoire naturelle, 25 rue Cuvier, 75005, Paris, France.

Herpetology Combined Museum Collections Database

The Department of Herpetology, California Academy of Sciences is host to the *Herpetology Combined Museum Collections Database*. At present, the entire herpetological holdings of the following institutions are on-line and accessible: California Academy of Sciences (CAS), Carnegie Museum (CM), Louisiana State University (LSUMZ), Texas Natural History Collection (THNC), University of California, Berkeley (MVZ), University of Texas, Arlington (UTA), Smithsonian (USNM), and the Peabody Museum, Yale (YPM). In addition, the database includes the Caudata and Gymnophiona holdings of Harvard University (MCZ).

Data are limited to numbers of specimens held in each institution by genus and/or species; i.e., who has what and how many. The HCMC Database is accessible by (1) searching gopherspace via Veronica using the keyword "herpetology," (2) by accessing the CAS gopher directly: %gopher gopher.calacademy.org; or (3) via World Wide Web: http://www.calacademy.org.

Institutions wishing to add their data to the HCMCD should contact: *Jens Vindum, California Academy of Sciences; e-mail: jvindum@calacademy.org or José Rosado, Museum of Comparative Zoology; e-mail: jrosado@mcz.harvard.edu.*

Submitted by: *Robert C. Drewes, Curator & Chairman, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA. e-mail: casherp@mercury.sfsu.edu.*

Texas Natural History Collections Databases

The Texas Natural History collections (TNHC), a division of Texas Memorial Museum of the University of Texas at Austin, is pleased to announce availability of collections databases and collections-related files:

http:/www.utexas.edu/depts/tnhc/.www
gopher://gopher.utexas.edu:3003/11/pub/tnhc
(or follow gopher menus: Texas; University of Texas Austin; Colleges and Departments; College of Natural Sciences; Texas Natural History Collections)

WAIS-indexed databases from the ichthyology and herpetology collections are searchable. We are also pleased to provide related collaborative projects through the same location. The Business Office of the American Society of Ichthyologists and Herpetologists (ASIH), now based at TNHC, provides (WWW & Gopher) an updated membership directory, meeting announcements, and general information about the society. Finally, the University of Texas Biodiversity Resources and Collections (UT-BRAC) collaborative project (WWW & Gopher) provides links to other natural history and biodiversity resources at UT Austin.

Please contact us should you experience any difficulties accessing these files, or with your comments and questions. *Dean A. Hendrickson, Curator of Ichthyology (e-mail: deanhend@mail.utexas.edu; tel. 512-471-9774; fax 512-471-9775); David C. Cannatella, Curator of Herpetology (e-mail: catfish@mail.utexas.edu); or Carol K. Malcolm, Collections Manager for Ichthyology and Herpetology (e-mail: cmalcolm@utxvms.cc.utexas.edu).*

Charles Stearns Grant-in-Aid for Herpetological Research at the California Academy of Sciences

The Department of Herpetology is pleased to provide limited financial aid—mostly to cover round trip transportation and limited per diem expenses—to graduate students who wish to visit our collections to support research in systematics.

Proposals should include a short—no more than one page—description of the research project, a budget, and a letter of support from the student's faculty advisor.

Proposals are due on 15 October 1995, with notification by 1 December 1995. Grantees are expected to complete their Academy visit by 15 September 1996. Please call 415-750-7037 for further information.

Send proposals to: *Herpetology Research Grants, Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, USA.*

Call for Student Proposals

The J. Larry Landers Student Research Award is presented annually to the best student research project concerning the biology of the gopher tortoise, *Gopherus polyphemus*, or any aspects of its sandhill community. This would include vegetation management practices and burrow commensals. Recent awards have averaged $400. Students interested in applying should submit a concise description of their project with a detailed budget (no more than four pages, double spaced) and a brief curriculum vita to *Bob Herrington, Research Advisory Committee, Department of Biology, Georgia Southwestern College, Americus, Georgia 31709, USA.* Deadline for receipt of proposal to be considered for the 1995 award is 31 August 1995.

Murphy Retires from Dallas Zoo

James B. Murphy, Curator of the Department of Herpetology at the Dallas Zoo, will retire as of 1 June 1995. His new address after this date will be: *National Zoo, c/o Herpetology Department, 3000 Connecticut Avenue, N.W., Washington, D.C. 20008, USA.*

Dallas Zoo Rattlesnakes Available

The Dallas Zoo is willing to donate a laboratory colony of amelanistic western diamondback rattlesnakes (*Crotalus atrox*) with anomalous variable scalation to a researcher interested in continuing a study of phenotypic variation of scutellation in this taxon. Two publications have resulted from data obtained from this group of snakes which includes virtually "scaleless" individuals (Murphy et al. 1987, Herpetologica 43:292–300; McCrady et al. 1994, Zoo Biology 13:95–106). Send proposal to: *Fred LaRue, Deputy Director of Animal Operations, Dallas Zoo, 621 East Clarendon Drive, Dallas, Texas 75203, USA.*

Amphibians and Pest Control

With the current interest in diversification in farming, and a progressive move to more environmentally-friendly organic farming systems, the Ministry of Agriculture in Britain has commissioned a review of the current state of knowledge on the role that amphibians play in the control of invertebrate pest species, with particular reference to organic farm systems. I am currently working on this project along with Pim Arntzen at the University of Bangor, Wales, United Kingdom.

Although popular accounts exist of examples of amphibians as biological control agents, many of these are out of date and probably do not reflect the current state of affairs. We are interested in getting a range of views on the following issues:

1. Incidences where a decline in amphibian numbers has resulted in pest/insect outbreaks and/or an increase in pesticide use.
2. Any examples of organic agriculture in which amphibians have been especially encouraged for their function in pest control.
3. Evidence of the persistence of amphibian populations in association with farm ponds, ditches, etc., or agricultural environments in general.
4. Any other thoughts on the role amphibians may play as controllers of invertebrate numbers.

To be incorporated in the present survey, information must be received by 15 July 1995. Please reply to John Wilkinson c/o Pim Arntzen on BSS181@Bangor.ac.uk, or in writing to: *John W. Wilkinson, School of Biological Sciences, Brambell Building, University of Bangor, Gwynedd LL57 2UW, United Kingdom.*

Bullfrog Harvest Information Needed

The Ontario Ministry of Natural Resources is currently trying to build a case to end the commercial and recreational harvesting of American bullfrogs (*Rana catesbeiana*) in the province. Consequently, information is needed to support this change. Study results from the northeastern U.S. or midwestern states would be especially useful. Any recent information that you can provide that relates to bullfrog conservation, management, or population declines would be very helpful. Please send information to: *Kevin Lamacraft, Information Officer, Brockville Area Office, P.O. Box 605, 10 Oxford Avenue, Brockville, Ontario, Canada, K6V 5Y8. Tel. (613) 498-9625 or e-mail: SOrchard@RBML01.RBCM.GOV.BC.CA.*

DAPTF Bullfrog Introduction Questionnaire

Investigations into amphibian declines sometimes indicate that introduced species are involved. Many amphibian workers are concerned that bullfrog introductions are responsible for severe damage to native faunas, especially other amphibian species. Although bullfrogs have already been introduced to many countries, and hence much damage may already have been done, new ranching operations or introductions are still being considered in areas outside this species' natural range. New bullfrog farming ventures are still initiated because of the appeal of financial return for a small investment. However, we know of no such operation which has been commercially successful.

Mike Lannoo, the Declining Amphibian Populations Task Force (DAPTF) Coordinator for the U.S., has recently been invited to join the Invasive Species Specialist Group of the Species Survival Commission, as an advisor on amphibian matters. The DAPTF has alerted this Specialist Group to the problems posed by bullfrogs becoming established outside of the natural range, with the result that the ISSG has proposed aiming recommendations at governmental levels. In order to provide a sound basis for these recommendations the DAPTF wishes to collate information on bullfrog introductions to establish the true magnitude of the problem. We need and welcome your contributions. We would like to know:

1. Sites/countries of bullfrog introductions (if possible distinguishing between direct introductions, escapes from farms/ranches, and incidental introductions via fish stocking).
2. Information on the impacts on native fauna.
3. Information on known eradication measures—successes or failures.
4. Whether any known bullfrog farms/ranches have been economically viable.
5. Any other comments that may be of importance.

In order to draw up firm conclusions, we would be grateful if literature could be cited in your response. Alternatively, if you can pass on personal observations, then a note of your professional status (e.g., wildlife manager, professional ecologist, etc.) would add weight to any conclusions drawn. In addition, please supply your address and phone number for any necessary follow-up inquiries. Please send information to: *Michael Lannoo, Muncie Center for Medical Education, Rm. 209 Maria Bingham, Ball State University, Muncie, Indiana 47306-0230, USA; e-mail: 00mjlannoo@bsuvc.bsu.edu.*

Addendum to Wilfred T. Neill Bibliography

In 1993 we published a biographical sketch and bibliography of Wilfred T. Neill (Liner et al. 1993. Smithsonian Herp. Infor. Serv. 95:1–24). At that time we felt reasonably sure that all publications of this prolific author were covered but this was not the case. Recently, a publication that we overlooked was brought to our attention by C. Kenneth Dodd, Jr., to whom we are grateful. The citation is: Neill, W. T. 1964. Road log, pp. 7–10 *In:* W. Auffenberg, W. T. Neill, T. H. Patton, and S. D. Webb. Guidebook 1964 Field Trip in Central Florida. Soc. Vert. Paleo. Ann. Meeting. Sponsored by the University of Florida and the Florida Geological Survey, Gainesville, Florida. 15 November 1964. 52 pp.

Ernest A. Liner, 310 Malibou Boulevard, Houma, Louisiana 70364-2598, USA, and *David L. Auth, Department of Herpetology, Florida Museum of Natural History, Museum Road, University of Florida, Gainesville, Florida 32611-2035, USA.*

Transfer of Sensitive Information

The National Biological Service is formulating a policy on protecting sensitive location data (e.g., breeding sites for endangered amphibians). To develop a policy that suits the needs of all vulnerable taxa will require input from many persons. If you know of a situation where ad lib information transfer could damage a wild population or taxon, send a one paragraph description of the circumstances to: *Dr. David H. Ellis, Endangered Species Research Branch, Patuxent Environmental Science Center, 11510 American Holly Drive, Laurel, Maryland 20708-4019, USA.*

MEETINGS

Meetings Calendar

15-19 June 1995—Annual Meeting of the American Society of Ichthyologists and The Herpetologists' League. University of Alberta, Edmonton, Alberta, Canada. Contact Dr. Joseph S. Nelson, Department of Biological Sciences, University of Alberta, Edmonton, Canada T6G ZE9. Tel. (403) 492-4741. Fax (403) 492-9234.

23–25 June 1995—International Gecko Society Symposium. Palm Mountain Resort, Palm Springs, California. Contact IGS Symposium, P.O. Box 370423, San Diego, California 92137-0423, USA.

6–10 July 1995—International Congress of Chelonian Conservation. Tortoise Village, Gonfaron, France. Contact: Secretariat, SOPTOM, B.p. 24, 83590 Gonfaron, France. Tel. (33) 94 78 26 41. Fax (33) 94 78 24 27.

8–13 August 1995—Annual Meeting of the Society for the Study of Amphibians and Reptiles. Appalachian State University, Boone, North Carolina, USA. *Refer to meeting announcement on page 58 of this issue for contact numbers and detailed information.*

25–30 August 1995—2nd International Asian Herpetological Meeting. Ashgabat, Turkmenistan. Contact: Theodore J. Papenfuss, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA. *Refer to meeting announcement below.*

26–29 October 1995—2nd Annual Conference of the Association of Reptile and Amphibian Veterinarians (ARAV), Sacramento, California, USA. *Refer to meeting announcement below for further details.*

Mid-April 1996—2nd International Conference on the Biology and Conservation of the South Asian Amphibians and Reptiles, University of Peradeniya, Sri Lanka. Deadline for receipt of abstracts 30 August 1995. Contact: Anslem de Silva, Conference Director, Faculty of Medicine, University of Peradeniya, Sri Lanka. Tel. 94-08-88130. Fax 94-08-32572.

Second International Asian Herpetological Meeting

The Asiatic Herpetological Research Society, Institute of Zoology, Academy of Sciences of Turkmenistan, and Nikolsky's Herpetological Society under the Russian Academy of Sciences will hold the Second International Asian Herpetological Meeting in Ashgabat, Turkmenistan from 6 to 10 September 1995.

Ashgabat is the captial of Turkmenistan. It is situated between the foothills of the Kopet-Dagh Mountains and the Kara-Kum desert. This area is of great herpetological interest. About 80 species of amphibians and reptiles including the Desert Monitor (*Varanus griseus*) and Central Asian Cobra (*Naja oxiana*) occur in the vicinity of Ashgabat. Excursions will be arranged to visit natural habitats and cultural sites in this country.

Persons interested in attending the meeting should contact any of the following individuals to register or to obtain additional information:

Dr. Sc. Sakhat M. Shammakov, Institute of Zoology, Academy of Sciences of Turkmenistan, 744000 Ashgabat, Azady Street 59, Turkmenistan. Tel. (363-2) 25-37-91; fax (363-2) 25-37-91 or (363-2) 29-04-92.

Dr. Theodore J. Papenfuss, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA. Tel. (510) 642-3567; fax (510) 643-8238; e-mail: asiaherp@uclink2.berkeley.edu.

Dr. Sc. Natalia B. Ananjeva, Department of Herpetology, Zoological Institute, Russian Academy of Sciences, 199034 St. Petersburg, Russia. Tel. (812) 218-07-11 or 218-03-11; fax (812) 219-29-41; e-mail: anb@zisp.spb.su.

2nd Annual ARAV Conference

The Association of Reptile and Amphibian Veterinarians (ARAV) will hold its second annual conference 26–29 October 1995 at the Radisson Hotel in Sacramento, California. Herpetoculturists, professional herpetologists, veterinarians, and students are invited to attend. Workshops on basic and advanced herptile medicine and surgery, as well as presentations on herp husbandry, reproduction, conservation, medicine, surgery, and research will be included in the three day event.

For conference registration or ARAV membership information contact: *Wilbur Amand, VMD, P.O. Box 605, 1 Smithbridge Road, Chester Heights, Pennsylvania 19017, USA. Fax (215) 387-2165.*

III Congreso Latinoamericano de Ecología

The 3rd Latin American Congress of Ecology will be held at the Universidad de Los Andes, Mérida, Venezuela, from 22–28 October 1995. Deadline for receipt of abstracts is 30 July 1995. Fees are US $100 (regular) and US $70 (students).

For more information, please contact *Dr. Jaime E. Péfaur, Executive Secretary, III CLAE, Fax (58) 74 401286; e-mail CLAE@ula.ve.*

1995 ASC Annual Meeting at UC Berkeley

The 1995 ASC Annual Meeting will be hosted jointly by the University of California, Berkeley and the California Academy of Sciences on 30 June – 2 July. The meeting will feature a workshop on "Natural History Collections on the Information Superhighway." Partnerships among systematics collections of various kinds, and state and federal agencies will be the topic of another session.

Representatives of NSF, the National Biological Service, and EPA have been invited to talk about government partnerships and information superhighway issues. Speakers will address efforts to create a National Biodiversity Information Infrastructure or Center for Biodiversity Information, and the role of systematics databases therein. A representative of Conabio, México's biodiversity center, has also been invited.

For registration and hote information, contact: *ASC, 730 11th Street, NW, Second Floor, Washington, D.C. 20001-4521; Tel. (202) 347-2850; fax (202) 347-0072.*

Herpetological Review Now On-line

A pre-publication listing of the contents of each issue of *HR* is now available from several on-line sources. Postings should occur approximately one month before the publication of the next issue. This service should be helpful to herpetologists in countries where mail delivery is unpredictable, as well as providing pre-publication information to other interested persons. *HR*'s on-line contents listing is available from the following:

Herp-Net — direct dial to 215-464-3562 (300–2400bps 8-N-1) or 215-698-1905 (9600, 14.4kbs) 24 hours per day. Select "Herp. Review" menu item.

Via **Usenet** newsgroup, "sci.bio.herp" (use any newsreader available on your network account), look for the posting "Herpetological Review Contents."

The Herpetology World Wide Web at Harvard, maintained by Michael Eisen, can be accessed at:

http://xtal200.harvard.edu:8000/herp

Then select the menu item "Current Contents of Herp Journals."

Via the **HERP-L** distribution list available to any Internet address. To subscribe send email to listproc@xtal200.harvard.edu with the phrase "subscribe HERP-L <your name>" in the body of the message.

On the commercial **CompuServe** Information Service in their Animal Forum [Go Petstwo] reptile/amphibian library section 6. Search by keyword "SSAR." On **America Online**, under "pet" section, search reptile files.

This service is made possible by Mark Miller and the Herpetology On-Line Network. Miller can be reached by FAX at 215-464-3561 or Internet email: mmiller@tjuvm.tju.edu.

REGIONAL SOCIETIES

Regional Herp Society Conference at SSAR Annual Meeting

The annual SSAR meeting this August will feature a Regional Herpetological Society Conference consisting of eight presentations. The conference, designed to share ideas, programs, and projects relating to regional herpetological societies, is scheduled for Thursday, 10 August, from 0845 to 1500 hours. All individuals attending the SSAR meeting are invited to attend any or all of the papers. The program appears below:

Welcome and Introductions
"Producing a High Quality Regional Herpetological Society Newsletter, with or without a Computer," by J. C. Beane and B. Bartholomew.
"Mid-Ohio Herpetological Society's 'Counselor's Corner,'" by S. Highley.
"Public Involvement in the Protection of Endangered Reptiles in Ontario," by B. Johnson, D. Martin, and B. Porchuk.
"Tax-Exempt Status for Herpetological Societies: Is it Worth the Hassle?" by M. Kikta.
"Contributions Which Non-academic Herpetologists Can Make to the Scientific Study of Declining Amphibian Populations," by S. Moody.
"Regional Herpetological Societies and the Science Olympiad," by G. W. Renwick and M. J. Rosenberg.
"Marketing Herpetology," by J. H. Schoenfelder.
"North Carolina Herpetological Society: Educational and Research Endeavors," by A. Somers.
"Educational Programs of the Long Island Herpetological Society," by P. R. Warny, Jr.
Open Forum: "Regional Herpetological Societies—Where Do We Go from Here?"

A display of regional herpetological society newsletters representing about 75 regional societies will be available for viewing throughout the SSAR meeting. For further information about this conference, contact the Regional Society Liaison (see inside back cover).

NOAH Journal Revived

The *Journal of the Northern Ohio Association of Herpetologists* is a semi-technical publication. Articles are of general interest to the amateur and professional herpetologist and herpetoculturist. Suitable articles for publication in the *Journal* range from original research to notes on captive husbandry or summary manuscripts on a specific topic within herpetology. After a several year leave of absence, the *Journal* is again being published by NOAH. Currently, efforts are being made to produce a semi-annual publication. Titles in the current issue include: "A review of temperature-dependent sex determination in reptiles," by Mark S. Wilson; "Over de soorten zeilhagedissen van het geslact *Hydrosaurus* (About the sail lizard species of the genus *Hydrosaurus*)," by Gerard Visser and Judith van der Koore (translated by Bert Langerwerf); "*Heterodon* and other not-so-harmless 'harmless' snakes," by Mark T. Witwer; "The reptiles of the Dalby District and adjacent parts of the Darling Downs (Queensland)," by Raymond Hoser and John Scanlen.

For more inforamtion on J. NOAH, contact *Gregory J. Watkins-Colwell, Editor, 2323 N. Knoll, Beavercreek, Ohio 45431, USA (e-mail: GJWC@aol.com).* For more information on membership in NOAH, write to: *NOAH, Department of Biology, Case Western Reserve University, Cleveland, Ohio 44106, USA.*

Texas Herpetological Society Grants-in-Herpetology

Amount: Requests should not exceed $500.

Who May Apply: Priority one: Non-professional herpetologists, including non-students, amateurs, public school undergraduates, and college undergraduates. Priority two: Professionals, graduate students, and wildlife biologists.

Projects: All research projects dealing with Texas reptiles and amphibians, native or introduced, and dealing with conservation, natural history, distribution, evolution, systematics, ecology, behavior, physiology, or husbandry.

Proposal Format:

1. Typed, double-spaced, on one side of bond paper.

2. Cover page: Should include a) title; b) amount requested; c) project term; d) name and address of principal investigator(s); e) occupation.

3. Body: a) Clearly state the objectives; b) justify based on previous research or a lack thereof; c) define the relationship between the disposition of funds and the expected results; d) define the qualifications of all investigators in the project; and e) include a letter of agreement from each consultant. The body should not exceed 2500 words.

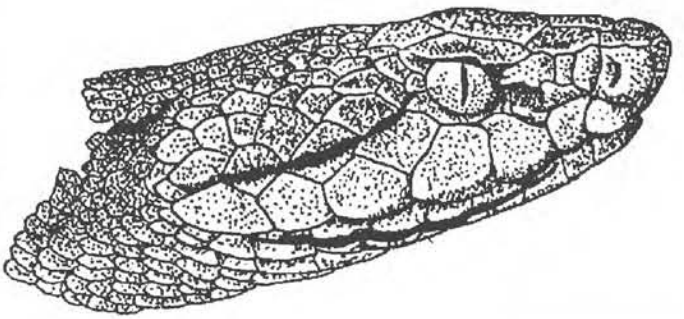
4. Budget: Budget items should be listed and justified. Funds requested can not be used for salaries.

5. Literature Citations: literature citations in the body should be referenced.

Report: In the event an award is made, a report as to the results and deposition of funds must be submitted to the Secretary/Treasurer within six months of the completion date stated in the proposal. A final report is required following the completion of the project.

Entry: An original and four copies of the proposal should be submitted to the Secretary/Treasurer prior to 1 January 1996. The number of awards made will depend on the number of requests and the amounts requested. The awards will be announced on 15 March 1996.

Send proposals to: *David Haynes, Sec./Treas., Texas Herpetological Society, 1810 W. Mulberry, San Antonio, Texas 78201, USA.*



Agkistrodon c. contortrix (Southern Copperhead). USA: South Carolina: Jasper Co. Illustration by Chuck Smith.

OBITUARY

In Remembrance of C. J. McCoy

C. J. (Jack) McCoy passed from this life on 7 July 1993 (see Herpetologica 50:379–382 for traditional obituary), yet through our recollections he lives on; our memories, in a sense, and his influence upon us, provide him immortality. The following collection of anecdotes from friends and colleagues embodies Jack as we knew him. Ranging from personal to field experience, each submission we received has been edited and presented accordingly.

Living in close quarters, sometimes under adverse conditions, exposes character; in a herpetologist it often unleashes a competitive spirit with, in Jack's case, tolerance and humor often in evidence:

"In June 1985, Ellen Censky, Paul Freed, Jack, and I went to Belize. We split up into two field teams; it was suggested that I be given a handicap since Ellen was my field partner. Jack and Paul returned with a couple of lizards. Ellen and I brought back *Sphenomorphus cherriei*, *Micrurus diastema*, *Drymarchon corais*, and a large *Bolitoglossa dofleini*, a new record for the country. We accepted bragging rights for the day's collections, brought out the 6 foot *Drymarchon*, and draped it across our shoulders for Jack's trophy picture. I first saw that photograph as a special label on a bottle of wine given to my wife on her 40th birthday. When confronted by the photo, supposedly taken in Australia of me and a lady herpetologist, all I could say was 'I don't remember any lady herpetologist in Australia.' One can imagine the discussion that followed; we were in a room filled with herpetologists. Jack, as he often did, got the last laugh." (Ray E. Ashton, Jr.)

"In 1964, P. Maslin, C. Carpenter, D. Tinkle, O. Cuellar, B. Clarke, Jack, and I went to the islands in the Sea of Cortez. On that trip I learned of Jack's abilities as swimmer, diver, lizard chaser, and humorist. Aboard ship Jack supplemented our diet from the sea; he and Orlando often skin dived for groupers on the fringes of the islands. Jack often swam with no clothes on. As a result, he developed a good tan, took on the appearance of a Mexican, and often sang like one, especially after a few beers." (James R. Dixon)

"During a field trip in Virginia, meal preparation was a group effort. Three days into the week Jack fixed a large pot of spaghetti. We all ate heartily, and there were few leftovers (or so we thought). The next morning there was more spaghetti in the pot than we had before supper; it seemed to multiply on its own. For the next three days Jack taught us that one could always eat spaghetti, even at breakfast!" (Joe and Wendy Mitchell)

"Jack was nearly always reserved in reaction and comment. At Reelfoot Lake, he, Dick Vogt, and I set out across the main southern basin of the lake. Dick ran the motor on the Carnegie's boat at full throttle, appropriate in most big lakes, but this lake is replete with barely submerged stumps and other snags. As the boat gathered speed, the prop would hit a stump and come flying out of the water with a whine. Jack simply frowned at Dick. Dick finally responded with 'Well, what do you want us to do—take a leisurely tour of the lake or get there and catch turtles?' The motor continued to function and survived nearly a dozen similar insults; Jack displayed only a few mildly 'ruffled feathers.'" (Michael A. Ewert)

With many of us, we suspect, the persona presented at work is a mere reflection of our true persona. With Jack, however, one noted little change between home, work, or play. One such example was suggested by Alvin Braswell.



Photograph courtesy R. B. Bury.

"In 1982, John Cooper and I arrived at Cape Hatteras the day Jack and Patsy McCoy were leaving (their fishing trip had not been too successful). As we arrived, two fishermen were dragging hugh bluefish across the road in front of the motel. Cooper and I grabbed our rods, and headed for the beach—following the drag marks in the sand. I had hardly gotten my bait into the water when a gentle bite turned into a tug-of-war that must have lasted 10 minutes. As I hoisted the bluefish out of the surf, I commented to Cooper that this quick catch was going to tear Jack up. Just then we saw Jack (carrying two large bluefish) and Patsy coming toward us. While he and Patsy had stopped to talk with some fishermen, 3 fifteen-pound chopper blues scooted up the beach right at their feet! My quick catch, coupled with the beach assault, would have driven many fishermen into a frenzied kicking of sand and shouting of profanity, but Jack handled it in the calm, rational manner that was typical of his approach to life. He always derived as much joy from the fish that others caught as he did from his own."

Straight-forward in his approach to inter-personal relationships, Jack became close personal friend, mentor, and confidant to many of us. Several examples of his sensitivity, patience, and ability to cooperate under trying circumstances were provided among the tributes we received. In addition to the excerpts provided below, we received contributions expressing similar sentiments from R. Bruce Bury, Roger Conant, and Hobart M. Smith; space limitations preclude our including them all.

"Jack was both a vigorous and prominent scientist, and a compassionate human being. When a museum curator felt entitled to my entire dissertation collection, even though he had provided no previous material assistance, I told him that my collection would go to Carnegie Museum. It specialized in herps from the region, and Jack had offered to reimburse me for the collection;

reimbursement was critical—I needed to pay my dissertation typist. The curator threatened to reject my dissertation unless Jack withdrew his offer. Jack withdrew his offer accordingly, then called to say that he would purchase the collection six months after my dissertation was approved. The curator was appeased, my needs, and the needs of the Carnegie, were met. All accomplished with neither confrontation nor humiliation! Jack found the means to solve problems diplomatically, yet effectively." (Dave Morafka).

"Jack was truly dedicated, and his influence will be felt for some time. In addition to his curatorial duties, he dedicated a lot of effort to the herpetological societies. He was a gentle soul, always willing to help others. Recently, when David Auth and I worked with Jack on a biography and bibliography of Wilfred T. Neill, I could tell he was delighted, in his quiet and unassuming way, whenever he located a reference or tidbit on Neill that we had not yet found. It was a pleasure to be skunked by Jack!" (Ernie Liner).

"A calming voice, a steady presence. Our friendship was fueled by shared friends and museum and societal business. Conversations, often as not, were over the phone or asides during committee meetings. These shared moments are remembered because of their helpfulness, but more fondly remembered are the all too infrequent field and social ones—an exchange of verbal barbs as we put on our boots to search for *Clemmys muhlenbergii* in an Erie Co., Pennsylvania, bog; sipping a pint in the Rutherford College pub and watching the frenzied and competitive interactions of colleagues and friends; and other flashes of conviviality as our professional paths brought us together and led us apart." (George R. Zug).

"I knew Jack as a person possessing honesty and integrity. He was never afraid to express his feelings or to admit his own shortcomings; he could be extremely blunt, but he was never malicious. I could always trust Jack for as direct and lucid an explanation of any situation as was possible. Jack was truly my mentor; whatever successes I achieve are due in large measure to his steady encouragement. Jack knew very well of the condition that would cause his death, and he faced it with dignity and quiet courage. He lived life fully to the very end, and that is the legacy I carry with me." (Andy Price).

"Jack was an easy person to work with; he was an ideal collaborator always pulling his share, or more. Distance was never a problem; Jack was a great correspondent and always responded in a timely fashion. He was also the consummate editor, often sending manuscripts back with more marginalia than text. He admitted to having a 'heavy hand,' but his recommendations always made significant improvements in quality and presentation." (Jeff Lovich).

"I admired his efforts at training people from other countries. Interaction with specialists is not as readily available abroad as it is here. I also remember Jack's sense of humor; it was so subtle that it was often some time after a conversation had concluded that one realized a response had been 'tongue in cheek.' His humor supplemented his willingness to support training, his kindness, and his patience." (Carl Gans).

"Jack was born in Texas, grew up in Oklahoma, and spent over half his life trying to get out of Pittsburgh. Once while I was a postdoc at Carnegie and preparing to make plane reservations for a field trip to Mexico he suggested I '...make the reservation Miami-Cozumel-Pittsburgh...I'll drive you to the airport.' It was late February, cold and dreary in Pittsburgh. We drove to Florida, stopped at Little Talbot Island State Park, bought a sack of fresh oysters, raked up a bushel of clams, bought a bottle of Tequila, and sat on the beach, fished, ate, and talked for two days—in warm weather." (Richard C. Vogt).

"In addition to his endless patience, his wonderful sense of humor, and his willingness to help others, Jack was an accomplished scientist in and out of the field of herpetology. I remember having lunch with him once at a small restaurant. He bit into a fish sandwich and, with joyous rapture, rattled off the scientific name of the fish he was eating! 'Are you serious?' I asked. 'How can you tell what it is just by biting into it.' His hearty laugh told me that the fish wasn't the only one who got 'caught.'" (Paul Freed).

"Jack supported the efforts of many an aspiring herpetologist; our relationship began in 1960, and continued throughout the development of my career. His support and advice guided me through a stint in the Peace Corps and a four-year term with the U.S. Navy (in Spain). While I was overseas, Jack answered my questions—often delivered twice weekly by post—and kept me "in touch" with the world, herpetological and otherwise. When I returned to the U.S., he guided me to my first professional position. Later he would edit manuscripts, write letters of recommendation, support grant applications, and provide meals and lodging at his home. I knew him well, considered him my best friend, yet never got the chance to know him well enough. In agreement with many of those who contributed to this tribute, I, too, shall feel the loss for many years to come." (Stephen D. Busack).

"You gotta be tough to be a herpetologist,' 'Patience is a virtue,' 'No teasa da curator'—the three rules in the Section of Amphibians and Reptiles, Carnegie Museum of Natural History. Jack was my teacher, my boss, my mentor; most of all, he was my friend. It will not be easy for me to get used to the idea that Jack is gone and that a source of profound advice and direction will no longer be there. We'll all miss you, Jack." (Ellen J. Censky).

Edited by
STEPHEN D. BUSACK
National Fish and Wildlife Forensic Lab
1490 East Main Street
Ashland, Oregon 97520, USA

and
ELLEN J. CENSKY
Section of Amphibians and Reptiles
Carnegie Museum of Natural History
4400 Forbes Avenue
Pittsburgh, Pennsylvania 15213, USA.

SSAR World Wide Web Page

SSAR has expanded its presence in cyberspace. In addition to the on-line postings for *Herp. Review* mentioned elsewhere in this issue, SSAR has begun a World Wide Web Page. Set your browser to

http://falcon.cc.ukans.edu/~gpisani/SSAR.html

and check us out. The site still is under construction, but more useful things are being added weekly. FORMER OFFICERS, EDITORS, COMMITTEE MEMBERS: please review the file "SSAR Officers and Editors" to check that your data are up-to-date. This file will be used eventually in a history of the Society. Send changes to George Pisani (gpisani@falcon.cc.ukans.edu).

LEGISLATION & CONSERVATION

Call for information on the status of amphibians and reptiles: This column serves to update the herpetological community on the regulatory status and protection measures implemented for rare, threatened, and endangered herps. We are in need of more information especially on the State and Province level. Please send pertinent information to the Section Editor.

USA: Department of the Interior: The U.S. Fish and Wildlife Service was petitioned on 15 September 1994 by the Biodiversity Legal Foundation (P.O. Box 18237, Boulder, Colorado 80308-1327, USA, tel. 303-442-3037) to list the Amargosa toad (*Bufo nelsoni*) as Endangered. The Amargosa toad is endemic to the Oasis Valley in Nye County, Nevada. According to BLF's petition, toads are known from only nine sites. The toads are dependent on springs within the valley. Grazing, exotic catfish, off-road vehicles, the battle for water rights, and a human population that has increased from 300 to 1800 in 30 years are included as threats. The USFWS currently lists *B. nelsoni* as C1 (Federal Register, Vol. 59, No. 219, 15 Nov 1994).

The USFWS has 90 days from the date of the petition was filed to rule whether the petition is valid, followed by one year to rule on the proposed listing. Those with comments should address them to: *Ms. Sherry Barrett, USFWS, 4600 Kietzke Lane, Bldg. C, Reno, Nevada 89502, USA. Submitted by: Ronald W. Marlow, 1634 Serenada Ave., Las Vegas, Nevada 89109-2509, USA.*

USA: Department of the Interior: The USFWS has issued a final rule listing the goliath frog (*Conraua goliath*) as Threatened. This huge amphibian is narrowly distributed in Central Africa and is vulnerable to commercial collection and to other problems (Federal Register, Vol. 59, No. 235, 8 December 1994).

USA: Department of the Interior: The USFWS has issued a final rule listing the arroyo southwestern toad (*Bufo microscaphus californicus*) as Endangered. The arroyo toad occurs exclusively in streams in southern California and northwestern Baja California, México. The arroyo toad has been extirpated from an estimated 75% of its former range. Threats to the survival of the species include habitat degradation, predation, and small population sizes (Federal Register, Vol. 59, No. 241, 16 December 1994).

USA: The Humane Society of the U.S. A report entitled, "Live Freshwater Turtle and Tortoise Trade in the United States" is available free. Ask for the report on official university, non-profit, or herp organization stationary. Write to: *Teresa Telecky, HSUS, 2100 "L" Street NW, Washington, D.C. 20037, USA. Submitted by: Allen Salzberg, 67-87 Booth St. #5B, Forest Hills, New York 11375, USA.*

Convention on International Trade in Endangered Species (CITES): The CITES Secretariat issued notification to members to suspend imports of the following herptile species: Oriental rat snake (*Ptyas mucosus*) [Peoples Republic of China and Indonesia], Indian bullfrog (*Rana tigerina*) and Asian bullfrog (*R. hexadactyla*) [India], ball python (*Python regius*) [Togo], and pancake tortoise (*Malacocherus tornieri*) [United Republic of Tanzania]. The countries from which these species originate have failed to implement the recomendations of the CITES Standing Committee such as creating national legislation for the protection of the species, and/or initiating studies to evaluate harvest levels and establish scientifically based sustainable-use management programs. Therefore, in accordance with the responsibility of the United States under CITES, and effective immediately and until further notice from the USFWS, no shipments of these species may be imported into the U.S. (Federal Register, Vol. 59, No. 234, 7 December 1994).

USA: Florida: The Florida Game and Freshwater Fish Commission (GFC) is proposing a legislative package to restructure current licenses and fees. The GFC proposes to increase the Venomous Reptile permit from $5 to $25, and increase the license fees to exhibit or sell animals. Permits for scientific collection which are currently issued free would cost up to $75. Currently, anyone can collect any quantity of unprotected herptiles in Florida without a license or permit. The GFC proposes to require anyone collecting more that two specimens at one time to purchase a license of $11 annually for residents, $150 annually for non-residents, or $25 for 10 days for non-residents. To comment or obtain more information contact: *Paul Moler (904) 955-2230 or Kevin Enge (904) 627-9674.*

CITES: At the Conference of CITES Parties held in Ft. Lauderdale, Florida, USA, 7–18 November 1994, the USFWS submitted a proposal to list all species of North American box turtles (genus *Terrapene*) in CITES Appendix II (except *T. coahuila*, which is already on Appendix I). Appendix II species are those that may become threatened with extinction unless trade is properly managed and regulated. The proposal was adopted by consensus. Any future exports of box turtles by the United States or other CITES Parties will require a CITES export permit from OMA (U.S. Department of the Interior, CITES Update #31, December 1994).

At the CITES conference, a resolution was adopted that establishes new standards, procedures, and requirements for the tagging of all crocodilian skins in international trade. New guidelines for evaluating marine turtle ranching proposals were also adopted. Specifically, these guideline require a comprehensive biological assessment and monitoring of the population to be ranched, effective implementation of a national program for turtle conservation, development and implementation of regional protocols for cooperative conservation among range states, and adequate controls by proponents and importing parties to ensure the trade in ranched turtles does not stimulate illegal trade.

Changes in status were approved for the following species of reptiles and amphibians (the new status follows each species in parentheses). Egyptian tortoise (*Testudo kleinmanni*) (App. I); black caiman (*Melanosuchus niger*), Ecuador population (App. II), Nile crocodile (*Crocodylus niloticus*), Zaire, Tanzania, Madagascar populations (App. II) and Somalia population (App. I); estuarine crocodile (*C. porosus*), Australia and Indonesia populations (App. II); all tuataras (genus *Sphenodon*) (App. I); Golden toad (*Bufo periglenes*) (App. I); and golden mantella (*Mantella aurantiaca*) (App. II).

USA: Virginia: An example of anti-environmental sentiment was unfortunately recently enacted in Virginia. The Chesapeake City Council, without objection from state wildlife officials, responding to a strong landowner rights movement, trespass concerns, and the ignorance and fears of the local public, demanded that researchers at Old Dominion University (ODU) and Christopher Newport University stop an eight-year radio-telemetry study of state-endangered canebrake rattlesnakes (*Crotalus horridus atricaudatus*). The study was being conducted on a natural population in a city-owned park. Adjacent landowners and the Chesapeake Farm Bureau became angry when they learned that the home ranges of the snakes included private property. The study was funded by private donations to the Virginia Department of Game and Inland Fisheries Nongame Program and was supporting several graduate students at ODU. Future funding, previously assured, is now in jeopardy for political reasons.

KURT A. BUHLMANN
SSAR Conservation Committee.

CURRENT RESEARCH

The purpose of **Current Research** is to present basic summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA. Comments and suggestions are also welcome.

Ecology

Using data collected between 1988–1992, Capula and Luiselli compared the fecundity of 12 cryptically colored adders to that of nine melanistic females. The melanistic females had a significantly higher rate of reproduction which the authors attributed to their superior ability to thermoregulate in the cool high altitudes.

CAPULA, M., AND L. LUISELLI. 1994. Reproductive strategies in alpine adders, *Vipera berus*. The black females bear more often. Acta Œcologia 15(2):207–214.

A recent paper by Vitt and Caldwell examines resource utilization and niche breadth for a community of two lizards species and eight frog species living in the Amazon forest leaf litter. Feeding guilds, activity patterns, and prey type and size are compared for the ten species.

VITT, L. J., AND J. P. CALDWELL. 1994. Resource utilization and guild structure of small vertebrates in the Amazon forest leaf litter. J. Zool., Lond. 234:463–476.

Three recent papers discuss different aspects of varanid biology and ecology. Tsellarius and Men'shikov determined that scent-marking behavior in *Varanus griseus* is used to identify age, sex, and even individuals within a community. They also examined seasonal scent-marking behavior. Yeboah compared the body length-weight relationship, basking and roosting temperatures, feeding habits, and behavior of two African monitors. Pianka discusses the evolution of body size in two subgenera of varanids, as well as many other aspects of their ecology. A food web for 40 species of Australian desert lizards is also presented.

TSELLARIUS, A. YU., AND YU. G. MEN'SHIKOV. 1994. Indirect communication and its role in the formation of social structure in *Varanus griseus* (Sauria). Russian J. Herpetol. 1(2):121–132

YEBOAH, S. 1993. Aspects of the biology of two sympatric species of monitor lizards *Varanus niloticus* and *Varanus exanthematicus* (Reptilia, Sauria) in Ghana. Afr. J. Ecol. 32:331–333.

PIANKA, E. R. 1994. Comparative ecology of *Varanus* in the Great Victorian Desert. Aust. J. Ecol. 19:395–408.

Biogeography

Kaiser et al. used allozymes of the diverse anuran genus *Eleutherodactylus* to examine the biogeography and phylogenetic relationships of the Lesser Antillean island arc plus Trinidad and Tobago. They conclude that *Eleutherodactylus* has colonized these islands from both South America and the Greater Antilles.

KAISER, H. T., F. SHARBEL, AND D. M. GREEN. 1994. Systematics and biogeography of eastern Caribbean *Eleutherodactylus* (Anura: Leptodactylidae): Evidence from allozymes. Amphibia-Reptilia 15:375–394.

Molecular Biology & Systematics

Molecular data may not be as neutral as previously thought. Malhotra and Thorpe examined the morphological and mtDNA variation of two species of *Anolis* on separate islands and found parallels between the two sets of data. Furthermore, the data sets were correlated with ecological gradients, suggesting mtDNA evolution may involve environmental selection.

MALHOTRA, A., AND R.S. THORPE. 1994. Parallels between island lizards suggests selection on mitochondrial DNA and morphology. Proc. R. Soc. Lond. B 257:37–42.

A new species is described, another resurrected, and three new synonyms of Madagascan *Phelsuma* are recognized in a revision of these lizards by Raxworthy and Nussbaum. A taxonomic key to the twenty Madagascan *Phelsuma* is also presented.

RAXWORTHY, C. J., AND R. A. NUSSBAUM. 1994. A partial systematic revision of the day geckos, *Phelsuma* Gray, of Madagascar (Reptilia: Squamata: Gekkonidae). Zool. J. Linn. Soc. 112:321–335.

Using both DNA sequence and allozymes, de Queiroz and Lawson estimate phylogenetic relationships of *Thamnophis*. The two methods yielded different phylogenies, whereas combining the data sets gives an almost fully resolved tree. The paper includes a discussion of combining molecular data from different techniques in order to gain better resolution of phylogenetic trees. Systematic conclusions include additional data supporting the placement of the problematic species *validus* in the genus *Thamnophis*.

DE QUEIROZ, A., AND R. LAWSON. 1994. Phylogenetic relationships of the garter snakes based on DNA sequence and allozyme variation. Biol. J. Linn. Soc. 53:209–229.

Source for Skin Toxins in Dendrobatids

Prey items have long been suspected of being the source of skin alkaloids found in dart-poison frogs, but conclusive proof was lacking. In a series of experiments John Daly and colleagues have shown that insect prey are the source of some, if not all, toxic skin alkaloids in these frogs. In the first paper, frogs were fed a diet of either fruit flies or native leaf-litter arthropods for a period of seven months. Skin alkaloids were virtually absent among control frogs, but abundant in frogs raised on leaf-litter arthropods. In the second paper, captive frogs were fed fruit flies dusted with various alkaloids, or ants (*Monomorium pharaonis*). The frogs were able to accumulate most of the skin alkaloids and store them for extended periods, although some toxins were not accumulated.

DALY, J. W., H. M. GARRAFFO, T. F. SPANDE, C. JARMILLO, AND A. S. RAND. 1994. Dietary source for skin alkaloids of poison frogs (Dendrobatidae)? J. Chem. Ecol. 20(4):943–955.

DALY, J. W., S. I. SECUNDA, H. M. GARRAFFO, T. F. SPANDE, A. WISNIESKI, AND J. F. COVER, JR. 1994. An uptake system for dietary alkaloids in poison frogs (Dendrobatidae). Toxicon 32(6):657–663.

Bibliography to German Herpetological Publications

The Deutsche Gesellschaft für Herpetologie und Terrarienkunde (German Society for Herpetology and Herpetoculture) recently published an index to the German publications *Salamandra, Elaphe, Elaphe N.F., Herpetofauna, Sauria,* and *Bücher*. Citations are taxonomically cross-referenced. For more information contact Andreas Mendt, DHGT, Postfach 1421, Locher Str. 18, D-53351 Rheinbach, Germany.

DEUTSCHE GESELLSCHAFT FÜR HERPETOLOGIE UND TERRARIENKUNDE. 1994. DGHT Bibliotheksverzeichnis. Deutsche Gesellschaft für Herpetologie und Terrarienkunde e. V., Rheinbach, Germany, 91 pp.

Biodiversity & Conservation

The status of the Texas horned lizard (*Phrynosoma cornutum*) was examined through field surveys of sites selected based on museum specimen records and through interviews and surveys completed by 700 Texans. The study found that *P. cornutum* has declined in eastern and central Texas, while populations appear healthy in west Texas. Declines were linked more to habitat alteration and pesticides than to introduced fire ants. This papers presents a relatively quick way to collect information on long-term population trends for conspicuous species.

DONALDSON, W., A. H. PRICE, AND J. MORSE. 1994. The current status and future prospects of the Texas horned lizard (*Phrynosoma cornutum*) in Texas. Texas J. Sci. 46(2):97–113.

Amphibian Declines

The status of amphibian populations in the Commonwealth of Independent States is reviewed in a paper appearing in the journal *Alytes*. The paper includes a table summarizing causes of declines for 25 species as well as an important list of Russian literature.

KUZMIN, S. L. 1994. The problem of declining amphibian populations in the Commonwealth of Independent States and adjacent territories. Alytes 12(3):123–134.

The Koordinationsstelle für Amphibien- und Reptilienschutz in der Schweiz (Coordination Center for the Protection of the Amphibians and reptiles in Switzerland) has completed an assessment of approximately 8000 amphibian spawning sites. Using a formula to evaluate each site, 891 sites were determined to be of national importance. This study presents many ideas which may be useful for other amphibian management programs.

BORGULA, A., P. FALLOT, AND J. RYSER. 1994. Inventar der amphibienlaichgebiete von nationaler bedeutung [An inventory of the amphibian breeding sites of national importance in Switzerland]. Schriftenreihe Umwelt - Natur und Landschaft (233):1–75.

A New Lissamphibian Lineage

An analysis of the first complete albanerpetontid amphibian (including traces of skin and possible male courtship glands) support the recognition of a distinct lissamphibian lineage. These salamander-like amphibians are suspected to be the sister group to Caudata and Salienta. A new genus and species are also described.

MCGOWAN, G., AND S. E. EVANS. 1995. Albanerpetontid amphibians from the Cretaceous of Spain. Nature 373:143–145.

Chameleon Eyes

Chameleons have long been recognized for their ability to move their eyes independently, but a recent study indicates chameleon eyes are structurally different than those of all other vertebrates. Not only do chameleons have higher image magnification than any other vertebrate eye scaled to the same size, their lens has a negative refractive power.

OTT, M., AND F. SCHAEFFEL. 1995. A negatively powered lens in the chameleon. Nature 373:692–694.

LAND, M. F. 1995. Fast-focus telephoto eye. Nature 373:658–659.

Herpetozoa

The Österreichische Gesellschaft für Herpetologie (Austrian Society for Herpetology) publishes the journal *Herpetozoa*. Original articles, reviews, notes, and book reviews in either English or German are considered for publication. Membership dues are $35 (ATS 350, DM 50), regular members or $70 (ATS 700, DM 100), sustaining members (VISA cards are accepted). More information may be obtained by writing ÖGH, Naturhistorisches Museum Wien, Herpetologische Sammlung, Burgring 7 - Postfach 417, A-1014 Wien, Austria. The contents of a recent issue are:

GARIBOLDI, A., AND M. A. L. ZUFFI. 1994. Notes on the population reinforcement project for *Emys orbicularis* (Linnaeus, 1758) in a natural park of northwestern Italy (Testudines: Emydidae) [Bemerkungen zu populationsstützenden maßnahmen für *Emys orbicularis* (Linnaeus, 1758) in einem Naturpark Nordwestitaliens (Testudines: Emydidae)]. Herpetozoa 7(3/4):83–89.

CAPULA, M., L. LUISELLI, L. RUGIERO, AND E. FILIPPI. 1994. A field experiment on the selection of basking sites by *Emys orbicularis* (Linnaeus, 1758) (Testudines: Emydidae) [Ein Feldexperiment zur Sonnplatzwahl von *Emys orbicularis* (Linnaeus, 1758) (Testudines: Emydidae)]. Herpetozoa 7(3/4):91–94.

NECAS, P. 1994. Bemerkungen zur Chamäleon-Sammlung des Naturhistorischen Museums in Wien, mit vorläufiger Beschreibung eines neuen Chamäleons aus Kenia (Squamata: Chamaeleonidae) [Notes on the chameleon collection of the Museum of Natural History in Vienna, with a preliminary description of a new chameleon from Kenya (Squamata: Chamaeleonidae)]. Herpetozoa 7(3/4):95–108.

CABELA, A., AND L. GIROLLA. 1994. Die Erstbesiedlung des Marchfeldkanals durch Amphibien (Amphibia; Wien, Niederösterreich) [The colonization of the Marchfeldkanal by amphibians (Amphibia; Vienna, Lower Austria)]. Herpetozoa 7(3/4):109–138.

GRILLITSCH, H., AND F. TIEDEMANN. 1994. Die Grottenolm-Typen Leopold Fitzingers (Caudata: Proteidae: *Proteus*) [Leopold Fitzinger's types of the Olm (Caudata: Proteidae: *Proteus*)]. Herpetozoa 7(3/4):139–148.

SCHWEIGER, M. 1994. Erstnachweis von *Elaphe longissima* (Laurenti, 1768) für die zentrale Osttürkei (Squamata: Serpentes: Colubridae) [First record of *Elaphe longissima* (Laurenti, 1768) from eastern Central Turkey (Squamata: Serpentes: Colubridae)]. Herpetozoa 7(3/4):149–151.

WALDER, C. 1994. Ein neuer Fundort der Kreuzkröte, *Bufo calamita* Laurenti, 1768, in Österreich (Anura: Bufonidae) [A new record of the natterjack toad, *Bufo calamita* Laurenti, 1768, in Austria (Anura: Bufonidae). Herpetozoa 7(3/4):153–154.

TIEDEMANN, F. 1994. 10 Jarhe Österreichische Gesellschaft für Herpetologie. Herpetozoa 7(3/4):155–156.

ARTICLES

Distribution and Abundance of *Emoia slevini* (Scincidae) in the Mariana Islands

The Mariana Islands have a depauperate oceanic herpetofauna (Rodda et al. 1991) and the only endemic reptile is *Emoia slevini* (Brown and Falanruw 1972). The range given for this species in a recent revision (Brown 1991), was simply, the Mariana Islands. Recent information (Rodda et al. 1991) indicated that this species has not been recorded from all islands in the Mariana archipelago. Rodda et al. (1991) summarized the distribution of *E. slevini* and listed this species as occurring on six (Cocos, Guam, Rota, Tinian, Alamagan, and Asuncion) of the 14 islands that have been herpetologically surveyed. They also predicted, based on a species richness/island-size relationship, that *E. slevini* should occur on an additional three islands (Anatahan, Pagan, and Agrihan).

Prior to 1988, lizards in the Mariana Islands were collected by hand or rubberband. Since then, the use of adhesive boards (Bauer and Sadlier 1992; Rodda et al. 1993) has largely replaced these traditional collecting techniques for diurnal lizards and provided a mechanism to estimate relative abundances. Many of the islands in the Mariana archipelago have been surveyed using this technique and three islands (Cocos, Alamagan, and Asuncion) have had *E. slevini* recorded by this method. In order to assess possible population density differences between these islands, we used catch-per-unit-effort (CPUE) data based on mean number of *E. slevini* captured per daylight trap-hour (Rodda et al. 1993).

Asuncion is represented by a single specimen collected in 1988. Additionally, Falanruw (1989) observed three large *E. slevini* (date uncertain but probably mid-1970's) and a probable clutch of eggs in 1975 on Asuncion. Alamagan is represented by 21 specimens collected in 1988. Tinian has a single specimen collected in 1946, and Rota, two specimens collected in 1945. Recent surveys on both Tinian and Rota (Wiles et al. 1989; 1990) failed to document this species, but in 1991, T. Case (pers. comm.) observed two probable *E. slevini* on Rota. Guam is represented by a single specimen collected in 1945 and extensive surveys between 1984 and the present have failed to yield any further specimens. Between 1970 and 1980, 27 specimens (23 of which were in the type series) were collected on Cocos. Between 1988 and 1993, an additional 9 specimens were collected, yielding a total for the island of 33. The total number of specimens for the Mariana Islands is 59.

Recently, *E. slevini* has been collected from three islands in the Mariana archipelago (Cocos, Alamagan, and Asuncion). Historical records extend this range to an additional three islands (Guam, Rota, and Tinian), but, with the exception of two sight records on Rota, recent surveys suggest that this species may be extinct on these islands. Recent vulcanism on two islands with predicted populations (Anatahan and Pagan) may have eliminated populations there. On the islands with known extant populations, Alamagan appears to have the densest population, and Cocos, the least dense.

In addition to a much higher CPUE (Fig. 1) for Alamagan, an additional line of evidence suggesting that *E. slevini is* more abundant on Alamagan than other sampled islands is the proportion of the total catch that was *E. slevini*. On Alamagan this was approximately 20%, compared to 8% (Asuncion) and 1% (Cocos). We interpret these data as Alamagan having a denser population of *E. slevini* than the other two islands. Reasons for this abundance on Alamagan may be related to a large feral ungulate population that deposits substantial quantites of dung, thereby supporting an enormous dipteran population.

A factor that could influence abundance of *E. slevini* may be the richness of the diurnal lizard community on these islands. Including *E. slevini*, Cocos has six species of scincids, and Alamagan and Asuncion each have three scincids. While the greater number of scincid species on Cocos Island may account for lowered abundance of *E. slevini*, the greater abundance of *E. slevini* on Alamagan compared to Asuncion (see Fig. 1 and above) may not be due to differences in scincid community richness.

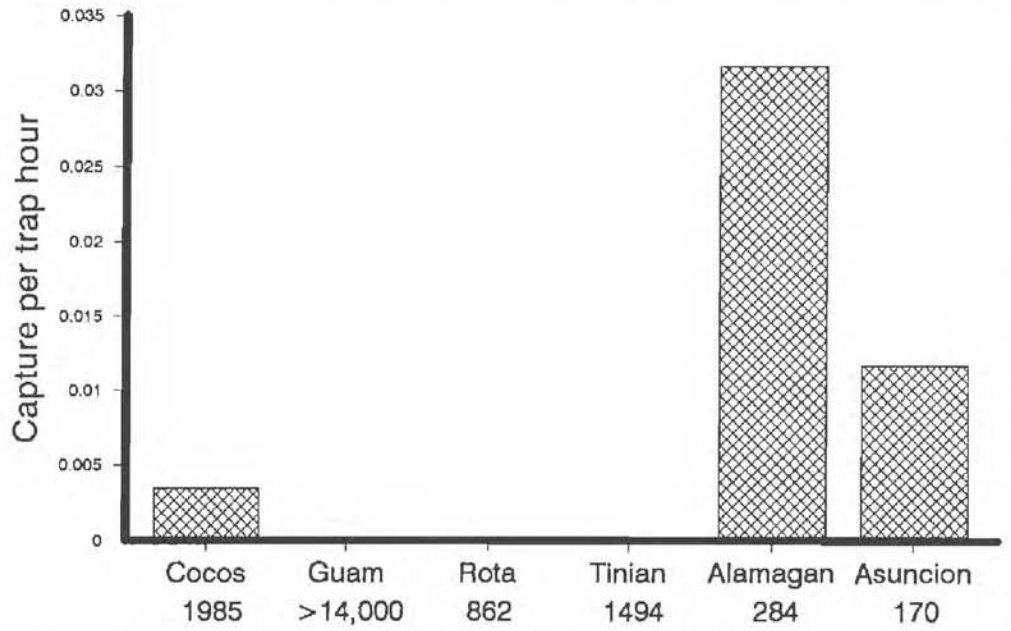
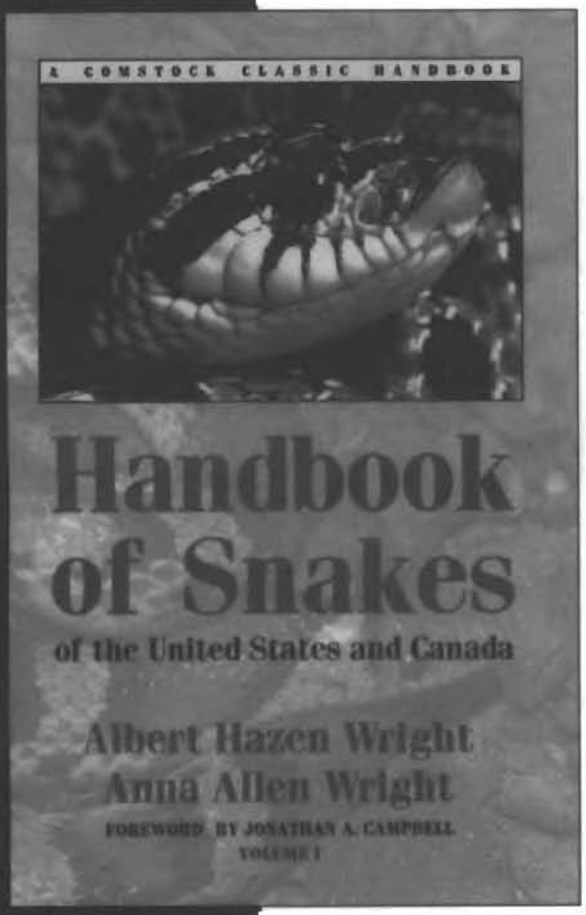


FIG. 1. Mean number of *Emoia slevini* captured per daylight trap/hour (CPUE) 1988–1993 for islands from which specimens have been collected. Numbers below each island name are trap-hours expended. Islands are arranged geographically (S to N). Effort for Rota includes trapping reported in Wiles et al. (1990).

The status of populations on the other three islands in the Marianas where *E. slevini* has been recorded (Guam, Rota, and Tinian) is problematical. The Guam population is likely extirpated as in excess of 14,000 trap-hours have been expended since 1988 in various habitats and no further specimens have been collected. Rota appears to have very low population densities or highly localized populations. The Tinian population may be extirpated or have, as yet undiscovered, localized populations similar to Rota.

Reasons for the decline of or failure to develop denser populations on Guam, Rota, and Tinian are enigmatic. It has been suggested that introduced species have negatively impacted *E. slevini* (Rodda et al. 1991), but the patchy presence of potentially detrimental introduced species does not cor-

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relate with known distributions of *E. slevini*. *Carlia* cf. *fusca* (an aggressive kleptoparasitic skink), *Suncus murinus* (a shrew), and the colubrid *Boiga irregularis* (a skink predator), occur on Guam. Dates of introduction on Guam of these species (*C.* cf. *fusca*, mid-1960's, McCoid [1993], Rodda and Fritts [1992]; *S. murinus*, 1953, Barbehenn [1962]; *B. irregularis*, late 1940's, Rodda et al. [1992]) occurred after the capture of the only specimen of *E. slevini*. However, during the period that these introduced species irrupted (1950–1985), few herpetological surveys were conducted. *Carlia* cf. *fusca* was probably introduced on Cocos in the late 1980's and is currently sympatric with *E. slevini* in forested areas. Both *S. murinus* and *B. irregularis* have not been introduced on Cocos. On Rota, *C.* cf. *fusca*, *S. murinus*, and *B. irregularis* are absent, but *E. slevini* is still rare. On Tinian, *B. irregularis* is not present, but *C.* cf. *fusca* and *S. murinus* are. No discernable pattern of introduced species having island-wide effects on populations of *E. slevini* is evident.

The relationship between *E. slevini* and its habitat requirements is obscure. It has been suggested that habitat alterations related to human activities may have played a role in the current intra-island distributional patterns of reptiles in the Mariana Islands (Wiles et al. 1989). On Alamagan and Asuncion, many specimens have been collected or observed in forested ravines. On Cocos, all specimens have come from a forested area. While it is certain that agricultural and destructive practices associated with WWII have affected the intra-island ranges of various species of lizards in the Marianas, sufficient primary and relatively undisturbed secondary habitats remained that should have allowed the persistence of *E. slevini*. At a minimum, at least 5% (2700 ha) of Guam remains as tall forest and substantial tracts adjacent to the only site of collection for *E. slevini* still exist. Tinian has approximately 5% (500 ha) of tall forest at present (Wiles et al. 1989). Rota has approximately 60% (5000 ha) of tall forest at present (Wiles et al. 1990). These areas contrast with the persistence of this species on Cocos with an area of 37 ha. Cocos Island has endured the development of a coconut plantation prior to WWII, construction of a U.S. military installation (formerly occupying approximately 1/4 of the island), two resorts (occupying a total of 1/2 the island), and at least three typhoons since 1949 that have overwashed the island (Neubauer and Neubauer 1981; per. obs.). Only about 1/4 of the island remains as regenerated atoll forest. This suggests that *E. slevini* may be able to persist (and rebound) after significant environmental perturbations, whatever the causes.

The total surface area of islands occupied by the species is less than 1900 ha (Alamagan = 1130 ha, Asuncion = 730 ha, Cocos = 37 ha). If preferred habitats are relatively undisturbed forested areas, then the actual range might be considerably less. The low population density and extremely limited distribution of the Cocos Island population (9 ha of forest) suggest that this population may be vulnerable to extirpation.

Acknowledgments.—Portions of this investigation were supported by the Endangered Species Conservation Program, Project E4 (to Guam). Ted Case generously contributed observations. Rebecca Hensley and Walter C. Brown kindly reviewed drafts of the manuscript. Robert Cruz, Earl Campbell III, and Rebecca Hensley aided in surveys on Cocos Island.

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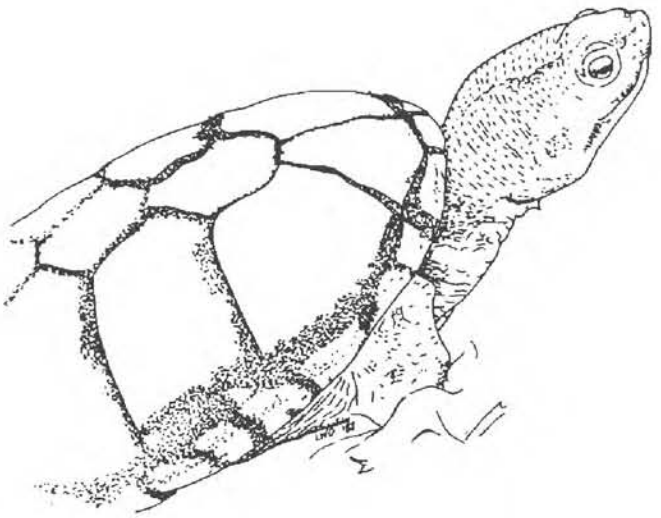
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MICHAEL JAMES MCCOID*
Division of Aquatic and Wildlife Resources
P.O. Box 2950 Agana, Guam 96910, USA

GORDON H. RODDA
National Biological Survey
4512 McMurry Avenue
Fort Collins, Colorado 80525-3400, USA

and
THOMAS H. FRITTS
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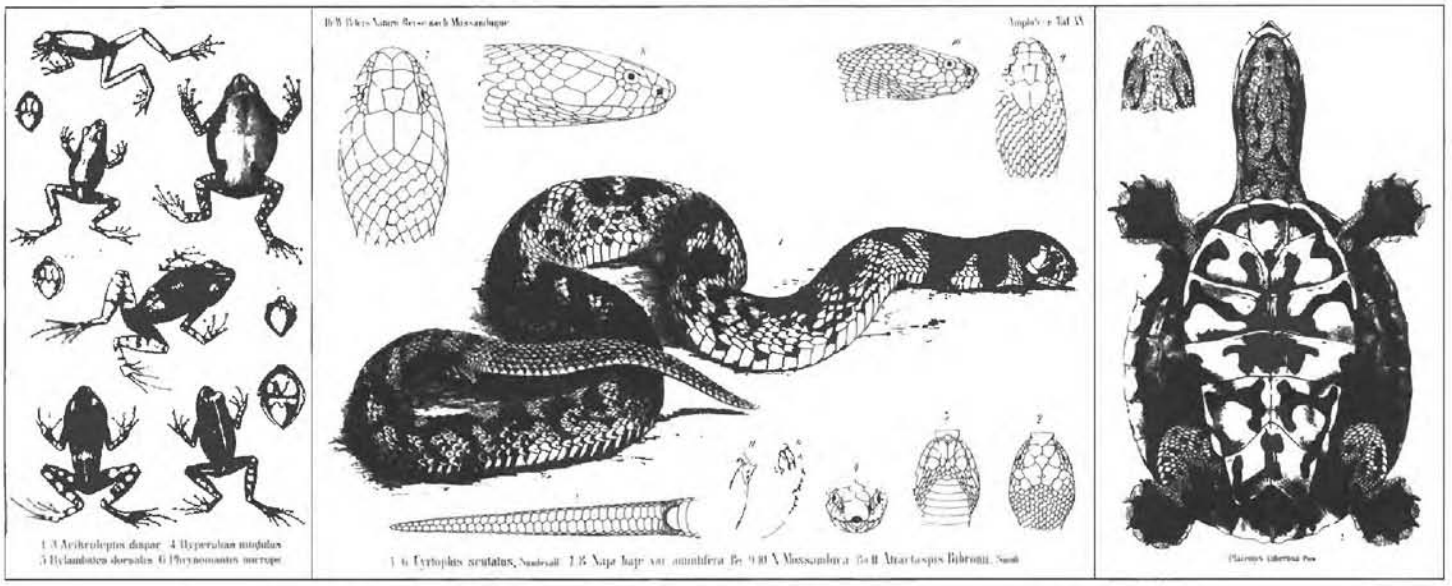
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Sumichrast's Skink (*Eumeces sumichrasti*) in Quintana Roo, México: A Correction

In 1963 (McCoy and Miller 1963) I reviewed the distribution of the Neotropical lowland skink *Eumeces sumichrasti* (Cope), and reported the first locality record for the species from the northern part of the Yucatan Peninsula, México. That locality, which was reported as X-can, Quintana Roo, was erroneously placed in Yucatan by Smith (1992:151) on the basis of information in Flores Villela and Gerez (1988:216–217). The confusion resulted from duplication of the place name X-can, which is a common problem when dealing with Mexican localities. In this case, however, the history of the story of the two X-cans, which was related to me by E. C. Welling M. (pers. comm.), is as follows.

The original village of X-can, Yucatan was a long-established trading center in the isolated northeastern part of the Yucatan Peninsula. When the Territory of Quintana Roo was created in 1902 from the eastern section of the state of Yucatan, the boundary was placed west of X-can, thus X-can was in Quintana Roo. This suited the villagers perfectly. The Yucatec Maya are fiercely independent people and the territorial capital (Ciudad Chetumal) was many kilometers to the south and relatively inaccessible. During the 1950's the solution of territorial disputes between the State of Campeche and the Territory of Quintana Roo resulted in realignment of the boundary between Yucatan and Quintana Roo (Dundee 1985). The realigned boundary was east of X-can, placing the village again in the State of Yucatan. With the advent of paved highways, constructed in the interim, X-can was conveniently accessible from the capital city of Merida. This was unacceptable to some of the residents of X-can, Yucatan, so they moved back across the territorial line and founded a new village, Pueblo Nuevo de X-can. X-can Nuevo lies at the junction of Mexican Highway 180, which runs from Merida to Puerto Juarez, and the highway south to Tulum.

The *Eumeces sumichrasti* that I reported (McCoy and Miller 1963) was collected at X-Can Nuevo, Quintana Roo. Hence the species should be removed from the Yucatan faunal list, where it would not be expected to occur on ecological grounds. The only record for Campeche (Velasco 1895) is unsupported by specimens, although the species surely occurs in the evergreen rainforest in the southern part of that state. X-can Nuevo remains the only known locality for the species in the northern Yucatan Peninsula (J. C. Lee, pers. comm.). Whether it represents a disjunct population, as mapped by Lee (1980:Fig. 20), cannot be determined without further collecting effort in the intervening area.

Smith (1992) also questioned the record of *Eumeces sumichrasti* from Xalapa, Veracruz (Boulenger 1887), as the species typically occurs in lowland forest habitats, usually below 300 m elevation. A specimen in the Carnegie Museum of Natural History (CM 43544) from Atoyac, Veracruz, ca. 500 m elevation, documents an inland occurrence in Veracruz. Undoubtedly the range of the species extends inland along river valleys, wherein tropical forest habitats penetrate the xeric uplands.

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C. J. McCOY*
Section of Amphibians and Reptiles
Carnegie Museum of Natural History
Pittsburgh, Pennsylvania 15213, USA.

* *deceased.*

Field Observation of Predation on Bennett's Tree-kangaroo (*Dendrolagus bennettianus*) by an Amethystine Python (*Morelia amethistina*)

The amethystine python (*Morelia amethistina*) is found in Australia (North-east Queensland), the islands of Torres Strait and New Guinea. It is the largest member of the family Boidae in the region with specimens in excess of 8 m reported (Cogger 1992; Shine 1991). There have been no systematic field studies of this species. From museum and captive studies, as well as incidental field observations, it is alternatively reported to feed on a wide variety of vertebrates (Cogger 1992) or on mammals exclusively (Shine 1991). In a field study of Bennett's tree-kangaroo (*Dendrolagus bennettianus*), one individual amethystine python was potentially a significant predator of the study population and this communication reports the details of this predation.

Dendrolagus bennettianus is sexually size dimorphic, with adult male body mass up to 14 kg and females up to 10.5 kg, and the largest arboreal mammal found in Australia's tropical rainforests. It has an extremely restricted distribution, occurring only in the closed forests of an area of less than 4,000 km^2 between the Daintree River and Cooktown in Far North Queensland. The general biology of tree-kangaroos is poorly known and the main aim of this study (Martin 1992) was to investigate the diet and habitat requirements of *Dendrolagus bennettianus* which was regarded as a rare and possibly endangered species. The field study was conducted at Shipton's Flat (15°48', 145°14'), about 40 km south of Cooktown, in a 36 ha study area in lowland vineforest (240 m above sea level). This region is on the drier, northwestern fringe of Australia's major tropical rainforest belt and much of the closed forest here occurs in small patches, usually surrounded by open woodlands dominated by *Eucalyptus* species. For a more comprehensive description of the area see Martin (1992). In this area *Dendrolagus bennettianus* was found to be predominantly nocturnally active and to have a largely folivorous diet. Diurnally, it was extremely cryptic and spent most of the day sitting high up in the canopy, usually concealed in vines.

The first python kill of a study animal occurred during the night of 1 December 1990, sometime after 2200 h. The *D. bennettianus* killed, a juvenile female weighing 2.1 kg, had been captured and fitted with a radio collar 12 days earlier. It had been monitored from this time with its position and activity determined once every 12 h. On 2 December its radio signal was tracked to an engorged amethystine python lying under the dead foliage of a recently

fallen tree on the edge of the closed forest. A *Aidia racemosa*, a preferred food tree species of *D. bennettianus*, was nearby and its heavily scratched trunk indicated that it was being regularly visited by tree-kangaroos. In this area *D. bennettianus* are in the habit of moving each night from their daytime roosts, which are usually large trees towards the center of their home ranges, to feed in preferred food trees, many of which are located near the edge of the closed forest. Slip and Shine (1988) reported that the diamond python (*Morelia spilota spilota*) is an ambush predator that takes mammalian prey by sitting and waiting beside frequently used trails or, in the case of arboreal prey, in the forks of frequently used trees. *Morelia amethistina* probably hunts in a similar manner and this juvenile *D. bennettianus* was possibly taken either in or at the base of this *A. racemosa* feed tree.

The *M. amethistina* was 3.3 m in total length and had a mass of 10.5 kg. Sex was not determined. When closely examined it was found to have a recent, but partially healed laceration, approximately 150 mm long, across its throat. It looked like a rip from a claw, but it wasn't sufficiently fresh to have been inflicted by the juvenile tree-kangaroo. Subsequent events suggested that it may have been inflicted by the mother of this juvenile, who may have been killed by the same python.

Female *D. bennettianus* and their young usually remain together until the young are sub-adults in excess of 5 kg in body weight. Adult male *D. bennettianus* are predominantly solitary and usually only come into contact with juveniles when consorting with adult females. However, at the time the juvenile *D. bennettianus* was first captured it was accompanied by an adult male. It was too small to be independent and it was assumed that its mother had died. After its release the juvenile moved widely through the closed forest—presumably through its mother's former range (Fig. 1 shows the 95% isopleth of the harmonic mean home range). However, it did not reunite with an adult female. The failure of this juvenile to find its mother, the recent lacerations on the throat of the *M. amethistina*, and its location within the same area all combine to suggest that the mother may also have been killed by this python a few weeks earlier.

Morelia amethistina has a narrow pyloric sphincter and the radio-transmitter ingested with the juvenile tree-kangaroo remained lodged in the stomach of the python. This enabled me to locate it almost daily for 44 days, from 2 December 1990 until 15 January 1991 (Fig. 1). The snake divided its time about equally between the open and closed forest, with three periods of substantial inactivity. When active it moved between 109 and 348 m each day (mean = 190 m, SE = 73.6, N = 12). The day after it was first located the python moved a short distance (36 m)—possibly as a result of it being disturbed when it was handled for weighing and measuring. It remained substantially inactive for the following 8 days (2–9 December), either coiled on the ground or in the canopy. It then moved through the open forest for several days before becoming inactive under the base of a large dead tree for 9 days (17–26 December). During this time it may have been

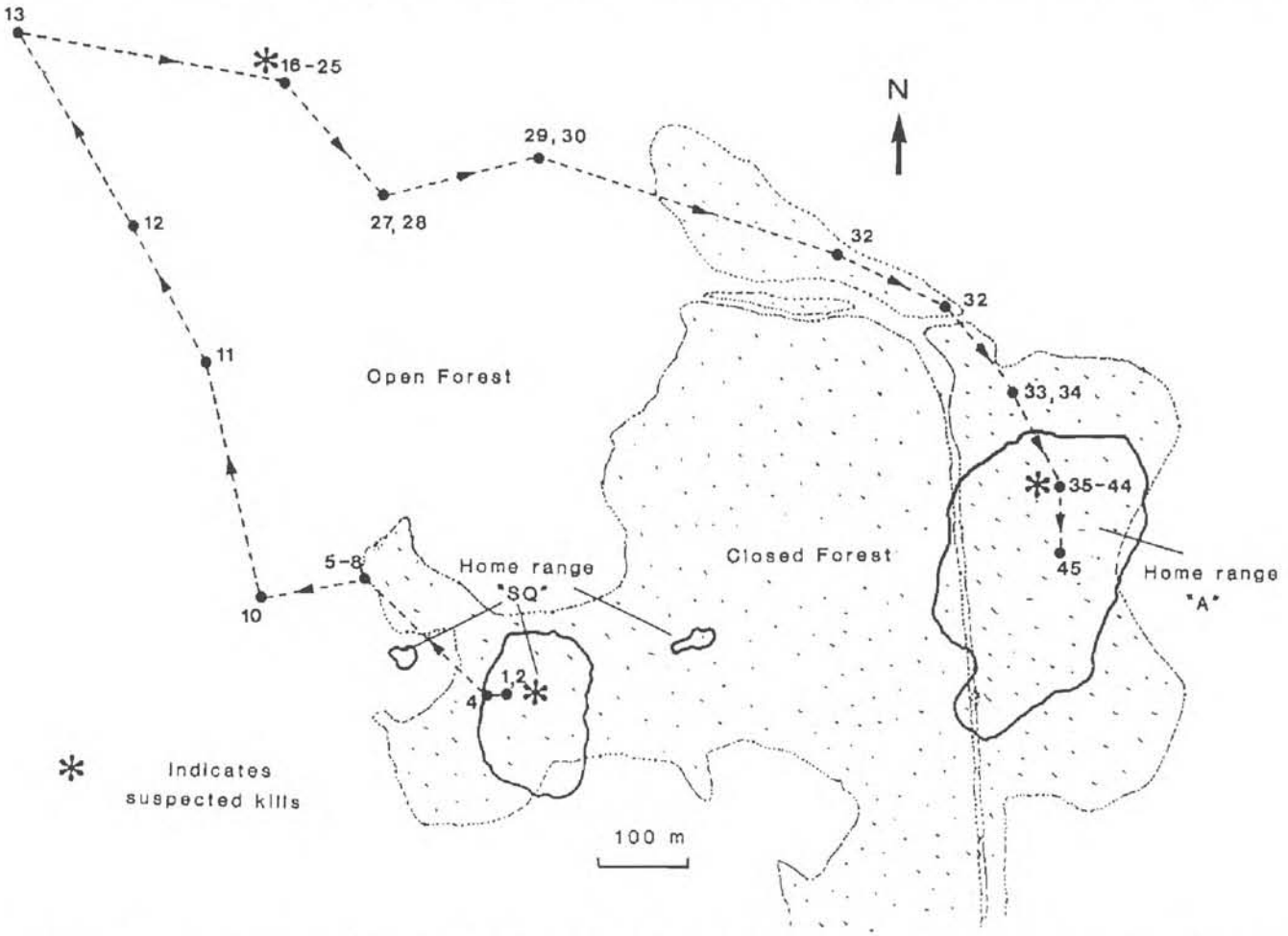


FIG. 1. Map of the study area showing the route of the python after it ingested the juvenile tree-kangaroo. The daily locations of the python are depicted as numbered points, the numbers indicating the days elapsed since it ingested the first tree-kangaroo ("Sq"). The heavy dashed line linking these points is the shortest distance between them and indicates the general direction of movement of the python but not its actual route. The area of closed forest is marked with light stippling. The boundaries of the home ranges areas (represented by the 95% isopleth of the harmonic mean) of the two tree-kangaroos taken ("Sq" and "A") are indicated by a solid line.

digesting prey it had taken in the open forest, but it was not possible to examine the python to confirm this. On 2 January it re-entered the closed forest, and by 5 January it had moved into the center of the home range of another radio-collared study animal—an adult female *D. bennettianus* accompanied by her juvenile male young (Fig. 1). This juvenile was not fitted with a radio collar. The *M. amethistina* remained in this location, inactive in the canopy, for 8 days (5–13 January). It could not be seen during this time, but its radio signal suggested that it was either in, or close by, a large specimen of *Castanospermum australe* that was frequently used as a daytime roost by the resident female tree-kangaroo and her young. This female and her young were not observed between 4 January and 8 January because of difficult weather conditions associated with an incoming cyclone. When last seen on 4 January the juvenile was still with the mother, but it was not seen again after this. It is conjectured that this animal was killed and eaten by the python on 5 January.

On 15 January the python was captured and held captive for several weeks until a veterinary surgeon could be found who would operate and remove the radio transmitter from its stomach. Some mammalian hair was found in the stomach during surgery, but most of it was caught up around the collar and possibly belonged to the first tree-kangaroo killed. After the stitches were removed and it had fully recovered and was feeding again, the python was released back into the wild.

While it has been reported that *M. amethistina* prefer mammalian prey (Shine 1991), smaller individuals are notorious predators of domestic poultry in this region and probably prey on all endotherms. Other mammalian species known to be taken by amethystine pythons in this area include agile wallabies (*Macropus agilis*), bandicoots (*Isodon macrourus* and *Perameles nasuta*), spectacled fruit bats (*Pteropus conspicillatus*) (C. Roberts, pers. comm. 1991) and common striped possums (*Dactylopsila trivigata*) (Handasyde and Martin, unpubl.). The *M. amethistina* monitored in this study possibly had a significant impact on tree-kangaroo recruitment. Of only four pouch-young known to be born in the study area during 1989-90, one was eaten and another suspected to have been eaten. In addition the mother of one of these juveniles also may have been killed by the same python. While the evidence is largely circumstantial, the observations suggest that large *M. amethistina* have the potential to have an impact on the abundance of tree-kangaroos in lowland rainforest.

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ROGER W. MARTIN
Department of Ecology and Evolutionary Biology
Monash University
Clayton, Victoria 3168
Australia

POINTS OF VIEW

Parsimony

There is much to respond to in Pritchard's (1994) polemic entitled "Cladism: The Great Delusion." His treatment of parsimony is especially egregious, and I limit my remarks to that topic. Pritchard's (1994:105–6) criticisms are: (1) most parsimonious cladograms are unrealistic because they are always divergent—none shows lineage reticulation that might represent the formation of new species from interspecific hybridization; (2) the parsimony method does not take into account "prior knowledge" of the probability of homoplasy; (3) "good zoogeographic judgment" is not used as evidence; (4) independent evolution is so extensive in some groups (he cites Testudinidae) that a cladogram would collapse into an unresolved hypothesis of species relationships; (5) the use of parsimony in historical inference assumes independent evolution is rare. I answer these claims seriatim.

(1) It is true that cladograms are almost always presented as divergent hypotheses, because that pattern is sufficient to minimize hypotheses of homoplasy (convergence, parallelism and evolutionary reversal), except where necessary (see item 5b below). However, contrary to Pritchard's assertions, cladistic hypotheses can be reticulate, and cladists accept the notion of an interspecific hybrid origin of some species (e.g., Frost and Wright 1988; Humphries 1983; McDade 1990, 1992; Nelson 1983; Wanntorp 1983).

(2) The issue of "knowledge" of the probability of homoplasy can be taken into account by differential character weighting, either *a priori* or *a posteriori* (Farris 1969; Kluge and Farris 1969). In general, however, cladists tend to be cautious in making these kinds of knowledge claims because the empirical and theoretical justifications for them are often weak.

(3) That "good zoogeographic judgment" is not used as evidence is not a criticism of parsimony. Various classes of potential evidence are used in cladistic parsimony analyses, and the decision to exclude certain sources is defended on grounds other than having to do with parsimony (e.g., Kluge 1993; Kluge and Wolf 1993; see also item 5 below). For example, the age of origin of species, as might be inferred from the fossil record, is not employed ordinarily as evidence of phylogenetic relationships because temporal order could not then be used as an *independent* test of those relationships (Gauthier et al. 1988:188–190).

(4) The issue of homoplasious evolution being so extensive that it results in a completely polytomous most parsimonious hypothesis of relationships is an empirical question that can (and should) be looked at seriously. Indeed, if the Testudinidae cladogram is completely unresolved then one could conclude that parsimony has been useful in documenting that extraordinary case (see item 5e below). Until such research has been done we can only wonder about the evidentiary basis for Pritchard's assertion.

(5) According to Farris (1979, 1980a,b, 1982a,b, 1983, 1985, 1989:107; Farris and Kluge 1985, 1986), *in seeking the most parsimonious cladogram(s) for a data set of synapomorphies, requirements for ad hoc hypotheses of homoplasy are minimized, and it is on such a cladogram that explanatory power is maximized.* This justification for parsimony is widely accepted by cladists; however, important aspects of the arguments are often overlooked (e.g., Pritchard 1994), and I recount some of those details.

a. A cladogram by *itself* does not deductively imply the synapomorphic states of a character are homologous, even when

those shared-derived similarities are perfectly consistent with a hypothesized pattern of sister group relationships. A cladogram as a premise, and a consistent synapomorphy as a premise, does not lead necessarily to the conclusion of homology, because the two premises are not conjoined logically in that regard. Consider that a character with 110 distributed states does not have to be homologous even if cladogram (A,B)C is true.[1] Alternatively, however, a cladogram by *itself* does deductively imply homoplasy. To be convinced of this conclusion, consider character 011 in relation to cladogram (A,B)C. The observed distribution of state one in B and C can only be understood historically as independent evolution. Thus, one can see from this asymmetry in understanding why it is reasonable to bring parsimony to bear on the inference of homoplasy, but not on homology.[2] Of course, that a cladogram can deductively imply homoplasy does not mean that the phylogenetic hypothesis actually explains in some deeper evolutionary sense the basis for an inconsistent similarity—it only says that such a similarity is *coincidental* to (independent of) common ancestry.

b. Choosing the shortest length (most parsimonious—Kluge and Farris 1969) cladogram for a given data set, and using parsimony to optimize (minimize) the number of steps on that cladogram, are justified scientifically because explanations of homoplasy are understood to be *ad hoc*. *Ad hoc* hypotheses are to be avoided, because "[s]cience requires that choice among theories be decided by evidence, and the effect of an ad hoc hypothesis is precisely to dispose of an observation that otherwise would provide evidence against a theory. If such disposals were allowed freely, there could be no effective connection between theory and observation, and the concept of evidence would be meaningless" (Farris 1983:17). The *ad hoc* nature of homoplasy is of special concern in phylogenetic inference, because independent evolution can explain all manner of synapomorphy patterns, both those consistent and inconsistent with a cladogram (see 5a above).

c. As underscored above, the discovery of a cladistic hypothesis begins with minimizing requirements for *ad hoc* hypotheses of homoplasy for a given matrix of synapomorphies, and it concludes with explanatory power being maximized (Farris 1983:18). Generally in science, explanatory power is understood to be a function of *theory conforming to observation*, and in phylogenetic systematics the theory is inheritance and the observation is a novel trait shared by two or more groups of organisms. Thus, it is the most parsimonious cladogram that maximally explains shared-derived similarity as due to inheritance, i.e., synapomorphy as homology. Of course, providing such an explanation is no guarantee of accuracy, but then accuracy as it pertains to knowing the *truth* is not an obsession of cladists. Cladists focus on discovering the most rigorously tested and highly corroborated phylogenetic hypothesis, and that is why they seek the most parsimonious cladogram. Those who speculate on hypotheses of species relationships being more or less accurate do not employ parsimony in the sense of Farris (1983)—they judge their efforts according to the plausibility of the evolutionary models they employ in their determinations (Sober 1988).

d. Farris' explanatory power justification for parsimony has been criticized because some believe that it assumes homoplasies are rare in nature (e.g., Pritchard 1994). However, as Farris (1983:13; see also Sober 1988:136) countered long ago, the method of minimizing requirements for homoplasy does not necessarily presume minimality, i.e., rarity of homoplasy. As demonstrated with the example described above, neither hypothesis, (A,B)C or A(B,C), actually claims that homoplasies are rare—a cladogram places only a lower bound (but not an upper bound) on the number of homoplastic events required to explain the data. For example, it is possible to propose an even less parsimonious history for character 011 in relation to cladogram (A,B)C than the single independent origin of state one in B and in C—in fact there might have been indefinitely many such origins in just those two lineages.

e. Farris (1983) further assessed the sensitivity of parsimony to rarity of homoplasy with a more elaborate example. Consider three taxa, A, B and C, described by ten characters with the distribution 110 and one character with the distribution 011. Thus, parsimony requires that character 011 be interpreted as homoplasy in relation to cladogram (A,B)C, but the histories of the ten 110 characters may be judged an open question as regards homology or homoplasy. Alternatively, cladistic hypothesis A(B,C) requires that each of the 110 distributed characters be interpreted as homoplasy, while the 011 character is not interpreted as either homology or homoplasy. Farris (1983:13–14) then argued that if homoplasy were to be rare, it is quite likely that (A,B)C is the species genealogy, because in order for that hypothesis to be false, all ten 110 characters would have to be homoplasious.[3] Alternatively, homoplasy might be abundant, say to the extent that any ten of the eleven characters is homoplasious. In this context, Farris (1983:14) argued that if any one of the eleven characters is homologous, and that it is one of the 110 characters, then the (A,B)C cladogram is a much "better bet" than is the A(B,C) hypothesis. Thus, Farris concluded that as long as homoplasies are less than universal, there is no degree of homoplasy, by itself, sufficient to defend a less parsimonious cladogram over a more parsimonious pattern of sister group relationships. Of course, if homoplasies were to be universal, no inference methodology would be capable of recovering phylogeny.

The above comments cover only the most general aspects of parsimony, and only as they apply to cladistics. I strongly encourage the more philosophically/theoretically inclined readers of this journal to consult other sources on parsimony and the general subject of simplicity (see review by Kluge, 1984). Sober's (1993) short book on the "Philosophy Of Biology" has an excellent chapter on systematics, and his discussion of parsimony and likelihood is especially relevant. For the uninitiated empiricist, there are numerous herpetological examples to study, wherein cladistic methods are rigorously applied, including that of parsimony. One of the best studies that has come across my desk recently is by Crumly (1994), on the turtle genus *Gopherus*. It is a good model for the long overdue study on Testudinidae.

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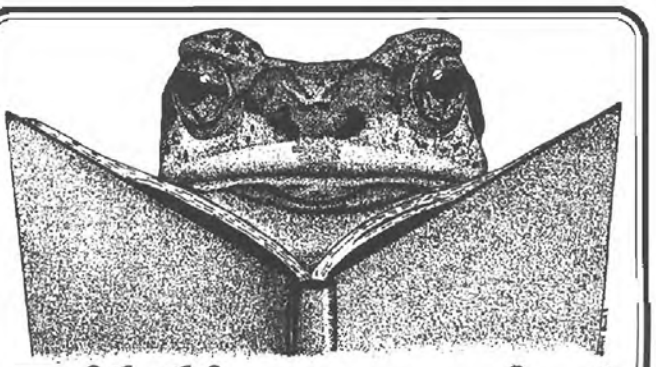
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ARNOLD G. KLUGE
Museum of Zoology
University of Michigan
Ann Arbor, Michigan 48109, USA.

[1] The parenthetic notation is meant to describe relative recency of common ancestry. For example, (A,B)C can be understood to mean that taxa A and B are more closely related to each other than either is to C. Two characters, with state distributions 110 and 011, are used to describe these three taxa. Character state 0 is assumed to be plesiomorphic, state 1 apomorphic (derived). Thus, the synapomorphy, shared-derived similarities, of the first character describes taxa A and B, whereas that of the second character describes B and C.

[2] The failure of induction to make such a distinction illustrates why that form of logic does not apply to phylogenetic inference.

[3] Given the assumption of character independence, the coincidental occurrence of homoplasy in all ten characters is taken to be very unlikely.



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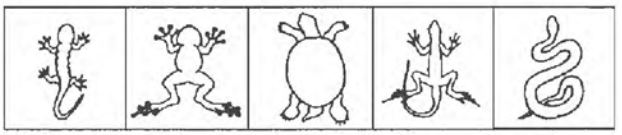


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Phylogenetic Approaches to Classification and Nomenclature, and the History of Taxonomy (An Alternative Interpretation)

Herpetological Review has recently featured a series of papers debating the merits of recent developments in the theory and practice of systematic biology, using herpetological examples. In the latest and longest paper in this series, Pritchard (1994) passionately argued against many of these "cladistic" developments. Here I address three issues raised in his paper that bear directly on my own writings concerning systematic theory and practice. These are: 1) the abandonment of paraphyletic higher taxa, 2) the replacement of the current ("Linnean") system of biological nomenclature, and 3) the significance of these proposals in the context of taxonomic history. Contrary to Pritchard's implications, the proposals in question are not based on arbitrary or illogical cladistic dogma but on well-established evolutionary principles. Moreover, these proposals are not passing fads but manifestations of an important trend in the historical development of biological taxonomy.

Paraphyly.—Pritchard opposes the proposal that groups each consisting of a common ancestor and all of its descendants (monophyletic groups, clades) should be recognized as higher taxa, but that groups each consisting of a common ancestor and only some of its descendants (paraphyletic groups) should not. He argues in favor of recognizing paraphyletic higher taxa—for example, a Reptilia that does not include birds—on the grounds that first, they agree with commonsense vernacular concepts, and second, they are congruent with a particular model of speciation, which he illustrates using a human socioeconomic analogy. All of his arguments, however, overlook some important considerations.

Pritchard's first argument for recognizing paraphyletic higher taxa overlooks the fact that much of scientific progress has consisted of replacing commonsense vernacular concepts with concepts derived from corroborated scientific theories. A few examples of commonsense vernacular concepts that were widely accepted in previous times but have largely been replaced in the face of accumulating data are a flat earth, a geocentric universe, solid matter, fixed continents, immutable species, and a single taxon for both amphibians and reptiles. Evolution is often said to be the unifying theory of biology, and most biologists accept the proposition that taxonomy is to be based on evolution. A fundamental component of the principle of evolution is the proliferation of species from common ancestors. Therefore, equating higher taxa with groups of species sharing a unique and exclusive common ancestry constitutes an evolutionary concept of higher taxa (Hennig 1966). The lack of correspondence between these clades or monophyletic groups and commonsense vernacular concepts of taxa is a poor reason for retaining the latter, and it might even be considered resisting scientific progress.

Pritchard also favors the recognition of paraphyletic taxa based on a model of speciation in which an ancestral species remains unchanged while giving rise to a modified descendant species. He argues that the unmodified ancestral species deserves the same taxonomic designation before and after giving rise to the modified descendant, which deserves recognition as a separate taxon (thus rendering the ancestral species paraphyletic). Pritchard's argument suffers from implicitly extending to higher taxa a model that applies properly to species alone. That is to say, although there are accepted evolutionary processes through which species give rise to other species, there is no known evolutionary process through which higher taxa give rise to other higher taxa of the same or greater rank in the Linnean hierarchy (e.g., Wiley 1979). It is this inflated assignment of categorical ranks that results in paraphyly. For example, assigning both Amphisbaenia and Lacertilia to the rank of suborder renders Lacertilia paraphyletic because it implies that Amphisbaenia is entirely separate from Lacertilia rather than being a subgroup of that taxon. Categorical assignments are made by humans. Therefore, paraphyletic higher taxa owe their existence as much to the human mental process of assigning ranks as to any evolutionary process. Systematists who advocate the elimination of paraphyletic higher taxa do so because they wish to recognize as taxa only those entities resulting entirely from evolutionary processes.

Pritchard uses a sociological analogy to illustrate the supposed rationality of recognizing paraphyletic taxa and, at the same time, the supposed irrationality of cladistic practice. He describes a situation in which a lineage of peasants—let us call it the Bauer clan ("Bauer" is German for "peasant")—produces a daughter who becomes educated and gives rise to a lineage of urban professionals. He argues that cladists would insist nonsensically that the urban professionals be called peasants because they are descended from peasants. This characterization of the cladistic position is erroneous and results from Pritchard's failure to distinguish between socioeconomic classes and genealogical lineages (or more generally, between classes and systems, see de Queiroz 1988). Everyone who makes this distinction, including cladists, will classify the descendants of the educated daughter as urban professionals according to socioeconomic criteria, but they will also realize that the descendants' change in socioeconomic status does not remove them from the Bauer clan. An analogous distinction applies to taxonomy. Consider a situation in which a clade composed of insectivores ancestrally—Squamata, for example—produces a descendant lineage that enters a new adaptive zone and gives rise to a clade of herbivores. As long as a distinction is made between classes based on diet and monophyletic entities, there will be no problem classifying the modified descendants as herbivores while at the same time recognizing that they are part of the squamatan clade.

Nomenclatural Systems.—Pritchard also criticizes a recent proposal to replace the current system of biological nomenclature with one based on evolutionary principles (de Queiroz and Gauthier 1990, 1992, 1994). In his view, this as an example of "contortions forced on cladists by...their own arbitrary rules," which represents "iconoclasm that is unlikely to appeal to anyone except highly theoretical cladists" (p. 105). Furthermore, Pritchard implies that the current system promotes nomenclatural stability and that adoption of the proposed alternative would result in "total sacrifice" (p. 105) of that stability. Although adoption of a phylogenetic system of nomenclature would be radical in some important respects, it would not, contrary to the impression given by Pritchard, produce utter nomenclatural chaos. Indeed, adopting a phylogenetic approach to nomenclature would largely solve problems of nomenclatural ambiguity and instability caused by the current system.

Pritchard blames cladistic doctrine for problems stemming from the nonevolutionary nature of the current nomenclatural system, using recent proposals concerning the nomenclature of acrodontan lizards to illustrate his points. Frost and Etheridge (1989) proposed to unite the families Agamidae and Chamaeleonidae into a single family as a result of their conclusions concerning paraphyly of the family Agamidae. Because "Chamaeleonidae" is the older name in the family group, it becomes the name of the new family-level taxon. As a consequence, many species that were formerly members of the family Agamidae will now belong to the family Chamaeleonidae, and the group of species formerly rec-

ognized as the family Chamaeleonidae will either be left nameless or require a new name. Pritchard supposes incorrectly that this nomenclatural ambiguity and instability stems from the cladistic prescription against paraphyletic taxa. In this particular case, the proposal was indeed intended to eliminate a paraphyletic taxon. Nevertheless, the problem is more general in that it applies to all changes involving the taxonomic practices of lumping and splitting, regardless of motivation. Ironically, Pritchard's paper begins as a defense of an earlier paper by Lazell (1992) that included a proposal to unite the families Agamidae and Iguanidae. Although unification of these families was proposed entirely for traditional reasons, it would result in ambiguity and instability very similar to that generated by the cladistic proposal.

In contrast with the current system of nomenclature, a phylogenetic system would promote unambiguous and stable evolutionary meanings of taxon names. The central issue is the manner in which taxon names are defined. Under the current system, names are implicitly defined in terms of a nonevolutionary principle—the Linnean taxonomic categories. For example, the name "Chamaeleonidae" is defined under the current system as the family level taxon containing the type-genus *Chamaeleo*. This genus, however, is contained within each of several taxa in a nested series (i.e.,...Squamata: Iguania: Acrodonta: Chamaeleonidae: Chamaeleoninae: Chamaeleonini...). Consequently, any change regarding assignment of these taxa to the family category will result in a nomenclatural change (e.g., what was once Acrodonta becomes Chamaeleonidae). Under a phylogenetic system, taxon names would be defined in the explicitly evolutionary terms of ancestry and descent. For example, "Chamaeleonidae" might be defined as the most recent common ancestor of *Chamaeleo* and *Brookesia*, and its descendants. Under such a definition, Linnean categorical assignments are irrelevant, and thus the nomenclatural ambiguity and instability caused by changes in categorical assignment would be eliminated. Consequently, the name "Chamaeleonidae" would remain associated with the clade stemming from the most recent common ancestor of the same set of species that has traditionally been included in that taxon (see de Queiroz and Gauthier 1990, 1992, 1994 for further discussion).

Replacing the current system of nomenclature with a phylogenetic one, or as Pritchard puts it "dumping the Linnean system of nomenclature" (p. 105), would not be as disruptive as he makes it sound. Although the Linnean taxonomic categories would be eliminated, the taxa themselves and their existing names would be preserved. For example, I have already indicated that there would still be a taxon Chamaeleonidae made up of all of the same species; the only difference would be that it would be neither a family nor a member of any other Linnean category. The hierarchical component of taxonomy would also remain intact. That is to say, nested series of taxa such as...Reptilia: Squamata: Iguania: Acrodonta: Chamaeleonidae...and...Reptilia: Testudines: Cryptodira: Chelonioidea: Cheloniidae...would continue to be recognized. Although the assignment of taxa to Linnean categories is an old tradition, it is widely acknowledged that this is a highly subjective and artificial practice. In short, reformulating the nomenclatural system with an evolutionary basis would not only promote nomenclatural universality and stability, it would also preserve most of the structure of existing taxonomies, eliminating only their most questionable component.

The History of Taxonomy.—Pritchard views the developments described above as fads "that may well not survive the decade, let alone the centuries" (p. 105). He likens "the hurricane of cladism" to the "storm of pheneticism" with the hope that "this too shall pass" (p. 109). These characterizations and hopes or predictions fail to take into consideration the history of taxonomy, in particular, the changing role played by the principle of evolution. This history suggests both a very different interpretation of the significance of the developments in question as well as a very different prediction concerning their fate.

The idea that living things are related by common descent gained widespread acceptance over a relatively brief span of time during the latter half of the previous century. The influence of this idea on taxonomic theory and practice, however, was not nearly as pervasive or rapid. Historians and biologists have asserted repeatedly that the concept of evolution had little or no impact on taxonomy, but this generalization is oversimplified. The impact of the concept of evolution on taxonomy, though significant, has been difficult to perceive because several of its important manifestations occurred at different times long after initial acceptance of the concept itself.

Immediately after widespread acceptance of the idea that living things are related by common descent, many aspects of taxonomy became evolutionary in only a superficial sense. Specifically, evolution was granted the role of an after-the-fact justification or interpretation for previously existing taxonomic methods and concepts. Throughout the post-Darwinian history of taxonomy, evolution has been granted an increasingly important role in that discipline in that it has come to function, in one area after another, as a central principle or tenet from which fundamental taxonomic concepts and methods are deduced (de Queiroz 1988).

Various occurrences in the historical development of taxonomy are interpretable as manifestations of this trend. For example, during the middle of the present century, concepts of species in which the principle of evolution played a superficial role were replaced by concepts of species in which that principle played a central role. Specifically, concepts of species as groups of similar organisms were replaced by concepts of species as population lineages. This conceptual shift required the rejection of previously recognized species taxa that consisted of reproductively separate populations. For example, morphologically similar leopard frogs that were formerly considered members of a single species are now considered to make up several cryptic or sibling species (Hillis 1988). The same conceptual shift also required the acceptance of previously unrecognized species taxa for phenotypically distinct groups of organisms that nonetheless formed a single interbreeding population. For example, morphologically dissimilar striped and banded kingsnakes in southern California that were formerly considered separate species are now considered morphs of a single polymorphic species (Klauber 1944; Mayr 1944).

The prescription against paraphyletic higher taxa represents an analogous change. Concepts of higher taxa in which the principle of evolution plays a superficial role are being replaced by concepts of higher taxa in which that principle plays a central role. Specifically, concepts of higher taxa as groups of similar species are being replaced by concepts of higher taxa as clades, groups of species sharing an exclusive common ancestry. This conceptual shift necessitates rejection of previously recognized higher taxa that constitute only parts of clades, that is, paraphyletic higher taxa. The same shift also necessitates the recognition of previously unrecognized higher taxa for groups of dissimilar species that nonetheless form a clade. For example, morphologically dissimilar scaled and feathered amniotes that until recently have been recognized as separate higher taxa are now being considered to form a single higher taxon and one of its subtaxa.

The proposed change regarding the system of nomenclature would extend a central role for the principle of evolution into yet another aspect of biological taxonomy. Under this proposal, a nonevolutionary concept of how the names of biological taxa are defined would be replaced with an explicitly evolutionary one.

Specifically, definitions stated in terms of the Linnean taxonomic categories would be replaced by definitions stated in terms of ancestry and descent. This conceptual shift will necessitate abandoning the Linnean taxonomic categories, but it will also increase nomenclatural clarity, universality, and stability.

In conclusion, a consideration of the historical development of taxonomy suggests an interpretation of recent taxonomic events and proposals that differs significantly from the interpretation offered by Pritchard. Both the increasing abandonment of paraphyletic higher taxa and the proposal for a phylogenetic system of nomenclature do not represent passing fads; instead, they represent the most recent stages in a process that has been unfolding for more than 130 years. It is therefore unlikely that these proposals will be abandoned after a brief period of popularity. Moreover, if evolution is truly the unifying theory that many biologists believe it is, then resisting cladistic concepts of higher taxa and the development of a phylogenetic system of nomenclature will be detrimental not only to systematic herpetology but to all of biology.

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KEVIN DE QUEIROZ
Division of Amphibians and Reptiles
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560, USA.



Response to Peter Pritchard

I read Peter Pritchard's article (1994), "Cladism: The Great Delusion." with some dismay. Although I disagree with many of Pritchard's points, writing a concise response to his paper proved difficult because there is little in our respective philosophies of science that provides a common ground on which to begin any kind of fruitful discussion. Moreover, although Pritchard did note a few current controversies, these issues were largely lost among Pritchard's visceral responses to a number of indisputable facts: (1) cladists use concepts and words that are unfamiliar to some (and which sound inelegant to Pritchard); (2) cladists are critical people, serious about what they do (mean spirited, maybe even religious cultists, by Pritchard's lights), who have no special respect for tradition or those Pritchard considers to have the elevated social standing as luminaries; (3) because of their preoccupation with the nature and evaluation of evidence, cladists have no respect for the claims of special knowledge that Pritchard thinks are self-evident and which underlie his approach to science; (4) cladists, like other evolutionary biologists, frequently use computer programs to help them address complex problems (which renders their conclusions scientifically and ethically questionable according to Pritchard); (5) cladists use explicit methods (which Pritchard complains are difficult to learn); and (6) cladists, like other scientists, sometimes make mistakes (but unlike other scientists exemplify to Pritchard all that is wrong in modern comparative biology). Because all of these statements are true, albeit in a somewhat different light than viewed by Pritchard, they do not require responses, beyond noting that none have anything to do with scientific issues. I do suggest, however, that published criticism is effective at limiting sloppy science, at least when that criticism is not itself sloppy, and that the open exchange of ideas within the forum of critical discussion has made for more progress in comparative biology than any hagiographical appreciation of putative luminaries ever could. In effect, Pritchard has joined this tradition of criticism; he just missed his intended targets.

Rather than rehash technical issues that have been treated extensively in journals such as *Cladistics*, *Systematic Biology*, and *Evolution*, and write pages and pages that most would not want to read, I think the most profitable option is to present a brief reading list that should obviate the fears and objections which some readers may share with Pritchard. Because phylogenetics has come to dominate systematic theory and practice in the last 20 years, I would hope that most will want to understand why it has succeeded so well as a scientific program before they accept Pritchard's accusations at face value.

As a first introduction for herpetologists to what this controversy is all about, one should refer to Kurt Schwenk's (1994) recent article in *Herpetological Review*, a good (if unintended) rebuttal to many of the points in Pritchard's article, although I would not be honest if I said I agreed with everything Kurt has written in this paper. I do not know if Kurt thinks of himself as a cladist or not. Nevertheless, I am pretty sure that Kurt and I are still on speaking terms.

The logical and factual errors in Pritchard's assertions regarding the information content of organismal characters, ancestry of supraspecific groups, and parsimony, are numerous. To begin to understand the issues interested readers should read "Systematics," Chapter 6 in Elliott Sober's *Philosophy of Biology* (1988), a good introduction to the philosophy of phylogenetic inference. For a summary of common analytical procedures used by phylogeneticists, Wiley et al. (1991) is the best source. Just because Pritchard thinks that this Think-and-Do Book is too diffi-

cult (in the previous incarnation as Brooks et al. 1984, that Pritchard was aware of) is no reason for others to avoid learning what the various algorithms are designed to do and what their underlying justifications are.

Pritchard's beliefs about paleontology are difficult to assess because his points are *non sequitur* to phylogenetic inference, and perhaps have more to do with the fact that *the* major contributor to turtle systematics during the last 20 years, Eugene Gaffney, is a paleontologist *and* a cladist, with whom Pritchard obviously has some differences. Along these lines, several of Pritchard's comments on turtle anatomy may be warranted. Regardless, Pritchard's method of arguing from the specific to the general, generally referred to as induction, is the most widely *rejected* scientific approach (Popper, 1989), so Pritchard's specific criticisms may be less relevant than they appear at first blush. The now somewhat dated, but still very useful symposium volume *Phylogenetic Analysis and Paleontology* (Cracraft and Eldredge [eds.], 1977) would be a good place to start to understand the legitimate controversies in systematic paleontology, as would a reading of papers by Gauthier et al. (1988) and Norell and Novacek (1992a, b). Pritchard's inaccurate assertion that cladists do not use fossils may have something to do with an ongoing controversy regarding the character information provided by *necessarily* incomplete fossils (addressed by Gauthier et al. 1988), but in light of Pritchard's awareness of Gaffney's work with turtle fossils and phylogenetics over the last 20 years, one must wonder what would motivate Pritchard to claim something that is so untrue in turtles, a group with which Pritchard claims such authority.

To alleviate concerns that there is a monolithic cladistic mind police working to undermine right-thinking biologists, I would suggest reading David Hull's (1988) *Science as a Process*, even though this summary of the sociological and intellectual development of cladistics has been criticized for historic inaccuracies. A cursory glance at the conflicting position papers in either *Cladistics* or *Systematic Biology* should also allay concerns about a cladistic glitterati.

Pritchard is poorly informed about the recent literature on speciation and other topics in modern evolutionary biology and for those who do not want to make his same mistakes I suggest reading the contributions in Marc Ereshefsky's (ed.) (1992) *The Units of Evolution* and Sober's (ed.) (1984) *Conceptual Issues in Evolutionary Biology*. The anthology by Evelyn F. Keller and Elisabeth A. Lloyd (eds.) (1992) *Keywords in Evolutionary Biology* is a particularly useful summary of key concepts and definitions in evolutionary biology. Although Pritchard uses the term "adaptive radiation" for a large number of related similar species in an unresolved polytomy, the term actually refers to the putative similar patterns of convergent archetypal diversification found in diverse centers of origin (Osborn 1902).

I was confused how Pritchard would regard a fairly well-resolved cladogram that I published in 1992 as "absolutely useless," because before its publication workers believed that Brazilian *Tropidurus* lizards were more closely related to Galapagos "*Tropidurus*" than to former *Plica* and *Uracentron*, and now they do not. At several points in his article Pritchard thrashes cladists for making what he thinks are unwarranted knowledge claims and then he slams me for not making enough of them, apparently, although it is difficult for me to see the logic of his position. The implication of Pritchard's negative reaction to my published statement about lack of topological resolution (the number of unrejected cladograms) is that having large numbers of possible trees that are neither supported nor rejected by evidence tells something about cladists' inability to intuit **truth**. My narrow reaction to this part of his article was surprise that Pritchard could not distinguish between saying something and saying nothing. More broadly, it is clear from his comments that Pritchard thinks that it is better to proclaim oneself an authority and make up a story based on plausibilities and assumptions of imagined or poorly understood processes, rather than on explicit independent lines of evidence. Pritchard's approach is not strictly scientific, but, instead is leavened with romantic beliefs in the primacy of human intuition and the intellectual paternalism of self-professed authorities.

My first reaction on reading Pritchard's paper was *not* to respond—how could I, without having to write a textbook and without offending the many turtle hobbyists who value Pritchard's opinions? On second thought, it was clear that I had to respond *because* of Pritchard's relatively large following among the younger cohort of herpetology, just the people who may get serious about herpetology and who need to know early on that herpetology is science, and fundamentally about the open discussion of evidence and rigorous formulation of theories, not the *hubristic* just-so stories that Pritchard thinks of as science. Regardless of Pritchard's chafing at being held to a standard of evidence that restricts his story-telling, it is because cladistics has provided a framework for the rational discussion of evidence and scientific theories about evolutionary processes (e.g., adaptation, phylogeny, and biogeography) that it is now a standard component, in one form or another, in evolution, comparative anatomy, and herpetology textbooks (Duellman and Trueb 1986; Pough et al. 1989; Ridley 1993), and is beginning to impact heavily in studies of behavior, physiology, and ecology (e.g., Brooks and McLennan 1991; Garland and Adolph 1994; Garland and Carter 1994; Miles and Dunham 1993; Vitt and Pianka 1994). That there have been excesses and mistakes in both theory and practice in phylogenetic inference no one could deny; in this historical inference is identical to all other empirical sciences as well as evolutionary biology before the advent of cladistics. Like those of other empirical sciences, the discovery methods of phylogenetic inference will become more sophisticated with open discussion and hard work; systematics will never return to a golden age of luminaries that never was. Therefore, for Pritchard to argue that because errors and critical statements have been made by cladists means that the forum for the open evaluation of evidence and assumptions should be rejected in exchange for authoritarianism and just-so stories, simply represents antiscientific romanticism.

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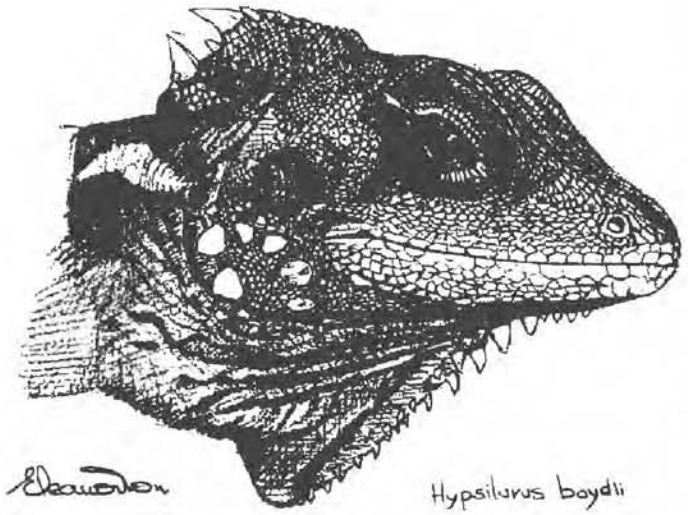
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DARREL FROST
Department of Herpetology and Ichthyology
American Museum of Natural History
Central Park West at 79th Street
New York, New York 10024, USA.



Hypsilurus boydii (Boyd's Forest Dragon). Australia: Mossman Gorge, northern Queensland. Illustration by Eleanor Torr, courtesy of Geordie Torr.

Cladistics: A Response to Pritchard

Scientific tools are not always received without controversy. The astronomer Tycho Brahe thought that using a telescope was cheating and assumed that they would go out of style. Pritchard (1994) similarly refuses what two generations of biologists are embracing as a great tool. Pritchard is determined to remain "unclad." I would simply point out that you can't get dressed until you know how.

In his recent discussion of cladistics (Pritchard 1994), it is clear from the outset that the author misunderstands his subject. Pritchard wants cladistics to be more than it is. It is not a totally new concept. It is not a new truth. It is a tool—a tool that allows biologists to evaluate evidence of a specific kind of relationship, recency of common ancestry or branching order. Because there can be only one correct branching order, the potential that we could recover that information and base a unified classification system on it should be very exciting to all biologists.

Cladistics, the attempt to reconstruct branching order among a set of terminal taxa using parsimony, has proven to be an invaluable tool for reconstructing the history of life. Consequently, it is having an important unifying effect on comparative biology (Brooks and McLennan 1991; Funk and Brooks 1990; Garland, and Carter 1994; Miles and Dunham 1993; Miyamoto and Cracraft 1993). Therefore, it is important that certain misunderstandings in Pritchard's contribution be addressed.

Phylogeny reconstruction and phylogenetic classification.—Pritchard (1994) misrepresents the positions of Gould and Mayr with regards to cladistics because he fails to recognize the utility of distinguishing the process of phylogeny reconstruction from the use of those reconstructions in classification. This important distinction was carefully pointed out in the pages of this journal very recently (Schwenk 1994). Pritchard (1994) wants us to believe that Gould and Mayr, like him, consider cladistics to be a great delusion. In fact, they are only opposed to the strict use of the results in classification. Ashlock (1979) summarized the view of the "evolutionary systematists" fifteen years ago by saying, "Cladists have made great contributions to systematic theory and methodology. Evolutionary systematists have, for the most part, accepted the analytical contribution of the cladists .... They object, however, to the automatic conversion of the cladogram into a classification." These views are repeated in Mayr and Ashlock (1991:234).

Gould (1989:38) embraces the concept of monophyly and elsewhere (Gould 1993:113) uses cladistic pattern observation in his discussion of the evolution of swim bladders from lungs. He states: "A reconstruction of vertebrate branching order gives a clear answer to this question." An earlier piece, "What, if anything is a zebra?" (Gould 1983), provides a summary of his views on cladistics. He calls cladistics "a formalization of procedures that good taxonomists followed intuitively but did not properly express in words, leading to endless quibbling and fuzziness of concepts." He adds that "...behind the names and nastiness lies an important set of principles." His major concern is that "some of our most common and comforting groups [like fish] no longer exist if classifications must be based on cladograms." Both Gould and Mayr apparently find the method conceptually sound and are only concerned about applying the results to classification (the need for which is discussed below). This is a far cry from Pritchard's implication that they find the cladistic method misleading.

Phylogenetic trees versus evolutionary trees.—It is important to recognize the difference between phylogenetic and evolutionary trees and to consider the relative testability of pattern versus

process hypotheses. Like many beginning students of phylogenetic systematics, Pritchard (1994) reads a cladogram as an evolutionary tree, from the bottom up. Cladograms are not evolutionary trees, they are schematic representations of recency of common ancestry. Because they are based on data derived from terminal taxa, they are constructed, in a sense, from the top down and should be read as sets within sets that share more and more inclusive branching events. Pritchard's desire to read cladograms as evolutionary trees leads to a long discussion of "missing links" that "would document the morphological evolution of life, ...by regular dichotomous splitting, to the taxa found today." He infers that cladists should expect to find representatives of all these nodes in the fossil record and points out that they are missing. But since the search for branching order does not require the recognition of ancestors, cladists do not search for, nor seek to identify, ancestors. Thus, they have made significant progress in spite of the well established problem that transitional forms are rare. Pritchard's mistaken view of cladistics prevents him from seeing the important fact that relative relatedness can be established even when there are large gaps in the record, or no fossil record at all.

Perhaps the most fundamental problem in Pritchard's approach to systematics is his reliance on untestable evolutionary scenarios. He fails to see the need for separation of pattern hypotheses from process hypotheses. By observing the results of evolution (pattern) a cladist attempts to reconstruct the relative recency of divergence of the groups of interest. Cladistic hypotheses can be tested by observing the features of the endpoints of evolution: fossil and living organisms. Pritchard's version of the "evolutionary" method frequently depends on hypotheses about the driving forces in specific evolutionary events. But it is extremely difficult, if not impossible, to scientifically test hypotheses about the causes of past evolutionary events. If we agree that a defining feature of science is testability, then classifications that rely on untestable process hypotheses are not science.

A specific example of Pritchard's attempt to use untestable process hypotheses (in this case to determine character polarity) is his suggestion that anyone who observes *Lepidochelys* using its shell to tamp down the sand over its nest might be convinced that the wide shell is an advanced feature for this behavior (Pritchard 1994:106). By pattern analysis, we can determine if the wide shell is primitive or derived for the genus, but it seems highly unlikely that we will ever know whether the wide shell originally evolved for nest-tamping or is secondarily used for this purpose.

Similarly, there is no way to test Pritchard's (1984) process hypothesis that the events which lead to a long neck in *Hydromedusa* are different from those which lead to a long neck in *Chelodina*. The pattern evidence in this case is ambiguous; morphological data suggests that these genera are sister taxa (Gaffney 1977), preliminary molecular results suggest that the South American and Australian chelids may each be monophyletic (Shaffer, pers. comm.).

Character selection in the cladistic and "evolutionary" schools.—It is also useful to reexamine Pritchard's claims about the types of characters and the degree of objectivity in the selection of characters that go into systematic studies. Pritchard (1994) reports that "evolutionary systematists" use all aspects of morphology and fossil history but use "judgment" to decide which are the "fundamental characters" and which are recent, plastic, or adaptive ones. He says "evolutionary systematists" emphasize the former and reject the latter. He would do systematics a great service if he could provide an explicit set of criteria for how one recognizes "fundamental" characters. His suggestion that systematists should reject adaptive characters means that we should not be using features such as the presence of vertebrae, four limbs, amnion, mammary glands, or for that matter, the turtle shell (all of which are highly adaptive) in our efforts to determine relationship!

The majority of practitioners in the cladistic school suggest that one cannot tell, a priori, which features will provide the phylogenetic message and which are noise. This information is available only after any message has been extracted. Choosing characters a priori suggests that one knows what the message should be. In dissecting out "fundamental features," the "evolutionary systematist" as described by Pritchard is being far less objective than the cladist.

However, Pritchard is correct in saying that cladists pick and choose their characters. Characters found in only one of the taxa of interest or all of the taxa of interest will not provide phylogenetic information and can be left out. Others may be found to be too variable within individual terminal taxa and are left out for that reason. But in every study with which I have been associated, any character that may shed light on relationships has been included.

Pritchard is inconsistent in his views about the data that should be considered in a systematic study. He (Pritchard 1994:103 bottom right) says that "traditional systematists ...[use] ...all aspects of the morphology ...," then on the next page he says they only use "fundamental" characters. Elsewhere he complains that cladists leave out undesirable characters, but then he is surprised to find a case in which I have used characters about which homology arguments may be questionable (i.e., reduction and loss of peripherals, and presence of an anterior hinge in kinosternids, carettochelyids, and trionychids; and presence of an intermaxillary foramen in staurotypines, carettochelyids, and trionychids) (Meylan 1987). These characters are, as Pritchard (1994) implies, best explained as independent occurrences in the Trionychia (Trionychidae and Carettochelyidae) and Kinosternidae (Meylan and Gaffney 1989). This determination of homoplasy is suggested by pattern evidence and not the untestable process hypotheses offered by Pritchard (1994). He tries to employ current structure and function to infer that these structures must have arisen from separate events—events that must have occurred at least 100 million years ago! I elected not to make this judgment a priori. The results of my first study of trionychoid relationships (including only living taxa) suggested that these features could best be explained as single events (Meylan 1987). A second study, which included new and important fossils (Meylan and Gaffney 1989), suggests that these features have occurred twice. This still does not make them "bogus" characters. For example, reduction (and loss) of peripherals within the epifamily Trionychoidae (along with paired ventral processes of the nuchal) suggests that the Cretaceous turtle, *Peltochelys* is the sister group of the Trionychia; reduction of peripherals within the Kinosternoidae (along with 9 other characters) suggests that the Kinosternidae is monophyletic (Meylan and Gaffney 1989; Meylan 1988).

In the work described above (Meylan and Gaffney 1989), 8 of 13 terminal taxa are extinct, and a major point of the paper is that inclusion of fossils overturns a set of relationships that were previously proposed on the basis of living taxa alone (Meylan 1987). In the paper from which Pritchard extracts a specific example for his argument that cladists ignore fossils (Gaffney and Meylan 1988), 55 of 144 included genera are extinct. Looking through a stack of Gaffney's papers I find that nearly every one includes data from extinct forms. So, Pritchard's claim that cladism ignores the fossil record seems preposterous based on the literature that he should know best.

The meaning of relationship.—In order for systematics to be scientifically useful, the concept of relationship needs to be uniformly applied. Since Pritchard seems intent on using a priori selection of "fundamental features" and an established strategy of "apocryphal stories" (see Brooks 1990) to determine relationships among turtles, it may not matter that he is also willing to allow "relationship" to mean different things to different workers. But this poor state of affairs is illustrated by his defense of a paraphyletic Agamidae. The realization that this family is paraphyletic with respect to the Chamaeleonidae means that it is the herpetological equivalent of my car and three geese. "Agamids" may be "more similar," but similarity is a poor criterion for classification. Like beauty, similarity is in the eye of the beholder. Thus, to some observers my car and three geese may be the most similar items in a set under consideration.

Given a single group to study, a morphologist, behaviorist, and two or more geneticists working with different genes might see different subsets in that group as being "most similar" and they might suggest four or more classifications, each acceptable under the "similarity" model. But all of these data could be interpreted in a cladistic framework, and if they were, the independent analyses would at least be aimed at finding the same single correct answer that reflected the one history of life. If every classification sought to reflect the one correct history of life, then at least there would be only one, and not many, correct classifications. It simply won't do to have multiple possible correct classifications. That is what we get if we continue to recognize non-monophyletic groups.

In closing, I would suggest a test of Pritchard's assertion of the lack of utility of the cladistic method. Look through the literature on turtle systematics for the past 50 years. Compare the contributions to systematics and classification made by the various schools. You will see that cladistics has proven to be an excellent tool for turtle systematics.

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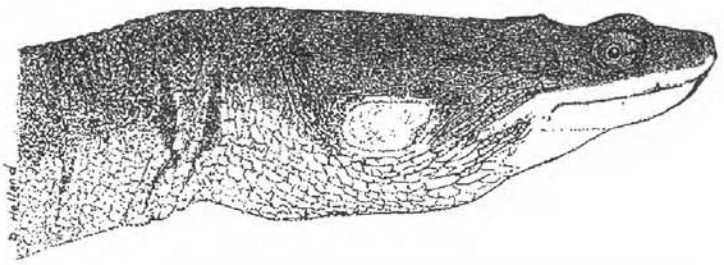
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PETER MEYLAN
Natural Sciences
Eckerd College
St. Petersburg, Florida 33711, USA.



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Human Nature, Science, and the Anonymous Peer Review System: Responses to Burke and Pisani

When we published our paper on the anonymous peer review system (Wilson and McCranie 1993), we wished to stimulate comments and, ultimately, change in an obstructionist and counterproductive set of procedures. Thus, we are pleased that Pisani (1994) and Burke (1994) responded. We mostly agree with Pisani, but see below. However, we disagree with Burke. At issue is the ability of science (in particular, herpetology) to survive the impact of the ethics of convenience and lowered professional expectations. Apparently, Burke and to a lesser degree Pisani act as apologists for these developments, citing the purported exigencies of "human nature."

Pisani (1994) opined that lack of editorial conscientiousness arises because "... editors, like other scientists, are human first and scientists/editors second, with all the room for ego abuse and lack of character that implies." We maintain that falling back on the old saw that "one cannot change human nature" is to attempt to excuse human frailties by resorting to folklore and that scientists are held to a higher standard. Although Pisani's suggestion that a "totally" anonymous peer review system, under discussion by KU's mammalogists, is "interesting," it is by no means "logical." First, a system in which "the author is unknown to the reviewer, who remains anonymous to the author" is not *totally* anonymous. After all, the identity of both is known to the editor (a *totally* anonymous system, in which no one is known to anyone else is an oxymoron; a system is a collection of *interrelated* parts). In addition, given the contact among herpetological colleagues working in the same area of research, it is unlikely that such a system would really keep identities of author and reviewer unknown to one another. Furthermore, authors frequently build on their past work and therefore cite themselves often. This type of system would be prone to greater abuse than the one we currently use, allowing both reviewer and author to operate in secrecy, increasing the chances for animosity among colleagues to arise. Finally, it would move the peer review process further from the cooperative atmosphere supposed to exist in science and further toward obeisance to the whims of "human nature." We believe that neither end is desirable nor defensible.

We reserve our strongest objections, however, to Burke's (1994) ideas, for it is therein that we find a logically inconsistent use of the term "human nature" and a seriously ill-informed view about the workings of science. Burke's response is carefully constructed, clearly written, and indisputable through the first four paragraphs. From that point onward, however, his argument is disarmingly confused.

Burke's first major point is that, "All systems are prone to abuses, and Wilson and McCranie are right to point out the need for periodic evaluation of the status quo." Whereas it may be correct to say that all systems are prone to abuse, we must do more than simply "evaluate the status quo." The nature of the scientific process requires us to expose and rectify such abuses to the system of science, because their continuance erodes its foundation.

Burke (1994) also believes our critique "... underestimates the effect onymity would have on the objective nature of our field." In defense of this view, Burke confusingly discussed the "... inherent conflict that we all face between subjective human nature and the objective nature of science." He noted that it has been his experience that "... anonymity dulls subjectivity and enhances objectivity." This is because he is acquainted with many of the authors whose papers he reviews. Consequently, he has "... made every effort to divorce [his] relationship from [his] evaluation of their work. Knowing that [he] would remain anonymous to the authors' greatly enhanced [his] ability to approach objectivity (consciously and presumably subconsciously)."

In his use of the term "human nature," Burke implies that there are certain features of human behavior over which we have little or no control. We interpret this to mean that these features are not subject to modification by life experience (i.e., learning); in other words, they are instinctive. Since notions of objectivity and subjectivity are outgrowths of human rationality and concepts that must be learned, using the term "human nature" in the context Burke does is specious and introduces a "red herring" into the dialogue. Thus, Burke maintained that "human nature" (in his sense) is "subjective," whereas "science" is not, and that movement from a subjective to an objective stance by a reviewer is facilitated by remaining "unknown" to the author. To say that "human nature" (in Burke's usage) is "subjective" is virtually redundant, since the word subjective means "proceeding from or taking place within an individual's mind such as to be unaffected by the external world" (American Heritage Dictionary, first edition). On the other hand, the word objective means "of or having to do with a material object as distinguished from a mental concept" (American Heritage Dictionary, first edition). Since science seeks to create a set of concepts to theoretically explain natural phenomena, it cannot be truly objective in the above-indicated sense of this word. Even giving Burke the benefit of the doubt and allowing that he considered objectivity to be synonymous with impartiality (some usages of the former come close to the usage of the latter), he maintained that such lack of prejudice or bias is enhanced by hiding one's identity. Such a position is interesting, if illogical, and would seem to mean, for instance, that members of the Ku Klux Klan wear hoods to show their lack of racial prejudice. Such a point of view is ludicrous. Objectivity or impartiality does not depend on anonymity, it depends on the reverse, an open acknowledgment of one's ability to stand up for one's opinions and conclusions. Beyond all this and of greater importance, onymity may have less effect on objectivity than on whether the review is constructive or destructive. Signing reviews has the value of encouraging constructive criticism on the part of the reviewer.

Burke's second major point is that we limited our discussion "to the effects of anonymous peer review on the scientific community." He stated that "... most scientists have patrons (e.g., granting agencies, private foundations, industry, taxpayers) and research results often impact those patrons." Furthermore, he noted that, "Because our results don't only impact us, it is important that persons outside our community have confidence in the integrity of our system of checks and balances." Burke's view appears to depend on the confusion of the *anonymous peer review system in particular* with the *peer review system in general*. The peer review system exists in order to best assure that what is published is as original, substantive, accurate, and defensible as it is possible for us to make it. Reviewer anonymity is not a prerequisite for such an outcome. *Both* authors *and* reviewers are held to draw conclusions that will stand up to scrutiny. Burke also maintains that allowing scientists to operate behind the cloak of anonymity will inspire confidence in people outside the scientific community "... in the integrity of our system of checks and balances." We confess to being nonplused as to how scientists operating in secret can inspire confidence in anyone about anything, especially our purported "integrity." Finally, Burke attempted to underscore the importance of his view by noting that a paper he recently published on the diet of sea turtles in New York waters "... will presumably be the basis for decisions

regarding habitat protection in New York." He maintained that, "The publication of [his] study following rigorous peer review by persons unknown to [him] can only strengthen its credibility and therefore its value to [his] patron, the New York State Department of Environmental Conservation." The question we ask of Burke is how and why the acknowledgment of reviewers' names during the peer review process is going to *undermine* the credibility of the study or its value to his patron. Let us put it another way. Let us say, for example, that Burke's study is sent to Randy McCranie or Larry Wilson for review. Because of their ethical position, stated in print, the one conducting the review signs his name to it. How will the acknowledgment of the name damage the credibility and value of Burke's study? Why is not the reverse the case? Why would not an honest review from one of these "established" researchers (to use Burke's language) not enhance the credibility of his study and its value to his patron?

Although we appreciate both the Burke and Pisani responses to our critique, we find ourselves at odds with their analyses, especially that of the former. Burke appears ready to jettison the need for absolute honesty in the sciences to allow for a timorous retreat behind the curtain of anonymity in order to inspire confidence in people who fund his research. This appears to us to be a particularly heinous brand of situational ethics giving rise to an unconscionable lowering of our professional expectations. The peer review system is supposed to allow substantive critiquing of one's work by his peers. Peers are those who have equal standing with oneself. We would find it difficult to accept as peers those who do not have the courage of their convictions sufficient to allow themselves to sign their own work.

In apologizing for such cowardly behavior on the part of the reviewer, Burke and Pisani appear willing to concede to editors more power in shaping the direction of herpetological research than we think they should have. This is because of the potential for sheltering destructive reviewers in anonymity in what is supposed to be an open, aboveboard, rigorous, and cooperative undertaking. We believe an onymous system would allow reviewers *and* editors to be held much more accountable for their editorial decisions. Burke and Pisani miss this point when they recount their generally productive experiences with journal editors as support for their views. Our experiences with editors usually have been similar. The point is that even though they may use their power wisely, they should not have the kind of power they do with the anonymous peer review system in a discipline utterly dependent on free and open discourse. Let us allow ego-driven, but cowardly reviewers to seek the psychological counseling they apparently need and discontinue maintaining a system that indulges them.

Lest we be accused of placing too much emphasis on the ill that a few reviewers operating behind the "iron curtain" of anonymity can commit, we wish to reiterate and emphasize that science depends on absolute openness and honesty (Sigma Xi 1986). Although the Sigma Xi document is primarily concerned with fraud in science, it does quote C. P. Snow to the effect that, "The only ethical principle which has made sciences possible is that the truth shall be told all the time." Fraud is a "deception deliberately practiced in order to secure unfair or unlawful gain" (American Heritage Dictionary, first edition). Hiding one's identify as an anonymous reviewer is also a form of deception not far removed from fraud. As such, its continued existence, like that of its uglier cousin, fraud, will unduly erode the openness and honesty vital to science.

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LARRY DAVID WILSON
Department of Biology
Miami-Dade Community College
Kendall Campus
Miami, Florida 33167, USA

and
JAMES R. MCCRANIE
10770 S. W. 164th Street
Miami, Florida 33157, USA.

Tail Waves, Eye Licks, Vocalizations, and Priorities

In systematics, "priority" is respected as much as it is in the history of technology. But in other fields of herpetology (e.g., behavior, morphology) papers too often claim priority for the observation of phenomena which in fact had been published long before. Most commonly this happens out of ignorance of the earlier work. Many authors do not exploit literature published in other languages and some—that published in other countries. I narrate here a couple of choice examples and propose a partial remedy.

A recent statement in *Herpetological Review* claimed that "this is the first record of tail waving behavior as part of a prey capture tactic in gekkonid lizards." The statement was made by Perez-Mellado (1994), who in the preceding paragraph described how *Tarentola mauritanica*, on Minorca (Balearic Islands), approached relatively large prey: "The lizards raised their tails during the slow approach, moving it laterally and sometimes with the distal portion of the tail slightly brought forward. The final charge was accompanied by increased vibration, shaking rapidly the tip of the tail."

Described or not, waving and vibrating the tail while stalking the prey are quite common among geckos. *Gekko hokuensis*, one of three species observed by Werner et al. (submitted), frequently showed these behaviors while foraging and stalking. In this case these tail movements were mainly seen during the brief pauses that this species makes in its intermittent advance.

Admittedly, it could have been that, just because of its commonness, this gekkonine behavior had not been reported earlier. Let me illustrate this point: Although Aristotele (4th century BC) had mentioned the voices of "oviparous quadrupeds," by the time I visited New Zealand in 1970, no vocalizations had been reported from the local skinks. When my hosts of the N.Z. Ecology Division (Tony Whitaker and Bruce Thomas) and I caught a skink and it cheeped (Frankenberg and Werner 1992; Werner 1973), and I expressed surprise, they said, "Yes, skinks squeak when caught." When I protested, "But none of you has ever reported this!" they said, "What is there to write about? Skinks just squeak when picked up."

But, as it happens, the gecko's rear end fared differently. Mertens (1946), in his classic monograph, explained that aposematic behaviors are expressions of excitement, which need not necessarily be caused by an enemy or a rival; rather, it can just as

well be aroused by a mate or a prey animal. Mertens continued (I translate), "Hence one sees, for example, some geckos, such as *Tropiocolotes steudneri* or *Ptychozoon kuhli*, performing with their tails the same undulating or waving motions, during the suspicious, tense, crawling upon an insect, as when meeting another lizard or else a larger creature."

Such oversight of earlier behavioral observations happens readily and is quite frequent. Skipping cases of personal bias, I revert to the gecko's head for a by now historical last example. No lesser a person than Hobart Smith (1952) described a gecko, *Sphaerodactylus notatus*, often licking the lips and wiping the lidless eye with its tongue. Smith concludes, "Whether it is a habit restricted to this genus or of general occurrence in geckos with immobile lids remains to be determined, inasmuch as no similar observations have, to my knowledge, been noted previously for any species." Later, Mitchell (1958) seemed to regard the eye wiping behavior of geckos as a local Australian discovery whereas Bustard (1963) credited Smith (1952) with this discovery.

But Smith's modest caution had been well placed. Already F. Werner (1913:9) had described eye-licking as a family trait of the Gekkonidae (I translate): "The tongue is wide, flat, a little notched at the tip. As a rule, it is extended only in drinking and in eating, as well as in cleaning the eye. In this it is extruded from the mouth sideways and extended so that it can completely lick the eye." Perhaps in Werner's wake, Aharoni (1929:63) described eye cleaning in *Ptyodactylus*.

In conclusion I propose that editors of herpetological journals would do well to be wary of manuscripts in which the Literature Cited is bound within the ghetto of any single language. This is true in general but applies in particular to such fields as morphology or behavior.

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YEHUDAH L. WERNER
Department of Evolution, Systematics and Ecology
The Hebrew University of Jerusalem
91904 Jerusalem, Israel.

To Stipple or Not to Stipple

Range maps are one of the most important features of any field or identification guide to reptiles and amphibians or other organisms. These maps can be extraordinarily useful and often stimulate other workers to explore areas of uncertainty that are disclosed. However, range maps appear in about as many formats as there are guides and authors, and thus are of variable usefulness.

The mapping style chosen is partially dependent on the purpose of the map and the portion of a particular publication that can be devoted to maps. Publications such as Conant and Collins (1991) do not detail individual locality records but use stippling in various ways to denote geographic ranges. This is appropriate when the geographic extent of the ranges included is large and the space allotted to map them is small. Regional or state field guides (e.g., Smith 1961; Minton 1972) detail individual locations with symbols. Some authors (e.g., Johnson 1987) mark each county with a symbol in the center of the county. Others (e.g., Smith 1961; Minton 1972), are more specific and place symbols at locations in each county for all specimens examined or previously reported in the literature. Many authors (e.g., for the *Catalogue of American Amphibians and Reptiles* accounts) also stipple their maps even when specific records are detailed. The purpose of this paper is to criticize the practice of stippling range maps that mark individual localities with symbols, but not to reopen an earlier discussion on range map accuracy (Axtell 1983, 1987; Blem 1987a, b).

Rather than provide a lengthy list of examples from regional field guides or from *Catalogue* accounts, I will cite a single example drawn from Smith (1961). I chose this work because it is, in my opinion, one of the best regional field guides ever published. Although it has been in print for over 30 years, without revision or updating, it is still a highly useful work for students of Illinois herpetology. The particular example I have chosen, the range map for *Clonophis kirtlandii*, was selected because it typifies a species whose limited range is poorly known.

Among the many regional field guides and *Catalogue* accounts I have examined, stippling is used for one of two purposes. First, it is used to show areas of intergradation between subspecies by utilizing differing shading styles for the various taxa involved. This usage, when based on examination of specimens, communicates objective information.

The second purpose is to indicate the presumed range of the species by including areas from which the species has not been collected. If the stippling includes such areas, then it is speculation by the mapper that the taxon occurs there. This speculation can be considered a hypothesis. Such hypotheses can be tested by field searches of the area in question. However, such a hypothesis can only be verified; it cannot be falsified. Even if the area is searched and no specimens are found, the hypothesis cannot be falsified because it is always possible that the species was missed.

Published speculations of distributions using range map stippling can have unfortunate results. Stippled range maps tend to validate a hypothetical distribution. Even though the speculative nature of the map is pointed out by the original mapper, such maps are frequently uncritically accepted by subsequent workers. If the organism happens to be endangered or threatened (as is *C. kirtlandii*), then uncritical acceptance of speculative range maps can have important political and economic consequences.

I have redrawn the stippled portion of the range map for *C. kirtlandii* (Fig. 1a, from Smith, p. 253). This map reflects Smith's apparent belief that this snake also occurs in all or parts of Kankakee, Iroquois, Ford, Livingston, Moultrie, and Edgar

counties (portions of Illinois east and north of the Shelbyville moraine), although no specimens or published records existed when the map was prepared. Rossman and Powell (1985) also stippled these counties even though no specimens had been reported in the intervening 24 years.

Since publication of Smith (1961), Tucker (1977) and Bavetz (1994) have addressed variation and distribution in *C. kirtlandii*. I (Tucker 1977) noted that no specimens had been discovered in the first four mentioned counties (see above) and questioned whether or not the snake occurred there. Bavetz (1994) noted that the same four counties still had no documented populations. He also noted that this particular area had been covered by post-glacial lake beds. We both had observed that samples from the northern counties of Illinois were slightly differentiated meristically from samples collected in central Illinois.

The documented localities of *C. kirtlandii* are plotted (Fig. 1b) along with the location of these post-glacial lakes from Willman and Frye (1970, Fig. 9). The virtual absence of overlap between localities for *C. kirtlandii* and the former location of the glacial lakes is evident. Although the documented range of *C. kirtlandii* has been considerably extended (Rossman and Powell 1985), no specimens have been reported in the portion of Illinois containing these post-glacial features. This suspected hiatus in the range of the species is consistent with the very slight morphological differentiation that Tucker (1977) and Bavetz (1994) noted.

Had Smith (1961) or Rossman and Powell (1985) published their maps for *C. kirtlandii* without stippling, this apparent hiatus in the range would have been much more obvious. More interest in investigating this gap might have been generated among herpetologists.

In this instance, use of stippling was not only speculative but possibly inhibited subsequent investigation of the species in this area. At present no investigator has looked at the distribution of Illinois reptiles and amphibians in relation to these post-glacial features. Examination of Smith's maps shows a paucity or absence of records in this region for several widely distributed species. These species include *Ambystoma maculatum*, *A. tigrinum*, *Plethodon cinereus*, *Necturus maculosus*, *Bufo woodhousii fowleri*, *Pseudacris crucifer*, *P. triseriata triseriata*, *Rana catesbeiana*, *R. sylvatica*, *Elaphe obsoleta obsoleta*, *Storeria occipitomaculata*, *Regina grahami*, *R. septemvittata*, and *Sisturus catenatus*. All of these species, like *C. kirtlandii*, have been found both north and south of the area in which Pleistocene lake sediments occur in Illinois, but no or few localities are known from within the area occupied by these sediments. Other glacial features such as the Shelbyville morainal system (Smith 1961) are also known to be correlated with distributions of reptiles and amphibians in Illinois. It is possible that the absence of records for many of these species may reflect the likelihood that common species are ignored by collectors and less likely to be preserved, deposited in institutional collections, or reported in the literature. But this cannot be said for less common species such as *C. kirtlandii* and *Sisturus catenatus*.

Therefore, stippling of range maps with localities marked by symbols in regional field guides or in the *Catalogue* should be avoided or discontinued except where it is used to denote areas of intergradation between adjacent subspecies. Speculations on distribution should be placed in the text rather than on the maps.

Acknowledgments.—I thank M. Bavetz for sharing information from his thesis with me. R. W. Axtell's and J. T. Collins' criticisms of the manuscript are much appreciated.

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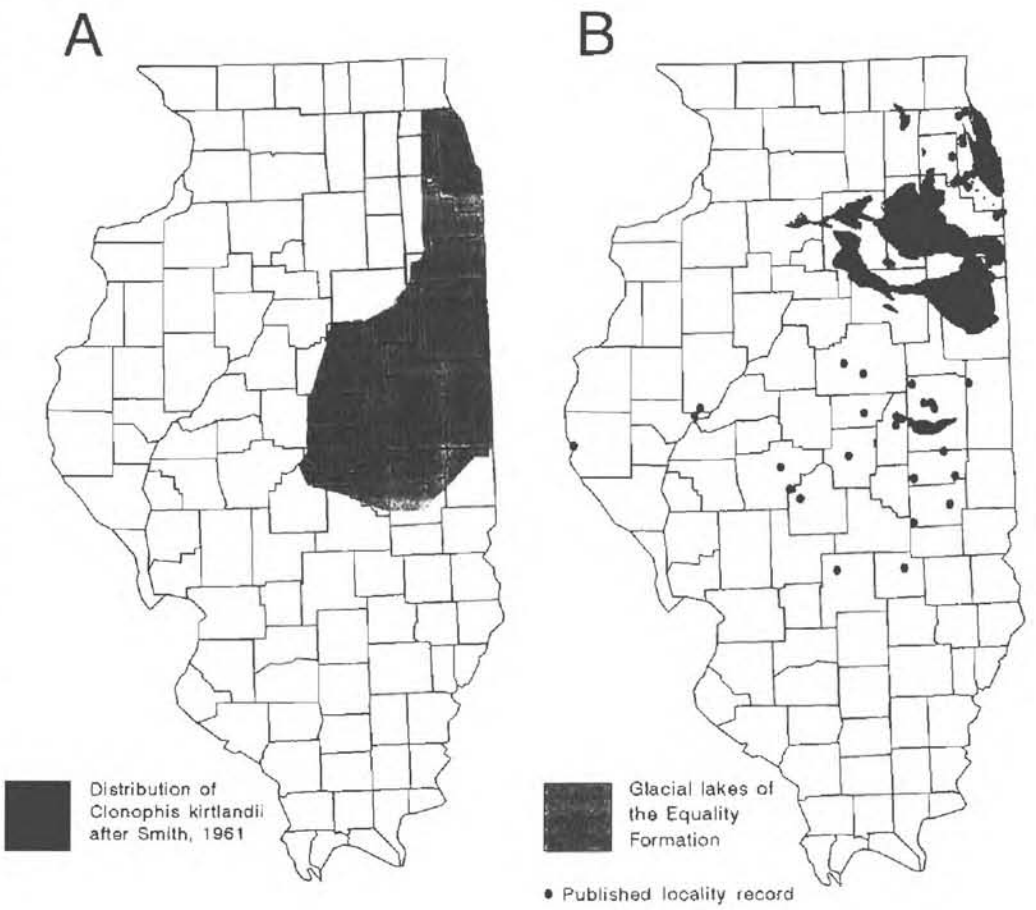


FIG. 1. Two ways of depicting the Illinois distribution of *Clonophis kirtlandii*. (A) Distribution map redrawn from Smith (1961). (B) Modified range map showing known localities for *C. kirtlandii* and locations of post-glacial lakes.

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JOHN K. TUCKER
Illinois Natural History Survey
Long Term Resource Monitoring Program Pool 26
4134 Alby Street
Alton, Illinois 62002, USA.

TECHNIQUES

A Simple Aquatic Funnel Trap and its Application to Wetland Amphibian Monitoring

Techniques for monitoring adult amphibians at breeding sites are described by Scott and Woodward (1994) and Dodd and Scott (1994). Quantitative sampling techniques for larvae are reviewed by Shaffer et al. (1994). In these reviews, aquatic funnel trapping was bypassed as a method for monitoring adults but recommended as a tool for estimating species richness and relative abundance of larvae.

In unpublished studies, I used large, bulky, and expensive wire mesh funnel traps (e.g., minnow traps) to determine palustrine wetland use by adult *Pseudacris regilla*, *Taricha granulosa* and *Ambystoma gracile*, and stream use by larval *Dicamptodon tenebrosus*. I baited traps with plain or shrimp oil dipped salmon eggs (Pautski's Balls of Fire) in a perforated 35 mm film canister to increase the capture rate of amphibians. Calef (1973) used a trap made by fastening an insect screen funnel into a 3.5 liter (1 gallon) plastic jug to capture tadpoles of *Rana aurora*. Calef, however, provided no other details such as jug diameter or specific mode of application. Whitman (1974, cited in Riley and Bookhout 1990) used a plastic aquatic funnel trap to capture macroinvertebrates. Riley and Bookhout (1990) altered Whitman's trap to monitor invertebrate activity in the water column. The adapted trap is constructed by stapling top and bottom ends from two 2-L plastic beverage bottles together.

The absence of explicit design characteristics for amphibian funnel traps in the herpetological literature (Dodd and Scott 1994; Scott and Woodward 1994; Shaffer et al. 1994), my successful amphibian census experiences with minnow traps, and the publication of Riley and Bookhout's (1990) inexpensive and easily constructed invertebrate funnel trap prompted me to investigate the potential merits of Riley and Bookhout's trap in amphibian censusing. I describe here the details of trap materials and construction, with modifications that have enabled me to use it successfully for wetland amphibian censusing under diverse habitat conditions without adult and larval mortality.

Materials and Construction.—Each funnel trap set-up requires two clean, clear plastic, 2-L soda-pop bottles, three 0.32 cm (1/8 inch) diameter aluminum rivets with a 0.48 - 0.63 cm (3/16-1/4 inch) grip range, three 0.32 cm (1/8) inch) diameter aluminum washer plates, three plastic clothespins, and one 0.79 cm (5/16 inch) or slightly thicker stainless steel rod of length determined by water depths to be sampled.

Using a razor blade I cut an initial slit near the top of one bottle approximately 0.3 cm below the end of the neck taper within the bottle's midsection. I separate the top by continuing the cut with scissors around the bottle. I similarly cut the bottom from the second bottle with a cut 0.3 cm beyond the seam at the base but again within the midsection of the bottle. The top ends of both bottles are saved. Next I use a hot nail to burn four 0.32 cm holes into the larger section and into the clothespins. I burn one air/water exchange hole 0.3 cm below the bottle's taper within the midsection, and three rivet holes in a straight line at 4, 9, and 14 cm from the bottom along the opposite side. I also clip roughly 1/4 of the plastic from one handle of each clothespin and then burn a 0.32 cm hole into the center tip section of each unclipped end. I then rivet a clothespin through the handle to each hole in the bottles' midsection. Finally, I reverse the short tapered funnel end and slide it within the bottom of the main bottle forming a tight, escape-proof fit and overlapping lip for stapling (Fig. 1).

Applications.—I have attached up to three traps along one stainless steel rod to simultaneously measure captures in 2 m of water at several depths within the water column. In deep water I position traps vertically with funnel side down. This maintains the required air pocket within the top so captured amphibians don't suffocate. In shallow water I drive rods with attached traps diagonally in the water, again making certain to provide air pockets. Water-filled traps not fastened to rods sink and will kill captured amphibians. Although heavier than aluminum, I use stainless steel rods because they do not corrode and therefore, minimize water quality impacts. I also bait traps with 5-10 salmon eggs but have never tested trapping success between baited and unbaited traps, nor between shrimp and non shrimp oil dipped eggs.

I found my funnel trap set-up invaluable in determining spring arrival times of breeding *Ambystoma macrodactylum*, *Ambystoma gracile*, *Taricha granulosa*, *Rana aurora* and *Pseudacris regilla*. Leonard and Richter (1994) have successfully combined several months of aquatic funnel trapping with mark-recapture statistics to census adult *Ambystoma macrodactylum* populations in a small breeding pond. At some wetlands these aquatic funnel traps captured adult amphibians that were not previously detected by visual searches, dipnetting, or pitfall trapping.

Funnel traps also enabled me to describe the spatial and temporal microhabitat use by larval *Ambystoma gracile* and *Rana aurora* (Richter, in prep.). I have captured larvae using these traps with minimal habitat disturbance, by simultaneously trapping in yellow water-lily (*Nuphar polysepalum*), cattail (*Typha latifolia*), and soft rush (*Juncus effusus*) dominated emergent plant communities and in open water areas of varied depths, over 8-hour day, 8-hour night, and during 48-hour trapping periods without mortality. Karlstrom (pers. comm.) used these traps successfully in 1994 to

TECHNIQUES

Articles suitable for publication in this section should describe either a novel technique or refinement of an existing one. Descriptions of methods, materials, study sites, etc., should be sufficiently detailed to permit an assessment of the utility of the technique or equipment for other areas or taxa. Manuscripts should be sent directly to the section editor: *Stephen D. Busack, National Fish & Wildlife Forensics Laboratory, 1490 East Main Street, Ashland, Oregon 97520, USA.*

The Snake Rake: A New Tool for Collecting Reptiles and Amphibians

Conant and Collins (1991) described several useful tools for collecting reptiles and amphibians including traditional snake hooks and potato rakes. The most useful tools in the field are often those that can serve more than one purpose. Unless one is planning on a single activity such as pinning snakes or raking through leaf litter, a multipurpose tool is advantageous. I have designed a simple, multipurpose tool for use in the field.

The snake rake, as I call it, is constructed from a 120 cm length of 19 mm diameter aluminum pipe and two 25 cm long pieces of 6.5 mm diameter steel round stock (Fig. 1). The two pieces of round stock are each bent 90 degrees at a point equidistant from the ends. The two pieces of round stock are then welded together along one length with the unattached ends directed roughly 25 degrees away from each other. The head is then attached to the end of the aluminum pole using two 27 mm hose clamps seated over the welded portion. This creates a two-tined fork that can be used to rake through leaf litter, roll logs and rocks, pin snakes and, lift bark and boards. This design is convenient when traveling since it can be disassembled for transport.

The snake rake can be constructed at home with a few tools. If welding materials are not available contact a local welding shop. Using heads that were constructed by a welding shop, I have assembled several rakes for less than twelve dollars each.

I have used snake rakes in habitats ranging from Ecuadorian cloud forests to Californian deserts and have found it to be a strong walking stick as well as a versatile tool. Low cost of construction and availability of materials add to the appeal of this design.

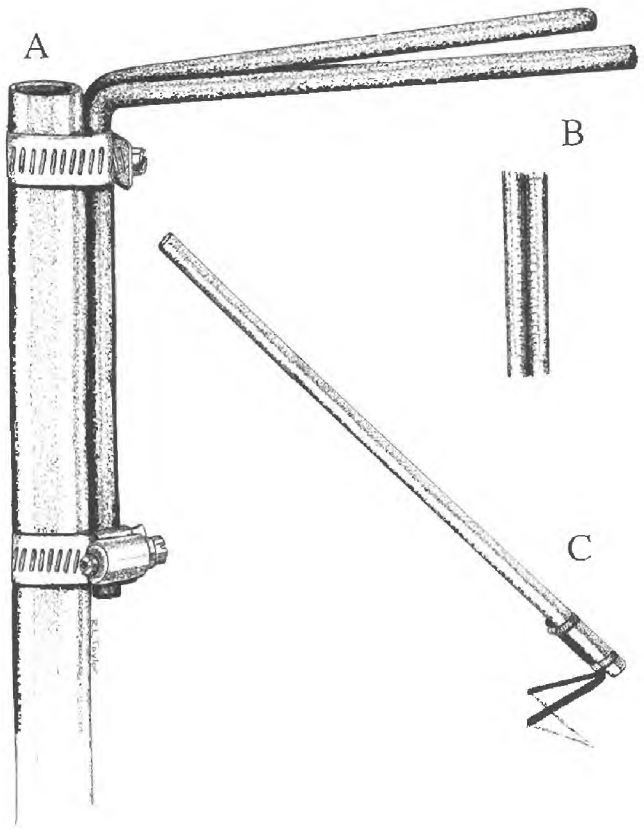


FIG. 1. (A) Detail of head of snake rake. (B) View of weld joining tines in plane of shaft. (C) Snake rake (120 cm).

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ANDREW G. GLUESENKAMP
Department of Evolution and Ecology
The University of California at Davis
Davis, California 95616, USA.

A Photographic Mark-Recapture Method for Patterned Amphibians

Studies involving mark-recapture in amphibians have employed a variety of techniques that facilitate the identification of individuals (Donnelly et al. 1994; Ferner 1979). The most widely used of these has been toe-clipping (Hillis and Bellis 1971; Twitty 1966; Wells and Wells 1976) and tagging (Elmberg 1989; Massey 1970; Nickerson and May 1973; Woolley 1973). More recent innovations include fluorescent marking (Nishikawa and Service 1988; Taylor and Deegan 1982), radioisotope tagging (Hardy 1985; Semlitsch 1981), and PIT (passive integrated transponder) tagging (Camper and Dixon 1988).

Ferner (1979) suggested the ideal method of recognizing individual salamanders was to use their variation in integument pattern. Hagstrom (1973) photographed ventral patterns of *Triturus cristatus* and *T. vulgaris* to identify individuals, and Healy (1975) used differences in dorsal spot pattern to distinguish between individual *Notophthalmus viridescens*. Loafman (1991) described a technique by which individual spotted salamanders (*Ambystoma maculatum*) could be recognized by their spot pattern.

Herein I describe an inexpensive photographic technique in which individual amphibians can be recognized by their dorsal patterns. Advantages of the technique include: 1) Animals are not physically harmed in any way, 2) animals are permanently "marked," and 3) the technique is easy to use, relatively time-efficient, and inexpensive.

A camera box (15 X 18 cm X 25 cm high) is constructed of 1.6 cm thick plywood, with a hole (7.1 cm diam) in the top to fit a 35-

mm camera lens (Fig. 1). A second hole (1.5 cm diam), also in the top, allows the insertion of a penlight. The bottom of the apparatus is removable and holds a small box in which specimens are placed (Fig. 1). The specimen box is sized appropriately to preclude movement during photography. A strap with a snap holds the bottom in place while the box is being carried or not in use. The stage (bottom) is painted black and is equipped with an adhesive label that can be numbered each time a different animal is photographed. The penlight eliminates the need for using a flash, which would require a more elaborate design. Although amphibians could be photographed without such an apparatus, the box allows consistency in photographic quality, and helps keep salamanders motionless while being photographed.

I have successfully employed the technique in the mark-recapture of 128 adult *Ambystoma opacum* in south-central Louisiana in 1991–92. Nesting females placed on their nests (after being photographed) were found to reattend their eggs in nearly all cases. Eight salamanders (6%) were identified as recaptures using the technique. Sampling bias (due to subterranean nesting) is believed responsible for the low recapture rate.

Salamanders were recognized by their distinct barring, including appearance and number of bars on the dorsum. No apparent ontogenetic change in pattern (an assumption of the technique) was seen over a one-year period; use of the technique with juvenile *A. opacum* would not be informative. As with *A. maculatum* (Loafman 1991), the head patterns alone of *A. opacum* in this study were often (80% of the time) different enough to distinguish between individuals.

A 35-mm camera and color print film (200 ASA) were used. Prints were easier to compare than were slides, and were placed in a photo album where they were labelled accordingly. Photographs of recent captures could then be compared to each previous photograph in the album.

Because individual *A. opacum* often display digit anomalies such as varying numbers of toes or branching of regenerated toes (pers. obs.), and because regeneration of toes can present problems in the identification of marked individuals (Ferner 1979), toe-clipping was not used. *Ambystoma opacum* metamorphs and juveniles show variable regeneration rates depending on the nature of the clip, but the technique is at least somewhat successful, and may be effective on adults (D. Scott, pers. comm.).

Pit-tagging is desirable because marking is permanent, the procedure is simple, and the tags are reliable. However, both the initial cost (tag reader) and individual tags are relatively expensive (Table 1).

TABLE 1. Comparative costs (in US $) of photography and the two most widely used techniques for marking salamanders (* = based on 50% recapture rate, ** = example for N = 300 salamanders marked).

Technique	Initial cost	Cost/salamander	Total**
toe-clipping	$ 5	no cost	$ 5
photography	$ 12	$ 1.06*	$ 330
PIT-tagging	$ 950	$ 5.75	$1725

Donnelly et al. (1994) recommended consideration of time and resources (as well as characteristics of the target organism) as important in the choice of marking technique for amphibians. Where expense is not a factor, PIT-tagging may be the preferred marking technique, particularly when very large numbers of animals are to be marked. Given a funding constraint, one is left with either toe-clipping or photography as a marking technique. Toe-clipping, while the most inexpensive (Table 1), is impeded by regeneration and may adversely affect the animal. Photography as a marking technique is intermediate in cost compared to other methods (Table 1), and is the least damaging of the available techniques.

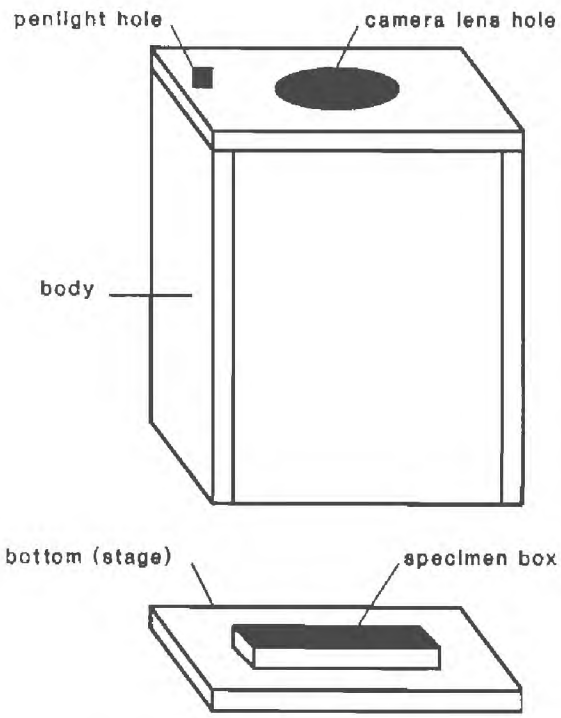


FIG. 1. Basic diagram of camera box for salamanders.

Pitfalls of the photographic technique include the expense of film (ca. $0.29/picture) and film processing (ca. $0.42/print), and the box is slightly cumbersome in the field (approx. wt. = 2090 g). Overall the box has been shown to be reliable for identification of *A. opacum*, was used successfully on several *A. maculatum* and a few *Rana utricularia*, and may be useful for a number of patterned amphibians as a preferred method in mark-recapture studies, particularly those constrained by money.

Acknowledgments.—I thank Jeanne Young, Daniel Doody, Jim Armacost, and Jeff Tamplin for their assistance in the field.

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J. SEAN DOODY
Museum of Natural Science
Highland Road
Louisiana State University
Baton Rouge, Louisiana 70808, USA.

Present address: Dept. of Biological Sciences, Southeastern Louisiana University, Box 814, Hammond, Louisiana 70402, USA.

A Method for Catching Lizards in Trees and Rock Crevices

A number of methods have been described for catching diurnal, active, and easily seen lizards, including pit fall traps, nooseguns, and rubber bands (Cogger 1992; Simmons 1987). A baited noose and plastic tube refugia were presented as capture methods by Strong et al. (1993). None of these methods is particularly successful on sedentary animals that inhabit tree hollows or rock crevices. To date the only method for extraction of these animals from their refugia has been through general harassment until the animal moves out. On many occasions this method results in the destruction of habitat, and/or harm to the animal.

During the wet season (November 1992–March 1993), a study commenced on the spotted tree goanna (*Varanus timorensis similis*) (Christian, unpubl. data). This is a pygmy goanna with a maximum snout-vent length of 230 mm and a maximum mass of 200 g. Average size is 186 mm SVL (SD = 26.2, N = 70) and 84 g (SD = 36.1, N = 69). The study site was located 30 km east of Darwin, Northern Territory, Australia. The goannas were found to frequent the hollowed center of wooden posts in an abandoned fence line. The depth of the central hole ranged from 200 mm to 1500 mm.

The two materials used in the extraction of the lizards from the hole were a set of stainless steel forceps (500 mm) to grasp the animal, and a length of wire (1500 mm long) with a hook at one end. The wire was a piece of plain fencing wire 2, 3, or 4 mm diameter (16, 10, or 8 gauge) bent to form a U-shape at one end. The sharp end of the U was bent back upon itself so that it did not have any rough or sharp edges (Fig. 1). A handle was made by bending 80 mm of wire at the top at 90°. The handle was bent in the same direction as the hook section so that when the hook was down a hole, it was possible to determine the direction it was facing.

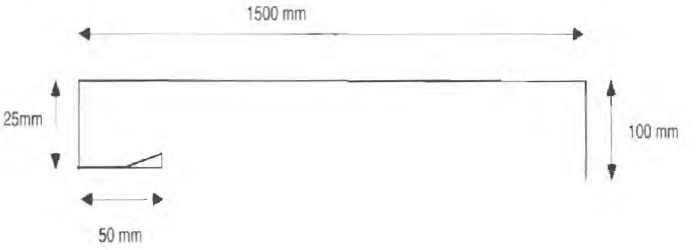


FIG. 1. Diagram of wire hook used to extract *Varanus timorensis similis*.

An animal was first sighted in a hole using a small flashlight, with note taken of its depth and orientation. The hook was then passed down the hole over the back of the animal until it was in line with the anterior third of the animal's tail, but below the legs, assuming the animal was facing the entrance of its hole. The hook was then turned so the tail was encompassed by the hook. At this point the legs acted as a towing point so when the hook was lifted it was positioned around the base of the tail and held by the back legs. The lizard was then lifted in a smooth motion to the top of the hole. The constant pressure on the hook when lifting the animal prevented it from turning around. When the animal was in reach it could either be grasped by the head with the forceps or pulled completely from the hole with the hook. Sometimes an animal turned around in the hole or was facing the wrong direction. A little more care was then needed to extract the animal; in most instances the animal was lifted at mid-body to a point where it could be grasped with the forceps and manipulated to allow the hook to pull it completely from the hole. Lizards could be extracted from shallow holes using only the forceps.

The combination of forceps and hook is the most effective method used by us to date for the capture of *V. timorensis similis*. During a twelve-month period, over 200 animals were caught using this method. The average time taken to catch an animal using this method was 3 min. Circumstances determined which type of wire was used. We were successful using both stiff and soft wire. Some words of caution should be expressed. Although this method is less damaging to the habitat and offers substantial benefits in reduced capture time of animals, it is possible to injure the animal. The most important point is to always make sure the hook is blunt with NO sharp or protruding edges. The hook should be around the base of the tail of the animal before pulling upward. It is an easy mistake to think the hook is around the tail when it has actually penetrated the cloaca. Therefore it is necessary to watch the progress of the hook using the flashlight during the initial positioning around the tail. The same caution holds for animals facing away from the opening. It is possible for an animal to open its mouth in an aggressive stand when facing this way, and the hook to enter its mouth. When first developing the hook system, we encountered penetration of the cloaca three times; however, all animals survived and were released at the point of capture.

We believe this technique should be applicable to both tree and rock-inhabiting lizards.

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GAVIN S. BEDFORD
KEITH CHRISTIAN
School of Biological Sciences
P.O. Box 40146
Casuarina, Northern Territory 0820. Australia

and
BLAISE BARRETTE
6294 Alma
Montreal, Quebec, Canada, H252W3.

Evaluation of a New Miniature Temperature Data Logger

Peterson and Dorcas (1994) described the advantages of using data loggers to measure variation in the environment. Scientists may be reluctant to use data loggers in field studies until their usefulness and reliability have been demonstrated. We used a new, miniature temperature data logger to measure the temperatures of nests and hibernacula of wild desert tortoises (*Gopherus agassizii*) at Yucca Mountain, Nye County, Nevada. Here we report on the accuracy, reliability, and ease of use of these data loggers. Reference to a company or product name does not imply approval or recommendation of the product by the U.S. Department of Energy to the exclusion of others that may be suitable. Quoted costs are from a published price list and are reported in U.S. dollars.

We obtained 30 reusable, temperature data loggers (Hobo-Temp, Onset Computer Corporation, Pocasset, Massachusetts; cost $99 ea.), contained in cylindrical plastic cases (35-mm film canisters) that were 3.3 cm in diameter and 5.3 cm long. Each unit with its case weighed 28 g. Measurable temperature range was -39 to 123°C, although other standard and custom ranges were available. Specified accuracy was 0.6°C from 0–40°C, 0.8°C at -10°C, and 1.0°C at -20°C. We chose units with internal thermistors, though units with an external thermistor were available for an additional $18 per unit. Each data logger could store 1800 measurements in nonvolatile memory. The data loggers could be programmed to measure temperatures over 31 possible durations from 15 min to 360 days with corresponding time intervals of 0.5 s to 4.8 h; they could not be programmed to measure temperatures at rounded intervals such as every hour. We used DOS and Windows versions of the program BOXCAR and a package of DOS programs called HOBO-PC (cost $49 ea.) to set sampling duration and other options and to download data. Data loggers were connected to a computer using a 9-pin to 3.5-mm stereo-jack cable (cost $9). We sealed the cases with cloth tape and/or silicone sealant to prevent the lids from leaking or coming off.

We tested the accuracy of the data loggers at 10°C intervals from -20 to 40°C using an oven (Delta Design, model 3900) and a calibrated thermometer (Instrulab, model 4202, system accuracy ≤0.04°C within tested range). Accuracy averaged 0.34°C (SD = 0.23°C) with a maximum error of 1.03°C. The data loggers were within manufacturer's specifications on 94% of the measurements, and the maximum deviation from the specifications was 0.2°C.

We used the data loggers in the field to measure temperatures of desert tortoise nests and hibernacula. In January 1993, we glued data loggers to the carapaces of three radio-marked, hibernating tortoises that were near their hibernacula entrances. We set the data loggers to record temperatures for 90 days at intervals of 1.2 h. We placed glue (Devcon Plastic Welder) on the data logger case and then pressed the case against the carapace without moving the tortoise. We pried the data loggers from the carapace of each animal after it left its hibernaculum in March 1993.

We placed 23 data loggers in desert tortoise nests at depths of 3–24 cm during May-July 1993 to measure nest temperatures. We programmed these units to record temperatures for 122 days at intervals of 1.6 h.

We judged the reliability of the data loggers based on whether all data were acquired by each data logger. No data loggers placed on tortoises or in nests failed. All data were within expected ranges.

We judged ease of use of the software subjectively. All programs were simple to use and worked well. We found that the delayed start-up option, whereby data sampling could be initiated without a computer by removing and re-inserting the battery, was not ideal because the time recorded by the data logger automatically started at midnight of 1 January 1980 and had to be corrected after the data were downloaded. If the start time and date were not recorded manually, this information was lost. For this reason, we preferred using a laptop or handheld computer to start data loggers in the field. We had to ensure the computer's internal clock was accurate because that is where the data loggers obtained the start time and date.

We preferred using the Windows version of BOXCAR when first learning how to start-up and download data loggers because all of the options were visible on a menu. However, when starting-up or downloading many data loggers or when translating many files to a spreadsheet format, the programs included with HOBO-PC were beneficial because options could be set using a batch file. This reduced the chance of selecting an incorrect option.

We found the Hobo-Temp to be a reliable and easy-to-use temperature data logger. A more advanced product now available features rounded sampling intervals (e.g., an interval of one minute or one hour), a switch for starting units in the field without a computer and without loss of time data, programmable start times, averaging of multiple samples, and storage of up to 32,000 measurements. In addition, similar products are available for measuring relative humidity, light intensity, voltage, pressure, and vibration. A waterproof case that is made for the temperature and light intensity data logger may enable use in wetter climates and aquatic habitats, but the relatively large size of the waterproof case (6 cm in diameter and 10 cm long) reduces the advantage of the data logger's small size. Though, data loggers will undoubtedly evolve into smaller and more feature-rich units, biologists already have access to useful miniature data loggers that are valuable tools for field studies.

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JAMES M. MUELLER
and
DANNY L. RAKESTRAW
EG&G Energy Measurements, Inc.
P.O. Box 1912
Las Vegas, Nevada 89125, USA.

HERPETOLOGICAL HUSBANDRY

Notes on the Captive Husbandry and Reproduction of the Texas Salamander *Eurycea neotenes* at the Dallas Aquarium

The Texas salamander, *Eurycea neotenes*, is one of several hemidactyliine neotenic plethodontid salamanders endemic to the waters of the Edwards Aquifer of south central Texas (Chippindale et al. 1992). They are distributed throughout the aquifer (Dixon 1987), and their taxonomy is currently being evaluated (Chippindale et al. 1992).

The Edwards Aquifer is a subterranean reservoir with outflow water surfacing at many points. The waters of the aquifer have been taxed heavily in recent years by cities, farms, and industries. Five species found in the aquifer are listed as endangered; consequently there is much concern for the welfare of the endemic wildlife of the area. Proper management of this aquifer is vital to the survival of these species.

In the spring of 1990, during a prolonged drought and continued heavy human use of water, parts of the Comal Springs began to dry rapidly. The Edwards Aquifer Research and Data Center (EARDC) at Southwest Texas State University organized the field collection of 80 *E. neotenes* during June 1990. A conference was called to receive input and opinions regarding the depletion of the aquifer's water and the resulting threats to the environment. United States Fish and Wildlife Service, EARDC, San Marcos National Fish Hatchery, Texas Parks and Wildlife, and four North American zoos/aquariums were represented at the conference. Salamanders collected prior to the conference were distributed among interested institutions with the hope that detailed data could be collected regarding the husbandry and reproductive strategies of this little known species. Naturally deposited eggs of neotenic *Eurycea* found in the Edwards Aquifer have never been discovered in the wild, despite concerted efforts.

The Dallas Aquarium acquired 20 specimens from the EARDC, a portion of which were divided into presumed pairs. Three pairs were housed individually in separate 3.8 L aquaria with a constant flow of fresh water from the aquarium well. Temperature of the well is a constant 22°C with pH ranging from 7.5–8.0 (Table 1). Overflow ports were fitted to the back of the aquaria to allow for water drainage. Wild specimens of *E. neotenes* have been collected in gravel substrate, dense submerged aquatic vegetation, and under rocks (Bruce 1976; Sweet 1977), so tank furniture was varied for each enclosure. Additionally some *Eurycea* spp. are known to deposit their eggs on the underside of buried rocks (Ireland 1974). The first aquarium was furnished with a 7 cm gravel substrate, the second was heavily planted with *Vesicularia dubyana* and *Hygrophila* sp., and the third was half filled with partially buried rocks and rock shards. The remaining individuals were housed in a 189.3 L aquarium with constant water flow and no furnishings other than several 25 cm sections of 1.3 cm (1/2 in) PVC pipe. All aquaria were positioned under a skylight to provide natural photoperiods. No other lighting was provided. Live foods offered included tubificid worms, *Gammarus* sp., and adult *Artemia* sp. Salamanders were observed feeding at various times of the day on all food types.

TABLE 1. Dallas Aquarium water composition.

Parameters:	
pH	7.5
Turbibity (NTU)	0.04
Chlorine	0.0
Total suspended solids	0.0
Total dissolved solids	635.
Total alkalinity as $CaC0_3$	353.
Phenol alkalinity as $CaCO_3$	0.
Total hardness as $CaCO_3$	451.
Calcium hardness as $CaCO_3$	432.
Chloride as Cl	61.
Sulfate as SO_4	86.
Nutrients:	
Ammonia as N	0.02
Organic as N	0.18
Nitrate as N	4.4
Nitrite as N	0.0
Ortho phosphate as P	0.07
Total phosphate as P	0.11
Demand:	
Total BOD_5	0.9

All results are in mg/L except pH, or as indicated.

Little activity was observed during daylight hours. Nocturnal activity was recorded on videotape with tinted red lighting as a source of illumination. Salamanders were observed feeding and moving throughout the enclosures with very little interaction noted between individuals. On 22 August 1990 an adult female in the planted tank exhibited obvious egg development, visible through the translucent abdominal wall. The following day a presumed male was observed chasing this female, but no other breeding or courtship behavior was observed. In the following months all animals were closely observed for egg development and/or courtship behavior. Nothing significant was recorded during this period.

During the evening hours of 18 and 19 February 1991, the gravid female deposited 19 white eggs, 2 mm diam, each surrounded by

a gelatinous envelope, and fixed singly to live plants. The eggs were moved to a separate tank to ensure there would be no predation by the adult salamanders or snails present within the breeding enclosure. After a period of 48 h, the incubation tank was covered with black polyurethane to exclude light, addressing the concern that light intensity might have any deleterious effect on the egg development. Embryonic development was documented by photomicrographs. Several eggs developed a fungal growth and were preserved. Between 5–10 March 1991, four eggs hatched. One larva was deformed and expired immediately. Upon hatching, the larval ground color was a creamy white with scattered pale tan dorsal speckling. The larvae possessed rudimentary external gills, no limbs, and an unpigmented iris. TL of hatchlings was 7 mm. Front limb development began with buds visible two days post hatching. Within four days, front legs were complete with digits, and larvae exhibited brown dorsal pigmentation with paired light colored vertebral spots. Hind limb development was observed on 15 March with digits visible on all four legs by 24 March. At 30 days post hatching, larvae were 15 mm TL and began feeding on live newly hatched brine shrimp nauplii, confirmed by the bright orange color of the brine shrimp visible through their translucent abdominal skin. At age two months, the young salamanders were 26 mm TL, and by 6 months of age the largest offspring measured 60 mm TL and showed signs of ova development. At one year post-hatching, two of the three offspring were obviously gravid with fully developed eggs. The third individual showed no ovarian development and was presumed to be a male. No other reproductive behavior was seen in the adults for a period longer than 1.5 yrs. The cues that triggered the first reproduction are unknown.

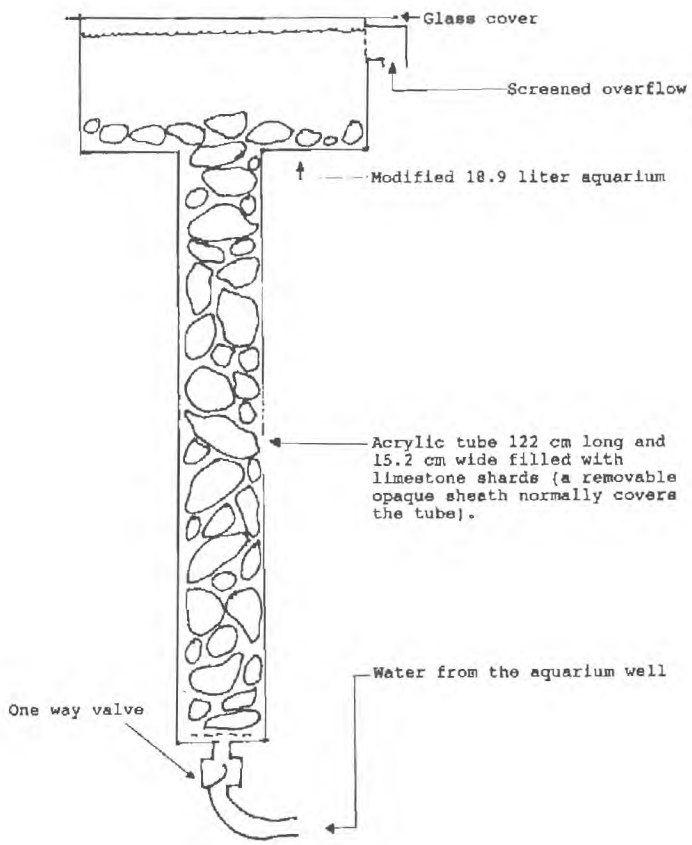


FIG. 1. Schematic of artificial aquifer.

The EARDC found that *E. nana* larvae of different ages can be collected in nets positioned over spring upwellings (Glenn Longley, pers. comm.). Our extended underwater observations in Comal Springs led us to hypothesize that the salamanders travel downward into the spring upwellings to deposit their eggs.

To test this hypothesis, we constructed an artificial aquifer consisting of a 122 cm long, 15.2 cm diam acrylic tube filled with limestone shards and fitted to the bottom of a 18.9 L aquarium (Fig. 1). Water was pumped upwards through the tube and exited through a screened overflow at the top of the aquarium. Flow rate for the artificial aquifer was measured at 5.5 L/min. The tube was equipped with a removable opaque covering to simulate the darkness of an underground aquifer and to permit periodic observations.

One of the original pairs and one F_1 pair were placed in the artificial aquifer on 23 February 1993. The original male was 91 mm TL and the female was 74 mm; the F_1 male was 76 mm TL and the F_1 female was 65 mm TL. Eggs laid by the F_1 female were discovered 38 days (2 April 1993) after the animals had been placed in the aquifer. Based upon rate of development of the previous clutch, the eggs appeared to be 2–4 days old. They were attached singly to rock shards in the lower portion of the aquifer. Hatching occurred ca. 12–13 April. On 10 May 1993 the founder female deposited more than 40 eggs in the artificial aquifer. The larval development subsequent to this oviposition differed from the two previous reproductions. A few of the larvae hatched, unpigmented and with no limb development on 30 May, but the majority of the larvae hatched between 6 and 13 June. The latter group of larvae hatched in a more advanced state with pigmentation of skin and iris diaphragm, and development of front limb buds. After hatching, 20 of the larvae were removed and placed in a separate aquarium for rearing. The remainder of the larvae were left in the parent enclosure for approximately two months. No predation on larvae by the adults was observed during this time. Neonates were then removed from the aquifer and divided between two rearing tanks.

On 13 March 1994 the founder female deposited at least 50 eggs in a similar fashion to her first reproduction on May 1993 in the artificial aquifer. Five eggs were removed to facilitate close observations of larval development.

We believe these three ovipositions in the artificial aquifer represent the "normal" reproductive mode of this species and may explain the difficulty of observing their eggs in nature. This propagation technique is now being tested by the U.S. Fish and Wildlife Service in an attempt to reproduce the closely related, but endangered San Marcos salamander, *Eurycea nana*.

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DAVID T. ROBERTS
Department of Herpetology
Dallas Zoo
621 East Clarendon Drive
Dallas, Texas 75203, USA

DAVID M. SCHLESER
and
THOMAS L. JORDAN
Dallas Aquarium
P.O. 150113 Juanita Craft Station
Dallas, Texas 75315, USA

Collecting and Feeding Harvester Ants (*Pogonomyrmex* spp.) to Captive Horned Lizards (*Phrynosoma* spp.)

Although ants, especially harvester ants of the genus *Pogonomyrmex*, are consumed in large numbers by many species of *Phrynosoma*, or horned lizards (Montanucci 1989a; Munger 1984a, b; Pianka and Parker 1975; Rissing 1981; Sherbrooke 1981, 1987; Whitford and Bryant 1979), ants are not a nutritional prerequisite for these lizards (Sherbrooke 1987). Other insects are part of the natural diet of horned lizards and may be accepted by captive animals. Nevertheless, including ants as a major component of the diet can facilitate the feeding and maintain the health of horned lizards in captivity (Baur 1973; Montanucci 1989b, c, d; personal observ.). Difficulties are frequently encountered both in procuring sufficient numbers of ants and in presenting the ants to the lizards in a fashion that ensures that they can be captured and eaten. Such difficulties have thwarted *Phrynosoma* research, and efforts to exhibit and maintain captive lizards.

In this report I describe hazards and precautions one should take when collecting harvester ants, as well as three successful methods of collecting *Pogonomyrmex* in large numbers. Also, I explain methods for feeding harvester ants to horned lizards in indoor and outdoor enclosures. The *Pogonomyrmex* species most commonly collected near Tucson and Portal, Arizona, were *P. rugosus*, *P. occidentalis*, and *P. desertorum*.

Caution must be exercised in handling *Pogonomyrmex* ants as they are capable of inflicting severe stings (Schmidt 1986), to which some people may have an allergic reaction. People with known allergic reactions to hymenopterans should not try to collect *Pogonomyrmex* ants. Harvester ants defend attacks on their colonies by orienting toward and climbing tall objects. If this is the collector, they will sting. Frequent stamping of the feet effectively dislodges ants from shoes (sandals/thongs should not be worn). By exposing skin on the legs, wearing shorts or rolling up long pant legs, one can feel or see climbing ants on the bare skin and quickly brush them off before they bite or sting. I was occasionally stung on the finger while picking up ants, usually when an ant managed to get between digits. Rubber gloves reduce this risk.

The first technique is used to collect surface-foraging workers that are returning to the entrance of a large colony. Large numbers of individual seed-harvesting ants are active on the surface in the morning and afternoon, depending on climatic conditions. A small depression in the soil (2–5 cm diam) is created at the colony nest entryway, the downward extended tunnels of which are plugged with soil to prevent subterranean escape of trapped ants. Returning ants fall into the depression, where they are trapped in the inverted cone in a fashion similar to that seen in an antlion trap. Continuously arriving ants accumulate in a writhing mass, digging, trying to climb the walls, and attacking each other. Every few minutes I collect ants by swiftly picking up the mass of ants with the tips of my first three fingers and thumb of one hand and quickly drop the ants into a glass jar with a screened lid, from which they can not escape. The procedure is repeated when a sufficient number of arriving forager ants have again gathered at the plugged tunnel entrance. During periods of peak harvester ant activity, hundreds to thousands of ants can be captured in a short time. A person may work several colonies simultaneously by allowing ants to accumulate at one colony entrance while collecting ants at the entrance of a nearby nest. Ants collected in this fashion should be fed to lizards the same day or they will die, probably because of desiccation. Dead ants are not accepted as food by horned lizards.

The second collecting technique is used to capture subsurface workers, and can be employed whether colonies are active or inactive on the surface. Since it involves excavation with a pointed shovel, the selection of site (amount of rocks and compaction of soil) will influence the difficulties encountered in capturing large numbers of ants. A hole is dug 10–30 cm deep in the colony entryway forming a cone-shaped pit, again roughly similar in form to an antlion trap. As defending ants exit from tunnels they are trapped in the pit. They collect in the bottom, trying to climb the walls. The ants can then be scooped up with a shovel, along with loose soil, and dumped into a portable container. Clean 5-gallon (18.9 L) plastic buckets work well, as the ants have difficulty climbing the smooth sides. The goal to keep in mind is to maximize the number of ants and minimize the amount of soil/rocks per shovelful/bucketful. The buckets should not be more that three-quarters filled with soil and ants. It is frequently possible to work several colonies in one area simultaneously, leaving each colony to gather more ants between shoveling bouts. Keep ants from each colony in separate buckets to avoid intercolony strife.

When moisture levels are high at the soil surface numerous subterranean workers may be encountered very near the surface. Frequently brood chambers are unearthed. Seasonally these yield large numbers of workers, alates, some callows, and brood (which are not usually eaten by the horned lizards). Sometimes ant activity in these near-surface chambers can be stimulated by flooding the soil with water, where feasible, several days in advance of digging. Advantage can be taken of the climbing behavior of colony-defending ants by scooping up ants congregating at the tops of piles of soil. Again, the collector needs to constantly be on the alert to avoid ant stings.

For transport in an automobile, buckets can be covered to prevent ant escape. If being transported in the back of a pickup truck this is not necessary, but the soil in each bucket should be shaded

to prevent long exposure to direct sunlight and desiccation of ants on the surface.

The third technique takes advantage of seasonal windfalls of alate ants congregating at lek sites. This requires knowing the timing, climatic stimuli, and lek siting of particular species of *Pogonomyrmex* (Hölldobler 1976). Flying, alate harvester ants of high caloric value can be netted with an insect net. When large numbers of reproductives are collected they can be refrigerated to extend the period of use as live food.

Lizards maintained indoors should be in enclosures at least one meter square, and equipped with proper heating and ultraviolet lighting (Sherbrooke 1987). A sand substrate facilitates burrowing by the lizards. Because excited ants prefer to climb, an elevated "hill" away from the sides and towards one end of the cage serves to keep ants more or less concentrated at one location in the cage during feeding. The concentration of ants, and the maintenance of ant-free areas are critical to stimulating feeding by the lizards. Initially, lizard feeding behavior may be inhibited by the presence of an observer, but after several days the lizards associate the observer with ants, alleviating the problem.

The rate of introduction of ants into the enclosure is critical, and is dependent on the rate of consumption of ants by the lizards. Initially only small numbers of ants (5–10) should be introduced, then following ingestion by the lizards, they can be replaced and augmented. The number of ants in a cage should never be so great that their activity results in ants becoming dispersed throughout the cage. When ants surround lizards on all sides the lizards may stop feeding, and may attempt to escape the enclosure. Non-feeding lizards may become objects of ant attack, and, although they have resistance to ant stings (Schmidt et al. 1989), mandibular bites appear to cause the lizards some discomfort.

Feeding can be facilitated, especially of ants dug up with soil, by maintaining lizards in outdoor enclosures. This eliminates the need for artificial lighting and heating in areas and seasons where the climate is appropriate. Enclosure walls must be buried deeply enough and be high and smooth enough to prevent lizard escape. In addition, enclosures must be protected from predators (wire mesh enclosure covers work well), and large enough to allow entry for feeding and other care of the lizards. In recent years I have used a 4.5 m x 5.5 m x 2.2 m high cage, divided into four 2.65 m x 2.13 m compartments, each surrounded by 0.6 m high sheet metal (28 gauge) walls. A 0.3 m cement footing-wall prevents subterranean escape of lizards and entry of predators.

These large enclosures are ideal for feeding ants mixed with soil in 5-gallon (18.9 L) buckets. The contents of the bucket, or several buckets (depending on numbers of ants and lizards) can be dumped on the center of the cage floor, building an elevated hill over time (which eventually must be removed). Lizards learn to approach this rise and feed on descending ants, while still having the entire periphery of the cage as a retreat. Ants frequently begin building burrows into the loose soil of the mound and, once established below the surface level, live for several days or longer without dying of desiccation. Ants in buckets can be maintained for a few days if the soil is kept damp and the buckets are not in direct sunlight.

Utilizing harvester ants with other foods (other ants, crickets and mealworms), I have maintained in captivity all seven species of horned lizards that occur in the United States for periods of weeks, months, and even several years. The best dietary mix varies with species of *Phrynosoma* (Montanucci 1989a; Pianka and Parker 1975). The numbers of lizards held was usually between fifty and one hundred, mainly for season-long behavioral studies, particularly with *P. cornutum*, after which they have been released at sites of capture. Thus, I have maintained large numbers of horned lizards in excellent condition for long periods of time and with most animals gaining significant weight. Occasionally individual animals do not adapt well to captivity in spite of these methods.

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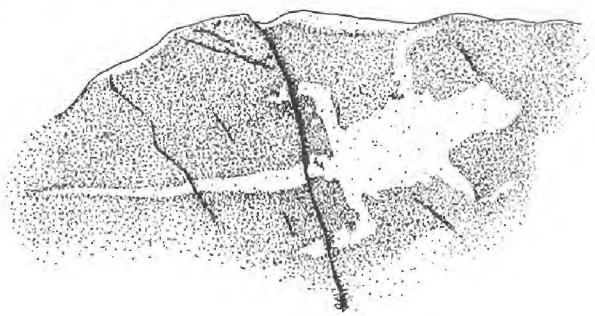
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WADE C. SHERBROOKE
Southwestern Research Station
American Museum of Natural History
Portal, Arizona 85632, USA.



Captive Breeding of Two Species of *Eleutherodactylus* (Anura: Leptodactylidae) from Puerto Rico, with Notes on Behavior in Captivity

Frogs of the genus *Eleutherodactylus* comprise an extremely successful and speciose group in the tropical Americas and the Caribbean. While the biology of several of the 500-plus known species has been investigated, little or nothing is known of the majority of these frogs, and new species are regularly being reported (e.g., Flores 1993; Hedges and Thomas 1992; Wiens and Coloma 1992). As a tool for the study of *Eleutherodactylus*, methods are described here which have been used to successfully breed in captivity two common species from Puerto Rico, *E. coqui* and *E. cochranae*.

Eleutherodactylus coqui is an ecological generalist occurring nearly island-wide in Puerto Rico, on adjacent islands, and in small introduced populations in Florida and Louisiana (Conant and Collins 1991; Rivero 1978; Schwartz and Henderson 1991). *Eleutherodactylus cochranae* is a much smaller and relatively unstudied frog, apparently restricted to the lowlands of Puerto Rico and several of the Virgin Islands (Rivero 1978; Schwartz and Henderson 1991). Both species were collected from backyards and gardens in the coastal town of Dorado, Puerto Rico during 1991–1993. Typical habitats in the collecting area consisted of moist bromeliads and ferns in cultivated gardens.

In captivity, frogs were housed in 10-gallon glass aquaria—51 cm (length) x 26 cm (width) x 32 cm (height)—with special provisions for the presence of suitable retreat sites, moisture, heat, and light. The substrate of the cages consisted of a single, level layer of approximately 1 cm diam natural stream pebbles, partially covered by ca. 1 cm of moist, untreated peat moss, both of which were obtained from local pet or garden supply stores. Smaller diameter pebbles were avoided as they posed a danger of ingestion during feeding. Retreat sites were provided by placing one or more small, locally purchased, potted bromeliads in each tank (*Guzmania* or *Vriesea* species). Care was taken to wash the bromeliads thoroughly to remove any pesticide or fertilizer residue prior to their placement in the aquaria. Cages were kept at a high level of humidity by both mist spraying and direct watering of the bromeliads with bottled spring water. Spraying and watering were performed as necessary to provide small puddles of water in the bases of the bromeliad leaves and to maintain a moist, but not wet, substrate. Humidity was retained by covering the screen cage top with a sheet of plastic wrap. Minimum cage temperatures were kept above 22°C by inserting a submersible 50 or 75 watt aquarium heater into a narrow-mouthed, 1 L plastic bottle filled with water and taped shut to prevent evaporation. These heating devices provided a "soft" heat source which did not present a burn or desiccation hazard. They were placed in the corner of tanks to provide a thermal gradient across the enclosure. Fluorescent lights (15 watt, General Electric) placed directly on the top of each cage raised the maximum temperature during the day to 25–27°C. The lights were placed on a timer to provide a 12 h diel cycle.

An attempt was made to provide as diverse a diet as possible to the frogs. During warm weather, adult frogs were fed a variety of moths attracted to outdoor lights, various hand caught spiders, grasshoppers, termites, and other easily captured insects. During the winters, the diet consisted almost entirely of locally purchased crickets (*Acheta domesticus*), house flies (*Musca domestica*), and locally cultured fruit flies (*Drosophila melanogaster*). While activity continued year round for both species, frogs showed decreasing interest in any one food type after prolonged feeding in the absence of other varieties. Feeding frequency was adjusted to accomodate the relative hunger level of each frog. For general maintenance this usually consisted of a sufficient quantity of items to equal approximately one fifth the frog's weight, twice a week.

In captivity, both species of frogs appeared to call normally and engage in apparently typical behaviors. Male advertisement calling, satellite behavior, and territory and retreat defense, as well as mating and parental care were all observed. Male *E. coqui* and *E. cochranae* both gave advertisement calls similar to those previously described (Drewery and Rand 1983). However, the calls of *E. coqui* collected at Dorado were of higher frequency than those previously reported from frogs at El Yunque (Drewery and Rand 1983; Narins and Capranica 1976; Stewart and Rand 1992). This is in agreement with the observed altitudinal variation in call frequency reported by Narins and Smith (1986). During aggressive interactions and territorial and retreat defense in captivity, *E. coqui* males gave multi-note extensions of their mating call, similar to those reported by Stewart and Rand (1991, 1992) and Stewart and Bishop (1994). Female *E. coqui* in captivity also gave occasional aggressive calls as previously described (Stewart and Rand 1991). Aggressive physical interactions observed between *E. coqui* consisted of butting and biting behaviors also previously described (Stewart and Rand 1991; Townsend et al. 1984). In contrast, male *E. cochranae* in captivity used a very different behavior during physical encounters. This consisted of "shoveling" under the opponent and attempting to dislodge the opponent from the substrate. This may be an adaptation making use of the flattened morphology of *E. cochranae*. Also unlike *E. coqui*, both sexes of *E. cochranae* gave a retreat defense call differing in pitch and timing from the typical male *E. cochranae* advertisement call.

Both species showed extreme satellite male behavior in captivity. Extra males placed within a tank with a mating pair caused disturbances in the normal mating activities. The extra males engaged in aggressive calling and physical interactions with the resident male. These behaviors usually prevented courtship and nesting. However, on several occasions more than one male was found in a nesting retreat attempting to amplex the female. Females occasionally deposited eggs in these circumstances (as evidenced by thinness and the lack of egg masses seen through the skin the following day), but the eggs were always eaten in those circumstances, apparently by the competing males. Conspecific cannibalism has been reported in *E. coqui* (Townsend et al. 1984), but mating interference as a satellite male strategy has not. However, mating interference has been observed in dense populations of *E. johnstoni* in Barbados (Ovaska and Hunte 1992). It is likely that these behaviors in captivity are a consequence of the confined conditions.

During courtship and mating, males of both species produced soft, repetitive calls similar to those mentioned previously for *E. coqui* (Townsend and Stewart 1986). These calls apparently served to attract the female to the nesting site and initiate amplexus. In captivity, amplexus was maintained by pairs of both species until the following day and undisturbed males remained with the eggs in the nest site during development and for as long as 5 days after hatching of the young frogs, as reported by Townsend et al. (1984) and Townsend and Stewart (1986). In captivity, male frogs protected their egg clutches in a manner similar to previous reports (Taigen et al. 1984; Townsend et al. 1984). During dry periods the fathers moved to other leaf axils containing water, then back to

the nest to rehydrate the eggs. Fathers defended their nests vigorously against intrusion from other frogs, insects, or inanimate objects. Eggs in the care of a male frog seldom developed bacterial or fungal infections: however, removing the eggs to another location nearly always produced infections.

During two years of captivity over 30 *E. coqui* clutches and over 20 *E. cochranae* clutches were observed. Breeding activity took place year-round. *E. coqui* laid 12–30 eggs per clutch (mean = 23), which took 15–33 days to hatch (mean = 22). The much smaller *E. cochranae* laid 5–10 eggs per clutch (mean = 8) which took 16–20 days to hatch (mean = 18). The eggs of both species were of approximately the same size (4–6 mm at hatching, mean = 5, N = 10 for each species). For females of both species, the time between each mating and oviposition was dependent on food supply. In one instance, it took only six days for a female *E. coqui* to lay a new clutch. Seven and eight-day intervals between clutches were not uncommon for either species when food was supplied in sufficient quantity. Since female *E. coqui* have been reported to deposit all of their mature eggs at each oviposition (Townsend and Stewart 1986), these times are indicative of the minimum maturation time for a clutch of ova, and thus the minimum breeding interval. If retreat sites, not food supply, limit natural populations (Stewart and Pough 1983), female eleutherodactylids may be able to produce clutches nearly three times faster than males can incubate them. This minimum breeding interval is considerably faster than the 58-day average interclutch interval reported from three female frogs at El Yunque (Townsend and Stewart 1994).

Similar to reports for *E. coqui* in the field (Townsend et al. 1984), males of both species in captivity rarely moved from their eggs during incubation, and appeared uninterested in insects as food items during brooding. However, fathers regularly consumed a small number of eggs during the course of the incubation. It is not clear whether this is a biologically significant behavior or an artifact of captivity, as males often ate their entire clutches if they or their nests were disturbed. Females of both species were voracious feeders, and appeared capable of consuming nearly their own weight in food items in a single evening, especially after egg deposition.

Hatchling frogs of both species measured 4–6 mm SVL (mean = 5, N = 10 for *E. coqui* and 5 for *E. cochranae*). They remained in the nest, guarded by the father for several days after hatching, at which point they began to disperse. The fathers of hatchling frogs remained uninterested in most insect food items, and did not attempt to eat the young frogs. On the other hand, the mothers were a significant source of predation if left in the same aquarium with hatchlings.

A major problem arose in feeding the juvenile frogs, as they were generally too small to eat even fruit flies (Woolbright and Stewart 1987). Oddly, juveniles of the smaller species, *E. cochranae*, were often capable of taking larger food items than juveniles of *E. coqui* of the same age and size. Without a consistent supply of tiny food items, mortality at the hatchling stage was high, generally greater than 95%. Froglets that were capable of eating fruit flies were raised in moss-filled 150 mm x 20 mm petri dishes placed under the plastic wrap on top of the adult frog aquaria until they were approximately 10 mm SVL. They were then transferred to an aquarium and fed pin-head crickets and small house flies. Information on adult *E. cochranae* raised under these conditions is lacking as juveniles of this species began to develop unidentified neurological problems at 10–15 mm SVL. Symptoms included inability to capture food items, unsteady movements, muscle spasms, and a soft enlargement of the head between the eyes. No captive born *E. cochranae* has survived long enough to reproduce. The reasons for this defect in development are unclear. However, juvenile *E. coqui* developed without difficulty and males reached sexual maturity in approximately 5–6 months, as evidenced by calling. Female *E. coqui* grew to a larger size than males, developed egg masses, and bred at approximately 12 months. Second generation captive *E. coqui* have also bred and produced normal offspring. The oldest frog in captivity was a male *E. coqui* that was collected as an adult in September 1991, and died in July 1994. This individual called somewhat atypically in 1993 and 1994, but was otherwise active and healthy, with no obvious cause of death.

Artificial environments of this type should prove useful for the propagation and study of other species of *Eleutherodactylus*. While the biological significance of observations made in artificial settings must be confirmed in the natural habitat, interesting behaviors noted in captivity can provide excellent direction towards the design and interpretation of field experiments. Captive breeding of these species has allowed intimate observations to be made during evidently normal behavior. These observations have indicated likely differences in biology between these two species, including differences in development, clutch size, call patterns, and aggressive interactions. In addition, captive breeding may be useful for conservation of drastically endangered species, since many species of *Eleutherodactylus* inhabit extremely restricted ranges that have been negatively affected by human activities.

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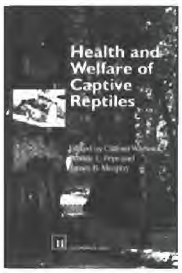
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SCOTT F. MICHAEL
Department of Microbiology
256 Bevill Building
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA
(e-mail: scott_michael@micro.microbio.uab.edu.).

NATURAL HISTORY NOTES

The **Natural History Notes** section (formerly Life History Notes) is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword which best describes the nature of their note (e.g., Reproduction, Longevity, Morphology, etc.). Use of figures to illustrate any data is encouraged, but should **replace** words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send two copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover). Manuscripts concerning reptiles should be sent to Lee A. Fitzgerald; those concerning amphibians should be sent to Charles W. Painter.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1990. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd ed., Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhvacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

AMBYSTOMA TEXANUM (Smallmouth Salamander). **MAXIMUM SIZE**. On 22 March 1993, between 2000 and 2100 h, CST, a gravid female *Ambystoma texanum* was collected during a rain shower on the Lake Kinkaid Spillway Road (SW1/4, Sec. 4, T9S, R3W), Jackson County, Illinois. As measured alive (chlorotone anesthetized), the specimen was: SVL = 106 mm; TL = 191 mm (SIUC H-4432, Herpetology Collection, Southern Illinois University at Carbondale). Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin, Boston, Massachusetts, 450 pp.) report the record size for this species as 178 mm (TL). Smith (1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28(1):1–298) reported a 171 mm (TL) specimen as the largest *A. texanum* from Illinois.

Submitted by **MICHAEL REDMER**, 21 West 103 Par Lane, Itasca, Illinois 60143, USA.

AMBYSTOMA TIGRINUM (Tiger Salamander). **REPRODUCTION**. Nussbaum et al. (1983. Amphibians and Reptiles of the Pacific Northwest. Univ. of Idaho Press, Moscow, p. 57.) reports that little is known about the life history of tiger salamanders in the Pacific Northwest, and gives an account of eggs being found in April in Medical Lake, Spokane Co., Washington. On 26 March 1994 we found approximately 75 eggs attached to stems of spikerush (*Eleocharis* sp.) and fallen branches in a roadside swale on the N side of the Frenchman Hills, Grant Co., Washington; SE 1/4 Sec.16, T17N, R26E (Verified by R.A. Nussbaum, UMMZ 205809). Of almost 20 eggs examined, all embryos were at stage 38 (Duellman and Trueb 1985. Biology of Amphibians. McGraw-Hill Book Company, New York, p. 131), indicating they had been deposited approximately two weeks earlier. All eggs had been attached singly, although it was common to see several eggs beside

one another on the same stem or branch. The eggs were found in water ranging between 5 and 30 cm deep. This record demonstrates that breeding may occur in early to mid-March in the Lower Columbia Basin.

Submitted by **WILLIAM P. LEONARD**, Washington Department of Natural Resources-Natural Heritage Program, P.O. Box 47046, Olympia, Washington 98504–7046, USA, and **DAVID M. DARDA**, Department of Biological Sciences. Central Washington University, Ellensburg, Washington 98926, USA.

PLETHODON GLUTINOSUS (Slimy Salamander). **MORPHOLOGY**. On 29 June 1992, while collecting salamanders as part of a long-term capture recapture study, I collected a juvenile *Plethodon glutinosus* 2.5 km W Hwy 160 near Big Black Mountain Ridge Road in Harlan County, Kentucky. The salamander exhibited extreme scoliosis but otherwise appeared in good health. Based on SVL (41 mm from tip of snout to posterior angle of vent), the age of this individual was estimated to be 2 or 3 yrs (Semlitsch 1980. Herpetologica 36:6–16). This estimate may be conservative since the SVL measurement did not include bends in the vertebral column. The salamander was photographed and released. On 20 July 1993 I recaptured this individual (identity verified by spot pattern record) about 1.5 m from the capture point of the previous year. I photographed the salamander (Fig. 1, top) and recorded its SVL (50 mm). It still appeared in good health. A radiograph confirmed external observations that the vertebral column exhibited extreme lateral arches which were most severe behind the forelimbs (Fig. 1, bottom). Thus, the vertebral column abnormality apparently did not inhibit growth or survival under natural conditions. I thank R. G. Wilson for providing the radiograph and C. McCallister for providing photographs.



FIG. 1. Juvenile *Plethodon glutinosus* exhibiting extreme scoliosis (top); (bottom) radiograph of same individual.

Submitted by **GLENN A. MARVIN**, Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA.

ANURA

BUFO TERRESTRIS (Southern Toad). **OOPHAGY**. On 28 March 1993 I observed a congregation of tadpoles feeding on a dead adult female *Bufo terrestris*. I collected the female and tadpoles (N = 114) to examine the nature of the feeding. I also found a second dead female nearby; however, no tadpoles were feeding on it. I collected this female and an additional 200 tadpoles to determine whether the tadpoles would eventually feed on the second female. After 3 days with the carcass and no other food supply, no feeding was observed.

I haphazardly selected 10 tadpoles captured with the first female and measured SVL and stage. Tadpoles were between 6 and 9 mm SVL, and stages 29 to 31 (Gosner 1960. Herpetologica 16:183–190). The first female toad was missing the right front and rear legs (jagged bones were exposed) and her stomach cavity was open. Tadpoles concentrated feeding activity around the opened venter. Within the body cavity the intestines and stomach were intact, but the female was gravid and many eggs were loose. I inspected 10 tadpoles to determine if they were feeding on the eggs. The presence of eggs in 3 of the tadpoles confirmed that the tadpoles were feeding on the eggs.

Cannibalism or oophagy by tadpoles has been documented in numerous species (Crump 1983. Am. Nat. 121:281–287; Polis and Myer 1985. J. Herpetol. 19:99–107). In some species, cannibalism or oophagy can be an important and regular feature of tadpole life history, while in others it may simply be an opportunistic food source. This observation represents the latter, as this type of oophagy is probably rare for *Bufo terrestris* tadpoles.

Submitted by **KIMBERLY J. BABBITT**, Department of Wildlife and Range Sciences, University of Florida, Gainesville, Florida 32611, USA.

HYLODES PHYLLODES (NCN). **PREDATION**. Picinguaba (23°22'S 48°45'W), southeastern Brazil, embraces an area of Atlantic slope rainforest. The small diurnal leptodactylid frog *Hylodes phyllodes* Heyer and Cocroft (SVL 27.5-35.5 mm) is commonly found on or among rocks and roots along small overgrown streams. The pisaurid spider, *Trechalea keyserlingi* F.O. Pickard-Cambridge, is predominantly nocturnal with diurnal activity being restricted to shadowed areas in cracks and under rocks, and is frequently associated with flowing water.

On 9 December 1991, between 1630 and 1700 h, we observed a subadult *T. keyserlingi* (13.8 mm body length) vertically positioned upside down on the side of a rock next to a stream. This spider caught a young *H. phyllodes* (17. 2 mm SVL) by one of its hind limbs as it passed on the leaf litter about 50 cm below. The frog tried unsuccessfully to get away but was eventually immobilized by the spider's toxin. At that moment both were collected and preserved. The spider was placed in the Instituto Butantan Collection (IBU 5319) and the frog in the Museu de Zoologia da Universidade de São Paulo (MZUSP 69850).

The frequency of predation on *H. phyllodes* by *T. keyserlingi* is unknown but may be common, because both species appear to occupy the same microhabitat. Also, since both species attain larger sizes, predation might include adult frogs. Other pisaurid spiders eat fish and tadpoles (McCormick and Polis 1982. Biol. Rev. 57:29–58) suggesting that this species also could prey on *Hylodes* larvae.

Although spiders are often cited as important predators of small frogs, few published records simultaneously identify predator and

prey species (McCormick and Polis, *op. cit.*). We found no literature concerning such interactions for Atlantic forest species.

Submitted by **LUIS CESAR SCHIESARI, FLORA ACUÑA JUNCÁ** and **GUSTAVO DE MATTOS ACCACIO,** Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, 20520, 01452-990, São Paulo-SP, Brazil.

LEPTODACTYLUS ALBILABRIS (Caribbean White-lipped Frog). **LARVAL DIET**. *Leptodactylus albilabris* is a common frog throughout Puerto Rico. It produces foam nests and its tadpoles occur in a variety of still and slowly flowing waters (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies, Descriptions, Distributions, and Natural History. Univ. of Florida Press, Gainesville. 720 pp.). Little is known of the larval biology of this species and nothing has been reported of the dietary habits of the tadpoles. On 19 May 1994, we observed *L. albilabris* tadpoles of sizes from approximately 6 mm (newly emerged from a nearby foam nest) to 13 mm in a shallow (<5 cm deep) stream at the bottom of a steep ravine in relatively undisturbed wet forest at an elevation of 700 m in the Reserva Forestal Carite (Guavate), Sierra de Cayey, Commonwealth of Puerto Rico (66°02'30"N, 18°05'45"W). Larger tadpoles in two separate pools in the stream were feeding. In one pool larvae were feeding on a dead earthworm (length ca. 100 mm). In the other they were removing flesh from the nearly fully skeletonized carcass of an anole (estimated intact SVL 60 mm). Features of the lizard's skull were consistent with those of *Anolis gundlachi*, which was abundant in the vegetation surrounding the stream. The only other anole observed near the stream was *A. evermanni*. Although few tadpole species are obligate carnivores (Bragg 1965. Gnomes of the Night, the Spadefoot Toads. Univ. of Pennsylvania Press, Philadelphia. 127 pp.), facultative carnivory is more widespread and can occur in species showing no obvious morphological feeding specializations (Heyer et al. 1975. Biotropica 7:100–111). Documentation of tadpole predation or scavenging on vertebrates is rare, but *Leptodactylus pentadactylus* preys on the tadpoles of other anurans (Heyer et al., *op. cit.*; Kluge 1981. Misc. Publ. Mus. Zool. Univ. Michigan 160:1–170). Scavenging of terrestrial vertebrates by larvae is less well-documented, but *Lechriodus fletcheri* tadpoles have been observed to feed on adults of the same species (Martin 1967. Aust. Nat. Hist. 15:326–330). Although the observation of scavenging on a terrestrial vertebrate carcass by *Leptodactylus albilabris* tadpoles is an isolated event, it suggests that facultative carnivory may be more widespread among members of the genus *Leptodactylus* than previously recognized. Further, it highlights the dietary plasticity and opportunistic feeding behavior capable by relatively generalized tadpoles.

Submitted by **RICARDO LEBRON, A. TINA BATRA, JAMES BONTEMPO, CHRISTIAN BUCKLEY, MITCHELL CRON, LINDA FENSTERMACHER, CHRISTINA MAHONEY, LAURA SCHMITT,** and **AARON M. BAUER**, Biology Department, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA.

PELTOPHRYNE GUENTHERI (NCN). **PARASITISM**. In the course of a dietary study of the endemic Hispaniolan toad, *Peltophryne guentheri*, we examined the stomach contents of 204 specimens. In three adult males from different sites in Haiti (Arbonite, near Los Poteaux) and the Dominican Republic (Independencia, near Lago Enriquillo; Monte Cristi, near Copey), we found immature nematodes (*Skrjabinoptera* sp., Physalopteroidea) admixed with ingesta. Prevalence was 1.5% (3 of 204 specimens examined). Intensities ranged from 1–4 (mean = 2.0) parasites per host. Total lengths of nematodes ranged from 1.7–2.4 mm (mean = 1.93 mm), maximum diameter from 14–15 μ (mean = 14.3 μ).

Skrjabinoptera has not been found previously in any amphibian (Baker 1987, Mem. Univ. Newfoundland Occ. Pap. Biol. No. 11), but *S. leiocephalorum* has been found in Hispaniolan lizard hosts. This parasite was originally described from *Leiocephalus schreibersii* and *L. barahonensis* (Greve and Powell 1989, J. Parasitol. 75:677–679; Powell et al. 1990, J. Helminthol. Soc. Washington 57:75–77). Powell et al. (1990. Herpetol. Rev. 21:60–61) noted its occurrence in *L. semilineatus*. Fobes et al. (1992. Carib. J. Sci. 28:200–207) and Moster et al. (1992. Bull. Maryland Herpetol. Soc. 28:150–161) found *S. leiocephalorum* in *Anolis cybotes* and *A. brevirostris*, respectively. That so many diverse lizards support this parasite suggests that a common prey item is the vector (probably one or more species of insect). *Peltophryne guentheri* may feed on the same prey. However, the low prevalence and the fact that all parasites were juveniles may reflect the inadequacy of *P. guentheri* as a final host.

We thank William E. Duellman and John S. Simmons, University of Kansas Museum of Natural History, for access to speci-

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mens in the Albert Schwartz Field Series. Specimens in the Bobby Witcher Memorial Collection at Avila College, Kansas City, Missouri, were collected with the help of many colleagues and students over the years. Sixto and Yvonne Incháustegui, Grupo Jaragua, Jose A. Ottenwalder, United Nations Development Program, and Andreas Schubert, Servicio Alemán and Departamento de Vida Silvestre, often have facilitated our opportunities for field research in the Dominican Republic. Permits were provided by Emílio A. Bautista M., Departamento de Vida Silvestre, República Dominicana.

Submitted by **KEELY J. PARSONS** and **ROBERT POWELL**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145, USA, and **JOHN H. GREVE**, Department of Veterinary Pathology, Iowa State University, Ames, Iowa 50011, USA.

PSEUDACRIS REGILLA (Pacific Chorus Frog). **REPRODUCTION**. On 28 and 29 August 1993, I observed *Pseudacris regilla* tadpoles in weakly brackish (~1.0%) ('brackish' sensu Remane and Schlieper 1971. Biology of Brackish Water. Wiley, New York. 327 pp.) supratidal pools on Frank Island and at South Beach, west-central Vancouver Island, British Columbia, Canada. Some inland populations of *P. regilla* frequent and presumably breed in brackish water (Brues 1928. Proc. Am. Acad. Arts Sci. 63:138–228; Brues 1932. Ibid. 67:184–303; Murray 1958. Herpetologica 11:33–48), but reproduction in brackish supratidal pools has not previously been reported. The Vancouver Island breeding pools appear similar to those used by *Bufo calamita* in Sweden (Andrén and Nilson 1985. Amphibia-Reptilia 6:137–142): pools are small (<3 m^2), shallow (<45 cm), and not connected to the ocean. At high tide they are no higher than 4 m above sea level and as close as 5 m to the water's edge. Salt spray and inundation of sea water during storms apparently adds salt water to these pools, but heavy rainfalls and surface runoff probably maintain salinities at dilute levels.

Although at least seven other amphibian species are sympatric with *Pseudacris regilla* across west-central Vancouver Island (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. Univ. Press of Idaho, Moscow. 332 pp.), I found only *P. regilla* tadpoles and aquatic arthropods in the supratidal pools. Tadpoles ranged in density from one to about 25 individuals per pool and stages 28 to 42 of Gosner (1960. Herpetologica 16:183–190). The late stage larvae suggest that metamorphosis successfully occurs; however, I failed to locate any metamorphosed frogs. I deposited seven voucher tadpoles from Frank Island in the University of Alberta Museum of Zoology (UAMZ 3001), Edmonton, Alberta.

I thank Josie Cleland (Clayoquot Biosphere Project, Tofino) for bringing the Frank Island tadpole pools to my attention, Dick Pereschitz for conveying a relevant paper, Gertie Hutchinson (Univ. Alberta) for salinity testing, and my wife, Joan Marklund, for tolerating my field studies while we were vacationing.

Submitted by **JAMES D. GARDNER**, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9, Canada.

PSEUDACRIS STRECKERI ILLINOENSIS (Illinois Chorus Frog). **BURROWS**. The fossorial chorus frogs *Pseudacris ornata* and *P. streckeri illinoensis* both use their forelimbs to burrow in the substrate (Brown et al. 1972. Herpetologica 28:325–328; Brown and Means 1984. Amphibia-Reptilia 5:261–273). Forward burrowing is unusual: most fossorial frogs dig backwards with their hind feet (Brown and Means, *op. cit.*). In *P. streckeri* this behavior is associated with subterranean feeding (Brown 1978. Herpetologica 34:212–216), and in both species with reduction of the intercalary phalanges in the forelimbs (Paukstis and Brown 1987. Brimleyana 13:55-61; Paukstis and Brown 1991. Can. J. Zool. 69:1297–1301). Few details about the burrows of free ranging chorus frogs of either species are available (Axtell and Haskell 1977. Nat. Hist. Misc. 202:1–8). We herein document the construction of burrows by newly transformed *P. s. illinoensis*, and add a further record of a burrow occupied by an adult male frog.

We observed a population of *P. s. illinoensis* in Madison County, Illinois (4.8 km SW Edwardsville, T4N, R9W, sec. 29). Soils in this area are Oakville fine sand and Bloomfield loamy fine sand (Goddard and Sabata 1986. Soil survey of Madison County, Illinois. U. S. Dept. Agriculture, Soil Conservation Service, U. S. Government Printing Office, Washington, D. C., 254 pp.), and are consistent with soils used by *P. s. illinoensis* from the lower Illinois River (Brown and Rose 1988. Illinois Nat. Hist. Surv. Biol. Notes 132:1-13).

On 20 April 1993 at 2230 h we dug one adult male (35 mm SVL) from a burrow 2.9 m from a breeding pond. This burrow was 45 cm long and 11 cm below the soil surface at its terminus. It appeared to be level with depth being produced by its location on a slope. The opening was semi-oval in shape (2.2 cm wide and 1.4 cm high) with a loose sand apron. Apparently, the loose sand was pushed from the burrow. The terminus consisted of a slightly enlarged chamber with damp but not saturated sand. The frog was well hydrated and active. We heard no calling from the vicinity of the burrow. Underground calling has been reported for *P. ornata* (Brown and Means, *op. cit.*).

The burrow was in an area of unvegetated sand. We excavated similar burrows (38), but found no other frogs. No excavated burrows were within 5 cm of plants. Some burrows could have been made by toads; choruses of *Bufo americanus* and *B. woodhousii fowleri* were present. Three male *B. americanus* were also dug from two burrows the same night. The larger burrows occupied by toads differed from the burrow made by the chorus frog in that their openings were circular with sand pushed up all around the margin of the opening. Toad burrows also dipped at a steeper angle. One toad burrow was 18 cm long and 12 cm deep; the other was 20 cm long and 10 cm deep.

Axtell and Haskell (*op. cit.*) reported that burrows of *P. s. illinoensis* dipped at a steep angle (20 cm depth with 10 cm lateral displacement) or were nearly vertical (2 of 3 burrows). The openings of those three burrows were similar to the one that we observed. The depths of the four (3 from Axtell and Haskell and one we report) known burrows of *P. s. illinoensis* averaged 15.2 cm (range 11–20 cm). Axtell and Haskell (*op. cit.* p. 2) also noted that burrows containing frogs were located in areas devoid of vegetation. These details are important because excavation of likely-looking burrows in vegetation-free areas in suitable sandy habitats is a useful method for locating specimens of the highly secretive *P. s. illinoensis* both at choruses (our record) and away from breeding sites (Axtell and Haskell's report).

Between 24 May and 12 June while conducting a survey of the site for transforming chorus frogs, 42 burrows containing newly transformed froglets were excavated in a wheat field near the natal pond. Twenty-three of these were in bare sand, but 19 were within 0.5 cm of wheat plants. No burrows were in heavy vegetation at the margins of the wheat field or between the wheat field and natal pond. Most burrows were less than 2 cm long (mean =

3.8 cm, range 1.2–15 cm, N = 22) and shallow, but one was 15.0 cm long and 4 cm deep at its terminus. Many froglets were seen at the mouth of burrows. When we approached, froglets usually fled by hopping into the open rather than into the burrow. All burrows were excavated during daylight and may have been temporary refuges constructed to avoid desiccation during a post-transformation migration.

Burrows containing either adult or newly transforming frogs were not found in heavy vegetation. Our observations support the hypothesis that sod or compacted soils are incompatible with the frog's burrowing life history (see Brown et al., *op. cit.*; Axtell and Haskell, *op. cit.*). If these contentions are true, vegetation in habitats used by *P. s. illinoensis* should be managed to prevent thickening or sod formation. Compaction of sandy soils by human or natural means may be detrimental to the persistence of the frog.

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Submitted by **JOHN K. TUCKER, JAMES B. CAMERER**, and **JAMES B. HATCHER**, Illinois Natural History Survey, 1005 Edwardsville Road, Wood River, Illinois 62095, USA.

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RANA CATESBEIANA (Bullfrog). **DIET**. True toads (Bufonidae) are infrequently reported in the diet of *Rana catesbeiana* (see review by Bury and Whelan 1984. U.S. Dept. Interior Fish and Wildlife Serv. Res. Pub. 155). On 31 July 1992 (2100 h), I collected two adult female bullfrogs (180 mm and 156 mm SVL, respectively) in a temporary roadside pool formed by overflow from a permanent irrigation pond, 12 km ESE of Hermanas, Luna County, New Mexico. Chorusing males of *Scaphiopus couchii*, *Spea multiplicata*, *Bufo cognatus*, *B. debilis*, and *Gastrophryne olivacea* were also present in this or nearby pools. The stomach of the larger bullfrog contained a *B. cognatus* (70 mm SVL), a *B. debilis* (42 mm SVL), and two tenebrionid beetles. The second frog had eaten an anuran, a mouse (both unidentifiable), a centipede (*Scolopendra* sp.), and several beetles. The *B. debilis* had been only recently ingested, whereas the *B. cognatus* probably had been eaten the previous night as it was partially digested.

Brown (1974. Southwest. Nat. 19:335–336), and Tucker and Sullivan (1975. Trans. Illinois State Acad. Sci. 68:167) noted that *Bufo* are apparently unpalatable to bullfrogs due to their toxic parotoid gland secretions which may cause regurgitation of the prey item or even immobilization of the predator. I shot both bullfrogs and therefore could not determine if the larger specimen exhibited symptoms of poisoning. It is noteworthy, however, that this frog, perhaps due to its large body mass, was able to consume the *B. debilis* after ingesting and partially digesting the *B. cognatus*. Similar observations of ingestion and digestion of *Bufo valliceps* by bullfrogs were reported recently by Platt and Fontenot (1993. Bull. Chicago Herpetol. Soc. 28:189–190).

The bullfrogs were collected under permit from the New Mexico Department of Game and Fish and are deposited (with stomach contents) in the Museum of Southwestern Biology, University of New Mexico (MSB 54999-55000). I thank W. G. Degenhardt, R. D. Jennings, and C. W. Painter for comments.

Submitted by **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

RANA TEMPORALIS (Golden Frog). **ECOLOGY**. Five adult (SVL 35.0–73.5 mm; mean = 53.80 ± SE 7.36 mm) *Rana temporalis* (Günther 1864) were collected 28 August 1990, from a forest in the vicinity of Tirunelveli (8° 25'-35' N, 77° 25'-35' E), Tamil Nadu State, India. The frogs were found on boulders along an intermittent stream bed. Two were males with enlarged testes (SVL 41.6 and 51.4 mm) and three were females with developed ovaries (SVL 67.5, 35.0 and 73.5 mm). Two of the females were gravid, one with SVL 67.5 mm contained 838 eggs (1.81% of body weight; mean = 0.07 mm, N = 3), another SVL 73.5 mm contained 1225 eggs (7.38% of body weight; mean = 0.14, N = 3).

Little data are available on the diet of this species. Abdulali (1962. J. Bombay Nat. Hist. Soc. 59:228–237) found three frogs, including a *Rana limnocharis*, in the stomachs of two *R. temporalis*. These *R. temporalis* contained food in their stomachs, constituting 0.20–1.46%, respectively, of the total body weight. A total of ten prey items were recovered from the five frogs reported here. Prey length ranged between 1.60–7.90 (mean = 4.66 ± SE 1.01) mm, and included two dipterans (including a stalk-eyed fly), two spiders, two cockroaches, two termites, and two unidentifled insects (one with eggs). The average number of prey items was 2 (SE 0.45, range 1–3 items).

Submitted by **INDRANEIL DAS**, Centre for Herpetology, Madras Crocodile Bank Trust, P.O. Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

TESTUDINES

CHRYSEMYS PICTA BELLI (Western Painted Turtle). **FEEDING BEHAVIOR**. *Chrysemys picta* is typically omnivorous (e.g., Ernst and Barbour 1989. Turtles of the World. Smithsonian Institution Press, Washington, D.C., 313 pp.; Raney and Lachner 1942. Copeia 1942:83–85). Although there is anecdotal information concerning painted turtles feeding on crustacean zooplankton (e.g., Brown 1992. J. Elisha Mitchell Sci. Soc. 108:38–54), the importance of zooplankton to turtle diets is poorly known (Knight and Gibbons 1968. Amer. Midl. Nat. 80:558–562; MacCulloch and Secoy 1983. Can. Jour. Zool. 61:1499–1509). This report examines the behavior of juvenile *C. p. belli* feeding on cladoceran zooplankton.

A juvenile *C. p. belli* (60 mm plastron length) was collected on 9 April 1993 while it was basking on a log in the littoral zone of Lone Star Lake (a 79 ha reservoir 20 km from Lawrence, Douglas Co., Kansas). The turtle was brought back to the laboratory, placed in a 19 L aquarium filled to a depth of 15 cm, and left overnight. A student placed a mixture of zooplankton in the aquaria and noticed that the turtle began to feed immediately. On 17 April 1993, I conducted an experiment to look at feeding behavior. After withholding food for 24 h, I placed 50 lab-cultured Daphnia magna (2–2.5 mm) in the aquarium (density = 5/L; water temperature = 20.5°C). I then observed the turtle for 5 min and counted the number of attacks and the number of successful attacks. Ten minutes after the trial was completed, I added 15 additional prey items of the same size to estimate the distance at which the turtle could locate *Daphnia*.

The turtle reacted immediately to the presence of prey, and attacked 39 *Daphnia* during the 5 min trial with a capture success of 92% (feeding rate = 7.2/min). During a typical feeding sequence, the turtle located a *Daphnia* while swimming underwater, oriented toward it, swam to within ca. 2 cm, retracted the head, and immediately lunged the head forward (termed a "head-lunge" by Brown, op. cit.) to capture the prey. The mean distance at which the turtle located *Daphnia* was 10 cm (range 4–11.5 cm). The turtle was released at the site of capture on 18 April 1993. I thank Thomas Berendonk for his initial observations.

Submitted by **ERIC F. MAURER**, Department of Systematics and Ecology, University of Kansas, Lawrence, Kansas 66045, USA.

ERETMOCHELYS IMBRICATA (Hawksbill). **PREDATION**. Records of shark predation on sea turtles are scarce, especially on the hawksbill (Witzell 1983. FAO Fish. Sinop. 137, Rome, 77 pp.). In the tropical eastern Atlantic Ocean the tiger shark, *Galeocerdo cuvier*, is a major predator on hawksbills (Cadenat 1977. Inst. Fr. Afr. Noire 19 (1):274–294). Here we report on a hawksbill eaten by a tiger shark in the western Atlantic Ocean, between Nova Viçosa and the Parcel de Abrolhos (18° 00' S, 39° 02' W), Bahia, eastern Brazil. On 2 March 1994 a whole juvenile hawksbill with carapace 34 cm long and 27 cm wide (curved measurements) was found by fishermen in the stomach of a shark with body mass 120 kg (estimated total length 250 cm, diameter of the jaws 31 cm) caught near reefs at a depth of about 15-20 m. The Nova Viçosa fishermen informed us that they frequently find sea turtles in the stomachs of tiger sharks. Predation on hawksbills by tiger sharks may be common, since both the turtle and the shark are associated with reefs and shallows (Böhlke and Chaplin 1968. Fishes of the Bahamas and adjacent Tropical Waters, Livingston Publ., Wynnewood, 771 pp.; Witzell, *op. cit.*). The turtle carapace and pieces of the shark jaws are deposited at the Museu de História Natural, Universidade Estadual de Campinas (ZUEC 1693 and 1960).

We thank I. Verjovsky, A. Batalha, and P. Bonino for introducing us to the fishermen of Nova Viçosa, G. de Jesus for information on tiger sharks, M. Martins for comments on the manuscript, and the CNPq for financial support.

Submitted by **JOÃO LUIZ GASPARINI**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil, and **IVAN SAZIMA**, Departamento de Zoologia, Universidade Estadual de Campinas, 13081-970 Campinas, São Paulo, Brazil.

HYDROMEDUSA MAXIMILIANI (Maximilian's Snake-necked Turtle). **JUVENILE MORPHOLOGY**. *Hydromedusa maximiliani* occurs in southeastern Brazil, from Espírito Santo to São Paulo (Ernst and Barbour 1989. Turtles of the World. Smithsonian Institution Press, Washington, D.C. 313 pp), living in shallow streams inside rain forests in mountainous regions. Although adults have been described in detail (Ernst and Barbour, *op. cit.*) there is no information on hatchling or juvenile morphology of this species.

From June to December 1993, several specimens (hatchlings, juveniles and adults) of *H. maximiliani* were observed and measured in the wild at Carlos Botelho State Reserve, São Paulo (24° 03' S; 47° 59' W). The mean carapace length of hatchlings and juveniles was 89.7 mm (N = 33; SD = 20.7 mm; range = 47.3–122.5 mm) and their mean mass was 78.2 g (N = 33; SD = 40.6 g; range = 15.0–160.5 g). Adult carapace length was 160.1 mm on average (N = 52; SD = 17.9 mm; range = 129.0–197.5 mm). The plastron color of hatchlings and juveniles was either completely dark with a yellowish bridge or yellowish with peripheral dark spots. The carapace was uniformly brown or dark gray, with the lower border of marginal scutes yellowish, with black sutures in some animals. Maxilla and mandible were blackish or yellowish (in adults, jaws are cream to yellow). The iris was black in all individuals. Dorsal and lateral parts of the head and neck and dorsal side of the limbs were brown or olive gray; ventral side of the limbs was yellowish or cream colored, similar to adults.

The main feature of the carapace morphology in juveniles is the marginal scutes, which from the seventh scutes posteriorly makes a serriform shape of the carapace rim. This characteristic disappears as the animal grows. None of the traits that exhibit sexual dimorphism in adults (Guix et al. 1992. Bol. Asoc. Herpetol. Esp. 3:23–25) was found to differ between male and female juveniles.

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Submitted by **FRANCO LEANDRO DE SOUZA**, Universidade Estadual Paulista, Departamento de Zoologia, 13506-900 Rio Claro, SP, Brazil.

HYDROMEDUSA TECTIFERA (South American Snake-necked Turtle). **PREDATION**. On 12 November 1990, I observed a giant otter, *Pteronura brasiliensis* eating an adult (25 cm carapace length) *Hydromedusa tectifera*. The animals were in a 10 X 15 m, 3 m deep pool formed by a moderately fast-flowing, 10 m wide

river located inside Tropical Atlantic Forest in southern São Paulo State, Brazil (25°03'S, 48°04'W), elevation 150 m. The otter held the turtle with its paws, keeping itself partly in the pool, while biting the anterior part of the turtle's carapace mainly around its borders. Upon detecting me, the otter left the carcass and disappeared. The turtle's head, neck and legs had been eaten. About 1.5 km downstream I found a turtle plastron 15 cm long which had been gnawed by an otter. There is no published information on the natural enemies of eastern Brazil *Hydromedusa* (Ernst and Barbour 1989. Turtles of the World. Smithsonian Inst. Press, Washington, D.C., 313 pp.). The rare giant otter has been observed, in the Atlantic Forest, to disturb dead leaves which accumulate at the bends of rivers, a favorite habitat for *H. tectifera* (pers. obs.). These observations suggest that otters may be an important predator of *H. tectifera* in southeastern Brazil.

I thank F. Olmos for comments on the first draft of the manuscript.

Submitted by **PAULO MARTUSCELLI**, Instituto Florestal de São Paulo, Calxa Postal 194, Peruibe, SP, 11750-970, Brazil.

LACERTILIA

CARLIA* CF. *FUSCA (NCN). **BEHAVIOR.** Although introduced *Carlia* cf. *fusca* (hereafter referred to as *Carlia*) has been implicated as a causal factor in declines of native scincids on Guam, Mariana Islands (Case and Bolger 1991. Evol. Ecol. 5:272–290; McCoid 1993. Herpetol. Rev. 24:1–17; Rodda and Fritts 1992. J. Herpetol. 26:166–174; Rodda et al. 1991. Micronesica 24:195–210), few corroborative data exist. Rodda and Fritts (*op. cit.*) presented retrospective museum data indicating a decline in native scincids while *Carlia* exhibited a reciprocal increase. These data, coupled with field observations, led these investigators to label *Carlia* as an aggressive kleptoparasite that displaced native scincids. It was routinely observed that *Carlia* would approach *Emoia caeruleocauda* that were foraging and either directly steal food or displace them from a foraging area. Herein, I provide additional observations and suggest that *Carlia* is also displacing native scincids by overt aggression and predation.

The most common native scincid on Guam is *Emoia caeruleocauda*; its distribution was probably island-wide at one time. Habitats with the current highest densities are primary and secondary forests, although enclaves of *E. caeruleocauda* can be found throughout the island in association with reasonably lush patio gardens and relict forest patches. In contrast, *Carlia* is now the most abundant scincid on Guam and is common in all habitats, including highly urbanized areas. *Emoia caeruleocauda* on Guam reaches a maximum SVL and mass of 54 mm, 3.3 g, while *Carlia* is longer and more robust (65 mm SVL, 6.3 g).

While trapping *Boiga irregularis* (brown tree snakes) on Guam (1989–1990), G. Rodda and I noticed that when adult *Hemidactylus frenatus* used as bait were released, they were frequently attacked by *Carlia*. On many other occasions, *Carlia* was observed on the forest floor chasing *E. caeruleocauda* for at least several meters. Often, *E. caeruleocauda* would escape *Carlia* by climbing vegetation where *Carlia* would rarely pursue higher than 1 m. On Guam, *E. caeruleocauda* appears to be more arboreal than on islands that lack *Carlia* (e.g., Rota, Mariana Islands) (pers. obs.). While using 'sticky traps' to collect lizards (Rodda et al. 1993. Herpetol. Rev. 24:99–100), I retrieved adult *Carlia* from traps with subadult *E. caeruleocauda* in their jaws on at least three occasions. It is likely the *Carlia* were attracted to the trapped skinks. On three occasions, the approach of an *E. caeruleocauda* to a *Carlia* in a basking site elicited a chase by the *Carlia*. In all three instances, the approaching *E. caeruleocauda* head-bobbed at a *Carlia* less than 1 m distant. The *Carlia* then head-bobbed and pursued. Despite being larger and heavier, size of the *Carlia* may not be important in agonistic interactions; a subadult *Carlia* (ca. 40 mm SVL) was observed chasing an adult male *E. caeruleocauda* (ca. 50 mm SVL). *Carlia* has also been seen to pursue, capture, and break off and devour a tail of an *E. caeruleocauda*. Pursuit of *Carlia* by *Emoia* has never been observed on Guam.

Recently, Petran et al. (1993. Science 259:354–358) concluded that behavioral exclusion by *Hemidactylus frenatus* affected local distributions of the native *Lepidodactylus lugubris*. McCoid and Hensley (1993. Herpetol. Rev. 24:87–88) augmented this portrait, using the same species, with observations of predation. It seems likely that local distributions of native scincids on Guam are being affected by introduced *Carlia* through similar competitive mechanisms. Behavioral exclusion, aggression, and predation on native scincids by *Carlia* probably all are important in altering the distribution of *E. caeruleocauda* on Guam.

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Submitted by **MICHAEL J. McCOID**, Division of Aquatic and Wildlife Resources, P. O. Box 2950, Agana, Guam 96910, USA. Current Address: Caesar Kleberg Wildlife Research Institute, Texas A&M University, Kingsville, Texas 78363, USA.

GALLOTIA GALLOTI (Canary Islands Lizard). **NECTAR FEEDING.** All four species of *Gallotia* (Lacertidae) currently living in the Canary Islands have been reported to eat a substantial amount of vegetable food (Kreffl 1950. Zool. Anz. 145(Suppl.):426–444; Molina-Borja 1991. Vieraea 20:1–9; Molina-Borja and Barquin 1986. Vieraea 16:233–236; Naranjo et al. 1991. Rev. Esp. Herp. 6:45–48). Plant parts consumed include leaves, flowers, flower buds, fruits and seeds, but there are no published accounts of any *Gallotia* feeding on nectar. In fact, observations of nectarivory in lizards are scarce and only a handful of species, mostly geckos, are known to regularly visit flowers to feed on nectar (Whitaker 1987. N. Z. J. Bot. 25:315–328). Here we report observations of nectar feeding in *G. galloti*, a medium-size lacertid (145 mm maximum SVL) inhabiting the westernmost islands of the Canarian archipelago (Barbadillo 1987. La Guia de Incafo de los Anfibios y Reptiles de la Peninsula Iberica, Islas Baleares y Canarias. Incafo, Madrid, 694 pp.).

Observations were conducted in Loro Parque, a privately owned zoological park located in the Punta Brava district of Puerto de la Cruz (Tenerife, Canary Islands). *Gallotia galloti* occur at relatively high densities throughout the park, but they are most conspicuous alongside the walkways in plots dominated by cacti and palm trees (*Phoenix* sp.), with no ground cover. The lizards are relatively undisturbed and tolerate close-range inspection by an observer. Adult *G. galloti* were seen carrying dates and other fruit in their mouths and occasionally picking up handouts provided by the visitors. Between 1400 and 1500 h on 23 August 1992 we noticed several *G. galloti* climbing through a hedgerow of crown of thorns (*Euphorbia milii* (= *E. splendens*), Euphorbiaceae), a thorned, woody-stemmed spurge from Madagascar. As many as five lizards were observed clinging to the shrubs, some ca. 50 cm from the

ground, sequentially lapping the nectar from several flowers. All the lizards foraging for nectar were juveniles; the dense branching and the sharp thorns may limit access to the flowers to all but the smallest individuals. Although *E. milii* is an exotic ornamental, the Canarian flora is rich in indigenous Euphorbiaceae that may be exploited as a natural source of nectar. Previous reports described adults of *G. galloti* feeding on leaves and flowers of *Euphorbia balsamifera* (Molina-Borja 1981. Doñana, Acta Vertebrata 8:43–78), adult *G. stehlini* from the island of Gran Canaria eating buds of *E. obtusifolia* and dry leaves of *Ricinus comunis* (Molina-Borja 1986. Vieraea 16:23–26), and juvenile *G. simonyi* from El Hierro Island taking flowers of *E. obtusifolia* (Machado 1985. Bonn. Zool. Beitr. 36:429–470).

Most observations of lizard nectarivory have occurred on islands (e.g., geckos: Whitaker, *op. cit.*; *Cnemidophorus murinus:* Dearing 1993. J. Herpetol. 27:111–114). Among lacertids, nectar feeding has been described in *Podarcis dugesii*, the Madeiran lizard (Elvers 1978. Botaniska Notiser 131:159–160), and *P. lilfordi* from Nitge (Menorca, Balearic Islands) (Brown et al. 1992. Oecologia 91:500–504). This note documents nectar feeding in another insular lizard species and reiterates the ability of *Gallotia galloti* to exploit a variety of food sources. We thank Matt Kramer, Statistical Research Division, U.S. Bureau of the Census, for his comments on this manuscript.

Submitted by **ENRIQUE FONT** and **MARIA JOSE FERRER**, Departamento de Biologia Animal, Universidad de Valencia, 46100 Burjasot, Valencia, Spain.

KENTROPYX ALTAMAZONICA (NCN). **COLOR**. Museu de Zoologia da Universidade de São Paulo, numbers 57891-57892. The "*calcarata*" group within the teiid genus *Kentropyx* have bright green stripes on the head and forebody at hatching which gradually become fainter with age. Adults are patterned with shades of brown, black, or grey which camouflage them among leaf litter (*K. calcarata* and *K. pelviceps*) or muddy river banks (*K. altamazonica*). In contrast, *K. striata*, which occurs in savannas and islands on the lower reaches of the Amazon River, has bright green coloration along the posterior dorsal surface of the body (Gallagher and Dixon 1992. Bolletin Museo regionale di Scienze naturali-Torino 10(1):125–171). Here we report the color of *K. altamazonica* which were encountered in flooded grasslands on islands in the central part of the Amazon River near Manaus Amazonas, Brazil (3°05'S, 60°00'W). At least 4 lizards were seen 16 June 1981 and two were shot with an air rifle and one was photographed to allow an accurate description of its color. The adult male had a brownish grey head with a faint green mid-dorsal stripe. Its flanks were grey with faint blue-green blotches. A rich brown dorsolateral stripe commencing at the hind legs broke up into large black blotches at mid-body and faded out so that it was barely distinguishable at the level of the forelimbs. Its extension to the eye was only discernable from tiny black irregularly distributed black blotches and a faint green stripe along its lower edge. The dorsal surface of the hindlimbs was brown with white blotches. The dorsal surface of the body lacked stripes and blotches. The nape of the neck was sky blue, becoming lime green at the level of the forelimbs. The lime green extended onto the tail about as far as the knee reaches when the hindlimb is extended backwards. The rest of the tail was light brown.

Scalation indicated that the lizard was definitely a *K. altamazonica* or, if a new cryptic species, at least a member of the "*calcarata*" species group. The sky blue on the nape of the neck has no equivalent among other species of *Kentropyx* but the generally uniform green dorsal surface is much more similar to that of *K. striata* than other members of the "*calcarata*" group. We speculate that the occupation of islands with flooded grassland habitat has resulted in color convergence between some populations of *K. altamazonica* and *K. striata*.

Submitted by **WILLIAM E. MAGNUSSON** and **ALBERTINA P. LIMA**, Departamento de Ecologia, Instituto Nacional de Pesquisas da Amazônia, CP 478, 69011-970 Manaus AM, Brazil.

PSAMMODROMUS ALGIRUS (Large Psammodromus). **PHONOTAXIS**. *Psammodromus algirus* is distributed throughout Iberia and parts of south western France. It is a medium-sized lacertid (8 cm SVL) with a robust body and large head (Arnold and Burton 1978. A Field Guide to the Reptiles and Amphibians of Britain and Europe. Collins, London, 272 pp.).

Seven adult male *P. algirus* were released into an enclosure at the Museo de Ciencias Naturales Field Station at El Ventorrillo, Madrid province (1000 m above sea level) in the Sierra de Guadarrama, central Spain. This enclosure was 65 m^2 and contained vegetation typical of the area (brooms; *Cytisus scoparius*, *Genista florida* and 'jara,' *Cistus laurifolius*) and in all respects reflected a normal habitat for *P. algirus*. These lizards are known to eat a wide variety of insects (Salvador 1985. Guia de Campo de los Anfibios y Reptiles de la Peninsula Iberica, Islas Baleares y Canarias. Unigraf, Madrid, 212 pp.) and I observed them eating two of the commoner species of orthopterans found at the site: *Oedipoda caerulescens* (Acrididae) and *Steropleurus stali* (Tettigoniidae). *S. stali* is a plump, flightless bushcricket about 2.5 cm long. The song of a male *S. stali* is a chirp of 252–305 ms duration with a frequency of 9700 Hz (Hartley et al. 1974. Anim. Behav. 22:382–389). The sound pressure level is about 70 dB at one meter and there is an inter-chirp interval of four to eight seconds (Bateman, unpubl.).

The following experiments were done on successive days in September 1993. All trials were carried out twice. 1) A recorded song of a male *S. stali* was played from a speaker situated in the center of the enclosure at ground level. 2) The song was played from the center of a bush approximately 30 cm above the ground. 3) This experiment was the same as experiment 1 except that a clear plastic container with four non-calling female *S. stali* was placed on top of the speaker. 4) This experiment was the same as experiment 2 except that a clear plastic container with four non-calling female *S. stali* was placed on top of the speaker. 5) The plastic container with the females (silent) was placed on the ground without the speaker. 6) Finally, three singing males were put in a small gauze box placed at ground level. In all cases speaker and/or bushcrickets were left for 30–40 minutes and if no reaction by the lizards was noted in that time the trial was terminated.

In experiments 1, 2, 3, and 4 there was a positive reaction to both trials. A male *P. algirus* was observed circling in towards the speaker when it was at ground level and circling in towards the base of the bush when the speaker was playing from above ground. The movement of these lizards appeared to be quite different from their behavior at other times when they were mostly making short runs into, or out of, shade. The lizard approached the speaker with the female bushcrickets on it more closely (within 10 cm) than the speaker without the bushcrickets (>20 cm). There was no reaction

to experiment 5 with the silent females and there was a single reaction to experiment 6 when a male again circled the gauze box and approached to within 10 cm before retreating again.

Several studies show that acoustic signallers run the risk of exposing themselves to predators, including calling gryllid crickets being hunted by herons (Bell 1979. New York Ent. Soc. 87(2):126–127) and calling tropical bushcrickets being hunted by bats (Belwood and Morris 1987. Science 238:64–67). In Britain the frequency range of the call of the bushcricket *Leptophyes punctatissima* overlaps that of shrews (Soricidae) and four species of foliage-gleaning bats and thus all are potential predators (Robinson 1990. *In* W. J. Bailey and D. C. F. Rentz (eds.), The Tettigoniidae: Biology, Systematics and Evolution, pp. 112–119. Crawford House Press, Bathurst).

These experiments demonstrated that an acoustic signal from a *Steropleurus* is evidently used by eavesdropping *P. algirus*. *Psammodromus algirus*, therefore, appear to use auditory cues in hunting acoustic prey, and may also use visual or olfactory cues at closer range.

I thank the directors of the El Ventorrillo Field Station, Drs. Alfredo Salvador, Luisma Carrascal, and Eulalia Moreno.

Submitted by **PHILIP W. BATEMAN**, Animal Behaviour Research Group, Department of Biology, The Open University, Walton Hall, Milton Keynes, MK7 6AA, U.K.

TUPINAMBIS TEGUIXIN (Tegu Lizard). **AQUATIC BEHAVIOR.** On 5 November 1993, while snorkeling in search of freshwater fish in a mountain creek pool about 300 m elevation at Ilhabela State Park, São Sebastião Island, Brazil (23°50'S, 45°20'W), I discovered a sleeping *Tupinambis teguixin sebastiani* Müller 1968 (Die Herpetofauna der Insel von São Sebastião, Saarbrucken Zeitung Verlag u. Druckrei Gmb H., 68 pp.) about 1 m TL and 30 cm SVL, on the bottom of the pool, 1.8 m deep. The lizard lacked the enlarged neck typical of adult males and showed a bright, new skin. The pool was located in rugged terrain covered by old second-growth and primary Atlantic forest, and was fed by a clear water creek 4-6 m wide that ran over sand and rocks. The day was sunny with air temperatures between 25–30°C, and water temperature between 15–18°C.

After watching the lizard for 10 min, without it ever moving, I lightly pulled its tail, which caused it to open its eyes, stare at me for a while, and close them again. After another pull, the lizard walked toward a pile of dead leaves that accumulated on the otherwise sand and gravel bottom and partly buried itself. Moments later it walked along the bottom towards an emerging rock, which it climbed until its head was above the water. I avoided further disturbing the lizard, and after about 10 min of watching me, it dove towards a submersed rock 1.1 m deep and laid itself by the rock's side, closing its eyes and not moving for 12 min, when it again walked along the bottom and positioned itself under a rock 0.5 m under the water. After another 10 min, disturbed by my attempts of following and measuring it, the tegu dove to deeper waters, this time half walking, half swimming with lateral strokes of its tail, and I was unable to find it again.

Why a tegu, regarded as a terrestrial lizard, would choose to sleep underwater in a cold stream (despite using a wet suit I was shivering after half an hour in the water) has no easy explanation. Although it may be a strategy to evade predators, the many boulders on shore would also offer shelter. It seems unlikely that the lizard was just taking a break after searching for food, as the stream was notably poor on fish, crabs, and crayfish that could be prey for a tegu. Perhaps the cold water offered a thermally comfortable environment for the lizard, but as the area is entirely covered by humid forest, other opportunities for finding adequate microclimates were likely at hand.

Although my observations may be regarded only as an oddity (but see Achaval and Langguth 1976. Boletin Soc. Zool. Uruguay 2:107) I am aware of two instances of tegus being caught in gill nets set at sea near the rocky shores of São Sebastião Island.

Submitted by **FABIO OLMOS**, Parque Estadual de Ilhabela, r. Morro da Cruz 608, Ilhabela, SP, 11630-000, Brazil.

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CROTALUS VIRIDIS (Western Rattlesnake). **PHENOLOGY.** Mating in spring is apparently infrequent for *Crotalus viridis*. Spring mating has been reported in *Crotalus v. oreganus* along the Pacific Coast (Fitch 1949. Amer. Midl. Nat. 41:513–579; Fitch and Glading 1947. California Fish and Game 33:103–123; Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley, 1533 pp.) and was assumed to occur in populations of *C. v. oreganus* in Idaho (Diller and Wallace 1984. Herpetologica 40:182–193). However, many investigations involving intensive observation of free-ranging snakes have described midsummer to early fall matings in most *C. viridis* subspecies (see Ernst 1992. Venomous Reptiles of North America, Smithsonian Institution Press, Washington. 236 pp.).

During an investigation of activity patterns and feeding habits of a population of *Crotalus viridis viridis* in the Nebraska Sand Hills (42°15'0"N, 101°07'3"W), males were observed accompanying females five times during the mid-summer to early autumn mating period. Male-male combat was observed once on 1 Au-

gust 1991. Field observations were not conducted between 17 May and 16 July 1991 .

A single episode of courtship was observed in the spring on 6 April 1991 (this was not an observation of "commonly occurring spring mating" as misquoted by Duvall et al. 1992. *In* J. A. Campbell and E. D. Brodie, Jr., (eds.), Biology of the Pitvipers, pp. 321–336, Selva, Tyler, Texas). The female snake measured 835 mm SVL and weighed 428 g while the male measured 730 mm SVL and weighed 338 g. This pair of snakes was found 1 m from a prairie dog (*Cynomys ludovicianus*) burrow, containing the sloughed skin of the courted female. Ten meters away another fresh slough, that of the courting male, was found in the entrance of another prairie dog burrow. Dorsal patterns of slough and snake were matched for positive identification. The position of the skins suggested that they were sloughed as the snakes exited the burrows. Several loops of the male's body fell over the female's body and his tail was curled under and around the female's tail effecting cloacal apposition. The male intensively courted the female for 3.25 h. Sequence and duration of male courtship behaviors were consistent with those described previously for western rattlesnakes (Ernst, *op. cit.*; Hayes 1986. J. Herpetol. 20:246–249). The female was quiescent throughout the period of observation and did not tongue-flick, although she did exhibit the tail-whipping behavior described previously by Hayes (*op. cit.*). The snakes were courting when discovered at 1600 h and continued until 1915 h (sunset), at which time both snakes were collected. The snakes were not copulating at the time of collection. Eversion of the male's hemipenes was not observed, nor was intromission positively determined nor excluded.

Taken as a whole these observations suggest that most mating activity in this population occurs from mid-summer to early fall, consistent with previously published descriptions of mating phenology in this subspecies. While the observation of spring courtship may represent a relatively unusual event in this population, it raises the possibility that mating may occur in the spring as well as the fall for some populations of prairie rattlesnakes. Additionally, this observation agrees with the hypothesis that ecdysis and release of pheromones signalling female sexual receptivity may be linked.

Financial support of this research was provided by the University of Nebraska at Omaha Department of Biology, the University of Nebraska Graduate Student Research Fund, and by Tom and Caroline Holycross.

Submitted by **ANDREW T. HOLYCROSS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287-1501, USA.

DIADOPHIS PUNCTATUS MODESTUS (San Bernardino Ringneck Snake). **DIET**. In April, 1992, a single individual of *Diadophis punctatus modestus* was collected from under a small board just off Redlands Boulevard, 1.0 mile south of San Timoteo Canyon Road in northern Riverside County, California. Examination in the laboratory revealed the snake had consumed a single individual of *Anniella pulchra* (California legless lizard). The lizard was swallowed head-first and most of the anterior portion of the body (including the skull, cervical vertebrae, and perhaps 1 or 2 anterior trunk vertebrae) was digested. Extremely degraded fragments of the left dentary and one or two cervical vertebrae remained. The snake measured 288 mm SVL (360 mm total length), the lizard approximately 130 mm (total remaining length). Neither specimen was weighed. To our knowledge, *Diadophis* has not previously been reported to prey upon *Anniella*. Specimens are curated in the University of California Museum of Paleontology (*Diadophis*, UCMP 140630; *Anniella*, UCMP 140631).

Submitted by **CHRISTOPHER J. BELL**, Department of Integrative Biology and Museum of Paleontology, University of California, Berkeley, California 94720, USA, and **JAMES K. BOWDEN**, Division of Earth Sciences, San Bernardino County Museum, 2024 Orange Tree Lane, Redlands, California 92374, USA.

HIEROPHIS VIRIDIFLAVUS (Western Whip Snake). **COMMUNAL NESTING**. Seasonal aggregations are sometimes observed in viperid (Duvall et al. 1985. Natl. Geogr. Res. 1:80–111; Fitch 1960. Univ. Kansas Mus. Nat. Hist. Publ. 13:85–288; Fukada 1962. Bull. Kyoto Gakugei Univ. Ser. B Math. Nat. Sci. 20:12–19) and colubrid (Henderson et al. 1980. Milwaukee Publ. Mus. Contrib. Biol. Geol. 32:1–9; Swain and Smith 1978. J. Herpetol. 34:175–177) snakes. Aggregations often occur before parturition (i.e., birthing rookeries, see Duvall et al., *op. cit.*). Unfortunately, little is known about the number of individuals in aggregations nor the site fidelity of aggregations across years.

Here we document an aggregation of female *Hierophis viridiflavus* in central Italy. Observations occurred about 50 km N Rome, Oriolo Romano, Province of Viterbo, 450 m above sea level. The site was characterized by a partially dilapidated stony box (5.0 x 3.5 m) bordered by rich spiny vegetation (mainly *Rubus* sp.) and completely surrounded by cultivated fields. We initiated the study in September 1989 when we captured 23 newborn *H. viridiflavus* (18–22 cm total length) in an area of 50 m^2. We regularly surveyed this site during late June 1990, 1991, and 1992. This aggregation of newborn snakes was noteworthy because 1) this species is not commonly encountered in cultivated habitats at the study area, and 2) the number of neonate snakes was greater than could be produced by a single female. Female *H. viridiflavus* normally produce 3–7 eggs per year in this area.

In June 1990 we collected five gravid female *H. viridiflavus* (Table 1). Snakes were measured (total length), marked (using scale clip procedures described in Brown and Parker 1976. J. Herpetol. 10:247–249), radiographed to obtain clutch size information, and released at the site of capture. No males, non-gravid females, nor juveniles were found.

During June 1991 we captured six gravid female *H. viridiflavus*, but still no males, non-gravid females, nor juveniles were observed. Gravid females were processed as before. Four of the six snakes were recaptures.

During June 1992, we captured two gravid females, while no other snakes were observed. Both females had been marked in 1990 and recaptured in 1991. This suggests that reproduction is annual at this site. There was a strong positive correlation between clutch size and female total length($r = 0.82$, Y-intercept = -18.41, slope = 0.198, $F = 22.80$, $P = 0.0005$). Because growth was slow fecundity also increased slowly as snakes aged (see Table 1).

All female *H. viridiflavus* marked during this study were observed near the stony box only during June (i.e., shortly before egg laying; see Luiselli and Rugiero 1990. Herpetozoa (Wien) 2:107–115), while absent during the rest of the year. On the other hand, juveniles were observed from late August to mid September (i.e., shortly after egg hatching), but not seen during other parts of the year.

Based on our observation we formulated preliminary conclusions: 1) The study site was regularly visited by female snakes for egg laying, possibly due to conditions favorable for incubation; 2) Nest site fidelity was high. Females used the site for egg laying in different years. We do not know if females stay in the area of the stone box during other times of the year. A telemetric study could resolve this question. If females use the area around the box only for nesting several questions remain unanswered. 1) How far do females travel from habitats used in other times of the year? 2) What conditions make the area around the stony box suitable as a nest site? 3) How do females navigate and recognize the nest site? We continue to study this phenomenon in order to answer these and other questions. Recently we discovered two other communal nest sites within a few kilometers of the study site, suggesting that communal nesting may be relatively common for *H. viridiflavus*.

TABLE 1. Gravid *Hierophis viridiflavus* captured during June 1990, 1991, and 1992, respectively. Individuals are distinguished by letters (A, B, C, etc.). TL = total length (in cm); CS = clutch size.

Snake	1990		1991		1992	
	TL	CS	TL	CS	TL	CS
A	117.2	4	118.0	4	118.7	4
B	121.3	6				
C	115.8	5	116.9	5		
D	112.9	4	113.4	5	115.2	5
E	126.4	7	127.1	7		
F			110.0	3		
G			115.5	5		

Submitted by **MASSIMO CAPULA** and **LUCA LUISELLI**, Dipartimento di Biologia Animale e dell'Uomo, Università di Roma "La Sapienza," via A. Borelli 50, 00161 Roma, Italia.

LEPTOPHIS MODESTUS (NCN). **MORPHOLOGY**. On 19 July 1991, I collected a specimen of *Leptophis modestus* in Honduras, Departamento Comayagua, Cordillera de Montecillos, 1.6 km N, 0.2 km E Cerro San Juanillo, elevation 1960 m (14°29'44" N, 87°53'03" W). It was active in vegetation 4 m above ground in cloud forest dominated by the trees *Quercus skinneri, Matudea trinervia, Persea americana* var. *nubigena*, and *Podocarpus oleifolius*.

The snake was an adult male, SVL 1201 mm, tail 802 mm, 386 g. Nasal was divided, loreal absent (fused with prefrontal which borders 2nd and 3rd supralabials) preoculars 2; postoculars 2; temporals 1-2; supralabials 8-8 with 4th and 5th entering orbit; infralabials 11-10; ventrals 177; anal divided; dorsal scales in 15-15-11 rows with 1st row smooth and all others strongly keeled. Dorsum was uniform green; keels dirty yellow-green, most conspicuous at midbody; overlapped edges of dorsals blue, posterior tips black; lower, anterior dorsals yellow; midbody and posterior dorsals with black lower and trailing edges; skin between dorsal scales black. Venter bright yellow anteriorly grading to bluish and to pale green posteriorly. Rostral and supralabials yellow with green upper edges; a short, narrow postocular black bar on the upper edges of supralabials 7 L and 7-8 R; chin yellow cream grading to bright yellow on throat; iris golden with brown medial horizontal bar; tongue metallic blue.

Absence of a loreal plate and the presence of two preoculars instead of one adds to the range of morphologic variation reported for this species (Fig. 1). The specimen keys out to *Leptophis ahaetulla occidentalis* (using Peters and Orejas-Miranda. 1970. U.S. Natl. Mus. Bull. No. 297, 347 pp.). While the presence or absence of a loreal is a key character in diagnosing species, most of the species of *Leptophis* (= *Thalerophis*) exhibit variation (Oliver 1948. Bull. Amer. Mus. Nat. Hist. 92(4):160–280). This locality extends the known range 45 km to the east (Wilson et. al. 1986. Milwaukee Publ. Mus. Contr. Biol. and Geol. No. 66, 8 pp). Identification was verified by Gustavo A. Cruz and the specimen is deposited at Universidad Nacional Autonoma de Honduras (UNAH 2747).

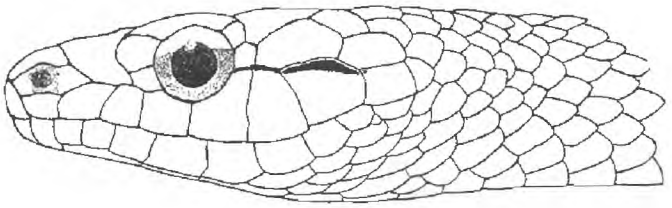


FIG. 1. Profile of *Leptophis modestus*, UNAH 2747.

Submitted by **PETER HOLM**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

LIASIS OLIVACEUS (Olive Python). **ALBINISM**. In March 1993 a female albino olive python (*Liasis olivaceus*) was collected near Woodcutters Mine, 80 km south of Darwin, Northern Territory, Australia. The animal is being kept alive at the Northern Territory University. The mining site is surrounded by small rocky hills dominated by eucalypt forest. At capture this animal was a subadult, ca. 1.5 m SVL (Shine 1992. Australian Snakes: A Natural History. Reed Books Pty Ltd., Balgowlah, 223 pp.). This python bears the pink eyes and tongue characteristic of an albino; however, the dorsal surface is cream-colored rather than white. The ventral surface is white. This is the first known report of albinism in this species.

Submitted by **GAVIN S. BEDFORD**, School of Biological Sciences, Northern Territory University, P.O. Box 40146 Casuarina, N.T., Australia, and **ROB COWARD**, Karama, N.T., Australia.

NERODIA SIPEDON SIPEDON (Northern Water Snake). **FEEDING**. On 24 June 1993 a young-of-the-year northern water snake was observed hunting smallmouth salamander (*Ambystoma texanum*) larvae in a small, shaded, temporary pond near the Charleston side-channel reservoir (NW1/4 Sec. 24, T11N, R9E), Coles Co., Illinois.

The pond (about 10 m long, 1 m wide, and 30 cm deep) was located at the bottom of a forested east-facing slope. A variety of aquatic macrophytes, insects, and *Bufo* larvae also inhabited the pond, but no fish were present.

I observed the water snake for about fifteen minutes. The snake waited at the water's surface supported by the vegetation. Its head

was raised above the water in an s-shape. When the smallmouth salamander larva broke the surface of the water to breath, the snake would strike and grab the salamander. The snake then proceeded to eat it. The foraging sequence was repeated about three times before the larva was captured.

Submitted by **MALCOLM L. McCALLUM**, Department of Zoology, Eastern Illinois University, Charleston, Illinois 61920, USA.

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RHADINAEA LACHRYMANS (NCN). **PREY.** The diet of *Rhadinaea lachrymans* consists mainly of frogs, toads, and salamanders, in addition to terrestrial egg masses of frogs (*Eleutherodactylus*) and salamanders (Myers 1974. Bull. Amer. Mus. Nat. Hist. 153(1):81). Here, we report an observation of *R. lachrymans* feeding on *Bolitoglossa engelhardti*. On 16 April 1992, a juvenile female (MZFC 5967: SVL = 307 mm, TL = 421 mm) was collected by Adolfo Navarro in a cloud forest at El Chiquihuite (Volcan Tacana), Union Juarez, Chiapas, México, 2150 m elevation. Inspection of the stomach contents revealed a *Bolitoglossa engelhardti* (MZFC 5968: SVL = 29.6 mm). The body was intact and its tail had been broken into three pieces (1.6 + 7.6 + 19.0 = 28.2 mm).

Sazima et al. (1992. Herpetol. Rev. 23:120–121) suggested the small size, elongated head, and slender body of *Rhadinaea bilineata* make it well-suited for foraging on amphibians. The same generalizations apply to *Rhadinaea lachrymans*.

We thank Adolfo Navarro, Oscar Flores, and Mario Mancilla for comments on this manuscript and assistance in the field work. Financial assistance was provided by the Direccion General de Asuntos del Personal Academico (DGAPA) proyect IN201789.

Submitted by **FERNANDO MENDOZA QUIJANO** and **ALEJANDRA RENDON ROJAS,** Museo de Zoologia, Facultad de Ciencias, U.N.A.M. Apdo. Postal 70-399, México D.F. 04510, México.

SISTRURUS CATENATUS CATENATUS (Eastern Massasauga). **REPRODUCTION.** Throughout its range, the eastern massasauga (*Sistrurus catenatus*) demonstrates considerable variation in reproductive potential (Reinert 1981. Amer. Midl. Nat. 105:393–395). Mean litter size, for example, ranges from 5.3 in Texas to 11.1 in Wisconsin (Seigel 1986. Biol. Cons. 35:333–346). There are no published accounts of litter characteristics for the species in Ohio, where it is restricted to a few populations and currently recognized as a species of special interest, due largely to habitat loss.

Two pregnant *S. catenatus* were captured on 29 June 1993 at Area C of Wright-Patterson Air Force (WPAFB), Greene Co., Ohio. They were retained in individual enclosures heated to 27°C at the Dayton Museum of Natural History.

On 7 August 1993, the smaller female (500 mm SVL) gave birth to 9 neonates (6 male, 3 female) and 1 infertile ovum. Snout-vent length ranged from 154–190 mm (mean = 182.11, SD = 12.046). Body weight ranged from 7–8 g (mean = 7.556, SD = 0.527). On 21 August 1993 the larger female (565 mm SVL, 209 g) gave birth to 9 males. Snout-vent length ranged from 215–230 mm (mean = 223.667, SD = 5.788). Body weight ranged from 11–14 g (mean = 12.00, SD = 1.118). All neonates were sexed by probing. The offspring of the second female were significantly longer and heavier than those of the first female (ANOVA for SVL: df = 1, f = 87.015, p< 0.01; ANOVA for mass: df = 1, f = 116.364, p< 0.01 respectively). When the effects of body size were removed, there were no significant differences in weight between litters (ANCOVA for mass: df = 1, f = 0.099, p = 0.7571).

The mean litter size of these females is comparable with the mean reported for an Illinois population (mean = 9.5, SD = 3.209; Wright 1941. Amer. Midl. Nat. 25: 659–672). In terms of size at birth, these two litters were similar to the Pennsylvania population with mean for Ohio of 202.9 mm (SD = 23.26) and 206.2 mm (SD = 32.524) for Pennsylvania (Swanson 1933. Copeia 1933:37). Seigel and Fitch (1985. J. Anim. Ecol. 54:497–505) found litter size variation was higher within than between populations, and attributed this to female size differences. In the present case, the adult females differed in body size, but litter size did not. The variation in size at birth, however, could be attributed to difference in female body size, with larger females having larger neonates.

All animals used in this study were marked, photographed for dorsal pattern recognition, and released at the maternal capture site.

I thank T. Lucas and the rest of WPAFB Office of Environmental Management for logistic support and permission to capture rattlesnakes. I am grateful to the Dayton Museum of Natural History for providing lab space. This study was conducted under contract with The Nature Conservancy.

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biological Sciences, Edison State Community College, 1973 Edison Drive, Piqua, Ohio 45356, USA.



Scaphiopus h. holbrookii (Eastern Spadefoot). Illustration by Mark C. Erelli.

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors must adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins 1990, *Standard Common and Current Scientific Names for North American Amphibians and Reptiles, Third Edition*, Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author — curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al., 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985(3):802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full — spell out state names — no abbreviations).

Some further comments. This geographic distribution section does not publish "observation" records. Records submitted should be based on preserved specimens which have been placed in a university or museum collection (private collection depository records are discouraged; institutional collection records will receive precedence in case of conflict). A good quality color slide or photograph may substitute for a preserved specimen only when the live specimen could not be collected for the following reasons: it was a protected species, it was found in a protected area, or the logistics of preservation were prohibitive (such as large turtles or crocodilians). Color slides and photographs *must* be deposited in a university or museum collection along with complete locality data, and the color slide catalog number(s) must be included in the same manner as a preserved record. Before you submit a manuscript to us, check Censky (1988, *Index to Geographic Distribution Records in Herpetological Review: 1967–1986*) to make sure you are not duplicating a previously published record.

Please submit any geographic distribution records in the **standard format only** to the Section Co-editors, Joseph T. Collins (USA & Canadian records only), Natural History Museum—Dyche Hall, The University of Kansas, Lawrence, Kansas 66045–2454, USA (E-mail: jcollins@kuhub.cc.ukans.edu), or Jerry D. Johnson (the rest of the world), Department of Biology, El Paso Community College, P.O. Box 20500, El Paso, Texas 79998-0500, USA. Short manuscripts are strongly discouraged, and are only acceptable when data cannot be presented adequately in the standard format.

Recommended citation for new distribution records appearing in this section is: Painter, C. W., and C. M. Milensky. 1993. Geographic Distribution. *Crotalus tigris*. Herpetol. Rev. 24:155–156.

CAUDATA

AMPHIUMA MEANS (Two-toed Amphiuma). USA: FLORIDA: Taylor Co: Tide Swamp Unit, Big Bend Wildlife Management Area, SE 1/4 Sec. 1, Verified by David L. Auth. Florida Museum of Natural History (UF 91101). One adult caught during drift-fence study in fresh water marsh. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians in Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida. 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

AMPHIUMA PHOLETER (One-toed Amphiuma). USA: FLORIDA: Taylor Co: Spring Creek Unit, Big Bend Wildlife Management Area. 1992. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91094). Adult caught in drift-fence array. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida. 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). CANADA: NOVA SCOTIA: Cumberland Co: Emery Meadows, 45°38'30"N, 63°46'W. 16 May 1993. S. C. Friet and M. D. MacDonald. Verified by John Gilhen. Nova Scotia Museum of Natural History (NSM 10248). County record. One adult female found guarding nest of 25 eggs; located in sphagnum and grass along NE edge of small pool at head of Emery Brook, NW corner of Emery Meadows Bog; Ducks Unlimited Canada marsh adjacent to Trans-Canada Highway 114, 45°41'30"N; 63°43'W. 26 June 1993. S. C. Friet and M. D. MacDonald. Verified by J. Gilhen. NSM 10249. One female guarding a nest of 15 eggs; found at the base of a spruce snag in sphagnum at NE edge of marsh. These two records greatly expand the known range in Nova Scotia and may offer a possible range link with New Brunswick.

Submitted by **STEPHEN C. FRIET** and **MICHAEL D. MACDONALD**, Department of Biology, Life Sciences Centre, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: VIRGINIA: Scott Co: Jefferson National Forest, beaver meadow along Glady Fork, ca. 10 km SE Norton, 2900 feet (884 m). All captures were made at a drift fence/pitfall array operated by the Division of Natural Heritage, Virginia Department of Conservation and Recreation: 11–23 June 1993 (Carnegie Museum of Natural History, CM 140195), 23 June–22 July 1993 (Virginia Museum of Natural History, VMNH 6537) and 22 July–18 August 1993 (VMNH 6538). All verified by Joseph C. Mitchell. New county record; first record from extreme SW Virginia (Tobey 1985, Virginia's Amphibians and Reptiles: A Distributional Survey. Publ. Virginia Herpetol. Soc., Purcellville, Virginia. 114 pp.) Extends range in Virginia ca. 200 km W of record from Buffalo Mountain, Floyd County (J. C. Mitchell and C. A. Pague, unpubl. data) and partially fills in the range gap between Virginia and Kentucky depicted in Conant and Collins (1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **STEVEN M. ROBLE** and **CHRISTOPHER S. HOBSON**, Division of Natural Heritage, Virginia Department of Conservation and Recreation, 1500 East Main Street, Suite 312, Richmond, Virginia 23219, USA.

NOTOPHTHALMUS VIRIDESCENS PIAROPICOLA (Peninsula Newt). USA: FLORIDA: Taylor Co: Spring Creek Unit, Big Bend Wildlife Management Area. 1992. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91099). Specimen caught in drift-fence array. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

ANURA

BUFO PUNCTATUS (Red-spotted Toad). USA: NEW MEXICO: Roosevelt Co: Melrose Bombing Range, 21.6 km S and 8.8 km E

of Tolar, Sheep Canyon. 7 August 1993. C. M. McCain and J. N. Stuart. University of New Mexico Museum of Southwestern Biology (MSB 56517–18, adults), USNM 335065 (lot of 3 tadpoles); 28 August 1993. D. T. Scott. MSB 56477 (lot of 3 juveniles). All verified by W. G. Degenhardt and S. W. Gotte. New county record; extends range SE in New Mexico from known localities in Quay and De Baca counties (W. G. Degenhardt, C. W. Painter, and A. H. Price, *in litt.*) to the western escarpment of the Llano Estacado (Southern High Plains). The paucity of records from on the Llano Estacado proper in eastern New Mexico and western Texas (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Press, College Station. 434 pp.) suggests a general lack of suitable habitat for *B. punctatus*, except at the margins of the plain.

Submitted by **JAMES N. STUART** and **DAMIEN T. SCOTT**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

HYLA CHRYSOSCELIS (Cope's Gray Treefrog). USA: FLORIDA: Taylor Co: Tide Swamp Unit, Big Bend Wildlife Management Area, NW 1/4 Sec. 28, T8S, R7E. 9 November 1993. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91095). One adult caught in a hardwood swamp adjacent to a drift-fence array. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

RANA CAPITO AESOPUS (Florida Gopher Frog). USA: FLORIDA: Taylor Co: Perry, jct. Osceola Street and Plantation Road, SE 1/4 Sec. 30, T4S, R8E. 30 May 1994. Harry J. Dutton. Verified by David L. Auth. Florida Museum of Natural History (UF 91093). Specimen caught in swimming pool. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

RANA CATESBEIANA (Bullfrog). USA: ILLINOIS: DeKalb Co: Kishwaukee River, City of DeKalb, 41°55.8'N, 88°45.8'W. 10 June 1993. H. D. Walley. Verified by Tom Near. Northern Illinois University (HDW-NIU 1510–1). County record; fills gap between Lee and Cook counties (Smith 1961, The Amphibians and Reptiles of Illinois. Bull. Illinois Nat. Hist. Surv. 28:1–298); LaSalle Co: Paw Paw Creek, Paw Paw, 41°55.8'N, 88°45.8'W, 12 August 1994, H. D. Walley. HDW-NIU 1518. Verified by Tom Near. County record; fills gap between Knox, Fulton and McClean counties (Smith, *op. cit.*).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA.

RANA PALUSTRIS (Pickerel Frog). USA: ILLINOIS: Calhoun Co: Madison Creek, Tepen Hollow Road (NE 1/4 Sec. 17, T12S, R2W). 2 September 1994. J. K. Tucker and J. B. Camerer. Verified by C. Phillips. Illinois Natural History Survey (INHS 11353); Middle Fork of Fox Creek, along Bess Hollow Road, ca. 2.8 km NW jct. with Rt. 96 (NE 1/4 Sec. 1, T9S, R3W). 6 October 1994. M. Redmer. Verified by M. J. Blanford. Department of Zoology, Southern Illinois University at Carbondale (SIU-C H4738–4739). New county record. Jersey Co: Chautauqua (NE 1/4 Sec. 13, T6N, R12W). 3 May 1962. R. Brown. Verified by M. J. Blanford. Department of Biological Sciences, Southern Illinois University at Edwardsville (SIU-E 1598); Chautauqua Resort (Sec. 13, T6N, R12W). 17 April 1968. D. Thompson. Verified by M. J. Blanford. SIU-E 1591. Field tag erroneously places this locality in Madison County; Grafton, 1.8 km N and 1 km E of Rt. 100 and River Road (NE 1/4 Sec. 10, T6N, R12W). 17 April 1971. L. J. LaJeone. Verified by M. J. Blanford. SIU-E 1601–1602; Wooded stream parallel to Rosedale Road, behind Mississippi River State Waterfowl Management Area Headquarters (NW 1/4 Sec. 21, T21N, R1W). 6 October 1994. M. Redmer. Verified by M. J. Blanford. SIU-C H 4740. New county record; Madison Co: base of limestone bluff at edge of creek (Sec. 8, T6N, R10W). 4 April 1967. S. L. Smith. Verified by M. J. Blanford. SIU-E 1592; Alton, 0.4 km N of Mississippi River in swampy area (probably Sec. 5, T5N, R10W). 8 May 1963. G. Thompson. Verified by M. J. Blanford. SIU-E 1592. New county record; These three county records fill a gap in the Illinois distribution of *Rana palustris* between Pike and Greene counties on the north to St. Clair County on the south (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298; Redmer and Ballard 1995, Herpetol. Rev. 26(1):49–53). With the exception of Jackson County, the documented range of this species now includes all Mississippi River border counties from Adams County on the north to Alexander County on the south. All live specimens collected in 1994 had golden yellow flash coloration on their thighs (Redmer and Mierzwa 1994, Bull. Chicago Herpetol. Soc. 29:21–30).

Submitted by **MICHAEL REDMER**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901, USA, **JAMES B. CAMERER** and **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA, and **JEFFERY CAPPS**, Department of Biological Sciences, Southern Illinois University at Edwardsville, Edwardsville, Illinois 62026, USA.

RANA PIPIENS (Northern Leopard Frog). USA: ARIZONA: Mohave Co: Truxton Spring at Truxton Wash. NE 1/4 SE 1/4 Sec. 26, T24N, R13W. 3 August 1994. J. Eric Wallace. Adult male and female. Verified by James E. Platz. Arizona State University Lower Vertebrate Collection (ASU 30214–30215). Only Northern Leopard Frogs found to date in Mohave County. These frogs represent an isolated population 160 km WNW of the nearest known extant population in Arizona.

Submitted by **J. ERIC WALLACE**, Arizona Game and Fish Department, Nongame Branch, 2221 West Greenway Road, Phoenix, Arizona 85023, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: COLORADO: El Paso Co: erosion control pond adjacent to West Fork of Red Creek, U.S. Army Fort Carson Military Reservation, 13 km NE Penrose, 38°32'55"N, 104°55'58"W. 7 June 1991. Richard L. Bunn. Verified by Hobart M. Smith. UCM photograph 92. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.). Northernmost known locality in the Arkansas River drainage.

Submitted by **RICHARD L. BUNN**, Wildlife Branch, DECAM, AFZC-ECM-NR, Building 302, Fort Carson, Colorado 80913-5000, USA.

CROCODYLIA

PALEOSUCHUS TRIGONATUS (Schneider's Smooth-fronted Caiman). GUYANA: Region I (NORTH-WEST DISTRICT): Almond Beach near Waini Point (8°23.969'N, 59°45.286'W; cf. Waini Point at 8°23.738'N, 59°48.786'W). 7 July 1993. P. C. H. Pritchard. Verified by David Auth. 109 cm (total length) adult male (tip of tail missing) emerged from sea and rested on beach. Photographed and videotaped. Kodachrome slide deposited in Florida Museum of Natural History (PCHP 002 October 1994). Animal was underweight but seemingly healthy; it was released in a freshwater pond behind the beach. First marine record for species; closest records are from Lower Demerara and Lower Essequibo rivers, Guyana (Medem 1983, Crocodylia de Sur America, Vol. 2:95); closest Venezuela record is from Angostura, Lower Orinoco (Lichtenstein and von Martens 1856, Nomenclatur Reptilium et Amphibium Musei Berolinensis, iv: 48. Berlin).

Submitted by **PETER C. H. PRITCHARD**, Florida Audubon Society, 400 Hwy 436 #200, Casselberry, Florida 32707, USA.

TESTUDINES

APALONE SPINFERA (Spiny Softshell). USA: ILLINOIS: LaSalle Co: 1.75 miles (2.8 km) W Utica, Pecumsaugan Creek, SW 1/4 Sec. 7 T33N, R2E. 10 May 1992, H. D. Walley. Verified by Tom Near. Northern Illinois University (HDW-NIU-1493). County record; fills gap between DeKalb, Kendall and Putnam counties (Smith 1961, The Amphibians and Reptiles of Illinois. Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois, DeKalb, Illinois 60115.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: COLORADO: Arapahoe Co: South Platte Park, NW 1/4 Sec. 32, T5S, R68W. 17 June 1993. Raymond H. Sperger. Verified by Lauren Livo. UCM color slide 87 of a female that had just laid a total of ca. 50 eggs. First county record and maximum number of eggs recorded in Colorado (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife. Denver. 131 pp.).

Submitted by **RAYMOND H. SPERGER**, Theo. H. Carson Nature Center, 7301 South Platte River Parkway, Littleton, Colorado 80120-2968, USA; **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

CHRYSEMYS PICTA BELLII (Western Painted Turtle). USA: COLORADO: Arapahoe Co: South Platte Park on Mineral Avenue between Lake 5 and Cooley Lake, S side of west-bound lanes, SE 1/4 Sec. 30, T5S, R68W. 2 August 1992. Raymond H. Sperger. Verified by Lauren Livo. UCM 57019. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.).

Submitted by **RAYMOND H. SPERGER**, Theo L. Carson Nature Center, 7301 South Platte River Parkway, Littleton, Colorado 80120-2968, USA; **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

DERMATEMYS MAWII (Central American River Turtle). MEXICO: QUINTANA ROO: La Union, Hondo River, 6 km NE La Union town (17°53'47"N, 88°52'34"W). 24 June 1994. Collected by M. Suárez and H. Bahena Basave. Verified by O. Flores-Villela. Museo de Zoologia del Centro de Investigaciones de Zuintana Roo (MZCIQRO 339). New record to Quintana Roo, Yucatan Peninsula, that verifies suspected distribution in Quintana Roo state (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.)

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

GRAPTEMYS PSEUDOGEOGRAPHICA OUACHITENSIS (Ouachita Map Turtle). USA: MISSISSIPPI: Sunflower Co: Quiver River, 0.8 river km NE of Big Sunflower and Quiver Rivers confluence, Sec. 25, T19N, R4W. 1 September 1994. K. J. Killgore and J. Morrow. Verified by Neil H. Douglas. Northeast Louisiana Univ. Mus. of Zool. (NLU 70490). This voucher represents a new county record and confirms presumed distribution in this area (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **STEVEN G. GEORGE**, **JACK KILLGORE**, and **SHERRY L. HARREL**, U.S. Army Engineer Waterways Experiment Station, ER-A, 3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199, USA.

KINOSTERNON SUBRUBRUM (Eastern Mud Turtle). USA: ILLINOIS: Pulaski Co: 2 mi E Karnak. 12 August 1976. L. M. Page and M. A. Morris. Verified by Christopher A. Phillips. Illinois Natural History Survey (INHS 10304). First record for county. Pope Co: 1 mi W New Liberty on Unionville Road, in flooded hardwood forest in a foot of water at the base of a young tree adjacent to a remnant bald cypress swamp. 17 April 1994. K. Jacobson. Southern Illinois University at Carbondale Herpetology Collection (SIUC R-2689, adult male, carapace length 10.2 cm); identifiable plastron and other hard parts on a road adjacent to the same swamp. 2 June 1994. R. A. Brandon and M. Redmer. SIUC R-2672. First voucher specimens from a specific locality in county, although there have been other indications this turtle occurs in there. Cagle (1946, Am. Midl. Nat. 36:690–691) mentioned finding this species in "... a drainage ditch south of Dixon Springs, Illinois," and Smith (1961, Illinois Nat. Hist. Surv. Bull. 28:1–298) placed this locality in Pope County. There is another Pope County specimen (Carnegie Museum of Natural History 108574) collected by Edward Moll in 1971, but it lacks specific locality information.

Submitted by **RONALD A. BRANDON**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901, USA, and **KRISTINE JACOBSON**, 276 Cedar Creek Road, Makanda, Illinois 62958, USA.

STAUROTYPUS TRIPORCATUS (Mexican Giant Musk Turtle). MEXICO: QUINTANA ROO: La Union, Hondo River, 6 km NE La Union town (17°53'47"N, 88°52'34"W). 28 January 1993. Collected by H. Bahena Basave. Verified by O. Flores-Villela. Museo de Zoologia del Centro de Investigaciones de Zuintana Roo (MZCIQRO 340). New record for Quintana Roo, Yucatan Peninsula, that verifies and confirm a doubtful record in central part of Quintana Roo state (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.)

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

TERRAPENE CAROLINA CAROLINA (Eastern Box Turtle). USA: ILLINOIS: Scott Co: NE 1/4 Sec. 20, T14N, R12W, Winchester Road, 0.2 km N Winchester. 21 August 1994. J. K. Tucker. Verified by Chris Phillips, Illinois Natural History Survey (INHS 11322). New county record, extends documented range 28 km NE of nearest previous documented record (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298) and east of undocumented record for Morgan County (Applegate 1975, Trans. Illinois State Acad. Sci. 68:17). However, location of the latter record is uncertain as township and range cited in paper is actually located in Montgomery County from which Smith (*op. cit.*) reported documented records of the species.

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). USA: ILLINOIS: Calhoun Co: NE 1/4 Sec. 27, T8S, R2W, 3.7 km N Kampsville on Illinois Rt. 100. 24 May 1994. J. K. Tucker. Verified by C. Phillips, Illinois Natural History Survey (INHS 11323). New county record.

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

AMPHISBAENIA

RHINEURA FLORIDANA (Florida Worm Lizard). USA: FLORIDA: Taylor Co: Athena, Josh Ezel Grade. August 1993. Cindy Hunt. Verified by David L. Auth, Florida Museum of Natural History (UF 91089). Collected while excavating in a scrub oak habitat. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles and Crocodilians. Windward Publishing, Miami, Florida, 191 pp.) and partially fills the range hiatus as shown in Conant and Collins (1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Extends the range of this species 40 km NW of the westernmost locality in the state (Meylan 1984, Herpetol. Rev. 15:23–24). There is a record from Liberty County, which is farther west than Taylor County, but it is believed to be based on unreliable data (David L. Auth, pers. comm.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

LACERTILIA

ANOLIS DISTICHUS (Bark Anole). USA: FLORIDA: Monroe Co: Key Vaca, Marathon, small woodland near Mile Marker 50 on U.S. Rt. 1. 29 July 1994. Gregory J. Watkins-Colwell. Verified by E. E. Williams. Animal photographed in the wild. KU 221730. Several adults and juveniles found on utility poles and tree trunks near open areas of the woodland. County and locality record for this introduced species (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two: Lizards, Turtles and Crocodilians. Windward Publ., Miami, Florida, 191 pp.; Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biology, Sinclair Community College, 444 West Third Street, Dayton, Ohio 45402, USA, and **KELLIE A. WATKINS-COLWELL**, 2323 North Knoll Drive, Beavercreek, Ohio 45131, USA.

ANOLIS JACARE (NCN). VENEZUELA: ESTADO TACHIRA: Betania, 2150 m. 2 February 1979. Jaime Péfaur. Colección de Vertebrados de la Universidad de Los Andes (CVULA 896). First State record; Estado Merida: Monte Zerpa, 2200 m., 26 October 1990. Amelia Díaz de Pascual. CVULA 1698. Northernmost record for the species. Both verified by Juan Elías García Pérez. These specimens were identified as *Phenacosaurus niceforoi* in CVULA collection and most probably correspond to the localities, without vouchers, of "región de Betania, hacia el Páramo de Tamá, Estado Táchira" and "cercanías de la Ciudad de Mérida" reported for this species by Péfaur and de Pascual (1982, Actas VIII Congreso Latinoamericano de Zoología, Oct. 1980, Mérida, Venezuela:241). Táchira records extends known range ca. 190 km SW of the type locality (Boulenger 1903, Ann. Mag. Nat. Hist. [7]11:482; Williams et al. 1970, Breviora 353:1–15). Based on current evidence, the presence of *Phenacosaurus niceforoi* in the Venezuelan Andes is rejected, and the statement that this taxon is shared by the Cordillera de Mérida and the Colombian Cordillera Oriental (Péfaur and de Pascual 1984:249, 251) remains to be supported.

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela.

ANOLIS LAEVIVENTRIS (White Anole). MÉXICO: HIDALGO: Municipality of San Bartolo Tutotepec (20°25'N, 98°12'W) near Condege. 22 May 1970. J. Gimate. Verified by Ticul Alvarez Solórzano. Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB 6377). First state record; extends known range at least ca. 165 km NW from former records in central Veracruz (Xalapa, Actopan, Mirador, Orizaba, Xicaltepec, and Xico; Smith and Taylor 1950, Bull. U.S. Natl. Mus. 199:1–253).

Submitted by **ADRIAN-NIETO MONTES DE OCA**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA, and **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

ANOLIS LEMURINUS BOURGEAEI (Bourgeae's Ghost Anole). MÉXICO: HIDALGO: Municipality of San Bartolo Tutotepec, 3 km N San Bartolo Tutotepec (20°25'N, 98°12'W), 1190 m elev. 3 April 1979. A. Flores. Verified by Ticul Alvarez Solórzano. Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB 10881). First state record; extends known range at least ca. 190 km NW from former records in central Veracruz (Huatusco and Orizaba; Smith and Taylor 1950, Bull. U.S. Natl. Mus. 199:1–253).

Submitted by **ADRIAN-NIETO MONTES DE OCA**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA, and **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

ANOLIS SERICEUS (Silky Anole). MÉXICO: HIDALGO: Municipality of Huejutla de Reyes, 1 km S Tehuetlán (21°02'N, 98°31'W), 390 m elev. 14 May 1980. M. Rodríguez. Verified by Ticul Alvarez Solórzano. Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB 11005). First state record. Lee (1980, Copeia 1980:310–320) provided locality records of the species for the states of Tamaulipas, San Luis Potosí, and Veracruz; Lee (1983, Cat. Am. Amphib. Rept. 340.1–340.2) included eastern Hidalgo and Puebla in his distribution map for the species, but did not provide locality records for these states. This record partly fills the hiatus between Xilitla, San Luis Potosí, ca. 60 km to the northwest, and records from Veracruz to the east and southeast (Lee 1980, *op. cit.*); Municipality of Actopan, 5 km E Actopan (20°16'N, 98°56'W). 8 March 1972. L. Ruiz. Verified by Ticul Alvarez Solórzano. ENCB 7301–04. Extends distribution at least ca. 260 km NW from former records in central Veracruz (vicinity of Córdoba, Lee 1980, *op. cit.*), and represents the inlandmost record for the species in the northern portion of its range.

Submitted by **ADRIAN-NIETO MONTES DE OCA**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA, and **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

CNEMIDOPHORUS SEXLINEATUS (Six-lined Racerunner). USA: FLORIDA: Taylor Co: Tide Swamp Unit, Big Bend Wildlife Management Area, NW 1/4 Sec. 33, T8S, R7E. 6 October 1993. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91098). Specimen caught in drift-fence array. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles & Crocodilians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

COLEONYX BREVIS (Texas Banded Gecko). USA: NEW MEXICO: Lincoln Co: White Sands Missile range, Oscura Mountains, 9 km NE jct. Range Road 7 and Range Road 12; 4.6 km N Range Road 12 to Schist Site; ca. 40 air km E and 35 air km S San Antonio (33°32'10.5"N, 106°20'03.2"W). 30 May 1994. L. K. Kamees and D. W. Burkett. Verified by C. W. Painter. University New Mexico Museum Southwestern Biology (MSB 57268). County record (Degenhardt et al. The Amphibians and Reptiles of New Mexico. In press).

Submitted by **LARRY K. KAMEES** and **DOUGLAS W. BURKETT**, Cortez III Service Corporation, P.O. Box L, White Sands Missile Range, New Mexico 88002-9998, USA.

EUMECES FASCIATUS (Five-lined Skink). USA: FLORIDA: Taylor Co: Spring Creek Unit, Big Bend Wildlife Management Area. 1992. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91096). Specimen caught in drift-fence array. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles & Crocodilians. Second Ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

EUMECES FASCIATUS (Five-lined Skink). USA: ILLINOIS: Jersey Co: S 1/2 Sec. 12, T6N, R13W, under tin, at Brussels Ferry, 3.8 km WNW Grafton, near Ill. Rt. 100. 18 May 1994. J. K. Tucker and J. B. Hatcher. Verified by C. Phillips. Illinois Natural History Survey (INHS 11412). New county record.

Submitted by **JOHN K. TUCKER** and **JAMES B. HATCHER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

HEMIDACTYLUS MABOUIA (Tropical House Gecko). USA: FLORIDA: Monroe Co: Key Vaca, Marathon, under debris in a small woodland near mile marker 50 on U. S. Rt. 1. 25 July 1994. Gregory J. Watkins-Colwell. Verified by J. T. Collins. Juvenile caught under plywood in wooded area. KU 221732. This is a new island record, but not a county record, for this species (Meshaka et al. 1994, Herpetol. Rev. 25:80–81).

Submitted by **GREGORY J. WATKINS-COLWELL** and **KELLIE A. WATKINS-COLWELL**, Biology Department, Sinclair Community College, Dayton, Ohio 45402, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: FLORIDA: Escambia Co: Santa Rosa Island, Sabine Yacht Club, T3N, R29W. 6 August 1994. John B. Jensen and Jodie B. Jensen. Florida Museum of Natural History (UF 91969); Okaloosa Co: Ft. Walton Beach, apartment complex on South Avenue, 0.5 km west of Eglin Parkway, Sec. 1, T2S, R24W. 23 October 1994. LeAnn West. UF 94152–53. All verified by Paul Moler. New county records for this introduced species (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Populations in both counties assumed to be well established based on individuals of various size classes observed.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

SCELOPORUS GRACIOSUS GRACIOSUS (Northern Sagebrush Lizard). USA: COLORADO: Grand Co: 1.3 km W and 1.3 km S Radium, SE 1/4 SW 1/4 Sec. 28, T1S, R82W. 16 September 1994. G. Horstman. Verified by L. J. Livo. UCM Color Slide 89. New county record; extends range ca. 14 km ENE of nearest records at McCoy, Eagle County (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildl. Publ., Denver. 131 pp.).

Submitted by **GREG HORSTMAN**, Colorado Division of Wildlife, 711 Independent, Grand Junction, Colorado 81505, USA.

SCELOPORUS UNDULATUS (Fence Lizard). USA: ILLINOIS: Madison Co: NE 1/4 Sec. 10, T5N, R10W, on rocks near bluff, 0.6 km W Alton, near Ill. Rt. 100. 3 October 1994. J. K. Tucker. Verified by C. Phillips. Illinois Natural History Survey (INHS 11408). New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

SERPENTES

CLONOPHIS KIRTLANDII (Kirtland's Snake). USA: ILLINOIS: Shelby Co: NW 1/4 Sec. 1, T10N, R6E, under cardboard in relictual prairie between ICG railroad and U.S. Rt. 45, 1.2 mi N Sigel. 12 May 1994. J. K. Tucker. Verified by C. Phillips. Illinois

Natural History Survey (INHS 11351). Collected under Illinois Dept. Cons. Permit 94-3S. New county record; fills gap in range between Effingham and Coles counties (Brown et al. 1975, Herpetol. Rev. 6:78–79; Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298).

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

COLUBER CONSTRICTOR FLAVIVENTRIS (Eastern Yellowbelly Racer). USA: COLORADO: Arapahoe Co: South Platte Park, SE 1/4 Sec. 30, T5S, R68W. June 1991. Raymond H. Sperger. Verified by Lauren Livo. UCM color slide 88. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.).

Submitted by **RAYMOND H. SPERGER**, Theo L. Carson Nature Center, 7301 South Platte River Parkway, Littleton, Colorado 80120-2968, USA; **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

COLUBER CONSTRICTOR FOXII (Blue Racer). USA: ILLINOIS: Greene Co: SE 1/4 Sec. 15, T10N, R10W, DOR Ill Rt. 108, 1.1 km W junction U.S. Rt. 67. 7 October 1994. J. K. Tucker. Verified by C. Phillips. Illinois Natural History Survey (INHS 11421). New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA, and **GARY L. PAUKSTIS**, 2489 Quail Court, Aurora, Illinois 60504, USA.

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). USA: ILLINOIS: Jersey Co: NE 1/4 Sec. 14, T6N, R12W, DOR Ill. Rt. 100, 0.3 km E Rice Hollow Road; NE 1/4 Sec. 21, T6N, R11W, DOR Ill. Rt. 100, 0.3 km E Elsah Road. 1 October 1994. J. K. Tucker. Both verified by C. Phillips. Illinois Natural History Survey (INHS 11444 and 11445, respectively). Previously reported by Smith (1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298) from Jersey County based on Principia College specimen (number 490) collected in 1949 which I reexamined to confirm identity. First listed specimen reported herein extends range of subspecies, which is listed as endangered in Illinois, 3.1 km WNW of Principia record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

HETERODON NASICUS (Western Hognose Snake). USA: ILLINOIS: Jo Daviess Co: Savanna Army Depot, SW1/4 Sec. 24, T26N, R1E, at the junction of River Road and Burning Grounds Road. 12 July 1994. M. McCallum and E. Moll. Illinois Natural History Survey (INHS color slide 1994-1). Verified by C. Phillips. New county record (male, length = 470 mm).

Submitted by **MALCOLM L. McCALLUM**, 103 Rex Drive, Collinsville, Illinois 62234, USA.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: ARIZONA: Cochise Co: 31°35'40"N 109°14'19"W. 23 June 1994. Andrew T. Holycross (Arizona Game and Fish scientific collecting permit HLYCR000038). Arizona State University Animal Care Facility (living specimen). Specimen captured in a drift fence/funnel trap array in a tobosa grassland. First county record and first verifiable record in Arizona south of the Mogollon Rim (Williams 1988. Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*, 2nd ed. Milwaukee Publ. Mus. 176 pp.). Extends range ca. 320 km south from the nearest known specimen to the north (Charles Lowe, pers. comm.) and ca. 225 km west from the nearest New Mexico locality (Degenhardt et al., in press. The Amphibians and Reptiles of New Mexico. Univ. of New Mexico Press, Albuquerque). The specimen is a male, 70.4 g body weight, 522 mm SVL, 613 mm total length. Confirms unpublished record for same location (UAZ 50283 photographic voucher). James P. Tracey and Dale T. Tracey. 15 July 1988. Verified by Charles Lowe. The Tracey specimen is also a male, 7.8 g body weight, 273 mm SVL, 314 mm total length. Measurements made on 9 September 1988.

Our specimen not only confirms the Tracey record but may lend credence to Yarrow's (1875. Rep. Geog. Geol. Expl. Surv. W 100th Mer., Engineer. Dept. U.S. Army 5:509-584) records from "Camp Apache, Ariz" as discussed by Williams (*op. cit.*). Although Williams (*op. cit.*, p. 92) did not verify these records and suggested that they may be *L. pyromelana*, he later (*op. cit.*, p. 93) states that he has "no reason to doubt" their authenticity. Apache (Cochise Co., Arizona) is apparently the "Camp Apache" of Yarrow (*op. cit.*) and lies ca. 16 km NE of our collection locality.

Another specimen was found subsequent to the previous records in the Animas Valley of New Mexico, ca. 30 km SE of the Holycross specimen. USA: NEW MEXICO: Hidalgo County: 2.4 km N of Cloverdale. 13 September 1994. Jeff Gee and Barney Tomberlin. Verified by Charles Painter. Museum of Southwestern Biology MSB 58186 (shed skin). Found in grassland beneath a board. First county record, first record for the Animas Valley, and fills a gap in the known distribution between the Arizona specimens and the nearest records in New Mexico (see above). The Peloncillo Mountains of Arizona and New Mexico separate the San Bernardino Valley (Arizona specimens cited above) and the Animas Valley (this specimen).

Submitted by **ANDREW T. HOLYCROSS**, Department of Zoology, Arizona State University, Tempe, Arizona 85827-1501, USA, and **CECIL SCHWALBE**, National Biological Survey, Cooperative Park Studies Unit, University of Arizona, Tucson, Arizona 85721, USA.

MICRURUS BROWNI (Brown's Coral Snake). MÉXICO: QUINTANA ROO: La Union, under litter, 0.15 km N La Union town (17°53'47"N, 88°52'34"W). 17 December 1992. Museo de Zoologia del Centro de Investigaciones de Quintana Roo (MZCIQRO 206); 8 km N La Union Town. 6 January 1993. MZCIZRO 209; La Union town. 3 February 1993. MZCIQRO 229; near Hondo River, 4 km NE La Union town. 20 February 1993. MZCIQRO 245; La Union town. 29 March 1993. MZCIQRO 253. All collected by Humberto Bahena Basave and verified by O. Flores-Villela. New record for Quintana Roo state and the Yucatan Peninsula (Lee 1980, Univ. Kansas Nat. Hist. Mus. Misc. Publ. 67:1–75).

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

OPISTHOTROPIS KUATUNENSIS (Striped Stream Snake). HONG KONG TERRITORY: LANTAU ISLAND (Tai Yue Shan): Tei Tong Tsai, ca 300 m elev. Michael Lau. 19 May 1993. Verified by Stephen Karsen. Museum of Comparative Zoology (MCZ A 11991). First island voucher. Known distribution peculiarly dis-

continuous: known from southeastern (Fujian, Jiangxi, and Zhejiang) and south-central (Guangxi) China, but not Hunan or Guangdong in between (Zhao and Adler 1993, Herpetology of China. SSAR Contrib. Herpetol. 10:248). Also well known from the Hong Kong New Territories adjacent to Guangdong, but not Hong Kong Island (Karsen, Lau, and Bogadek 1986, Hong Kong Amphibians and Reptiles. Urban Council, Hong Kong: 100). Karsen et al. (idem.) mention Lantau Island, but Karsen reports (pers. comm.) that was a sight record.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA.

PITUOPHIS CATENIFER DESERTICOLA (Great Basin Gopher Snake). USA: COLORADO: Grand Co: 0.7 km W and 1.0 km S Radium, NW 1/4 SW1/4 Sec. 27, T1S, R82W. 16 September 1994. G. Horstman. Verified by L. J. Livo. UCM Color Slide 90. New county record; extends range ca. 41 km NE of nearest record near Eagle, Eagle County, in the Colorado River drainage and is the easternmost record of this subspecies in the state (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.).

Submitted by **GREG HORSTMAN**, Colorado Division of Wildlife, 711 Independent, Grand Junction, Colorado 81505, USA.

RHINOCHEILUS LECONTEI TESSELLATUS (Texas Longnose Snake). USA: OKLAHOMA: Texas Co: 0.45 km W Guymon. 15 October 1973. Collector unknown. Verified by Richard L. Holland. UCM 57039. First county record (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, 370 pp.).

Submitted by **KURT SCHAEFER**, Department of Biology, Panhandle State University, Goodwell, Oklahoma 73939, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

SISTRURUS CATENATUS TERGEMINUS X EDWARDSII (Massasauga). USA: COLORADO: El Paso Co: school yard at Edison. September-October 1987 or 1988. Stephen T. Pegler. Verified by Richard L. Holland. UCM 57099. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.). The first author's experience indicates that until 1989 the species was moderately common in El Paso County, but thereafter became rare and now approaches extirpation in that general area. As an isolated population (Conant and Collins 1991, A Field guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.) it merits the protection already afforded by the Colorado Division of Wildlife, and stronger measures should be considered.

Submitted by **STEPHEN T. PEGLER**, Denver Seminary, 3401 South University Boulevard, No. 202, Englewood, Colorado 80110, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado, 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado, 80309-0334, USA.

TANTILLA CUCULLATA (Blackhood Snake). USA: TEXAS: Terrell Co: ca. 8 mi E Sanderson on U.S. Rt. 90 (AOR). 8 June 1991. Observed and photographed by John C. Fraser. KU Color Slide 11135. County record; fills hiatus between Pecos and Val Verde (as mapped by Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp); Val Verde Co: 3 mi S Loma Alta on U.S. Rt. 277 (AOR). 4 June 1991. Observed and photographed by John C. Fraser. KU Color Slide 11134. Both verified by John E. Simmons. Although not a county record, both this and the Terrell County specimen exhibit narrowly broken neck rings (characteristic of *Tantilla cucullata*), and the Val Verde County example, from an area on the E edge of the range of *T. diabola*, makes untenable the continued recognition of the Devil's River Blackhead Snake as a distinct taxon.

Submitted by **KELLY J. IRWIN**, 2218 West 2nd Street, Topeka, Kansas 66606, USA; and **JOSEPH T. COLLINS**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA.

THAMNOPHIS PROXIMUS PROXIMUS (Western Ribbon Snake). USA: ILLINOIS: Greene Co: NE 1/4 Sec. 21, T9N, R13W, DOR on Co. Rd. 325E, 0.2 km N junction with Co. Rd. 630N. 17 October 1994. J. K. Tucker. Illinois Natural History Survey (INHS 11426). Calhoun Co: SE 1/4 Sec. 29, T8S, R3W, DOR on Ill. Rt. 96 at jct. with Co. Rd. 3180N (Infidel Hollow Road). 19 October 1994. J. K. Tucker. INHS 11428. Verified by C. Phillips. Illinois Natural History Survey (INHS). New county records.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

THAMNOPHIS SIRTALIS PARIETALIS (Red-sided Garter Snake). USA: OKLAHOMA: Beaver Co: Slapout. 17 March 1974. Collector unknown. Verified by Richard L. Holland. UCM 57037. First county record (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, 370 pp.) and a westward range extension of ca. 48 km from Ft. Supply, (Woodward County) for the subspecies in Oklahoma.

Submitted by **KURT SCHAEFER**, Department of Biology, Panhandle State University, Goodwell, Oklahoma 73939, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). USA: ILLINOIS: Scott Co: NE 1/4 Sec. 20, T14N, R12W, Winchester Road, 0.1 km N Winchester. 21 August 1994. J. K. Tucker. Verified by Chris Phillips, Illinois Natural History Survey (INHS 11350). New county record.

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

TRETANORHINUS NIGROLUTEUS (Orangebelly Swamp Snake). MÉXICO: QUINTANA ROO: La Union, in Hondo River, 3 km NE La Union town (17°53'47"N, 88°52'34"W). 27 January 1993. H. Bahena Basave. Museo de Zoologia del Centro de Investigaciones de Quintana Roo (MZCIQRO 223); in Hondo River, La Union town, 31 March 1993. H. Bahena Basave. Both verified by O. Flores-Villela. MZCIQRO 258. New record to Quintana Roo, Yucatan Peninsula.

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

New Island Records from Panay, Philippines

Even though the island of Panay ranks seventh in size in the Philippine Archipelago, until recently few faunal surveys had been done there (Gonzales and Kennedy 1990). From 1983 through 1989 the National Museum of the Philippines (PNM) sponsored several expeditions to Panay, the last being co-sponsored by the Cincinnati Museum of Natural History (CMNH). Fourteen new island records of amphibians and reptiles are reported below with specimens being deposited at either CMNH or PNM. Common names were taken from Alcala (1986) when available. Records were checked in Alcala (1986) and against the catalogs of the following collections: California Academy of Sciences, Carnegie Museum of Natural History, Field Museum of Natural History, National Museum of the Philippines, The Rabor Collection (University of the Philippines at Los Banos), U.S. National Museum of Natural History, and an unpublished list compiled by Ronald I. Crombie. Identifications were verified by Ronald I. Crombie.

ANURA

Rana everetti (Everett's Frog). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 210 m elev. 4 October 1989. J. W. Ferner. CMNH 3153. Island record.

Rana leytensis (Leyte Frog). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy. February 1987. R. Sison and L. Pelayo. PNM 1114. Island record.

Platymantis guentheri (Guenther's Forest Frog). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 950 m elev. 17 October 1989. J. W. Ferner. CMNH 3166. Island record.

SAURIA

Draco sp. (Flying Lizards). Aklan Province: Ibajay Municipality: Barrio Bugtong-bato. August 1983. CMNH 3237–3239 (PNM Field Nos. 367–370, 373, 375); Antique Province: Barbasa Municipality: Barrio Igapalge. August 1989. PNM Field Nos. 338-343; Iloilo Province: Viejo Municipality: Barotac Viejo, Sitio San Francisco. March 1988. CMNH 3240-3241 (PNM Field Nos. 344-346). R. Sison. Island record for genus. Currently, specific names are not reliable in this genus based on taxonomic revisions underway (R. I. Crombie, pers. comm.).

Hemidactylus stejnegeri (Stejneger's House Gecko). Iloilo Province: Dingle Municipality: Barrio Moroboro, Bulabog-Puti-an National Park, 100 m elev. 19 October 1989. R. Sison. CMNH 3225. Island record.

Gekko mindorensis (Mindoro Narrow-disked Gecko). Iloilo Province: Dingle Municipality: Barrio Moroboro, Bulabog Putiraan National Park, 100 m elev. 22 October 1989. R. Sison. PNM Field No. 2500. Island record.

Gonyocephalus sp. (Anglehead Lizards). Aklan Province: Libacao Municipality: Barrio Danao. February 1987. PNM 1130–1132. R. Sison and L. Pelayo. Island record for genus. Currently, specific names are not reliable in this genus based on revisions underway (see Ross and Gonzales 1991).

Mabuya indeprensa. Iloilo Province: Mt. Baloy. February 1987. CMNH 3247 (PNM 1151-1152). R. Sison and L. Pelayo. Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 200 m elev. 4 October 1989. PNM Field No. 97. J. W. Ferner. Island record.

Sphenomorphus fasciatus (Banded Sphenomorphus). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 1200 m elev. 13 October 1989. CMNH 3248. R. Kennedy. Island record.

Tropidophorus grayi (Spiny Waterside Skink). Antique Province: Valderrama Municipality: Barrio Binanogan. 24 May 1989. PNM Field No. 96. R. Sison. Island record.

SERPENTES

Chrysopelea paradisi (Paradise Snake). Aklan Province: Ibajay Municipality: Barrio Bugtong-bato. 8 July 1983. PNM 1050. R. Sison. Island record.

Oligodon modestus (Spotted-bellied Short-headed Snake). Aklan Province: Libacao Municipality: Barrio Jamindang. March 1987. PNM 1066. R. Sison and L. Pelayo. Island record.

Dendrelaphis caudolineatus (Lined Slender Arboreal Snake). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 200 m elev. 1 October 1989. CMNH 3254. R. Sison. Island record.

Pseudorhabdion mcnamarae (McNamara's Burrowing Snake). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 950 m elev. 14 October 1989. PNM Field Nos. 163 and 209. R. Sison. Island record.

Acknowledgments.— We thank R. I. Crombie for his patient assistance as we became more familiar with Philippine herpetofauna. The logistical support for this project provided by R. S. Kennedy is greatly appreciated. Thanks to R. S. Kennedy, J. Cabalquinto, E. Canada, M. Ebreo, R. Fernandez, J. Lasugas, M. Manuel, and V. Samarita and numerous other assistants for their aid in the field. Financial support was generously provided by the Cincinnati Museum of Natural History and Thomas More College.

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ROGELIO SISON,
PEDRO C. GONZALES
Zoology Division
National Museum of the Philippines
Rizal Park
Manila, Philippines
and

JOHN W. FERNER
Department of Biology
Thomas More College
Crestview Hills, Kentucky 41017, USA,
and
Cincinnati Museum of Natural History
1720 Gilbert Avenue
Cincinnati, Ohio 45202, USA.

New Distributional Records of Amphibians and Reptiles from New Hampshire

As part of on-going surveys of the amphibians and reptiles of New England (Klemens 1993), a small collection of preserved amphibians and reptiles from New Hampshire was accumulated, representing both my efforts as well as those of several colleagues. Collections were deposited at the American Museum of Natural History (AMNH) and significantly augment Taylor's (1993) distribution maps of New Hampshire's herpetofauna. Identifications were verified by Darrel R. Frost.

CAUDATA

Ambystoma maculatum (Spotted Salamander). Sullivan Co: Cornish, pond E of Chase Cemetery near Rt. 12-A. 20 April 1986. R. P. Cook. AMNH 128996. First record from Sullivan County, documenting Taylor's (1993:23) unconfirmed "sighting reports."

Desmognathus f. fuscus (Northern Dusky Salamander). Rockingham Co: Seabrook, E of U. S. Rt. 1, S of Seabrook Station. 29 March 1986. R. P. Cook. AMNH 128997. First record from Rockingham County and first documentation of this species' occurrence in New Hampshire's coastal region (Taylor 1993:26).

Plethodon cinereus (Redback Salamander). Sullivan Co: Cornish. 15 May 1986. R. P. Cook. AMNH 129021. First record from Sullivan County (Taylor 1993:29).

ANURA

Hyla versicolor (Gray Treefrog). Sullivan Co: Cornish, pond E of Chase Cemetery near Rt. 12-A. 25 May 1986. R. P. Cook. AMNH 129050. First record from Sullivan County (Taylor 1993:36).

Pseudacris c. crucifer (Northern Spring Peeper). Sullivan Co: Cornish, E of Rt. 12-A, ca. 0.25 mi. N Chase Cemetery. 18 April 1986. R. P. Cook. AMNH 129048–49. First record from Sullivan County documenting Taylor's (1993:37) unconfirmed "sighting reports."

TESTUDINES

Chelydra s. serpentina (Common Snapping Turtle). Grafton Co: Landaff, trib. to Pearl Lake, 1020 feet elev. 27 June 1982. M. W. and N. S. Klemens. AMNH 124936. Extends New Hampshire range 15 miles NNE from Grafton County record mapped by Taylor (1993:46).

Chrysemys picta (Painted Turtle). Grafton Co: Landaff, Chandler Pond, 1100 feet elev. 27 June 1982. M. W. and N. S. Klemens. AMNH 124937–38. Extends New Hampshire range 30 miles NNE from southern Grafton County record mapped by Taylor (1993:50).

SERPENTES

Lampropeltis t. triangulum (Eastern Milk Snake). Carroll Co: ca. 5 mi. N Center Sandwich on Maple Ridge Road. 17 June 1967. H. J. Greer. AMNH 100394. First record from Carroll County documenting Taylor's (1993:61) unconfirmed "sighting report."

Lampropeltis t. triangulum (Eastern Milk Snake). Grafton Co: Landaff, near Merrill Mountain Road. 29 June 1982. E. Twaronite. AMNH 124942. First record from Grafton County (Taylor 1993:61).

Nerodia s. sipedon (Northern Water Snake). Merrimack Co: Warner, near wooded inlet stream to Ballard Brook above Joppa Road. 5 February 1991. D. Carroll. AMNH 137472. Extends New Hampshire range 25 miles W from record near Rockingham-Merrimack county line mapped by Taylor (1993:54).

Acknowledgments.—David Carroll, Robert P. Cook, Mary Hake, Josephine Kelleher, Nicole S. Klemens, and Eugene Twaronite provided specimens and/or assistance with New Hampshire field work. All collections were made under the provisions of scientific collecting permits issued by the New Hampshire Fish and Game Department.

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MICHAEL W. KLEMENS
Wildlife Conservation Society
185th Street and Southern Boulevard
Bronx, New York 10460, USA.

Recent Distribution Records for Amphibians and Reptiles in Illinois

Since Smith's (1961, Bull. Illinois Nat. Hist. Surv. 28:1–298) comprehensive work on the amphibians and reptiles of Illinois, a number of short articles have reported new information on the distribution of some Illinois species. Many of these articles treated individual species, frequently those uncommon in the state or secretive (e.g., *Hemidactylium scutatum, Scaphiopus holbrookii, Ophisaurus attenuatus, Clonophis kirtlandii*). Several short articles provided blocks of new distribution information for multiple species, for example, Holman (1966, Trans. Illinois State Acad. Sci. 59:298–300), Moll (1962, Herpetologica 18:207–209), Moll et al. (1977, Herpetol. Rev. 8:85), Morris (1976, Herpetol. Rev. 7:126–127), Munyer and Parmalee (1967, Trans. Illinois State Acad. Sci. 60:200–202), Schramm and Nordgren (1977, Trans. Illinois State Acad. Sci. 70:243) and Thurow and Sliwinski (1991, Bull. Chicago Herpetol. Soc. 26:129–132). The bibliography of Illinois herpetological literature from 1960 to 1980 (Morris et al. 1983, Bull. Illinois Nat. Hist. Surv. 33:123–138) included distribution records during that period.

Some Illinois counties for which Smith had few records have remained poorly known. Even some species considered to be com-

mon statewide or common in surrounding regions are undocumented for those counties (e.g., Boone, Clinton, Fayette, and JoDaviess).

This article includes new county records and recent records for several species in disjunct portions of their Illinois ranges. Several vouchers are included to confirm literature records not previously documented. Vouchers have been deposited in the herpetology collections of the following institutions: Illinois Natural History Survey (INHS, verified by C. Phillips); Milwaukee Public Museum Photo Collection (MPM, verified by G. S. Casper), and Southern Illinois University at Carbondale, Department of Zoology (SIUC, verified by R. A. Brandon).

CAUDATA

Ambystoma laterale (Blue-spotted Salamander). DuPage Co: Wood Dale Grove Forest Preserve, North Conservation Area (NW 1/4 Sec. 22, T40N, R11E). 14 April 1987. M. Redmer. INHS 10800. Darien, near 91st Street and Rt. 83 (SW 1/4 Sec. 2, T37N, R11E). 4 June 1989. M. Redmer. SIUC H-3805. Specimens confirm previous literature records (Jessup 1981, Bull. Chicago Herpetol. Soc. 16:44–46; Mierzwa 1987, Bull. Chicago Herpetol. Soc. 22:121; Ludwig et al. 1992, Trans. Illinois State Acad. Sci. 85:187–199) in which no vouchers were mentioned.

Ambystoma maculatum (Spotted Salamander). Monroe Co: 5.8–7.1 km N Randolph County line on Prairie du Rocher/Valmeyer Road (T4S, R10W). 3 April 1991. R. A. Brandon and S. R. Ballard. SIUC H-4265–69. Pinkle's Woods along Bluff Road (NE 1/4 Sec. 22, T3S, R11W). 23 March 1993. M. Redmer. SIUC H-4435. New county record.

Ambystoma t. tigrinum (Eastern Tiger Salamander). Boone Co: pond near Kishwaukee River at Lawrenceville Road (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10804. New county record.

Eurycea longicauda melanopleura (Dark-sided Salamander). Jersey Co: Pere Marquette State Park, tributary of Graham Hollow (northern Sec. 7, T6N, R12W). 4 July 1991. R. A. Brandon, D. Brandon, S. R. Ballard and J. Howard. SIUC H-4437. New county record.

Siren intermedia nettingi (Western Lesser Siren). Fayette Co: 0.8 km E Hurricane Creek on County Road 800N (SW 1/4 Sec. 19, T5N, R1W). 8 May 1993. S. R. Ballard, A. Jones, B. Jones. SIUC H4448-49. New county record.

ANURA

Scaphiopus h. holbrookii (Eastern Spadefoot). Pope Co: New Liberty, 0.6 km NW jct. Unionville Road on Bay City Road (NE 1/4 Sec. 17, T16S, R7E). 31 July 1993. M. Redmer. SIUC H-4440. Documents county record of Thompson et al. (1968, Trans. Illinois State Acad. Sci. 61:427) for which no vouchers exist (R. A. Brandon, pers. comm.). Williamson Co: Wolf Creek, on Wolf Creek Road, 1.1 km S Palestine Church (NW 1/4 Sec. 36, T10S, R1E). 20 September 1992. M. Redmer. SIUC H-4150. New county record; northernmost record for central Shawnee Hills.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). Pope Co: small pond NE of Golconda (SE 1/4 Sec. 9, T12S, R7E). 11 August 1992. D. Spivey. SIUC H-4103. 1.6 km W New Liberty (western Sec. 17, T16S, R7E). 22 June 1991. S. J. Karsen. SIUC H-4107. New county record.

Bufo a. americanus (Eastern American Toad). Boone Co: Kishwaukee River at Piscasaw Creek (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10810-811. New county record; Lee Co: Green River Conservation Area, S shore of Atkinson Road Marsh (NW 1/4 Sec. 13, T19N, R8E). Pump Factory Road, across flooded field from Area 6 parking lot (SE 1/4 Sec. 18, T19N, R9E). 7 April 1991. M. Redmer. SIUC H-4082 and H-4075, respectively. Franklin Creek State Park, NW portion, Twist Road across from park office (NE 1/4 Sec. 33, T22N, R10E). 6 April 1991. M. Redmer. SIUC H-4080. New county record.

Hyla chrysoscelis (Cope's Gray Treefrog). Lee Co: Nachusa Grasslands, fen area (NW 1/4 Sec. 21, T22N, R10E). 15 May 1988. M. Redmer, J. Levell. MPM P-148. New county record identified by sonogram (on file at MPM).

Hyla cinerea (Green Treefrog). Massac Co: Mermet Lake Conservation Area (NW 1/4 Sec. 35, T14S, R3E). 17 June 1989. S. J. Karsen. SIUC H-3777. New county record; Pope Co: ca. 1.6 km W New Liberty on Unionville Road (SW 1/4 Sec.17, T16S, R7E). 22 July 1993. M. Redmer, R. A. Brandon, M. Bavetz. SIUC H-4450. Next to Barren Creek on Bay City Road just west of bridge (NE 1/4 Sec. 35, T14S, R6E). 31 July 1993. M. Redmer. SIUC H-4442. Smithland Locks and Dam Road, 0.1–0.3 km W Army Corps buildings (SE 1/4 Sec. 33 T15S, R7E). 31 July 1993. M. Redmer. SIUC H-4443–47. New county record; SE most records in state; Williamson Co: Crab Orchard National Wildlife Refuge, Spillway Road swamp (SW 1/4 Sec. 4, T10S, R1E). 10 July 1992. M. Redmer. SIUC H-4102. New county record; extends range ca. 17–20 km NE of previous records in SW Jackson County.

Hyla versicolor (Gray Treefrog). DuPage Co: Waterfall Glen Forest Preserve, Bluff Road Pond (SW 1/4 Sec. 11, T37N, R11E). 21 May 1988. M. Redmer. MPM P-149. Identified by sonogram (on file at MPM); confirms previous literature record for county (Ludwig et al. 1992, Trans. Illinois State Acad. Sci. 85:187–199).

Pseudacris c. crucifer (Northern Spring Peeper). Franklin Co: ca. 2 km SW Zeigler (NW 1/4 Sec. 26, T7S, R1E). 28 March 1989. M. Redmer. SIUC H-3430. New county record; Lee Co: Nachusa Grasslands fen (NW 1/4 Sec. 21, T22N, R10E). 15 May 1988. M. Redmer. MPM P-150. Franklin Creek State Park, NW side, Twist Road pond (NE 1/4 Sec. 33, T22N, R10E). 6 April 1991. M. Redmer. SIUC H-4067–68. New county record; continues sporadic distribution in northern Illinois; Massac Co: S of New Columbia (SW 1/4 Sec. 16, T14S, R4E). 25 March 1989. M. Redmer. SIUC H-3435–36. New county record; Perry Co: Pyramid State Park (NW 1/4 Sec. 14, T6S, R3W). 24 March 1989. M. Redmer. SIUC H-3431–32. New county record; Washington Co: Washington County Conservation Area (SE 1/4 Sec. 7, T2S, R2W). 24 March 1989. M. Redmer. SIUC H-3433–34. New county record.

Pseudacris t. triseriata (Western Chorus Frog). Lee Co: Green River Conservation Area, flooded field at Hunting Area 3 (NW 1/4 Sec. 18, T19N, R9E). 5 April 1991. M. Redmer. SIUC H4071–72. Franklin Creek State Park, Twist Road Pond (NE 1/4 Sec. 33, T22N, R10E). 6 April 1991. M. Redmer. SIUC H-4070. New county record.

Rana catesbeiana (Bullfrog). Boone Co: Kishwaukee River at Piscasaw Creek confluence (SW 1/4 Sec. 30, T44N, R4E). 18 July 1988. M. Redmer. INHS 10807–08. New county record; Marshall Co: 0.8 km N Woodford/Marshall County line on Rt. 26 (NE 1/4 Sec. 34, T29N, R3W) and 1.8 km N Woodford/Marshall County line on Rt. 26 (NE 1/4 Sec. 27, T29N, R3W). 19 and 20 June 1990. S. R. Ballard. SIUC H-3948–49 respectively. New county record.

Rana clamitans melanota (Green Frog). Marshall Co: 0.8 km N Woodford/Marshall County line on Rt. 26 and along RR Tracks (NW 1/4 Sec. 35, T29N, R3W). 20 June 1990. S. R. Ballard and D. Ferrari. SIUC H-3950–52. New county record; Randolph Co: Kaskaskia Island, in Old River under St. Mary's Bridge (SE 1/4 Sec. 8, T7S, R10E). 30 April 1989. M. Redmer. SIUC H-3437. New county record; first Illinois record from west of the Mississippi River.

Rana palustris (Pickerel Frog). Randolph Co: 0.4 km S Monroe/Randolph County line on Prairie du Rocher-Valmeyer Road. 11 April 1991. S. R. Ballard. SIUC H-4270. New county record; St. Clair Co: Imbs Road, ca. 1.8 km SW Zion Church and 2.5 km NE Phelps (NW 1/4 Sec. 26, T1N, R10W). 7 April 1993. M. Redmer. SIUC H-4428. Verifies old literature record (Hurter 1893, St. Louis Acad. Sci. Trans. 6:251–261, cited by Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

TESTUDINES

Chelydra s. serpentina (Common Snapping Turtle). Lee Co: Rt. 26, 1.1 km N of Union Road (SE 1/4 Sec. 4, T19N, R9E). 23 June 1991. M. Redmer. SIUC R-2349. New county record; Stephenson Co: Le-Aqua-Na State Park, Waddams Creek at picnic area (NW 1/4 Sec. 17, T28N, R6E). 28 July 1991. M. Redmer. SIUC R2302. New county record.

Sternotherus odoratus (Common Musk Turtle). Franklin Co: ca. 2 km SW Zeigler (NE 1/4 Sec. 27, T7S, R1E). 28 September 1988. M. Redmer and S. J. Karsen. SIUC R-2081. New county record; Pulaski Co: 2 km SSE Perks (Sec. 14, T14S, R1E). 13 May 1986. R. A. Brandon and M. A. Morris. SIUC R-2122. New county record; Whiteside Co: Mississippi River, ca. 3 km upstream from Lock and Dam 13 (NE 1/4 Sec. 2, T22N, R3W). 3 September 1987. M. Redmer. SIUC R-2475. New county record; confirms presence in NW Illinois (Conant and Collins 1991, A Field Guide to the Reptiles and Amphibians of Eastern and Central North America. 3rd Edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Kinosternon subrubrum (Eastern Mud Turtle). Gallatin Co: 2.4 km N Saline Mines (northern Sec. 23, T10S, R9E). 25 March 1991. S. R. Ballard and R. A. Brandon. SIUC R-2476. New county record; Perry Co: 2.2 km E DuQouin on RR tracks in Reese Creek Bottoms (NE 1/4 Sec. 15, T6S, R1W). 7 April 1993. S. J. Karsen. SIUC R-2481. New county record.

Chrysemys picta (Painted Turtle). Boone Co: Genoa Road at Kishwaukee River (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10816. New county record; Greene Co: Rt. 108, 6.1 km W jct. Rt. 267 (NW 1/4 Sec. 19, T10N, R12W). 24 July 1993. S. R. Ballard. SIUC R-2480. New county record; Lee Co: Rt. 26 at Union Road (SW 1/4 Sec. 10, T19N, R9E). 19 May 1991. M. Redmer. SIUC R-2337. Franklin Creek State Park, NW portion, on Twist Road (NE 1/4 Sec. 33, T22N, R10E). 22 June 1991. M. Redmer. SIUC R-2454. New county record; Perry Co.: 3.2 km E DuQuoin on Rt. 14 (NW 1/4 Sec. 27, T6S, R1W). 2 October 1988. R. G. Weck. SIUC R-2143. New county record; fills in gap between Randolph, Washington, Jefferson, Franklin and Jackson counties.

Graptemys geographica (Common Map Turtle). DuPage Co: Warrenville Grove Forest Preserve, below dam (NE 1/4 Sec. 3, T39N, R9E). 17 July 1989. M. Redmer. SIUC R-2482. Confirms literature record (Ludwig et al. 1992, Trans. Illinois State Acad. Sci. 85:187–199).

Terrapene c. carolina (Eastern Box Turtle). Randolph Co: 3.2 km N of Rockwood on Rt. 3 (SW 1/4 Sec. 2, T8S, R6W). 22 July 1988. R. G. Weck. SIUC R-2232. New county record; fills in gap between Monroe and Jackson counties.

Apalone s. spinifera (Eastern Spiny Softshell). Lee Co: Green River at Rt. 26 bridge (NW 1/4 Sec. 4, T19N, R9E). 4 May 1991. M. Redmer. SIUC R-2315. New county record; fills gap between Whiteside, Ogle, and Bureau counties.

SAURIA

Cnemidophorus s. sexlineatus (Six-lined Racerunner). Pulaski Co: near Karnak (NE 1/4 Sec. 15, T14S, R2E). 12 July 1989. S. Karsen. SIUC R-2169. New county record.

SERPENTES

Coluber constrictor (Racer). Hardin Co: Karber's Ridge Road, 1.5 km NE jct. Rt. 34 (SE 1/4 Sec. 11, T11S, R7E). 26 May 1990. S. R. Ballard. SIUC R-2221. New county record, fills gap between Pope and Gallatin counties; Lee Co: Green River Conservation Area Hunting Area 2 (SE 1/4 Sec. 7, T19N, R9E). 4 June 1991. M. Bavetz, R. Flick, M. Redmer, R. A. Brandon. SIUC R-2339. New county record; Madison Co: Sand Road in Poag, just E jct. with Poag Road (SW 1/4 Sec. 18, T4N, R8W). 5 October 1993. S. R. Ballard. SIUC R-2492. New county record.

Elaphe v. vulpina (Western Fox Snake). Boone Co: ca. 2 km NW Caledonia, Greenlee Road at RR Tracks (NW 1/4 Sec. 17, T45N, R3E). 5 September 1988. M. Redmer. INHS 10809. New county record; JoDaviess Co: 0.5 km N Carroll/JoDaviess County line on Rt. 84 (SW 1/4 Sec. 36, T26N, R2E). 26 May 1989. M. Redmer. SIUC R-2207. New county record and NW most record in state; Lee Co: Green River Conservation Area, Maytown Road 0.3 km E Pump Factory Road (SW 1/4 Sec. 17, T19N, R9E). 20 May 1991. M. Redmer. SIUC R-2343. New county record; Warren Co: 2 km NE Roseville on County Road 900N at R. Killy Farm (south-central Sec. 16, T9N, R2W). 5 June 1993. M. Redmer. SIUC R-2471. New county record.

Farancia abacura reinwardtii (Western Mud Snake). Pope Co: 1.2 km W New Liberty (center of Sec. 17, T16S, R7E). 13 July 1991. S. J. Rarsen. SIUC R-2474. New county record.

Heterodon platirhinos (Eastern Hognose Snake). Whiteside Co: Fulton-Thompson Sand Prairie Nature Preserve, 4.5 km N Fulton (NW 1/4 Sec. 1, T22N, R3E). 3 September 1987. M. Redmer.

MPM P-131. New county record; St. Clair Co: Milstadt. May 1979 and May 1981. R. Young and R. Besse. SIUC R-1862–63 respectively. New county record.

Lampropeltis c. calligaster (Prairie Kingsnake). Johnson Co: Goreville (Sec. 22, T11S, R2E). 3 October 1989. S. Henning. SIUC R-2213. Confirms literature record (Klimstra and Hutchison 1965, Trans. Illinois State Acad. Sci. 58:151–156) for which no vouchers exist (R. A. Brandon, pers. comm.). Fills gap between Union, Williamson, Pope and Massac counties.

Lampropeltis t. triangulum (Eastern Milk Snake). Woodford Co: 1.6 km E Rt. 26, off upper Spring Bay Road, near Woodford/Tazewell county line (eastern Sec. 36, T27N, R4W). D. Holmes. SIUC R-2483. New county record.

Nerodia r. rhombifer (Diamondback Water Snake). Gallatin Co: cypress ditch 5 km W Shawneetown (NW 1/4 Sec. 20, T9S, R9E). 10 June 1989. S. J. Karsen. SIUC R-2214. New county record.

Nerodia sipedon pleuralis (Midland Water Snake). Massac Co: Mermet Lake Conservation Area (NW 1/4 Sec. 35, T14S, R3E). 17 June 1989. S. J. Karsen. SIUC R-2215. New county record; fills gap between Pulaski, Johnson and Pope counties.

Nerodia s. sipedon (Northern Water Snake). Boone Co: at confluence of Kishwaukee River and Piscasaw Creek (SW 1/4 Sec. 30, T44N, R9E). 3 July 1989. M. Redmer. SIUC R-2412. New county record; Whiteside Co: S entrance to Morrison-Rockwood St. Park (south-central Sec. 16, T21N, R2W). 5 June 1993. M. Redmer. SIUC R-2470. New county record.

Opheodrys aestivus (Rough Green Snake). Massac Co: Mermet Lake Conservation Area, W side of lake (Sec. 35, T14S, R3E). 6 May 1988. W. D. Robinson. SIUC R-2024. New county record; Pulaski Co: Belknap Road at Cache River, N of Karnak (NE 1/4 Sec. 15, T14S, R2E). 16 June 1988. R. A. Brandon, R. G. Weck and S. R. Ballard. SIUC R-2009. New county record.

Opheodrys vernalis (Smooth Green Snake). Lee Co: Green River Conservation Area, dirt road 0.5 km W Hunting Area 2 parking lot (SE 1/4 Sec. 7, T19N, R8E). 20 May 1991. M. Redmer. SIUC R2340. Franklin Creek State Park, Twist Road Pond (NE 1/4 Sec. 33, T22N, R10E). 22 June 1991. M. Redmer. SIUC R-2346. New county record.

Pituophis catenifer sayi (Bullsnake). Marshall Co: 0.8 km N Woodford/Marshall County line along RR tracks at Rt. 26 (NW 1/4 Sec. 35, T29N, R3W). 18 June 1992. S. R. Ballard. SIUC R-2479. New county record.

Regina septemvittata (Queen Snake). Ogle Co: White Pines Forest State Park, NW tributary to Pine Creek (NE 1/4 Sec. 8, T23N, R9E). 14 July 1991. M. Redmer. SIUC R-2300. Third record from Rock River Drainage, first record W of Rock River and NW most record in range of the species in Illinois (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298; Anton and Redmer 1991, Herpetol. Rev. 24:26).

Storeria dekayi wrightorum (Midland Brown Snake). Boone Co: Riverside Road at Beaver Creek (SE 1/4 Sec. 5, T44N, R3E). 30 July 1988. M. Redmer. INHS 10815. New county record; Carroll Co: Mississippi Palisades State Park, near RR tracks (SW 1/4 Sec. 21, T25N, R3E). 26 May 1989. M. Redmer. SIUC R-2209. New county record and NW most record in state; Clinton Co: Eldon Hazlet State Park, DOR on blacktop road 0.4 km E park office (NW 1/4 Sec. 33, T3N, R2W). 16 October 1993. S. R. Ballard. SIUC R-2493. New county record; Fayette Co: DOR on County Road 450N, 0.08 km W jct. with County Road 60E (central Sec. 7, T4N, R1W). 23 October 1993. S. R. Ballard. SIUC R-2496. New county record; Lee Co: Nachusa Grasslands, oak savanna (NW 1/4 Sec. 21, T22N, R10E). 15 May 1988. M. Redmer. MPM P-153. Franklin Creek State Park, NW portion along Twist Road, 0.4 km N park office (NE 1/4 sect33, T22N, R10E). 22 June 1991. M. Redmer. SIUC R-2295. Green River Conservation Area, Maytown Road at Parking Area 10 (SE 1/4 Sec. 13, T19N, R8E). 29 June 1991. M. Redmer. SIUC R-2341. New county record; Pope Co: 5 km SW New Liberty (NW 1/4 Sec. 35, T16S, R7E). 17 June 1989. S. J. Karsen. SIUC R-2216. New county record; fills gap between Johnson and Hardin counties.

Storeria o. occipitomaculata (Northern Redbelly Snake). Carroll Co: Mississippi Palisades State Park near RR tracks (SW 1/4 Sec. 21, T25N, R3E). 26 May 1989. M. Redmer. SIUC R-2210. New county record, NW most locality in state, and confirms presence of species in NW Illinois (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28: 1–298; Conant and Collins 1991, A Field Guide to the Reptiles and Amphibians of Eastern and Central North America. 3rd Edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.); Jersey Co: Pere Marquette State Park, Trail 9 (NE 1/4 Sec. 10, T6N, R13W). 22 June 1991. R. A. Brandon, D. Brandon, S. Ballard and J. Petzing. SIUC R-2473. New county record.

Thamnophis r. radix (Eastern Plains Garter Snake). Boone Co: along Lawrenceville Road near confluence of Kishwaukee River and Piscasaw Creek (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10812. New county record.

Thamnophis s. sirtalis (Eastern Garter Snake). Clinton Co: DOR on County Road 1840E, 1.1 km N jct. with County Road 1430N (central Sec. 7, T2N, R2W). 23 October 1993. S. R. Ballard. SIUC R2497. New county record; Johnson Co: ca. 1.6 km E West Vienna on Rt. 146 (east-central Sec. 33, T12S, R2E). 19 May 1988. R. A. Brandon and S. R. Ballard. SIUC R-2148-49. New county record, filling gap between Union, Williamson, Pope and Pulaski counties; Saline Co: 0.8 km SE Eldorado (Sec. 27, T8S, R7E). 12 October 1974. M. Anderson and K. Anderson. SIUC R-1860. New county record.

Agkistrodon contortrix mokasen (Northern Copperhead). Saline Co: 1.6 km W Horseshoe (Sec. 34, T10S, R7E). 22 September 1990. S. J. Karsen. SIUC R-2477. New county record. Franklin Co: (SE 1/4 Sec. 33, T5S, R4E). 20 August 1992. R. Hutchcraft. SIUC R-2478. New county record.

Crotalus horridus (Timber Rattlesnake). Pope Co: nine-day trail ride to One Horse Gap Lake (SE 1/4 Sec. 32, T11S, R7E). 18 May 1990. E. Steward Work Camp Crew. SIUC R-2220. New county record; fills gap between Johnson and Hardin counties.

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Portions of the field work were funded by the Illinois Endangered Species Protection Board and Illinois Department of Conservation (Nongame Wildlife Conservation Fund contracts to R. A. Brandon). Lee County photo vouchers were taken during a 1987 Chicago Herpetological Society field trip organized by K. S. Mierzwa.

MICHAEL REDMER
and
SCOTT R. BALLARD*
Department of Zoology
Southern Illinois University at Carbondale
Carbondale, Illinois 62901, USA.

**Current Address: Division of Natural Heritage, Illinois Department of Conservation, 4521 Alton Commerce Parkway, Alton, Illinois 62002, USA.*

BOOK REVIEWS

Biology of Whiptail Lizards (Genus *Cnemidophorus*), John W. Wright and Laurie J. Vitt (editors). 1993. The Oklahoma Museum of Natural History: i–xiv + 417 pp. Hardcover. US $29 plus shipping. ISBN 1-883090-01-6.

This volume is the outcome of a symposium devoted to the teiid genus *Cnemidophorus*. The symposium—conceived and organized by John W. Wright and held at the University of Oklahoma in August 1984 during the joint annual meetings of the American Society of Ichthyologists and Herpetologists, the Herpetologists' League, and the Society for the Study of Amphibians and Reptiles—brought together a diverse assemblage of over 50 specialists who presented 30 papers on a broad spectrum of topics related to *Cnemidophorus*. The resulting volume (The Herpetologists' League Special Publication No. 3), containing 15 separate papers by 22 authors, is dedicated to Charles H. Lowe and Richard G. Zweifel. Contributions have been revised and updated with additional findings through September 1992. The individual papers are not grouped under subject headings, but the topics covered include systematics, reproduction, physiology, behavior, ecology, and community level analyses. Not surprisingly, a pervasive topic is the differences and similarities between unisexual and bisexual species in aspects of their biology.

The preface by John Wright and Laurie Vitt explains that the decision to produce this volume was not reached until after the symposium, and that some of the symposium presentations were already in press or committed to be published elsewhere by that time. Included in the preface is a list of the authors and titles of all 30 papers that were presented at the symposium, as well as a list of 12 symposium papers that were published elsewhere and are thus not included in the present volume.

The first chapter is an introduction by Charles H. Lowe which provides an historical review of taxonomy and systematics of *Cnemidophorus* organized to cover three time periods from 1830 to 1990. Lowe's chronological presentation recounts the considerable difficulties and confusion experienced by workers attempting to discriminate taxa and discusses the major contributions during each time period that led to our current understanding of the genus. In the author's opinion, one of the most significant breakthroughs in discriminating *Cnemidophorus* taxa was the description of *C. neomexicanus* by Lowe and Zweifel (1952). For the first time, in addition to appearance in life and ecological information gathered in the field, discrimination of a *Cnemidophorus* species was based on statistical analysis of quantitative meristic data. The author further reviews the impact on *Cnemidophorus* research of the discovery of parthenogenesis in *Lacerta* by Darevsky, and more recently, the high level of taxonomic resolution achieved through chromosomal and molecular studies.

In Chapter 2, John W. Wright provides a summary of the evolutionary relationships of *Cnemidophorus* and a taxonomic arrangement partitioned into six species groups. The composition of each group is discussed and distribution maps and color photographs of representative taxa are provided. Wright reviews the origin and evolution of parthenogenesis in *Cnemidophorus* as well as the controversies surrounding nomenclature of parthenogenetic taxa. The lineages of parthenogenetic taxa are reviewed by species group, with particular reference to the results of mitochondrial DNA analyses. An alphabetical listing of the groups and their respective members, which contains over 100 taxa and includes over a dozen undescribed forms, differs substantially from the recent taxonomic arrangement of Maslin and Secoy (1986).

The next five papers present results of field investigations and literature reviews on the interrelated subjects of foraging ecology, thermoregulation, activity patterns, and locomotion.

Roger Anderson investigated foraging ecology of *Cnemidophorus tigris* at a six-hectare site in the Sonoran Desert of Riverside County, California, through systematic time-constrained field observations of foraging animals and quantitative assessments of vegetation, prey availability, and stomach contents. At this site, *C. tigris* was determined to be a wide forager that depended primarily on chemoreception to detect fossorial and hidden prey, but relied on vision to choose foraging pathways between and within patches of widely dispersed microhabitats. The results indicate that successful foraging in *C. tigris* is clearly not the result of opportunistic success during random wanderings.

Using experimental chambers, Richard Bowker explored questions relating to the brief daily activity periods of *C. exsanguis* and *C. velox* and the costs of their wide-foraging lifestyles by examining temperature regulation and the influence of water loss on activity times. Bowker discusses the relationships between maintaining precisely regulated body temperatures, the costs of activity, and the increase in water loss with increase in body temperature. The activity experiments indicated that water loss was proportional to length of activity, and Bowker concludes that water may be an important factor limiting daily activity in these animals.

Gustavo Casas-Andreu and Marco Gurrola-Hidalgo report on the comparative ecology of *C. communis* and *C. lineatissimus* at a tropical deciduous forest site in Jalisco, México. Average body temperatures for both species are slightly lower than those reported in a number of studies on *Cnemidophorus* from the southwestern United States, and daily activity patterns were unimodal, with greatest activity at mid-day during the entire year. Similar unimodal activity patterns have been found for other species of tropical tei-

ids, whereas bimodal activity patterns are reported for lizards from the southwestern United States.

Kay Etheridge and Lawrence Wit examine the comparatively short active season and the resulting long inactive period of adult *C. sexlineatus* in Alabama and discuss evidence from the literature and their own field work regarding the factors affecting this activity cycle. They conclude that the short annual activity period of *C. sexlineatus* can be attributed to a lack of territorial behavior, their wide-ranging foraging behavior and high foraging efficiency, avoidance of negative energy returns when food is scarce, and reduction of the risk of predation.

Locomotor performance and activity metabolism of *C. tigris* are reviewed by Theodore Garland and compared to the available quantitative data for other species of lizards. Results from the laboratory work reported here show that the endurance capacity of *C. tigris* is exceptionally high in comparison to that of other lizards, and appears to exceed what is required for foraging alone. Garland concludes that while the primary adaptive significance of high endurance capacity in *C. tigris* is unclear, a variety of activities other than foraging that may require high endurance capacities must be considered. Garland points out that the available comparative information is very limited and that additional data on other arid habitat *Cnemidophorus* are needed. Also, performance capacities demonstrated in the laboratory need to be compared to findings from the field.

The contributions by Vitt and Breitenbach, Trauth and Fagerberg, and Crews and Moore provide information on reproduction in *Cnemidophorus*. Laurie Vitt and Gary Breitenbach present an exhaustive review and synthesis of literature on reproduction and life histories of *Cnemidophorus*, emphasizing ecological aspects of reproduction. They compiled literature information on reproductive characteristics of 17 species of *Cnemidophorus* and a list of over 50 *Cnemidophorus* populations from which the reproductive data were obtained. The authors examine the available information on clutch size and egg mass, seasonality in reproduction and clutch frequency, geographic and temporal variation in reproduction, and female investment to provide support for five postulated differences in reproductive characteristics that would be expected between *Cnemidophorus* and typical wait-and-ambush lizard species.

Stanley Trauth and Wayne Fagerberg looked at eggshell ultrastructure of oviducal eggs from the hybrid species *C. laredoensis* compared with the eggshell morphology of *C. sexlineatus*, one of its parent species. In light of the results, the authors discuss the potential application of stereological methods for resolving eggshell ultrastructure in order to detect inter- and/or intraspecific differences in eggshells and as a means of correlating local environmental conditions of nest sites.

The paper by David Crews and Michael Moore provides an update on the ongoing investigations into the psychobiology of parthenogenetic whiptails and describes the relationship between pseudocopulatory behavior, hormonal correlates, and the ovarian cycle in *C. uniparens*. The authors also defend their interpretations of the causes and functions of pseudocopulatory behavior in parthenogenetic *Cnemidophorus* in light of contentions that pseudocopulation is an artifact of crowding in captivity and that reproductive condition is not associated with behavioral roles during pseudocopulation.

Thyroid activity and metabolic rate in *C. sexlineatus* were studied by Lawrence Wit and Jeffrey Sellers using animals caught from the wild over a 16-month period in Alabama and Georgia. They suggest that the lowered metabolic rate and elevated plasma thyroxine titers found in hibernating animals are not simply consequences of the animals becoming dormant in response to cold temperatures. The authors conclude that the increase in plasma thyroxine is due to decreased peripheral use of the hormone, as indicated by oxygen consumption, rather than increased production.

Beth Leuck's analysis of aggressive behavior between sympatric diploid and triploid *C. tesselatus* represents an insightful approach designed to investigate the effects of genetic relatedness on aggressive behavior. Under experimental conditions, lizards in mixed diploid and triploid trials had significantly more aggressive acts towards each other than those of the same ploidy level. Based on these results, Lueck concludes that diploid and triploid *C. tesselatus* appear able to distinguish genetic relatedness.

Three papers focus on competitive interactions and resource partitioning in communities with bisexual and parthenogenetic whiptail species. Joseph Schall studied a community of five *Cnemidophorus* species, two parthenogenetic and three bisexual, in southwestern Texas to test the hypothesis that all-female species should use a broader range of habitats and resources, have more patchy distributions, and live in more disturbed areas. The two parthenogenetic species, *C. exsanguis* and *C. tessealatus*, had microhabitat niche breadths approximately 25% larger than the three bisexual species and were found in a much broader range of macrohabitat types, but they were most common in disturbed areas. However, he found no evidence of a difference in diet between the bisexual and parthenogenetic species.

The remaining two papers report on field studies in southern New Mexico that employed experimental population manipulations to examine mechanisms of coexistence between *C. tigris* and a sympatric unisexual whiptail. As part of a nine-year study, Orlando Cuellar monitored the immigration of *C. tigris* into an open sandy field from which *C. uniparens* was being systematically removed. The density of *C. tigris* at the site increased after removal of *C. uniparens* but decreased when the latter was no longer being removed. Cuellar concludes that the parthenogenetic species was excluding the bisexual through competition, and that parthenogenetic and bisexual whiptails coexist by inhabiting neighboring but distinct microhabitats.

Andrew Price, Joseph Lapointe, and Wirt Atmar removed *C. tigris* from one of three study grids and *C. tesselatus* from another, with the third grid serving as a control. Because there was no change in habitat use, their results indicated no microhabitat segregation between the two species. Further, there was no measurable response by the parthenogenetic *C. tesselatus* through either recruitment or increased reproduction to the removal of *C. tigris*.

The book measures 6 x 9 inches and is printed on nonreflective paper in easy-to-read, single column format. It contains numerous text figures, six distribution maps, and 48 color photographs of representative taxa in six *Cnemidophorus* species groups, including some not previously illustrated. Literature citations are placed at the end of each paper, whereas an index to subject matter and scientific names was compiled for the entire volume.

The book suffers from a number of flaws in editing and production. There are numerous typographical errors in the text. In addition, there are egregious omissions and errors with respect to tables and figures. The most obvious omissions include a reference to table 2 on p. 57 when only table 1 is present in chapter 2. Also, table 3 is absent from chapter 8 although it is referenced once on p. 221 and twice on p. 225. In chapter 2, the legends for figures 5, 7, 9, 11, and 13 all refer to figure 2 for specimen references but none are provided with figure 2; the legend for figure 3

does give information for specimens from the Natural History Museum of Los Angeles County, but does not have museum information for the acronyms listed in the other figure legends. An incorrect legend was placed with figure 8 on p. 272. The editors subsequently distributed to book purchasers a corrected legend for this figure.

These criticisms aside, I have high praise for this uniquely important book. It represents a culmination of efforts that started with John Wright's inspiration to organize and carry to fruition the first symposium on *Cnemidophorus*. The book provides superb summaries of evolutionary and ecological research that will prove indispensable for future work on whiptails, as well as especially useful to anyone doing field research on lizards in general. The extensive bibliographies will provide the reader the opportunity to become familiar with the primary literature on virtually any aspect of whiptail biology. I highly recommend the book to those interested in technical work on lizards. At $29, it represents a welcome bargain during times of ever-increasing book prices.

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ROBERT P. REYNOLDS
National Biological Survey
National Museum of Natural History
Washington, D.C. 20560, USA.

The Amphibians and Reptiles of Alberta, by Anthony P. Russell and Aaron M. Bauer. 1993. Copublished by The University of Calgary Press, 2500 University Drive, N.W., Calgary, Alberta, T2N 1N4 and The University of Alberta Press, Athabasca Hall, Edmonton, Alberta, T6G 2E8, Canada. ISBN 1-895176-20-4, 264 pp. CAN $24.95 paperback, $29.95 hardcover. [Outside Canada prices are in US $.]

How do you build a full length layman's book out of a herpetofauna of only 18 species? The Russell-Bauer solution is to incorporate much more than just a local field guide into their book. *The Amphibians and Reptiles of Alberta* is really a compact general herpetology text, with special focus on the problems of prairie poikilotherms. The subtitle (printed inside, but strangely not on the cover) accurately describes this volume as both a "field guide" and a "primer of boreal herpetology."

The field guide, i.e. the Keys and Species Accounts, is the smaller portion of the book. The greater portion, the primer, is distributed among assorted chapters with titles such as "Characterization of Amphibians and Reptiles," "Zoogeography of the Alberta Herpetofauna," "Coping with the Cold," and "The Challenge of Aridity."

The scope of this book will make it a valuable addition to every high school and college library in Alberta. In the high school setting this book should help raise student interest in herpetology. In this regard, Tony Russell and Aaron Bauer deserve particular praise for including in their Keys and Species Accounts *Ascaphus truei, Chelydra serpentina, Coluber constrictor*, and *Charina bottae*. None of these species is yet reported in Alberta, but all could be there given their known ranges and ecology. By including these yet-to-be-found species in their book, Russell and Bauer challenge their readers to go out and find them. I can't imagine a better stimulus for neophyte herpetologists—in an admittedly herpetologically depauperate place like Alberta—than a chance to be the first to document a species' presence in the province.

To help the neophyte along, the field guide portion of this book is comprehensive, with good descriptions, keys, maps, natural history notes, glossary, etc. The authors include not just adults, but also eggs and larvae in their keys for amphibians. The Bibliography is much larger than in most existing state or provincial field guides. The color photographs by Wayne Lynch are first rate. They are esthetically pleasing and at the same time clearly reveal the features that distinguish the species.

On the negative side, too many of the line drawings are amateurish. All of the people involved in producing this book should—in good Canadian fashion—apologize to each other for the bizarre drawing on page 8, which shows a tadpole with gills growing out of its rump. Then they should agree to correct the drawing immediately, before any more copies of the book are printed.

In a similar vein, I was amused by two overly simplistic survivorship curves used to demonstrate the difference between r– and K–selection (Fig 7.5). The cartoon sketches of a frog (i.e., r–selected) and *Phrynosoma* (i.e., K–selected), incorporated in that figure, lead the reader to assume that "time," on the X-axis, is minimally one generation. However, if that were true, then we are very lucky not to be buried in short-horned lizards!

There are other problems with production. For example, my review copy of the paperback version had pages 119–126 printed twice.

In future editions the glossary should be expanded. Right now it includes only herpetological terms. But if readers need a definition for "tadpole," they probably need one for "taiga." And if "herpetofauna" deserves definition, then surely so does the "hypothalamus."

The couplet #9 in the Key to Larval Amphibians of Alberta has the word "anterior" where it should be "posterior." The correct information, however, is in the Species Accounts.

All of these flaws are minor and can be cleaned up in future editions. Overall, this is an important book that helps direct attention to boreal herpetology. Given the currently high public interest in a possible global decline of amphibians, this book is particularly timely. For if the issue of global decline is going to be rigorously assessed, we need to be especially attentive to shifts in the distribution of herps near the edges of their range. By informing the public of what is and is not known about the distribution of amphibians and reptiles at their northern limits, this book not only serves the people of Alberta but may ultimately help the 18 species of amphibians and reptiles that try to live up there with them.

RICHARD WASSERSUG
Department of Anatomy & Neurobiology
Sir Charles Tupper Medical Building
Dalhousie University
Halifax, Nova Scotia
B3H 4H7, Canada.

The Natural History of West Indian Boas, by Peter J. Tolson and Robert W. Henderson. R&A Publishing, Ltd., Taunton, Somerset, England. 125 pp., 72 color photographs. Hardcover US$75.00. ISBN 1-872688-04-7. Available in U.S. from Eric Thiss, Serpent's Tale Books, 464 Excelsior, Minnesota 55331, USA.

The boid fauna of the West Indies is unique and diverse, and includes some of the first species of reptiles to be recognized as endangered. Tolson and Henderson have produced an important and critically needed text on this subject. This book is a comprehensive, authoritative, and exhaustive analysis of these snakes, addressing their natural history, paleoherpetology, conservation status, and phylogeny.

The first section of the book addresses the natural history, geology, and geography of Greater and Lesser Antilles, with an analysis of each island group. The accounts of the geology and natural history of the Islands are interesting and provide an important framework for understanding the natural history of the boid taxa. The various habitats and biotopes are well illustrated by photographs and descriptive text. The chapter on the phylogeny of the boid fauna is thorough and accurate. The original hypotheses of relationship within this group proposed by Tolson have subsequently been corroborated by Kluge. A chapter on the zoogeography of the boid fauna reviews the fossil record and the phylogeny of this group with respect to the plate tectonics of the region. This information facilitates understanding of the modern distribution of these snakes.

The second section is a species account type of review. In addition to the strictly systematic information, the authors include range maps, natural history notes, food habits (both field observations and husbandry information) as well as reproductive husbandry information. Finally, notes on the conservation status of many of the taxa are included.

The third section is a review of the reproductive biology of *Epicrates* and *Tropidophis*, but does not include reproductive behavior of the two *Boa* taxa. This is not an exhaustive review, but includes interesting observations on captive behavior as well as some of Tolson's seminal studies on the relationships between climate and male-male interactions and testosterone levels.

The fourth section addresses the conservation issues of this group. Interestingly, the authors note that historical errors in population assessments led to incorrect assumptions on the relative scarcity of some taxa. The authors also note that the deleterious effect of the mongoose has been exaggerated.

This text is a superb overview of the boid taxa of the West Indies. Additionally, it is an excellent summary of the geology and natural history of this region, making it useful reading for herpetologists interested in other organisms of this region. The breadth and scope of the authors' analysis make this book fascinating and pleasurable reading, and it is a welcome departure from the traditional boiler-plate herpetology texts.

It is unfortunate that the publisher has priced this book at $75.00. It is also unfortunate that the quality of the illustrations is generally substandard. Many of the color photographs appear to have been improperly separated. The layout of the book is faulty; the top and bottom margins are crowded, and there is excessive white space in many areas. A glossary would have been helpful for those unfamiliar with some of the geologic terms.

These criticisms notwithstanding, this is an essential text for the student of herpetological natural history. It is easy and enjoyable reading, and is the definitive text on this subject.

RICHARD ROSS, M.D.
Institute for Herptological Research
at the Santa Barbara Zoo
500 Ninos Drive
Santa Barbara, California 93103, USA.

PUBLICATIONS RECEIVED

Australia's Reptiles [Volume 1: Snakes and Monitors] is based on the book of the same title by Wilson and Knowles. This new CD-ROM contains over 260 photographs of Australian monitors and terrestrial snakes; the full text of every species; distribution maps; scientific and common names; and notes on the current status of most species, and more.

Reptiles can be selected for display by scientific name, common name, genus, or family. The CD-ROM also contains a reptile trivia quiz, a glossary of reptile terms, and notes on the treatment of snakebite in Australia. Fascinating video clips are included from many of the Australian reptile parks.

The CD-ROM is designed for herpetologists, schools, libraries, herpetological societies, and naturalists with an MPC standard IBM-type personal computer with CD-ROM drive.

Volume I is available for US$49 plus $3 shipping from Satronics Communications, P.O. Box 52261, Philadelphia, Pennsylvania 19115-7261, USA. Volume II was planned for issue by November 1994 and contains nearly 800 images of skinks, geckos, and dragons.

For additional information, please write or send Internet mail to: mmiller@tjuvm.tju.edu.

Life on the Edge. A Guide to California's Endangered Natural Resources: Wildlife. Edited by Carl G. Thelander (with 200+ contributors). 1994. Biosystems Books, 303 Potrero Street, Santa Cruz, California 95060-2719, USA (tel. 1-800-983-5433). Format 9x12 inches, 550 pages (500+ pages in color), hardcover (also available in softcover). US $75.00. ISBN 0-930588-66-5.

This hefty (ca. 5 lbs.) volume presents 115 individual species accounts for rare and endangered taxa (fish, amphibians, reptiles, birds, mammals, and invertebrates). Species of herps profiled by individual accounts include seven salamanders (*Ambystoma macrodactylum croceum, Plethodon stormi, Batrachoseps aridus, B. simatus, B. stebbinsi, Hydromantes shastae*, and *H. brunus*), one anuran (*Bufo exsul*), the desert tortoise (*Gopherus agassizii*), four lizards (*Coleonyx switaki, Uma inornata, Gambelia sila*, and *Xantusia riversiana*), and four snakes (*Charina bottae umbratica, Masticophis lateralis euryxanthus, Thamnophis sirtalis tetrataenia*, and *T. gigas*). Interviews with prominent conservationists (such as Robert Stebbins and Kenneth Norris) and essays are included. The connections of Native American legends to wildlife are examined and illustrated. Although herpetologists are not likely to find much new information about their favorite animals here, this is a visually impressive volume that effectively conveys the magnitude of conservation problems facing Californians and their wildlife.

SSAR Committee Chairs and Coordinators

CHAIRPERSONS

Conservation
C. KENNETH DODD, JR.
National Biological Survey
7920 N.W. 71st Street
Gainesville, Florida 32653, USA

Grants-In-Herpetology
A. DALE BELCHER
Rio Grande Zoological Park
903 Tenth Street, SW
Albuquerque, New Mexico 87102, USA

Kennedy Student Award
KEN R. MARION
Biology Department, Box 4149
University of Alabama at Birmingham
Birmingham, Alabama 35294, USA

Long Range Planning
THOMAS H. FRITTS
USFWS, MRC111
National Museum of Natural History
10th and Constitution Ave., NW
Washington, D.C. 20560, USA

Meetings
TERRY E. GRAHAM
Department of Biology
Worcester State College
486 Chandler Street
Worcester, Massachusetts 01602–2597, USA

1995 Local Meeting
R. WAYNE VAN DEVENDER
Department of Biology
Appalachian State University
Boone, North Carolina 28608, USA

Regional Society Liaison
MARTIN J. ROSENBERG
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106–7080, USA

Resolutions
GEORGE R. PISANI
Department of Biological Sciences
University of Kansas
Lawrence, Kansas 66045–2106, USA

Zoo Liaison
JEFF ETTLING
Department of Herpetology
Sedgwick County Zoo
5555 Zoo Boulevard
Wichita, Kansas 67212, USA

COORDINATORS

Common and Scientific Names
JOSEPH T. COLLINS, Coordinator
Natural History Museum
The University of Kansas
Lawrence, Kansas 66045–2454, USA

Translations
RANDOLPH W. KROHMER
Science Department
Saint Xavier University
3700 West 103rd Street
Chicago, Illinois 60655, USA

Elector
DAVID L. HARDY, SR.
3905 Old Sabino Canyon Road
Tucson, Arizona 85715, USA

Meeting Events
DON C. FORESTER
Department of Biological Sciences
Towson State University
Towson, Maryland 21204, USA

Information for Contributors

Herpetological Review is a peer-reviewed quarterly that publishes, in English, articles and notes of a semi-technical or non-technical nature, as well as book reviews, institutional features, commentaries, regional and international herpetological society news, research requests of SSAR members, and letters from readers directed to the field of herpetology. Articles reporting the results of experimental research, descriptions of new taxa, or taxonomic revisions are not published in ***HR***, but should be submitted to the ***Journal of Herpetology*** (see inside front cover for Editor's address).

Authors should submit an original and two copies of manuscripts. Manuscripts should be typewritten, double-spaced, on 21.5 x 28 cm (8.5 x 11 inch) white paper. Refer to this issue of ***HR*** for style and format information. Detailed information for submissions to Geographic Distribution, Natural History Notes, and Recent Population Changes appear in a recent issue of ***HR*** under their respective headings.

Originals of illustrative material (e.g., tables, photographs, or diagrams) should be submitted with the text, with appropriate precautions taken to ensure delivery without damage. Illustrations should be discussed in the text and numbered sequentially with Arabic numbers. References to illustrations should be placed in parentheses at the end of sentences. Original photographs should be submitted as black and white glossy prints. For further guidelines, authors should consult *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers* (6th edition, 1994, Council of Biology Editors, Inc., 11 South LaSalle Street, Suite 1400, Chicago, Illinois 60603, USA).

Submissions for Techniques, Natural History Notes, Geographic Distribution, Herpetological Husbandry, Recent Population Changes, Regional Society News, and Legislation & Conservation Alert should be sent directly to the appropriate section editor. Please send review copies of books to the Book Review Section Editor. Manuscripts intended for publication as Articles or Points of View, as well as news notes and other material, should be sent to the Editor. Deadline for receipt of meeting announcements, news notes and related material is two months prior to each issue (e.g., 1 January for March issue).

The receipt of a manuscript by an editor will be promptly acknowledged. Although the advice and assistance of external reviewers will be sought for all manuscripts, the Editor has final responsibility for deciding whether a manuscript is suitable for publication. Notes submitted for publication in Geographic Distribution and Natural History Notes ordinarily will be reviewed by the Section Editor only. The editors reserve the right to edit a manuscript, but substantial alterations will not be made without permission of the primary author.

Reprints

Reprints of notes or articles published in ***HR*** should be ordered using the forms provided at the time page proofs are sent to the authors. Proofs are not sent to authors of Natural History Notes or Geographic Distribution manuscripts; these authors should indicate (at time of submission) whether reprints are desired and if so, the appropriate order forms will be sent prior to publication.

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Catalogue of American Amphibians and Reptiles

The ***Catalogue*** consists of loose-leaf accounts of taxa prepared by specialists, including synonymy, definition, description, distribution map, and comprehensive list of literature for each taxon. Covers amphibians and reptiles of the entire Western Hemisphere. Available by subscription only. See inside front cover to start annual subscription. Use the prices below to order back issues.

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Editor
ROBERT W. HANSEN
16333 Deer Path Lane
Clovis, California 93611, USA
(209) 323-7170
(209) 299-0161 fax

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Cleveland, Ohio 44106-7080, USA

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SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES



The Society for the Study of Amphibians and Reptiles, the largest international herpetological society, is a not-for-profit organization established to advance research, conservation, and education concerning amphibians and reptiles. Founded in 1958, SSAR is widely recognized today as having the most diverse society-sponsored program of services and publications for herpetologists. Membership is open to anyone with an interest in herpetology—professionals and serious amateurs alike—who wish to join with us to advance the goals of the Society.

All members of the SSAR are entitled to vote by mail ballot for Society officers, which allows overseas members to participate in determining the Society's activities; also, many international members attend the annual meetings and serve on editorial boards and committees. All members receive the Society's primary technical publication, the *Journal of Herpetology*, and its news-journal, *Herpetological Review*; both are published four times per year. Members also receive pre-publication discounts on other Society publications, which are advertised in *Herpetological Review*.

ANNUAL DUES AND SUBSCRIPTIONS–1995: The fees for individual memberships and institutional subscriptions are as follows: Individual membership US$40; Student membership $25; Family membership $55; Institutional subscription $70; Additional fee for air mail postage outside USA $25. Subscription to the *Catalogue of American Amphibians and Reptiles*: Individuals $15; Institutions $20.

Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Payment should be sent to: Karen L. Toepfer, SSAR Treasurer, P.O. Box 626, Hays, Kansas 67601–0626, USA. Telephone: (913) 623-4258; Fax: (913) 625-8890; e-mail: aren@ksuvm.ksu.edu or aren@ksuvm.bitnet.

Future Annual Meetings

1995 — Appalachian State University, Boone, North Carolina, USA, 8–13 August (R. Wayne Van Devender, Chair).
1996 — University of Kansas, Lawrence, Kansas, USA, 24–29 July (William E. Duellman, Chair).
1997 — University of Washington, Seattle, Washington, USA, 25 June–2 July.

SSAR BUSINESS

SSAR Election Results

Results of the recent SSAR election are as follows:

President-elect (to serve as President for 1996): *Louis J. Guillette, Jr.*

Secretary: *J. Eric Juterbock* (unopposed).

Treasurer: *Karen L. Toepfer* (unopposed).

Directors: *Don C. Forester, Lyndon A. Mitchell.*

Symposium on Amphibian Development

At the annual meeting in Boone, North Carolina (8–13 August 1995), SSAR is sponsoring a symposium on "Evolutionary Patterns of Amphibian Development," organized by Stephen Deban (University of California at Berkeley). This symposium features topics of amphibian development that are viewed from a comparative perspective. The focus is on how developmental mechanisms may contribute to evolutionary changes in amphibian lineages. Topics feature the effects of genome size on development, how physiological mechanisms may affect the evolution of metamorphic and paedomorphic forms, and overviews of the evolution and development of morphology and behavior in salamanders. The half-day symposium features the work of senior graduate students and recent post-doctoral students.

About our Cover

Trimeresurus flavomaculatus is a pitviper species endemic to the humid pluvial forests of the Philippines, an archipelago of about 7100 islands lying approximately 800 km off the SE coast of Asia. It is widespread and may include more than one species, although biochemical analyses will be necessary to establish this. As recognized presently, this species exists in a broad array of patterns and colors as well as feeding and microhabitat preferences: some are terrestrial, others arboreal. The most recent studies have been conducted by Leviton (1964. Philippine J. Sci. 93(2):251–276), and Schätti and Guillod (1990. Herpetofauna 12(66):32–34). The snake on the cover is a female, approximately 1400 mm in total length, from the live collection of The University of Texas at Arlington Collection of Vertebrates. It was photographed with a Pentax LX camera, Vivitar 90 mm f2.5 macro lens, on Fujichrome Velvia film, at 1/75th of a second at f22. The photographer is herpetologist William W. Lamar, Adjunct Professor at The University of Texas at Tyler and Research Associate at UT Arlington. He is co-author (with Jonathan A. Campbell) of *The Venomous Reptiles of Latin America*. When not conducting research on herps, Bill leads herp- and wildlife-oriented tours for Green Tracks, Inc.

SSAR Student Travel Awards Call for Applications

Ten SSAR Student Travel Awards of $200 each are available to undergraduate and graduate student members of the SSAR to help defray the cost of travel to the upcoming meeting in Boone, North Carolina. An applicant must be a student and a member of SSAR, must not have previously received a travel award from SSAR, and must be the first author of a paper or poster to be presented. An applicant must include in the application package:

1) a letter signed by his or her major advisor or department chair stating that he or she is currently an undergraduate or graduate student and that he or she is not completely funded for travel from another source;

2) an official copy of the poster or paper abstract to be presented;

3) a self-addressed, stamped envelope.

If the research is co-authored, the applicant must also include a letter from his/her advisor stating that the work was primarily the product of the applicant. All qualified applicants will be pooled and awardees will be drawn at random. Students from the local meeting site and current members of the SSAR Travel Awards Committee are excluded from applying for a travel award. APPLICATIONS MUST BE POSTMARKED BY 15 MAY 1995. Award recipients will be notified by early June 1995 and award checks will be dispersed at the meeting. Send applications to: *Dawn S. Wilson, Department of Biology, University of South Florida, Tampa, Florida 33620, USA. For further information Wilson may be contacted at: Tel. (813) 974-9175, FAX (813) 974-3263; e-mail WILSON@CHUMA.CAS.USF.EDU.*

SSAR Student Travel Awards Fundraiser Call For Donations

At the 1994 SSAR/HL meetings in Athens, Georgia, the newly formed SSAR Student Travel Awards Committee organized a frameable art silent auction to raise funds for students attending and presenting papers at an annual meeting. Because of the great success of the first silent auction (over $2000 raised), the Travel Awards Committee is pleased to announce the second frameable art silent auction to be held at the 1995 SSAR meeting in Boone, North Carolina. Many people attending the Athens meeting expressed an interest in donating an item to the silent auction. Items acceptable as a donation include: photos of your favorite study animal (or herpetologist!), line drawings, prints, paintings, or anything else that can be put into a frame, if not framed already. If you are interested in donating an item please contact Dawn S. Wilson (contact numbers above).

Herpetological Review Now On-line

A pre-publication listing of the contents of each issue of *HR* is now available from several on-line sources. Postings should occur approximately one month before the publication of the next issue. This service should be helpful to herpetologists in countries where mail delivery is unpredictable, as well as providing pre-publication information to other interested persons. *HR*'s on-line contents listing is available from the following:

Society for the Study of Amphibians and Reptiles
1995 Annual Meeting

Dates: 8–13 August 1995
Place: Appalachian State University, Boone, North Carolina, USA

Keynote Address: "Territorial Behavior: Testing the Assumptions," by Judy Stamps (University of California, Davis).

Symposium: "Eastern Rattlesnakes: Biology and Conservation of *Crotalus horridus* and *Crotalus adamanteus*." *Organizers*: William S. Brown (Skidmore College, Saratoga Springs, New York, USA) and Walt Timmerman (Helena, Montana, USA). *Participants for session on Timber Rattlesnake*: W. S. Brown, B. W. Bowen, A. -M.Clark, L. M. Bushar, H. K. Reinert, D. E. Keyler, B. L. Oldfield, R. Stechert, A. Breisch, S. H. Harwig, S. Smith, W. H. Martin, E. Possardt, T. Tyning, R. T. Zappalorti, D. Wynn, A. H. Savitzky, B. A. Savitzky, G. Rocco, J. B. Sealy, A. Soha, J. T. Taylor, A. C. Smith, Jr., K. Michell, R. R. Rupert, Jr., D. F. Fraser, J. Congdon. *Participants for session on Eastern Diamondback Rattlesnake*: W. Timmerman, W. Auffenberg, W. H. Martin, D. B. Means, G. Dalrymple, P. Kain, S. Telford, J. W. Gibbons, R. Mount, L. Jones.

Symposium: "Evolutionary Patterns of Amphibian Development." *Organizer:* Stephen M. Deban (University of California, Berkeley, USA). *Participants*: S. M. Deban, J. C. O'Reilly, D. M. Parichy, S. B. Marks, C. S. Rose, E. L. Jockusch.

Regional Societies Conference: "Regional Herpetological Societies: Programs and Projects." *Organizer*: Martin J. Rosenberg. Participants not yet finalized.

Workshop: "Herp Photography." *Organizers*: David Dennis and J. Eric Juterbock.

President's Travelogue Slide Shows: Profusely-illustrated lectures of exotic herps and habitats.

Multimedia Presentations: "Herps of the West" and "Amphibians of the Appalachians" by David Dennis and J. Eric Juterbock; "Herpetological Namesakes" by Kraig Adler, David Dennis, and J. Eric Juterbock.

Oral and Poster Sessions: Several concurrent sessions each day.

Student Paper Awards: Seibert Prizes to be awarded to the two best student-presented papers at the meeting ($250 first prize, $150 second prize).

Student Travel Grants: Ten awards of $200 each will be given. For details see SSAR Business in this issue (p. 1).

"The Great Reprint Scavenge" (for students only!). Professionals are asked to clear unwanted duplicate reprints out of their offices (and receive free raffle tickets as a "thank you").

Social Activities: Welcoming Social, the SSAR Annual Auction, Barbecue Dinner, Graduate Student Social, local tours.

Field Trips: Grandfather Mountain, Linville Gorge Wilderness Area, night trips for salamander watching, and others.

Live Exhibit: Featuring herps of the region. Sponsored by the North Carolina Herpetological Society and Appalachian State University. Animals available for viewing and photography.

Costs and Accommodations: Registration $75 student, $110 regular; $50 spouse. After 15 April 1995, registration fees will be $115, $145, and $50, respectively. Lodging at Broyhill Inn (meeting location) will be $40 (single occupancy) or $46 (double occupancy) per day. Dormitory room rates are $15 (single) or $10 (double) per day plus $8 for linen. Approximately 100 additional rooms are reserved at several local motels for $49–$70 per day. Note that Boone, North Carolina is a popular summer resort area; reservations should be made well in advance.

Further Details: See December 1994 issue of *Herpetological Review* (pages 133–135). Meeting Announcement/Call for Papers was mailed to all North American members of SSAR in January 1995; it is also available on request from *Dr. Robert Wayne Van Devender, Department of Biology, Appalachian State University, Boone, North Carolina 28608, USA (telephone 704-262-2665; fax 704-262-2127; e-mail vandevenderr@appstate.edu).* Address questions about meeting sites, rooms, registration, etc., to *Richard Hudson, Office of Conferences and Institutes, University Hall (telephone 704-262-3045; fax 704-262-4992; e-mail hudsonre@appstate.edu).*

SPECIAL OFFER TO ALL STUDENT HERPETOLOGISTS!

Free Copy of "Turtles of Venezuela" for Students Attending the August Meeting

AS AN INCENTIVE TO JOIN THE SOCIETY AND TO ATTEND its August meeting, SSAR is making a special offer. All student SSAR members who register for and attend the August 8–13, 1995 meeting in Boone, North Carolina, will receive a free copy of Pritchard and Trebbau's classic, "The Turtles of Venezuela," published by SSAR in 1984. The list price is US$45. This 414-page, clothbound book contains 48 color plates (25 watercolor portraits and 165 photos of turtles and habitats), with keys and spot distribution maps. This book is an exhaustive biology and natural history of the turtles of northern South America and covers fully half of the turtle species on the continent.

Dr. Peter Pritchard will be in attendance at the meeting and has kindly agreed to autograph copies on request.

In order to take advantage of this one-time-only offer, you must already be a student member of SSAR or join before the Boone meeting. The special student membership rate is still only US$25, which entitles you to receive *Journal of Herpetology* and *Herpetological Review* (4 issues of each per year) plus get pre-publication discounts on other SSAR publications. If you wish to join, fill out the spaces below.

YOUR NAME: _____

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Payment must be made in USA funds, payable to "SSAR," or by International Money Order, or with VISA or MasterCard (account number and expiration date must be provided). Send this form, or a copy of it, with payment, to:

Karen L. Toepfer, SSAR Treasurer
PO Box 626, Hays, Kansas 67601–0626, USA.

Telephone: area code 913, 623–4258.
Fax: area code 913, 625–8890.

When you register for the meeting, please mark the student box and indicate that you want a copy of "Turtles of Venezuela," so that we can have the proper number of copies shipped to North Carolina for distribution. *The deadline for requesting the book is 1 July 1995.*

Herp-Net — direct dial to 215-464-3562 (300-2400bps 8-N-1) or 215-698-1905 (9600, 14.4kbs) 24 hours per day. Select "Herp. Review" menu item.

Via **Usenet** newsgroup, "sci.bio.herp" (use any newsreader available on your network account), look for the posting "Herpetological Review Contents."

Via the **HERP-L** distribution list available to any Internet address. To subscribe send email to listproc@xtal200.harvard.edu with the phrase "subscribe HERP-L <your name>" in the body of the message.

On the commercial **CompuServe** Information Service in their Animal Forum (Go Petstwo) reptile/amphibian library section 6. Search by keyword "SSAR."

This service is made possible by Mark Miller and the Herpetology On-Line Network. Miller can be reached by FAX at 215-464-3561 or Internet email: mmiller@tjuvm.tju.edu.

SSAR General Guidelines for Field and Laboratory Studies on Amphibians and Reptiles

These guidelines were endorsed during the 1994 meeting of the SSAR Board of Directors. The intent of the guidelines is to focus the attention of herpetologists on ethical issues that are a part of the research process. Consideration of these issues, as reflected in the guidelines, should enhance the quality of herpetological research and minimize the impact of research on populations of amphibians and reptiles, and on their habitats.

I. Collecting

A. Investigators should consider the impact of collecting on a population, and remove no more individuals than necessary. Alternative non-lethal means of sampling should be considered.

B. Investigators should obtain the appropriate collecting and land-use permits.

II. Field Observations and Experiments

A. Investigators should attempt to minimize disturbance to the habitat, and to target and non-target populations.

B. Investigators should conduct appropriate preliminary studies to determine whether observation, confinement, or experimental manipulation affect the behavior of target animals.

C. Investigators should remove all markers, equipment, supplies, etc. from their field sites at the end of their project.

III. Laboratory Observations and Experiments

A. Animals should be obtained only from legal sources.

B. Given normal logistic and hygienic constraints, maintenance housing should simulate natural conditions of temperature, light, moisture, shelter, and cleanliness, and should follow appropriate animal care guidelines.

C. If animals are killed during or as a result of experimentation, or are subjected to pain or stress, the investigator should consider whether alternative experiments are possible, or whether the experiment should be performed at all.

D. The investigator should consider experimental designs by which sample sizes can be reduced or should perform experiments that collect several kinds of data on the same individual.

IV. General

A. Investigators should acquaint themselves with special rules of conduct or policies applicable to the area or habitat visited.

B. Investigators should abide by the spirit as well as the letter of relevant legislation.

REFERENCES

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FARNSWORTH, E. J., AND J. ROSOVSKY. 1993. The ethics of ecological field experimentation. Conserv. Biol. 7:463–472.

ROBIN ANDREWS
Department of Biology
Virginia Tech
Blacksburg, Virginia 24061, USA.

NEWSNOTES

Hamadryad

Currently in its 19th volume, *Hamadryad* is Asia's oldest peer-reviewed herpetological journal, and is published by the Centre for Herpetology, Madras Crocodile Bank Trust, India.

Recent papers in *Hamadryad*: Checklist of the amphibians of India; Territory-marking in *Eublepharis macularius*; Distribution of *Varanus salvator* in the Philippines; Breeding biology of *Aspideretes nigricans* in Chittagong; Eggs and hatchlings of lizards from Borneo; Captive breeding of frogs; Biology and conservation of wart snakes; Social hierarchy in *Varanus salvator*; Natural history of *Kachuga smithii*; Distribution of *Gavialis gangeticus*; Snake conservation in Sri Lanka; New species of *Cnemaspis* gecko from Indonesia; Sex ratios of Indian freshwater turtles; Feeding ecology of *Lissemys punctata*; Herpetology of Lambir Hills, Sarawak; Checklist of Pakistani geckos; New locality records of *Kachuga sylhetensis*; Growth of *Eretmochelys imbricata*; *Ophiophagus hannah* from a marginal habitat; Man-eating by *Crocodylus palustris*.

Annual subscription is US$25.00 (inclusive of airmail postage for one volume). Checks should be made out to "Madras Crocodile Bank Trust" and sent to: *Centre for Herpetology, Madras Crocodile Bank Trust, P.O. Bag 4, Mamallapuram, Tamil Nadu 603 104, India.*

New Journal from Sri Lanka

The Amphibian and Reptile Research Organization of Sri Lanka (ARROS) announces the publication of *Lyriocephalus*. This is the only journal dedicated to the publication of papers concerning the taxonomy, ecology, conservation, and other aspects of amphibians and reptiles of Sri Lanka. Each edition will include articles, short communications, book reviews, and announcements of activities and research projects of ARROS. Two issues per year are planned.

The contents of Volume 1, Number 1 are: An introduction to the herpetofauna of Sri Lanka; The Amphibia of Sri Lanka: a provisional checklist and their common names; The *Ichthyophis* in Sri Lanka: a short review; Natural history of *Ramanella obscura* (Amphibia: Microhylidae): some preliminary observations; Some notes on *Gonydactylus frenatus* (Gunther, 1864) (Reptilia: Gekkonidae); Amphibians and reptiles observed at Galekanda, Panwilathane; Some vernacular names of terrapins in Sri Lanka; Snakes observed in Gampola, Sri Lanka; Pattern of snakebite in Kandy District; *Amphiesma stolata* (Linnaeus, 1758): additional Sinhala names; Some beliefs regarding chelonians in Sri Lanka; Preliminary report of snakes and agamid lizards in Galle district; Some popular beliefs, traditions and practices concerning amphibians and reptiles of Sri Lanka; Reptile fauna of the Knuckles Range: Sri Lanka; Some reptiles and amphibians observed at Mahaweli System B and C; and two book reviews. The editor is Bryan Walker. The editorial board consists of W. R. Breckenridge, Indraneil Das, D. G. A. Perera, and Anslem de Silva.

Lyriocephalus is available for US$10.00. ARROS can cash personal checks, but cash is preferred because of the high cost of exchange. Orders should be sent to: *Anslem de Silva, President, ARROS, c/o Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka.*

Sociedad Herpetológica Mexicana

The Sociedad Herpetológica Mexicana invites all interested herpetologists to participate as members of the society. All members receive the publication *Boletín de la Sociedad Herpetológica Mexicana*, published two times per year. A national meeting is held every two years. The annual fees for individual membership are US$25.00 and US$15.00 for students. Payment should be made to Sociedad Herpetológica Mexicana and sent to: *Amaya González, ENEP-Iztacala, Laboratorio de Herpetología, Ap. Postal 314, 54090 Tlalnepantla, Edo. de México, México.*

Southwestern Research Station Volunteer Positions for 1995

Approximately 20 volunteer positions are open in 1995 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for twenty-four hours per week of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students; the latter may pursue their own research projects. Faculty knowing of promising students should alert them to this opportunity for professional experience toward, development of, and evaluation of their career goals.

Volunteers are needed between March 15 and November 1. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March–May) should submit applications by February 15, summer volunteers (June–August) by April 1, and fall volunteers (September–November) may apply any time.

For applications, write to: *Dr. Wade C. Sherbrooke, Director, Southwestern Research Station, American Museum of Natural History, Portal, Arizona 85632 USA; tel. 602-558-2396.*

Biology of Plethodontid Salamanders

A summer course of the same title will be offered 5–16 June 1995 at the Highlands Biological Station, located in the Blue Ridge Mountains of North Carolina—a region renowned for the diversity of its salamander fauna. The course will be taught by Dr. Stephen G. Tilley (Smith College) and is designed to acquaint students with plethodontid salamanders and to show how studies of these animals have enhanced our understanding of a series of major evolutionary and ecological topics. Numerous trips to significant salamander localities are a highlight of the course. For information, contact: *Highlands Biological Station, P.O. Drawer 580, Highlands, North Carolina 28741, USA. Tel. (704) 526-2602.*

MEETINGS

Meetings Calendar for 1995

22 April 1995—18th Annual All Florida Herpetological Conference. University of Florida, USA. Contact: Dr. David L. Auth (tel. 904-392-1721). *See further information below.*

2–6 June 1995—10th Annual Meeting of the Society for the Preservation of Natural History Collections (SPNHC). Royal Ontario Museum, Toronto, Canada. SPNHC '95 *Preserving the Record of Nature through Countless Ages*. Contact: Janet Waddington, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, Canada M5S 2C6.

15-19 June 1995—Annual Meeting of the American Society of Ichthyologists and Herpetologists and The Herpetologists' League. University of Alberta, Edmonton, Alberta, Canada. Contact Dr. Joseph S. Nelson, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E9. Tel. (403) 492-4741. FAX (403) 492-9234. E-mail: joe_nelson@biology.ualberta.ca.

23–25 June 1995—International Gecko Society Symposium. Palm Mountain Resort, Palm Springs, California. Contact IGS Symposium, P.O. Box 370423, San Diego, California 92137-0423, USA. *See ad on page 40 for further details.*

6–10 July 1995—International Congress of Chelonian Conservation. Tortoise Village, Gonfaron, France. Contact: Secretariat, SOPTOM, B.p. 24, 83590 Gonfaron, France. Tel. (33) 94 78 26 41. Fax (33) 94 78 24 27.

8–13 August 1995—Annual Meeting of the Society for the Study of Amphibians and Reptiles. Appalachian State University, Boone, North Carolina, USA. *Refer to meeting announcement on page 2 of this issue for contact numbers and other information.*

6–10 September 1995—2nd International Asian Herpetological Meeting. Ashgabat, Turkmenistan. Contact: Theodore J. Papenfuss, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA. Tel. (510) 642-3567. Fax (510) 643-8238. E-mail: asiaherp@uclink2.berkeley.edu.

18th Annual All Florida Herpetology Conference

The All Florida Herpetology Conference will be held 22 April 1995 at the University of Florida in Gainesville. The Florida Museum of Natural History and Gainesville Herpetological Society co-sponsor the event. Walter Auffenberg, David Auth, David Barker, Greg Brock, James Cox, Dante Fenolio, Robert Herrington, Harvey Lillywhite, Peter May, Joseph Mitchell, Ray Pauley, Michael Ready, and Kevin Wright will give talks. Richard Funk and Mark Wilson will conduct disease prevention workshops, and Patricia Ashton will lead a Young Herpetologists' Workshop. Herpetological art, supplies, and books will be exhibited for sale. An evening barbecue and auction will be held at the museum. To preregister, call or write to *Dr. David L. Auth, Division of Herpetology, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA. Tel. (904) 392-1721.*

LETTERS TO THE EDITOR

Is the SSAR an American or an International Society?

According to statistics released by the SSAR in 1983 and 1991, one out of five SSAR members resides outside the USA. Indeed, unlike other herpetological societies in the USA and the world, the SSAR's name includes no geographical specification. Nevertheless, all of the 38 key functionaries listed on the inside covers of Herpetol. Rev. 25(2), have US addresses; none of those hundreds of foreigners serves. This is remarkable because, most probably, those herpetologists, in any country, who elect to pay membership in a society abroad and to subscribe to a journal in a foreign language (how many Americans do so?) stand above the average of national society members.

Initially one tends to explain this deficiency, on the one hand, as a natural outcome of democratic election processes, and on the other hand, as practical for functional purposes. However, doubt as to the completeness of these explanations is raised by a statement in Herpetol. Rev. 25(2):41. Under "Donations Needed for SSAR Symposium," we read, "All donations are tax-deductible..." The item is not signed, so the Editor is responsible. Hence I ask: in how many countries other than the USA, of the tens in which members live, was this verified before printing the announcement? If, as I suspect, the answer is "none" (or "only Canada"), I ask further: are the non-USA members considered by the Editor as negligible, or have they merely been ignored?

YEHUDAH L. WERNER
Department of Evolution, Systematics and Ecology
Hebrew University
91904 Jerusalem
Israel.

The Editor replies.— Professor Werner is correct: we erred in not stating that income-tax deductibility would apply only to US members. As an international society based in the USA, SSAR has had a longstanding policy to avoid use of words such as "foreign," "foreigner," or any others that imply differential treatment of US and non-US members, but occasionally we slip up. Our policy also extends to the subtle addition of "USA" to the addresses of US officers and authors in all SSAR publications.

SSAR has as active international program. All of its publications are international in scope and its books in recent years have concerned Arabia, Australia, Brazil, China, Costa Rica, Iran, and Venezuela, and it is now becoming the major publisher of herpetological books on Asia. Several of these have been issued jointly with overseas herpetological societies. SSAR has actively supported international herpetological activities, most notably by making sizable grants to the first two world congresses. It also makes research grants to students from throughout the world. The society's own meetings are sometimes held outside the USA (in México and the UK, with plans for a Canadian meeting). We regularly have many overseas members at our meetings in the USA and special efforts are made to make them feel welcome. Prof. Werner himself has participated in these meetings on several occasions.

There is a practical restriction, however, on the national composition of the SSAR Board of Directors. Although any members may be elected, regardless of nationality, in order for the Board to function its members must meet together, face-to-face, at least once a year. Nominees must commit themselves to attend all Board meetings during their three-year term and, as most meetings are in the USA, this puts an additional burden on non-US members. Beginning in 1982, SSAR has designated one Board seat for someone outside the USA, which to date has been held by persons from Canada, México, and the UK. Our various committees and editorial boards, which originate many of the operating procedures and supervise the programs of SSAR, traditionally have international memberships. Moreover, by my count, 24% (176 of 726) of the authors of articles and notes appearing in the *Journal of Herpetology* and *Herpetological Review* for 1994 had non-USA addresses; this approximates the percentage (21%) of SSAR members who reside outside the USA.

It should also be noted that all members in SSAR are entitled to vote, whereas in some other societies only those in attendance at meetings do so, thus in effect restricting elections to US members. In short, SSAR has for a very long time encouraged international participation in developing and carrying out its programs. It is constantly seeking new ways to do so, however, and solicits members' ideas and advice. Please address your letters to the SSAR President for 1995: *Dr. Alan H. Savitzky (Department of Biological Science, Old Dominion University, Norfolk, Virginia 23508, USA. E-mail AHS100F@ODUVM.CC.ODU.EDU; FAX 804-683-5283).*

More on Conservation Biology

Campbell and Frost (1994. Herpetol. Rev. 25:100–102) describe vividly the problem of biological regulation. Biologists have complained privately for a generation; in public they've generally asked for what they got—motivated by an obviously false moral assumption (Porter 1993. Bull. Chicago Herp. Soc. 28:154–155)—and they're still asking today.

I suggest Campbell and Frost didn't go far enough. Biologists are indeed slow learners when it comes to political realities. They hope for special privilege: to just regulate others and leave themselves alone. That's no solution because the problem is more general. Political reality means putting public appearance over genuine reality. That means hype over substance and sound-bite over strategy; the treatment accorded systematists is a fitting model for any projected means to a long-term goal which comes under such short-range jurisdiction.

That's why political protection generally doesn't work. Herpetoculture does, because its animals are protected, *genuinely* protected, against all the rest of mankind—regardless of power, pull, or influence—by the private property system. That's the best possible protection against the depredations of men. Then the ideal solution, rarely feasible, is for private individuals (or groups) who do appreciate *Abronia*, etc., to privately buy, own, and manage appropriate habitat. Hindering this is where political regulation does the worst damage.

TOM PORTER
7812 Yarmouth
Reseda, California 91335, USA.

CURRENT RESEARCH

With this issue we introduce a new section to *HR*. The purpose of **Current Research** is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a wide variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editor: Breck Bartholomew, 195 West 200 North, Logan, Utah 84321-3905, USA. Comments and suggestions are also welcome.

Temperature-dependent Sex Determination

Richard C. Vogt discusses the possibility of using temperature-dependent sex determination (TSD) as a conservation tool in a recent issue of *Chelonian Conservation and Biology*. He argues that conservation programs that artificially incubate turtle eggs should attempt to produce more females than males, since male turtles breed with more than one female. This departure from the desired 1:1 sex ratio may help turtles recover faster. If, however, Frederic J. Janzen's predictions, based on a population of *Chrysemys picta* on an island in the Mississippi River are realized, global warming will cause many turtle species to produce primarily females.

VOGT, R. C. 1994. Temperature controlled sex determination as a tool for turtle conservation. Chelonian Conserv. Biol. 1(2):159–162.

JANZEN, F. J. 1994. Climate change and temperature-dependent sex determination in reptiles. Proc. Natl. Acad. Sci., USA 91:7487–7490.

Several additional papers on TSD in reptiles were published in the *Journal of Experimental Zoology*..Contents of this issue are:

LANCE, V. A. 1994. Introduction: Environmental sex determination in reptiles: Patterns and processes. J. Exp. Zool. 270(1):1–2.

EWERT, M. A., D. R. JACKSON, AND C. E. NELSON. 1994. Patterns of temperature-dependent sex determination in turtles. J. Exp. Zool. 270(1):3–15.

MROSOVSKY, N. 1994. Sex ratios of sea turtles. J. Exp. Zool. 270(1):16–27.

LANG, J. W., AND H. V. ANDREWS. 1994. Temperature-dependent sex determination in crocodilians. J. Exp. Zool. 270(1):28–44.

VIETS, B. E., M. A. EWERT, L. G. TALENT AND C. E. NELSON. 1994. Sex-determining mechanisms in squamate reptiles. J. Exp. Zool. 270(1):45–56.

SMITH, C. A., AND J. M. P. JOSS. 1994. Sertoli cell differentiation and gonadogenesis in *Alligator mississippiensis*. J. Exp. Zool. 270(1):57–70.

WIBBELS, T., J. J. BULL, AND D. CREWS. 1994. Temperature-dependent sex determination: A mechanistic approach. J. Exp. Zool. 270(1):71–78.

LANCE, V. A., AND M. H. BOGART. 1994. Studies on sex determination in the American alligator *Alligator mississippiensis*. J. Exp. Zool. 270(1):79–85.

PIEAU, C., M. GIRONDOT, N. RICHARDMERCIER, G. DESVAGES, M. DORIZZI, AND P. ZABORSKI. 1994. Temperature sensitivity of sexual differentiation of gonads in the European pond turtle: Hormonal involvement. J. Exp. Zool. 270(1):86–94.

JEYASURIA, P., W. M. ROOSENBURG, AND A. R. PLACE. 1994. Role of P-450 aromatase in sex determination of the diamondback terrapin, *Malaclemys terrapin*. J. Exp. Zool. 270(1):95–111.

CORIAT, A.-M., E. VALLELEY, M. W. J. FERGUSON, AND P. T. SHARP. 1994. Chromosomal and temperature-dependent sex determination: The search for a conserved mechanism. J. Exp. Zool. 270(1):112–116.

SPOTILA, J. R., L. D. SPOTILA, AND N. F. KAUFER. 1994. Molecular mechanisms of TSD in reptiles: A search for the magic bullet. J. Exp. Zool. 270(1):117–127.

Amphibian Water Economy

C. Barker Jørgensen recently published the results of experiments on water balance and hydration behavior in toads only to find similar experiments had been conducted nearly 200 years ago by Robert Townson. Jørgensen found these eighteenth century experiments to be of such importance he decided to revive Townson's work and incorporate it into modern literature.

JØRGENSEN, C. B. 1994. Robert Townson's observations on amphibian water economy revived. Comp. Biochem. Physiol. 109A(2):325–334.

Duvernoy's Secretions

Scott A. Weinstein and Kenneth V. Kardong reviewed the properties of Duvernoy's secretions in a recent paper published in *Toxicon*. In addition to reviewing the protein content and toxicity of these secretions, they also reviewed methods of secretion extraction, storage, and assay.

WEINSTEIN, S. A., AND K. V. KARDONG. 1994. Properties of Duvernoy's secretions from opisthoglyphous and aglyphous colubrid snakes. Toxicon 32(10):1161–1185.

Jaw Musculature

The premier issue of the *Russian Journal of Herpetology* includes a paper by Iordansky on the tendinous jaw muscles of several amphibians and reptiles. Homology and evolution of jaw musculature is discussed within both the Amphibia and Reptilia.

IORDANSKY, N. N. 1994. Tendons of jaw muscles in Amphibia and Reptilia: Homology and evolution. Russian J. Herpetol. 1(1):13–20.

The Linnean Society recently published a study of the jaw adductor musculature of alethinophidian snakes. In addition to proposing new nomenclature for the jaw adductor musculature in snakes, Hussam Zaher discusses phylogenetic relationships based on this musculature. Phylogenetic conclusions include support for Acrochordidae + Colubridae monophyly, separating the Tropidophiidae from all other Caenophidia, and removing Xenopeltidae from the 'booids.' In another recent paper Zaher uses this musculature data as well as additional morphological data to show the Tropidopheoidea *sensu lato* is polyphyletic. In order to make the taxonomy reflect recovered history Zaher recommends placing *Ungaliophis* and *Exiliboa* within the Booidea as a family, Ungaliopheidae. *Tropidophis* and *Trachyboa* remain in the superfamily Tropidopheoidea. This second paper is in French with an English abstract and two-page abridged version.

ZAHER, H. 1994. Comments on the evolution of the jaw adductor musculature of snakes. Zool. J. Linn. Soc. 111(4):339–384.

ZAHER, H. 1994. Les Tropidopheoidea (Serpentes; Alethinophidia) sont-ils réellement monophylétiques? Arguments en faveur de leur polyphylétisme [Are the Tropidopheoidea (Serpentes; Alethinophidia) really monophyletic? Arguments in favour of their polyphyletic status]. Comptes Rendus de L Academie Des Sciences Serie III - Sciences de La Vie - Life Sciences 317(5):471–478.

North American Tortoises

The U.S. Department of the Interior, National Biological Survey recently published a book on the four species of North American tortoises (genus *Gopherus*). Free copies may be obtained by contacting: *Publications Unit, U.S. Fish and Wildlife Service, 1849 C Street, N.W., Mail Stop 130, Webb Building, Washington, D.C. 20240, USA. Tel. (703) 358-1711.*

BURY, R. B., AND D. J. GERMANO. 1994. Biology of North American Tortoises. Fish and Wildlife Research No. 13, U.S.D.I. National Biological Survey, Washington, D.C. 204 pp.



Agonistic behavior in male *Gopherus agassizii* near St. George, Washington Co., Utah, USA. Photo courtesy of T. C. Esque, National Biological Survey.

With seventeen chapters, this book covers a wide variety of topics from systematics to nutrition and reproductive effort. The book's contents are:

BURY, R. B., AND D. J. GERMANO. Biology of North American tortoises: Introduction. pp. 1–5.

CRUMLY, C. R. Phylogenetic systematics of North American tortoises (genus *Gopherus*): Evidence for their classification. pp. 7–32.

CRUMLY, C. R., AND L. L. GRISMER. Validity of the tortoise *Xerobates lepidocephalus* Ottley and Velazques in Baja California. pp. 33–37.

MUSHINSKY, H. R., AND E. D. MCCOY. Comparison of gopher tortoise populations on islands and on the mainland in Florida. pp. 39–47.

FRITTS, T. H., AND R. D. JENNINGS. Distribution, habitat use, and status of the desert tortoise in Mexico. pp. 49–56.

BURY, R. B., T. C. ESQUE, L. A. DEFALCO, AND P. A. MEDICA. Distribution, habitat use, and protection of the desert tortoise in the eastern Mojave Desert. pp. 57–72.

GERMANO, D. J., R. B. BURY, T. C. ESQUE, T. H. FRITTS, AND P. A. MEDICA. Range and habitats of the desert tortoise. pp. 73–84.

CORN, P. S. Recent trends of desert tortoise populations in the Mojave Desert. pp. 85–93.

OLDMEYER, J. L. Livestock grazing and the desert tortoise in the Mojave desert. pp. 95–103.

ESQUE, T. C., AND E. L. PETERS. Ingestion of bones, stones, and soil by desert tortoises. pp. 105–111.

LINLEY, T. A., AND H. R. MUSHINSKY. Organic composition and energy content of eggs and hatchlings of the gopher tortoise. pp. 113–128.

DIEMER, J. E., AND C. T. MOORE. Reproduction of gopher tortoises in north-central Florida. pp. 129–137.

TOM, J. Microhabitats and use of burrows of Bolson tortoise hatchlings. pp. 139–146.

WILSON, D. S., H. R. MUSHINSKY, AND E. D. MCCOY. Home range, activity, and use of burrows of juvenile gopher tortoises in central Florida. pp. 147–160.

MORAFKA, D. J. Neonates: Missing links in the life histories of North American tortoises. pp. 161–173.

GERMANO, D. J. Comparative life histories of North American tortoises. pp 175–185.

GERMANO, D. J., AND R. B. BURY. Research on North American tortoises: A critique with suggestions for the future. pp. 187–204.

Studbooks

A healthy discussion of the use and usefulness of studbooks appeared in several recent issues of the Dutch journal *Het Terrarium*. The commentaries should prove interesting to individuals involved in captive breeding projects.

LANGEVELD, K. 1994. De zin van een stamboek [The purpose of a studbook]. Het Terrarium 11(12):222–225.

STEEHOUDER, T. 1994. Stamboeken: Een discussie [Studbooks: A discussion]. Het Terrarium 12(1):2–4.

BROUWERS, T. 1994. Stamboeken: Een reactie [Studbooks: A reaction]. Het Terrarium 12(1):5–7.

ROZA, E. 1994. De (on)zin van een stamboek [The nonsense of a studbook]. Het Terrarium 12(2):30–31.

LEENDERS, T. 1994. Stamboeken: Een reactie op de reactie en de discussie [Studbooks: A reaction to the reaction and the discussion]. Het Terrarium 12(2):32–34.

Amphibian Decline?

Although a number of recent papers have addressed aspects of amphibian decline, one is particularly interesting because it duplicates a survey completed by Frank Blanchard in 1923. During 1991 and 1992 Michael J. Lanno and colleagues surveyed the wetlands of Dickinson County, Iowa for amphibians. They found seven species of amphibians, five of which were recorded by Blanchard's survey. One of the new species, *Rana catesbeiana*, was introduced by state fisheries biologists while the other new species, *Bufo cognatus*, is thought to have migrated into the area. Two species reported by Blanchard were not found during Lanno et al.'s survey.

LANNO, M. J., K. LANG, T. WALTZ, AND G. S. PHILLIPS. 1994. An altered amphibian assemblage: Dickinson County, Iowa, 70 years after Frank Blanchard's survey. Am. Midl. Nat. 131:311–319.

Biomechanics

Bipedal locomotion is common in several species of tetrapodal reptiles and is commonly used during quick acceleration. Christian et al. present biomechanical arguments to show how and why bipedalism facilitates quick running.

CHRISTIAN, A., H.-G. HORN, AND H. PREUSCHOFT. 1994. Biomechanical reasons for bipedalism in reptiles. Amphibia-Reptilia 15(3):275–284.

Molecular Techniques

The hypothesis that multiple matings result in multiple paternity in *Vipera berus* was tested by Tegelström and Höggren trough the use of DNA fingerprinting and random amplified polymorphic DNA (RAPD). DNA fingerprinting proved most effective for distinguishing between large numbers of putative fathers, but both methods were adequate when fewer potential fathers were involved.

TEGELSTRÖM, HÅKAN, AND MATS HOGGREN. 1994. Paternity determination in the adder (*Vipera berus*)–DNA fingerprinting or random amplified polymorphic DNA. Biochemical Genetics 32(7/8):249–256.

Roger S. Thorpe and colleagues utilized several mtDNA regions as well as nuclear DNA to determine the colonization sequence of the Canary Island lizard *Gallotia galloti*. Although the nuclear DNA RAPD analysis and the 12s rRNA were unable to resolve the closer relationships, the other four methods yielded virtually identical phylogenies. A biogeographic hypothesis derived from the combined molecular data was consistent with the geologic history of the islands.

THORPE, R. S., D. P. MCGREGOR, A. M. CUMMING, AND W. C. JORDAN. 1994. DNA evolution and colonization sequence of island lizards in relation to geological history: mtDNA RFLP, cytochrome b, cytochrome oxidase, 12s rRNA sequence, and nuclear RAPD analysis. Evolution 48(2):230–240.

Lizard Ecology

Habitat, microhabitat, diel activity, and prey taxa and size were analyzed for five of the twelve species of lizards occurring at El Pinacate, Sonora, México. Unfortunately the publisher has apparently decided to print the tables and figures cited in this paper in part II which is expected in the December 1994 issue. Once these data are included this paper should be an important ecological study for this area.

ORTEGA-RUBIO, A., A. GONZALEZ-ROMERO, AND R. BARBAULT. 1994. Structure and functioning of a desert lizard community at El Pinacate, Sonora, Mexico. Part 1. The Herptile 19(3):120–128.

ARTICLES

A Review of the Adaptive Strategy Used by Hatchling Painted Turtles to Survive in the Cold

Painted turtles (*Chrysemys picta:* family Emydidae) are common residents of shallow lakes, ponds, and marshes across much of North America. They occur in southern Canada from Nova Scotia to British Columbia, and east of the Rocky Mountains in the U.S.A. as far south as Georgia, Alabama, Mississippi, and Louisiana (Ernst and Barbour 1972). These are among the best-studied of all freshwater turtles, owing to their extensive distribution, local abundance, diurnal habits, and ease of capture.

Courtship and mating occur among painted turtles soon after they emerge from winter dormancy, and nesting occurs a few weeks

A New Facsimile Reprint from the Society for the Study of Amphibians and Reptiles

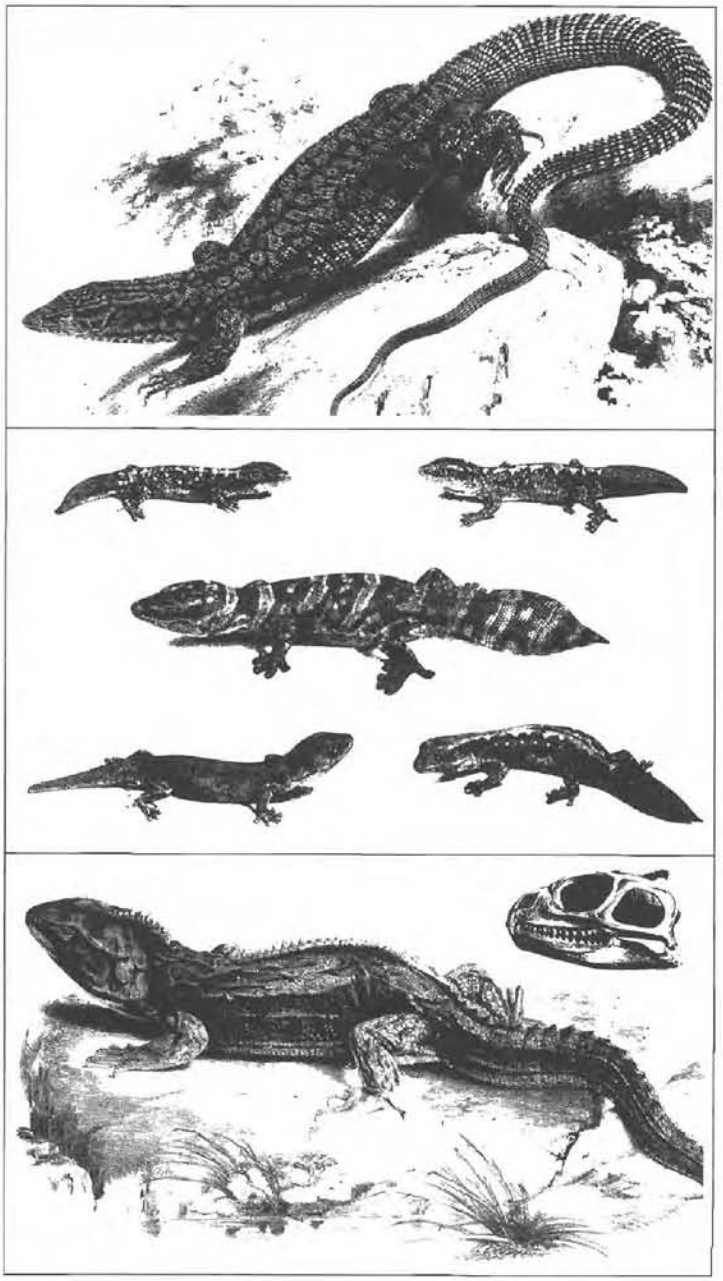
THE LIZARDS OF AUSTRALIA AND NEW ZEALAND

by John E. Gray and Albert Günther

with an introduction by Glenn M. Shea (University of Sydney)

THIS BOOK represents the first monograph dealing exclusively with the herpetofauna of Australia and New Zealand. It consists of two separate but related works that share the same set of plates. The first of these, by Gray and Günther, was issued in two sections (1845, 1875), as part of the scientific results of the voyage of H.M.S. *Erebus* and *Terror*, commanded by Captain Sir James Ross Clark, and sent by the British Admiralty during 1839–1843 to determine the limits of Antarctica and to explore Australia and New Zealand. This is the first comprehensive review of the lizards of Australia and New Zealand and gives the scientific name, synonymy, description, and distribution of each species. Many new species are described for the first time. The second work being reprinted in this volume is Gray's monograph, "The Lizards of Australia and New Zealand in the Collection of the British Museum" (1867), which is also a checklist containing the basic details for each species.

The outstanding feature of this reprint are the 20 lithographic plates, drawn by G. H. Ford, staff artist at the British Museum and one of the best natural history artists of the 19th century. These plates illustrate monitors (4 plates), pygopodids (1), geckos (3), skinks (9), agamids (2), and one of the tuatara, which was then classified as an agamid lizard. These exquisite drawings are among the most detailed and lifelike ever produced on the Australian and New Zealand herpetofaunas. They represent the first published illustrations of many of these species, including the tuatara. Half of the plates illustrate single animals in natural poses, whereas each of the others have as many as 15 figures (see reproductions, greatly reduced in size, at right).



Because these plates are of such exceptional quality, complete sets are being made available separately, printed on one side only of a heavy, acid-free paper stock. These plates measure 8 $^1/_2$ × 11 inches and are suitable for framing.

Specifications: 80 pages, 20 full-size plates. Format 8 $^1/_2$ × 11 inches (21.5 × 28 cm). Clothbound. To be published June 1995. ISBN 0–916984–34–6.

THE LIZARDS OF AUSTRALIA AND NEW ZEALAND

- Price of book to SSAR members *before publication* . . . US$ 16
- Price of book to Institutions and Non-members . . . . . $ 20
- Price of set of 20 plates, in protective plastic wrapper . $ 12

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Send orders to Robert D. Aldridge, SSAR Publications Secretary, Department of Biology, St. Louis University, 3507 Laclede Avenue, St. Louis, Missouri 63103, USA (*Telephone*: area code 314, 977–3910 or –3916; *fax*: 314, 977–3117). Please make checks payable to "SSAR." Overseas orders must be paid in USA funds using a draft drawn on American banks (include an additional amount to cover bank conversion charges) or by International Money Order. Orders may be charged to MasterCard or VISA (account number and expiration date must be provided). Membership details and a complete list of SSAR publications can be obtained on request to Dr. Aldridge.

later (Ernst and Barbour 1972). Each gravid female comes onto land, locates an appropriate nest-site, and excavates a flask-shaped cavity in (usually) sandy or loamy soil (Cagle 1937). She then deposits a clutch of 2–20 eggs in the subterranean chamber (Ernst and Barbour 1972). The eggs in most clutches are arranged into layers, with eggs at the bottom being only 6–10 cm from the surface of the ground and those at the top being even more superficial in their location (Cagle 1937; Cahn 1937; Ernst and Barbour 1972; Legler 1954). The female then scrapes dirt back into the neck of the cavity, camouflages the opening, and returns to water (Legler 1954), leaving the eggs to develop under physical conditions dictated largely by prevailing weather, by depth of the egg chamber, and by slope and aspect of the nest site (Packard and Packard 1988).

Baby painted turtles hatch from their eggs approximately two months after oviposition (Cagle et al. 1993; DePari 1988), but the neonates do not emerge immediately from their nest cavity. Instead, the hatchlings usually remain inside the shallow nest throughout the autumn and winter, and do not dig their way out of the chamber until the following spring (Breitenbach et al. 1984; Cagle 1954; DePari 1988; Hartweg 1946; Lindeman 1991; Mitchell 1988; Packard et al. 1989; Woolverton 1963). This "adaptive strategy" for overwintering apparently enables hatchlings to avoid exposure to predators at a time of year when days are becoming shorter, ambient temperatures are declining, and opportunities for growth are limited (Wilbur 1975). The strategy may have profound consequences, however, for neonates in populations toward the northern limit of the range of distribution.

Temperatures in nests are highly variable during winter at higher latitudes. Nests in protected sites that receive a deep, insulative layer of snow may not experience temperatures much below freezing at any time during winter (Breitenbach et al. 1984; Packard et al. 1989; Paukstis et al. 1989). In more exposed locations, however, lower temperatures may be sustained in nests for several weeks (DePari 1988), and minima between -5°C and -10°C may occur during the coldest part of winter (DePari 1988; Packard et al. 1989; St. Clair and Gregory 1990; Storey et al. 1988; Woolverton 1963). Hatchlings do not migrate downward into the soil to avoid these temperatures, but instead remain in the nest chamber where they necessarily encounter the cold (Breitenbach et al. 1984; DePari 1988; Storey et al. 1988). Nonetheless, many hatchlings survive such exposure and subsequently emerge from their nests when the ground thaws in the spring (DePari 1988; Packard et al. 1989; Storey et al. 1988; Woolverton 1963).

The remarkable ability of neonatal painted turtles to survive exposure to subzero temperatures has been widely attributed to a tolerance by the animals for freezing of water in the extracellular space (Zug 1993). According to this theory of "natural freeze tolerance," hatchlings begin to freeze at high subzero temperatures when liquid in the extracellular compartment reaches a limit of supercooling or when this solution is inoculated (or "seeded") by ice penetrating into the compartment from the frozen soil (Storey and Storey 1992). Freezing of extracellular fluids presumably is initiated when temperature is at or slightly below the equilibrium freezing point of -0.65°C (Packard and Packard 1995; Storey et al. 1991), so cells are not subjected to the osmotic shock that would occur if the extracellular fluids were supercooled more deeply before they began to freeze (Claussen et al. 1990). Moreover, small amounts of "cryoprotectants" (like glucose) may be released from the liver and distributed to peripheral tissues before the circulation is caused to shut down by ice forming in vascular channels (Churchill and Storey 1991; Storey et al. 1988). These cryoprotectants presumably protect cells from damage that would otherwise result from the cellular dehydration which accompanies freezing of water in the extracellular space (Carpenter and Crowe 1988).

Close examination of the theory reveals some shortcomings, however. For example, the theory rests, in part, on the belief that turtles are caused to freeze at high subzero temperatures by spontaneous (= homogeneous or heterogeneous) nucleation or by inoculation (Storey and Storey 1992). One line of evidence supporting this belief is the observation that hatchlings in some laboratory studies began to freeze at temperatures between -1°C and -4°C (Churchill and Storey 1992; Storey et al. 1988)—a result that has been taken to mean that the animals experienced spontaneous nucleation. However, the procedure for holding neonates prior to study apparently caused skin in the axillary and inguinal pockets of the turtles to be contaminated with damp sphagnum (Packard and Packard 1995). When the turtles later were exposed to subzero temperatures, water in the sphagnum must have frozen and the resultant ice probably caused the turtles themselves to freeze by inoculation (Packard and Packard 1995). Indeed, turtles that have been cleaned and dried prior to being exposed to subzero temperatures can easily be supercooled to -12°C without freezing (Packard and Packard 1993a, 1995). Thus, hatchlings actually are not at significant risk of freezing at high subzero temperatures as a result of spontaneous nucleation.

The companion belief, namely that hatchlings are highly susceptible to inoculation by ice in frozen soil, is based on studies of inoculative freezing in frogs, not painted turtles (Storey and Storey 1992). Recent experiments indicate that the extrapolation from frogs to painted turtles is unwarranted, because the integument of the head, neck, and limbs of hatchlings resists the transmission of ice into body compartments from the environment (Packard and Packard 1993b). Although the integument in the axillary and inguinal pouches apparently is less resistant than skin on the extremities to conducting ice into body fluids (Packard and Packard, 1993b, 1995), neonates tend to withdraw their head and limbs into the shell during hibernation. This behavior minimizes the probability that soil will come into contact with skin in the axillary and inguinal pouches and thereby enhances the basic mechanism for preventing inoculation. The mechanism is effective, because neonates in artificial nests in frozen soil commonly remain alive and unfrozen at temperatures as low as -10°C (Packard and Packard 1993a, 1993b). Thus, inoculative freezing is not a foregone conclusion for turtles that are in contact with ice in the frozen soil.

The theory of "natural freeze tolerance" is weakened also by uncertainties concerning the ability of hatchlings actually to withstand freezing. Whereas turtles appear to have survived freezing in some experiments (Churchill and Storey 1992; Storey et al. 1988), none has tolerated freezing in other investigations (Packard and Packard 1993a, 1993b, 1995). Moreover, results of experiments reporting that baby painted turtles are tolerant of freezing are not entirely concordant, nor are the results easily reconciled with data from the field. For example, turtles in one laboratory experiment are said to have survived freezing at -2.5°C for 11 days, but none of the animals in another experiment from the same laboratory was able to tolerate freezing at -2.5°C for as long as 6 days (Churchill and Storey 1992). Animals that were frozen at -4.0°C in both of these experiments were dead within 12 hr (Churchill and Storey 1992), and no animal has survived even brief freezing at lower temperatures (Storey et al. 1988). Hatchlings in the field nonetheless withstand exposure to temperatures below -2.5°C for several months (DePari 1988), and some turtles

tolerate at least brief exposure to extremes of -10° and -11°C (DePari 1988; Woolverton 1963).

When the discrepancies between survival by animals in the lab and by those in the field are considered together with the unsupported assumption that turtles necessarily begin to freeze at high subzero temperatures, questions arise concerning the general importance to hatchling painted turtles of a tolerance to freezing. Such a tolerance presumably could enable some hatchlings to survive brief exposure to relatively high subzero temperatures, but surviving a brief bout or two of freezing usually would not see the hatchlings safely through the winter. Relatively high subzero temperatures that would lead to brief freezing are likely to exist in northern parts of the range of distribution only when the soil is cooling during early winter and warming in early spring. Thus, tolerance to freezing would not be sufficient to enable turtles to survive the long periods of exposure to lower temperatures that commonly occur in mid-winter in nests in the field (DePari 1988; Packard et al. 1989; St. Clair and Gregory 1990; Storey et al. 1988; Woolverton 1963).

A more likely explanation for the remarkable ability of hatchling painted turtles to withstand exposure to cold is that they sustain a state of supercooling and thereby avoid freezing altogether. Substances that could initiate the formation of ice seem to be absent from body fluids of hatchlings, so turtles are not at appreciable risk of freezing spontaneously at temperatures above -12°C (Packard and Packard 1993a, 1995). Moreover, the integument of hatchlings resists the transmission of ice into body compartments from the environment, so turtles are not assured of freezing even when they make contact with ice in the frozen soil (Packard and Packard 1993b). Consequently, turtles may survive extended periods in frozen soil without freezing (Packard and Packard 1993a, 1993b, 1995).

According to this theory of "natural freeze resistance," some turtles experience inoculation after they have been in contact with ice in the soil for periods of hours, days, or weeks (Packard and Packard 1993b, 1995). The vapor pressure of supercooled body fluids in a turtle is higher than that of ice in the frozen soil, and the difference is greater at low subzero temperatures than at high subzero temperatures (Salt 1963). Every animal therefore loses water vapor continuously by diffusion across its integument, and the rate of diffusion is determined by the degree of supercooling. This vapor presumably condenses onto nearby crystals of ice in the frozen soil, thereby causing the crystals to grow slowly toward the source of the vapor (Salt 1963). In time, the crystals may penetrate the skin and inoculate the body fluids, and the resultant freezing of body fluids is fatal (Packard and Packard 1993a, 1993b, 1995). The probability of inoculation, and death, consequently is influenced by both the duration of exposure to ice in the soil and the low temperatures that are reached in the nest cavity.

Thus, turtles that survive exposure to cold while overwintering in nests in the field probably remain unfrozen, and they do so without the benefit of antifreezes (Packard and Packard 1995; Storey et al. 1991). Indeed, this adaptive strategy has only two requirements: (1) heterogeneous nucleators must not be present in the body fluids, and (2) the integument must resist the penetration of ice into body compartments from the environment (Dorsey 1948). It remains to be determined whether these properties are unique to painted turtles or whether the properties are of wide occurrence among neonatal emydids.

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GARY C. PACKARD
and
MARY J. PACKARD
Department of Biology
Colorado State University
Fort Collins, Colorado 80523, USA.

Clutch Sizes in a Community of Snakes from the Mountains of the Valley of México

In recent years, studies associated with the evolution of clutch size have been of central interest. Although it seems to be the oldest topic in life history, we still need more data on several species of reptiles to test the influence of female body size on clutch size. Several studies have indicated that clutch or brood size increases with maternal body size in reptiles (Congdon and Gibbons 1985; Fitch 1985; Ford and Seigel 1989; Moll 1979; Seigel and Fitch 1984; Seigel and Ford 1987; Vitt 1986). In spite of these studies on evolution of clutch size, the relationships among female body size, clutch size, and offspring size in reptiles are not clear (Brockelman 1975).

Since Fitch's (1970) study on lizard and snake reproduction, nothing has been published on reproduction in snake communities. Most of the reports on reproduction for Mexican snakes have been based on single specimens (see review by Fitch 1970). Here we present reproductive data for 24 adult females of six species of snakes collected between 1983 and 1987 in pine and pine-oak forest in Zoquiapan (19°41'30"N, 98°42'30"W), and Cahuacán (19°37'48"N, 99°24'54"W) in the state of México at an elevation of 3200 and 2600 m, respectively.

Clutch sizes of 24 females of *Conopsis biserialis, Pituophis deppei deppei, Storeria storerioides, Thamnophis eques eques, Thamnophis scalaris scaliger* (Colubridae), and *Crotalus triseriatus triseriatus* (Viperidae) were recorded. Snakes were captured in the field between early July and September. They were taken to the laboratory and 22 of 24 were autopsied within 4–8 h after capture. The eggs were removed from the females and preserved in 10% formalin. The number of eggs in each ovary was recorded to obtain the clutch size, and one each of *Storeria storerioides* and *Thamnophis e. eques* were maintained in captivity. The captive females gave birth in July (*S. storerioides*) and September (*T. e. eques*) 1986.

The following data were recorded: snout-vent length (SVL), body mass of the adult females, clutch size, and total clutch mass of the offspring. We correlated the clutch size with SVL because the latter is a less variable measure of body size than mass. We used analysis of variance (ANOVA) to determine if clutch size was related to body size.

Table 1 summarizes the reproductive characteristics of the six species. Clutch size was positively and significantly correlated with SVL ($r^2 = 0.9106$, $F_{1,20} = 97.141$, $P < 0.001$) (Fig. 1).

The captive *Storeria storerioides* (SVL = 325 mm, mass = 42.0 g) gave birth to 19 offspring [mean SVL = 107.2 ± 5.6 mm (100–115 mm), mean mass = 1.54 ± 0.18 g (1.2–1.9)]. The relative clutch mass (RCM) of the female was 0.698 g. The captive female of *Thamnophis e. eques* (SVL = 367 mm, mass = 45.0 g) gave birth to 15 offspring [mean SVL = 148.6 ± 10.6 mm (140–170), mean mass = 1.97 g ± 0.23 (1.7–2.5)]; RCM was 0.655 g.

All species, except *Pituophis d. deppei* are viviparous, a characteristic of many squamates occurring at high elevations. Until

Table 1. Mean, standard deviation, and range for reproductive traits of six temperate zone species of Mexican snakes.

Species	Female		Clutch size	Egg diameter
	SVL (mm)	Mass (g)		(mm)
Conopsis biserialis	196.0 ± 9.4 (183–205) (N = 4)	11.03 ± 3.3 (6.7–15.0) (N = 4)	4.5 ± 2.3 (2.0-8.0) (N = 4)	14.9 x 8.0 (13.0 x 7.0–17.0 x 9.0) (N = 4)
Storeria storerioides	258.2 ± 29.1 (230.0–312.0) (N = 5)	15.3 ± 7.5 (9.0–30.0) (N = 5)	5.4 ± 2.6 (3.0–10.0) (N = 5)	21.2 x 10.1 (20.0 x 9.0–23.0 x 12.0) (N = 5)
Pituophis d. deppei	762.5 ± 96.0 (650.0–900.0) (N = 4)	——	18.0 ± 2.9 (14.0–22.0) (N = 4)	——
Thamnophis e. eques	331.5 ± 40.3 (268.0–367.0) (N = 4)	28.6 ± 7.8 (17.9–39.0) (N = 4)	10.7 ± 2.9 (7.0–15.0) (N = 4)	
Thamnophis scalaris scaliger	630.0 ± 60.0 (570.0–690.0) (N = 2)	——	15.0 ± 1.0 (14.0–16.0) (N = 2)	
Crotalus t. triseriatus	471.7 ± 16.5 (450.0–490.0) (N = 3)	——	10.7 ± 3.4 (6.0–14.0) (N = 3)	

now, there have not been any data available on clutch sizes of snakes that inhabit temperate zones of México. Our data show a significant correlation between SVL and clutch size for the six species ($X^2 = 3.972$, $P < 0.05$). The results suggest that clutch size is a function of female size. All species showed an increase in clutch size with increased female body size.

Variation in body size and clutch size within and among species (Table 1) could be evidence that these species are responding to factors such as phylogenetic relationships and food availability in the environment (Ford and Seigel 1989; Seigel and Ford 1991, 1992). Variation in life history traits, such as female body size, clutch size, offspring size, and growth rate is caused by energy intake (Ballinger 1977; Stearns 1976). For the snakes that we examined, we do not have data on food intake, but the relationship between body size and clutch size could be a response to the factors indicated above.

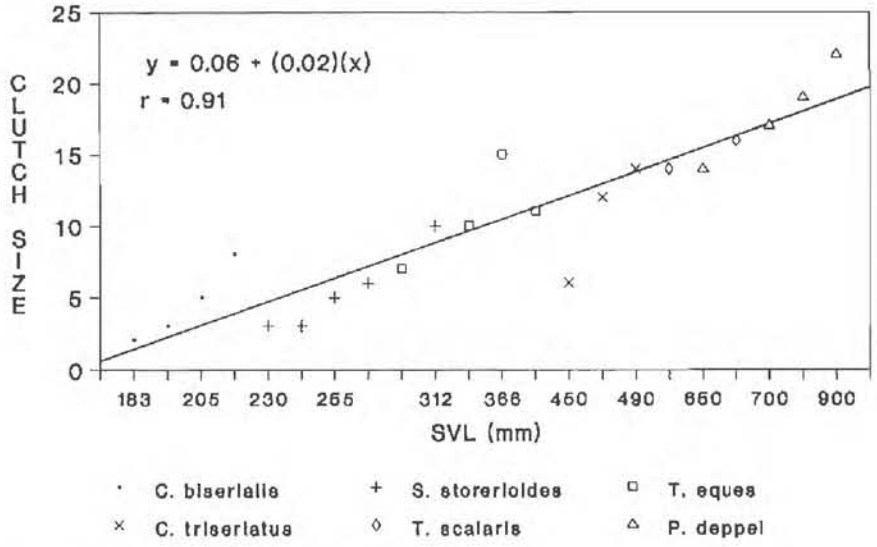


FIG. 1. Relationship of clutch size to snout-vent lengths.

Ford and Seigel (1989) found that life history traits, clutch size, and clutch mass changed in response to the food resource levels, and that changes in these characteristics could be a plastic response to the environment. However, for RCM they did not find any relationship with changes in resources availability. Our data set is too small to make comparisons as we only had two viviparous snakes that gave birth in captivity. The RCM of viviparous species reported by Seigel et al. (1986) was between 0.201 g in *Nerodia fasciata* and 0.426 g in *Tropidoclonion lineatum*, while in our two samples the RCM values were higher but SVL smaller. The SVL of *N. fasciata* was greater than that of *T. lineatum*, and the same characteristics in SVL were found for *Storeria storerioides* and *Thamnophis e. eques*, that is, the bigger snake had a lower RCM than the smaller snake. This could support the findings of Ford and Seigel (1989) that food intake and SVL are not related to RCM.

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AURELIO RAMIREZ-BAUTISTA
Laboratorio de Herpetología,
Departamento de Zoología,
Instituto de Biología, UNAM
A.P. 70-153, C. U., C.P. 04510,
México 20, Distrito Federal, México

GUADALUPE GUTIÉRREZ-MAYÉN
Escuela de Biología
Universidad Autonoma de Puebla
4 Sur #104, Edificio Carolino. 72000
Puebla, Puebla, México

and

ALBERTO GONZALEZ-ROMERO
Departamento de Ecología y
Comportamiento Animal
Instituto de Ecología, A. C.
A. P. 63, 91000,
Xalapa, Veracruz, México.

The Type Locality of the Frog *Acris crepitans*

The original type locality of *Acris crepitans* Baird (1854) has invariably been understood as the "northern states generally," inasmuch as Baird directly cited no other locality and gave the area indicated as the "habitat" for the species.

With that understanding, limited only by the parameters implied by the "northern states," two restrictions of the type locality have been published. The earliest (Smith and Taylor 1950:359) cited Albany, Albany Co., New York, as the restricted type locality, possibly because DeKay's work (1842), cited in the original description, was published there. That locality is, however, outside of the known range of the species, as pointed out by Duellman (1970:647), by about 80 km, and therefore that restriction is untenable. The northernmost precise locality of record in New York is "Third Binnewater Lake, 5 km SW Kingston, Ulster Co." (Benton and Smiley 1961). Although the species no longer exists there, one of us (ARB) has found it at several other sites in the immediate vicinity.

Unaware of the Smith/Taylor restriction, Schmidt (1953:68) restricted the type locality to the "Potomac River at Harper's Ferry, West Virginia," on unknown grounds. That restriction is here refuted, not because it is outside of either the known range of the species or the "northern states" (which might be construed as any Union state, which West Virginia was, or any north of the Mason-Dixon line, which West Virginia was not), but because the original description does, in fact, provide a more restricted locality than has been assumed in acceptance of the "northern states" as the original type locality.

Baird (1854) not only described the species, briefly, but cited as a synonym "*Hylodes gryllus* LeConte" of DeKay's great classic on the zoology of New York (1842:70, pl. 22, fig. 61). That reference is therefore a part of the type material (hypodigm), and it does clearly provide a more restricted locality for the species, namely New York. This we regard as the original type locality, inasmuch as Baird actually did not specify a type locality as such—only the general range, under the rubric of "habitat.".

Unfortunately no more precise locality than "New York" is cited for the species in DeKay's work, but it is reasonable to suppose that DeKay observed the frog near his home, indicated in the preface of the book as "The Locusts, Queen's County."

According to The National Cyclopaedia of American Biography, in the 1830's "the state of New York was publishing valuable works ... and Dr. DeKay was selected to contribute a book on the zoology of the state, a work of great difficulty, owing to the lack of printed material.... The result of his work was embodied in five quarto volumes.... In order to work at his zoology, he left the city for "The Locusts," a country place at Oyster Bay, Long Island, where he resided until his death" 21 November 1851. The eastern part of the original Queen's Co. was separated in 1899 as Nassau Co., where Oyster Bay is now registered.

There are several early collections of *Acris* from Queen's, Nassau, and Suffolk counties, so it is apparently safe to assume that the frog occurred in the vicinity of DeKay's home and that he was familar with it. Although at one time the species undoubtedly ranged throughout the island, no records after the 1930's exist, and the species may well no longer occur there.

Nevertheless, since the species did once occur in the vicinity of DeKay's home near Oyster Bay, where most of the Zoology of New York was written, we regard the present restriction of the type locality of *Acris crepitans* to "The Locusts, near Oyster Bay, Nassau Co., Long Island, New York" as appropriate and soundly conformant with present knowledge.

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HOBART M. SMITH
Department of EPO Biology
University of Colorado
Boulder, Colorado 80309–0334, USA

ROBERT T. ZAPPALORTI
Herpetological Associates, Inc.
2525 Dover Road-Bamber Lake
Forked River, New Jersey 08210, USA

ALVIN R. BREISCH
New York State Department of Environmental Conservation
Endangered Species Unit
Wildlife Resources Center
Delmar, New York 12054–9767, USA

and
DANIEL L. McKINLEY
10 Knowles Terrace
Albany, New York 12203, USA.

Evidence of Possible Sperm Storage in the Caiman, *Paleosuchus palpebrosus*

Sperm storage has been reported in a number of chelonians and squamates but it has not been reported in crocodilians (Ferguson 1985). In squamates, sperm storage is made possible by structures located in the oviducts and in some species fertile eggs can be produced months or even years after copulation (Goin et al. 1978). Some male snakes store sperm over winter in the ductus deferens and are then used during mating the following spring (Seigel and Ford 1987). Some chelonians can also store sperm, females producing viable eggs for several years after last mating (Goin et al. 1978). Hatten and Gist (1975) found sperm stored in the albumen secreting tubules in the box turtle, *Terrapene carolina*. Gist and Jones (1987) later reported stored sperm in these structures in nine species of chelonians.

On 25 February 1981, the National Zoological Park received one male and three female dwarf caiman, *Paleosuchus palpebrosus*, from Surinam. A fourth female was added to the group on 5 August 1984. Sex was determined using the method described by Brazaitis (1969). This group was moved into a livestock watering tank on 12 September 1990 and maintained there until 6 March 1991 when three of the females were removed. These three females have since been maintained together without contact with

any other individuals. On 7 July 1992, 488 days after the last contact with a male, 16 eggs were found submerged in the tank. Mean egg weight was 64.8 g (range 59.2–68.0 g), mean width was 40.3 mm (range 38.3–41.4 mm) and mean length was 66.9 mm (range 63.1–70.1 mm). All eggs were normal in appearance and were incubated at approximately 28°C in an environmental chamber. By 10 July, six eggs had begun to band, an indication of fertility (Ferguson 1985). Mean band width measured at the top of each egg was 20.2 mm (range 13.9–28.9 mm). By 16 July, band width had increased to a mean 31.7 mm (range 27.7–37.0 mm) indicating embryonic development. A seventh egg began to band on 18 July. As band growth seemed arrested by the beginning of September, the seven eggs were dissected by NZP pathologists to determine development. One egg contained a live, well-developed embryo. The remaining six eggs had decayed to the point that possible embryonic tissue could be seen only in two, possible blood spots in another two, and in the remaining two eggs nothing indicating fertility could be discerned.

On 24 January 1993 two of the three females were measured. Their snout-vent lengths were 59.6 cm and 56.3 cm. The third female is of very similar size. At this time, the sex of the three females was rechecked (Brazaitis 1969).

In crocodilians, the interval between insemination and egg-laying reportedly varies between species (Ferguson 1985). The longest interval, five months, was reported by Pooley and Gans (1976) for the Nile crocodile, *Crocodylus niloticus*. This was determined through field observations but in such cases it may be difficult to determine when copulation attempts are successful or if the male is producing viable sperm. In captivity at the National Zoological Park, Cuban crocodiles, *Crocodylus rhombifer*, begin to court and attempt copulation in December and continue for several months before eggs are laid the following April or May (pers. observ.). Even though pool water is relatively clear and the crocodiles are close to the observer, it is still difficult to determine when copulation attempts are successful. Ferguson (1985) suggested detailed autopsies to verify the seemingly variable intervals between insemination and egg-laying in different species. The interval measured here for *P. palpebrosus* is the longest reported in a crocodilian. No attempt to locate sperm storage structures in this species has been published; however, they have not been found in either the American alligator, *Alligator mississippiensis* or *C. niloticus* (Ferguson 1985). Detailed descriptions of the adult crocodilian oviduct are not available, though it reportedly is generally similar to that of chelonians (Gist and Jones 1987). However, because sperm storage structures have not been reported in crocodilians does not mean they do not exist. Long term sperm storage in chelonians was reported before the sperm storage structures, the tubular albumen-secreting glands in the oviduct, were discovered (Hatten and Gist 1975).

A decrease in fertility was noted in this clutch of *P. palpebrosus* eggs compared to other clutches laid at NZP by females with continuous access to a male. Similarly, decreases in fertility have been shown to occur in egg clutches laid by diamondback terrapins, *Malaclemys terrapin*, as the time interval from last mating increases (Goin et al. 1978).

Sperm storage may be an advantage for a crocodilian species which reportedly occurs in low densities in the wild (Ross and Magnusson 1989). Such a capability would allow reproduction by females that do not have regular access to males.

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MICHAEL DAVENPORT
Department of Herpetology
National Zoological Park
3000 Block of Connecticut Avenue, N.W.
Washington, D.C. 20008, USA.

Distributional Notes for the Night Lizard *Lepidophyma gaigeae* (Xantusiidae)

Gaige's tropical night lizard, *Lepidophyma gaigeae*, is a relatively small flat-bodied member of the family Xantusiidae, variously placed in the subfamily Xantusiinae (Savage 1959) or Lepidophyminae (Crother et al. 1986; Smith 1987). Since its original description by Mosauer (1936), the scattered published records report this night lizard as occurring in rock fissures and between loose rocks in limestone areas. It occurs chiefly in pine-oak forests, as well as the walnut belt of the Sierra Madre Oriental in northwestern Hidalgo and northeastern Querétaro, México, at elevations of 1515–2200 m (Bezy 1984, 1988, 1989; Bezy and Camarillo 1992; Dixon et al. 1972; Smith 1973; Smith and Taylor 1950). Xantusiid lizards have been described as habitat specialists (Bezy 1989), and the ranges of the majority of species are fragmented, characteristic of primitive, relictual groups (Bezy 1972).

In early August 1991, the author and two colleagues, Carlos Camacho (CCA) and Dionisio Saucedo (DSR) found two *L. gaigeae* (AGA0767, SVL = 42.5 mm, sub-adult; CCA01 1, SVL = 55.1 mm, adult) about 2 km SSW of the small village of Verdosas (10 airline km north of Zimapán, and 18 km ESE of Durango, Hidalgo). The habitat at this locality is pine-oak forest, and both lizards were found under loose rocks on a rocky slope at elevations of 2170 and 2520 m respectively (Figs. 1A, B). The following reptiles, associated with the same habitat at this locality, were also collected: *Sceloporus grammicus, S. jarrovi immucronatus, S. torquatus melanogaster, S. parvus scutulatus, Gerrhonotus liocephalus taylori, Leptophis mexicanus*, and *Crotalus triseriatus aquilus*.

In addition, during field trips to eastern Querétaro and western Hidalgo (near the border between these states) the author collected two specimens of *L. gaigeae* in October 1989 and April 1990. The

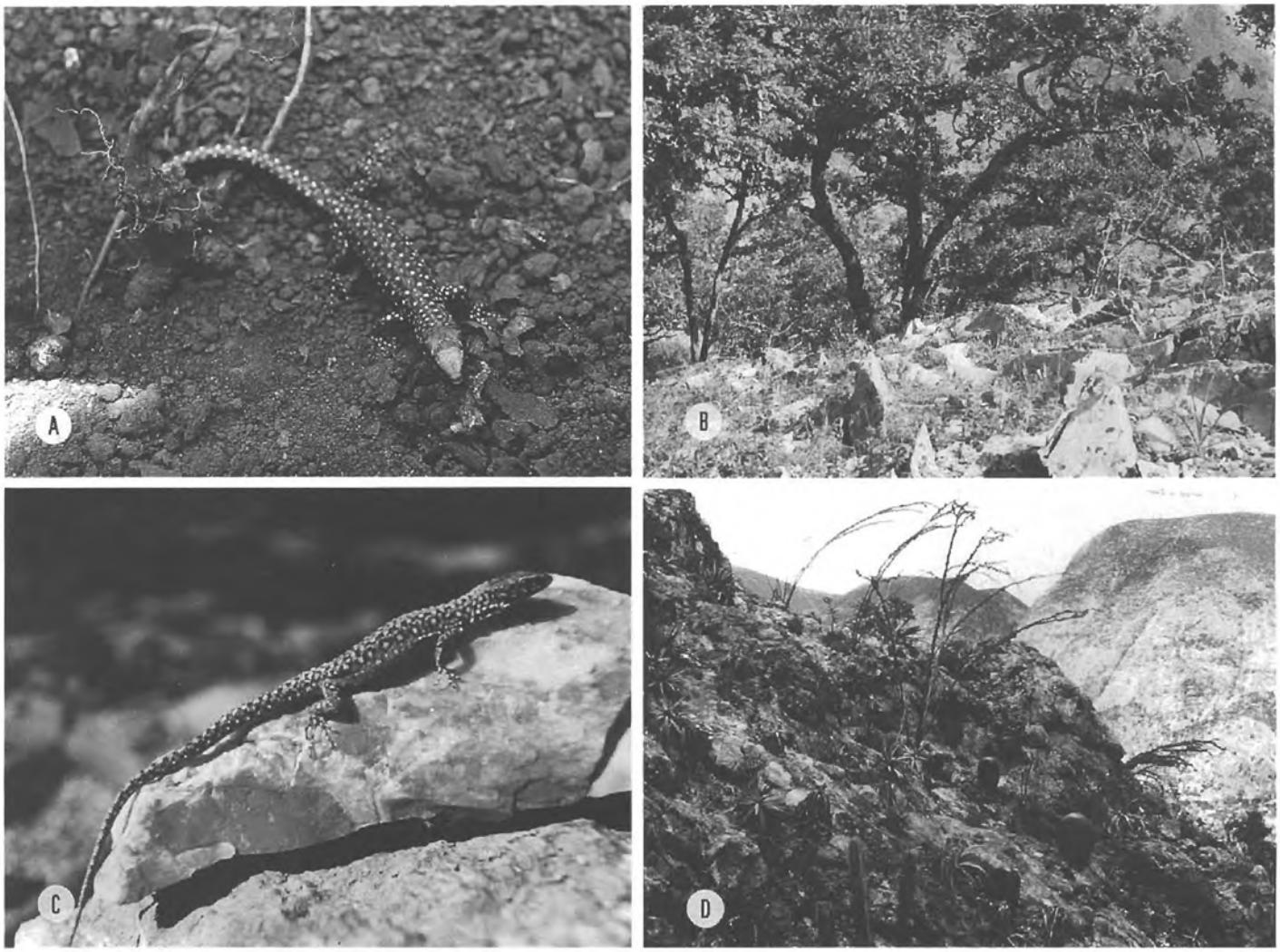


FIG. 1. Living individuals of *Lepidophyma gaigeae* and their habitats in Hidalgo and Querétaro. A. Adult specimen CCA011 from Verdosas, Hidalgo. B. Pine-oak forest at Verdosas, typical habitat of *L. gaigeae*. C. Adult specimen AGA0644 from Cerro Prieto, Querétaro. D. Xerophytic vegetation of Cerro La Cruz, near El Arenal, Hidalgo, an unusual habitat for *L. gaigeae*. The Cañon del Infiernillo and Cerro Prieto are visible in the background.

specimens were taken at two localities near the confluence of the Río Tula and Río San Juan, which then become the Río Moctezuma, which in turn flows through Cañon del Infiernillo (Fig. 2). An adult specimen (Fig. 1C; AGA0644, SVL = 49.1 mm) was found in a crevice on a rocky slope of Cerro Prieto, north of Rancho Nuevo, ca. 30 km ESE of Cadereyta de Montes, Querétaro, at an elevation of 1560 m. A juvenile specimen (AGA0667, SVL = 37.0 mm) was found in a similar area on Cerro Prieto, but close to the western edge of the Cañon del Infiernillo at 1532 m. A third specimen (AGA0762, SVL = 51.6 mm, adult) was collected in June 1991 under rocks in a small cave in the mountains, 1 km south of El Arenal, Hidalgo, not far from the eastern margin of the Río Tula, at an elevation of 1520 m (Fig. 2). At least three other specimens were observed in the cave or at its entrance.

All specimens (except AGA0667) are still alive in the Laboratorio de Herpetología of the Escuela Nacional de Estudios Profesionales Iztacala (ENEPI), UNAM, in Tlalnepantla, State of México.

In contrast to the Verdosas area, the above-mentioned localities support xerophytic vegetation—the crassicaule desert bush association—whose main elements are *Stenocereus dumortieri, Myrtyllocactus geometrizans, Astrophytum ornatum, Cylindropuntia* sp., *Opuntia* sp., *Mammillaria compressa, M. elongata, Echinocactus platyacanthus, E. grusonii, Prosopis laevigata, Celtis pallida, Fouqueria splendens*, and *Jatropha dioica* (CFE-PHZ 1989; Rzedowski 1981) (Fig. 1D). Other reptiles found at these localities are characteristic of xerophytic habitats: *Sceloporus variabilis variabilis, S. parvus scutulatus, S. spinosus spinosus, Cnemidophorus gularis scalaris, Trimorphodon tau tau*, and *Pituophis deppei jani*.

Our collection of *Lepidophyma gaigeae* from xerophytic habitats parallels the situation in northern Querétaro, where the species occurs primarily in pine-oak woodland, but is rarely found in thorn scrub of the Jalpan Valley at 600 m (Dixon et al. 1972). Our records extend the range about 42 airline km SSW of the southernmost distributional record previously published: 27 km S of Jacala, near Durango, Hidalgo (see Fig. 2; Bezy 1984; Dixon et al. 1972).

As in populations of *L. gaigeae* occurring between El Lobo and Jalpan, Querétaro (Dixon et al. 1972) and near Durango in Hidalgo (Mosauer 1936; Smith 1973), the specimens reported herein belong to populations separated from each other by vegetational differences, topography, and the Río Moctezuma. These observations suggest that either: 1) the distribution of *L. gaigeae* is broader

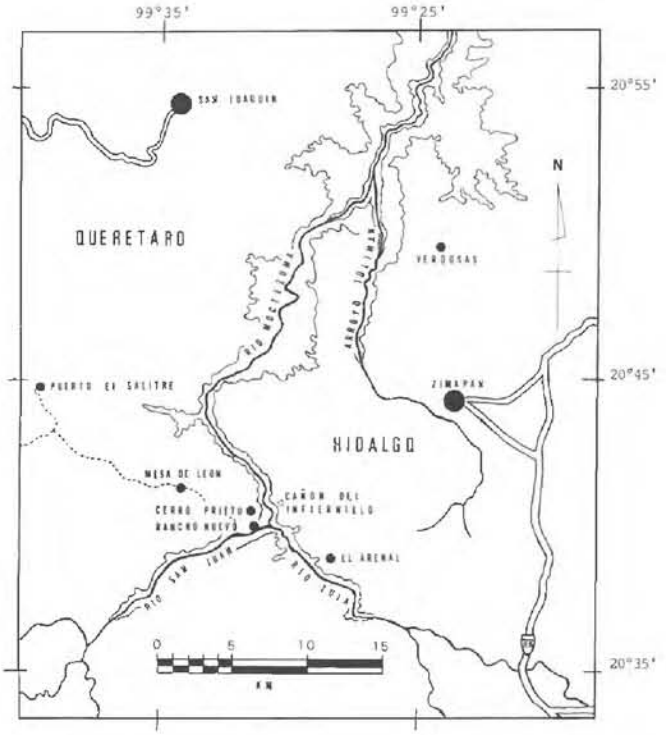


FIG. 2. Collection sites of *Lepidophyma gaigeae* in eastern Querétaro and western Hidalgo, México (refer to text). Additional points of reference are included.

than presently documented, and perhaps is nearly continuous between known populations, but obscured by low densities and secretive habits; or 2) these are relictual populations and reflect the previous range of the species. Clearly, additional field work is needed to more accurately understand the distribution of *L. gaigeae*.

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ARTURO GONZALEZ A.
c/o Dr. Saitou Takashi
Animal Ecology Department
Institute of Biological Sciences
University of Tsukuba
1-1-1 Tennodai Tsukuba-shi, Ibaraki-ken 305. Japan
and
San Marcos 79
San Marcos
Azcapotzalco D.F. 02020, México.

POINTS OF VIEW

Scalation: Terminological Acceptance Long Overdue

Herpetologists writing in the English language have essentially universally applied the term "scale" to the "thin, flat, overlapping, rigid, horny plates forming the outer protective covering of the body in many ... reptiles...," as defined in Webster's New World Dictionary, revised 1980. Essentially the same definition is given in the other great dictionaries of the English language (e.g., the Oxford English Dictionary, 1989; the American Heritage Dictionary, 1992; the Random House English Dictionary, 1987; Webster's Third New International Dictionary of the English Language, 1976), as well as the many, far more frequently used abridged dictionaries widely distributed in schools and homes throughout the U.S.A. and other countries. As noted in virtually all such references, "scale" is also applied to the similar structures of fishes, on the tail of some mammals, and on the legs of most birds. Analogous structures on the wings of most lepidopterans also are termed scales, and so are several other structures of both organic and inorganic occurrence. The epidermal reptilian, avian, and mammalian structures are now accepted as homologous, the others not.

A few other names have been applied to reptilian scales, such as squamae, scutes, plates, shields, laminae, and scutella (Peters 1964:310), but they are seldom used except in a few special contexts (Dundee 1989:63). "Scute" in herpetology refers usually to large scales, as do "lamina," "shield," or "plate" (Peters 1964:315). On the other hand, "scutella" are regarded commonly as small

scales, as stated by both Peters (1964:315) and general English dictionaries (e.g., Webster's New World Dictionary, revised 1980, p. 1282). Although "squama" is a term commonly noted in dictionaries (but not, per se, in Peters' book), it is almost never used in herpetology, perhaps as too stilted, pompous, or affected, especially with the term "scale" so widely accepted and commonly used. Dundee (1989) suggested that herpetologists might well confine themselves "wholly to scute or scale for all epidermal derivatives."

Curiously, however, with rare exception dictionaries include only those nouns, meaning the state or arrangement of scales, that are derived from the least used alternatives for "scale." Of such nouns, the most commonly adopted in herpetological literature is "scutellation," and this is the term that most meticulous editors have insisted be used instead of "scalation." "Pholidosis" is also to be found in dictionaries, derived from the Greek word "pholidos," but that word, or a derivative thereof, has apparently never found its way into English herpetological usage in lieu of "scale." "Squamation" also is commonly cited in dictionaries (but, strangely, not in Peters) and Peters (1964:315) lists "scutation," but both are objectionable on the basis of derivation from words seldom used for the structures involved. "Lepidosis" appears in several of the Webster dictionaries, in application to scale arrangement, but is also derived from a word (lepis) always used only in compound words.

"Scalation" is the inclusive to be preferred, because of its derivation from the overwhelmingly preferred term "scale." It even crept into Peters' dictionary (1964:261), where he defined "pholidosis" succinctly and simply as "scalation," although the latter term did not appear otherwise in his book, perhaps in deference to the absence of the term, even though "natural," in all of the most frequently used English dictionaries.

Two exceptions, and only two, to the general absence of "scalation" in English dictionaries, have been found. The 1976 edition of Webster's Third New International Dictionary entered the word and defined it simply as "lepidosis 2," in turn defined as "the arrangement and character of the scales or shields of an animal" (otherwise as "a scaly skin disease (as ichthyosis)"). The 1987 edition of the Random House Dictionary of the English Language likewise has an entry for "scalation," defined as "1. an arrangement of scales, as on a fish. 2. ichthyosis."

The origin of the term "scalation" is uncertain. It was frequently used by Taylor, appearing in his first publication in 1915 (e.g., p. 103, last line). Even earlier, in 1911–1912, he used the term in a dissertation written in partial fulfillment of the requirements for a Master's degree; the manuscript was published posthumously (Rundquist 1993). The word "scalation" appears at least on p. 12 of the published dissertation. Taylor continued to use that term until about 1936, when he switched to "squamation."

Not surprisingly, Smith (e.g., 1936), as a student of Taylor's, also freely used the term "scalation," until persuaded that it was "officially" (i.e., in known dictionaries) non-existent.

Actually, no "official" lexicon in English exists to which usage must conform. If a word is used in print, it exists, and its usage, or awareness of its usage, is the only qualification necessary for inclusion in dictionaries or any of the several registers of new words, of which that by Algeo and Algeo (1991) is the most informative and delightful by virtue of its introduction—a virtual primer in neologistics. According to those authors, a word is "new" if it does not appear in dictionaries at the time of its consideration, and under that definition, "scalation" can no longer be considered "new," because of its known usage of over at least 80 years, and its inclusion in at least two dictionaries in the last two decades. The Algeos go on to observe that some new words, termed "nonce" words, are "coined for a particular use and unlikely to become a permanent part of the vocabulary," and on those grounds are sometimes rejected for new-word registers. Certainly "scalation" does not fall in the nonce category. Indeed, its role is of long-standing and of considerable potential magnitude.

Obviously lexicographers up to the present time have given inadequate weight to the existence of "scalation" in the herpetological sense (certainly extendable to other vertebrates in which homologous scales occur, and even to fishes, whose scales are not homologous with the tetrapod ones, but are so closely analogous that the same derivative of "scalation" does not offend propriety), or to the much greater rationale for its existence and usage than for any of the commonly entered alternatives. On the basis of that rationale, and of the word's respectable history of usage, we urge that herpetologists and others no longer avoid usage of the term, where appropriate, in their attempts to conform with assumed dictionary authority that in fact has no "official" standing and is no longer universal. Lexicographers should make amends for past omissions by inclusion of "scalation," if need be at the expense of some of the usually entered synonyms that are seldom used and/or are less appropriate, in future editions of abridged as well as unabridged lexicons.

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HOBART M. SMITH
Department of EPO Biology
University of Colorado
Boulder, Colorado 80309–0334, USA

and
DAVID CHISZAR
Department of Psychology
University of Colorado
Boulder, Colorado 80309–0345, USA.

